Enhancing intelligent urban road transport network and cooperative systems for highly automated vehicles

MAVEN

Stakeholder consultation with local authorities and urban road stakeholders

15 November 2016, Barcelona

This document records the findings from the first MAVEN stakeholder consultation workshop that took place in Barcelona on 15 November 2016. Local authorities and other urban road stakeholders were invited to share their views on the role and impact of increasingly automated vehicles on urban roads and traffic management. Feedback was gathered through an online real-time voting tool to engage the audience.

The aim of this first MAVEN stakeholder consultation workshop was to discuss and review the preliminary MAVEN system concept, use case descriptions, and assessment and demonstration plan. The workshop addressed the role and responsibilities of cities and traffic management in the context of highly automated driving, including political, institutional and organisational aspects as well as the broader perspective of passenger transport in smart/future cities.

INITIAL REMARKS

The audience

The workshop was attended by 34 registered participants, of which some two-thirds were representing local government. More than half of the workshop participants who responded to the first question on the online voting system said they were attending the MAVEN workshop to have a better understanding of technical aspects regarding automation whereas around one third said they wanted to have a better understanding of the policy impact.

For instance, the city of Amsterdam's interest in automation has been prompted by a discussion about whether to build new underground parking garages. Such an investment is significant and should last many, many decades. The advent of automated vehicles begs the question as to whether parking will be required. This led to a discussion about whether cities should be accommodating automated cars or not, given that some studies suggest an increase in km travelled. Most agreed that cities should try to influence this process by for instance penalising empty self-driving cars. Copenhagen has recently been given permission to test automated vehicles, similar to the shuttle services being piloted in Aalborg. For Copenhagen, it is important to consider the priorities of cities, such as social inclusion.

A majority admitted they were new to the subject of automation; the rest of the audience had previous knowledge. To many participants, automation is understood as vehicles driving themselves in specific environments. The remaining participants understood automation as being either a vehicle that drives itself from door to door or a vehicle that only automates specific driving tasks. Information from projects, conferences and workshops are seen as the main sources of information related to automated vehicles.

SETTING THE SCENE

Recent developments in automated driving, Jaap Vreeswijk, MAPtm

The main reason for introducing automated driving is to **reduce accidents caused by human error** which today represent 93% of all road accidents. Automation has attracted lots of **media attention** lately; however it is not new: There was already a platoon demo on the San Diego highway in 1998. More recent initiatives are being led by Google and Tesla. The European co-funded projects CityMobil and CityMobil2 have piloted automated shuttles. Truck platooning has already been tested on the highways. (European) **Politics** have also looked into autonomous driving, notably the Declaration of Amsterdam on Cooperation in the field of connected and automated driving which was adopted under the Dutch presidency of the Council of the EU in April 2016

Different levels of automation have been identified: Level 1 (Driver assistance) & Level 2 (Partial automation) are already there today. Level 3 (Conditional automation) is an interesting level as the vehicle monitors the environment but the driver is always the fall-back. Then there is Level 4 (High automation) and Level 5 (Full automation). Studies show that the driver needs between 8 and 32 seconds to resume driving task. For this reason, MAVEN holds the view that Level 3 automation is unlikely to happen, ie, there will be a jump from Level 2 to Level 4.

There are still many issues that need to be thoroughly investigated such as how to interact with drivers in the vehicle and with other road users outside? There is an expectation that automated vehicles will reduce injuries and accidents, but how do you deal with an accident involving an automated vehicle whose software has malfunctioned? Regarding ethics: what level of risk is acceptable?

In the a**utomated driving landscape, there are** 4 types of vehicles: traditional, autonomous, connected and cooperative-automated. It is likely that there will be a mix of these vehicles in the coming years, and that the mix will change over time.

During the discussion, a number of questions and points were raised, including the possibility of retrofitting manually driven vehicles to make them automated. Given the substantial computational power that would be needed for automation, retrofitting would be very challenging, albeit not impossible. The key issue is safety. It was agreed that the co-existence of manually driven and automated cars will be the norm for many decades because some people will drive older (especially classic) cars for many years.

