Autonomy & Motor Insurance

What Happens Next?

An RSA report into autonomous vehicles & experiences from the GATEway Project

Ian Kemp – July 2018

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Executive Summary

This report draws on RSA's experiences with the three year GATEway project - which included a trial of autonomous vehicles in Greenwich and considers the role of the insurance industry as it looks to embrace technological change.

We also surveyed 10,000 consumers on their views around self-driving cars and their expectations regarding motor insurance. The survey feedback has helped us tie lessons from the project back to the impacts and views in the 'real world'.

There are over 31 million vehicles on Britain's roads today, but according to the Department for Transport around 26,000 people were killed or seriously injured on the roads last year. Around 93% of all crashes are attributed to human error and the automation of the driving task has the potential to significantly reduce death and injuries saving millions of lives.

Autonomous Vehicles (AVs) are therefore regarded by many as a major landmark in making our roads safer whilst continuing to improve mobility and productivity. They will allow people who are currently unable (due to disability, the lack of a licence, or their age for instance) to 'drive' a car and enable goods and freight to move around without humans at the wheel.

Unlike humans, driverless cars won't speed, or run a red light; they won't get distracted, fall asleep, or get road rage; and they will be far less likely to be involved in an accident. Vehicle reaction times will be quicker than any person and they will be able to connect directly with other road users and infrastructure in real time. At their best, autonomous vehicles will make journeys smoother, safer and be more energy efficient, whilst eliminating speeding, drink driving and reducing pollution.

This is no longer a space age fantasy. Advanced Driver Assistance Systems (ADAS) that help to avoid crashes and mitigate accidents are already present in many vehicles and the range of available ADAS is growing exponentially. There is a path of rapid progress towards an ever increasing automation of the driving task, both in terms of the availability of technology and the adaptation of the regulatory environment that is required to permit it.

RSA and the insurance industry fully support the development of AVs and are working closely with stakeholders to make it a reality. AVs will be with us in the next decade, though it is likely to be far longer before they become the rule rather than the exception on our roads. Whilst nearly six in ten drivers were excited about the development of AVs - over a quarter expressed concern about driverless cars being hacked and vulnerable to crashing. The adoption of this new technology as AVs arrive ensures there is still plenty of time for car manufacturers, the insurance industry, government and the media to fully educate drivers and consumers about the advantages of a new technology that will literally save millions of lives whilst making our roads safer and less polluted.

That said, if full autonomy is the ultimate end game, the intervening period of disruption will be considerable. As an industry, we need to be looking now at the opportunities and implications that technology is bringing and how we can absorb these changes and reflect them into our underwriting and pricing.

Alongside the changes in technology, there are also changing societal dynamics – a move from ownership to 'usage', a slow shift towards electric and alternatively fueled vehicles, and a change in consumers' expectations – vehicles that can sometimes spend 96% of their life sitting on driveways and in car parks are increasingly seen as an expensive asset. As social media and mobile computing propagate, people welcome the opportunity to either socialise or work whilst in a vehicle moving from A to B.

These trends can be linked to the differing expectations of different generations - 18 to 24-year-olds are the most positive about driverless cars – 50% think the future of cars sounds exciting, compared to just 13% of over-55s. Likewise just over half of 18-24s think driverless cars will be on the roads within five years and 29% would trade their car in for a driverless car if they have the choice,

There are risks along the way - drivers could be lulled into a false sense of security by the marketing of new driver assistance features making their way into cars. Some terms used to name these features are in danger of giving the false impression of a level of autonomy not yet available. Specific and rigorous descriptors are required to describe and categorise vehicle automation, so that the risk they pose for the driver is more accurately rated for insurance purposes.

The nature of insurance and related liabilities is changing. The challenge for the insurance industry is to understand and respond to such disruptions; protecting and supporting consumers and businesses on the journey. RSA - as an insurer that has been in business for over 300 years - is well equipped to do this, keeping the customer at the centre of everything we do.

#InsuringTheFuture

1. The GATEway Project's aim (Greenwich Automated Transport Environment) was to understand how automated vehicles can fit into our future urban mobility needs and the barriers we must overcome before these vehicles become a reality on our roads.

Foreword

Not a day goes by without autonomous cars being mentioned in the media. While they attract huge public interest, they also raise concerns over the safety and viability of the technology.

Gaining consumer trust in the capability of systems will be paramount and so trials are crucial for building confidence. Through the Automated and Electric Vehicle Bill (AEVB), the UK Government has paved the way for the introduction of these new mobility concepts and recognised the key role that Insurance will play in the transport ecosystem.

There will be no single flavour for autonomy.

As well as the potential of automated private cars enabling hands free driving within the next five years, we'll also see entirely new transport solutions without drivers or controls. These vehicles will be mixing with regular human driven vehicles presenting additional challenges for the insurance world.

The insurance community with the ABI and Thatcham's support has risen to the challenge, taking an active role in Government funded projects to identify the needs of their industry and provide solutions before the technology is widespread.

RSA's participation in the GATEway project has been a valuable source of knowledge and their experience and learnings have been widely shared to help deliver an efficient and stable transition into this brave new world.

Matthew Avery, Director of Insurance Research at Thatcham Research

Thatcham Research is the motor insurers' automotive research centre. Established by the motor insurance industry in 1969, the centre's main aim is to contain or reduce the cost of motor insurance claims whilst maintaining safety standards.

Today, Thatcham Research still occupies its unique position as the UK's only 'not for profit' insurer funded research centre. Whilst the original aims remain intact, the centre now enjoys a much wider remit at the forefront of the latest vehicle technology research, spanning safety, security and repair.

Thatcham Research
Safer cars, fewer crashes

Background to autonomous vehicles and driverless cars

Since we moved from travelling by horse and cart to using motor vehicles, technology has continued to adapt and develop. Current vehicles bear little resemblance to those of yesteryear - or even ten years ago; especially when it comes to new safety features and 'assistance' systems that make the driver's role easier, safer and some would say more pleasurable. Indeed, the number of road deaths and those seriously injured from road traffic accidents (RTAs) has continued to fall across the UK for a number of years. Not unsurprisingly, 87% of adults would like our roads to be safer for all users, including drivers, cyclists and pedestrians.

However, globally there are still over 1.2 million annual road traffic deaths and with human error to blame in around 93% of all accidents; continued improvement in safety and autonomy means that driverless vehicles have the potential to save lives by minimising incidents and reducing risk:

Reasons for a movement towards automated vehicles

Human Cost

- There are circa 1.25 million road deaths annually*
- Road Traffic injuries are currently estimated to be the 9th leading cause of death across all age groups and are predicted to rise to the 7th leading cause by 2030.*
- They are the **leading** cause of death amongst people aged 15 – 20*
- Almost half of all deaths on the roads are among those with the least protection – motorcyclists, cyclists & pedestrians*
- 93% of all motor accidents have human factors either as a cause or contributory factor

* World Health Organisation (WHO) Report

Environmental and Societal

- In the past 3 years there has been a 16% increase in the numbers of vehicle on the world's roads – in 2014 alone, a record 67 million passenger cars came into circulation*
- The average car is parked for 96% of the time
- In 2017 there were over 31 million vehicle registered for GB roads
- Productivity gains expected as people who no longer have to drive having time that can be used to work, play or socialise

As well as the reduction in road deaths and injuries, there are other factors driving the development of the new technology.

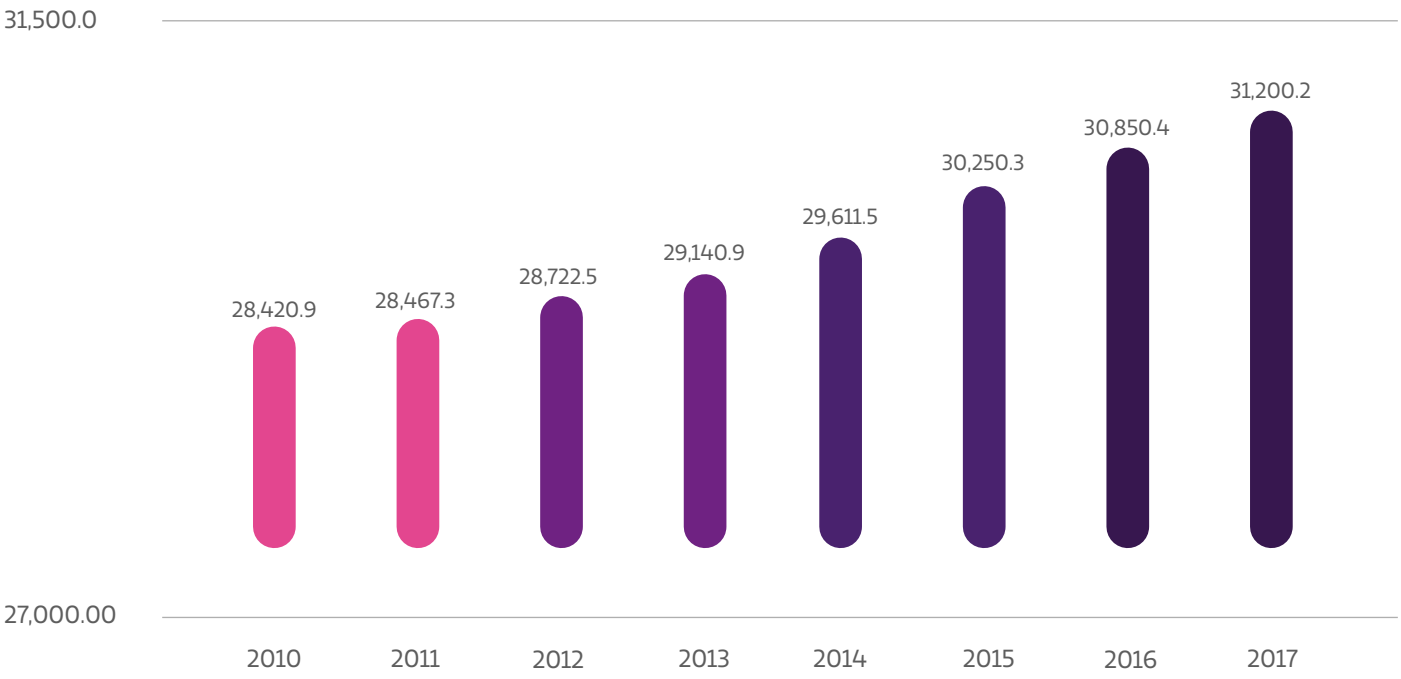
Over the past eight years, the number of vehicles on the roads has grown from 28.4 to 31.2 million and this trajectory is set to continue. Alongside growing car ownership come the challenges of increased congestion on our roads, more pressure and expense for parking and urban pollution.

