THINKING cities

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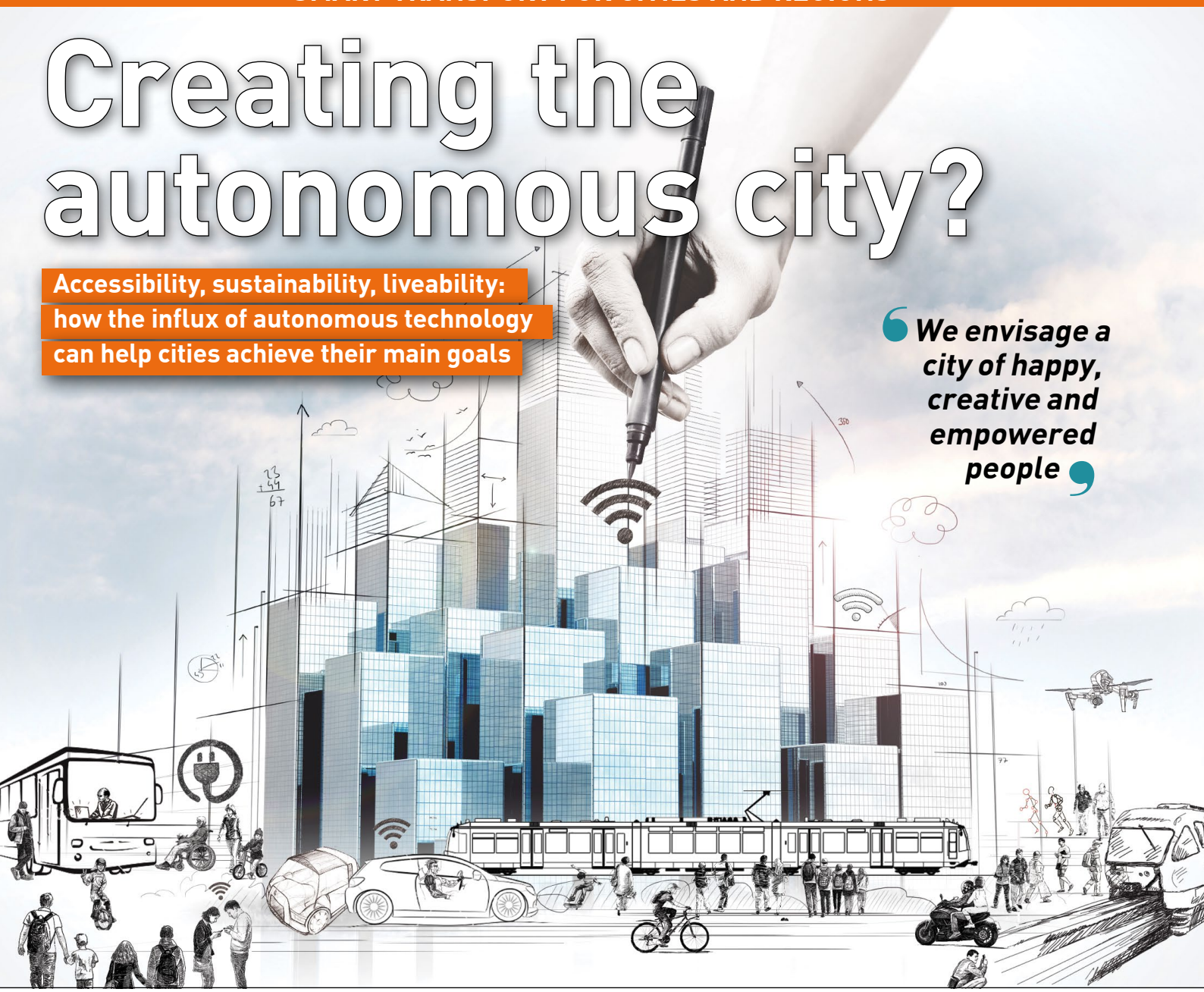

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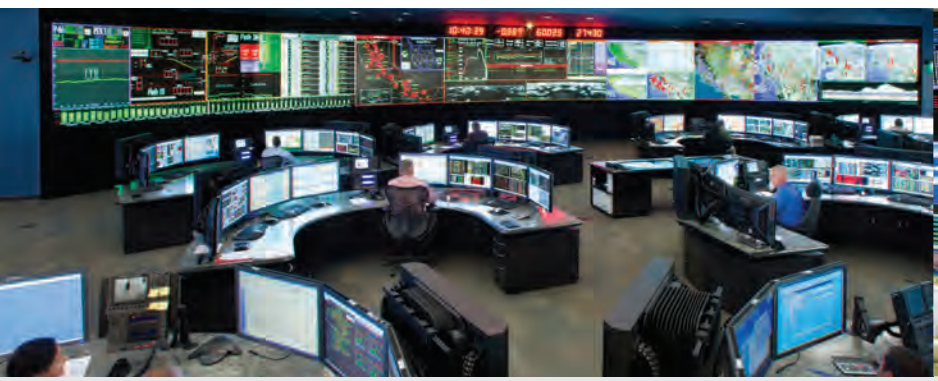

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A degree of autonomy

Karen Vancluysen and **Kevin Borras** wonder just how autonomous a city needs to be to meet the pressing mobility needs of its citizens

What role can automated vehicles play in cities? There are substantial research and development activities worldwide and claims made by at least one vehicle manufacturer that autonomous vehicles will be on the roads within the next five years. This begats several rather interesting questions: Firstly, just how feasible is that? Secondly, is this something that cities actually want and are preparing for? Are cities considering where automation can contribute to their vision of their future? And should cities be actively engaging in these developments or should they remain an observe?

Cities are striving to reduce the amount of cars that are increasingly congesting their streets and giving rise to air quality and pollution issues. Replacing driven vehicles with automated vehicles will not solve the problems of congestion and deliver the goal of more liveable cities. In fact, research by the OECD shows that, if anything, the automation of cars could lead to an increase in the number of kilometres travelled.

If the increased road capacity that automation is slated to deliver is not managed sufficiently (and efficiently) cities could be creating a whole range of new problems as the additional space created would need to fit into the existing mix of urban mobility infrastructures already in place.

Furthermore, the OECD study also shows that while highways could benefit the most out of automation, its application at urban and suburban levels would mostly benefit passenger and delivery shuttles, as well as taxis, all of which typically operate at low speeds.

Additional challenges arise when cities are confronted with automated vehicle-related conundrums that, while they may appear to be some years away from being addressable, need to be considered now.

For example, what might be the impact of automated functions on vehicle movements and traffic management? What might be the impact of automation and road safety, particularly on vulnerable road users?

There are also a number of infrastructure aspects that cannot be ignored:

Physical aspects, such as road markings, parked cars and other obstacles require vehicle-to-vehicle and vehicle-to-infrastructure communications equipment, ground-based units for global navigation systems, dedicated facilities comparable to bus and bicycle lanes, on-street parking restrictions, and specific roadway or pavement modifications.

Digital aspects would include quandaries such as what data is required from road/traffic authorities and what is actually feasible. There are also questions regarding the maintenance of highly detailed roadway maps and pertinent traffic operations data.

Another point worth noting is the change in behaviour that will be required by the citizens themselves in terms of simple road rules. Think about the last time you crossed a road in a city – how much information did you take in aurally before crossing? It's surprising how much your decision to cross a road is influenced by sound: you recognise the sound of a car slowing down or changing down a gear even though you may not be able to see it. This certainly won't be an instinct you will be able to rely upon when autonomous, electric vehicles start to populate our city streets.

> ***There are a huge number of positive effects that autonomous cities can have on our lives***

There are of course a huge number of positive effects that autonomous cities will have on our lives. We all know the statistics that prove that an enormous percentage of vehicular accidents are caused by human error, so with the human element somewhat removed from the equation it will surely lead to a significant reduction in the number of crashes, and that can only be a good thing. And what about autonomous public transport?

One recent tragic event that occurred very close to H3B Media's headquarters, the Croydon tram crash that claimed the lives of seven people and resulted in many more seriously injured, appears to have been the result of, if not human error, the lack of human intervention. If the driver fell asleep or blacked out due to a medical condition then the arguments for driverless public transit systems and services will only be strengthened (Lyon Metro's Line D and the Docklands Light Railway in London serve as a case in point).

In the autonomous vehicle world one of the most talked-about elements is the level of automation and what is appropriate for trucks and passenger vehicles. This also applies to public transit. The defined levels range from Level 1 (basic driver assistance) to Level 5 (full automation). Human drivers monitor the driving environment in Levels 1 and 2, while for Levels 3-5 the driving environment is monitored by the automated driving system itself. Could these levels of automation be applied to cities as well as vehicles?

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On behalf of the whole SWARCO team

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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.

- **Rotterdam** – Pex Langenberg, Alderman for Sustainability and Mobility
- **Dubai** – H.E Mattar Al Tayer, Director General and Chairman of the Board of Executive Directors, RTA
- **La Rochelle** – Jean-François Fountaine, Mayor of La Rochelle and President of La Rochelle Urban Community
- **Jerusalem** – City Council Member, Fleur Hassan-Nahoum

Photo: Marc Nolte

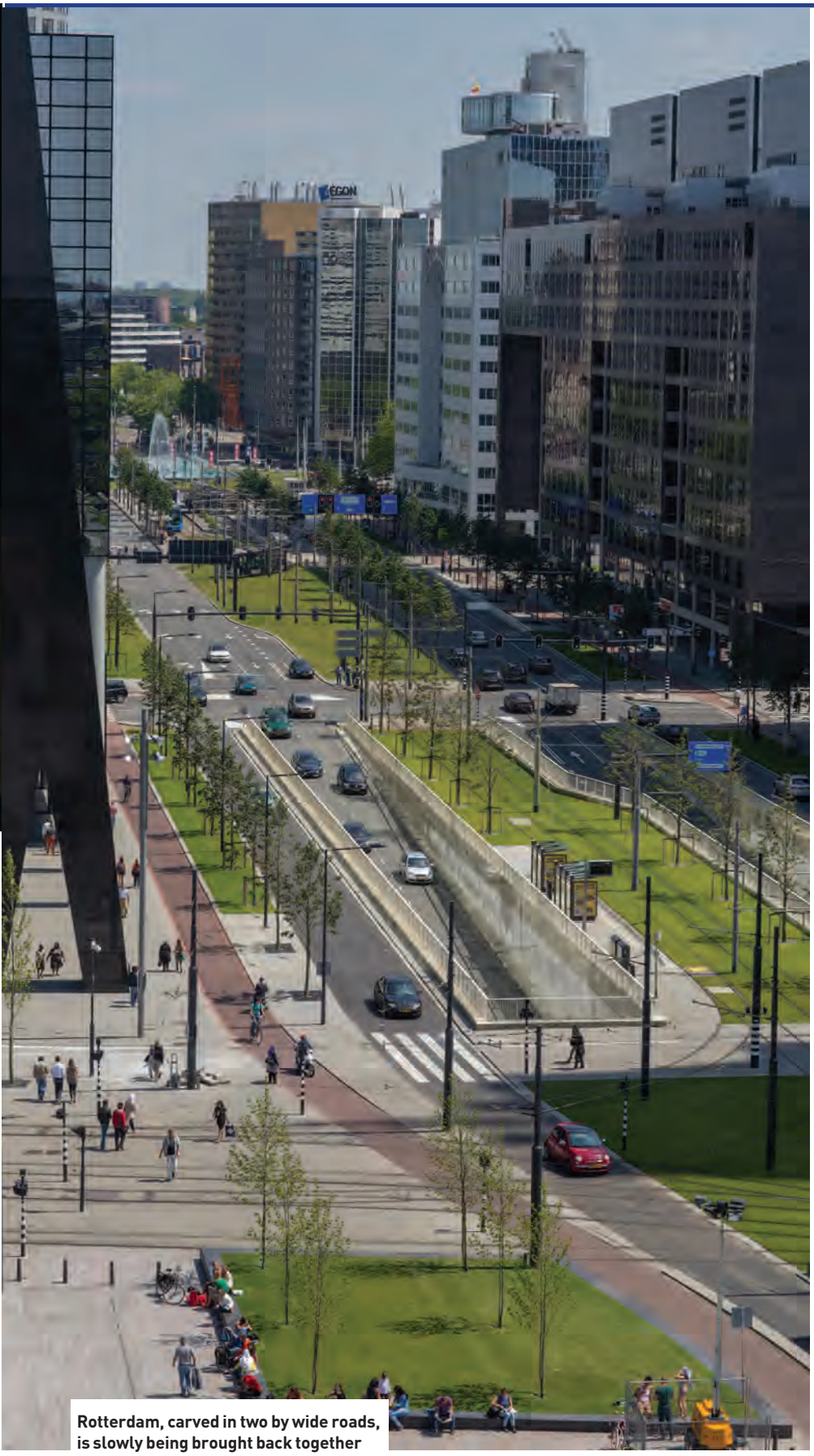
Two halves make a whole

Thinking Cities talks to **Pex Langenberg**, Alderman for Sustainability and Mobility for the City of Rotterdam, about striking the right balance between the two. Interview by **Pascal Hofmann** and **Anna Feiner**

***Thinking Cities* (TC): Mr. Langenberg, your portfolio consists of two major themes: Mobility and Sustainability. What challenges does Rotterdam face and how can they be addressed within the themes of your portfolio?**

Mobility has been literally dividing the city for too long. A functional design in the 1950s has resulted in broad roads with multiple car lanes, carving the city centre in two. Our new objective is that mobility should be a binding factor in Rotterdam. That means that we want to reroute traffic that has no destination in the city to ring roads. We want to relieve this urban living area from harmful emissions and unhealthy air. In some places 50 per cent of harmful, unhealthy particulate emissions originate from traffic.

This is where Mobility and Sustainability meet up in its best form. In order to grow as an attractive, healthy and strong economic city, urban mobility has to evolve at the same pace. This means flexibility, room for innovation and finding a balance between economic growth, resulting in more traffic, and offering an attractive city to live in and visit. It's my goal to provide



Rotterdam, carved in two by wide roads, is slowly being brought back together

Rotterdam photos: Eric Fecken

solutions to these challenges. My portfolio has the best consistency for these solutions.

How difficult is finding that balance in Rotterdam?

Rotterdam has been rebuilt after being bombarded during the Second World War. Our infrastructure is completely different than other Dutch cities. Rotterdam has been focussing on car mobility for decades. The 's-Gravendijkwal leading to the Maastunnel and the Coolsingel are examples of that focus; these urban highways were once a symbol of prosperity, but now they're seen as unwanted and unhealthy so close to a dense living area.

That gives you an idea of the change of perspective. That change, plus the expected growth, makes Rotterdam follow two principles: 'Rerouting traffic, to where it belongs' and 'The City Lounge'.

What do these principles mean? How do you put them in effect?

The 'City Lounge' is the leading principle for the city centre of Rotterdam. This ambitious programme beholds the use of higher quality materials, hospitable public spaces with a comfortable and personal look and feel. This also means more room for pedestrians and cyclists.

Based on the City Lounge idea, we strongly advocate using bicycles and public transport for passenger mobility Important in this notion is that we want to make these forms of mobility more attractive than using your car. Clean cars are more than welcome in our city.

Public transport in Rotterdam already has the highest consumer rating in the Netherlands so by making sure that our cycling facilities are of the highest quality, we want to tempt people to get on their bikes. For example, inhabitants

> ***"We have heat sensors that sense the amount of cyclists waiting and give more green when it's busy"***

Rotterdam has a reputation for being one of the more congested cities in the Netherlands

can inspire each other through a Rotterdam cycling community called 'fietsfan010'. Here attention is brought to problems in our facilities. Because of this community cycling trails and bicycle parking facilities have been improved.

The Coolsingel, that 'four-lane arterial road' in the city centre, will be redeveloped to form a car-restricted boulevard with plenty of space for cycling, walking and green areas. These kinds of redevelopments make former barriers into public spaces where people can meet, recreate, live.

Through traffic is guided over the ring roads around Rotterdam. When someone from outside the city wants to visit the city centre of Rotterdam, he or she uses public transport, or a combination of car and public transport via our Park + Ride facilities. By doing so, we manage the increasing pressure on our infrastructure and bring balance in the use of car, bike, public transport and pedestrians.

How do you stimulate these changes?

We stimulate change mainly by facilitating. Transitions need time and space. In Rotterdam, as I said before, we make it happen by facilitating the transition. This means we give people, organisations, companies with good initiatives, with innovative ideas, room to make those initiatives happen. This can be by stimulating them with funds, introducing parties to each other or simply give them physical room to experiment.

At the beginning of this year, we established a large environmental zone in Rotterdam that applies to both passenger cars and trucks. By combining this with a scrapping scheme, residents with older, polluting cars, usually a financially vulnerable group, will be spared. An environmental zone is an effective measure. In order to foster the change towards an emission free fleet, we help stimulate electric car use in Rotterdam. We've just launched our 2000th charging point in the city and we are almost doubling this amount by 2018.

Another way to stimulate a change in mobility is by facilitating other forms. We're optimizing our cycling infrastructure. That's done by infrastructural adjustments like wider, two-way bike lanes, new asphalt or more parking spaces for cyclists. But we also experiment for a better 'cycling flow'.

We have rain sensors that give cyclists more green at traffic lights when it rains, heat sensors that sense the amount of cyclists waiting and give more green when it's busy. But we're also trying out a 'green predictor' that shows the right cycling speed in order to get green at the next traffic light, making a cyclist stop and start less. These measures also mean that cyclists will gain an advantage over motorists, which can stimulate motorists to grab the bike for shorter distances.

What challenges and solutions do you see for logistics?

Rotterdam is proud of its record of being a city that's open to innovation

Although it accounts for just 10 per cent of traffic movements, trucks and delivery traffic represent a relatively large polluter, good for about 60 per cent of NOx emissions and 40 per cent of the PM10. With the improving economic conditions, urban logistics will intensify. That presents us with the challenge of keeping the increasing logistic demand from pressurizing quality of life in the city.

We can, of course, stimulate efficient driving behaviour and thus there is now a Drivers' Competition: via an app that measures driving behaviour, a group of 'good drivers' is being created who, during a finals day, will compete for the title of 'best driver in Rotterdam'. This is good for creating awareness and that's a necessity for change.

Even more importantly, making the fleet of logistic vehicles cleaner and emission-free is our main goal. That, however, is something that can only be achieved by availability and especially affordability of electric or hybrid-electric vans and trucks. Developments in this area seem to be slower than in personal mobility.

The municipality's role is to stimulate demand for these electric vehicles. Various initiatives have been launched with Light Electric Vehicles or cargo bikes that perform last mile deliveries and we are working on granting electric vehicles extra privileges, such as the use of the bus lane and more lenient delivery times.

Therefore, we appeal to the European government: facilitate the tempo and set up a European Fund or subsidy scheme to help finance electric vans and trucks.

I am asking manufacturers to innovate, and develop an electric or partially electric logistics solution, since there is a genuine and growing demand.

Is there anything else you would like to say to our readers?

Next to hoping that you will have a very successful conference in Rotterdam, I'd like to call upon all cities to facilitate and stimulate the changes we need in order to keep cities liveable. And to all organizations, I'd like to say: Rotterdam has always been a testing ground for (technical) innovations, our door is open!

FYI

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Efficient and seamless:
Dubai's phased approach to smartness

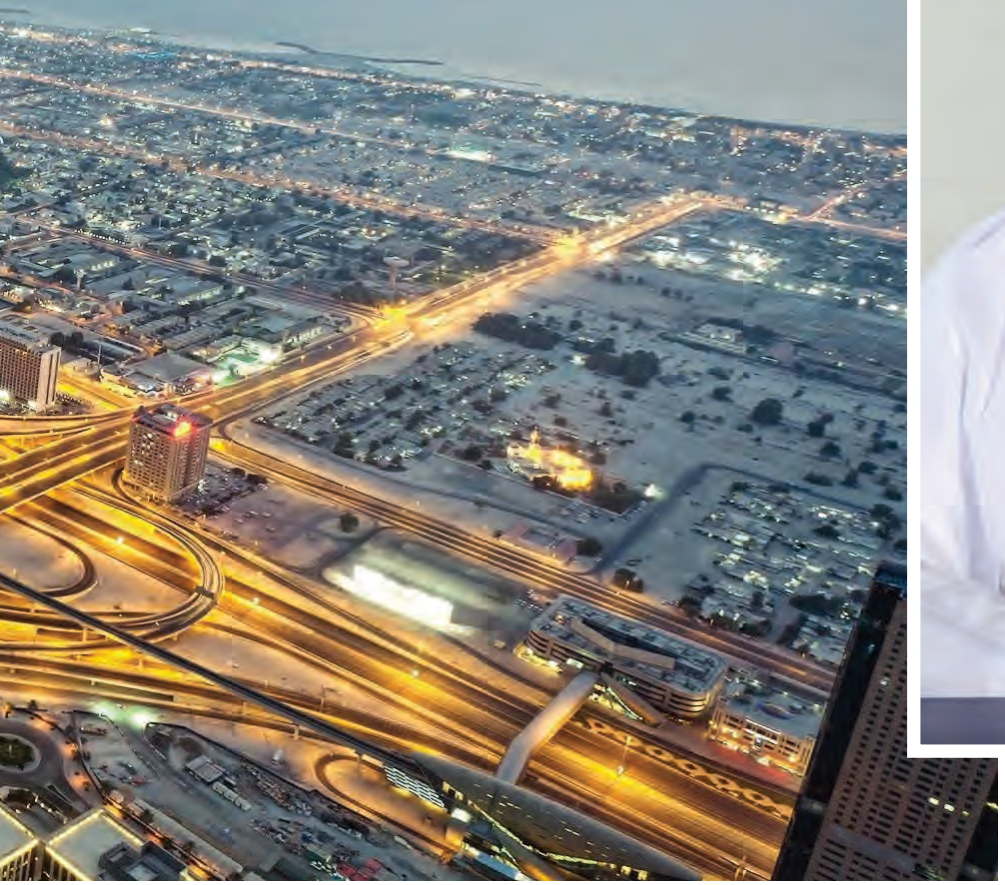
***Thinking Cities* (TC): As a start, could you please present to our readers the very ambitious Dubai Government Initiative, aimed at transforming Dubai into the Smartest City in the world?**

Under the visionary and charismatic leadership of H.H Sheikh Mohammed bin Rashid Al Maktoum - Vice President and Prime Minister of UAE and the Ruler of Dubai, Dubai has achieved tremendous economic growth and is considered a regional role model. H.H Sheikh Mohammed launched the Smart Government initiative in May 2013, calling on all government departments to make all their services available through smart platforms. The government departments were given until the end of May 2015 to complete the transformation from e-Government to Smart Government.

The Smart City initiative was then launched in March 2014 and has three years to complete. Dubai's Smart City strategy features six key dimensions such as Smart Economy, Smart Living, Smart Mobility, Smart Governance, Smart Environment, and Smart People whereas Smart ICT Infrastructure acts as the common enabler underlying all smart city services.

Smart Dubai envisions a smart and sustainable city that is 'Efficient, Seamless, Safe and Impactful'. Dubai's transformation into a smart city will happen in three phases: Smart Life, Smart Economy, and

Fiona D'Cunha and **Daniela Stoycheva** talk to **H.E Mattar Al Tayer**, Director General, Chairman of the Board of Executive Directors, RTA. RTA is the Roads and Transport Authority of Dubai, the United Arab Emirates (UAE)



Smart Tourism. Smart Life is to do with services - education, health care, telecom, transportation, telecommunication, utilities, and energy. Smart Economy is related to ports, airports, smart bourses, and smart jobs, efforts to support the economy, while Smart Tourism will deal with services related to visas, aviation, smart gates, hotels, restaurants, etc.

What is Dubai Roads and Transport Authority (RTA)'s role in this Smart City initiative?

RTA (established by the Government of Dubai in November 2005) is responsible for contributing to the Smart Mobility dimension of Smart Dubai strategic vision and plays a critical role in transforming Dubai to the Smartest City on Earth in collaboration with other strategic partners (eight public sector organizations and two smart districts – Dubai Silicon Oasis and Dubai Design District).

RTA is mandated to provide efficient transportation in the Emirate aligned with the Dubai economic development plan. RTA's vision is "Safe and smooth transport for all". The continuing development and growth of Dubai as a globally competitive business hub and tourist destination makes the provision of a safe and smooth transport system high priority for the Government of Dubai. To fulfil this mission, the RTA is responsible for developing

transport strategies and preparing supporting legislation, planning and implementing transportation infrastructure projects in a manner that is safe and complies with the highest international standards, and operating such networks efficiently and in the public interest.

RTA has developed a Smart City Strategy in line with Smart Dubai strategy and is responsible for contribution to Smart Mobility dimension among others. As part of it, RTA also revised its corporate strategy and introduced Smart Dubai and People Happiness as key strategic objectives. RTA Smart City roadmap consists of over 50 projects. The Smart Mobility vision of RTA includes all modes of transport such as Metro, Tram, Buses, Private Cars, Water taxi, Dubai Taxi and non-motorized modes such as walking and cycling.

Some noteworthy examples of smart city projects of RTA are for instance:

- Enterprise Command and Control Centre (Integrating all modes of transport)
- Unified Fare Collection – Smart Card
- Smart Bus Shelters
- ICT based Parking Guidance System
- Autonomous Cars (under study)
- Connected Vehicles (under study)
- Hybrid Buses
- Smart Navigation System (Smart Drive)
- Real Time Passenger Information
- Nine Smart Apps serving customers of public transport, private car owners and corporate customers.

You mention that for both the Dubai Government and the RTA it was important to make people happier. How can a smart city bring about happiness?

