The journey towards
Full Driving Automation

Executive Summary

Driverless cars promise to transform fleet operations, with the UK becoming a world leader in an intelligent mobility market worth £900bn.

That was the UK government expectation for 2025, as detailed in our 2016 Autonomous Vehicles (AV) white paper. Has this ambitious prediction stood the test of time? Well, huge progress has certainly been made, tempered by a healthy dose of reality.

Using the Gartner Hype Cycle, the 'Peak of Inflated Expectations' was 2018/19, when General Motors president Daniel Ammann said that autonomous vehicles represented **"the biggest business opportunity since the creation of the internet"**, and Elon Musk felt "very confident" that Tesla owners would be sending their cars out as robotaxis the following year. The 'Trough of Disillusionment' followed when such exorbitant claims failed to materialise.

There are welcome signs now though that we're entering the 'Slope of Enlightenment', with better-funded pilots, more mature products and the benefits of self-driving becoming increasingly well-publicised and accepted.

Most importantly, this is no longer the stuff of science fiction. Driverless vehicles are now operating on public roads, albeit in small numbers. In 2022, General Motors–backed Cruise started offering robotaxi rides to the public in San Francisco with no human safety driver on board.

Other early robotaxi services include Waymo (previously Google's self-driving car project) in Phoenix, Amazon-owned Zoox in California, Hyundai-backed Motional in Las Vegas and China's Baidu in Wuhan.

In the UK, Oxbotica (now Oxa) ran the first zero-occupancy, fully self-driving, electric vehicle on publicly accessible roads anywhere in Europe.

Minister of State for Investment, Lord Grimstone (formerly chairman of Barclays Bank), said: **"This exciting development will further strengthen the UK's reputation as a leading destination to develop and deploy self-driving vehicles, as well as helping grow a sector that will support highly skilled jobs across the country."**

Please note the 'self-driving' reference. Industry terminology has evolved too, with BSI's Connected and Automated Mobility (CAM) Vocabulary informing companies and authorities the world over.

In 2023, the CAVForth project achieved another major breakthrough, launching the UK's first self-driving bus service. Operated by Stagecoach, a fleet of five single-decker self-driving Alexander Dennis Enviro200AV buses now run between Ferrytoll Park & Ride in Fife and Edinburgh Park Transport Interchange, a 14-mile route which includes crossing the iconic Forth Road Bridge.

David Webb, Head of Innovation at the Centre for Connected and Autonomous Vehicles (CCAV), described it as "a global first". Back in 2016, we highlighted the formation of this "new joint policy unit" by The Department for Transport (DfT) and The Department for Business, Innovation and Skills (BIS). CCAV has gone on to play a pivotal role in many UK self-driving successes.

So, we are indeed a world leader. The pound note value of this ecosystem, however, is the subject of much debate. As of August 2023, the latest government estimate is that: **"The UK market alone could be worth as much as £42bn by 2035, creating as many as 38,000 jobs in the sector."** These figures featured in the 2022 Queen's Speech lobby pack and have become something of a government mantra.

In 2022, a Research and Markets report forecast that the global autonomous vehicles market will be worth US$325.9bn by 2030, expanding at a mighty compound annual growth rate (CAGR) of 47.1%. While the Cross-Domain Safety Assurance for Automated Transport Systems report, published in March 2023, says: "The economic potential of the global automated transport ecosystem is projected to reach over £750bn by 2035." Big numbers.

In terms of transforming fleet operations, a 2023 McKinsey Future of Mobility paper quoted a survey showing that 46% of people are "open to replacing their private vehicles with other modes of transport in the coming decade"; with 70% **"willing to use a shared autonomous shuttle with up to three others"**.

Overall, our 2016 AV white paper was extraordinarily prescient, far more detailed and circumspect than other contemporary sources. This 2023 paper will again look to the future, providing the most recent case studies, analysis and statistics on all the key self-driving issues.

The title, **"The Journey Towards Full Driving Automation"**, refers to the ultimate 'go anywhere' self-driving capability. As Dr Lance Eliot, world-renowned expert on AI, wrote in Forbes: **"There is not yet a true self-driving car at Level 5. We don't yet even know if this will be possible to achieve, nor how long it will take to get there."**

venson

Jesse Norman

Self-driving:
Are we nearly there yet?

The concept of self-driving isn't new. In fiction, we have the likes of Herbie, the VW Beetle from the 1969 film The Love Bug, Kitt from Knight Rider (1982) and the Johnny Cab taxis from Total Recall (1990).

Some of these vehicles are 'goodies' and some 'baddies', highlighting a perception challenge that continues to this day.

Back in the real world, there were some pioneering prototypes, such as the Self-Transport Road and Rail Car (StaRRcar), designed by Harvard graduate William Alden in the 1960s. This battery-powered three-seater could be driven 'normally', but also had the ability to join tracks installed alongside existing roads.

StaRRcar drivers, it was envisaged, could then retake control to continue their journey, or leave their vehicle at a car park, ready to be used by others. So, connected, automated, shared and electric (CASE) in modern parlance.

Similarly, a UK TV news report from May 1971, now much-shared on social media, showcases "driverless cars and the future of motoring". It was filmed at the Road Research Laboratory (RRL) in Berkshire, now TRL.

The reporter says: **"The very last word is the totally automatic car, no driver at all. The whole thing's remotely controlled by cables and electrics under the road."** More like Scalextric than self-driving, but he goes on to say: **"It's all needed because you and I are not as good as machines. We tire, we lose concentration, we get cross. The day may come when the driver becomes totally redundant."**

Fast forward 50 years and vehicle manufacturers and governments the world over are gearing up for precisely that scenario, with the safety case to the fore.

In 2017, the Association of British Insurers (ABI) told The House of Lords Science and Technology Select Committee that human error was a causal factor in 90-95% of road traffic accidents.

In 2018, the European Transport Safety Council (ETSC) concluded that the EU target of cutting deaths by half in the decade to 2020 was very unlikely to be reached.

ETSC executive director Antonio Avenoso, said: "The time for action is long overdue. We are calling for safer vehicle standards such as mandatory fitment of Automated Emergency Braking (AEB) and Intelligent Speed Assistance (ISA); better infrastructure safety rules and a solid framework for the safe rollout of automated driving."

Also in 2018, Bob Lutz, former Vice Chair of General Motors, made his famous observation that: **"Human drivers are distracted. They drink. They text. They take drugs. Autonomous vehicles do none of that."**

Here, Roads Minister Jesse Norman announced a three-year review by the Law Commission of England and Wales, and the Scottish Law Commission, to devise an "extensive regulatory reform programme" to ensure **"the right laws are in place before the widespread use of these vehicles on UK roads".**

As featured in our 2016 white paper, early self-driving road trials were already up and running in the UK by then, notably The GATEway Project in London, Venturer in Bristol, and UK Autodrive in Milton Keynes and Coventry.

GATEway saw a fleet of driverless pods providing a shuttle service around a 3.4km route on the Greenwich Peninsula. Developed by British companies Westfield Sportscars and Heathrow Enterprises, and powered by Fusion Processing technology, the pods had no steering wheels or typical driver controls.

The Venturer trial studied, amongst other things, handover of control between a vehicle and driver, concluding that the functionality should "proceed with caution".

While UK Autodrive, with partner Jaguar Land Rover, sought to address the fact that, in times of heavy congestion, up to 30% of traffic consists of vehicles looking for parking spaces.

"In the future, connected features will alert drivers to empty spaces and autonomous vehicles will be able to drive straight to them," said Tim Armitage, Arup's UK Autodrive project director.

Meanwhile, a driver who put his Tesla into Autopilot and moved into the passenger seat while travelling at 40mph on the M1 was disqualified for 18 months after footage was posted online.

PC Caldicutt, of Hertfordshire Police, said: **"He not only endangered his own life but the lives of other innocent people using the motorway. This case should serve as an example to all drivers who have access to autopilot controls. I want to stress that they are in no way a substitute for a competent motorist in the driving seat who can react appropriately to the road ahead."**

The GATEway Project, London

SAE Levels

Around this time, many newspaper articles started quoting the SAE Levels of Driving Automation. Launched in 2014 by US-based SAE International, formerly the Society of Automotive Engineers, the document in question is SAE J3016 Recommended Practice: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles.

The most recent version, published in May 2021, sets out the responsibilities of "the human in the driver's seat" at each level.

For Levels 0-2, it says: **"You are driving whenever these driver support features are engaged — even if your feet are off the pedals and you are not steering"** and **"You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety".** Basically, you're still a driver.

Expectations for Levels 4-5 are straightforward enough too: **"You are not driving when these automated driving features are engaged — even if you are seated in the driver's seat"** and **"These automated driving features will not require you to take over driving"**. Basically, you're now a passenger.

Which leaves Level 3, and the instruction: **"When the feature requests, you must drive"**, applicable to features such as **"traffic jam chauffeur"**. This is the most controversial part of the scale, with some experts vehemently opposed to systems which rely on the handing over and/or retaking of control.

In 2022, AA president, Edmund King, said: **"The world of transport is changing rapidly with new innovations and technologies for consumers to choose from. Regardless of how people travel, we must keep the consumer at the heart of it.**

"Drivers will need to be part of the conversation when it comes to introducing more autonomous technology in cars. Drivers are nervous about handing over responsibility to the car, but are supportive of technology such as autonomous emergency braking which enhance safety."

SAE **J3016** LEVELS OF DRIVING AUTOMATION
Learn more here: sae.org/standards/content/j3016_202104

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You **are** driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You **are not** driving when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			**These are automated driving features**		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/ acceleration support to the driver	These features provide steering AND brake/ acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering OR • adaptive cruise control	• lane centering AND • adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/ steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions

Given the complexity of such advanced vehicles, the consumer education challenge is not to be underestimated. Salvage specialist Scrap Car Comparison analysed the owner's manuals for 100 of the UK's most popular vehicles. It found that Audi has by far the heftiest, with the R8 being longest, at 616,064 words, followed by the e-tron, at 603,649 words, both around three times longer than the Ford F-Series in third at 194,305 words.