While the solution won't solely be reliant on autonomy, it forms part of a series of interconnected events starting to change our roads: the move towards transportation becoming (more) autonomous; more connectivity between vehicles and surrounding infrastructure; and a move towards alternative fuel vehicles (AFVs) such as electric cars. Even with concerns around technology 54% of our survey said that they would like their car to be powered by cleaner methods such as solar (21%), electric (18%) or a hybrid (15%).

> **"Autonomous vehicles are an area where we feel we've got a competitive advantage"**
>
> *Richard Harrington, the UK's automotive minister*

Licensed Vehicles in Great Britain
Q1 2010 to Q1 2017

Licensed Vehicles in Great Britain ('000s)



Department for Transport statistics

Vehicle Licensing Statistics

Licensed cars at the end of the year for Great Britain 2010 - 2017

While we might not see universal take-up straight away, fully self-driving vehicles are expected to have a transformational effect on road transport. They will unlock huge productivity and capacity benefits while changing ownership models, cutting vehicle numbers, increasing personal mobility and dramatically improving road safety. RSA and the insurance industry support the development of this concept and are working closely with stakeholders to make it a reality (see page 17 for a case study of our involvement in recent GATEway driverless vehicle trials in Greenwich).

The UK Government shares this view and has been leading the way through the publication of 'The Pathway to Driverless Cars', the industry 'Code of Practice' for trialling and testing AVs on UK roads and by setting up a bespoke Government department – C-CAV (Centre – Connected and Autonomous vehicles).

Over £100m funding has also been provided for collaborative R&D – so far extending to 73 projects and over 200 organisations including GATEway. Projects have included testing autonomous vehicles on highways and on trials of remote-control parking as well as CAV simulations and modelling on an upcoming self-driving passenger service.

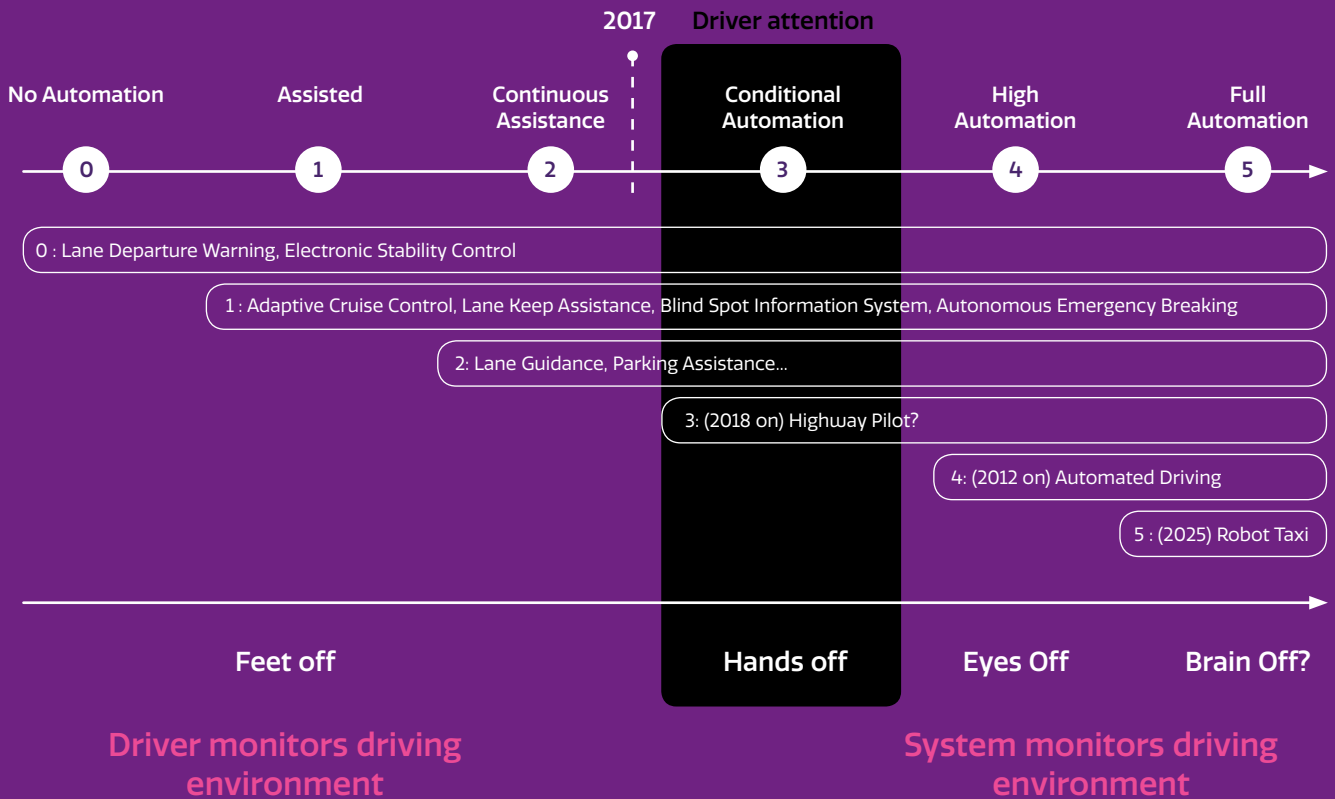
Richard Harrington, the UK's automotive minister, predicts this will lead to driverless cars in production within the next decade; a view shared by our survey where the majority (67%) of adults believe we will have driverless cars on the road within the next ten years.

Defining assisted and autonomous technology and levels of automation

The Society of Automotive Engineers (SAE) has developed a useful six-step scale in order to define levels of assistance and automation, intended to help the automotive industry plan for the development of ADAS and automated driving. They show the progression from familiar technologies that control longitudinal braking (e.g. auto emergency braking) or lateral steering (e.g. emergency lane keeping) in a narrow range of circumstances.

The six levels are shown below.

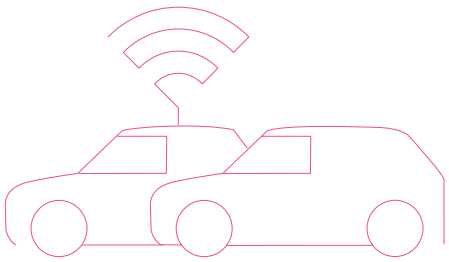
SAE Levels of Autonomy



The useful mnemonic, 'Feet Off', 'Hands Off', 'Eyes Off' and 'Brain Off' is a handy way of identifying the various degrees of functionality each level can bring and we can see that at lower levels it is the driver responsible for monitoring the driving environment. At higher levels, this becomes the role of the 'system'.

However, the terminology can be confusing: while 'assisted' and 'autonomous' as descriptions of a vehicle's technological capability are used fairly loosely, they are not strictly interchangeable. There is a related concern that drivers are being lulled into a false sense of security by the way driver assistance features are marketed. As such, drivers are not treating these features with the level of scrutiny and attention required, resulting in crashes and dangerous driving.

We believe the following terminology is the most appropriate way of describing the different levels of technology currently being tested and developed by manufacturers:



Assisted driving refers to technologies that support steering, accelerating or braking, but where the driver must remain actively engaged in the driving task, monitoring the road situation ahead – these are generally equivalent to SAE Level 2.

Automated driving allows the vehicle to take full control of speed and direction and enables the user to undertake other tasks not related to the control of the vehicle. In effect, the driver becomes a temporary passenger, but automation is limited to specific areas – these vehicles are equivalent to SAE Level 4.

Fully automated or autonomous vehicles refers to vehicles without driving controls whereby all occupants are passengers and the control and navigation of the vehicle is entirely down to the vehicle itself. They are able to undertake a full journey door-to-door in automated mode without driver input and are regarded as SAE Level 5.

Definition of an automated vehicle for insurance purposes

In terms of the formal definition for an automated vehicle, the Autonomous & Electric Vehicle Bill (AEVB) offers the following definition:

An automated vehicle is a vehicle capable of operating in clearly defined automated mode(s) which can safely drive the vehicle in specified design domains without the need to be controlled or monitored by an individual

To meet this definition, the vehicle must meet minimum criteria for its automated systems – consequently a system that requires the driver to control, or monitor the vehicle, in any way cannot be classified as automated.

RSA, similar to most insurers, believes that there is a need for more specific descriptors to describe and categorise vehicle technology and the functionality it provides, taking into account the shades of grey between assistance and automation.

