EUROPEAN CITIES AND REGIONS NETWORKING FOR INNOVATIVE TRANSPORT SOLUTIONS

ROAD VEHICLE AUTOMATION AND CITIES AND REGIONS

mobility & traffic efficiency

This discussion paper offers the perspective of Polis member cities and regions on road vehicle automation.

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1. BACKGROUND

Vehicle automation is one of the leading discussion topics in transport technology circles. Even non-transport professionals, including members of the public, can hardly remain immune to this subject given the significant media coverage about driverless cars. Global regions (US, Europe and Australasia) are competing to be the first to bring automation on to the roads, as are some of Europe's Members States, and naturally the vehicle manufacturers themselves, be it the traditional OEMs or new market entrants such as large technology companies.

While there are some local and regional transport authorities cooperating in pilots for (partially) automated vehicles (AVs), the majority are awaiting outcomes from "early adopter" cities or regions to understand the legal, transport and policy impacts of automated transport as well as public acceptance. This is a reasonable approach in circumstances where these agencies have little or no internal capacity for engagement in this exploratory activity.

Given the potential impact of self-driving cars in urban areas, for example in terms of congestion, environmental impact, road safety, user behaviour and infrastructure management, local and regional authorities and public transport providers need to play a more prominent role in the development of policy around AVs.

2. WHY PREPARE A DISCUSSION PAPER ON AUTOMATED ROAD VEHICLES?

Polis is concerned about the optimism bias conveyed by the media and literature about the introduction of AVs, especially automated cars which appear to be the focus. Expectations are being created that self-driving cars will be there tomorrow, will always operate perfectly and will solve congestion and eliminate accidents. While automated cars may bring some benefits, there is also the possibility that their widespread introduction in urban areas could lead to increased congestion, negative environmental impacts (unless all AVs are electric and/or powered by renewables) and negative health impacts, if walking and cycling are discouraged. Their introduction therefore needs to be carefully managed in the context of sustainable urban mobility objectives. In other words, even if they prove to be technically and commercially viable, it might be necessary to limit the use of AVs for policy reasons.

While automated cars may bring some benefits, there is also the possibility that their widespread introduction in urban areas could lead to increased congestion, negative environmental impacts and negative health impacts, if walking and cycling are discouraged.

Against this backdrop, Polis saw the need to promote a discussion among its members about vehicle automation, focusing on the car as opposed to lorries and buses and on 'personal mobility' rather than logistics. While some of the points raised in the paper may well apply to these other modes, they do merit a separate discussion document. The aims of this paper are:

a. to raise awareness of AV developments and their potential mobility impact among city and regional administrations and to assist them in setting transport policies and plans to deal with them;

b. to raise awareness of city and regional transport policies among vehicle manufacturers and other automated vehicle players;

c. to communicate the views of local government on AV developments to a wide range of policy makers, in particular the European Commission and national governments, which are injecting substantial public funds to support research and development on AVs and building strategies to support AV deployment[1];

d. to challenge the AV community to develop products and services that fit the communities they will be used in.