To put that into perspective, at an average English silent reading speed of 238 words per minute, both the R8 and e-tron manuals take over 40 hours to complete, comparable to Tolstoy's titanic tome, War and Peace.

In early 2023, Microsoft co-founder Bill Gates, noted: **"Right now, we're close to the tipping point - between Levels 2 and 3 - when cars are becoming available that allow the driver to take their hands off the wheel and let the system drive in certain circumstances. The first Level 3 car was recently approved for use in the United States, although only in very specific conditions."**

That was Mercedes' Drive Pilot, available on 2024 S-Class and EQS Sedan models. **"Certification in Nevada marks the start of its international rollout and, with it, the dawning of a new era,"** said Mercedes-Benz CTO, Markus Schäfer.

Back in the UK, in April 2023, The Department for Transport approved the use of Ford's BlueCruise system on parts of our motorway network – the first time drivers here could legally take their hands off the wheel. Ford, Government ministers, Thatcham, and others, emphasised it is Level 2 driver assistance, but that didn't stop the media from misleadingly describing it as self-driving.

As the All-Party Parliamentary Group (APPG) on Connected and Automated Mobility stated in its red lines: **"A statutory definition of self-driving must be established to distinguish this technology from assisted driving"**.

At the time of writing, only a select few have gained the ability to sometimes go hands-free – drivers of 2023 Ford Mustang Mach-E cars who activate a subscription. They can then use the "hands-off, eyes-on" tech on 2,300 miles of pre-mapped motorways in England, Scotland and Wales – the new 'Blue Zones'.

Tom Leggett, of Thatcham Research, emphasised: **"For the first time ever drivers will be permitted to take their hands off the wheel. However, their eyes must remain on the road ahead. Crucially, the driver is not permitted to use their mobile, fall asleep or conduct any activity that takes attention away from the road."**

Tom Leggett

So, when it comes to self-driving cars, the answer to the question "Are we nearly there yet?" is a resounding "Yes."

Case Studies

UK Case Study: Oxa

On 20 May 2022, Oxford-based self-driving software specialist Oxa (formerly Oxbotica) announced a landmark success – running a vehicle with no human on open roads in the UK for the first time.

The all-electric AppliedEV vehicle boasted radar vision, laser-based sensors and the Oxa Driver System, but what was more striking is what it didn't have – doors, windows, seats, pedals or a steering wheel. Instead, it featured an array of self-driving tech mounted on a small pylon fixed to the centre of the chassis.

The Driver software provided the vehicle with a rich understanding of its surroundings, with multiple Artificial Intelligence (AI) continuously checking decisions.

Oxa founder & CTO, Professor Paul Newman, said: **"We are changing the way people and goods move. Our goal is to be indistinguishable from perfect on safety, and this achievement, alongside our partners, is proof of that. It's a historic moment for the UK, the transport and logistics sector, and autonomous vehicle technology."**

The plan is to deploy a goods delivery variant, with Alex Harvey, Chief of Advanced Technology at Ocado Technology, saying: **"This is a fantastic milestone and we are delighted to see Oxbotica making significant progress towards zero-occupancy goods deliveries.**

"We are excited about providing this transformational capability to Ocado Smart Platform (OSP) partners at the earliest possible opportunity."

UK Case Study: CAVForth

The UK's first full-sized single decker self-driving bus service is already up and running, albeit with a safety driver. In May 2023, Stagecoach Bus began operating a frequent timetable with capacity for 10,000 passenger journeys per week on route AB1 in Scotland.

Officially still a trial, a fleet of five Alexander Dennis Enviro200AV buses travel at up to 50mph from the Ferrytoll Park & Ride in Fife to Edinburgh Park Transport Interchange, including crossing the iconic Forth Road Bridge.

Scotland's Transport Minister, Kevin Stewart, and Ray O'Toole, Executive Chairman for Stagecoach, were among those at the media launch, with David Webb, Head of Innovation at CCAV, heralding it "a global first".

One of the early passengers told the BBC: **"I wasn't worried at all. You wouldn't know the difference between this and a normal bus."**

The company behind the software platform is Bristol-based Fusion Processing. Back in 2021, CEO Jim Hutchinson predicted that CAVForth would put the UK on the self-driving map. **"We developed the CAVstar platform as a scalable solution – a drive system we could put into pretty much any vehicle, from small cars up to HGV,"** he said.

In February 2023, the next phase of the project, CAVForth2, won further CCAV funding to extend the route into Dunfermline city centre.

UK Case Study: Milton Park

In January 2023, a consortium led by First Bus, with partners including Oxfordshire County Council, the University of the West of England, and Zipabout, launched the UK's first self-driving electric bus at Milton Park (near Didcot and Abingdon).

Richard Holden MP, Parliamentary Under Secretary of State with responsibility for roads and local transport, said: **"It's thrilling to see our £3m investment help British firms and engineers pioneer new exciting ideas to achieve our vision of a truly efficient and sustainable transport network."**

Janette Bell, Managing Director at First Bus, said: **"The launch of the UK's first zero emission autonomous vehicle is a stellar example of how**

technology can support modal shift, with wide partnership working between central and local government, operators and local business."

As with CAVForth, the project was backed by CCAV and used software by Fusion Processing. Fusion CEO Jim Hutchinson explained: **"It does have a safety driver on board at all times, for regulatory purposes, but it can drive itself in all conditions. It's SAE Level 4, so that means within a defined area. This is a great showcase for an on-demand route."**

The culmination of a five-year project, the Milton Park service is part of the Mi-Link green travel programme being operated by First Bus.

UK Case Study: Wayve

In March 2023, Microsoft co-founder Bill Gates blogged about his experience of being driven around London in a self-driving Wayve.ai car, with a safety driver.

"Wayve is a start-up that's developing a new approach to autonomous driving," he said. **"Other technologies work only on maps. Wayve's technology operates more like a human driver – learning how to drive in one city and then applying that knowledge to new places."**

Sitting in the passenger seat, he told Wayve CEO Alex Kendall (sitting in the back): **"I'll give you credit for picking one of the most difficult situations I've seen in an autonomous car. London is a very challenging place to drive. The humans are having a hard time trying to make judgement calls."**

Kendall explained: "**The algorithm is now controlling the speed, the steering, the indication, the braking, everything about the car's driving. It's making decisions based on what we see.**

It's interpreting the environment, understanding the context and making the safest decisions.

"The way we move around cities hasn't changed in 100 years. This is the next big wave of technology. It will improve the environment for vulnerable road users, decrease the amount of traffic, improve safety, allow more public transport and more shared mobility."

At the end of his ride, Gates enthused: "**That was fantastic!"**

UK Case Study: Imperium Drive

Imperium Drive made headlines in 2023 thanks to its Fetch remote driving rental car delivery service.

A trained remote driver, or operator, is responsible for driving the car on the road, based on live video feeds and sensor feedback sent over public infrastructure, like 4G and 5G networks.

"We have our own small fleet of cars and are running a small-scale commercial pilot within the city boundaries of Milton Keynes," explained Chief Technology Officer, Sandip Gangakhedkar.

"Once the car is delivered, the customer can unlock it and drive it themselves, so at that point it ceases to be any kind of driverless experience. Once they've finished using it, the remote operator can re-take control and bring it back

to base. It's a new take on how autonomy can be developed sustainably and incrementally.

"As well as the UK government's code of practice for trialling automated vehicles, we've also taken on board additional guidelines and specifications (from BSI, CCAV, the Law Commission and others), around what it means to be safe, responsible and socially equitable.

"The socially equitable aspect is often overlooked. Fetch decouples car ownership from car access, so you don't need to own a car to enjoy its benefits.

"Roll-out has to be gradual, because it has to be done responsibly. At the same time, our human-in-the-loop approach can be an important steppingstone to full self-driving."

US Case Study: Cruise

Q1 2022 saw a giant leap forward for self-driving in America, with General Motors–backed Cruise offering robotaxi rides to the public in San Francisco with no safety driver.

The company posted a video showing early consumer reactions, ranging from **"This is so cool"** to **"Just weird"**, **"Slightly scary"** to **"A lot smoother than I was expecting"**.

Just a few months later, as the UK began festivities to mark The Queen's Platinum Jubilee, Cruise was celebrating again. This time, the award of a permit to charge for its self-driving car journeys.

The initial fleet consisted of 30 Chevrolet Bolt EVs limited to a max 30mph. They were also not to be used on highways or during heavy rain.

The eyes of the world are on this pioneering rollout, and it hasn't all been plain sailing. For example, a video went viral of San Francisco police pulling over a Cruise robotaxi only to find it devoid of humans. **"Ain't nobody in it!"** said a bemused officer.

A more serious blue light incident involved a fire engine on a 4am shout being briefly delayed (for about 25 seconds), which resulted in a swathe of negative media coverage.

San Francisco Standard reporter Kevin Truong described a much more mundane experience, saying: "It didn't stop in quite the right place for pick-up, then waited a while to overtake a stopped delivery truck, but that was about the extent of the drama."

UK Self-driving Legislation

During a panel session at the MOVE 2023 urban mobility event in London, The Law Commission's Nicholas Paines QC noted that the three-year review of legislation to enable the deployment of automated vehicles on British roads was the first time the Commission had been asked to design a law for the future. This momentous work has heavily informed the government's self-driving strategy.

Reporting to CCAV, the project involved three rounds of consultation between November 2018 and December 2020. In this time, it held more than 350 meetings with interested parties and processed over 400 written responses.

Published in January 2022, jointly by the Law Commission of England and Wales and the Scottish Law Commission, it defined an automated vehicle as one which can drive itself without being controlled or monitored by an individual for at least part of a journey.

The opening remarks to the report summary stated: **"This has profound legal consequences. A human driver can no longer be the principal focus of accountability for road safety. Instead, new systems of safety assurance are needed, both before and after vehicles are allowed to drive themselves on roads and other public places. We therefore recommend a new Automated Vehicle Act, setting out new regulatory regimes and new legal actors."**

New key concepts include the Authorised Self-Driving Entity (ASDE), User-in-Charge (UIC), and No User-in-Charge (NUIC). An ADSE is the manufacturer or developer that puts the vehicle forward for authorisation and takes responsibility for its actions.

