Law Commission
Reforming the law

Scottish Law Commission
promoting law reform

Automated Vehicles: Consultation Paper 3 - A regulatory framework for automated vehicles

A joint consultation paper

Law Commission
Consultation Paper 252

Scottish Law Commission
Discussion Paper 171

Law Commission

Reforming the law

Scottish Law Commission

promoting law reform

Law Commission

Consultation Paper No 252

Scottish Law Commission

Discussion Paper No 171

Automated Vehicles:

Consultation Paper 3 –

A regulatory framework for automated vehicles

A joint consultation paper

18 December 2020

This publication is available at https://www.lawcom.gov.uk/project/automated-vehicles/ and at https://www.scotlawcom.gov.uk/publications.

THE LAW COMMISSIONS – HOW WE CONSULT

Topic of this consultation: In 2018, the Centre for Connected and Automated Vehicles (CCAV) asked the Law Commission of England and Wales and the Scottish Law Commission to examine options for regulating automated road vehicles.

This is the third paper in that review. We make provisional proposals for a new regulatory system, examining the definition of "self-driving"; safety assurance before AVs are deployed on the road; and how to assure safety on an ongoing basis. We also consider user and fleet operator responsibilities, civil liability, criminal liability and access to data.

Duration of the consultation: We invite responses from 18 December 2020 to 18 March 2021.

Comments may be sent:

Using an online form at:

https://consult.justice.gov.uk/law-commission/automated-vehicles-regulatory-framework

We have also produced a questionnaire in word format available on request. We are happy to accept comments in other formats. Please send your response:

By email to	automatedvehicles@lawcommission.gov.uk
OR	
By post to	Automated Vehicles Team, Law Commission, 1st Floor, Tower, 52 Queen Anne's Gate, London, SW1H 9AG.

If you send your comments by post, it would be helpful if, whenever possible, you could also send them by email.

Availability of materials: The consultation paper is available on our websites at https://www.lawcom.gov.uk/project/automated-vehicles/ and https://www.scotlawcom.gov.uk/law-reform/law-reform-projects/joint-projects/automated-vehicles/
We are committed to providing accessible publications. If you require this consultation paper to be made available in a different format please email automatedvehicles@lawcommission.gov.uk or call 020 3334 0200.

After the consultation: The responses to this consultation will inform the next stages of this project. We aim to produce a final report with recommendations by the end of 2021.

Geographical scope: This consultation paper applies to the laws of England, Wales and Scotland.

Consultation Principles: The Law Commission follows the Consultation Principles set out by the Cabinet Office. The Principles are available on the Cabinet Office website at: https://www.gov.uk/government/publications/consultation-principles-guidance.

Information provided to the Law Commissions: We aim to be transparent in our decision-making, and to explain the basis on which we have reached conclusions. This means that we may publish or disclose information you provide, including personal information. For example, we may publish an extract of your response in the Law Commissions' publications, or publish the response itself. Additionally, we may be required to disclose the information in accordance with the Freedom of Information Act 2000 or the Freedom of Information (Scotland) Act 2002. We will process your personal data in accordance with the General Data Protection Regulation.

If you consider that it is necessary for all or some of the information that you provide to be treated as confidential, and so neither published nor disclosed, please contact us before sending it. Please limit the confidential material to the minimum, clearly identify it and explain why you want it to be confidential. We cannot guarantee that confidentiality can be maintained in all circumstances and an automatic disclaimer generated by your IT system will not be regarded as binding on the Law Commissions.

Alternatively, you may want your response to be anonymous. That means that we may refer to what you say in your response but will not reveal that the information came from you. If so, please make this clear.

We list those who responded to our consultations in our reports. If you provide a confidential response your name will appear in that list. If your response is anonymous, we will not include your name in the list unless you have given us permission to do so.

Further information about how we handle data is available at https://www.lawcom.gov.uk/document/handling-data/ and https://www.scotlawcom.gov.uk/about-us/freedom-information/.

Any queries about the contents of this Privacy Notice can be directed to:

enquiries@lawcommission.gov.uk and info@scotlawcom.gov.uk.

About the Law Commissions: The Law Commission and the Scottish Law Commission were set up by the Law Commissions Act 1965 for the purpose of promoting the reform of the law.

The Law Commissioners are: The Hon Mr Justice Green, *Chair*, Professor Sarah Green, Professor Nicholas Hopkins, Professor Penney Lewis and Nicholas Paines QC. The Chief Executive is Phillip Golding.

The Scottish Law Commissioners are: The Rt Hon Lady Paton, *Chair*, David Bartos, Professor Gillian Black, Kate Dowdalls QC and Professor Frankie McCarthy. The Chief Executive is Malcolm McMillan.

List of Abbreviations

ABI: The Association of British Insurers.

ADS: Automated Driving System.

ADAS: Advanced Driver Assistance System.

ADSE: Automated Driving System Entity.

AEV Act: Automated and Electric Vehicles Act 2018.

ALARP: as low as reasonably practicable.

ALKS: Automated Lane Keeping System.

AV: automated vehicle.

BSI: British Standards Institution.

CAV: Connected and Autonomous Vehicle.

CCAV: Centre for Connected and Autonomous Vehicles.

CP1: Consultation Paper 1.

CP2: Consultation Paper 2.

DfT: Department for Transport.

DDT: Dynamic Driving Task.

DSSAD: Data Storage Systems for Automated Driving.

DVSA: Driver and Vehicle Standards Agency.

EDR: Event Data Recorder.

GDPR: General Data Protection Regulation 2016/679.

GPSR: General Product Safety Regulations 2005 SI 2005/1803.

HARPS: Highly Automated Road Passenger Service.

IEEE: Institute of Electrical and Electronics Engineers.

ISO: International Organization for Standardisation.

MSU: Market Surveillance Unit.

NUIC: No user-in-charge vehicle.

NSSTA: National Small Series Type Approval.

ODD: Operational Design Domain.

OECD: Organisation for Economic Co-operation and Development.

OEM: Original Equipment Manufacturer.

PHV: Private Hire Vehicle.

PSV: Public Service Vehicle.

SAE: Society of Automotive Engineers.

SMMT: Society of Motor Manufacturers and Traders.

StVG: *Strassenverkehrsgesetz* (the German Road Traffic Act).

TfL: Transport for London.

TRO: Traffic Regulation Order.

UNECE: United Nations Economic Commission for Europe.

VCA: Vehicle Certification Agency.

WVTA: Whole Vehicle Type-Approval.

Glossary

ABI/Thatcham Report: Association of British Insurers (ABI) and Thatcham Research, *Defining Safe Automated Driving. Insurer Requirements for Highway Automation* (September 2019).

Advanced Driver Assistance System: Vehicle-based electronic systems which provide driver assistance.

Automated driving system: A term used in the SAE Taxonomy to describe a vehicle system that uses both hardware and software to perform the dynamic driving task on a sustained basis. Sometimes abbreviated to ADS.

Automated driving system entity: The entity that puts the ADS forward for legal categorisation as self-driving and is legally responsible for how the ADS performs dynamic control. The automated driving system entity must have been closely involved in assessing the safety of the ADS and have sufficient funds (e.g. to organise a recall). This may be the vehicle manufacturer or software designer or a joint venture between the two. We discuss the ADSE role and its associated obligations in Chapter 8. Sometimes abbreviated as ADSE.

Automated Lane Keeping System (ALKS): a system which steers and controls vehicle speed in lane for extended periods on motorways.

ALKS Regulation: UN Regulation 157 on uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems ECE/TRANS/WP.29/2020/81 (25 June 2020).

Allianz study: MA Kreutner and others, *Needs and Requirements of EDR for Automated Vehicles – Analysis based on Insurance Claims Reported to Allianz Germany*.

Automated vehicles: a general term used to describe vehicles containing an automated driving system which is able to perform the dynamic driving task.

Call for Evidence: Centre for Connected and Autonomous Vehicles, *Safe Use of Automated Driving Systems Call for Evidence* (August 2020).

Conditional automation: A term used in the SAE Taxonomy to describe an automated driving system which can perform the entire dynamic driving task but with the expectation that a user will be receptive and respond appropriately to requests to intervene and certain failures affecting the vehicle: SAE Level 3.

Connectivity: Connectivity in the context of connected cars refers to cars with a wireless connection that allows them to communicate with their internal and external environments, including with a remote supervisor and with other cars in a fleet of connected cars.

Consultation Paper 1: The first consultation paper in the joint review of automated vehicles by the Law Commission and Scottish Law Commission. It was published in November 2018 and is available at: https://www.lawcom.gov.uk/project/automated-vehicles/.

Consultation Paper 2: The second consultation paper in the joint review of automated vehicles by the Law Commission and Scottish Law Commission. It was published in October 2019 and is available at: https://www.lawcom.gov.uk/project/automated-vehicles/.

Cybersecurity Regulation: UN Regulation on uniform provisions concerning the approval of vehicles with regard to cyber security and of cybersecurity management systems, ECE/TRANS/WP.29/2020/79.

DfT Annual Report 2019: Department for Transport, *Reported Road Casualties in Great Britain, Annual Report 2019* (September 2020).

Driver assistance: Individual automation features such as adaptive cruise control or lane changing features which assist the driver. The driver is still responsible for the dynamic driving task including monitoring the environment.

Dynamic driving task: A term used in the SAE Taxonomy to describe the real-time operational and tactical functions required to operate a vehicle in on-road traffic, excluding the strategic functions such as trip scheduling and selection of destinations and waypoints.

Fault accident: An accident where, if a human driver had driven the car instead of an ADS, the driver would be held liable for causing the accident in the civil law of negligence.

Haptic: involving the transmission of information through sense of touch.

HARPS: Highly automated road passenger services. The term refers to a service which uses highly automated vehicles to supply road journeys to passengers without a human driver or user-in-charge. Some services may resemble taxi, private hire or bus services; others may look and operate differently.

HF-IRADS: Human Factors in International Regulations for Automated Driving Systems group position paper submitted on 18 September 2020 to the Global Forum for Road Traffic Safety.

Highly automated vehicle: a term used in the SAE Taxonomy to describe a vehicle equipped with an automated driving system which can perform the dynamic driving task without requiring a user to be receptive to requests to intervene. SAE Level 4.

Human factors research: The study of how humans behave, both physically and mentally, in relation to particular environments, systems, products or services. Also sometimes referred to as ergonomics.

ISO/SAE DPAS 22736: A draft revision to the SAE Taxonomy dated November 2020.

Minimal risk condition: A term used in the SAE Taxonomy to describe a stable, stopped condition to which a user or an ADS may bring a vehicle in order to reduce the risk of a crash when a given trip cannot or should not be continued.

Mobileye RSS Report: Mobileye, S Shalev-Shwartz, S Shammah and A Shashua, "On a Formal Model of Safe and Scalable Self-driving Cars" (2017).

Non-user-in-charge (NUIC) vehicle: a highly automated vehicle which is authorised for use without a user-in-charge.

Original Equipment Manufacturer: The manufacturer who assembles the entire vehicle and who can apply for "systems" approval.

Operational design domain: A term used in the SAE Taxonomy to describe the domain within which an automated driving system can drive itself. It may be limited by geography, time, type of road, weather or in some other way. Sometimes abbreviated to ODD.

RAND Report: M Blumenthal and others, *Safe Enough: Approaches to Assessing Acceptable Safety for Automated Vehicles, RAND Corporation* (October 2020).

Remote supervision: Using connectivity to allow a human to supervise vehicles even if they are not in vehicle or in line of sight of the vehicle.

Revised General Safety Regulation 2019/2144: Regulation 2019/2144 on type-approval requirements as regards general safety and the protection of vehicle occupants and vulnerable road users.

Risk mitigation manoeuvre: Bringing the vehicle to a controlled stop.

Self-driving vehicle: A vehicle which meets the legal definition of self-driving for the purposes of the Automated and Electric Vehicles Act 2018 and is classified as able to safely drive itself under the proposals in this paper.

Society of Automotive Engineers International (SAE): The society which established the levels of automation of vehicles from 0 to 5 in their technical document J3016.

SAE Taxonomy: Society of Automotive Engineers International, J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles first published in 2014 and last revised in June 2018.

Society of Motor Manufacturers and Traders: A trade association representing more than 800 automotive companies in the UK.

Software Update Regulation: UN Regulation on uniform provisions concerning the approval of vehicles with regard to software update processes and software update management systems.

Transition demand: An alert issued by an ADS to the user-in-charge to take over the dynamic driving task from the ADS, communicated through visual, audio and haptic signals, which gives the user-in-charge a transition period within which to respond. Absent a response, the ADS performs a risk mitigation manoeuvre bringing it to a stop.

Transition period: The period of time during which the transition demand is made and the user-in-charge is expected to regain situational awareness and take over the dynamic driving task.

Type approver: Under the 1958 Agreement Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts (ECE/TRANS/WP.29/2016/2) each Contracting Party issuing type approvals pursuant to a UN Regulation must specify an approval authority for the UN Regulation. The approval authority shall have the responsibility for all aspects of type approval pursuant to the Regulation. This approval authority may designate technical services to carry out on its behalf testing and inspections. The type approval authority for the UK is the Vehicle Certification Agency (VCA).

User-in-charge: A human who has access to the controls of an automated vehicle, and is either in the vehicle or in direct sight of it. The user-in-charge is not a driver while the automated driving system is correctly engaged but must be qualified and fit to drive. Their main role is to take over following a transition demand. They would also have obligations relating to non-dynamic driving task requirements including duties to maintain and insure the vehicle, secure loads carried by the vehicle and report accidents. An automated vehicle would require a user-in-charge unless it is authorised to operate without one. The user-in-charge is discussed in chapter 12.

Contents

Chapter 1: Introduction

1.1 This is the third consultation in a review of automated vehicles by the Law Commission of England and Wales and the Scottish Law Commission. In 2018 the Centre for Connected and Autonomous Vehicles (CCAV) asked us to review the UK's regulatory framework to enable the safe and effective deployment of automated vehicles on Britain's roads.

1.2 Our first consultation paper ("Consultation Paper 1") looked at issues that affect all automated vehicles (AVs) regardless of how they are used. We considered how safety should be assured before AVs are placed on the market, as well as how they should be monitored once they are on the road. We then explored criminal and civil liability. Finally, we examined how to adapt road rules for artificial intelligence.

1.3 Our second consultation paper ("Consultation Paper 2") focussed on the regulation of Highly Automated Road Passenger Services, or "HARPS". We coined this term to refer to services which will use highly automated vehicles to supply road journeys to passengers. Vehicles used for these services will be capable of travelling empty or with only passengers on board. We considered a national operator licensing scheme for HARPS as well as the private use of such vehicles. We also examined the issues of accessibility for older and disabled people, how to control congestion on public roads, and how regulation might integrate AVs with public transport.

1.4 This paper returns to key themes in both papers provisionally to propose a regulatory framework for the first self-driving vehicles. We consider the definition of "self-driving"; an authorisation process for pre-deployment (before they are placed on the market); and how to assure safety in-use, on an ongoing basis. We also set out the proposed responsibilities of users and fleet operators; consider new criminal offences and civil liability; and look at what data needs to be collected to make our provisional proposals work.

1.5 We seek responses to this consultation by **18 March 2021**. Although we are happy to receive responses in any form, consultees may find it most convenient to use the online response portal at https://consult.justice.gov.uk/law-commission/automated-vehicles-regulatory-framework.

REGULATING AT THE RIGHT TIME

1.6 This is the first time that the Law Commissions have been asked to develop legal reforms in anticipation of future development, the course of which is still uncertain. The challenge is to regulate at the right time; premature intervention could stifle innovation but late intervention could jeopardise safety.

1.7 Since our last consultation paper there have been two significant developments. First, the United Nations Economic Commission for Europe (UNECE) has passed a regulation to authorise the use of Automated Lane Keeping Systems (ALKS). For now, ALKS are relatively limited. They would only be used at low speeds (up to 37 miles an hour) on motorways. However, ALKS provide the first real-life example of what a self-driving vehicle might look like. They may also happen relatively quickly. ALKS could be approved for use on UK roads in 2021.

1.8 ALKS bring sharp focus to three questions we address in this paper: when does a vehicle meet the definition and threshold for self-driving? How should this decision be taken? And, if vehicles are regarded as self-driving, how should they be monitored while in-use on the road? These questions are now becoming urgent. The way they are answered for ALKS could affect the structure of AV regulation for many years to come.

1.9 Secondly, this paper is being published as the UK prepares to end its transition period with the European Union. For the first time since 1973, Great Britain will apply UNECE vehicle regulations without also having to apply EU law. This will allow Great Britain to adopt a more extensive national scheme than the one contemplated in Consultation Paper 1.

1.10 In other ways, however, the trajectory of automated vehicle development remains uncertain. For some topics (such as remote operation and passenger services) there remains a risk that we might regulate too early. Although this paper covers a wide range of topics, some proposals are much more developed than others. Our focus is on the definition of self-driving, on an initial approval scheme, and on establishing a system for in-use monitoring. When we address other topics, we outline a system with considerable flexibility to deal with future events.

CONSULTATION PAPER 1

1.11 We published Consultation Paper 1 in November 2018 and received 178 written responses. We are very grateful to all those who responded and who shared their views with us at meetings and conferences. The full analysis of responses as well as all of the individual responses to Consultation Paper 1 are available online.[1]

1.12 Here we outline the main proposals in that paper.

A "user-in-charge"

1.13 In Consultation Paper 1 we provisionally proposed that highly automated vehicles should have a "user-in-charge" able to operate the controls, unless the vehicle is specifically authorised to operate without one. The user-in-charge would need to be qualified and fit to drive, but would not be a driver while the automated driving system is correctly engaged. Instead the role of a user-in-charge would be to take over driving, either in planned circumstances or in unplanned circumstances where the vehicle has come to a safe stop.

1.14 We were encouraged by the support shown for the concept of a user-in-charge. Most consultees (79%) agreed with our proposal that AVs should have a user-in-charge. However, many consultees asked whether the user-in-charge would need to be in the vehicle, or whether they could be in a remote control centre. We propose that the term

1 https://www.lawcom.gov.uk/project/automated-vehicles/.

user-in-charge should be confined to a person in or in line of sight of the vehicle; we return to the concept of a user-in-charge in Chapter 12 of this consultation.

Safety assurance

1.15 We provisionally proposed that the UK Government should establish a safety assurance scheme to complement the current system of international type approval. This would apply both before vehicles were placed on the market (pre-deployment) and after placement, when vehicles were in-use on the road.

1.16 We said that every automated driving system (ADS) put forward for authorisation should be backed by an entity to vouch for it. We called this entity the "Automated Driving System Entity" or ADSE. In the event of a problem, the regulator under the scheme would have powers to apply a range of regulatory sanctions to the ADSE, including improvement notices, fines or (in serious cases) withdrawal of approval.

1.17 These provisional proposals received wide agreement. We have now developed them in the light of the changing nature of international regulation and recent developments in self-driving. They form the core of this paper.

Civil liability

1.18 The Automated and Electric Vehicles Act 2018[2] introduced new provisions to compensate the victims of accidents caused by AVs. To reduce the need for victims to be involved in prolonged litigation, the insurer is liable to compensate the victim without proof of fault. The insurer may then reclaim damages from any other party liable for the accident. Although consultees discussed several of the details in the 2018 Act, most welcomed its overarching principles.

1.19 As we discuss in Chapter 16, the civil liability regime was thought generally "good enough for now",[3] although it may need to be reviewed in the light of practical experience.

Criminal liability

1.20 Consultation Paper 1 looked at offences which arise directly from the way that the vehicle is driven, such as dangerous driving or exceeding speed limits. We provisionally proposed that the user-in-charge would not be responsible for the behaviour of a vehicle while it is driving itself. Instead, the safety assurance agency would apply a new system of regulatory sanctions against the ADSE, designed to prevent problems from arising again.

1.21 We then considered other offences which do not arise directly from the dynamic driving task, such as those relating to insurance and roadworthiness. In law these liabilities are currently placed on "users". We provisionally proposed that the law should be amended to clarify that users-in-charge are "users" for these purposes. A

---

2 The Automated and Electric Vehicles Act 2018 has not yet come into force.

3 See Automated Vehicles: Analysis of Responses to the Preliminary Consultation Paper (2019), https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2019/06/Automated-Vehicles-Analysis-of-Responses.pdf (CP1 Analysis of Responses), para 6.133.

user-in-charge would therefore be required to insure the vehicle and make sure that it is roadworthy.

Criminal liability for causing death or serious injury by driving

1.22 In Consultation Paper 1 we noted nine separate "aggravated" offences of causing death or serious injury while driving. There is a trend towards increasing both the spread of the offences and the sentences which can be imposed. Prison sentences are common. In England and Wales, in the 10 years from 2009 to 2018, 3,214 people were imprisoned for causing death or serious injury by driving.[4]

1.23 For self-driving vehicles, as there will be no driver, society will not have someone to blame in the way that occurs for conventional vehicles. For the most part, following a collision, the emphasis will be on understanding what went wrong and preventing it from happening again.

1.24 However, we sought views on whether to review the possibility of new corporate offences where wrongs by a developer of an ADS resulted in death or serious injury. Most consultees (84%) thought that we should review this issue. The results of our review are set out in Chapter 14.[5]

Adapting road rules

1.25 Human drivers apply road rules using their discretion and judgement in any given situation. We considered the challenges involved in developing a "digital highway code" to govern the actions of highly automated vehicles. How far could human discretion be converted into precise rules? To focus the debate we asked three sample questions: how far should automated vehicles mount the pavement; exceed speed limits; or edge through pedestrians?

1.26 The responses suggest that it is not possible to produce a digital highway code that sets precise rules for every instance. Instead, there were strong calls for a more structured dialogue between developers and regulators to consider areas of concern and promote consistency. In Chapter 11 we urge Government to consider establishing a forum for collaborating in this area.[6]

CONSULTATION PAPER 2

1.27 We published Consultation Paper 2 in October 2019. We received 109 responses to the paper from consultees working in a wide variety of sectors. Again, we are extremely grateful for the depth and breadth of the discussion, both in written responses and face to face. The full analysis of responses as well as all of the individual responses to Consultation Paper 2 are available online.[7]

---

4 Ministry of Justice, *Criminal Justice system statistics quarterly: outcomes by offences data tool* (December 2018), https://www.gov.uk/government/statistics/criminal-justice-system-statistics-quarterly-december-2018. For discussion, see paras 5.25 to 5.26, below.

5 The Law Commission of England and Wales has also recently begun working on a freestanding project on Corporate Criminal Liability. See https://www.lawcom.gov.uk/project/corporate-criminal-liability/.

6 See Summary of CP1 Analysis of Responses, para 6.7.

7 https://www.lawcom.gov.uk/project/automated-vehicles/.

1.28 Our main proposals from that paper are summarised below.

A national HARPS licensing scheme

1.29 Traditionally, road passenger services have been categorised in terms of taxis, minicabs (private hire), buses and coaches, with separate regulatory systems applying to each. We did not think that HARPS could be shoehorned into these existing categories. Furthermore, some aspects of taxi and private hire regulation are unsuited to HARPS, such as the emphasis on regulating drivers and the small size of many licensing authorities.

1.30 We provisionally proposed that HARPS should be subject to a new single national (GB-wide) system of operator licensing. We asked if consultees agreed. This drew considerable support: 89% of consultees said yes.

1.31 We also provisionally proposed that there should be a national scheme of basic safety standards for operating a HARPS. The vast majority (95%) of consultees agreed. Consultees thought that national standards would provide a consistent level of safety and ensure a "level playing field" for developers.

Defining a HARPS operator

1.32 We looked at the potential scope of a new HARPS operator licensing scheme. We provisionally proposed to define a HARPS operator as any business which carries passengers for hire or reward using highly automated vehicles on a road without a human driver or a user-in-charge.

1.33 Most consultees (79%) agreed. However, some expressed reservations about the phrases "on a road" and "hire or reward". We note these concerns. We also note criticisms of the complexity of our proposals on how to regulate privately owned highly automated vehicles without a user-in-charge.

1.34 In Chapter 13 we return to the discussion of how to regulate AVs that rely on remote operation. We are now thinking in terms of a basic level of regulation (Tier 1) for all those who operate AVs remotely. Additional provisions (Tier 2) would apply to specific uses, such as passenger services and freight. This would include embedding accessibility standards for older and disabled people into the regulatory framework for HARPS.

Integrating HARPS with public transport

1.35 In Consultation Paper 2 we considered how automated services could help achieve wider transport goals. We set out a positive vision, in which automated services would reduce dependency on car ownership, and lead to more flexible, affordable shared services. By freeing space currently used by on-street parking, and promoting safer, calmer driving, they could lead to more cycling and walking and healthier streets.

1.36 However, we also noted risks, where even more motor vehicles joined overcrowded roads, undermining trains and buses. One particular challenge will be to prevent "empty cruising" where AVs circle around busy cities simply because it is cheaper to cruise than to park. We discussed a range of regulatory tools to control congestion and cruising, including road pricing and statutory partnerships between local authorities and operators.

1.37 We note the strong desire among consultees to create healthier cities. There was consensus that this required more opportunities for walking and cycling; favouring public transport over private cars; and taking prompt action to reduce pollution and carbon emissions. Achieving these goals will be a major challenge over the next few years, as the country recovers from the COVID-19 crisis. AVs have the potential to be part of this vision, and we note the detailed discussion about how regulation could help that potential to be realised. As the first vehicles to operate without a user-in-charge become available, we urge the Government to return to these issues.

DEVOLUTION

1.38 Our current assumption is that any new legislation would be enacted at Westminster. However, by virtue of section 28(8) of the Scotland Act 1998 (in Scotland), section 107(6) of the Government of Wales Act 2006 (in Wales) and the Sewel Convention, the UK Parliament will not normally legislate for devolved matters without the concurrence of the devolved legislatures. Thus devolved legislative competence in Scotland and Wales would need to be taken into account.

1.39 Following the Wales Act 2017, the Welsh Assembly is now able to pass legislation provided it does not relate to a matter reserved to the UK Parliament. Reserved matters relating to road transport include: regulation of the construction of motor vehicles; regulation of the use of vehicles; road traffic offences; driver licensing; and insurance of motor vehicles. This means that none of the matters under consideration in this paper are devolved to Wales.

1.40 Under the Scotland Act 1998, some transport matters are similarly reserved to Westminster, including the Road Traffic Act 1988 and the Road Traffic Offenders Act 1988. Other matters are not reserved, and are within the competence of the Scottish Parliament. This includes the law of delict and criminal offences other than those contained in road traffic legislation.

1.41 Our remit does not extend to Northern Ireland: we can only make recommendations in respect of England, Wales and Scotland. Northern Ireland is subject to different constraints under the Ireland-Northern Ireland protocol and will require a different system of regulation.

STRUCTURE OF THIS PAPER

1.42 The consultation paper is divided into 18 chapters:

(1) Chapter 1 is this introduction.

(2) Chapter 2 considers key concepts and definitions, including the nature of a road, terms used to describe automated vehicles and the main legal actors.

The meaning of “self-driving”

1.43 Three chapters look at what it means for a vehicle to safely drive itself. Using ALKS as a case study, we consider when a vehicle does not need monitoring by an individual and is safe (or at least safe enough).

(3) Chapter 3 examines the ALKS Regulation, possibly the first example of self-driving technology. We consider the government’s call for evidence and how this maps on to broader questions about the meaning of self-driving in law, under the Automated and Electric Vehicles Act 2018.

(4) Chapter 4 considers human intervention, attempting to pin down when a vehicle can drive itself without needing to be monitored by an individual. We provisionally consider that an individual who is not monitoring a vehicle can be expected to respond to a clear and timely transition demand but not to other circumstances.

(5) Chapter 5 asks: how safe is safe enough? We consider the threshold of safety that an AV should be required to satisfy before being authorised for deployment on roads. We consider four possible standards: (1) as safe as reasonably practicable; (2) as safe as a competent and careful driver; (3) does not cause a fault accident; (4) a positive risk balance. Each standard has both strengths and weaknesses and we advocate a combined approach of all four.

Safety assurance before deployment

1.44 The next three chapters consider how to assure that self-driving vehicles are safe before they are placed on the market.

(6) Chapter 6 sets out the current law. It looks at how vehicle standards are regulated under the UNECE and EU frameworks and at national level. We consider some practical elements of getting approval, and the extent to which international frameworks provide leeway to set national policy on AVs.

(7) Chapter 7 considers how regulators could assess AV safety pre-deployment. We outline current automotive safety standards and the new work being carried out by standards institutions such as ISO, BSI and IEEE. We also discuss the the role of track testing, road testing and simulation. We then compare self-certification with third-party testing and highlight the crucial role of safety cases during the approvals process.

(8) Chapter 8 makes provisional proposals to approve AVs before they are deployed on the road. We propose that manufacturers should have a choice when bringing an ADS to market. They could either obtain type approval at international (UNECE) level or apply under a national scheme for GB-only approval. There would then be a separate self-driving “categorisation” decision, which will determine issues of criminal and civil liability.

Safety in use

1.45 Given how often the road environment changes, one cannot expect a vehicle to be approved once and then remain safe throughout its life. Self-driving vehicles will need to be monitored while they are in-use, on an ongoing basis.

(9) Chapter 9 sets out the current law of in-use monitoring, often referred to as "market surveillance". Although there is much in the current law to draw on, we consider it too limited to meet the challenges of self-driving. We provisionally propose an enhanced statutory scheme to assure the safety of automated vehicles (AVs) while they are in-use, with additional statutory responsibilities and powers.

(10) Chapter 10 considers five challenges of assuring the safety of AVs in use on the roads. These are regulating software updates; cybersecurity; updating maps; communicating information to users; and collecting data to compare automated and conventional driving.

(11) Chapter 11 considers how to deal with breaches of traffic rules and how to learn from collisions, so as promote a safety culture. In both cases we propose a move away from the current emphasis on criminal prosecution. We also consider how road rules may be adapted to apply more effectively to AVs.

User and fleet operator responsibilities

1.46 In the next two chapters we consider the responsibilities of those who use and operate self-driving vehicles. These will depend on whether a vehicle is (or is not) required to have a user in charge.

(12) Chapter 12 revisits the concept of a user-in-charge. The main role of the user-in-charge would be to take over driving, either following a transition demand or because of a conscious choice. We explain that a user-in-charge must be qualified and fit to drive, is responsible for the vehicle being insured and adequately maintained and must report accidents.

(13) Chapter 13 looks at vehicles authorised to operate without a user-in-charge. We describe these as "no user-in-charge" vehicles (or NUICs). We provisionally propose that every NUIC should have a licensed operator, with responsibilities to supervise, insure and maintain the vehicle, and to report accidents and near misses.

Criminal offences

1.47 Our general approach is to move away from blame and criminal offences. Instead we wish to move towards a learning culture, in which adverse events lead to regulatory interventions designed to improve systems for the future. However, we provisionally propose new criminal offences in two limited circumstances.

(14) Chapter 14 provisionally proposes new criminal offences where an ADSE misleads regulators. There should also be an aggravated offence where this leads to a death or serious injury.

(15) Chapter 15 considers how third parties might interfere with AVs. Although most forms of interference are already criminal offences, we provisionally propose some additions.

Compensation and data

1.48 The next two chapters look at civil liability and access to data.

(16) Chapter 16 revisits compensation for victims of AV incidents. The Automated and Electric Vehicles Act 2018 introduced reforms to smooth the path to compensation for those injured by self-driving vehicles. Our provisional conclusion is that the 2018 Act remains “good enough for now”.

(17) Chapter 17 looks at access to data. Under our terms of reference, most issues of "data protection and privacy" are outside the scope of this project. However, several of our provisional proposals will only work with access to data (including location data). Location data is required to investigate traffic incidents and to establish criminal and civil liability. To protect privacy, care will be needed over how such data is stored and disseminated.

Consultation questions

(18) Finally, Chapter 18 lists all the questions we are asking in this paper.

1.49 Appendix 1 lists the stakeholders who have given their time to meet us and the conferences we have attended.

NEXT STEPS

1.50 Publication of this paper starts a three month consultation period ending on 18 March 2021. We propose to publish our final report with recommendations for legislation in the last quarter of 2021.

ACKNOWLEDGEMENTS AND THANKS

1.51 We have held more than 200 meetings with individuals and organisations since the start of the project and we are very grateful to them for giving us their time and expertise. We include a list of stakeholders we have met and conferences attended throughout the project in Appendix 1. We look forward to receiving responses from these stakeholders as well as from other stakeholders and the general public.

THE TEAM WORKING ON THE PROJECT

1.52 Various staff have contributed to this paper. At the Law Commission of England and Wales the lead lawyers were Jessica Uguccioni, Tamara Goriely and Connor Champ. They were assisted first by Alastair Richardson and Danielle Worden, and then by Jagoda Klimowicz and Gianna Seglias. At the Scottish Law Commission, the staff were Charles Garland (project manager and lawyer), Scott Cormack and Elizabeth Connaughton (legal assistants).

Chapter 2: Key concepts

2.1 In this chapter we introduce some of the key concepts we use in the paper. We start by looking at the nature of roads. We then look at "dynamic driving" and "operational design domain", drawing on the work of the Society of Automotive Engineers International (SAE). We discuss three terms to describe vehicles that can operate without a human driver: automated vehicle (AV); automated driving system (ADS); and self-driving. We consider two paths to automation. Finally, we look at the three main actors, who under our scheme would be allocated some form of responsibility for self-driving vehicles.

THE NATURE OF ROADS

2.2 Under our terms of reference, this project is limited to the use of AVs on roads or other public places.

Legal definitions

2.3 As we explore in Appendix 2, the terms "road" and "other public place" are widely used in road traffic legislation. They have been interpreted many times by the courts both in England and Wales and in Scotland.

2.4 Essentially a road is a way by which travellers may move from place A to place B and to which the public have access.[8] Access is not simply about motorised access: if, for example, members of the public are allowed to go for a walk or exercise their dogs on a university campus road, that road falls within road traffic legislation.[9] Furthermore, the public do not necessarily have to have a clear right to use the road, provided that they do use it as a matter of fact and that use is permitted, either expressly or implicitly.[10]

2.5 Similarly, a public place is a place which is actually used by the general public, without objection by the landowner or occupier.[11] So, for example, where a car park is open to the public, the marked lanes used to reach bays are "roads", while the bays themselves are "other public places".

---

8 *Clarke v General Accident Fire and Life Assurance Corpn plc and Cutter v Eagle Star Insurance Co Ltd [Conjoined Appeals]* [1998] 1 WLR 1647 at 1652, citing *Harrison v Hill* 1932 JC 13 at 16; in Scotland: *Aird v Vannet* 1999 JC 205.

9 *Cowan v DPP* [2013] EWHC 192 (Admin), [2013] All ER (D) 116 (Jan); in Scotland: *Brown v Braid* 1985 SLT 37. For discussion of the even wider approach taken, see Appendix 2.

10 As discussed in Appendix 2, in Scots law access can include unlawful access, provided it is not obtained through overcoming a physical obstruction or in defiance of an express or implied prohibition: see *Teale v Macleod* 2008 SCCR 12 at [7] and [9] following *Harrison v Hill* 1932 JC 13 at 17 (Lord Sands).

11 *Yates v Murray* 2004 JC 16 at 21. For further discussion, see Appendix 2.

Restricted space versus public access

2.6 Technology already exists to allow AVs to be used safely in restricted areas. They can, for example, be used in private warehouses or in mines or quarries. They can also be used on rails or "guideways". An example would be the pods at Heathrow Airport, which use a fenced and dedicated route to take passengers from a car park to a terminal.[12]

2.7 These controlled environments are much less challenging than roads. On a railway, for example, a central authority controls access to the tracks. Trains may only use the track if they are scheduled to do so, and steps are taken to keep out trespassers, usually by erecting fences. A similar level of control can be exercised in warehouses, quarries and mines. Roads, on the other hand, allow public access, often to a wide range of different users.

What are roads used for?

2.8 A road is designed to allow people and material to travel from A to B. This may occur in many different ways. Even motorways are open to a variety of traffic, including heavy goods vehicles, vans, coaches, cars and motorcycles. For urban areas, the range is much wider, also including pedestrians, bicycles, pets, wheelchairs, prams, buggies, scooters and roller-bladers. Rural areas will have sheep, cows and horses.

2.9 Secondly, roads run through streets. Streets are not simply a way of getting from A to B but are the heart of communities. Ideally, they are places where people can enjoy being where they are, through shopping, exercise or meeting at pavement tables. One can visualise a world where, with less traffic and wider pavements, streets would be a place where children could play, lovers could stroll, and older people could watch the world go by.[13] Streets are also a place for social and political expression, through parades, funeral corteges, marches and demonstrations.

2.10 Thirdly, roads are the place where society maintains the vital infrastructure that runs underneath them, including electric and broadband cables, and gas, water and sewage pipes. Much as road users complain about burst pipes and roadworks, underground pipework and cabling are an integral part of the road environment.

2.11 Roads, then, allow open access to many people, in multiple contexts, for differing purposes, often simultaneously. This means that space may be contested and negotiated, rather than controlled. At an individual level, the interplay between so many road users in such a complex environment leads to an almost infinite number of scenarios, not all of which are controlled by clear rules. At a political level, it leads to a constant readjustment of how road space is allocated - whether through temporary road closures, new bus or cycle lanes or changes to the Highway Code. Such changes are frequent: from 2016 to 2019, the Highway Code was changed 14 times.

---

12 See https://www.heathrow.com/transport-and-directions/heathrow-parking/heathrow-pod-parking-terminal-5. Another example of the use of guideways is the Cambridge Guided Busway: see https://www.thebusway.info/.

13 For a discussion of the importance of "healthy streets", see http://content.tfl.gov.uk/healthy-streets-for-london.pdf, https://www.livingstreets.org.uk/ and https://healthystreets.com/.

2.12 The complexity and malleability of roads is a theme throughout this paper. While the traditional system of type approval has focused on assessing vehicles before they are placed on the road, AVs will require much greater monitoring to ensure that they continue to be safe while in-use.[14]

Dedicated ways?

2.13 It is possible to deploy AVs on dedicated ways, from which other road users are prohibited: an example would be the Heathrow pods. This type of deployment is more akin to a railway than a road and falls outside the scope of our project. AVs using dedicated ways are covered by the railway safety regulations, which apply not only to railways but also to "other guided transport systems". The regulations cover not only passenger vehicles using "rails, beams, slots, guides", but also to those using "a guidance system which is automatic".[15]

2.14 This paper does not deal with dedicated ways. Instead, it addresses how AVs will be deployed on roads and other places where the public has access. We have worked on the assumption that all road users who currently have access to roads will continue to do so. We do not propose that any existing road users should have their freedom to use the road restricted simply to make way for AVs. That said, it may be desirable to create priority lanes for AVs that are used for a socially useful purpose, such a providing a bus service.

THE SAE TAXONOMY

2.15 Most discussions of AVs draw on the work of the Society of Automotive Engineers International (SAE). In 2014, the SAE first published its "taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles". As we discuss in Chapter 4, the document has been updated several times since, and aims to provide a common language for discussing driving automation.

2.16 There are two key concepts developed by the SAE which we use throughout this report and introduce here: the "dynamic driving task" and the "operational design domain".

The dynamic driving task

2.17 The SAE Taxonomy defines the core of what it means to drive from a technical perspective. A critical definition is the "dynamic driving task" (or DDT). It has the following key elements:

(1) sustained lateral and longitudinal motion-control of the vehicle: steering, accelerating and braking;

---

14 For a discussion of what is "safe" (or at least "safe enough"), see Ch 5.

15 Railways and Other Guided Transport Systems (Safety) Regulations 2006, SI 2006 No 599, reg 2.

(2) object and event detection, recognition, classification, response preparation and response: monitoring the driving environment and reacting to other road users and the conditions of the road.[16]

2.18 Several "driver support" features, such as advanced cruise control, can steer, accelerate and brake, but cannot respond to all the conditions of the road. These features still require the driver to pay attention and react to other road users and road signs. Without "object and event detection and response",[17] a vehicle does not have self-driving capabilities.

2.19 In law, drivers have many responsibilities. Some relate to dynamic driving (such as following road signs or driving with due care and attention). Here the driver is required to notice objects and events in the driving environment and to respond in the way they control the vehicle (by steering, accelerating, braking and/or indicating). However, the law also imposes responsibilities on drivers which do not relate to dynamic driving. Examples would be carrying insurance, maintaining roadworthiness or ensuring that children wear seat belts.[18]

2.20 The distinction can be illustrated with an example. Following an accident, drivers have legal obligations to stop, to exchange details and to report to the police. We see the obligation to stop as part of dynamic driving: it requires monitoring the environment and responding to an event by steering and braking.[19] However, the obligations to exchange details and to report to the police are not part of dynamic driving. This means that to be self-driving a vehicle must be able to detect a collision and bring the vehicle to a safe stop (or at least issue a transition demand so that the user can do so). However, the system would not necessarily be expected to exchange details or report accidents: that would be left to the user-in-charge.

The Operational Design Domain (ODD)

2.21 The Operational Design Domain sets out the conditions in which any automated system or feature is designed to function. The conditions may relate to a place (such as a city); a type of road (such as a motorway); a time of day (such as during daylight); a speed (such as under 60km an hour); or weather (such as not in snow).[20] The ODD is set by the manufacturer and will need to be endorsed by the regulator.

2.22 While driving, an Automated Driving System may exit its ODD for many reasons: to take the examples above, the vehicle may leave the motorway or it might start

---

16 Society of Automotive Engineers International (SAE), J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles (June 2018) (SAE Taxonomy) p 6, section 3.13 (DDT). This is a summary of the general definition of the DDT and its six subtasks which also encompass the operational and tactical aspects of driving. These include manoeuvre planning and enhancing conspicuity through lighting and signalling. See also ISO/SAE DPAS 22736, p 8 section 3.10.

17 SAE Taxonomy p 14, section 3.20; and ISO/SAE DPAS 22736 p 16 section 3.19.

18 It is an offence for a person to drive a car on a road with a child passenger under 14 years of age who is not wearing the appropriate seat belt or restraint: Road Traffic Act 1988, s 15.

19 It is part of the "response" as part of "Object and Event Detection and Response" (OEDR), SAE Taxonomy, p 14, section 3.20.

20 SAE Taxonomy, p 14, section 3.22; ISO/SAE DPAS 22736 section 3.21.

snowing. In this case, the system will need to issue a transition demand to a human to take over driving or come to a stop. The latest draft of the taxonomy acknowledges that during this time, "an ADS may operate temporarily outside of its ODD".[21]

AUTOMATED VEHICLES, AUTOMATED DRIVING SYSTEMS AND SELF-DRIVING

2.23 There is considerable controversy over how to refer to the new technology, which is variously called automated driving, autonomous driving or self-driving. In this paper we refer to automated vehicles, automated driving systems and self-driving vehicles. Here we explain briefly what we mean by these phrases.

Automated vehicles (AV)

2.24 This project is concerned with the automated vehicles. We use the phrase "automated vehicles" (or more commonly AVs) to refer in general terms to vehicles containing an automated driving system which is able to conduct the dynamic driving task.[22]

Automated driving systems (ADS)

2.25 In their taxonomy, the SAE define an automated driving system (ADS) as the combination of software and hardware capable of performing the entire dynamic driving task (DDT). This is contrasted with driving automation features which assist a human driver by carrying out only part of the DDT.[23]

2.26 We use the term ADS to refers to a combination of software, hardware and sensors which is able (or purports to be able) to drive a vehicle. It is a system within a vehicle, not the vehicle itself. Given that the technology is still evolving, it is not possible to define the exact hardware and software configuration that might constitute any particular ADS.

Self-driving

2.27 The Automated and Electric Vehicles Act 2018 refers to vehicles which are capable of "safely driving themselves". This is defined, in section 8(1)(a), as "operating in a mode in which the vehicle is not being controlled, and does not need to be monitored, by an individual".

2.28 In this paper, we use the term "self-driving" as a legal definition and as a threshold marking the line between advanced driver assistance and automated vehicles. As we discuss in Chapter 8, there needs to be a clear legal test and procedure to decide whether a vehicle is capable of "safely driving itself". A self-driving vehicle is one which meets this test.

---

21 ISO/SAE DPAS 22736, p 9, section 3.12, Note 6. We discuss the status of this draft in Ch 4.

22 We acknowledge the term is ambiguous (a vehicle can be an AV even when the ADS is not engaged). However this umbrella term is widely used for regulatory purposes for the reasons stated by the Uniform Law Commission in its model Automated Operation of Vehicles Act, p 5, at https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=2dd86096-2546-dfe8-eeb6-91c11e0e1b2b&forceDialog=0.

23 SAE Taxonomy, pp 3 and 6.

TWO PATHS TO AUTOMATION

2.29 In Consultation Paper 1, we suggested that automated driving might be developed in two ways.

(1) In Path 1, automated features are increasingly incorporated in vehicles sold across borders to a mass consumer market. Initially, these vehicles will continue to have a human in the driving seat though, as the technology improves, the human would be able to cede the driving task to the ADS in more circumstances.

(2) In Path 2, vehicles are deployed without a human driver in limited local contexts, followed by a gradual expansion of their range of use.

2.30 This division is not clear or fixed and we do not use it as a legal definition. However, it remains a useful way to think about how the first AVs will be brought to market. While Consultation Paper 1 was more concerned with Path 1 vehicles, Consultation Paper 2 focused on Path 2.

2.31 At the present state of AV development, international efforts for regulatory harmonisation have focussed on Path 1 vehicles, especially for use on motorways. Automated Lane Keeping Systems are a step along Path 1 and may soon be extended to cover lane changing and faster speeds. Given this focus, much of the paper discusses the interaction between the ADS and a human in the driving seat.

2.32 However, Path 2 is also an important route to deployment. We discuss the challenges of Path 2 vehicles which do not have a user-in-charge in Chapter 13.

KEY ACTORS

2.33 In our previous consultation papers, we outlined three key roles associated with self-driving. These are:

(1) *an Automated Driving System Entity* (or ADSE) which takes responsibility for the ADS;

(2) a *user-in-charge*, who can be thought of as the human in the driving seat. In our view, every self-driving vehicle should have a user-in-charge, unless the vehicle is specifically authorised for use without one. The user-in-charge must be qualified and fit to drive, as they may be called on to take over driving following a transition demand. While the ADS is engaged they are not responsible for dynamic driving but do retain other driver responsibilities.

(3) a *licensed fleet operator*, who would take responsibility for operating vehicles which are authorised for use without a user-in-charge.

2.34 We have developed and refined these categories of legal actor over our three consultation papers.

(1) In Chapter 8, we explain that an *ADSE* is the vehicle manufacturer or software developer who puts a vehicle equipped with an ADS forward for categorisation as self-driving. The ADSE must register with the safety assurance regulator and

is the first point of contact if things go wrong. Our proposals retain some flexibility about who the ADSE is: it may be a vehicle manufacturer, or software developer, or a partnership between the two. However, the ADSE must show that it was closely involved in assessing the safety of the vehicle. It must also have sufficient funds to respond to regulatory action and to organise a recall.

(2) Chapter 12 outlines the role and responsibilities of the *user-in-charge*. Although initially, the user-in-charge will be the human in the driving seat, we have refined our definition to cover new features, such as automated parking using mobile phone controls. We now define a user-in-charge as an individual in position to operate the controls who is either in the vehicle or in direct sight of the vehicle (that is, someone who can see the vehicle without relying on connectivity).

(3) Chapter 13 considers the obligations of *licensed fleet operators* when remotely operating a vehicle with no user-in-charge. A fleet operator is an organisation rather than an individual. All operators will be subject to basic Tier 1 duties, such as maintaining and supervising vehicles and reporting incidents. They may also be subject to additional Tier 2 duties if, for example, they are running a passenger service or operating heavy goods vehicles.

2.35 The following table provides a brief overview of how these actors fit together.

OVERVIEW OF KEY LEGAL ACTORS IN THE LAW COMMISSIONS' PROPOSED AV REGULATORY SCHEME

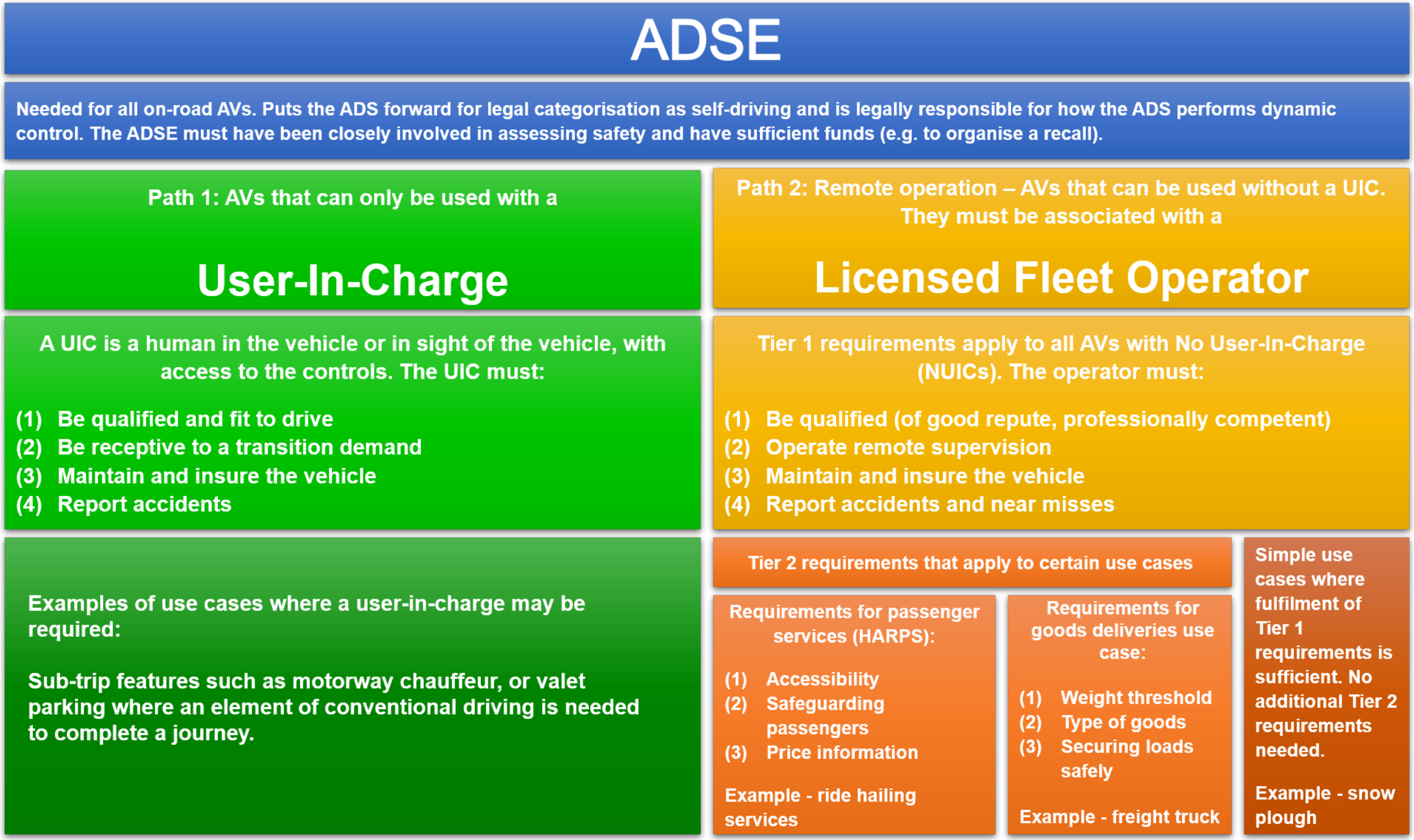

Figure 2.1 - Overview of the key legal actors

Chapter 3: A Case-Study - Automated Lane Keeping Systems

3.1 When should a vehicle be considered to be capable of "driving itself"? This question is highly controversial, with fraught discussion over forms of automation which rely on the human user to take control in some circumstances.

3.2 In June 2020, the United Nations Economic Commission for Europe (UNECE) adopted a Regulation to permit Automated Lane Keeping Systems (ALKS) to receive type approval under the international scheme of type approval described in chapter 6. Essentially, ALKS technology is able to steer and control vehicle speed in lane for extended periods on motorways. At present, ALKS are relatively limited. They are confined to cars (M1 vehicles) operating at low speeds, up to 60km (37 miles) an hour. They allow car drivers caught in motorway traffic jams to relax and possibly perform other activities through the infotainment system, such as looking at messages.

3.3 However, ALKS are widely seen as the first example of self-driving technology. The UN describe ALKS as "the first regulatory step for an automated driving system… in traffic", where "the activated system is in primary control of the vehicle".[1] In August 2020, the UK Government issued a call for evidence, exploring whether ALKS meet the test for self-driving set out in the AEVA 2018.[2]

3.4 ALKS may soon be followed by further regulatory steps towards automated driving. For example, Germany has proposed amendments to the ALKS regulation to cover lane changing capability and increase the maximum permitted speeds.[3] The UK Government has asked whether ALKS should be allowed to operate at speeds of up to 70 miles an hour, provided the manufacturer declares that the system has the capability to do so safely.[4]

3.5 This means that the way that ALKS are categorised and regulated sets an important precedent for the future of self-driving. The debate over ALKS gives a practical context to previously theoretical discussions about how robots and humans interact, and how safe is safe enough. In this chapter, we summarise the UN Regulation on

1 UN Regulation 157 on uniform provision concerning the approval of vehicles with regards to Automated lane Keeping System ECE/TRANS/WP.29/2020/81 (25 June 2020) (ALKS Regulation), Introduction.

2 CCAV, *Safe Use of Automated Driving Systems Call for Evidence* (August 2020) (Call for Evidence), https://www.gov.uk/government/consultations/safe-use-of-automated-lane-keeping-system-on-gb-motorways-call-for-evidence.

3 UNECE, Virtual informal meeting of the (WP.29/GRVA) Working Party on Automated/Autonomous and Connected Vehicles (7th session), 21 - 25 September 2020, (Germany) Proposals for an amendment to UN Regulation on Automated Lane Keeping Systems (ALKS): UNECE/TRANS/WP.29/GRVA/2020/33 (lane change) and ECE/TRANS/WP.29/GRVA/2020/32 (increased maximum speed of up to 130km/h). In GB the highest speed limit is 112 km/h on motorways and dual carriageways.

4 Call for Evidence, para 6.4. We note 70 mph = 112 kph here.

ALKS, the UK Government's call for evidence and the current definition of self-driving. This can be seen as a case study for subsequent chapters which consider the role of human intervention and how safe is safe enough. The UK Department for Transport will be publishing its analysis of the outcomes of that call for evidence by Spring 2021. We will continue to work closely with the Department to make sure our evolving proposals for regulatory reform take into account any nearer term changes relating to ALKS.

ALKS: THE CONTINUING ROLE OF A HUMAN DRIVER

3.6 The ALKS regulation requires a human in the driving seat, which it describes as a "driver".[5] The system must ensure that the driver is in the driving seat with their safety belt fastened,[6] available to take over the dynamic driving task. The Regulation requires the system to monitor that the driver is looking ahead through eye and head recognition technology. If the driver is unavailable, the system "shall immediately provide a distinctive warning".[7]

3.7 At some point, an activated system will need to "transition back control to the driver",[8] by issuing a "transition demand".[9] A transition demand will be issued following:

(1) A planned event (such as exit from the motorway);

(2) An unplanned event, defined as "a situation which is unknown in advance, but assumed as very likely in happening".[10] The Regulation gives five examples: road construction; inclement weather; approaching emergency vehicle; missing lane marking; or a load falling from a truck; and

(3) A failure affecting the operation of the system.

3.8 The transition demand will cut out all the activities on the on-board infotainment screen,[11] except for those permitted during driving (such as the satnav). It will also issue visual, auditory and/or haptic warnings.[12] In other words, the driver will be alerted by escalating warning signals: flashing lights, a loud noise and/or movements, such as vibrations to the seat or tugging at the seatbelt. The driver then has a set period to take control of the driving task, which must be at least 10 seconds.[13]

---

5 See discussion in Chapter 2 and the discussion of 'driver' among the key concepts.

6 ALKS Regulation, para 6.1.1.

7 ALKS Regulation, para 6.1.3.1.

8 ALKS Regulation, para 5.4.

9 ALKS Regulation, para 2.2.

10 ALKS Regulation, para 2.5.

11 ALKS Regulation, para 6.1.4.

12 ALKS Regulation, para 6.4.1.

13 ALKS Regulation, para 5.4.4.1. However, a minimum risk manoeuvre may be initiated immediately – without waiting for the 10 seconds to be up – in case of a severe ALKS or severe vehicle failure, para 5.4.4.1.1. The manufacturer must specify the failures that would activate the manoeuvre without waiting, para 5.4.4.1.2.

3.9 If the driver does not respond to the transition demand, the vehicle will perform a "Minimum Risk Manoeuvre".[14] The vehicle will come to a slow stop in lane, with its hazard warning lights on.[15] The system will then disengage and the vehicle will remain at a standstill until the human driver takes over.

REQUIREMENTS AS TO HOW THE ALKS DRIVES

3.10 The UN Regulation sets out several broad principles about how ALKS should drive. Paragraph 5.1.1 states that "the activated system shall manage all situations including failures, and shall be free of unreasonable risks for the vehicle occupants or any other road users". It goes on to say that "the activated system shall not cause any collisions that are reasonably foreseeable and preventable". Furthermore, "if a collision can be safely avoided without causing another one, it shall be avoided".

Specific standards

3.11 These broad principles are supplemented by specific standards. First and foremost, the Regulation requires the system to keep the vehicle in lane. The activated system shall "ensure that the vehicle does not cross any lane marking (outer edge of the front tyre to outer edge of the lane marking)".[16] The vehicle is not permitted to change lane or swerve into the crash barrier to avoid a collision.

3.12 The Regulation specifies minimum following distances in good weather. For example, when travelling at 60km an hour, an ALKS-enabled vehicle must stay 26.7 metres from the vehicle ahead. If a car cuts in front, the ALKS would reduce its speed "without harsh braking" to re-establish the minimum distance.[17]

3.13 There are no minimum following distances for wet, windy or icy weather. Instead, there is a general requirement that the system "shall adapt the vehicle speed to infrastructural and environmental conditions", including inclement weather.[18] For fog, "the ALKS shall implement strategies to detect and compensate for environmental conditions that reduce the detection range".[19] These strategies must be described by the manufacturer and assessed by the type approval authority.

3.14 The system must be able to bring the vehicle to a complete stop behind a stationary vehicle, a stationary road user or a blocked lane of travel.[20] It must also be able to

14 ALKS Regulation, para 2.7.

15 ALKS Regulation, para 5.5.1.

16 ALKS Regulation, para 5.2.1.

17 ALKS Regulation para 5.2.3.3 requires the vehicle to "readjust the minimum following distance at the next available opportunity without any harsh braking unless an emergency manoeuvre would become necessary".

18 ALKS Regulation, para 5.2.3.2.

19 ALKS Regulation, para 7.1.3.

20 ALKS Regulation, para 5.2.4.

detect the risk of a collision, due to a decelerating lead vehicle, a cutting in vehicle or a suddenly appearing obstacle.[21]

3.15 An Annex to the Regulation then provides guidance on how to assess performance for these scenarios. It sets out detailed formulae, derived from Japanese studies of real-world driving for three "critical scenarios".[22] These are

(1) Cut-in: the "other vehicle" suddenly merges in front of the vehicle fitted with the ALKS (the "ego vehicle");

(2) Cut-out: the "other vehicle" suddenly exits the lane of the "ego vehicle"; and

(3) Deceleration: the "other vehicle" suddenly decelerates in front of the "ego vehicle".

3.16 Although pedestrians are not generally allowed on motorways, a system designed for traffic jams might encounter them. There may, for example, be emergency or road workers, or pedestrians who leave their cars after a collision. The Regulation therefore sets specific requirements where the vehicle has an unobstructed view of a pedestrian crossing in front of the vehicle.[23]

Other scenarios

3.17 In other scenarios, paragraph 5.2.5 states that ALKS should minimise risks "at least to the level at which a competent and careful human driver could minimize the risks". As we discuss in Chapter 5, this is a difficult and demanding standard which may be difficult to achieve in the early stages of automated driving. Paragraph 5.2.5.4 adds:

> It is recognised that the fulfilment of the requirement in paragraph 5.2.5. may not be fully achieved in other [non-specified] conditions. However, the system shall not deactivate or unreasonably switch the control strategy in these other conditions.[24]

3.18 It is worth looking briefly at some of the scenarios that are not specified in the Regulation, and where the competent and careful human driver test may not be fully achieved. This might include, for example, a partially obstructed view of a pedestrian walking in front of a car in the neighbouring lane. While a careful and competent human driver would have no difficulty in recognising a person, this will be more challenging for a driving automation feature.

3.19 Although an ALKS is expected to stop and record an entry if it is involved in a detectable collision, there are no standards in the Regulation for which collisions should be detected. At present, event data recorders only detect collisions involving a

---

21 ALKS Regulation, para 5.2.5.

22 ALKS Regulation, Annex 4, Appendix 3.

23 ALKS Regulation, para 5.2.5.3.

24 The second sentence is designed to ensure that the system does not have a different control strategy (for example deactivation of pedestrian detection, or not commanding full braking force) under non-prescribed conditions.

sharp deceleration. They may not be triggered by glancing blows or where the vehicle collides with something with a much lower mass (as where a car collides with a motorcycle or pedestrian).[25]

3.20 Thirdly, the Regulation does not include specific standards for how the ALKS will distinguish between the variety of objects that might be lying in the road.[26] Clearly an ALKS should not stop for debris which it can easily drive over (such as a plastic bag) but it must stop for an obstacle which blocks the lane (such as a breeze block). In an extreme case, an ALKS might even encounter a casualty, such as a motorcyclist, lying in the road - when it would become imperative to stop.

3.21 Distinguishing between objects is left to the manufacturer, bearing in mind the general standard, that "the activated system shall not cause any collisions that are reasonably foreseeable and preventable".[27]

COMPLYING WITH TRAFFIC RULES

3.22 The ALKS Regulation requires that "the activated system shall comply with traffic rules relating to the [dynamic driving task] in the country of operation".[28] It is easy to state the principle, but much more difficult to implement it, given the number and complexity of traffic laws, which differ from jurisdiction to jurisdiction.

3.23 The ALKS Regulation includes a form listing the "Contracting Party regions where the vehicle manufacturer has declared that the ALKS has been assessed to comply with local traffic rules".[29] For each country, the type approval authority provides a Yes/No answer and comments on any restrictions.

3.24 It is not clear how much information a manufacturer must give the type approval authority about the system's ability to comply with traffic laws. There is no specific requirement for manufacturers to list traffic laws in each of the 56 potential jurisdictions or to discuss how the law has been interpreted. Nor is there any requirement to address how each individual law will be complied with.

3.25 In Annex 4, manufacturers are required to provide a documentation package dealing with functional and operational safety, setting out the manufacturer's safety concept. This includes references to traffic rules. Yet not all traffic rules are about safety. Some

---

25 For discussion of data recording following a collision, see Ch 17.

26 ALKS must be tested to see if they can avoid a collision with an object in different positions, both fully and partially blocking the lane. However, here is no requirement to use a variety of objects in this test (ALKS Regulation, Annex 5, para 4.2).

27 ALKS Regulation, para 5.1.1.

28 ALKS Regulation, para 5.1.2. We note that the UNECE resolution on the deployment of highly and fully automated vehicles in road traffic, passed by the Global Forum on Road Traffic Safety (Working Party 1) in 2018 also requires automated vehicles to comply with traffic rules. However, the 2018 resolution does not apply to ALKS systems which are a form of conditional automation rather than "highly or fully automated systems". The resolution is available in Annex 1 of the Report of the Global Forum for Road Traffic Safety on its seventy-seventh session ECE/TRANS/WP.1/165.

