

Written evidence submitted by National Highways (SDV0039)

Introduction

National Highways is the Government-owned company responsible for operating, maintaining, and improving England's motorways and major A-roads (the Strategic Road Network – SRN). The safety of those using, working or living alongside our network is our number one priority.

Our road network totals around 4500 miles and forms the economic arteries of the country – connecting regions, business and people 24 hours a day, 7 days a week. We carry a third of all traffic by mileage and two thirds of all freight.

Innovation, technology and research play critical roles in helping National Highways make our roads safer, greener, more efficient and easier to use – at the same time as increasing capacity to meet rising demand and deliver greater economic returns.

For the purposes of this written submission, we have included information on connected vehicles as well as autonomous (automated) vehicles. These are collectively referred to as connected and automated vehicles (CAV).

By connected vehicles, we mean those that can communicate with other vehicles or infrastructure on the road network. A good example is freight platoons; where a lead vehicle, within which the driver has full control, is electronically coupled to other vehicles in the platoon, allowing drivers of the following vehicles to cede elements of control to the lead vehicle.

By automated vehicles we mean those that can safely and lawfully drive themselves without the need for driver intervention, for some or all of a journey. An early example of this is likely to be automated lane keeping systems (ALKS). Automated (or self-driving) vehicles are distinct from those with advanced driver assistance systems, such as assisted braking systems (ABS). Driver assistance systems require the driver to be in control at all times.

We have provided information in this submission on how we are working with the Government, academia and industry to ensure that we understand both the evolving technology and support the implementation to maximise the benefits and minimise the risks.

We also note that in the Government's recently published document "Connected and Automated Mobility 2025"¹, it includes a description of our work on digital roads, in particular Digital for Customer including connected services.

It is in that context that National Highways provides this evidence.

Summary

National Highways recognises the significant benefits that CAVs may bring to the safety and smooth operation of the SRN. We are also conscious of the risks new technology may bring and we are working to support the Government on their safe introduction. We want everyone who travels on our network and works on it to get home, safe and well.

We believe CAVs will transform how road users travel, creating more integrated, reliable, and safer journeys. Through active collaboration with the Government, industry, international bodies and academia, we can deliver even safer and better roads that connect people and connect our country; realising the benefits that these technologies can deliver on the SRN and beyond.

We welcome the growing demand to trial these innovative technologies and services on our network and we are keen to continue working with CAV trialling organisations and support them to get their trials on-road safely.

CAVs promise significant safety benefits which could help contribute to our ambition of zero harm for all those using or working on the SRN. They may provide the opportunity to prevent high proportions of casualty collisions by removing the potential for human error but to achieve this, the technology needs to be reliable and consistent.

National Highways recognises that new CAV technology will bring opportunities to transform how we manage our network. We have invested and will continue to invest in research and innovation to better understand the impacts of CAV on our road network. The technology has potential applications for National Highways that may give us an even better understanding of network conditions, with the information coming from vehicles telling us about traffic flow and speed, allowing us to provide our customers with more timely and accurate information. It could also provide real time data about asset condition, such as the quality of the white lines or the presence of pot-holes.

The pace of uptake of CAVs will be key to realising these benefits. The Government's Centre for Connected and Autonomous Vehicles (CCAV) has projected that vehicles capable of automated driving may account for approximately 36% of all new car sales in the UK by 2035. A study² evaluating

the safety impact of CAVs predicts a potentially compelling road safety impact, with traffic conflicts (for example rear end, lane changes & vehicle crossings) significantly reduced even at relatively low market penetration rates.