In particular, the Law Commissions recommended that, once a vehicle is authorised as having self-driving features, and these are engaged, the system of legal accountability should change as follows:

1) The person in the driving seat will no longer be a driver but will become a "user-in-charge". They will have immunity from a wide range of offences related to the way the vehicle drives, ranging from dangerous or careless driving, to exceeding the speed limit or running a red light. However, the user-in-charge will retain other driver duties, such as arranging insurance and checking loads. They may be also be required to take over driving in response to a "transition demand", if the vehicle encounters a problem it cannot handle.

2) The vehicle will be backed by an Authorised Self-Driving Entity (ASDE). If the automated driving system (ADS) feature causes the vehicle to drive in a way which would be criminal if performed by a human driver, this would be dealt with as a regulatory matter. The issue would be resolved between the in-use regulator and the ASDE. The emphasis would be on understanding what happened and applying that learning to improve future safety.

3) Some ADS features may be authorised for use without a user-in-charge. We refer to these as "no user-in-charge" (NUIC) features. Here any occupants of the vehicle will simply be passengers. Responsibilities for overseeing the journey will be undertaken by an organisation, a licensed NUIC operator.

4) For purposes of civil liability, the provisions of the Automated and Electric Vehicles Act 2018 will apply. Victims who suffer injury or damage will not need to prove that anyone was at fault. Instead, the insurer will compensate the victim directly.

Further recommendations of particular interest to fleet managers included that, to obtain a NUIC operator licence, passenger service and freight companies should be: a) Of good repute, b) Have appropriate financial standing, c) Have a centre of operations in Great Britain, and d) Be professionally competent.

Speaking in 2021, lead lawyer on the project, Jessica Uguccioni, said: "Our analysis is still evolving, not just in terms of the framework we would like to see, but suggesting changes to existing legislation and identifying gaps.

"For passenger cars, there are two main routes to market: gradually adding driving automation features to consumer vehicles, which may be capable of self-driving for part of a journey but still rely on a human driver to complete a trip; and the ride hail model, with vehicles that can carry passengers or drive empty, and can complete trips while self-driving.

"The oversight needs to be very different, although there is some common ground. The safety assurance scheme applies regardless of the use case. But for cars which cannot complete a journey in self-driving mode, it is important to have a user in charge – a new legal role reflecting the responsibilities of being less than a driver but more than a passenger. On the other hand, fleet operators play a crucial supervisory role for automated vehicles that do not need a user-in-charge."

The Highway Code

In a major development for connected and automated mobility (CAM) in the UK, on 20 April 2022 the government set out changes to The Highway Code to move Britain "closer to a self-driving revolution".

Transport Minister, Trudy Harrison, said: **"This is a major milestone in our safe introduction of self-driving vehicles, which will revolutionise the way we travel, making our future journeys greener, safer and more reliable.**

"This exciting technology is developing at pace right here in Great Britain and we're ensuring we have strong foundations in place for drivers when it takes to our roads.

"In doing so, we can help improve travel for all while boosting economic growth across the nation and securing Britain's place as a global science superpower."

The announcement certainly had the wow factor, asserting that: "Britain's first vehicles approved for self-driving could be ready for use later this year." This was 2022, remember.

The changes were necessary, therefore, to "clarify drivers' responsibilities in self-driving vehicles, including when a driver must be ready to take back control".

The line that got the lion's share of attention, though, was this: **"The plans also include a change to current regulation, allowing drivers to view content that is not related to driving on built-in display screens, while the self-driving vehicle is in control. It will, however, still be illegal to use mobile phones in self-driving mode, given the greater risk they pose in distracting drivers."**

The national press went into meltdown, with a story by Jeremy Clarkson in The Sun on 22 April headlined: **"Driverless cars are pointless – and they have built-in instructions to kill you"**. The next day, The Guardian ran with: **"A self-driving revolution? Don't believe the hype: we're barely out of second gear"**.

In a more measured response, barrister Alex Glassbrook, author of 2017's **"The Law of Driverless Cars: An Introduction"** and co-author of 2019's **"A Practical Guide to the Law of Driverless Cars"**, highlighted the launch of a new government webpage for "**Self-driving vehicles listed for use in Great Britain"**.

As of September 2023, no vehicles are listed. The government, probably wisely, appears to have re-evaluated the timeline. So, the question remains: Will cars equipped with Automated Lane Keeping Systems (ALKS) be the first to be officially recognised as "automated"?

Trudy Harrison

Target CAM 2025

In August 2022, the UK government published its eagerly awaited report, "Connected & Automated Mobility 2025: Realising the benefits of self-driving vehicles in the UK".

It was prefaced by a joint statement by Grant Shapps, Secretary of State for Transport, and Kwasi Kwarteng, Secretary of State for Business, Energy and Industrial Strategy.

"This document sets out government's response to the Law Commissions' recommendations and commits to a new legislative framework for safe self-driving road vehicles, based on these recommendations," it read. **"This new framework will enable innovation whilst also ensuring safety.**

"In addition to the substantial gains in getting from A to B safely, these technologies could deliver huge economic benefits, attracting international investment and reinforcing the UK's place as a global science superpower.

"The UK market alone could be worth as much as £42bn by 2035, creating as many as 38,000 jobs in the sector. The UK is in an excellent position to secure the benefits of these new technologies, and they can be part of our approach to Build Back Better from the COVID-19 pandemic."

Promising to have the self-driving vehicle framework in place by 2025, it predicted that 40% of new cars in the UK could have self-driving capabilities by 2035. Key elements of the coming "transport revolution", included:

• Self-driving technologies in zero-emission cars, buses and delivery vehicles

• Connected services, with traffic lights and vehicles speaking to each other

• CAM services improving access to transport for people with mobility issues

• CAM reducing the cost and improving the reliability of transport services

It noted that, crucially, even at relatively low levels of automation, these technologies can reduce collisions.

In particular, it highlighted the Connected and Automated Vehicles: Process for Assuring Safety and Security (CAVPASS) programme, launched by government in 2019, to put in place the processes, systems and capabilities necessary for government assurance of the safety and cyber resilience of connected and self-driving vehicles by 2025.

Led by CCAV, the CAVPASS team includes staff from across the DfT and agencies including the Vehicle Certification Agency (VCA), Driver and Vehicle Standards Agency (DVSA) and Driver and Vehicle Licensing Agency (DVLA), as well as Innovate UK, the Law Commissions, and the National Cyber Security Centre (NCSC).

The report concluded that: "Self-driving vehicles are fast approaching commercialisation in markets across the world. This will be the future of road travel, but we are at the beginning of this journey, and human drivers will share the roads with self-driving vehicles for many years to come. It is therefore vital for us to manage the changes that connected and self-driving technologies will bring by introducing the right rules, training and support at the right time."

HM Government

Connected & Automated Mobility 2025: Realising the benefits of self-driving vehicles in the UK

CP 719   August 2022

The C in CAM

It's important to remember that self-driving will not happen in isolation. It is just one of several road transport megatrends happening simultaneously.

Dr Joanna White

Various acronyms attempt to nutshell this complicated picture, with Steve Kendall, product manager at the Driver and Vehicle Standards Agency (DVSA), championing LACES (lightweight, automated, connected, electric and shared) over shorter versions, such as SEA (shared, electric and autonomous).

Dr Joanna White, Roads Development Director at National Highways, said: **"We try not to choose particular technologies – whether it's radar, lidar, cellular – we are interested in all of it. It could be 5G and, via the DfT, we work closely with the Department for Digital, Culture, Media and Sport (DCMS), which leads on that. One of the most positive government actions was the requirement for mobile operators to provide 90% coverage of the motorway network by 2026."**

According to the government's Connected & Automated Mobility 2025 report, 4G coverage across major roads in the UK is currently at 66%, with urban coverage at 84% and rural coverage at 57%.

At the Financial Times' Future of the Car Summit 2022, Volvo Cars CEO, Jim Rowan, formerly of Dyson and BlackBerry, likened the current state of play in the automotive industry to that of the telecoms industry as it moved from feature phones to smartphones.

"The smartphone enriched that product to a level that no one had really envisaged, and how much more that became a part of everyday life was transformational," he said.

"The same thing is going to happen in the auto industry, or in the next generation mobility industry as I prefer to call it. What we'll be able to do with next gen mobility is going to be tremendously different from what we currently do with cars.

"Remember, the next generation that we need to bring into the car market is Gen Z, digital natives born into a digital world. They expect connectivity, they expect services to be available seamlessly between their car, home and phone. It's not a wow factor to them."

In the early 2010s, telematics was the hot topic in fleet management. In the embryonic self-driving industry, however, this wasn't always a good thing. In 2013, Charlie Miller and Chris Valasek demonstrated how easily a hacker could disable or apply the brakes, turn the steering wheel and cause acceleration. This caused a considerable degree of panic at the time, but the market is much more mature now. KPMG's Autonomous Vehicles Readiness Index 2020 noted that the UK was leading on policy, legislation and cyber security.

More than Telematics

An early Zenzic CAM Scale-Up winner was Beam Connectivity. CEO Thomas Sors said: **"When it comes to connected and automated mobility (CAM), we see a lot of focus on the 'A' part, but not so much about 'C', which is our focus. Connectivity is the essential foundation for automation later on, but at the moment it often doesn't perform very well.**

"Our CVaaS solution provides a better user experience and can unlock the value of data generated by vehicle fleets. It offers a new way of getting data from vehicles to the cloud and back-end, or to send data into the vehicle. Because we're brand new, there are no issues with legacy software – privacy by design and security by design are embedded all the way through our process, not an afterthought or a bolt-on.

"From the manufacturer or fleet operator perspective, prognostics is an interesting area – fixing things before they go wrong. Then there's the ability to understand usage patterns and perform over the air (OTA) updates. Another thing we're already seeing is support to improve the driving experience, for example, vehicle to infrastructure (V2I) communications being used to reduce congestion."