> ***In RTA, we associate 'happiness' in customers with delivering the smart apps to the public from all social segments"***

RTA's Smart Drive Dubai app

Smart Dubai was born out of the visionary approach of H.H Sheikh Mohammed Bin Rashid to focus the city's unified effort towards its most valued asset - its people. RTA is keen on mapping out an important philosophy in designing services such that they become both accessible and easy-to-use, particularly as we have to tackle and provide services to a culturally diverse group of customers comprising over 200 nationalities. Our focal attention and methodology has revolved around the customer. Therefore, we were keen on using a variety of communication channels with the customers in order to identify their prime service needs and embark on providing them over the mobile phone.

In RTA, we associate 'happiness' in customers with delivering the smart apps to the public from all social segments on one hand, and that the services provided must be seamless, easy and fast on the other. Eventually, we work towards the vision of H.H. Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice-president, Prime Minister and Ruler of Dubai in bringing happiness to people including UAE citizens, visitors, businesspeople and tourists from all over the world. In our vision, a person that is informed about the smart choices available, has them always at hand and can easily use them, is less stressed with daily routines, such as where to park, how much will this cost him and where to get a taxi from at a moment when he badly needs one. Therefore, this person is happier and we can say that, yes, the, smart city brings about happiness.

Could you tell us a bit more about how you engaged the citizens in order to determine their needs and ultimately deliver 'happiness' to them?

In order to maintain excellence in the provision of its smart services, RTA put at the forefront of its priorities to focus on the ongoing improvements and development of smart services. It also enhanced the spirit of innovation among young people, particularly university and college students by launching in

The 'nol' card

January 2015 a contest for the university and college students to develop smart applications. The winners in the contest were announced during GITEX (Annual information technology exhibition) in 2015. RTA also developed a partnership with the private sector and strategic partners to provide quality smart services to the clients.

In the near future, the RTA will be focusing on sustained improvements and development of smart services, and will continue stimulating the creative spirit amongst the youth, especially university students. Moreover, the RTA will also uplift the partnership with the private sector, and strategic partners to deliver excellent and smart services to clients.

RTA believes that 'Customer Needs & Expectations' must be met at all touch points and that modern organisations must act proactively to predict their "Customers' Needs, Expectations, Pulse and even their Customer Appetite". As such, RTA has developed a complete framework to deliver this ambitious goal, calling it "the Framework for Integrated Customer Insight" or the "FICI". Using the FICI framework, RTA Customers are encouraged to give their feedback through more than 14 channels, customer data is then collected, analysed and visualised to discover the customers' needs and expectations. Initiatives and projects are then planned and executed to cover the needs discovered.

In addition, RTA engages with our customers and people of Dubai in many other new and innovative ways. For instance, RTA conducts regular interactions with customers through a Customer Council. It conducts innovation labs inviting customers, students and others to provide feedback and take part in problem-solving and brainstorming for ideas with the objective of achieving people's happiness. It has also established an Innovation Club with representatives from diverse groups giving them an opportunity to interact with top management of RTA and provide customer feedback.

What is Dubai doing to integrate transportation services with transport information and payment services?

RTA has invested in the 'nol' card to be the Unified Transport Payment card for all transport modes including Metro, Tram, Buses, Taxi, Water Taxi and Parking. The wealth of information that is being generated by using the 'nol' cards can be utilized to provide tailored services for customers by understanding their journeys. RTA also has a plan for the expansion of 'nol' for non-Transport payments. The recent initiative towards this is where 'nol' can be used in Dubai Public Parks. There has also been a signing of Memorandum of Understating with Dubai Smart Office to announce 'nol' as a mode of payment for Government or Retail Services.

RTA is developing Dubai Integrated Mobility Platform (DIMP) that will integrate all modes of transport, transport services with information and payment services. The DIMP will offer a comprehensive mobility solution through a single platform that integrates all functionalities and modes/services of transport, and offers a seamless customised journey experience in Dubai. DIMP will integrate RTA and third party offerings for the benefit of Dubai's citizens, residents and visitors, corporates as well as the Dubai Government.

It is important to highlight that H.H Sheikh Mohammed launched Dubai's Autonomous Transportation Strategy in April 2016. This strategy sets an ambitious target of 25 per cent of all transportation trips in Dubai to be smart and driverless by 2030. A joint venture between the Roads and Transport Authority and Dubai Future Foundation, the strategy focuses on four pillars: individuals, technology, policies and legislations and infrastructure. Thanks to a driverless metro, many customers of RTA already enjoy a smart and driverless world-class public transport experience.

Can you compare the 'before' and 'after' Dubai as a Smart City situation?

Like any other complex transformation initiative, Dubai Smart City initiative is a Journey and a work in progress. For the Government of Dubai as well as RTA, this journey will continue in line with Dubai 2021 Plan that envisages a city of happy, creative and empowered people and which is their preferred place to live, work and visit.

FYI

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Experiment and innovate

Jean-François Fountaine, Mayor of La Rochelle and President of La Rochelle Urban Community (Communauté d'Agglomération de La Rochelle), talks to *Thinking Cities*'s **Pasquale Cancellara** and **Thomas Mourey**

During the last few decades La Rochelle has been at the forefront of innovative urban mobility and recognised as a pioneer at national and European levels. From December 2014 to April 2015, La Rochelle hosted a demonstration of Automated Road Transport vehicles in its centre, under the European project CityMobil2. The positive results achieved have confirmed the city's willingness to go further

La Rochelle benefits from a generous choice of public transit options and modes

in the integration of automation in urban mobility. Mr. Jean-François Fountaine, Mayor of La Rochelle and President of the Urban Community (Communauté d'Agglomération), speaks to *Thinking Cities.*

M Fountaine, could you please tell us why your city decided to take part in the CityMobil2 project? What were your main expectations from the project's onsite demonstrations?

For years La Rochelle has been a city turned towards innovation and experimentation, our credo being innovative and electric powered vehicles. Therefore, the CityMobil2 project offered a step further, building on the earlier demonstrations conducted in 2008 and 2011. Through CityMobil2 we wanted to test the reaction of La Rochelle's inhabitants towards the potential of introducing these vehicles in our local urban transport mix.

What were the main obstacles that you had to overcome?

I wouldn't say we encountered barriers but rather some reluctance and difficulties to overcome. In the first place the lack of legislation on automation did not facilitate the startup of our demonstration. But in the end, the continuous dialogue we set up with the Ministries has been very useful to our demonstration and beyond; the subsequent demonstrations in France have benefitted. We made a choice, not the easiest one, to conduct this experimentation in the centre of the city, in an open environment, which necessarily implies sharing the road with other users such as cyclists and pedestrians. We also found some "ideological barriers" of the type "Automation equals job loss".

Could you highlight some lessons that you learned from your involvement in the CityMobil2 project?

Firstly that in such demonstrations, ambitious by nature, you have to keep your feet on the ground, not to become too vainly ambitious, not to believe that automated transport addresses all problems and questions. Realism must preside and a real service must be brought to customers. Secondly that the inhabitants of La Rochelle Urban Community are committed to innovation in transport and they are especially enthusiastic about our "city as a living lab" status!

Lastly I would say that social acceptance of automation is underway and there is a real need and place for this type of transportation, judging by the proliferation of automated vehicles experiments since we made our first test.

The city of La Rochelle has recently integrated ARTS (Automated Road Transport System) into its SUMPs (Sustainable Urban Mobility Plan)? How do you see the role of automation in the city's long term sustainable mobility plans?

Our public transport network is being redesigned and will be implemented from September 2017. We already imagine that some automated road transport system will complement the more conventional transport services (for the "first"/"last" mile) possibly in the heart of some activity parks (I'm thinking notably about Atlantech Low Carbon Park) but also in the city centre itself, to support the actions we took to prevent the Old Harbour from becoming overun with car traffic.

Automated transport systems play an important role in the urban transport mix particularly in complementing the traditional transport services (the so-called 'last mile' or 'first-mile'). Where exactly in the city do you think ARTS can make a true difference - university campuses, tourist areas, etc.?

A prerequisite for this is an evolution of the legislation and an improvement of the technology to fully meet our needs. Safety is crucial: it was our number one priority for the past

demonstrations and it will be in the future. Automation in transport is being closely watched, and some accidents have already occurred.

Different types of automated transport systems in the city - and beyond the city centre - can be imagined in the future (shuttles, convoys of shuttles or buses if needed).

As I said I think automated shuttles have a future if they come as a complementary mode in the transport supply chain, in particular if they are linked to our BRT lines, in order to feed them. Such vehicles may be used for tourism purposes or more generally as a "last mile" complement in the historic heart of La Rochelle, but they could also be seen as an aid to walking – which is something we also try to stimulate.

Some other uses might be considered, notably to manage more efficiently our electric car-sharing service YéloMobile. Imagine YéloMobile electric vehicles that can go by themselves closer to the customer or relocate to a station in order to meet the demand.

In areas other than the historical city centre (with larger avenues or boulevards), we could imagine the circulation of bigger vehicles that would circulate on a dedicated lane. This could be an answer to the weak point represented by the speed limit we encountered during the CityMobil2 demonstration in our city. It is also conceivable that automated vehicles could be used in urban logistics, a topic on which we are currently working to define a strategy.

Whatever the uses might be, what is certain is that we do not want these vehicles to be "gadgets" or a simple attraction. They must address a need, and ensure a mobility service - both efficient and flexible.

How do you see the future of automated vehicles in Europe? Will they become a true alternative on a collective level (public transport) or more on an individual base?

Both, I would say! But not at the same time. Car manufacturers are currently working hard to develop automated cars. I am fascinated by the acceleration of their developments. But I believe that in the years to come, the car manufacturers will deliver cars offering very advanced and efficient "driver assistance" systems rather than a "full automation" system: it will take some time before we see autonomous cars go where you want, from door to door, on all types of road.

But if we talk about the near future, we need to think collectively. We must also think about the public space in our cities ... and this space is becoming more and more valuable. We want a quiet and peaceful city. We do not want to replace bottlenecks of individual conventional cars by traffic jams of autonomous cars. That is why I favour a collective approach - as an efficient, flexible addition that encourages us to use public transport.

We of course keep in mind that individual autonomous car will also circulate on our roads in the future, and that all systems will need to be (inter-)connected. What is immediately at stake now is to improve the legislation that allows these vehicles to operate in town permanently beyond one-off demonstrations.

What would be your recommendations for other cities wishing to demonstrate or deploy automated systems?

To form a strong local partnership (mobility authority/city, operator, research laboratories, etc.) made up of actively involved and committed people.

To prepare upstream the consultation with stakeholders, make sure that every aspect of communication and information dissemination is not left out.

To have a clear vision of how the whole system could work, consider its integration with the other modes of transport and road users and think about an integrated pricing system.

What would you recommend to the European Commission and to the industry sector?

To quickly adopt a standardised regulation at a European level (at least). To keep helping those cities wishing to go further in the introduction of automated vehicles in urban areas, despite the diverse or complex environments. And by doing so, contributing to the move from pilot experiments to a permanent offer of an automated transport service.

And still pay the closest attention to the human: automation must be introduced in order to free human beings from painful or repetitive tasks. As far as transport is concerned, automation can have extremely positive effects on road safety and environment but it can also have a negative impact if the process is not managed properly. This is why the European Commission must, in parallel to demonstrations, develop in-depth studies on the impact of automated systems in the city, including those focusing on the interaction of these automated vehicles with pedestrians and cyclists.

FYI

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Holy City, wholly mobile

Pasquale Cancellara discusses Jerusalem's urban mobility priorities and plans with City Council Executive Member **Fleur Hassan-Nahoum**

The continuing trend of focusing on mass transit and non-motorized modes will be the most noticeable to Jerusalem residents

How would you describe transport in Jerusalem? What are the main challenges and trends currently? Jerusalem as a city continues to expand and change dynamically in terms of culture, economy, land use and transportation. The state of our mass transit today versus a decade ago is a drastic leap forward due to national and local measures continuing to build upon each other for further progress. One such example is the nationwide rollout of the Rav-Kav (reloadable smart-card payment system) replacing multi-pass paper purchases, which allowed for local buses to introduce all-doors boarding to reduce dwell time at stations.

The landscape of the main commercial corridor in Jerusalem, Jaffa Street, used to feature a four-lane roadway congested with private traffic and over a dozen bus lines. Since 2011, Jaffa Street is home to a pedestrian plaza extending over two kilometers, lined with retail stores with the Jerusalem's first light rail transit (LRT), the Red Line, running along its median (below).

This new mode of transit connects over 250,000 residents in various neighborhoods to the downtown core and brings visitors directly from the central bus station to the Old City and its holy sites. The completion of bus rapid transit (BRT) lanes along the main north-south vehicular corridors of Hebron Road and King George Street have significantly sped up bus travel times from the outer districts to the city center. With two future light rail lines currently in the design phase with an opening anticipated in 2025, we look to a transformed Jerusalem for the better use by its residents and its visitors.

The continuing trend of focusing on mass transit and non-motorized modes will be the most noticeable to Jerusalem residents in the coming two decades. To build upon the physical infrastructure gains, the municipality has developed an application Maslulan (translated as "Router") to provide better point-to-point navigation within the city by including both the light rail and bus networks. The main challenge is the speed of rolling out these enhancements – the first light rail line took over a decade to construct. However, the construction of three park-and-ride stations in addition to the ongoing extensions of the Red Line towards the Hadassah Ein Kerem Hospital and the campuses of Hebrew University, both being major public institutions with thousands of daily commuters, have progressed at a faster ace.

Jerusalem has recently released a Low Emission Zone (LEZ) programme – what are its main features and what kind of impact will it have on the city?

Further quality of life gains for Jerusalemites are in the works via the Low Emission Zone or LEZ program – a cooperative plan between the Jerusalem Municipality and the Ministries of Transportation and Environmental Protection. The aim is to limit the access to heavy trucks and bus to the city centre during business hours and to allow it only to newer and less polluting models. This will reduce vehicle usage or shift users to cleaner vehicles, for local businesses receiving deliveries and for public or private buses crossing the downtown area.

The measure is expected to reduce air pollution primarily within the LEZ cordon but will also generate spillover benefits to the rest of the city with the cleaner vehicles traveling on their streets. In order to provide public outreach and education on the benefits and restrictions of this environmental cordon, there will be a gradual introduction of the LEZ with warnings given to offending vehicles starting in mid-2017 and fines only starting towards the end of 2018. In short,

Sustainability is high on the agenda in Jerusalem

with the implementation of the LEZ – Jerusalemites will breathe in cleaner air within and beyond their downtown pedestrian zones within several years.

The EU wants to phase out conventionally fueled vehicles by 2050 and move towards carbon neutral urban logistics by 2030 (European Directive on Alternative Fuels and Infrastructure) - does the city of Jerusalem have an alternative fuels plan for the future?

Jerusalem approaches alternative fuels as a potential solution to reducing the environmental impact of necessary municipal vehicles, whether it be trash collection trucks or industrial buildings. With the anticipated arrival of the national natural gas pipeline to the city in 2019, the municipality is conducting a feasibility study on the creation of a CNG (compressed natural gas) fueling station for municipal and private use. Furthermore, there is currently an investigative study underway on the impact of biodiesel fuels on the existing fleet of municipal trucks to ascertain if increased emissions or engine damage will occur over the long-term use of biodiesel.

How do you see the role of alternative modes of transport in the city – walking, cycling, car sharing?

Non-motorized modes of transportation, mainly walking, already act as the 'last leg' of many trips within Jerusalem. Encouraging the use of bicycles, despite the hilly topography, is an ongoing commitment via the additional construction of bike lanes in and around the city. Recently, a 42-kilometer long bicycle pathway was opened to the public as part of the completion of the Jerusalem Park, which belts the city in green and provides recreational facilities for residents along its length.

In the coming decade, a bike-share program is in the works for the downtown area of the city. Since even walking and cycling cannot cover all the residents of Jerusalem, especially the burgeoning demographic sector of children, car-sharing and shuttles are the approach we are pursuing to provide for their transit needs. In fact, car-sharing is already occurring organically within the dense confines of the ultra-Orthodox populated zones of Jerusalem, where limited parking and limited incomes give way to shared use of vanpools – all without any city intervention or subsidy.

On a more formal level, the municipality continues to expand shuttle access to holy sites in the Old City, to major sporting events, and to large office parks on the outskirts of Jerusalem – all free of charge from park-and-ride lots located out of the way of residential areas to alleviate the burden on local residents near such high-demand venues. Last but certainly not least, cooperation between local city government and a local NGO is working to improve the walking infrastructure for residents and organize active outdoor activities for healthier citizens. As the LRT and BRT lines continue to expand, the freed-up space in the streets will allow for wider and greener pedestrian zones for both transit and cultural events.

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

The model cities that Jerusalem aspires to match or even surpass are Rotterdam, (The Netherlands) with regards to the LEZ and Freiburg (Germany) with respect to the LRT.

The German city's extensive tram network combined with feeder buses acts as a parallel to the Jerusalem plan of three light rail lines criss-crossing the city – two in a north-south direction and one going east-west – with bus rapid transit lines spurring off to local neighborhoods. In its own right, the recently expanded LEZ of Rotterdam acts as a good example to Jerusalem with the similar gradual buildup of the area from the city centre outwards along with expanding the enforcement from only trucks and buses to private vehicles. Jerusalem is keenly interested in learning more about the implementation and enforcement issues of LEZs as well as the development of grassroots measures to encourage the healthy lifestyle of residents.

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Environment and Health in Transport

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

- **Ile De France:** Making EV charging at home a reality
- **Portland:** Technology supporting bike commuting
- **Electric Vehicles:** Do we have the infrastructure to cope with EV demand?
- **Trondheim:** Green transport is on the rise - finally
- **Sarajevo:** The challenges to the future development of urban cycling

Photo: Transport for London

Building a charge

BienVEnu: making EV charging at home a reality, by **Fanny Granger**

BienVEnu is a demonstrator that aims at developing and testing new EV (electric vehicle) charging solutions in existing residential housing blocks (condominiums, private and social lessors). This three-year project, based in Paris and its outskirts, seeks to simplify the deployment of EVs with innovative technology and an enhanced commercial offer for its easy adoption.

Coordinated by Enedis (ex-ERDF), it brings together eight firms, big and small: Enedis, CentraleSupélec, Clem', G2Mobility, Nexans, Park'n Plug, Tetragora and Trialog. It is part of ADEME's Investments for the Future Program, and gets support from the Ile de France Region.

THE COMPLEX ISSUE OF RECHARGING IN COLLECTIVE HOUSING

The French national legislation supports EVs as one of the main contributors to low carbon politics. In the next few years, residential housing will become the main location for recharging EVs. However, charging EVs in such an urban area remains difficult and expensive, and public charging points can't assure the ever-growing need by themselves.

The BienVEnu project tests out a number of experimental approaches to solve that problem, and specifically the complex issue of recharging in collective housing. The goal is to recruit 10 buildings by the end of 2016 and have them equipped quickly afterwards, allowing time to adapt according to each situation and feedback for the duration of the project. BienVEnu is based on new and smart technologies, including but not limited to smart charging and modularity, making it a viable solution on the long term.

- **Smart charging:** the infrastructure is made to be efficiently controlled by the way of an algorithm developed specifically for this purpose, the use of smart charging points and a "smart box", allowing for it all to function properly.
- **Modularity:** most charging stations are built based on the "star"-form or hub. BienVEnu proposes an alternative with a

cable called a "bus" that goes along the parking spaces, allowing for new charging points to be easily added even after the parking is fully equipped.

Moreover, BienVEnu not only aims at studying the technical, economical and regulatory challenges of collective housing charging but also sets out to offer a fully functioning and

sustainable electromobility service. EV users living in buildings taking part in the project will have the opportunity to recharge right at home, and a car-sharing service will also be available to all residents. They will be assisted in all their EV needs: reservation platform, maintenance, simple billing system.

THE CHALLENGE OF ACCESSIBILITY

One of the challenges BienVEnu works towards solving is accessibility and comprehension. As it is, the public has little access to EVs in France, except for publicly shared cars available in Paris. EV owners have a tough time finding solutions when it comes to recharging, and prospect owners find it disenchanting to think about. French legislation has changed these past years to support EV deployment, but misconceptions and little access still constraint it. This is where BienVEnu comes in.

Not only does it boost accessibility for existing users, it is also an opportunity for everyone to become one. With this solution to EV charging at home, BienVEnu makes it simpler for everyone to discover (and adopt) electric mobility, from condominium owners to private and social lessors. In addition to private charging stations, the project includes a car sharing service, making it easier for residents to familiarize themselves with electric mobility, and allows them to "test drive" before making a final purchasing decision. BienVEnu also explores other options of collective mobility, in the forms of carpooling and "peer to peer", a service which allows EV owners to share their own vehicles and/or charging points with others.

The project so far

- Five buildings recruited, with a goal of 10. Out of the five, two have now been equipped.
- "Grand Prix du Jury des Trophées de la Transition Energétique" (Grand Jury Prize for the Energy Transition Trophies, held by l'Usine Nouvelle) received in June
- Elected by the public as one of the 47th "100 projects for climate" (out of almost 600 submissions), an initiative by the French Environment Ministry.
- Invited to be presented to the French President and French Environment Minister at the Elysée for the first anniversary of the Energy Transition law, side by side with only 6 other projects

ONE YEAR IN, TWO TO GO

The partnership celebrated its first anniversary on 4 October 2016, with the inauguration of the first building equipped with the solution. In the 19th arrondissement of Paris, partners and guests gathered around the new infrastructure.

The residents of the SNI Île-de-France building are the first to benefit from the solution. The system installed in the building's parking lot has six charge points for the residents' electric cars as well as two car sharing charging stations with two available vehicles (a Renault Zoé and a Mitsubishi Outlander). Users/residents register (at no charge) on a dedicated platform where they can then reserve either of the vehicles for a specific time. "I believe this is the future", declared the first user of the service during the event.

The celebration came after a year of developing technical solutions and meeting with building managers, finding the right approaches and understanding what did and did not appeal to the different actors at play. This was done by way of a behavioral analysis that will go on for the duration of the project, helping the partners adjust and making a real and effective offer come to life.

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Cycles of invention

Supporting bike commuting through technology: **Zach Henkin** reports on a regional pilot project that looks at benefits and barriers to the adoption of electric-assist bicycles for commuters

The City of Portland, Oregon currently has claim to the largest percentage of bicycle commuters for a large city within the United States. These commuters make use of the bike lanes, trails and other city infrastructure and contribute to a less congested transportation systems and cleaner air by lowering the amount of vehicle miles travelled.

These active-transportation commuters also enjoy further public health and quality of life benefits. However, until now, converting individuals to bike commuting has focused on road infrastructure and safety and not on other barriers, such as ease of the ride itself and eliminating the concern of hills and distance.

Electric bicycles, already an overwhelming success in Asia and Europe, have received a limited reception in American markets. While bicyclists in Asia and Europe are already thinking of and seeing bicycling as an inherent part of urban transportation, many in the United States still see it as purely, or mainly, recreational.

As cities become more congested, they will need to plan for and support smart infrastructure. Multimodal transportation will become a necessity for cities that are absorbing population gains while also trying to achieve sustainability goals. Two-wheeled mobility solutions such as bike shares and electric bicycles will become an increasingly important piece of the urban transportation puzzle, especially as they relate to first-/last-mile transportation solutions. With these exciting changes, the electric bicycle is poised to become the next big thing in urban transportation in the United States.

Drive Oregon conducted an electric bicycle pilot project to identify how attitudes and perceptions toward electric bicycles changed after usage and a social media campaign to increase interest and exposure to electric bicycles and their benefits in Oregon.

ELECTRIC BICYCLE TRANSIT CONNECTION PILOT PROJECT

In partnership with the Transportation Research and Education Center of Portland State University and Kaiser Permanente Northwest, Drive Oregon's electric bicycle pilot sought to make findings on how electric bicycles were perceived by study participants, and to test whether a folding electric bicycle could be a reliable transportation option when paired with public transportation.

The electric bicycle chosen for the study through a public request for proposals process was a Currie iZip E3 Compact. The primary criteria for the bicycle selected were that the bike was foldable and have a peddle-assist cadence electric assist function.

The project took place between April 2014 and September 2015 in the Portland region on three Kaiser Permanente Northwest campuses. Employees were issued an electric bicycle for 10 weeks to use for a variety of transportation needs, but especially focusing on first-/last-mile commuting combined with public transit. Participants were asked to complete surveys before, during, and after use of the electric bicycle.

The program consisted of six cohorts of participants of about 30 employees each at the three regional campuses in a different part of the Portland metropolitan area. Cohorts participated in the study for 10 weeks. Before the study, about 45 per cent of participants had biked in the past month and cited as barriers to biking more often being: bad weather (50 per cent), logistics (41 per cent), the need to carry more than the bike could handle (36 per cent), sweat (32 per cent) and hills (29 per cent). Electric bicycles are particularly well-suited to address the last two concerns; sweat and hills.

RESULTS

Results from the participant surveys were analyzed using statistical software and GIS. Results showed that participants biked farther, were more confident, and generally perceived fewer barriers to making trips due to the ease in overcoming hills and reducing sweat. The study found that "over half of the respondents (56 per cent) reported using the electric bicycle to commute to work at least once a week, and over a fifth (22 per cent) used the bike three or more times per week." Even better, "overall, the number of people commuting to work by bicycle at least once per week more than doubled during the study."

Overall, bike confidence increased throughout the pilot with 28 per cent showing a greater confidence while only 13 per cent indicated a decreasing confidence at the end of the 10 weeks. Participants felt that the electric bicycles "were comfortable (89 per cent), fun (92 per cent) and easy to use overall (93 per cent)." They also felt safe (92 per cent) and more comfortable in traffic (67 per cent) compared to standard bikes and had an overall positive experience (75 per cent rated the experience as good or very good, versus only 4 per cent reporting poor or very poor).

