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Intelligent Transport Systems UK
Empowering Transport Technology

Call for Evidence: Connected and automated mobility study
Intelligent Transport Systems UK, June 2024

Intelligent Transport Systems UK (ITS UK) is the national industry association for transport technology. We provide a national platform to support the roll out of technology for a cleaner, safer and more effective transport network, both at home and abroad.

ITS UK has 175+ members, from both the private and public sector, and covering all sizes and disciplines, with members working in areas like Connected and Automated Mobility, Road User Charging, Mobility as a Service (MaaS), traffic management and enforcement, integrated transport, connected and autonomous vehicles, public transport services, smart ticketing and much more. More information on ITS UK and the intelligent transport sector can be found at www.its-uk.org

We believe that intelligent transport has a vital role to play in supporting the UK Government's ambitions:

- **Economic growth:** The sector is conservatively valued at £1.5bn and generates £15bn a year for the UK economy. It is an important export, with UK businesses integral in the roll out of intelligent transport overseas, and there is potential for the UK to develop a competitive advantage in the sector in the future, with the global market expected to be worth £900bn by 2025. The industry also supports highly skilled jobs and training opportunities.
- **Decarbonisation:** The intelligent transport sector is vital in incentivising the travelling public to low carbon forms of transport and decarbonising the road, rail and wider transport network. The sector is ready to support Government in reaching Net Zero by 2050.
- **Supporting Zero Harm:** Intelligent transport systems can help reduce road deaths, such as by helping local and national transport authorities, through data, to identify potentially hazardous junctions. Similarly, the implementation of new operational and enforcement technology can help ensure we continue to make our roads safer for all who use them.
- **Optimising capacity & cost efficiency:** Intelligent transport has a key role in optimising the usage of our transport network, by making best use of current infrastructure assets, incentivising behaviour change and through the predictive maintenance of infrastructure, to name a few. Ultimately, this ensures the best possible usage of our limited road and rail network and can provide cost effective increases in capacity.

Our response to the questions raised in the call for evidence is as follows.

1. What opportunities and risks could self-driving vehicles present for freight and logistics?

The introduction of self-driving vehicles in freight and logistics represent a significant

opportunity for lowering costs, boosting productivity and improving overall efficiency in the sector. However, possible benefits and the challenges to achieving these vary depending on the application of this technology across geographies and freight markets (such as commodities). It is therefore important to make distinctions in use cases when appraising the opportunities and risks.

- **To what extent do self-driving vehicles for freight provide an opportunity for cost savings for retail and business customers?**

Across all use cases of self-driving in freight and logistics, the main opportunity is to reduce the cost of driver labour, particularly in an industry which faces driver shortages and where work can be dangerous (in depots or marshalling) or have undesirable shift patterns. This is especially true for business customers and deliveries which are mostly realised by Heavy Motor Vehicles (HMV). HMV deliveries would prosper from operating around the clock while foregoing the cost of drivers carrying out deliveries during expensive times in the night – potentially under tired or stressful conditions.

Removing driver costs, and increasing the efficiency of deliveries through more space per vehicle is not only beneficial for the freight and logistics sector, the lower costs and higher efficiencies mean that supply chains across the country would benefit too, providing a cross-sectoral positive economic externality.

Similarly in a retail environment, the same principles that underpin how costs can be lowered for business customers are transferable. Reducing driver costs and improving the resilience of supply chains, and increasing vehicle capacity represents a huge savings opportunity. Retail also stands to largely benefit by automating scheduling, which can improve reliability and remove the operational cost of scheduling deliveries.

- **Are there any barriers to realising the benefits – for example around how customers would interact with automated deliveries – and how could these be addressed?**

All freight subsectors face challenges to their introduction with regards to customer interfaces. Important questions remain on how to operate the first and last mile of deliveries, how various commodity groups are transported, and how customers interact with autonomous vehicles. For business customers and HMV deliveries, human intervention is still required at depots and distribution centres to unlock doors and pull curtains. A process is also required to administer refuelling/recharging, as distances are longer for these deliveries. The degree to which refuelling/recharging can be automated must also be explored.

Different commodities require different attentions and needs, for example, hazardous chemicals, livestock or fresh goods. All the aforementioned would require different levels of supervision and intervention. Testing for each commodity group and the required vehicle architecture is essential prior to a widespread introduction of self-driving vehicles in freight. Some commodity groups will face easier uptake and applications than others.