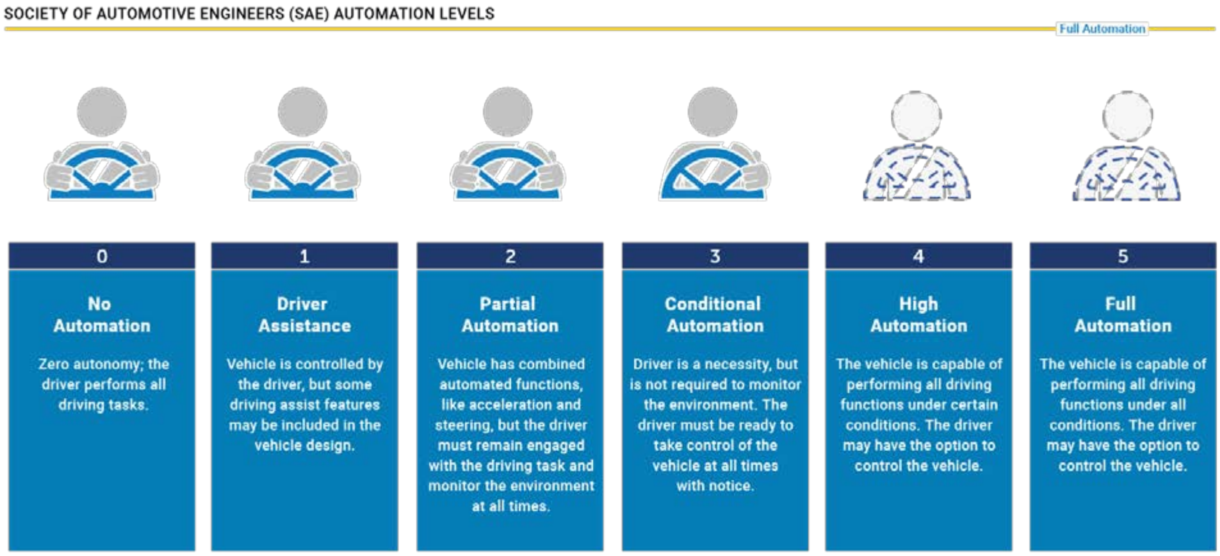
The remainder of this paper explores the definition of automation; the potential impacts of automation and the issues that city/regional authorities need to address and engage on, as automated motoring advances.

3. TERMINOLOGY: DOES AUTOMATION REALLY MEAN AUTOMATION?

Different levels of automation, defined by the US Society of Automotive Engineers (SAE), have been adopted in Europe. Some of the lower levels of automation are already being offered in newer cars today, such as adaptive cruise control or parking assistance. Rather than providing full autonomy, these systems were designed to support the driver, who remains in full control of the vehicle.

Car maker announcements about the imminent arrival of 'autonomous cars', widely reported in the media, are creating expectations that fully driverless cars will be here soon, usable everywhere, and the end of manual driving is near. These headlines often fail to make the distinction between automating certain driving functions in specific environments (levels 1-4) and automating the full driving task in any environment (level 5). The latter level is the most talked about in the studies and the press, yet it is the one that is the most difficult to achieve, particularly in an urban environment. Will it take 10 years as some industry players claim, or 50+ years according to a growing voice of European and US experts[2]?

Headlines often fail to make the distinction between automating certain driving functions in specific environments (levels 1-4) and automating the full driving task in any environment (level 5).



Source: NHTSA adapted from SAE J3016

[1] For example, the European R&D Programmes H2020, the European automotive strategy initiative GEAR 2030, the EC-led C-ITS Deployment Platform and the UK government's Centre for Connected & Automated Driving, among others

[2] *Paths to a self-driving future*, KiM Netherlands Institute for Transport Policy Analysis and *The truth about self-driving cars*, Steven Schladover, University of Berkeley and California Path Programme Manager, Scientific American magazine, June 2016

4. WHAT ARE THE POTENTIAL IMPACTS OF AUTOMATED VEHICLES FOR CITIES AND REGIONS?

There are many uncertainties about when partially and fully automated vehicles will arrive, in what form (vehicle type, privately owned or shared, autonomous or cooperative, etc.) and over what timespan. While these uncertainties make it very difficult to predict the potential impacts, this should not prevent transport authorities from starting to reflect on this, drawing on the findings of various AV studies and projects and their own experience as transport planners and managers. Polis has undertaken such an exercise: the approach taken has involved identifying potential positive and negative outcomes across a broad range of transport domains. Such an exercise may encourage transport authorities to think about which policies and measures they can adopt to achieve positive outcomes and to avert or mitigate negative ones. The potential effects of automated road vehicles, described below, have been considered primarily in the situation when all vehicles are fully automated. The effects of a hybrid environment, in which automated and non-automated vehicles co-exist, is less clear. Added to this uncertainty is the effect of partially automated vehicles in this mixed traffic environment.

Transport authorities need to think about which policies and measures they can adopt to achieve positive outcomes from fully automated vehicles and to avert or mitigate negative ones.