The study suggests that electric bicycles do enable users to bike more often, and increase the frequency of biking even for people who previously rode a conventional bicycle as part of their commute. Electric bicycles are also enabling those who might otherwise not bike because of physical limitations or proximity to their destinations to use a bicycle for their transportation needs[2].

SIMILAR INITIATIVES

Other regions and cities across the country are examining other aspects of two-wheeled urban transportation such as mobile electric bicycle sharing. Solar Oakland, a community partnership to bring sustainable urban transportation via solar-powered electric bicycles and scooters to Oakland, California, launched a pilot program in January 2016.

The pilot program brought eight solar-powered bicycles to Jack London Square in south Oakland. The electric bicycles were provided by Mahindra GenZe and housed in a custom-built solar-powered charging station from DC Solar. The pilot program allows commercial residents daily use of the electric bicycles so that they can experience and explore Oakland in a new way. Bike Solar Oakland is collecting data on the bicycles, the solar panel power, and how the station is being utilized, and hopes to expand the pilot project growing to ultimately serve larger transportation needs of Oakland[3].

Because solar-powered and electric bicycles can be an important part of existing sustainable transit models, providing residents with alternative, efficient, and sustainable transportation options, innovative transportation projects like Bike Solar Oakland's pilot program and the Portland electric bicycle pilot project serve both smart cities: connected, urban, and thriving. Taken together, pilot projects like these pave the way for comprehensive campaigns to increase adoption of electric bicycles across the country - and to move them out of the realm of early adopters into an essential part of the urban transportation fabric.

CONCLUSION

As cities become more urban and denser, they will need to create innovative and usable transportation solutions - and electric bicycles are primed to become a large piece of that puzzle. Electric bicycles can reduce barriers to participation in cycling. While barriers like hills and sweat stand in the way for many commuters to adopt bicycling

as their primary transportation, an electric-assist bicycle can mitigate these barriers. Electric bicycles can also make people more comfortable on and with a bicycle, as well as encouraging more trips by bicycle.

The pilot program and subsequent outreach shows that there is an inherent interest in electric bikes and we encourage other communities to consider similar programs. Electric bicycles can increase biking in urban areas because they provide electric power assistance, which can address the limits of trip distance, physical ability, and terrain. Because of this, electric bicycles and bike sharing programs are a great solution to the growing demands of urban and smart cities.

As a next step, Drive Oregon plans on seeing how electric bicycles, particularly electric bicycle share programs, can increase EV adoption in low-income communities. Our own pilot was limited by the demographics making up Kaiser's employees. As a result, 88 per cent had a household income over US$50,000 (and 48 per cent over US$100,000). While we expect the barriers for low-income communities to be similar to those found in the Kaiser study, an additional pilot may uncover additional concerns, such as electric bicycle cost, safe electric bicycle storage and overall community safety.

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Fuelled by electricity

The electric vehicle revolution is only just getting started. In the next year or two, the market could really take off. Do we have the infrastructure to cope with this? **Johan Sjöberg** investigates

Photo courtesy of Transport for London

There could be 50,000 electric and other ultra low emission vehicles in London in just four years' time

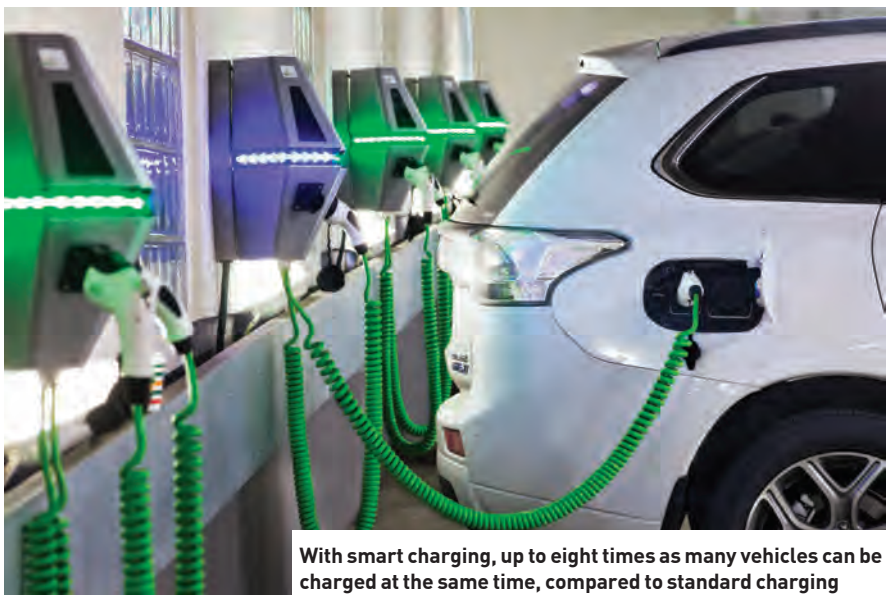
Starting next year, London's fleet of black taxis will be going electric. From January 2018, a little over a year from now, no new diesel taxis can be registered.

This illustrates the speed at which the world of transport is switching from combustion engines to electric drive. Although the pace of change in the London taxi fleet is accelerated by the need to cut pollution in the British capital, it also shows how technology has reached a point where widespread use of electric vehicles has become not just feasible, but almost inevitable. We are at a tipping point.

Consumers in the UK market had five electric vehicles to choose from In 2012. Today, the number has grown to 39 while prices have dropped, the operating range of the batteries has improved and incentives have become more generous. Between 2007 and 2010, the number of plug-in electric vehicles sold worldwide totalled just under 12,000. In 2015, sales exceeded hall a million. Over the last five years, global sales have increased more than ten times.

In Norway, the country with the most developed market for electric vehicles, 22 per cent of new vehicle registrations were electric in 2015. Other markets are in catch-up mode. In the Netherlands, plug-in electric vehicles had 10 per cent market share in 2015; Sweden had 2.5 per cent; France 1.2 per cent; UK 1.1 per cent; and Germany 0.7 per cent. When market penetration in large

"Cars remain plugged in for much longer than the charge requires, so there are opportunities to stagger the charging over time"



With smart charging, up to eight times as many vehicles can be charged at the same time, compared to standard charging

economies start to approach the same level as in Norway – and this could start to happen in the next couple of years – this will have a serious impact on the world market for electric vehicles.

This will reduce the need for fossil fuels, but increase demand for electricity. So where are all these electric vehicles going to charge? When the electric car is stationary and plugged in, it is a rather power hungry device. Charging an electric vehicle takes a minimum of 2300 watt, placing it within the ranks of the greediest household appliances such as heater fans, kettles and hair dryers. But while the hair dryer is only used for five minutes at a time, the car charger will stay on for eight hours, as 2300 watt will only give a slow charge. For semi-fast charging, nearly ten times higher output is needed and for fast charging, twenty times more.

HIGH POWER USER

While car manufacturers have stepped up to the challenge and bring new technology to the market at a rapid pace, the charging infrastructure shows few signs of changing.

"A plug-in vehicle requires 6 to 10 kWh per day. This is a lot of energy compared to other loads," says Patrik Lindergren, MD of charging equipment manufacturer Chargestorm.

"Most installations use 16A, single phase, but if you have more chargers, you require more output. Some vehicles, for instance Tesla, can use three phase current, enabling charging up to 11kW, assuming that you have access to three phase current at your property," says Lindergren.

But even if appropriate charging equipment is installed in or near homes, the distribution network does not have enough capacity for all households to draw maximum demand at the same time. The network is sized assuming everybody have different patterns of behaviour. This may work when providing energy for cooking Sunday lunches, but when it comes to work commuting, we all tend to move like one herd – just look at the rush hour in our big cities. This crush is about to be mimicked on the electricity network, as everybody get back at night at the same time and put their electric vehicle on charge.

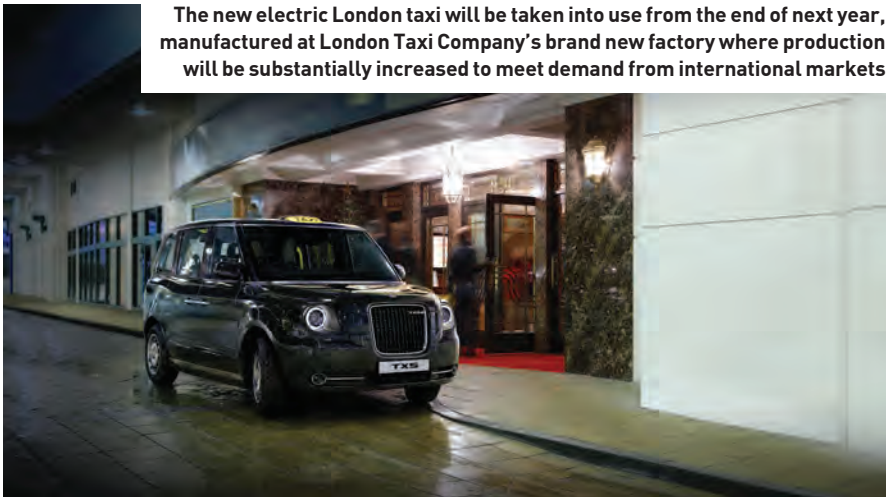
"Fortunately, cars remain plugged in for much longer than the charge requires, so there are opportunities to stagger the charging over time. Smart chargers can also balance the load between vehicles. For instance, if two vehicles are plugged into a system that would normally supply 22 kW, they can be allocated 11 kW each. By cleverly arranging the charging cycles, up to eight times as many vehicles can be charged during the same time period. Similar technology can also be used at electricity substations to balance the power on a neighbourhood level between households in areas where many draw high loads," says Lindergren.

"But this is on the condition that you don't draw more energy than the electricity infrastructure can provide. Utility companies have a standard tariff up to a specific output, for instance 63A. Above that, a price penalty is applied. This can be very high, perhaps fifty times as high per kWh as the standard rate. This can make some investments unprofitable," Lindergren points out.

NO ROOM FOR DIY

However, keeping your vehicle plugged in for a long period of time brings it own issues.

"While the wiring in your house



The new electric London taxi will be taken into use from the end of next year, manufactured at London Taxi Company's brand new factory where production will be substantially increased to meet demand from international markets

Photo courtesy of Transport for London

The rush hour could get replicated on the electricity network if everyone arrives at home at the same time and puts their electric vehicle on charge

might be fine for bursts of, say, half an hour during normal use, it may not be up to prolonged use with high output, such as required for charging a vehicle. This can result in elevated temperatures and a house fire," warns Per Höjevik at the Swedish National Electrical Safety Board..

"We recommend that a dedicated charge point is used, installed by a qualified electrician who can check that the wiring is sound all the way back to the fuse board."

Electric vehicles are supplied with a Mode 2 cable designed to plug directly into a wall socket. However, anecdotal evidence suggests that car owners often use extension cables that do not meet the same standards as the charging equipment, even running these through open windows and across pavements.

"A Mode 2 cable should be used without extension leads on a dedicated circuit protected by a 10A fuse and a residual current device. The output is restricted to 2.2 kW so charging will be relatively slow," says Jostein Ween Grav, senior engineer at the Norwegian Directorate for Civil Protection, which counts electrical safety among its duties.

"A wall-mounted Mode 3 charger is a far better alternative. The appliance, with its external cables, can be used for either slow overnight charging or semi-fast charging, from 3.6 to 22 kW, which will likely become the norm in the future. There is no risk of overheating or fire and it has a built-in RCD. Mode 3 can also be used for load balancing and for communication within the electrical installation. This will be especially useful as electricity prices here in Norway will vary on an hourly basis from 2018, with all households being fitted with a new electricity meter for this purpose. If you want to take advantage of all the benefits a modern electrical vehicle can offer, a Mode 2 charger with an ordinary wall socket is no alternative," says Grav.

CHECK INCOMING

The electrical installation in most private homes can support two 3 kW charge points or one 7 kW charge point. Some older properties with lower capacity supplies may require an upgrade to the incoming supply.

British utility company Scottish & Southern Energy (SSE) has highlighted how local networks may require upgrades due to the effects of clustering, or the tendency of people to be inspired by their neighbours. Driving an electric vehicle has many advantages and users tend to become very attached to the concept. If they manage to rouse their neighbours' interest, the reasoning goes, there could be a strong uptake in a particular small area. Such clusters could have a disproportionate impact on parts of the network. Scottish and Southern Energy modelled a scenario where 40 per cent to 70 per cent of homes on an average street would have electric vehicles. If this were to happen, one-third of all low-voltage circuits would need to be upgraded.

SSE introduced a solution using monitoring technology in the substation and at the charge points. This way, the company could control the

The batteries of electric cars not in use might get used as energy storage to stabilise energy supply from alternative energy sources such as wind and solar power

charging when capacity was nearing its peak, allowing all of the cars to be charged through the night without overloading the system. This can be used either on a permanent basis, or as a temporary solution until the network can be reinforced. The company now monitors its network for the growth of potential clusters.

CUT THE PEAKS

"There is enough energy to run the entire vehicle fleet on electricity. The problem is one of output. If everyone charges their vehicle at the same time, there will likely be a bottleneck situation," says Stefan Pettersson, associate professor and research manager for electromobility at Viktoria Swedish ICT research institute in Gothenburg.

"There may be problems on a household level, if you charge your vehicle and run the washing machine at the same time; there may local be problems at the substation if the whole neighbourhood try to charge their vehicles at the same time; or three may be major infrastructure problems if the whole nation arrives home from work and start to charge simultaneously.

"The priority in any demand management system is to cut the peaks. The peaks drive the costs. One obvious solution is to stagger charging over time, for instance throughout the night. At the moment we are running a research project aimed at finding out whether this will be acceptable to users. I suspect that to some users, it will be very important to have their vehicle fully charged and ready to go in the shortest possible time. Others will want to charge at the lowest tariff available. Still others will prefer to charge when green energy is available. By asking the users about their preferences, I think we will be able to find a way to spread charging over time."

PAYMENT MODELS

"We are also running a project looking at options for charging at dwellings with shared occupancy, such as blocks of flats. There are different models for sharing the cost. At the moment it seems that the most successful way is to apply a flat charge to all the parking spaces in an area, or to all spaces with charging facilities. The electricity itself is so inexpensive that it is hardly worth the cost for metering the energy and identifying the user.

"Another aspect is that we may see car ownership come down in the future. Owning a car seems less important to young people of today than for previous generations, with fewer of them learning to drive. The high purchase price of electric vehicles, combined with another social trend, the sharing economy, may result in a drop of the overall number of vehicles purchased. This will have knock-on effects on the need for infrastructure."

INFRASTRUCTURE IS KEY

"I have worked with this for about seven years. When we started working with plug-in hybrids at Volvo, we naïvely thought that all we had to do was to replace the driveline in the car. As far as the car goes, that

The charging infrastructure is key to the development of the electric vehicle market

holds some truth; it's still an ordinary car with a different driveline. But the infrastructure is the bottleneck. There has to be an infrastructure that works for people," says Johan Konnberg, senior advisor for E-mobility at Volvo Car Corporation.

"For as long I've worked with this, sales volumes of electric vehicles have doubled each year. Do I think this will continue? I think it will accelerate. Several car manufacturers are now launching some very attractive models that are entering the market in 2017 and 2018. I don't have a crystal ball, but I think we will see a significant growth," says Konnberg.

One organisation that has crunched the numbers is Transport for London (TfL), the local government body responsible for the transport system in Greater London.

TfL believes that ultra-low emission vehicles, which includes battery electric vehicles, plug-in hybrid vehicles, range-extended electric vehicles and hydrogen fuel cell electric vehicles, will represent 100 per cent of sales by 2040. In its most ambitious scenario, these vehicles will have reached 60 percent of sales by 2030. In a more conservative scenario, sales will have reached 30 percent by 2030. Under the conservative scenario, the number of these vehicles in London will be over 20,000 in 2020 and will be approaching 100,000 in 2025. This means a 25-fold increase in these vehicles in London, assuming the conservative scenario. In the more ambitious scenario, the number of these vehicles in London is estimated to reach 50,000 in 2020 and reach 220,000 in 2025.

LONGER RANGE AVAILABLE

Like Konnberg at Volvo Car Corporation, TfL recognises that the key to getting more electric vehicles on the road is a large number of charge points, giving users the confidence they can charge up when they need to.

Car manufacturers are now bringing electric vehicle technology to the market at a rapid pace

The organisation plans to use its own fleet and public sector procurement to accelerate uptake. A rapid charge point network will be deployed by 2018. Plans to provide charge points for residents without off-street parking are also taking shape.

"Electric vehicle technology is now sufficiently well developed for a wide market breakthrough. Many customers are asking for longer range, and this is something we see being delivered by major manufacturers, says Francisco Carranza, managing director for Renault-Nissan Energy Services.

"The trend towards shared mobility works great in tandem with electromobility, reducing the number of cars on the road. This is a complementary ownership model; we don't see it as cannibalising the private ownership market. More efficient use will drive down costs and make car travel affordable for new users in markets where mobility would otherwise be too costly.

Carranza also sees opportunities for using the batteries of stationary electric vehicles as an energy store, a concept known as vehicle-to-grid.

"Private cars are under-utilised. Average usage time for cars is 4 per cent and average occupancy is 1.3 passengers. Vehicle-to-grid charging could make use of the vehicle during the time it is not being driven. It could even open up for new ownership models. Imagine, for instance, that you might get paid to own a car.

"The battery capacity of parked electric vehicles can be used to stabilise the power supply when using alternative energy sources such as solar or wind power. Millions of cars can be consolidated to make up one large energy store. This can be a huge help to decarbonise the energy sector.

"No big changes are needed to the physical infrastructure to achieve this. The main obstacle is the national regulatory framework in different countries, as provisions have to be made for selling electricity to the network," concludes Carranza.

So although a cursory look at an average traffic queue may suggest that fossil fuelled private transport is here to stay, radical change may be just around the corner.

'The stone age did not end for lack of stone and the oil age will end long before the world runs out of oil,' predicted Saudi Arabia's oil minister Sheikh Zaki Yamani back in the 1970s.

It seems he might have had a point.

FYI

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Increasingly green

A recent survey[1] showed that public opinion has turned in favour of greener transport despite initial resistance. It's certainly on the rise in Trondheim, Norway, as **Chin Yu Lee** and **Bjorn Ove Berthelsen** report

"Thank you for cycling"

Photo: Miljøpakken

Trondheim is situated in central Norway and is the country's third largest city. The city covers 342.3 km² and is a major logistic hub for the region of Trøndelag and Mid-Scandinavia. It has 188,000 inhabitants, approximately one sixth of which are students. Hosting the Norwegian University of Science and Technology (NTNU) and SINTEF, the biggest independent multidisciplinary research institution in Scandinavia, Trondheim is known as the technological capital of Norway.

During the last few years, Trondheim has achieved a shift from standard cars to greener transport modes that have never previoously been seen in a Norwegian city. The quick result has been achieved due to political resolve and a policy mix designed both to restrict car use and encourage other modes of non-motorised and low-carbon transport options. This article highlights the key actions in this green transition.

MILJØPAKKEN (GREENER TRONDHEIM) - A PARTNERSHIP FOR SUSTAINABLE TRANSPORT

In 2008, Trondheim was a city beset by traffic problems and lacking in

> ***"The first measures were implemented in the summer of 2008 with bus lanes being regulated in the city centre"***

Photo: Knut Opeide, Statens vegvesen

funds to build new infrastructure. In the same year the Norwegian parliament adopted new targets to make Norway climate neutral by 2030. Local politicians in Trondheim decided to take action. Half of the city's greenhouse gas emissions were transport-related; traffic had to be reduced. The City of Trondheim decided to set up a cutting-edge and cross-administrative project involving Trondheim Municipality, South-Trøndelag County Authority and the National Road Authority. The Green Partnership Agreement was born. Miljøpakken or Greener Trondheim is a partnership for sustainable transport. The main goal is to cut greenhouse gas emissions through a suite of measures including reducing car traffic. At the same time, Trondheim is gaining some 3000 new inhabitants every year. The corresponding growth in transport demand must in practice be covered by walking, cycling or public transport.

The first measures were implemented in the summer of 2008 with bus lanes being regulated in the city centre. The effects were immediate. Buses arrived at their destinations more quickly and car traffic was reduced. The Norwegian parliament approved Miljøpakken in 2009. This gave Trondheim the possibility to receive financial support from the state towards implementing the program. The most controversial measure was the re-introduction of a toll system with double charging for rush-hour traffic. Half of the income from the toll system goes to improving the road network while the other half goes to developing green transport solutions. This was an explicit policy goal to transfer funds from motorists to those who use environmentally friendly forms of transport.

To date, the results have been impressive. The number of car trips has fallen from 58 per cent to 52.9 per cent. Traffic measured at the city's toll stations is 17 per cent lower today than in 2010. Use of public transport is up by 60 per cent since 2008. The number of cyclists commuting to and from the city centre has increased by 50 per cent since 2010. The number of people walking to and from the city centre has increased by 28 per cent since 2010. Finally, local air quality is better now than it has been in 20 years.

Proposing Miljøpakken was a brave move for the politicians. Although these restrictive measures were unpopular in the beginning, a recent survey[2] conducted by a local newspaper showed that public opinion has turned in favour of these measures.

Photo: Knut Opeide, Statens vegvesen

Miljøpakken is soon entering its third phase in 2017. Earlier this year, Trondheim signed the first Urban Environment Agreement among Norwegian cities. This agreement between the national and local authorities will bring more financial resources for green mobility in Trondheim.

GREEN HIGHWAY – A REGIONAL COLLABORATION IN MID-SCANDINAVIA

The Mid-Scandinavian region between Trondheim in Norway and Sundsvall in Sweden shares a common cultural heritage and has been connected through trade and other types of collaboration for more than 1000 years. This connection has been strengthened through "Nordens grønne belte (The Nordic Green Belt)" under the European Union Interreg Sweden-Norway programme[3]. Other than reduction of GHG emissions and environmental issues, green growth, innovation and job creation are also policy goals of the programme.

In recent years, this region has been devoted to sustainable mobility. The key drivers of this development are the municipalities of Sundsvall, Østersund and Trondheim. The SØT-cooperation has been developed through three periods of three-year-long Interreg IVA projects during 2008-2018 based on the vision of establishing a fossil-free, inter-regional transport corridor. The 460km of highway E6/E14 between Trondheim and Sundsvall is called the Green Highway®.

After years of close collaboration, the three cities have become pioneers in widespread usage of electric vehicles (EV) and charging infrastructure. Since 2015, the focus has also shifted to activities that promote and enhance the total value chains of biogas and hydrogen as options for fossil-free fuels.

FOSSIL-FREE PUBLIC TRANSPORTATION FROM 2019

In Norway, the regional authorities are responsible of the public transport system. While the Norwegian National Transport Plan for 2018-2029 has proposed that city buses shall be zero-emission by 2025, South-Trøndelag County Authority (STFK) and its public transportation company AtB aim at achieving a fossil-free public transportation in the Trondheim region as from 2019. The buses will be mainly fueled by biogas and partly by biodiesel, supplemented by fully battery electric buses.

In terms of holistic and strategic planning matters, STFK has structured their work for future-oriented public transport in five elements: fuels and energy forms, land-use analysis, route structures, super buses in Trondheim and material strategy (for procurement priorities). In August 2019, the public transportation system in Trondheim will be totally revamped. Three lines of super buses will form the backbone of the system, supplemented by five lines of electric buses and other measures to make the connection as seamless and user-friendly as possible.

Some 40 fully electric buses will be purchased in 2017, and this will be the largest order of its kind in Norway. The driving distances vary from 3 to 15 kilometers throughout the five lines. The electric buses will be charged rapidly by pantographs at the end station(s) of each line. These vehicles, low in CO2 and other types of emissions and noise level, are well-suited to the urban environment. Perhaps even more importantly, an economic analysis

Trondheim, Norway's capital of technology, puts great efforts in low-carbon mobility

E-bus lines in Trondheim from autumn 2019

demonstrated that financial savings can be expected from shifting from fossil fuels to electricity[4].

ELECTROMOBILITY IN TRONDHEIM

Norway adopted its first incentives for electric vehicles (EVs) in 1990. To-date, Norway has the highest number of Electric Vehicles (EVs) in the world. This substantial growth in EVs has several attributes, inducing a favourable regulatory framework set by the government, substantial financial incentives making EVs a cost-saving option in relation to fossil fuel models, and construction of an extensive charging infrastructure to counter fears of limited driving range. The Norwegian success shows that an incentives scheme should be composed of both push and pull factors.

The City of Trondheim is a driver for local and regional penetration of EVs. The density in Trondheim is at present in the region of 31 EVs per 1000 inhabitants. By end of 2016, it is expected that 5870 battery electric vehicles (BEVs) and just under 1400 plug-in hybrid electric vehicles (PHEVs) will register, making up approximately 8 per cent of the total fleet of light vehicles. The majority of these vehicles are privately owned and only a small percentage is operated by companies and other fleet owners. Regarding charging infrastructure, Trondheim has a total of 85 charging locations, nine of which are fast charging stations/locations. Trondheim has also a full-scale Tesla super-charging station with eight outlets. Trondheim Municipality is constantly in dialogue and collaboration with research institutions and industrial actors to promote fossil-free mobility in the city.

Photo © Carl-Erik Eriksson, Trondheim Municipality

ZERO EMISSION KNOWLEDGE AXIS

The City Council has set an ambitious climate goal of 80 per cent reduction of GHG emissions by 2030 (from a 1991 baseline). In order to make Trondheim a smart and sustainable city, it is necessary to think differently and innovatively and cooperate in a wide network.

Trondheim Municipality and NTNU have since long established close collaboration in many aspects. Trondheim provides itself as a city lab for various research and development activities. From January 2016, NTNU became the biggest university in Norway after a merger with three other university colleges. In light of the merging process, the Norwegian government approved of a large campus concentration initiative in Trondheim. This move is also intended to bring great opportunities for urban transformation.