Prognostics is still in its infancy, but another futuristic service, maintenance and repair (SMR) capability – remote diagnostics – is already an everyday reality. The Institute of the Motor Industry (IMI) research paper "Meeting The Demand For Skilled Vehicle Technicians In The Age Of ADAS" made headlines in 2023, predicting that the sector will require 106,000 ADAS-qualified technicians by 2030.

It forecast that 44% of the UK car parc will have Level 2 autonomy by 2030, with features such as Adaptive Cruise Control (ACC) and Lane Keeping Assistance (LKA) becoming standard. It also estimated that there were only around 3,000 UK-based ADAS-qualified technicians at the end of 2022.

Thomas Sors

Formed in the Netherlands in 2012, winning the Automechanika Innovation Award in 2018, Jifeline says collaborative remote diagnostics can help.

With a Europe-wide network including technicians from vehicle manufacturers, main dealers and big aftermarket players, Business Development Director, Richard Taylor, explains: **"By connecting our J-ReX tool via the OBD, you open the door to our fast-growing technical ecosystem. We have partners in 25+ countries with over 15,000 customers and over 350 technicians between them.**

"Whether it's a common job like key coding, a windscreen or bumper sensor calibration, or something more complicated, you can outsource it to a specialist anywhere in Europe. Within our dashboard, you can refine your choice based on requirements ranging from knowledge to success rate to price.

"We liken our model to an old-fashioned telephone exchange, with the ability to plug into hundreds of different partners, finding the best people for that particular job. Individual

businesses could be limited by their own staffing. The easiest way to increase capacity is to utilise a technician from a partner. Collaboration really is the key to solving this skills issue."

Steve Scofield, Head of Business Development at the IMI, says: **"From a skills perspective, the IMI is downstream of the research and testing being conducted by groups like CCAV, but we're continually horizon-scanning and engaging with key stakeholders – that's all part of being future-proof.**

"We have strong partnerships with organisations like Thatcham and BSI to make sure we can see what's coming, to build-in industry requirements, to drive continuing professional development (CPD), and to ensure there's recognition of accredited training like IMI TechSafe."

Multi-Vehicle Coordination

Another area with gamechanging potential is multi-vehicle coordination (MVC). Dr Charlie Wartnaby, chief engineer at Applus IDIADA, was technical lead for the ground-breaking Multi-Car Collision Avoidance (MuCCA) project.

"Connected vehicles offer massive safety and efficiency improvements, for example, by warning about stopped vehicles or advising on speed to get through traffic lights on green," he said. **"There was a bit of a VHS versus Betamax situation, with both WiFi-based short-range communications and the C-V2X 5G-based protocol, so we upgraded our IDAPT tool to support both."**

Early simulations by Zenzic CAM Scale-Up winner Eloy indicate a 20% timesaving from MVC for country lane passing, and up to 80% for car park entry and exit.

Eloy Co-founder, Damian Horton, says: **"We demonstrated our narrow road warning solution, which reduces the need for reversing to find a passing**

point, at The Transport Technology Forum at UTAC. That involved just two vehicles. The next phase is to get it working with 20 vehicles in a controlled environment, then up to 100, and scale from there. We're looking for the right partners, ranging from ports and farms to construction traffic, freight and public transport – probably fleets initially."

Then there's in-car payments (ICPs). McKinsey's 2020 consumer survey on autonomous driving, connectivity, electrification, and shared mobility (ACES) found that 39% of consumers were interested in unlocking additional digital features after purchasing a vehicle – a figure that rises to 47% for customers of premium OEMs.

Nico Kersten, CEO of Mercedes Pay, said: **"If you have digital extras available, you can really reconfigure your car. Two important words are trust and responsibility. This is how we need to approach data."**
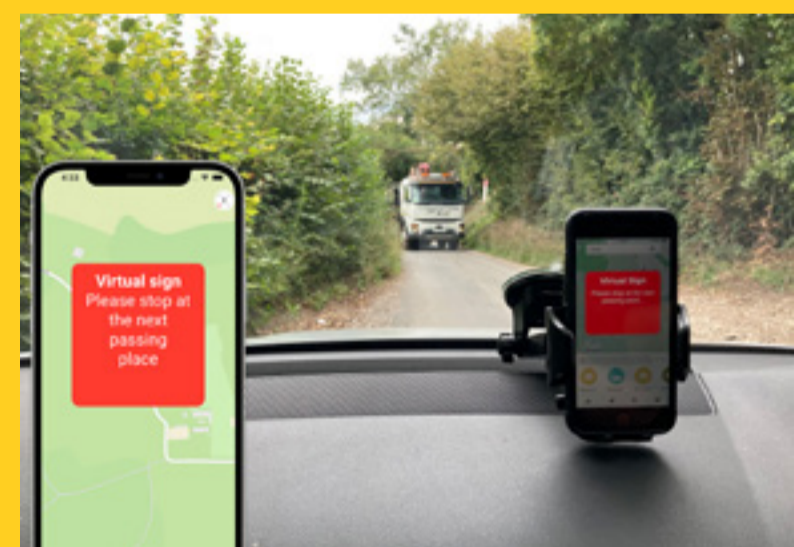
CCAV: Commercialising CAM

In February 2023, the UK government confirmed the seven winners of its Commercialising Connected and Automated Mobility (CAM) competition, designed to help British companies seize early opportunities to develop experimental projects into ready-for-market offerings.

Industry consortia agreed to match a £40m+ public grant, meaning that each will receive a healthy share of £81m in combined government and industry funding via CCAV.

Business Secretary, Grant Shapps, said: **"In just a few years' time, the business of self-driving vehicles could add tens of billions to our economy and create tens of thousands of jobs across the UK. This is a massive opportunity to drive forward our priority to grow the economy, which we are determined to seize.**

"The support we are providing today will help our transport and technology pioneers steal a march on the global competition, by turning their bright ideas into market-ready products sooner than anyone else."

Each recipient is expected to demonstrate a sustainable commercial service by 2025, with the money allocated as follows:

- **CAVForth II by Fusion Processing**, with project partners Stagecoach Group, Alexander Dennis, University of the West of England, and Edinburgh Napier University, will receive £10.4m to launch the world's first full-sized self-driving bus service in Edinburgh.

- **Hub2Hub by HVS**, with project partners Asda and Fusion Processing, will receive £13.2m to develop a new zero-emissions self-driving HGV for the UK market, delivering never-seen-before levels of efficiency and operational cost savings for logistics operators.

- **Multi-Area Connected Automated Mobility by Conigital**, with project partners the National Exhibition Centre (NEC), Direct Line Group, Coventry City Council, Solihull Metropolitan Borough Council, University of Warwick, Coventry University, dRisk, IPG Automotive and West Midlands Combined Authority, will receive £15.2m to establish a remote driving control hub to oversee self-driving vehicles operating in Solihull and Coventry.

- **Project Cambridge Connector by the Greater Cambridge Partnership**, including Cambridgeshire County Council, Cambridge City Council, South Cambridgeshire District Council and University of Cambridge, along with project partners dRisk, Stagecoach East, IPG Automotive UK, Conigital and Gamma Energy, will receive £17.4m to trial on-demand self-driving taxis across two sites – Cambridge University's West Cambridge Campus and the Cambridge Biomedical Campus.

- **Project Harlander by Belfast Harbour**, with partners to be confirmed but expected to be Horiba Mira, Angoka, BT, and REE Automotive UK, will receive £11m to deploy a self-driving shuttle service around Belfast Harbour. It will be Northern Ireland's first operationally ready, scalable, and commercially viable deployment of a fully automated shuttle service on mixed-use public roads.

- **Sunderland Advanced Mobility Shuttle by the City of Sunderland Council**, with partners Stagecoach North East, Angoka, Aurrigo (Richmond Design and Marketing), Newcastle University, Swansea University, and BAI Communications, will receive £6m to build and trial a self-driving shuttle service to serve two high-volume destinations – the University of Sunderland and Sunderland Royal Hospital.

- **V-CAL by the North East Automotive Alliance**, with partners Vantec, Nissan Motor Manufacturing UK (NMUK), StreetDrone, Nokia, Newcastle University, Angoka, and Womble Bond Dickinson (UK), will receive £8m to rollout self-driving and remotely piloted HGVs between the Vantec and Nissan sites in Sunderland, including both public and private land.

A further £600,000 is also being awarded for feasibility studies to explore how self-driving technology could improve public transport in four parts of the UK currently suffering from congestion.

It includes £142,000 for "Dedicated, Driverless" spaces on the route between Hemel Hempstead and Stansted Airport in Hertfordshire and Essex, £92,000 for an Autonomous Rapid Transit corridor in eastern Cambridge, £151,000 for automated platooning shuttle vehicles using tyre-on-tarmac technology in Birmingham and Solihull, and £200,000 for the Advanced Very Rapid Transit (AVRT) concept in Milton Keynes.

The UK government will deliver 'Commercialising CAM' in partnership with Innovate UK and Zenzic. Innovate UK is the UK's innovation agency, which provides money and support to organisations to make new products and services.

Innovate UK Executive Director for Net Zero, Mike Biddle, said: **"The CAM sector is of crucial importance to the UK, with the potential to deliver safer, cleaner and more efficient transport systems across a wide range of settings.**

"This latest, multi-year round of government's Commercialising CAM funds builds on the success of previous collaborative R&D programmes, stimulating innovation to ensure the UK is at the forefront of the transition towards the commercialisation of self-driving services."

World-leading Manufacturing

Six months later, in September 2023, came another huge cash injection. The UK government announced the recipients of £50m in funding "to cement the UK as the best location in the world to manufacture". The winners included several major self-driving-related projects.

Chancellor of the Exchequer, Jeremy Hunt, said: **"From farm tractors fuelled by hydrogen to rapid-charge first responder motorcycles, these projects show we are not short of innovators in this country.**

"By supporting growth in the industries of the future, including through better regulation, we are delivering on our plan to get the economy growing and make the UK the best place in the world to start and grow a business."