Our plans for the third road period (2025-2030) will need to lay the foundations for a step towards greater levels of connectivity and automation on our network. We are assessing what actions need to be taken over 2025-2030 to ensure our network is ready for higher levels of connectivity and automation. Although the speed of adoption is uncertain, we expect there to be mixed traffic for a considerable period. Part of our role will be to make changes to our system, data and technology to enable “early adopters” to take advantage of increasing connectivity and automation, while also ensuring that our network continues to run effectively for all our customers, regardless of their vehicle capabilities. Data is particularly important for CAVs, so, ensuring the data we collect and provide to customers is accurate, timely and reliable is particularly key. We also need to make sure that our operational technology and the systems which support it continue to be secure and reliable so we have a good base from which to support move to greater connectivity.

We believe that CAVs will have the following impacts on National Highways’ activities:

Safety: CAVs have the potential to make our roads safer, but at the same time the technology must be developed and deployed in a controlled and safe way that safeguards all road users including roadworkers and responders. We believe there needs to be minimum standards agreed internationally.

Innovation: Within the transport innovation field, CAV technology is developing rapidly. Our programme of innovation plays a key role in making our roads safer, efficient and greener.

Economic benefits: The SRN is a vital economic artery for the country – technology, including CAV, can improve utilisation and enhance economic benefits by reducing delays and through more productive use of travel time.³

Collaboration: National Highways is working with the Government, industry and academia, both within the UK and internationally, to play a full role in unlocking the benefits of CAV. It is a joint endeavour requiring collaboration and action from all parties to deliver all the elements required to enable growth and development of CAV.

Greener SRN: Full network connectivity solutions to support CAVs by 2035 can help deliver our ambition for road users to have net zero journeys by 2050 by reducing the need for further physical infrastructure such as message signs, as well as improving road space utilisation.

Real world: We are taking a real-world, operational approach to this technology, including using our infrastructure to support testing. We welcome the growing demand to trial these innovative technologies and services on our network. We are keen to continue to work with CAV trialling organisations and support them to get their trials on-road safely.

Vehicles are becoming increasingly more sophisticated; designed to keep users safer and make journeys more enjoyable. Technology has the potential to change how we travel and the information we receive about our journey, with increasing connectivity and automation and potentially self-driving cars. National Highways is preparing for this in our investment planning for future Road Periods. We will continue to work with the Government, industry and other partners to see that the benefits of CAV are harnessed for our road users and the SRN, and that the technology is deployed in a safe and sustainable way across our network.

National Highways and Connected and Automated Vehicles

We have been actively investigating this type of technology for over ten years, when, as an executive agency of the Department for Transport (DfT), the Highways Agency started looking at co-operative highways systems and in-vehicle traffic management.

National Highways provides advice, guidance and standards on the SRN. We collaborate with the Government's Centre for Connected and Autonomous Vehicles (CCAV), the British Standards Institute's (BSI) PAS Programme and the International Transport Forum (ITF).

We support Government initiatives like the Connected and Automated Vehicles Process for Assuring Safety and Security (CAVPASS) and the Automated Vehicle Driver Responsibility in Vehicle Education Group (AV-DRiVE). We also work closely with industry bodies such as the Society for Motor Manufacturers and Traders (SMMT), ZENZIC and the Automotive Electronic Systems Innovation Network (AESIN).

National Highways has a dedicated Connected and Automated Vehicles Team to lead our collaboration with industry and other road authorities, coordinate business research, provide input to corporate strategies and liaise with the Government on related matters.

We also support and lead safe trial activity on the SRN. To be more transparent and approachable to CAV developers who wish to test and trial on the SRN, in August 2022 we published 'Safety risk assurance for connected and autonomous vehicle (CAV) trials on the SRN' document⁴. It outlines the approach we expect organisations to follow when carrying out safety risk assessments for trials of connected and automated vehicle technology and services on the strategic road network.

In 2021, National Highways' "Digital Roads Strategy"⁵ set out a vision for how we will continue to harness digital, data, and technology to transform how the SRN is designed, built, operated, and used. From digital design, intelligent assets and connected and automated plant and vehicles, through to how we generate and use our data, our ambition is that national corridors will be CAV enabled. We also envisage that freight automation will be well established on routes to major international gateways and that our customers will travel on digitally-enabled roads, making their journeys safer, more efficient, and environmentally sustainable. Our design, construction and operational activities will be digitised and automated.