Introduction to the MAVEN project, Robbin Blokpoel, Dynniq

MAVEN's focus is the urban environment which has not been the subject of much research in relation to automated vehicles. Four vehicles in total will be piloted by DLR and Hyundai. Because of the difficulty to operate platooning in a real road environment, **MAVEN will instead conduct emulations** while performing field tests. MAVEN will build a model of a city based on the open source SUMO software which offers advanced simulation to override normal drivers' behaviour e.g. vehicles can platoon very close. The project comprises 2 pilot sites in Braunschweig and Helmond. MAVEN wants to verify that what it creates is politically feasible.

MAVEN use cases & high level requirements, Ondrej Pribyl, Czech Technical University

Most of the MAVEN use cases are based on platooning. Feedback collected shows that they are a good starting point though some believe that they would be difficult for drivers to accept. Once the algorithms are ready, they will be applied to real intersection simulation with different penetration rates. A question from the audience raised the point on whether higher automation would lead to platooning. For Ondrej (CTU), the cooperation perspective is more efficient than the automation perspective. Another question related to the role of the cyclist in the platoon and how it would interact with the vehicle platoon? Is a cyclist more important than a platoon?

The audience said that these use cases reflected somewhat the needs of a road authority but should not be implemented tomorrow. In fact, the project purpose is to understand first the impact of the scenarios. It was recommended that the scenarios be investigated at both peak and off-peak hour.

Some members of the audience felt that the use cases were technology driven and too theoretical and that they should relate to real-life case studies. There is a need to show cities what's in it for them by linking the use cases to real world transport problems (e.g. how to deal with high volumes of tourist buses along specific corridors?). It was suggested that the scenarios are run with pedestrians and that there be a dedicated workshop with freight players.

It was queried how the platooning use cases with vehicle-infrastructure interaction could be implemented when the business logic/intelligence is held at the higher level of the control centre (or at least the zonal/area level) rather than at the traffic signal controller, requiring low-latency highly reliable communication. There was no clear answer to this question.

Concerning the operation of the platoons, some members of the audience held doubts about whether to alert other road users about automated platoons as this may lead to behaviour of trying to disrupt the platoon.

To the question "What technical requirements or non-technical requirements do you want to have for MAVEN use cases?", suggestions from the audience were clustered as follows:

Data/technology

- Data usage should be feasible even at 100% penetration rate
- Standards for messaging (V2V, V2I).
- How to manage the (large quantities of) data?
- Make use of other projects (e.g. PPA)
- How to manage data traffic (high volumes of data)?
- Technical standardisation, interoperability, clarity about communications, technology (4G vs G5); cost-benefit analysis first, impact assessment (KPI based)

Human behaviour component/vulnerable road users/evaluation

- Should be checked in congestion situation, with a lot of VRUs at the same time
- Human behaviour in relation to platooning.
- Cyclist numbers need to be taken into account.
- Driver behaviour.
- Scalability
- Mix traffic users.
- People safety need always to be assured

Transition phase

- Use cases that describe the transition between what we have now and pervasive C-ITS
- Step-by-step approach in the emulation considering that non-automated vehicles are predominant before fully automated vehicles will flow in our cities
- Effects of different mixes of automated and non-automated vehicles, failure of one or more components, reliability
- Describe in the use cases and tests also the viewpoint of the non-automated vehicles/road users

Network/infrastructure

- MAVEN should ensure use cases are as close to reality as possible
- Mixed traffic, safety, emergency,
- What happens in case of malfunction?
- Don't just model cars, but also vehicle fleets – of interest for cities in terms of C-ITS
- Who makes platooning happen? Authority / City? Or others? Include all actors in the chain and study the strengths/weaknesses
- Need to have a better understanding of the benefits, safety, travel time, environmental effect!
- What are the infrastructure needs?

