techUK

techUK.org | @techUK

National Infrastructure Commission Connected and Automated Mobility Study

techUK response

techUK welcomes the National Infrastructure Commission's (NICs) study into connected and automated mobility (CAM). This is an exciting time for the UK's burgeoning CAM sector, with new legislation, the Automated Vehicles Act 2024, laying the foundations for the deployment of all levels of automated vehicles (SAE Level 3-5) on public roads within the coming years.

In this response, we have addressed a number of key questions posed by the call for evidence, including an examination of the benefits of CAM, key use cases and applications and the impact and implications for infrastructure, both digital and physical.

A note on terminology

Throughout this report we use "Connected and Automated Mobility (CAM)" to align with the latest BSI Flex 1890 v5.0 2023-04[1]. While we use "CAM" as an all-encompassing term, some use cases we describe as "automated", "AV" or "CAV", capable of entirely automating the driving task with no human intervention on public roads.

1. **The benefits of CAM across personal, public transport and freight**

There are a multitude benefits presented by CAM, spanning social, economic and environmental factors. We have grouped personal mobility, public transport and freight to avoid repetition as in most instances the benefits are true for all of these use cases. There are, however, some benefits that are specific to particular use cases and industries, which we have highlighted where appropriate.

Social benefits of CAM

There is widespread appreciation for the benefits that CAM can deliver across the UK. A recent study by consultancy Arup, commissioned by the Centre for Connected & Automated Vehicles (CCAV), investigating the use of CAM in public transport found that 85% people in their general population survey saw merits in implementing CAM systems across the UK[2].

In terms of the benefits, widespread CAM adoption could contribute to improvements in on-road and off-road safety, with an estimated 3,900 fewer fatalities and a reduction of around 60,000 serious accidents over the period between 2023 and 2040 according to the SMMT[3].

The greatest proportion of these are in passenger vehicle segments, both privately owned cars as well as passenger transport services, which are expected to account for up to 80% and 87% of the reductions in fatalities and serious accidents respectively. Given 29,742 people were killed or seriously injured in road collisions in Britain in 2022, and human error is a contributory factor in up to 88% of all road traffic accidents, the potential contribution of automated

[1] https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/bsi-flex-1890-connected-and-automated-mobility-vocabulary/

[2] https://www.arup.com/perspectives/publications/research/section/research-insights-into-an-autonomous-future

[3] https://www.smmt.co.uk/2023/11/connected-and-automated-mobility-revolution-set-to-deliver-66-billion-prize-by-2040/

vehicles to road safety could be significant[4]. National Highways cites research in its 'Strategic Road Network 2050' strategy that just 25% CAV penetration could reduce traffic conflicts by up to 47% on the motorway[5].

A US study suggests, over the course of 15 years, many more lives could be saved by deploying highly automated vehicles early, even when they were just 10% safer than the average human driver. One of the world's leading reinsurers published a study recently showing automated vehicles are significantly safer than human-driven ones, with bodily injury claim frequency down by 100% and property damage claim frequency reduced by 76% in the 3.8 million miles of commercial operations of an automated ride-hailing service in two major cities in the United States[6].

CAM could also offer people with mobility issues, or who are unable to drive, the freedom to travel. The SMMT shows 56% of disabled people were the most excited about automated vehicles, six in ten people with limited mobility believed automated vehicles will help them obtain higher quality of life, and nearly half of all older people believed automated vehicles will enable them to more easily fulfil day-to-day tasks such as grocery shopping or visiting the doctor.

Economic benefits of CAM

The SMMT study also shows that CAM could deliver annual economic benefits as high as £66 billion by 2040 and an estimated additional 342,000 additional jobs overall in the economy, of which 12,250 are in automotive manufacturing.

Just over half of this total, £34 billion, is real economic impact, which accrues to improved commercial and business outcomes for CAM users, increased output from producers of connected and automated vehicles and enhanced opportunities for the wider supply chain and adjacent sectors such as telecoms, digital services, insurance, retail and media.

The study suggests that private passenger cars and car-based passenger services such as taxis, private hires and ride-hailing are the dominant automated vehicle use cases in terms of the impact on the economy, accounting for 87% (£36 billion) of the £42 billion opportunity delivered by on-road applications, itself a subset of the overall £66 billion economic impact to the UK by 2040. Automated buses and coaches, meanwhile, are expected to deliver £1.7 billion to the national economy. In the non-passenger transport use cases, businesses and sectors such as logistics, agriculture, mining, construction, public administration and defence could benefit from more efficient movement of goods and industrial processes.