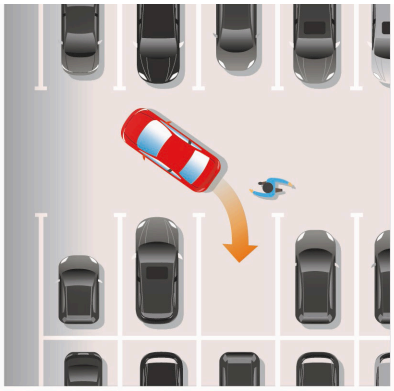
In addition, for insurance purposes, where a vehicle is being used will also be key. Consumers will need to see and understand more specific 'design domain' functionality (i.e. where they can operate) for certainty of policy coverage.

Vehicles may operate in one or more of four 'Design Domains'

- **Parking**
- **<30mph limit (typically city conditions)**
- **<60mph (inter urban conditions)**
- **Motorway**

These are explained below:

Assisted and Automated Design Domain Definitions



The system shall support the driver to park the vehicle or, in a controlled area, can independently manoeuvre the vehicle, including into and out of parking zones/ spaces without the driver present and avoiding collision with infrastructure, people and other vehicles and obstructions.

The system shall support the driver, or control the vehicle, over a speed range typical of city conditions <30mph and be able to manage typical city manoeuvres and conflicts at junctions, roundabouts, traffic lights and with pedestrians, cyclists, powered two wheelers (PTW) and complex unusual traffic conditions.

The system shall support the driver, or control the vehicle, over a speed range typical of inter-urban conditions <60mph and be able to manage typical inter-urban manoeuvres and conflicts at junctions, roundabouts, traffic lights and with pedestrians, cyclists, PTW and between unusual rural and urban conditions.

The system shall support the driver, or shall control the vehicle, over a full speed range likely to be used on a highway up to 70mph and will recognise variable speed limits. The system may be capable of automatic lane changing and overtaking.

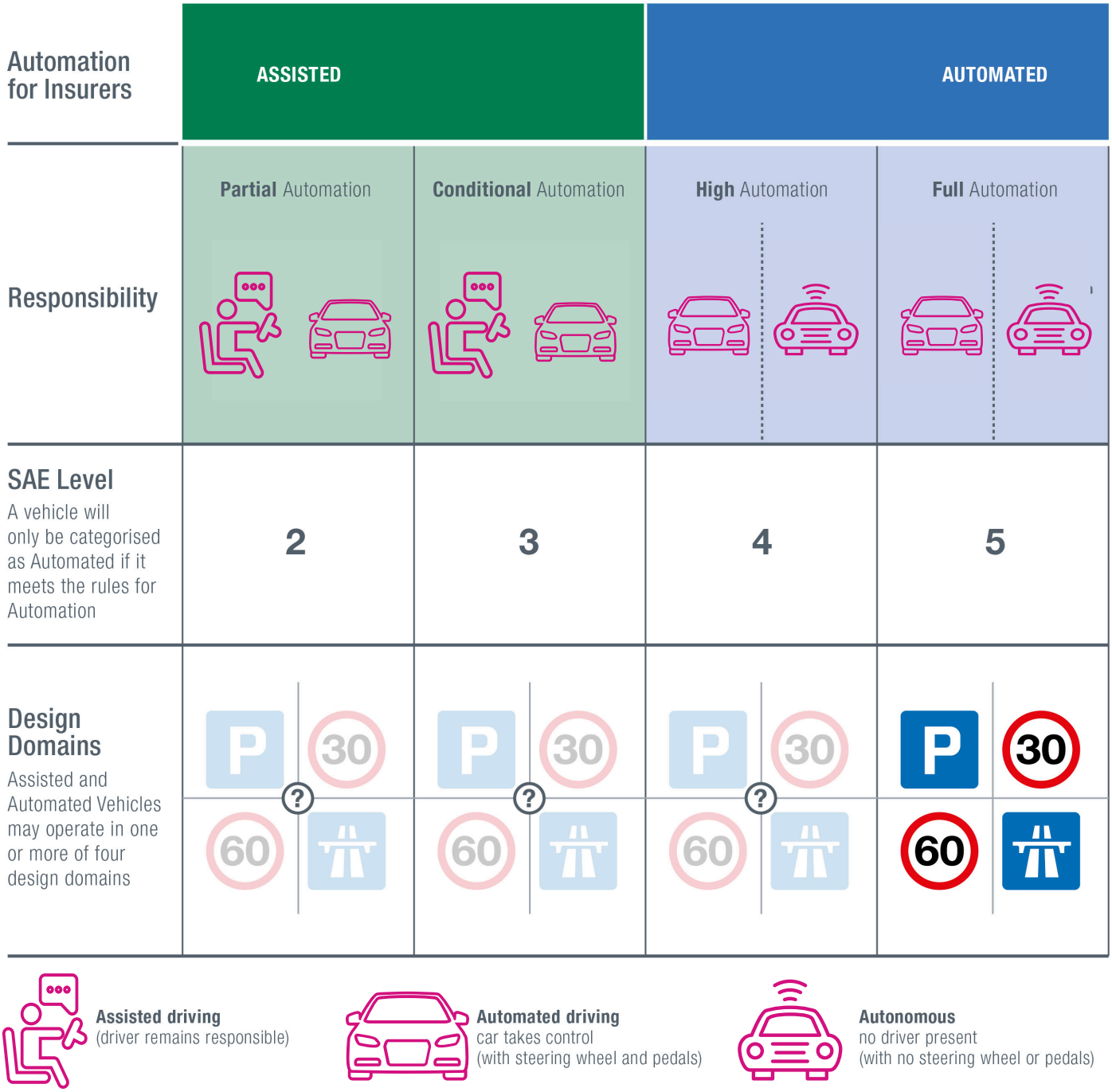
Speeds shown relate to the UK. Other countries may adapt different limits.

These domains have been established on the principle that the vehicle should be controlled in a way that safely navigates the specified design domain abiding by its governing rules.

Figure 1 represents assisted and automated functionality for the insurance context, including the domains in which each can be used.

Below SAE level 5, assisted or automated vehicles may operate in one or more of the design domains, and whilst these domains determine operating location, other factors such as weather, time of day, and road conditions may also constrain the use of assisted and automated functionality.

Figure 1: Assisted and Automated – the Insurer View



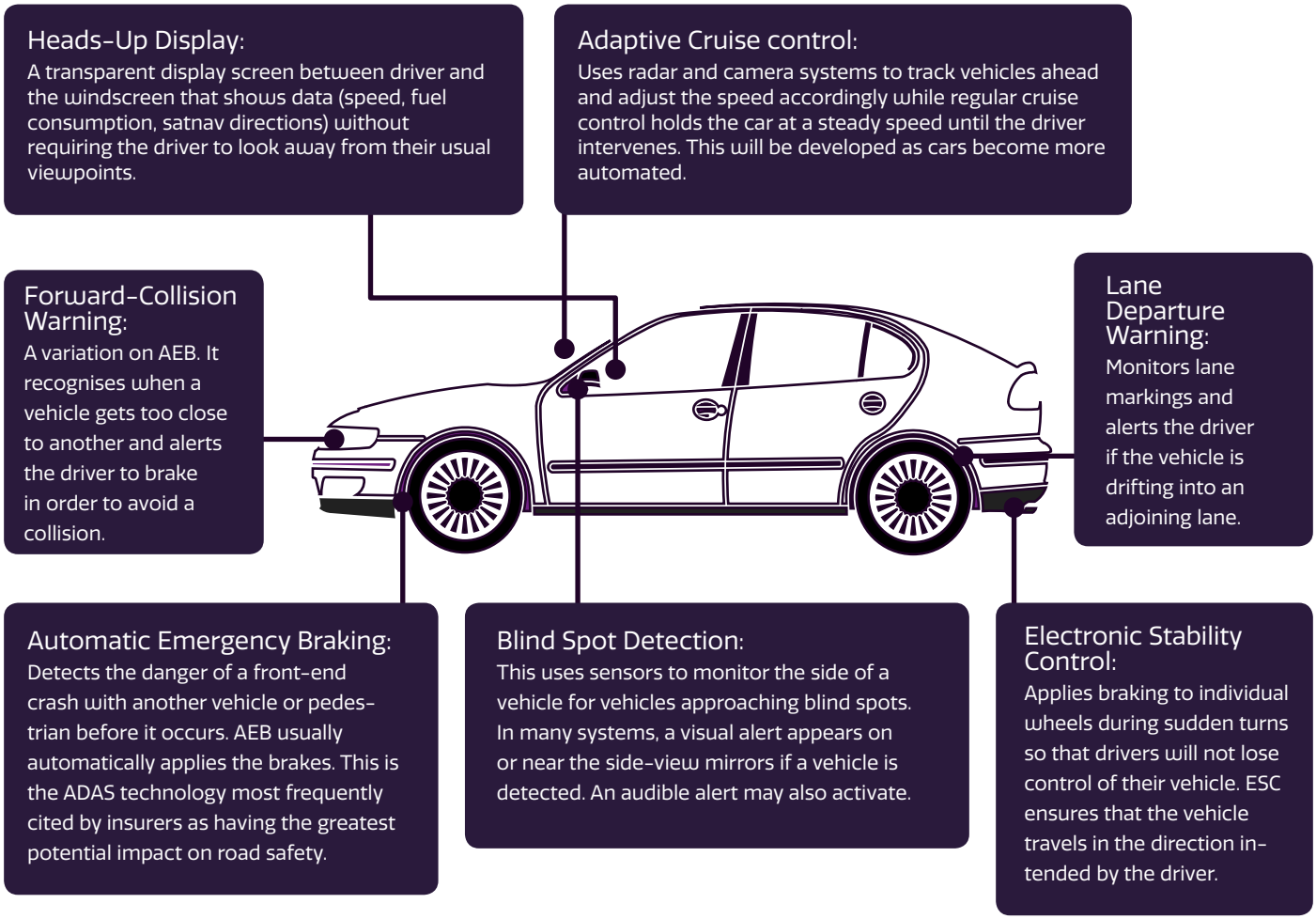
Vehicle technology

Whilst fully self-driving vehicles remain some time away with many technical challenges still to be resolved, intermediate technologies are being implemented. Sometimes called smart tech, a range of features is becoming more common now as standard features in most new cars - for instance, nearly a quarter of consumers have parking sensors in their car.