Likely uses, including private cars, public transport and commercial vehicles

National Highways sees two main applications for CAVs on the SRN:

Road users: CAV has the potential to be applied in support of the use of the SRN by both the public and by business to make the SRN safer (through reduced collisions) and provide smoother journeys by improving traffic flow when the network is busy, thereby using existing capacity better.

Maintenance/Construction: using CAV construction machinery (plant) to undertake some aspects of highways maintenance and construction activities. Such plant would be connected to its environment through sensors or wireless transfer of data with a remote operator while the automated element refers to aspects of the vehicle's operation and also movement around a site.⁶

CAVs also have the potential to remove some of our existing maintenance needs around physical infrastructure like message signs (as this information will be passed directly to the vehicles), however, there may be increased needs to maintain infrastructure such as road markings, if these are needed by the car sensors.

The path to vehicle automation will be phased. Before full automation, new vehicle technologies will bring fundamental changes to how customers travel on the SRN. Digital connectivity offers the most immediate opportunities to develop and improve customer experience. Speeds and coverage are set to expand by 2030, and the UK will have nationwide gigabit-capable broadband, with 5G coverage for the majority of the population. This means faster wireless connectivity, which will enable real-time information to be shared between users and operators through increasingly sophisticated traffic management and in-car information systems.

Whilst transitioning to automated and machine-driven miles will be a gradual process, in the immediate term, vehicles will use a range of driver assistance systems. Innovations such as automated lane keeping systems (ALKS) are already at high levels of technical maturity and expected to become commonplace within the decade. We recognise there is currently a disparity in application between cars and commercial vehicles (like vans, freight) and would like to see provision across the fleet.

Self-driving vehicles have the potential to fundamentally change how people travel on the SRN, allowing drivers to hand control of the driving task to the vehicle. ALKS are the first to be developed to allow the driver to disengage from the driving task, initially under certain conditions and at low speeds on motorways.

The DfT has recently consulted⁷ on the safe use of these systems and has identified the next steps required before adoption. These include: how best to provide driver information and education; consulting on changes to the Highway Code; continued discussions with insurers and manufacturers; and research to scope the technical requirements for higher speeds and lane changes.

Progress of research and trials in the UK and abroad

National Highways works with, and alongside, industry, academia and the Government to support and deliver trials and conduct research into CAVs. These trials are all helping us to prepare for a future which includes CAVs.

Since 2015 we have completed pioneering CAV trials. These trials included UK Connected Intelligent Transport Environment (UKCITE), A2/M2 connected corridor, HelmUK (freight platooning) and HumanDrive (Nissan led 230-mile automated drive).

In Annex A we have set out a table summarising the trials and research.

The trials considered various elements:

- Safety risk assessment informing trial design and operation;
- Timeliness (latency) and accuracy of information provided;
- Communications methods and impact on delivery of information into vehicles;
- Cyber security requirements to feed into development of British and international standards (with the British Standards Institute, BSI);
- Impact of connected vehicles on fuel efficiency and emissions; and
- Interaction between the vehicle and physical infrastructure on the SRN (including message signs and road markings).

We are already using the learning from our trials in a number of ways including:

Safety risk governance & framework - in August 2022 we published⁸ our guidance on safety risk assurance for CAV trials on the SRN. It outlines the approach we expect trialling organisations to follow when carrying out safety risk assessments for trials of CAV technology and services on our network. This used learning from across our trials, in particular freight platooning and HumanDrive.

Development of a connected services roadmap – we brought together learning from the A2/M2 pilot and the UKCITE project to influence our “digital for customers” project. We are seeking to provide information to third parties to use to provide in-vehicle information. This includes a decision to focus on using cellular communications, e.g. 4G and 5G networks, rather than providing a dedicated wi-fi network.