4.1. Travel behaviour

The impact of AVs on travel behaviour is the one area that holds great unknowns. At one end of the spectrum, where the private car remains an important mode of transport and the introduction of AVs is not a managed process, some studies[3] suggest there may well be a shift from sustainable modes (public transport, walking and cycling) to AV cars (whether privately owned or shared), leading to an increase in kilometres travelled, including the possibility of 'empty km' where cars would drive to a designated parking area once the occupant has been dropped off or even drive around the city to avoid paying a parking fee. Besides the rise in km travelled and subsequent congestion, the impact on public health would be dire due to the decrease in walking and cycling.

At the other end of the spectrum, where the growth in AVs goes hand in hand with a rise in shared mobility, to complement high capacity transport (tram, metro, train), walking and cycling, there is potential for a drop in private car use and ownership and avoidance of a scenario of empty private vehicles driving around looking for a place to park or to avoid paying a parking fee.

It is difficult to predict what will happen. While many transport authorities would no doubt prefer the second scenario, there are important pre-conditions and risks, namely the creation of sufficient shared mobility fleet capacity and a massive shift from the private car to shared mobility and public transport - many people are still attached to their car for the personal freedom and independence it offers. A mobility study in Barcelona found that 69% of drivers today believe they will still be driving a car in 10 years' time[4]. Price is no

[3] *Urban mobility systems upgrade*, International Transport Forum and city of Amsterdam-commissioned study *Impact of self-driving vehicles on the city of Amsterdam*

[4] *Citizens and mobility in Barcelona – current situation and future prospects*, Creafutur, June 2017

longer a key factor in car ownership. In fact, automation may well accelerate the private car option, since time stuck in traffic could be spent doing other things.

Moreover, for economic efficiency reasons, the shared mobility fleet owner may want all vehicles operating all the time, which would entail either a smaller fleet size meeting off-peak demand and only a part of peak demand, or a larger fleet size meeting peak demand and redundancy during off-peak. Automation will not change this reality. A fleet owner of automated vehicles will want each vehicle to pay its way (as there will still be capital costs, maintenance costs, inspection costs, fuelling costs, among others). Therefore, the idea that AV vehicles will be 'always available' may turn out to be an economic delusion. To manage demand peaks, it is not unrealistic to assume that dynamic pricing of on-demand services would become the norm, as is the case today for at least one major ride hailing company. Another hypothesis gaining traction would see private car owners putting their own vehicle into service when not using it, thus generating an income for the owner to off-set the cost of the vehicle.

The idea that shared and automated vehicles will be 'always available' may turn out to be an economic delusion.

A further consequence of the shared mobility scenario is the possibility of it replacing public transport partially or completely, rather than being complementary. One study suggests that a robotaxi trip could cost as little as a few cents per km, making it very cheap and convenient to use this service to perform the whole door-to-door trip[5]. In such a scenario, it is not inconceivable that the growth in automated and shared mobility could herald the end of public transport as we know it. Policy makers need to think about the future and not leave it to market parties alone, through the development of a clear vision and policy.

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4.2. Spatial aspects

4.2.1. Reduction of (on and off-street) parking space

When vehicles can drive themselves anywhere without the intervention of a driver, it has been suggested[6] that a significant amount of on-street parking and off-street parking could become redundant as the vehicle will be able to drop off its occupant(s) and then either drive off to a convenient place to park (in the case of a private car) or take on other passengers (in case of an automated taxi). The size of the parking space reduction will depend on many factors, including modal split and the level of car ownership and the space set aside for parking and drop-off zones. For such a scenario to materialise would require very substantial changes in user behaviour and the development of services which are secure, reliable, comfortable, convenient and affordable compared with the alternatives.

[5] *From Parking to Parks – Cities and the Self-Driving Car Disruption*, Tony Seba, Joint Research Centre CAV workshop, 13/6/17

[6] *Urban mobility systems upgrade*, International Transport Forum

Furthermore, any reduction in demand for parking would need to be managed to ensure that freed-up urban road space is put to other uses before it is taken up by those who do not choose to relinquish their car. The introduction of automated vehicles creates an opportunity to redesign streets and to use that space more efficiently than today. For instance, future streets could have different usages depending on time of day and type of demand.

The introduction of automated vehicles creates an opportunity to redesign streets and to use that space more efficiently.