Jeremy Hunt

In addition to 12 mainly clean fuel-related projects to be funded via the Advanced Propulsion Centre (APC), CCAV announced £18.5m in joint government and industry funding for 13 new self-driving projects.

Designed to address critical technology gaps, enhance safety and security, improve performance and reliability, and create scalable opportunities both domestically and globally, these CAM supply chain projects will be delivered in partnership with Zenzic and Innovate UK. The headline facts and figures for each project are as follows:

- **AIM-DBW** – lead partner Aim Technologies, with TRL – to deliver a universal drive-by-wire system to enable the automation of throttle, steering, braking and gears. Grant: £400,000.

- **Autonomous Cargo** – lead partner Aurrigo, with UPS – to create a self-driving 7.5 tonne dolly for airside cargo movements, along with a simulation tool. Grant: £480,000.

- **Certus** – lead partner Horiba Mira, with Coventry University, Connected Places Catapult, Polestar Automotive UK, and IPG Automotive UK – to provide a verification and validation (V&V) test requirements toolset for an automated driving system (ADS). Grant: £1.5m.

- **DeepSafe** – lead partner Drisk.ai, with Imperial College London, Claytex Services, DG Cities, and rFpro – to support the V&V of ADSs through industry-critical data and a next-generation simulation toolchain. Grant: £2m.

- **DriveSafeAI** – lead partner Wayve Technologies, with University of Warwick – to develop a safety assurance framework for the safe deployment of AI in self-driving technology across all driving domains. Grant: £1.9m

- **Driven By Sound** – lead partner Calyo, with Baro Vehicles – a collaborative initiative to create a robust navigation system for automated vehicles, with a particular emphasis on adverse weather handling. Grant: £910,000.

- **evolvAD** – lead partner Nissan Motor Manufacturing UK, with TRL, Humanising Autonomy, Connected Places Catapult, and SBD Automotive – to develop an AV capable of safely driving in residential, urban and rural environments. Grant: £2.3m.

- **High-Performance Imaging Radar (HPIR)** – lead partner Aptcore, with Garfield Microelectronics, Plextek Services, and Cambridge Sensoriis – to develop a high-performance imaging radar specifically for AVs. Grant: £1.8m.

- **Photonic Inertial Sensors for Automotive (PISA)** – lead partner Zero Point Motion, with WAE Technologies, University of the West of England, and the Royal Institute of Navigation – to leverage Micro Electromechanical Systems (MEMS), Photonic Integrated Circuits (PICs), and low-cost laser/detectors to develop advanced position and navigation sensors. Grant: £1.4m.

- **Sim4CAMSens** – lead partner Claytex Services, with University of Warwick, National Physical Laboratory, Syselek (UK), Compound Semiconductor Applications Catapult, rFpro, Oxford RF Solutions, and Techworkshub – to enable accurate representation of ADS sensors in simulation. Grant: £2m.

- **StreetCAV** – lead partner Smart City Consultancy, with Dell Corporation, Milton Keynes Borough Council, and Ohmio UK – will create a 'plug-and-play' roadside connectivity solution for self-driving shuttles, robots and drone-based services. Grant: £1.8m.

- **Systems for Autonomy in Fail Operational Environments (SAFE)** – lead partner Streetdrone, with Alcon Components, University Of Surrey, and Chassis Autonomy – will develop a fail operational drive-by-wire technology platform to enable safe SAE Level 4 autonomy. Grant: £1.2m.

- **Torque Overlay Automated Steering Technology (TOAST)** – lead partners Titan Motorsport & Automotive Engineering, with Alexander Dennis, and TRL – will develop a modular dual redundant steer-by-wire system for heavily automated and electric vehicles. Grant: £760,000.

Decarbonisation and Technology Minister, Jesse Norman, commented: **"Self-driving vehicles have the potential to transform how we get around, making journeys safer, more convenient and more accessible, while also creating skilled jobs. These grant winners underline how the UK is at the cutting edge in developing automated technologies that are not only innovative but have safety at their heart."**

Key player: Zenzic

Created by government and industry to champion the UK Connected and Automated Mobility (CAM) ecosystem, Zenzic's mission is to "accelerate the self-driving revolution" and deliver "a safer, more secure, sustainable and inclusive transport future".

As well as part responsibility for CCAV's Commercialising CAM competitions (along with Innovate UK), it co-ordinates the world-leading set of facilities that make up CAM Testbed UK, provides strategic insights via the UK CAM Roadmap, and helps selected start-ups and SMEs to "verify innovative solutions at pace" via the Zenzic CAM Scale-Up programme.

Together, the UK government and "significant players globally" have invested over £200m in CAM Testbed UK to offer an unrivalled environment for the modelling, simulation, testing, and trial deployment of CAM solutions. The facilities include:

- **Assured CAV** – developed by Horiba Mira in partnership with Coventry University, fully configurable and 5G ready, it was created to enable seamless transition from virtual to controlled to public test environments.

- **Convex** – operated by the University of Warwick, is an open platform for the commercial exchange of data from a diverse range of sources such as vehicles, infrastructure and traffic control.

- **Midlands Future Mobility (MFM)** – covering over 200 miles of trialing environment it features campus (mini-city), urban, rural and highway roads, and includes Safety Pool, the world's largest public simulation scenario database.

- **Smart Mobility Living Lab: London (SMLL)** – the UK's most advanced connected urban testbed. Using public and private roads in Greenwich and Stratford, it provides semi-controlled test environments and simulation-based testing.

- **UTAC Millbrook-Culham** – the UTAC and UK Atomic Energy Authority operated testbeds provide secure access to a 2,000-person population, the world's first 5G open testbed for transport, and a CAM testbed, including for Mobility as a Service (MaaS).

Meanwhile, the industry-endorsed UK CAM Roadmap was created to demonstrate not only what is happening in the fast-growing self-driving ecosystem, but also what should be happening – "to be used as a tool around which people can collaborate".

The first Roadmap, published in 2019, ran until 2030. It has now been extended to 2035. The "golden threads" identified include:

- **Cyber Resilience** – to use the UK's cyber expertise to inform global best practice with a focus on resilience in the event of a cyber failure or threat, rather than trying to build 'an unbreakable system'.

- **Legislation and Regulation** – including the establishment of a UK-wide approval process for high volumes of self-driving vehicles.

- **Safety** – including the sharing of safety critical data vehicle-to-vehicle, in addition to the necessary legal and regulatory changes.

- **CAM Services** – including public education programmes, business models and a UK-wide licencing framework for personal mobility and freight and logistics services.

- **Public Acceptability** – including developments that build trust, ensuring the public are comfortable with and want to use CAM services.

- **Infrastructure** – supporting UK cities and regions to start creating blueprints of how to adapt and integrate future CAM technologies and services.

Zenzic says the Roadmap brings together industry, government and academia to provide evidence and insights to support businesses, investors and legislators in their decision making regarding the development and deployment of CAM in the UK.

Craig Stephens, Director for Controls & Automated Systems at Ford Motor Company, said: **"The Roadmap highlights significant challenges that require cross industry support such as cyber resilience, use of simulation environments, sign-off and type approval, and in-use compliance. We are all confident that Connected and Automated Mobility is the future and the Roadmap provides a direction and a well-ordered set of critical enablers."**

Another important aspect of Zenzic's work is the prestigious CAM Scale-Up programme, consisting of government grants and wide-ranging support for selected small and medium sized UK-based companies.

Previous winners include communication integrity specialist, Angoka, Beam Connectivity (run by Thomas Sors, previously head of Dyson's Connected Vehicle programme), pod-based public transport provider, Dromos, multi-vehicle coordination developer, Eloy, and solid-state 360-degree radar manufacturer, Oxford RF.

In July 2023, Zenzic announced the latest 'cohort' of successful companies:

- Gamma Energy specialises in renewable energy and is a partner in the Project Cambridge Connector on-demand self-driving taxi trial.

- Helix Geospace develops antennas and array systems to improve navigation precision and offer enhanced resilience against jamming and spoofing.

- Megasets, having been shortlisted in 2022, has now won backing to develop its AV synthetic datasets.

- Reed Mobility is the independent expert consultancy on future mobility run by Dr Nick Reed.

- Robotiz3d is developing robots with machine learning capabilities for road maintenance, particularly fixing potholes.

A Zenzic statement read: **"These pioneering companies have demonstrated remarkable potential in the field of connected and automated mobility (CAM), and we are excited to support their journey towards bringing their innovative solutions to the market.**

"Their participation in the Zenzic CAM Scale-Up UK programme will provide them with unique opportunities to test and refine their products at the renowned CAM Testbed UK facilities, ensuring their solutions meet the highest standards of performance and safety."

With big-name corporate partners including Honda, Thales and Vodafone, their work will be celebrated at the annual CAM Innovators event in London.

The 2023 CAM Scale-Up UK innovators: MEGASETS, Gamma energy, helix geospace, reed mobility, Robotiz3d, CAM TESTBED UK, PLUGANDPLAY, ZENZIC — Find out more

Key Player: **BSI**

Venson partner's quality and environmental accreditation supplier BSI, the UK National Standards Body, is one of the most influential organisations in the world when it comes to self-driving good practice.

Connected and automated vehicles:
A review of the UK's legislation and good practice

A BSI white paper

Best known for its Kitemark scheme, over the last few years, BSI has developed and published several highly respected CAM standards, including:

- PAS 1880 on the design guidelines for developing control systems
- PAS 1881 on the requirements for operational safety cases
- PAS 1882 on the collection, curation, storage and sharing of information
- PAS 1883 on defining operational design domains (ODD)
- PAS 1884 on the requirements for the use of a safety operator
- PAS 1885 on protections against cyber security threats
- BSI Flex 1890 – the CAM Vocabulary on consistency of terminology

In June 2022, the BSI white paper "Connected and automated vehicles: A review of the UK's legislation and good practice", was published to assist those developing, trialling, testing and deploying CAM vehicles in the UK.