Environmental benefits

Automated vehicles have the potential to improve traffic efficiency when deployed in substantial numbers and travelling at optimised speeds and headway gaps, leading to better air quality and lower emissions. A government-commissioned study suggests a 12% improvement in delays and a 21% improvement in journey time reliability on urban roads in peak traffic periods even with low numbers of automated vehicles[7]. According to National

[4] https://www.gov.uk/government/statistics/reported-road-casualties-great-britain-annual-report-2022/reported-road-casualties-great-britain-annual-report-2022
[5] https://nationalhighways.co.uk/media/ob1lqvqr/cre22_0150-masterplan-national-highways-ris3_final-1.pdf
[6] https://waymo.com/blog/2023/09/waymos-autonomous-vehicles-are-significantly-safer-than-human-driven-ones/
[7]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/530091/impacts-of-connected-and-autonomous-vehicles-on-traffic-flow-summary-report.pdf

Highways, significant connected and autonomous mileage could realise greater operational resilience for the Strategic Road Network.

2. The risks to CAM across personal, public transport and freight

There are a number of risks to the CAM sector that apply equally across personal, public transport and freight use cases. Addressing these must be a policy priority if we are to achieve adoption at the rate required to leverage the benefits outlined above.

Lack of regulatory certainty

A lack of regulatory clarity is the largest risk facing the UK's CAM sector. Specifically, the inability to remove the human driver (safety operator) outside of a very limited trial setting in order to run a commercial service. Incomplete regulation poses the biggest threat to companies developing 'No User in Charge' (NUiC) services and operating models. Typically, NUiC services include robo-taxi, shuttles, public transport and logistics.

The Automated Vehicles Act 2024 (AV Act) is a positive step forward and has set the foundation for a regulatory framework to safely remove the driver. However, taking advantage of the powers within the AV Act requires the framework to be completed by a programme of secondary legislation. This should include establishing the process for assessing safety (the National Safety Principles) as a matter of priority, to ensure that industry is clear on how to meet the standard for deployment. The AV Act also fails to regulate for use cases that operate on the pavement, such as delivery robots. Further clarity is therefore needed around how the Government intends to support the deployment of autonomous micro-mobility since measures to create a new Low-Speed Zero Emission Vehicle class were also dropped[8].

The Government previously pledged that by 2025 "the UK will begin to see deployments of self-driving vehicles…creating an early commercial market for the technologies." Disappointingly, it now appears the Government will not deliver on this commitment to industry given the limited time remaining to this deadline and the political instability caused by a General Election.

Missing deadlines undermines industry's confidence in the UK market and may drive investment overseas. To capitalise on the benefits of CAM, the next Government must make it a priority to complete the UK's regulatory framework as soon as possible to enable commercial deployment. This should be done in close alignment with Department for Transport's International Vehicle Standards team to ensure a cohesive approach with the UN-level type approval regulations, which are already being negotiated. Without the framework, innovative businesses could chose to commercialise their technology within more permissive overseas markets, diminishing UK competitiveness in the global CAM industry and hampering economic growth.

Lack of social acceptance

CAM services risk being rejected by communities if they are not introduced in a way that builds trust. The introduction of new transport measures can be politicised if there is not a clear rationale and benefit presented to the public. This has been seen with the introduction of 'clean air zones' across the country where a lack of communication and engagement with communities led to misinformation spreading, distrust proliferating and the ultimate cancellation of projects[9].

[8] https://www.pacts.org.uk/a-setback-for-e-scooter-legislation/
[9] https://www.fleetnews.co.uk/news/environment/2023/09/07/cambridge-scraps-congestion-charge-plans

The Government's own research demonstrates that exposure to CAM is the most effective way of building public awareness and confidence in the technology[10]. The research also shows that presence of a safety operator behind the wheel gives the impression to users that the technology is quite far from being ready for widespread use. A policy change to enable trials and deployment to take place without the safety operator as soon as possible will help overcome this through increased public exposure and understanding of how the technology works.