Most cities are not waiting for automated vehicles to remove their parking capacity. The demands of pedestrians, cycling, bus priority, air quality and quality public realm have meant that the level of on-street parking is diminishing rapidly in any case. Vehicle automation is not a pre-requisite or economic cause for such re-arrangement of urban space, but it may well accelerate this process.

4.2.2. Urban sprawl and longer commuting trips

Travel time is often cited as a benefit of automated vehicles, since the car occupant(s) would be able to spend the trip doing more productive things, such as reading, working or sleeping. One of the possible effects is that trips could become longer as people move further away from their work place (often in the city) to areas where homes are cheaper and larger and where proximity to the public transport network, such as the railway network, is not needed. This would encourage greater car use to and within cities, leading to an increase km travelled, and is not a sustainable evolution, even in the case of electric-powered vehicles.

Trips may become longer as people move further away from their work place to areas where homes are cheaper and larger.

4.3. Socio-economic aspects

4.3.1. Enhancing accessibility to persons with limited transport access

It is claimed that automating vehicles could, in the longer term, reduce the cost of passenger transport service provision especially for those transport services operating in areas of low and dispersed demand, such as rural areas and suburbs, and special transport services for the elderly and disabled. Currently, such services are either heavily subsidised or few and far between. By removing the cost of the driver, an automated passenger transport service could potentially offer a service on demand at lower cost, thereby increasing the accessibility of people living in these areas, especially those people without access to a car, such as the elderly, the disabled and those on a low income.

In a context of shared automated vehicles, access to transport may be improved for those with limited access currently. However, different levels of service may well emerge, depending on ability to pay.

4.3.2. Increasing social division and inequality

There is a risk that automation may reinforce or even accelerate inequality if it is not designed in the right way. In a scenario of market-operated fleets of shared and automated cars, which manage themselves on the road, there is a risk that different levels of service could emerge. It is not so far-fetched to envisage premium service subscribers gaining access to better and faster services than basic subscribers. Such a scenario may be avoided where shared and automated mobility is introduced as part of an integrated planning process and where the road/traffic authority retains strategic control of the network.

Furthermore, the AV service is likely to require users to be on-line and connected with mobile devices. This requirement will not suit those who cannot use these devices or afford them, leading to a widening of the digital gap. In addition, the requirement that the intending passenger must provide personal details (eg, of where they wish to travel) to a private or impersonal computing system is not something that would sit well with many cultures or individuals in the EU.

4.3.3. Employment

There is no doubt that the advent of AVs will have a significant impact on many different jobs that the transportation sector supports, from vehicle engineering and vehicle maintenance through to taxi and bus driving. Changes to the profession are already happening due to digitalisation (eg, taxi drivers rely on digital maps rather than know how) and the growth in electric vehicles. Automation does not necessarily have to equate to job losses; new types of jobs may emerge that are less monotonous in nature, more people oriented and require other skill sets. What is important is to anticipate the new jobs that will be needed, work with those affected by the change and make them the owner of the process. Once automation is no longer a taboo, it will be possible to make progress in this direction.

If handled in the right way, automation could lead to new types of jobs that are less monotonous in nature, more people oriented and require other skill sets. Anticipating those new jobs and making affected workers the owner of the process is key.

4.3.4. Value of time

Figures running into the billions of euros are often cited as the cost of congestion in Europe, due to the time lost by those stuck in traffic. While automation may not necessarily solve congestion, the time drivers spend in congestion may no longer be considered an economic cost because this time can be spent doing other productive things. This is especially important for professional drivers, such as lorry drivers. However, as indicated in the previous section, automation may well lead to longer road-based commuting trips. This may lead to far more vehicles or km travelled but provide an opportunity for economic development in the less crowded and developed areas of a region or country.

4.3.5. Public finances

The cumulative impact of potential changes to mobility resulting from vehicle automation may well affect public sector budgets. Already today, the tax exemption of electric vehicles from many national and local regimes, combined with the loss of fuel tax, is being felt. In a scenario where automated vehicles lead to fewer privately-owned cars and less revenue from parking fees and fines, new streams of income will need to be created, possibly through road user charging as several studies have suggested, including the city of Amsterdam-commissioned study[7].