For retail customers, who would require smaller automated vehicles delivering to houses, the barrier lies in defining the ways in which automated vehicles interact with customers to ensure the safety and delivery of goods to the correct person.

- **How do the opportunities and risks vary between urban and interurban environments?**

Interurban environments may hold the potential for a faster and simpler uptake of self-driving vehicles. HMV and larger trucks could deliver from depots to distribution centres outside of cities, using automated technology to transport goods rather than people, in simpler, less populated environments. However, in both environments, it is yet to be defined how self-driving vehicles would interact with those driven by humans. A freight delivery of several vehicles on a highway provides a further challenge in merging and exiting lanes for other vehicles.

In urban environments characterised by more frequent stops and delivery, mechanisms are required to carry out the final stage deliveries and to monitor the safety of the goods delivered. Self-driving freight vehicles in urban environments will need to ensure safety whilst moving around the public, emergency vehicles, and other vehicle types e.g. bicycles or motorbikes.

2. What are the opportunities and risks that privately owned or individually leased (e.g. as part of a car club type arrangement) self-driving vehicles, and self-driving ride-hailing or ride-pooling services (taxi type), could bring to households and to wider society?

Both privately owned vehicles and ride-pooling services can provide important opportunities to individual households and wider society. The propositions are particularly impactful in rural environments where self-driving vehicles may be a viable option for individuals who cannot drive because of age or disability, providing a personalised mobility option. For example, self-driving technology may have applications in rural demand responsive transport (DRT) schemes. However, privately owned self-driving vehicles are expected to be expensive to the point that their widespread adoption will not be seen for several years to come.

Self-driving ride-hailing services could possibly deliver an affordable, comfortable and reliable alternative for city commuters or those unable to drive. By shifting the delivery of a transport service via a ride-share to those who specifically request it, unnecessary journeys employed by larger vehicles can be eliminated in favour of more accurate and reliable ride-sharing services. Local authorities could review their deployment of public transport systems in rural areas, either supplementing or replacing existing services with the nimbler and more reliable self-driving ride-hailing. In doing so, they would unlock an opportunity for ride-pooling business models to be integrated into wider multi-modal transport systems. This would ultimately improve connectivity, and social mobility. Yet, it would most likely require a franchising model due to initially high costs.

Self-driving ride-pooling services could discourage those who rely on a private car from private ownership. An autonomous ride-pooling business model could benefit from certain incentives that can be passed on to individuals e.g. no congestion charges, no parking fees.

The principal challenges with a privately leased self-driving vehicles is that, while it allows owners to gain time lost driving, it does not encourage a modal shift or alleviate congestion in urban settings. Furthermore, in order for these cars to operate on roads, data transfer infrastructure may be required that is compatible with different vehicles and manufacturers, presenting an additional technical requirement. A complex security process in transferring ownership for privately owned self-driving vehicles will also be required in the case of second-hand sales.

There are also significant concerns over the cyber-security of self-driving vehicles in any business model or application. There is a potential that these vehicles could be weaponised through hacking, so a robust cyber-security system must be in place alongside other supporting infrastructure.

3. What are the different trajectories for uptake and which do you think is most likely? Areas you may wish to cover in your response include:

- **To what extent do you anticipate a shift from the private ownership model of vehicles to the Mobility as a Service model, which makes more use of shared and public transport services alongside active travel?**

Currently, the first areas of uptake are predicted to be in the movement of commodity goods as opposed to passengers. Although self-driving vehicles may have the easiest path of uptake travelling on highways in inter-urban environments between depots, it is worth noting that the individual geographic conditions of each place make for different challenges in any application of CAVs. Depot to depot automated deliveries are arguably the easiest to implement as human intervention is predicted to be minimal, and only required during the first and last mile of deliveries and perhaps in charging/refuelling stations. Whilst there are still important safety concerns in the handling of certain commodities and the interactions of large HMV CAV vehicles with human-driven cars, public acceptance barriers are likely to be less of an issue if vehicles are not initially transporting large amounts of people or proposed as an alternative to the privately owned car.

Shifts from private ownership models into a MaaS model that makes use of shared and public transport services are difficult to predict. Currently the shared vehicle model for carpooling companies is struggling to make a business case. The current lack of car clubs means that as a service, it is squeezed between private ownership and public transport options. Nevertheless, these services are growing and perceptions are changing (despite this growth failing to affect car sales yet). The introduction of self-driving vehicles could provide an attractive addition to MaaS models by reducing operation costs through the removal of a driver. However, if profits are consolidated by operators, then MaaS platforms will not benefit.