These features are driven by a range of factors including comfort and safety, but also legislation – the EU has ruled that all vehicles be equipped with autonomous emergency-braking systems together with ten other named safety features by 2021.

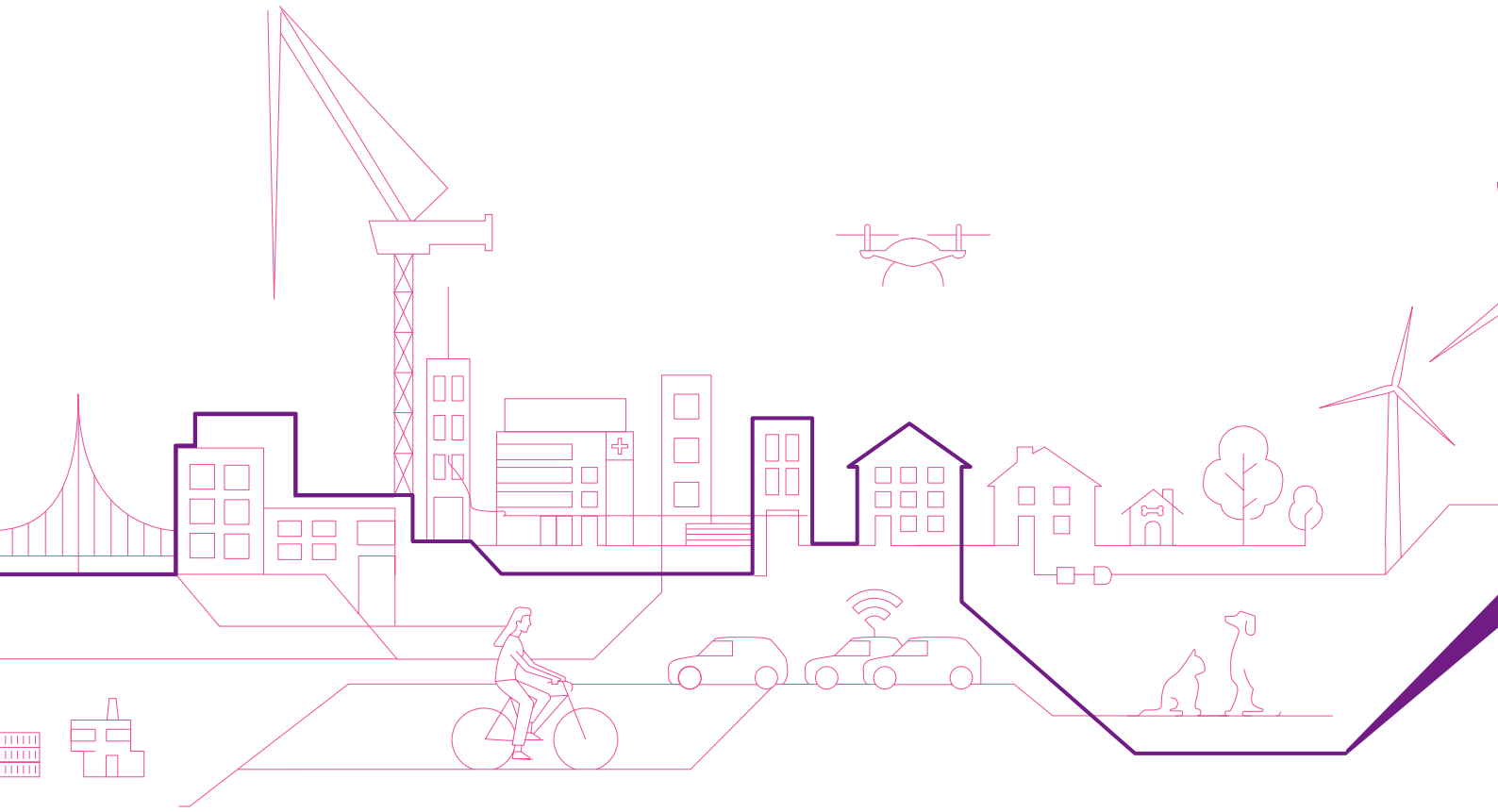
Figure 2 shows some popular current ADAS features and new iterations are regularly being developed and rolled out. Sitting behind the clever functionality is a growing range of sensors – often multiple radars, lidars and cameras / video systems.

Figure 2: Popular ADAS features



As in figure 2, the different features can take varying degrees of control from the driver, but ultimately still require the driver to be attentive and responsible for the safe operation of the vehicle.

Whilst changes to regulations will encourage and control these functionalities there may still be increased risk that drivers misunderstand what their car can and cannot do. As drivers are encouraged to use automation to become further and further 'out-of-the loop', there is the risk that it takes them longer and longer to respond should they need to, with the consequent risk of an accident. Interestingly, this view is shared by 61% of the adults surveyed who said their biggest issue with driverless cars is the technology, with 33% worried that the software will go wrong, 15% not wanting to hand over control to a computer and 9% worried that the cars could get hacked.



Assessing the insurance implications of growing autonomy

This section of our report draws on the experience of the GATEway project to consider the risks and opportunities of the move towards greater autonomy for insurers.

Insurers are highly supportive of driver assistance systems – both those that act in the brief moments before a collision (e.g. AEB) or support, but not replace a driver and those that deliver full automated driving.

Similarly, for those systems with the highest level of autonomy (e.g. the GATEway pods) we are very positive and fully support the deployment at the earliest opportunity. Our experiences on the Greenwich GATEway project reinforces this view.

However, there is a gap in the middle of these ends of the spectrum (around SAE level 3) - where the vehicle can execute most manoeuvres unaided by the driver, but the driver is still expected to intervene (potentially at very short notice) in an emergency – that raises significant concerns about public confusion and safety.

1 The Automated and Electrical Vehicle Bill

The Automated and Electric Vehicle Bill (AEVB), first introduced to Parliament on 18th October 2017 is currently working its way through Parliment and is likely to be enacted in 2018. We see this first piece of legislation as part of a rolling programme of reform driving the Government's agenda of introducing AVs on to the UK's roads and promoting an environment where manufacturers and suppliers can promote the UK's research and development and manufacturing capabilities. Alongside this, the Law Commission has announced a three year review into supporting legislation.

There are five key areas that are particularly likely to affect insurance and insurers. These are:

- The AEVB states that the Secretary of State must prepare and keep up to date, a list of all motor vehicles that meet the definition of an AV.
    - Insurers are actively engaging in the consultation process to help determine the criteria used to create the list. Ideally, the data concerning the automated functionality of a vehicle must be:
        - Available at each individual vehicle level and identifiable via the vehicle identification number (VIN)
        - Capable of being updated for future potential 'over the air' updates
- The Bill provides one point of contact for third parties in the event of an accident i.e. the insurer.
    - Having one point of contact in the event of an accident is 'customer friendly' in that there is no risk of being caught between an insurer and say manufacturer/supplier in trying to determine which organisation is responsible for liability
- The 'driver' of a vehicle that is in autonomous mode is counted as a passenger in the vehicle (a third party) and would be able to claim for injury whereas currently this is not possible as they would be the person responsible.
- The Bill includes strengthened rights of recovery for an insurer against 'persons' responsible for an accident (e.g. supplier or manufacturer).
    - To settle claims arising when vehicles are in autonomous mode, both the insurer and the vehicle manufacturer will need to have immediate access to sufficient data from the vehicle to determine whether the vehicle or driver was in control when the accident occurred.
- It allows for the insurer to exclude or limit payments to an insured person if they made or had knowledge of the unauthorised alteration of software of the vehicle or the failure to install safety critical software.

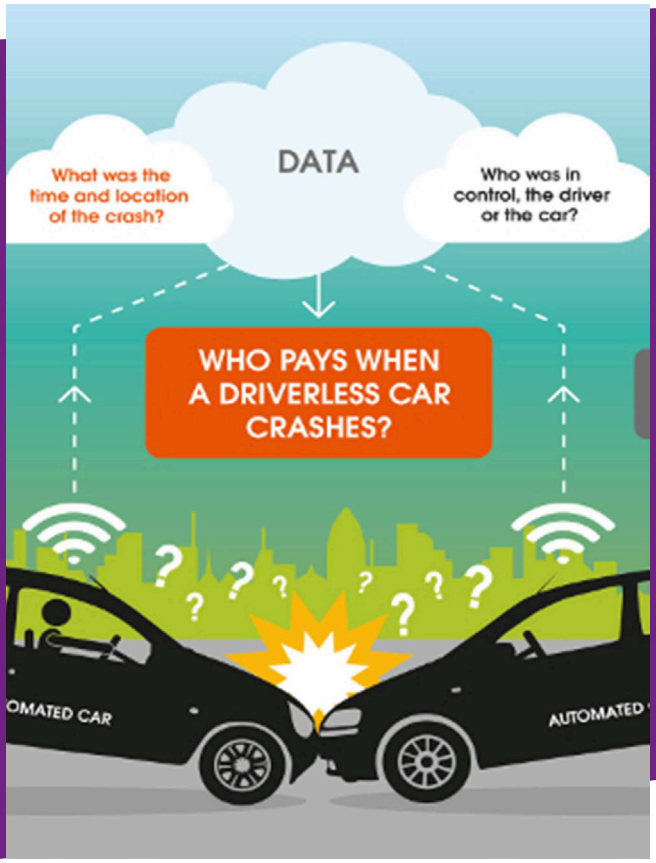
2 Underwriting and pricing

When underwriting any risk, the first and key element is always 'Identification and evaluation of the risk' – Identification and mitigation of risks is key to managing the overall frequency and severity of losses.