4.4. Road Safety

4.4.1. Using technology to tackle driver distraction and to enforce road safety rules

Potential road safety benefits are a key driver for AV developments. Such claims are attributed to the removal of driver distraction because the vehicles are equipped with technology to detect and avoid collisions and programmed to comply with traffic rules such as speed limits. Current road engineering measures (speed bumps, traffic calming) and enforcement can be expensive for the road authorities and are not always effective. Consequently, vehicles that are programmed to respect speed limits hold great appeal among road authorities. In practice, ensuring compliance may not be simple because the rules, regulations and road signs have adapted to local circumstances over the years. For instance, the same rule may be interpreted differently by a pedestrian or a driver in Berlin compared to Barcelona. Laws and regulations are interpreted in a given context. Therefore, to deliver full automation requires a close dialogue between industry and transport/road authorities.

Achieving road safety benefits presumes that systems are always on, always fully operational and will 'fail safe'. This is a big ask: in 2017, connected cars can be hacked; transport booking systems overbooked; fleet management systems can fail: power and communication systems have outages; components fail; and navigation guidance is not infallible. Automated vehicle systems technologies will therefore need to prove that they are robust, secure and can revert to fail-safe mode when needed.

4.4.2. Interaction with non-AV road users

The safe interaction of automated vehicles with other road users is paramount, especially vulnerable road users (pedestrians and cyclists). If automated vehicles were to share the road with these road users and even non-automated road vehicles including motorcyclists, the safety implications would have to be carefully considered. Ensuring the necessary level of safety, in terms of safe distance and safe speed for instance, may mean that automation is not able to deliver its full potential in terms of efficiency. The safe interaction with other road users during the long transition phase is also a key issue.

Furthermore, it is evident that if automated driving for private vehicles is vouched as acceptable by a city, then it should be safe for trucks and buses too. The notion of a driverless

If automated cars are acceptable in a city, then it should be safe for trucks and buses too. Yet, the notion of a driverless truck moving through city streets among cyclists and pedestrians is not the usual picture presented, and may confirm the optimism bias evident in AV discourse.

[7] *Impact of self-driving vehicles on the city of Amsterdam*, conducted by the Boston Consulting Group

truck moving through city streets among cyclists and pedestrians is not the usual picture presented by proponents of AV, and perhaps gives credibility to the optimism bias that is evident in discourse on AV.

In addition to the above, there are many other safety-related issues that need to be resolved such as the hierarchy of safety priorities (does the vehicle hit the pedestrian or the oncoming vehicle?) and liability (allocation of responsibility in case of an incident).

4.5. Traffic Efficiency

4.5.1. Road space management

Due to their ability to move in platoons with little headway, it is claimed that automated vehicles could enable traffic to flow more efficiently and smoothly. While this may be relatively simple for highway driving, it is less clear in city centres, where road links are short and interrupted by pedestrian crossings, parked vehicles, etc. How such platooning will operate in practice, especially where AVs must co-exist with other road users, requires further investigation and evidence – the MAVEN[8] project may produce new insights. There is concern about the capability of vehicle sensors and how the AV will react on a busy street. Will the sensors be so sensitive as to stop regularly, thereby becoming a hindrance to traffic flow? More insight is needed. One piece of research[9] found that any traffic efficiency gains may only materialise in the medium to long-term, once AVs are well tried and tested and the penetration level is high. The interim period could be painful.

Automated vehicles may lead to more efficient and smoother traffic flow on motorways but the picture is less clear in city centres, where road links are short and are interrupted by pedestrian crossings and parked vehicles.

Several other AV use cases related to the efficient use of urban and regional road space have been put forward, including the use of bus lanes by AVs during off-peak periods or indeed anytime the bus lane is not occupied. Consideration of these use cases will vary from one transport authority to the next and will depend on local policy.

4.5.2. Richer data for traffic and asset management

Increasing vehicle intelligence and connectivity is offering the opportunity to create a pool of data that could assist the road authority/operator. Anonymised location and destination data generated by the vehicle could enable road authorities to make better short-term traffic forecasting and to distribute vehicles more efficiently over the network. However, it should be noted that some cities choose to stack excess traffic at least problematic locations, rather

8 http://maven-its.eu/

9 *The impact of automation on the urban environment – Findings of Finnish study,* Pirkko Rämä and Satu Innamaa, VTI (Finland) presented at CityMobil2 Reference Group workshop, La Rochelle, 30/3/15

than redistribute over the network, and individual vehicle data is not necessary for this.