- **How do you expect the cost of self-driving vehicles – both the upfront cost and ongoing maintenance costs – to change over time?**

With regards to the costs of self-driving vehicles, No User in Charge (NUiC) vehicles will in all likelihood initially be very expensive. Like electric vehicles, the additional technology required is likely to first manifest in high-end luxury vehicles before it can trickle down to the mass-market and more affordable vehicles (although it should be noted that this will take several years due to the UK approval process). In the public transport domain, it is evident that significant levels of human monitoring will be required which will incur associated costs. The need to ensure a safe environment, help for those less abled, and proper ticketing enforcement requires a "captain" solely responsible for these tasks, or alternatively remote monitoring through cameras. Costs are also likely to be incurred in cleaning personnel and back-office operators.

- **How do you expect the cost of self-driving vehicles – both the upfront cost and ongoing maintenance costs – to change over time?**

Uptake is affected not just by the individual or shared nature of a self-driving vehicle, but also by the different geographies, and the UK does not necessarily provide the easiest geography for uptake. Many of the UK roads are characterised by terraced housing, and narrow roads with parked cars, or rural single lane carriageways with horses, badgers, tractors, combine harvesters etc. Self-driving vehicles, particularly those with no mechanisms for human intervention, will need to have very accurate handling and the ability to react appropriately when confronted with emergency services on these roads. This challenge is of course further exacerbated in urban environments with a higher volume of cars.

- **How would the widespread adoption of self-driving vehicles be expected to affect congestion in urban areas?**

There are two possibilities concerning the adoption of self-driving vehicles in congested urban areas. One possibility, is that widespread privately owned self-driving vehicles does not significantly impact congestion positively, as it simply swaps one vehicle for another. While CAVs might be more risk-averse there is no evidence to this manifesting in congestion times. The affordable uptake of autonomous ride-hailing services could discourage modal shifts away from public transport and active travel for city dwellers. The possibility for these vehicles to remain in transit as long they are deployed, while privately owned vehicle rate remains the same, could result in congestion worsening.

The other possibility, is that an uptake in the self-driving ride-pooling model actively discourages private ownership in city dwellers and commuters. Autonomous vehicles would improve the efficiency and directness of travel as they would not get lost or aimlessly drive in search of parking, results in congestion improving within urban areas.

- **How would active travel and public health be affected by the widespread adoption of self-driving vehicles?**

The transport technology industry works under the assumption that most if not all self-driving vehicles will be electric. Given their widespread uptake will take place in the following decades and will have to be in line with current climate commitments. Therefore, it is safe to assume that the widespread adoption of self-driving vehicles will result in better air quality and a positive contributor to public health, especially for those living in urban areas. On the other hand, as previously discussed, if their widespread adoption, at a low cost, results in a move away from active travel, then it is possible it will negatively impact public health. Another important factor to consider in the case of self-driving public transport and ride-pooling services, is that an effective sanitation strategy is needed to accompany widespread uptake.

4. **What are the opportunities and risks for public transport from self-driving vehicles? Areas you may wish to cover in your response include:**

- **What new public transport services could automation or connectivity enable, for example in rural areas or disconnected neighbourhoods?**

Automation and connectivity can empower two public transport services which are of particular benefit to rural and disconnected communities - Demand Responsive Transport (DRT) and ride-pooling. DRT has the potential to be significantly improved by automation and connection. Applying these technologies to DRT systems would allow for automated and predictive scheduling for pickups in the areas where they are needed most, increasing public transport's reliability and reducing wait times. There are also opportunities to combine DRT or indeed other public transport services in rural settings with cross-sectoral uses e.g. medicine and prescription delivery, maximising the utility of each trip and providing a more attractive commercial case.

Similarly, autonomous ride-pooling services could provide a cheaper more ecological yet reliable option to privately owned vehicles in rural areas. There are opportunities to experiment with business models of joint-leasing, privately owned CAVs rented for ride-pooling, or existing car club fleets substituted for CAVs. Either way, passengers could request regularly scheduled joint rides into urban areas for work or for designated trips in advance. Both DRT and ride-pooling models have the potential for integration into end-to-end journeys and the overall improvement in connectivity.