In the GATEway pilot, our starting point was to understand what the requirements were that vehicles/operators would need to fulfil in order to be an 'acceptable' risk. Here we relied on the provisions of the DfT Code of Practice. These include provisions around the appropriate stewarding/marshalling of AVs under testing conditions as well as a mandatory speed limit of 15mph. The Code of Practice in conjunction with the TRL safety case demonstrated the risk to be an 'acceptable' one.

In terms of pricing considerations, there are many similarities with traditional risks – a key element for us was the physical security of the pods (similar to the action we would take on any high value vehicle, regardless of type). Location, value, use, claims history and mileage will remain rateable considerations. Moving forward, it is the 'driver' – as a key rating factor – that is likely to be supplanted by the software, hardware and computer algorithms on the vehicle.

Data insurers believe should be available in the event of an incident



Key Data Fields

- GPS-event time stamp
- GPS-event location
- Automated status – on or off
- Automated mode - parking or driving
- Automated transition time stamp
- Record of driver intervention of steering or braking, throttle or indicator
- Time since last driver interaction
- Driver seat occupancy
- Driver belt latch

3 Data availability and capture

Vehicle level data is fundamental to settling claims quickly and efficiently. To determine whether the vehicle had been operating in automated mode at the time of the incident, it will be vital that the insurer has immediate access to sufficient data from the vehicle to determine whether the automated mode was actually being used at the time of the incident.

There will be a number of categories of data that may be available including 'non-sensitive' data such as congestion information; 'commercially sensitive data' (i.e. manufacturer IP on the vehicle); 'personal' data (telemetry – location, speed etc.); and 'incident' specific data (accident data).

Laws and protocols need to be developed around the ownership, handling, storage, security and use of the data for insurers and other stakeholders. Crucially, the data should be provided in a timely and consistent format and readily available to the insurer and manufacturer. Impartial access to technical and occupant information data will allow a fact based assessment of the cause of collisions involving vehicles that have automated driving systems because:

- The presence of systems capable of automated driving is openly identifiable.
- System status is known at the time of the incident.

This is particularly beneficial as:

- It allows for the possibility of the driver as well as the owner of the vehicle to exonerate themselves and be able to prove potential manufacturer liability and vice versa protection of vehicle manufacturers and suppliers against unjustified claims.
- It will save potentially expensive litigation, particularly where cameras are involved as it will more readily identify culpability and end the 'he said, she said' counter claims of those involved in an incident.
- Motor insurers have a level playing field with vehicle manufacturers to establish liability.
- It will enable the continuous improvement of assisted and automated driving systems and the optimisation of road safety.
- The key challenge for the insurance industry will be around timely data access, storage, and analysis, together with mandatory timescales for keeping the data. The Association of British Insurers (ABI) in conjunction with Thatcham, has identified nine data fields that should be mandatorily recorded and stored. This should allow standardised non-discriminating access to the data for all parties with a legitimate interest in an individual case (owner of the vehicle, driver, insurer, vehicle manufacturer, supplier, authorities).

4 Cyber risk

Whilst a cyber-attack is already a potential threat to vehicles, the new generations of assisted and autonomous vehicles are likely to be more susceptible and the results more serious.

A cyber risk could present itself in a number of ways in relation to an insurable event, in the GATEway project these were scoped to be:

- Malicious attack/cyber attack
- Accidental damage during system maintenance
- Inability to recover data due to error
- Insecure or untested hardware or software

These events could have been caused by:

- Networking of computers
- Vehicles linking to other vehicles
- Vehicles linking to other infrastructure
- Deliberate/accidental planting of viruses

With respect to the trials, the safety case provided suitable mitigations against the risk of a cyber event and included industry best practice testing of software and hardware throughout the trials. No cyber-attacks were detected. There will be similar risks and potential mitigations on new production AVs.

Ultimately, there needs to be appropriate technical and organisational measures for protecting the integrity of the vehicles and their systems, which need to start with the manufacturer. High levels of technical safety, including suitable cryptography, layering, separation and identity authentication, should be continuously refined for the software, firmware and hardware of the vehicles as well as remote access to the vehicle via telecommunications networks.

Guidelines for ensuring a vehicles cyber security are currently being developed and include:

- Verifiable security measures based on existing security standards
- Integrity protection measures
- Appropriate measures to manage used cryptographic keys
- Protection of the integrity of internal communications between controllers
- Strong mutual authentication and secure communication for remote access for online services

Insurers support these guidelines, and will need to consider their future approach to cyber and motor vehicles including suitable limits and conditions. At present an event (i.e. first or third party loss caused by a cyber event) would be covered to the extent of the existing policy limits.

5 Claims

Ultimately, a motor policy is considered an 'all-risks' policy so covers 'everything' with specific exclusions. Some covers may be 'unlimited' e.g. third party bodily injury through the auspices of the RTA. Others will have specific limits and these will often be specific to the individual policy or insurer wording.

So whilst there will need to be adaptations to current policies, new rating and pricing, new categories of cover (e.g. cyber), new claims heads of damage and policy wordings will need to be updated to include new definitions and conditions, the motor policy will continue to respond to any insurable event.

With vehicle safety improving, and the number of claims (frequency) reducing, this is going to have a positive effect on the total cost of claims and ultimately on insurance premiums. Vehicles will still be stolen, get damaged and are still expected to have accidents, but any reduction in the 93% of losses caused by human involvement in the driving process will be positive. In our research, this potential impact on affordability of insurance was recognised by only 33% of adults.

One reason for the positive impact is that the enabling technology required to automate the normal driving task will also be capable of enhancing the performance of emergency pre-crash features such as AEB. For example, AEB will operate effectively in complex junction and side-on crashes and will be enhanced by automated emergency steering (AES) to further improve collision avoidance. These new and improved ADAS features are expected to be active 24/7 whilst driving and effective on all road types; regardless of whether the automated driving mode is being used. And as currently nearly 7 in 10 (68%) car owners would choose to keep their own car if given the option between keeping it or getting a driverless car, it does mean safety and road injuries will continue to fall regardless of the speed of adoption of wider autonomy.

The timescales for any impact on premiums will be intrinsically linked to both the timescales for new technology to be fully embedded and deployed and the interaction between the cost of and numbers of claims.

The GATEway project

What was GATEway?

For the past three years, RSA has been one of a number of partners – but the only insurer - collaborating on the government funded GATEway project (Greenwich Automated Transport Environment) into autonomous vehicles.

The GATEway project was a world-leading research programme, funded by government and industry. It aimed to demonstrate the use of automated vehicles for 'last mile' mobility, seamlessly connecting existing transport hubs with residential and commercial areas using a zero emission, low noise, on-demand transport system. Research findings from the project are helping guide the wider roll out of automated vehicle technology in all forms of surface transport, including cars and lorries.

GATEway, based in the Royal Borough of Greenwich, included the testing of a cargo pod in conjunction with grocery delivery company Ocado, trialling Automatic Valet Parking (AVP) and the development of 'pods' capable of operating fully autonomously and safely on the streets of London. Adapted from the automated shuttle pods used at Heathrow, the new pods are capable of navigating UK streets without the need for dedicated tracks.

Developed by British companies Westfield Sportscars, Heathrow Enterprises and Fusion, the pod has no steering wheel or typical driver controls and was the UK's first fully automated shuttle vehicle. By the end of the trials there were a fleet of pods in operation, with up to four running at a time.

RSA's role:

- RSA has been involved since the start of the project in helping understand the risks that come with autonomous vehicles and the mitigations that need to be in place for safe operation.
- RSA provided the insurance for the prototype shuttle and subsequent pods throughout the offsite testing and trialling around the Greenwich Peninsula.
- Being involved in the project has provided us with some key insights into the future potential of fully autonomous vehicles as part of the vehicle landscape and how insurers need to consider and respond to the developing risks and changing nature of vehicle technology.

Throughout the project, safety was a priority for the consortium partners and stakeholders. In the absence of relevant safety standards, a safety case framework was developed by TRL using the Code of Practice (DfT, 2015) as the baseline. The safety case had the following three primary requirements:

- To demonstrate that the trials were safe and that risks to all affected parties had been identified, managed and reduced to a tolerable level.
- To demonstrate compliance with applicable legislation, standards and guidance.
- To provide the required evidence and reassurance to stakeholders including landowners, Royal Borough of Greenwich and other consortium members.

GATEway Consortium Members

The consortium was made up of a number of companies from different sectors, each bringing a different skill set to the group.

Why did RSA participate in this project?