In particular, it provided guidance on the interrelationship between CCAV's Code of Practice (CoP), BSI's own standards programme and the current legislative requirements, explaining what's legally binding and what's only advised.

On the CCAV CoP, it noted that: a) A driver must be present, in or out of the vehicle, who is ready, able, and willing to resume control of the vehicle; b) The vehicle must be roadworthy; and c) There must be appropriate insurance in place. Top of the list under "aims and objectives" was increasing public confidence.

Section 5 covered The Law Commissions' review of the legal framework for automated vehicles, plus relevant rules under the following:

- The Road Traffic Act 1988
- The Road Vehicles (Construction and Use) Regulations 1986
- The Motor Vehicles (Driving Licences) Regulations 1999
- The Automated and Electric Vehicles Act 2018
- The Health and Safety at Work Act 1974
- The UK General Data Protection Regulation

It covered the Government's controversial plan "to list ALKS models as automated vehicles from 2022" (since dropped, or at least delayed), and highlighted the Law Commissions' recommendation that automated vehicles must be able to record and store data necessary for incident investigation.

Standards in Action

As an example of the standards in action, Oxa's 2022 zero-occupancy on-road trial, was conducted in line with BSI's PAS 1881:2020 and 1883:2020.

In April 2023, BSI unveiled the fifth iteration of the Vocabulary it first launched in 2020. It includes 103 key self-driving definitions and 60 commonly used abbreviations. The most significant change was amending the title from connected and autonomous vehicles (CAV) to connected and automated mobility (CAM), along with the whole standards programme that BSI is developing with CCAV.

Technical author Dr Nick Reed, of Reed Mobility, explained: **"CAM better aligns with what the industry is now doing. There's the Zenzic CAM Roadmap, the government response to the Law Commission used CAM. It presents a strong picture of how the UK is positioning itself, how this technology is going to have such a positive impact on communities and businesses.**

"One definition I particularly like is automated driving. It's very simple now. Automated driving is when the dynamic driving task is performed by the automated driving system. That's it. There are notes to help the reader understand exactly what we mean, but that's a really clear definition of what is, and, just as important, what isn't, automated driving.

"Putting the Vocab together is interesting and challenging, with the technical advisory group including people from academia and the public and private sectors. One day we'll reach an asymptote where much of the technology is standardised, but we're not there yet. You only need to look at the media coverage of Ford's hands-free announcement to see that there's a lot of work still to do.

"These technologies are evolving rapidly, which is why the Vocab is so important – to help the industry reach that consistency of language. It's great that government and others see the value, for example, when Innovate UK specified use of it for their Commercialising CAM competition.

"The Vocab provides a strong basis for what the Secretary of State for Transport is likely to be considering when listing a vehicle as self-driving."

Nick Fleming, Associate Director at BSI, added: **"It's not about looking at self-driving vehicles in isolation. The technologies will be core to a range of future mobility solutions – private vehicles, light passenger services and commercial freight. These will combine to offer the potential to make our transport system more efficient, which can deliver more inclusive and sustainable mobility. Safety is paramount. CAM is where the industry is headed and standards will take that wider viewpoint.**

"If the language isn't right, or if there's huge variation, it can cause confusion. Clarity can help to build public confidence in a technology that has the opportunity to bring benefit to society, if trust is there. We know the Vocab has been accessed by companies and authorities the world over – that shows its relevance.

"This Vocabulary is fundamental to our wider CAM programme. It was the first standard developed through BSI's Flex process, which has now been adopted across BSI. We're increasingly finding, especially in areas of emerging technologies, the value of developing standards in a more agile way

– to be able to make changes more frequently. That's positive from a perspective of informing and supporting regulatory development.

"We'll soon be starting work on new standards relating to the remote operation of vehicles, including remote driving, looking at both the technical system requirements and, crucially, the human factors. The technology can be used as a fallback capability for self-driving vehicles, and for vehicles with more limited automation – to deliver and collect lease vehicles, for instance.

"Over the next few years, we'll be looking at standards focused on the testing and validation of self-driving technologies – thinking about cybersecurity and what good operational safety looks like. Standards can help to ensure that the transition from advanced trials to commercial deployment happens safely, bringing all the societal benefits to life."

International Standards

Another big win for BSI came in August 2023, with the launch of the new ISO 34503:2023 international standard for the safe operation of self-driving vehicles.

Based on BSI PAS 1883, it uses the Operational Design Domain (ODD) concept championed by Professor Siddartha Khastgir, of WMG at the University of Warwick.

The new ISO standard (full title: Road Vehicles — Test scenarios for automated driving systems — Specification for operational design domain) provides specifications for three key categories:

- Scenery elements: non-movable elements e.g. roads, bridges, traffic lights
- Environment conditions: weather and other atmospheric conditions
- Dynamic elements: all movable objects and actors

The ISO website explains that the document is mainly applicable to Level 3 and 4 automated driving systems (ADS). It is primarily intended to be used by organisations conducting trials, testing and commercial deployment, and may also be of interest to insurers, regulators, service providers, national, local and regional governments.

"It's exciting to see the launch of this new international standard, given the potential benefits that can be realised by testing automated vehicles so they can operate safely on our roads," said Fleming.

"This new ISO standard has been inspired by the UK document, BSI PAS 1883:2020, the first taxonomy for ODDs developed in conjunction with UK experts and the government's Centre for Connected and Automated Vehicles.

"BSI would like to thank Professor Khastgir for his effort in helping to lead this work at the international level which, along with PAS 1883, shows the leadership the UK is having in the development of global standardisation for self-driving vehicles."

Big Issue:
Insurance

In February 2023, in the Banqueting Suite at one of London's most iconic buildings, Tom Allebone-Webb, Head of Strategy & Innovation at Lloyd's, introduced a packed audience of insurance professionals to Professor Paul Newman, Founder and CTO of Oxbotica (now Oxa).

The prestigious address in question was 1 Lime Street, the Richard Rogers-designed home of Lloyd's of London, and the official title of the event was The Future of Autonomy.

"The combined impact of mobility as a service, electric vehicles and automation will be huge," said Sam Tiltman, Sharing Economy and Mobility Leader for the UK & Ireland at Marsh. **"If autonomous vehicles deliver on their premise, they will significantly reduce risk, so if we don't invest in this, then we, as an industry, will be disrupted."**

If any attendees were labouring under the impression that this is still the stuff of science fiction, the skateboard-like Oxbotica car parked outside the grand main entrance must have piqued their interest.

> **"Insurance and autonomy are intertwined, because both will be everywhere,"** said Newman. **"Since the days of the horse and cart we have persisted with the idea of one operator per vehicle. Now it can be 'n' operators per vehicle, and it will be insurers who decide what 'n' is."**

He used the introduction of wolves to Yellowstone National Park as an analogy for the kind of 'trophic cascade' that self-driving vehicles will bring about. For example, the energy-saving benefits of lights being turned off at automated ports – because autonomous vehicles don't need them.

More pertinently, he continued: **"Offline, the residual data from autonomy can be used to assess risk. Online, at a danger point, you can change behaviour. We call this insurance-in-the-loop."**

The insurance for Oxbotica's successful on-road zero-occupancy trial, in 2022, was arranged by Marsh and created by Apollo Group's Insuring Businesses Of Tomorrow, Today (ibott) initiative, in partnership with Aioi Nissay Dowa Europe – the first insurance of its kind in the UK, tailored specifically for the risks associated with Level 4 autonomy on open roads.

"This is not just about risk management, the depth of data is transformative, it requires us to be collaborative," said Rebecca Marsden, formerly of Apollo and now VP of Risk and Insurance at Oxa.

"Under our partnership with Oxbotica, we see them as a buyer of insurance today but a future distributor of insurance products or even a co-insurance partner," said Apollo's Chris Moore.

"This industry is currently very product focused, whereas we need to transition to being client and solution focussed. We have to break out of our silos and create a new product, an autonomy product."

Newman concluded: **"Consider the combined experience of all vehicles in all places against the experience inside the skull of a 16-year-old just learning to drive. That's all about risk, insurance and lifelong learning.**

"The work will be ongoing, not something you can photocopy. It will involve the sharing of best practice and keeping in mind why I got into this in the first place – safety. More parents should keep their kids, and more kids should keep their parents."

Focus on Fleet

In terms of road cars, Mercedes caused a stir in 2022 for appearing to accept responsibility for accidents caused by its Drive Pilot system.

"On paper, the liability is clear, but I think there is some work still to do, together, before we can work out how it would play out in practice," said Doug Jenkins, Motor Technical Risk Manager at AXA Insurance UK.

"There's also a massive difference between retail insurance and fleet insurance. For an individual policyholder, one of these ALKS-equipped cars would probably be on a comprehensive policy with a small excess, whereas in the fleet market a lot of people almost self-insure, with huge excesses on third party only cover. I'm guessing Mercedes focused on the retail business, but it will be interesting to see the implications for fleets.

"Let's think about what happens in a claim: You're lucky enough to be given one of these cars as a fleet vehicle and unfortunately you get sideswiped. There might well be a sticker on the windscreen with the number of an accident management company or a fleet manager. What happens next is important. The person who takes the first notification call will run through a script and ask certain questions. They'll ask what happened and you might say "They clipped me and took off the wing mirror", you're unlikely to say, "It was an issue with their lane assist system".

"If it's a sub-£5,000 claim, an accident management company might well just authorise the repair and arrange it via one of their approved repair centres. Job done. This Mercedes announcement means interfering with that very efficient process. Even if an insurer starts looking at the cause of the accident, the report might say "The vehicle just came to a stop – it was a malfunction". The driver was still supposed to remain in control so how do you attribute blame to the lane assist?

"As an insurer providing basic Road Traffic Act (RTA) cover, we would have to pay any losses and then go to Mercedes and say we'd like our money back. We will need to develop the process of sign-off and how the costs are charged back – of course, these things will come as we get deeper into the deployment of AVs."