29 ALKS Regulation, Annex 1, Appendix.

laws (such as stopping after an accident)[30] are about accountability, rather than preventing the accident that has already happened.

3.26 There is also a requirement for a real-world test, during which there must be no violation of traffic rules.[31] However, it would be sufficient to have just one test, in one jurisdiction. There is no requirement for a real-world test in each of the jurisdictions listed by the manufacturer.

3.27 The ALKS regulation clearly requires compliance with traffic rules in each jurisdiction, but there are major challenges, both in achieving and assessing compliance. Assessing compliance is especially problematic as the type approval authority may have no knowledge of traffic rules in other jurisdictions.

The call for evidence: problematic scenarios

3.28 The call for evidence raises three problematic scenarios about compliance with road traffic rules, which we summarise below. In each scenario Vehicle A is an ALKS enabled vehicle with automated mode engaged, where the driver is not paying attention to the environment outside the vehicle.

(1) **Responding to an enforcement vehicle:** A police officer notices that Vehicle A has a faulty brake light. The police officer pulls in behind it and switches on flashing blue lights. Under section 35 of the Road Traffic Act 1988, it is a criminal offence for a driver to “neglect or refuse” to stop in these circumstances - a point which is reinforced by Rule 106 of the Highway Code.

Whilst an ALKS-capable vehicle will not be able to pull over, it may be able to issue a transition demand to the driver when it detects the police vehicle. However, there is no explicit requirement for Vehicle A to possess rear-facing sensors. The vehicle may therefore struggle to know to make a transition demand if it is being requested to stop by the police.

(2) **Stopping after an incident:** Vehicle A is proceeding along in its lane in heavy traffic at low speed. Motorcyclist B is filtering between the lanes of traffic. As the traffic flow speeds up, Motorcyclist B is caught unaware by Vehicle A and is knocked from her bike into the road. Under section 170 of the Road Traffic Act 1988, a driver is obliged to stop, a point reinforced in Rule 286.

Although the ALKS regulation requires a vehicle to stop if a collision is detected, no standards exist for collision detection systems. It is therefore not clear whether Vehicle A will issue a transition demand in these circumstances.

(3) **Reading road signs:** Vehicle A is proceeding along its lane in heavy traffic. There has been an accident ahead. To manage traffic flow, a temporary speed limit has been set at 30 mph. This is communicated on a gantry sign above the road with the new speed limit inside a red ring. Rule 261 requires drivers to obey this sign.

---

30 Road Traffic Act 1988, s 170 (Duty of driver to stop, report accident and give information or documents).

31 ALKS Regulation, Annex 5, para 5.4.

> Although the ALKS regulation sets detailed requirements for sensors' forward and lateral detection ranges, there are no specific requirements for the vehicle to sense upwards, so as to detect information on a gantry.

3.29 In each case, the Call for Evidence asks for input from manufacturers about how the system will comply with traffic rules in the UK.

Complying with traffic rules: responses to the Call for Evidence

3.30 Responses to the Call for Evidence indicated many ways in which ALKS-enabled vehicles may be able to deal with these scenarios.

3.31 There are many possible technological solutions. For example, for detecting emergency vehicles, Mercedes-Benz expressly referred to its ability to interact with emergency vehicles as described in the documents it provides to US regulators:

> DRIVE PILOT is also equipped with microphones, which, in addition to cameras, enable it to detect the presence of an emergency vehicle approaching the vicinity of the DRIVE PILOT vehicle. When an approaching emergency vehicle is detected, DRIVE PILOT issues a request to the fallback-ready user to resume driving until the emergency vehicle has passed.[32]

3.32 WMG, University of Warwick added that "the police car might send an over the air message to the system".[33]

3.33 For the detection of minor collisions, respondents mentioned the possibility of combining sensor information with kinematic triggers.[34] As consultancy Reed Mobility put it:

> I would anticipate this being detected by vehicle sensors detecting close proximity of a collision partner and combining this with simultaneous kinematic triggers to establish with a high degree of certainty that a minor collision has occurred.

---

32 Mercedes Benz, Introducing Drive Pilot: an automated driving system for the highway, p 21, available through NHTSA's Automated Driving Systems (ADSs – SAE International Automation Levels 3-5) Voluntary Safety Self-Assessment (VSSA) Disclosure Index at https://www.nhtsa.gov/automated-driving-systems/voluntary-safety-self-assessment.

33 WMG, University of Warwick, response to the Call for Evidence, Question 10, p 7.

34 Kinematics is a branch of mechanics describing the geometry of motion without references to the causes of motion.

3.34 Similarly, vehicles are already grappling with reading road signs. Under EU Regulation 2019/2144,[35] vehicles must be equipped with an intelligent speed assistance system by July 2022, which works through "observation of road signs and signals".[36]

3.35 However, the Society of Motor Manufacturers and Traders (SMMT) pointed out that there is no explicit requirement within the ALKS Regulation to require systems to detect and respond to emergency vehicles. Instead, the human in the driving seat ("the fallback ready user")[37] should notice and respond:

> The Highway Code must be amended to clarify that the fallback-ready user should retain the **residual responsibility** of remaining **vigilant** to **extraordinary** external conditions where it is not appropriate to continue using the automated driving functionality.[38] (emphasis in original)

3.36 Similarly, in an unavoidable low-energy collision, the SMMT comments that "the braking force of the vehicle should draw the fallback-ready user's attention to the situation":

> Moreover, it is unlikely that the fallback-ready user, even if engaged in permitted activities other than driving, will be oblivious to any contact with the vehicle, even if it is low-energy".[39]

3.37 In other words, although many ALKS will be able to recognise emergency vehicles and low-energy impacts, there is some uncertainty that all ALKS will be able to do so. In some cases, ALKS may rely on the person in the driving seat to notice and respond to the situation, even in the absence of a transition demand.

3.38 These scenarios raise difficult questions about the scope of the definition of self-driving. How far is the need to remain "vigilant to extraordinary external conditions" compatible with undertaking non-driving related activities? And who decides: is it a matter for nation states or international regulation? These questions are not easy to answer and we consider them below.

THE LEGAL IMPLICATIONS: A MATTER FOR EACH JURISDICTION

3.39 Although the UN Regulation describes ALKS as "the first regulatory step" towards automated driving and provides technical requirements, it does not indicate how the *use* of ALKS should be regulated in individual jurisdictions. It does not, for example, indicate how jurisdictions should assign civil and criminal liability for issues that arise

---

35 Regulation 2019/2144 on type-approval requirements as regards general safety and the protection of vehicle occupants and vulnerable road users, Official Journal L325 of 16.12.2019 comes into effect on 6 July 2022 and amends Regulation 2018/858.

36 Regulation 2019/2144, art 6(2)(c). The system alerts the driver when the speed limit is exceeded (but does not prevent the driver exceeding that limit). The system can be switched off by the driver at will where, for example, road signs are missing or defective. The driver is still expected to pay attention; see Recital 11.

37 In SAE terminology a fallback-ready user exists at Level 3 and has to take over control on the move. We discuss this in Ch 4.

38 SMMT response to the Call for Evidence, para 37.

39 SMMT response to the Call for Evidence, para 45.

from the how the ALKS drives. The measures in the ALKS regulation "are without prejudice to driver behaviour rules on how to use these systems in Contracting Parties".[40] As the recent amendment to the Vienna Convention on Road Traffic 1968 makes clear, automated driving is subject to "domestic legislation governing operation".[41]

3.40 Furthermore, the ALKS Regulation does not state whether drivers should be allowed to engage in non-driving related activities while the ALKS is engaged (such as looking at the infotainment screen to check emails or watch a film). This point is made explicit in the introduction to the Regulation. As we noted above, although the Regulation requires most activities displayed on the infotainment screen to be suspended as soon as a transition demand is issued,[42] this is without prejudice to national laws about how these systems may lawfully be used at a national level.[43]

The UNECE draft resolution on "activities other than driving"

3.41 The issue of secondary activities has been addressed by another part of the UNECE: the Global Forum for Road Traffic Safety (known as Working Party 1).

3.42 In March 2021, Working Party 1 will consider a draft resolution on activities other than driving which drivers may undertake when the automated driving system is engaged. The draft resolution applies to vehicles equipped with automated driving systems which issue transition demands to the driver. Drivers using such automated driving systems need to be ready and able to exercise dynamic control, and may be expected to do so on a transition demand.[44]

3.43 Non-driving related activities (unrelated to dynamic control of the vehicle) may be permitted if four criteria are met:

(1) These activities do not prevent the driver from responding to demands from the automated driving system for taking dynamic control. The resolution says the user should be "ready and able" to take control;

(2) These activities are consistent with the prescribed use of the automated driving system and its defined functions;

---

40 ALKS Regulation, Introduction.

41 Vienna Convention on Road Traffic, Article 34 Bis, paragraph (b), available in the Report of the Global Forum for Road Traffic Safety on its eighty-first session ECE/TRANS/WP.1/173, Annex 1. The explanatory memorandum to the amendment expressly states that individual jurisdictions "could also impose additional requirements for the operation of automated driving systems", Annex 2.

42 As discussed earlier, an exception is made for activities normally permitted while driving, such as satnavs.

43 ALKS Regulation, Introduction.

44 The draft resolution refers to the technical capabilities an ADS needs in order to support the driver to safely undertake non-driving related activities. Section IV of the draft resolution states that it is assumed that automated driving systems will support outcomes including "… sufficient lead time for the driver to complete a safe process to take dynamic control" and "the performance of appropriate risk mitigation manoeuvres (including where the automated driving system takes action if the driver disregards a transition demand or if it is determined that the driver is not ready and able to respond to a transition demand from the automated driving system)."

(3) The driver complies with traffic laws applicable in the country regarding activities other than driving; and

(4) The driver has and maintains the capabilities necessary to fulfil their respective duties regardless of whether an automated driving system is engaged.

3.44 By including point 3, the resolution confirms that, even if the other criteria are met, contracting states may decide not to permit secondary activities. The matter is one for local discretion.

THE DEFINITION OF SELF-DRIVING IN GREAT BRITAIN

3.45 Under section 1 of the Automated and Electric Vehicles (AEV) Act 2018, the Secretary of State must prepare a list of all motor vehicles that are (in the Secretary of State's opinion) "designed or adapted to be capable, at least in some circumstances or situations, of safely driving themselves".

3.46 Section 8(1)(a) defines "driving itself" as "operating in a mode in which it is not being controlled, and does not need to be monitored, by an individual".

3.47 The question is whether a vehicle equipped with an approved ALKS system would meet this definition. Can the ALKS safely drive itself without being monitored by an individual?

Why the definition of self-driving matters

3.48 At present, the definition only affects civil claims. The AEV Act 2018 introduces a new form of liability by which an insurer becomes liable for accidents caused by a listed vehicle "when driving itself".

3.49 However, in our first consultation paper, we said that the definition should also affect criminal liability. We proposed that where the vehicle is listed as capable of driving itself and the automated driving system (ADS) is correctly engaged, the human user would not be liable for criminal offences arising out of the dynamic driving task. Instead, any problems would be dealt with by regulatory action against the automated driving system entity (ADSE). Two thirds of consultees agreed. Many saw this as logical, given that the human user no longer had any control over the way the vehicle was driven.

3.50 Therefore, under our proposed scheme, the definition of self-driving matters a great deal. If a vehicle is classified as self-driving and the ADS is correctly engaged, the person in the driving seat becomes a "user-in-charge" rather than a driver. This has several implications:

(1) The user-in-charge could lawfully undertake activities which drivers of conventional vehicles are not allowed to do as it would distract them from driving. Examples are watching a movie or reading emails.

(2) If there is a collision caused by a vehicle driving itself:

(a) the insurer would compensate the victim, irrespective of fault by either the user-in-charge or the ADSE;

(b) the user-in-charge could not be prosecuted for offences such as careless or dangerous driving.

(3) The user-in-charge could not be prosecuted for a wide range of other offences, such as exceeding the speed limit or running a red light.

(4) Instead, if the ADS acted in a way which would be criminal if done by a human driver, this would be dealt with as a regulatory matter. The issue would be resolved between the regulator of the AV safety assurance scheme and the entity which is responsible for the safety of the automated driving system (the Automated Driving System Entity or ADSE).[45]

3.51 There is a crucial conceptual leap between human driving and self-driving. On one side of the line, an advanced driver assistance system might give the impression of self-driving, as it acts to steer the car and control acceleration and braking. However, as the system cannot deal with all situations, the human behind the wheel is required to monitor the driving environment and respond to events. The human would be blamed for dangerous or careless driving – and, if someone dies as a result, might spend years in prison.

3.52 On the other side of the line, the ADS is regarded as self-driving. The steering and acceleration may look similar. However, the human in the driving seat may relax and divert their attention, knowing that they are not responsible for anything that happens while the ADS is correctly engaged. The ADS itself monitors the driving environment and responds to events.

3.53 This means that under our scheme it would be crucial to distinguish between systems which can (and cannot) "safely drive themselves" without needing to be "monitored by an individual". Where should this dividing line fall?

The monitoring test and control test

3.54 In its call for evidence, the Government sets out two tests which it proposes to use to decide whether a vehicle or type of vehicle is capable of driving itself safely: the monitoring test and the control test.[46]

(1) The monitoring test states that an individual does not need to monitor the vehicle if the vehicle can safely achieve the following without human monitoring:

(a) comply with relevant road traffic rules;

(b) avoid collisions which a competent and careful driver could avoid;

(c) treat other road users with reasonable consideration;

(d) avoid putting itself in a position where it would be the cause of a collision;

45 Under our proposals in Ch 14, it would also be a criminal offence for the ADSE to misrepresent or conceal safety-critical information. These would target wrongdoing by the corporation itself, senior management and employees that directly participated in the wrongdoing.

46 Call for Evidence, p 23.

(e) recognise when it is operating outside of its operational design domain.

(2) The control test states that a vehicle is not being ‘controlled’ by an individual if the individual controls none of the following:

(a) longitudinal dynamics (speed, acceleration, braking, gear selection);

(b) lateral dynamics (steering).

3.55 Annex A to the Call for Evidence listed each criterion against an equivalent provision in the ALKS Regulation. On this basis, the UK Government reached the preliminary assessment that ALKS are self-driving within the meaning of the AEV Act 2018, subject to responses and further evidence.

3.56 The Call for Evidence asked if these tests provide a reasonable framework for testing compliance with the AEVA definition of automation; and if consultees agreed with the preliminary assessment.[47]

The definition of self-driving: responses to the Call for Evidence

A controversial issue

3.57 Consultees were split on whether ALKS should be listed under the AEV Act 2018 as self-driving. At one end of the spectrum, the Association of British Insurers (ABI) and Thatcham argued strongly that ALKS should not be listed:

> In our opinion, ALKS fails the Government’s own test of whether it should be regarded as automated under the definition of the AEV [Act]. Of the 12 key requirements for safe automated driving set out by the insurance industry in 2019, only 2 (Location Specific and Starting Automation) are clearly and unambiguously met….
>
> ALKS systems require the driver to take back control to maintain safety and cannot emulate a safe and competent driver. The technology may have benefits but only as an extension of today’s Assisted driving technologies.

3.58 At the other end of the spectrum, the SMMT said that all ALKS enabled vehicles should be listed:

> We believe the definition of an automated vehicle set out in AEVA 2018 is aligned with the requirements of Regulation 157 [The ALKS Regulation]. A vehicle with ALKS is designed to be capable, in at least some circumstances or situations, i.e. its ODD, of safely driving itself.[48]

3.59 The SMMT emphasised that the UK should list all type-approved ALKS, without additional checks or tests:

---

[47] Call for Evidence, p 23.

[48] SMMT response to the Call for Evidence, para 27.

> Vehicle manufacturers will design, develop and manufacture vehicles with ALKS for global markets. As such, it is of paramount importance for contracting parties to follow and apply international regulations in order to avoid a patchwork of fragmented individual national regulations.[49]

Concerns about applying the tests

3.60 There was comparatively little discussion of the monitoring and control tests themselves. Instead, the debate was about how the tests were applied. Again, ABI and Thatcham put the point strongly:

> Any high-level approach that simplifies a highly complex task into 7 principles is going to be open to a large degree of interpretation. Thatcham and the ABI strongly disagree with the interpretation of how ALKS meets these criteria.[50]

3.61 They pointed to a need for "significant additional technical details" to "reduce the room for local interpretation".[51]

3.62 The Faculty of Advocates made some comments on the tests themselves, but were particularly critical of the way that the tests had been applied in Annex A:

> Annex A does not appear to be such an assessment: it appears to tabulate the draft test criteria against certain 'requirements' which are pre-filtered by their understood relevance to those requirements.

3.63 WMG asked for "further guidance at a UK level":

> For example, the regulation states: "The activated system shall not cause any collisions that are reasonably foreseeable and preventable". The terms "reasonably foreseeable and preventable" are subjective terms and open to interpretation. Therefore, more guidance is needed to ensure common understanding and safety targets for ALKS system.

Requests for further research

3.64 Several respondents said that further research was needed about how ALKS would work before making a decision whether to list the vehicle as capable of safely driving itself under section 1 of the AEV Act 2018; or to permit the human in the driving seat to engage in non-driving related activities whilst the ALKS is engaged. Reed Mobility said that "more research is required to understand how ALKS performs before it could be considered to offer true automated driving as per AEVA".

3.65 Burges Salmon LLP opposed allowing secondary activities before further evidence had been gathered. They cited various academic studies in support, concluding that:

> whilst we acknowledge the possibility that secondary activities may alleviate issues related to experiencing periods of "low cognitive load", it is not clear that

49 SMMT response to the Call for Evidence, para 30.

50 ABI/Thatcham response to the Call for Evidence, para 35.

51 ABI/Thatcham response to the Call for Evidence, para 36.

there is a sufficient evidence base to demonstrate that in this context and the relative net benefits suggested.

3.66 The RAC Foundation also noted the need to consider how rules on secondary activities would work in practice:

> Drivers can still routinely be seen using handheld devices whilst driving despite successive increases in penalties, either because they have missed or misunderstood the law or because they judge the chances of being caught are so slim. The government needs to consider very carefully how, in the real world, people will behave and act accordingly.

CONCLUSION: THREE QUESTIONS

3.67 The debate over ALKS raises three controversial questions of what it means for a vehicle to be self-driving as a matter of law.

(1) The first is about monitoring. If the human in the driving seat is not monitoring the vehicle or the outside environment, how far can they be expected to intervene, in response either to a transition demand or exceptional external conditions? We discuss this in depth in Chapter 4. We draw on the considerable literature on what it means for an individual to monitor the driving environment, the vehicle or the way that it drives.

(2) Secondly, how safe is safe enough? For example, does the system have to drive as well as a competent and careful driver in all circumstances, or is it enough that they are better than human drivers overall? We discuss different safety thresholds in Chapter 5.

(3) Thirdly, who decides: should decisions about what is self-driving be made internationally, or by nation states? While vehicle regulation is mostly governed by UNECE regulations, driving behaviour is a national competence. Self-driving straddles both areas. We describe the current law in Chapter 6, discuss methods for assessing AV safety in Chapter 7 and make provisional proposals in Chapter 8.

3.68 These questions relate to all systems with the potential for self-driving which may be developed over the next decade. This paper is not simply about ALKS, although the debate over ALKS has given the discussion a sharper focus.

3.69 The first question is definitional: if a vehicle needs to be monitored, it may be perfectly safe and acceptable, but not self-driving. The next question is: can the vehicle *safely* drive itself? This is a separate question: in theory a car could act dangerously, while still driving itself. However, it is an essential threshold, marking the boundary between driver assistance and self-driving. Under section 1 of the AEV Act 2018, the Secretary of State must be of the opinion that a vehicle can safely drive itself, at least in some circumstances. If the vehicle is not safe, it should not be listed as self-driving.

3.70 In practice, of course, the two questions are intertwined. If a vehicle is not safe without being monitored, this suggests that it does need to be monitored. Neither the definition nor the threshold have been met.

3.71 The Call for Evidence suggests that both questions are technical ones, which could be decided at UNECE level. Rather than make a separate decision about each make and model of vehicles, the Secretary of State's list might simply reference particular UNECE regulations.[52] This would mean that if a UNECE regulation were included on the list, any vehicle with a system approved under that regulation would automatically be listed as self-driving.

3.72 We have concerns about this approach, especially when Great Britain takes the next step towards self-driving - which is to absolve the human in the driving seat from criminal liability for what the vehicle does. In the absence of driver liability there needs to be an alternative effective way of regulating AV driving behaviour at national level.

3.73 In Chapter 8, we provisionally propose a national process for deciding whether a vehicle is safe enough to be allowed on the road without human monitoring. This means that (for example) some ALKS may meet the tests for self-driving while others may not. It also involves identifying an entity with a presence in Great Britain (the Automated Driving System Entity, or ADSE), to take responsibility for the way the vehicle drives on an ongoing basis.

52 Call for Evidence, para 3.12.

Chapter 4: Self-driving and human intervention

4.1 If a vehicle is driving itself, how far can a human in the driving seat be expected to intervene when things go wrong? If a driving automation feature is engaged, must the human continue to monitor the driving environment, or can they relax and carry out other activities (such as checking their messages)? And if they have relaxed into other activities, when and how should they be called on to take over the driving task? These are central questions which go to the meaning of self-driving.

4.2 In this chapter, we consider human intervention in Path 1 vehicles. These require a human in the vehicle[53] (or sometimes, in sight of the vehicle, as with auto-parking and auto-summons features). By contrast, Path 2 vehicles can travel empty and will be tracked remotely.[54] We consider intervention from a remote operations centre in Chapter 13.

4.3 As we have seen in Chapter 3, under the Automated and Electric Vehicles Act 2018 (AEV Act), a key test is whether the vehicle "does not need to be monitored by an individual".[55] We think that it is right to focus on the need for human monitoring, but pinning down the meaning of "monitoring" has proved more difficult than it may have first appeared.

4.4 Here we start by looking at the way humans respond when doing very little, and how much they tend to over-rely on machines. We then consider the work of the Society of Automotive Engineers International (SAE) in classifying levels of automation. We focus on "Level 3" systems, which do not require users to monitor the driving environment, but do require users to be receptive to a "request to intervene". We look at the way in which the SAE distinguishes between "monitoring" and "receptivity".

4.5 We then consider how these issues have been approached in UNECE resolutions and in other jurisdictions, particularly in Germany, Japan and the US. In the UK, the Association of British Insurers (ABI) and Thatcham research have also considered these issues.

4.6 Different sources use different terminology. Although the SAE refer to an alert given by a Level 3 system as "a request to intervene", this may understate its importance. The UN Regulation on Automated Lane Keeping refers to a "transition demand".[56] This gives a clearer picture of the significance of the alert, and we have adopted the term "transition demand" in this paper.

---

53 We refer to this person as the user-in-charge.

54 For the difference between Path 1 and Path 2 vehicles, see diagram in ch 2 above.

55 Automated and Electric Vehicles Act 2018, s 8(1)(a).

56 UN Regulation 157 on uniform provision concerning the approval of vehicles with regards to Automated lane Keeping System ECE/TRANS/WP.29/2020/81 (ALKS Regulation), para 2.2.

4.7 As we discuss below, we think that if a transition demand is timely and clear, it is reasonable to expect the user-in-charge to respond to it. However, we have strong concerns over any requirement that the user-in-charge should be expected to notice problems in the absence of a transition demand. On this basis, we think that some conditionally automated[57] systems will qualify as self-driving while others will not.

HUMAN FACTORS RESEARCH: THE PROBLEM OF PASSIVITY

4.8 There is a robust body of human factors[58] research showing that people find it more difficult to monitor a task passively than to be actively engaged in it.[59] The less people are called on to do, the more likely they are to lose concentration and become drowsy, inattentive or distracted. Furthermore, after using machines for a while without incident, people tend to become over-confident. They will then rely on automation even if they are told that it is not safe to do so. Over time, erosion of driving skills may also become a concern as people drive less and less.[60]

4.9 As we move incrementally towards automated driving, the problem of over-reliance has come to the fore. Misuse and abuse of driving automation features has already led to dangerous risk-taking. For example, in 2018 a driver moved into the passenger seat on an English motorway, while the driver assistance system propelled the car at 40 miles an hour. When convicted of dangerous driving, the driver commented that he was "the unlucky one who got caught".[61] Unfortunately, there have also been fatalities associated with over-reliance on driver assistance features.[62]

4.10 This means that increases in the sophistication of driving automation do not necessarily lead to increases in safety. Several commentators have pointed to a "dip" in safety between helpful assistance and true self-driving. There comes a point in which the system gives the appearance of self-driving without being good enough to cope with common scenarios (such as weaving motorcycles, inconsistent road markings or parked vehicles partially occupying the lane).

4.11 As Professor Philip Koopman and Beth Oysk explain:

---

57 Also referred to as SAE Level 3 systems in the SAE Taxonomy discussed below.

58 "Human factors" is a discipline concerned with understanding the interaction between humans, machines and the environment in which they operate. See for example the website of the International Ergonomics Association, https://www.iea.cc/whats/index.html.

59 We summarised this material in CP1, Appendix 3.

60 Similar issues have arisen in aviation as flying has become increasingly automated, see the Federal Aviation Administration Safety Alerts for Operators at https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo/all_safos/media/2013/safo13002.pdf.

61 CP1, note 118.

62 This has been the case with drivers who have over-relied on Tesla's "Autopilot" system. For example, Joshua Brown died in May 2016 when his Tesla collided with a truck on a Florida Highway: see https://www.nytimes.com/2016/07/02/business/joshua-brown-technology-enthusiast-tested-the-limits-of-his-tesla.html. In March 2018, Walter Huang died when his Tesla collided with a concrete barrier in California: see https://www.bbc.co.uk/news/technology-51645566.

> Perhaps counter-intuitively, the probability of a supervisor failure is likely to increase as the autonomy failure rate decreases. (…) In other words, the less often autonomy fails, the less reliable supervisor intervention becomes. The most dangerous operational region will be when the autonomy is failing often enough to present a significantly elevated risk, but not often enough to keep the supervisor alert and engaged.[63]

4.12 The point can be illustrated schematically by the following (theoretical) diagram:[64]

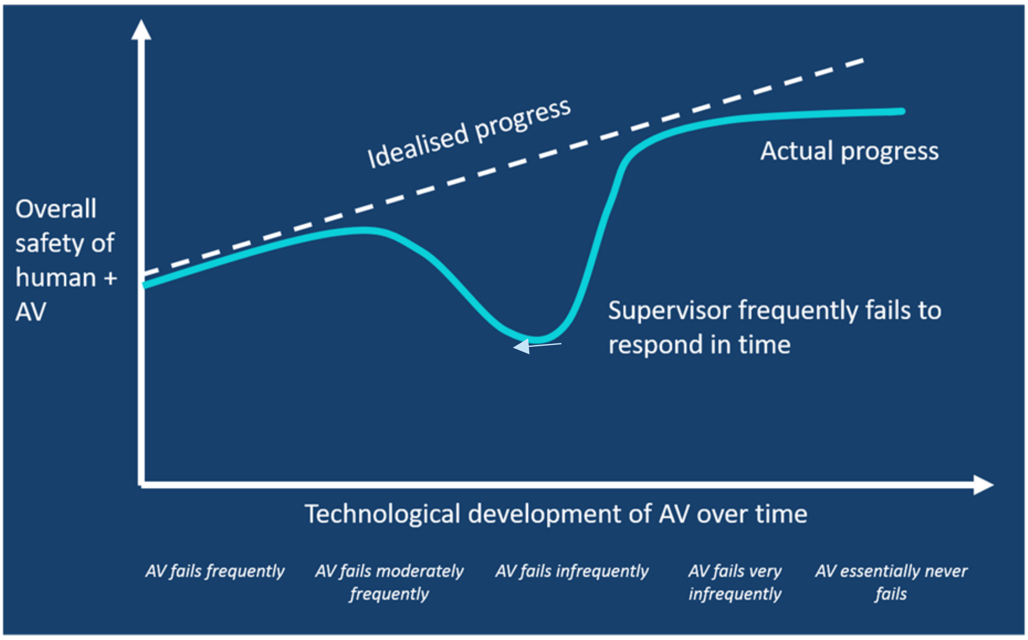

Figure 4.1 – A comparison between the idealised progress and actual progress of the development of AVs

4.13 The law cannot prevent the human tendency to lose concentration while monitoring or to over-rely on technology. However, the law should not exacerbate the problem. It must give clear messages about what is self-driving and what is not.

4.14 Those responding to our first consultation paper stressed that people using these driving automation features need to understand what is (or is not) expected of them. They called for a clear dividing line between vehicles which can safely drive themselves and those which merely assist a human driver.[65] We therefore propose a single definition of self-driving to cover both civil and criminal liability.

---

63 P Koopman and B Osyk, "Safety Argument Considerations for Public Road Testing of Autonomous Vehicles" (2019) 1(2) *SAE International Journal of Advances and Current Practices in Mobility* 512.

64 See also F Flemisch "Uncanny and Unsafe Valley of Assistance and Automation: First Sketch and Application to Vehicle Automation", in C Schlick (ed), *Advances in Ergonomic Design of Systems, Products and Processes* (2017).

65 The Association of British Insurers (ABI) and Thatcham Research have published extensively on this matter. See for example *Defining Safe Automated Driving. Insurer Requirements for Highway Automation* (September 2019) (ABI/Thatcham Report), https://www.abi.org.uk/globalassets/files/publications/public/motor/2019/defining-safe-automation-technical-document-aug-2019.pdf. We refer to this further below at paras 4.70 to 4.76 below.

THE SAE TAXONOMY

4.15 SAE published its taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles in 2014. It has been revised several times, with the latest publicly available version released in 2018 (the "SAE Taxonomy").[66] It sets out a six level system, as illustrated below.

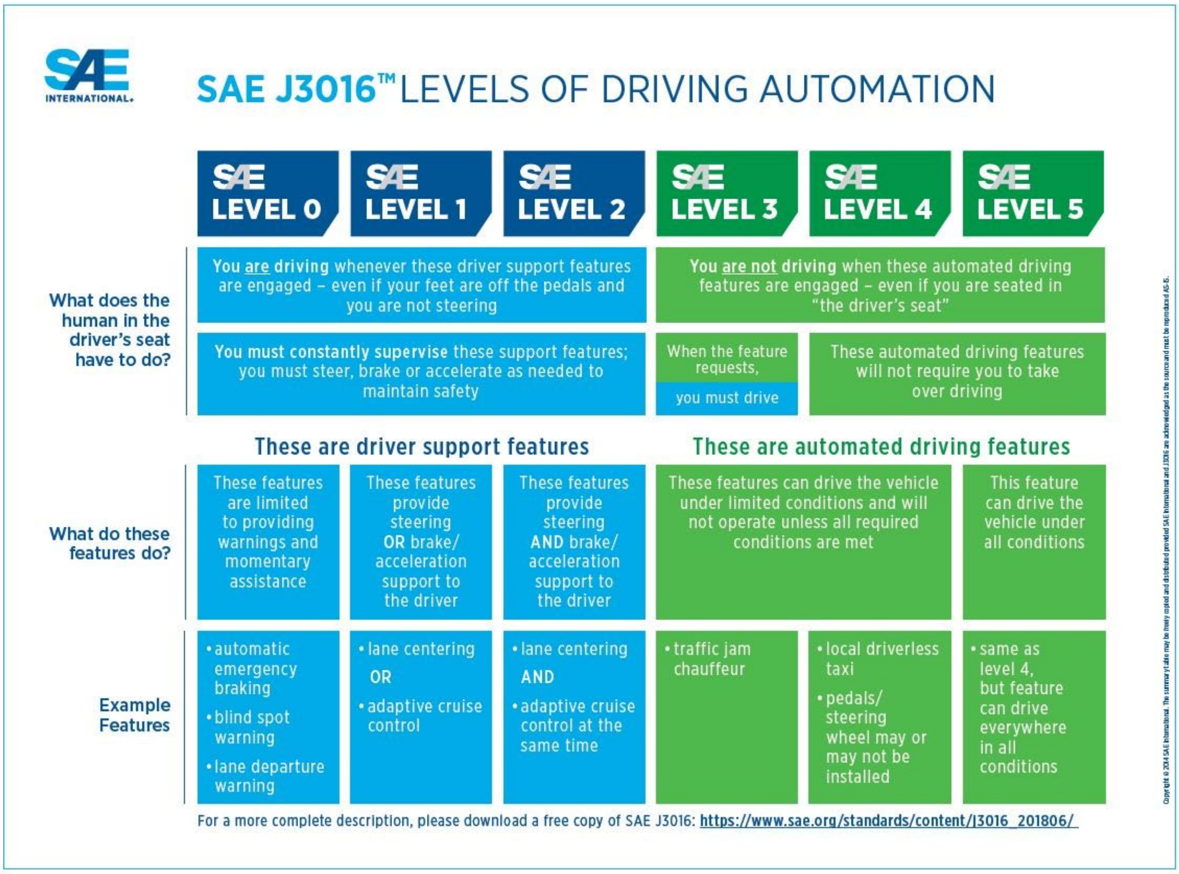

Figure 4.2 – A simplified visual chart of the SAE J3016 levels (from SAE.org)

4.16 The most marginal level is "conditional automation" (Level 3), in which the automated driving feature is generally capable of performing all the driving tasks but a human in the driving seat is expected to respond to its "request to intervene". In SAE terminology, at Level 3, a human "fallback-ready user" must be receptive to the request or to an evident vehicle systems failure, but is not expected to monitor the driving environment.[67]

---

66 Society of Automotive Engineers International (SAE), *J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles* (June 2018) (SAE Taxonomy).

67 SAE Taxonomy, paras 3.19, 3.19.2 and 5.4.

4.17 Level 3 can be contrasted with Level 4 (high automation). Here, if the user fails to respond to a handover alert, the issue is not safety-critical. Instead the system will put the vehicle into a "minimal risk condition".[68]

4.18 The SAE Taxonomy is described as "descriptive and informative, rather than normative", and "technical rather than legal".[69] It aims to "be useful across disciplines", including engineering and law, by providing a technical description of the respective roles of human users, the driving automation system and other vehicle systems and components.[70] It does so on the basis of parameters defined by manufacturers.[71]

4.19 Importantly, the taxonomy does not determine legal responsibilities. Legal responsibility reflects judgments of fairness, accountability and allocation of risk in society, which go beyond engineering definitions or manufacturer specifications. Our views, on which we are consulting with this paper, are informed by the technical specifications in the SAE Taxonomy but are not dictated by them.

4.20 During our previous consultations we found considerable variation in what people understood each level of automation to cover, even among those working in the field.[72] People often refer to the tables published by the SAE rather than engaging with the full SAE Taxonomy set out in the detailed 35 page document.[73] Nonetheless the SAE Taxonomy is the most widely used description of driving automation and the closest people working in the field have to a common language.[74]

---

68 In the United States, the Uniform Law Commission (ULC) has described the distinction in the following terms: "Level 3 and 4 automated driving are distinguished from each other by who or what is expected to reasonably continue or terminate a trip when the automated driving system cannot complete it. At level 4, an automated driving system that encounters a failure or condition for which it was not designed can consistently achieve a 'minimal risk condition' by bringing the vehicle to a reasonably safe stopping point such as a highway shoulder. At level 3, in contrast, a particular vehicle user is expected to intervene under these circumstances (after appropriate warning by the automated driving system or the vehicle) to either drive the vehicle to its destination or, if this is no longer practical, to achieve a 'minimal risk condition.'", see ULC discussions (February 2018) at https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=53d82b1e-a0af-dcfd-f268-69ad552cd7a0&forceDialog=0.

69 SAE Taxonomy, pp 1 and 18.

70 SAE Taxonomy, p 1.

71 SAE Taxonomy, p 24: "The manufacturer of a driving automation system determines that system's requirements, operational design domain, and operating characteristics, including the level of driving automation… The manufacturer also defines the proper use of that system". ISO/SAE DPAS 22736 broadly uses the same language but refers to a driving automation system "feature" rather than simply to the driving automation system; see p 29.

72 Common misconceptions include that 'Level 5' systems are the only ones that do not require any human intervention to complete a trip (whereas this can also include Level 4 systems, if the trip is entirely within the operational design domain (ODD)). Whereas Level 5 systems are defined as not having ODD limitations due to technological capability of the ADS, the SAE observe that a system that could be used "on all roads throughout the US" but which for legal or business reasons could not cross the border into Canada or Mexico would still be Level 5. See SAE Taxonomy, p 33.

73 ISO/SAE DPAS 22736 is 40 pages.

74 Ironically, "self-driving" is listed among the "deprecated terms" in the SAE Taxonomy. However it is the language used in the Automated and Electric Vehicles Act 2018.

4.21 Since 2018, the SAE has been collaborating with the International Organization for Standardization (ISO) to revise its taxonomy.[75] The Joint Working Group has produced a draft, and we are grateful to Steven Shladover and Siddartha Khastgir for allowing us to refer to it.[76] References to the SAE Taxonomy in this paper are to the 2018 published version, unless there are changes, in which case we refer to the Joint Working Group's draft revision of November 2020 ("ISO/SAE DPAS 22736").[77]

Supervision, monitoring and receptivity

4.22 The SAE Taxonomy relies on precise differences between three terms: supervision, monitoring and receptivity.

4.23 Supervision is the most comprehensive term. It includes not only monitoring for problems but also responding to them.[78] Drivers are expected to supervise driver assistance features at Levels 1 and 2 but are not required to supervise at Levels 3 or above.[79]

4.24 Monitoring describes a range of functions "involving real-time human or machine sensing and processing of data" to operate a vehicle or to support its operation.[80] The SAE subdivides monitoring into three categories:

(1) monitoring the driving environment, which includes object and event detection, recognition and response preparation;

(2) monitoring vehicle performance for DDT performance-relevant system failures.[81] These in turn may arise either due to an ADS malfunction or due to "other vehicle system failures"; and

(3) monitoring driving automation system performance, to see whether the system is performing part or all of the DDT appropriately.[82]

---

75 This was formed in 2018 by the SAE On-Road Automated Driving (ORAD) Committee and the ISO TC204/WG14.

76 The ability to refer to the latest thinking on these questions is more relevant than quoting a definitive version, as we wish to open up discussion.

77 ISO/TC 204 Intelligent transport systems, Project: ISO/SAE Approved Working Item PAS 22736*/SAE J3016, Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles* (November 2020).

78 SAE Taxonomy, p 15.

79 SAE Taxonomy, pp 24 and 25. See also ISO/SAE DPAS 22736 p 30: "Unlike Level 1 and 2 driver support features, Level 3 and 4 ADS features are designed to monitor and enforce their ODD limitations while engaged, and to prevent engagement or operation outside of their prescribed ODD."

80 SAE Taxonomy, p 12.

81 SAE Taxonomy, p 13.

82 See in particular SAE Taxonomy, p 13: "At higher levels of driving automation (Levels 3-5), the ADS monitors its own performance of the complete DDT".

4.25 Level 4 systems monitor all three aspects.[83] Level 3 systems monitor the driving environment and ADS performance but not vehicle performance (except to the extent it arises from an ADS malfunction).[84] This leaves a gap. Although the user is expected to be "receptive" to evident failures in non-ADS systems within the vehicle,[85] neither the system nor the user is required to monitor them. [86] Rather, the risks arising from "other vehicle system failures" are mitigated through braking as part of the vehicle's "failure mitigation strategy".[87]

4.26 Receptivity is defined as "an aspect of consciousness characterized by a person's ability to reliably and appropriately focus his/her attention in response to a stimulus".[88] The SAE distinguish receptivity from monitoring, using the following example:

> A person who becomes aware of a fire alarm or a telephone ringing may not necessarily have been monitoring the fire alarm or the telephone. Likewise, a user who becomes aware of a trailer hitch falling off may not necessarily have been monitoring the trailer hitch. [89]

4.27 Monitoring and supervising are familiar legal terms. They involve positive actions that can be objectively verified externally. By contrast, receptivity is a mental state that involves no external action. The requirement to be receptive can only be meaningfully observed by the user "not doing" something that is inconsistent with receiving the stimulus. For example, a person cannot be receptive to a sound alert if they are wearing noise-cancelling headphones. To comply with the obligation, a user needs to know what they must be receptive to. They may also need to rehearse how to respond appropriately if the stimulus arises. That is why, in addition to installing fire alarms, organisations have fire drills.

4.28 At Level 3, the human in the driving seat (referred to as a "fallback-ready user") does not have to supervise or monitor the system. However, they do need to remain receptive to two separate categories of stimuli: "requests to intervene" (that is, transition demands) and "evident vehicle system failures". As we discuss below, these raise very different issues.

---

83 SAE Taxonomy: "While a level 4 ADS is engaged in stop-and-go traffic, a malfunctioning brake caliper causes the vehicle to pull to the left when the brakes are applied. The ADS recognizes this deviation, corrects the vehicle's lateral position and transitions to a limp-home mode until it achieves a minimal risk condition".

84 SAE Taxonomy, p 13: "While performing the DDT, Level 4 and 5 ADSs monitor vehicle performance. However, for Level 3 ADSs, as well as for Level 1 and 2 driving automation systems, the human driver is assumed to be receptive to vehicle conditions that adversely affect the DDT".

85 These are described as "other vehicle systems" in paras. 5.4 and 3.18 of the SAE Taxonomy.

86 SAE Taxonomy, p 33: the fallback-ready user of an SAE Level 3 vehicle must be able to perform the DDT fallback "whenever required, including in cases when a DDT performance-relevant vehicle system failure has occurred that the ADS may not be monitoring (such as a broken suspension component)".

87 ISO/SAE DPAS 22736, p 9: "A vehicle function (not an ADS function) designed to automatically bring an ADS-equipped vehicle to a controlled stop in path…".

88 SAE Taxonomy, p 14.

89 SAE Taxonomy, p 12.

Requests to intervene (transition demands)

4.29 ISO/SAE DPAS 22736 defines a "request to intervene" as:

> An alert provided by a Level 3 ADS to a fallback-ready user indicating that s/he should promptly perform the DDT fallback, which may entail resuming manual operation of the vehicle (i.e., becoming a driver again), or achieving a minimal risk condition if the vehicle is not operable.[90]

4.30 Thus a request to intervene applies only at Level 3. This contrasts with the 2018 SAE Taxonomy, where the term also applied to Level 4 and 5 systems which prompt a human user to resume driving.[91] ISO/SAE DPAS 22736 explains:

> it may be possible for a passenger in a Level 4 or 5 ADS-operated vehicle to also resume manual operation of the vehicle… However, even when alerted by the ADS to take over vehicle operation, a passenger of such a vehicle is not required to do so to ensure competent operation, as Level 4 and 5 ADS features/vehicles are capable of automatically achieving a minimal risk condition when necessary. Thus, such an alert to a passenger of a Level 4 or 5 ADS-operated vehicle is not a "request to intervene" as defined herein for Level 3 ADS-equipped vehicles.[92]

4.31 For Level 4 systems the ISO/SAE DPAS 22736 talks of "alerts" or "prompts" to the passenger to resume driving upon ODD exit.[93]

4.32 Human factors research indicates that there are challenges to humans taking over the driving task at short notice. It takes time to regain situational awareness, so as to read the road and understand hazards in front, to the side and behind the vehicle. The SAE therefore requires that requests to intervene are "timely".[94] In other words, the system must be capable of continuing to perform the DDT "for at least several seconds" after the request to intervene,[95] so as to allow the human to regain situational awareness.

Minimal risk conditions

4.33 The main difference between SAE Level 3 and SAE Level 4 is that, following a failed prompt to intervene, a Level 4 vehicle can achieve a "minimal risk condition". At Level 4, responding to the prompt is not safety-critical, while at Level 3 it is.

---

90 ISO/SAE DPAS 22736, p 18.

91 SAE Taxonomy, pp 22 and 23: "ADS (while engaged) performs the DDT fallback and transitions automatically to a minimal risk condition when… a user does not respond to a request to intervene".

92 ISO/SAE DPAS 22736, p 18.

93 See also ISO/SAE DPAS 22736, pp 28 and 31.

94 SAE Taxonomy, p 22: "ADS (while engaged): Determines whether ODD limits are about to be exceeded and, if so, issues a timely request to intervene to the DDT fallback-ready user. Determines whether there is a DDT performance-relevant system failure of the ADS and, if so, issues a timely request to intervene to the DDT fallback-ready user".

95 SAE Taxonomy, pp 7 and 12.

4.34 A minimal risk condition is described as

> a stable, stopped condition to which a user or an ADS may bring a vehicle… in order to reduce the risk of a crash when a given trip cannot or should not be continued.[96]

4.35 The SAE explain that the characteristics of a minimal risk condition may vary depending on the system failure, the Operational Design Domain (ODD) and "the particular operating conditions when the system failure or the ODD exit occurs":

> It may entail automatically bringing the vehicle to a stop in its current travel path or it may entail a more extensive manoeuvre designed to remove the vehicle from an active lane of traffic and/or to automatically return the vehicle to its dispatching facility.[97]

4.36 However, the SAE do *not* specify what the minimal risk conditions must be. It particular, they do not state that the stop must be safe.

Failure mitigation strategies

4.37 The SAE Taxonomy also refers to a vehicle's "failure mitigation strategy" as an additional feature for vehicles equipped with Level 2 and 3 driving automation features. A failure mitigation strategy is designed to bring the vehicle to a controlled stop wherever the vehicle happens to be, if the driver fails to supervise the feature's performance (Level 2), or if the fallback-ready user fails to perform the fallback when prompted (Level 3).[98]

4.38 ISO/SAE DPAS 22763 expands this concept. In Level 3 systems, a failure mitigation strategy may also be triggered by a "prolonged failure" of the user to resume driving after a request to intervene. In a Level 4 vehicle it could be triggered by "a system failure or external event so catastrophic that it incapacitates the ADS" meaning a minimal risk condition cannot be achieved.[99]

SAE Levels 3 and 4: a blurred border

4.39 It has proved difficult to make a clear divide between Level 3 and Level 4 on the basis of a minimal risk condition. As ISO/SAE DPAS 22736 comments, certain Level 3 systems "may be capable of achieving a [minimal risk condition] in limited conditions".[100] The combination of "limited" minimal risk conditions and failure mitigation strategies means that a failure of a fallback-ready user to respond may not be catastrophic, even if it is from far from ideal.

4.40 In practice, most Level 3 systems will be programmed to stop if the user fails to respond to a request to intervene, even if the stop is not necessarily a safe stop. In the

---

96 ISO/SAE DPAS 22736, p 14.

97 SAE Taxonomy, section 3.17.

98 SAE Taxonomy, p 31.

99 ISO/SAE DPAS 22736, p 9.

100 ISO/SAE DPAS 22736, p 30.

case of Automated Lane Keeping Systems (ALKS), for example, if the user fails to respond to a transition demand, the vehicle come to a gradual stop in lane on a motorway. The ALKS Regulation refers to a "minimum risk manoeuvre".[101] This is

> a procedure aimed at minimising risks in traffic, which is automatically performed by the system after a transition demand without driver response or in the case of a severe ALKS or vehicle failure.[102]

4.41 In practice, a Level 3 "minimum risk manoeuvre" (in the UNECE terminology used for ALKS) may be difficult to distinguish from achieving a Level 4 "minimal risk condition" (the terminology used by the SAE), which in some circumstances may also involve coming to a stop in lane. The terminology itself can lead to confusion, as people sometimes refer to "minimal risk manoeuvres" in respect of Level 4 systems in terms of the manoeuvres used to achieve a minimal risk condition.

Evident failures

4.42 Under Level 3 the SAE Taxonomy, users must not only be receptive to transition demands. They must also be receptive to evident failures in other vehicle systems. As the 2018 publication states, the fallback-ready user is:

> receptive to ADS-issued requests to intervene, as well as to DDT performance-relevant system failures *in other vehicle systems*.[103] *(emphasis added)*

4.43 The SAE give examples of evident failures in other vehicle systems: a broken tie rod; a broken body or suspension component; and a sudden tyre blow-out.[104] The fallback-ready user is expected to respond to these failures "whether or not the ADS issues a request to intervene".[105] These are distinguished from a failure of the ADS itself, such as a malfunctioning radar sensor, which will trigger a request to intervene.[106]

4.44 The requirement for an individual to be receptive to and consequently respond to evident vehicle failures does not provide a clear legal boundary for when a human should stop having the legal responsibilities of a driver. We return to this below.

OTHER INTERNATIONAL WORK

4.45 The SAE taxonomy is one of various attempts to define self-driving at an international level. Below we look at the UNECE 2018 resolution on highly and fully automated vehicles; the UNECE draft resolution on "activities other than driving"; and the EU

[101] ALKS Regulation, para 2.7.

[102] ALKS Regulation, para 2.7.

[103] SAE Taxonomy, p 24.

[104] SAE Taxonomy, p 24.

[105] SAE Taxonomy, p 14.

[106] SAE Taxonomy, p 12: "A Level 3 ADS experiences a DDT performance-relevant system failure in one of its radar sensors, which prevents it from reliably detecting objects in the vehicle's pathway. The ADS responds by issuing a request to intervene to the DDT fallback-ready user. The ADS continues to perform the DDT, while reducing vehicle speed, for several seconds to allow time for the DDT fallback-ready user to resume operation of the vehicle in an orderly manner".

2019 General Safety Regulation. We then consider reforms in Germany and Japan and proposed reforms in the United States.

The UNECE 2018 resolution on highly and fully automated vehicles

4.46 The United Nations Economic Committee for Europe (UNECE) organises the Global Forum on Road Traffic Safety, known as Working Party 1. In 2018, Working Party 1 passed a resolution on the deployment of highly and fully automated vehicles in road traffic. The terms "highly" and "fully" automated vehicles correspond to SAE Levels 4 and 5.

4.47 The resolution sets out the response expected when an automated driving system reaches its limits. It says that automated driving systems in highly and fully automated vehicles should:

> be capable of achieving a state that maximises road safety when a given trip cannot or should not be completed for example in case of a failure in the automated driving system or other vehicle system.[107]

4.48 The resolution also requires automated driving systems to comply with traffic rules.[108]

The UNECE draft resolution on "activities other than driving": assumptions

4.49 In March 2021, Working Party 1 will consider a resolution for what an ADS must do before "drivers" can engage in non-driving-related activities. It applies to systems that issue transition demands. The draft sets out a number of assumptions about the technical capability of an ADS to support a driver to safely undertake activities other than driving. In broad terms, the draft provides that:

> automated driving systems will support the following outcomes:
>
> (a) Safe interaction between the driver and the automated driving system through an effective and intuitive human-machine interface;
>
> (b) Automated driving system responsibility for the safe execution of dynamic control, when the automated driving system is performing the driving task;
>
> (c) A safe, predictable transition phase, which includes sufficient lead time for the driver to complete a safe process to take dynamic control;
>
> (d) The ability to determine that the driver is ready and able to respond to a transition demand from the automated driving system, and to react appropriately depending on whether the driver intentionally takes dynamic control;

---

107 UNECE, Report of the Global Forum for Road Traffic Safety on its seventy-seventh session (3 October 2018) ECE/TRANS/WP.1/165, Annex 1 (2018 UNECE Resolution), para 4(f).

108 2018 UNECE Resolution, para 5(d)(ii).

(e) The performance of emergency manoeuvres, as drivers cannot be expected to take dynamic control in situations that are safety- and time-critical; and

(f) The performance of appropriate risk mitigation manoeuvres (including where the automated driving system takes action if the driver disregards a transition demand or if it is determined that the driver is not ready and able to respond to a transition demand from the automated driving system).[109]

4.50 These assumptions highlight how reliant road traffic safety is on drivers paying attention, and the important safeguards that need to be in place before that can be changed.

The EU 2019 General Safety Regulation

4.51 The General Safety Regulation came into force in November 2019.[110] It identifies specific technical requirements for automated vehicles and fully automated vehicles[111] using the following definitions:

(1) "automated vehicles": motor vehicles designed and constructed to move autonomously for certain periods of time without continuous driver supervision but in respect of which driver intervention is still expected or required;[112] and

(2) "fully automated vehicles: motor vehicles that have been designed and constructed to move autonomously without any driver supervision.[113]

4.52 The term "automated vehicle" in the General Safety Regulation appears to cover Level 3 systems, but there are differences in terminology compared with the SAE taxonomy.

4.53 The regulation defines automated vehicles as being designed to move without "continuous supervision", while fully automated vehicles are defined as being designed to "move autonomously" without "any driver supervision" at all. This is in contrast to ISO/SAE DPAS 22736 which expressly envisages that no driver supervision is required for Level 3[114] (or higher) level systems.[115] It is not clear what

109 Draft resolution on safety considerations for activities other than driving undertaken by the driver in a vehicle when its automated driving system is engaged, Section IV (December 2020) submitted by France, Germany, Japan, Luxemburg, the Netherlands, Sweden, and the UK for consideration by UNECE WP1.

110 Regulation 2019/2144 on type-approval requirements as regards general safety and the protection of vehicle occupants and vulnerable road users (Revised General Safety Regulation 2019/2144).

111 Revised General Safety Regulation 2019/2144, Art 11.

112 Revised General Safety Regulation 2019/2144, Art 3(21).

113 Revised General Safety Regulation 2019/2144, Art 3(22).

114 ISO/SAE DPAS 22736, p 30: "The DDT fallback-ready user need not supervise a Level 3 ADS while it is engaged but is expected to be prepared to either resume DDT performance when the ADS issues a request to intervene or to perform the fallback and achieve a minimal risk condition if the failure condition precludes continued vehicle operation".

115 ISO/SAE DPAS 22736, p 31: "The user does not need to supervise a Level 4 ADS feature or be receptive to a request to intervene while the ADS is engaged".

the regulation expects by way of "non-continuous supervision" or how far this is similar to "receptivity" in the SAE Taxonomy sense.

4.54 For automated vehicles, the regulation refers to a "driver" rather than a fallback-ready user. This suggests (but does not specify) that a human driver could continue to be criminally liable when things go wrong, if an ADS is engaged and they are not continuously supervising.

4.55 Despite considerable work in this field, there does not appear to be an international consensus, either on the terms to be used or on the legal consequences of different levels of automation.

The German approach

4.56 In Consultation Paper 1, we noted modifications to the German Road Traffic Act, known in German as Strassenverkehrsgesetz (StVG).[116] They permit the use of vehicles with highly and fully automated features that perform the dynamic driving task. The German category of "highly automated" vehicles, as defined by the StVG, includes "conditionally automated" vehicles.

4.57 The German approach is to allow limited non-driving related activities when such systems are engaged, provided that the automated driving system is used in the manner intended by the manufacturer. The driver can divert their attention when such a system is engaged, but must remain "wahrnehmungsbereit", meaning ready to perceive. This means that the driver must be in position to take over the driving task when prompted by the automated driving system, or when they realise that they must do so because of "obvious circumstances" that the conditions for the use of the system are no longer met.

4.58 It is unclear what will be considered an "obvious circumstance". When the amendments were being considered in the German Bundesrat this term was subject to debate.[117] Important road signs and inclement weather were cited as examples of things that might be considered obvious, but would require very different levels of readiness and perception. It is also unclear whether obvious circumstances will include conditions requiring some situational awareness, such as where the vehicle begins to veer between lanes, or cross white lines. This will likely need to be decided on a case-by-case basis by the German courts.

4.59 Importantly, the StVG also states that the driver who engages such a feature remains the driver at all times, even when the system is exercising control over the vehicle. They might remain directly liable for the full range of road traffic offences.[118]

---

116 CP1, para 3.91.

117 Deutscher Bundesrat, Plenarprotokoll 954. Sitzung, 10.03.2017. The Bundesrat is the upper house of the German parliament. Their response and concerns regarding the introduction of the amendments are available at https://www.bundesrat.de/SharedDocs/downloads/DE/plenarprotokolle/2017/Plenarprotokoll-954.pdf?__blob=publicationFile&v=2.

118 Road traffic offences under the German Road Traffic Regulations (or Strassenverkehrsordnung "StVO") require intentional or negligent breach in order to be established (StVO, s.49). Engagement of an ADS and compliance with the manufacturer's conditions of its operation might be capable of providing a defence.

4.60 The German approach differs from the approach taken by the SAE, whereby the user of a Level 3 vehicle is expected to be "receptive" to requests to intervene or evident failures but is not required to monitor either the driving environment or the way the ADS is driving. It also differs from the approach taken in the AEV Act. If a human driver still has to check for "obvious circumstances", we think the vehicle still needs to be monitored and would not meet the definition of self-driving.

4.61 In the future, the German framework may accommodate a category of automated vehicles which can be operated without a driver. Reports from some news outlets have indicated that Germany is drafting new legislation for a national approval scheme which would approve vehicles equivalent to SAE Level 4.[119] The legislation is thought to be in draft form and would come before the Bundestag for consideration in Summer 2021. It was reported that the legislation will define a new role of "technical supervisor", who will in most cases be located remotely rather than in the vehicle. This supervisor would presumably have different obligations from those of a driver, though it is not clear to what extent the technical supervisor would be required to monitor the driving environment.

The Japanese approach

4.62 In 2019, Japan introduced reforms to support automated driving. It amended both the Road Transport Vehicle Act[120] to set safety standards for automated driving systems and the Road Traffic Act to enable driving automation features of SAE Level 3 and above to be used on public roads.[121]

4.63 The reforms amend the definition of driving to include use of an "autonomous driving device".[122] This means that the user remains a "driver" even when the device is engaged and has the same fundamental obligations. Laws prohibiting mobile phone use and other screens no longer apply under certain driving environment conditions.[123] However, drivers are still expected to pay attention and notice a change in driving environment conditions when the device is engaged. As Professor Imai of the Law School of Hosei University of Japan, notes:

> If the driving environment conditions are no longer fulfilled, the driver must take over driving authority and duties involved. Accordingly, conditions that would make prompt take overs difficult (for example, drinking alcohol, sleeping in the car, using a smartphone, or reading) are prohibited. This viewpoint is adopted under the revised law.[124]

---

119 See https://www.eenewseurope.com/news/german-law-aims-be-first-driverless-cars/page/0/1.

120 Law No. 14, 2019. Enacted May 17, 2019.

121 Law No. 20, 2019. Enacted May 28, 2019.

122 Japan's revised Traffic Act, Section 2, clause 1–17. This is an ADS in the Act.

123 Japan's revised Traffic Act, Section 71, clause 4–2-2.

124 T Imai, "Legal regulation of autonomous driving technology: Current conditions and issues in Japan", (2019) 43(4) *International Association of Traffic and Safety Sciences (IATSS) Research*, pp 263 to 267.

4.64 Sleeping is not allowed for drivers using an autonomous driving device.[125] As for watching movies and sending emails, it depends on the circumstances. Drivers "should be able to immediately recognize" a change in the vehicle's roadworthiness[126] or that the environment conditions are not satisfied.[127] Drivers should also "be in a state to immediately and reliably operate the vehicle's equipment, other than the automatic operation devices". This has some similarities with the requirement to remain "ready to perceive" in German law. Drivers could be at fault for failing to notice "obvious circumstances" whereby the conditions for continued lawful operation of the autonomous driving device are no longer met.[128]

4.65 Professor Imai has been critical of this approach:

> In the revised act, drivers for autonomous driving systems at a technical level 3 are required to maintain a steady gaze on autonomous driving devices that are installed in the vehicle. However, this added liability for continuous monitoring, is not required by the SAE definition of level 3. It shows a discrepancy between technical and legal evaluation of level 3. The person in a level 3 autonomous driving vehicle should really be considered not as a driver but as an occupant before take over happened. The status as an occupant should change when a take over of the driving control is requested and the control is transferred from the autonomous driving system to the occupant.[129]

4.66 Honda is the first company to receive type approval for vehicles equipped with its autonomous driving device, Traffic Jam Pilot. Honda is planning to launch a Honda Legend equipped with Traffic Jam Pilot by 31 March 2021.[130]

The United States' Uniform Law Commission model law

4.67 The United States' Uniform Law Commission provides model laws for states to adopt and adapt as they wish. In 2019 it published an Automated Operation of Vehicles Act, for states to incorporate within their motor vehicle codes. The Act establishes an "automated driving provider" (similar to an ADSE) to take responsibility for an automated driving feature.

4.68 Unlike the German or Japanese approach, the US model law does not require the human in the driving seat to take over following a transition demand or in other "obvious" circumstances. Instead, it provides that "automated operation… continues until a human driver or human operator other than the automated-driving provider

---

125 It appears that sleeping would be an offence under s 119, cl 1, sub-cl 9 and 9-3 of the revised Traffic Act. Although this is not expressly stated in the Act, the Director of Transportation of the National Police Agency has expressed this view: see minutes of the House of Representatives Cabinet Committee Meeting, No 19, 2019, p 6.

126 Section 71-4-2 of the revised Traffic Act and Section 41, clause 2 of the Road Transport Vehicle Act.

127 Section 71-4-2 of the revised Traffic Act and Section 41, clause 2 of the Road Transport Vehicle Act

128 Section 119(2).

129 T Imai, "Legal regulation of autonomous driving technology: Current conditions and issues in Japan" (2019) 43(4) International Association of Traffic and Safety Sciences Research, p 263.

130 See Honda's press release: https://global.honda/newsroom/news/2020/4201111eng.html.

terminates the automated operation".[131] In other words, the human user only becomes a driver through a deliberate act. Neither transition demands or evident vehicle failures automatically shift legal responsibility for dynamic driving to the human user.[132]

4.69 Three considerations motivated this approach.

(1) Driving is a serious responsibility that should be affirmatively accepted rather than passively assumed. In short, driving should be *taken* but never *given*.

(2) The instinct for self-preservation should sufficiently incentivise vehicle occupants to respond appropriately to transition demands. Creating a new and potentially unclear legal obligation would therefore add little and, in any event, might have been outside the scope of the Act.

(3) The "automated-driving provider" (ADP) is in the best position to ensure that someone responds to a transition demand. For example, an ADP could alert a non-responsive user through increasingly urgent audio, visual and haptic signals; notify law enforcement; enlist a remote driver to intervene; or even restrict the non-responsive user from accessing the automated driving feature in the future. Specifying that the ADP remains the legal driver until a human driver affirmatively responds to a transition demand provides an especially strong incentive for the ADP to take such measures.

THE ABI/THATCHAM REPORT

4.70 In the UK, these issues have been considered in detail by the Association of British Insurers and Thatcham Research. In September 2019 they published a joint document setting out a three-part taxonomy:[133]

(1) *Assisted driving*, where the driver remains in charge of the driving task and must constantly monitor the road environment.

(2) *Automated driving,* where the user-in-charge needs to be available for transition of control, but not to maintain safety.

(3) *Autonomous driving,* where the vehicle has full responsibility for the dynamic driving task, and the user is effectively a passenger.

4.71 In broad terms, these correspond to the three categories used in this paper: driver assistance; self-driving with a user-in-charge; and self-driving without a user-in-charge.

---

131 Uniform Law Commission, Automated Operation of Vehicles Act (December 2019), s 2(4); available at https://www.uniformlaws.org/committees/community-home?CommunityKey=4e70cf8e-a3f4-4c55-9d27-fb3e2ab241d6.

132 Uniform Law Commission, Automated Operation of Vehicles Act (December 2019), s 9(c) makes the automated driving provider liable for driving offences during automated operation.