The Knowledge Axis (Kunnskapsaksen), stretching from Sluppen in the south to the waterfront Brattøra/Nyhavna in the north, is the playground for future smart growth in Trondheim. Along the Knowledge Axis, there are many prominent knowledge institutions at international, national and regional level, including NTNU's city campus. Physically, this also covers the main axis for public transportation. The City of Trondheim aims to showcase the Knowledge Axis as a zero-emission neighborhood.

The story of Trondheim proves that low-carbon mobility outcomes are achievable through a combination of local, regional, and national policy, and the politicians should not be afraid of enacting unpopular measures. To reach the ambitious goals, close working relationships with local knowledge institutions pay big dividends.

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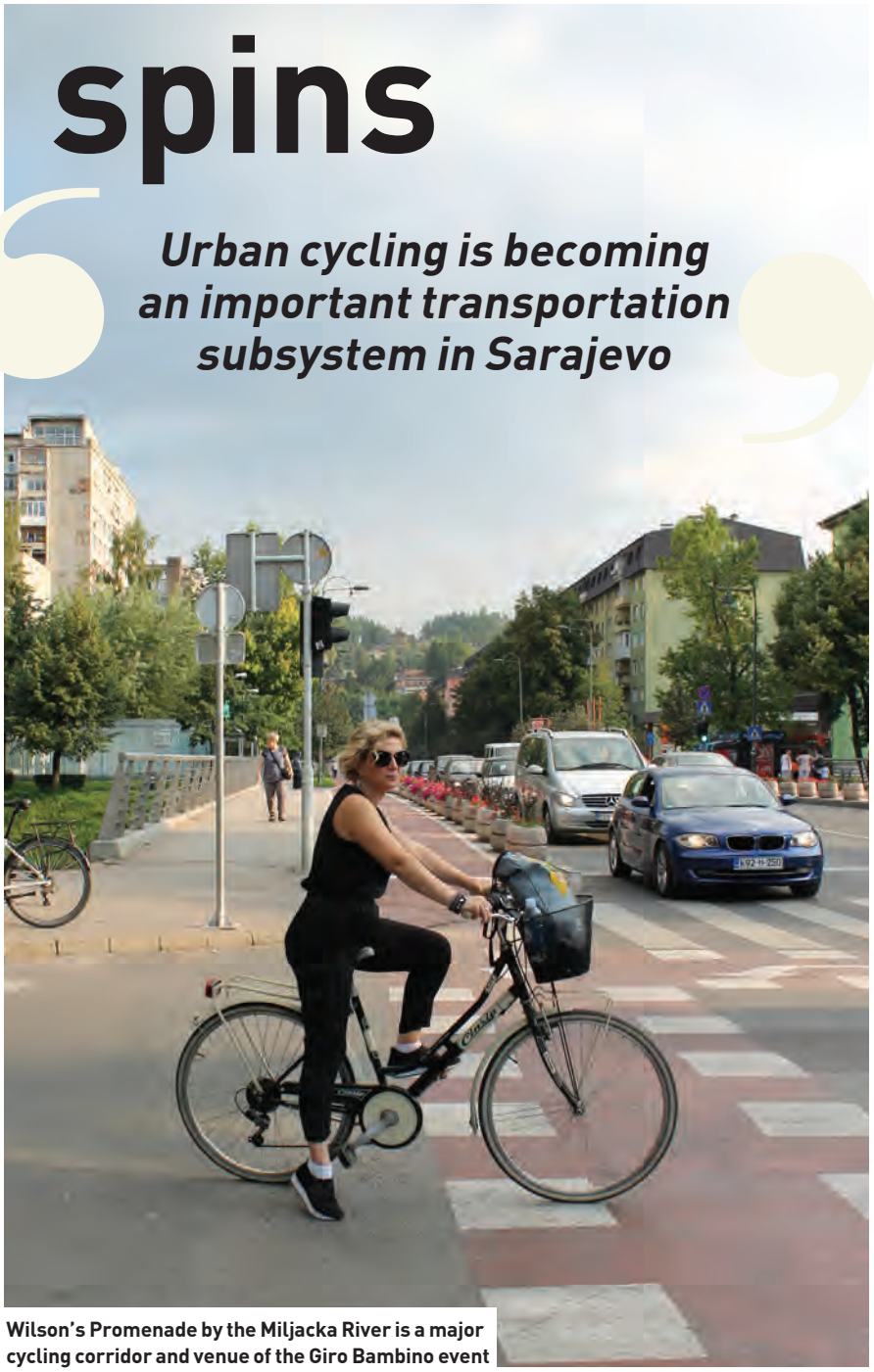
Urban spins

Sarajevo, like many cities in the Western Balkans, is a city where urban cycling has been developing at a fast pace in the last decade. The city has started buidling infrastructure but the real catalysts of this positive change have come from civil society organizations and also from the private sector, says **Damir Margeta**. So what are the challenges to the future development of urban cycling in Sarajevo? What kind of infrastructure is necessary and how can local govenment, civil society organizations and private investors engage and cooperate to improve the cycling experience and make important steps towards making city greener and smarter?

Urban cycling is becoming an important transportation subsystem in Sarajevo



Wilson's Promenade by the Miljacka River is a major cycling corridor and venue of the Giro Bambino event

Sarajevo is the capital of Bosnia and Herzegovina, with an urban population of 400,000, rising to 688,000 in the metropolitan area. Sarajevo is perhaps best known for the assassination of Franz Ferdinand which marked the start of the First World War and also as the host city of the 16th Winter Olympic Games in 1984. More recently, it has become known due to the war in Bosnia during the early 1990s when the city suffered heavily in the longest siege in the history of modern warfare. Geographically, it is surrounded by mountains and situated in the valley of the river Miljacka, where Sarajevo extends in an east-west direction for nearly 15 kilometers along the river flow.

The specific geographical position and shape, together with its turbulent history during which the city was ruled by the Ottomans, Austro

Hungarians and the period of Bosnia as a federal part of two Yugoslavias, resulted in a city consisting of three discrete architectual entities with different architectural styles and, crucially, different organization and treatment of traffic. The road network of the city comprises not just narrow alleys and streets (sokaci) in Bascarsija (the Ottoman city center) and mahalas, the neigborhoods of individual housing on the surronding hills, wide streets and squares of the Viennese Secession, but also the modern urban highways, along which lie the densly populated neighbourhoods of collective housing in tall buildings and skycrapers.

For almost 25 years, Bosnia and Herzegovina has been an independent state and its capital is in a phase of rapid development and demographic growth, meaning that there is less space available and with a compelling need for increasing urbanization. With the rapid personal motorization typically inherent in post-transition countries, there are now more than 130,000 cars registered in Sarajevo. All this brings an additional load on the city's road network and its public transport system. Consequently, more complex requirements for planning and organizing a transportation system impose the need for the creation of quality living conditions in the city by following the example of other European cities with an emphasis on the effort to preserve and improve environmental quality.

However, in the past decade there has been much more effort to increase the awareness of efficient energy use, accompanied by debate and actions on making city transportation more functional. Urban cycling is attempting to become part of the move towards a smarter and more efficient transportation system in the city. The number of urban cyclist commuters has been growing every season over the past few years and lately it has been followed with a steady trend of bicycle infrastructure development. Urban cycling is becoming an important transportation subsystem in Sarajevo. It aspires to be a part of the solution to traffic jams, lower emissions of greenhouse gases and traffic pollutio and to bring many positive effects to the city and its citizens - especially bike commuters.

A SHORT HISTORY OF BICYCLE FACILITIES DEVELOPMENT IN SARAJEVO

The first bike trails in Sarajevo were built in the 1970s and the first systematic planning of bicycle facilities was set in the city's urban development plan for 1986-2015 when almost 70 km of bicycle paths were planned in the city's metropolitan area.

The organizing of bicycle transportation was planned on wide boulevards parallel to the city motorway and tram tracks as part of a wider vision of urban transport and urban highways. Here, the cyclists freely moved together with pedestrians in neighborhoods that were built under the former Yugoslavia and subsequently became even more urbanized in the post-war period. The realization of the plan to build bicycle facilities stopped with the beginning of the war between 1992 and 1995 when the city suffered under siege. Then the bicycle, along with sleds, becomes the basic mean of transport for citizens during the war so that defenders of Sarajevo could ride to positions of defence and civilians could get food and water to their homes in order to survive. As a reminder of the tough days, in front of Sarajevo's war hospital, a sculpture of a bicyle immersed in concrete was set as a permanent reminder of its role in the survival of the besieged city. With the establishment of peace, the bicycle as a means of transportation was put aside and Sarajevo, as well as other cities in countries in transition, experienced oan unprecedented accelerateion in individual motorisation that resulted in the more than 135,000 motor vehicles registered today.

However, positive steps toward the development of sustainable forms of transport have been taken. In recent years, citizens of Sarajevo have spontaneously been opting for a bicycle commute as a lightweight, fast, flexible alternative form of individual transportation. Moreover, the first kilometers of bicycle paths are now being built but it is interesting how this expansion of bicycle commuting occurred. In the early 2000s, the bicycle primarly became popular as a means of recreation for riding on Sarajevo's surrounding mountains, the terrain providing excellent conditions for mountain biking which has seen it voted as one of the top destinations in Europe for adventure

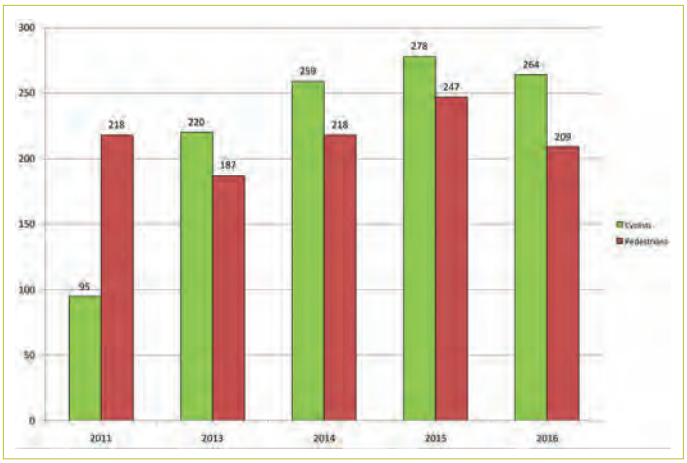


Figure 1. Counting traffic on the first shared-use bicycle – pedestrian path, built in 2010 in Sarajevo's Otoka neighborhood (*Performed for two hours in the afternoon during weekdays in the spring months of May or June in excellent weather when there are the most cyclists)

tourism. In the following years, the number of cyclists in the streets of Sarajevo also increased, and several bike shops have been opened. This development marked the start of the bicycle economy in Sarajevo. At the same time, citizens started noticing the lack of bicycle infrastructure and the underdevelopment of proper bicycle facilities. They demanded substantial construction in order to provide conditions for organizing this type of transport. As a result, Giro di Sarajevo, Sarajevo's first civil society for the promotion and advocacy of urban cycling, was established in 2008 by a group of bicycle enthusiasts who wanted to make a change and contribute by putting pressure on local government and proposing ideas on enhancing bicycle commuting in the city.

CIVIL SOCIETY ROLE IN THE BICYCLE FACILITIES DEVELOPMENT

Later that same year, a mass protest cyclist ride was held in which almost 600 cyclists blocked traffic in the city's main streets and demanded local authorities address the non-existence of bicycle facilities by devoting urgent attention to it with participation from the public. In the years that followed the event became a favorite September tradition of Sarajevo's cyclist community

As the organization acquired recognition, the local government started to pay more attention to cyclists as a growing trend, but still without making decisive moves to meeting their needs in order to acommodate urban cycling and reap its benefits. The next year Giro organized another event that became traditional, Giro Bambino, where the youngest Sarajevans were taught cycling safety on a bicycle riding range on Wilson's Promenade, next to the Miljacka River. Soon, with the push from the non-government sector, the first short sections of bicycle-pedestrian paths were built in 2010 and different levels of local government started to invest public money in studies and design documentation, but still without in-depth analysis or conducting polls among the cyclist population and bike shops and without quality dialogue with organizations who represent them.

The ciivil society sector continued gaining momentum. Professionals from Giro started proposing design solutions for bicycle facilities. First in 2012 for the very first 3 km long bicycle lane in Wilson's Promenade which garnered substantial media coverage and public attention, but no support from the city or the local officials. The following year, on Giro's proposal, the first professionally designed bicycle parking lot with a capacity for 20 bikes was built in front of the BBI Center, the most important shopping mall in the city centre. The mall owners alotted the land and Center Municipality financed the building of the parking. This was the first introduction of the 'staple' racks in Sarajevo and was the first cooperation of private, non-governmet sector and local government in bicycle facilities development.

This admittedly small but important step later led to the setting up of several other bicycle parking lots at attractive locations in downtown that were also proposed by Giro di Sarajevo asociates and financed by the local government, the Center and Old Town municipalities. Further, the organisation expanded its work by giving a design proposal for the first bike shelter that was built in May 2016 in the front yard of Sarajevo's Third Gymnasium.

A cyclist traverses Skenderija Bridge

Soon after, a private investor, Dukat, a major milk company, decided to invest in building bike shelters in other cities in Bosnia, in a public-private partnership with Giro. With their invesment, improved design by Giro's engineers and with the help of the local community and local cycling activists, the bike shelters were built in Mostar, Banja Luka, Tuzla and Bihać with strong prospects of continuing the project in the future in other cities.

BUILDING BICYCLE PATHS IN SARAJEVO

Meanwhile, starting in 2014 the City Council and County of Sarajevo Road Authority started building the first kilometers of bicyle paths on the territory of Novi Grad, Ilidza and Novo Sarajevo municipalities. Paths were usally built on the the wide boulevards where they were easily integrated into the walkways or as a recovery of previous bicycle paths from the Yugoslav period. In only two years, 10 km of bike paths were recovered and built.

Likewise in every country without experience in designing and building bicycle infrastructure and without proper strategy for its development, these paths suffered from many technical deficiencies such as the inability to create a direct and coherent bike path network between different municipalities or the omission of denivelation on bicycle-pedestrian paths where this method of traffic segregation could have been used in order to physically separate cyclists and pedestrians.

Preservation of physical obstacles like city light posts within the bike paths that later had to be relocated or the complete conversion of walkways to bike paths were also shotcomings of the newly built bicycle facilities in Sarajevo. In spite of these problems, its construction represented a big push toward the development of urban cycling in Sarajevo and showed the willingness of the local government to invest public money in this mode of transportation. However, the topic needs to be addressed more professionally, transparently and closely in the future phases with necessary participation of all relevant stakeholders because the length and construction of unconnected sections of bike paths in not enough to encourage urban cycling in the city.

BIKE-SHARE SYSTEM – ANOTHER GIANT STEP FORWARD

Final proof that urban cycling has a bright future in Sarajevo occured in June 2016 when the biggest breakthrough in the development of the bicycle commute as a subsystem of public transport in Sarajevo happened - the introduction of a public bike-share system, Nextbike. Unlike other European cities, the system is financed entirely by private funds.

A group of young entrepreneurs, employed in one Sarajevo's top marketing agencies, decided to offer a bike-share service to the citizens. Although the basin relief of Sarajevo and the complicated and long procedures for acquiring permits for available public spaces in the city were limiting factors for the rapid development of Nextbike, this public bike-share system has become a great success.

Today it operates at seven stations at attractive locations and has a fleet of 50 bikes. In the first five months of operation, the system counted nearly 4,000 registered users, of which 1300 actively use Nextbike service. They

Bike shelters installed in Bihac this year

rented bikes 17,000 times and rode them more than 40,000 km, with each bike being rented about 2.4 times per day. According to all relevant indicators of operation, Sarajevo's public bike-share system is keeping pace with previously implemented similar public bike share schemes in other capitals of the region.

The fact that the most rentals take place during the morning and afternoon peak hours indicates that the scheme has established itself as a sub-system of the city's public transport network and shows the clear need to expand the network of stations to attractive locations in the city to keep bikes available to as many citizens as possible.

A LOOK TO THE NEAR FUTURE

The trend of urban commuters riding bikes as transportation of choice will surely grow in future years - it will grow even without any further development of the cycle path network in the city. This trend offers many advantages to the city and its people. Even though the number of cyclists on the city road network is still not big enough to cause serious traffic issues, it is reasonable to expect that problems of insufficient bicycle infrastructure with some noticeable technical shortcomings may hinder the establishment of urban cycling as a fully fledged mode of transportation in the city.

One solution to the present situation and a way for the future can be the devising of a proper strategy that will include a set of actions. First, the process of planning, designing and building of bicycle facilities has to be meaningful and professionally organized to provide proper capacity in proper areas and locations in the city. New bicycle facilities must not be built randomly and without considering the needs of Sarajevo's cyclist. There is a need for thorough analysis, surveys and traffic survey as it was previously practiced. Designers have to respect positive engineering solutions and successful examples from other countries, not just Bosnian guidelines for bicycle facility design.

In the case of Sarajevo, there are established civil society organizations and pofessionals that have already gained experience in the planning of bicycle facilities, for which they have received recognition by the public. It is worth nothing that more than 3,000 cyclists joined the Giro di Sarajevo protest ride this year. Additionally, it is important to establish public-private partnerships in future development of bike-share schemes and to develop it in accordance with the traffic demandof Sarajevo's citizens. Finally, coordinated and professional work will result in a mutual goal of enhancing the bicycle commute experience and developing it in a fully organized and sustainable transportation sub-system that will improve overall transportation and livability in Sarajevo.

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The 2016 Polis Conference takes place on 1 and 2 December in Rotterdam.

The Annual Polis Conference provides an opportunity for cities, metropolitan areas and regions to showcase their transport achievements to a large audience, and for the wider transport community to engage with representatives of local and regional authorities on innovative transport solutions.

The conference offers a mix of high-level plenary sessions, with prominent figures debating topical issues and trends, and technical sessions showing innovation in policy and practice across the transport spectrum.

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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

- **Tallinn** – Free transport for all is more than a dream
- **Toulouse** – A new mobility strategy where everybody wins
- **Electric Vehicles** – How smart cities are embracing EV culture
- **Berlin** – Who will win the new mobility race?

Free ride

The dream of free public transport in Estonia's capital, by **Daniela Stoycheva**

A specially commissioned Eurobarometer survey published in December 2013 indicated that cheaper public transport is considered by 59 per cent of Europeans as the most important measure that could improve travel within cities (in Denmark that figure was 75 per cent; in Germany and the Netherlands and 67 per cent in Austria). Some citizens, however, such as those in Bucharest, have looked at a political campaign proposal to make public transport in the city free, albeit with a sceptical eye. Many have claimed that such a measure will make the quality of the fleets and the rides even worse.

Across Europe, a number of smaller sized cities tried to introduce free public transport in the late 1990s: Templin in Germany; Châteauroux and Aubagne in France; and Hasselt, Belgium, to name a few. Ridership in all of those places increased substantially when fares were removed. Hasselt, one of the most closely analysed, made buses free in 1997 and ridership increased more than tenfold, but ultimatelyit was not sustainable. Facing budget problems, Hasselt had to reintroduce fares after 16 years, although young people, seniors and those receiving public benefits can still ride for free.

Tallinn has bucked the trend for targeted free ridership and made it available to all of the city's 440,000 residents

Targeted free ridership of the sort Hasselt has now is much more common around the world. Many cities and college towns in the United States have free 'circulator' buses on downtown or campus routes. Singapore is experimenting with free train rides early in the morning to relieve crowding during the morning rush hour. And Chengdu, China, has offered a mix of all these: free rides for seniors, free rides on 44 central bus lines and free rides from 5-7 am on all terrestrial public transport excluding the underground.

What has made Tallinn the 'capital of free public transport' is, however, that it is the largest city in the world to offer free public transport and that this right is universal in the city, being for all residents of Tallinn and not just for targeted groups. Since January 2013, Estonia's capital made public transport on buses, trams, trolleybuses and commuter trains in the city free for residents.

Started as a political idea, the initiative has been very popular with Tallinners ever since its introduction. A 2010 survey showed that 49 per cent of respondents expressed dissatisfaction with fares, more than twice the number who complained about crowding and frequency of service. In a recent opinion poll, nine out of 10 people said they were happy with how

Tallinn is the largest city in the world to offer free public transport and this right is universal in the city, being for all residents of the city, not just for targeted groups

free public transport has been working so far. The results of the first year were the best so far: an increase of municipal public transport rides with 6,5 per cent and decrease of car traffic in the city centre by 15 per cent. Nearly 15 per cent of residents claim that free public transport has had strong or moderate impact to their shopping and free time spending patterns. In 2014 and 2015 the number of trips had stabilised.

THE FINANCIAL EQUATION

At the start of the project, the municipality decided that its budget allowed for investing in such an undertaking money that was freed up from other places, such as the construction of public water and sewer infrastructure, which was about to end. The merger of two municipal transit companies, one that ran the buses and the other the trams and trolleybuses, brought some savings from administration costs.

Tallinn's mayor, Edgar Savisaar, unveiled the idea of making public transport free in the beginning of 2012, saying that it would relieve traffic jams, reduce the number of accidents and above all provide better access to public transport to families in economically difficult situations. The city administration put the question to a referendum conducted among Tallinn residents, where 76 per cent of those who did vote said 'yes' to free public transport.

So how does it work in practice? Public transport is free only for Tallinn residents. For €2 they are entitled to a "green card", which allows them limitless travel within the city. Residents do need however to swipe the card over a validating device when boarding the vehicles. They also must carry an identification card proving that they are a registered resident of Tallinn.

The registered resident part is crucial to how Tallinn is paying for its free public transport. Before, there were thousands of unregistered residents of Tallinn, meaning that they lived in the city but were paying taxes to another town or village where they had previously lived.

Now, free public transport is an incentive for those people to register and get on Tallinn's tax rolls. Since the free public transport referendum in March 2012 the population of Tallinn has increased by more than 25,000 residents and subsequently exceeded 440,000. They contribute new annual revenues of about €10 million - almost equal to the €12

Tallinn residents are entitled to a Green Card that enables them to travel on public transport for free

> ***Since the free public transport referendum in March 2012 the population of Tallinn has increased by more than 25,000 residents and subsequently exceeded 440,000***

million that the city budget has lost from not collecting ticket fares.

"If all the registrants were taxpayers," says Deputy Mayor Taavi Aas, "then the project costs of free transportation would be covered." In addition, Tallinn has also increased parking tariffs that keeps cars away from the city centre and provides additional income to the city budget.

DEMOGRAPHIC BENEFITS

Researchers from the Centre for Transport Studies, Royal Institute of Technology in Sweden have also found evidence of social benefits in the form of improved access to the city. Of all the districts in Tallinn, transit ridership jumped the most in Lasnamäe, a densely populated area with high unemployment and a large ethnic minority population of Russians.

The big question now is whether Tallinn will be able to sustain free transit in the long run or go the way of Hasselt. The first three years have shown that the former was possible. The city even bought new hybrid buses and has plans to replace all buses with modern ones within five years. Tramlines are also under renovation and there are currently plans to purchase 20 brand new trams. Indeed, as Andres Harjo, Head of Tallinn's Transport Department says, it is important to remember that price is not everything. Free rides will not be effective if public transport vehicles become overcrowded, slow, uncomfortable or unreliable. Quality is also an important factor to bring new passengers to public transport.

LESSONS FOR CITY FOLLOWERS

Mayor Savisaar said in front of officials from Europe and China in a conference organised in August 2013: "We are frequently asked...why we are offering free-of-charge public transport. It is actually more appropriate to ask why most cities in the world still don't."

However, the economics of free transit may be different in other cities. One reason why it has worked in Tallinn is that the system was highly subsidized to begin with. That is not the case in London, for example, where fares account for 85 per cent of public transport revenues. Free fares there would leave a gaping budget hole. "It is easier to waiver the ticket revenue if there's already a large subsidy," Aas said on Tallinn TV. "The subsidised part used to be 70 per cent in Tallinn. Now it's 94 per cent." Different from Hasselt, Tallinn also has its own public transport operator, thus making the scheme less vulnerable from outside price hikes.

As the Swedish researchers concluded in their study, the most important lesson is financial stability and being able to do that sustainably in the long run.

The city does not only have to replace the income lost to fare collection on an annual basis, but also to guarantee that the network can be extended and the level of service improved. In Estonia, a very large share of the local budget comes from municipal taxes. Therefore, the city of Tallinn did their calculations very well when they introduced the scheme.