As to the implications of attaching liability to the vehicle rather than the driver, Jenkins said: **"I wish I had a pound for every time this came up in conversation! Let's say the law changes and self-driving is allowed. What cover would be needed? Does it look like a motor policy? At AXA we've got working groups looking at that. It's all in the wording but very few people read the 50-page agreements – they just want to be covered, so we want to make the end product as comprehensive as possible.**

"The definition of insurance is transferring risk. Somebody pays for loss or damage caused by something going wrong. That's the bottom line. We currently insure several organisations trialling autonomous vehicles in the UK, so we understand the exposure. They're close to the point where they want to take the safety drivers out, and we're very involved in that discussion.

"The rate of progress is increasing. I bought a Q4 recently and Audi's technical centre couldn't answer one of my queries because "it is too new". We've recently clarified our cover for electric vehicles (EVs), looking at things like cables trailing and chargers blowing up. These are new eventualities, but it's just a case of changing the wording to respond to these new customer needs.

"When it comes to full autonomy, I know it sounds complicated but, in all honesty, I don't think it will be. Rest assured, by working with The Association of British Insurers (ABI) and Thatcham, the insurance industry will take new factors into account and provide the right cover."

As Jonathan Dye, chair of the Automated Driving Insurer Group (ADIG), and head of underwriting at QBE, put it: **"In addition to education and collaboration across industry sectors, a key element will be the sharing of data and the transparency of what each specific vehicle is capable of at a point in time.**

"With some models likely to have the self-driving technology as 'optional', or as an 'over the air update', meaning it would be possible to change a vehicle's capabilities overnight, it's imperative the driver has a full and clear understanding of the vehicle's limitations post update and that they are adequately protected by purchasing an appropriate insurance product."

Big Issue:
Public Opinion

"If I had asked people what they wanted, they would have said faster horses," Henry Ford is often quoted as saying. Still, it is telling that one of Zenzic's golden threads is public acceptability.

Self-driving vehicles divide opinion. For supporters, they represent a giant leap forward for mobility and road safety. For detractors, they're a nightmare mix of cybersecurity and ethical concerns, with many conversations quickly turning to The Terminator films.

As Applied EV CEO, Julian Broadbent, told The Future of Autonomy audience at Lloyd's: **"Mainly people find self-driving vehicles very dull, but there is a danger of a 'scary clown' problem."**

Following the much-publicised death of Elaine Herzberg, in Arizona in 2018, multiple surveys showed that people across the world become more wary of them. Herzberg died after being hit by a prototype Uber self-driving car operating with a safety driver.

This was the time of peak robotaxi hype, remember, yet five years on the public acceptance needle doesn't seem to have moved significantly. In 2018, a University of Greenwich study found that 43% of 925 respondents "felt positive" towards the concept of connected and autonomous vehicles. In 2023, Go Compare found that 45% of UK population don't like the idea of autonomous vehicles. Is that progress?

One of the most comprehensive recent studies was The Trust in Automation survey of 4,000 car owners (half in the UK and half in America) conducted in 2022 by Thatcham Research. 73% of UK respondents said they "recognised the benefits of emerging automated driving technology".

When asked what they considered to be the key benefits, the most popular option was improved safety (21%), followed by improving mobility for the elderly and disabled (14%) and reduced pollution (8%). Just 3% saw freeing up time to work as an advantage!

"Drivers are beginning to recognise that automation can deliver significant societal benefits in terms of safety, mobility and sustainability," said Matthew Avery, Chief Strategic Research Officer at Thatcham Research.

However, a further finding was that 52% of UK drivers mistakenly believe that fully autonomous driving is possible today. In the US, this number rises to 72%.

Thatcham Research | Trust in Automation Survey

Analysis: Self-Driving hype

52% of UK drivers wrongly believe they can buy a fully Autonomous car today. This number rises to 72% in the US

"Realising the government's stated safety ambition for automated vehicles is dependent on driver education. This can't just be lip service," said Avery.

"With more than half of the UK public believing that autonomous driving is here today, the perception is racing ahead of the reality. This demonstrates just how much work needs to be done to set realistic consumer expectations of the first vehicles offering limited self-driving functionality, when they do become available."

Notably, Tesla has come in for a lot of criticism over its confusingly named Full Self-Driving (FSD) package. A group called the Dawn Project even ran an advert during the 2023 Super Bowl calling on the US National Highway Traffic Safety Administration (NHTSA) to ban it.

Self-driving Appeal

It seems to have contributed to a divergence in terminology too, with the US still using "autonomous" – and haulage companies such as Kodiak and TuSimple embracing "driver-out" – while the UK has shifted in favour of "automated" and "self-driving".

In sponsoring the new Senate Bill (1398), Senator Lena Gonzalez, of California, is seeking to increase consumer safety **"...by requiring dealers and manufacturers that sell new passenger vehicles equipped with a semiautonomous driving assistance feature... to give a clear description of the functions and limitations of those features."**

A further stateside statistic, from The Insurance Institute for Highway Safety (IIHS) in 2022, is that, while 35% said they found self-driving technology "extremely appealing", and 23% said it was "not at all appealing", a surprisingly high percentage were "at least somewhat comfortable" with in-cabin driver monitoring to support such systems: 70% for steering wheel sensors, 59% for camera monitoring of driver hands, and 57% for camera monitoring of driver gaze.

On the safety point, a Washington Post article compared Herzberg's death to the 1896 UK case of Bridget Driscoll, reportedly the first pedestrian to be killed by an automobile.

The motor industry has made huge strides on safety, with Vision Zero, passed by the Swedish parliament in 1997, now widely adopted. Venson partner RoSPA recognises that "human beings' lives and health should never be compromised by their need to travel". National Highways has a target to "reduce the number of people killed or injured on the road network as close as possible to zero by 2040".

There's a lot of work to do. The World Health Organization (WHO) estimates that approximately 1.3m people die each year as a result of road traffic crashes, with vulnerable road users – pedestrians, cyclists and motorcyclists – accounting for the majority of these deaths. Road traffic injuries are the leading cause of death among children and young adults.

The author of The Law of Driverless Cars: An Introduction, barrister Alex Glassbrook, notes that: **"Driver assistance systems have been accumulating for some time, but the legal standard for driving has not really altered since 1971. It was then that Lord Denning, in the case of Nettleship v Weston, set what can be summarised as the standard of the reasonably prudent human driver."** This has become an important self-driving benchmark.

In summer 2023, the Department for Transport (DfT) and CCAV published a new report on The Great Self-Driving Exploration – a series of large-scale public engagement events delivered in partnership with Thinks Insight & Strategy, University College London (UCL) and Aurrigo.

The aim was to study public perceptions towards, and effective communication about, self-driving.

The "A citizen view of self-driving technology in future transport systems" report largely analysed the responses from a "high exposure audience" of 177 participants, who took part in a three-week programme of "deliberative engagement", including pre- and post-ride surveys. Further feedback came from "medium exposure" and "low exposure" audiences, of 450 and 250 participants respectively.

In one task, the participants were asked to design an advert to describe self-driving vehicles to the public. The report said: **"The participants overwhelmingly focused on communicating the potential benefits of introducing self-driving vehicles rather than any of their concerns.**

"Broadly speaking, to effectively improve awareness of self-driving vehicles it was seen as necessary to communicate their advantages over and above traditional human-driven vehicles."

As to how best to communicate with the public, the research concluded that the top five key themes are:

1. **Safety** – both improved road safety and reassurance on self-driving vehicle safety.

2. **Reliability and security** – especially the balancing of AI technology and human backup.

3. **Accessibility** – promoting mobility for all.

4. **Shared** – improved public transport and the environmental benefits of fewer private car journeys.

5. **Costs** – being cheaper than the existing options is a powerful message.

Familiarity with self-driving increased significantly among the high exposure participants, with 68% saying they knew 'a fair amount' by the end of the research, compared to just 11% at the outset.

In a welcome repeat of the Partners for Automated Vehicle Education (PAVE) findings in America – **"we like to put on demonstration events to demystify the technology and the good news is that knowledge and experience change attitudes"** – participant 'comfort' increased during The Great Self-Driving Exploration process, both in terms of using self-driving vehicles and sharing roads with them.

Expert View:
National Highways

Malcolm Wilkinson, Head of CAV & Energy at National Highways, says:

"We need to understand our role as a highway authority. What do we need to think about in terms of highway designs, data/information provision and maintenance standards? What do we need to be investigating to make sure that we as the highway authority are playing our part, doing what motor manufacturers and the public expect of us?

"There's been a lot of talk about the need for the white lines to be readable by automated vehicles. Is that still the case? If so, what does that mean for our maintenance schedules? Can we use the data from vehicles to inform our congestion management? Is there data we can use for asset management purposes?

"Particularly over the next few years, with a mixed fleet with different levels of autonomy, that's going to present new scenarios, new risks. As a highway authority we need to be conscious of those – how they're going to affect our operations and the safety of the travelling public.

"Our connected corridor project on the A2/M2 was very successful, certainly an important steppingstone. It was a joint project with Kent County Council (KCC), Transport for London (TfL), the Department for Transport (DfT) and others. We demonstrated that cellular and WiFi connectivity can be used to put highway information into vehicles, for example, signage, warnings and green lights. We also demonstrated that data can transfer the other way – to us from vehicles. The project informed our Digital Roads vision and Connected Services roadmap, influencing elements of our Digital for Customer programme.

"The Connected and Autonomous Vehicles: Infrastructure Appraisal Readiness (CAVIAR) project used both simulations and real-world data collection. The number one recommendation was the need for further study to determine how CAVs can best navigate roadworks. This potentially includes infrastructure-based solutions, such as smart traffic cones, and OEMs developing 'cautious' behaviours, to be triggered once a CAV enters a work zone.

"The HelmUK freight platooning trial, that we led, working closely with DfT, was another really valuable exercise. We demonstrated real-world use of platooning on the M5/M6, although the fuel savings were very modest and didn't replicate what we were seeing on the test tracks. This was largely due to the need to break up the platoon at many of the junctions. It is one of those technologies you can see working brilliantly on long outback roads in Australia, but the advantages of putting it into every cab in the UK are less obvious. It's important to learn from initiative like the ENSEMBLE multi-brand truck platooning project in Europe."