There is also evidence to suggest that users, especially older adults or those with mobility issues, have greater trust and comfort within AVs that can communicate and explain their behaviour in sufficient detail. Participants in the FLOURISH study reported increased trust ratings through engaging with a Human Machine Interface, either by voice or touch[11]. British AV developer Wayve has developed LINGO-2, a driving model that links vision, language, and action, providing visibility into the decision-making process of the driving model. LINGO-2 provides a continuous driving commentary of its decisions, showing how the driving model adapts its actions and explanations in accordance with various scene elements. This technology provides an indication of the alignment between explanations and decision-making and could therefore aid public trust and understanding of automated systems.

Lack of sustainable funding

NUiC services, especially in public transport, will require some level of public investment or subsidy to scale. This is particularly true in rural or semi-urban areas where the ability to run commercially viable public transport services is already challenging and has led to a sustained decline in conventional bus services[12].

With local and regional authority budgets under strain, it is unlikely that funding for CAM services can be delivered through existing budgets. This means that central Government will need to 'de-risk' the initial investment from public transport authorities through making funding available to those wishing to deploy CAM services. This could follow a similar model to the Future Transport Zones programme, designed to increase the uptake of sustainable transport options such as e-scooters to ensure that services are sustainable and can be delivered at an acceptable cost to end-users.

In the longer term, the cost benefit of CAM should improve overall financial efficiency of public transport systems, passing savings back to local areas and communities. This is through the savings generated through changed resourcing requirements and cost of the technology coming down over time. These savings are also true of the freight and trucking sectors.

Lack of manufacturing capacity

As things stand, the majority of vehicles used in CAM trials are conventional vehicles that have been retrofitted to give them self-driving capabilities. However, as the industry scales, industry will require 'native' driverless vehicles – in other words – vehicles that have been designed and manufactured as self-driving vehicles from the outset.

The UK must ensure that it has the domestic manufacturing capacity and capabilities needed to meet the demand for 'native' driverless vehicles the global CAM industry. Currently manufacturing of these vehicles and their component parts mostly takes place outside of the UK. However, to maximise the economic benefits of the CAM industry it is critical UK government begins considering how it intends to support the creation of a native driverless vehicle manufacturing sector to meet demand both in the UK and overseas.

---

[10] https://assets.publishing.service.gov.uk/media/649d83a8bb13dc0012b2e35d/great-self-driving-exploration-citizen-view-of-self-driving-technology.pdf

[11] https://cp.catapult.org.uk/project/flourish-project-improving-accessibility-with-cav-technology/

[12] https://rsnonline.org.uk/the-decline-of-bus-services-in-rural-england-a-deepening-divide

3. Infrastructure considerations (both physical and digital)

The specific infrastructure requirements needed to enable CAM are minimal as most developers are working to deployment without any specific upgrades needed. While there are examples of CAM services operating on standalone infrastructure around the world, these are a typically mass-transit (e.g. trams and light rail) which would require this infrastructure whether part of a CAM or conventional service.

Physical infrastructure

In order to deliver the maximum social and environmental benefit, an AV operating as part of a CAM service should be capable of integrating into the existing infrastructure without any specific upgrades. This is because they are 'trained' in real-world and synthetic driving environments[13] and capable of handling day-to-day conditions.

Maintaining road infrastructure to high standards benefits all road users and future Authorised Self-Driving Entities (ASDEs) will appropriately determine whether degraded infrastructure will prevent safe operation of their technology. On the Strategic Road Network, National Highways has stated its ambition for ensuring that all national corridors are CAV-enabled by 2050[14]. However, given significant market penetration of CAM is anticipated to come within the next decade and the minimal infrastructure modification required by the vehicles, infrastructure authorities must be preparing for deployment as soon as regulation permits.

Electric vehicle charging infrastructure

The majority of AV vehicles will be electric, meaning that charging infrastructure is another key consideration. NUiC service vehicles will charge at depots and potentially at on-street rapid charging stations. However a host of well documented constraints make the path to electrification challenging. At depots, techUK members report numerous challenges installing chargers including a lack of local grid capacity, long connection queues and land planning issues.

Charging away from depots (e.g. on delivery routes) may be possible in dense urban areas such as London where there is a good supply of rapid chargers. However, the picture is different in suburban and rural areas where current charging infrastructure distribution exceeds the range of current battery technology. A dependable, bookable, distributed commercial fast charger network would serve to support wider rollout of EVs, including automated vehicles in the future.

We also welcome the commitments from Ofgem to reform the grid connections process[15], however would like to see more tangible action taken on improving access to the grid to deliver the key infrastructure underpinning the technology sector, from EV charge points to data centres.