The nature of insurance is changing. In the past we have always been there to help people get their lives back on track following a major incident and/or financial loss. Whilst insurers will continue to help consumers and businesses recover from these events, the nature of risk is changing and we are looking more and more at the technology, products and services that will help prevent these risks from materialising in the first place. We want to be taking a proactive approach to helping our customers avoid such situations.

Automated vehicles are expected to be much safer than conventional vehicles – if we can automate the driving task and reduce the risk of human error; we can improve the safety of our roads. As insurers, we want to be at the forefront of these changes.

Lessons learned

Our engagement in the trial expanded our understanding of the implications of automated and autonomous vehicles and raised a number of new questions for the industry to consider. These include:

1 Access to data

- We need a better understanding of the access to, storage of and ownership of, the data from autonomous vehicles, particularly in the event of an incident or loss.
- The breadth of data and amount of video and camera footage produced by vehicles is extremely large by traditional standards. There is a need to determine whether and how this can be used for rating and underwriting purposes and ensure that the volume and complexity of data can be accommodated.

2 Who is liable?

- Manufacturers and insurers will need to work more closely to determine liability in the event of an incident – whether a vehicle or driver was responsible.
- Whilst the legal and regulatory environment is developing it needs to keep track with the rapid advancements of technology. The Highway Code for instance was written for a different age – different obligations on the 'driver' and new, more up to date guidance is now required.
- Currently a key underwriting factor is the driver and insurers will rate based on age, claims history, medical conditions, convictions and other considerations. When we move to a truly autonomous vehicle these will all be largely superfluous rating factors.
- Replacing the driver as the key pricing factor, will be the software, hardware, sensors and algorithms of the vehicle technology, maybe also the manufacturer's philosophy. As an industry boasting a 'big data' capability, much of the historical claims data and trends will be redundant. New rating methodology will need to be developed.
- Claims teams will be facing different types of claims (e.g. involving sensors, software and hardware elements). Subrogation against third parties is set to increase and AFVs such as electric vehicles, which currently only form circa 5% of vehicles in the UK are likely to become more prevalent – repair networks and supply chains will need to be adapted.

3 Using technology to understand the risks

- It will be important to identify exactly which features are fitted to each vehicle. Different configurations of sensors will impact a vehicle's susceptibility to a claim and which of those features are enabled (i.e. may be fitted but not operational) will also have an effect. Overall there is expected to be a shifting of the dynamics between the frequency and severity of different types of claims.
- How an insurer can price the risk of each system where their functionality and use may differ between safe and potentially unsafe functionalities and different 'design domains will be a key question.

4 Public understanding

- An interesting lesson from the GATEway project was the generally positive feedback from the public during the trials – the vast majority of whom either saw the pods in action, or had the opportunity to ride in one.
- While we are unlikely to see the pods travelling on a motorway they definitely have a place in smart city development, and the general public is supportive of this.
- However, broader questions around public understanding do need to be tackled.
    - Will drivers understand what is and isn't automated driving?
    - Will drivers become confused as to when they are driving and when they are not?
    - Will variation in performance, attentiveness and handover procedures between different manufacturers create further confusion?
    - Does this confusion create the potential for a new category of (potentially serious) accidents where a driver fails to respond appropriately to take-over requests from the vehicle?
    - How will manufacturers, dealerships and hire companies etc. educate drivers as to the capability of their vehicles and their responsibilities as drivers? Will that responsibility fall on insurers?

Ultimately insurers will become responsible for any accident involving a vehicle operating in an automated mode, so over the next few years insurers will need to engage with all of these issues: sharing information and seeking answers to the questions collaboratively.

Consumer survey results

Throughout the GATEway project, the temperature of the public was taken to see their understanding and support for this driving horizon. RSA also authorized an independent survey of over 10,000 UK drivers – 88% of which were also car owners to get a current read about their views on driverless cars now that the first phase of the project was complete.

Welcoming AVs and soon....

Overall 61% of drivers welcomed the arrival of the self-driving or driverless car with nearly nine out ten drivers wanting our roads safer for all road users – motorists, cyclists and pedestrians. 67% saw this as within touching distance – believing we will have driverless cars on the road within the next ten years.

The chance to change what happens on our roads had strong appeal:

- Nearly 7 in 10 adults want to see no more drink drivers on UK roads (67%)
- More than half want no more speeding drivers (54%)
- Just under half want no more prangs or accidents (47%)
- 59% want less traffic
- 57% no more traffic jams at all

The impact on the environment was also paramount - 54% want less pollution, 48% wish to see less litter and rubbish, and 30% less roadkill.

...by educating our biggest fears

In spite of this enthusiasm for driving's new future, respondents expressed concern about the safety aspects of the new technology being used.

61% of adults surveyed saying their biggest issue with driverless cars is the technology, with 33% worried that the software will go wrong and cars will still crash. 15% don't want to hand over control to a computer – they go wrong all the time, 9% worried that the cars could get hacked and 4% simply don't understand the technology.

The Gateway Project

"The driverless car is far more than just a moving piece of office IT. In the medium-term, problems such as ensuring that vehicles can trust connections to things around them with a digital pulse, including other cars, remains an open but tractable problem. Detecting security issues during the operation of such systems, countering problems in real-time and the legal ramifications of failure are all things that will keep our community and our wider networks working for some time to come."

The Security of Driverless Cars
Dr Deeph Chana,
Deputy Director, Institute for Security Science and Technology,
Imperial College, London

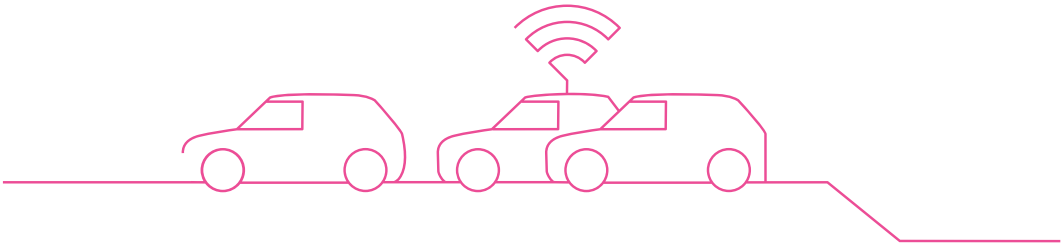
The gender differences were also stark when it came to safety. More men are swayed by the idea of self-driving cars than women – 32% of men say they like the idea of autonomous vehicles, as the future of cars sounds exciting. This compares to 23% of women. Conversely, women are most likely to say they don't like the idea due to safety concerns (33%).

Is safety the biggest concern?

Ironically whilst safety of the new technology was the biggest concern, the concern for safety was not reflected in the respondents' choice of features for an ideal car. When presented with 32 features for the optimum car – including many safety features such as Automatic Emergency Braking, autopilot, lane control, automatic parking and parking sensors – only one safety feature made the top five:

Features on the ideal car:

1. Puncture proof tyres **60%**
2. Parking sensors **60%**
3. Air-conditioning **59%**
4. Power steering **59%**
5. Satnav **56%**



However, there was a stark contrast in the preferences of younger drivers, whose lifestyle was reflected in the choices they made about their ideal car, 18-24-year-olds are significantly more interested than the older age groups in Bluetooth (52%) charging points (48%), bulletproof glass (37%), on-board assistants like Onstar or Alexa (30%) and biometric entry (29%).

The impact on car insurance

When AVs are fully adopted the impact on our roads will be significant in the reduction of deaths, injuries and vehicle repairs. This has the potential to create a very positive impact for insurance claims and therefore insurance premiums.

Overall survey respondents recognised this as over a third of people think driverless cars will significantly reduce the 1.2 million deaths on the world's roads each year and a third believing driverless cars will make insurance premiums more affordable. However, men are significantly more positive that driverless cars will reduce the number of road deaths per year (44% versus 26%).

Of those who think it will reduce premiums, 70% expect they will drop by at least 25% in price. Again, the gender bias was significant - more men (40%) think insurance premiums will be made more affordable thanks to driverless cars than women (27%).

All modes of transport...

The positive attitude to AVs extended beyond the car. While one in five adults believe that driverless transportation is best for all journey types listed, including mass transportation, long motorway journeys, journeys under a mile and personal journeys - nearly a third (30%) believe driverless transportation would be best for mass transportation.

More than half (53%) were happy to fly on a plane which uses autopilot during the flight, 56% on trains like the Docklands Light Railway which run without a driver and, on the ground, 67% would be happy to travel on airport mass transit systems like monorails and where pods ferry you from the car park to terminals,

Irrespective of the transport only one in ten (9%) said they would avoid using it all if they knew it was "driverless".

The pace of change, adoption and implications

Automation is only one of the trends we are seeing within insurance more generally and specifically within motor insurance. Consumer trends are helping to drive innovation in insurance models and InsurTech.

At RSA we put customers at the heart of our business and InsurTech will provide new ways of helping us to do this. It can help us be more proactive, efficient in the provision of customer-friendly insurance products and provide cover for new and emerging risks.