Policy

- MAVEN should not only solve technical issues but address user (citizen) needs and explore its potential for modal shift
- System performance, driver behaviour, strategic context (control, policy, etc), benefits quantification, scalability, future proof
- Business case: what's in it for the cities; liability issues; city policy to reduce car use

THE PERSPECTIVE OF A CITY AUTHORITY

Phil Williams, Digital Greenwich, Royal Borough of Greenwich, London

Greenwich, one of London's boroughs, has a population of 275k over 40 km sq. 20 million visitors come to Greenwich every year. Population is expected to grow by one-third by 2028. The 65+ year age group is expected to rise by 57%. The travel situation is not going to get better by throwing automated cars at it. Nearly half of all car journeys are made inside the borough.

Greenwich has started thinking more in terms of **accessibility**, and giving people alternative modes to go where they need to go. Are cars really our future? Can we sustain more and more cars? London has good public transport, but need more of it because it is already saturated. The borough is looking at what automated vehicles means for Greenwich and how other cities are interacting with them.

Greenwich is involved in many projects, including one dealing with data and the communications networks (eg, fibre optics) that are needed for this. Others, such as GATEway and ATLAS, could be quite expensive solutions. The borough is looking to MAVEN to provide insights into how managed automated vehicles could work in Greenwich: it is thinking about shared spaces and last mile services.

Some key issues which require further thought: what happens at the boundaries between boroughs which have not implemented the system? This could be mid-way along a road. What are the advantages of

automated vehicles in a congested environment, or at multiple junctions? Automation has to be implemented incrementally for public acceptance reasons.

Gert Blom, City of Helmond

According to Gert, cities should be involved in automated vehicle discussions and developments. **Fatal accidents have an impact on cities**, this is the main reason to be involved in automation. ITS could play a big role in mobility solutions. However, we should avoid having autonomous vehicles but instead should look to vehicles that are connected amongst themselves and with the infrastructure, traffic manager and other users. The Freilot project pilot showed a 13% fuel saving for truck drivers. Through its involvement in many projects, Helmond feels it now has enough piloting experience to move towards large-scale deployment. Key considerations are vulnerable road user safety and services such as ISA (intelligent speed adaption) for which there is a strong business/societal case for cities. The impact of automated vehicles goes beyond mobility domains such as freight to encompass wider issues such as land use. MAVEN offers an opportunity to bridge the missing link between automated vehicles and traffic management.

REQUIREMENTS ARISING FROM THE WORKSHOP DISCUSSIONS AND ONLINE QUESTIONNAIRE

1. The societal objectives of a city authority

The ambition of most cities is to build a city where people don't want to use cars. But the reality is that few want to give up their cars because they do not see an alternative that offers as much flexibility.

Among the most **critical issues in cities related to mobility and infrastructure**, parking and congestion are high on the agenda. Car parks can be already upgraded with cameras but not to level 5 automation. Other critical issues include vulnerable road users, cyclists and pedestrians along with liveability and public space. On the contrary, funding and costs were considered less critical. This aspect nonetheless raised the concern about **who is going to pay for automation.**

Considering automated vehicles operating in normal traffic, **the key issue is safety.** There is a need to have guarantees on safety. Security, liability, traffic regulations, and human factors were equally pointed out to be important aspects to be considered. Public awareness, infrastructure investment and identification of automated vehicles by inhabitants were identified as being the least important relatively speaking.

2. The transition phase

Automated vehicle penetration: A slight majority of participants said that their cities were **NOT preparing** for the introduction of automated vehicles. The level of automation influences the time horizon. In a full automation scenario, the majority of respondents replied that it is unlikely to be there for another 20-30 years from now, followed by 10-20 years, and 30+ years.

Concerning the **retrofitting** of older vehicles to make them more automated: if money is no object, anything is possible. But technically-speaking it would be very challenging. The technology has to operate in a complex system and needs to be reliable. Manufacturers are improving their products and learning from each generation of vehicles. Upgrading is therefore not the solution. Some enquired how long older cars could still be operating alongside automated cars. This is extremely difficult to answer and therefore it is

safer to assume that it will be a very long time before we can ensure there is 100% penetration. Legislation could be used to prohibit older cars but this would need to be implemented across all Member States.

Standardisation is a slow process. Cities cannot wait forever but they do worry about the lack of standardisation. They are concerned about making investments now and having to upgrade their systems later. In terms of the direct effects of MAVEN, they are looking forward to having a good overview of the impacts of fully automated vehicles on the road network. They suggested that the city model used for the simulation and assessment be based on a representative network.