"It's very exciting times. We want people to embrace CAV technology and enjoy the benefits. My personal view is that they will probably be available more quickly than many people think."

Malcolm Wilkinson

Expert View:
The RAC Foundation

Steve Gooding, RAC Foundation director and member of the CCAV expert advisory board, says:

"If you're in a vehicle that is so highly automated that you don't need to be involved in controlling it – like you're sitting on a train - then it shouldn't be a problem. But there's an issue here, which is, if you tell me the vehicle is driving itself, it better had be.

"We know that with the most advanced driver-assist technologies you might not be doing much of the driving task. But what if you're required to retake control, and at a moment's notice? I draw a sharp distinction here – and we're all going to have to get our heads around it – between advanced driver-assistance and genuine automation. It's often described as a continuum, but there's a massive step-change between being a full-time passenger and a part-time driver.

"What I've been saying consistently is that the vehicle has to be designed to cope with crisis moments, because humans don't snap back into control very well. My plea to the designers is for pity's sake don't make the human the failsafe – we're arguably the weakest link in the drivetrain.

"What about the drivers of non-automated vehicles? Imagine, you might be driving along a motorway and a car goes past you with the person in the driving seat apparently fast asleep or reading a broadsheet. You might think 'What's that idiot doing?' and maybe sound your horn. You might think, 'Good grief, there's going to be a crash, I'd better call the police'. How are we going to feel about that?

"Or imagine you're in a supermarket car park. Other shoppers struggling with their bags might be quite shocked to see a car coming towards them that appears to have nobody in it. It's not science fiction anymore. We need to move the conversation on, to start gearing people up for the thought that this is going to happen, and soon.

"The first incarnation of driverless technology that appears to be headed our way is the automated lane keeping system (ALKS). That's the technology that's closest to market and closest to deployment in this country. ALKS enables the vehicle to speed up and slow down and stay within a defined lane on a motorway.

"Of course, ALKS is some way short of genuine self-driving – but one might imagine a button by which, in the same way that I could trigger adaptive cruise control on a motorway, I could go one step further and trigger a system that would take me on to a certain junction, within the legal speed limit, anticipating the traffic ahead, steering and braking if necessary. That's a world I suspect many drivers would welcome."

Steve Gooding

AV-DRIVE
Communications Toolkit

In June 2023, the Automated Vehicle Driver Responsibility in Vehicle Education group (AV-DRIVE) launched Version 2 of its Self-driving Vehicle Communications Toolkit, to support industry messaging as more advanced vehicle technologies come to market.

It was created by Venson partners the British Vehicle Rental and Leasing Association (BVRLA), the Royal Society for the Prevention of Accidents (ROSPA), and the Society of Motor Manufacturers and Traders (SMMT), along with other industry big hitters including CCAV, the DVSA, the Association of British Insurers (ABI), National Highways, The RAC Foundation and Thatcham Research.

Asserting that **"We're preparing to deliver a safety revolution",** the Toolkit provides a set of suggested definitions and explanations, using plain language, for fleet businesses and others to use in marketing and advertising. It also contains links to some handy downloadable visual aids.

"By working together to communicate clearly and consistently about self-driving vehicle technology, we will build market confidence, avoid confusion, and harness the full benefits of this technology," the introduction explains.

For starters, it outlines five 'Guiding Principles' for marketing self-driving road cars, developed by manufacturers and government and supported by the Advertising Standards Authority (ASA):

1. A self-driving feature must be described sufficiently clearly so as not to mislead, including setting out the circumstances in which that feature can function.

2. A self-driving feature must be described sufficiently clearly so that it is distinguished from an assisted driving feature.

3. Where both self-driving and assisted driving features are described, they must be clearly distinguished from each other.

4. An assisted driving feature should not be described in a way that could convey the impression that it is a self-driving feature.

5. The name of a self-driving or assisted driving feature must not mislead by conveying that it is the other – ancillary words may be necessary to avoid confusion.

In the 'Language' section, it notes that: **"Our use of language is important because of the need to build public understanding and ensure clarity of associated responsibilities. Although often used interchangeably, we are using the terms 'Self-Driving' and 'Automated' in distinct ways.**

"A self-driving vehicle is one that has at least one self-driving feature, delivering sufficiently high levels of automation that it meets a legally defined threshold and is capable of safely driving itself with no human input. Such features could provide self-driving capability for all or part of a journey. While the term 'automated' vehicle will continue to be used by the sector and in legislation, 'self-driving' is a better term to support public understanding and will become a protected term for the purposes of marketing products to the public."

The 'Terminology' section of the Toolkit advises against the use of words such as assist, assistance and assisted, as well as automatic, autonomous, driverless and robotic, to describe self-driving technologies.

It also advises against referring to the SAE Levels when engaging with the public, and repeatedly emphasises that driver assistance systems (such as adaptive cruise control, blind spot monitoring and automatic emergency braking) are not self-driving features.

It posits that an Automated Lane Keeping System (ALKS) is "expected to be the first self- driving technology", subject to approval by the Vehicle Certification Agency (VCA), and reminds us that "the Secretary of State for Transport will publish a list of vehicles deemed as self-driving". This can be found at www.gov.uk/ guidance/self-driving-vehicles-listed-for-use-in-great-britain

The Toolkit provides this explainer on the potential new driver responsibility of retaking control: **"When the self-driving mode is engaged, the driver can perform limited activities. The driver must however remain in the driving seat with the seatbelt on, and cannot use a hand-held mobile phone or other hand-held devices (e.g. tablets). This ensures the driver is facing the road and ready to resume control of the driving when needed."**

....

Key instructions include:

- **DO have a MOT certificate, ensure the vehicle is roadworthy, taxed and insured.**
- **DON'T fall asleep – you may be required to retake control.**
- **DON'T drink alcohol – normal drink-driving laws apply, even if the vehicle is in self-driving mode.**

....

An insurance explainer emphasises that: **"Specialist self-driving vehicle insurance policies will cover the vehicle both when the self-driving mode is on, and when you are in control of driving it. If you are operating a vehicle with self-driving features, you must ensure that it has the appropriate insurance in place. You should always carefully review your policy to ensure that the coverage is right for you."**

Throughout, the overriding message is that safety is the number one priority for all stakeholders.

Conclusions

With some truly incredible new technologies now very close to being market-ready, and the legislative framework taking shape, Venson urges fleet managers, and the wider fleet sector, to recognise that the self-driving revolution is here.

Daniel Ruiz

This white paper details how the connected and automated (CAM) ecosystem has evolved significantly since our previous report on the subject seven short years ago. There is much to be excited about and to prepare for.

From a UK perspective, there is also a lot to be proud of. One of the world's leading experts on self-driving embedded software, Philip Koopman, author of the book "How Safe Is Safe Enough?", recently described the UK as "the adults in the room" when it comes to regulation. High praise indeed.

Who better to sum up where we are on the journey towards SAE Level 5, "full driving automation", than Oxbridge engineering graduate, Dr Daniel Ruiz. In a stellar 40-year career, he set up the Transport Coordination Centre for the 2012 Olympics, founded the Transport Technology Forum (TTF), and was the first head of Zenzic.

Now a director at the Office of Rail and Road (ORR), and reviewer of major projects for the Cabinet Office, he said: **"In CAM, it's certainly the case that hype held things back. People became interested in just driverless cars, and that narrow interest resulted in a focus on the wrong things – not the best outcomes for society.**

"Robotaxis have long been the sex symbol of the autonomous vehicle parc, but they're not necessarily going to make the biggest, or soonest, impact. There's an emerging realisation that there are greater opportunities in autonomous freight.

"This is partly because freight doesn't complain about how fast it goes around corners. It's also because of the many off-highway opportunities. This enables you to prove safety and efficacy.

"Until recently, there were very few modes of transport. Now there's electric scooters and bikes, hire schemes, ride sharing and more. We need to put less emphasis on the mode and think more in terms of getting from A to B in the most efficient and comfortable way."

In this white paper, we focussed on the implications for passenger and commercial vehicles. It should be noted that small delivery robots and drones will also have a part to play.

The architect of the operational design domain, Professor Siddartha Khastgir, has reached out beyond automotive, and there are promising signs that the concept could also be helpful in automated air and sea transport. **"Safety, and the corresponding perceived safety, remain the biggest challenges for commercialisation,"** he said.

As we went to press, in September 2023, Cambridge-based independent market research provider, IDTechEx, provided compelling evidence that the best self-driving vehicles are already safer than the average human driver.

In 2022, during 863,000 miles of testing, Cruise safety drivers in California only needed to intervene nine times. What's more, IDTechEx concluded that four of these nine disengagements were caused by the poor performance of other drivers.

For the UK government, the most pressing question for road cars is whether ALKS should be the first system defined in law as 'automated', given the lack of ability to find safe harbour should something go wrong.

The final word goes to Neil Atherton, Sales and Marketing Director at Autoglass. **"Much has been made of the dawn of fully autonomous vehicles, but in reality many of these technologies are already in our vehicles,"** he said. **"Drivers and the wider automotive industry need to be ready to use and maintain them."**

Safe self-driving will change the world for the better and fleet operators will be in the vanguard, taking on vital new responsibilities and reaping the commercial benefits.

Miles Per Disengagement

Venson fleet management solutions

Company vehicles are an important asset for supporting core business operations and that's why our contract hire and fleet management solutions are created in response to our clients' needs and are based on our commitment to long term partnership and exceptional customer service.

Testimony to this is our client retention rate of over 95%. Along with exceptional service we ensure our clients receive great value from their fleet, by delivering solutions that are based on impartial advice and that provide tangible financial return. We can do this because we've only ever specialised in managing fleets, so our knowledge and in-depth understanding of the market is the best in this sector and relevant to public, private, not for profit and emergency service organisations.

We also believe in true partnership, working with fleet operators and their drivers to ensure they always receive the most appropriate solution to support their operational and financial needs.

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