There is a host of other vehicle-generated data that could be useful for the traffic and asset manager, to support dynamic traffic management, to monitor the state of the road (eg, presence of potholes or ice), to manage access regulations dynamically or to enforce traffic rules, among others. Much of this functionality is unrelated to whether or not the vehicle is automated, however, and should be available well before AVs are rolled out, by means of cooperative ITS (C-ITS) tools which will start to be implemented in the coming years.

4.6. Infrastructure

4.6.1. Infrastructure requirements

The infrastructure requirements of AVs are not clear. Indeed, the implementation path for AVs is very uncertain, with several approaches put forward. From a vehicle perspective, the ‘autonomous vehicle’ approach, whereby vehicles adapt to the existing road environment and rely on onboard technology (eg, cameras, lidar, digital maps), contrasts with the connected and automated vehicle (CAV) and connected, cooperative and automated vehicle (CCAV) approaches, which add on vehicle-infrastructure communications capability to the autonomous vehicle. There are also advocates of the systems approach to automation, which goes beyond vehicles to the road environment, and requires roads to be engineered (physically and digitally) to accommodate automated vehicles safely.

The pros and cons of the different automation paths need to be examined from a city and regional road perspective. This includes the safety of all road users, investments, policy and roles and responsibilities.

The pros and cons of each of these approaches need to be defined from the perspective of a city and regional road authority, particularly concerning the safety of all road users, the level of investment, wider public policy goals and the traffic managers’ role in an automated future. For instance, it is currently understood that the autonomous vehicle would not require any infrastructure adaptations; however, the road authority would not be able to gather data from and communicate with a vehicle, unless it enters into a data-sharing agreement with a service provider (OEM or other) – this is the CAV approach. Conversely, a CCAV approach (further detail in section 4.6.2.) would require investment to enable the direct communication between the roadside and the automated vehicle. It remains to be seen which approach offers the best solution to the traffic manager to implement, for example, dynamic demand management measures such as access restrictions or road user charging. Earlier research has shown that automation building on C-ITS could enable smoother traffic flow due to the shorter vehicle headways compared to autonomous vehicles.[10]

The systems approach to automation, promoted by the European project CityMobil2, is geared towards the infrastructure and particularly on ensuring that the road environment is suited to the safe operation of automated vehicles. Central to this approach is a safety assessment, which itself typically leads to requirements for some infrastructure modifications, such as installing a communications network, road signs or road markings, as well as the adoption of certain traffic measures, such as removing on-street parking. While this approach would require some infrastructure investment, it may well appeal to cities and regions as it was designed very much with public transport in mind, in particular, delivering automated first/last mile services to link up with the traditional high capacity network. It is therefore suited to those areas of low and dispersed travel demand where running a conventional bus service is too costly. This approach is also far closer to market as its application is restricted to designated routes, which makes the implementation process more manageable in financial and practical terms.

Delivering automated first/last mile services to link up with the traditional high capacity network is closer to market as its application is restricted to designated routes, which makes the implementation process more manageable in financial and practical terms.

There is a concern that the co-existence of AV and other road users could lead to parallel traffic management systems that would raise costs for road authorities. The issue of liability, especially where connectivity is required, is also an issue. Until there is a greater understanding of the implications of automation, including for infrastructure, it is difficult for urban road authorities to make plans. Whatever approach is ultimately adopted, if the infrastructure requirements (clear road markings, communications infrastructure and reliable data) are stringent and prove to be too financially onerous for road authorities to bear alone, new business models will be required.

4.6.2. The role of C-ITS in the AV picture

C-ITS is the technology that can deliver direct vehicle to vehicle and vehicle to infrastructure communication. This technology domain is not new; it has been the subject of research, development and trials for more than a decade, and more recently, of strategy and policy coordination through the EC's C-ITS Deployment Platform, the Amsterdam Group and other fora. Most mature C-ITS use cases are intended to improve road safety and traffic efficiency independently of vehicle automation developments. However, C-ITS is also viewed as a key enabler of automation, notably by improving situational awareness whereby vehicles and road-side systems share data with each other about the road situation, such as a cyclist approaching a junction.