Expectations from associated project partners: MAVEN is not expecting data from associated partners, unless the project decides to scale up. MAVEN is primarily interested in having their opinions and views. Participants stated that they like to be involved on a regular basis and would welcome another workshop in about one year's time.

In terms of **infrastructure**, the assumption is that the MAVEN services will build on the C-ITS infrastructure that is already installed. This is the case in Helmond, which already has some C-ITS infrastructure from previous projects.

Several **financing** aspects came up in the discussion: firstly, the drop in income from parking fees and therefore less income to spend on infrastructure. Secondly, the financial resources can vary differently depending on the size of a city, ie, generally the bigger the city, the more resources and skills available to invest in new technology and systems.

3. Impact assessment

Many agreed that the impact of **automated driving goes beyond the mobility domain**, notably toward the freight sector and land use, and that automated vehicles will have a major impact on **safety, efficiency and air quality**. The audience considered that the number of vehicles trips and km driven are less likely to be impacted by automation.

There cannot be automation without connectivity. Opinions were diverging when asked if automated driving is worth development support by public authorities or whether cities must strive to incrementally introduce automated driving services. Nonetheless, the majority seemed to agree that **current C-ITS investments are not a waste of money**.

Most participants believe that **public transport is the vehicle class that has the most potential for automation**, followed by taxies and delivery services. Some cities may introduce some C-ITS services. **Taxis** are the big issue in Amsterdam. When full automation is there, it is believed that taxis will work out cheaper than having a car. **Automating public transport** would make mobility more accessible to people. However, it was also argued that people may feel threatened by sudden changes (ie, no drivers in buses) and so there is a need for step by step approach.

The **impact on society** will largely depend on which automated services are being introduced and for whom. It is assumed that the cost of automating public transport will be met by the cities in terms of the vehicle fleet, infrastructure and loss of drivers. But there is a shared concern that cities will not have money for a new fleet and unemployed bus drivers. Other concerns were raised regarding the **health effect** of introducing automated driving which may lead to a reduction in walking and cycling, and increased isolation because people will interact less once they are in an automated vehicle. What is the social effect of these

developments? We still want to create pedestrians and cycling communities. It is imperative for cities to understand what are the needs and what behaviour they want to change.

The reality of what cities want to happen and what will happen is quite different, ie, automated private cars will be on the road on a larger scale than public transport and technology will develop quicker than cities have time to react and quicker than they can adapt their infrastructure. Market forces will push cities down a route faster than they can follow.

On **MAVEN's impact assessment**, stakeholders are interested to learn about:

- Costs (for users and for infrastructure, gains) / CBA
- Impact (on safety, on car use, time reliability)
- Efficiency (travel time, emissions, energy savings)
- Transition / operational (best/worst use case, infrastructure requirements, capacity, restrictions, replicability, guideline)
- Robust results backed by numbers
- Scale
- Replicability / Guideline (for cities and manufactures)
- Applicability

4. The traffic manager's role and responsibilities

Many agreed that a traffic manager should be able to communicate directly with an automated vehicle and give directions. Opinions were more cautions on road authorities having an active role in investing to facilitate automated driving as a form of traffic management and on the need for traffic management to become simpler and requiring less interventions. Nearly everybody agreed that the traffic manager will still be needed despite the fact that automated vehicles may manage themselves as a system.

Regarding the changing role and responsibilities of a traffic manager, traffic management is becoming increasingly linked to policy; it is no longer just about cars but about accessibility. Additionally, it was observed that traffic management is becoming a strategic tool for delivering a whole range of transport policies, and the ultimate goal of becoming a liveable city, which is a qualitative rather than quantitative notion, i.e. it is more of a personal perception (less congestion, better air quality, walkable city). Overall the group supported the assertion that **traffic management will become more strategic in the future,** translating policy goals into operations, and that while more operational decisions will be made by systems, these will be guided by policy. One final note, it should not be overlooked that traffic management systems are mainly installed in big cities; smaller cities do not tend to have them. How to deal with the boundaries?