133 ABI/Thatcham. Defining Safe Automated Driving, September 2019..

4.72 The paper then lists twelve key criteria for the safe introduction of automated driving. Some important themes emerge. First, the paper draws attention to the considerable confusion among drivers about what the various automation features currently on the market can (or more importantly cannot) do. It argues that manufacturers must eliminate consumer confusion through appropriate system naming,[134] adverts and manuals. The paper highlights that many of the difficulties in regulating automated driving arise from the interaction of automated driving systems and their users. Drivers may take control by mistake, or fail to take control when they should. The paper therefore argues for human-machine interfaces which are simple and intuitive to understand. In particular, "all changes of user role in the operation of the vehicle shall use the applicable clear Offer and Confirm or Request and Confirm process".[135]

4.73 The paper also highlights the dangers of a vehicle stopping in lane following a failed transition demand:

> Stopping in a live traffic lane on the highway presents a clear risk of a serious collision from the rear as well as introducing a new hazard to the other vehicles in the same lane.[136]

4.74 This may be a particular problem for traffic jam features, once the jam starts to clear:

> Traffic is transient and congested speeds of 50 km/h could change to busy but more freely flowing traffic of 80, 90 or 100 km/h or more in a much shorter time than the 45 seconds that some human factors research thinks is necessary to safely bring a driver back into the loop.[137]

4.75 However, the paper acknowledges that there may be ways to mitigate the risk, particularly if the ADS could continue to operate safely at its maximum speed even though surrounding traffic was travelling much faster. Risk could also be mitigated by using "aggressive and effective means" to bring the driver back into the loop quickly.

4.76 The ABI and Thatcham conclude that some SAE Level 3 systems might qualify as automated driving, but most will not:

> Depending on the implementation and capability of the ADS, it is anticipated that some SAE Level 3 systems might be able to meet the criteria for Automated Driving, but the majority will be classified as assisted with the

---

[134] Research has shown that the name given to an automation feature has a strong effect of driver's perceptions of its capability: see E Teoh, "What's in a name? Drivers' perceptions of the use of five SAE level 2 driving automation systems" (2020) 72 Journal of Safety Research 145; and H Abraham, B Seppelt, B Mehler, and B Reimer, "What's in a name: vehicle technology branding & consumer expectations for automation" (2017) *Proceedings of the 9th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, pp 24 to 27. See discussions about consumer information and marketing at paras 10.47 to 10.50 below.

[135] ABI/Thatcham Report, p 66.

[136] ABI/Thatcham Report, p 28.

[137] ABI/Thatcham Report, p 28.

expectation that their drivers will not be allowed to undertake secondary tasks as they ultimately remain responsible for the dynamic driving.[138]

OUR PROVISIONAL VIEWS

4.77 The law needs to be clear about what is or is not self-driving. This is particularly important for those Part 1 vehicles which can perform the DDT during some but not all of the journey. We do not think that a vehicle can be accepted as self-driving for some purposes (such as allowing the use of screens for non-driving related activities) but not for others (such as criminal liability). If a user is told that they may (for example) check their emails while the system is engaged, we do not think that they can be blamed for a collision caused by the ADS while they are distracted from the driving task. The AEV Act already makes the insurer civilly liable in these circumstances. Without a clear change to criminal liability, there is a risk that users may receive mixed messages and then be blamed for incidents they can do little about. The move to self-driving is therefore a leap rather than a step.

4.78 The AEV Act defines "driving itself" as "operating in a mode in which it is not being controlled, and does not need to be monitored, by an individual".[139] The key word is "monitored". Unlike the SAE Taxonomy, the AEV Act does not attempt to define what this means. In our view, a vehicle is only self-driving if the user does not need to monitor the driving environment, the vehicle or the way the ADS drives. However, this does not preclude the need for the user-in-charge to remain receptive to a clear alert. As we explore below, an individual who is not "monitoring" may still be expected to be receptive to a clear and timely transition demand, but not to other issues.

RECEPTIVITY TO A CLEAR AND TIMELY TRANSITION DEMAND

4.79 We think it is possible to remain receptive to a very clear multisensory alert, even if one is not monitoring either the environment or the system. It is reasonable to expect a user who is not monitoring a system to respond to a transition demand that:

(1) cuts out any permitted non-driving related screen-use (through, for example, the onboard infotainment system);

(2) provides clear visual, audio and haptic signals;[140] and

(3) gives sufficient time to gain situational awareness.

4.80 In our view, the need to respond to such a transition demand is compatible with self-driving, as it does not require "monitoring". However, in the interests of safety, if the user fails to respond, the vehicle should be able to carry out a failure mitigation strategy by, for example, coming to a gradual stop in lane.

138 ABI/Thatcham Report, p 17.

139 AEV Act, s 8(1)(a).

140 Haptic refers to transmitting information through touch (eg making the seat vibrate).

4.81 On this basis, it would be possible to accept some Level 3 systems as self-driving. Below we explain that we do not regard self-driving as dependent on achieving a "minimal risk condition" in all circumstances following a failed transition demand.

4.82 However, this raises some difficult issues. The first is whether a transition demand should require both visual audio *and* haptic warnings (or whether visual and audio warnings alone would suffice). The second is what counts as a sufficient time to gain situational awareness. The third concerns the legal consequences if the user fails to take over following a transition demand. We discuss these issues below.

Reasons for not restricting the concept of self-driving to SAE Level 4 vehicles

4.83 In response to Consultation Paper 1, several consultees argued that vehicles equipped with SAE Level 3 systems should not be regarded as self-driving. Instead, a vehicle should only be regarded as self-driving if, following a failed handover request, it could come to a safe stop by the side of the road (meeting the criteria of SAE Level 4 systems).[141] Recently, in their response to the Call for Evidence, the ABI and Thatcham considered that ALKS failed their requirement on "ending automation" on the grounds that a stop in lane is unsafe. Instead, the vehicle should be able to reach the hard shoulder or a safe refuge before stopping.[142]

4.84 In our view, regulators are unlikely to find a clear dividing line between Level 3 and Level 4 systems solely on the basis of whether the ADS can achieve a minimal risk condition without human intervention. We say this for three reasons.

(1) A minimal risk condition is described only in general terms. It is simply "a stable, stopped condition"[143] which reduces the risk of a crash. This might include breaking the law by, for example, stopping on double red lines, or even bringing the vehicle to a controlled stop in path (which looks similar to failure mitigation).

(2) It is clear from the SAE Taxonomy that even Level 4 vehicles may, as a matter of what is technically feasible, have to rely on a failure mitigation strategy in some circumstances. This may occur in certain "rare, catastrophic failure conditions that render the ADS non-functional through, for example, loss of backup power after initial power failure or incapacitation of the ADS's computing capability".[144]

(3) There is no clear consensus over what amounts to a safe stop. On motorways, all lane running (with no hard shoulder) has led to debate on this issue.[145] Ideally, drivers should exit the motorway or reach an emergency refuge area. However, the Government advises drivers who cannot reach a refuge to "move

141 Analysis of Responses to CP1, para 3.17 to 3.133.

142 ABI/Thatcham response to CCAV, Safe Use of Automated Driving Systems Call for Evidence (August 2020) (Call for Evidence), para 1.28(8).

143 ISO/SAE DPAS 22736, p 14, section 3.16.

144 SAE Taxonomy, p 32, section 8.6.

145 See Department for Transport, *Smart Motorway Safety Evidence Stocktake and Action Plan* (March 2020), https://www.gov.uk/government/publications/smart-motorway-evidence-stocktake-and-action-plan.

into the left-hand lane and put on your hazard lights". Again, this may look similar to failure mitigation.

4.85 A self-driving system must be safe, but this is a more complex decision than merely considering the nature of stopping if the user fails to respond to a request to intervene.

4.86 We welcome further work by technical experts to help define requirements for a minimal risk condition. This will be a crucial element of any safety case for an ADS.[146] However, at present it is unlikely to provide regulators with a clear threshold for what constitutes self-driving.

The need for multisensory alerts

4.87 The main reason why we consider it reasonable for a user to respond to a transition demand even if they are not "monitoring" the vehicle is that a demand will use multiple senses. Even if the driver is not looking at the dashboard, they will still hear the noise - and even if they are hearing-impaired, they will feel a haptic signal, such as a tug on their seatbelts.

4.88 Although we expect that ALKS will use all three types of signal, this is not required by the ALKS Regulation. Instead, the Regulation requires "an optical and in addition an acoustic and/or haptic warning signal".[147]

4.89 Hearing loss affects around 11 million people in the UK, or one in six of the population.[148] At present, this does not affect the ability to drive a car. People who are profoundly deaf can hold a car driving licence.[149] It is important not to put any obstacles in the way of deaf drivers. In our view, before a vehicle can be regarded as self-driving, the signals should be sufficient to allow the transition demand to be received by a user who cannot hear and who is not monitoring the car dashboard.

Sufficient time to gain situational awareness

4.90 As we saw, the ALKS Regulation provides that if the driver fails to respond to a transition demand, at least 10 seconds should elapse before the minimum risk manoeuvre is started.[150]

4.91 Following a transition demand, the user needs to come out of any activity they have been engaged in and reposition their hands and feet on the controls. They also need to work out what is around them, referred to as gaining "situational awareness". This takes time; although several studies indicate that 10 seconds is sufficient, the findings are inconsistent.[151] The time from transition demand to take over may vary depending

---

146 We discuss the safety case for the ADS in Ch 7.

147 ALKS Regulation, para 6.4.1.

148 https://www.hearinglink.org/your-hearing/about-hearing/facts-about-deafness-hearing-loss/.

149 There are hearing requirements for coach and lorry drivers: https://www.gov.uk/deafness-and-driving.

150 ALKS regulation, para 6.4.4.1.

151 For a review of the literature see M Walch, "From car-driver-handovers to cooperative interfaces: Visions for driver–vehicle interaction in automated driving" in G Meixner & C Müller (eds), *Automotive user interfaces: Creating interactive experiences in the car* (2017).

on several factors, including the complexity of the driving environment, whether it is day or night, and how engaging the non-driving activity proves to be. And if users have more time, they may take it, coming out of their other activities only at the last moment.[152]

4.92 In its response to the call for evidence, the ABI and Thatcham argued that 10 seconds is insufficient. They cited three studies to:

> highlight the difference in take over time (typically just a few seconds) and the time at which a driver is mentally and cognitively aware of the traffic conditions and can make a correct evasive decision, typically 15 – 40 seconds.

4.93 We are not in a position to decide what the minimum period should be between the transition demand and the need to take back control. At this stage, all we can say is that it should be at least 10 seconds.[153] This is a difficult area and will need to be monitored in practice.

The consequences of failing to take back control

4.94 As we have seen, different jurisdictions take different approaches. In Japan, a driver who fails to respond to a transition demand could face a fine of up to ¥100,000 (approximately £715). By contrast, under the US Uniform Law Commission model law, the driver faces no penalties.

4.95 The consequences of failing to take back control will depend on the sophistication of the system and the circumstances of the stop. In some case, the vehicle will simply come to a legal, safe stop. In others, a relatively minor offence may be committed, such as stopping safety on double red lines. Alternatively, the consequences could be extremely serious, as where a vehicle causes a multiple collision by stopping in lane on a free-flowing motorway. In these cases, a penalty of £715 would be far too low. However, as the technology develops, we hope that failing to take back control will become an increasingly minor failing, with fewer and fewer adverse consequences.

4.96 We return to this issue in Chapter 12, in which we provisionally propose that following a failed transition demand, the user-in-charge would assume the criminal liabilities of a driver. If the manoeuvre constitutes a criminal offence, the user-in-charge should be liable for that offence, on the basis that the user-in-charge should have responded to the transition demand. Our intention is to provide flexible penalties: in some cases, the offence will be minor, while in others it may be extremely serious (such as causing death by dangerous driving).

Distinguishing transition demands from transition information

4.97 We understand that some manufacturers are discussing the use of prompts to take over driving that fall short of "transition demands". These may be referred to as "transition information notices". An example would be where the ADS can continue to exercise dynamic control but only at a reduced speed due to a change in the weather

152 B Zhang and others, "Determinants of take-over time from automated driving: A meta-analysis of 129 studies" (2019) 64 (7) *Transportation Research* 285.

153 The matter has been considered in detail by the UNECE Working Party 29.

or a sensor malfunction. Alternatively, the AV might need to "limp home" rather than complete the planned journey due to construction works. In these situations, the system might suggest that the user-in-charge takes over, but failure to do so would not prevent the ADS from continuing to exercise the dynamic driving task.

4.98 As a matter of law, it is important to make a clear distinction between transition demands, to which users must respond, and "transition information" to resume driving, response to which is purely optional. Under our provisional proposals, the distinction has legal consequences. Following a failure to respond to a transition demand, the user-in-charge becomes criminally liable for the consequences. By contrast, following transition information, the user-in-charge may resume dynamic driving but failure to do so has no legal consequences.

4.99 If transition information notices become part of self-driving, the ADSE would need to explain the nature of the transition in its safety case. The distinction between transition demands and transition information would need to be endorsed by the regulator and communicated clearly to users during training.

RESPONDING TO EVENTS IN THE ABSENCE OF A TRANSITION DEMAND

4.100 It is one thing to say that a user should be receptive to a transition demand. It is another to suggest that a user who is not monitoring either the vehicle or the driving environment can or should respond appropriately to other cues, such as a road sign, snow or tyre blowout.

Tyre blowouts

4.101 As we have seen, the SAE requires a fallback ready user in a Level 3 system to respond to evident vehicle failures. The SAE and ISO provide the example of a tyre blowout:

> A vehicle with an engaged Level 3 ADS experiences a sudden tyre blow-out, which causes the vehicle to handle very poorly, giving the fallback-ready user ample kinesthetic feedback indicating a vehicle malfunction necessitating intervention. The fallback-ready user responds by resuming the DDT, turning on the hazard lamps, and pulling the vehicle onto the closest road shoulder, thereby achieving a minimal risk condition.[154]

4.102 We are surprised by the use of a tyre blowout as an example where the fallback-ready user should be relied on to intervene. Even those who are fully engaged in the driving task may find it difficult to react appropriately. Fatalities are common: in the United States, the National Highway Traffic Safety Administration reports that in 2017, over 700 people were killed in incidents involving tyre blowouts.[155]

4.103 When faced with a vehicle swerving over the road, drivers often panic by braking hard. But as driving websites stress, "sudden braking is the single worst thing that you can do if a tyre blows out".[156] We fear that the tendency to panic and brake will be even

---

154 ISO/SAE DPAS 22736, p 14.

155 https://www.nhtsa.gov/equipment/tires.

156 https://smartdriving.co.uk/Driving/Driving_emergencies/blowout.htm.

more pronounced where a user is not “monitoring” the driving environment but emerges from other activities to find that the vehicle is out of control.

4.104 In our view, it would be a mistake to rely on the user of a self-driving vehicle to deal appropriately with a tyre blowout. There are several ways to prevent tyres from blowing, such as using sensors to ensure that they are correctly inflated. And the ADS may be better at keeping the vehicle steady and allowing it to come to a slow halt. If the risk of a blow-out is very low, and the ADS or vehicle’s failure mitigation strategy can deal with the situation sufficiently to prevent catastrophic consequences, that may be safe enough, even without human intervention.

4.105 At Level 4 and 5 the SAE acknowledge the dangers associated with ill-judged interventions, stating that such vehicles “need not be designed to allow a user to perform DDT fallback and, indeed, may be designed to disallow it in order to reduce crash risk”.[157]

Other “obvious” circumstances

4.106 Under the SAE Taxonomy, a fallback-ready user is only expected to respond to a limited category of events in the absence of a transition demand. The user only needs respond to problems with the vehicle itself, rather than anything in the driving environment.

4.107 However, other commentators have suggested a much wider variety of “evident” or “obvious” events. As we have seen, in Germany there was debate over whether users should be expected to notice important road signs or snow. In its response to the Call for Evidence, the SMMT suggested that the presence of an emergency vehicle would constitute an “extraordinary external condition” to which the user should respond. During discussions, we have heard a variety of other examples, including a minor collision and someone throwing rocks from a motorway bridge

4.108 We have grave reservations about all these examples. A user who is not monitoring the driving environment is unlikely to notice either a road sign or that the ADS is failing to comply with it. They are also unlikely to notice someone on a motorway bridge. And if they do see a falling object, several responses might be appropriate, from accelerating to swerving to braking. As the user-in-charge will lack time to gain sufficient situational awareness to decide which of these responses is appropriate, they may panic and make things worse.

4.109 Some (but not all) of the suggested obvious circumstances involve a loud noise (such as emergency sirens or the impact of a collision). Here the idea that a driver who is engrossed in messages might notice is a little more credible. However, requiring users to intervene in response to external noise would prevent the system from being used by those whose hearing may be impaired and who would need to turn up the volume of whatever they were listening to. It would also be necessary to stop users from listening to loud music. Such limitations would be difficult to define and to put into practice. Until now, self-driving vehicles have been sold on the basis that they will

157 SAE Taxonomy, p 8.

increase opportunities for those with disabilities and will allow more non-driving related activities, rather than fewer.

4.110 Instead, we agree with WMG, University of Warwick. In their response to the Call for Evidence they stated:

> some ALKS systems may be unable to 'respond' to special vehicles and manufacturers may choose to define them out of their ODD. This is a perfectly legitimate thing to do. However, defining special vehicle as out of the system's ODD, still put the onus on the manufacturer to detect the presence of that attribute, i.e. monitor the ODD.

If the system cannot respond to an emergency vehicle, it will need to issue a transition demand.

4.111 The categories of "evident failure", "obvious circumstances" and "extraordinary external conditions" do not seem to be based on human factors research examining what users can reasonably be expected to respond to. Instead, they have the potential to expand to include almost any circumstance with which the ADS is unable to cope. They could be used to blame human users for failures within the ADS.

4.112 To be classified as self-driving, we provisionally propose that an ADS must be safe enough even if the human user does not intervene in response to any event except a clear and timely transition demand. We discuss what is "safe enough" in the following chapter.

4.113 This does not mean that the ADS must be able to deal with absolutely everything. Some events, such as a meteor strike or a plane landing on the motorway, are so unlikely that they do not need to be considered. Others, such as a bridge collapse, cannot be mitigated even by good human drivers. In many circumstances, it is enough for the ADS to recognise that it is outside its ODD and to issue a transition demand. Failure mitigation strategies of the vehicle provide a further safety net.

Consultation Question 1.

4.114 We provisionally propose that:

(1) a vehicle should not be classified as self-driving if, with the ADS engaged, the user-in-charge needs to monitor the driving environment, the vehicle or the way it drives;

(2) it is nevertheless compatible with self-driving to require the user-in-charge to respond to a clear and timely transition demand which:

(a) cuts out any non-driving related screen use;

(b) provides clear visual, audio and haptic signals; and

(c) gives sufficient time to gain situational awareness;

(3) to be classified as self-driving, the vehicle must be safe enough even if the human user does not intervene in response to any event except a clear and timely transition demand.

Do you agree?

Consultation Question 2.

4.115 We welcome views on whether self-driving features should be designed to ensure that they can be used by people with hearing loss.

Chapter 5: How safe is safe enough?

5.1 As we discussed in Chapter 3, the test for whether vehicles should be listed as self-driving involves asking whether they are "capable, at least in some circumstances or situations, of *safely* driving themselves".[158] The crucial word is "safely".

5.2 In this chapter we look at what it means for automated vehicles (AVs) to be safe, or at least safe enough to be deployed on British roads. These are difficult questions. As the RAND Corporation notes:

> AV safety has proven to be a complex undertaking. Establishing the baseline level of AV safety and the improvement required for AV safety over time are particularly complicated. People cannot "look under the hood" to understand the basis for any given developer's claims about safety.[159]

5.3 In this chapter we discuss how to set a safety threshold. We start by summarising the current risks of the road, as shown by road casualty figures.

5.4 We then look briefly at the literature on the public perception of risk. A standard definition is that a thing is safe "if its attendant risks are judged to be acceptable".[160] The risk must be acceptable to (and accepted by) those who bear it. In the case of self-driving vehicles, the risks are borne by all those on or near roads (that is, the general public). As we explore below, people do not assess risks in simple numeric terms. People often accept risks which are familiar, voluntary or accompanied by a clear benefit. People are less accepting of risks which are new, strange or imposed, or which have no clear benefit for them.

5.5 In the next section, we consider four possible standards for deciding how safe is safe enough. These are:

(1) as safe as reasonably practicable;

(2) as safe as a competent and careful human driver;

(3) does not cause a fault accident;[161] and

(4) a positive risk balance (so that, overall, AVs are safer than the average human driver).

---

158 Automated and Electric Vehicles Act 2018, s 1.

159 RAND Corporation, *Safe Enough: Approaches to Assessing Acceptable Safety for Automated Vehicles* (2020) ("RAND Report"), p 1, https://www.rand.org/pubs/research_reports/RRA569-1.html.

160 W Lowrance, *Of Acceptable Risk: Science and the Determination of Safety* (1976).

161 A "fault accident" is one where if a human driver had driven the car instead of an ADS, the driver would be held liable in negligence for causing the accident.

5.6 As we shall see, each of these standards has strengths and weaknesses. The RAND Corporation notes that “there is no consensus about what approaches should be used” to set safety thresholds.[162] They identify two divergent approaches. Some respondents make comparisons with a safe human driver (referred to in the UK as a “competent and careful” driver). Others aim to improve on the current level of casualties caused by human drivers in general (average drivers). These two standards set very different thresholds. Drivers in general “still have a lot of accidents on the roadway”, while competent and careful ones have very few.[163]

5.7 We do not think that it is possible to prescribe a single, simple answer. Instead the issue of how safe is safe enough involves political judgement, bearing in mind all four standards.

5.8 Our aspiration is that AVs would meet the standard of a safe human driver. In other words, they would avoid any collision which a competent and careful human driver could have avoided. In some circumstances, however, this may not be achievable. People may accept a lower standard, especially if the AV is not seen as causing a fault accident. In addition, overall, AVs must reduce deaths and serious injuries on our roads: there must be a positive risk balance. Fourthly, AVs must also be as safe as reasonably practicable. If they can be made safer than a competent human driver, they should be, provided that the safety measures are not disproportionate to the risk.

5.9 Finally, we ask if AVs might take such a slow and cautious approach that they are criticised for holding up traffic. This in turn could decrease overall road safety if human road users take more risks as a result. We think that, initially, AVs should abide by traffic laws, unless it is in the interests of safety not to do so. However, as experience is gained from placing self-driving vehicles on the road, it may be necessary to make some adjustments to traffic rules in the interests of traffic flow. In Chapter 11 we discuss the process for making these adjustments.

SETTING THE SAFETY THRESHOLD

5.10 The RAND Corporation comment that “safety” is approached in different ways. It can be a measurement, a process or a threshold. In this chapter, we focus on the high-level policy question: how does one set the overall safety threshold? In other words, what is the minimum standard of safety required before AVs can be deployed on the road?

5.11 In Chapter 7 we consider the safety process: We consider ways to ensure that all relevant safety issues have been considered, and that the system responds as intended. As with many discussions of process, we highlight the importance of the safety case.

5.12 It will also be necessary to measure whether an AV meets the threshold that has been set. Although this chapter focuses on setting the threshold, it is not possible to separate this from questions of measurement. A threshold or standard is only useful if it is measurable; it is not worth setting unless one can assess systems against it. On

[162] RAND Report, p x.

[163] RAND Report, p 40.

the other hand, looking only at what can be measured might miss the point. The result could be detailed measurements of things which do not matter.

5.13 We therefore introduce issues of measurement here and explore them in more depth in Chapter 10.

ROAD CASUALTIES: CURRENT FIGURES

5.14 Roads are relatively dangerous places. In 2019, 1,752 people were killed on roads in Great Britain,[164] compared with only 111 fatal injuries at work.[165]

5.15 However, the level of road casualties varies substantially – between countries, over time, and between different road users. We explored some of these differences in Consultation Paper 1.[166] We drew on fatality rates, because they are generally reliable across time and place, though similar arguments can be made for non-fatal injuries.

5.16 By international standards, the UK has a very low rate of road deaths.[167] Our rate is below that of the USA and the European average. The differences are marked: as we discussed, death rates in the USA and some European countries (Poland, Latvia and Croatia) were almost four times higher than in the UK.[168]

5.17 Similarly, in Great Britain road deaths in 2019 (1,752) were only a quarter of what they were in 1930 (7,074), even though there are now many more cars on the road. Successive UK Governments have placed considerable emphasis on road safety, with the result that road deaths fell by 54% from 2004 to 2012. Since 2012, however, the overall number of deaths has plateaued.[169]

5.18 Some road users are more vulnerable than others, with casualty rates higher for pedestrians, cyclists and motorcyclists than for car users. Motorcyclists are particularly likely to die, with almost 105 motorcycle fatalities per billion miles travelled, compared with only 1.6 for car occupants.[170]

---

164 Department for Transport*, Reported Road Casualties in Great Britain, Annual Report 2019* (2020) (DfT Annual Report 2019), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/922717/reported-road-casualties-annual-report-2019.pdf.

165 This figure relates to 2019/20 and is provisional: see Health and Safety Executive, *Workplace fatal injuries in Great Britain* (2020), https://www.hse.gov.uk/statistics/pdf/fatalinjuries.pdf.

166 See CP1, paras 5.86 to 5.97.

167 The UK's average of approximately 2.6 deaths per 100,000 population (using Office for National Statistics data from 2019 for total population and Department for Transport's 2018/19 data on fatalities) is more than 10 times lower than the global average of 27.5 deaths per 100,000 population. According to the World Health Organisation's Global Status Report 2018 there continues to be a strong association between the risk of a road traffic death and the income level of countries. The risk of dying in a road incident is more than three times higher in low-income countries than in high-income countries.

168 CP1, paras 5.88 to 5.90.

169 DfT Annual Report 2019, chart 1.

170 DfT Annual Report 2019, chart 7.

5.19 These differences mean that there is no single global metric of how many road casualties might be considered acceptable. An automated driving system might have a lower casualty rate than human drivers in the USA but a higher comparative casualty rate when placed on UK roads. Furthermore, a level of casualties which is acceptable now may become unacceptable in the future. And people may view risks to vulnerable road users differently from risks to car occupants. The issue of how safe is safe enough raises difficult philosophical questions that defy easy answers.

5.20 However, these questions are also deeply practical. The safety goals set determine what counts as a "pass" or "fail" when an AV is tested. As noted by Lyft in its Voluntary Safety Self-Assessment:

> establishing clear and understandable measures of safety for [AVs] is a critical step to earn the trust of our customers and stakeholders, including cities and states where we develop or intend to operate.'[171]

HOW DO PEOPLE JUDGE THE ACCEPTABILITY OF RISKS?

5.21 There is a considerable literature on how people judge whether risks are acceptable.[172] The consistent message is that people do not apply a single metric. They do not, for example, decide that a risk of one in a million chance of death is acceptable, while a one in 100,000 chance of death is not.[173] Instead, they view some risks differently from others. People are much more tolerant of familiar risks, assumed voluntarily for a clear benefit. They are intolerant of new or unusual risks, imposed on them for no benefit.[174] As the HSE point out:

> particularly important for man-made hazards are 'how well the process (giving rise to the hazard) is understood, how equitably the danger is distributed and how well individuals can control their exposure and whether risk is assumed voluntarily'.[175]

---

171 Lyft, *Self-Driving Safety Report* (2020), p 8, https://self-driving.lyft.com/wp-content/uploads/2020/06/Safety_Report_2020.pdf.

172 For reviews of the literature, see Health & Safety Laboratory*, Review of the Public Perception of Risk, and Stakeholder Engagement* (2016), https://www.hse.gov.uk/research/hsl_pdf/2005/hsl0516.pdf; Health & Safety Laboratory, *Risk perception and risk communication: A review of the literature* (1999), https://www.hse.gov.uk/research/crr_pdf/1999/crr99248.pdf.

173 This approach to calculating safety is referred to as Minimum Endogenous Mortality (MEM). It looks at the mortality rate of a typical young person, and attempts to calculate how great an increase to this rate might be acceptable: see eg CENELEC, EN50126: *Railway applications. The specification and demonstration of reliability, availability, maintainability and safety* (1999). We do not think that it is a helpful approach in this context.

174 B Fischhoff, P Slovic, S Lichtenstein, S Read and B Combs, "How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits" (1978) 9 *Policy Science* 127.

175 Health & Safety Executive, *Reducing risks, protecting people: HSE's decision-making process* (2001) https://www.hse.gov.uk/Risk/theory/r2p2.pdf, citing B Fischhoff, P Slovic, S Lichtenstein, S Read and B Combs, "How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits" (1978) 9 *Policy Sciences* 127.

People are also much more tolerant of risks to adults than risks to children.[176]

5.22 On this basis, some human drivers are surprisingly tolerant of the risks involved in overtaking. They assume the risk voluntarily, are in control of the process and receive a clear benefit by reaching their destination more quickly. The user of an AV may have less immediate control, but they still act voluntarily in engaging the system and they still receive a benefit. Other road users, however, may feel very differently.

5.23 Although AVs will not drive when tired, distracted or drunk, they may fail in new and unexpected ways. As the RAND Corporation notes, situations that challenge a human driver might not challenge an AV, and situations that challenge an AV may not be difficult for human drivers.[177]

5.24 Where failures appear new and strange, the public will be concerned – even though the overall number of incidents is reduced. And the public may be particularly intolerant of risks that affect vulnerable road users. The Uber accident which killed a pedestrian in Arizona[178] sparked huge media scrutiny and public concern compared to the many other road traffic fatalities that happen daily – nearly 3,700 worldwide.[179] Moreover the damage to public confidence appeared greater than that caused by fatalities linked to Tesla's driver assistance system, "Autopilot". Although the deaths of some Tesla owners have also been publicised, Tesla owners were seen as assuming risks on a more voluntary basis.[180]

5.25 Where unacceptable risks result in harm, there is a strong desire to blame someone. At present, the criminal process acts as a channel for that blame through the prosecution of individual drivers. In Consultation Paper 1 we identified nine offences of causing death or serious injury by driving.[181] We noted the significant public pressure to create more offences and to increase sentences for the existing offences.[182] Prison sentences are common. For example, in the 10 years between 2009 to 2018, 3,214 people were imprisoned in England and Wales for offences of causing death or

---

176 It is a cause of deep concern that road traffic injury is now the leading cause of death for children and young adults aged 5 to 29 years. See World Health Organisation, *Global Status Report on Road Safety* (2018), https://www.who.int/violence_injury_prevention/road_safety_status/2018/en/.

177 RAND Corporation, *Measuring Automated Vehicle Safety* (2018), p 18, https://www.rand.org/pubs/research_reports/RR2662.html.

178 Elaine Herzberg was killed while crossing the road in Tempe Arizona on 18 March 2018. For an account of the accident and its aftermath, see NY Times, 'How a self-driving uber killed a pedestrian in Arizona (21 March 2018), https://www.nytimes.com/interactive/2018/03/20/us/self-driving-uber-pedestrian-killed.html.

179 Globally, approximately 1.35 million people die each year as a result of road traffic crashes. World Health Organisation, *Global Status Report on Road Safety* (2018) <https://www.who.int/violence_injury_prevention/road_safety_status/2018/en/>.

180 For example, Joshua Brown died in May 2016 when his Tesla collided with a truck on a Florida Highway: see NY Times, Times, "Joshua Brown, Who Died in Self-Driving Accident, Tested Limits of His Tesla" (1 July 2016), https://www.nytimes.com/2016/07/02/business/joshua-brown-technology-enthusiast-tested-the-limits-of-his-tesla.html. In March 2018, Walter Huang died when his car collided with a concrete barrier in California: see BBC, "Tesla Autopilot crash driver 'was playing video game" (26 February 2020), https://www.bbc.co.uk/news/technology-51645566.

181 Background paper 2 to CP1, paras 2.3 to 2.6.

182 Background paper 2 to CP1, paras 2.25 to 2.27.

serious injury by driving. This included 1,357 people imprisoned for causing death by dangerous driving and 1,027 imprisoned for causing serious injury by dangerous driving.[183] The process of blame, trial and imprisonment is one way in which society copes with the current level of road casualties.

5.26 With self-driving, there will be no individual drivers to blame.[184] Blame may therefore be directed not only at manufacturers and developers but also at regulators and politicians. As the HSE states in its discussion of the theory of risk, risks which raise societal concerns can become "intensely political". If the risk eventuates:

> the result would be a consequential loss of trust by the public not only in the duty holders with the primary responsibility for reducing the risk, but also in the regulator and Government – even if current provisions and arrangements were very good.[185]

AS SAFE AS "REASONABLY PRACTICABLE"

5.27 Within the UK, the most commonly used safety standard across all industries is that a risk must be "as low as reasonably practicable" (referred to as ALARP). The standard derives from the Health and Safety at Work etc Act 1974 which (for example) places an obligation on an employer "to ensure, *so far as is reasonably practicable*, the health, safety and welfare at work of all his employees".[186] The standard also applies to risks imposed by employers on the general public.[187]

5.28 In 1949, the Court of Appeal set out the classic definition of the phrase "reasonably practicable":

> 'reasonably practicable' is a narrower term than 'physically possible' … a computation must be made by the owner in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other, and that, if it be shown that there is a gross disproportion between them – the risk

---

183 Ministry of Justice, *Criminal justice system statistics quarterly: outcomes by offence data tool* (2018), https://www.gov.uk/government/statistics/criminal-justice-system-statistics-quarterly-december-2018. In relation to Scotland there were 27,504 convictions in 2018-19 for motor vehicle offences, of which around 89% resulted in a fine, 4% in a community payback order, 4% in an admonition, and 1.5% in a prison sentence: Scottish Government, *Criminal Proceedings in Scotland: 2018-19* (2020) p 68, https://www.gov.scot/publications/criminal-proceedings-scotland-2018-19/pages/42/.

184 Currently, most trials of self-driving technology today include at least a safety driver in the vehicle. The safety driver remains responsible for driving throughout the trial.

185 Health and Safety Executive, *Reducing risks, protecting people: HSE's decision-making process* (2001), https://www.hse.gov.uk/risk/theory/r2p2.pdf.

186 Health and Safety at Work etc Act 1974, s 2(1). Other Acts concerned with safety use different wording, but also rely heavily on concepts of reasonableness. For example, under the Occupiers' Liability Act 1957 s 2(2), the occupier should "take such care as in all the circumstances of the case is reasonable to see that the visitor will be reasonably safe in using the premises for the purposes for which he is invited or permitted" to be there. Under the Consumer Protection Act 1987 s 3, a product is defective "if the safety of the product is not such as persons generally are entitled to expect", taking into account what "might reasonably be expected to be done with or in relation to the product".

187 Health and Safety at Work etc Act 1974, s 3(1).

> being insignificant in relation to the sacrifice – the defendants discharge the onus on them.[188]

5.29 In other words, the scale of the risk must be weighed against the trouble, time and money needed to control it. Employers should then take all measures except those which are "grossly disproportionate". If taken literally, this would suggest that an employer is obliged to take some disproportionate measures, so long as they are not "grossly" disproportionate. Subsequent cases, however, have drawn back from suggesting that disproportionate measures are needed.[189] Rather, the test requires employers to justify failures to mitigate risks and to err on the side of caution. As Lord Reid said in 1954:

> as men's lives may be at stake it should not lightly be held that to take a practicable precaution is unreasonable.[190]

5.30 The Health and Safety Executive (HSE) provides guidance on how the ALARP test should be applied.[191] The HSE explain that in the great majority of cases, it is possible to refer to "existing 'good practice' that has been established by a process of discussion with stakeholders to achieve a consensus about what is ALARP". However, for high-hazard, complex or novel situations, it may be necessary to rely on more formal decision-making techniques.

A flexible test

5.31 The HSE describe ALARP as a flexible test.

> This flexibility is a great advantage but it has its drawbacks, too. Deciding whether a risk is ALARP can be challenging because it requires duty-holders and us to exercise judgement.[192]

5.32 AVs present particular challenges in applying ALARP. First, the technology is new, which means that many issues are not covered by existing good practice. Secondly, roads are inherently dangerous – much more dangerous than workplaces. As we saw, fatal injuries on roads are over 15 times greater than at work.[193] The third challenge relates to the scope, variety and complexity of risks an AV will encounter. The developer is faced with a huge range of scenarios and interactions to consider.

5.33 Finally, the risks from roads are widely distributed. Almost everyone uses roads and would therefore face some potential risk if an AV were to drive in an unsafe way.

---

188 *Edwards v National Coal Board* [1949] 1 KB 704, p 712 by Asquith LJ which is derived from *Sharp v Coltness Iron Company* 1937 SC (HL) 37, p 75; and [1938] AC 90, p 94 by Lord Atkin.

189 For further discussion of this issue, see Appendix 3.

190 *Marshall v Gotham Co Ltd* [1954] AC 360, p 373.

191 Health and Safety Executive, *Risk management: Expert guidance,* https://www.hse.gov.uk/risk/theory/alarpglance.html.

192 Above.

193 These figures relate to 2018/19 and are currently provisional: see Health and Safety Executive, *Workplace fatal injuries in Great Britain* (July 2019), https://www.hse.gov.uk/statistics/pdf/fatalinjuries.pdf.

However, some of the benefits from AVs will only accrue to their users. The debate over safety needs to look at the distribution of risk as well as overall casualties.

5.34 There is much to learn from the ALARP standard, including the onus on duty-holders to take practicable precautions unless it is clearly unreasonable to do so. However, automated driving raises new and difficult issues that need to be probed in greater detail.

AS SAFE AS A COMPETENT AND CAREFUL DRIVER

5.35 A common answer to "how well should an automated vehicle drive?" is that it should drive as well as a competent and careful human driver.[194] As we discussed in Chapter 3, this standard is included in the UNECE Regulation on Automated Lane Keeping Systems (ALKS).[195] The standard is also set out in the Department for Transport's Call for Evidence. This puts the need to "avoid collisions which a competent and careful driver could avoid" alongside other criteria such as "comply[ing] with traffic rules", "treat[ing] other road users with reasonable consideration" and "avoid[ing] putting itself in a position where it would be the cause of a collision".[196]

5.36 However, it is a high standard to meet. Competent and careful drivers rarely cause accidents. In one often-quoted US study by the National Highway Safety Administration, 94% of serious crashes involving light vehicles were put down to "human error".[197] In other words, only 6% involved drivers who were being competent and careful. Most adverse incidents involve drivers who drive too fast, fail to keep a proper look out, carry out illegal manoeuvres or misjudge speeds and distances. Often drivers are distracted, drowsy or drunk.[198]

5.37 In response to Consultation Paper 1, Professor Bryan Reimer put the problem of making comparisons with competent and careful drivers succinctly: "humans and robots will make different mistakes". Robots may introduce significant improvements in some scenarios, while failing to be quite as good as humans in others. If regulators disallow automated driving until robots are as good as the best human drivers in every situation, society might be deprived of the overall safety benefits for many years. As Nidhi Kalra and David Groves argued:

---

194 For example, Kodiak has introduced the concept of the "Kodiak Driver" who "will never text and drive, or drive drunk, distracted, or drowsy": Kodiak *Safety Report* (2020), https://kodiak.ai/safety-report/.

195 ALKS Regulation, para 5.2.5.

196 CCAV, *Safe Use of Automated Lane Keeping System – Call for Evidence* (2020) (Call for Evidence) p 23, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911016/safe-use-of-automated-lane-keeping-system-alks-call-for-evidence.pdf.

197 The data was collected from 2005 to 2007: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812115.

198 The NHTSA study refers to recognition errors such as "driver's inattention, internal and external distractions, and inadequate surveillance" as the most common reason. Decision error such as driving too fast for conditions, illegal manoeuvres and misjudgements accounted for about 33 percent (±3.7%) of the crashes.

> Waiting for [AVs] that are many times safer than human drivers misses opportunities to save lives. It is the very definition of allowing perfect to be the enemy of good.[199]

5.38 The authors modelled the effects of allowing highly AVs for consumer use when safety performance is just 10% better than that of the average human driver, compared with policies under which safety performance had to be 75% or 90% better. They found that over 15 years, many more lives were saved by introducing highly AVs early (when they were just 10% better).[200] While we wait for robots to reach the high and possibly hypothetical standard of the "competent and careful driver", many people may be injured by the realities of everyday bad human driving.

5.39 The ALKS Regulation itself recognises that meeting the standards of a competent and careful driver may not be "fully achieved" in all circumstances.[201] As an ALKS equipped vehicle cannot change lane, it does not have the full competence of a human driver. As Thatcham and the ABI comment:

> the inability of an ALKS to execute a lane change prevents it, at a fundamental level, from being considered capable of avoiding every collision in a motorway environment that a careful and competent human driver could.[202]

5.40 We have identified the following hypothetical examples of possible circumstances where an ALKS might not be as good as competent and careful human drivers.

(1) A partially obstructed view of a pedestrian walking in front of a car in the neighbouring lane. While humans learn from birth to recognise other humans from even small details, this may be more challenging for an automated system.

(2) Objects on the road. A human driver brings life skills and context to distinguish between objects which can be driven over (such as leaves) and those which require a stop (such as a tree). An automated driving system may not have the same ability to distinguish between the full range of possible objects.

(3) An oncoming vehicle. Humans, when faced with another vehicle coming straight towards them in the third lane of a motorway will swerve, including (where necessary) into the central reservation and crash barrier. ALKS, however, will merely brake in lane.

(4) A casualty lying on the ground. Humans' abilities and instincts combine to make driving over a prone body taboo. ALKS, with a more limited capacity to

---

199 N Kalra and D Groves, *The Enemy of Good: Estimating the Cost of Waiting for Nearly Perfect AVs* (2017) p ix (*The Enemy of Good*), https://www.rand.org/content/dam/rand/pubs/research_reports/RR2100/RR2150/RAND_RR2150.pdf.

200 Kalra and Groves comment that and "those savings can be significant — tens of thousands to hundreds of thousands of lives": see *The Enemy of Good*, p 25.

201 ALKS Regulation, para 5.2.5.4.

202 ABI and Thatcham Research response to the Call for Evidence, para 56.

recognise humans combined with an inability to change lanes, may be less likely to avoid striking a casualty.

5.41 These examples are not all the same. Some are common (debris on the road) while others are extremely rare (such as an oncoming vehicle on a motorway). Some actions, if carried out by a human, would attract significant censure (such as driving over a casualty). Others would not attract blame. For example, a human driver would not be considered at fault for failing to swerve for a car driving the wrong way down a motorway.

5.42 In the following sections we consider how far these factors (fault and likelihood) are relevant when deciding if it is acceptable to depart from the standard of "a careful and competent driver".

DOES NOT CAUSE A FAULT ACCIDENT

5.43 An alternative, slightly lower standard, is that an automated vehicle should not cause a fault accident. The test draws on the "duty of care" as established in the law of negligence to compensate victims of accidents. This sets an objective standard, under which drivers are held liable if they did not perform as a reasonable driver would have done in the circumstances. Essentially, the test is as follows: if this behaviour had been performed by a human driver, would the driver be held liable in negligence for causing the accident? Considerable work is being carried out to capture legal standards in mathematical models.

Responsibility-Sensitive Safety (RSS)

5.44 Mobileye (an Intel company) has proposed a mathematical model "to formalize an interpretation of the duty of care law", which they term "Responsibility-Sensitivity Safety" (RSS).[203] RSS starts with five "common sense" rules.

(1) Do not hit someone from behind.

(2) Do not cut-in recklessly.

(3) Right of way is given, not taken.

(4) Be careful in areas with limited visibility.

(5) If you can avoid an accident without causing another one, you must do it.[204]

5.45 It then converts these "semantic" rules into mathematical models which set out safe speeds and distances from other road users in a variety of scenarios. These are designed to reflect the human need "to exercise care due to the uncertainty regarding the actions of other road users". However, they do not take "the extreme worst case

---

203 Mobileye, "On a Formal Model of Safe and Scalable Self-driving Cars" (2017) (Mobileye RSS Report) p 6, https://www.mobileye.com/responsibility-sensitive-safety/vision_zero_with_map.pdf.

204 Mobileye RSS Report, section 3.

about the actions of other road users", which would make driving impossible.[205] Mobileye explain:

> As absolute safety is impossible as long as AVs share the road with human drivers, we start defining an AV as safe if it doesn't cause collisions.[206]

5.46 RSS then defines causing an accident in terms of responsibility and gives it a specific meaning: "an agent is responsible for the accident if it did not comply with the proper response constraints".[207] The hope is if an AV can be programmed with all the required response constraints then, by definition, it can never "cause" an accident.

Example: a child runs out from between parked cars

5.47 The approach can be demonstrated by looking at a particularly difficult scenario, where a child runs into the road from between parked cars. If the AV only "sees" the child at the last moment, it might not be able to brake in time. However, "RSS determines that a vehicle is not responsible for an accident with an occluded pedestrian" if the conditions are met.[208] Essentially these conditions are mathematical formulations of common-sense rules: don't go at an unreasonable speed; and brake as soon as you see the child.

5.48 The issue, of course, is how to determine an "unreasonable speed". In the model, this may include not only the speed limit but also the type of street. In time, the model may become more sensitive, for example by reducing speeds when passing a school at the end of the school day.

5.49 An AV will have many advantages when avoiding children running into the road. They will be more law abiding – and will not exceed speed limits. They will also have faster reaction times and therefore be able to apply the brakes more quickly. However, they may lack some of a human driver's sensitivity to context. They may, for example, fail to realise the need to slow down if a group of excited children are on one side of the street and an ice cream van is on the other.

5.50 By contrast, the courts have held that a reasonable driver is expected to be "armed with common-sense and experience of the way that pedestrians, particularly children, are likely to behave in the circumstances".[209] This includes having regard to "the

---

[205] Mobileye RSS Report, section 3.

[206] Mobileye, *A plan to develop safe autonomous vehicles. And prove it* (2017) p 4, https://newsroom.intel.com/newsroom/wp-content/uploads/sites/11/2017/10/autonomous-vehicle-safety-strategy.pdf.

[207] Mobileye RSS Report, p 27.

[208] Mobileye, *Implementing the RSS Model on NHTSA Pre-Crash Scenarios* (2018), p 16 https://static.mobileye.com/website/corporate/rss/rss_on_nhtsa.pdf.

[209] *Moore v Poyner* [1975] RTR 127, p 132.

allurement of the ice cream van" and the likely lack of care taken by "a young child rushing towards" it.[210]

5.51 Where a child dies, few cases reach the courts. Insurers find it easier to pay the low damages involved rather than litigate the issue.[211] The cases which do reach the courts tend to involve lifelong injuries. In the Scottish case of *Jackson v Murray*, a 13 year-old girl was seriously injured when she stepped out from behind a school minibus into the path of a car travelling in the opposite direction.[212] The car was travelling at 50 mph, below the speed limit of 60 mph. Although the immediate cause of the incident was the action of the child in crossing the road, the car driver was held to be liable to her in delict because he had not reduced his speed on seeing a stationary school bus and was not keeping a proper look-out.

5.52 The appeal concerned issues of contributory negligence. While the trial judge assessed that the girl was 90% contributorily negligent, this was reduced to 70% on appeal and to 50% by the Supreme Court. It is well established that in deciding contributory negligence, the court must consider the respective "causative potency" and blameworthiness of the parties' actions. However, the Court was acutely aware that the "fault" which attaches to a child who fails to look after her own interests cannot be equated to the fault which attaches to a driver who endangers others. In incidents of this nature, the driver is held to a high standard and expected to respond to contextual clues (such as a stationary school bus with its hazard lights on) which may be difficult for an AV to detect.

Advantages and limitations

5.53 The idea of a "safety envelope" which converts good driving into transparent mathematical expressions is now widely seen as an important element of safety. The Institute of Electrical and Electronics Engineers (IEEE) have set up a working group to develop a standard based on the RSS approach.[213] Similarly, EasyMile refers to a

---

210 *Kite v Nolan* [1983] RTR 253, p 256. In this case, the Court found for the defendant, who had been driving at only 15mph. However, the Court held that in determining whether there had been a breach of the duty of care, the judge had to consider all the contextual factors.

211 In England and Wales, compensation payments will amount to bereavement damages of £15,120, and funeral costs: Fatal Accidents Act 1976, ss 1A(3), 3(5). In Scotland, compensation payments will be damages for loss of society and guidance, bereavement, and any distress in contemplating the deceased's suffering: Damages (Scotland) Act 2011, s 4(3). Awards of compensation for loss of society on the death of a relative tend to be significantly higher in Scotland than in England: G Dalyell, "A comparison of fatal accident claims in England and Scotland" (2011) Journal of Personal Injury Law (1), pp 12 to 13. The amount of damages will depend on whether a jury or a single judge is to decide the case. That matter is decided after a case reaches court. Juries are thought to award higher amounts of damages.

212 *Jackson v Murray* [2015] UKSC 5, [2015] 2 All ER 805.

213 IEEE, *P2846 - Formal Model for Safety Considerations in Automated Vehicle Decision Making* (2020), https://standards.ieee.org/project/2846.html.

"safety corridor"[214] and Nvidia have proposed a Safety Force Field.[215] As we saw in Chapter 3, the approach also forms an important part of the ALKS Regulation. For example, the Regulation prescribes detailed separation distances and includes formulas for reacting to "cut-in" vehicles.

5.54 The approach has many advantages.

(1) It is transparent. The logic of the decision making is easier to explain compared with systems that rely more heavily on deep neural networks and machine learning.

(2) It is robust. Once the safety parameters are set, they only change if a deliberate decision is taken to alter them.

(3) It is achievable. It does not require complex simulations or billions of miles of driving to establish safety.

5.55 However, it is not a guarantee of safety. RSS can only guarantee that an AV will not cause a collision if one applies a particularly narrow definition of "cause" (namely that an accident is "caused" by a vehicle which fails to follow response constraints).[216]

5.56 There are two main limitations. First, there will always be circumstances that are not captured by the rules, even if one attempts to be comprehensive. For example, Mobileye recently used a database of 6 million crashes held by the US National Highway Traffic Safety Administration (NHTSA) to see if the RSS model could have avoided those collisions. This was summarised into 37 pre-crash scenarios, covering 99.4% of crashes on the database.[217] However, some important scenarios were not covered. The analysis did not include scenarios which were specific to motorcycles or bicycles; nor did it include collisions with stationary objects.[218]

5.57 As automated driving develops, the industry has become more aware of the variety of scenarios that arise on roads. In its 2017 guidance,[219] NHTSA recommended that AVs should be able to demonstrate 28 basic behavioural competencies, as identified by California Partners for Advanced Transit and Highways (PATH). In its 2018 Voluntary Safety Self-Assessment, Waymo added another 19 scenarios, including maintaining a

---

214 Easymile *Safety Report* (2020) p 23, https://easymile.com/sites/default/files/easymile_safety_report.pdf. Many of these voluntary safety self-assessments emphasise the ability of AVs to avoid incidents through maintaining appropriate distances and speed. See eg the concept of a "safety envelope", Safety Report (2020) p 19, https://uber.app.box.com/v/UberATGSafetyReport.

215 D Nistér, H Lee, J Ng and Y Wang, *The Safety Force Field* (2019), https://www.nvidia.com/content/dam/en-zz/Solutions/self-driving-cars/safety-force-field/the-safety-force-field.pdf.

216 Mobileye RSS Report, p 27.

217 Mobileye, *Implementing the RSS Model on NHTSA Pre-Crash Scenarios* (July 2018) https://static.mobileye.com/website/corporate/rss/rss_on_nhtsa.pdf.

218 Above, p 17: "the RSS model copes only with scenarios in a multi-agent environment. Hence, scenarios within the NHTSA research that do not stem from multi-agent scenarios (such as vehicle failure, loss of control, crashing into a stationary object, etc) are not covered".

219 NHTSA, *Automated Driving Systems 2.0: A Vision for Safety* (2017), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf.

safe distance from cycles, detecting and responding to animals, motorcycles and school buses, and navigating railroad crossings.[220]

5.58 As discussed in Chapter 3, even on motorways, there are several points of vulnerability not covered by specific rules within the ALKS Regulation.[221] In urban areas, AVs need to interact with a myriad of other (more unusual) road users, including wheelchairs, mobility scooters, e-scooters, skate-boards and roller-blades. In some places (such as central London and rural areas), they will also encounter horses.[222] The danger is that developers will focus on the many scenarios addressed by the mathematical models and neglect scenarios which are not included. Some initial work, for example, failed to include level crossings, where it is imperative not to stop.[223] As Koopman notes, scenario-based testing risks myopia and confirmation bias unless rare events not yet encountered by the AV are explored.[224]

5.59 Secondly, even if a scenario is captured, the mathematical rules will never catch all the contextual aspects which lead road users and courts to blame a driver for what has happened. Developers, regulators and politicians will need to add an additional reality check to decide if an outcome is acceptable.

A POSITIVE RISK BALANCE

5.60 The final possible answer to the question "how safe is safe enough" is "safer than human drivers prove to be on average". This is the answer given by a consortium of auto manufacturers and developers.[225] In 2019 they published a white paper, "Safety First for Automated Driving", to provide guidance for assuring the safety of automated driving systems.[226]

5.61 The white paper is based on the overarching principle of "a positive risk balance compared to human driving performance", as recommended by the German Ethics Commission in 2017.[227] The concept is defined in terms of "a risk benefit evaluation

---

220 Waymo, *Safety Report* (2018), https://storage.googleapis.com/sdc-prod/v1/safety-report/Safety%20Report%202018.pdf.

221 See above at para 3.18.

222 In its response to us, the British Horse Society stressed the need to take into account horses' sometimes unpredictable behaviour. Rule 214 of the Highway Code states: "Do not scare animals by sounding your horn, revving your engine or accelerating rapidly once you have passed them". Rule 215 states: "Be particularly careful of horse riders and horse-drawn vehicles especially when overtaking. Always pass wide and slowly". Constraints will be needed to avoid frightening horses, as well as not colliding with them

223 See for example, the 19 PATH scenarios, recommended by NHTSA, *Automated Driving Systems 2.0: A Vision for Safety* (2017), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf.

224 P Koopman et al, "Credible Autonomy Safety Argumentation" [2019] 27th Safety Critical Systems Symposium.

225 Consortium members include Aptiv, Audi, Baidu, BMW, Continental, Daimler, FCAUS LLC, HERE, Infineon, Intel and Volkswagen.

226 *Safety First for Automated Driving* (2019), https://www.daimler.com/innovation/case/autonomous/safety-first-for-automated-driving-2.html.

227 BMVI, *Ethics Commission: automated and connected driving – report* (extract) (2017), https://www.bmvi.de/SharedDocs/EN/publications/report-ethics-commission-automated-and-connected-

with a lower remaining risk of traffic participation due to automated vehicles".[228] Automated driving is justified on the basis that it causes fewer casualties on average than human driving.

5.62 This moves away from the idea that an automated driving system must be as good as non-negligent drivers in all circumstances. As the paper puts it:

> a slightly negative safety balance of the automated driving system in rare improbable scenarios may still be acceptable, providing a positive risk balance is maintained across all situations.[229]

5.63 The idea of a positive risk balance has an intuitive logic. Although it seems problematic to trade the risk of injury for social or economic benefits (such as better time use), it is clearly possible to trade some safety risks against other safety benefits.

5.64 Developers have argued that AVs have the potential to be several orders of magnitude better than human driven vehicles[230] due to their quick reaction times, law-abiding approach, and variety of sensors (providing 360 degree vision).[231] This means that even if AVs cause some additional casualties initially, they would have the potential in the future to offer significant safety gains. This would suggest that AVs should be allowed on the road soon, so that the improvements can take place and the potential gains can be realised. As we saw, Kalra and Groves argue that once AVs are even 10% safer than a human driver, it would be wrong *not* to allow them on the roads.[232] It would deprive society of benefits of the technology and result in needless casualties.

5.65 However, the idea of a positive risk balance it is not without its problems. The most recent report from the RAND Corporation highlights that average drivers "still have a lot of accidents on the roadway".[233] Furthermore, the median driver is much better than the mean.[234] Given that the casualties that occur involve only a small minority of (often poor) drivers, a benchmark of "better than the mean" may be seen as too low.

---

driving.pdf?__blob=publicationFile. The standard is commonly used by safety engineers and is sometimes known as GAMAB ("globalement au moins aussi bon" or "overall at least as good").

228 *Safety First for Automated Driving* (2019) p 137. "Traffic participation" refers to road use: if the amount of road use remains steady, the overall risk of using the roads must be reduced.

229 *Safety First for Automated Driving* (2019) p 10.

230 See Mobileye RSS Report, suggesting the probability of a fatality per million miles travelled should be 10^{-9}, three orders of magnitude less than the current rate for human drivers.

231 In the Voluntary Safety Self-Assessments published on the NHTSA website, almost every company mentions 360 degree sensor coverage (including Apple, Uber, BMW iNext, Mercedes Benz, EasyMile, GM Cruise and Waymo).

232 *The Enemy of Good*.

233 RAND Report, p 40.

234 This point can be illustrated by a brief look at the figures. In 2019, 32.7 million people in the UK held a valid driving licence and there were 153,153 reported casualties. This gives a ratio of 0.005 casualties per driver. However, the great majority of drivers were not involved in any incidents involving reported casualties - showing that most drivers are better than the (mean) average.

Furthermore, people may be less prepared to accept new risks (from robots) than familiar risks (from human drivers)

5.66 Here we raise three issues with the positive risk balance test. These relate to public perception, equity, and measurement.

Public perception

5.67 People are much more attuned to what has happened than to what has not happened. Inevitably, someone will be killed or seriously injured by an AV. The victim will be a real person, with family, friends, hopes and aspirations. Their picture will appear in the media, provoking considerable sympathy. By contrast, on the positive side of the balance, those who did not die are not identifiable people, but statistical constructs. They are faceless.

5.68 In these circumstances, developers, regulators and politicians will still need to make the case for automated driving, producing figures showing an overall decline in injury rates and mentioning the many people injured by human drivers. But it will not be an easy sell. The figures are likely to be treated sceptically and be subject to some debate. As we discuss below, we think that a Government agency will need to devote resources to collecting data, so as to provide robust proof of those who have not been injured.

Equity

5.69 As the literature on public perception of risks shows, equity is an important factor in determining whether people will tolerate a risk.[235] People are more likely to accept risks if they think that they are distributed fairly. They are less prepared to accept risks if their distribution is seen as unfair. This means that an overall reduction in risk may not be persuasive if (for example) the risk reduction is enjoyed by one group (such as car occupants) while the additional risks are experienced by another group (such as vulnerable road users).

5.70 This is not to suggest that human drivers are necessarily better at reducing risks to vulnerable road users than AVs. AVs' more cautious approach, coupled with improved sensors and better reaction times, may bring benefits for cyclists and pedestrians. On the other hand, drivers can perceive and predict the behaviour of other road users in a more contextual way. Given the differing abilities of humans and AVs, their risk profiles are unlikely to be the same.

5.71 Even with a positive risk balance, the result may still be perceived as unfair if some groups enjoy the benefits while other groups suffer the risks. Politicians and regulators need to have regard for the distribution of risk as well as the overall balance.

---

[235] For reviews of the literature, see Health & Safety Laboratory, *Review of the Public Perception of Risk, and Stakeholder Engagement* (2005), https://www.hse.gov.uk/research/hsl_pdf/2005/hsl0516.pdf; Health & Safety Laboratory, *Risk perception and risk communication: A review of the literature* (1999), https://www.hse.gov.uk/research/crr_pdf/1999/crr99248.pdf

Protected characteristics

5.72 Concern about unfair risk allocation is particularly acute if a group is adversely affected on the basis of race, sex, age, disability or other protected characteristics.[236]

5.73 The Equality Act 2010 prohibits imposing detriment on people on the basis of protected characteristics in various circumstances. Furthermore, regulators of AVs (as public authorities) are subject to the public sector equality duty. They must, in the exercise of their functions, have due regard to eliminating discrimination and advancing equality of opportunity for persons with protected characteristics.[237] This does not necessarily require regulators to conduct a formal equality impact assessment when they make the decision to classify vehicles as self-driving, but they are obliged to give active consideration to equality issues.[238]

5.74 In Consultation Paper 1 we cited several examples where bias has crept into the design of vehicles and automated systems. Air bags save many lives, but the first generation of air bags posed risks to smaller passengers, such as women of small stature, the elderly, and children, because they were developed with adult males in mind.[239] Current facial recognition software may also exhibit a bias towards white, male faces. For non-white and non-male faces, the accuracy of facial recognition systems may decline significantly. [240]

5.75 In the future, there are ways in which AVs might adversely affect protected groups, even if they have a positive risk balance overall. Systems may not have been trained to deal with the full variety of wheelchairs and mobility scooters; or they may struggle to recognise dark-skinned faces in the dark. If systems are designed to recognise pedestrians through leg movements, those movements may not be as pronounced for people wearing long skirts or robes. Where designers are drawn predominantly from

---

236 The protected characteristics are set out in s 4 of the Equality Act 2010: age; disability; gender reassignment; marriage and civil partnership; pregnancy and maternity; race; religion or belief; sex; and sexual orientation.

237 Equality Act 2010, s 149.

238 For guidance, see Government Equalities Office, *Equality Act 2010 Public Sector Equality Duty* (30 June 2011), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/85041/equality-duty.pdf.

239 NHTSA determined that 291 deaths were caused by air bags between 1990 and July 2008, primarily due to the extreme force that is necessary to meet the performance standard of protecting the unbelted adult male passenger. See D Glassbrenner, Estimating the Lives Saved by Safety Belts and Air Bags, https://nces.ed.gov/FCSM/pdf/2003FCSM_Glassbrenner.pdf, referred to in RAND Corporation, Autonomous Vehicle Technology, A Guide for Policy Makers (2016) p 102, https://www.rand.org/pubs/research_reports/RR443-2.html.

240 See NY Times, “Facial Recognition Is Accurate, if You’re a White Guy” (9 February 2018) https://www.nytimes.com/2018/02/09/technology/facial-recognition-race-artificial-intelligence.html. Recently, the BBC reported that the UK passport photo checker programme was twice as likely to fail photographs submitted by darker-skinned women compared with those submitted by lighter skinned men: “UK passport photo checker shows bias against dark-skinned women” (7 October 2020), https://www.bbc.co.uk/news/technology-54349538.

one demographic group (such as young men) it is easy for the diversity of those affected by the design to be overlooked.[241]

5.76 When we consulted on these issues, several developers argued that it would be impossible to ensure that AVs always treated everyone equally. However, it is important to show that AVs have been trained with a sufficient diversity of training data to be representative of those in the operational design domain in which the vehicle would be used.[242] Furthermore, all groups must enjoy a minimum level of safety, notwithstanding inevitable variation in how well different features may be recognised and responded to.[243]

5.77 As Transport Systems Catapult observed, the redistribution of risk from one group to another is an ethical issue.[244] AVs therefore bring ethical questions to the fore. While the actions of individual drivers lead to "in the moment safety", AV regulators will need consider how risk is distributed between one group and another. This includes questions of how to justify the imposition of harm on some more than others. In future it may be necessary to consider an explicit requirement to address the ethical dimension of such changes.

5.78 The current law already obliges AV regulators to have due regard to eliminating discrimination and advancing equality. We welcome practical suggestions about how this can be done.

Measurement

5.79 The final problem with the "positive risk balance" test is that it is difficult to measure. Both the RAND Corporation[245] and Intel Mobileye[246] have shown how difficult it would be to measure whether AVs are safer than human drivers *before* they are deployed commercially. This is partly because it would take billions of miles of test driving to provide a sufficient statistical sample to show any safety difference. Simulation plays a valuable role in verifying and validating the behaviour of AVs in the absence of statistical data. However, we will never fully understand how AVs will interact with human drivers and other road users until they are deployed in real world conditions.[247]

---

241 For discussion of this issue in the context of gender, see C Criado Perez, *Invisible Women: Exposing Data Bias in a World Designed for Men* (2019).

242 This could be part of the safety case presented by an ADSE to the regulator. See chs 7 and 8 below.

243 Analysis of Responses (June 2019), paras 9.115 to 9.133.

244 Transport Systems Catapult, *Taxonomy of scenarios for automated driving - technical report* (2017), p 31.

245 Mathematic modelling demonstrates, for example, that based on fatalities alone, it would take 8.8 billion miles of driving to show with 95% confidence that automated driving had 20% fewer fatalities than the average US rate: see RAND Corporation, *Driving to Safety: How many miles of driving would it take to demonstrate autonomous vehicle reliability?* (2016), https://www.rand.org/content/dam/rand/pubs/research_reports/RR1400/RR1478/RAND_RR1478.pdf.