[10] *The impact of automation on the urban environment – Findings of Finnish study,* Pirkko Rämä and Satu Innamaa, VTI (Finland) presented at CityMobil2 Reference Group workshop, La Rochelle, 30/3/15

Through EU projects such as CIMEC[11] and CODECS[12], local authorities are exploring how C-ITS can support traffic management functions such as monitoring vehicle flows and designated vehicle priority at traffic lights. The case for investing in C-ITS infrastructure is still being worked out; long-term investment in new infrastructure is not easy to secure at times of public sector budget cuts, especially where the cost and benefits are relatively unknown. Besides financing, another key issue to address is access to in-vehicle data (and related privacy issues): specifically, what vehicle data can be accessed by transport authorities to support the traffic and asset management task.

Long-term investment in new infrastructure is not easy to secure at times of public sector budget cuts, especially where the cost and benefits are relatively unknown.

Nonetheless, some local authorities, notably the Dutch city of Helmond, hold the view that investments in C-ITS today are paving the way for automated vehicles in the future and that there should be no automation without connectivity. Most other local authorities are not in a position to express an opinion on this matter.

5. LEGAL, LIABILITY AND REGULATORY ASPECTS

There are many legal issues that need to be addressed before AVs can be introduced, some of which have been touched upon in this paper and which include the below. More detailed work is required.

- There should always be someone legally responsible for the driving of a car, be that the person inside the vehicle or an 'other' (be it a fleet manager, control centre or elsewhere).
- New AV-specific traffic rules may need to be created.
- Where AV fleets are rolled out in car-sharing clubs, the public authority may be expected to have regulatory oversight, as they currently do with taxis.
- Where road authorities interact with the automated vehicle, by means of communication technology (CAV/CCAV), (i) the issue of liability needs to be understood and (ii) EU rules may be needed to enable road/traffic authorities to access vehicle data to support the traffic and asset management and enforcement task.

6. PARTIAL AUTOMATION

One of the main drivers for automating vehicles is to reduce driver-induced accidents. The driver will only relinquish full control from level 4 onwards, which is still some way from commercial deployment. Cars offering partial automation, whereby some driving tasks can be automated, are already on the market, albeit on a small scale. One study has shown that it can take anything between 1.9 and 25.7 seconds for a driver to take back control of the driving task in a hands-off and eyes-off driving situation[13]. This is

[11] www.cimec-project.eu
[12] www.codecs-project.eu
[13] *Takeover Time in Highly Automated Vehicles: Noncritical Transitions to and From Manual Control,* Alexander Eriksson, Neville A. Stanton, University of Southampton (UK)

unsafe. There needs to be a greater understanding of the benefits and risks of partially automated vehicles, especially for what concerns road safety.

To deliver the efficiency potential of partially automated vehicles, it has been suggested that they could be deployed on dedicated lanes on urban streets, ie, they would not mix with other types of road users. The feasibility and policy benefits of such a scenario need to be explored because there is very limited space - a majority of urban roads are single lane only - and sustainable modes (public transport, walking and cycling) are gaining ever greater priority for the use of such road space.

There are many uncertainties around automation, not least when it will arrive, in what form and over what period.

7. WHAT ARE THE KEY ISSUES THAT CITY AND REGIONAL AUTHORITIES SHOULD BE WORKING ON?

While the full-scale roll out of fully automated vehicles is still many years away, local authorities should be anticipating this and seeking to influence developments.

Despite the uncertainties, local authorities are afforded an opportunity to reflect on how they would like to use automation to serve their transport goals.

7.1. AV planning and policy formulation

Urban planning is by nature long-term. Investments made today must last decades and local authorities seek to future proof them, ie, ensure that any investment and other major decisions made today take account of future changes in the transport sector, demographics and travel demand/supply. There are many uncertainties around automation, not least when it will arrive, in what form and over what period, which make it difficult to anticipate when and how to prepare for this. The impact is likely to go beyond the transport domain, towards the freight sector and land use. Despite these uncertainties, local authorities are afforded an opportunity to reflect on how they would like to use automation to serve their transport goals and to start thinking about what is the best policy framework and set of rules to achieve this. The AV-ready planning tools being developed within the CoEXist[14] project should offer a useful starting point.