- **What is the scope for self-driving vehicles to reduce the costs of public transport services and enhance their attractiveness?**

The aforementioned models of DRT and ride-pooling possess attractive cost-effective potential. By maximising the efficiency with which these transport systems can secure users, there is a genuine possibility to raise revenue and lower costs through removing the costs of drivers and having smaller vehicles carry out more frequent on-demand journeys. The same can be said for the potential to substitute buses with CAVs and replace private vehicles with self-driving ride-sharing in urban settings.

We can assume that some aspects of the quality of services will improve as the frequency can be optimised to prioritise the most on-demand locations in an automated fashion. The network can adapt as priorities shift throughout the day. While measures need to be in place to ensure less busy urban neighbourhoods are not underserviced, the prospect of faster more frequent services could play a big part in encouraging a shift towards public transport. Additionally, if CAVs in public transport services can be integrated as parts of longer end-to-end journeys, for example on the rail network, we could see this contribute to a modal shift in public transport.

Inherently, a higher passenger volume in any of the systems described results in higher revenues and the removal of drivers and larger vehicles can lower costs for public transport operators.

- **How might the availability of self-driving vehicles for personal mobility (see section above), affect demand for public transport?**

It is unlikely that the proliferation of self-driving vehicles for personal use will affect this. It will depend on what costs for either application of self-driving vehicles comes to, but it is expected that the respective costs of these services should create an optimised demand for self-driving vehicles that is a mix of both. While personal self-driving vehicles are expected to be very expensive in their initial stages – meaning they are no initial threat to public transport users - even in a future where the prices have become accessible to larger portions of the population, lower prices in technology should also translate to public transport methods implementing self-driving vehicles. These prices can be passed on to consumers and also lower public transport fares, maintaining them an attractive proposition.

- **Are there any interventions that may be needed to ensure affordable public transport, or ride-sharing/ride-pooling options, remain available?**

In order to ensure that these public transport options remain available, at least in their initial stages, they will require several interventions. For one, ensuring the vehicles remain clean and aren't vandalised will become essential and will require people to ensure cleanliness and hygiene is maintained, both from a public health and user experience perspective.

It will also be necessary to implement a system through which the safety of these public transport modes can be maintained around the clock. Uptake could be severely hindered if passengers feel vulnerable riding self-driving vehicles.

5. **Self-driving vehicles are expected by the legal framework to operate with existing road conditions and current levels of digital connectivity. But are there specific interventions in relation to physical highway infrastructure and/or digital connectivity that could enable greater benefits from the use of self-driving vehicles on urban or interurban roads?**

Robust digital security infrastructure will be required nationally to accompany CAVs and protect them from being hacked, weaponised or stolen. Roadside infrastructure, such as roadside sensors and roadside communications infrastructure, may need to be updated in order to communicate with CAVs in more complex ways than are currently enabled, while a lot of work is still required in preparing the right physical and digital infrastructure environment. These improvements can only yield positive impacts to other drivers and non-drivers alike.

Physical infrastructure will also need bolstering. Road quality will likely need to be held to a high-standard for the safety of the self-driving vehicle – for example, those inside connected vehicles driving in a platoon could have exponentially bad results if one hits a pothole. Signage and lanes must also be kept to a high standard in order for them to be recognised by self-driving vehicles that utilise cameras. These improvements will result in a safer environment for all drivers, who will benefit from overall higher quality road and highway infrastructure.

6. We are interested in the impacts that self-driving vehicles could have on different groups in society, including those with protected characteristics recognised by equalities legislation. To what extent could they help address existing inequalities and improve transport inclusion, including for people who are unable to drive due to a disability or age?

Self-driving privately owned vehicles, ride-sharing services, and public transport modes all provide excellent alternatives for individuals who are unable to drive, allowing them to travel more. Privately owned CAMs could reduce an individual's inability to drive, while ride-sharing services could provide a more affordable option for those who do not need to travel as much, but still want to schedule rides in comfort. AVs in DRT and public transport are theorised to increase in frequency and reliability for most, meaning that those who cannot drive and cannot afford to own a self-driving vehicle should still benefit.

In terms of inclusion, there are questions across all applications of autonomous vehicles, but particularly those related to public transport, with regards to what mechanisms are necessary to ensure safety, accessibility and inclusion on these vehicles.

• Are there any issues around personal safety to consider?