246 Mobileye has conducted a similar calculation; to reduce the fatality rate by three orders of magnitude would require testing in the order of thirty billion miles: Mobileye RSS Report.

247 Koopman and Wagner set out a framework for improving the effectiveness of safety validation through simulation. They adopt a layered approach using high fidelity simulation to explicitly validate the assumptions and simplifications of lower fidelity testing. This can progressively erode unknown residual

5.80 The most reliable figures will therefore be collected after deployment. In Consultation Paper 1 we proposed that a Government agency should monitor the accident rate of self-driving vehicles compared with human drivers. The great majority of consultees agreed: out of 126 responses, 105 (83%) said that the safety scheme should monitor and compare accident rates. Only 3 (2%) disagreed and 18 (14%) answered “other”. However, many people drew attention to the technical challenges involved in this exercise.

5.81 Within Great Britain, there are two key data sources. The STATS19 database is used by the police to report traffic accidents that result in personal injury. This is supplemented by the Road Accident In-Depth Studies (RAIDS) database, which is more limited in its geographical scope but provides higher level data about the causes of accidents. Consultees said that these data sources need to be reviewed if they are to be used to compare automated and human-driven vehicles.

5.82 The first issue is that one may need to extend data collection to include more cases, particularly about more minor collisions. As ABI and Thatcham explained, the STATS19 statistics:

> are based on road accidents that are reported to the police and may therefore not provide an adequate analysis of low-impact and low-severity accidents, which may not be reported to the police.[248]

5.83 Secondly, comparisons require better data about miles travelled in different domains, times and conditions. One would need to know, for example, how many miles had been travelled by AVs on motorways (in daylight and in the dark), to enable a comparison to be made. As The Floow said:

> domains, times and conditions must be checked like for like against human and other machine "drivers" statistics to enable true comparison.[249]

5.84 Direct Line Group pointed out that this data is not readily available and would need to be collected. The British Standards Institute’s PAS 1883, which defines a common language to describe operational design domains, is an important step towards enabling such comparisons.[250]

5.85 Even if one has data to compare collision rates for a particular operational design domain like motorways, the appropriate comparison with human drivers is not necessarily straightforward. Some drivers (such as those aged 17 to 24) have more

risks, helping to better manage uncertainty within the automated vehicle safety case. See Koopman and Wagner, *Toward a framework for Highly Automated Vehicle Safety Validation* (2018), https://users.ece.cmu.edu/~koopman/pubs/koopman18_av_safety_validation.pdf.

248 Analysis of Responses to CP1, para 5.142.

249 Analysis of Responses to CP1, para 5.119.

250 BSI’s *PAS 1883:2020 Operational Design Domain (ODD) taxonomy for an automated driving system (ADS) – Specification* (2020), https://www.bsigroup.com/globalassets/localfiles/en-gb/cav/pas1883.pdf.

accidents than others.[251] This leads to difficult questions about the sort of drivers replaced by AVs. If AVs replace middle-aged drivers of new vehicles on motorways, then the appropriate comparison collision rate may be lower than a generic average would suggest. On the other hand, if automated shuttles replace young drivers who used to return from the pub under the influence of alcohol, the comparison may be high – but contested. (The public would not be reassured by being told that AVs are safer than drunk drivers).

5.86 These problems are not insoluble. The RAND Corporation has consulted extensively on how to measure safety in AVs and recommends a variety of approaches,[252] which we discuss in Chapter 10. The answer is likely to lie in putting together a variety of measures, including traffic rule infractions and assessments of "roadmanship" (responding well to situations) as well as actual collisions. An important element involves collecting comparative data on conventional vehicles by (for example) placing unobtrusive sensors on them.[253]

5.87 However, there is no simple solution. The safety agency will not only need to review current data sources and collect data on collisions and on miles driven. They will also need to work with the public to agree appropriate comparisons. Finally, the safety agency will need to consider the distribution of risk. Even if AVs reduce casualties overall, there will be concerns if they increase the risks to protected or vulnerable groups. We return to measurement issues in Chapter 10 and ask for consultees' views at paragraph 10.79.

COULD SELF-DRIVING VEHICLES BE *TOO* CAUTIOUS?

5.88 Many developers have highlighted their vehicle's defensive driving approach.[254] Might AVs drive so slowly and cautiously that they hold up the traffic flow, causing human drivers and other road users around them to take too many risks?

The trade-off between speed and safety

5.89 One reason why AVs have the potential to be safer is that they will drive more slowly and cautiously than human drivers.

5.90 The trade-off between speed and safety was illustrated recently by a US research study and the reaction to it. In May 2020, the Insurance Institute for Highway Safety published an analysis of crash information which attempted to categorise the human

---

251 Department for Transport, *Facts on Young Car Drivers* (2015) p 3: "Young car drivers made up 18 per cent of all car drivers involved in reported road accidents in 2013. However, this is considerably higher than the 5 per cent of miles they account for."

252 RAND Corporation, *Measuring Automated Vehicle Safety* (2018), https://www.rand.org/pubs/research_reports/RR2662.html.

253 See also ch 17 below.

254 See eg Kodiak, *Safety Report* (2020), https://kodiak.ai/safety-report/; Nuro, *Delivering safety: Nuro's approach* (2018), https://static1.squarespace.com/static/57bcb0e02994ca36c2ee746c/t/5b9a00848a922d8eaecf65a2/1536819358607/delivering_safety_nuros_approach.pdf.

errors AVs would need to avoid to be safer.[255] It found that sensing and perceiving errors accounted for 23 percent of the total. Incapacitation (mainly from alcohol) accounted for 10 percent. As self-driving vehicles have better sensors and never get drunk, the study suggested that these errors (around a third) would be easy to eliminate.

5.91 However, human drivers often deliberately traded safety for speed. Planning and deciding errors, such as speeding and illegal manoeuvres, were contributing factors in about 40 percent of crashes in the study sample.[256] To eliminate these crashes, AVs would need to drive more slowly and cautiously.

5.92 The study drew considerable criticisms from Partners for Automated Vehicle Education (PAVE), a consortium which promotes the benefits of AVs.[257] PAVE made two criticisms of the study and its coverage.

5.93 First, PAVE criticised headlines that "self-driving cars could only prevent a third of US crashes", on the grounds that all attempts to quantify how many crashes could be prevented were fundamentally speculative. PAVE accepted that automated technology was not a panacea to prevent all death. However, they objected that the one third figure was just as laden with assumptions "as the overly-optimistic view" it seeks to replace. We agree. We do not think it helpful to look at existing crashes and speculate that automated driving might prevent any specific proportion of human errors, whether than figure is a 33% or 94%.

5.94 Secondly, PAVE pointed out that AVs will indeed make different (and better) trade-offs between safety and speed. Unlike human drivers they will comply much more rigorously with the road rules, including speed limits.

5.95 Although the debate was framed in terms of controversy, there is an underlying consensus. One of the main reasons that AVs will be safer is that they will abide by speed limits and other traffic rules, and carry out fewer dangerous manoeuvres, such as overtaking. In most cases this will be a major advantage, for both safety and the environment. However, in some scenarios it opens the possibility that AVs could impede traffic flow (as we discuss below).

Should AVs abide by speed limits?

5.96 In Consultation Paper 1 we were keen to test whether the public would accept slower vehicles, which might hold up traffic. We asked if there were any circumstances in which an automated driving system should be permitted to exceed the speed limit provided they kept within police guidelines of 10% plus 2 miles.

5.97 Answers to this question were split down the middle. Out of 123 respondents who engaged with the question, 60 respondents said that AVs should never speed. Academics and safety groups put robust arguments in favour of complying with speed

---

[255] Insurance Institute for Highway Safety, *What humanlike errors do autonomous vehicles need to avoid to maximize safety?* (2020), https://www.iihs.org/topics/bibliography/ref/2205.

[256] The remaining categories were execution/performance (23%) and predicting (17%).

[257] PAVE Blog, *On The Life Saving Potential of Autonomous Vehicles* (4 June 2020), https://medium.com/pave-campaign/on-the-life-saving-potential-of-autonomous-vehicles-b002a668b530.

limits in all circumstances, pointing to the strong links between speeding and injury. It was also thought that law-abiding AVs would have a calming effect on other traffic. By contrast, when the RAC polled its members, two-thirds (68%) thought that AVs should be allowed to exceed the speed limit if it helped maintain traffic flow. Motorists were clearly concerned about being "stuck" behind an AV.

5.98 There is strong evidence to show that improved speed limit compliance brings safety and environmental benefits and has only a marginal effect on travel times.[258] After analysing responses to Consultation Paper 1 we have formed the view that AVs should always abide by speed limits. This upholds the law, reduces injuries and acts as a model for other traffic.

Introducing human discretion into rules?

5.99 That said, introducing AVs will be a learning experience. The RAND Corporation has suggested measuring not only the safety of AVs themselves but also their impact on the broader ecosystem. For example, traffic in areas with AVs may become calmer and more predictable. Conversely, negative effects may be observed.[259]

5.100 Our starting point is that AVs should abide by traffic rules. However, human drivers often interpret rules flexibly. As society learns from the experience of deploying AVs on the roads, we envisage that some adjustments may need to be made in some circumstances, to address the lack of discretion in how AVs drive.

5.101 Take a simple example: a cyclist proceeding at 11 miles an hour can only be overtaken by crossing double white lines. Under Rule 129 of the Highway Code, drivers are only permitted to cross double white lines to pass a pedal cycle if it is travelling at 10 miles an hour or less. Nevertheless, human drivers might use some discretion, weighing both the ease and safety of the overtaking manoeuvre and the tailback behind them. By contrast, a law-abiding AV would simply follow patiently behind the cyclist. This might not have a calming effect on following traffic. Instead, human drivers may become impatient and frustrated, and take more risks than they would otherwise.

5.102 This illustrates a more general point. The effect of a road rule may be different if it is followed to the letter than if it is subject to drivers' flexible interpretation. In a few cases, there may be a need to adjust road rules in the light of practical experience of how AVs drive. In Chapter 11 we look at how this process of adjustment might be managed.

---

258 More constant speeds and fewer collisions has the potential to reduce congestion. See European Road Safety Observatory, Speed and Speed Management (2018), https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/ersosynthesis2018-speedspeedmanagement.pdf. For a summary of evidence on 20 miles per hour speed limits, see evidence to the Scottish Parliament at https://www.parliament.scot/S5_Rural/Research_evidence_20mph_bILL.pdf.

259 RAND Corporation, *Measuring Automated Vehicle Safety* (2018), https://www.rand.org/pubs/research_reports/RR2662.html.

CONCLUSION

A blend of all four tests

5.103 There is no single or easy test for whether a vehicle is safe enough to be acceptable. Instead, we see the final decision as balancing all four standards set out in paragraph 5.5. A political decision will have to be made as to the acceptable level of safety of AVs in comparison with human drivers, but in any event AVs should be made as safe as is reasonably practicable.

5.104 The vehicle will need to be tested against the many scenarios which might arise in its operational design domain (both likely and unlikely). For each scenario, the aspiration must be that the vehicle will respond as well as a competent and careful human driver, by abiding by traffic rules, avoiding collisions and treating other road users with consideration.

5.105 In some cases, this may not be fully achievable. Here it is worth asking whether the vehicle would be "at fault". The test is: if this behaviour had been performed by a human driver, would the driver be held liable in negligence for causing the accident? If the problem is rare and the vehicle is not at fault, some differences between the response of the AV and that of a competent and careful human driver may be acceptable.

5.106 The next question is whether the vehicle will always achieve its intended outcome. Many tests of components and systems will follow familiar automotive testing procedures. For these, the idea that risk should be "as low as reasonably practical" (ALARP) provides a well understood standard. Furthermore, to ensure that a vehicle is reliable in real world conditions, it will need to be embedded in robust processes, for example to update software, to maintain sensors and to communicate with human users. We consider these in detail in Chapter 10.

5.107 Overall, there is consensus that AVs need to achieve a positive risk balance. In other words, they should be removed from the roads unless they cause fewer injuries than human drivers. Furthermore, they should not redistribute risk in a way which damages those who receive no benefit from the technology.

5.108 To measure this outcome, it is necessary to monitor the accident rate of AVs compared with that of human drivers. An Expert Group on the ethics of Connected and Autonomous Vehicles (CAVs) has described this as "vital":

> to prove that CAVs achieve the anticipated road safety improvements, it will be vital to establish an objective baseline and coherent metrics of road safety that enable a fair assessment of CAVs' performance relative to non-CAVs and thereby publicly demonstrate CAVs' societal benefit.[260]

---

260 See Horizon 2020 Commission Expert Group, *Ethics of connected and automated vehicles* (2020), https://ec.europa.eu/info/sites/info/files/research_and_innovation/ethics_of_connected_and_automated_vehicles_report.pdf.

A political rather than technical decision

5.109 This careful balancing of different tests means that the final decision involves an element of judgement. The overarching question is: will the remaining risks be acceptable to the public? That question is quintessentially political.

5.110 In Chapter 3 we noted that the debate over ALKS has shone a spotlight on the nature of the decision under section 1 of the Automated and Electric Vehicles Act 2018 (AEVA). What is involved in deciding that a vehicle is safe enough to drive itself without human monitoring?

5.111 The Call for Evidence suggested that this is a technical decision:

> The Secretary of State has to take a decision as to whether to list a vehicle as an automated vehicle under AEVA. His decision is not discretionary, but will instead be a decision based on the facts and features of particular vehicles or vehicle types, when measured against the definition in AEVA.[261]

5.112 One option being considered is that the Secretary of State's list might reference particular UNECE regulations which set technical standards for automated driving systems. On this basis, if a system is approved under a listed regulation by one type approval authority within the 56 UNECE countries, it would be deemed safe enough for British roads.

5.113 We think this approach risks confusing the issue of whether a system meets technical standards with a separate question: is the vehicle (together with the processes surrounding it) safe enough to be acceptable to the British public? In Consultation Paper 1 we described the standard of how safe AVs need to be before they can be deployed as a policy question for Government.[262] We continue to hold this view.

5.114 Section 1 of the Automated and Electric Vehicles Act 2018 places the decision on whether a vehicle is capable of safely driving itself on the Secretary of State. It also affords the Secretary of State some discretion (“in the Secretary of State’s opinion”). In this aspect, we think that the 2018 Act takes the correct approach.

5.115 The Secretary of State’s decision can (and should) be informed by technical experts. We discuss the technical aspects of assuring safety in Chapter 7. Experts can check components against standards. They can see how an AV performs on the test track or the road. They can also test the AV against a large database of scenarios to see which scenarios the AV can (and cannot) deal with effectively. These tests can inform political decisions, such as whether, for example, benefits to many road users outweigh the dangers to a few road users in some rare scenarios. However, there will always be some risk. Whether this remaining risk is acceptable is a political decision.

---

[261] Call for Evidence, p 22.

[262] CP1, para 5.82.

A national or international decision?

5.116 in Chapter 6 we discuss the various international treaties in this area. We conclude that the decision on whether a vehicle is sufficiently safe to be treated as self-driving is a national competence.

5.117 In our view the decision over whether the risks of self-driving are acceptable to the public can – and should – be taken at national level. There are huge variations in the level of road deaths around the world: some contracting parties to the Geneva and Vienna Road Traffic Conventions have a level of road deaths that is many times that of Great Britain.[263] The tolerance for risk is much greater in some jurisdictions than in others. This will make it difficult (if not impossible) to reach international agreement that a given system is safe enough in the 84 quite different jurisdictions which are contracting parties to the Vienna Convention on Road Traffic.[264]

Consultation Question 3.

5.118 We provisionally propose that the decision whether a vehicle is sufficiently safe to "safely drive itself" should be made by the Secretary of State, as informed by advice from a specialist regulator.

Do you agree?

Consultation Question 4.

5.119 We welcome observations on which of the following standards is most appropriate when assessing the safety of automated vehicles:

(1) as safe as a competent and careful human driver;

(2) as safe as a human driver who does not cause a fault accident;

(3) overall, safer than the average human driver.

Consultation Question 5.

5.120 We welcome observations on how automated vehicles can be made as safe as reasonably practicable.

---

263 See CP1, paras 5.88 to 5.90.

264 For a list see https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XI-B-19&chapter=11&Temp=mtdsg3&clang=_en.

Consultation Question 6.

5.121 We welcome practical suggestions for how AV regulators can fulfil their public sector equality duty.

5.122 In Consultation Paper 1 we said that testing before AVs are placed on the market can only go some way towards ensuring that AVs are safe. We explained that we would not know the full picture until they had been used in real world conditions.[265] Given the complexities and difficulties of deciding whether AVs are sufficiently safe before they are deployed, we see post-deployment safety assurance as essential. We discuss this in Chapters 9 to 11.

265 CP1, para 5.1.

Chapter 6: Regulating vehicle standards pre-deployment - the legal background

6.1 Currently, motor vehicles are subject to regulatory approval before they are sold. A type approval authority tests both components and systems against standards. Once the individual components and systems have been approved, a vehicle may then be given a "whole vehicle approval certificate". Without such a certificate, vehicles may not be registered or used on the road.

6.2 The system is international. Vehicle standards are set both by the United Nations Economic Commission for Europe (UNECE) and the European Union (EU). Since 1973, the UK has received many standards through a three-part chain. UNECE standards have been adopted into EU law, which has then been implemented in the UK. From a UK perspective, it has not been necessary to distinguish between those provisions which originated from the UNECE and those which originated from the EU: they were all part of regulating a highly-integrated cross-border automotive industry.

6.3 This is set to change. From 1 January 2021, the UK will apply UNECE standards directly, without the medium of the EU. It is therefore necessary to unpick the current system, to distinguish between UNECE and EU obligations.

6.4 Here we set out the legal background, updating and expanding on the account in Consultation Paper 1. It is in four sections.

(1) We start with an outline of the UNECE agreement and EU law, including how they deal with exemptions for new technology.

(2) We then look at the current system of national approvals and how it will change after the end of the transition period on 1 January 2021.

(3) We explore how the system works in practice, focussing on the difference between components, systems and whole vehicles, and considering how much standards vary across the world.

(4) Finally, we consider how far the UK Government is bound by international obligations, and how far it has the freedom to set up its own scheme to approve self-driving vehicles.

6.5 In Consultation Paper 1 we provisionally proposed a limited national scheme for modifications and small series.[266] As we explore in Chapter 8, we are now proposing a broader national scheme for automated driving systems, open to both manufacturers and developers. Manufacturers would have a choice of seeking approval at either international or national level.

---

[266] These limitations (to systems installed in pre-registered vehicles and to new vehicles make in small numbers) were necessary to comply with EU law.

THE THREE-PART SYSTEM IN OUTLINE

UNECE type approvals under the revised 1958 agreement

6.6 The UNECE was set up in 1947 to help rebuild post-war Europe by strengthening economic relations - both between European countries and with the rest of the world. In 1958, as part of this mandate, an international treaty was introduced, that aimed to reduce technical barriers to international trade in vehicles. The UK ratified the agreement in 1963.

6.7 The treaty has now been revised three times, most recently in 2017. It currently has 54 contracting parties,[267] covering 56 countries.[268] It extends far beyond Europe and includes (for example) Japan, South Korea and Australia.

6.8 We refer to the treaty as the "revised 1958 agreement", as shorthand for the UNECE agreement "concerning the adoption of uniform technical prescriptions for wheeled vehicles and their parts".[269] The agreement sets up an administrative committee, known as Working Party 29,[270] which is tasked with creating regulations for vehicle components and systems. These are referred to as UN Regulations.

6.9 There are currently 157 UN Regulations. As we explain below, some cover components (such as headlamps or tyres) and some cover "systems" (such as braking or steering). This year, Working Party 29 approved a new UN Regulation on "automated lane keeping systems" (or ALKS). Traditionally, the UNECE Regulations have not covered whole vehicles, though steps are now being taken towards achieving mutual recognition of whole vehicles.[271]

6.10 The UNECE agreement works on the principle of mutual recognition. Each contracting state designates a type approval authority. Manufacturers submit their product to their chosen authority, to decide whether the product meets the terms of the UN Regulation. A product approved by one contracting party's authority under a UN

---

267 The 54 contracting parties are: *Albania, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Denmark, Egypt, Estonia, European Union, Finland, France, Georgia, Germany, Greece, Hungary, Italy, Japan, Kazakhstan, Latvia, Lithuania, Luxembourg, Malaysia, Montenegro, Netherlands, New Zealand, Nigeria, North Macedonia, Norway, Pakistan, Poland, Portugal, Republic of Korea, Republic of Moldova, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, Ukraine, United Kingdom.*

268 The EU is a contracting party in its own right. Three countries (Ireland, Malta and Cyprus) are not "contracting parties" but are covered by the agreement by virtue of their EU membership.

269 The full title is "Agreement concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations". For the text, see https://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2017/E-ECE-TRANS-505-Rev.3e.pdf.

270 Technically, Working Party 29 (WP29) sits as the administrative committee for three separate agreements concerned with vehicles. These are the revised 1958 agreement; the 1998 on Global Technical Regulations; and the 1997 Agreement on Rules for Periodical Technical Inspections. However, UN Regulations under the 1958 agreement take up much of its work.

271 UN Regulation No 0 – Uniform provisions concerning the International Whole Vehicle Approval, annexed to the 1958 agreement in July 2018.

Regulation must be accepted by all those contracting parties who have "applied the regulation". As Article 3(2) states, a party must not require "any further testing, documentation, certification or marking concerning these type approvals".

The EU framework

6.11 The EU is a significant contributor to Working Party 29. It is a contracting party to the revised 1958 agreement in its own right and controls a block of 25 out of the 54 votes.

6.12 In addition to its work within the UNECE, the EU has established further harmonisation among its own member states. Until September 2020, the EU scheme was set out in the Framework Directive 2007. The Framework Directive has now been replaced by EU Regulation 2018/858 which came into force on 1 September 2020.[272]

6.13 Regulation 2018/858 incorporates UN Regulations. It also adds to them, in two main ways:

(1) In some areas, most notably on emissions, the EU has established its own standards for vehicles placed on the market within the EU.[273]

(2) The EU also has a system for whole vehicle type approval.

6.14 To obtain EU whole vehicle type approval, the manufacturer must apply to a type approval authority in one of the member states. For the UK this was the Vehicle Certification Agency (VCA). The manufacturer needs to show that the constituent systems and components of the vehicle comply with UN or EU regulations. The manufacturer must also satisfy the approval authority that there will be "conformity of production" - that is that the production models will be manufactured according to the approved specifications.

6.15 If the requirements are satisfied, the approval authority issues a Whole Vehicle Type Approval (WVTA) certificate. The manufacturer then provides a "certificate of conformity" for each production vehicle to confirm that it meets the specification in the WVTA certificate. The certificate of conformity certifies that the vehicle can be sold, registered and used in the EU.

Exemption approval for new technology

Exemptions under EU law

6.16 There is a long-standing procedure in EU law to cater for new technology which is incompatible with existing UN Regulations. Article 39 of Regulation 2018/858 applies where a system, component or unit "incorporates new technologies or new concepts

---

272 Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC.

273 Other significant "EU only" regulations relate (for example) to registration plates and vehicle identification; washers and wipers; wheel guards; masses and dimensions; tyre installation; the refrigerant in air conditioning systems; gear shift indicators, and eCall (which telephones the emergency services following a major collision).

that are incompatible with one or more regulatory acts". If the system nevertheless meets the test of ensuring "at least an equivalent level of safety and environmental protection", an approval authority may grant provisional approval.[274]

6.17 Initially that approval is only valid in the territory of that type approval authority, though authorities in other member states may accept it if they wish.[275] The approval authority must then inform the European Commission, which decides whether to accept or refuse approval. If the European Commission accepts the approval, it "adopts implementing acts". This has the effect that all member states must accept the technology.[276]

Exemptions under the revised 1958 agreement

6.18 A similar exemption procedure was added by Revision 3 of the 1958 agreement. Under Article 12.6:

> A Contracting Party applying a UN Regulation may grant an exemption approval pursuant to a UN Regulation for a single type of wheeled vehicle, equipment or part which is based on a new technology, when this new technology is not covered by the existing UN Regulation, and is incompatible with one or more requirements of this UN Regulation.

6.19 As with the EU scheme, the exemption is subject to central authorisation. The Administrative Committee may authorise the approval if it is satisfied that there is evidence of "at least an equivalent level of safety and environmental protection" to that provided by existing Regulations.[277]

6.20 Once an approval has been authorised, there is a presumption that it will apply to all UNECE contracting parties. However, the revised 1958 Agreement differs from the EU article 39 procedure in an important respect. While EU member states are obliged to accept the Commission's decision, UNECE states may notify their disagreement or intention not to accept an exemption approval.[278] If so, the notifying state is not obliged to accept the new technology within its territory.

NATIONAL APPROVAL AND REGISTRATION

National approval

6.21 EU member states have limited rights to permit vehicles to be used on their own roads without EU type approval. National approval is only available for vehicles produced in limited numbers (or "small series"). The limits are low. Under the Framework Directive, for example, cars (referred to as M1 vehicles)[279] were only considered to be a small

---

274 Art 39.1 and 2. This replaces Art 20 of the Framework Directive 2007, written in similar terms.

275 Art 39.5.

276 Art 39.3.

277 Sch 7, para 3(3).

278 Sch 7, para 7.

279 M1 vehicles are is designed and constructed for the carriage of passengers and have no more than nine seats.

series where annual production did not exceed 100 vehicles. Under Regulation 2018/85, this figure has been increased to 250.[280]

6.22 Within the UK, the VCA offers "national small series type approval" (NSSTA) for low volume manufacturers who intend to sell only in the UK. The VCA explains that

> The advantages of NSSTA are relaxed technical requirements for some subjects, a more pragmatic approach to the Conformity of Production (CoP) requirements, and reduction in administrative requirements.[281]

6.23 There is also a scheme for "individual vehicle approval" which allows people to manufacture or import single vehicles or a few vehicles at a time. In Great Britain, vehicles must be inspected by the Driver and Vehicle Standards Agency in order to confirm they meet the technical requirements set out in the legislation.[282]

Requirements for approval documents before registration

6.24 It is necessary to show that a vehicle has been approved before its first registration with the Driver and Vehicle Licensing Agency.[283] Furthermore, it is a criminal offence to use a vehicle on the road without such a certificate.[284] In Great Britain, it is also an offence to supply some classes of vehicle unless they have type approval.[285]

6.25 Until December 2020, the key document required to register the great majority of vehicles is the EU "certificate of conformity". This is issued by the manufacturer confirming that the vehicle corresponds to an EU WVTA certificate issued to the manufacturer by a type approval authority in one of the EU member states. However, this is now set to change.

Whole vehicle type approval in Great Britain from 1 January 2021

6.26 At the end of the transition period in December 2020, the system of whole vehicle type approval will change for Great Britain (though not for Northern Ireland). WVTA certificates issued in the UK will no longer be valid for sales or registrations on the EU market. Similarly, paperwork which relies on a WVTA certificate issued outside the UK will no longer be automatically accepted for registering a vehicle with the Driver and Vehicle Licensing Agency.[286] EU WVTAs will only be valid if the vehicle was in the UK on or before 31 December 2020.

---

280 Article 23 of Directive 2007/46/EC and Art 42 of Regulation 2018/858.

281 VCA, Type Approval for Passenger Vehicles M1 to M3, https://www.vehicle-certification-agency.gov.uk/vehicle-type-approval/type-approval-for-passenger-vehicles/.

282 In Northern Ireland, the task is carried out by the Driver and Vehicle Agency.

283 Or, in Northern Ireland, Driver and Vehicle Agency.

284 Road Traffic Act 1988, s 63(1) in Great Britain and Road Traffic (Northern Ireland) Order 1981, art 31E in Northern Ireland.

285 Road Traffic Act 1988, s 65(1).

286 DfT*, Issuing GB type approval from 1 January 2021* (September 2020) at https://www.vehicle-certification-agency.gov.uk/wp-content/uploads/2020/09/GB-Type-Approval-Scheme.pdf.

6.27 These changes are intended to take effect whether or not there is a free trade agreement between the UK and the EU. In its negotiating strategy published in February 2020, the Government confirmed that it is seeking to facilitate trade in motor vehicles based on international standards. This "should draw on the parties' commitments to mutual recognition of type approvals for products covered by UN regulations" and allow for cooperation and information exchange.[287] However, the UK Government is not seeking to continue the mutual recognition of WVTA certificates.

6.28 From 1 January 2021 the UK will operate a GB type approval system. The new system will differ between existing vehicle models that already have EU WVTA and new models.

Existing models

6.29 For new vehicles which have valid EU WVTA, vehicle manufacturers will need to apply for provisional GB type approval before placing their products on the UK market. The Government explains that this will be an administrative procedure:

> From 1 January 2021, the VCA will issue provisional GB type approvals to manufacturers holding valid EU type approvals. This may include vehicles manufactured before 1 January 2021, and those not in the UK on 31 December 2020.[288]

6.30 The provisional UK type-approval will be valid for a maximum of two years. Within this period, provisional approvals will need to be converted into full GB type-approvals.[289] Legislation to allow the VCA to convert provisional type-approvals into full type-approvals is expected to be in place during 2021.[290]

New models

6.31 Manufacturers with new vehicle models will need to obtain GB type-approval if they intend to place them onto the UK market after 31 December 2020. The vehicles must meet all of the requirements of the GB type approval scheme. Legislation which sets out these requirements is expected in the first half of 2021.[291] Until then manufacturers of new models seeking approval will be issued with provisional GB type approval.[292]

Whole vehicle approval in Northern Ireland

6.32 This project is limited to England, Wales and Scotland. It does not make any proposals for Northern Ireland. Here we simply note that under the terms of the

---

287 HM Government, *The Future Relationship with the EU: The UK's Approach to Negotiations* (February 2020).

288 DfT, *Issuing GB type approval from 1 January 2021* (September 2020), p 4.

289 Above, p 8.

290 Above, p 4.

291 Above, p 9.

292 Above.

Northern Ireland Protocol, EU Regulation 2018/858 will continue to apply in Northern Ireland.[293]

HOW DOES TYPE APPROVAL WORK IN PRACTICE?

UNECE approval for "components" and "systems"

6.33 The 1958 revised agreement distinguishes between "components" and "systems". Parts manufacturers may apply for component approval, without specifying the vehicle in which it will be installed. However, only the manufacturer who assembles the whole vehicle can apply for "systems" approval. Within the industry, the vehicle assembler is known as the "OEM" which stands for "original equipment manufacturer".

6.34 A headlamp, for example, would be considered a "component". Thus a parts manufacturer (such as Bosch) might apply for lamp approval. The type approval authority will then assess the colour and brightness of the lamps, under the appropriate UN Regulation.

6.35 However, there is always a 'system' regulation to go with each kind of component, specifying how the components must be installed. This system approval must be applied for by the OEM (such as Ford). This means that if Ford uses a Bosch lamp in one of their cars, Ford would need to obtain system approval to show that they have complied with requirements on lighting installation, which cover (for example) the location and electrical operation of the lamp.[294]

6.36 There are systems regulations for many different aspects of the vehicles. They not only cover major systems such as braking and steering, but other less obvious aspects, such as glazing installation, seatbelt anchorages, crashworthiness and external projections.

6.37 When an OEM receives "system approval", the approval will only be valid for a particular "vehicle type". There is no standard definition of "vehicle type". Instead, the term is defined separately in each UN Regulation. For example:

(1) For braking systems, under Regulation 13H, a vehicle is only of the same type if it meets the listed requirements (such as the same maximum mass, distributed along the axles in the same way, with the same maximum speed).[295]

(2) For steering systems, under Regulation 79, the list is different. Vehicles must have (for example) the same steering control, steering transmission, steered wheels and energy source.[296]

---

293 Protocol on Ireland/Northern Ireland, Annex 5, para 8.

294 To add to the complexities, it is also possible to approve "separate technical units", which are similar to components but need to be tested within vehicle. A high voltage battery, for example, needs to be assessed as part of a whole vehicle, because the type-approver will need to ensure that it is safe in a crash (which depends on other aspects of the vehicle performance).

295 UN Regulation 13H, para 2.2.

296 UN Regulation 79, para 2.2.

6.38 An automated lane keeping system (ALKS) is a system. This means that under the UN Regulation on ALKS, only the OEM can obtain ALKS type approval.[297] The system must be installed in a vehicle and approval is only granted for vehicles of that type. "Vehicle type" concerning ALKS is defined as "a category of vehicles" which do not differ in "essential aspects" or in "features which significantly influence the performances of ALKS".[298] The UN Regulation does not specify which features might influenced the performance of ALKS.

6.39 In Chapter 8 we propose that, in a national scheme, developers should also have the opportunity to seek approval for automated driving systems.

EU whole vehicle type approval in practice

6.40 To gain approval for a whole vehicle, the OEM must show that each individual component and system meets the requirements set out in EU Regulation 2018/858 for a given vehicle category. Typically, this involves evidencing around 70 approvals for components and systems under UN Regulations. Vehicle manufacturers also need to obtain approvals for a small number of EU-only requirements (for example, on exhaust emissions, windscreen wipers or eCall).[299]

6.41 When all the individual component and system approvals are in place, the OEM submits a production sample of the whole vehicle to its chosen type approval authority. The authority does not test the whole vehicle as such. Instead, it checks that each component and system matches the specification contained in the individual component and system approvals. The OEM must also satisfy the approval authority that there will be "conformity of production". This requires OEMs to document how they follow quality assurance principles (such as ISO 9001).[300]

6.42 In 2016 the Society of Motor Manufactures and Traders noted that obtaining whole vehicle approval for a passenger vehicle normally took between six and 18 months, and cost between £350,000 and £500,000.[301]

6.43 Whole vehicle approval is also limited to a vehicle type, but the whole vehicle type will often be narrower than the vehicle types defined in the various systems regulations.[302]

---

297 UN Regulation 153, para 3.1.

298 UN Regulation 153, para 2.1.1

299 eCall telephones the emergency services following a major collision. For other EU-only requirements, see para 6.13.

300 A International Organisation for Standardisation (ISO) standard which sets out criteria for a quality management system.

301 Society of Motor Manufacturers and Traders (SMMT), Type Approval: SMMT Issues Paper-November 2016, https://www.smmt.co.uk/wp-content/uploads/sites/2/SMMT-Brexit-issue-paper-TYPE-APPROVAL.pdf

302 For example, a manufacturer may produce several vehicles which hold different whole vehicle approvals, but because they are sufficiently similar with respect to the electrical architecture, they may all be covered by a single Cyber Security system approval. Similarly, 2-, 3- and 4-axle trucks would all be different "vehicle types", but may share a single lighting system approval.

Choosing the type approval authority

6.44 Component approvals on a given vehicle will typically be granted by a variety of different type approval authorities, depending on where the manufacturer of the part is based.

6.45 For systems and whole vehicle approval, some OEMs may choose to deal with a single type approval authority. Some may obtain systems approvals from one (or more) type approval authority and the whole vehicle approval from another. We were told that these decisions tend to be based on history and geography, together with cost and availability.

6.46 Historically, most manufacturers who used the VCA would apply for the full suite of the system and whole vehicle approvals. Following the UK's exit from the EU, this has changed. Manufacturers may apply to the VCA for system approvals granted under UN Regulations and then go to a type approval authority in an EU member state for EU system approvals and the WVTA certificate. The VCA also acts as a technical service for type approval authorities in Sweden and the Netherlands, so VCA may do the technical work while authorities in Sweden or the Netherlands provide the EU certificate.

How far do whole vehicles differ between UNECE countries?

6.47 The UNECE revised 1958 agreement has led to considerable standardisation between its contracting parties, particularly for components and systems.

6.48 However, for mass-produced vehicles, there are usually some differences between models sold in the EU and models sold elsewhere (such as Japan and Korea). For whole vehicles there are subtle differences in the suite of regulations required (most notably on emissions).

6.49 We have been told that is possible to build a single specification for all UNECE contracting parties, but it would be built to "highest common denominator" standards and therefore more costly than necessary for each market.[303] Single models sold to all UNECE countries tend to be high-end vehicles rather than mid-market mass-produced cars. Differences in the specification may also respond to different consumer demand in the various markets.

6.50 At the end of the transition period, the UK will acquire the power to set new substantive requirements for whole vehicles. Differences may not be significant initially but may become more significant in time. For example, the UK Government is committed to ending the sale of new petrol cars and vans by the end of 2030, irrespective of developments in the EU. However, as far as vehicle parts are concerned (components and systems), the UK intends to remain within the UNECE.

Differences with non-UNECE countries

6.51 Some major countries, such as China and the USA, are not parties to the UNECE revised 1958 agreement. This has led to separate vehicle markets, particularly between UNECE parties and North America (the USA, Canada and Mexico). US

303 We are grateful to staff at the VCA for these explanations.

Federal Motor Vehicle Safety Standards are sometimes incompatible with UN Regulations, which means that it is not currently possible to make one vehicle that can legally be sold in both the US and Europe.

6.52 The 1998 Agreement on UN Global Technical Regulations was an attempt to overcome these differences. It has 33 contracting parties, which includes not only UNECE parties but also the USA, Canada and China. The aim is to establish the United Nations Global Technical Regulations (UN GTRs) by consensus vote.

6.53 Some progress has been made, with 14 UN GTRs adopted. However, unlike the revised 1958 agreement, the 1998 agreement has no procedures for type approval or mutual recognition. Nor do UN GTRs have any independent legal force. They only take effect if they are transposed into national or regional law.

6.54 A further issue is that, in the USA, vehicles are not subject to regulatory checks prior to sale. Instead, vehicle manufacturers are required to self-certify that their vehicles meet national standards.[304] The regulator then performs spot-checks on vehicles once they are on the market and can impose sanctions on a manufacturer if their vehicles are found not to be compliant. This form of approval is generally referred to as "self-certification". The combination of the different procedural and substantive requirements has made it difficult to integrate the UNECE and North American markets.

FREEDOM TO SET POLICY? COMPARING UNECE AND EU OBLIGATIONS

6.55 From 1 January 2021, the UK's international legal obligations will change, from being bound by both EU and UNECE law to being bound by UNECE law alone. This will allow Great Britain more freedom to set its own policy, though that freedom is not unlimited. Given the significance of this change, it is worth spelling out the similarities and differences between obligations under EU law and under the UNECE agreement.

6.56 Under the EU Framework Directive and its replacement (Regulation 2018/858), member states have twin obligations:

(1) they *must* accept all components, systems and vehicles that comply with EU law onto their markets ("the obligation to accept"); and

(2) they have only limited rights to permit the use of components, systems and vehicles which do *not* comply with EU standards (in other words, a limited "right to allow").

6.57 Under the UNECE system, the obligation to accept products is less rigorous and there is no limitation on parties' right to allow other components, systems or vehicles onto their markets. We start by looking at the obligation to accept and then at the right to allow.

---

304 Motor Vehicle Safety, Title 49 United States Code, ch 301.

The obligation to accept onto the market

The position in EU law

6.58 Once a type-approval authority of any member state approves a vehicle or part, other member states are required to allow it onto their markets. The key provision is EU Regulation 2018/858 article 6(5), which states:

> Member States shall not prohibit, restrict or impede the **placing on the market**, the registration or **the entry into service** of vehicles, systems, components or separate technical units that comply with this Regulation, except in the cases provided for in Chapter XI. [emphasis added]

6.59 The key phrases are "placing on the market" and "entry into service". "Placing on the market" refers to the supply of the vehicle or part. "Entry into service" is wider, and is defined as:

> the **first use, for its intended purpose**, in the Union, of a vehicle, system, component, separate technical unit, part or equipment.[305] [emphasis added]

6.60 This leads to questions about the "intended purpose" of a component or system. Clearly, not all purposes must be allowed: if a tyre is "intended" to be used at up to 200km an hour, this does not require member states to allow users to exceed the speed limit. However, it can be a difficult test to apply, especially if an automated driving feature is "intended" to allow non-driving related screen use.

6.61 Now that the UK has left the EU, Regulation 2018/858 has the status of retained EU law. It is, however, open to the UK Government to repeal article 6(5). The UNECE agreement contains no mention of using a system for its intended purpose.

The UNECE agreement compared to EU law

6.62 Under the revised 1958 agreement, once a contracting party has "applied a regulation", that party is obliged to accept all internationally approved systems for "placement onto its market". "Placement onto a market" refers to the sale or supply of the vehicle or part, Contracting parties must allow the supply without requiring "any further testing, documentation, certification or marking concerning these type approvals".[306]

6.63 This is similar to the obligation to accept for placement under EU Regulation 2018/858. However, it is not as wide as the EU term "entry into service", which requires the member state to allow the product to be used for its intended purpose.[307]

---

305 Regulation 2018/858, Art 3(51).

306 UNECE revised 1958 agreement, Art 3(2).

307 Regulation 2018/858, Art 3(51).

6.64 Under both UNECE and EU law, countries may prohibit the sale and use of products if they fail to conform to the regulation or present a serious risk. This is then subject to a dispute procedure.[308]

6.65 In other ways, however, the revised 1958 agreement is much less restrictive than EU law. Under the revised 1958 agreement:

(1) Contracting parties are not bound to follow new regulations. Under Article 1.4, parties may notify their disagreement with a new regulation, following which the regulation does not apply. By contrast, under EU law, new regulations are mandatory.

(2) Contracting parties may delay implementing a new regulation. Again, under Article 1.4, parties may notify "their intention not to apply" the regulation on the agreed commencement date.

(3) Contracting parties may cease to apply an existing UN Regulation after giving one year's notice. As Article 1.6 states, "any Contracting Party applying a UN Regulation may at any time notify the Secretary-General, subject to one year's notice, about its intention to cease applying that UN Regulation". Parties do not need to provide any justification for this decision.

(4) Contracting parties may decide not to accept type approvals granted under earlier versions of UN Regulations. Article 12 states that while parties may issue type approvals pursuant to earlier versions of UN Regulations, they are "not be obliged to accept type approvals issued pursuant to these earlier versions".

(5) Both schemes include exemption procedures for new technology, in which initial approvals are subject to central authorisation.[309] However, while EU member states are obliged to accept the central decision, UNECE states may notify their disagreement or intention not to accept the exemption approval.[310] Again, no justification need be provided.

The right to allow

6.66 More fundamentally, under the UNECE agreement, contracting parties can retain their own rules, in addition to UNECE regulations. Article 1.1 spells out that Contracting Parties "have the possibility to keep their own national/regional legislation". In other words, they may allow vehicles onto their roads which do not comply with UNECE regulations.

---

308 See revised 1958 agreement, Art 4.2. Under EU Regulation 2018/858 Art 54, member states may refuse registration for a maximum of 6 months, and must immediately notify the EU Commission who decides the issue.

309 Under Regulation 2018/858, the decision is made by the EU Commission. Under sched 7, of the revised 1958 agreement, the decision is made by the UNECE Administrative Committee.

310 Sched 7, para 7.

6.67 This differs from the position under EU law, where member states have only limited rights to allow vehicles which do not comply with the mandatory Regulations. As we have seen, under EU Regulation 2018/858, the right to develop national standards is generally confined to modifications and small series. For M1 vehicles, a small series was defined as cars produced in a series of 250 or less per calendar year.[311]

6.68 For this reason, our original proposals for UK safety assurance were limited to modifications and small series. This limitation is no longer required, and we have developed our proposals accordingly.

The position under future trade agreements

6.69 As we have seen, the revised 1958 agreement allows contracting parties to disapply UN regulations without justification. However, this right may be restricted by trade agreements. Several trade agreements bind states to apply UN regulations unless they provide rigorous justification based on scientific evidence.

The UK-Korea Free Trade Agreement

6.70 An example is the UK free trade agreement with the Republic of Korea, signed in September 2019 and expected to take effect on 1 January 2021.[312] This includes a commitment to adopt new UN Regulations, unless there are good reasons not to. A key provision is Article 4.1 of Annex 2-C. This requires both parties, as soon as practicable after a new UN Regulation is adopted, to provide market access "for products originating in the other Party" which comply with the regulation. This applies

> unless there are substantiated reasons based on scientific or technical information why a specific UN ECE Regulation is ineffective or inappropriate for ensuring road safety or the protection of environment or public health.[313]

6.71 However, not all free trade agreements agreed by the UK contain obligations to adopt new UN Regulations. The free trade agreement between the UK and Japan contains an obligation to adopt new UN Regulations, but only where the parties agree these do not "significantly diverge" from a joint draft developed by the parties and submitted to Working Party 29.[314] This means that the UK will only be obliged to implement new UN Regulations which its own representatives played a role in drafting.

The EU-Japan Economic Partnership Agreement (EPA): a model for EU negotiations

6.72 In its approach to negotiations with the EU*,* published in February 2020, the UK Government confirmed that it is seeking to "facilitate trade in all categories of motor

---

[311] Regulation 2018/858, Annex V, para A2.

[312] The key provisions on motor vehicles and parts are set out in UK-Korea Free Trade Agreement annex 2-C, to be found in vol 2 part 1, at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/830522/UK_Korea_Free_Trade_Agreement_v2.pt1.pdf.

[313] UK-Korea Free Trade Agreement, Annex 2-C, Art 4.1.

[314] UK-Japan Free Trade Agreement, Annex 2-C, Art 7.

vehicles, equipment and parts, based on international standards on vehicle safety and environmental protection”.[315] To this end:

> It should draw on the parties’ commitments to mutual recognition of type approvals for products covered by UN regulations, consistent with the approach in agreements such as the EU-Japan EPA.[316]

6.73 The EU-Japan EPA requires the parties to justify any decision to cease to apply a UN regulation. Either party may cease to apply a UN regulation in “exceptional circumstances”, but the party must engage in dialogue and provide “duly substantiated reasons”.[317] In extreme cases, the other party may impose sanctions for ceasing to apply UN regulations. For 10 years following the Agreement, “each of the Parties reserves the right to suspend equivalent concessions” if the other Party “does not apply or ceases applying a UN Regulation” specified in the Annex.[318]

Relevance for this project

6.74 We have written this paper on the basis that the Government will wish to continue to apply all UN Regulations, included those associated with driving automation. We assume that any refusal or delay in applying a UN Regulation would be exceptional and would need to be justified. Under agreements which follow the UK-Korea model, the UK would need to collect “scientific and technical information” to justify any decision to prevent an internationally approved automated driving system from operating on UK roads.

6.75 However, as we discuss in Chapter 8, UNECE approval need not be the only route to market in England, Wales and Scotland. There is nothing to prevent the UK from setting up its own parallel scheme to approve automated driving systems for use in Great Britain.

Traffic law is a matter for domestic legislation

6.76 While vehicle standards are governed by international obligations, traffic law remains an issue for contracting states. Despite some attempts at harmonisation through the Geneva and Vienna Conventions on Road Traffic, major differences remain. For example, out of the 56 countries which are parties to the revised 1958 agreement, 46 drive on the right while 10 drive on the left. Issues about how an Automated Driving System (ADS) drives, and how its driving should be regulated, remain a matter for states.

6.77 We are encouraged in this view by the amendment 34 Bis to the Vienna Convention on Road Traffic 1968 to deal with self-driving vehicles. This was adopted in

---

315 HM Government, *The Future Relationship with the EU: The UK’s Approach to Negotiations* (February 2020) at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/868874/The_Future_Relationship_with_the_EU.pdf. At the time the text was finalised (15 December 2020), UK-EU trade negotiations were ongoing.

316 Above, para 19.

317 EU-Japan EPA, Annex 2-C, Art 8.

318 EU-Japan EPA, Annex 2-C, Art 18. See also the identically drafted Art 18 in Annex 2-C of the UK-Japan Free Trade Agreement.

September 2020 by UNECE Working Party 1, which oversees the operation of the Convention. The amendment states that the requirement in the Convention for every moving vehicle to have a driver is "deemed to be satisfied" while:

> the vehicle is using an automated driving system which complies with:
>
> (a) domestic technical regulations, and any applicable international legal instrument, concerning wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles, and
>
> (b) domestic legislation governing operation.
>
> The effect of this article is limited to the territory of the contracting party where the relevant domestic technical regulations and legislation governing operation apply.[319]

6.78 Thus, under the amendment, an ADS might be approved under either domestic or UN regulations. In either case, the ADS must *also* comply with domestic legislation governing the way it operates. In other words, contracting parties are free to add domestic operational requirements to the international type approval. The explanatory memorandum which accompanies the proposed amendment puts this point explicitly:

> Furthermore, the automated driving system must comply with "domestic legislation governing operation"…. Under this provision a party could also impose additional requirements for the operation of automated driving systems.[320]

6.79 We return to this issue in Chapter 8. We distinguish between decisions on vehicle systems (which will continue to be governed by UN Regulations) and decisions on driving liability (which are a matter of national competence). We propose a two-part test. The first part would approve the system (at either international or domestic level). The second part would decide issues of civil and criminal liability, by categorising a system as self-driving.

---

319 UNECE, Amendment proposal to Article 34 in the 1968 Convention on Road Traffic ECE/TRANS/WP.1/2020/1/Rev.1, section I, https://unece.org/fileadmin/DAM/trans/doc/2020/wp1/ECE-TRANS-WP1-2020-1-_Rev1e_.pdf.

320 UNECE, Revised Amendment proposal to the 1968 Convention on Road Traffic (10 July 2020), ECE/TRANS/WP.1/2020/1/Rev.1, Explanatory Memorandum, para 8.

Chapter 7: Assessing safety pre-deployment

7.1 In Chapter 5 we considered how safe an automated vehicle (AV) needs to be before it may be deployed on Britain's roads. Here we consider the equally difficult question of how to assess whether an AV is as safe as it needs to be before it is allowed on the road.

7.2 While the previous chapter discussed the law, this chapter focuses on the practicalities of assessing AV safety. There is a growing literature on the engineering challenges, both in setting standards and in debating testing methods. Our intention is to summarise the main strands within this literature. We see this as essential background to the proposed legal framework for pre-deployment safety assurance discussed in Chapter 8.

7.3 As we explain below, standards play a crucial role in assessing vehicle safety. Over the last few years, there has been a proliferation of new standards, many specifically for automated driving.[321] As yet, however, there is no single agreed approach. There are also a variety of testing approaches - using test tracks, public roads and simulation - each with its own strengths and weaknesses.

7.4 A key question is how far a safety assurance agency should rely on self-certification by manufacturers and how far it should require testing by third parties. We look briefly at how other jurisdictions have approached this issue. When we consulted on this issue in 2018, almost all consultees wanted some element of third-party testing. However, even with some external tests, much of the assessment is likely to rely on an audit of the safety case documents submitted by the manufacturer or developer. We consider safety cases, and look at how they are used in other high-risk industries in the UK.

7.5 It will be important to maintain a flexible system, drawing on a range of techniques, and learning from best practice in other jurisdictions. One clear message is that the safety of a particular AV cannot be assessed at one single point of time. Automated driving systems (ADS) and the vehicles in which they are fitted will need to be assessed before they are deployed on the road - and then will need to be monitored in practice on an ongoing basis.

7.6 In the next chapter, we make proposals for a new legal framework to provide initial approval of automated driving systems and to categorise a whole vehicle as able to safely drive itself. We consider ongoing safety assurance in Chapters 9 to 11.

---

321 See Theme one (Safety & Assurance) in the BSI, CAV Standards Roadmap, August 2020. BSI's roadmap summarises national, European and global projects on standards related to automated driving as of June 2020: https://www.bsigroup.com/en-GB/CAV/cav-resources/download-cav-roadmap/.

STANDARDS

7.7 The British Standards Institute (BSI) describes a standard as an agreed way of doing something.[322] Standards typically cover an activity, such as manufacturing a product, planning a process or managing a safety scheme. Standards may also establish a common taxonomy and definitions. The work discussed in Chapter 4 to define "SAE Levels" is one example of a common taxonomy established by a standard.[323] Thousands of standards have been published by agencies such as ISO (International Organization for Standardization); and IEEE (Institute of Electrical and Electronics Engineers), as well as by BSI and SAE International.

7.8 Many standards describe potential verification and validation processes to assure the safety of a product. "Verification" evaluates a system or component to prove that it meets all of its specified requirements.[324] "Validation", by contrast, aims to prove that an end product meets its design intent.[325] While verification checks whether a system or component complies with imposed conditions (such as those contained in specifications, regulations or standards) validation shows that the end product does what it is required to do.

Current automotive standards

7.9 In the automotive sector, prominent standards include ISO 26262 and ISO 21448.

7.10 ISO 26262 aims to eliminate electric/electronic/ programmable (E/E/P) system malfunctions in road vehicles.[326] To ensure that E/E/P systems have undergone an appropriate level of rigour during their design and construction, it sets out four "Automotive Safety Integrity Levels" (ASILs). These range from A to D. ASIL D is the most serious, with likely potential for life-threatening or fatal injury. The ASILs are used to specify which of the requirements of ISO 26262 are applicable to avoid "unreasonable residual risk". For example, electric steering has the potential to cause significant harm if it malfunctions and is classified as an ASIL D system. This means that manufacturers should follow the requirements specified by ISO 26262 for ASIL D systems when designing and constructing electric steering.

7.11 ISO 26262 is aimed at improving the functional safety of vehicle systems.[327] However, as Mobileye graphically explains: "the most Functionally Safe vehicle in the world can still crash into everyone and everything due to bad logic in the code that results in an

---

322 https://www.bsigroup.com/en-GB/standards/Information-about-standards/what-is-a-standard/.

323 Society of Automotive Engineers (SAE) International, J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles (June 2018).

324 BSI, *BSI CAV Vocabulary 2.0* (2020), para 2.1.64.

325 Above, para 2.1.57.

326 ISO, *ISO 26262-1*, https://standardsdevelopment.bsigroup.com/drafts/2017-01559/000000000030360575?standardsReference=BS%20EN%20ISO%2013849-1#/_Toc36811060, 1.51. Functional safety is defined as the absence of unreasonable risk due to hazards caused by malfunctioning behaviour of systems. In turn, malfunctioning behaviour is defined as a failure or unintended behaviour of an item with respect to its design intent.

327 Functional safety asks if a system operates as it was designed to operate, whereas nominal safety considers whether the design is sufficient to reduce the risks to acceptable levels.

unsafe driving decision. Functional Safety cannot help us here; instead this is the domain of Nominal safety."[328]

7.12 ISO 21448, by comparison, aims at reducing the risks that result from the functional shortcomings of a system or by reasonably foreseeable misuse by users.[329] The standard addresses the safety of the intended functionality (SOTIF), in contrast to ISO 26262 which is aimed at mitigating the risk of system failure. It can be applied to many systems in modern vehicles, such as electronic steering and airbag deployment. It is especially applicable to emergency braking and Advanced Driver Assistance Systems (ADAS).

7.13 Neither standard was specifically developed for automated driving. There is debate about how far these standards can be applied to AVs. Experts have noted that ISO 26262 focusses on each individual E/E/P system rather than on the automated driving system as a whole.[330] As an ADS may be comprised of many individual E/E/P systems, the concern is that ISO 26262 may not adequately assess how these systems interact and work together.[331]

7.14 At the same time, it is expected that AVs will be trained with artificial intelligence and machine learning. One of the proclaimed benefits is that AVs will "learn" to become safer over time. However, this also means that the system could learn to react in a way that was not foreseen during the design and approval process. The methods in ISO 21448 may be insufficient for considering machine learning systems which are "non-deterministic". In other words, not all the actions of the system can be accounted for or explained by its designers.[332]

Standards for automated vehicles

7.15 The last few years have seen many initiatives to develop standards for AVs. However, there is no single agreed standard governing the industry. Some standards are high-level and aspirational. Others are very specific, relating to AV terminology, the behaviour of the vehicle or one part of the development process.

---

328 Mobileye, S Shalev-Shwartz, S Shammah and A Shashua, "On a Formal Model of Safe and Scalable Self-driving Cars" (21 August 2017) (Mobileye RSS Report) p 3, https://www.mobileye.com/responsibility-sensitive-safety/vision_zero_with_map.pdf.

329 For an overview of the standard see https://www.iso.org/standard/70939.html.

330 C Bergenhem et al. *How to Reach Complete Safety Requirement Refinement for Autonomous Vehicles* (2015). CARS 2015 - Critical Automotive applications: Robustness & Safety, Paris, France, 2015-09-08.

331 Hazard analysis techniques such as System-Theoretic Process Analysis (STPA), developed by Prof. Nancy Leveson of MIT, have been suggested by some experts as a way to better understand the risks of such complex interactions.

332 P Koopman et al. *A Safety Standard Approach for Fully Autonomous Vehicles* (2019). In: A Romanovsky et al. (eds) Computer Safety, Reliability, and Security. SAFECOMP 2019. Lecture Notes in Computer Science, vol 11699. Springer, Cham. https://doi.org/10.1007/978-3-030-26250-1_26, 2.2. See also Waymo *Waymo's Safety Methodologies and Safety Readiness Determinations* (October 2020) pp 8 to 9.

7.16 CCAV have sponsored the British Standards Institute to develop four standards related to AV development.[333] One of these is the PAS 1881 standard which gives guidance on how to build a safety case for AV trials in the UK. It outlines how trialling organisations might ensure that risks to all affected parties are "as low as reasonably practicable (ALARP)". The standard focusses on operational control measures such as the training of safety drivers to demonstrate that risk has been managed but does not consider the safety of the automated systems themselves.

7.17 Manufacturers have also begun to develop standards for AVs. In September 2019, a consortium of Original Equipment Manufacturers (OEMs) and mobility companies published a white paper, "Safety First for Automated Driving" ("SaFAD").[334] The paper provides guidance on developing and validating a safe automated driving system and has been developed into an industry-wide standard.[335] It foresees that simulations, track testing and real-world testing will all be used in constructing a safety case. It also suggests continued field-monitoring throughout the lifetime of a system.

7.18 Some standards are also being developed which focus on the behaviour of automated vehicles. As we discussed in Chapter 5, Mobileye has proposed a mathematical approach to ensure that automated vehicles are safe, termed Responsibility-Sensitive Safety (RSS).[336] The IEEE have created a working group to develop a standard (IEEE 2846) based on the RSS model.

7.19 Other more general safety standards may also have some applicability to AV design. BSI has analysed hundreds of existing standards which could be applied to the design of automated vehicles in developing its Roadmap for CAV standards.[337] For example, ISO 13849-1 provides guidance for the design and integration of "safety-related parts of control systems" and may be relevant to the safety control systems of AVs.

7.20 Standards directed at ongoing management might also be applicable. The ISO 9001 series, for example, sets out criteria to ensure a quality management system. This standard might be used by an ADSE to ensure that they have an adequate management system in place to ensure they fulfil their duties in relation to the ongoing safety of an ADS.

7.21 In time, the use of particular standards may become best practice for the development, design and management of AVs. These practices might eventually be incorporated into more prescriptive regulations relating to the approval of automated

---

333 PAS 1880 provides a set of initial guidelines for control system design for automated vehicles; PAS 1881 provides the minimum requirements for assuring the safety case for automated vehicle trials and testing; PAS 1882 provides minimum requirements for data recording on a CAV; PAS 1883 provides minimum requirements for a hierarchical taxonomy for Operational Design Domain (ODD) definition.

334 Consortium members include Aptiv, Audi, Baidu, BMW, Continental, Daimler, FCAUS LLC, HERE, Infineon, Intel and Volkswagen. This white paper has now been developed into an ISO standard designated ISO/TR 4804:2020.

335 ISO/TR 4804:2020, Road vehicles — Safety and cybersecurity for automated driving systems — Design, verification and validation.

336 Mobileye RSS Report.

337 BSI, Connected and Automated Vehicles Roadmap, at https://www.bsigroup.com/en-GB/CAV/cav-resources/download-cav-roadmap/.

vehicles.[338] However, in the early years of deployment, developers will likely use a wide variety of standards. For this reason, approval authorities may find it useful to prepare guidance for developers on preferred standards and best practice, so as to expedite the approval process.

TESTING METHODS

7.22 As part of the authorisation process, an ADS will have to be validated against safety requirements. The manufacturer or developer will need to provide documentation to demonstrate that the system is safe. The documentation may show that a prescribed set of engineering standards were followed or that something has been proven to meet the requisite level of safety through use.[339]

7.23 However, most AV documentation will rely on testing. The documentation will need to rely on tests of specific scenarios and, possibly, on "brute force" testing (to show thousands of hours of simulation or millions of miles driven on the road without mishap). The approval authority may then want to carry out its own tests, either itself or through approved technical services.

7.24 Whether tests are carried out by developers or by regulators, there is no one perfect method of testing. A mix of methods will be needed. Below we consider the three main testing methods: track testing, road tests and simulations.

Track testing

7.25 It is already common for manufacturers to make use of specialist track and other testing facilities to assure the performance and safety of vehicles. Safety programmes such as the European New Car Assessment Programme (Euro NCAP) rely on track and crash tests under controlled conditions. In an AV context, the UK Government has focussed investment in this area, developing CAM Testbed UK.[340] The recent UNECE Regulation on Automated Lane Keeping Systems (ALKS) requires six specific track tests, including avoiding a collision with a road user, following a lead vehicle and dealing with a cut-in vehicle.[341]

7.26 Specialist track testing can offer valuable insights into the way an ADS reacts in given scenarios. It is especially suitable for scenarios which are high-risk or highly dynamic which would not be safe to test on public roads. It also offers a high level of control and repeatability when compared to road testing. However, it can only offer insight into the scenarios tested. Real roads are more complicated environments and AVs will encounter many scenarios not tested on the track.

---

338 The UNECE's working party on Automated and Connected Vehicles (GRVA) now has an Informal Working Group on Validation Methods for Automated Driving (VMAD) which will work on developing assessment methods.

339 P Koopman et al. *A Safety Standard Approach for Fully Autonomous Vehicles* (2019). In: A Romanovsky et al. (eds) Computer Safety, Reliability, and Security. SAFECOMP 2019. Lecture Notes in Computer Science, vol 11699. Springer, Cham. https://doi.org/10.1007/978-3-030-26250-1_26, p 1; Tim Patrick Kelley, *Arguing Safety – A systematic Approach to managing safety cases*, University of York, 1998 PhD thesis p 11.

340 https://zenzic.io/testbed-uk/.

341 ALKS Regulation, Annex 5, para 4.

Road testing

7.27 Public road trials offer the opportunity to test an ADS under “real-world conditions”. It has, to date, been the most prominent method of testing AV safety.

7.28 Many jurisdictions around the world require manufacturers to apply for a permit before testing on public roads. Currently, this is not required in the UK. Testing and trialling AVs on public roads in the UK is possible “if carried out in line with UK law”. As part of complying with the law, CCAV’s Code of Practice emphasises that trialling organisations must have:

(1) a driver or operator, in or out of the vehicle, who is ready, able, and willing to resume control of the vehicle;

(2) a roadworthy vehicle; and

(3) appropriate insurance in place.[342]

7.29 The code also encourages developers to speak with road and enforcement authorities, develop engagement plans and have data recorders fitted.[343] As noted above, PAS 1881 has also been sponsored by CCAV to aid trialling organisations in building a safety case for trials in the UK.

7.30 Data from public road trials is likely to play an important role in assuring the approval authorities that an ADS system is ready for widespread deployment. Public road trials may also be used to validate track tests and simulation results. It is at the centre of NHTSA’s Automated Vehicle Transparency and Engagement for Safe Testing Initiative (AV TEST Initiative) launched in June 2020.[344]

7.31 However, public road trials alone can be an impractical way to validate AV safety. They require an enormous number of miles driven to provide a statistically credible safety argument.[345] Vehicles also need to be able to handle unusual situations which are rarely encountered during public road trials. Additionally, every time the ADS software is updated, more public road testing would need to be performed to ensure that the safety argument remains valid. This is also true for track testing and simulation, but the process for public road trials is more time-consuming and expensive.