Potential implications for infrastructure, both physical and digital

National Highways’ active involvement in trialling and researching CAV is shaping our thinking. Safety will be a key driver in determining what changes to physical infrastructure, if any, will be required in the future.

Whilst it is too early to determine exactly what changes to physical infrastructure and our associated design standards might be required to accommodate CAV in the future, we believe CAVs will require changes to digital (better connectivity) and may require changes in the physical infrastructure (such as additional road signs or performance requirements and may reduce the need for traditional roadside communications infrastructure like message signs).

The HumanDrive project highlighted some considerations required when assessing the readiness of existing SRN infrastructure to accommodate CAVs:

- Clear and consistent road markings, road signs and signals – we are now building on this work through our research to look at the performance requirements needed in this space.
- Additional signage may also be a requirement in the deployment of automated driving systems. For example, this may include the installation of national speed limit signage on slip-roads, to ensure that the system functionalities understand the road environment. This finding now needs to be considered alongside the potential introduction of Intelligent Speed Adaptation as part of the EU General Safety Regulations that the UK Government is considering adopting.
- Roadworks (both emergency and scheduled) will need to be communicated to CAVs so they can decide a route preference – this service now forms part of our digital for customer work.

In terms of digital infrastructure, we are focussing on utilising cellular communications as our preference for information provision. This requires good coverage levels for 4G and 5G communications across all road networks and therefore it is imperative that mobile network operators deliver their commitment to deliver 95% coverage for 4G by 2026 as part of the Shared Rural Network project⁹.

One of the benefits of CAVs is the potential to better utilise the SRN. It may reduce pressure for new infrastructure (roads) to increase capacity and potentially reduce the need to operate congestion management and queue protection, known as the Motorway Incident Detection and Automated Signalling system – MIDAS. A report¹⁰ for DfT in 2016 suggested that once CAV penetration on the SRN exceeds 50%, benefits, for example, in terms of reduced delay, would be achieved. However, it is also possible that users' ability to use travel time for other purposes encourages more travel, reducing this benefit.

We will continue to research and support trials that build understanding as the technology continues to develop.

The regulatory framework, including legal status and approval and authorisation processes

National Highways does not set regulatory standards for CAVs but we do provide input into consultations. For example, we responded to a recent Law Commission consultation on autonomous vehicles (AVs)¹¹. Due to our role as a custodian of the SRN, our comments focussed on the safe deployment of AVs on the SRN and accident investigation, where our safety specialists work with the police to understand causes of collisions.

National Highways is involved in the Government's CAVPASS (Connected and Automated Vehicles Process for Assuring Safety and Security) programme. CAVPASS is developing a comprehensive safety and security assurance process to enable the widescale deployment of connected and automated vehicles on UK roads.

It is the responsibility of the vehicle manufacturer to inform purchasers of AVs how to use them safely, with car dealerships required to do the same as those vehicles move into the used car market. Led by the Centre for Connected and Autonomous Vehicles (CCAV), National Highways is contributing to a new joint working group (AV-DRIVE) with industry and civil society leaders to steer and support driver education. This group will initially focus on Automated Lane Keep Assist Systems (ALKS) and other user-in-charge automated vehicle technologies, but in the longer term will look to expand to cover the difference between automated and driver assistance systems, and the use of more highly automated systems as they become commercially available.

We are also building close relationships with the Automated Vehicle Technologies Team at International Vehicle Standards in the DfT to understand the type approval process, identify trends and likely early adopters of CAV systems so that we may better prepare our SRN for their arrival.

We believe that if the roll out of CAV is to be successful, there needs to be consistent standards and common environment in which CAVs can operate. Minimum standards need to be established to allow all vehicles to interact with each other and infrastructure consistently – to ensure safety and so that we can understand the operating environment. This may lead to the development of better services, such as getting early warning of road asset issues.