Figure 3: Effect of InsurTech on motor insurers

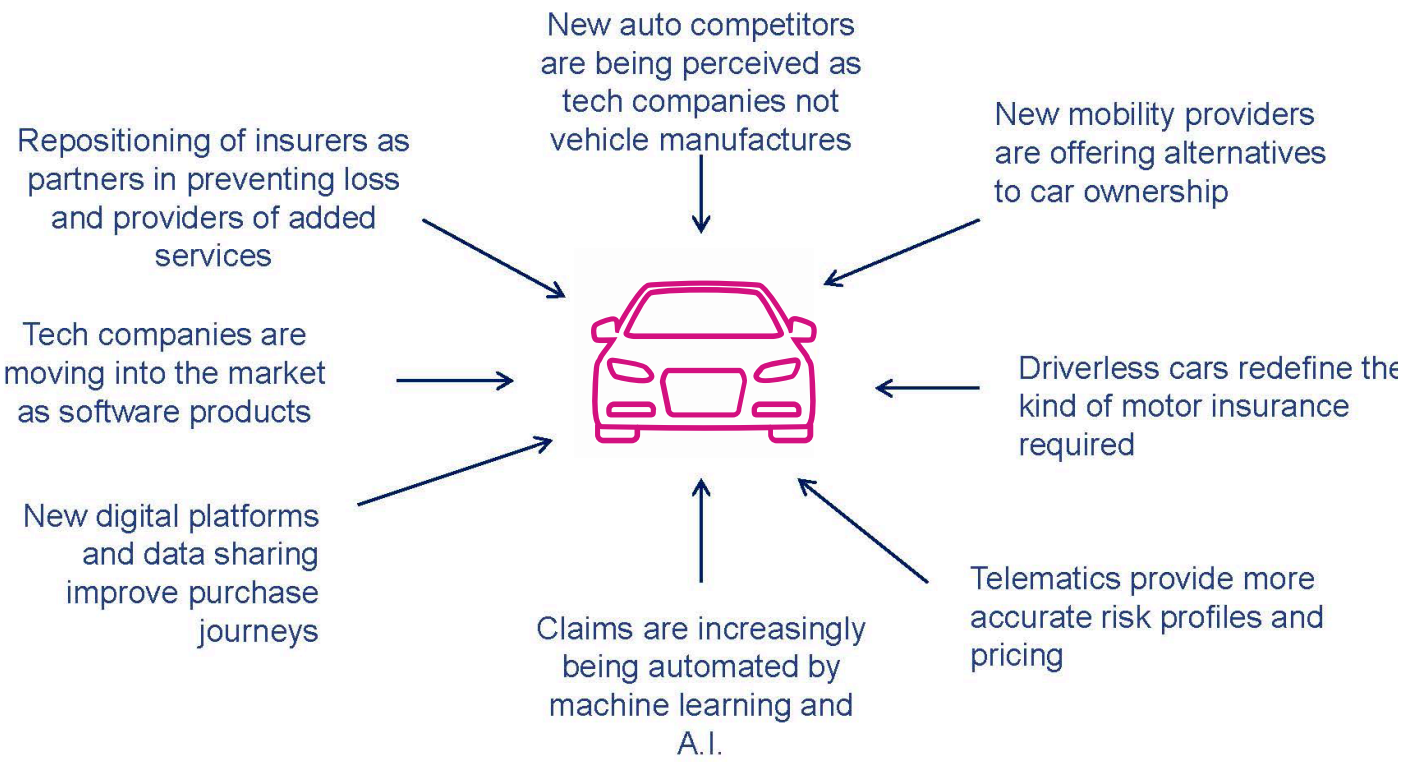


Figure 3 shows some of the influences currently coming to bear on the industry, including autonomous vehicles starting to redefine the kind of motor insurance required. It's likely that a number of the influences will converge and happen in conjunction with each other. For instance, driverless cars may be linked to new mobility providers offering alternative propositions to the current car ownership model.

The changing landscape and consumer uptake

We don't know how quickly ADAS (Advanced Driver Assistance Systems) and technology will become established; either in terms of timelines or geographical roll out (including 'design domains'), but adoption will steadily grow though the six SAE levels of autonomy as the technology delivers. Wider societal shifts will support this change:

- Usage not ownership – car sharing and ride sharing is on the up. Density in cities is slowing down car ownership.
- Change in fuel types – for example the move towards electric vehicles.
- Environmental concerns including pollution levels.
- An increasing proportion of millennials and younger population cohorts with different expectations and the increasing consumer adoption of technology.

Take up will be influenced by growing evidence of benefits over time, manufacturer marketing, and greater penetration and integration of technology such as automated braking in all types of vehicle, making it a more accepted and everyday part of driving.

> "Autonomous driving is not going to be a Big Bang; it's going to be a series of little steps"
>
> *Toscan Bennet, Vice President Product Planning, Volvo*

Challenges for motor insurers and future insurance implications

The slow build towards take up and full automation will bring with it its own challenges, which the insurance industry will need to carefully consider and respond.

- Will the customer understand what is and what isn't automated driving? Will drivers become confused as to when they are ' driving' or not?
- Will the variations in description of systems, performance, attentiveness and handover procedure between different manufacturers create confusion?
- New types of collision may occur in assisted driving modes where the vehicle provides a high level of assistance in driving tasks, but the driver may not be sufficiently aware to intervene appropriately in problematic situations, which could occur at any time.
- Whilst different vehicles have similar assisted features, the functionalities of these features may be quite different, potentially leading to driver confusion and incidents.
- Manually driven, assisted and automated vehicles will need to co-exist and share our roads - a mixed and evolving car park will represent an ongoing risk to insurers.
- The need to shift the emphasis on underwriting and pricing away from the 'driver' and on to the software, hardware, sensors and algorithms deployed on autonomous vehicles. Data and pricing/rating algorithms will need to be developed .
- Claims handling procedures will need to be reviewed to take into account the emerging technologies including new sensors and hardware as well the potential increase in subrogation against third parties. Insurer Repair Networks will have to be able to deal with new technologies, calibrations of sensors and the potential increase in AFVs. With the AEVB bill enacted, there will also need to be a good understanding around the revised liabilities of different parties.

Finally, underpinning the development in technology is the need for regulation and legislation to adapt to and keep up with technological advances and infrastructure to be fit for purpose.

So when will we see changes?

The answer is that we are already seeing changes through the introduction of technology and a changing trend in claims – the frequency of losses is gradually falling as assistance systems (e.g. AEB) are making driving and the roads a safer place. Alongside this, the severity (cost) of claims is rising. This can be attributable to the cost of the technology – lidars, radars, cameras etc. all come at a price and with the technology adapting fast, and becoming more 'cutting edge', the cost to an insurer from even modest incidents with no third party involvement, will initially be more expensive claim settlements.

Another consideration is that whilst new technology is being constantly rolled out, it often starts on high end and prestige vehicles or as expensive optional extras. AEB, for instance, which has been around for over five years is still only a standard or optional fit on around 50% of new cars. Allied to the fact that the average age of vehicles on the UK roads is around seven to nine years old, we can see that whilst proven technology can make the roads safer, it can take upwards of a decade or more for new technology to be standard on more than 75% of vehicles on the road at any one time.

Looking ahead, it is useful to look at the future across different time horizons:

Medium term (5-10 years)

AEB and other driver assist functions such as cruise control and ABS (anti-lock braking systems) are now a standard fit on many vehicles, with the latter having been mandatory on new EU cars since 2004. Other technologies are constantly being introduced and will become more commonplace over the next decade. These are likely to include a number of Level 4 AVs, certainly operating in defined domains e.g. on motorways.

As most of the advances are incremental and often marketed as safety or comfort features, consumers are likely to accept the first of these without question. However, with regards to higher level autonomy, it is more difficult to predict the speed with which we will see mass adoption – public acceptance becomes more of an issue and may be linked to negative press reports around incidents involving AVs. Perceptions around overall safety of technology are increasingly important.

Linked to this is the importance of education – making sure drivers receive adequate training and guidance around exactly what the vehicle is capable of and what their responsibilities are.

Long term (10-30 years)

If the rate of adoption in the medium term is unclear, it is even more so over the longer term as there are so many unknown factors (infrastructure preparedness including suitable communications' networks, regulations and legislation, as well as consumer adoption).

Timescales vary hugely with a recent Bank of England survey estimating that fully-autonomous new car sales will not outweigh manual cars until 2031 and with new cars only making up around 10% of the cars on our roads; it will be much longer before the majority of cars are driverless. Other commentators are more bullish suggesting a quicker adoption mid 2020's and some predicting wide scale adoption being 25 or more years away.

> "Several industry analysts note that wide scale adoption of autonomous vehicles will not be fully realized for at least 25 more years"
>
> *Munich Re*

Whilst longer term adoption is difficult to predict, it is likely that fully-autonomous cars will be available to consumers sooner – early 2020s and that we are likely to see AVs operating on public roads by 2025. This is certainly in line with the Government's ambition. The Bank of England's survey of insurers and technology firms indicates that autonomous vehicles (Levels 4 or 5) would account for 30% of new vehicle sales by 2027.

Regardless of speed of adoption, early entrants are likely to be 'domain restricted' (e.g. motorways), part of 'last mile' or urban centre solutions (e.g. complementary to existing park and ride offerings).

Summary

Autonomous vehicles are coming - they are no longer a space age fantasy. With over 31m vehicles on the road and this figure still rising autonomous vehicles have the potential to make journeys smoother, more energy efficient and safer.

Around 93% of all crashes are attributed to human error and so driver automation using robust and well-designed technology has the potential to significantly reduce death and injuries and with over one million deaths on the world's roads each year the benefits will be huge.

And whilst full autonomy may be seen by many as the ultimate end game, the intervening period of disruption will be considerable. As an industry, we need to be looking now at the opportunities and implications that technology is bringing in this area. Every major motor manufacturer and tier one automotive supplier will have an AV strategy and alongside traditional manufacturers, many of the world's largest technology companies and many SMEs and research institutions are also involved in AV research and development.

