Government – Department for Transport (DfT) and the Department for Business, Energy and Industrial Strategy (BEIS) – Supplementary written evidence (AUV0095)

Future Uses of Autonomous Vehicles in the UK

Introduction

1. The Government welcomes the Committee’s request for supplementary evidence from the following sessions,

   a. 22 November, Rt Hon John Hayes MP, Minister of State, Department for Transport, and Mr Nick Hurd MP, Minister of State for Climate Change and Industry, Department for Business, Energy and Industrial Strategy

      i. A copy of a letter [Rt Hon John Hayes CBE MP] has written to the Chief Scientific Adviser about work on the future of mobility

      ii. A note on modelling and microsimulation of mixed fleets carried out by the Department

      iii. A note on scoping work being carried out for a study of human behaviour in relation to autonomous vehicles

      iv. A note on further work for rural areas in relation to autonomous vehicles

   b. 1 November, Ian Yarnold, International Vehicle Standards Division, Department for Transport (DfT) and Iain Forbes, Head of UK Government’s Centre for Connected and Autonomous Vehicles (CCAV)

      v. A Cabinet Office co-ordinating committee [for Robotics and Autonomous Systems] ... which departments are represented?

      vi. Work on modelling mixed fleets.

      vii. The [A2/]M2 trial.
1) A copy of a letter Minister John Hayes has written to the Chief Scientific Adviser about work on the future of mobility

From the Minister of State
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Dear Sir Mark,

I am very pleased that the Government Office for Science is proposing to undertake a Foresight investigation into the "Future of Mobility".

It's critical that government has a handle on how social, economic and demographic trends will affect the country's transport system.

Moreover, the rapid pace of technological change makes it very challenging to have a clear insight into how transport will look in the future and where the time critical decision points are.

This project is an excellent opportunity to have long and serious look at the issues, challenges and opportunities, and help us in government to plan for the future transport needs of people.

I very much look forward to seeing the emerging and final conclusions.

Rt. Hon John Hayes CBE MP
2) A note on modelling and microsimulation of mixed fleets carried out by the Department

Overview

a. In October 2015, DfT commissioned Atkins to carry out new research (using micro-simulation modelling techniques) to investigate the potential large-scale impacts of CAVs on traffic flow and network performance on urban and inter-urban roads.
b. This project is amongst the most extensive and pragmatic research of this type, and provides the most comprehensive analysis of the impacts of CAVs on network performance and will form an important part of the UK and international evidence base.
c. The research sheds new light on how different levels of CAV technology, variations in the degree of cautious or assertive behaviour of CAVs, and different levels of CAV penetration in the vehicle fleet, could impact the journeys people take on our roads.
d. The findings are largely positive, showing that CAVs offer major potential to reduce delays, improve journey times and improve journey reliability on strategic and urban road networks.
e. But the work also highlights that these benefits are not a given, depending heavily on the proportion of CAVs in the fleet as well as the extent to which CAVs adopt cautious or assertive behaviour (which may vary according to user or manufacturer preferences).
f. It is also important to note that this work represents a simplified view of impacts, due to both the limitations of the modelling tools employed, and fact that the work considered lateral and longitudinal vehicle behaviour but did not consider wider factors that will influence network performance – such as demand effects, safety or driver behaviour.
g. As such, this research should be considered as a first step in understanding the large-scale network impacts of these technologies, with significant further work required. The Department has already commissioned additional research in this area, and is also working with the Transport Systems Catapult to support the development of new analytical approaches to model and assess the impacts and benefits of CAVs.
h. This research is currently being developed for publication next year.

Broad conclusions of the research

i. Average journey times, delay and network capacity have been shown to improve with increasing penetration and capability of CAVs – and could offer major improvements, particularly in high-speed, high-flow situations. Journey time reliability could also improve dramatically.
j. Benefits are not limited to CAVs – all road users would benefit from any improvements in network performance, even those in ‘legacy’ vehicles.
k. At low penetrations, more advanced CAVs are likely to be limited by the vehicles around them. This research suggests the likely tipping point for the proportion of enhanced vehicles in the fleet required to produce major traffic flow benefits may be between 50% and 75%.

l. Benefits are likely to depend heavily on user or manufacturer preferences – particularly around comfort and safety. If users want vehicles to behave cautiously, network benefits will be reduced, and could even worsen network performance in some circumstances.

**Impacts on strategic roads**

m. In low-penetration scenarios, benefits are relatively small, but increase as technology and penetration improves.

n. In peak period traffic, with 100% penetration of assertive CAVs, we could see:
   i. Journey times reduced by more than 11%
   ii. Delay reduced by more than 40%
   iii. Journey time reliability [defined as the standard deviation] improved by more than 54%

**Impacts on urban roads**

o. In low-penetration scenarios, much greater benefits are seen in peak period traffic in urban areas - with a 12% improvement in delay, 21% improvement in journey times and a nearly 80% improvement in journey time reliability.

p. This suggests that urban traffic could see significant benefits even from lower-level “driver assistance” technologies

3) **A note on scoping work being carried out for a study of human behaviour in relation to autonomous vehicles**

**Overview**

q. In February 2016, DfT commissioned a scoping study to understand the main social and behavioural questions relating to autonomous vehicles (AVs) and whether any evidence currently exists to answer these questions. The scoping study involved:
   i. a review of the literature relating to the social and behavioural aspects of AVs
   ii. exploration of the research being undertaken by the Government-funded four cities driverless car trials, including visits to each of the trials
   iii. extensive engagement with experts to explore the social and behavioural implications of AVs. This included topics such as data security, impact on the labour market, city infrastructure, implications for public health and the differences between urban and rural areas.
The findings from the scoping study will inform DfT and the wider research and innovation community in this area, to ensure better and more successful policy development and delivery.