Simulation

7.32 Simulations involve testing the ADS without deploying the vehicle on a road. As the name suggests, tests of the ADS’s driving capabilities are simulated at a software,

---

342 CCAV, Code of Practice: Automated vehicle trialling (6 February 2019), Introduction, at https://www.gov.uk/government/publications/trialling-automated-vehicle-technologies-in-public/code-of-practice-automated-vehicle-trialling,

343 See also BSI PAS 1882 on data recording for CAVs.

344 See https://www.nhtsa.gov/automated-vehicles-safety/av-test.

345 See Nidhi and Paddock, Driving to Safety: How Many Miles of Driving Would It Take to Demonstrate Autonomous Vehicle Reliability? Santa Monica, Calif.: RAND Corporation, RR-1478-RC, 2016 at https://www.rand.org/pubs/research_reports/RR1478.html.

hardware and vehicle level. Simulation is seen as an effective way to assess the capability of ADSs and it offers several potential advantages over road testing. First and foremost, it is safer. It also has lower operational costs.[346] Simulations, when used to supplement on-road testing, can drastically reduce the time taken to validate the safety of an ADS. Simulation also offers the chance to test “corner cases”[347] and known rare events that would not be as readily testable in the real world.[348]

7.33 However, to ensure that the simulation testing produces accurate results, scenarios must adequately reflect actual road conditions and the ODDs within which AVs will operate. Simulations must also be sufficiently varied to check that the ADS is capable of dealing with all the situations it might encounter.

7.34 Many OEMs and developers are developing their own databases of scenarios to test in simulation.[349] Several initiatives have sought to create standardised systems, which bring databases together. Examples are PEGASUS,[350] ASAM,[351] MUSICC[352] and the Midlands Future Mobility National Scenario database.[353] The European Commission’s joint research centre has also proposed that a centralised scenario database should be established at an EU or international level.[354] Data could then be collected from different sources and used by developers to validate their systems. This would prevent a siloed approach where the developer or approval authority used their own, perhaps relatively limited, scenario database.

7.35 Simulation will play a key part in assessing safety, but it is not without its problems.

(1) One issue is how scenarios should be assessed. The MUSICC database, for example, proposes pass/fail scoring to assess the results of individual

---

346 P Koopman et al *Credible Autonomy Safety Argumentation*, Safety Critical Systems Club Symposium proceedings 2019, para 2.4.

347 Unpredictable situations or circumstances outside the normal operating parameters of an ADS.

348 Z Ding “Accelerated evaluation of automated vehicles,” http://www-personal.umich.edu/~zhaoding/accelerated-evaluation.html.

349 See https://techcrunch.com/2019/07/10/waymo-has-now-driven-10-billion-autonomous-miles-in-simulation/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAHy6TjOskUCFrCIDmKGVMjZD2kk2Kgzi6TL4EOiLCf7EPpzVTYAuUjUUeqfdQHnyyk2tsJN3qmtsaCL3Nm0z92Qx4Pttdcbca1E8ljG0hHE_5qXJjEpECxRVXsA0cLrHJslRhUEIpCG4E3CCJvD5E-ThKeVEJKQIddIDRiLYsdMU and https://medium.com/fiveai/digital-londons-testing-safely-with-simulation-1c1645ab6f6d.

350 PEGASUS Projekt, “Pegasus Method: An Overview,” 2019, https://www.pegasusprojekt.de/files/tmpl/Pegasus-Abschlussveranstaltung/PEGASUS-Gesamtmethode.pdf.

351 ASAM, “ASAM OpenSCENARIO,” 26 July 2017, https://www.asam.net/standards/detail/openscenario/.

352 Connected Places Catapult MUSICC project, “Multi User Scenario Catalogue for Connected Autonomous Vehicles,” 2019, https://cp.catapult.org.uk/case-studies/musicc/.

353 https://midlandsfuturemobility.co.uk/services/simulation/.

354 The joint research centre has been contributing to UNECE’s informal group on Validation Methods for Automated Driving (VMAD) which will work on developing assessment methods for automated vehicles. See https://wiki.unece.org/pages/viewpage.action?pageId=60361611.

scenarios.[355] As the project documentation acknowledges, some road behaviours are easily categorised as pass/fail in simulation (such as speeding or running a red light). Others are risk-based and harder to score (such as the amount of distance to leave between cars in inclement weather).[356]

(2) If simulation alone is employed there is a risk that actual vehicle dynamics and subsystem interactions will not be adequately modelled.[357]

(3) Simulation can only validate against scenarios which are tested. There is always a risk that situations will arise after the vehicle has been deployed which were not covered by the simulation.

7.36 One challenge will be to include a sufficiently wide variety of scenarios which also accurately represents the intended ODD of an ADS.[358] In response to Consultation Paper 1, many groups told us that AVs must be tested in their dealings with all possible road users, including the full diversity of pedestrians, cycles, prams, pushchairs, wheelchairs, pets and horses. As Sustrans put it, the technology needs to respond to the diversity of bike types, with “tandems, recumbents, electrically-assisted bikes and children’s bikes” all part of the fleet.[359] Furthermore, the range of road users changes constantly: e-scooters were hardly seen on UK roads three years ago.

7.37 The fear is that the smaller and more homogeneous the group responsible for collecting the scenarios, and the more remote that group is from the communities affected, the greater the chance that some scenarios could be overlooked. Where a scenario database is used in the assessment process, we think that there should be some formal mechanisms for consulting on the range of scenarios included.[360] This would reassure road user groups that particular road users have not been missed. Below, we ask whether an approval authority that intends to use a scenario database as part of the testing procedure should consult on the range of scenarios to be included.

SELF-CERTIFICATION AND THIRD-PARTY TESTING

Our first consultation

7.38 In our first consultation, we asked how far a safety assurance system should be based on self-certification and how far on third-party testing. The great majority of respondents thought that third-party testing should play some part in the safety

---

355 R Myers and Z Saigol “Pass-Fail Criteria for Scenario-Based Testing of Automated Driving Systems” https://arxiv.org/abs/2005.09417v2.

356 Though the MUSICC project does propose a framework for assessment of these risk-based scenarios as well.

357 P Koopman and M Wagner, *Toward a Framework for Highly Automated Vehicle Safety Validation*, SAE World congress 2018.

358 The World Economic Forum *Safe Drive Initiative: SafeDI scenario-based AV policy framework – an overview for policy-makers* (November 2020), paras 3.4 to 3.5.

359 CP1 Analysis, paras 2.12 to 2.14.

360 The World Economic Forum *Safe Drive Initiative: SafeDI scenario-based AV policy framework – an overview for policy-makers* (November 2020), para 3.4.

assurance process.[361] However, some respondents noted that the two approaches are not mutually exclusive, and one is not inherently preferable to the other. As a respondent put it, “a strong self-certification regime would likely lead to better outcomes than a weak third-party testing regime”.[362]

7.39 There were a variety of opinions on how third-party testing might be conducted. Some argued for a standardised set of scenarios that could be used by a third party to test the ADS. To prevent developers from designing for the test, the third-party should randomise these scenarios from an extensive test set.

7.40 Others saw the role of the third-party as being an auditor of the developer’s safety case. These audits would verify that the testing data was accurate and that the evidence obtained was robust. There was also a need for the regulator to ensure that appropriate processes were in place to manage the ongoing safety of the ADS once deployed.

7.41 Some respondents stressed the importance of third-party testing using the final, complete automated vehicle on test tracks and on public roads.[363]

Other jurisdictions

7.42 Other countries have also considered the balance between self-certification and third party testing. Below we outline the approach taken in a few prominent jurisdictions.

Australia

7.43 In June 2017, the National Transport Commission (NTC) of Australia consulted on whether to require third-party testing in the context of automated vehicles. Following consultation, they concluded that pre-market approval by a third party would be “resource-intensive and time-consuming” and could limit or obstruct safety-related innovations. However, the NTC thought that pre-market checks might be more feasible in the long term, once regulators have a better understanding of the technology and its risks.[364]

7.44 The NTC subsequently published a 2018 Regulation Impact Statement. This put forward their preferred option under which the ADSE would provide self-certification against fixed criteria. This would be combined with oversight by a government agency, specific offences and enforcement measures. The ADSE would also be subject to a “primary safety duty” which was described as:

> overarching and positive general safety duty… to ensure that the ADS is as safe as reasonably practicable.[365]

---

361 Some 83% of respondents thought that third-party testing should play some part in safety assurance.

362 See CP1 Analysis of response, para 4.62.

363 See Analysis of CP1, para 4.62.

364 NTC Australia, Assuring safety in automated vehicles Policy Paper (Nov 2017) p 26.

365 NTC Australia, Safety Assurance for Automated Driving Systems: Decision Regulation Impact Statement (November 2018) p 43.

7.45 Furthermore it is foreseen this duty would:

> support the mandatory self-certification approach as an ongoing duty throughout the life cycle of the ADS. It would aim to ensure that in-service safety risks and hazards that are not identified through the safety assurance system process are managed and that unsafe behaviours that are not otherwise captured by prescribed offences are prevented.[366]

California

7.46 In April 2018, California established regulatory regimes for the testing and deployment of automated vehicles. These regimes provide for vehicles which do not have a safety driver.[367] The Californian system is based on self-certification by a "manufacturer". This covers not only those who produce an autonomous vehicle from raw materials or basic components, but also a person who modifies any vehicle by installing autonomous technology.[368]

7.47 To obtain a deployment permit the manufacturer must certify that it has "conducted test and validation methods and is satisfied that the vehicle is safe for deployment on public roads".[369] The manufacturer or their authorised representative must sign and certify under penalty of perjury that, among other things, their automated vehicles:

(1) are designed to be incapable of operating in autonomous mode outside their operational design domains; [370]

(2) are equipped with data recorders capable of recording and storing all relevant data;[371]

(3) are designed to detect and respond to roadway situations in compliance with the California Vehicle Code and local regulations, *except* when necessary to enhance the safety of the vehicle's occupants and/or other road users;[372] and

(4) meets current industry standards on cyber-security.[373]

7.48 The manufacturer must also undertake to provide updates that ensure compliance with any changes to the California Vehicle Code and local regulation.[374]

---

366 As above.

367 To date five testing permits for vehicles without a safety driver have been issued. For the full list of permits issued see https://www.dmv.ca.gov/portal/vehicle-industry-services/autonomous-vehicles/autonomous-vehicle-testing-permit-holders/.

368 California Vehicle Code, section 470 and 38750 (5).

369 California Code of Regulations, *Autonomous Vehicle Regulations*, §228.06. (a)(11)

370 California Code of Regulations, *Autonomous Vehicle Regulations*, §228.06. (a)(1)

371 Above, §228.06. (a)(6).

372 Above, §228.06. (a)(9).

373 Above, §228.06. (a)(9)(A).

374 Above, §228.06. (a)(9)(A).

7.49 If a manufacturer intends for a vehicle to be sold or leased to other people, a consumer or end-user education plan must be submitted with the application.[375] The plan must include an explanation of how the end-user will receive education after purchasing a previously-owned vehicle.[376]

Germany

7.50 In 2017, Germany made amendments to its Road Traffic Act (Strassenverkehrsgesetz or "StVG") to allow the use of motor vehicles with highly or fully automated driving features. Most of these amendments focus on the liability of the driver of such a vehicle and their responsibilities. In terms of the approval of automated driving technologies, sections 1a (2) and (3) are the most relevant. These must be read with the Road Traffic Licensing Regulations (Straßenverkehrs-Zulassungs-Ordnung, or "StVZO") under which all vehicles in Germany are licensed for use on public roads.

7.51 Section 1a (2) defines "motor vehicles with highly or fully automated driving functions". The first part of section 1a (2) states that such vehicles are those which have technology that:

(1) when activated, can control the motor vehicle – including longitudinal and lateral control – to perform the driving task (vehicle control);

(2) is able, during "highly" or "fully automated" driving, to comply with the relevant traffic rules and regulations for operating a vehicle;

(3) can be overridden or deactivated manually by the driver at any time;

(4) is able to identify when there is a need to hand back control to the driver;

(5) is able to indicate to the driver – by means of a visible, audible, tactile or otherwise perceptible signal – the need to retake manual control of the vehicle with a sufficient time buffer before it returns control of the vehicle to the driver; and

(6) indicates that use is running counter to the system description.

7.52 The second sentence of section 1a (2) then requires the manufacturer of such a vehicle to state in "a binding manner"[377] that the vehicle meets the technical requirements set out in section 1a (2). It is not clear how, when or to whom this statement must be made. It appears to obligate the manufacturer to describe their system and to ensure that its limits are clear to the driver.

7.53 Section1a (3) clarifies that the amendments only apply to vehicles which are licensed in accordance with the requirements of the StVG, fulfil the technical functions set out in 1a (2) and also whose highly or fully automated driving functions:

---

375 Above, §228.06 (c)(1).

376 Above, §228.06 (c)(1)(c).

377 StVG, § 1a (2).

(a) are described in international regulation applicable in the territorial extent of the Act and comply with them

(b) or have received a type-approval pursuant to Article 20 of Directive 2007/46 EC of the European Parliament and Council (the type-approval framework Directive).

7.54 Section 1a (3) indicates that the approval of such automated systems in Germany is still very much contingent on international type approval. [378] Traditionally type approval requires some third party testing .

7.55 However, section 1a (2) suggests that international type approval may not be wholly sufficient in all circumstances. Take an example where an ADS is approved by (say) the Korean type approval authority but there are fears that it may not comply with all relevant traffic rules in Germany. In addition to showing UNECE type approval, the manufacturer must give a binding statement of compliance with the technological requirements set out in the StVG. Without this binding statement, the vehicles will not be regarded as highly or fully automated.

7.56 Other parts of the German amendments make clear that the user of a vehicle fitted with automated technology remains the driver of the vehicle.[379] This is very different to our proposed scheme to regulate self-driving technology. In our scheme the user of such vehicle is not a driver whilst a self-driving system is correctly engaged.

Singapore

7.57 In 2017, Singapore amended its Road Traffic Act to provide for approved trials and approved "special use" of "autonomous motor vehicles".[380] The definition of an autonomous motor vehicles is similar to the UK definition of self-driving under the AEV Act 2018. It refers to a motor vehicle which is fitted "wholly or substantially" with an "autonomous system" which is:

> a system that enables the operation of the motor vehicle without the active physical control of, or monitoring by, a human operator.[381]

7.58 A "special use" covers "the use on a road of an autonomous motor vehicle by a specified person authorised by the Authority".

---

378 News reports indicate that the draft legislation on "driverless" SAE Level 4 vehicles to be considered by the Bundestag in 2021 provides for a two-stage approval procedure. It has been reported that authorisation will require both compliance with technical specifications set at the national level and the definition of an operational design domain by the manufacturer: https://www.eenewseurope.com/news/german-law-aims-be-first-driverless-cars/page/0/1. It is unclear what role the manufacturer's declaration will play in approval of SAE Level 4 vehicles, and to what extent third party testing will be required.

379 StVG, § 1a (4). See para 4.60 above for a discussion of the "technical supervisor" under new draft amendments to the StVG.

380 Road Traffic Act (autonomous motor vehicles) Rules 2017.

381 Singapore Road Traffic Act, s 2 (1).

7.59 The amendments give the Minister broad powers to make rules. When approving a trial or special use the Minister can:

> prescribe the use of the autonomous motor vehicles in the approved trial or approved special use, and their construction, design and equipment, for the safety of other road users or for public safety or both.[382]

7.60 So, for example, the rules may exempt AVs from construction or use rules that apply to ordinary vehicles.[383]

7.61 This regime is intended as a "regulatory sandbox" with which to trial AV technologies in Singapore.[384] At the end of five years the Ministry of Transport in Singapore will consider enacting more permanent legislation.[385]

7.62 In additional to the amendments to the Road Traffic Act, Singapore authorities have also worked on developing standards for AVs. In 2019 Enterprise Singapore and Singapore's Land Transport Authority (LTA) published a set of provision national AV standards, referred to as Technical Reference 68 (TR 68). These standards outline basic behaviours to which AVs should be capable of adhering. TR 68 also gives guidance on general safety considerations, cybersecurity and the capture and formatting of data. Currently the standard is provisional and only voluntary in nature. It will be developed over the coming years based on feedback received from those applying it.

SAFETY CASES

7.63 Whatever the final mix of assessment techniques, it is likely that a large part of the process will involve regulators assessing documentation from the manufacturer or developer offering evidence that the system is safe. This is a common process in many high-risk industries. For example, the nuclear, oil and gas and rail sectors all require evidence of safety to be presented to the relevant regulatory authority.

7.64 Over time, the way this has been done has changed. Previously, approaches to safety in these industries focussed on prescriptive requirements: operators could claim that their systems were safe by adhering to a code or regulation.[386] However, following incidents such as Windscale, Flixborough, Piper Alpha and Clapham, legislation has been introduced to requires safety cases as part of the safety assurance process.

---

382 Singapore Road Traffic Act, s 6C (h).

383 Singapore Road Traffic Act, s 6D (1).

384 Opening speech in Singapore Parliament by Second Minister for Transport Ng Chee Meng for the Road Traffic (amendment Bill second Reading) 07 Feb 2017. For a discussion on regulatory sandboxes for emerging technologies see Deloitte, Deloitte Centre for Government Insights, *The future of regulation: Principles for regulating emerging technologies*, 2018, https://www2.deloitte.com/content/dam/insights/us/articles/4538_Future-of-regulation/DI_Future-of-regulation.pdf.

385 Above.

386 The Health Foundation *Evidence: Using safety cases in industry and healthcare* 2012 p 3.

Regulations require that operators present a safety case at the approval stage and maintain the safety case throughout the operational life of the system.[387]

7.65 The safety case is a document, or a set of documents, which present a clear, comprehensive and defensible argument for the safety of a given system in a given context.[388] The Ministry of Defence describes a safety case as:

> a structured argument, supported by a body of evidence that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given operating environment.[389]

7.66 Manufacturers and operators must demonstrate that they have systematically and proactively tried to understand the risks of their systems and the measures needed to reduce these risks. Appropriate processes must also be put in place to measure the effectiveness of any risk control measures.[390]

7.67 Systems must still be compliant with any mandated technical standards or regulations. However, the proper implementation of a safety case should go beyond mere compliance or a "tick-box" exercise. Lord Cullen's influential report into the Piper Alpha oil platform explosion, which recommended safety cases in the petrochemical industry, noted that a safety case would allow regulators to see how operators had fulfilled the obligations. Importantly, it would also provide assurance to the operators and manufacturers themselves that they have followed a systematic and thorough approach to ensure that their systems are safe.[391]

What is in a safety case?

7.68 A safety case consists of three main elements: claims, argument and evidence. The claims should define the safety objective or requirements of the system. The argument must then communicate the relationship between the evidence and the claims - implied arguments are not enough.

7.69 The safety objective or requirements will vary depending on the industry. For many safety-critical industries the objective is to reduce the risks to a level as low as reasonably practicable (ALARP).[392]

7.70 The specific structure of the arguments and evidence will also vary. The Office of Nuclear Regulation, for example, sets no format for how operators of nuclear systems

---

387 See, for example, the Offshore Installations (Safety Case) Regulations 2005 or The Control of Major Accident Hazards Regulations 2015 in relation to the petrochemical industry. More examples are discussed below.

388 T Kelley, "Arguing Safety – A systematic Approach to managing safety cases" (1998) University of York PhD thesis, p 22.

389 *The UK Ministry of defence (MoD) Standard 00-56*.

390 The Health Foundation *Evidence: Using safety cases in industry and healthcare* 2012 p 3.

391 Lord Cullen, *The Public Inquiry into the Piper Alpha disaster* (Department of Energy, November 1990).

392 This reflects responsibilities under the Health and Safety at Work etc Act 1974: for further discussion see ch 5 above.

must present their safety case. In a 2012 report the Health Foundation identified that a safety case should generally provide the following:

(1) a system description and its operational context;

(2) the safety claims and safety criteria;

(3) what hazards have been identified;

(4) what risk control measures have been put in place;

(5) why the residual level of risk is acceptable; and

(6) an overview of the how safety management system is organised, including roles responsibilities and safety polices.[393]

The safety case should highlight the major hazards and concentrate on these: it should not be packed with detail on trivial risks. Preliminary hazard identification and analysis should be done early in the project lifecycle to scope the activities and resources needed to build the safety case.[394] Evidence should be provided throughout to back up claims made by the safety case.

Safety cases in other high-risk industries

7.71 Safety cases are required in several high-risk industries. In civil aviation, safety cases are used by services such as air navigation, airworthiness management and maintenance providers. Organisations involved in such services are required to implement a system for safety oversight and monitoring. The Civil Aviation Authority provides guidance on how such organisations can meet their obligations to implement a safety management system (SMS). Safety cases should be incorporated as part of the documentation for the SMS.[395]

7.72 Safety cases are a key component in licensing UK nuclear installations. Under the Health and Safety at Work Act 1974 and the Nuclear Installations Act 1965, licences to operate nuclear installation sites must be granted by the Nuclear Directorate of the Health and Safety Executive (HSE).

7.73 Licences are granted to use a site for a specific time, with specific conditions attached.[396] Those wishing to obtain a licence must submit a safety case which justifies the safety of the design, construction and ongoing operation of the nuclear installation.[397] The safety case must also be maintained throughout a facility's defined lifetime.[398] If conditions are breached, the regulator has the power to serve

---

393 The Health Foundation *Evidence: Using safety cases in industry and healthcare* 2012, p 5.

394 Ministry of Defence white paper on managing risk and safety cases 2011, p 38.

395 Civil Aviation Authority, Guidance to organisations on safety management systems, CAP 795.

396 Nuclear Installations Act 1965, s 4 (1).

397 See Office for Nuclear Regulation, *The Purpose, Scope, And Content of Safety Cases* 2019.

398 Above, p 20.

improvement and prohibition notices, withdraw approvals, take specific actions under the conditions of the licence and prosecute a licensee.[399]

7.74 In the petrochemical industry, both onshore and offshore facilities require a safety case to operate. The Control of Major Accident Hazards Regulations 2015 require operators of "upper tier" sites to create a safety case (referred to as "safety reports"). Similarly, offshore sites are required to create and maintain a safety case under the Offshore Installations (Safety Case) Regulations 2005. Both sets of regulations require that site operators identify hazards, assess risk and outline safety management systems and emergency plans. Operators must submit their safety case to the HSE for acceptance.

7.75 In the railway industry, the UK managed railway safety under a safety case regime from 1994 until 2006. The Railways (Safety Case) Regulations 1994 and then the Railway (Safety Case) Regulations 2000 required railways operators to submit a safety case to the regulatory authority. As in other industries, the purpose of the safety case was to demonstrate that risks had been identified and adequate control structures were in place to reduce the risk. This safety case regime was replaced in 2006 with a European-wide certification scheme which sought to facilitate inter-operability.

Safety cases in the automotive industry

7.76 As vehicles become more complex, safety cases are becoming an important part of the automotive manufacturing process. For example, ISO 26262 was developed in response to the increasing complexity of electric, electronic and programmable systems (E/E/P) in vehicles. It requires that manufacturers develop a safety case which progressively compiles the work products of each development stage.[400] These work products then form the evidence for the safety case.

7.77 Some existing UNECE regulations also require safety cases as part of the type approval of certain complex systems. For example, Annex 8 of Regulation 13 H for braking and Annex 6 of Regulation 79 on steering set out requirements for evidence based documentation which must be presented to the approval authority. Annex 4 of the recent ALKS regulation also has similar requirements.

7.78 Automotive safety cases generally have safety goals, functional safety requirements, and technical safety requirements. High-level arguments are used to show that the manufacturer has eliminated unreasonable risks and met the safety goals.[401] Technical and regulatory requirements are incorporated into the arguments. Importantly the arguments are not limited to the design of the vehicle but also must

---

399 Nuclear Installations Act 1965, ss 3 to 5, Health and Safety at Work Act 1974 ss 18 to 25, Energy Act 2013 s 74, and see also Office for Nuclear Regulation. *Our Enforcement Policy Statement* (2019).

400 The Health Foundation *Evidence: Supplements to Using safety cases in industry and healthcare* 2012 p 83.

401 The type of evidence required to support arguments depend on the ASIL level associated with a given automotive system. ASILs are determined in terms of severity, probability of exposure and controllability. They specify safety and validation requirements for achieving an acceptable level of safety and residual risk.

address the entire lifecycle of the vehicle. These include production, maintenance, and how to evaluate and respond to incidents once the vehicle is deployed.

7.79 In their 2012 assessment of automotive safety cases, the Health Foundation noted a lack of consensus on how automotive safety cases should be used. Some manufacturers treat the safety case as a repository of the work products generated during the safety lifecycle, whilst others see the role of the safety case as showing how their product is safe.[402]

Safety cases and AV standards

7.80 Explicit references are made to safety cases in many of the emerging standards for automated vehicle development. As we have seen, the BSI PAS 1881 standard is specifically designed to help developers build safety cases for automated vehicle trials and development testing in the UK. Similarly, the SaFad white paper specifies the use of ISO 26262 compliant processes to validate the safety of an AV. It also specifies particulars which "support" and "build" an AV safety case.

7.81 The UL 4600 standard was developed by Edge Case Research and Underwriters Laboratories. It is another standard explicitly designed to help developers and manufacturers of automated products like self-driving cars to build a safety case for their product. It sets out a methodology by which the developer or manufacturer can explain why an AV is acceptably safe through a comprehensive and structured set of claims or goals. These claims or goals must then be supported by arguments and evidence.

7.82 As an example, if the manufacturer of an AV were to claim that their AV "will not hit pedestrians", this must be supported by arguments such as "the AV will detect all pedestrians" or the "AV will stop or avoid detected pedestrians". This would then need to backed by evidence, such as detection tests performed on the AV.[403] The aim is get the manufacturer to explain the specifics of their claims so that an independent assessor can analyse whether the product is safe.

7.83 UL 4600 also sets out a structure for the safety case, dividing claims into areas such as "risk assessment", "interacting with Non-Driver Humans" and "verification, validation, and testing". Throughout it has extensive lists to "prompt" users to consider things which the standard defines as "mandatory", "required", "highly recommended" and "recommended". It also specifies how conformity with these prompts will be achieved and potential "pitfalls". For example, in the risk assessment component it notes problems with certain methods of estimating risk.[404]

7.84 As with many safety cases, the UL 4600 standard adopts a "lifecycle approach". It requires developers to consider the use of the vehicle throughout its operational life. This approach also requires that the supply chain for the maintenance of the vehicle has been considered. For example, if a claim is made that a camera will be clean due

---

[402] The Health Foundation *Evidence: Supplements to Using safety cases in industry and healthcare* 2012, p 83.

[403] See https://users.ece.cmu.edu/~koopman/talks/191010_UL4600_TECH_Webinar.pdf.

[404] UL 4600, 6.4.1.2.

to the use of a spray wash, developers should account for a faulty low-fluid sensor, or the possibility that fluid has insufficient anti-freeze for winter.[405]

7.85 UL 4600 is structured to provide feedback. The standard requires developers to have in place mechanisms for collecting and processing field feedback data.[406] They must also have processes for managing any uncertainties, assumptions and potential gaps in the safety case on an ongoing basis.[407]

Using safety cases during the approval process

7.86 Much work is being done on technical regulations at a UNECE level to ensure that automated features can be incorporated into the type approval process. However, technical regulations take time to develop. Also, in the early years of development, AVs may well use different standards and technologies. It is therefore almost inevitable that safety cases will form part - probably a crucial part - of any approval process. As we saw, safety cases are already a significant part of the ALKS Regulation.[408] They are also widely used in other high-risk industries.

7.87 A safety case requires the manufacturer or developer to come up with an argument for why the system is safe. In other words, those wishing to deploy systems must proactively assess risks.[409] It allows a developer or manufacturer to argue for their own approach to safety. In the absence of widely accepted technical standards, this could allow the regulator to assess each ADS on its merits.

7.88 Another benefit is that a safety case integrates evidence from the development process in a structured way. For example, evidence from road trials, simulation and track tests can be presented in a comprehensive and cohesive format, allowing the regulator to assess a given system.

7.89 Finally, under our proposed scheme, the ADSE will have significant responsibilities for the safety of the ADS on an ongoing basis, perhaps for the entire operational life of the vehicle. A properly constructed safety case could take an entire lifecycle approach, allowing the ADSE to demonstrate how it will fulfil their ongoing duties.

7.90 This is not to say that the safety case approach is perfect. In its 2012 report on safety cases in the medical sector, the Health Company note the following dangers of safety cases:

(1) if not implemented properly, safety cases could become a paper exercise;

---

405 See https://medium.com/@pr_97195/an-overview-of-draft-ul-4600-standard-for-safety-for-the-evaluation-of-autonomous-products-a50083762591.

406 UL 4600, 17.4.

407 UL 4600, 17.4.1.2.

408 See above, ch 3.

409 This is one of the most often cited benefits of a safety case regime. See Sujan et al. Should healthcare providers do safety cases? Lessons from a cross-industry review of safety case practice Safety science p 182.

(2) they might be removed from everyday practice and become exercises in shifting potential liability; and

(3) they might be produced by the wrong people or those outside the organisation.[410]

7.91 Furthermore, in some established industries where they are used, it is not clear whether safety cases have improved the overall safety of the industry.[411] It may also be a significant challenge for the developer or manufacturer to generate appropriate evidence for the claims they make or the ODDs in which they seek to deploy. More complex ODDs may require more robust evidence.

7.92 The poor use of safety cases has also been highlighted in some accident reports. For example, in reviewing the Nimrod aircraft crash in Afghanistan in 2006, Charles Haddon-Cave QC found that the safety case was riddled with errors. Those responsible assumed that the Nimrod was "safe anyway" because it had been flown for 30 years. The safety case had become a "tick box" exercise.[412]

7.93 Given that safety cases are likely to play a significant role in assessing AVs, it is important that they are compiled honestly and accurately and do not suppress evidence. In Chapter 14 we consider how far an ADSE might be criminally culpable for safety failures. However, we think that criminal penalties are appropriate where safety cases are inaccurate or incomplete.

CONCLUSION

7.94 AV technology is still in its infancy. Methods of assessment are beginning to emerge and will develop in time. However, there are significant challenges involved in assessing the safety of the first generations of AVs. All the available assessment methods have both strengths and weaknesses, with no consensus on how to proceed.

7.95 In a 2019 paper, Koopman and others argue for a combined approach:

> We believe that the difficult constraints of creating a safety standard for HAVs[413] can be met with an approach that combines: use of a safety case for the overarching structure, specifying breadth of safety case scope, incorporating lessons learned, updating for a changing environment, and using a multi-layered feedback approach that includes independent assessment. This approach accounts for not only managing the risk

---

410 The Health Foundation *Using safety cases in industry and healthcare* 2012 p 4.

411 Sujan and others, "Should healthcare providers do safety cases? Lessons from a cross-industry review of safety case practice" (2016) *Safety Science* p 181.

412 Charles Haddon-Cave QC, *The Nimrod Review* HC 1025, 2009 p 10.

413 Highly automated vehicles.

presented by unknowns, but also the evolving technology and changing operational environment.[414]

7.96 Under this approach, the safety case is central. However, regulators play a significant role, both in specifying what must be in the safety case and in providing independent assessment. The authors see independent assessment as "essential":

> This is especially true in light of the high-stakes, high pressure environment of HAV development. Beyond providing essential checks and balances on system safety, independent assessment can provide a way to share lessons learned without revealing proprietary design details.[415]

7.97 The final key is feedback: safety is not a one-off assessment but an ongoing process, in which manufacturers and assessors are continually learning from experience.

7.98 From our review of possible methods, we provisionally agree with that conclusion. Assessment methods are still developing, and best practice would suggest simulations, track tests and road tests are all required. These need to be carried out by the developer during the development process, with additional checks by the regulator at the end of the process. The exact combination should be constantly evaluated and will need to be adjusted in line with best practice as it emerges.

Consultation Question 7.

7.99 We provisionally propose.that:

(1) safety assessment should use a variety of techniques;

(2) manufacturers/developers should submit a safety case to regulators showing why they believe that the automated driving system is safe;

(3) regulators should:

  (a) provide guidelines for what is in the safety case;

  (b) audit the safety case;

  (c) prepare guidance for manufacturers and developers on preferred standards; and

  (d) carry out at least some independent tests.

Do you agree?

---

414 P Koopman et al *A Safety Standard Approach for Fully Autonomous Vehicles* (2019) in A Romanovsky et al. (eds) Computer Safety, Reliability, and Security. SAFECOMP 2019. Lecture Notes in Computer Science, vol 11699. Springer, Cham. https://doi.org/10.1007/978-3-030-26250-1_26 p 329.

415 Above, p 330.

Consultation Question 8.

7.100 We seek views on whether an approval authority that intends to use a scenario database as part of the testing procedure should consult road user groups on the range of scenarios to be included.

Chapter 8: Initial approvals and categorisation – proposals

8.1 In Consultation Paper 1 we tentatively proposed that the UK should set up a new safety assurance scheme with power to authorise automated driving systems (ADSs) installed as modifications or in small series. Our proposal received widespread support. Out of 129 consultees who answered this question, 108 (84%) agreed.

8.2 We continue to support the idea of a national safety assurance scheme with power to authorise an ADS. However, we have now developed our proposals in light of the changing legal background.[416] As we discussed in Chapter 6, from January 2021, Great Britain will have greater freedom to authorise vehicles which do not have international type approval.

8.3 Therefore our proposed safety assurance scheme is no longer limited to modifications and small series. Instead, we propose that developers should have a choice. To place an ADS onto the market:

(1) a manufacturer could apply for type approval at international (UNECE)[417] level; or

(2) a manufacturer or developer could apply under the national ADS approval scheme for GB-only approval.

8.4 However, ADS approval would not, of itself, assure that the vehicle could safely drive itself, meeting the tests discussed in Chapters 4 and 5. Categorising a vehicle as able to safely drive itself would be a second, separate stage of the process.

8.5 This two-step process (of type approval and categorisation) is set out in the following diagram:

[416] As discussed in Ch 6, under Regulation 2018/858 on the approval and market surveillance of motor vehicles, EU member states have only limited rights to permit the use of components, systems and vehicles which do not comply with EU standards. Following the end of the transition period, Regulation 2018/858 will be binding in Northern Ireland but not in England, Wales or Scotland.

[417] United Nations Economic Commission for Europe.

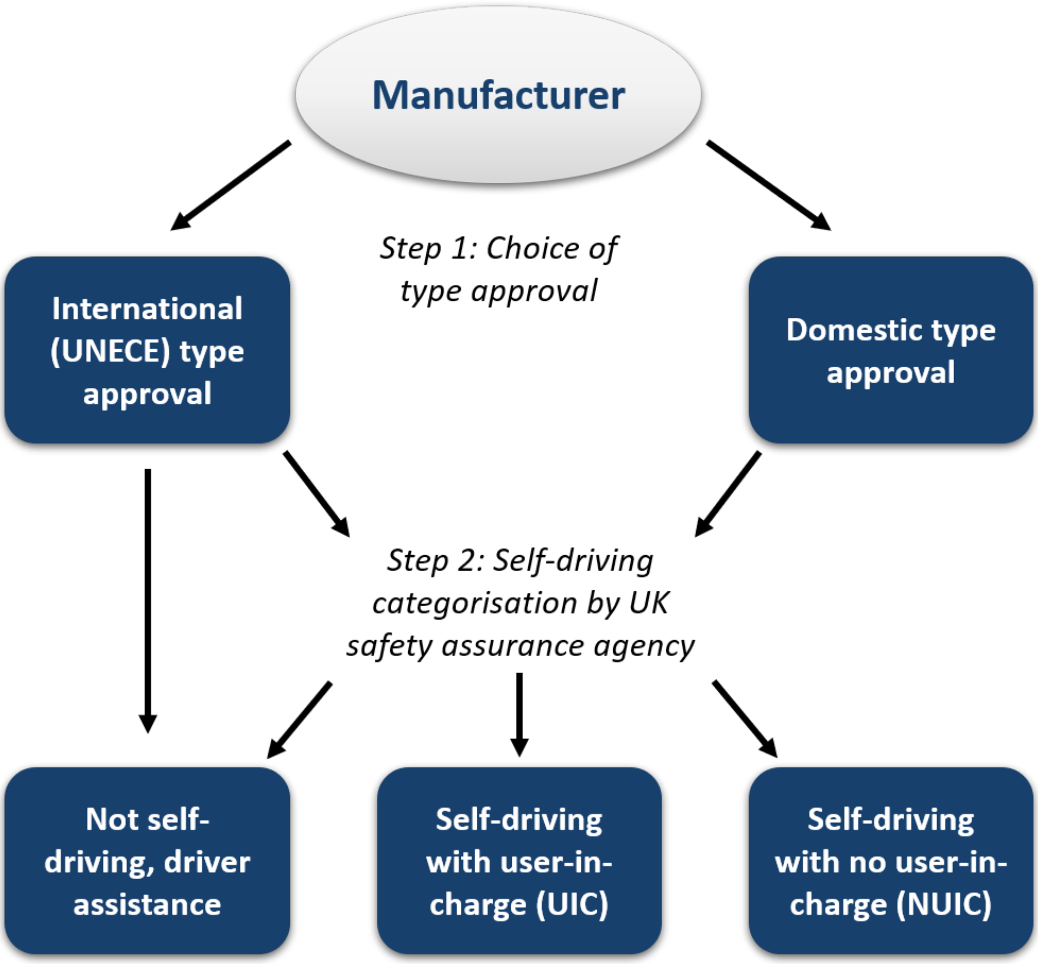

Figure 8.1: The initial authorisation process.

8.6 In this chapter we start with our proposal to prohibit the use of a vehicle with an unauthorised ADS. By ADS we mean the combination of software, hardware and sensors that drives (or purports to drive) a vehicle.

8.7 We then look at Step 1, which is to gain ADS approval. We discuss the manufacturer's choice between obtaining ADS authorisation at either international or national level before considering how to set up a system of national ADS approval.

8.8 Step 2 is categorisation. While national or international type approval is largely concerned with technical issues, the categorisation decision is wider and more holistic. Rather than focus on a single system, it considers the safety of the vehicle as a whole, as embedded within safe processes to update, maintain and repair that vehicle and inform users about their responsibilities.

PROHIBITING UNAUTHORISED AUTOMATED DRIVING SYSTEMS

8.9 As we proposed in Consultation Paper 1, every ADS must obtain approval. We said that this would "address a possible loophole in the current law, under which it might be legal to install an automated driving system, even if it does not meet national requirements".[418]

8.10 In Consultation Paper 1 we explained the details of this proposal in the following terms:

> We tentatively propose that, following a new system to authorise automated driving systems, unauthorised systems should be prohibited. In other words, the Road Vehicles (Construction and Use) Regulations 1986 should be amended to require that every automated driving system is authorised either at international or national level. Under section 42 of the Road Traffic Act 1988 it would then be a criminal offence if a person "uses on a road a motor vehicle… which does not comply with such a requirement, or causes or permits a motor vehicle… to be so used".[419]

8.11 Our proposal to prohibit unauthorised ADSs received near universal support. Out of 121 respondents answering the question, 109 (90%) agreed, and only 3 disagreed. The concerns raised related to trials rather than to commercial deployment.[420]

8.12 Here we repeat the same proposal as we made previously, for the same reasons, subject to an exemption for trials.

An exemption for trials

8.13 Several respondents pointed out that an ADS must be tested before it can be approved. This means that it must be legal to use an unapproved ADS in testing, albeit with a safety driver.

8.14 In Consultation Paper 1 we explained that exemption procedures already exist for tests and trials. Under the Road Vehicles (Authorisation of Special Types) (General) Order 2003, exemptions are available for "any new or improved type of motor vehicle or trailer which is constructed for tests or trials".[421] The exemptions apply to some (but by no means all) of the provisions that govern construction.

8.15 Developers who wish to make more radical changes may apply for a special vehicle order, issued under section 44 of the Road Traffic Act 1988 or section 11 of the Public Passenger Vehicles Act 1981.[422] Among other things, these powers may be used in relation to "special types of motor vehicles or trailers, which are constructed either for special purposes or for tests or trials".[423] Using the powers granted by these sections, the Secretary of State may authorise exceptions or modifications to the normal rules for certain categories of vehicles to be used on roads.

---

418 Automated Vehicles: a joint preliminary consultation paper (2018) Law Commission Consultation Paper No 240; Scottish Law Commission Discussion Paper No 166 (CP1), para 4.106

419 CP1, para 4.105.

420 For further details, see Analysis of Responses, paras 4.30 to 4.37.

421 Road Vehicles (Authorisation of Special Types) (General) Order SI 2003 No 1998, art 36(1)(c).

422 Section 11 applies to vehicles adapted to carry more than 8 passengers.

423 Road Traffic Act 1988, s 44(1)(a).

8.16 We intend that these (or similar) exemption procedures should continue to apply to all construction and use requirements that might restrict automated driving trials. This would include granting exemptions to the prohibition on using an unauthorised ADS.

Consultation Question 9.

8.17 We provisionally propose that:

(1) unauthorised automated driving systems should be prohibited; and

(2) this should be subject to an exemption procedure by which the Secretary of State may authorise unauthorised systems to be used in tests and trials.

Do you agree?

A CHOICE OF APPROVAL SYSTEM

8.18 We are now proposing that the Government should establish a scheme to approve ADSs, which should apply both to systems installed before and after registration and irrespective of the number of vehicles in the series. This approval would allow vehicles to be deployed on the roads of Great Britain and we refer to it as "the national ADS approval scheme".

8.19 Our proposals would provide manufacturers with a free choice about how type approval is obtained. They may either obtain approval:

(1) at international level, by complying with a UN Regulation or exemption, or

(2) at domestic level, by applying under the new national ADS approval scheme.

8.20 Either route would provide authorisation to put a vehicle incorporating an ADS onto roads in Great Britain. The difference is that national approval would allow the ADS to be used only in Great Britain, and not elsewhere.

8.21 At present, under UN Regulations, system approval can only be sought by the manufacturer who assembles the whole vehicle (known as the Original Equipment Manufacturer, or OEM).[424] By contrast, applications for national approval would not be limited to the OEM. It would also be possible for developers to apply for national approval of an ADS they have created. We anticipate that the developer would submit the ADS for testing installed in a vehicle. However, the developer need not have been

[424] For a discussion of system approval, see Ch 6 above. An example of the limitation to manufacturers is found in para 3.1 of UN Regulation 153 on Automated Lane Keeping Systems, which states that "the application for approval of a vehicle type with regard to the ALKS shall be submitted by the vehicle manufacturer or by the manufacturer's authorized representative".

involved in manufacturing that vehicle. Developers could install systems into existing vehicles (for example, to supply local passenger services).[425]

8.22 In practice, this twin-track approach is likely to reflect the two "paths to automation", outlined in Chapter 2. In Path 1, automated features are added to vehicles sold to a mass consumer market. Here international approval is likely to be more attractive, as it allows the vehicle to be sold across borders.

8.23 By contrast, in Path 2, vehicles are deployed without a human driver in limited local contexts. Here national approval may have several advantages. The national ADS approval scheme will be able to authorise systems for a local operational design domain, without waiting for agreement between all the contracting states of the UNECE. It would be also be open to a greater range of producers, including those who concentrate on developing self-driving software rather than manufacturing the whole vehicle. By developing its own scheme, Great Britain would be in the position to pioneer the development of such vehicles in localised contexts, allowing new forms of highly automated passenger and freight services.

8.24 That said, the scope of the national approval scheme would not depend on the development path. The distinction between Path 1 and Path 2 is a matter of practicality, not law. Under our proposed scheme, a manufacturer would have a free choice to obtain authorisation at either international or national level, irrespective of the development path.

Consultation Question 10.

8.25 We provisionally propose that:

(1) the Government should establish a domestic scheme to approve automated driving systems (ADSs) for use on roads in Great Britain (a "national ADS approval scheme");

(2) manufacturers should have a free choice to apply for approval under either the UNECE system of international type approvals or through the national scheme;

(3) developers should be able to submit an ADS for national approval, even if they are not responsible for manufacturing the whole vehicle.

Do you agree?

---

425 This approach has been common in trials: an example is the CAVForth project, where self-driving capability is being installed into existing buses along a 14-mile route across the Forth Road Bridge between Fife and Edinburgh. See https://www.transport.gov.scot/transport-network/roads/connected-and-autonomous-vehicles-cav/project-cavforth/. Stakeholders have also noted that there is already a well-established process for multistage type approval which might be relevant eg where a vehicle is adapted to be wheelchair accessible.

SETTING UP A NATIONAL ADS APPROVAL SCHEME

Existing regulation-making powers

8.26 The legislation already exists to establish a national ADS approval scheme. The Road Traffic Act 1988 provides the Secretary of State with wide regulation-making powers to prescribe "type approval requirements". These may be made "with respect to the design, construction, equipment and marking" of both vehicles and vehicle parts before they are used on a road.[426] The regulations may also be used to authorise who should carry out the examinations.[427] Furthermore, the Secretary of State may give directions "with respect to the manner in which examinations… are to be carried out".[428]

8.27 In our view, these regulation-making powers are already sufficient to establish a national ADS approval scheme.

8.28 The approval system could work in two broad ways. One way would be to verify the system against a detailed list of specifications. Most UN Regulations work in this way: as we have seen, the ALKS Regulation[429] sets out detailed rules for some specific scenarios (though it takes a broad-brush approach to others). These detailed specifications could be set out in secondary legislation.

8.29 An alternative approach would be similar to the exemption procedures for new technologies in EU law and the revised 1958 agreement.[430] These provide that new technologies or new concepts may be approved even if they do not meet the detailed specifications set out in UN Regulations, so long as they ensure "at least an equivalent level of safety and environmental protection". This requires a broader validation. The applicant would provide a full safety case and the type approval authority would then have discretion to establish its own methods to assess that case.

8.30 This open approach would appear particularly well-suited for localised "Path 2" systems. Here the developer may have designed the ADS for a limited and specific operational design domain in a way which was not foreseen by regulators. The scheme could offer such developers an open invitation to submit their ADS, together with a safety case showing why the system provides an equivalent level of safety.

8.31 The legislation appears sufficiently broad to allow for both approaches. It would be possible to establish one or more national ADS approval schemes through regulation, without further legislative reform.

---

426 Road Traffic Act 1988, s 54(1).

427 Road Traffic Act 1988, s 61(2)(f)(i).

428 Road Traffic Act 1988, s 61(3).

429 UN Regulation 157 on uniform provision concerning the approval of vehicles with regards to Automated lane Keeping System ECE/TRANS/WP.29/2020/81 (25 June 2020), as discussed in Ch 3.

430 As discussed in Ch 6. The EU provisions are now in art 39 of Regulation 2018/858 (and were formerly in art 20 of the Framework Directive). The UNECE procedure is in art 12.6 and sch 7 of the revised 1958 agreement.

Approving a system, not a vehicle

8.32 Like the UNECE Agreement, the Road Traffic Act 1988 distinguishes between approving vehicles and approving parts.[431] Both UNECE and national ADS approval would apply to a system within a vehicle, rather than a whole vehicle. Some developers have indicated to the Law Commissions that they seek to produce and sell ADSs which can be adapted and installed in multiple vehicle types.

8.33 Given that use-cases and models of ADS development are still evolving, we do not think it appropriate to define the exact hardware and software configuration that might constitute an ADS. However, in broad terms, we see an ADS as a combination of software, hardware and sensors, which can be installed in a "type" of vehicle.

Defining the type of vehicle

8.34 As we saw in Chapter 6, a "vehicle type" is wider than a make and model but is usually narrower than a category (such as M1). Each UN Regulation includes a separate definition of "vehicle type". Under the ALKS Regulation, an automated lane keeping system can be approved for vehicles which do not differ in "features which significantly influence the performances of ALKS".[432] As yet, there is no guidance on which vehicle features might influence the performance of an ALKS. Size and weight are clearly significant, but other factors may also prove important.

8.35 In our view, the definition of the vehicle type in which an ADS might be installed will need detailed discussion in each safety case. When the national regulator approves an ADS, it will need to specify the vehicle type in which it can be installed, drawing on the discussion in the safety case and any additional tests and audits.

Assessing how an ADS is installed

8.36 In Chapter 6 we discussed how, for each component approved at UN level, there is also a "system regulation" which specifies how the component should be installed. We provisionally propose a similar approach here. Once an ADS has been approved, it should be accompanied by specifications on how the system must be installed within the vehicle.

8.37 In Chapter 7 we gave an example from the UL 4600 standard: if a claim is made that a camera will be cleaned by a spray wash, developers should account for a faulty low-fluid sensor or insufficient anti-freeze in winter. The implication is that even seemingly minor components (such as a low-fluid sensor) can, in some contexts, become safety critical. An ADS which relies on spray washes to clean its cameras is only safe if it is installed in a vehicle with the appropriate spray wash. The example also illustrates the importance of communicating with users. If, for example, the safety case requires that users add anti-freeze to the spray wash for lateral and rear-facing cameras, this must be communicated effectively.

---

431 For example, the Road Traffic Act 1988 deals with vehicle approvals in s 54(1)(a) and part approvals in s 54(1)(b).

432 Proposal for a new UN Regulation on uniform provisions concerning the approval of vehicles with regards to Automated Lane Keeping System ECE/TRANS/WP.29/2020/81, 2.1.1.

8.38 In our view, if an ADS is installed in pre-registered vehicles, an example vehicle (with the ADS installed) should be submitted to the regulator for national type approval. The regulator would check that it has been installed in an appropriate type of vehicle in the correct way.

Appeals

8.39 The Road Vehicles (Approval) Regulations 2020 provide an appeal procedure for those aggrieved by a type approval decision.[433] Under regulation 19, the appeal is to the approval authority which appoints an examiner to re-examine the vehicle.

8.40 The appeal must state the grounds on which it is made, and be accompanied by documents, further evidence and a prescribed fee.[434] The approval authority must then send a notice setting a time and place for the re-examination.[435]

8.41 The Vehicle Certification Agency (VCA) website contains guidance on its appeals procedures. It states:

> Following the receipt of an appeal, the Quality and Accreditation Manager will give it initial consideration. If the appeal is to be upheld following this initial review the appellant will be notified, otherwise the appellant will be informed that an appeals panel is to be convened. Members of the appeals panel will be independent from the work area to which the appeal concerns and the appellant will be notified as soon as possible of the panel's decision, normally within 28 working days from receipt of the appeal. The outcome of the appeals panel is final.[436]

8.42 We welcome observations on how the appeal procedure works in practice, and whether it is suited to our proposed national ADS approval scheme.

[433] The Road Vehicles (Approval) Regulations SI 2020 No 818 implement Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018, and are enabled by the European Communities Act 1972, s 2(2), sch 2, para 1.

[434] Road Vehicles (Approval) Regulations SI 2020 No 818, reg 19(3).

[435] Above, reg 19(4)(a).

[436] See https://www.vehicle-certification-agency.gov.uk/complaints-and-appeals/.

Consultation Question 11.

8.43 We provisionally propose that:

(1) an ADS approval scheme should be established through regulation under the Road Traffic Act 1988, without further legislative reform;

(2) an ADS should be defined as a combination of software, hardware and sensors, which can be installed in a "type" of vehicle.an ADS should be defined as a combination of software, hardware and sensors, which can be installed in a "type" of vehicle;

(3) when an ADS is approved, the approval should be accompanied by specifications for:

(a) the type of vehicle in which it can be installed; and

(b) how the ADS is installed within the vehicle;

(4) where an ADS is installed in a pre-registered vehicle, an example vehicle should be submitted to the regulator for approval of the installation.

Do you agree?

Consultation Question 12.

8.44 We invite observations on the appeal process in regulation 19 of the Road Vehicles (Approval) Regulations 2020, including:

(1) how it works in practice; and

(2) how well it is suited to the proposed national ADS approval scheme.

CATEGORISING A VEHICLE AS ABLE "TO DRIVE ITSELF SAFELY"

8.45 In Chapter 3 we discussed the British definition of self-driving under the Automated and Electric Vehicles (AEV) Act 2018. We noted that the vehicle must be capable, at least in some circumstances, of safely driving itself, without being monitored by an individual.[437] The legislation provides a clear dividing line between driving automation systems which need to be monitored by a human driver ("driver assistance systems") and those which do not.

8.46 We propose that before a vehicle can be listed as self-driving, the Secretary of State should make a decision about whether it can safely drive itself without being

437 Automated and Electrical Vehicles 2018, ss 1(1) and s 8(1)(a).

monitored, this decision would be separate from the approval decision. There are three possible outcomes. The first outcome is that it is not self-driving, in which case the ADS could be used as driver assistance. If the vehicle is listed as self-driving, it would be listed either as self-driving with a user-in-charge, or as self-driving without a user-in-charge. An example of a user-in-charge AV might be a vehicle equipped with ALKS (as the feature is designed to require a human to drive some of the time during a journey).[438] An example of an AV without a user-in-charge might be a dedicated pod carrying passengers in a city-centre (with no expectation that the users will ever drive).

8.47 For the reasons we set out below, we propose that this categorisation process should apply irrespective of how the type approval was obtained. In other words, systems with international type approval *and* systems with national approval would both need to be submitted under the GB safety scheme for a decision on categorisation as self-driving.

The leap to self-driving

8.48 Under the AEV Act 2018, the concept of a vehicle driving itself is only relevant for the purposes of civil liability. However, in Chapter 12 we propose that the definition of self-driving should also apply to criminal liability.

8.49 This means that the dividing line between driver assistance and automated driving has profound legal and conceptual consequences. With driver assistance systems, the human in the driving seat remains a driver. Drivers are liable to be prosecuted for a huge range of offences, from exceeding the speed limit to causing death by dangerous driving. However, under our proposals, in the case of automated driving systems which enable the vehicle to drive itself, the person in the driving seat whilst the ADS is engaged would not be criminally liable for anything done as part of the dynamic driving task. In other words, they could not be prosecuted for anything concerned with steering, acceleration, braking or signalling.

8.50 Instead, we are proposing that every ADS would be backed by an Automated Driving System Entity (ADSE). Where the ADS acts in a way which (if done by a human driver) would lead to criminal or civil liabilities, the ADSE would be subject to regulatory action under the safety assurance scheme. The aim would be to stop mistakes from happening again. There would therefore be gradated sanctions, including improvement notices, fines and (in the most serious cases) recalls.

8.51 Other countries have not taken this step. So far, we are not aware of any country which has passed legislation which absolves the human user from criminal liability in this way. This is understandable: at the current stage of the technology there is reluctance to take the leap from blaming and criminalising human drivers to regulating the entity behind the system. However, if we are to reach full self-driving, this leap is a necessary part of the process.

8.52 Although vehicle standards are international, traffic law remains an issue for contracting states. In Chapter 6, we noted the amendment 34 Bis to the Vienna

[438] We describe how ALKS is intended to function and are not pre-empting whether the feature should or should not be regarded as self-driving.

Convention on Road Traffic 1968 on self-driving vehicles. The amendment clarifies that an ADS must comply with "domestic legislation governing operation", which entitles parties to impose additional requirements for vehicles allowed to drive themselves.[439]

The need to categorise vehicles at domestic level

8.53 Whether or not a vehicle is self-driving would have major implications under our scheme. As discussed in Chapter 6, the implications may be different in other jurisdictions, as there is no international agreement on what constitutes self-driving.

8.54 For these reasons, we think that the decision on whether a vehicle can safely drive itself should be taken at national level. This will require a detailed consideration not only of whether the system is safe and robust but also whether it can comply with GB traffic laws to such an extent that it does not need human monitoring. As we discuss in Chapter 6, the fact that an automated lane-keeping system, for example, has been given international type approval may not necessarily be sufficient to determine the issue. Some further process is required to categorise a vehicle as self-driving, either with or without a user-in-charge.

8.55 Self-driving categorisation asks a different question from type approval. Type approval under the UNECE agreement asks whether the system meets the terms of the UN Regulation, and is therefore suitable for placement onto the market. Self-driving categorisation asks if the system is safe without being monitored by an individual to such an extent that individuals in the vehicle can be absolved from liability for the dynamic driving task. While UN Regulations focus on verifying against specifications, the categorisation decision is instead concerned with validating against a standard - can that model of vehicle safely drive itself without being monitored by an individual? We note that in Japan the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) sets the driving environment conditions[440] for lawful use for each ADS individually based on the applicable device's performance.[441]

8.56 The categorisation decision also enables the safety assurance scheme to identify an entity which can be held accountable for the actions of the vehicle (the ADSE). We see the ADSE as crucial to enabling effective enforcement of ADS safety requirements and having a workable system of monitoring and sanctions.[442] The ADSE concept was originally developed by Australia's National Transport Commission

---

439 Explanatory notes, para 8. For further discussion see Ch 6.

440 These are based on the driving automation feature's operational design domain with constraints that can be geographic, meteorological, time of day or speed based for example.

441 Japan's Revised Road Transport Vehicle Act Section 41, clause 2, Law No. 14, 2019. Enacted May 17, 2019. Enforced May 24 2019.

442 National Transport Commission, "A national in-service safety law for automated vehicles" (October 2020), https://www.ntc.gov.au/sites/default/files/assets/files/NTC-Discussion-Paper-national-in-service-safety-law-for-AVs.pdf.

and the "Automated Driving Provider" in the model law adopted by the United States' Uniform Law Commission in 2019 also fulfils a similar function.[443]

The decision should not replicate the UN process

8.57 Under our proposals, once an ADS has been type approved, either internationally or domestically, it would then need to be considered within the context of a whole vehicle and its surrounding processes. An example of the model of vehicle together with its safety case would then be submitted to the UK safety regulator for categorisation.

8.58 Clearly, the categorisation process must not replicate the checks that have already been carried out. Under the terms of the revised 1958 agreement, contracting parties must not require further testing or documentation for issues that have already been covered by type approval. However, it is permissible to require new documentation and tests for issues that are not covered by the type approval process, and which are aimed at answering a different question.

8.59 While national or international type approval is largely concerned with technical issues (verifying systems against specifications), the categorisation decision is wider and more holistic. Experts will need to audit the safety case, considering every aspect of how the vehicle will be used. Can the vehicle comply with traffic laws? Are users' responsibilities clearly communicated? How will software be updated? How are issues relating to data addressed?

8.60 For some internationally approved systems that are clearly self-driving, the categorisation process might be a formality. Alternatively, nearly all the checks might have been conducted by the type approver, with only a few additional issues needing to be considered. In other cases, however, the internationally approved system may not cover or sufficiently address important aspects of compliance with domestic law. In such cases, categorisation may involve asking manufacturers for additional information about how the system will abide by UK traffic rules and checking aspects of the vehicle that are not covered by the type approval process.

8.61 Under our proposals, vehicles would have to undergo the same categorisation process irrespective of whether the original approval was international or domestic. This means that a system might be approved by the national ADS approval scheme and the ADS-enabled vehicle might then be categorised as driver assistance. We do not think this will be common. Most systems that are designed as driver assistance systems would be installed in "Path 1" mass market consumer vehicles sold across borders and submitted for international approval. However, under our proposals a system might receive national ADS approval but the subsequent categorisation process may allow it to be used only to assist a human driver.

The system or the vehicle?

8.62 UNECE approval is focussed on components and systems. It will therefore be granted to a vehicle type with respect to its automated driving *system,* such as an automated lane keeping system (or ALKS). The installation of the system in that vehicle type is

[443] Uniform Automated Operation of Vehicles Act, https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=a78d1ab0-fac8-9ea1-d8f2-a77612050e6e&forceDialog=0, p 2.

encompassed as part of the approval process. For components, UNECE approvals specifically refer to how they must be installed in different vehicles. However, UN Regulations do not approve the whole vehicle. That is a matter for contracting parties (or, in the case of the EU, groups of contracting parties).

8.63 By contrast, the decision taken about whether a vehicle can drive itself safely applies to the *whole vehicle*. Furthermore, one is not simply looking at the safety of the physical vehicle. The hardware needs to be within a framework of safe processes, where software can be updated and where users understand their maintenance and repair obligations. We therefore see the classification decision as looking at the safety of the vehicle as whole, as embedded within safe processes to update, maintain and repair that vehicle.

The role of the ADSE

8.64 Our proposal is that all self-driving systems should be backed by an Automated Driving System Entity (ADSE). The ADSE will need to register with the safety assurance scheme. Previously, we have described the ADSE as the manufacturer or developer which puts an ADS forward for approval. We have now developed our thinking and it would be more accurate to say that the ADSE puts the vehicle forward for categorisation as safe self-driving.

8.65 A wide variety of organisations may work together to develop self-driving vehicles. They may also use a variety of structures to manufacture vehicles, bring them to market or deploy them on the roads. Whatever the internal structures, we think it is important that a single entity is registered with the safety assurance scheme as the first point of reference in the event of problems.

8.66 In most cases we think that the ADSE will be the manufacturer. However, we recognise that it might also be a software developer; or a partnership between developer and manufacturer. As the industry is still developing, we have sought to remain flexible in our approach.

8.67 However, we need to be clear about the ADSE's responsibilities. The ADSE must put its name to the safety case. It will need to show that it has been sufficiently involved in assessing safety and writing the safety case to vouch for the information in it. If the information in itis inaccurate, the ADSE might be guilty of a serious criminal offence, as discussed in Chapter 14.

Appropriate financial standing

8.68 The ADSE will be subject to regulatory sanctions if things go wrong. As we discuss in Chapter 11, it could be served with an improvement notice (for example, requiring it to update software). The ADSE could also be fined for continuing breaches or could be required to recall its vehicles. An ADSE must not be a straw company: it must have sufficient financial resources to meet these obligations. Furthermore, those funds need to accessible: they would either need to be in the UK or in a jurisdiction which recognises a UK legal judgment.

8.69 At this stage, we do not wish to be prescriptive, either about the total funds needed or about how they are held. In Consultation Paper 2 we discussed the appropriate financial standing for HARPS operators, drawing on the current provisions for Public

Service Vehicle operators. These require an operator to show this it has at its disposal capital and reserves of at least 9,000 euros where one vehicle is used and 5,000 euros for each additional vehicle.[444] Operators may show that the money is available in a variety of ways. As an alternative to submitting audited accounts, the operator may provide other evidence, such as bank guarantees, credit facilities or insurance policies. The Senior Traffic Commissioner has issued detailed guidance on the issue, stressing that the finance must be truly available on an ongoing basis.[445]

8.70 We anticipate that the financial standing requirements for ADSEs would be similarly flexible. They would need to ensure that the obligations of the ADSE would continue to be funded despite its insolvency. The legislation should set out the principle, which could then be supplemented by regulations and guidance. This would allow the total amount to be linked to the number of vehicles and to be demonstrated in a variety of ways (such as bank guarantees or insurance policies).

---

444 Regulation (EC) 1071/2009, establishing common rules for road transport operators, art 7(1). See Public Passenger Vehicles Act 1981, s 14ZA(2)(c). This is in addition to any requirement to insure the vehicle.

445 Senior Traffic Commissioner, *Statutory Document No 2: Finance* (September 2020), para 19, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/922141/Stat_Doc_2_Finance_-_Version_10.0_to_publish.pdf.

Consultation Question 13.

8.71 We provisionally propose that:

(1) once an ADS has received type approval at either international or domestic level, an Automated Driving System Entity (ADSE) would need to submit the vehicle to the UK safety regulator for categorisation as able to safely drive itself;

(2) the safety regulator should make a recommendation to the Secretary of State for how the vehicle should be classified;

(3) it should be open to the safety regulator to recommend that an ADS-enabled vehicle is classified in one of three ways: as not self-driving but driver assistance; as self-driving only with a user-in-charge; or as self-driving without a user-in-charge;

(4) the safety regulator should only recommend classification as self-driving (either with or without a user-in-charge) if it is satisfied that:

(a) an ADSE is registered as taking responsibility for the system;

(b) the ADSE was closely involved in assessing safety and creating the safety case; and

(c) the ADSE has sufficient funds accessible to the regulator to respond to improvement notices, to pay fines and to organise a recall.