Digital infrastructure

Increasing data and digital connectivity will enable new business models and services and unlock significant new economic and social value. Transport, as a piece of critical national infrastructure, is a high-priority slice of the network, and techUK members are confident that the low latency connectivity required to support CAM can be delivered.

---

[13] https://wayve.ai/thinking/ghost-gym-neural-simulator/

[14] https://nationalhighways.co.uk/media/ob1lqvqr/cre22_0150-masterplan-national-highways-ris3_final-1.pdf

[15] https://www.techuk.org/resource/ofgem-open-letter-on-future-reform-to-the-electricity-connections-process.html

The roll-out of 4G and 5G is making this possible thanks to the work of mobile network operators and Department of Science, Technology and Innovation in improving coverage through programmes such as the Shared Rural Network[16]. InnovateUK expects widespread 4G connectivity by 2025 and 5G by 2030 across the transport network[17].

However, it is important to note that AVs do not require uninterrupted connectivity in order to operate. This is because the Automated Driving System (ADS), the 'brain' driving the vehicle using a combination of technologies including cameras, sensors and AI are not reliant on connectivity. This means that if a vehicle temporarily loses internet connectivity, the ADS will continue to safely drive the vehicle until connection is reestablished. Similarly, while there are benefits to V2V and V2X delivered over 5G[18], these communications are not a requisite of safe CAM operations.

The approach for localisation for some AVs will require reliable access to GPS and satellite positioning, as well as geospatial datasets for mapping and route planning[19]. We support the continued investment by Government into growing the UK's space-technology capabilities to support a range of future transport use-cases across road, air and sea[20]. We also support the Geospatial Commission's recommendations to improve how location data and location technologies can work together by defining accuracy standards and improving data sharing practices to make connected vehicle data more accessible and reusable[21].

From a cyber security perspective, it is important to clarify that many AVs are not designed to be remotely driven. Therefore 'malicious takeover' is not possible. Nonetheless, other cyber-physical threats include to the overall connected system, leading to instances of disruption. This is why manufacturers and operators of AVs will, by regulation, need to demonstrate the robustness of their cyber security defences under the AV Act.

The AV Act has also mandated the digitisation of Traffic Regulation Orders (TROs) which while enabling AVs to operate more effectively through the digital transmission of road regulation, will also spur innovation across the transport industry including in maps, parking and EV charging. This was recently described in Highways Magazine as the 'biggest shake-up to network management in a generation'[22].

Conclusion

We welcome the NIC's investigation into the CAM sector and look forward to lending our continued support as the report is developed over the coming months.

This is an exciting time for the UK's burgeoning sector and we hope that this evidence provides some deeper insights that will be useful for informing the NIC's recommendations.

---

[16] https://srn.org.uk/
[17] https://www.ukri.org/wp-content/uploads/2022/01/IUK-110122-UK-Transport-Vision-2050.pdf
[18] https://www.vodafone.co.uk/business/5g-for-business/5g-customer-stories/midlands-future-mobility
[19] https://www.gov.uk/government/publications/finding-the-way-forward-location-data-to-enable-connected-and-automated-mobility/finding-the-way-forward-location-data-to-enable-connected-and-automated-mobility
[20] https://www.techuk.org/resource/techuk-s-first-emerging-space-technologies-report-is-now-live.html
[21] https://www.gov.uk/government/publications/finding-the-way-forward-location-data-to-enable-connected-and-automated-mobility/finding-the-way-forward-location-data-to-enable-connected-and-automated-mobility
[22] https://www.highwaysmagazine.co.uk/Digital-TROs-confirmed-Biggest-shake-up-to-network-management-in-a-generation/13700

From a policy perspective, the sector has come great strides in the last 5 years. With deployment on the horizon, we hope that Government, both local and national, infrastructure authorities, and industry will unite in a shared vision to leverage the transformative benefits of CAM.

About techUK

techUK is a membership organisation launched in 2013 to champion the technology sector and prepare and empower the UK for what comes next, delivering a better future for people, society, the economy and the planet. It is the UK's leading technology membership organisation, with more than 1,000 members spread across the UK. We are a network that enables our members to learn from each other and grow in a way which contributes to the country both socially and economically. By working collaboratively with government and others, we provide expert guidance and insight for our members and stakeholders about how to prepare for the future, anticipate change and realise the positive potential of technology in a fast-moving world.