FYI

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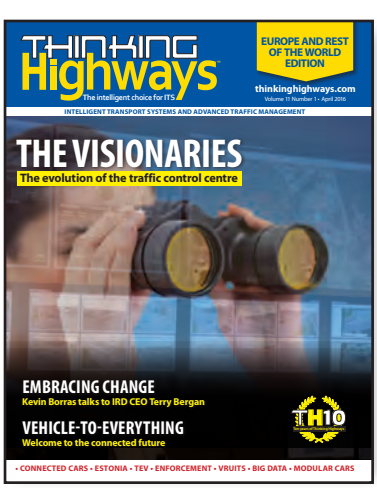
You stopped to look because it's cute

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



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Toulouse to win

Mary Malicet examines Greater Toulouse's new mobility strategy

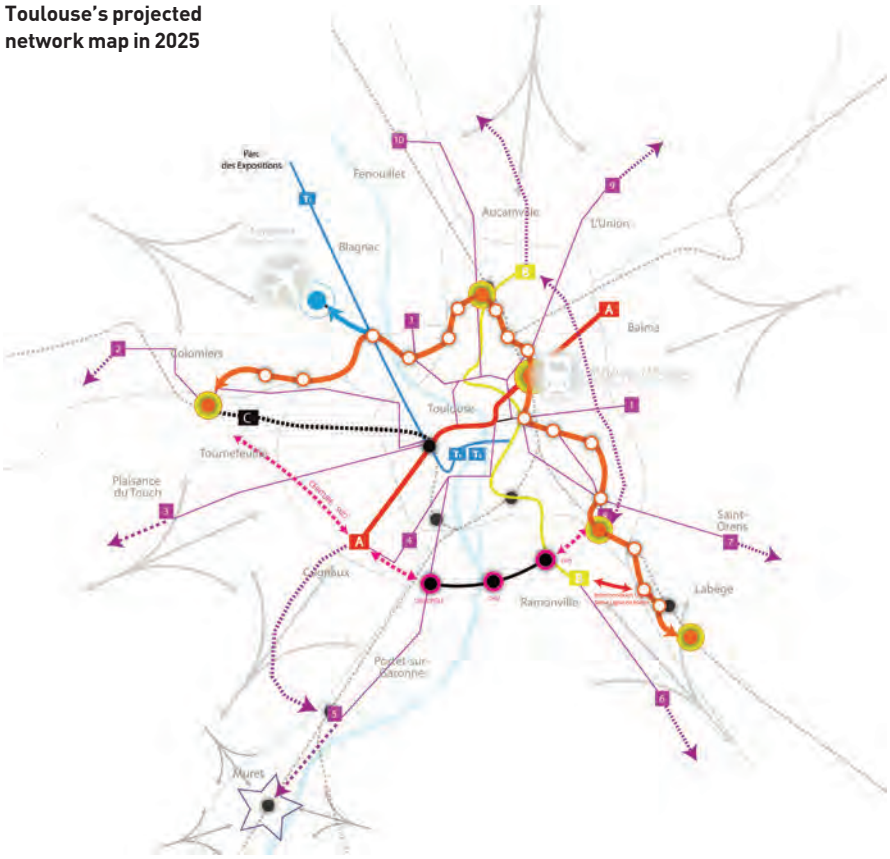
SMTC-Tisséo, the public transport authority for the Greater Toulouse area, is currently revising its Sustainable Urban Mobility Plan, called the "Mobilities 2020-2025-2030 Project". The territory has to face an unprecedented rising demand for travel, while anticipating the mobility of tomorrow.

SMTC-Tisséo comprises four inter-municipality associations, defining transport development and investment policy. Currently it is responsible for a large territory covering 115 municipalities and more than 1 million inhabitants, with Toulouse as the central city representing 450,000 inhabitants.

The public transport network, which registered over 170 million validations in 2015 in Toulouse's metropolitan area "Tisséo", offers:

- Two automatic metro lines (A and B) with 27 km in total
- Two tramway lines (T1 and T2) with 16 km in total
- A bus network of 90 urban lines with 870 km and 595 buses
- Transport on Demand bus network

Toulouse's projected network map in 2025



- Service for People with Reduced Mobility
- Parks and Ride with 7255 slots
- Bicycle parks
- Mobility management services (Carpooling service, Mobility Agency, Workplace Mobility Plans for companies,)
- Carsharing (Citiz) and bikesharing (VélôToulouse) services.

In France, cities with over one million inhabitants must adopt a Sustainable Urban Mobility Plan. In Toulouse, this framework document aiming at planning major transport infrastructures and mobility services is established by SMTC-Tisséo in a collegial manner with its four members and other associated public entities.

HALF A MILLION MORE JOURNEYS BY 2025

Toulouse is one of the most dynamic and attractive metropolitan areas in France in terms of economy, housing and studying. Key figures include:

- 115,000 students
- + 15,000 new inhabitants every year
- + 7000 new jobs every year
- + 150,000 new jobs over the last 20 years.

However, some areas are still poorly served by public transport facilities, especially the world competitiveness cluster Aerospace Valley (dedicated to aeronautics, space and embedded systems) with its 70 000 jobs.

Besides, transport infrastructures (ring road, high speed roads, metro line A) are increasingly saturated (3.8 million trips a day, all modes of transport included, over Greater Toulouse), with only 8 per cent commuting trips being made using public transport (the great majority being made in private vehicles, during the rush hour, with ever longer journey times). Crucially there are significant health risks with fine particulate matter limits being regularly exceeded.

Thus, this significant demographic dynamic strongly impacts travel demand: by 2025, 500,000 additional daily trips, all modes included, will have to be absorbed by the Tisséo public transport network - that is the equivalent of the current daily frequentation of the Tisséo network in 2015, or indeed of the ringroad.

THE "MOBILITIES 2020-2025-2030" PROJECT

As a response, SMTC-Tisséo is committing to an ambitious transport policy with the "Mobilities 2020-2025-2030" project (equivalent to its SUMP revision) that will answer the growing demand for travel, limit congestion and atmospheric pollution phenomena and maintain economic vitality and the quality of life.

One main objective is to welcome and manage half of the 500,000 additional daily trips on the current and future Tisséo network.

Three major objectives are pursued:

- Reinforce accessibility to the metropolitan area of Toulouse,
- Maintain the attractiveness of business and employment areas,
- Organize the mobility conditions in the perspective of a sustained growth.

As well as one cross-cutting challenge:

- Anticipate the mobility of tomorrow.
- Three levers are being targeted:
- Modal shift, or how to operate train, metro, tram, bus, walking, cycling, car-sharing all together.
- Coherence between urban planning and mobility, or how to develop the city and public transportation simultaneously.
- Organization of road networks and parking, or how best to develop and manage the roads

One of Toulouse's forthcoming measures: the Lineo bus network comprising 10 smart new lines

and parking spaces.

- A total of Euro4 billion are scheduled to be invested in major public transport projects under the auspices of HORIZON 2025, including:
- A 3rd Metro line "Toulouse Aerospace Express" - a new major diagonal for economy, innovation and quality of life:
  - 20 stations;
  - A 28 km line;
  - Urban, national and international connections (urban network, rail station, airport);
  - 65 per cent of employments to be served by the Tisséo network and half of the inhabitants to be less than 10 minutes from the network;
- A High Performance Bus network "Lineo" - 10 efficient, reliable and comfortable lines:
  - higher frequency, more regularity, operating hours equivalent to metro and tram, better accessibility;
- An innovative urban Cable Car system for the south belt of the metropolitan area:
  - rapid (10 minutes journey ; when currently 20 minutes by car and 45 minutes by public transport), dedicated lane, wide and accessible cabins, high frequency, operating hours equivalent to metro and Linéo;
- Doubling the capacity of Metro line A – to answer the growing demand during rush hours:
  - Stations and trains extended to 52 meters (currently 26 meters), higher frequency

ANTICIPATING THE MOBILITY OF TOMORROW

Beyond the major planned infrastructure projects, anticipating the mobility of tomorrow in terms of new mobilities and new usages is key to better answer users' future needs.

Based on users' experience in the current and future transport network, lines of innovation are being proposed in the "Mobilities 2020-2025-2030" project - including the following areas of reflection:

- 4G connection in metro lines;
- Dematerialized transport tickets (smartphone), integrated multimodal pricing, remote purchase of tickets;
- Multimodal mobile application integrating traffic and parking data, accessible paths, etc;
- Shared mobility – carsharing, dynamic carpooling, car rental between individuals, bike sharing, motorcycle sharing, etc;
- Multimodal, multi-service and connected interchanges;
- Test of self-driving public transport shuttles on experimental sites;
- Evolutionary and connected public spaces, smart housing related to mobility.

Moreover, the development of partnerships with public and private stakeholders will be developed to take full advantage of the local ecosystem.

PUBLIC CONSULTATION AND NEXT STEPS

Based on wide consultation ongoing since 2015 (official consultations and thematic com¬missions as well as additional partnership meetings), the "Mobilities 2020-2025-2030" project was formalised by SMTC-Tisséo elected officials in October 2016.

This step had launched the official debate with associated public entities (State, Occitanie Region, Haute-Garonne Department, municipalities, user associations, economic development councils and so on) in view of the final approval of the "Mobilities 2020-2025-2030" project by SMTC-Tisséo early 2018.

FYI

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One smart mobility solution has helped a UK County Council generate savings of more than EUR 1.5 million annually, and improved local citizens' satisfaction with the Council's services. Another car-sharing solution has secured the backing of Mercedes-Benz, and has also announced an innovative partnership with a large national taxi cooperative.

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frontierCities² will build on the success to-date, expanding the network of trial and deployment cities to a **100+ cities**! A new frontierCities **Call for Proposals** will be launched during **December 2016 or January 2017**, including **Market Acceleration Grants** to help bring existing tested solutions to new cities and markets, and **FI-Tech Development & Acceleration Grants** for developing new FIWARE-enabled solutions.

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A new way of thinking

Electric vehicles are playing an increasingly crucial role in the development of smart cities, says **Sander Van Der Veen**

The term 'Smart Cities' or 'Thinking Cities' are phrases that sound very cool but what do they actually mean? We come across these buzzwords more and more, yet everyone has different views on what they mean. It's not the intention of this article to lay down yet another definition, but to zoom into the role of electric vehicles (EVs) in smart cities a bit more.

Most people agree that smart cities, at the very least, are self-sustainable, generating power from a mix of centralised and distributed power sources such as solar, wind and hydro. All appliances in a smart city should be completely interconnected. In an ideal scenario, a full implementation of the Internet of Things would mean that all devices - cars, powerplants, dishwashers etc. are online and constantly transmitting and receiving data.

FROM RENEWABLES TO ELECTRIC VEHICLES

Ideally, smart cities should have a near-100 per cent renewable energy generation capacity. However, we need to take into consideration that these power sources are by nature intermittent: the wind doesn't blow every day and the sun doesn't shine at night.

Even during the day there may be periods of strong wind and clear

The advent of the Internet of Things has opened up a whole new world of opportunities for the electric vehicle and energy generation sectors

skies followed by grey skies without a breeze.

This can create a situation where suddenly we need to generate more power to meet the demand. Today, we have a large amount of mainly gas-fired powerplants that can quickly ramp up to fill in the gaps. The opposite also happens today. For example, in Germany there is so much solar and wind power that on occasion we need to put that to work somewhere (we can't stop the wind or sunshine at will) which, believe or not, results in Germany paying neighbouring countries to use their electricity.

The industry is putting heaps of work into solving both of the above problems at once: stationary battery storage. The most vivid example is the Tesla Powerwall. These batteries do exactly what you expect; they store energy when there is an oversupply of power and discharge again when there is a shortage of power. The additional advantage here is that this process takes milliseconds rather than minutes in case of traditional power plants.

Stationary battery storage helps to fill the gaps with a renewable energy generation capacity. But even on a more local scale it will help to address peaks in energy demand. Imagine everyone drives an EV and plugs it in when coming home from work. This peak load can easily be addressed by discharging stationary storage batteries on the grid.

The interesting thing here is that EVs themselves are essentially batteries on wheels. That means that everything just described above can and will equally be carried out by electric vehicles. As such, EVs play an essential role in a smart city's energy management. Not many people realise it, but it is the first time in human history that the automotive industry becomes interlinked with the electric industry.

In Germany there is so much solar and wind power that on occasion we need to put that to work somewhere that often results in Germany paying neighbouring countries to use their electricity

ENERGY TRADING

When all devices are connected to the Internet, it opens a world of opportunities that we cannot even begin to imagine today. One aspect that is particularly interesting is trading of energy. When energy pricing becomes real-time for every connected device, it becomes entirely thinkable to set trading rules for devices. This is particularly powerful for local communities that want to

> ***This is the first time in human history that the automotive industry has become interlinked with the electricity industry***

go largely 'off grid'. Imagine a street where half the households have solar panels and energy storage and the other half has not. You could think of a system where for every kWh that is fed back into the grid, a household gets a virtual energy token, let's call it an 'electricoin'. Neighbouring houses might use their 'electricoins' to pay for the energy that someone else in the street has produced, without intervention from a central third party. Sonnen, a German-based battery manufacturing company is pioneering with this with their Sonnen Community.

All EV charging networks across the country would be completely interoperable because they all accept 'electricoins' as a payment method. Everyone carries his 'electricoins' in his virtual wallet. That means that the 'electricoins' that you earned by producing solar kWhs at home with your solar panels can now be used to charge your electric vehicle at any public charge point.

WIRELESS CHARGING

Many people today have never plugged in a car and are definitely not used to seeing cars hooked up to charge points via a cable. However, the next generation charging mechanisms, wireless charging, are already underway and will be adopted on a large scale in smart cities. In the smart city all parking bays will be equipped with induction plates on the floor. By simply parking your car in the bay, your car will be charged wirelessly via the induction plate. If that sounds far-fetched, think of how your electric toothbrush charges. To take it a step further, all roads in the city will consist of induction plates ensuring your car is charging while driving.

Today, most cars are standing still for 80 per cent of the time – this is not a very efficient use of that capital to say the least. In a smart city the reverse situation would occur, in which cars are in use 80 per cent of the

time. Very few people would still own a car privately, except for the hobbyists among us. Cars become increasingly comparable with public transportation.

Car manufacturers are no longer scrutinised by their shareholders on how many cars they have sold in a given year, but rather on how many miles they have sold. Entire fleets of cars are constantly running through the city and can be hailed by anyone who's in need. These cars are equipped with the latest and greatest technologies and will autonomously bring you to your destination, while you are getting some work done in the car.

This also not too hard to imagine and, perhaps, not as far away in the future as you might think. Tesla recently announced that every car rolling out of the factory today has all the necessary hardware on board to be able to drive fully autonomously. To prepare the system, each and every Tesla car on the road will use the coming two years to learn from real life situations and adjust its algorithms accordingly. Because thousands upon thousands of Teslas are sharing these experiences with each other, the combined experience makes the car itself a better driver than any person alive.

A great example of this is hailing of taxi from apps that have become ingrained into our everyday life very quickly. In a matter of only a few years the likes of Uber have spread across the entire globe with their ride-hailing apps. Tesla will soon introduce their Tesla Network, which completes the picture of self-driving electric vehicles that can be hailed via an app.

Car manufacturers will no longer be scrutinised by their shareholders on how many cars they have sold in a given year, but rather on how many miles they have sold

SCARY?

Every device connected to the Internet? Driverless cars? Energy trading with neighbours? It may sound scary and, to a certain degree, rightfully so. As we are increasing the connectivity in our lives we are losing more of our privacy. Not only that, we are introducing more and more Artificial Intelligence (AI). AI can be our friend and help us to improve our standards of living, but as Elon Musk and Prof Stephen Hawking often point out, can also threaten our very existence. As much as I am an engineer and fan of technology, I think they have a valid point. We as the human species will need to decide collectively to what extent we are willing to give up our privacy as well as our control over the machines we use. The day that AI reaches human-level intelligence may well be the last day as we know it, for we have never experienced life on earth with a being that is smarter than ourselves and we have no way of knowing what that being would do so we better be extremely careful with this.

I'd like to end with a positive note here. The development towards smart cities means there will be an enormous amount of jobs created to get there. If we get it right, it results in a quality of life much better than it is today and hopefully with welfare much better spread across the globe. Electric vehicles are just one cog in the machine.

FYI
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A disruptive shade of green

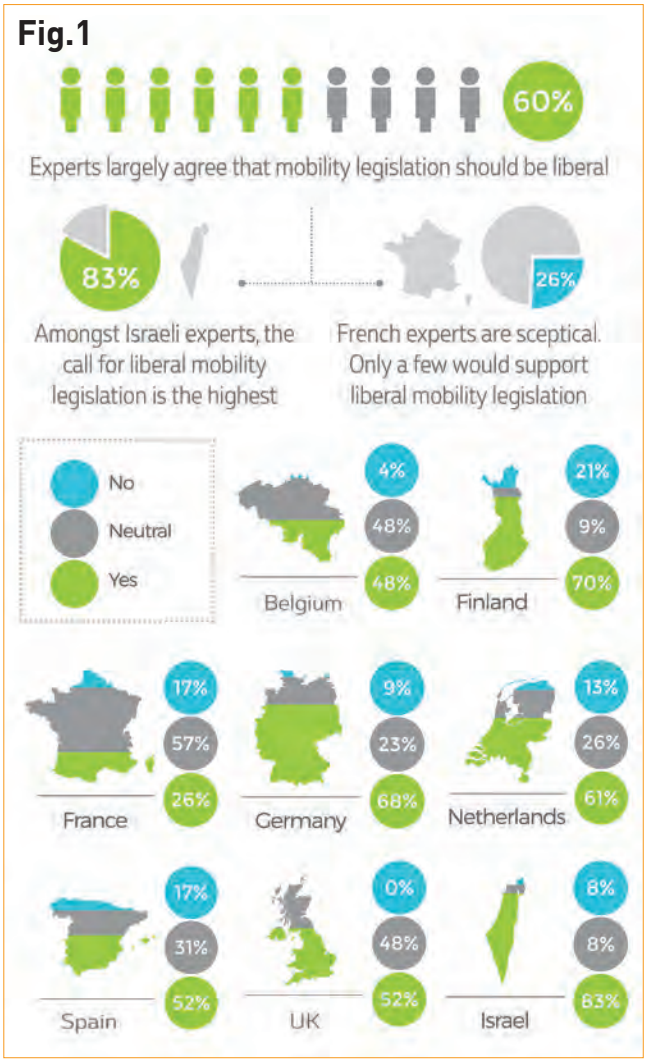
Who will win the new mobility race? **Egbert Huenewaldt** looks at how current developments are shaking up the mobility market

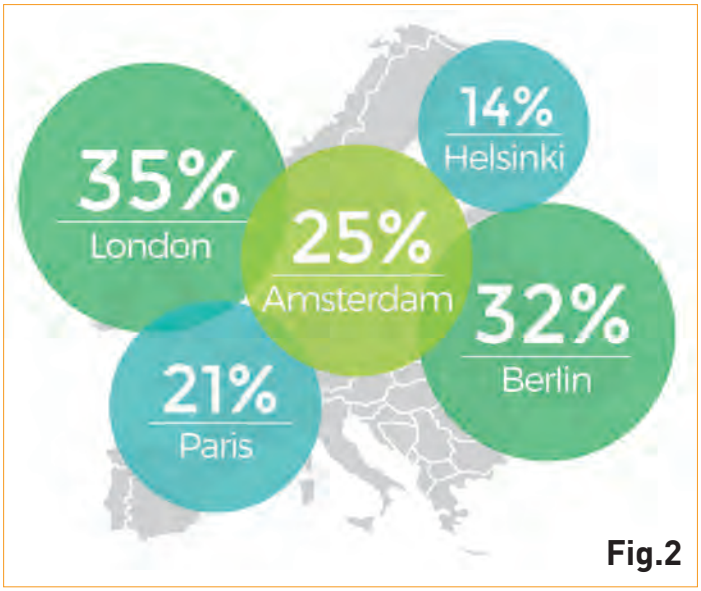
The mobility market is shifting from product-based to service-based modes of business. With increasing digitalization and emerging disruptive mobility services, a growing demand for innovative, integrated, and well-managed mobility solutions is being met by various start-ups. These are trying to harness the momentum of new market opportunities and profitable growth. With a wide range of new start-ups surfacing offering fast-changing new mobility solutions, the concept of new mobility services has moved beyond merely being a hot-topic. As a consequence, the European new mobility market is becoming transparent.

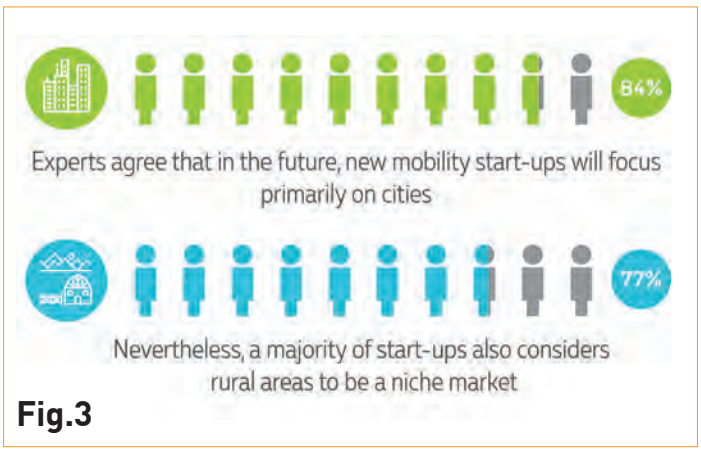
Currently, an important task for authorities and public transport agencies (PTAs) is to grasp the rapidly evolving market for new mobility services. Since PTAs are organized at a local level, in most cases, their new mobility services maintain a local individual focus with low rates of transferability.

The Berlin-based consultancy Green Business Development (GBD) conducted an independent expert survey with the aim to bring more transparency into the new mobility market. GBD's European new mobility survey 2016 is the first Europe-wide expert survey on the development of this extremely dynamic market. More than 200 experts from eight countries participated in this study. Respondents included experts from nine business sectors: the automotive industry, start-ups, public transport agencies, accelerators and incubators, investors, consultancies, governments and public sector, research institutes and universities. Mobility services are regarded as comprehensive solutions that integrate the users' mobility ecosystems. In this study the term 'new mobility' includes various forms of new mobility services: car-sharing, ride-sharing, e-hailing, intermodal mobility services, parking services and logistics services.

Fig.1: Opinions regarding liberal mobility legislation / Fig.2: New mobility hotspots in Europe / Fig. 3: Cities vs. rural areas







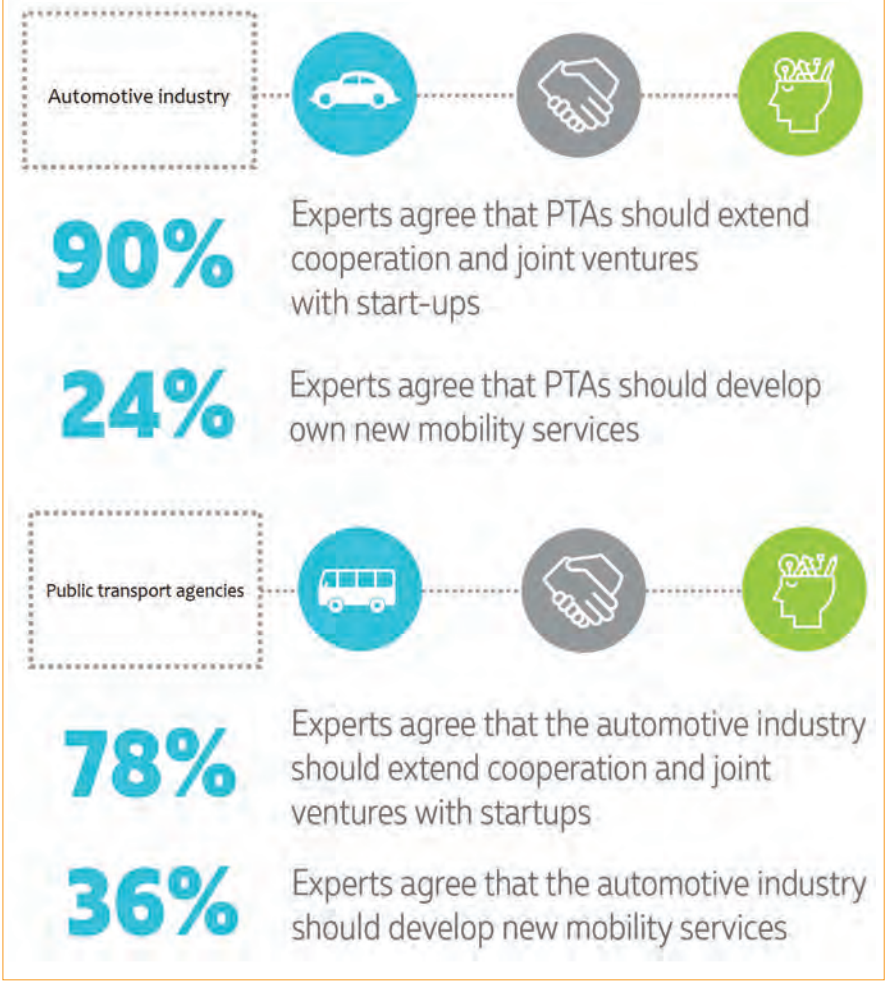
LEGISLATION PLAYS A CRUCIAL ROLE IN THE DEVELOPMENT OF THE MOBILITY MARKET

Against the backdrop of changing mobility behaviour, innovative concepts, resources, as well as organizational and technical solutions are necessary. This also includes a change in mobility legislation. According to 60 per cent of experts, mobility legislation should become more liberal. While the agreement in most countries ranges from 48-70 per cent, amongst Israeli experts the call for liberal mobility legislation to ensure efficient urban mobility is the highest (83 per cent). French experts, however, remain sceptical. Only a few (26 per cent) would support liberal mobility legislation (figure 1).

CONTRASTING DEVELOPMENTS IN CITIES AND RURAL AREAS

Currently, new mobility solutions mainly target large urban areas. Concepts such as carsharing and intermodal mobility services have already arrived in metropolitan areas with mature infrastructure and large populations in place. Higher density makes cities particularly attractive. According to experts, the new mobility hotspots of the next few years are expected to be London (35 per cent), Berlin (32 per cent) and Amsterdam (25 per cent) 84 per cent of experts agree that start-ups will continue to focus on cities first. While currently rural areas appear to be chronically neglected, 77 per cent of experts see an opportunity for mobility service providers to explore this attractive niche by adapting their offer structures and developing innovative schemes

Fig. 4: Appropriate reactions by public transport agencies and the automotive industry regarding the changing mobility market



START-UPS ARE DISRUPTING THE MOBILITY MARKET

The mobility market is changing from a two-pillar model of public transport and the automotive industry to a triangular relationship with start-ups. The protagonists who cooperate with start-ups will have a decisive market advantage. 78 per cent of experts agree that the automotive industry should extend cooperation and joint ventures with start-ups. While 36 per cent agree that the automotive industry should develop own new mobility services. Similar recommendations are given to PTAs: while only 24 per cent of experts agree that PTAs should develop their own intelligent transportation system (ITS) services, 90 per cent would recommend increased cooperation and joint-ventures with start-ups Figure 2 The most promising new mobility segments appear to be e-hailing and carsharing which, according to experts, are expected to grow by 13 per cent, and intermodal mobility services by 12 per cent within the next five years until 2021.