Do you agree?

A LEGISLATIVE FRAMEWORK FOR THE CATEGORISATION DECISION

A need for legislative change?

8.72 The current system for categorising a vehicle as self-driving is set out in section 1 of the Automated and Electric Vehicles Act 2018. There is much in the current legislation which we endorse. As we have already discussed, we think that it is right that the decision should be made by the Secretary of State; and that the decision should relate to the vehicle as a whole (rather than to the ADS). We also think that the broad terms of the test are correct: to be categorised as self-driving safely, the vehicle must be able to safely drive itself even if it is not being monitored by an individual in the vehicle.

8.73 We note the simplicity of the section. This contrasts sharply with sections 54 to 65 of the Road Traffic Act 1988, which rely on many regulation-making powers (including who may carry out assessments and appeals).

8.74 In practice, we fear that section 1 may be too simple to deal with the complexities of the decision that needs to be made. We have already addressed some of these complexities.

(1) The safety regulator will need to make recommendations on how to classify the vehicle to the Secretary of State, which in turn are based on a standard of how safe is safe enough set by the Secretary of State.

(2) The categorisation decision can have three outcomes (not safe self-driving; safe self-driving with a user-in-charge; or safe self-driving without a user in charge).

(3) This decision asks not only if the ADS has been approved but whether it can be used without human monitoring.

(4) The decision considers whether the ADS has been safely embedded within both a model of vehicle and within a series of processes. These processes look at whether maps and software are kept up-to-date; how information is communicated to users; and how the vehicle is maintained and repaired.

(5) Furthermore, the way in which vehicles are categorised must be capable of being changed and adjusted in the light of experience.

8.75 All this suggests that the legislation should include regulation-making powers which can be used to set standards and to establish decision-making procedures. Regulations would bring some parliamentary oversight and formality to the process, while still allowing sufficient flexibility to learn from experience.

8.76 We also think that the decision is sufficiently important that an ADSE aggrieved by a decision should have a right of appeal. We ask if the legislation should include appeal provisions similar to those in regulation 19 of the Road Vehicles (Approval) Regulations 2020.

Consultation Question 14.

8.77 We provisionally propose that a new legislative framework should provide regulation-making powers to specify:

(a) who should assess whether a vehicle is capable of self-driving;

(b) the procedure for doing so; and

(c) criteria for doing so.

Do you agree?

Consultation Question 15.

8.78 We seek views on whether new legislation should include provisions for appeals against a categorisation decision. If so, should these be similar to those in regulation 19 of the Road Vehicles (Approval) Regulations 2020?

A power to allow self-driving vehicles to be used in limited numbers?

8.79 In Consultation Paper 1, we discussed the RAND Corporation's proposal for a "graded" approach to deploying automated vehicles, in which limited initial deployment is used to gather more safety data.[446] At first, manufacturers would provide regulators with evidence from their own trials, gained from track-based tests, virtual testing and road-trials with safety drivers. On this basis, the regulator would allow a small number of vehicles to be deployed commercially, on the condition that the deployment was used to gather data.[447] Once safety had been demonstrated, the number of vehicles would be increased. This approach is analogous to that taken in pharmaceutical trials, which gradually gather more data and use this data to help determine safety.[448]

8.80 In our second consultation we commented that there were benefits in taking a phased approach to automated vehicle deployment, to maximise safety and manage risk.[449] A small initial deployment could be used to understand how an ADS performs in the real world before full deployment is authorised.

8.81 We thought that this was particularly important for passenger services, where the operator would need to show that the service could be managed safely, without disrupting traffic flow. We asked consultees whether the agency which licensed automated passenger services ("HARPS") should have power to limit the number of vehicles a given operator could use in a given place for an initial period.[450] A majority (64%) of respondents agreed that there should be a power to limit the number of

---

446 See RAND Corporation, *Challenges and approaches to realizing autonomous vehicle safety* (2017). This document was created from recorded testimony presented by Nidhi Kalra (of the RAND Corporation) to the (US) House Energy and Commerce Committee, Subcommittee on Digital Commerce and Consumer Protection on 14 February 2017. Available at https://www.rand.org/content/dam/rand/pubs/testimonies/CT400/CT475/RAND_CT475.pdf.

447 We discuss the challenges of monitoring the safety of automated vehicles following commercial deployment, see Ch 5.

448 New drugs go through a multi-stage "discovery and screening phase", followed by clinical trials increasing the number of participants at each stage before safety and labelling are reviewed for final (unrestricted) approval. For an overview of the process in the European Union, see http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/general/general_content_001772.jsp&mid=WC0b01ac0580b18a39.

449 Automated Vehicles: Consultation Paper 2 on Passenger Services and Public Transport: a joint consultation paper (2019) Law Commission Consultation Paper No 245; Scottish Law Commission Discussion Paper No 169 (CP2), para 7.95.

450 CP2, Consultation Question 33.

vehicles for an initial period,[451] but there was no consensus on how long this period should be.[452]

8.82 Here we seek views on whether the regulator which classifies vehicles as self-driving should have similar powers to permit self-driving vehicles to be deployed, but only in limited numbers. The purpose of a limited deployment would be to gather more data to assess the safety of vehicles in real world conditions.

Consultation Question 16.

8.83 We seek views on whether the regulator that classifies vehicles as self-driving should have power to allow their deployment in limited numbers, so as to gather further data on their safety in real world conditions.

451 CP2 Analysis of responses, 7.110.

452 CP2 Analysis of responses, 7.113.

Chapter 9: Market surveillance – the current law

9.1 In EU law, the term "market surveillance" refers to actions by public authorities to assess products already on the market. The aim is to ensure that products comply with EU legal requirements and do not endanger health, safety or the environment.[453] A variety of sanctions can be placed on non-compliant products, including recalls.[454]

9.2 Until 2016, there were no market surveillance provisions specifically for motor vehicles. Instead, vehicles were subject to the general provisions which applied to all consumer products. These were set out in two separate pieces of EU legislation. Regulation 765/2008 imposed obligations on member states to establish market surveillance authorities, but it did not contain a power to remove unsafe products. Meanwhile, the General Product Safety Directive 2001[455] provided powers to respond to safety concerns, including the power to issue recalls. Both instruments have been incorporated into UK law and are outlined below.

9.3 The emissions scandal in 2015 illustrated weaknesses in how vehicles were assessed in-service.[456] Following the scandal, new measures have been implemented at both domestic and EU level, though these have focused heavily on emissions. This has led to a complex legal landscape.

9.4 In this chapter we describe the current system for ensuring the safety and legal compliance of vehicles once they have been placed on the market and are in-use. Although there is much in the current law to draw on, we consider it too limited to meet the challenges of self-driving.

9.5 This chapter does not ask questions but forms the essential background to Chapter 10. In Chapter 10 we provisionally propose an enhanced statutory scheme to assure the safety of automated vehicles (AVs) while they are in-use, with additional statutory responsibilities and powers.

THE GENERAL MARKET SURVEILLANCE OBLIGATION: REGULATION 765/2008

9.6 EU Regulation 765/2008 applies to all EU-regulated products. It requires member states to establish market surveillance authorities to ensure that products comply with EU legislation and "do not endanger health, safety or any other aspect of public

---

453 Definition adapted from EU Regulation on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (EC) No 2018/858 Official Journal J L 151 of 14.6.2018 (EU Regulation 2018/858), art 2(34).

454 See European Commission, *Market surveillance for products*, https://ec.europa.eu/growth/single-market/goods/building-blocks/market-surveillance_en.

455 Directive on general product safety 2001/95/EC, Official Journal L 11 of 15.1.2002 p 4.

456 See paras 9.18 to 9.19 below.

interest protection".[457] Following the end of the transition period, the Regulation will become part of UK law, with some minor amendments.[458]

9.7 Under both the UK and EU versions of the Regulation, market surveillance authorities must ensure that products are withdrawn if they would compromise the health or safety of users. This applies when products are used in accordance with their intended purpose or under conditions which can be reasonably foreseen and when properly installed and maintained.[459]

9.8 There must be adequate procedures to:

(a) follow up complaints relating to risks associated with regulated products;

(b) monitor accidents and harm to health suspected to have been caused by those products;

(c) verify that corrective action has been taken; and

(d) follow up scientific and technical knowledge concerning safety issues.[460]

9.9 Authorities are obliged to perform appropriate checks on an adequate scale "by documentary checks" and "where appropriate, physical and laboratory checks on the basis of adequate samples".[461] Where products present a serious risk requiring rapid intervention, products must be recalled, withdrawn or prohibited.[462]

POWERS TO ACT: GENERAL PRODUCT SAFETY REGULATIONS 2005

9.10 The obligations on producers and distributors to ensure safety, together with the powers to remove unsafe products, are set out in the General Product Safety Directive 2001. This has been implemented into UK law in the General Product Safety Regulations 2005 (GPSR).[463] Here we focus on the GPSR.

9.11 The GPSR places a general obligation on producers and distributors to ensure that products are safe.[464] It is a criminal offence to supply an unsafe product, carrying a maximum term of imprisonment of 12 months.[465] This is subject to a due diligence

---

457 EU Regulation 765/2008 on Accreditation and Market Surveillance (EC) No 765/2008, Official Journal L 218 of 13.8.2008 (EU Regulation 765/2008), art 2.17.

458 Product Safety and Metrology etc (Amendment etc) (EU Exit) Regulations SI 2019 No 696, sch 33.

459 EU Regulation 765/2008, art 16, as amended by Product Safety and Metrology etc (Amendment etc) (EU Exit) Regulations 2019/696, sch 33, para 16.

460 EU Regulation 765/2008, art 18.

461 EU Regulation No 765/2008, art 19(1) as amended by Product Safety and Metrology etc (Amendment etc) (EU Exit) Regulations SI 2019 No 696, sch 33, para 19(a).

462 Regulation (EC) No 765/2008, art 20(1) as amended by Product Safety and Metrology etc (Amendment etc) (EU Exit) Regulations SI 2019 No 696, sch 33, para 20(a).

463 The General Product Safety Regulations SI 2005 No 1803 (GPSR).

464 GPSR, reg 5.

465 Or £20,000 fine: GPSR, reg 20(1).

defence, where a defendant can show that they took all reasonable steps and exercised all due diligence to avoid committing the offence.[466]

9.12 The duty of safety is accompanied by a variety of other obligations, including an obligation to provide consumers with information about risks[467] and to notify the authorities about unsafe products.[468] Again, failure to comply is a criminal offence.[469]

9.13 Importantly, from our point of view, regulation 36 of the GPSR requires "enforcement authorities" to "undertake market surveillance of products employing appropriate means and procedures".[470] It permits the Government to establish, update and implement "sectoral surveillance programmes by categories of products" and to review their effectiveness. In the short term, regulation 36 could be used to establish a sectorial surveillance programme specifically for AVs.

Recall and other notices

9.14 The GPSR give enforcement authorities the power to recall unsafe products. Regulation 15 states:

> Where an enforcement authority has reasonable grounds for believing that a product is a dangerous product and that it has already been supplied or made available to consumers, the authority may serve a notice ("a recall notice") requiring the person on whom it is served to use his reasonable endeavours to organise the return of the product from consumers to that person or to such other person as is specified in the notice.[471]

9.15 Recall notices must be a proportionate response. They can only be issued where:

(1) any other action would be insufficient to prevent the risks to health and safety;

(2) the action currently undertaken by the producer or the distributor is unsatisfactory or insufficient to prevent the risks; and

(3) the authority has given the producer or distributor a minimum of 7 days' notice.[472]

9.16 The authority also has power to issue other notices. These include:

---

466 GPSR, reg 29.

467 GPSR, reg 7.

468 GPSR, reg 9.

469 GPSR, reg 20(2).

470 Prior to the EU Regulation 2018/858, the term "market surveillance" was not defined, either by GPSR or the General Product Safety Directive 2001.

471 GPSR, reg 15(1).

472 GPSR, reg 15(4).

(1) a suspension notice, prohibiting a person from supplying or distributing the product for a period of time;[473]

(2) a requirement to mark the product with warnings about the product;[474]

(3) a withdrawal notice, prohibiting any further placement on the market.[475]

9.17 An appeals process enables producers or suppliers to challenge the decisions of the enforcement authority to issue these safety notices.[476]

THE EMISSIONS SCANDAL

9.18 In 2015, the weaknesses of the legal framework were exposed by the VW emissions scandal. When the US Environmental Protection agency discovered illegal "defeat devices" in Volkswagen cars, it became clear that type approval tests had systematically underestimated emissions from diesel cars.[477] Non-complying vehicles had been allowed onto the market, and regulators had failed to notice the problem. This was partly because in Europe the emphasis was on type approval before vehicles were placed on the market. Unlike the US, there was little supervision of vehicle standards once vehicles were in service.

9.19 In 2016, the House of Commons Transport Committee prepared a report on the issue which (among other things) criticised the lack of in-service surveillance to spot check vehicles.[478] They concluded that the in-service work that the Vehicle Certification Agency (VCA) had conducted prior to 2011 had been "inadequate and underfunded".[479] The Committee recommended:

> The Department for Transport must consult on what would constitute a robust in-service surveillance system and what data it should release and how it should do so.[480]

THE MARKET SURVEILLANCE UNIT

9.20 In summer 2016, the Department for Transport established the Market Surveillance Unit (MSU) to check that vehicles on the UK market comply with type approval and

---

473 GPSR, reg 11.

474 GPSR, reg 12. The authority can also "make the marketing of the product subject to prior conditions".

475 GPSR, reg 14.

476 GPSR, reg 17.

477 The concern was a growing gap between "official" diesel emissions, as measured under laboratory conditions, and "real world" emissions occurring on the road. Reports suggested that this was partly due to outdated test procedures and "flexibilities" in test procedures, which allowed manufacturers to optimise performance in the tests (by for, example, reducing vehicle mass, adjusting brakes or overinflating tyres).

478 Volkswagen emissions scandal and vehicle type approval, Report of the House of Commons Transport Committee (2016-17) HC 69, https://publications.parliament.uk/pa/cm201617/cmselect/cmtrans/69/69.pdf.

479 Above, para 54.

480 Above, para 54.

emissions standards.[481] The MSU is based within the Driver and Vehicle Standards Agency (DVSA) and works closely with the Vehicle Certification Agency (VCA).

9.21 As the MSU was set up in the wake of the emissions scandal, most of its work has focussed on emissions standards. The MSU carries out a vehicle emissions testing programme and publishes the results.[482] The vehicles are selected for testing from hire fleets or, in the case of public service vehicles, from operators.[483] The MSU engages in open dialogue with manufacturers, for example to understand why a vehicle may achieve the legal emissions limit when tested on the official test cycle but may emit higher emissions in other situations.[484] The report also shows how the MSU cooperates with market surveillance authorities in other states.[485]

9.22 In addition to planned testing, the MSU investigates areas of potential non-compliance that are brought to its attention. It invites contacts from within the industry and from the public.[486] In 2018, the MSU reported that this system was broadly effective: "vehicles in use on UK roads are generally compliant with the type approval requirements".[487]

SPECIFIC VEHICLE PROVISIONS: REGULATION 2018/858

9.23 The new emphasis on in-service vehicle surveillance has also been reflected in EU law. In September 2020, the old EU Framework Directive on type approval was replaced by EU Regulation 2018/858. Under section 3 of the EU Withdrawal Act 2018, this regulation became part of UK law.[488] To provide for the enforcement of Regulation 2018/858 in the UK, the Road Vehicles (Approval) Regulations 2020, were introduced. These regulations expand the possible penalties for non-compliance with type approval requirements.

9.24 Regulation 2018/858 requires that both member states and the UK establish market surveillance authorities to ensure compliance with EU and UNECE type approval requirements. In many ways this replicates the provisions in Regulation 765/2008. However, Regulation 2018/858 is much more specific.

---

481 Vehicle Market Surveillance Unit, *Results of the 2018 Vehicle Emissions Testing programme* (July 2019) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/836934/vehicle-market-surveillance-unit-programme-results-2018.pdf, para 1.2.

482 Above, para 2.3

483 Except for Public Service Vehicles which are sourced from operators.

484 Vehicle Market Surveillance Unit, *Results of the 2018 Vehicle Emissions Testing programme*, para 3.18.

485 For example, the MSU was explicitly influenced by the findings of the Federal Motor Transport Authority in Germany in relation to a fleet of vehicles produced by Daimler AG which appeared not to comply with EU emissions standards, Vehicle Market Surveillance Unit, *Results of the 2018 Vehicle Emissions Testing programme,* para 4.96.

486 Above, para 6.8.

487 Above, para 6.1.

488 S 3 contains a "saver" provision which transposes existing EU regulations, including Regulation 2018/858, into UK law following the expiration of the transition period on 31 December 2020.

9.25 The market surveillance authority for vehicles must carry out regular checks to verify that vehicles, systems, components and separate technical units comply with the relevant requirements. At a minimum, one test for every 40,000 new motor vehicles registered in the UK must be carried out in a given year.[489] When carrying out such checks, market surveillance authorities must take account of: (a) established principles of risk assessment; (b) substantiated complaints; and (c) any other relevant information.[490]

Separating market surveillance from type approval

9.26 Regulation 2018/858 requires that approval authorities and market surveillance authorities be separate from each other when carrying out their tasks.[491] Recital 25 states that:

> In order to avoid potential conflicts of interest, approval authorities and market surveillance authorities should not be linked when carrying out their tasks. Where a member state chooses to place these authorities within the same organisation, it should at least ensure that the organisation has structures that ensure that the activities of the authorities remain distinct from one another in terms of their direct management and decision-making.

9.27 This is reflected in article 6(1):

> Member States shall ensure that their own approval authorities and market surveillance authorities adhere to a strict separation of roles and responsibilities and that they each function independently from each other. Those authorities may be within the same organisation provided that their activities are managed autonomously as part of separate structures.

9.28 The Road Vehicles (Approval) Regulations 2020, which provide the domestic regulatory framework implementing Regulation 2018/858, identify the Secretary of State as both the type approval and the market surveillance authority for the UK. In practice however the VCA carries out the role of type approval whilst the DVSA caries out the market surveillance role via its MSU.

A difficult dividing line: the UNECE view

9.29 The dividing line between pre-placement assessment and in-use assessment is becoming blurred by issues such as software updates and cyber-security. When UNECE Working Party 29 discussed software updates and cybersecurity in 2019, delegates questioned how far they could make regulations governing the whole lifetime of a vehicle or the whole life-cycle of a vehicle type. They invited the UN secretariat (the Office of Legal Affairs in New York) to provide guidance on this point.

---

489 Regulation 2018/858, art 8(2).

490 Regulation 2018/858, art 8(1).

491 Regulation 2018/858, recital 25. See also art 6(1).

9.30 The secretariat presented a note on the issue to Working Party 29 in March 2020. The note observed that the 1958 Revised Agreement[492] was largely silent on the issue. Thus the Agreement did not "limit the time when controls can be done and when non-compliance can be found".[493] The author proposed the following interpretation:

> Provisions related to the lifecycle of a vehicle type and the lifetime of vehicles find a sufficient legal basis in the 1958 Agreement and the precedents in existing UN Regulations…. However, any Contracting Party to the Agreement may agree or disagree to adopt Lifetime and/or Lifecycle related provisions, on a case by case basis.[494]

9.31 This raises a difficult issue. Should AV safety be entrusted to a single regulator? Or should the original type approval decision be separated from monitoring the safety of AVs while they are in-use on the roads? We return to this issue in Chapter 10.

CIVIL PENALTIES

9.32 In 2018, the new UK institutional arrangements for checking emissions, outlined at paragraphs 9.20 to 9.22 above, were supplemented by additional regulations. The Road Vehicles (Defeat Device, Fuel Consumption and Type Approval) Regulations 2018 make it a criminal offence for a manufacturer to place a vehicle on the market with an emission defeat device.[495] The 2018 Regulations were limited in that they only applied to emission defeat devices, but were nevertheless innovative in that they allowed for both civil and criminal penalties. As an alternative to prosecution, the VCA could impose penalties of up to £50,000 for each vehicle fitted with a defeat device. Much of the substance of these regulations has been incorporated into the 2020 Road Vehicles (Approval) Regulations.

9.33 The 2020 Road Vehicles (Approval) Regulations now allow the UK authorities to use civil penalties for all infringements related to the type approval process. Under the 2020 Regulations, the approval authority can impose financial penalties of up to £50,000 where it "is satisfied, on a balance of probabilities, that the person has committed an offence".[496] However, the approval authority cannot require a penalty if "the person shows that there was a reasonable excuse for committing the offence" or criminal proceedings have been instituted against the person in respect of it.[497]

---

492 "Agreement concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts". For the text, see https://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2017/E-ECE-TRANS-505-Rev.3e.pdf.

493 Note by the Secretariat, *The 1958 Agreement and lifetime/lifecycle considerations, presented to the 180th WP.29, 10-12 March 2020*, https://www.unece.org/fileadmin/DAM/trans/doc/2020/wp29/WP29-180-18e.pdf, para 13.

494 Above, para 31.

495 The Road Vehicles (Defeat Device, Fuel Consumption and Type Approval) Regulations SI 2018 No 673 amend the Road Vehicles (Approval) Regulations SI 2009 No 717.

496 Road Vehicles (Approval) Regulations SI 2020 No 818 (2020 Regulations), sched 4 part 2, para 4(1), (3). The 2020 Regulations also incorporated the provisions in the 2018 Regulations on defeat systems.

497 Above, sched 4 part 2, para 4(2).

9.34 If the approval authority decides to impose a civil penalty, it must give the person a penalty notice.[498] The recipient may then object.[499] If the issue cannot be resolved, the recipient may appeal to the county court or sheriff court,[500] which may transfer proceedings to the High Court or the Court of Session.[501] The appeal takes the form of a re-hearing of the decision and may have regard to matters of which the approval authority was unaware. The court can decide to reduce or cancel the penalty.[502]

9.35 We think that civil penalties are an interesting innovation and could also be appropriate to ensure the safety of AVs in use.

THE DVSA CODE OF PRACTICE

9.36 The Driver and Vehicle Standards Agency (DVSA) is the government-appointed authority in the UK responsible for product safety in the automotive sector.[503] It has responsibilities to monitor and investigate issues that affect automotive product safety.

9.37 DVSA has published a code of practice on vehicle safety defects and recalls ("the code"), using the GPSR as the legal basis.[504] The code outlines DVSA's responsibilities, which include:

(1) investigating and determining safety defects;

(2) forming agreements with producers to rectify safety defects;

(3) monitoring producers' actions in managing rectification plans;

(4) publishing information for consumers to help them understand their responsibilities; and

(5) helping producers make the right decisions around understanding risks and the potential actions that they need to take.[505]

Safety defects

9.38 The code defines a "safety defect" as

---

498 Above, sched 4 part 2, para 5(1).

499 Above, sched 4 part 2, para 6(1).

500 Road Vehicles (Approval) Regulations 2020, sched 4 part 2, para 7. Or, in Scotland, to the sheriff.

501 Above, sched 4 part 2, para 7(8)(a). Or in Scotland, the Court of Session.

502 Above, sched 4 part 2, para 7(4).

503 The Driver and Vehicle Standards Agency Trading Fund Order SI 2015 No 41, sch 1.

504 DVSA, *Vehicle safety defects and recalls: code of practice*, https://www.gov.uk/government/publications/code-of-practice-on-vehicle-safety-defects-and-recalls/vehicle-safety-defects-and-recalls-code-of-practice (DVSA code of practice). The code was developed in consultation with manufacturer and industry groups such as the Society of Motor Manufacturers and Traders (SMMT), the British Vehicle Rental and Leasing Association (BVRLA) and the Independent Automotive Aftermarket Federation (IAAF).

505 DVSA code of practice.

a failure due to design and/or construction, which is likely to affect the safe operation of the product – and pose a significant risk to the driver, occupants and others.[506]

9.39 So, for example, a safety defect can be in a physical component or software and could occur at any point in the life of the product. In the case of aftermarket components or accessories, the defect may be one of compatibility with a vehicle for which it is promoted.[507]

Producer and distributor obligations

9.40 As we have seen, the GPSR impose a variety of obligations on producers and distributors. The code fleshes out these obligations by explaining that producers must (among other things):

(1) monitor the safety of the product in service

(2) investigate problems, whether reported by DVSA, users or others

(3) analyse the potential risks;

(4) notify DVSA of a safety defect immediately;

(5) propose a course of action to deal with the defects and agree it with DVSA; and

(6) deliver the agreed course of action, including notifying users and arranging any rectification works.[508]

9.41 Distributors must participate in monitoring the safety of a product by, for example:

(1) passing on any information on potential safety defects to the producer in the first instance (or to DVSA where appropriate); and

(2) supporting the producer as necessary in providing any information to the DVSA, in any recall or similar efforts.[509]

Safety recalls, warnings and requirements

9.42 Where a safety defect has been found, the producer is expected to agree a plan with DVSA which might include:

(1) *safety recalls (stop drive)*: there is an immediate threat to safety, so the vehicle must not be driven.

---

506 Above, para 3.

507 DVSA code of practice, para 3.

508 Above, para 2.2.

509 Above, para 2.3.

(2) *safety recalls*: the threat is not immediate and can be mitigated with "reasonable" consumer action.

(3) *consumer / garage warning*: the safety defect can be mitigated through vehicle maintenance or similar checks. This may be used with a recall.

(4) *amendment to maintenance or servicing requirements*: a reasonable change to maintenance or servicing requirements can detect a potential problem and avoid the defect.[510]

CONCLUSION

9.43 Provisions already exist for market surveillance of AVs. The Government has legislative authority under regulation 36 of the General Product Safety Regulations 2005 to establish a sectoral surveillance programmes specifically for AVs. A surveillance authority could receive complaints and work with manufacturers to resolve problems. It would have formal powers to issue recall notices; to suspend or prohibit the supply of automated driving systems; or require warnings about how they are used. It could also bring criminal prosecutions against producers and distributors who supply unsafe products. This would provide the bare bones of a scheme to assure the safety of AVs while they are in-use on the road.

9.44 However, the current law is designed to deal with conventional vehicles. It puts considerable emphasis on the mechanical test to ensure that specific vehicle systems adhere to technical regulations. This form of testing is unlikely to detect problems in dynamic driving behaviours that are particularly relevant to AVs

9.45 In Chapter 10 we discuss the challenges of assuring the safety and legality of AVs when they are in use on roads. In our provisional view, these new challenges require new powers. We therefore provisionally propose an enhanced scheme, with additional statutory responsibilities and powers.

9.46 However, there are also some noteworthy features of the current law which we wish to keep. First, market surveillance is not only concerned with health and safety. It must also ensure that products comply with the law. We therefore envisage a scheme which not only considers whether AVs are safe but also considers whether they are law-abiding more generally.

9.47 Secondly, we note the introduction of civil penalties under the Road Vehicles (Approval) Regulations 2020. In Chapter 11 we provisionally propose that civil penalties (or regulatory fines) should be a feature of the new scheme.

9.48 The legislation is also concerned to avoid "regulatory capture". Under Regulation 2018/858 approval authorities and market surveillance authorities should not be linked "to avoid potential conflicts of interest". In Chapter 10 we ask if regulatory capture is best avoided though separations between prior approval and assurance for vehicles in use, or whether other mechanisms can achieve the same goal.

---

[510] DVSA code of practice, para 7.1

Chapter 10: Assuring safety in use

10.1 As we explored in Chapter 6, the traditional UNECE approach to vehicle standards has been to focus on approving vehicles before they are deployed. Relatively few resources have been put into "market surveillance" by regulators to ensure that vehicles are safe in practice.

10.2 With automated vehicles (AVs), this will need to change. Safety assurance will be required on an ongoing basis. This is partly because AVs develop as their software is updated. It is partly because the technology is unknown: to some extent, it is not possible to be sure that AVs are safe until they have been observed under real-world conditions. And, finally, vehicles have relatively long lifespans, during which roads, road users and laws change. The average car lasts just under 14 years,[511] while buses, coaches and trucks last longer. Even if an AV complies with driving rules at the time it is approved, it may no longer do so several years later.

10.3 In this chapter we consider some of the challenges of assuring the safety of AVs following deployment, when they are in use on the roads. We refer to this as in-use AV safety assurance. There are many different aspects of this task. In this chapter we discuss five:

(1) regulating software updates;

(2) cybersecurity;

(3) updating maps;

(4) communicating information to users; and

(5) collecting data to compare automated and conventional driving.

10.4 In the next chapter we consider two further issues:

(1) sanctions for breach of traffic rules; and

(2) how to learn lessons from collision investigation.

10.5 This is not a definitive list. It is difficult to know how significant these seven issues will be in practice, or what other issues might arise. Our aim here is to give a flavour of the challenges of regulating AVs once they have been deployed on the roads. In our provisional view, these challenges, when taken together, require an enhanced statutory scheme to assure the safety of AVs while they are in-use.

SOFTWARE UPDATES

10.6 Traditional vehicle testing looks at a vehicle at one point in time. As section 45 of the Road Traffic Act 1988 puts it, the test certificate shows that the requirements were

[511] https://www.smmt.co.uk/industry-topics/sustainability/average-vehicle-age/.

complied with “at the date of the examination”. Automated Driving Systems (ADSs), however, will change as their software is updated. Examples already exist where car manufacturers have updated vehicle software, enabling advanced driving assistance features not present when the vehicle type entered the market.[512]

10.7 This issue has led to regulatory developments at UNECE level. The EU has also highlighted the issue of software updates, noting the need for UN regulations on software updates to be adopted “on a mandatory basis as soon as possible after their entry into force”.[513]

UNECE regulation on software update processes

10.8 In June 2020 the UNECE adopted a new Regulation on “uniform provisions concerning the approval of software update processes”.[514] It will come into force in January 2021.

10.9 The Regulation applies to both passenger and goods vehicles that permit software updates.[515] It does not dictate the contents of the update. Rather it seeks to standardise the way that updates are managed and installed. Among other things, it requires manufacturers to assess the effect of each update and to document its purpose, verification and validation.[516] Each software update that is relevant to type approval must be given a unique identifier, known as an RX Software Identification Number.

Software Update Management Systems

10.10 Under the UNECE Regulation, vehicles that permit software updates can only be approved if the manufacturer has a Software Update Management System (SUMS) in place which complies with the Regulation. A SUMS is defined as:

> a systematic approach defining organizational processes and procedures to comply with the requirements for delivery of software updates according to this Regulation.[517]

10.11 The manufacturer must apply to an approval authority for a certificate of compliance, demonstrating that it has the necessary processes in place.[518] The certificate will

---

512 Tesla’s autopilot was released as an update available for purchase. It enabled advanced driver assistance features for vehicles which did not previously have these features.

513 Recital 27 of Regulation 2019/2144. Recital 27 also highlights that related security measures should not compromise the obligations of a vehicle manufacturer to provide access to comprehensive diagnostic information and in-vehicle data relevant to repair and maintenance.

514 UN Regulation on uniform provisions concerning the approval of vehicles with regard to software update processes and of software update management systems ECE/TRANS/WP.29/2020/80 (Software Update Regulation), https://unece.org/fileadmin/DAM/trans/doc/2020/wp29/ECE-TRANS-WP29-2020-080e.pdf. The proposal has now been adopted and is sitting with the UN for six months before coming into force.

515 Potentially also to categories O, R, S and T. Software Update Regulation, para 1.1.

516 Software Update Regulation, para 7.1.2.5.

517 Software Update Regulation, para 2.

518 Software Update Regulation, para 6.4.

remain valid for a maximum of three years unless withdrawn by the approval authority.[519]

Identifying the effect of an update

10.12 To demonstrate SUMS compliance, the manufacturer must show that it has processes in place "to assess, identify and record" the effect of each update.[520] In particular, manufacturers must assess whether a software update will affect the vehicle's type approval. Among other thing, this involves considering whether the software will:

(1) impact or alter any of the parameters used to approve the system; [521]

(2) add or enable any functions that were not present when the vehicle was approved;[522]

(3) affect test results;[523] or

(4) modify functions that affect the vehicle's type approval.[524]

10.13 The Regulation is not limited to updates that directly affect type approval. Manufacturers must also have a process to assess, identify and record if a software update will:

(1) affect any other system required for the safe and continued operation of the vehicle; or

(2) add or alter the functionality of the vehicle compared to when it was registered.[525]

Installing updates

10.14 Under the Regulation, the manufacturer needs to ensure that vehicles can install updates safely. For example, the installation process needs to be able to:

(1) cope with failed or interrupted updates, either by restoring systems to their previous version or by putting the vehicle into a safe state;[526]

---

519 Software Update Regulation, para 6.6.

520 Software Update Regulation, para 7.1.1.

521 Software Update Regulation, para 7.1.1.8.

522 Software Update Regulation, para 7.1.1.9.

523 Software Update Regulation, para 7.1.1.9(b).

524 Software Update Regulation, para 7.1.1.9(c).

525 Software Update Regulation, para 7.1.1.10.

526 Software Update Regulation, para 7.2.2.1.1.

(2) execute updates only when the vehicle has enough power to complete the process;[527] and

(3) where updating whilst driving may not be safe, ensure that the vehicle cannot be driven.[528]

10.15 Manufacturers must demonstrate that the SUMS can inform vehicle users about updates both before[529] and after[530] they are executed.

Notifying the original approval authority

10.16 The Regulation provides that "every modification of the vehicle type which affects its technical performance and/or documentation required in this Regulation" shall be notified to the approval authority which granted the original approval.[531] This means that modifications which affect the type approval of the software update management system would need to be checked by the original approval authority for the system.

10.17 However, the software update Regulation does not set out what must happen when a software update affects the type approval of another system. Presumably, if a software update affected the braking system (for example), the manufacturer would notify the approval authority for the braking system to check whether the original braking system approval was still valid. Under the UNECE system, this authority may be different from the one that approved the software update management system.

10.18 It is not clear how this will work in practice. We do not know how often manufacturers will return to approval authorities with software updates, or how much work will be involved in approving them. Manufacturers may issue many updates, often small in themselves, but significant when taken together. An update to fix one problem may create another: for example, an update designed to prevent an AV stopping unnecessarily (eg for leaves) might prevent it from stopping necessarily (eg for fallen trees).

10.19 Some element of judgement will be required. If manufacturers take an overly cautious approach and return to approval authorities for every small change, this could cause delay and backlogs. Conversely, if they take a more robust view, and roll out updates without prior approval, the system may be difficult to monitor. From the perspective of a type approval authority, it might be pragmatic to assess updates which affect fundamental aspects of a system but to allow minor updates. However, the impact of each update would need to be understood before it could be classified as "minor." As Informal documentation on the UNECE website notes, the "highly coupled nature of

527 Software Update Regulation, para 7.2.2.1.2.

528 Software Update Regulation, para 7.2.2.3.

529 Software Update Regulation, para 7.2.2.2.

530 Software Update Regulation, para 7.2.2.4.

531 Software Update Regulation, para 8.1.

automotive systems" means that the impact of software updates will need to be clearly identified.[532]

The obligation to update

10.20 It is common for driving laws to change: from 2016 to 2019, the Highway Code was updated 14 times.[533] A vehicle may comply with traffic rules at the time it was approved, only to find that it is no longer compliant after a change in the law. As we have seen,[534] the Californian regulations on deploying autonomous vehicles provide for this. Manufacturers must undertake to provide updates to ensure compliance with any changes to the Californian equivalent of the Highway Code or local regulations.[535]

10.21 At present, there is no clear obligation on manufacturers to issue software updates in these circumstances. Individual UNECE regulations stipulate conditions which should be met throughout the lifetime of a system. For example, the UNECE regulation on Automated Lane Keeping Systems (ALKS) states that ALKS must comply with traffic laws.[536] This suggests that the manufacturer should update systems as laws change, but the obligation to update is not spelled out.

The current regulation of software updates: conclusion

10.22 UNECE regulation requires manufacturers to have a clear system to assess and record software updates. Where an update would affect the type approval of another system, it appears that the manufacturer must return to the authority which provided the original approval.[537] However, the way this will work in practice is unclear. Furthermore, there are no specific provisions to require manufacturers to issue updates when laws and circumstances change.

10.23 We hope that UN Regulation related to software updates will be interpreted flexibly, so as not to cause delays and duplication. Take an example where a manufacturer obtains type approval for an ADS system from the Luxembourg type approval authority,[538] certifying among other things that the vehicle complies with UK traffic laws. An aspect of UK law then changes. We think that UK regulators should have powers to require an update in these circumstances. When the update is produced it may then be simpler and quicker for the manufacturer to deal with a local regulator (who understands the legal change) rather than return to Luxembourg for approval.

---

532 United Nations Economic Commission for Europe*, Software Updates-Type Approval and Surveillance Measures*, https://wiki.unece.org/download/attachments/42041676/TFCS-04-12e%20%28NL%29%20Type%20Approval%20of%20Software%20updates.pdf?api=v2.

533 Many would not affect automated driving (such as changes to first aid advice, or on rules about smoking in vehicles). However, others might have an effect, such as changes brought about by the introduction of smart motorways. The proposed changes on protecting vulnerable road users could have a substantial effect.

534 See Ch 7 for a discussion of the Californian regulations regarding AVs.

535 California Code of Regulations, Application for a Permit for Post-Testing Deployment of Autonomous Vehicles on Public Roads s 228.06, 9A.

536 For a more detailed discussion of this point, see Ch 3.

537 See https://www.unece.org/fileadmin/DAM/trans/doc/2020/wp29/WP29-182-06e.pdf.

538 Société Nationale de Certification et d'Homologation (snch) is Luxembourg's designated authority, see https://www.snch.lu/fr-FR/Page/Homologation.

10.24 In Chapter 8 we proposed that every ADS should be backed by a registered entity: the ADSE. In our view, the ADSE should be under a continuing duty to ensure that an ADS acts safely and in compliance with the law. If it is necessary to update software to achieve this goal, the ADSE should do so.

10.25 In this chapter we propose an enhanced scheme to assure the safety of AVs while they are in-use. As part of their enhanced powers, we propose that regulators should have powers to compel updates where necessary. We invite comments on whether the scheme should also include a power to approve software updates that apply only within Great Britain. This might enable some updates to be rolled out more quickly, especially where updates respond to changes in traffic laws which could be difficult for a non-UK type approval authority to assess.

CYBERSECURITY

10.26 Assurance for software updates is linked to cybersecurity. A UNECE task force has recognised that software updates have security aspects that need to be considered.[539] The UNECE has therefore adopted a new UN Regulation on uniform provisions concerning the approval of vehicles with regard to their cybersecurity management systems.[540]

10.27 Cybersecurity for automated vehicles lies outside the remit of the Law Commissions' work. The Centre for Connected and Autonomous Vehicles is leading on this policy area directly at a domestic level, whilst IVS is involved in the UNECE's efforts on cybersecurity. We have therefore not looked at how cybersecurity should be assured or how it should be incorporated into our proposed basic regulatory framework.

10.28 However, responsibility for cybersecurity will be an important consideration when establishing the in-use safety assurance process. Although we will not examine how cybersecurity should be assured or regulated, we welcome views on where institutional responsibility for cybersecurity should sit at a domestic level. We ask if cybersecurity should be one of the responsibilities of a generic in-service safety assurance agency. An alternative approach would be to establish a specialist unit.

MAPS AND OTHER DATA SOURCES

The importance of maps

10.29 Although developers differ in their approach to maps, some see maps as the key to understanding the fixed parts of the road environment. Waymo has set out its own approach as follows.

> These maps are distinct from basic satellite imagery or online maps. Instead Waymo's maps provide our vehicle with a deep understanding of the physical environment: road types, the distance and dimensions of the road itself, and

---

539 Draft Recommendation on Software Updates of the Task Force on Cyber Security and Over-the-air issues, ECE/TRANS/WP.29/GRVA/2019/3, para 1.2.2.

540 UN Regulation on uniform provisions concerning the approval of vehicles with regard to cyber security and of cybersecurity management systems, ECE/TRANS/WP.29/2020/79 (Cybersecurity Regulation), https://unece.org/fileadmin/DAM/trans/doc/2020/wp29grva/ECE-TRANS-WP29-2020-079-Revised.pdf.

other topographical features. We take that data and add salient information that includes traffic control information such as the lengths of crosswalks, the locations of traffic lights, and relevant signage. With our maps installed onboard our vehicle, our system can then focus on the parts of the environment that change dynamically around it, such as other road users.[541]

10.30 Similarly, Intel Mobileye describes crowd sourced High-Definition (HD) maps as "a major contribution", such that:

> the system has full knowledge on where to expect potential dangers: it knows in advance where there should be lanes that might merge to our lane, who has the priority, where to expect traffic lights, where to expect occluded pedestrians, etc.[542]

10.31 Maps also prevent an ADS from being engaged outside its geographical operational design domain. Mercedes-Benz explains that its AV

> is 'geo-fenced,' meaning that, in addition to other limitations, its operational design domain is further defined with a precise, high-definition map that tightly defines the vehicle's prescribed area of operation; by design the vehicle is prevented from leaving this area.[543]

10.32 HD maps are nothing like the conventional maps used for navigation today. Often, they require a vehicle to drive the route to collect data, which is then subject to both automated and human processing. Aurora notes:

> the Aurora Driver relies on its lidar and cameras to collect the data required to build a map. Once collected, the data is processed through a combination of automated and manual production and quality-assurance tooling, and made available to the entire fleet.[544]

10.33 Some maps are being developed in-house and are highly integrated with the ADS of particular developers (such as Waymo, Aurora and AutoX). Others are provided by specialised companies. For example, Nvidia says it "collaborates with mapping companies all over the world".[545]

10.34 Given the importance of mapping, the issue needs to be considered both at initial authorisation and on an ongoing basis.

---

541 Waymo Voluntary Safety Self-Assessment, p 18. For further discussion of Waymo's approach to maps see: *The Waymo Driver Handbook: How our highly-detailed maps help unlock new locations for autonomous driving*, https://blog.waymo.com/2020/09/the-waymo-driver-handbook-mapping.html.

542 S Shalev-Shwartz, S Shammah, A Shashua, *Vision Zero: Can Roadway Accidents be Eliminated without Compromising Traffic Throughput?* Mobileye (2018) p 6, https://static.mobileye.com/website/corporate/rss/vision_zero_with_map.pdf.

543 Mercedes-Benz Voluntary Safety Self-Assessment, p 16.

544 Aurora, The New Era of Mobility Safety Report 2018 Voluntary Safety Self-Assessment, pp 21, 22.

545 These include HERE, TomTom, Baidu, NvInfo, Autonavi, ZENRIN, South Korean Telecom Co, KingWayTek "and many startups": Nvidia Voluntary Safety Self-Assessments, p 20.

Standards for creating and updating maps

10.35 Maps are one of the "data sources" used by an ADS to define its operational design domain, alongside others (such as weather warnings or information from infrastructure).[546] The UL 4600 standard, which we discussed in Chapter 7, requires safety cases to include a "quality assurance approach to external data sources related to ODD change detection", which considers both accuracy and timeliness.[547]

10.36 Significant efforts are being made to harmonise standards for AV maps, but most are in the initial stages.[548] In its Roadmap for CAV Standards, BSI identified a gap in the standards for "off-vehicle sources", such as maps and communications with infrastructure. They saw this as a priority.[549]

10.37 In the absence of an agreed industry standard, approval authorities will need to rely on manufacturers to explain their system in their safety cases. They will need to show why their method of map integration is robust and why the system will be safe even if the map fails.

10.38 However, we do not see this as a single event. In our provisional view, there also needs to be assurance that maps are kept up-to-date on an ongoing basis.

The challenges of keeping maps up-to-date

10.39 Many companies are working on ways to use real-time sensing from one vehicle to alert other vehicles. For example, the Chinese AV developer, AutoX, uses real-time sensing to update maps to reflect transient events like road construction.[550] Waymo describes a similar approach:

> If a change in the roadway (eg, a collision up ahead that closes an intersection) is detected, our vehicle can re-route itself within the systems operational design domain and alert our operations center so that other vehicles in the fleet can avoid the area. In this case, the maps not only serve as an added reference point to our software, but also provide important feedback to our system.[551]

10.40 Despite the potential of vehicle-to-everything (V2X) communication of this sort, mobile coverage is a challenge. V2X communication is likely to require a mobile network of at

---

546 Underwriters Laboratories and Edge Case Research, ANSI/UL 4600 Standard for Safety for the Evaluation of Autonomous Products, gives the example of "high resolution maps used to augment navigation and infrastructure perception capabilities" requiring justification as part of the safety argument in respect of sensor diversity and/or redundancy. See https://ul.org/UL4600.

547 UL 4600, para 8.2.4.2. For our discussion of UL 4600 see Ch 7 above.

548 For example, BSI has published a dictionary for cooperative intelligent transport and automated driving which covers static data (such road signs and buildings) (BS PD ISO/TR 21718:2019). An ISO standard for describing "geographic data files" for use in automated vehicles is in the preliminary stages (ISO GDF 5.1) and BSI has proposed a standard for harmonising map data (PD ISO/TS 22726-1 & 2).

549 BSI Roadmap for CAV Standards, Theme 2.

550 AutoX, Safety Factor, 2018 Voluntary Safety Self-Assessment, p 21.

551 Waymo Voluntary Safety Self-Assessment, p 18.

least 4G standard. At present, 4G coverage in the UK is patchy: around 10% of motorways and 42% of A and B roads do not have a reliable signal.[552]

10.41 A second challenge in keeping maps up-to-date is incorporating changes in Traffic Regulation Orders (TROs). As discussed in Consultation Paper 2, TROs give local authorities wide powers to regulate the use of a given road, through (for example) one-way streets, priority lanes or parking restrictions. Yet often TROs are not in a digital, machine-readable format. The Department for Transport is carrying out a review, TRO Alpha, to create more digital TROs. The aim is to support a range of new services, including digital mapping for AVs.[553]

10.42 In consultation, the British Parking Association described digital TROs as "mission-critical".[554] They stressed that in addition to "a substantial one-off effort" to ensure that TROs are "fully digital and entirely accurate", there needs to be an ongoing maintenance duty. TROs change frequently and "TRO digital maintenance" is a new area for local authorities. As yet, we do not know how this process will work or how it will be funded. In our view, the in-use AV safety assurance scheme should help develop systems for communicating TRO changes to AVs accurately and promptly.

10.43 A third challenge is the cost of updating. HD maps may require an element of manual processing,[555] which can be expensive. In Consultation Paper 2, we noted that consumers who pay a significant purchase price for an AV may be faced with high and unpredictable updating and maintenance costs. These costs may not be subject to competitive pressure.[556] Thought will need to be given to the funding model for map updating.

Maps: implications for in-use safety assurance

10.44 At present, in UNECE countries, there are no legal mechanisms to compel map updates. This differs from the Californian approach. When applying for a permit to deploy an AV in California, a manufacturer must certify that it will make available updates "pertaining to location and mapping" where this is necessary for the safe operation of the vehicle.[557]

10.45 A future safety assurance scheme will need to ensure that maps are kept up-to-date, even if the updating process proves difficult or expensive. We provisionally propose that where maps are necessary for the safe and legal operation of an ADS, the ADSE

---

552 SMMT, *Connected and Autonomous Vehicles, 2019 Report* (2019) p 12, https://www.smmt.co.uk/wp-content/uploads/sites/2/SMMT-CONNECTED-REPORT-2019.pdf.

553 Department for Transport, *Traffic Regulation Order Data Model (TRO-DM) Alpha/Beta*, https://www.digitalmarketplace.service.gov.uk/digital-outcomes-and-specialists/opportunities/12691. For further discussion, see CP2, paras 7.4 to 7.23.

554 For a discussion of the issues involved, see Analysis of responses to CP2, paras 7.7 to 7.36.

555 Waymo state that it has automated most of the process, but not all: "Every time our cars detect changes on the road, they automatically upload the data, which gets shared with the rest of the fleet after, *in some cases, being additionally checked by our mapping team*." (emphasis added). See The Waymo Driver Handbook 21 September 2020, at https://blog.waymo.com/2020/09/the-waymo-driver-handbook-mapping.html.

556 CP2, paras 5.54 to 5.59. For responses on this issue, see CP2 Analysis, paras 5.102 to 5.103.

557 Californian Code of Regulations, section 228.06, 9B.

should be under a duty to keep maps up-to-date. Ensuring compliance with this duty would be the responsibility of regulators under our proposed enhanced scheme for in-use safety assurance.

CONSUMER INFORMATION AND MARKETING

The importance of consumer information

10.46 Consumers receive information about vehicles from many sources, including marketing, the "sales pitch" during a test drive and the owner's manual. The message given at each stage needs to reinforce an accurate understanding of what the vehicle can (and more importantly, cannot) do. If a vehicle's capabilities are overplayed during marketing, subsequent warnings about system limitations will be less effective.

10.47 The importance of quality information to consumers is highlighted in a recent European Commission study:

> One of the most important tasks is the avoidance of known operator errors, such as mode confusion, automation surprises and overreliance….[A]greement regarding the minimum requirements for information to be presented to the driver in order to promote user understanding and trust are essential to protect road safety.[558]

10.48 Drivers have already become confused about the capabilities of vehicles on the market today. The ABI and Thatcham summarise the evidence as follows:

> For example, [one study] [559] found that 7 in 10 drivers believed that they can purchase a car today that can drive itself. [Another study][560] found that even the name of systems was important. Almost half of drivers thought it was safe to remove their hands from the wheel of a system named autopilot compared to just over 20% for one named traffic jam assist. Six percent thought it would be ok to take a nap with an autopilot system compared to 3% for other names.[561]

10.49 In response to our first consultation, many respondents agreed that there should be greater oversight of how automated features are marketed. Thatcham saw "a real need for "more coherent messaging from manufacturers".[562] We agree. Communicating information about system functionality may be safety critical. Users

---

558 European Commission, Study on the effects of automation on road user behaviour and performance, 14 October 2020, at https://op.europa.eu/en/publication-detail/-/publication/6d947c46-140d-11eb-b57e-01aa75ed71a1.

559 Euro NCAP, Testing Automation, www.euroncap.com (2018).

560 Teoh, E, What's in a name? Drivers' perceptions of the use of five SAE level 2 driving automation systems, Insurance Institute for Highway Safety (2019).

561 ABI/Thatcham, Defining Safe Automated Driving (2019), https://www.abi.org.uk/globalassets/files/publications/public/motor/2019/defining-safe-automation-technical-document-aug-2019.pdf, p 18.

562 ABI/Thatcham, *Assisted and Automated Driving Technical Assessment* (June 2018).

need clear and memorable information about the limits of a vehicle's operational design domain.

Diffuse institutional arrangements

10.50 Although there are powers to regulate marketing, the institutional structures are diffuse. At present, marketing terms are not considered as part of the type approval process. In Consultation Paper 1 we highlighted the debate following the decision by the Dutch type approval authority, RDW, to approve the Tesla autopilot system. When challenged that the term "autopilot" might suggest that drivers could use the system without monitoring, RDW explained that they approved technical aspects, not names.[563]

10.51 As we discussed in Chapter 9, consumer information has an important role in market surveillance. The General Product Safety Regulations 2005 require producers to provide consumers with information, enabling them to assess risks which are not "immediately obvious without adequate warnings" and to take precautions.[564] Market surveillance authorities may require suppliers to mark the product with warnings which are "suitable, clearly worded and easily comprehensible".[565] They may also impose other conditions in the way that products are marketed.

10.52 Under the Consumer Protection from Unfair Trading Regulations 2008, traders are forbidden from making misleading statements or misleading omissions.[566] If they do, action can be brought against them by trading standards officers employed by local authorities.[567] Where advertisements are misleading or encourage irresponsible driving behaviour, it is also possible to complain to the Advertising Standards Authority (ASA). The ASA does not have formal statutory powers. However, it can publicise its rulings, require that an advertisement is withdrawn or amended and refer issues to Trading Standards for further action.[568]

10.53 In Germany, the issue has been approached as a matter of unfair competition. Recently, the Centre for Protection against Unfair Competition (Wettbewerbszentrale) took action against Tesla for its use of the word "autopilot". The Centre argued that the term, taken with associated marketing material, mislead customers into believing that the vehicles could drive autonomously. The court in Munich agreed and banned Tesla

---

563 Reuters, 17 October 2016, "Dutch Regulator weighs Tesla's use of "Autopilot" name". See https://www.reuters.com/article/us-tesla-netherlands-idUSKBN12H1EK - discussed at CP1, para 4.39.

564 General Product Safety Regulations 2005 (SI 2005 no 1803), reg 7.

565 General Product Safety Regulations 2005 (SI 2005 no 1803), reg 12.

566 SI 2008 No 1277, regs 5 and 6. The 2008 Regulations implemented the Unfair Commercial Practices Directive 2005/29/EC.

567 In Scotland the trading standards officer will make a report to the Procurator Fiscal who will bring the prosecution.

568 In March 2017, the ASA found that an advert by Jaguar Land Rover Ltd was irresponsible and encouraged unsafe driving. The advert claimed that the in-built technology in the car meant the driver could use their car as an extension of the workplace. ASA required Jaguar Land Rover Ltd not to show the advert again. See Advertising Standards Authority, *ASA Ruling on Jaguar Land Rover Ltd* (8 March 2017), https://www.asa.org.uk/rulings/jaguar-land-rover-ltd-a16-357750.html.

from repeating misleading claims.[569] In the US consumer rights groups have also urged the Federal Trade Commission to investigate whether the name “autopilot” is misleading.[570]

Consumer information: implications for in-service safety assurance

10.54 In consultation, many consultees thought that Trading Standards and the Advertising Standards Authority should continue in their present roles.[571] This involves responding to misleading marketing claims across sectors, including the automotive industry. We agree, and do not seek to change these arrangements.

10.55 However, AV safety raises concerns which go beyond those in other sectors. The technology is new and poorly understood yet, unless users understand what they must do, users may endanger not only themselves but other road users. Specialist expertise may be needed to identify when consumer misunderstandings are safety critical and to respond promptly.

10.56 Market surveillance authorities already have powers to require “suitable, clearly worded and easily comprehensible” warnings. They may also impose other conditions on how products are marketed, which might include preventing the use of some words.[572] However, we think this issue should be highlighted. We provisionally propose that regulators under the in-use AV safety assurance scheme should identify when safety requires individuals to understand what actions they should take. Regulators should then ensure that information about these actions is communicated in a clear and effective way and that any potentially misleading statements are removed.

Training

10.57 In our first consultation paper, we highlighted that additional driver training may become desirable for those using advanced driver assistance systems (ADASs). When asked, 69% of respondents felt that there was a need to provide drivers with additional training on ADASs.[573]

10.58 Training may also be desirable for users of ADSs. As discussed in Chapter 4, research suggests that humans require time to regain situational awareness when taking over the driving task at short notice. Some studies indicate that, even after control has been returned, it might take some time for the human to become completely comfortable with the control of a vehicle.[574]

---

569 https://www.bbc.co.uk/news/technology-53418069.

570 https://www.bbc.co.uk/news/technology-44225059.

571 CP1 Analysis paras 5.32 and 5.33.

572 General Product Safety Regulations 2005, reg 12(2).

573 CP1 Analysis.

574 VENTURER. *Trial 1: Planned Handover: technical Report*, 2017 available from https://www.venturer-cars.com/wp-content/uploads/2017/05/VENTURER-Trial-1-Planned-Handover-Technical-Report.pdf.

10.59 Some human factors experts also describe the importance of training a user's understanding or "mental model" of a given system. Relying on users to develop their mental model without first providing information about the limitations and functionality of a system can result in critical errors.[575] One study suggested that users are particularly prone to these errors in high-demand situations, such as during an emergency transition demand.[576]

10.60 Another pilot study on conditional driving automation found that behavioural training led to drivers being more likely to notice a hazard during transition when compared to a group that had only been given a user manual.[577] Whilst only a small pilot, the study shows that user training could be useful for mitigating some of the hazards of automation.

10.61 If training is seen as desirable, there is then a question about who is best placed to provide such training. In our first consultation paper we thought it premature to consider changes to the main driving test for ADAS as such systems were not yet widely used. Moreover, each manufacturer would have a different system, so it would be difficult to offer training on all the variables. These problems are even more acute when considering automated driving systems.

10.62 The responses to the Government's call for evidence on ALKS showed strong support for driver education. Many consultees thought that manufacturers would be best placed to provide training on their individual systems. They suggested a range of possible methods, including high quality training videos and online courses. One consultee suggested that a "demonstration mode" of the haptic and other warnings could be built into the system to enable learning.

10.63 In the previous section we noted that regulators under the in-use AV safety assurance scheme should identify when safety requires information to be communicated in a clear and effective way. As part of this exercise, the regulator should assess training information provided by the manufacturer. Below we propose that ADSEs should be under a general duty to communicate information about an ADS to users in a clear and effective way. Where necessary, this should include training (including, for example, demonstration videos).

COLLECTING AND COMPARING SAFETY DATA

10.64 In Chapter 5 we discussed both the importance and the difficulties of comparing the safety of AVs with that of human drivers. At present, road safety statistics provide reliable data about rare events (such as fatalities) but fewer data about common

---

575 A K Pradhan AK, G Pai, J Radadiya, M A Knodler, C Fitzpatrick and W J Horrey , "Proposed Framework for Identifying and Predicting Operator Errors When using Advanced Vehicle Technologies" (2020) 2674(10) *Transportation Research Record* 105.; E Shaw, D Large and G Burnett, Driver Training for Future Automated Vehicles: Introducing CHAT (CHeck, Assess and Takeover) (2020) London: RAC Foundation.

576 A K Pradhan AK, G Pai, J Radadiya, M A Knodler, C Fitzpatrick and W J Horrey , "Proposed Framework for Identifying and Predicting Operator Errors When using Advanced Vehicle Technologies" (2020) 2674(10) *Transportation Research Record* 105.

577 E Shaw, D Large and G Burnett, Driver Training for Future Automated Vehicles: Introducing CHAT (CHeck, Assess and Takeover) (2020) London: RAC Foundation.

events (such as minor collisions). Any system to compare safety will need to devise comparison measures and gather appropriate data for both automated and conventional driving.

Disengagement reports

10.65 One of the first measures used to assess safety were "disengagements". In California, for example, manufacturers must report the number of times a safety driver takes over (or the system otherwise disengages) for every 1,000 miles travelled.[578] These reports have been extensively criticised.[579] A "good" score may reflect many miles accumulated in easy conditions (such as open highways) rather than in challenging urban streets. Disengagement scores could even create perverse incentives by, for example, discouraging safety drivers from taking over even when doing so would be considerate to other road users.

Leading and lagging measures

10.66 The RAND Corporation has explored a range of alternative measures with which to assess safety.[580] In a 2018 report it aimed to find good safety measures, which are valid, reliable, feasible and non-manipulable.

10.67 The report differentiates between leading measures (proxy measures, recording instances of bad driving which could have led to harm) and lagging measures (recording outcomes which have led to actual harm). While lagging measures (such as counting casualties) provide the most accurate reflections of safety, they are rare events and, by definition, have resulted in harm. By contrast, leading measures (such as failures to follow road rules or "near-miss" events) can act as warnings.

10.68 One possible leading measure is to collect data on traffic infractions, particularly those which are closely related to safety, such as running red lights. We return to this in the following chapter.

10.69 Another approach is to look at "roadcraft". This is defined as not creating a hazard to other road users and responding well to hazards created by others. One attempt to measure roadcraft is the safety envelope used by Intel Mobileye in its system of Responsibility Sensitive Safety. This involves asking whether the AV maintained a safe distance from vehicles in front and to the side; gave way appropriately; and exercised caution when its perception was limited. Another approach is to count

---

578 See California Code of Regulations, s 227.50. "Disengagement" is defined as a deactivation of the autonomous mode when a failure of the autonomous technology is detected; or when the safe operation of the vehicle requires that the autonomous vehicle test driver disengage the autonomous mode;, or in the case of driverless vehicles, when the safety of the vehicle, the occupants of the vehicle, or the public requires that the autonomous technology be deactivated.

579 For criticism of these metrics see for example https://www.theverge.com/2020/2/26/21142685/california-dmv-self-driving-car-disengagement-report-data; Aurora and Uber Voluntary Safety Self-Assessments; Grace Strickland and John McNelis, Autonomous vehicle reporting data is driving AV innovation right off the road, Techcrunch 4 August 2020.

580 Laura Fraade-Blanar, Marjory S. Blumenthal, James M. Anderson, Nidhi Kalra, Measuring Automated Vehicle Safety, Forging a Framework, RAND Corporation (2018), https://www.rand.org/pubs/research_reports/RR2662.html.

"safety-critical incidents" where, should each road user's course remain unchanged, a crash would occur.

10.70 Each measure has its own strengths and weaknesses. The RAND report recommends a framework which incorporates a variety of measures. For lagging measures, this involves counting deaths, serious injuries and other collisions. For leading measures, it also involves collecting data on safety envelope violations, disengagements and safety-related traffic infractions.[581]

10.71 An important element of implementing these measures is to have comparisons with conventional vehicles. This requires collecting both event data (such as infractions) and exposure data (such as miles driven). This might, for example, involve placing unobtrusive sensors on conventional vehicles in a variety of defined operational design domains.

Measuring across software updates

10.72 All the lagging and leading measures are collected over time: they assume that the system is steady. Yet driving behaviour may change with each software update. The Rand report comments that "upgrades and updates present a large challenge to measuring AV safety using exposure-based measures".[582]

10.73 In theory, measures could be recalculated for each major upgrade. However, it is more likely that a series of small changes could have a significant cumulative effect. The RAND Corporation's preferred approach is to use a moving or weighted average for safety performance across each upgrade or change.[583]

Ecosystem measures

10.74 RAND also sees merit in measuring the impact of AVs on the broader ecosystem.[584] For example, traffic in areas with AVs may become calmer and more predictable or (possibly) more frustrated and risk-taking. AVs might encourage more cycling and walking (or might even discourage it). One way forward would be to compare overall incident rates and road use between areas with AVs and those without.[585]

Comparing data: implications for in-use AV safety assurance

10.75 In Chapter 5 we described measuring comparative safety as essential if the public are to have faith in the technology. However, these comparisons are far from easy.[586] A range of measures will be required, so that comparisons are sufficiently robust to withstand public scrutiny. There are also challenges in data collection, with a need to

---

581 RAND, Measuring Automated Vehicle Safety, Forging a Framework (2018), Table 3.4, p 41.

582 RAND, Measuring Automated Vehicle Safety, Forging a Framework (2018), p 45.

583 RAND, Measuring Automated Vehicle Safety, Forging a Framework (2018), pp 44-46.

584 RAND, Measuring Automated Vehicle Safety, Forging a Framework (2018), p 46.

585 Comparisons could also be made between areas with varying concentrations of automated vehicles.

586 We note that the International Telecommunication Union's FG-AI4AD focus group, is currently exploring how such comparisons might best be made. See https://www.itu.int/en/ITU-T/focusgroups/ai4ad/Pages/default.aspx.

collect data for both AV and conventional vehicles, covering both events and exposure.

10.76 In our view this will require specialist, dedicated expertise over a period of time. We provisionally propose that scheme regulators should be under a statutory duty to devise measures to compare the safety of automated and conventional vehicles. They will need sufficient powers to collect the required data.

PROPOSALS

The continuing duties of an ADSE

10.77 In Chapter 8 we proposed that every ADS which is categorised as “self-driving” should be backed by an entity (or ADSE). The ADSE would be registered with the safety assurance scheme as taking responsibility for the system. We see the ADSE as having duties to ensure that an ADS continues to operate in a safe and law-abiding way. In particular, an ADSE should be under a duty to ensure that software and maps are kept up-to-date. We ask consultees if they agree.

An enhanced scheme to assure AV safety in-use

10.78 In Chapter 9 we noted the existing powers to establish a market surveillance scheme that is responsible for the in-use safety assurance of automated vehicles. Under the General Product Safety Regulations 2005, a safety regulator could receive complaints and work with manufacturers to resolve problems. It would have formal powers to issue recall notices; to suspend or prohibit the supply of AVs; or to require warnings about how they are used. It could also bring criminal prosecutions[587] against producers and distributors who supply unsafe products.