It is crucial that there is a clear definition of what constitutes an automated vehicle, so that regulators and insurers can classify and provide insurance cover for these vehicles appropriately and whilst technology itself is not the sole determinant: we need a robust infrastructure and communications network in place supported by updated regulations and legislation. Education is also tremendously important. Drivers need to know the capabilities of their vehicles and what responsibilities lay with them. Education for the driver, particularly facing different systems from manufacturers, will be key and whilst there are various changes in legislation and regulations underway, much more is needed before the rules that govern Britain's roads and cars are aligned with the shifts in technology.

Whilst timescales are fluid and societal changes and public perceptions of the safety of autonomous vehicles are key, greater autonomy is coming and we need to be prepared for it!

Glossary of terms

ABI	Association of British Insurers
ABS	Anti-locking Braking Systems
ACC	Adaptive Cruise Control
AD	Assisted Driving
ADAS	Advanced Driver Assistance Systems
AEB	Autonomous Emergency Braking
AES	Automated Emergency Steering
AEVB	Autonomous & Electric Vehicle Bill
AFV	Alternative Fuel Vehicles
AV	Autonomous Vehicles
BLIS	Blind Spot Information System
C-CAV	Centre – Connected and Autonomous vehicles
ESC	Electronic Stability Control
GATEway	Greenwich Automated Transport Environment
LDW	Lane Departure Warning
LKA	Lane Keep Assistance
RTA	Road Traffic Accident
SAE	Society of Automotive Engineers
WHO	World Health Organisation

About the author

With over 30 years in the industry, Ian Kemp is an experienced underwriting professional and has been responsible for the RSA commercial motor portfolio for the past eight years.

Ian is the company lead in the Greenwich GATEway autonomous vehicle project and a consortium board member. The GATEway project trialed both AVP technologies and level 5 autonomous 'pods' around the Greenwich peninsula testing technology, user sentiment and the interaction between autonomous vehicles and pedestrians. Ian is also a member of the CIHT and sits on the ABI committee looking at future vehicle technologies. He is a regular speaker at industry events on industry developments.

Ian has a fascination for all things motor and sees an unprecedented period of disruption and realignment ahead for the industry over the next five years driven by increasing levels of technology, automation, shift in customer behaviours and societal level changes.

Ian Kemp, Charterer Insurer, ACII, MBA, MCIHT
RSA Commercial Motor Underwriting Director

APPENDIX 1

RSA Self Drive Research – Research methodology

An online survey was conducted by Atomik Research among 10,003 UK adults – made up of 9,001 drivers and 1,002 non-drivers. This included 8,842 car owners and 1,161 non car owners. The research fieldwork took place between 7th and 20th June 2018. Atomik Research is an independent creative market research agency that employs MRS-certified researchers and abides to MRS code.

General attitudes towards driverless cars

- 39% of adults surveyed do not like the idea of self-driving cars, with 27% worrying about the safety of them and 11% saying they love to drive and don't want to give it up. However, 27% do like the thought of autonomous vehicles as the future of cars sounds exciting. 15% say it sounds ok and 18% aren't sure as they don't understand enough about it.
    - 28% of drivers think the future of driverless cars sounds exciting, compared to 20% of non-drivers.
    - 35% of non-drivers worry about the safety of driverless cars, compared to 26% of drivers.
- While 67% would be happy to travel on airport mass transit systems like monorails and where pods ferry you from the car park to terminals, 24% would prefer not to, and 9% would actually avoid travelling in this way because it's driverless.
- Though nearly half of those surveyed (47%) would not enjoy traveling on a plane which uses autopilot during the flight 53% don't mind that it's driverless.
- 56% would be happy on trains like the Docklands Light Railway which run without a driver, though 32% would prefer not to and 12% would avoid travelling in this way because it's driverless.
- 61% of adults surveyed say their biggest issue with driverless cars is the technology, with 33% worried that the software will go wrong and cars will still crash, 15% don't want to hand over control to a computer – they go wrong all the time, 9% worried that the cars could get hacked and 4% simply don't understand the technology.
- One in three adults find nothing exciting about driverless cars (35%). However 14% are excited driverless cars could offer a journey without any stress, 12% look forward to not having to navigate or worry about getting lost and 12% are excited to be able to relax and have some down time.
- Only 27% of adults feel self-driving cars which would allow children, the elderly, the blind, and people with disabilities to "drive" would be a good idea. 34% did not think it was a good idea and 35% answered maybe.
- The majority (67%) of adults surveyed believe we will have driverless cars on the road within the next 10 years; while 28% think it will be over a decade away and 5% believing we will never have it.
- A third (33%) of adults think driverless cars will make insurance premiums more affordable. Of those who think it will reduce premiums, 70% expect they will drop by at least 25% in price.
- However, 36% of adults surveyed don't think it will make premiums more affordable and 31% don't know.
- 35% of people think driverless cars will significantly reduce the 1.2 million deaths on the world's roads each year. However, 32% don't think we will see a significant reduction and 33% don't know.

Vehicle preferences

- 87% of adults would like our roads to be safer for all users, including drivers, cyclists and pedestrians.

- Nearly 7 in 10 adults would like to see no more drink drivers on UK roads (67%), over half want no more speeding drivers (54%) and no more prangs or accidents (47%). Many adults would like to see less traffic (59%) and no more traffic jams at all on UK roads (57%). Concerning the environment, 54% would like less pollution, 48% wish to see less litter and rubbish and 30% less roadkill.

    1. When imagining their ideal car these were the top 10 features adults would like to have:
    2. Puncture proof tyres (60%)
    3. Parking sensors (60%)
    4. Air-conditioning (59%)
    5. Power steering (59%)
    6. Satnav (56%)
    7. Electronic windows (55%)
    8. Automatic windscreen wipers (48%)
    9. Automatic parking (48%)
    10. Automatic lights (48%)
    11. Traffic jam alerts (46%)

- One in five adults did not know what they would like their cars to be powered by even if money were no object (20%). However, 54% would like their car to be powered by cleaner methods such as solar (21%), electric (18%) or a hybrid (15%).

- While one in five adults believe that driverless transportation is best for all journey types listed, including mass transportation, long motorway journeys, journeys under a mile and personal journeys, 22% believe that driverless transportation would not be better for any of these journeys.

- People are more likely to say driverless transportation would be best for mass transportation (30%) than personal journeys (14%).

- When asked about the situations that driverless cars would be most suitable for, 26% say motorways only and 21% say urban or city driving only. However, 27% think all of the above situations (including rural driving) and 21% say none of these situations.

- Despite over a quarter (27%) of adults surveyed feeling that driverless cars would be most suitable for all situations, only 20% are willing to trade their own car for a driverless car.

- Nearly 7 in 10 (68%) car owners would choose to keep their own car if given the option between keeping it and getting a driverless car.

Gender differences

- More men are swayed by the idea of self-driving cars than women – 32% of men say they like the idea of autonomous vehicles, as the future of cars sounds exciting. This compares to 23% of women. Conversely, women are most likely to say they don't like the idea due to safety concerns (33%).

- Women are more likely than men to avoid autonomous methods of travel due to it being driverless – such as in a plane with autopilot (19%) and on trains like the DLR without a driver (14%).

- The main concern that women have with driverless cars is that the software will go wrong and cars will still crash (37%).

- Furthermore, driverless cars mean children, the elderly, the blind and people with disabilities would be able to "drive" cars, which 39% of women say isn't a good idea while just 20% think it is. In comparison, more men think it is a good idea (34%) than not (28%).

- Men are significantly more positive that driverless cars will reduce the number of road deaths per year significantly (44%) than women (26%) are.

- More men (40%) think insurance premiums will be made more affordable thanks to driverless cars than women (27%).

Age differences

- 18-24-year-olds are the most positive about driverless cars – 50% think the future of cars sounds exciting, compared to just 20% of 45-54s, and 13% of over-55s.
- Older adults are most likely to worry about the safety of these vehicles, including 40% of over-55s and a third (33%) of 45-54s.
- All age groups share the main concern of software failing and driverless cars still crashing. Yet while older adults are more likely to say they don't understand how we can have traditional and self-driving cars on the roads together (17% of over-55s) or that they don't want to hand over control to a computer (17% of over-55s), younger adults aged 18-24 are more likely than older adults to worry about the potential for hacking (16% of 18-24s vs 6% of over-55s).
- 57% of over-55s say nothing excites them about driverless cars.
- Imagining their ideal car, 18-24-year-olds are significantly more interested than the older age groups in Bluetooth (52%) charging points (48%), bulletproof glass (37%), on-board assistants like Onstar or Alexa (30%) and biometric entry (29%).
- Over-55s are most likely to want more practical elements, that aren't so futuristic, such as air-conditioning (68%), automatic lights (55%), automatic parking (55%) and automatic windscreen wipers (57%).
- 52% of 18-24s and 50% of 25-44s think driverless cars will reduce road accident deaths, compared to 29% of 45-54s and 19% of over-55s.
- 18-24s (53%) and 25-44s (47%) are also most likely to think insurance premiums will be more affordable as a result of driverless cars, with a hopeful 29% of these age groups thinking they will be reduced by half / 50% and 36% thinking they could be reduced by a quarter.
- Just over half (54%) of 18-24s think driverless cars will be on the roads within 5 years, compared to 51% of 25-34s, 45% of 35-44s, 31% of 45-54s and 28% of over-55s. 35% of over-55s think it is over a decade away compared to 16% of 18-24s.
- 29% of 18-24s would trade their car in for a driverless car if they have the choice, compared to 25% of 25-44s, 20% of 45-54s and 12% of over-55s.