Given that the SRN is a key part of connecting the UK with business around the world, we see a need for an international approach to regulatory issues such as technical standards. We will continue to work with CEDR (Conference of European Directors of Roads) and other roads administrations, sharing knowledge, co-operating and collaborating on research and trials.

Safety and perceptions of safety, including the relationship with other road users such as pedestrians, cyclists and conventionally driven vehicles

The protection of those who use and work on the SRN remains National Highways' priority. Recognising the benefits CAV could bring, questions remain regarding the operation of CAVs on the SRN, including:

- How to ensure that CAVs operate in a way that does not make the SRN less safe or users feel less safe?
- How CAVs take emergency action in a safe way – for example, how and where do they come to a stop in an emergency?
- How do CAVs make decisions on what to prioritise in an emergency?
- What is the interaction between CAVs and non-CAV vehicles or non-motorised users (including those working on the SRN)? How each can predict the actions of the other and how can this be managed?

The introduction of CAVs present an opportunity to prevent potentially significant proportions of road collisions, in particular by removing the potential for human error. Drivers failing to look properly or judge another vehicle's path or speed are the most commonly reported factors in casualty collisions.

With this potential development comes a number of uncertainties. The level of connectivity and autonomy will play a direct role in the magnitude of benefits that are possible. Whilst increased information provision is likely to offer some benefit, the majority of the safety and the efficiency benefit is likely to be derived from coordinated vehicles movement and collaborative driving.

The pace of uptake will be key to realising these benefits. The Government's Centre for Connected and Autonomous Vehicles (CCAV) has projected that by 2035, 40% of new cars in the UK could have self-driving capabilities.

A study¹², from UKCITE, evaluating the safety impact of CAVs predicts a potentially compelling road safety impact, with traffic conflicts (for example rear-end, lane changes & vehicle crossings) significantly reduced even at relatively low market penetration rates, with the introduction of vehicle to vehicle connected services such as Emergency Electronic Braking Light systems

By introducing these new technologies, we predict that new safety challenges may emerge and require great care - from physical network adaptation to the management of a technologically mixed fleet. In particular, the implications these vehicles may have for driver behaviour and acceptability.

National Highways will continue to support and gather research and evidence from trials to build the understanding of this emerging sector and technology.

The role of the Government and other responsible bodies, such as National Highways and local authorities; and potential effects on patterns of car ownership, vehicle taxation and decarbonisation in the car market.

National Highways will continue to fund and support trials and research into CAVs.

We use the results from the completed trials and research projects to understand the implications on National Highways as a network operator to enable CAVs to be deployed on the SRN (as well as other roads such as local authority roads). This work will identify where we can improve infrastructure, rationalise or remove physical infrastructure and replace with virtual infrastructure to communicate information. It will help us ensure our planning for future Road Periods (RIS 3 and onwards) includes this investment and meets our ambitions in Digital Roads and decarbonisation.

Our existing system of operational technology allows us to monitor our network, control traffic where we need to and inform customers of changes. Acting as a system operator in this way helps support safety on our network, improve capacity and reduce delays.

Significant increases in data, connectivity and computational ability will bring opportunities and choices in how we carry out this role in the future. In the long term, this could range from providing better real-time data on current and predicted travel conditions to vehicles and customers (either directly or through aggregators) all the way to implementing a full Intelligent Transport System (ITS), which uses sensors, real-time data, traffic and control systems and data analytics to maximise network outcomes and improve safety.

Where we are on this spectrum is likely to depend on the type of road and customer needs, as well as on wider policy and technology developments. Our Digital Roads strategy set out some of this long term thinking. We will continue to work with government, industry and Transport Focus to look at how our role as system operator could evolve to improve the service we offer to customers and meet their changing needs. National Highways will continue to provide advice, guidance and standards on connected and automated vehicles and the SRN. We will work with, and alongside, industry, academia and the Government to build understanding and enable opportunities for technology to be developed and safely tested.

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Endnotes