10.79 This forms the basis of our proposed in-use AV safety assurance scheme. As we explained in Chapter 9 there are many aspects of the current scheme which we wish to retain. As at present, regulators under the scheme should have wide responsibilities, not only for safety but also to ensure that AVs comply with the law and do not endanger “any other aspect of public interest protection”.[588] Regulators should also exercise the current powers to issue recall notices, to suspend or prohibit AVs from being used on the road and to prosecute producers and distributors who supply unsafe products.

10.80 However, AVs also bring new challenges, which require new responsibilities and new powers. We have discussed five of these challenges here. In the following chapter we consider two more: the need to investigate and sanction breaches of traffic rules and the need to investigate and learn from collisions.

10.81 To respond to these challenges, we provisionally propose legislation to provide an enhanced scheme to assure AVs when they are in-use on the roads. In our view, the scheme requires additional statutory responsibilities and powers. We therefore seek views, both on the principle of an enhanced scheme and on what the additional responsibilities and powers should be. The scheme will also need to include powers to

[587] In Scotland it could provide a report to the Procurator Fiscal or Crown Office with a view to prosecution by either the Fiscal or the Lord Advocate.

[588] EU Regulation 765/2008 on Accreditation and Market Surveillance, art 2.17.

obtain data, which we discuss in Chapter 17. To back up these powers, we think that regulators should be able to apply a range of flexible sanctions, as discussed in Chapter 11.

Consultation Question 17.

10.82 We provisionally propose that legislation should establish a scheme to assure the safety of automated driving systems following deployment, giving scheme regulators enhanced responsibilities and powers.

Do you agree?

Consultation Question 18.

10.83 We provisionally propose that the enhanced scheme should give regulators the following responsibilities and powers:

(1) scheme regulators should be responsible for comparing the safety of automated and conventional vehicles using a range of measures;

(2) to do this the regulator should have power to collect information on:

(a) leading measures (instances of bad driving which could have led to harm) and

(b) lagging measures (outcomes which led to actual harm);

(3) regulators should have the power to require an ADSE:

(a) to update software where an update is needed to ensure safety and continued compliance with the law;

(b) to keep maps up-to-date, where an AV relies on maps to ensure safety and compliance with the law;

(c) to communicate information about an ADS to users in a clear and effective way, including where necessary through training.

Do you agree?

Consultation Question 19.

10.84 We welcome views on the following issues:

(1) Should scheme regulators be empowered to approve software updates that apply only within the UK, without requiring the manufacturer to return to the original type approval authority?

(2) Should the scheme also deal with cybersecurity?

(3) Are other powers needed? (Note that data is discussed in Chapter 17.)

Institutional arrangements: one body or two?

10.85 As we discussed in Chapter 9, EU law requires that approval authorities and market surveillance should function independently. If they are part of the same organisation, their activities must be "managed autonomously as part of separate structures".[589]

10.86 The UNECE has taken a different approach. The UN Office of Legal Affairs has advised Working Party 29 that while the 1958 Agreement is "primarily" about type approval before vehicles are placed on the market, the 1958 Agreement "does not limit the time when controls can be done and when non-compliance can be found".[590] Therefore type approval authorities can both issue initial approvals and take action on an ongoing basis[591] This means that where a system no longer complies with a regulation it was approved under, the issuing type approval authority can withdraw approval. Additionally some regulations require the manufacturer to periodically report certain information to the original type approval authority.[592] In this sense, type approval authorities already have some in-use responsibilities for systems they approve. However these responsibilities can be differentiated from market surveillance schemes which survey all vehicles on the market regardless of who issued the type approval.

10.87 Great Britain now has freedom to decide its own policy on the best institutional structure. After the end of the transitional period, Parliament may repeal the EU provision. Similarly, the guidance from the UN Office of Legal Affairs clarifies that any

589 Regulation 2018/858, art 6(1), discussed in Ch 9.

590 Note by the Secretariat, The 1958 Agreement and lifetime/lifecycle considerations, presented to the 180th WP.29, 10-12 March 2020 at https://www.unece.org/fileadmin/DAM/trans/doc/2020/wp29/WP29-180-18e.pdf, para 13.

591 As discussed in Ch 9, the Road Vehicles (Approval) Regulations 2020 allow the Secretary of State through the responsible agency to both approve systems and impose civil penalties if infringements are subsequently found.

592 The ALKS regulation, for example, requires that the manufacturer report in-service issues to the type approval authority which approved the system.

contracting party to the revised 1958 Agreement may agree or disagree to adopt ongoing provisions, on a case by case basis".[593]

10.88 The question, therefore, is whether to use one body or two. Should Great Britain establish a single safety assurance scheme to undertake safety checks both before and after AVs have been placed on the road? Alternatively, should the scheme to assure safety while AVs are in use be kept separate from type approval authorities, which largely consider safety before deployment?

Arguments for a single body

10.89 When we consulted on this issue in 2018, most consultees favoured a single body. Out of 120 consultees, 87 (73%) agreed that the agency which approves the ADS should also be responsible for ongoing safety assurance.[594] The reasons for favouring a single body were that it would bring together expertise and would stop problems from falling between demarcation lines. As Bryan Reimer said:

> The agency should have oversight over all software, hardware changes, recalls etc. Only an agency that has records of testing during design and development can effectively assess if a software update or hardware change is being completed and tested according to the initial design tests or needs additional testing is needed etc.

10.90 Similarly, Richard Sarginson said that "split responsibility seems likely to sow the seeds for mistakes and a lack of co-ordination".[595]

Arguments for separate bodies

10.91 Regulation 2018/858 states that approval authorities and market surveillance authorities should not be linked "to avoid potential conflicts of interest". The fear is that the authority which approved an ADS might be reluctant to accept that it is dangerous. It might even have established a close working relationship with the manufacturer, and therefore be subject to "regulatory capture".[596] New, fresh thinking might be required from a separate agency.

10.92 On the other hand, a separate market surveillance authority may also be reluctant to believe that that the original approval was flawed - thinking (possibly wrongly) that issues have already been checked. Regulatory capture is an issue in both models. Other mechanisms might mitigate the risk of its occurrence, such as duties to consult or an advisory committee that brings in a range of external interests (such as road user and safety groups).

---

593 Note by the Secretariat, The 1958 Agreement and lifetime/lifecycle considerations, presented to the 180th WP.29, 10-12 March 2020 at https://www.unece.org/fileadmin/DAM/trans/doc/2020/wp29/WP29-180-18e.pdf, para 31.

594 Automated Vehicles: Analysis of Responses to the Preliminary Consultation Paper (2019) Law Commission Analysis of Responses to LCCP No 240/SLCDP No 166, para 5.8.

595 Analysis of Responses to the Preliminary Consultation Paper (2019), paras 5.10-11.

596 Regulatory capture describes the phenomenon where regulatory bodies become too close or too aligned with the industry or interests they are tasked with regulating.

10.93 Another argument is that a "two body" structure builds on the expertise that already exists. At present, in the UK, type approval is a matter for the Vehicle Certification Agency (VCA) while vehicle approval and continuous compliance examinations together with market surveillance and vehicle recalls are carried out by the Driver and Vehicle Standards Agency (DVSA). Several other respondents praised the high reputation of these agencies and saw no compelling reasons for change. For example, the RAC Foundation commented:

> There appears to us to be no compelling safety reason why these two functions should necessarily be combined in a single agency - they are akin to functions currently split between the DVSA and the VCA.

10.94 However, it added that one might come to a different answer "as a matter of operational efficiency", as the testing and auditing regime developed.

10.95 The Society of Motor Manufacturers & Traders (SMMT) said:

> These agencies have a reputation for competence and fairness, which are essential for ensuring fair competition and adequate choice for consumers, including in servicing and repairing automated vehicles. Duplication of roles and responsibilities is highly undesirable, as it creates confusion and economic inefficiencies.

10.96 Similarly Uber "cautioned against moving too quickly to make major structural changes to regulate this technology while it is still under development", noting that:

> establishing any such an agency… would require significant resources to implement in a way that does not delay the introduction of these safety-related technologies from being introduced onto public roads.

10.97 The main argument, therefore, for retaining two bodies is that it would allow the UK to respond more quickly to the introduction of AVs by building on expertise and organisational structures that already exist. Although there is a danger that issues may slip between the two bodies, this danger could be overcome by close working relationships. The DVSA already work closely with the VCA to make determinations on whether a vehicle complies with type approval requirements. These ties could be strengthened.

Question: one body or two?

10.98 Much has happened since our 2018 consultation, with new UNECE Regulations on software updating and the possibility of vehicles that meet the test for self-driving. Given these developments, we are reconsulting on this issue. We welcome views on whether all safety assurance duties should be combined in a single body, or whether pre-deployment safety assurance should be separated from the in-use safety assurance scheme.

10.99 We also welcome views on how to guard against regulatory capture by ensuring that regulators are open to wider views. This might include formal duties to consult or an advisory committee that brings in road user and safety groups.

Consultation Question 20.

10.100 Should the authority administering the scheme to assure safety while automated vehicles are in use be kept separate from type approval authorities (as is already the case)? Alternatively, should both functions be combined in a single body?

Consultation Question 21.

10.101 What formal mechanisms could be used to ensure that the regulator administering the scheme is open to external views (such as duties to consult or an advisory committee)?

Chapter 11: Investigating traffic infractions and collisions

11.1 In Chapter 10 we looked at some of the challenges facing a scheme to assure the safety of automated vehicles (AVs) while they are in service on the roads. Here we consider two further challenges. The first is how to deal with breaches of traffic rules. The second is how to learn from collisions, so as to promote a safety culture.

11.2 In both cases, we propose a move away from the current emphasis on the criminal prosecution of human drivers. Instead, we propose that the in-use safety assurance scheme should investigate breaches of traffic rules and apply a flexible range of regulatory sanctions.

11.3 We also identify a need to learn from collisions in a way that promotes a culture of safety. We propose a small specialist investigation unit to analyse data on collisions involving automated vehicles. It would also investigate the most serious, complex or high-profile collisions and make recommendations to improve safety without allocating blame.

A ROBOT DRIVING LICENCE?

11.4 Traditionally, the law on vehicle standards deals with products rather than behaviour. Drivers on the other hand, are regulated through a system of driver licensing. Driver licensing starts with a driving test, but it does not end there. Those who break the law may be subjected to civil penalties and fixed penalty notices or sent on retraining courses. Alternatively, they may be prosecuted through the criminal courts, resulting in penalty points on their licence, fines, disqualification, community service or even imprisonment.

11.5 These sanctions are imposed on a large scale. In England and Wales in 2018, the police recorded 2.5 million motoring offences, mostly (85%) of exceeding speed limits. Out of the 2.5 million cases, 45% resulted in driver retraining (usually a speed awareness course); 40% in a penalty payment; and 15% in further court action.[597] In addition, local authorities are estimated to have issued over two million penalty charge notices relating to bus lane, box junction and other moving traffic infringements.[598]

---

597 Home Office National Statistics, *Police powers and procedures: England and Wales, year ending 31 March 2019*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/841408/police-powers-procedures-mar19-hosb2519.pdf, p 39. In relation to Scotland there were 27,504 convictions in 2018-19 for motor vehicle offences, of which around 89% resulted in a fine, 4% in a community payback order, 4% in an admonition, and 1.5% in a prison sentence: Scottish Government, Criminal Proceedings in Scotland, 2018 – 2019, https://www.gov.scot/publications/criminal-proceedings-scotland-2018-19/pages/42/, p 68.

598 Based on research by Dr Adam Snow, the RAC Foundation estimated 2.5 million bus lane and moving traffic PCNs in 2015: see RAC Foundation, Drivers receiving 12 million penalties annually, (2017) https://www.racfoundation.org/media-centre/drivers-receiving-12-million-penalties-annually.

There were nearly 90,000 Bus Lane Charge Enforcement Notices issued by Glasgow City Council in 2018/19.[599]

11.6 One advantage of AVs is that they should be considerably more law abiding. Much of this enforcement may no longer be necessary. However, infractions may still occur. The legal framework will need to include a system for dealing with traffic rule infractions by an ADS. Should we be thinking in terms of a robot driving licence - with retraining, fines, points and possible disqualification?

11.7 Several jurisdictions have described a regulatory system for automated vehicles through an analogy with human driving licences. For example, in 2018, the Dutch infrastructure minister announced a legal framework for AVs in the following terms:

> So I'm creating a legal framework for automated driving. Laying down requirements for reliability and safety that cars must meet before they can hit the road. A driving licence for self-driving cars, if you like. Not for the driver – but for the car itself![600]

11.8 The system was developed in cooperation between the Dutch Vehicle Authority (RDW), the main road authority (Rijkswaterstaat) and the central office for driving exams (CBR).[601] However, it may be many years before an AV driving licence is awarded.[602]

11.9 In the previous chapter we provisionally proposed that an Automated Driving System Entity (ADSE) should be under a continuing duty to ensure that an Automated Driving System (ADS) acts safely and in compliance with the law. This proposal has many points of similarity with human driver licensing. Both ADSE continuing duties and the regulation of human drivers include elements of ongoing monitoring as well as one-off approval. Furthermore, both ADSEs and drivers should be subject to a series of graduated sanctions for traffic rule infractions. In both cases, the sanctions should include retraining/software updates; fines; a way of cumulating multiple small infractions (as with licensing "points"); and disqualification/withdrawal of authorisation.

11.10 However, the analogy can only be pursued so far. Individuals and companies do not respond to sanctions in the same way. We are not suggesting that the ADSE whose ADS exceeds the speed limit should be sent on a speed awareness course, issued with a fixed penalty notice of £100 or given three points on its licence. Nor do we think

---

599 Information and Data Protection Team, Response to Request Under the Freedom of Information (Scotland) Act 2002, (February 2020): Whatdotheyknow.com/request/646244.

600 Speech given by Cora van Nieuwenhuizen, Minister of Infrastructure and Water Management on 20 March 2018 available at https://www.government.nl/documents/speeches/2018/03/26/speech-by-cora-van-nieuwenhuizen-minister-of-infrastructure-and-water-management-at-the-opening-of-intertraffic-amsterdam-20-march-2018.

601 KPMG 2019 AV Readiness Index, at https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/2019-autonomous-vehicles-readiness-index.pdf, p 14.

602 The KPMG AV Readiness Index for 2020 reports problems in solving edge cases; see https://assets.kpmg/content/dam/kpmg/xx/pdf/2020/07/2020-autonomous-vehicles-readiness-index.pdf.

that an ADS which wrongfully stops in a box junction should necessarily lead to the ADSE being fined £130.

11.11 Instead, breaches of traffic rules by an ADS should be seen as an early warning sign. It is important to learn from what went wrong and stop it happening again. If, however, infractions persist and the ADSE fails to update software and maps appropriately, then greater penalties should be imposed, that reflect the seriousness of the situation.

A NEW SYSTEM OF SANCTIONS FOR BREACH OF TRAFFIC RULES

11.12 In Consultation Paper 1 we proposed that the human in the driving seat should no longer be liable for any dynamic driving offences committed when a vehicle is driving itself. This led to the question of what should happen if a vehicle carries out a manoeuvre which (if done by a human) would amount to an offence.

Speeding: an example

11.13 In Consultation Paper 1 we gave the example of speeding. Although the ADS would be programmed not to exceed speed limits, speeding offences may still occur, for a variety of reasons. For example, the highway authority may have failed to communicate a temporary speed limit; the person responsible for the vehicle may have failed to update the software (or may have uploaded unauthorised software); or the system may be faulty.

11.14 Under the current law, if a speed camera detects a vehicle driving at 37 miles an hour in a 30 mile an hour area, the police serve "a notice of intended prosecution" on the registered keeper. We tentatively proposed that if a vehicle was driving itself at the time, the registered keeper should be required to say so, and to provide the relevant data to the police.[603] The police would then investigate why the speeding infringement occurred. The issue might be resolved by liaising with the Highway Authority[604] to provide better traffic signs. Alternatively, a prosecution might be brought against the owner for failing to update software or for installing unauthorised software.

11.15 If the problem appears to lie with the software itself, we proposed that the issue should be submitted to the new safety assurance scheme. The regulator under the scheme would then investigate what has gone wrong. The regulator under the scheme would have power to impose a range of graduated sanctions on the ADSE.

11.16 Speeding is only one example. We asked if a similar approach should apply whenever an ADS causes a vehicle to behave in a way which would be an offence if done by a human driver.

Regulatory investigation

11.17 There was widespread agreement that where an offence appears to have been caused by an ADS, the police should refer the matter to a regulatory authority for investigation. Of the 101 consultees who responded, 84 consultees (83%) agreed and only six disagreed. Consultees thought that the regulatory authority would have

---

603 CP1, paras 7.23 to 7.35.

604 Roads Authority in Scotland.

specialist expertise and would be able to bring about quick improvements to the system.

11.18 These proposals remain part of our proposed scheme. If a traffic rule infraction appears to have been caused by an ADS, we provisionally propose that the matter should be investigated by the in-use safety assurance scheme. As the RAND Corporation's paper has argued, traffic infractions are an important leading indicator of safety concerns.[605] Many infractions raise direct safety concerns: examples are speeding; running red lights; going against the flow in one-way streets; or observed instances of careless or dangerous driving. We think that if these behaviours are observed it is essential that the in-use safety assurance scheme is notified, so that action can be taken immediately. The scheme should then have a range of sanctions, explored below.

Other contraventions

11.19 In response to Consultation Paper 1, several consultees asked what would happen in the event of other traffic contraventions, enforced through civil penalties. In a joint response, PATROL[606] and the Traffic Penalty Tribunal emphasised that civil enforcement is not confined to parking but includes the use of bus lanes, moving traffic restrictions (such as box junctions) and failures to pay road charges and tolls.

11.20 Contraventions such as the wrongful use of bus lanes may not be safety critical, but they are against the public interest. They are also evidence that something has gone wrong with an ADS. Most systems of market surveillance are not confined to safety in a narrow sense. They also consider other ways in which products may infringe the public interest. In our view, the in-use assurance system should also look at issues of wider public interest. This would include taking action against vehicles that infringed traffic rules by misusing priority lanes or impeding traffic flow.

The alternative view

11.21 We are aware of an alternative view, namely that if an ADSE is not subject to the same penalties as a human driver they could be seen as "getting away with it". Drivers often express concerns that signage is confusing, causing them to enter bus lanes or box junctions by mistake.[607] It has been said that if humans are fined in these circumstances, an ADSE should face the same fine.

---

605 See Ch 10.

606 Parking and Traffic Regulations Outside London, a joint committee representing over 300 local authorities in England (outside London) and Wales.

607 For concerns about so-called "moneybox junctions" see This is Money, *Watch out! 'Money box' junctions that fleece drivers are spreading across Britain: Stray into one and you face a £130 fine* (2020) https://www.thisismoney.co.uk/money/cars/article-8725397/Money-box-junctions-Stray-one-face-130-fine.html; Daily Mail, *EXCLUSIVE - The 'moneybox junction' earning grasping council £1.9 MILLION a year: Camera catches twice as many drivers in month after rat run road shut* (2020) https://www.dailymail.co.uk/news/article-7869701/Moneybox-junction-earns-grasping-council-1-9-MILLION-year-CCTV-catches-twice-number-drivers.html; and The Mirror, *This notorious 'money-box' junction has raked in £12 million in fines in just 6 YEARS* (2016) https://www.mirror.co.uk/news/uk-news/notorious-money-box-junction-raked-9036632.

11.22 However, human drivers and ADSEs do not respond to penalties in the same way. For an ADSE, paying a £130 fine is unlikely to achieve greater compliance. In some cases, a series of fines may be excessive – such as where the problem results from a local authority's failure to publicise its traffic regulation orders in a digitally accessible format. In other cases, the penalty may be far too low. The ADSE may find it easier and cheaper simply to pay the fine rather than to address the underlying issue. Applying driving fines to an ADSE would not promote a learning culture; nor would it address failures to update software and maps.

11.23 Instead, we provisionally propose that all traffic infractions which appear to have been caused by an ADS should be considered by the in-use scheme, even those which are not related to safety. In other words, all infractions would be dealt with through a graduated system of regulatory sanctions. In some cases, the in-use safety assurance scheme might find that the reason for the infraction is poor signage or inconsistent rules (where, for example, it is not possible to see the exit before entering a box junction). In these cases, we do not think that applying a penalty would be appropriate. Instead, we hope that improvements in signage and rules will benefit both AVs and human drivers.

Consultation Question 22.

11.24 We provisionally propose that a statutory scheme to assure AVs in-use should:

(1) investigate safety-related traffic infractions (such as exceeding the speed limit; running red lights; or careless or dangerous driving);

(2) investigate other traffic infractions, including those subject to penalty charge notices;

(3) if fault lies with the ADSE, apply a flexible range of regulatory sanctions.

Do you agree?

THE RANGE OF REGULATORY SANCTIONS

11.25 In Consultation Paper 1 we proposed an ADSE should be subject to a range of regulatory sanctions, including improvement notices, fines and suspension or withdrawal of ADS approval. There was widespread agreement. Of the 102 consultees who responded, 91 (89%) agreed and only 4 disagreed. It was felt that regulatory sanctions would be more tailored and nuanced and could respond to a pattern of incidents rather than isolated occurrences.[608]

11.26 Here we draw on experience in other sectors to explain the conceptual shift from criminal to regulatory sanctions and to consider the range of sanctions that might be needed. We propose that the legislation should provide for a wide range of

[608] CP1 Analysis, paras 7.57 to 7.77.

discretionary sanctions, to provide regulators with flexibility in responding to new concerns.

The move from criminal prosecution to regulatory sanctions

11.27 Traditionally, many regulatory systems have relied on enforcement through the criminal courts. However, the use of criminal law for relatively minor regulatory breaches is problematic. Crimes carry a strong social stigma. Therefore, criminal sanctions are best used to allocate blame and punish behaviour that is morally condemned. If the goal is to change behaviour rather than express moral disapprobation, regulatory sanctions may be more effective.

11.28 In 2010 the Law Commission published a paper on how criminal enforcement and regulatory sanctions should be used in a regulatory context.[609] It found that in practice, many regulatory offences are never used, subjecting businesses “to illusory and empty threats”.[610] This is because bringing a criminal prosecution is expensive, takes a long time and produces very uncertain outcomes.[611] Even if the defendant is found guilty “sentencing judges do not have the specialist knowledge” needed to impose “appropriate and proportionate sanctions”.[612] The result may be a small fine which does little to deter wrongdoing.

11.29 In an appendix, Professor Julia Black gave examples of failures to prosecute - and how even successful prosecutions can result in minor fines. An example would be a fine of £30,000 on a defendant paid £60,000 to dump toxic waste, which cost £167,000 to clean up. She contrasts this with fines measured in millions imposed by financial services regulators.[613]

11.30 The paper noted the wide and flexible range of non-criminal sanctions made available to regulatory bodies under the Regulatory Enforcement and Sanctions Act 2008. These include fixed monetary penalties, stop notices or enforcement undertakings (by which the business agrees to take specific actions to prevent a problem from reoccurring or restore the damage caused). Sanctions such as these enable a more proportionate, speedy response to regulatory breaches. They can be flexible and targeted in their design and implementation, producing “higher probabilities of sanctioning and, in turn, higher levels of deterrence”.[614]

11.31 On this basis, the Law Commission made the following proposal:

> The criminal law should only be employed to deal with wrongdoers who deserve the stigma associated with criminal conviction because they have

---

609 Criminal Liability in Regulatory Contexts: A Consultation Paper (2010) Law Commission Consultation Paper No 195, http://www.lawcom.gov.uk/app/uploads/2015/06/cp195_Criminal_Liability_consultation.pdf.

610 Above, para 1.27.

611 Above, para 1.32.

612 Above, para 1.7.

613 ‘A Review of Enforcement Techniques – Professor Julia Black’, Criminal Liability in Regulatory Contexts: A Consultation Paper (2010) Law Commission Consultation Paper No 195, para A.16.

614 Above, para A. 21.

engaged in seriously reprehensible conduct. It should not be used as the primary means of promoting regulatory objectives.[615]

11.32 In Chapter 14 we discuss a new criminal offence to deal with seriously reprehensible conduct by those who take safety risks with automated vehicles. For the most part, however, we propose that the criminal offences normally associated with driving should not apply to an ADSE. Instead, there should be a wide and flexible range of regulatory sanctions. We look at the possible range in more detail below.

Warnings

11.33 Regulators make extensive use of warnings, which range from informal advice to formal cautions. Warnings can be effective in promoting compliance and do not require extensive administrative resources to administer.[616] However, warning notices are most effective when they are backed with credible threats of further sanction. As Macrory explains:

> advice and incentives should play a key role in ensuring regulatory compliance, and should normally be the first response of regulators. Nevertheless, an effective sanction regime plays an equally vital role in a successful regulatory regime. It underpins the regulator's advisory functions, and its very existence will often act as an inducement to compliance without the need to invoke the formal sanctions.[617]

11.34 Formal warnings are used in the financial sector. For example, the Financial Conduct Authority (FCA) is required to issue a warning notice if it is considering imposing a penalty on an authorised person.[618] The recipient then has the right to make representations to the FCA. In the light of these representations, the FCA decides whether to issue a decision notice.[619]

11.35 In response to Consultation Paper 1, several respondents stressed that the regulator should start with a co-operative approach. There may be many reasons why problems have occurred, from the user's failure to update; to overgrown signs; to difficulties in communicating traffic regulation orders. The system should allow for discussion and informal advice as well as more formal warnings. We agree.

Financial penalties

11.36 Financial penalties are commonly used for regulatory sanctions. They have four main purposes.

---

[615] Criminal Liability in Regulatory Contexts: A Consultation Paper (2010) Law Commission Consultation Paper No 195, Proposal 1.

[616] Criminal Liability in Regulatory Contexts: A Consultation Paper (2010) Law Commission Consultation Paper No 195.

[617] Richard Macrory, *Regulatory Justice: Making Sanctions Effective Final Report* (November 2006), para 1.11, https://webarchive.nationalarchives.gov.uk/20121205164501/http:/www.bis.gov.uk/files/file44593.pdf.

[618] Financial Services and Markets Act 2000, s 207.

[619] Financial Conduct Authority, *The Decision Procedure and Penalties manual*, (December 2020) https://www.handbook.fca.org.uk/handbook/DEPP.pdf.

(1) *Redressing unfair advantage*: sanctions can ensure that businesses which have saved costs through non-compliance do not gain an unfair advantage over compliant businesses.

(2) *Recompensing for harms done*: where breaches result in damage to individuals or other costs for society, sanctions can provide recompense.

(3) *Condemnation*: sanctions can represent a societal condemnation of the regulatory breach.

(4) *Deterrence*: sanctions act as a deterrent to the sanctioned business and send a wider message to the regulated sector.[620]

11.37 Professor Black argues that the amount of the penalty should reflect the purpose it is trying to achieve. If the aim is to deter future conduct, the operator should not be better off by failing to comply.[621] If the aim is to provide recompense, the "polluter pays" principle should guide the appropriate level. Alternatively, the fine might seek to recover the profits accrued to operators through non-compliance. In those circumstances, the fine should track any profits gained.[622]

11.38 The purpose of the fine can also influence where the fine money goes. In the energy sector, for example, the legislation distinguishes between penalties and consumer redress orders. Penalties must be paid into the consolidated fund, to be used towards all Government expenditure.[623] Consumer redress orders, on the other hand, can be used to compensate customers affected by the consequences of a contravention.[624] Where "it is impractical to identify all affected consumers, payment could, for example, be ordered to a proxy group or to a suitable fund to recognise wider detriment to the market".[625] Following a power outage in August 2019, three energy firms agreed to pay £10.5 million into Ofgem's redress fund to compensate homes and businesses left without electricity.[626]

11.39 These competing rationales were evident when the DVSA sought to impose a fine on Volkswagen following the dieselgate scandal.[627] Volkswagen reportedly refused to pay £1 million to the Department for Transport to upgrade emissions testing. It argued that the monitoring process for which the fine would be used was not directly related to the

---

620 Richard Macrory, *Regulatory Justice: Making Sanctions Effective Final Report* (November 2006), para 1.12, https://webarchive.nationalarchives.gov.uk/20121205164501/http:/www.bis.gov.uk/files/file44593.pdf.

621 'A Review of Enforcement Techniques – Professor Julia Black*',* Criminal Liability in Regulatory Contexts: A Consultation Paper (2010) Law Commission Consultation Paper No 195, Appendix A.

622 Above.

623 Electricity Act 1989, s 27A(10) and Gas Act 1986, s 30A(10).

624 Electricity Act 1986, s 27G and Gas Act 1986, s 30G

625 Ofgem, *Enforcement Guidelines* (2017), https://www.ofgem.gov.uk/system/files/docs/2017/10/enforcement_guidelines_october_2017.pdf, p 60.

626 Ofgem, *Companies pay £10.5 million over 9 August power cut*, (January 2020), https://www.ofgem.gov.uk/publications-and-updates/companies-pay-105-million-over-9-august-power-cut.

627 We discuss the emissions scandal above at para 9.18.

breach, because it could involve monitoring products from all manufacturers. Volkswagen had already paid £1.1m towards the cost of retesting existing cars.[628]

11.40 In our provisional view the legislation on automated driving should include provision for both fines and redress orders. Fines should be paid to the Consolidated Fund and should be used to deter and condemn.

11.41 Redress orders would not be needed to recompense individual victims, who would be paid by the insurer under section 2 of the Automated and Electric Vehicles Act 2018. However, redress orders could be used for other forms of compensation. For example, if automated vehicles repeatedly misused bus lanes, a redress order could compensate bus passengers for longer journey times.[629] Alternatively, owners might be unable to use automated features in their vehicles because of inordinate delays in producing mapping and software updates. In these circumstances, a redress order could compensate owners.

Compliance orders

11.42 A compliance order requires a business to take steps to bring itself back into compliance. For example, a business may make good a piece of unsafe equipment by changing a process or providing training.[630]

11.43 In the field of consumer protection, many enforcement powers are designed to stop businesses from doing something. For example, regulators may seek an injunction or interdict to stop a business from using unfair terms;[631] or they may apply to a court for an enforcement order to prevent a business from breaching the Consumer Protection from Unfair Trading Regulations 2008.[632]

11.44 However, some enforcement powers also can be used to require businesses to take positive action. For example, Part 4 of the Enterprise Act 2002 enables the Competition and Markets Authority (CMA) to conduct market investigations into markets with suspected competition problems. The Act gives the CMA powers to take remedial action by, for example, requiring activities to be carried on separately from any other activities. Paragraph 10(2) of Schedule 8 sets out a power which has resonance in an AV context:

> An order may require a person who is supplying… goods or services to supply such goods or services to a particular standard or in a particular manner or to

---

628 Autocar, *Volkswagen declines to pay £1m DfT post-dieselgate bill,* (2017) https://www.autocar.co.uk/car-news/industry/volkswagen-declines-pay-%C2%A31m-dft-post-dieselgate-bill.

629 An order could be directed at a specified category of consumers (eg all consumers served by a particular company) or an appropriate charity or trust or organisation whose objectives make it a suitable proxy for consumers who might have been directly affected.

630 Julie Morris and Jeremy Phillips (eds), *The Law of Regulatory Sanctions and Enforcement* (2011), para 5.71.

631 Consumer Rights Act 2015, sched 3.

632 Enterprise Act 2002, Part 8.

do anything which the relevant authority considers appropriate to facilitate the provision of such goods or services to that standard or in that manner.[633]

11.45 We see compliance orders as an essential party of the regulatory mix. As we proposed in Chapter 10, the regulator should have the power to require an ADSE to (for example) provide updated software and maps or require better information for users.

Regulator discretion

11.46 The Regulatory Enforcement and Sanctions Act 2008 (RESA) provides for considerable regulator discretion. RESA confers on Ministers the power to make regulations enabling regulators to impose “discretionary requirements on a person in relation to a relevant offence”.[634] These include requirements to

(1) pay a monetary penalty of such amount as the regulator may determine;

(2) take such steps as a regulator may specify, within such period as it may specify, to secure that the offence does not continue or recur; or

(3) take such steps as a regulator may specify, within such period as it may specify, to secure that the position is, so far as possible, restored to what it would have been if the offence had not been committed.[635]

11.47 A variable monetary penalty allows regulators to determine the appropriate level of fine on a case-by-case basis. This flexibility allows regulators to consider the circumstances of the breach and of the non-compliant business. For example, the penalty may be set at a level that recognises a history of non-compliance.[636]

11.48 Given the many uncertainties in regulating automated vehicles, there is a strong case for considerable discretion in this area.

Restorative conferences

11.49 Where a problem occurs, restorative conferences bring those most directly affected together to discuss what needs to be done to repair the harm and prevent a reoccurrence.

11.50 Restorative conferences were used by the Australian Competition and Consumer Commission following the mis-selling of insurance policies to Aboriginal communities. Senior insurance company managers came away ashamed from visits to remote communities where they met with the victims of insurance mis-selling, local Aboriginal

---

633 Enterprise Act 2002, sched 8, para 10(2).

634 RESA, s 42(1).

635 RESA, s 42(3).

636 Julie Morris and Jeremy Phillips (eds), *The Law of Regulatory Sanctions and Enforcement* (2011), para 5.69.

community councils and local officials.[637] The company ultimately agreed to compensate policyholders, establish an education fund for financial literacy and conduct an internal inquiry. These outcomes were significantly better than could have been expected through litigation.

11.51 Restorative conferences could encourage a greater understanding between all those directly affected by an incident. The Macrory report received overwhelming support from consultees for the use of restorative conferences.[638]

11.52 In the context of AVs, restorative conferences could be appropriate in some circumstances.[639] Following a death or serious injury, for example, senior managers from the ADSE could meet the victim and/or their family face to face to discuss why the accident happened and what steps were being taken to ensure that it never happened again.

The range of regulatory sanctions: proposals

Consultation Question 23.

11.53 We provisionally propose that the regulator which assures the safety of AVs in-use should have powers to impose the following sanctions on ADSEs:

(1) informal and formal warnings;

(2) fines;

(3) redress orders;

(4) compliance orders;

(5) suspension of authorisation;

(6) withdrawal of authorisation; and

(7) recommendation of attendance at a restorative conference.

Do you agree?

---

637 Christine Parker, “Restorative Justice in Business Regulation? The Australian Competition and Consumer Commissions Use of Enforceable Undertakings” (2004) 67(2) Modern Law Review, 222.

638 Richard Macrory, *Regulatory Justice: Making Sanctions Effective Final Report* (November 2006), https://webarchive.nationalarchives.gov.uk/20121205164501/http:/www.bis.gov.uk/files/file44593.pdf para 4.39.

639 In the criminal context the Restorative Justice Council recommends that for any kind of communication to take place, the offender must have admitted to the crime, and both victim and offender must be willing to participate. Restorative justice can though be used for any type of crime and at any stage of the criminal justice system, including alongside a prison sentence. (see https://restorativejustice.org.uk/about-restorative-justice).

Consultation Question 24.

11.54 We provisionally propose that the legislation should provide the regulator with discretion over:

(1) the amount of any monetary penalty; and

(2) the steps which should be taken to prevent re-occurrence of a breach.

Do you agree?

COLLISION INVESTIGATION

11.55 It is one thing to investigate why an ADS might have exceeded a speed limit or entered a bus lane. It is another to investigate a serious collision, possibly resulting in injuries and fatalities. Even here, however, stakeholders impressed upon us the importance of promoting a culture of safety, where lessons can be learnt and shared, and fed back into the safety assurance process. Stakeholders often contrasted a safety culture with a blame culture. If developers feel blamed for everything that goes wrong, they may become defensive, with little sharing of information or openness to change.

11.56 The aviation industry is often cited as fostering a safety culture because specialist investigators make recommendations to enable both regulators and manufacturers to improve safety. In the UK aviation, like the rail and maritime sectors, has a specialist accident investigator known as the Air Accidents Investigation Branch (AAIB). The AAIB investigates the causes of air accidents and is widely trusted by stakeholders in the sector.[640] In 2015, the AAIB's chief inspector gave evidence to a House of Commons Select Committee report into the investigation of clinical accidents in the NHS. Concerning the work of the AAIB, he said:

> People […] have learned that, if they actually report these things, when they come to our attention, they are dealt with in a very much no-blame environment. We go to great lengths to ensure that our reports and our investigations do not carry any blame or liability.[641]

11.57 As the AAIB investigates causes rather than apportioning blame, its investigations ask different questions to those of criminal investigations, which may be conducted separately. Rather than determine where liability should lie, they attempt to learn lessons from the incident so that they can make recommendations and increase the overall safety of air transportation. Similarly the Rail Accident Investigation Branch

[640] See "The Department for Transport's Air Accidents Investigation Branch" in House of Commons Select Committee, *Investigating clinical incidents in the NHS* (24 March 2015), https://publications.parliament.uk/pa/cm201415/cmselect/cmpubadm/886/886.pdf.

[641] Above, para 83.

(RAIB) and Marine Accident Investigation Branch (MAIB) work using the same ethos and approach in their respective fields.

Responses to our first consultation

11.58 The UK has specialised units to investigate the causes of aviation, rail and maritime accidents, but does not have a specialist road investigation branch. Road traffic collisions are investigated by coroners[642] or the police. Our first consultation invited views on how collisions involving AVs should be investigated.

11.59 We noted the work of the RAC Foundation, which has long campaigned for a more investigatory approach to collisions.[643] In 2018 the Government announced that it would provide the Foundation with £480,000 to help identify and understand common themes and patterns that result in death and injury on the roads, so as to shape future policy.[644]

11.60 We asked if the new challenges of AVs required specialist expertise to identify patterns and investigate high-profile collisions. Responses were mixed. Many safety groups called for a new collision investigation branch (CIB). It was thought that a new body would have specialist expertise, be able to analyse trends and take a no-blame approach to investigations.

11.61 Some stakeholders highlighted that with automation the nature of road traffic collisions is likely to change, so as to become more like those in other transport sectors:

> Road accidents will become more similar to air or maritime accidents where the causes are often mistakes within the interactions of the human operators with a complex control system. In contrast police investigation is more appropriate where the cause of accidents is more directly related to human intentions and motivations.[645]

11.62 Other respondents had reservations about the idea. Some cited the large costs involved in setting up a standalone collision investigation branch and the risk of duplicating work already undertaken by police forces. Police stakeholders also emphasised their existing expertise. They were also able to attend the scene quickly and close roads to facilitate investigations.

---

642 In Scotland, the Procurator Fiscal may hold a Fatal Accident Inquiry.

643 S Gooding, RAC Foundation, *Towards an Accident Investigation Branch for the Roads?* (December 2017). See more recently C Jackson and N Kyle, RAC Foundation, *A Highways Accident Investigation Branch – What Lessons Can Be Learnt from the Rail Industry and the Cullen Inquiry* (April 2018); NA Stanton, RAC Foundation, *Models and Methods for Collision Analysis: A guide for policymakers and practitioners* (March 2019) and S Jeavons and A Runacres, RAC Foundation, *International Review of Road Collision Investigation Approaches* (December 2020).

644 See Department for Transport, *Drink drivers faced swifter justice with new roadside breathalysers*, (June 2018) https://www.gov.uk/government/news/drink-drivers-face-swifter-justice-with-new-roadside-breathalysers and RAC Foundation, *Crash investigation stepped up a gear*, (June 2018) https://www.racfoundation.org/media-centre/crash-investigation-stepped-up-a-gear.

645 Response from Heather G Bradshaw-Martin. See also analysis of responses to CP 1, paras 5.88 to 5.95.

11.63 Nevertheless, some police forces were cautiously supportive of a CIB. For example, one police stakeholder suggested that a CIB could be reserved for investigating some of the most serious and high-profile collisions, leaving to the police forces the more day-to-day road traffic collision investigations. The Metropolitan Police Service suggested that a CIB for collisions involving automated vehicles could perform a role similar to that performed by the Forensic Science Service, a now defunct organisation which provided independent expert services to police services. Whilst the CIB would produce independent reports focusing solely on safety, the police could rely on these reports in their own investigations.[646]

The advantages of specialist collision investigation

11.64 Specialist collision investigation could be desirable for two reasons. Firstly, automated vehicles will be complex systems with many parties involved. To understand the causes of collisions it may be necessary to examine many factors. Some factors may be wide ranging and lie outside the normal remit of road collision investigations. These might include the ADSE's safety management systems and how these have been implemented in practice. They may also include human factors such as how users interact with the ADS interface. A report commissioned by the RAC foundation used the fatal 2018 Uber collision in Arizona as a case study to illustrate the many underlying influences which can cause an accident.[647] The report emphasised that "collisions do not result from any single point of failure" but are "systemic and multicausal in nature".[648]

11.65 The second reason is that specialist collision investigation could help monitor the safety standard for AVs. As we highlighted in Chapter 5, policy makers need to decide on a level of safety that automated vehicles must attain. A specialist unit would be able to pool data from multiple incidents to make appropriate observations on the overall safety level. Crucially, they would be able to dedicate resources to understanding why vehicles might have been involved in a collision and whether the causal factors mean that vehicles are failing to meet the set standard.

11.66 We note concerns that specialist collision investigation might undermine or duplicate the role of police forces in investigating crime. However, as some stakeholders emphasised, an investigation unit need not be a frontline force which undertakes a detailed investigation for every incident involving an AV. A good approach might be to collect and analyse data on accidents in a central database and reserve investigations for the most serious, complicated or high-profile collisions.

11.67 This would be similar to the approach taken in the United States. There the National Transportation Safety Board (NTSB) investigates highway accidents with wide-ranging safety implications. They also conduct studies and research to identify common risks or the underlying causes of crashes. In recent years the NTSB has investigated

---

646 AIBs are usually set up such that they have clear rules about the sharing of data with police and other agencies and clarity in relation to use of their reports. See RAC Foundation, *International Review of Road Collision Investigation Approaches,* (December 2020) for a review.

647 NA Stanton, RAC Foundation, 'Models and Methods for Collision Analysis: A guide for policymakers and practitioners' (March 2019).

648 Above, p 14.

several incidents involving vehicles with partial automation.[649] Their reports are comprehensive, addressing issues with the technology itself, highway infrastructure and oversight of such systems.[650] They make recommendations to improve safety.

11.68 Overall, we provisionally consider that a specialist unit could develop expertise, share lessons learnt and make recommendations about safety to both ADSEs and to regulators. The publication of recommendations might even induce compliance without the need for formal sanctions, serving to promote a culture of safety. This would, in turn, feed into a learning culture, where AVs become ever safer as the technology matures.

Consultation Question 25.

11.69 We provisionally propose that a specialist collision investigation unit should be established:

(1) to analyse data on collisions involving automated vehicles;

(2) to investigate the most serious, complex or high-profile collisions; and

(3) to make recommendations to improve safety without allocating blame.

Do you agree?

ADAPTING ROAD RULES

11.70 Our starting point is that AVs should abide by current road rules. However, we recognise that blind obedience to rules can cause problems. As we explored in Consultation Paper 1, rules may conflict. Rule following can also be incompatible with safety in some circumstances: where for example a car swerves into a bus lane to avoid a child. In other cases, rule following could impede traffic to an unacceptable extent.

11.71 In Consultation Paper 1 we asked three “sample questions” about whether automated vehicles should ever mount the pavement, exceed the speed limit or “edge through” pedestrians. Our aim was to use these examples to address broader questions about when automated vehicles should be allowed (or required) to depart from road rules.

11.72 All three issues proved controversial:

(1) *Mounting the pavement*: A small majority (56%) thought that this would be acceptable to allow emergency vehicles to pass, while 52% thought it would be

[649] National Transport Safety Board, *Final Reports for 2 Advanced Driver Assistance System Crash Investigations Published*, (2020) https://www.ntsb.gov/news/press-releases/Pages/NR20200319.aspx.

[650] National Transport Safety Board, *Final Reports for 2 Advanced Driver Assistance System Crash Investigations Published*, (2020) https://www.ntsb.gov/news/press-releases/Pages/NR20200319.aspx.

acceptable to avoid an accident. However, many arguments were put that mounting the pavement at speed should never be permitted.

(2) *Exceeding speed limits*: Here views were split. While RAC members and other motorists generally supported exceeding the speed limit within accepted tolerances in some circumstances, many safety groups put forward a strong view that speeding was never acceptable.

(3) *Edging through pedestrians*: A majority of respondents thought it would never be acceptable to edge through pedestrians in a way that introduced any chance of injury. However, a few respondents thought that without some small but credible threat it would be difficult for automated vehicles to make progress.

11.73 The responses we received demonstrate the difficulties of adapting road rules to automated driving. This is not simply the technical challenge of replacing broad standards with determinate rules. It also raises policy issues of considerable public concern. As Driverless Futures put it, "the process of determining parameters will not be value-free nor objective, and needs to involve a wide consultation and likely further empirical evidence".

11.74 The strong public concern about road rules is leading to a series of Government and regulatory initiatives.[651] The latest example is the review of the Highway Code announced in July 2020 to improve the safety of vulnerable road users.[652] The review is proposing new rules about overtaking, passing distances, priority at junctions and opening vehicle doors.

11.75 The proposals suggest a trend towards replacing standards with rules. One proposed change, for example, is that there should be quantified rules about how much distance a vehicle should leave when passing pedestrians, cyclists and horse riders. Generally, the proposals require a minimum passing distance of 1.5 metres at lower speeds, and 2 metres at higher speeds and for larger vehicles.

11.76 This is an interesting step towards greater precision. However, the proposals are still a long way away from a "digital highway code" that can be used by AV engineers.[653] The proposed rules state that the minimum passing distance for "a large vehicle" is 2 metres in all conditions regardless of speed. They also mention "extra care" in "bad

---

651 In June 2019 we quoted the inquiry into pavement parking, the Transport (Scotland) Bill 2019 and the Cats Bill (which would impose new duties on drivers to stop and report accidents which injure cats): See CP1 Analysis para 9.179.

652 Department for Transport, *Cycling and Walking Investment, Strategy: Safety Review, Consultation on a review of The Highway Code* (July 2020) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904038/consultation-on-a-review-of-the-highway-code.pdf. The results of this consultation and next steps are expected to be published by the end of January 2021.

653 This aspiration is echoed in the European Commission, *Study on the effects of automation on road user behaviour and performance, Final Report*, (2020) https://wiki.unece.org/download/attachments/109350564/FRAV-06-14.pdf?api=v2, p 12, whose main recommendation in respect of adapting current traffic rules is that they "need to be translated into exact and measurable rules that can be programmable for ADS (sometimes also called the "digital traffic act").

weather" including "high winds" and at night.[654] These terms are open to a range of interpretations. Variation in interpretation is expected between human drivers, but it may be less acceptable between different AVs.

Promoting collaboration

11.77 We do not think it would be appropriate for Government to attempt to turn the highway code into algorithms that can be programmed into automated driving systems. After analysing the response to Consultation Paper 1 we concluded that a digital highway code that sets precise rules for every instance is not possible. It is impossible to predict all future scenarios in advance and an expectation that regulators should do this would place an impossible burden on them. In the same way, it is not desirable nor realistic to ask developers to deterministically prescribe the behaviour of ADSs in advance for every scenario.

11.78 However, it is possible to provide a more structured dialogue between developers and regulators, which allows developers to raise issues of concern. Regulators cannot provide precise rules, but they can set out broad principles for developers to follow. They can also ensure good information conduits with developers, so that systems can adapt to the many new initiatives in this area.

11.79 We therefore propose that Government should establish a forum for collaboration on the application of road rules to self-driving vehicles. Areas where work could be usefully undertaken include:

(1) providing guidance on interpreting indeterminate terms in legislation and in the Highway Code;[655]

(2) identifying possible additions to the Highway Code to resolve conflicts between two automated vehicles (and which are currently resolved through non-standard communication between human drivers).

11.80 Several jurisdictions are now considering these issues, with useful precedents from Singapore[656] and the Netherlands.[657] A potential model could be to follow Singapore's approach by setting up a working group. This brings together a panel of developers

---

654 Proposed additions to Highway Code Rule 163.

655 Examples include Highway Code rules 144 to 158 that you must not drive dangerously, drive without due care and attention, drive without reasonable consideration of other road users, and Rules 204 to 225 relating to "road users requiring extra care".

656 See Singapore's Land Transport Authority work on the regulation of automated vehicles. On 31 January 2019 it published Technical Reference 68, Part I – Basic behaviour which describes road rules as subject to a hierarchy of importance, with safety as the primary objective and traffic flow as the secondary objective. It notes the need for "a shift in validation methods from ambiguous, subjective and qualitative references to definitive and quantitative measurements for the AV to follow". Its examples, such as crossing double white lines to overtake an illegally parked car, resonate with our questions about mounting the pavement.

657 Speech given by Cora van Nieuwenhuizen, Minister of Infrastructure and Water Management on 20 March 2018 available at https://www.government.nl/documents/speeches/2018/03/26/speech-by-cora-van-nieuwenhuizen-minister-of-infrastructure-and-water-management-at-the-opening-of-intertraffic-amsterdam-20-march-2018.

and regulators, chaired by a respected independent expert. The aims of the group would be to promote:

(1) debate on how existing road rules apply to automated vehicles;

(2) consistency between developers in how they interpret road rules;

(3) public understanding of how conflicts in road rules are dealt with (eg circumstances where white lines may be crossed or mounting the pavement may occur).

11.81 The working group would report back to the public and a wide variety of interest groups to ensure appropriate input and representation of diverse societal interests. We welcome views on its composition and processes for public engagement.

Consultation Question 26.

11.82 We provisionally propose that the UK Government should establish a forum for collaboration on the application of road rules to self-driving vehicles.

Do you agree?

Consultation Question 27.

11.83 We welcome views on:

(1) the issues the forum should consider;

(2) the composition of the forum; and

(3) its processes for public engagement.

Chapter 12: The user-in-charge

12.1 The first automated vehicles (AVs) are likely to rely on a human in the driving seat to take over the controls in some circumstances. In our first Consultation Paper, we proposed that while an Automated Driving System (ADS) is engaged the person in the driving seat would not be a driver but a "user-in-charge". We said that every AV should have a user-in-charge in a position to operate the controls, unless the AV was specifically authorised to function without one. The main role of the user-in-charge would be to take over driving, either following a transition demand or because of a conscious choice. They would also have responsibility for driver duties that do not arise from dynamic driving (such as ensuring children wear seatbelts, duties after an accident, and some aspects of vehicle maintenance).

12.2 The majority of consultees responding to our first consultation paper (79%) supported the idea of a user-in-charge. It would allow the safe use of AVs at the stage of development when the vehicle could drive itself for part of the trip, but a human might need to drive at some stage. However, many consultees asked for more clarity about how the idea would work, particularly if the vehicle was being supervised by someone outside the vehicle.

12.3 We considered remote supervision in Consultation Paper 2. We proposed that a person would only be described as a user-in-charge if they were in the vehicle or in sight of the vehicle (as with automated parking or summons functions[658]). Many vehicles may be supervised remotely, by a human sitting in front of a bank of screens in a remote control centre. However, remote control centres raised different regulatory challenges, which need to be approached in another way.[659] We consider them in Chapter 13.

12.4 Here we develop the concept of user-in-charge, drawing on responses from both consultation papers. In essence, a user-in-charge is an individual:

(1) who is not driving because an ADS is engaged; but

(2) who is physically present in the vehicle or in direct sight of the vehicle, with access to controls; and

(3) who must be qualified and fit to drive.

658 An individual can use a summons automated feature to enable a vehicle to leave a parking space and navigate around obstacles to meet that person.

659 Human Factors in International Regulations for Automated Driving Systems (HF-IRADS) group, which operates under the auspices of the International Ergonomics Association, prepared an informal document submitted at the eighty-first session of the UNECE's Global Forum for Road Traffic Safety in Geneva, 21-25 September 2020. The document provides guidance on the major human factors challenges to be considered when providing remote support and control to assist vehicle operation under automation. See https://www.unece.org/fileadmin/DAM/trans/doc/2020/wp1/ECE-TRANS-WP1-SEPT-2020-Informal-8e..pdf.

12.5 We propose that the user-in-charge will not be liable for criminal offences which arise out of the dynamic driving task. However, we address the difficult issue of where an offence arises partly before and partly after the handover. An example is where an AV turns into a one-way street in the wrong direction: the user-in-charge then takes over but fails to avoid a collision.

12.6 We also propose two new offences:

(1) using a vehicle as, or causing or permitting a vehicle to be used by, an unfit or unqualified user-in-charge; and

(2) allowing oneself to be carried without a user-in-charge.

12.7 Finally, we consider the user-in-charge's liability for non-dynamic driving offences (such as using a vehicle without insurance or failing to maintain a vehicle).

THE CONCEPT OF A USER-IN-CHARGE

The role of a user-in-charge

12.8 The main role of a user-in-charge is to be ready to take over driving. Under our proposals, the user-in-charge would be free to take over driving at any stage. The only limitation would be the need to go through a procedure (known as "offer and confirm") to prevent this from happening by mistake.

12.9 Often the takeover will be planned: for example, where an ADS can only be used on a motorway, the user-in-charge would take-over driving to exit the motorway.

12.10 In some cases the takeover will be unplanned. Importantly, the user-in-charge is expected to take over driving following a transition demand. In Consultation Paper 1 we said that the takeover would be from a stopped position, after the vehicle had reached a minimal risk condition. We have now adapted our provisional view in the light of the ALKS Regulation,[660] which is predicated on a human available to take over driving within 10 seconds of a transition demand. If this does not occur, the consequence is highly undesirable: the ALKS stops the vehicle in lane. Under our current proposals, a user-in-charge must be ready, qualified and fit to take over driving a moving vehicle following a transition demand, in accordance with the design of the system.

In (or in direct sight of) the vehicle in a position to operate the controls

12.11 We have defined a user-in-charge as an individual in position to operate the controls of a vehicle while an ADS is engaged, and who is either in the vehicle or in direct sight of the vehicle. As we explain below, this will often amount to being the person in the driving seat. However, the intention is that the definition should be sufficiently flexible to adjust to new forms of control by users. We intend it to cover features such as remote parking or auto summons where the user may be outside of the vehicle, but not remote operation (as set out below).

660 UN Regulation 157 on uniform provision concerning the approval of vehicles with regards to Automated lane Keeping System ECE/TRANS/WP.29/2020/81 (ALKS Regulation). This is discussed in detail in Ch 3.

In the driving seat

12.12 The simplest, most recognisable instance is a user-in-charge who is sitting in the driving seat with access to the control interface of the vehicle. We expect that initially, being in position to operate the controls will be tantamount to being in the driving seat. This means that if a vehicle is listed under the AEV Act as only safe to drive itself with a user-in-charge, it would be a criminal offence for the person in the driving seat to be drunk or disqualified.

12.13 However, as the design of vehicles changes, the concept of a "driving seat" will change, with a wider variety of controls, including those operated from outside the vehicle. We have therefore defined a user-in-charge so as to take these possibilities into account.

In direct sight

12.14 To accommodate technological innovations, we propose that a user-in-charge may also be "in direct sight"[661] of the vehicle, with access to the controls. For example, if a mobile phone app is developed to park a vehicle automatically, the user-in-charge may exit the vehicle with the phone controls in their hand. Similarly, they might want to summon their vehicle from its parking place.

12.15 However, the user-in-charge must be in a position to respond to a transition demand if the vehicle encounters a problem. This means that the user-in-charge needs to be able to gain situational awareness of where the vehicle is and to take over the controls. Failing this, if the vehicle comes to a stop in an inappropriate place, the user-in-charge will need to move the vehicle. We therefore consider that the user-in-charge should have visual contact with the vehicle. As such, it is best defined as close enough to read the number plate of the vehicle (which is approximately 20 metres).

12.16 We prefer to use the phrase "in direct sight" rather than limiting the definition by distance, since it is possible to be close to a vehicle while unable to see it; for example, if the user-in-charge were to walk around the corner, they may find it difficult to respond to a transition demand. Finally, "in direct sight" includes the requirement actually to see the vehicle, by wearing glasses or contact lenses if necessary. However, the sight must be direct, without using remote connectivity or mirrors.

Remote supervision

12.17 In response to Consultation Paper 1, several consultees suggested that the user-in-charge might be a remote operator supervising in a control room. Remote supervision has an important role in the development of AVs but we think it should be regulated separately.

12.18 In remote operation, the nature of the "driving" and "monitoring" task changes. It is no longer simply a matter of individual skill, as we understand driving now, but requires organisations to develop safe systems in a new way. In Chapter 13, we discuss some

[661] We discuss the regulatory boundary between Visual Line of Sight (VLOS) and Beyond Visual Line of Sight (BVLOS) as used in aviation further below under the heading "remote supervision".

of the challenges of remote operation, including connectivity, equipment, training and rest periods.

12.19 This approach is consistent with that adopted by the Civil Aviation Authority (CAA) when regulating drones:

> The remote pilot of a small unmanned aircraft must maintain direct, unaided visual contact with the aircraft sufficient to monitor its flight path in relation to other aircraft, persons, vehicles, vessels and structures for the purpose of avoiding collisions.[662]

12.20 Where a drone is engaged in "Beyond Visual Line of Sight" flight, the operator must receive specific approval from the CAA.[663]

No responsibility for dynamic driving

12.21 While the ADS is engaged, the user-in-charge is not a driver and is not responsible for the dynamic driving task. Therefore, the user-in-charge would not be liable for any "dynamic driving offence". We discuss the nature of a dynamic driving offence in Chapter 2. It is any offence which involves a breach of a duty to monitor the driving environment and respond appropriately by using the vehicle controls to steer, accelerate, brake, turn on lights or indicate.[664] Dangerous driving, careless driving, failing to abide by traffic signs and failing to stop after an accident are all dynamic driving offences.

12.22 Similarly, the user-in-charge would not be liable to compensate victims for an accident that occurs while the ADS is engaged. Instead, the Automated and Electric Vehicles Act 2018 provides for a new form of liability: where an accident is caused by an automated vehicle when driving itself and the vehicle is insured, the insurer is liable for any damage.[665]

12.23 As we explain below, the user-in-charge would have other responsibilities that do not arise from the dynamic driving task, such as carrying insurance.

---

662 Air Navigation Order 2016, Article 94(3).

663 See the Civil Aviation Authority website: https://www.caa.co.uk/Commercial-industry/Aircraft/Unmanned-aircraft/Small-drones/Regulations-relating-to-the-commercial-use-of-small-drones/.

664 As we outline in Chapter 16 below, under the Automated and Electric Vehicles Act 2018 an AV's insurer is liable in civil law for any damage caused by the vehicle in automated mode.

665 Automated and Electric Vehicles Act 2018, s 2(1).

Consultation Question 28.

12.24 We provisionally propose that that the user-in-charge:

(1) should be defined as an individual in the position to operate the controls of a vehicle while an ADS is engaged and who is either in the vehicle or in direct sight of the vehicle; and

(2) is not a driver while the ADS is engaged, and would not be liable for any criminal offence or civil penalty (such as a parking ticket) which arises out of dynamic driving.

Do you agree?

HANDOVER

Circumstances of takeover

12.25 We refer to the transition between the human performing the dynamic driving task and the ADS as the "handover". As we propose in Chapter 4, the user-in-charge is not expected to monitor either the ADS or the driving environment. They would only be required to intervene following a transition demand which gives clear visual, audio and haptic signals and which provides sufficient time for the user-in-charge to gain situational awareness. The ALKS Regulation sets the time at a minimum of 10 seconds.

12.26 A user-in-charge would not be required to takeover driving in urgent circumstances while the vehicle is moving. It has even been that they should be discouraged from doing so.

12.27 In response to Consultation Paper 1, many respondents expressed concern that users-in-charge would intervene inappropriately and make the situation worse. Mills & Reeve gave the hypothetical example of a vehicle which is about to carry out evasive action and has calculated that a collision can be avoided just by braking. The user-in-charge is not aware that the vehicle has this plan, takes over and swerves off the road, causing damage. Dr Chris Tennant argued that "there are likely to be far more negative outcomes from users-in-charge seizing control mistakenly than from users-in-charge being prevented from intervening". The Met Office pointed out that in low visibility weather conditions, such as dense fog, ADS operating sensors have a significant advantage over the human eye. Burges Salmon LLP suggested that users-in-charge should be prevented from taking control, unless the takeover is pre-planned or the vehicle has come to a safe stop.

12.28 While we agree that unnecessary intervention should be discouraged, we do not think that a legal prohibition on taking control would be practicable. There may be difficulty in drawing a line between planned and unplanned takeovers in practice. We would not wish to criminalise changes of mind, as where a user decides to take over driving to pull into a service station. There may also be instances in which an unplanned takeover that is not initiated by the system is desirable (where, for example, the user-in-charge notices that the road ahead is closed).

12.29 An important issue is that a user-in-charge should not be able to take over driving by mistake (by, for example, inadvertently touching the steering wheel). The Association of British Insurers (ABI) stressed the need for a clear "offer and confirm" protocol, whereby any request to hand over the driving task should only be effective when confirmed by the human driver. If the user-in-charge fails to confirm that they are prepared to retake control, the ADS must be capable of continuing to drive safely or of achieving a minimal risk condition. Several other consultees endorsed this approach. AVs will therefore need to be designed with a procedure to ensure that any take-over is deliberate.

12.30 In addition, design features may limit the circumstances of takeover to ensure safety. Driver monitoring technology can prevent takeovers by drivers who display features of being inattentive (for example by not having their eyes on the road or being in a reclined body position).

Effect of takeover

12.31 Following a completed handover, the user-in-charge would become a driver, with all the responsibilities of a driver. From this point, the driver would be subject to the same distraction laws as any other driver, and would be liable in civil and criminal law for any infringements of road rules or standards (subject to a limited defence where the actions of the ADS made a criminal offence unavoidable, as discussed below).

Failing to respond to a transition demand

12.32 The first generation of self-driving vehicles are likely to rely on transition demands to be safe. The demand must be sufficiently signalled to the user-in-charge through visual, audio and haptic alerts. It must disable all activities displayed on any in-vehicle infotainment screen, other than those permitted whilst driving (such as a sat nav). A transition demand must also allow for sufficient time to gain situational awareness. The transition period ends when the minimum risk manoeuvre begins.[666]

12.33 We propose that, following the end of the transition demand period, the user-in-charge would re-acquire the legal obligations of a driver. Even if they have not taken control of the vehicle, they would be deemed to be a driver and their immunity for dynamic driving offences would cease. This means that the user-in-charge would become liable in both civil and criminal law, for anything that the vehicle does following the end of the transition demand period. This would be subject to the usual civil and criminal law principles which exempt drivers from failures due to incapacitation, such as a heart attack or stroke.[667]

---

666 We use the term adopted by the UNECE in the ALKS Regulation. We understand some systems may continue to issue a transition demand even while they are performing a minimum risk manoeuvre. That would not prolong the transition demand period from a legal perspective.

667 In the criminal law the relevant defence would be non-insane automatism. In England and Wales, see *Attorney-General's Reference (No 2 of 1992)* [1993] 3 WLR 982. In Scots law, see *HMA v Ritchie* 1926 JC 45; *Ross v HMA* 1991 JC 210; and *MacLeod v Mathieson* 1993 SCCR 488.

12.34 In the case of ALKS, if a user-in-charge fails to take over, the vehicle would stop gradually in lane on a motorway with hazard lights flashing. It is a criminal offence for a person using a motorway to stop unnecessarily in an active lane.[668] By failing to take over, the user-in-charge would become a driver and would be liable for that offence. On non-motorways, there are similar offences (such as stopping on double red lines). Stopping in lane might also constitute driving without due care and attention or, possibly, dangerous driving.