80 per cent of experts, however, believe that only a few start-ups will survive in the next 5-10 years This is largely believed especially amongst experts from the automotive industry (93 per cent), while respondents from start-ups (67 per cent) and incubators and accelerators (75 per cent) remain more optimistic.

DYNAMIC MOBILITY MARKET SITUATION WITH LOW INTERNATIONAL TRANSPARENCY

When asked about the most promising start-ups in the respondents'

Fig. 5: Only a few start-ups will survive the new mobility race

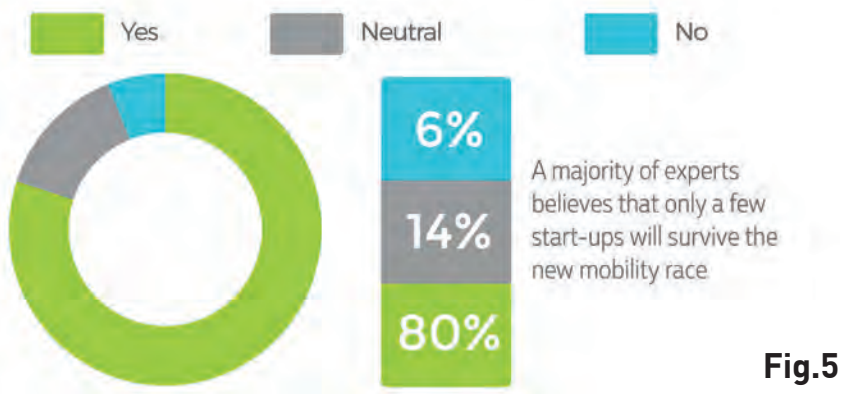


Fig.5

Additional information about GBD

Green Business Development (GBD) GmbH is one of the leading consultancies in the area of green business development in Germany. With our expertise, we help corporations, start-ups, investors and public authorities build up innovation and growth at the intersection of the green economy and the digital economy. New Mobility is one of our core competences. We offer our clients services that comprise research & strategy, business development, start-up monitoring, and market expansion advisory.

respective country, more than 120 different start-ups were named. The undecided position is also reflected when asked who will dominate the European new mobility market. 29 per cent of experts believe that European start-ups will have a decisive market advantage and will dominate, while only 14 per cent expect US. Start-ups to successfully set hold in the European market. The majority of experts, however, maintain a neutral position (46 per cent -59 per cent) on this issue,

CONCLUSION AND RECOMMENDATIONS

- PTAs and local authorities will be facing a rapidly developing and extremely dynamic mobility market. Lots of start-ups with innovative mobility solutions and ideas are grasping new business opportunities and are pushing themselves between the 'hardware' of PTAs and their customers.
- Legislation plays a key role in shaping the market of new mobility services. By enforcing restrictive legislation, public authorities will be able to defend current practices of public transport in cities for some time, however not in the long-run. New mobility concepts offer not only competition but also improved services and environmentally friendly solutions for citizens. Recognizing that there is a need to adjust current mobility legislation will enable authorities and PTAs to actively shape the development of the new mobility market, instead of merely reacting with individual solutions to disrupting changes.
- Appropriate reactions by PTAs can be twofold: PTAs can either develop mutually beneficial relationships by ways of enhanced cooperation and joint ventures with start-ups or develop own regionally integrated ITS-solutions with various PTAs pooling their IT-resources.
- Successful start-ups are allocating large investments to marketing to unlock customer access. Their fruitful business models are based on optimizing usability while using the expensive 'hardware' (buses, trains, subways, cars) of public authorities and private owners (peer-to-peer). PTAs can help to actively shape this rapidly evolving market using their decisive advantage - the access to their customers. Looking at these developments, PTAs and authorities are forced to react, not to lose market shares in the area of intermodal mobility services when start-ups will be tapping into the PTAs' existing customer base.
- While currently, most cities and regions are adapting individual, local solutions with low rates of transferability, investors and start-ups have recognized the need to generate new mobility services that follow a common international approach: one IT-solution for multiple regions and countries. The demand for Mobility as a Service (MaaS) solutions with an international scope that provide enhanced efficiency and maximum usability for customers is rising. Initiatives such as Polis' Traffic Efficiency and Mobility are therefore key to deepening and coordinating ITS-solutions on a European level.

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greenbusinessdevelopment.de

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Social and Economic Challenges of Transport

This section focuses on mobility for urban economic development and social policy. This includes accessibility of transport for the mobility impaired and accessibility to basic services for everyone; the financing of public transport and transport projects generally; and regulation, planning and governance

- **Barcelona** – Superblocks, and air quality, are on the rise
- **CIVITAS** – Cleaner, better transport for Europe... and beyond
- **Public Transit** – A new report into shared mobility examined

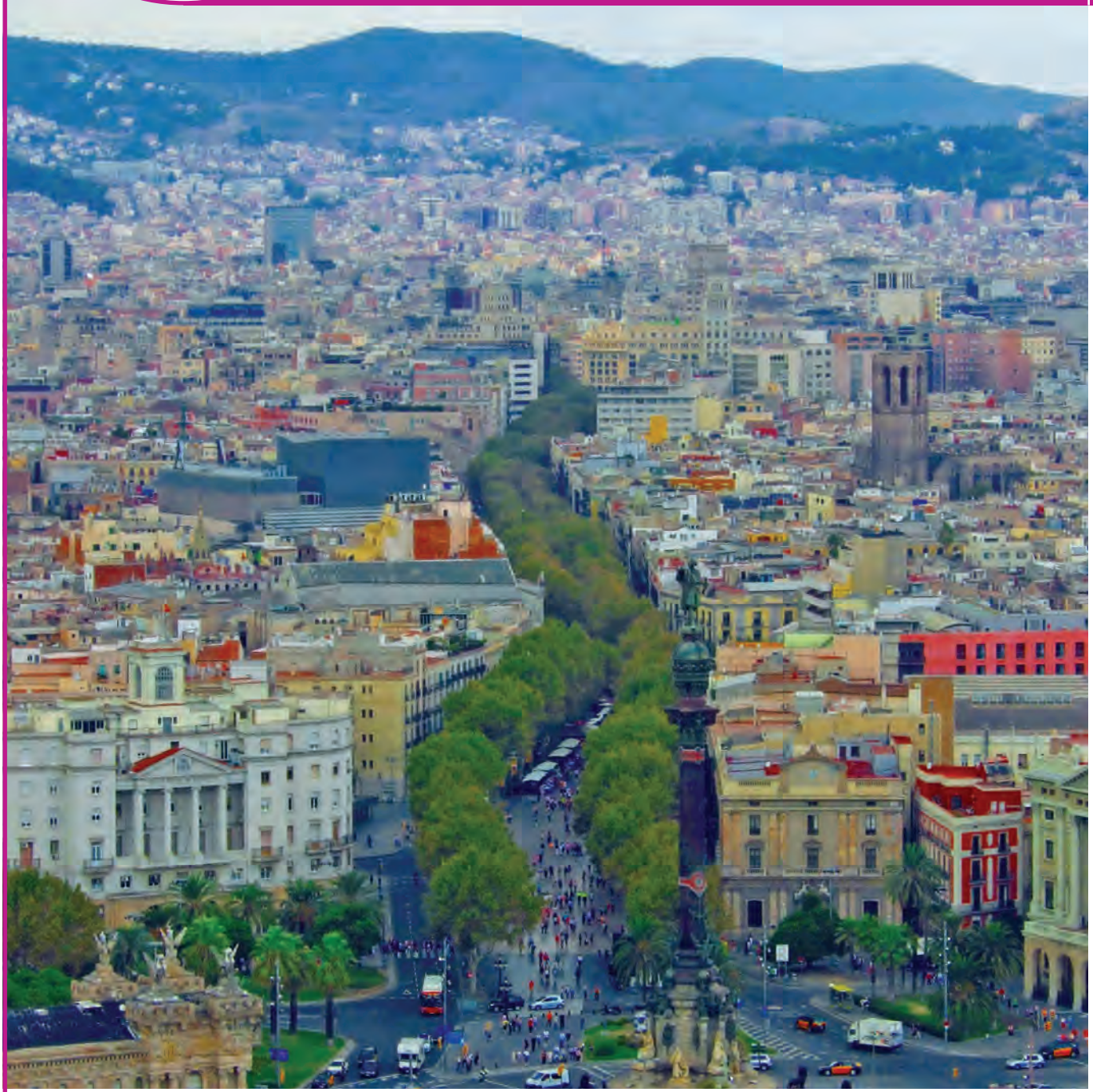


Photo: Barcelona City Council

Barcelona's Eixample district

A breath of fresh air: rise of the superblocks

Air quality in Barcelona's metropolitan area regularly fails to meet EU standards. **Daniela Stoycheva** discovers how the city is attempting to give air and space back to its citizens

Barcelona and the 39 municipalities around it account for only 2.3 per cent of Catalonia's total area but for 60 per cent of the region's population, about 4 million inhabitants. It is one of the most economically powerful urban areas in the Mediterranean, producing about 65 per cent of the Catalan GDP. With its concentration of population, economic activity and mobility, and the presence of large logistics infrastructures, together with certain constraints of orography, climate and urban structure, the levels of nitrogen dioxide (NO_2) and suspended particulate matter (PM_{10}) in the conurbation of Barcelona regularly exceed some of the thresholds legislated by the EU. A specific feature of the agglomeration of Barcelona, which impacts on

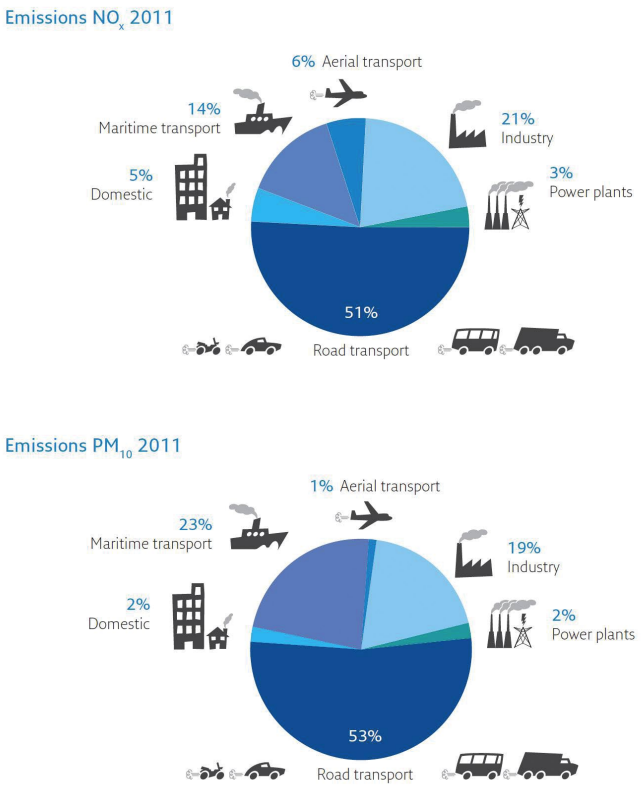
air quality, is its land use model and street and building typologies. The city of Barcelona and the surrounding towns have a high population and vehicle density, concentrating pollutant emissions in a small area.

The other factor that complicates the pollution problem in Barcelona and its surroundings is the type of inner-city urban development, with narrow streets and relatively high buildings, making it more difficult for pollutants to be dispersed by the wind and natural air currents.

For several years, air pollution in Barcelona has exceeded World Health Organisation (WHO) limits for safety. An estimated 3500 people die prematurely each year in the metropolitan area from air pollution-related illnesses. A study released by the Environmental Epidemiology Agency determined that about 1200 deaths could have been avoided if Barcelona conurbation met the air quality standards recommended by the European Union.

The 2008 European Air Quality Directive allowed Member States to have, under strict conditions, time extensions for meeting the air quality standards for PM_{10}, NO_2 and benzene. Since those time extensions have expired, Barcelona will start facing serious fines if the city continues to exceed the limits. Although the PM_{10} have remained below the limits in recent years thanks to the implementation of the measures of the 2007-2014 Air Quality Plan, as well as the economic crisis, the NO_2 levels continue to exceed them.

The updated Inventory of pollutant emissions in the Special Atmospheric Environment Protection Area (SPA) of 2011 provides the necessary information to identify emissions of the main pollutants disaggregated by pollutant and by sector. The Inventory highlights that road transport generates almost half of the NOX and PM_{10} emissions (Graph 1). The main causes are the high volume of traffic,



Emissions in the conurbation of Barcelona in 2011 by pollutant and by sector

the growth in the number of vehicles and the growing proportion of diesel vehicles, reaching values as high as 70 per cent of the circulating vehicles in Barcelona city.

TAKING ACTION: THE AIR QUALITY ACTION PLAN, HORIZON 2020

The *Air Quality Action Plan in Special Atmospheric Environment Protection Areas* approved by the Catalan government in September 2014, is the new instrument for planning, fostering and regulating actions aimed at improving air quality in the special atmospheric environment protection area consisting of Barcelona and the 39 municipalities comprising its agglomeration.

The purpose of the plan is to improve air quality and to guarantee compliance with the European air quality directives. It is a comprehensive legislative document which stipulates actions for the sectors of Transport and Mobility, the Specific Logistics Areas, the Industry and Energy sectors, and the Domestic and Residential sectors. The Plan encompasses key areas such as vehicle traffic, the port and airport, citizen awareness and taxation, among others, and establishes responsibilities, indicators and implementation timelines. Full attainment of its objectives shall take place by 2020. It also provides guidelines for the municipalities included in the Plan, particularly for those with more than 100,000 inhabitants.

An interesting point in the plan is that it creates an economic policy instrument by providing a series of tax measures which will be pooled into a fund to finance air quality improvement actions and, in particular, actions to improve public transport. The Atmospheric Environment Protection Fund that will be put in operation will also be used to improve noise quality and to prevent atmospheric pollution.

Some of the most essential aspects

in the Plan related to the Transport and Mobility sector are:

- It proposes integrated mobility management, addressing both infrastructures and mobility services, and promotes a change of model based on public transport and active mobility (walking and cycling);
- It advocates clean fuels and electric vehicles in private daily mobility promoting increase of the charging network and toll discounts for clean vehicles;
- It urges the Catalan automotive industry to lead to the manufacture of alternative-drive, low-emission vehicles;
- It promotes the rail freight transport and the use of LNG (liquefied natural gas) and other alternative fuels in vessels, lorries and working machinery in the Port of Barcelona;
- It enables effective measures to be activated during pollution episodes, with restrictions on private vehicle traffic to discourage their use, while providing incentives to use public transport and non-polluting vehicles. Preventive measures should also be implemented so that certain levels of pollution are not attained;
- It aligns with the Catalan Public Health Plan (PINSAP), giving priority to prevention over intervention and also with the European Union's Clean Air for Europe Programme.

The plan demands a higher level of commitment from all areas of government and stipulates co-responsibility of all stakeholders in its implementation (Government of Catalonia, local authorities, companies and private citizens). The local authorities play a leading role in the development of some of the Plan's basic measures. Municipalities with more than 100,000 inhabitants are required to implement certain mandatory measures, such as the creation of urban areas with protected atmosphere, but above all, they have the opportunity to voluntarily take extra steps to improve the quality of life of their citizens.

The ambition

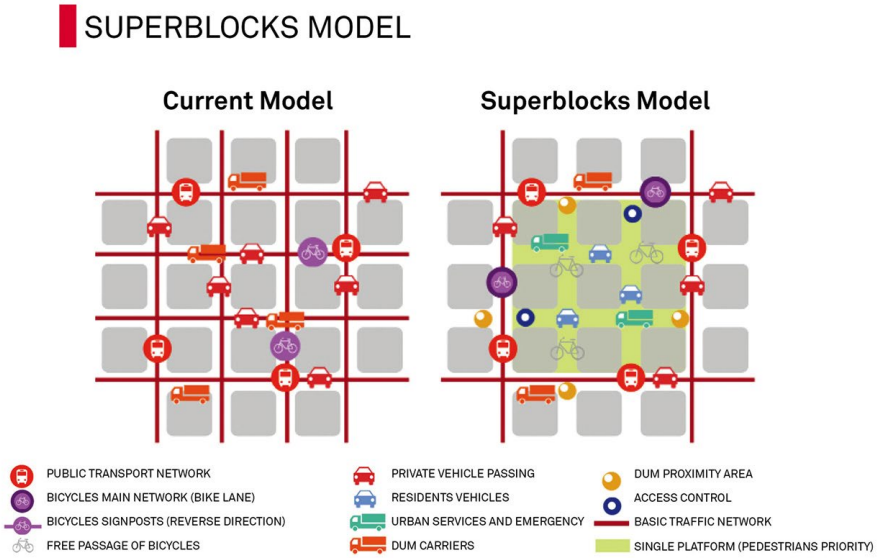
"Streets have to go back to being guarantors of vitality throughout the entire urban fabric, to creating opportunities for the establishment of greenery and to promoting positive community life among local residents of all ages and origins. We need to fill the city's streets with life again. Establishing Superblocks in Barcelona is the strategy we are employing for achieving this goal" - The implementation of the Superblocks programme in Barcelona: Filling our streets with life, Barcelona City Council

An intense consultation process with citizen associations, such as neighbourhood associations, trade unions, associations and companies operating in the automotive and manufacturing industries, was undertaken before the final plan was approved. Of the comments submitted, 93 per cent have been incorporated in the plan.

THE SUPERBLOCK: BARCELONA'S ANSWER TO THE CITY'S AIR QUALITY CHALLENGES

On a city level, Barcelona City Council has been working actively to address the air quality challenges discussed. Barcelona's Urban Mobility Plan (UMP) 2013-2018 was drafted as a planning tool defining the lines of action that will govern urban mobility in the coming years, with the strategic mission of continuing to move towards a more sustainable, efficient, equitable, safer and healthier collective mobility model. The UMP advocates a series of measures aimed at attaching greater importance to pedestrians and cyclists, promoting the use of collective public transport and reducing the use of private vehicles.

Traffic, being the main reason for air pollution and health problems



is also considered responsible for elevated noise levels. Over 60 per cent of Barcelona's residents live with noise levels higher than those deemed healthy by legislation. The city council also cites road accidents, sedentary lifestyles (one in five children in Barcelona are overweight or at risk of reaching that state), and the lack of green spaces as reasons driving the plan. Improving the quality of the city in general, road safety and the efficiency of the entire mobility system result are other principal objectives of the Plan, other than air quality.

The Superblocks (*superilles*) have been identified as the main measure in the UMP and solution to the challenges that the city of Barcelona has been facing.

The objectives are high: by implementing the *superilles*, the city wants to reduce car and moped use by 21 per cent by the end of the implementation and increase mobility by foot, bike and public transport. At the same time, it aims to keep the level of traffic network saturation similar to the present. The plan wants to return 60 per cent of the street space currently used by cars back to the citizens for pedestrian use. The amount of usable public space would thus increase by whole 268 per cent. The goal is that this transformation humanise public space, increasing Barcelona residents' access to the city, with new areas for recreation and social interaction along the historic city streets.

"As a Mediterranean city, its residents spend a long time on the streets – those streets need to be second homes, or extensions of one's residence, at all times", says Janet Sanz, city councillor for ecology, urbanism and mobility and deputy mayor of the city[1].

This Superblocks model turns on its head the way most cities have been organised since the second half of the 20th century: there, streets have been designed under criteria that give priority to private traffic, seeking maximum motorised-traffic fluidity and capacity and providing the shortest and straightest route for cars, by taking up the central part of streets and ensuring continuity at junctions. The new proposal, in contrast, prioritises the use of roads by people in most cases, by relegating cars to their role as a means of individual transport, behind public transport.

What is a Superblock?

The Superblocks model is a way of organising the city based on reversing the distribution of public space among vehicles and people, giving priority to the citizen, to improve environmental conditions and people's quality of life[2].

BACK TO THE ROOTS

Barcelona's revolutionary design, engineered by the Catalan urban planner Ildefons Cerdà i Sunyer in the late 19th century, had at its core the idea that the city should breathe and – for both ideological and public health reasons – planned for the population to be spread out equally, as well as providing green spaces within each block.

The flexibility of the grid system designed by Cerdà has enabled the city to absorb a growing population and subsequent rise in traffic levels, as well as the various user requirements that have been changing over time. Compact cities have numerous indisputable social and environment advantages. However, Barcelona has one of the highest population densities in Europe, having grown continuously in the last century. Barcelona government's new plan has essentially aimed at the same vision that Cerdà had - reclaiming most of the streets for the community, and increasing the sustainable mobility.

The plan is modelled on the original idea of the Eixample area from the 19th century. It is designed in a simple grid that means that the neighbourhood can easily be sectioned off: nine blocks will become one pedestrianised superblock, with 160 intersections inside converted to city squares. Superblocks will be smaller than neighbourhoods, but bigger than actual blocks. Car, scooter, lorry and bus traffic will then be restricted to just the roads in the superblock perimeters, and they will only be allowed in the streets in between if they are residents or providing local businesses, and at a greatly reduced speed. This will turn the secondary streets into the so-called 'citizen spaces' for culture, leisure and the community.

STRATEGIC GOALS AND IMPLEMENTATION MEASURES

The strategic goals that characterise *"The implementation of the Superblocks programme in Barcelona: Filling our streets with life"* can be summarised in the following four points:

- Improving the habitability of public spaces;
- Moving towards more sustainable mobility;
- Increasing and improving urban greenery and biodiversity;
- Promoting public participation and joint responsibility.

Technical criteria are to be established that will shape the action lines behind those strategic goals, ie related to habitability, greenery and biodiversity and mobility. The Superblock Programme provides for three types of actions according to the level of intervention in the public space: basic, tactical and structuring initiatives.

The *basic initiatives* refer to measures focused mainly on traffic prioritisation, such as changes in traffic

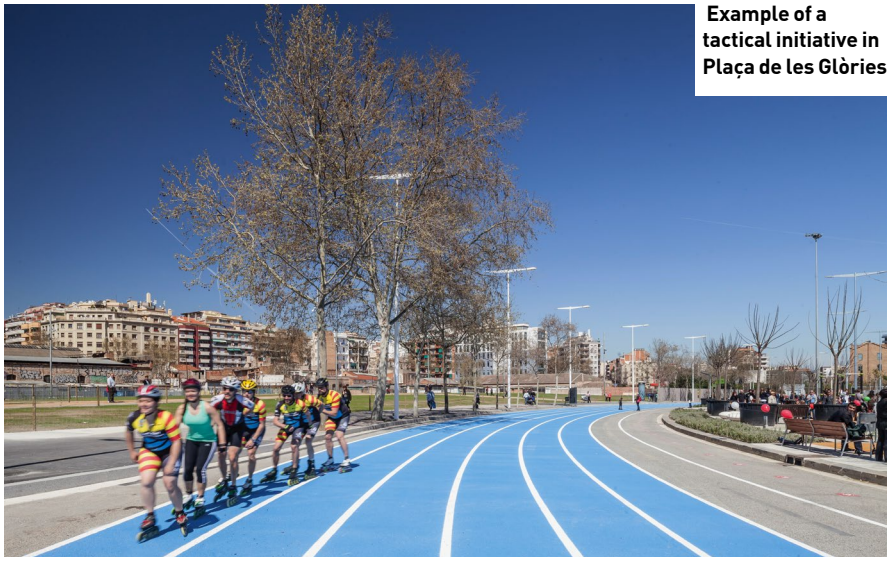


Photo: Barcelona City Council

Example of a tactical initiative in Plaça de les Glòries

direction, traffic bans depending on type of vehicle, and streamlined parking.

The *tactical initiatives* are low budget, temporary and reversible which are used for demonstrating the model's application. They can be considered as trial-and-error measures where the effect sought is to change the uses that people make of streets – one of the most significant challenges for the Superblock project. The tactical initiatives consist of actions with great potential for transforming the use of public space without the need for carrying out large-scale work. To be more specific, these could be measures for management, urban furniture and painting. That way the public can experience and appreciate the effects of the change and express their opinions.

Finally, *structuring initiatives* are such that enjoy large consensus and which are stable over time, able to involve more substantial budgets and apply corroborated models.

The current initiatives are intended to be carried out under two major lines: citizen participation and tactical urban planning. No major physical changes are planned at the start. The first initiatives will involve commitment to flexible physical changes with budgets that are small and, in some cases, reversible. That way city residents can quickly reclaim streets and see for themselves whether or not the model is working.

When implemented to the full, Superblocks will be complemented by the introduction of 300km of new cycling lanes (there are currently around 100km), as well as an orthogonal bus network that has already been put in place, whereby buses only navigate a series of main thoroughfares. The goal of the orthogonal network of bus routes is reducing the number of routes, but keeping the same number of buses and increasing the frequency to cut waiting times and traffic.

The new system, when completed, will reduce the number of routes from 94 to 28, waiting time to less than five minutes (the current average being 14), and trip time – with one connection – to less than 35 minutes across the city. This system should ensure that anyone is less than 300 metres from a bus stop at any time and that one could go from any point A to point B with just one transfer in 95 per cent of the cases. In the very final stage, curbside parking within the Superblocks should disappear (by building off-street garages), and the maximum speed be 10 km/h, allowing people to use the streets for games, sport and cultural activities, such as outdoor cinema.