This research is currently being developed for publication next year.

**Headline Findings and Implications**

The main findings from the scoping study and literature review are:

i. To date, the social, behavioural and societal aspects of AVs are under-researched and most of the literature has focused on the technical aspects.

ii. Nearly 400 social and behavioural questions were identified and they can be broken down into the following four categories:

1. The interaction between the user/driver and highly automated/autonomous car (e.g. in a partial automation context, how quickly are drivers able to take back control of the vehicle?)

2. The interaction of other road users, including pedestrians with the highly automated/autonomous car (e.g. how do others in the road environment feel about increased automation and how will they respond to it?)

3. The attitudes of the general public towards autonomous cars, including public acceptability. (e.g. to what extent are people concerned about issues such as road safety and data security, will people be willing to pay for them, and how might these concerns be alleviated?)

4. The wider, longer-term social, economic and environmental impacts of autonomous vehicles. (e.g. what are the impacts of AV use on congestion and the environment, will they have public health implications? How will AVs be deployed? What uses will they have? Who will use them and for what purposes - e.g. niche/specialist uses vs intra-urban/local journeys vs inter-urban/long distance travel?)

The Government-funded four cities driverless car trials are each undertaking research which can be expected to produce useful evidence to support the growing understanding of the social and behavioural impacts of AVs. However, this work on its own will not answer all the social and behavioural research questions that need to be understood to inform policy development.

The report makes a number of recommendations for future research to address some of the social and behavioural research questions identified. Those recommendations include public dialogue with citizens and businesses to provide insight into factors that drive attitudes and likely behavioural responses to autonomous vehicles. Government cannot do it alone and we anticipate contributions towards the social and behavioural research agenda from academia, industry and other stakeholders.
This research should be considered as a first step in understanding the large-scale social and behavioural impacts of these technologies, with significant further work required. The Department is working on developing the next stage of research and we recognise the urgent need to better understand the new relationship between the driver and the vehicle in highly automated modes and also to understand the implications of AVs for people who live and work in rural areas.

4) A note on further work for rural areas in relation to autonomous vehicles

a. The human behaviour study (3, above) involved extensive engagement with experts to explore the social and behavioural implications of AVs. This included topics such as data security, impact on the labour market, city infrastructure, implications for public health and the differences between urban and rural areas.

b. The Department for Transport is working on developing the next stage of research. It recognises the urgent need to understand better the new relationship between the driver and the vehicle in highly automated modes and also to understand the implications of AVs for people who live and work in rural areas.

c. The Connected Corridor (see 7, below) provides a unique opportunity to test these technologies on a route comprising a mixture of urban roads in one of Europe’s mega-Cities (London), inter-urban (A2 / M2) and international gateway to the Port of Dover / Eurotunnel, as well as on surrounding local road networks in Kent. Integrating these networks is a key outcome for the pilot.

d. The Corridor will create an open test-bed which will give UK industry the opportunity to develop their own services, business models and partnering agreements, and exploit commercial opportunities for vehicle-to-infrastructure applications.

5) A “RAS Cabinet Office co-ordinating committee” was mentioned - which departments are represented?

a. In 2016, Cabinet Office convened a time-limited working group to support information sharing and coordination of government activities on the Robotics and Autonomous Systems agenda. Departments represented included: BEIS (then BIS and DECC), DfT, Defra, Cabinet Office, MOD, DH and DCMS, plus a number of relevant agencies including EPSRC and Innovate UK. The group has now wound down but its work has fed into current activity including the BEIS-led Industrial Strategy process.

6) Further information on work on modelling mixed fleets.
7) **A2/M2 CONNECTED VEHICLE CORRIDOR**

a. Connected vehicles that can talk to each other, and to the roadside infrastructure, are the future. We want the UK to embrace these technologies which will transform our roads and open up a brand new route for global investment. The potential for transformation is significant, and vehicle to infrastructure and vehicle to vehicle communications will enable safer road conditions for users.

b. The Department for Transport and its partners (Highways England, Kent County Council and Transport for London) are designing a flagship “connected vehicle corridor” on the A2/M2 London to Dover route, a £15 million living laboratory for deploying a range of services and wireless communications technologies that these vehicles will need to operate.

c. The investigation and testing, then subsequent installation and trialling, of cooperative Intelligent Transport Systems (C-ITS) on the London to Dover Connected Vehicle Corridor will demonstrate how technology can be used to tackle congestion, and to improve journey reliability and road safety, while supporting innovation and growth.

d. The Corridor will create an open test-bed which will give UK industry the opportunity to develop their own services, business models and partnering agreements, and exploit commercial opportunities for vehicle to infrastructure applications.

e. The Corridor provides a unique opportunity to test these technologies on a route comprising a mixture of urban roads in one of Europe’s mega-Cities (London), inter-urban (A2 / M2) and international gateway to the Port of Dover / Eurotunnel, as well as on surrounding local road networks in Kent. Integrating these networks is a key outcome for the pilot – as shown below.
f. The link to the mainland Europe is important – the partnership has developed a partnership with Belgium/France/Netherlands to create a network of connected vehicle services which will enable vehicles to travel from Vienna to London – using the same services, with technology applied to common standards.

g. The pilot will provide a proof of concept for providing road users with direct information, from the roadside infrastructure, that will provide safety information about hazards ahead and road safety information about road works in the carriageway. Further safety enhancements, including vehicle-to-vehicle safety related information, will be considered within further phases of development.

h. Feasibility studies considering the technologies, services, and data management have been completed. We are now gearing up to start the detailed design of the infrastructure and communication systems to deliver the services– with first deployment programmed for 2018/19.

December 2016