People with disabilities, whether visible or not, at times require additional help when navigating public transport, whether with ramps or with help carrying bags etc. In current hypothetical applications of autonomous public transport modes i.e. DRT, buses and ride-sharing services, the implications for inclusion of not having a driver, are not a big concern for personal safety. It is something the UK already implements with Docklands Light Rail (DLR), having instead a member of staff who gives a presence, checks tickets and provides assistance. Likewise, underground carriages do not have physical monitoring and widespread concern is minimal, as support exists at the stations. A similar type of operation could be set up on autonomous DRT, buses and coaches, wherein there are roving members of staff or 'bus captains' that ensure everyone, but especially those less abled – physically or neurologically, receive support with whatever they made need, at least in the early stages of these applications.

• How will impacts vary across different income groups?

Whether different income groups benefit from CAVs will depend on the price or fare of the journeys. The arguments for how CAVs can lower costs of public transport, and provide those in rural locations or those with disabilities with additional optimised transport options, suggest that self-driving vehicles can be a big contributor towards reducing transport inequality and improving social mobility.

- **Are there other interventions necessary to enable and maximise benefits?**

For one, there is still a gap in research theorising how people with physical and neurological disabilities interact with self-driving vehicles, particularly in public transport. There is a myriad possibility into what this could look like, but much research remains to be done in defining and creating the processes for doing so.

There is also still an issue in creating trust with other road users and the wider public. The CAV industry and Government needs to consider employing some efforts into developing products that make transport customers and wider society feel they are safe and in control when interacting with CAVs.

7. Are the benefits that may be secured from autonomy and connectivity inevitably intertwined or could they be separated?

- **Are connected rather than automated features more important for some use cases?**

Although often discussed together, there are significant benefits of connected vehicles that extend beyond automation. Connected vehicles are already commonplace on the road network, interacting with other vehicles and infrastructure and sharing data that allows for smoother and more efficient journeys, and supports the safety of road users. However, the use of this data is restricted by siloes across transport authorities and the question of ‘who pays’ for these services (often due to the limited budgets of these organisations).

Increasingly, benefits of these technologies are being missed due to a lack of a strategic approach across vehicle manufacturers, mobile network operators and road operators. A clear example of this is the use of eCall (the SOS button in vehicles) data, which is often not utilised by road operators even though it could alert them to areas on their network where accidents are likely to occur.

Government has a key role to play in bringing these sectors together to support this growing industry. In 2020, the Department for Transport published a Connected Vehicle Data Research report, setting out how connected vehicle data could be utilised, for example, through talking traffic systems that optimise traffic flows. This document should be revisited and developed further, with a national connected vehicles strategy set out.

- **Are policy and infrastructure interventions the same for optimising connectivity and automated benefits?**

Roadside connectivity infrastructure already exists, yet it is likely it will have to be improved to support automated vehicles. Automation might require a much more comprehensive and robust digital and cellular infrastructure consisting of highly detailed digital mapping, faster more powerful cellular connectivity and cybersecurity defences. The benefits that can be secured by creating the right infrastructure for autonomy, will in itself also improve connectivity.

8. What effect might the adoption of self-driving vehicles have on carbon emissions from the transport sector?

The question of how CAVs affects decarbonisation efforts partially depends on whether self-driving vehicles will be electric vehicles (EVs). It is assumed that they will be, given how timelines for widespread adoption line up with the UK’s carbon and climate goals. Assuming that the introduction of these new vehicles are EVs, then they can reduce carbon emissions by replacing traditional fuel-powered transport modes. There is also the possibility that CAVs will encourage ride-pooling methods as opposed to private vehicle ownership, further reducing emissions by removing private cars off the road. However, it is important to consider the lifecycle of existing vehicles, and avoid scrapping vehicles that still have long lives left. Given the average UK vehicle life is more than a decade, there will be a long curve to get CAVs through to commercialisation. Disposal of existing vehicles has an environmental cost in itself, and retrofitting vehicles with autonomous capabilities is a possibility that should be explored to avoid doing so.

- **What additional measures might be required to ensure that they contribute to meeting emissions targets for 2035 and 2050?**

Ultimately, the services that are provided by CAM need to be safe and reliable in order to achieve public acceptance and encourage better travel habits (as set out in the Automated Vehicles Act). As we have seen with other transport policies, if the public don’t like a service or a policy, they are now much more willing to reject it.

It is also important to consider urban traffic management, and to weigh up how to support CAVs, in ways that still encourage a modal shift to active travel and public or shared transport methods.

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