It is estimated that when the Superblocks model is implemented to the full, pedestrians will enjoy 94 per cent of the space on the inner streets of the Superblocks, pollution will be reduced dramatically, ensuring that 94 per cent of the population will not be exposed to dangerous levels of particulate matter, and 73.5 per cent will not experience noise levels over 65 dB. The ideal walkable area will be a mix of residential and commercial areas. Another Spanish city, Vitoria-Gasteis, has implemented its own Superblocks since 2008 and has seen a positive impact on pedestrian space, noise and air quality, as well as an increase in business activities.

The new designs will be installed in nine different places across Barcelona (starting with the most polluted and at the same time central Eixample neighbourhood) with an estimated total project cost of about 11 million. The city has, however, identified 120 intersections where the concept could be applied, stating that car-free spaces are a right for everybody no matter what part of town.

FIRST IMPLEMENTATION – FACING REALITY

The first "Superilla" pilot project implementation in Cerdà city expansion grid, started operation in mid-September 2016 in Poble Nou. The lack of through-traffic and the single lane for motor vehicles moving within the block leaves most of the area free for cyclists and pedestrians to enjoy.

Despite that the residents living in the area were generally in favour of the Superblocks programme and they have been well informed about it by means of various citizen participatory processes. However, confronting the reality of the Superblock was not accepted by everyone with the

same enthusiasm, as a *Cities of the Future* article[3] reports.

It faced some fierce opposition from unhappy residents and local businesses complaining about loss of curbside parking and changes of bus stops and street direction. Some long-term residents reacted angrily about the change of location of bus stops and routes, arguing that now they had to walk one or two blocks further to the nearest stop, which before had been right on their block. Of course, others discovered a brand new bus stop virtually on their doorstep, when they were used to walking further.

One of the main challenges in installing the Superblocks is the abundance of curbside parking in Barcelona. Residents and commuters alike tend to believe that on-street parking is a car owner's basic right and that no administration should be allowed to limit or take it away. Barcelona has more than 140,000 on-street parking spaces, more than half of which are not regulated. Many residents leave their cars parked outside their apartment block for months without using them. Every time the city starts to regulate parking in an unregulated area, it faces protests.

Photo: Barcelona City Council

The citizen participation process in the Superblocks model

The majority of the 570,000 cars registered in Barcelona, however, are parked in public or private off-street garages. That means that eliminating some of the curbside residential parking in the city would affect less than 10 per cent of the vehicles. But having a parking spot on your doorstep is non-negotiable for some residents, who consider it a de facto right. Thus, the hardest in the Superblocks' implementation will indeed be challenging people's long-standing habits and making a cultural shift in the way people view and use the streets.

Some have also argued that it is not fair that some residents should enjoy the pedestrian areas in the Superblocks while others, in the outer streets, face roads full of traffic, noise, and pollution. The first Superblock in Barcelona was also criticised from the opposition parties within the city council. The strong reactions to this first experience with Superblocks has shown that they will face greater opposition than anticipated. Salvador Rueda, the director of the Urban Ecology Agency, the agency that designed the Superblock model, said however that a lesson learned from earlier Superblocks was that initial opposition gave way to acceptance, in part because of a growing consensus about the benefits.

At the same time, the Superblocks are not only being deployed in Barcelona. Vitoria (Basque country), Ferrol and La Coruña (Galicia) and Quito (Ecuador) have also started considering the implementation of that concept. We can only hope that more cities will follow suit, if not to use the Superblock concept, at least to create space for the people.

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The lab that keeps on living

Since it was launched in 2002, the CIVITAS Initiative has tested and implemented over 700 measures and urban transport solutions in more than 69 Living Lab cities Europe-wide. The CIVITAS Initiative is a programme run by the European Commission, funded under Horizon2020 that helps cities to achieve a more sustainable, clean and energy efficient urban transport system by implementing and evaluating an ambitious, integrated set of technology- and policy-based measures.

It also runs a number of research projects that focus on establishing new knowledge or exploring the feasibility of a new/improved technology, product, process, service or solution related to transport.

To date, there have been five CIVITAS phases, with a total of 200m of EU funding allocated to implement measures in 80 cities with 500m of investment (see figure 1).

CIVITAS2020 aims to involve an ever-growing number of cities in the CIVITAS Initiative, not as project partners, but as stakeholders subscribing to a new mobility culture. Within the scope of the Living Lab and Research projects, CIVITAS explores 10 thematic areas as shown in figure 2, left.

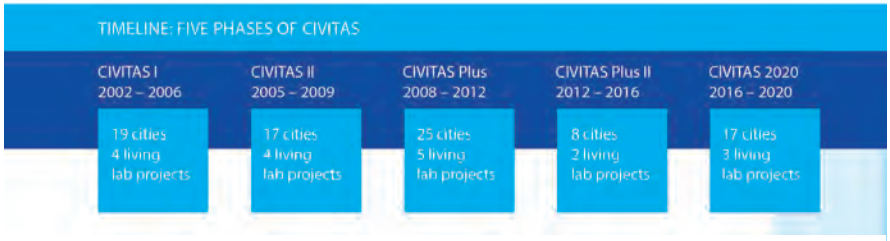

Figure 1: the five phases of CIVITAS and (below) Figure 2: CIVITAS' 10 thematic areas

LIVING LAB PROJECTS

The new phase of CIVITAS sees the addition of three new Living Lab projects covering port, island and suburban cities and regions.

CIVITAS ECCENTRIC

This project focuses on sustainable mobility in suburban districts

CIVITAS - CIty-VITAlity-Sustainability - is a network of cities dedicated to cleaner, better transport in Europe and beyond. In supporting and evaluating an integrated approach towards transport planning, CIVITAS aims to create more sustainable, accessible and liveable urban environments for citizens, as **Helen Franzen** explains

CIVITAS Eccentric (left) and CIVITAS Portis (right)

and silent and CO2-free city logistics, two important areas that have previously received less attention in urban mobility policies. In five living labs, the project demonstrates the potential and replicability of integrated and inclusive urban planning approaches, innovative policies and emerging technologies. Clean vehicles and fuels are being tested, new regulations and services formulated and consolidation solutions developed in close partnerships with the private sector.

CIVITAS DESTINATIONS

This project shows the effectiveness of innovative sustainable mobility solutions in six cities in which tourism plays a dominant role for the local economy. Each partner-city is testing new ways to help residents, tourists and freight flow more effectively and more sustainably through their cities. The project aims to show how sustainable mobility boost economic growth and job creation in European cities with strong tourist economies while providing healthy and sustainable environments for visitors and residents alike.

CIVITAS PORTIS

This project is testing innovative and sustainable urban mobility solutions in five European port cities. The five living labs are implementing mobility measures, supporting their multifunctional role of cities, ports and gateways to inland areas. The project aims to show that sustainable mobility can increase functional and social cohesion between city centres and ports, while pushing the economy forward and boosting the allure of modern urban environments.

CIVITAS RESEARCH & INNOVATION PROJECTS

The research and innovation projects, run under CIVITAS, focus on establishing new knowledge or exploring the feasibility of new technologies, products, processes, services or solutions related to transport.

For this purpose they may include basic and applied research, technology development and

The project so far

Training and study visits in cities across Europe

CIVITAS offers a peer-to-peer exchange programme for practitioners and city representatives who are interested in learning from and sharing with their peers from other European cities.

Tailor-made work placements are offered, as well as study visits, to see innovative transport solutions being developed and deployed first-hand.

Award for pioneering work in sustainable transport

The CIVITAS presents an award each year to members of the CIVITAS Forum Network whose transport policies or activities to achieve clean urban transport are outstanding.

Winners are awarded based entirely on the merit of their applications and the awards presented at the annual CIVITAS Forum conference.

Annual CIVITAS Forum

Held in a different country each year, the CIVITAS Forum brings together representatives from member cities to exchange ideas and influence the urban agenda.

The three-day conference offers collaborative workshops, state-of-the-art presentations and interesting site visits.

CIVINETS: join a group of like-minded cities in your country

CIVITAS national groups known as CIVINETs gather stakeholders, from the same country, who are working in the field of urban sustainable mobility.

Members exchange information in their own language working together to engage with the European Union and national governments, about transport policy issues, legislation, regulations, and funding.

CIVITAS Thematic Groups

Specialised Thematic Groups working across the ten areas described above, bring together experts from across the field of sustainable urban mobility.

Members will pool their expertise on analysing current transport-related policy, and have the opportunity to take part in study tours, webinars, training workshops, peer review exercises and annual meetings.

CIVITAS Europe-wide city network

Ambitious towns and cities can, by making a commitment to introducing an ambitious, sustainable urban transport policy, apply to become members of the CIVITAS Forum.

Members joining this trans-European network benefit from assistance with policy formation, learning and sharing of information, and provision of funding information.

integration, testing and validation in small-scale demonstrations or pilot activities aiming to show technical feasibility of cleaner, better transport options for cities.

A CONNECTED APPROACH

CIVITAS emphasises the need for an integrated approach towards sustainable and energy efficient urban transport strategies in European cities.

On this basis, CIVITAS 2020 seeks to interconnect knowledge, experience and people working in the sector, by offering practitioners and city representatives a range of opportunities (see box, left).

By building a strong network of cities, sharing knowledge and experiences, nurturing political commitment and testing new marketable solutions, CIVITAS2020 offers cities the opportunity to shape the debate on better, cleaner transport and make sure this remains a top priority in Europe and beyond.

CIVITAS2020 will also be participating in the Polis annual conference on "Transport innovation for sustainable cities and regions", taking place on 1 and 2 December 2016 in Rotterdam, the Netherlands.

FYI

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Public share issue

Dr Andreas Kossak dissects APTA's report on Shared Mobility and the Transformation of Public Transit

In March 2016 the American Public Transit Association (APTA) published intermediate results of its extensive research activities on shared mobility. The report was titled Shared Mobility and the Transformation of Public Transit[1] and was submitted by the Shared Use Mobility Center (SUMC), based in Chicago, Illinois. The research work was carried out within the framework of the Transit Cooperative Research Program (TCRP) of the Transportation Research Board (TRB) and US National Academies of Sciences.

Basically, public transit itself (short and long distance) is the germ cell of shared mobility and still the by far the most important shared mobility mode. The connection and cooperation respectively of other shared mobility modes with public transit is not new either. It principally comprises all mobility chains including public transit in the sense of horizontal mobility sharing: walking, biking or driving to and from public transit stops/stations and potentially changing within the transit systems. The first step of a systematic connection of transit and automobile transport has been the introduction of organized Park + Ride (P+R) at urban/metropolitan rail stations, beginning in Chicago (1955) and London (1958), followed by Hamburg, Germany in the early 1960s[2]. The P+R was in that context was later supplemented by so-called Kiss+Ride (K+R) zones for dropping or picking up transit passengers near to the entrances of the rail stations.

The next important step of improving shared mobility has been the organization and implementation of metropolitan transport associations aimed at optimizing/coordinating

Bike+Ride at a station in Hamburg

> ***Appraising the future of car sharing realistically, one will come to the conclusion that it will indeed substantially increase"***

the supply/operation, ticketing and the information of all transit operators/entities in the respective region. The worldwide first association of this kind was established in 1965 in the metropolitan region of Hamburg, the Hamburger Verkehrs-verbund (HVV). The Park + Ride facilities were subsequently supplemented by Bike + Ride facilities (B+R) which have been gradually improved by providing guarded spaces and/or bike boxes fitted with a lock and key; at main stations they have even been combined with repair services.

Other proven shared modes that have been practiced for decades are taxis, car-hiring and co-riding services, hitchhiking and car-pooling - some of them complementing public transit or even directly cooperating with it; some competing with it. All of these modes can be attributed to a first phase of a Transformation of Public Transit in connection with a growing diversity of Mobility Sharing.

Recently the traditional shared mobility modes have been substantially supplemented by dynamically growing car-sharing (car2go, DriveNow, etc) and bike-sharing services – provided either in general or specifically connected to public transit, partly resulting in a cannibalization and/or neglect of the conventional P+R and B+R facilities[2]. The traditional taxis and car-hiring services have recently come up against some very aggressive competition from highly professional organized ad-hoc ride-sourcing services such as Uber and Lyft. This has led, in particular in Germany, to a lot of trouble regarding the regulative conditions (laws regulating the prepositions for the transport of strange people on an economical basis). The outcome is still open.

Meanwhile the advocates of maximal car-sharing (irrespective of, or in context with, the vision of a bright future of autonomous cars) proclaim that within only a couple of years it will no longer be necessary to own a car or have a driving license in order to serve any mobility demand at any time, anywhere, far better than is possible today[3]. In most of the respective scenarios public transit is not to be found. According to a study published by the OECD in 2016, only about 10 per cent (or even substantially less) of the number of today's automobiles are necessary to let the respective scenar-io come true[4].

Apart from the fact that the results of the OECD-study and of similar studies are based on more or less questionable methodical procedures (follow the money)[5], it does for example not comply with the still growing number of cars and the level of car-ownership (at least in Germany) as well as the fact that the highlights of the major in-ternational automobile shows are the ever bigger, faster, more individual, and more expensive models.

Appraising the future of car sharing realistically, one will come to the conclusion that it will indeed substantially increase - however, not to such an extent that the use of private cars and of public transit will be substituted to a reasonable amount.

A certain part will indeed substitute the traffic comprising private cars and public transit, but the major part will primarily complement it[4].

The progress of digitalization in recent years has provided manifold possibilities for enriching the potential of shared mobility; that will continue dynamically in the future. The public transit could and should play a leading role in this context for various reasons: environment, resources and security to name but three. Several public transit operators and associations in Germany have striven for years to expanding their activities in the field of comprehensive mobility management but they are still mostly some distance away yet from exploiting the full potential - not least because they are losing efficiency through competing with entities in other regions or even within the same supply area.

In Germany, the Hamburg transit authority (Hamburger Hochbahn AG, HHA) and the Hamburg transit association (the aformentioned HVV) are claiming to be a leading player in this regard – in particular since they started a project called 'switchh', partnering with car-sharing and car-hiring suppliers[6]. Taking into account the profile of the project, it is questionable at best (and far away from the typical hanseatic understatement) to claim that it's a globally unique mobility offering.

Below, some of the main passages of chapters two and three of the report are cited directly or generalized and/or commented upon. Finally the headlines of the concluding Recommendations for the Transit Community (chapter four) are cited.

INTRODUCTION OF THE EXECUTIVE SUMMARY

Technology is transforming transportation. The ability to conveniently request, track, and pay for trips via mobile devices is changing the way people get around and interact with cities. This report examines the relationship of public transportation to shared modes, including bike-sharing, car-sharing, and ride-sourcing services provided by companies such as Uber and Lyft. The research included participation by seven cities: Austin, Boston, Chicago, Los Angeles, San Francisco, Seattle and Washington, DC.

Some have predicted that by creating a robust network of mobility options, these new modes will help reduce car ownership and increase use of public transit, which will continue to function as the backbone of an integrated, multimodal transportation system. The objective of this research analysis, which is distilled from a larger forthcoming study on the same topic, is to examine these issues and explore opportunities and challenges for public transportation as they relate to technology-enabled mobility services, including suggesting ways that public transit can learn from, build upon, and interface with these new modes.

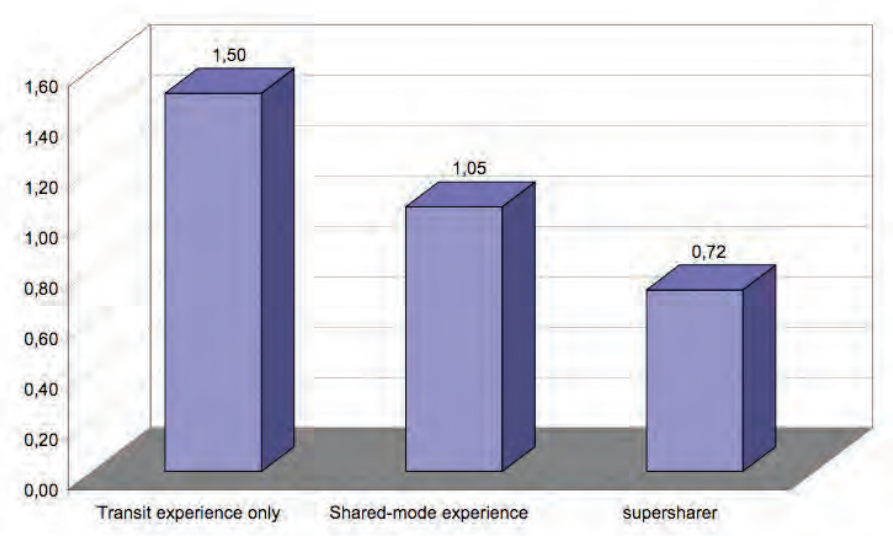
To accomplish this task, the study draws from several sources, including in-depth interviews with transportation officials, a survey of shared mobility users, and analysis of transit and ride-sourcing capacity and demand. Together, these elements provide a snapshot of a rapidly widening mobility ecosystem at an early moment in its evolution.

KEY FINDINGS

1. The more people use shared modes, the more likely they are to use public transit, own fewer cars, and spend less on transportation overall. Super-sharers, people who routinely use several shared modes, such as bike-sharing, car-sharing (eg, car2go or Zipcar), and ride-sourcing, save the most money and own half as many household cars as people who use public transit alone (figure 3).

A survey of more than 4,500 shared mobility users in the seven study cities showed that rail and bus transit were the most commonly used shared modes (about 65 per cent), followed by bike-sharing (12 per cent), car-sharing (11 per cent) and ride-sourcing (10 per cent). Nearly 10 per cent of all respondents can be classified as Super-sharer; Super-sharer normally use various forms of shared modes for all travel purposes (business, shopping, recreation, social, errands); however, even 57 per cent of the super-sharer said public bus or train was the single

Figure 3: Household vehicle ownership, by shared mode experience (based on [1])



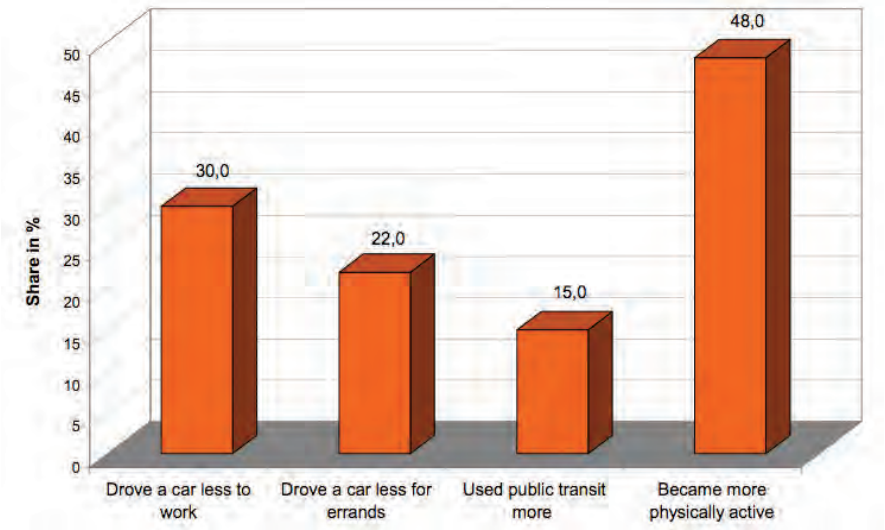


Figure 4: Lifestyle changes since starting to use shared modes, all respondents (based on [1])

shared modes they use most often, followed by bike-sharing (22 per cent).

The frequent use of shared modes is effecting a significant lifestyle change (figure 4).

2. Shared modes complement public transit, enhancing urban mobility. Ride-sourcing services are most frequently used for social trips between 10pm and 4am, times when public transit runs infrequently or is not available. Shared modes substitute more for automobile trips than public transit trips.

The research conducted for the study suggests that, instead of competing for the same riders, public transit and Ride-sourcing complement one another by serving different trip types. Ride-sourcing is mainly used for trip purposes like recreation and social and during time periods where only few or even no public transit is available. Only relatively few people use ride-sourcing for commuting. And those doing that do it only occasionally.

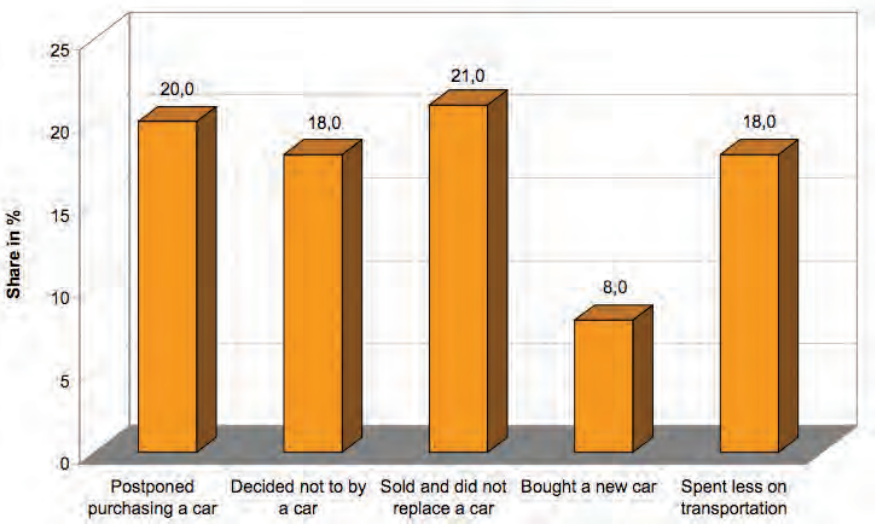
3. Shared modes will continue to grow in significance, and public entities should identify opportunities to engage with them to ensure that benefits are widely and equitably shared. Public transit agencies should seize opportunities to improve urban mobility for all users through collaboration and public-private partnerships, including greater integration of service, information and payment methods.

It is explicitly emphasized that everyone can benefit from a transport system that provides more mobility options through seamless transfers, integrated fare payment methods, and improved information. However, such a system is only possible if public sector entities make a concerted effort to ensure that collaboration with private mobility provider results in services that work for people of all ages, all incomes and all mobility needs. In the context of this complex the following aspects are addressed in particular:

- The permanently growing potential for partnerships and collaboration
- Keeping the tech-enabled innovations fair and accessible
- Paying attention of the equity implications of fare and service integration
- Public transit is the mode of choice for every income level
- Lower income households have much to gain from wider availability of shared use modes

In this context the transport sector and market-overlapping paying-, information- and management-systems play a key role – in particular based on electronic ticketing[7]. To date full advantage of the potential of e-ticketing has not been taken. This is in particular true for the transit sector

Figure 5: Household and financial changes since starting to use shared modes, all respondents (based on [1])



> ***Technology and business models from the shared mobility industry can help drive down costs and increase service availability"***

in Germany. With the government supported model-project Fahrsmart in the early 1990s Germany was on a worldwide competitive track in this regard[8]. However, most of the following ambitious e-ticketing projects have not been as successful as initially expected/hoped. The status of e-ticketing in the Berlin-Brandenburg transit association for example is today far beyond that having been planned to be reached in 2002[9].

4. The public sector and private operators are eager to collaborate to improve paratransit service using emerging approaches and technology. While a number of regulatory and institutional hurdles complicate partnerships in this area, technology and business models from the shared mobility industry can help drive down costs, increase service availability and improve rider experience.

The term Paratransit was introduced in the US in the early 1970s. According to the dictionary of public transport it is defined as follows[10]: Forms of public transport services using normal streets and roads which are more flexible and personalized than conventional fixed-route, fixed schedule service, but do not include such services as charter Bus and exclusive-ride taxi; paratransit vehicles are usually available to the public on demand, by subscription, or on a shared ride basis.

Today in the United States paratransit is often connected to

Lift Paratransit in Portland, Oregon

community transit services, which are mostly highly subsidized door-to-door services with special vehicles or taxis. A typical example is the Lift Paratransit Service in Portland, Oregon[11]. Such services play a growing important role in serving the mobility needs of elderly people and or those, who are not able to use the regular public transit, because of their handicaps. These services are in general strongly regulated and very expensive. As a consequence of the demographic change the demand for such services are rapidly growing since years. This is true as well for the effects of continuing urbanization on low dense populated (rural) areas, where only vary few or even no regular public transit is available.

It is stated, that the technologies and business models of the new shared-use modes will likely find applicability to paratransit in two main ways:

First, individual technologies developed for new shared mobility services can be folded into existing paratransit operations as part of the ongoing technical evolution of the sector. Some applicable methods and technologies include:

- Interactive reservation, confirmation, schedule adjustment and cancellation systems;
- Dynamic dispatch and routing of vehicles;
- Route combination for riders with similar origins/destinations;
- App-based payment integrated into reservation systems;
- Ability to track vehicle arrival and share trip details, location, and estimated arrival time with caregivers or other third-parties; and
- Real-time customer feedback.

The second, and perhaps more revolutionary, application would be the direct provision of transportation services to persons with disabilities by new ride-sourcing or microtransit providers. While this might seem like an extension of traditional taxi subsidies or dial-a-ride forms of demand response transportation, fundamental differences in the underlying business models make this more complicated - while offering the possibility for greater positive change if certain questions can be resolved.

Regarding paratransit, comparably detailed comments are made in the report. That is justified on one hand by referring to the broad

variety of applications and complexity of boundary conditions and on the other hand refers to the fact that the classical public transit can take in manifold regards advantage of the innovations in terms of operation, business models and applied technology. Of particular note are flexible reservation services (including ad-hoc request) and complementary 'concierge services'. The latter means a personalized complement of technology-based services, in particular for customers who want to access these service but either don't have a smartphone or can't use the default interface. This type of service has been tested in numerous pilot projects.

RECOMMENDATIONS FOR PUBLIC TRANSIT AGENCIES...

The full title of the chapter is 'Recommendations for public transit agencies for building on innovations and cooperating with shared modes' and it is introduced by the following paragraph: "This report concludes by presenting recommended actions that public entities - public transit agencies, transportation departments, and other local and regional agencies - can take to promote useful cooperation between public and private mobility providers. It also suggests regulatory enhancements, institutional realignments, and forms of public-private engagement that would allow innovation to flourish while still providing mobility as safely, broadly, and equitably as possible."