Policy makers at EU and national level are not giving enough attention to the potential impacts of AVs on sustainable mobility policy.

7.2. Taking a holistic approach to automation

Much of the current focus of AV developments is on the technology and the car. Insufficient attention is being given by policy makers at EU and national level to the potential impacts on sustainable mobility policy and to those services where automation can make a positive contribution to sustainable transport goals. Most transport authorities do not want to see automated private cars or shared mobility fleets erode a well-functioning high capacity public transport service. However, there is certainly scope to build a transport offer combining high capacity and individual modes that responds to customer demands and delivers on public goals of accessibility, inclusion and liveability. This is a debate the transport authorities should be framing, together with key stakeholders such as the

Transport authorities do not want to see automated private cars or shared mobility fleets erode a well-functioning high capacity public transport service.

[14] www.h2020-coexist.eu

vehicle manufacturers and technology providers and transport service providers, among others.

7.3. Securing sustainable travel behaviour

The potential for AVs to increase the number of trips and passenger km has been alluded to several times in this document. This is certainly an outcome that local authorities will not want to happen, especially in view of current policies to promote the sustainable modes of public transport, walking and cycling. Local authorities today need to think about which policies and other measures can be taken to minimise this risk. For instance, if a transport authority wishes to pave the way for fewer private vehicles, bold planning decisions could already be made today to accelerate the uptake and dependence on public transport, cycling, walking, taxis and car clubs.

There is a need to understand the potential changes to travel demand and behaviour as a result of AVs.

7.4. Managing change

The impacts of automating and connecting vehicles, and the new business opportunities this will create, could transform the way in which mobility is provided in the future and the way in which people travel, both of which will have an impact on demand for road space and how vehicles are managed on a road network. Understanding what these changes may be and how best to prepare for and influence them as a city or regional transport authority is important to ensure informed decisions are taken.

Changes to the roles and responsibilities of the traffic manager need to be anticipated.

One key area that will see change is the role of the private sector in delivering mobility services – OEMs for instance see their role as a car sharing service provider growing exponentially in an automated future. How will this growing sector for shared mobility and on-demand services be governed in the future? This is an issue that is already being faced today in light of the growth of ride hailing and free-floating bike sharing services.

It is important that transport authorities do not simply adapt to new realities but contribute to the discussion on what those new realities should be.

The role of the traffic manager is already changing, with the proliferation of information services for drivers and other road users. Increased connectivity and automation may well mean that the traffic manager has even less influence on dynamic traffic management. Such changes to roles and responsibilities need to be considered now. It is important that transport authorities do not simply adapt to new realities but contribute to the discussion on what those new realities should be.

7.5. Personal security and safety

As AV systems will have to be designed such that the vehicle will always stop in front of a pedestrian, AVs – and their occupants – become obvious targets for intimidation or worse. Validation systems will be required such that the public will be satisfied to trust that the right vehicle will bring them to the right destination. However, such validation also runs the risk of hacking or corruption.

Finally, the person responsible for the vehicle will need to be identified for each trip, in case of on-street accidents, to ensure that the vehicle remains at the scene, can be removed under instruction by the police, and that the traffic police can consider/examine the elements resulting from the accident.

8. RECOMMENDATIONS

a. City and regional transport authorities should become more AV-aware and should start thinking about what policies are needed to ensure a positive outcome from AVs.

b. There is a need for a structured dialogue between the transport authorities, industry and service providers on various issues related to AV developments, including the issue of data sharing and governance.

c. More research is needed on the impact of automated vehicles in the urban environment, in terms of all the issues raised in this paper.

d. National government and the European Commission should pay greater attention to sustainable mobility goals, in line with the EU Transport White Paper, as they develop policy on AVs. Cities, regions and their transport authorities should be systematically consulted. The Commission and Member States can also play a role in enabling the above recommendations, through research programmes, regulation and as facilitators of multi-stakeholder cooperation.

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