The following complexities are addressed:

- Make mobility the goal and change performance metrics;
- Lay the groundwork for strong public-private-partnerships and targeted investments in the mobility system, including public transit and shared modes;
- Maintain accessibility and equity as central mandates for urban and regional mobility especially with and evolving mix of public and private entities;
- Extent fare integration and mobile payment to goals beyond smoothing fare-box interactions, such as subsidy administration, mode-shift goals, and gathering rider-ship data;
- Keep information open and widely available for the broadest benefit;
- Transform public transportation agencies into mobility agencies.

CONCLUSION

The APTA Report on the meaning, the potential and the conditions of shared mobility in connection with public transit refers to an issue of high actuality for the public transit community in Europe. That is true in particular with regard to the yet latent - and even more for the expected - changes in mobility behaviour and the mobility needs of the population. The positioning and the activities of the transit industry in this context will be decisive, whether it will take profit of it or will be cannibalized by it.

While in the past it was argued, for many good reasons, that public transit practices in the United States are only to a very limited degree transferable to Europe or Germany in particular, because of the different role, history, and boundary conditions, the opposite is true for shared mobility. Because of that it is deemed to be highly recommendable to study and check the content and the recommendations documented in the respective report in detail regarding its relevance for the own business. This is particularly worthwhile regarding the comprehensive, integrated approach.

Similar, extensive research work on the respective issues should be carried out, resulting in a White Paper referring to the specific conditions and needs in Europe, taking into account the yet limited progress in taking full advantage of the readily availa-ble and still dynamically growing technological potential of services such as e-ticketing and automation.

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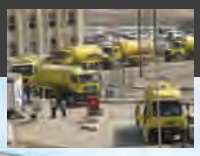

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Safety and Security in Transport

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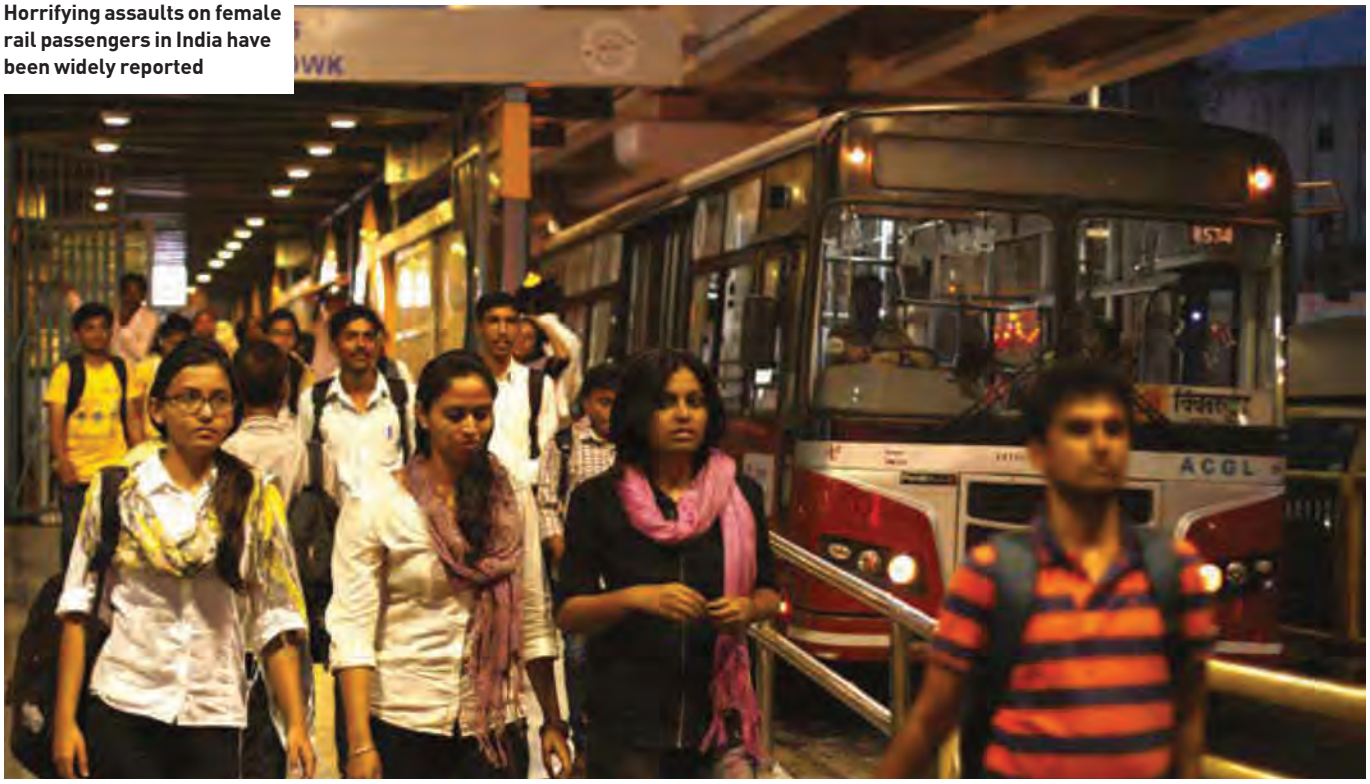
- **SLoCaT** – How women will benefit from the outcomes of the New Urban Agenda
- **Smart City Workstations** – From a source of frustration to the pinnacle of efficiency

Bringing Venus closer to Mars

How will a new urban agenda increase, among other things, how safe women feel using public transit? **Heather Allen** investigates

It's fair to say that 2016 has been a year of surprises – none less than the vote by Britain to leave the European Union and most recently the election of Donald Trump as President of the United States. Both were "who would have thought it?" moments when even those who are not interested in politics have no choice but to take something of an interest. The only thing that appears to be sure is that we simply have no idea how either of these two game-changing events will actually work out. In addition to national politics, the international political scene has also seen a lot of change in the past 12 months.

September 2015 saw a new set of sustainable development goals being



Horrifying assaults on female rail passengers in India have been widely reported

put in place, after one of the more comprehensive stakeholder engagement processes ever undertaken by the United Nations (UN). Just a year later the Paris Climate Agreement was agreed by some 197 countries and came into force on 4 November 2016, far quicker than anyone thought possible. In October, a new non-binding New Urban Agenda was agreed as a framework for urban development. All three are now highly relevant for cities as local action is required to deliver them. They all have goals on equity and inclusiveness, but more specifically on gender and women's empowerment.

Gender was recognized in 2009 within the UNFCCC climate change process – and this has now been expanded to an annual Gender and Climate Change day within the UN Climate Change Conference; this year it is one of the four priorities for the Moroccan Presidency. New language is being put forward to be included in the Action Agenda for the Paris Agreement to include it more formally.

GENDER-SPECIFIC MOBILITY

So why is this either necessary or important you may ask? It is often difficult to understand the relevance of such high level international agreements and how they influence anything that might be put in place at local or city level. All three of them have recognized the need not only to be more inclusive but that as 50 per cent or more of the population are women we should look at how we can make sure both men and women are playing an equal role in achieving them. Men and women may share common values but the way we react and our pathways to get there are often quite different – as highlighted in the book Women Are From Venus, Men Are From Mars.

Certainly urban women have become more empowered over the years, but unfortunately in both the developed and the developing world statistics on violence against women and girls show that this is growing rather than decreasing. Studies have shown that this increases with stressful situations, in particular with unemployment or displacement. The increasingly precarious nature of many families living near the poverty line in urban areas means that it is on the rise. In addition there are a growing number of single heads of household and the family structures and stability are being increasingly eroded.

It is clear that if women are to be able to contribute to the household income they need equal access to education and jobs, and here transport comes into the picture. The transport patterns and mobility habits of men and women are quite different and there are numerous studies that have looked into this. Men tend to take longer, more regular trips, while women will make more frequent and complex trips, often associated with fitting in the needs of others such as children or close family members as well as shopping or errands. They also use and rely on public transport more than men – and usually have less access to the family car, if

It is important that women continue to use public transport as we know we need to increase our usage and recognize that many women are already doing this more then men are

The FIA Foundation's "Safe and Sound" report and fact sheet

there is one. Yet despite women being higher users of public transport there is little extra attention given to their particular needs in planning or operating it. In addition women and men have rather different views on safety and security – a 'Mars and Venus' difference!

A GLOBAL CONCERN

Affordable and accessible public transport is very important to women and their empowerment in terms of access to health, education and jobs as well as in their daily lives and family duties. However, using public transport is not always an enjoyable experience for them. Recent work looking into the situation of the harassment of women while using public transport shows that it is a daily occurrence for many. The whole journey can be risky in many cities especially when women may be travelling at certain times of the day.

Surprisingly the FIA Foundation report Safe and Sound found it occurs extensively in London, Paris and New York. In the UK, one in eight women stated that they felt so unsafe using public transport that they avoided using it. It also found that as much as 90% of incidents are not reported.

The harassment of women and girls includes verbal (particularly linked to race, faith or culture), visual or sexual and occurs at all points along the journey, on the way to public transport and while actually travelling on buses or trains. Part of the problem is that women often think that it is in some way their fault and so work needs to be done with them to help draw the line as to what is acceptable and what goes beyond this. A new study has recently been launched to investigate this further and help throw more light onto the subject. Three cities in Latin America – Quito, Ecuador; Buenos Aires; Argentina and Santiago, Chile will use a common methodology to show what may be due to the local context and what is similar in each city. The study will look into the impacts of poor and overcrowded public transport services, as well as how the trip to and from the public transport stop or station may also put them at risk. The study will bring

Women-only railway carriages on in the Middle East, among other places, are quite commonplace

together transport professionals (as well as transport operators and planners) with sociologists and women's groups to exchange information and work on a tool kit for cities and other authorities. Suggestions on how to address women's only transport and the use of technology will be investigated. This can provide useful guidance for both the developed and the developing world.

GENDER NEUTRAL

Making public transport safe is not just an issue for women as it should be safe for everyone. Men suffer from violent attacks more than women, although rape of course does happen. The daily insidious harassment of visual or verbal is different to this. CCTV cameras are part of a technical solution that can help to provide an increased level of security but most of all we need to work on public awareness and a zero tolerance approach combined with clear indications of what to do if you find yourself in such a situation. Safe and Sound found that programmes that helped to quickly identify the perpetrators were very effective and part of this is encouraging women to know when something is beyond being acceptable and know how to say so. Clearly advertised panic buttons and help lines help to inform women (or anyone for that matter) of what they can and should do.

Women must be convinced that public transport is safe for them to travel on and much more effort needs to be put here. It is important that women continue to use public transport, as we know we need to increase our usage and recognize that many women are already doing this more then men are. Yet here is the rub. If you have ever travelled with small children on public transport you will know how difficult this is. So cars become more desirable at different life stages. As women become more empowered they also buy cars, often thinking that they and their families are safer going by car. Looking at the statistics comparing public transport and cars – this is certainly not the case!

However, this should not be seen as a feminist issue but rather as a socio-economic one. Women (and men) need to have safe and affordable access to all types of public transport and this will also positively impact local and national economic development. The contrary is also true – and from this research it seems more true for men. Women will just reduce their transport horizons if they perceive that transport is not safe. As we live more in urban and peri-urban areas we need to reassure women that taking public transport is the right thing to do.

Having gender in the text of these international agreements helps to make it easier for governments to increase their efforts towards ensuring that women are able to take part more actively in all aspects of life. But more importantly if we are to achieve the ambitions of these international agreements – whether they are connected with sustainable development, climate change or a new inclusive urban agenda – we need to understand better what women need and want especially in a city context. We need to bring Venus a little closer to Mars – or make the unimaginable a reality.

Having gender in the text of these international agreements helps to make it easier for governments to increase their efforts towards ensuring that women are able to take part more actively in all aspects of life

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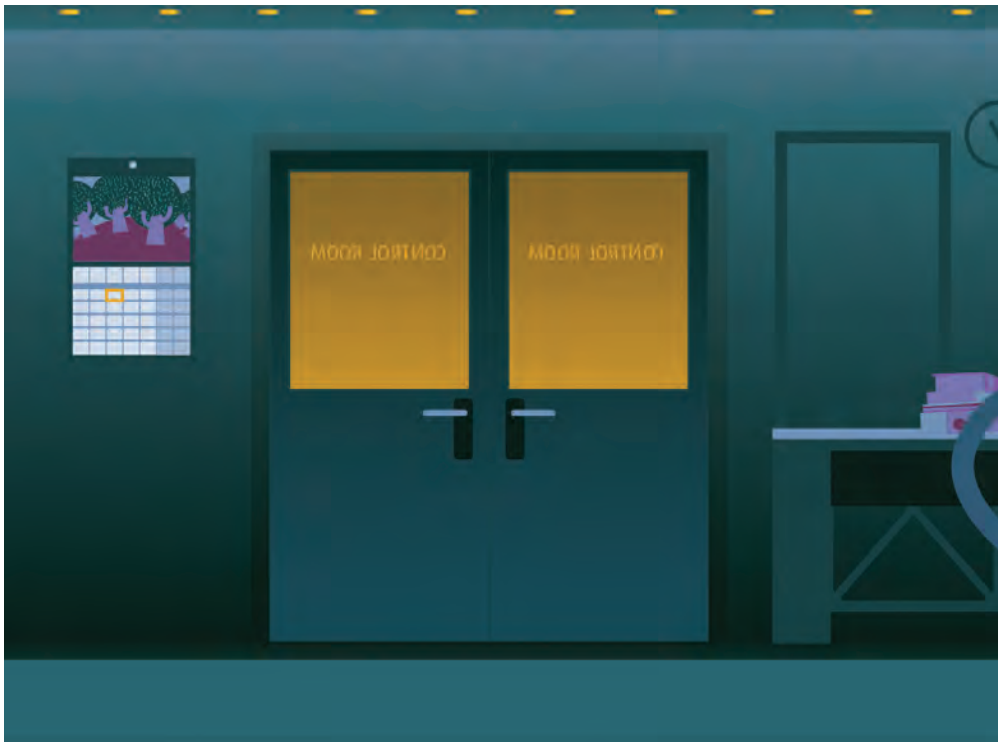


Station approach

The smart city operator workspace: **Johan Bekaert** charts the course from a source of frustration to the pinnacle of efficiency

Control room technology has changed tremendously over the past 25 years. The amount of available data has grown through the roof, cameras have greatly improved, and additional information can now be integrated in the control room as well. But operators still work in the same way. Their tools have changed, the resolution of their monitors has improved, and they have an Internet connection, but the way they work has stayed pretty much unaltered. So, to bring the operator workspace into the 21st century, something verging on revolutionary was required.

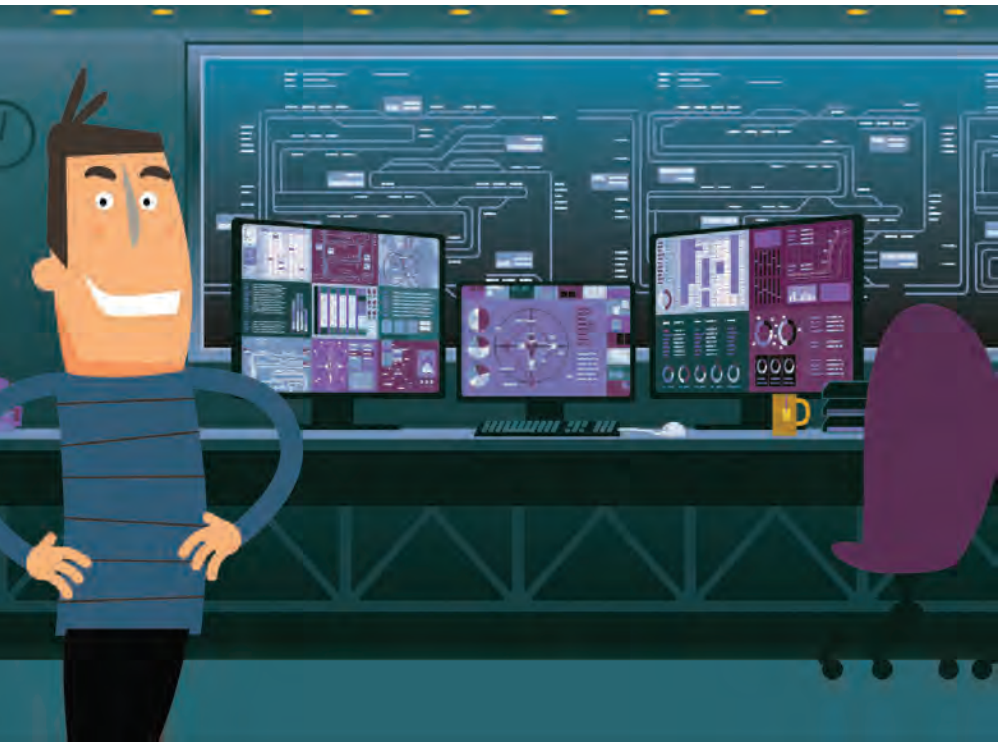
The amount of data generated in the world is huge. 'Big data' is an enormous understatement – the amount is in fact so overwhelming that, according to research firm IDC, only about 0.5 per cent is currently used and analyzed. That's quite astonishing. In control rooms in general, and in traffic management centres in particular, there are still heaps of useful information that remains untouched. That's why ever-more powerful computers and software are being used to process and analyze the data. But, however powerful the machines and software become, there's just one thing people want to keep as is: the final decisions must be taken by a human. The operator is still the centre of the control room, and that's where he or she belongs. The decision to lock down a highway or close all routes into out of a city cannot be taken by a machine – and, most likely, it will stay that way for at least the next 10 years.

THE SECURITY DILEMMA

However, even though operators are extremely important, their job is not easy or efficient. Things can get really complex – especially when dealing with systems at different security levels. These systems need to be separate at all times, which means that the operator has multiple computers to operate – each with its individual keyboard and mouse combination forcing the operator to constantly move around to consult a particular piece of information. A very ineffective way of working indeed, but necessary to get a complete overview of the situation.

SEARCHING FOR THE HOLY GRAIL OF OPERATOR EFFICIENCY

So, is it the case that no manufacturer has ever tried to come up with a solution for this situation? Well, many have – and all have failed for one reason or another. First, there were the KVM switches, allowing the operator to work on multiple computers with just one keyboard, mouse, and monitor. Although this sounds like a pretty decent solution, it has a number of flaws. First of all, it's impossible to view multiple sources simultaneously. This can be really troublesome in emergency situations, when



all relevant information is needed in the blink of an eye. A workaround for this is to keep the monitors connected to the computers, and just use the switch for the keyboard and mouse. But this greatly expands the operator workspace and still keeps the operator moving around – in this case, while carrying a keyboard and mouse... Secondly, it is quite a nuisance to constantly be using the switch, which – typically in stressful situations – can lead to mistakes.

Another approach is the use of virtualization software, which allows all applications to run on the same server. This sounds great but many vendors of operations control software still prefer to run their most demanding applications on dedicated machines – for robustness and reliability reasons – while reserving virtualization for things like dashboard applications or administrative software. Although more and more vendors enable their software to run on virtualized platforms, there are still a lot that don't. Furthermore, many control rooms still work with legacy applications that are not fit for virtualization.

Desktop sharing is another technology with a lot of potential in the control room, but still limited use. This is a great way to help operators collaborate, but it's mainly used for static applications and not for the important dynamic information.

DESIGNING BOTTOM-UP

To address this situation and meet this most pressing of needs Barco has introduced OpSpace, a dramatically different operator workspace solution. In fact, OpSpace combines IP-based KVM switching, virtualization and desktop sharing software, and puts them in a robust and simple user environment. "When designing a new product, engineers tend to start with an idea, create a prototype, and then go to alpha customers to get feedback," Dirk Hendrickx, GM Barco Operational Collaboration Systems, explains. "For OpSpace, we started by talking to operators to learn how they want to work, what their utopian workspace would look like. This opened up a lot of new insights for us, making us take drastic design decisions we would never have thought of ourselves."

Smart city operations workstations have to be ergonomically on-point

OpSpace provides operators with a single, personalized, concurrent view on applications, remote desktops and video streams – all freely combined onto a single, high-resolution unified display surface spanning multiple displays on their desk. Operators get a complete overview of the situation and can control all applications with a single keyboard and mouse. "The objective was to create a workspace that feels very comfortable to operators," Hendrickx says. "It doesn't really make sense for operators to have to think about which security system a certain piece of information is located on. OpSpace provides all necessary applications and data in the same environment. All of the information the operator needs is instantly accessible, and can be consulted and manipulated with a single keyboard and mouse. This saves time in crisis situations, and leads to better decision-making."

Keeping operations staff focused and comfortable is undeniably vital

ENSURING A COMPLETE SITUATIONAL OVERVIEW

Operators usually have a large number of windows to monitor, typically more than one per display. OpSpace offers a large pixel space across multiple monitors and allows the operator to display multiple sources per physical monitor enough to keep all vital windows open at all times. In the blink of an eye, the operator has a complete overview of the situation. The concept of a unified pixel space allows the operator to move any window to any location on the screens and to shape the window layout according to the needs of the situation at hand. Whenever required, the operator can create a 'perspective' of different sources by combining multiple applications or sources into one logical view, and correlating information from different sources into a single view to handle a specific situation. Moreover, these perspectives can then be shared with colleagues in the same control room, in a remote crisis room, and even in the field.

"A very specific thing we learned from our talks with operators was to employ the 'Work Area' concept," Dirk Hendrickx says. "This allows the operator to copy any application to the work area in front of him or her. The operator can then interact with this application, while maintaining an overview of the other signals still present in her peripheral vision, without moving around. In this way, the overall layout of the operator workspace remains constant – so the operator is never confused about the whereabouts of a particular piece of information – while the work he needs to focus on is always right of front of him."

SLAYING THE LATENCY DRAGON

With OpSpace, Barco has also found the perfect balance between security and fluid workflow. The system provides secure access to systems across multiple security domains via 'uni-directional' hardware encoders, integrating only at the presentation layer. As an extra security measure, OpSpace separates operators physically from the back-end systems that host the actual operational content. "Creating a virtual work environment was a challenge we really wanted to tackle," Hendrickx continues. "It gives us the opportunity to integrate all systems in a logical way, and it removes all computers from the control room and eases maintenance by storing all the hardware in a separate location. But we really needed to eliminate latency a dragon that has devoured so many virtual systems before. Operators should have the feeling that the computer is still located under their desk. We kept this criterion constantly in mind and I'm happy to say we really nailed it!"

Furthermore, OpSpace uses standard networking technology, server and desktop virtualization infrastructure. It also allows integration of legacy systems on the operator's desk by using high-performance hardware encoding technologies, allowing secure consolidation of information across multiple isolated networks. Plus, the system is fully scalable, so customers can adapt the solution to their changing needs, thus safeguarding their investment.

A NATURAL WAY OF WORKING

When you watch OpSpace in action, it actually feels like the only natural way of working. It's as if an operator workspace is supposed to work like this – and to think that years of R&D efforts were needed to create such a natural system! The user can select the number and size of the screens. This means that you can build a system with three or four monitors lined up on the desk; or you can have more – and larger – displays stacked on top of each other. The first configuration is handy when there is a large video wall in the control room; the second is most often used in smaller rooms without a video wall.

FYI
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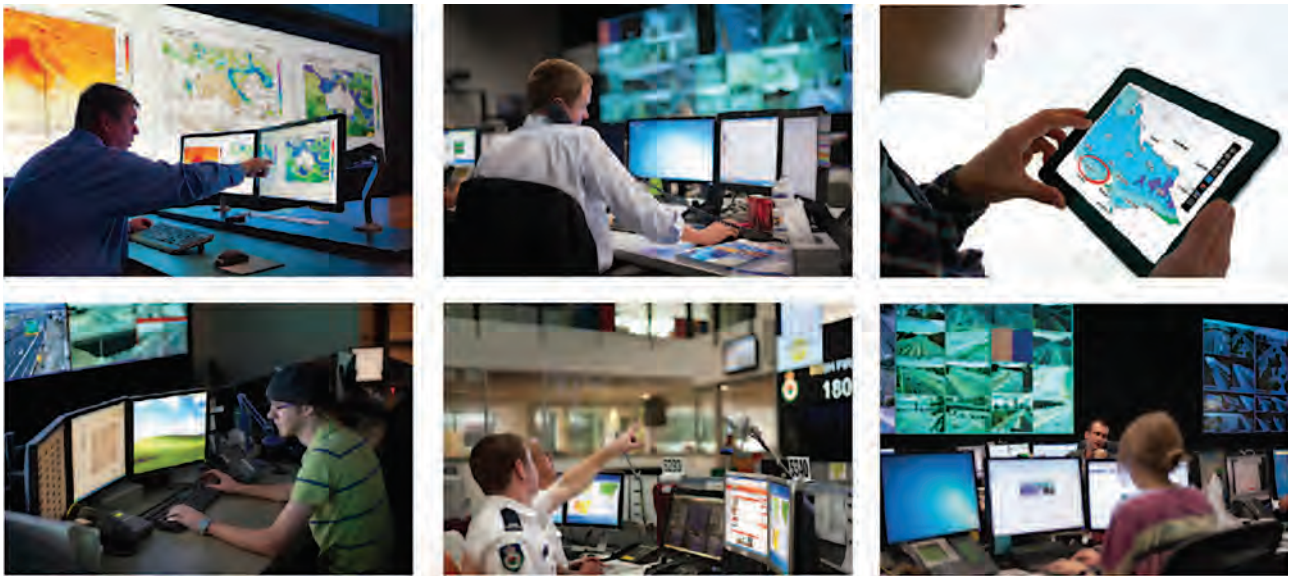

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