12.35 This does not mean that failing to respond to a transition demand would automatically lead to an offence. If the vehicle is able to park itself safety and legally at the side of the road, no offence will have been committed. We seek to adopt a flexible approach to the legal consequences of failing to take over that depends on the harm done. Initially, with ALKS, failing to respond is likely to be a serious criminal offence. As the sophistication increases, it may become a much more minor, as a failure to respond becomes less and less safety critical.

12.36 Eventually, we would hope that transition demands would not be necessary: the vehicle would be able to achieve a minimal risk condition in all circumstances without endangering road safety or obstructing traffic flow. The user-in-charge may have continuing duties that do not arise directly from dynamic driving (such as carrying insurance) but would no-longer be required to resume driving during a trip. In this case, if the ADS could not complete a journey as planned, it might prompt the user-in-charge to take over, but failures to respond would have no legal consequences. In Chapter 4 we refer to such notifications as "transition information notices" rather than a "transition demand". The ADSE would need to distinguish between a transition demand and transition information in its safety case, and this distinction would need to be endorsed by the regulator.

Consultation Question 29.

12.37 We provisionally propose that following the end of the transition demand period:

(1) the user-in-charge should re-acquire the legal obligations of a driver, whether or not they have taken control of the vehicle; and

(2) if, following a failure to respond to a transition demand, the vehicle stops in a manner which constitutes a criminal offence, the user-in-charge should be considered a driver and should therefore be liable for that offence.

Do you agree?

[668] In England and Wales, the Motorways Traffic (England and Wales) Regulations 1982, reg 7. In Scotland, the Road Traffic Regulation Act 1984, s 17(4) as read with the Motorways Traffic (Scotland) Regulations 1995, reg 6(1).

CRIMINAL LIABILITY FOR BEING UNQUALIFIED OR UNFIT TO DRIVE

12.38 In Consultation Paper 1 we proposed that the requirement to be qualified and fit to drive be backed by criminal offences. We asked consultees:

> Do you agree that where a vehicle is listed as only safe to drive itself with a user-in-charge, it should be a criminal offence for the person able to operate the controls ("the user-in-charge"):
>
> (1) not to hold a driving licence for the vehicle;
>
> (2) to be disqualified from driving;
>
> (3) to have eyesight which fails to comply with the prescribed requirements for driving;
>
> (4) to hold a licence where the application included a declaration regarding a disability which the user knew to be false;
>
> (5) to be unfit to drive through drink or drugs; or
>
> (6) to have alcohol levels over the prescribed limits?

12.39 There was near consensus about all these requirements except (3) and (4) on eyesight and disability. Although a majority of consultees agreed with these requirements, a minority argued that they will limit the benefit disabled people can gain from AVs. We think that, since the intended purpose of a user-in-charge is to effect safe takeover and begin dynamic driving, the eyesight and disability provisions are necessary. However, the user-in-charge concept only applies to vehicles which require handover in some specific situations. It is envisaged that there will be a list of self-driving vehicles which do not require a user-in-charge, and those vehicles would provide significant advantages for those unable to drive for reasons of disability.

12.40 In some cases, legislative reform is not strictly necessary. Under section 4(2) of the Road Traffic Act 1988, it is already an offence to be "in charge" of a vehicle while unfit to drive through drink or drugs. This would apply to a person who is not driving but who is sitting in the driving seat and might drive in the future. However, other offences, such as driving while disqualified apply only to drivers.[669]

12.41 Several consultees, including the Senators of the College of Justice[670] and the Crown Prosecution Service, thought the duties of the user-in-charge should be properly set out in legislation. We agree that, if legislation on the user-in-charge is passed, it should include a consolidated, comprehensive list of duties.

Could a user-in-charge hold a provisional licence?

12.42 Until recently, those with provisional licences were not allowed to drive on a motorway. In June 2018, the law changed. Learner drivers are now able to take

---

669 Road Traffic Act 1988, s 103.

670 Court of Session judges in Scotland.

driving lessons on motorways in England, Scotland and Wales, provided that they are accompanied by an approved driving instructor and the car is fitted with dual controls.[671] This raises the issue of whether a learner driver should be allowed to engage an ADS and act as a user-in-charge.

12.43 The argument for allowing a person with a provisional licence to engage an ADS is that it would enable new drivers to be trained in how to use these systems. If automated features become a common part of drivers' experiences, it will be desirable to encourage new drivers to acquire familiarity with them.[672] The argument against is that responding to a transition demand could be difficult even for experienced drivers. It might be exceptionally challenging for a learner driver. It may also be difficult to supervise the learner, given the time pressures and the possibility of dual delay (in which the learner fails to respond and the supervisor does not immediately notice the failure).

12.44 One compromise might be to apply the law for motorways to all learner drivers. On this basis a person with a provisional licence would be able to act as a user-in-charge, but only if accompanied by an approved driving instructor in a car fitted with dual controls.[673] We seek views.

Consultation Question 30.

12.45 We seek views on whether a person with a provisional licence should be allowed to act as a user-in-charge, if accompanied by an approved driving instructor in a vehicle with dual controls.

Identifying the user-in-charge

12.46 We have considered how to identify a user-in-charge where there are several (possibly drunk) passengers, none of whom wants to carry responsibility for the situation.

12.47 Under our proposals, the user-in-charge is the person with access to the controls. In practice, in the foreseeable future, user-in-charge vehicles are likely to have a driving seat and the user-in-charge will be sitting in the driving seat.[674] This means that the user-in-charge will be easily identifiable. For example, if the person in the driving seat

[671] The Highway Code, Rule 253.

[672] See the discussion of driver training in CP1, para 5.39 to 5.55.

[673] It could be argued that in a dual control car, the instructor is also in a position to operate the controls and is therefore a user-in-charge. However, the instructor has only direct access to the brake, not the steering wheel. The learner driver more closely corresponds to our definition of a user-in-charge, because they are in the driving seat with access to both brakes and steering.

[674] Transition demands are likely to be implemented through a combination of gaze detection and biometric indicators. This will necessitate one person sitting in a position where these measurements can occur. For example, the ALKS Regulation refers to this as a driver availability recognition system, at para 6.

is drunk, they have committed an offence. The same would be true if they were standing next to the vehicle, with mobile phone remote parking controls in their hand.

12.48 However, this does not absolve others linked to the journey of all responsibility. Below we outline two new offences. These relate to causing or permitting the use of a vehicle by an unfit or unqualified user-in-charge; and allowing oneself to be carried without a user-in-charge.

Causing or permitting the use of a vehicle by an unfit user-in-charge

12.49 "Cause or permit offences" are used commonly in road traffic law. For example, it is an offence to cause or permit the use of a vehicle in a dangerous condition,[675] or in breach of requirements as to brakes,[676] weight,[677] speed detection devices,[678] control of vehicle,[679] or other construction and use requirements.[680] It is also an offence to cause or permit another person to drive a vehicle without a driving licence.[681]

12.50 While offences of using a motor vehicle are ones of strict liability, the "cause or permit" offences require a guilty mind.[682] To "cause" requires a positive act involving some degree of control and direction.[683] A passenger would only be liable for causing the offence if they knew that the user-in-charge was unfit or unqualified, and in some way directed or encouraged them to be a user-in-charge. For example, if following an evening of drinking, a passenger were to open the door next to the driving seat, encourage their inebriated friend inside and tell them to switch on the ADS, they would be causing unauthorised use.

12.51 The offence of permitting carries a broader meaning, and includes permission which is inferred.[684] A person permits an unlawful event not only where they have knowledge of that event, but also where they wilfully shut their eyes to the obvious or deliberately refrain from making proper inquiry.[685] If a passenger steps into a vehicle with a user-in-charge who is slurring their speech and showing other signs of inebriation, and the passenger passively continues to be carried with no inquiries made, they would be criminally liable for permitting the user-in-charge's actions.

12.52 Cause or permit offences are not limited to passengers in the vehicle itself. For example, an employer would be liable if they suspected that a worker had lost their

---

675 Road Traffic Act 1988, s 40A.

676 Road Traffic Act 1988, s 41A.

677 Road Traffic Act 1988, s 41B.

678 Road Traffic Act 1988, s 41C.

679 Road Traffic Act 1988, s 41D.

680 Road Traffic Act 1988, s 42.

681 Road Traffic Act 1988, s 87.

682 *Ross Hillman Ltd v Bond* [1974] RTR 279; *Wilkinson's Road Traffic Offences* (29th ed 2019), paras 1-161 to 162.

683 *McLeod v Buchanan* [1940] 2 All ER 179, at p 187; *Shave v Rosner* [1954] 2 All ER 280; *Wilkinson's Road Traffic Offences* (29th ed 2019), para 1-163.

684 *McLeod v Buchanan* [1940] 2 All ER 179, at p 187.

685 *Wilkinson's Road Traffic Offences* (29th ed 2019), para 1-167.

licence but nevertheless allowed them to use an automated van that required a user-in-charge.

Consultation Question 31.

12.53 We provisionally propose that legislation should create new offences of:

(1) using an automated vehicle as an unfit or unqualified user-in-charge; and

(2) causing or permitting the use of an automated vehicle by an unfit or unqualified user-in-charge.

Do you agree?

A new offence: allowing oneself to be carried without a user-in-charge

12.54 In Consultation Paper 1, we proposed a new offence of allowing oneself to be carried in a vehicle without a user-in-charge. This offence targets situations where no one has access to the controls. We proposed that in such cases, all passengers would be guilty. There was widespread agreement amongst consultees that this should be an offence, subject to certain caveats.

12.55 Some consultees were concerned that the offence could operate unfairly. Passengers would be subject to criminal penalties when they had no knowledge that a user-in-charge was required in law, or that there was no user-in-charge in fact: for example, where the passenger is a child (Weightmans LLP); a blind person unaware that there is no user-in-charge in the vehicle (Richard Morris, Andrew Catlin); or a person who is unconscious or asleep (Andrew Catlin).

12.56 Consultees suggested adding a mental element to the offence to exclude such cases.

(1) The Law Society of Scotland suggested that the offence applies only where a passenger *knowingly allows* themselves to be carried in a vehicle where there is no user-in-charge;

(2) The RAC Foundation suggested that the offence applies to whoever triggered the ADS, if they knew that there was no user-in-charge. However, this may be difficult to establish. Where four drunk passengers leave a bar and agree to travel home in an AV, it may be difficult to know who triggered the ADS.

(3) FOCIS and Stewarts Law suggested limiting the offence to passengers who knew or ought to have known that a user-in-charge is required.

12.57 Alternatively, for simplicity, the offence could follow the strict liability structure of section 24 of the Road Traffic Act 1988, which states:

> (1) Not more than one person may be carried on a road on a bicycle… unless it is constructed or adapted for the carriage of more than one person…

> (3) If a person is carried on a bicycle in contravention of subsection (1) above, *each of the persons carried is guilty of an offence*.

12.58 We accept that some occupants might bear more moral responsibility than others. The owner might be expected to know more about the vehicle than a passing hitchhiker and parents would be more responsible than children. In the light of the concerns expressed we seek views on whether it should be an offence to be carried in a vehicle without a user-in-charge knowing that there was no user-in-charge, in circumstances when the passenger knew or ought to have known that a user-in-charge was required.

Consultation Question 32.

12.59 We provisionally propose that persons carried without a user-in-charge should be guilty of a criminal offence. Do you agree?

Consultation Question 33.

12.60 We seek views on whether the new proposed offence of being carried without a user-in-charge should only apply if the person:

(1) knew that the vehicle did not have a user-in-charge; and

(2) knew or ought to have known that a user-in-charge was required.

CRIMINAL LIABILITY FOLLOWING HANDOVER

12.61 As explained above, once takeover from the ADS to the user-in-charge has been effected, the user-in-charge becomes a driver in the eyes of the law, and is liable for any driving offences committed. In Consultation Paper 1, we consulted on whether this should be subject to a limited exception. We asked whether consultees agreed that:

> If the user-in-charge takes control to mitigate a risk of accident caused by the automated driving system, the vehicle should still be considered to be driving itself if the user-in-charge fails to prevent the accident?[686]

12.62 The difficulty of determining liability as between the user-in-charge and the ADS is illustrated by two separate situations.

(1) Situation 1: the user-in-charge intervenes to attempt to prevent an offence which the ADS caused. For example, while in self-driving mode, an automated vehicle mistakenly turns into a one-way street in the wrong direction. The user-in-charge takes over, but is unable to avoid a collision. Alternatively, no collision takes place, but in the moment the user-in-charge takes over, they are driving in

[686] CP1, Consultation Question 1(3).

the wrong direction, and absent an exception they are guilty of an offence simply on that basis.

(2) Situation 2: the user-in-charge intervenes where there is no transition demand and makes the situation worse. For example, where the ADS is about to take evasive action to prevent a collision, the user-in-charge's intervention prevents that evasive action and a collision results.

12.63 In Situation 1, it would seem unfair to hold the driver liable for the offence. However, consultees were split on how to deal with Situation 2. Some thought that as interventions are difficult, users-in-charge deserve considerable leeway. Furthermore, even if the intervention made things worse, the ADS may have failed to communicate its planned actions appropriately. Others argued that the user-in-charge should bear responsibility, as it is artificial to pretend the ADS is driving where the user-in-charge is in control. It was said that users-in-charge should be discouraged from intervening without a transition demand and allowing the user-in-charge legal carte blanche would act as encouragement.

12.64 Many consultees were against a blanket approach and thought that liability should be decided on a case-by-case basis.

(1) The Faculty of Advocates suggested a presumption of ADS responsibility when the user-in-charge intervenes to prevent an accident, rebuttable if the user-in-charge was negligent. However, a user-in-charge might act reasonably but still fail to prevent an accident which the ADS would have prevented, since the ADS is likely to be a better "driver" than a human. Several consultees thought that it would be artificial to hold the ADS responsible in such situations.

(2) UKAEA and Transport Systems Catapult suggested that the ADS carry responsibility where the user-in-charge's intervention was *reasonable*. To be workable, it would require guidance about how to judge reasonableness. The subjective perception of the user-in-charge, or even the subjective perception of a *reasonable* user-in-charge, may differ from an objectively reasonable response (as where the ADS is about to take evasive action of which the user-in-charge is unaware).

(3) AXA XL and AXA UK suggested that the starting point should be ADS responsibility, subject to contributory negligence where an intervention is badly handled by the user-in-charge. Contributory negligence is a useful tool in civil cases, where damages can be apportioned. However, criminal offences operate on a binary basis: either the user-in-charge committed the offence or they did not. Contributory negligence does not solve issues of criminal liability.

(4) Finally, our preferred option is to recognise that a user-in-charge becomes a driver as soon as they take over control. However, drivers should have a specific and limited defence if, given the actions of the ADS, a competent and careful driver could not have avoided the offence. This would avoid holding the ADS responsible for actions that it did not take; equally it would protect drivers against being found guilty of criminal offences they had no opportunity to avoid.

12.65 We seek views.

Consultation Question 34.

12.66 We provisionally propose that a user-in-charge who takes over control of the vehicle:

(1) should be considered a driver; but

(2) should have a specific defence to a criminal offence if, given the actions of the ADS, a competent and careful driver could not have avoided the offence.

Do you agree? If not, we welcome views on alternative legal tests.

Failing to avert a risk of serious injury

12.67 In Consultation Paper 1 we asked if there should be a criminal offence of failing to take reasonable steps to avert a risk of serious injury, where the user-in-charge was subjectively aware of such a risk.

12.68 Views were split.[687] Although some consultees thought that this was in the interests of safety, others thought that it would encourage inappropriate intervention. The Faculty of Advocates put the argument in the following terms:

> Attaching criminal liability to intervene in a system, which should by definition require no intervention, would... have the undesirable effect of encouraging "users-in-charge" to intervene based on their own perception of risk. This perception may be wrong or (as they are not expected to maintain full awareness) based on an inadequate or flawed understanding of the driving environment. In our view, that may well create risk by leading to increased unsafe human intervention into systems operating safely.

12.69 There was also concern that it would blur lines of responsibility, suggesting that the ADSE was not fully responsible for what had happened.

12.70 As the user-in-charge is not required to monitor the driving environment, we suggested that the offence should only apply to those who are subjectively aware of the risk. However, consultees thought that this would be arbitrary. As Burges Salmon LLP commented, it might even encourage users-in-charge to pay as little attention as possible, so as not to be subjectively aware of risks.

12.71 In Chapter 4 we explain that there needs to be a clear line between advanced driver assistance systems and self-driving vehicles which do not need to be monitored. Where an ADS is correctly engaged in a self-driving vehicle, the user-in-charge is no longer responsible for the dynamic driving task. The suggested offence would risk blurring this line and we do not think it should be part of our proposals.

---

687 CP1 Analysis, paras 3.75 to 3.94.

OFFENCES THAT DO NOT ARISE FROM THE DYNAMIC DRIVING TASK

12.72 The user-in charge would not be a driver for the purpose of any criminal offence concerned with “the lateral and longitudinal control” control of the vehicle. However, the user-in-charge would bear criminal responsibility for other offences, which do not arise directly from dynamic control, such as those relating to insurance and maintenance. Users-in-charge would also be responsible for where a vehicle is left, for reporting accidents and for ensuring that children wear seat belts.

12.73 Here we discuss the main offences which would continue to apply to a user-in-charge.

Insurance

12.74 Under section 143(1)(a) of the Road Traffic Act 1988 it is an offence to use a motor vehicle on a road or other public place without insurance. The courts have tended to interpret the term “user” to mean driver.[688]

12.75 In Consultation Paper 1 we provisionally proposed that the legislation should be amended to clarify that users-in-charge are “users” for the purposes of insurance offences. In other words, the user-in-charge would commit a criminal offence if the vehicle were not insured. Under the AEV Act, the insurance policy must cover both the human driver and the ADS.[689]

12.76 This received widespread agreement and we maintain the proposal here.

Roadworthiness

12.77 The Road Traffic Act 1988 contains several offences of using a vehicle in an unroadworthy condition. For example:

(1) section 40A applies to vehicles in a dangerous condition;

(2) section 41A applies to brakes, steering-gear and tyres;

(3) section 41B applies to overloading; and

(4) section 42 applies to other construction and use requirements.

12.78 These offences apply to a person who “uses” a motor vehicle on a road. We asked if legislation should clarify that a user-in-charge is a user for these purposes.

12.79 Several consultees pointed out that a user-in-charge may find it hard to know whether an automated vehicle is unroadworthy. This is particularly true where the problem lies with a software update. However, it might also be difficult for a user-in-charge to notice other roadworthiness failings. Richard Morris of Innovate UK commented:

---

688 Background Paper 1 to CP1, para 1.6.

689 Automated and Electric Vehicles Act 2018, Schedule, para 19(2).

> Most human drivers will notice substantial roadworthiness failings but often, in practice, miss more subtle failings…. A flat tyre is usually noticeable, but a tyre slightly below recommended pressure may not be...
>
> Concealed issues may be determined in some cases by better instrumentation on the vehicle (oil state, oil level, brake pad wear, etc.) but issues like worn steering joints or split CV boots would be more difficult and similar to the problems a normal driver faces – in practice they are left to servicing / MOT checks. Issues like failed indicator or other light bulbs can be sensed automatically, but broken lamp lenses or cracked glazing will be more problematic.

12.80 The problem is not confined to self-driving vehicles. As vehicles become more sophisticated, it is more difficult for users to notice failings. Greater reliance is being placed on self-checking systems.

12.81 At present, we do not know which faults an AV will be able to detect and which fall to the responsibility of the user-in-charge. As we discussed in Chapter 8, when type approval is issued, we think that regulators should ensure that users are provided with clear and comprehensive information about their maintenance obligations. This includes a list of the checks users would be expected to make before a journey.

12.82 It is likely that some roadworthiness obligations will remain highly relevant to AVs. For example, under section 40A, it is an offence to use a vehicle if "the weight, position or distribution of its load, or the manner in which it is secured", involves a danger of injury. This could be particularly important for AVs. Similarly, all drivers should be aware of the obligation to check tyre tread under section 41A, and we think this will continue to be relevant to users-in-charge. However, other issues would fall on the ADSE. In Chapter 10, for example, we discuss the ADSE's responsibility for software updates.

12.83 Our provisional view is that, in the early stages of automation, the roadworthiness offences in the Road Traffic Act 1988 should continue to apply to users-in-charge. This reflects the current law: the offences apply to those who "use" a vehicle, and the courts are highly likely to interpret this as including a user-in-charge. At a stage of development when self-driving features are used for only part of a journey, it would appear arbitrary to make a distinction depending on when the problem was observed. If it is an offence to drive the vehicle with a broken indicator, we think it should also be an offence to engage the ADS in that condition.

12.84 However, we are aware that the requirement to ensure roadworthiness is changing, as the sophistication of vehicles develops. We provisionally propose that the legislation should include a regulation-making power to adapt these offences. The aim would be to replace the current provisions with a full list of roadworthiness conditions that are the responsibility of the user-in-charge, so that people are aware of what they need to check. At the same time, the regulations could clarify which issues fall solely on the ADSE (such as those relating to software). Some may be a joint responsibility.

Leaving the vehicle in a prohibited place

12.85 Many offences relate to leaving a vehicle.[690] Some are general, such as leaving a vehicle in a dangerous position contrary to section 22 of the Road Traffic Act 1988. Others are location-sensitive. For example, it is an offence to park a vehicle on a cycle track without lawful authority.[691] It is also an offence to permit a vehicle to remain at rest on a motorway hard shoulder for longer than is necessary in the circumstances.[692]

12.86 The legislation uses a variety of terms to describe who is liable for these offences. Section 22 applies to "a person in charge of a vehicle". Others apply to a person who parks.[693] Under the Motorways Traffic (England and Wales) Regulations 1982,[694] offences may be committed by anyone who "uses a motorway". There is very little case law on how these various phrases should be interpreted.

12.87 Where a vehicle has a user-in-charge, we think it would be helpful to clarify that the user-in-charge is responsible for removing a vehicle that is illegally parked, either by assuming manual driving or (alternatively) by calling a tow-truck, where the vehicle is immobilised. The minority of consultees who disagreed with this proposal did so on the mistaken basis that it required manual driving in every case.

Responsibilities following an accident

12.88 Following an accident, drivers are required to stop and provide identifying details. If, for any reason, they fail to do so, they must report the accident in person to a police station or constable within 24 hours of the accident.[695]

12.89 The obligation to stop arises out of the dynamic driving task. It requires steering to the side of the road and braking. Therefore, a vehicle classified as self-driving should either stop or issue a transition demand for the user-in-charge to take over.

12.90 However, the obligation to provide identifying details or to report the accident to the police does not arise from the dynamic driving task. We proposed that these obligations should remain with the user-in-charge. Again, this drew widespread agreement and we repeat the proposal here.

Ensuring that children wear seatbelts

12.91 Under section 15 of the Road Traffic Act 1988, it is an offence for a person to drive a vehicle on a road with a child passenger under 14 years of age who is not wearing the

---

690 For further discussion, see Background Paper 1 to CP1. The Table at 1a lists 12 such offences.

691 Road Traffic Act 1988, s 21.

692 See Motorways Traffic (England and Wales) Regulations 1982, regs 9 and 7(3)(b). For an account of this offence see background paper 1. Similar provisions apply to Scotland: Motorways Traffic (Scotland) Regulations 1995, regs 6 and 8.

693 For example, under Road Traffic Act 1988, s 21 "any person who, without lawful authority… parks a [mechanically propelled] vehicle wholly or partly on a cycle track is guilty of an offence".

694 In Scotland, the relevant legislation is the Road Traffic Regulation Act 1984, s 17(4); Motorways Traffic (Scotland) Regulations 1995.

695 Road Traffic Act 1988, s 170: for further discussion see Background Paper 1.

appropriate seat belt or restraint.[696] Again, this does not arise out of the dynamic driving task, and we thought the obligation should remain with the user-in-charge. Most consultees agreed and we repeat the proposal here.

Complying with directions from the police or traffic officers

12.92 Under section 35 of the Road Traffic Act 1988, it is a criminal offence for a driver to "neglect or refuse" to stop when directed to do so by a constable in the execution of their duty, or by a traffic officer. Drivers must also comply with a constable or traffic officer's directions to "proceed in, or keep to, a particular line of traffic". Similarly, under section 163 of the Act, it is an offence for a driver to fail to stop "on being required to do so by a constable in uniform or a traffic officer".

12.93 Again, the obligation to stop arises out of the dynamic driving task. A self-driving vehicle will either have to come to a stop or issue a transition demand. However, following the stop or transition demand, it should then fall on the user-in-charge to stop the vehicle and/or comply with directions to "proceed in, or keep to, a particular line of traffic". This may require special legislative provision. The user-in-charge will be responsible because the ADS has disengaged.

Consultation Question 35.

12.94 We provisionally propose that the user-in-charge should be liable for criminal offences which do not arise from the dynamic driving task, including those related to:

(1) insurance;

(2) maintaining the vehicle in a roadworthy condition (including installing safety critical software updates);

(3) parking;

(4) duties following accidents to provide information and report accidents to the police; and

(5) ensuring child passengers wear seatbelts.

Do you agree?

---

696 There are various exceptions for buses, coaches and minivans: http://www.childcarseats.org.uk/the-law/other-vehicles-buses-coaches-and-minibuses/. There is also an exception for classic cars which were originally made without seatbelts. Such cars may not carry children under 3 years old, while children over 3 are only allowed to sit in the back seats.

Consultation Question 36.

12.95 We provisionally propose that the legislation should include a regulation-making power to clarify those roadworthiness failings which are (and those which are not) the responsibility of the user-in-charge.

Do you agree?

Chapter 13: Remote operation: no user-in-charge vehicles

INTRODUCTION

13.1 Some automated vehicles will not need a human to drive at any stage to complete a trip. Indeed, some "Path 2" vehicles may have no steering wheel or brake pedals.[697] In this chapter we describe vehicles which are sufficiently automated to be authorised to carry out journeys without a user-in-charge. In the absence of an agreed terminology, we refer to them as "no user-in-charge" vehicles, or NUICs. The defining feature of a NUIC is that it can travel empty. Alternatively, if there are people in the vehicle, these people are merely passengers. They have no legal responsibility for the way that the vehicle drives and are under no obligation to intervene.

Use cases

13.2 In Consultation Paper 2, we highlighted one particular way in which NUICS could be used. This would be to provide Highly Automated Road Passenger Services (or HARPS). Traditionally, road passenger services have been divided into taxis, private hire, buses, coaches and car hire, with separate regulatory regimes applying to each. In Consultation Paper 2 we said that these divisions are becoming blurred and may disappear altogether in an automated world.[698] We considered how HARPS might be regulated and integrated with public transport.

13.3 However, HARPS are not the only use. NUIC vehicles might be privately owned. Although we do not think this will be common, the idea of private ownership has a strong appeal, particularly for those in isolated locations or excluded from driving for reasons of disability.

13.4 NUICS may also be used to carry freight. This again could cover a wide range, from heavy goods vehicles, to vans, to small delivery pods. Under our terms of reference, we are asked to focus on passenger transport rather than goods, so freight has not been a major part of our project. However, the difficulties of implementing AV passenger transport solutions and the COVID-19 crisis have renewed interest in ensuring resilient delivery systems that are less dependent on human drivers. Automating freight delivery is now seen as a greater priority than before. [699]

13.5 Finally, NUICS might have a range of other uses, from automated snow ploughs to street sweeping.[700] They may also have different uses and layouts at different times,

---

697 For a discussion of the difference between Path 1 and Path 2, see Chapter 2.

698 CP2 para 1.21.

699 See for example, World Economic Forum, How COVID-19 could open the door for driverless deliveries (7 April 2020) https://www.weforum.org/agenda/2020/04/how-covid-19-could-open-the-door-for-driverless-deliveries/.

700 For example, Semcon is a company developing autonomous snow ploughs for use at airports, currently being tested in Norway: https://semcon.com/yeti/.

for example carrying passengers for certain journeys and goods for others (or both together). There may also be uses we cannot yet envisage.

This chapter

13.6 At the present stage of development, it appears that NUICs will require some level of supervision from a remote operation centre. In this chapter we start by looking at how remote operation will work and the challenges it brings. We then consider how remote operation fits with the definition of self-driving outlined in Chapter 4.

13.7 The next question is how those who operate NUICs will be regulated. In Consultation Paper 2 we developed proposals to license HARPS operators. Operators would be under a range of duties, including maintenance, remote supervision and reporting failures. We now consider how far all those who operate NUICs should be licensed, irrespective of the use to which the vehicles are put.

13.8 Under our current proposals, different use cases would be subject to different tiers of regulation. Whereas all licensed operators would be subject to Tier 1 duties, some would be subject to further Tier 2 duties, depending on the use case. Those operating passenger services (HARPS), for example, would be under additional duties to ensure that the service is accessible and to safeguard passengers. Freight operators would be subject to different Tier 2 duties: these may, for example, relate to loading or coupling and uncoupling cabs and trailers.

Figure 13.1 – overview of the role of a licenced fleet operator

THE NATURE OF REMOTE OPERATION

13.9 In Consultation Paper 2 we proposed a requirement that vehicles be adequately supervised. By this, we meant that operators should know where their vehicles are and (if stopped in inappropriate places) should remove them. Supervision would not necessarily require having a human sitting in a control room in front of a bank of screens. However, this is the approach taken by many developers.

13.10 We noted two broad views on how remote operation might work. In the first, a human is in a position to step in and exert longitudinal and lateral control of the vehicle. In the second, the human provides assistance and high-level commands, but has no direct control of the vehicle.

13.11 Several developers took the second view. They explained that remote supervisors will not steer vehicles. Instead, they will respond to a request and decide a course of action which the vehicle will then implement. Mobileye, for example, did not regard the person in the control room as a standby driver: they would not engage in routine driving or intervene to avoid accidents. Instead, they would intervene only if the vehicle reached a complete stop and was unable to make a decision on the available data. The remote human would then choose from a pre-defined list of decisions.[701]

13.12 Similarly, FiveAI anticipated that a supervisor would be able to take control only at the vehicle's instigation and not under their own volition. The human would have "nonreal time situational awareness" of the vehicle and be in a position to advise the vehicle with plans to resume operation or achieve a safer stop.[702]

13.13 Nissan has also published its plans for "remote human support to help driverless autonomous vehicles make decisions in unpredictable situations such as obstructions on the road". If the automated driving system encounters an obstacle, it will bring itself to a safe stop and call the command centre. The human mobility manager will then decide on the correct action. The path is set by the human (for example, by drawing it on a map), and the vehicle then drives itself.[703]

13.14 By contrast, other respondents saw remote supervisors as also including the role of emergency drivers. For example, the Society of Motor Manufacturers said that "a remote operator must ... be in a position to assume control of the vehicle remotely and perform a manoeuvre". Dr Charles Fox saw remote humans as "a small group of highly trained emergency drivers" to take control of the vehicle.

THE CHALLENGES OF REMOTE OPERATION

13.15 Remote operation of vehicles is a step into the unknown. Despite several trials and increased interest in the subject, there is little public information about how remote operation works or the regulatory challenges it poses.

---

701 See response from Mobileye to the Preliminary Consultation Paper in Analysis of Responses to the Preliminary Consultation Paper (19 June 2019), para 3.27.

702 See FiveAI's response to Consultation Paper 1, https://www.lawcom.gov.uk/project/automated-vehicles/.

703 See https://www.nissan-global.com/EN/TECHNOLOGY/OVERVIEW/sam.html.

13.16 We considered some possible issues in Consultation Paper 2. We have also drawn on work for the UNECE by a group of human factor experts known as HF-IRADS (Human Factors in International Regulations for Automated Driving Systems). In September 2020 HF-IRADS submitted a position paper which set out some of the challenges of remote operation.[704]

13.17 HF-IRADS concluded that "currently, there is a lack of evidence that remote vehicle operation on public roads can be performed safely".[705] Therefore, any discussion on how it might be regulated is highly tentative.

Connectivity

13.18 Remote supervision relies on connectivity, so operators will need to ensure that connectivity is adequate for the purpose. As HF-IRADS point out, the feeds required for proper supervision will place great demand on the bandwidth and potentially lead to latency[706] or loss of contact with the vehicle.

> There will probably be a need for a high-resolution video and audio feed from the vehicle, possibly in stereo. The greater the pixel resolution and the greater the field of view required, the more the demand on bandwidth. Lags and judders in communication also become critical.[707]

13.19 If the operator needs to control the vehicle, a fixed time lag can be a problem. However, variability in lag can be even more of a challenge to good performance than the lag itself.[708] As the HF-IRADS paper notes, "consistency of transmission could be a basic requirement".[709]

13.20 Currently, CCAV's Code of Practice of practice for trialling highlights that those conducting remote-controlled vehicle tests should "have a full understanding of connectivity in chosen operational domains".[710] The Code states that staff should be trained to mitigate and respond safely to any connectivity or control issues.[711] It also recommends that data on connectivity, network access, and latency should be recorded.[712] Similar considerations are likely to apply to commercial operation.

---

704 Human Factors in International Regulations for Automated Driving Systems group position paper submitted on 18 September 2020 to the Global Forum for Road Traffic Safety (HF-IRADS): https://www.unece.org/fileadmin/DAM/trans/doc/2020/wp1/ECE-TRANS-WP1-SEPT-2020-Informal-8e..pdf.

705 HF-IRADS p 7.

706 Latency means the time delay before a transfer of data begins following an instruction for its transfer.

707 HF-IRADS p 6.

708 J Davis, C Smyth and K McDowell (2010). The effects of time lag on driving performance and a possible mitigation. IEEE Transactions on Robotics 26(3): 590-593.

709 HF-IRADS p 6.

710 Above, para 5.11.

711 Above, para 4.13.

712 Above, para 5.14.

Cyber-security

13.21 Cyber-security is an issue of acute public concern. The Society of Motor Manufacturers and Traders has noted that failure in this area may “undermine public confidence in the technology” and also “present genuine risks to public safety”.[713] Cyber-security will need to be considered by both the designer of an ADS and the operator of such a system.

13.22 At a high level, the UK Government has produced guidance on vehicle cyber-security for connected and automated vehicles.[714] This emphasises security-by-design: as Principle 8 puts it, the system must be “designed to be resilient to attacks”. CCAV’s Code of Practice for trialling recommends that this guidance should be followed.[715] It also suggests that trialling organisations consider adopting the British Standards Institute’s PAS 1885 standard on automotive cyber-security.[716]

13.23 As understanding of the issues develops, operators will need to follow the latest best practice in this area.

Maintaining situational awareness

13.24 The HF-IRADS paper points out how difficult it is for a remote operator to maintain situational awareness. The first problem is that can be difficult to judge depths from a flat screen. This Civil Aviation Authority notes this concern with remote operation of drones:

> Images captured by a camera and displayed on a flat screen afford the pilot little by way of depth perception and no peripheral vision. This can make it difficult for the pilot to accurately judge speed and distance and to maintain sufficient awareness of the area surrounding the aircraft to effectively ‘see and avoid’ obstacles and other aircraft.[717]

13.25 HF-IRADS also highlight concerns about relying on video feeds alone. The paper points out that operators lack physical sensations: they are deprived of the sense of motion which those in the vehicle take for granted. Research suggests that this physical detachment can lead to a decreased sense of urgency and less empathy.[718] Although information about some aspects of vehicle movement can be provided in different ways, this risks information overload, especially when the operator is reviewing multiple vehicles. Remote operators also report boredom, combined with inattention, distraction and even motion sickness.

---

713 SMMT, *Connected and Autonomous Vehicles: Position paper* (February 2017), p 29.

714 HM Government, *Key Principles of Cyber security for Connected and Automated Vehicles* (2017), https://www.gov.uk/government/publications/principles-of-cyber-security-for-connected-and-automated-vehicles/the-key-principles-of-vehicle-cyber-security-for-connected-and-automated-vehicles.

715 CCAV, *Code of Practice: Automated vehicle trialling* (February 2019), para 2.17.

716 BSI, *The fundamental principles of automotive cyber security – specification*, PAS 1885: 2018 .

717 See the Civil Aviation Authority website: https://www.caa.co.uk/Commercial-industry/Aircraft/Unmanned-aircraft/Small-drones/Regulations-relating-to-the-commercial-use-of-small-drones/.

718 HF-IRADS.

13.26 The paper suggests that remote operation centres should be designed around the human operator, "focusing on factor such as *optimum seating distance, information presentation, task simplification,* and *noise and light optimization"*.[719] It might also be necessary to include haptic feedback, providing some of the sense of motion of being in the vehicle.

Training and rest periods

13.27 Remote operators will need specific, targeted training, in addition to holding a driving licence for any vehicle they control. They will also need health checks and regular breaks.

13.28 There may be lessons from other safety critical control centres, such as air traffic control or railway operating centres. For example, an air traffic controller must be given a half hour break during or after every two-hour period.[720]

13.29 On the railways, tasks such as signalling, dispatching or "receiving and relaying of communications" are defined as "safety critical work".[721] Controllers must ensure that people carrying out such work (including control centre staff) have been assessed as fit for that work;[722] and do not carry out these tasks if affected by fatigue.[723] The Office of Road and Rail (ORR) has issued guidance to avoid fatigue.[724] Among other things, this sets standards for breaks where tasks "require continuous sustained attention, with no natural breaks in the task and where a lapse in attention can lead to safety implications". Minimum breaks are 10 to 15 minutes every two hours during the day and every hour during the night.

Protocols in the event of failure

13.30 We assume that when vehicles encounter problems, they will be programmed to come to a stop. However, even a safe stop may cause a hazard to oncoming traffic. Staff will need to intervene promptly to assist passengers, alert emergency services and remove the vehicle. In some cases, they may need to talk to other road users who have been involved in collisions with the vehicle. They will then need to document the problem and retain data to prevent it from happening again.

---

719 HF-IRADS, p 4.

720 The Civil Aviation Authority has established a Scheme for Regulation of Air Traffic Controllers' Hours (SRATCOH). This also sets out rules for the maximum hours in a shift and for the hours which can be worked in a 30-day period. Rest breaks are expected to provide a certain detachment from the operation e.g. rest areas and quiet spaces. (CAP 670 – ATS Safety requirement, D27). Air traffic controllers are also subject to strict drink and drugs laws: see Railways and Transport Safety Act 2003, ss 92 to 94.

721 The Railways and Other Guided Transport Systems (Safety) Regulations 2006 SI 2006/599, reg 23. The regulations implement the European Railway Safety Directive 2004/49/EC 2004 into domestic law.

722 Above, reg 24(1)(a).

723 Above, reg 25(1).

724 ORR, *Managing Rail Staff Fatigue* (January 2012), https://orr.gov.uk/__data/assets/pdf_file/0005/2867/managing_rail_fatigue.pdf, pp 44 to 47.

13.31 This process will involve communicating with multiple parties, often in emotionally fraught circumstances. Operators will need clear and effective protocols to deal with these situations.

The challenges: conclusion

13.32 Remote operation will pose many challenges, especially if long periods of passivity are interspersed with short periods of stress. However, we do not know how difficult the task will be. The work will depend, for example, on how often vehicles seek assistance and how automated the supervision process becomes.

13.33 At this stage, we are not attempting to suggest how many vehicles can be supervised at once, what information should be displayed or what hours remote supervisors might work. However, any legislation should be sufficiently flexible to deal with such issues.[725]

THE DIFFERENT MEANINGS OF REMOTE OPERATION

13.34 The term "remote operation" is used to mean different things. As noted in Chapter 4, in 2018 the SAE and the ISO have formed a Joint Working Group to update the SAE Taxonomy. The Joint Working Group's draft revision of the SAE Taxonomy dated November 2020 ("ISO/SAE DPAS 22736")[726] distinguishes between three remote functions:

(1) fleet operations;[727]

(2) remote driving;[728] and

(3) remote assistance.[729]

Fleet operations

13.35 "Fleet operations" are activities that support a fleet of ADS-equipped AVs in driverless operation.[730] They include essential non-dynamic driving tasks such as:

(1) managing emergencies, summoning or providing remote assistance as needed, responding to customer requests, break-downs;

---

725 The BSI's CAV Roadmap published in August 2020 summarises the current standardisation landscape for automated driving, including national, European and global standards projects and related activities. The roadmap indicates that standards for remote operators will likely start to emerge from 2023 onwards, see https://www.bsigroup.com/en-GB/CAV/cav-resources/download-cav-roadmap/ (last visited 22 October 2020).

726 ISO/TC 204 Intelligent transport systems, Project: ISO/SAE Approved Working Item PAS 22736*/SAE J3016, Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles* (November 2020).

727 ISO/SAE DPAS 22736, p 13, section 3.13.

728 ISO/SAE DPAS 22736, p 18, section 3.24.

729 ISO/SAE DPAS 22736, p 17, section 3.23.

730 ISO/SAE DPAS 22736, p 13, section 3.13.

(2) serving as the responsible agent in dealings with law enforcement, emergency responders and other authorities;

(3) performing vehicle repair and maintenance.

13.36 Many of these functions are not only relevant to fleets. Some would be needed even for single, privately-owned vehicles. Where there is a user-in-charge, they fall on the user-in-charge. However, for NUIC vehicles some other party would need to be responsible for repairs and maintenance, for reporting accidents to the police and for removing vehicles that have broken down. We consider this below.

Remote driving

13.37 By contrast, remote driving is "real-time performance of part or all" of the dynamic driving task, including, real-time braking, steering, and acceleration by a remote driver.[731] From a technical perspective the SAE and ISO clearly state that "remote driving is not driving automation".[732]

Remote assistance

13.38 Remote assistance is defined as "event-driven provision, by a remotely-located human, of information or advice to an ADS-equipped vehicle in driverless operation" when the ADS encounters a situation it cannot handle.[733] Remote assistance has no overlap with remote driving: it "may include providing an ADS with revised goals and/or tasks" but "does not include real-time [dynamic driving task]".[734]

13.39 The SAE and ISO provide two examples of remote assistance.

(1) The AV encounters unannounced road construction and "the remotely-located human provides a new pathway for the vehicle to follow around the construction zone".[735]

(2) The AV "detects an object in its lane that seems too large to drive over". A remote assistant uses the vehicle's cameras to identify that the object is an empty bag that can be safely driven over, and instructs the AV to proceed.[736]

13.40 In both cases the remote assistant would not be expected to react to the potential hazard in real time. The vehicle would either stop or take other evasive action, and would then ask the remote assistant what best to do next.

---

731 Phantom Auto, Ottopia, Sweden's Einride, and Isreal's DriveU are among the companies developing remote driving technology.

732 ISO/SAE DPAS 22736, p 18, section 3.24, Note 3.

733 ISO/SAE DPAS 22736, p 17, section 3.23.

734 ISO/SAE DPAS 22736, p 17, section 3.23, Note 2 and Note 1 respectively.

735 ISO/SAE DPAS 22736, p 18, section 3.23, Example 1.

736 ISO/SAE DPAS 22736, p 18, section 3.23, Example 2.

APPLYING THE "CONTROL AND MONITORING" TESTS TO REMOTE OPERATION

13.41 In Chapter 3 we discuss the definition of self-driving under section 8(1) of the Automated and Electric Vehicles Act 2018. This states that a vehicle is "driving itself" if it is operating in a mode in which it is not being controlled, and does not need to be monitored, by an individual. In Chapters 4 we consider how this test would apply where an individual is in the vehicle (or in sight of the vehicle) and is in position to resume the role of a conventional driver. Different issues arise where the vehicle is being observed on a screen in a remote operation centre.

13.42 At one end of the spectrum, remote driving is not self-driving. At the other end, "fleet operation functions" are clearly compatible with the vehicle being self-driving. Between these two extremes, the issues become more nuanced, as discussed below.

Applying the control test to remote driving

13.43 "Remote driving" does not meet the definition of self-driving set out in 2018 Act. Instead, an individual exercises lateral and longitudinal control by steering the vehicle and operating its brakes. The United States' Uniform Law Commission has come to the same conclusion. Its 2019 model Automated Operation of Vehicles Act "does not cover remote driving, during which a human drives a vehicle while outside of or far from it."[737]

13.44 Remote driving is currently used in enclosed settings, such as warehouses, quarries and mines.[738] However, roads are considerably more complex. Given the difficulties of remote driving, it is unlikely that a vehicle which encounters other road users would rely entirely on a remote driver. Remote driving on roads may be confined to short periods in rare circumstances. Any ADSE or remote operator which mixed periods of remote driving with self-driving would be covered by our regulatory scheme and would need to show why the combination was safe in their safety cases.

13.45 However, if a vehicle were to rely completely on remote driving (so that it was controlled by an individual at all times) it would not meet the definition of self-driving. It would therefore fall outside the terms of our project.

13.46 Without legal change, the individual would have the full legal responsibilities of a driver, though this could be unfair where connectivity and screens made driving difficult.[739] If remote driving becomes common, it would be open to Government to add

---

[737] See the Uniform Law Commission, Automated Operation of Vehicles Act, 2019, p 1. However it goes on to say it covers some scenarios where "a remote human driver—even one who is working as an agent of the automated driving provider—might terminate automated operation", p8. At https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=2dd86096-2546-dfe8-eeb6-91c11e0e1b2b&forceDialog=0.

[738] See, for example, https://www.bbc.co.uk/news/business-54431056.

[739] As Bruce Mehler, human factors expert at MIT, pointed out, in most instances such individuals would be working for a company and may not have full control of the situation (such as a potentially limited interface that they do not maintain). Remote driving is very likely more difficult than immediately present driving. If the individual is employed by a company, that company may be better placed to assume legal responsibility for remote driving.

further regulatory requirements.[740] The topic of "driver outside the vehicle" has been considered on several occasions by the UNECE's Global Forum for Road Traffic Safety (WP1) and its informal working group.[741] Government could draw on this work.

Applying the monitoring test to remote assistance

13.47 In Chapter 4 we discussed how the first generation of automated vehicles will "handover" to a human in the driving seat. Rather than requiring constant monitoring, they will issue a transition demand. We said that it was possible to remain receptive to a clear alert which gives visual, audio and haptic signals, even if one is not monitoring either the environment or the system. Therefore, our understanding of self-driving would cover a system that required an individual to respond to a clear alert which provided the human with sufficient time to gain situational awareness.

13.48 We think that most remote operations would fall within this framework. The remote assistant would not be monitoring the immediate driving environment or the way the vehicle is driving. Instead, the assistant would respond to a clear alert after the vehicle has come to a stop. They would then step in to assist with path-planning and to authorise a particular course of action.[742]

13.49 The remote assistant may also keep an eye on other aspects of the journey. They may, for example, "monitor" charge levels to direct the vehicle to a suitable charge point. They could also "monitor" traffic information and weather forecasts, to ensure that the vehicle remains within its operational design domain - and does not (for example) enter flood waters it cannot navigate. HF-IRADS has likened these functions to "air traffic control". We do not think that they detract from the technology's self-driving capabilities.

13.50 However, at this stage, it is difficult to be sure that none of a remote assistant's functions will fall within the AEV Act's definition of "monitoring", as discussed in Chapter 4.

13.51 Furthermore, the process of remaining receptive to an alert for professional staff in a remote centre may feel different from remaining receptive to an alert while sitting in a car. Remote receptivity may be a much more active process, particularly if a person is supervising several vehicles at once. Staff may need to scan screens on an ongoing basis, if only to combat boredom and to know enough about where the vehicles are to

---

740 Government could, for example, require a new form of driver licence (with additional training); it could prescribe "drivers' hours" for how long professional drivers could drive remotely at a time; and it could add to construction and use regulations by setting minimum standards for connectivity.

741 See for example the UNECE WP1 Seventy-sixth session Geneva, 19-23 March 2018 Item 3 (c) of the provisional agenda Convention on Road Traffic (1968): Automated driving, The driver matrix, at https://www.unece.org/fileadmin/DAM/trans/doc/2018/wp1/ECE-TRANS-WP1-2018-3e_01.pdf ; and more recently, the UNECE WP1 Seventy-ninth session, Geneva, 17-20 September 2019, Item 3 (c) (ii) of the provisional agenda, The proposed draft resolution on remote driving, at http://www.unece.org/fileadmin/DAM/trans/doc/2019/wp1/ECE-TRANS-WP1-2019-2e_.pdf

742 Initial reports about the new German draft legislation on SAE Level 4 vehicles indicate that Germany is taking a similar approach. The "technical supervisor" designated by the draft seems to be a remote monitor who can authorise a manoeuvre in the event of problems rather than a remote driver. See: https://www.eenewseurope.com/news/german-law-aims-be-first-driverless-cars/page/0/1.

respond within a reasonable time. Staff will also be aware of their inability to get up and wander away. When asked what they are doing, staff may respond by saying that they are "supervising" or "monitoring" their vehicles. Further, it is possible that a layer of automation will do the monitoring and only send issues to staff.

13.52 Below, we welcome comments on whether the definition of self-driving should be applied differently to vehicles which do (and do not) have a user-in-charge.

A grey area: remote back-up drivers

13.53 In some cases, the person in a remote operation centre might be expected to intervene in an emergency, either to achieve a minimal risk condition or to take over driving.[743]

13.54 The ISO and SAE's latest revision of the SAE Taxonomy introduces the concept of a "remote fallback-ready users"[744] who is receptive to both ADS-issued requests to intervene and to evident DDT performance-relevant system failures. The draft gives the following example:

> "A Level 3 ADS [dedicated vehicle] encounters a crash scene for which emergency personnel are re-routing traffic; the ADS issues a request to intervene. The remote fallback-ready user becomes a remote driver and performs the fallback by remotely operating the vehicle."[745]

13.55 The idea that a person may take over driving a moving vehicle from a remote location raises concern. The risks are greater than when dealing with stopped vehicles. It is difficult enough for human in the vehicle to gain situational awareness following a request to intervene. These difficulties are increased when the human is only looking at a screen, without a sense of motion or danger. Emergency intervention may be acceptable in trials with highly trained safety drivers but would raise considerable regulatory challenges if used in commercial deployment.

13.56 In our view, any system which requires a person in a remote operations centre to take control of a moving vehicle requires careful regulation. We would therefore wish to bring it within the regulatory system for self-driving. This means that the vehicle would need to be assessed as safe to operate without a user-in-charge and that it would need to be managed by a licensed operator.

The consequences if vehicles need to be monitored

13.57 In Chapter 4 we discussed the legal consequences when a human in the driving seat did not control the vehicle but needed to monitor the driving environment and/or the

---

743 For example, Nuro (currently trialling in California, Texas and Arizona) says it "will use a remote operator as a backup, able to take control of [its low-speed self-driving delivery vehicles] and navigate them to a safe position". https://static1.squarespace.com/static/57bcb0e02994ca36c2ee746c/t/5b9a00848a922d8eaecf65a2/1536819358607/delivering_safety_nuros_approach.pdf. See also WeRide's press release on July 10, 2020 at https://werideai.medium.com/weride-leads-china-to-first-test-fully-driverless-cars-with-the-countrys-first-remote-control-93563e838b85.

744 ISO/DPAS 22736, p 21, section 3.31.3.2.

745 ISO/DPAS 22736, p 21, section 3.31.3.2, Example.

system. We said that this should be classified as driver assistance; the human should be regarded as a driver, with all the legal obligations and responsibilities that implies. We were concerned that one should only remove driver responsibilities when it was safe to do so.

13.58 Under the present law, we think that a person in a remote control centre would be considered a driver if they are controlling the vehicle by steering and braking. What is less clear, however, is the legal status of remote assistant who is not controlling the vehicle but who is monitoring it. It is not clear that a person in front of the screens would be regarded as a driver if they were merely looking at the driving environment and were not actually controlling the vehicle. In these circumstances, if the vehicle were not regarded as self-driving, there might be a regulatory gap.

13.59 Where an assistant is not controlling the vehicle but could be said to be "monitoring" it, we do not think that it would be appropriate to treat them as driving. The effect of labelling them as a driver would be to make them legally responsible for everything the vehicle does. This would place the many driver liabilities on a single individual, when the fault was more likely to lie elsewhere. For example, there might be a problem with the ADS, inadequate connectivity or a poorly-run remote operation centre. These would be a corporate rather than individual responsibility.

13.60 Bryant Walker-Smith has stressed that in these circumstances it is important to hold the company to account. He notes that a company that develops or deploys an ADS will necessarily promise that its system is reasonably safe:

> This promise, if credible, will be based on a thorough safety case that draws on diverse expertise and that acknowledges both technical and ethical uncertainties… the fundamental policy question should be whether the company that makes such a promise is worthy of public trust.[746]

13.61 Where a vehicle is being watched but not controlled by humans within a remote operation centre, we would wish to include that vehicle within the definition of self-driving. It would then be subject to our proposed safety assurance scheme, designed to evaluate the overall system, as developed by a company and documented in a safety case. It would avoid the highly undesirable outcome, in which a low-level employee was designated as a "driver" and blamed for organisational faults.

Should the legal test for "self-driving" be adjusted?

13.62 Given these different perceptions and outcomes, we welcome views on whether the current test for self-driving should be applied in the same way to both user-in -charge or NUIC vehicles.

13.63 As discussed in Chapter 3, the legal test for self-driving can be defined in terms of a "monitoring and control" test.[747] Our provisional view is that a vehicle is not self-driving if it is being "controlled" (through steering and braking) by an individual. For example, if an individual is steering and braking a vehicle from a remote location we do not think

---

[746] Ethics of Artificial Intelligence in Transport, in *The Oxford Handbook of Ethics of Artificial Intelligence* (2020), p 7 at https://ssrn.com/abstract=3463827.

[747] See ch 3.

that vehicle is “driving itself”. However, we think that if an individual is supervising a vehicle from a remote location, which might include an element of “monitoring”, that should not itself disqualify the vehicle from being “self-driving”. This means that any remote operation centre in which humans received alerts from an ADS would need to be regulated under our proposals, whether they took over the driving task or merely “assisted” the vehicle to plan a route.

13.64 One possibility would be to amend the definition of self-driving under the Automated and Electric Vehicles Act 2018, so that a vehicle would be seen as “self-driving” if it was operating in a mode in which:

(1) it was not being controlled (by steering and braking) by an individual; and

(2) did not need to be monitored by an individual in the vehicle or in sight of the vehicle.

13.65 This would clarify that even if an individual in a remote operations centre was scanning screens, the vehicle would still be regarded as self-driving. This means that the vehicle would only be permitted on the roads if it were classified as safe and overseen by a licensed operator.

13.66 We welcome views.

Consultation Question 37.

13.67 We provisionally propose that:

(1) where an individual is exercising lateral and longitudinal control (steering and braking) over a vehicle remotely, that should not be regarded as a form of “self-driving”; and

(2) where lateral and longitudinal control are exercised by an ADS, all other forms of remote operation should be regulated as “self-driving”.

Do you agree?

13.68 We welcome views on whether the current definition of when a vehicle “drives itself” under the Automated and Electric Vehicles Act 2018 should be amended to deal with some forms of remote operation which may involve a degree of “monitoring”.

OPERATOR LICENSING: PREVIOUS PROPOSALS

Previous proposals on HARPS operator licensing

13.69 Consultation Paper 2 focused on an operator licensing system for a subset of what we now refer to as no-user-in-charge vehicles: AVs used to carry passengers in the context of public transport. We referred to these as highly automated road passenger services, or “HARPS”. We provisionally proposed a single system to license businesses which carried passengers "for hire or reward" using highly automated vehicles on a road without a user-in-charge.[748]

13.70 We proposed that legislation should set out broad duties, with a power to issue statutory guidance on what those duties entailed. The operator would be under a duty to update, insure and maintain the vehicles and to guard against cyber-attacks. The operator would need to supervise the vehicles, probably (though not necessarily) though remote centres. We also proposed duties to report untoward events[749] and to take reasonable steps to safeguard passengers from assault, abuse or harassment.

13.71 There was considerable support for these proposals. A large majority (89%) agreed that there should be a new single national system of operator licensing. Similarly, 87% of consultees agreed that broad statutory duties should be combined with guidance. Many respondents emphasised the importance of flexibility and learning from experience.[750]

13.72 However, there was some concern that the scheme would be confined to roads rather than to roads and other public places. As discussed in Chapter 2, the definition of a road in the Road Traffic Act 1988 is relatively wide. While car park bays have been held not to be roads, the marked access lanes around the bays are roads. However, we note the respondents' concern that some automated vehicles might operate only in open spaces without identifiable edges. A way of addressing these concerns is to take the approach of the many sections of the Road Traffic Act 1988 which apply to "a road or other public place".[751] This would include any places to which the public has open physical access.

13.73 Furthermore, several consultees were concerned that important safeguards provided by our proposals were confined to passenger services. They thought that a similar licensing system should apply to all self-driving vehicles which did not have a user-in-charge, including vehicles which were privately owned. As we discuss below, this has led us to rethink our proposals.

Previous proposals on privately-owned vehicles

13.74 For privately-owned vehicles operating without a user-in-charge, we proposed that the main duties of insurance, maintenance and supervision should lie with the registered keeper. We explained that the registered keeper would be able to outsource those duties to a licensed provider if they so choose.

13.75 We considered whether it might be necessary to require registered keepers to use licensed providers and concluded that it was too early to judge. We therefore proposed that the legislation should include a regulation-making power to require

---

748 The phrase carrying passengers for hire or reward is found in Public Passenger Vehicles Act 1981, s 12(1) and defines those services which need a PSV licence. It has been interpreted several times by the courts: see *Albert v Motor insurers' Bureau* [1972] AC 301; *DPP v Sikondar* [1993] RTR 90 and *Rout v Swallow Hotels Ltd* [1993] RTR 80. For further discussion see CP2 paras 4.9 to 4.13.

749 We discuss "untoward events" in ch 10.

750 For discussion see CP2 Analysis, paras 4.146 to 4.151.

751 See, for example, Road Traffic Act 1988, ss 1 to s 5A.

registered keepers to outsource duties to a licensed provider. The power could be invoked if the need arose.

13.76 One problem with our proposal was how to draw a boundary between privately-owned vehicles and passenger services. In addition to the difficulties in deciding whether a service was provided "for hire or reward", we also discussed several special cases. We suggested a distinction between short term leasing (for less than 6 months) and leases which were more akin to private ownership (exclusive use for 6 months or more). We also looked at the possibility of "peer-to-peer" lending platforms, in which private owners let their vehicle to others.

13.77 Many consultees found our proposals too complex. Only a narrow majority (53%) of respondents agreed that we should distinguish between short-term and long-term leases. Several viewed the six-month time limit as arbitrary, and were split as to whether it should be shorter or longer. Others discussed the difficult boundary between "carrying passengers for hire or reward" as part of a business and "mere social kindness".[752] They thought that this distinction would be particularly difficult to apply to peer-to-peer lending.

13.78 More fundamentally, consultees were concerned that private individuals would lack sufficient expertise to fulfil the responsibilities placed on them. Supervision, cybersecurity and installing software posed particular concerns: consultees thought that these onerous, technical tasks should be carried out by skilled professionals. It was said that public safety and trust could be undermined if they were left to individuals who did not have the expertise and capacity to carry them out.

CURRENT PROPOSALS

13.79 In line with these responses, we now propose a more streamlined scheme. Initially, all NUICs should be supervised and maintained by a licensed operator, irrespective of whether they are used for private or business purposes, and whether or not they carry passengers. A private individual may still own a NUIC vehicle, but they must contract with a licensed operator for supervision and maintenance services. Maintenance for these purposes would include installing software and maintaining cybersecurity.

13.80 The proposal would be backed by criminal sanctions. It would be a crime to use a self-driving vehicle on a road or public place without a user-in-charge unless it was either operated by a licensed operator or covered by a contract with a licensed operator.

The distinction between the ADSE and the operator

13.81 In Consultation Paper 2 we drew a distinction between the role of the ADSE and the HARPS operator:

> The ADSE is the entity which takes responsibility for the automated driving system and must ensure that the design is safe. The HARPS operator is the entity which runs the vehicles and must ensure that the operation is safe.

[752] See CP2 Analysis of Responses paras 4.12 to 4.22 and 5.36 to 5.43.

13.82 We explained that the ADSE and operator may be the same body or different bodies, depending on how the technology is brought to market: for example, a manufacturer might also provide mobility services. Under our provisional proposals, if an ADSE operates a HARPS without a user-in-charge, the ADSE will also need a HARPS operator licence.

13.83 This dual approach contrasts with the position taken by the Uniform Law Commission in the USA. The Commission proposes that a single "Automated Driving Provider" should covers all aspects of complying with the technical and legal requirements for AVs.[753] For example, when Waymo One provides "fully driverless" ride-hailing services in the Phoenix East Valley area of Arizona it is both a designer (ADSE) and an operator.

13.84 The advantage of taking an integrated approach is that it requires a single organisation to take responsibility for all aspects of safety. It means that, if something goes wrong, the ADSE and operator cannot blame each other. The disadvantage is that requiring one combined organisation would reduce competition. It would effectively give a few major developers a monopoly of all automated passenger and freight services, reducing innovation in how these services are provided and increasing prices.

13.85 We continue to believe that the ADSE and operator roles are sufficiently different to justify separate regulatory systems. We ask consultees if they agree.

[753] See the Uniform Automated Operation of Vehicles Act drafted by the National Conference of Commissioners on Uniform State Laws in July 2019 at https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=a78d1ab0-fac8-9ea1-d8f2-a77612050e6e&forceDialog=0.

Consultation Question 38.

13.86 We provisionally propose that:

(1) the regulation of self-driving vehicles should distinguish between an Automated Driving System Entity (which vouches for the design of the system) and an operator (responsible for the operation of individual vehicles);

(2) all vehicles authorised for use on roads or other public places with no user-in-charge should either:

(a) be operated by a licensed operator; or

(b) be covered by a contract for with a licensed operator for supervision and maintenance services;

(3) it should be a criminal offence to use a NUIC vehicle on a road or other public place unless it is operated by a licensed operator or is covered by a contract with a licensed operator for supervision and maintenance services.

Do you agree?

Operator requirements

13.87 The requirements for a licensed operator would mirror the proposals we originally made for HARPS operators that they should:

(1) be of good repute;

(2) have appropriate financial standing;

(3) have an effective and stable establishment in Great Britain; and

(4) be professionally competent.

13.88 A strong majority of consultees (76%) agreed with these proposed requirements in the HARPS context.[754] We think they also apply to NUIC operators.

13.89 In Consultation Paper 2 we provisionally proposed that professional competence should be demonstrated by having a suitable transport manager to oversee operations. The idea is borrowed from public service vehicle (PSV) licensing. At present, every PSV operator must have a transport manager, who is of good repute and professionally competent. Most transport managers demonstrate professional competence by showing that they have passed a written examination.[755] We commented that HARPS would require different skills: in the early days people would still be learning as they go. We asked if HARPS operators also need a transport

[754] For discussion of these requirements see CP2 paras 4.55 to 4.73 and CP2 analysis, paras 4.54 to 4.69.

[755] CP2, paras 4.67 to 4.71.

manager, and if so, how the transport manager could demonstrate professional competence.

13.90 Many consultees supported the idea that a HARPS operator should employ a qualified transport manager, pointing out that many of the current transport management skills would continue to be relevant. Others, however, stressed the need for new skills in remote operation, software installation and technology. Five AI argued that the new challenges meant one should move away from the idea of a single qualified individual. Instead organisations should demonstrate competence through a safety management system, as set out in a safety case. We accept that the more one moves away from passenger services, the less appropriate the concept of a transport manager becomes.

13.91 We welcome views on whether a NUIC operator should demonstrate competence through a safety case rather than through a qualified individual.

Consultation Question 39.

13.92 We welcome views on whether NUIC operators should be required to demonstrate professional competence through a safety management system, as set out in a safety case.

Operator duties: Tier 1

13.93 In Consultation Paper 2 we discussed the various duties which would fall on HARPS operators. We have now looked at these duties again, and divided them into Tier 1 and Tier 2 duties. Under our revised scheme, Tier 1 duties would be limited to safety requirements and apply to those who operated any NUIC vehicle, however it was used. By contrast, Tier 2 duties would only apply only to some business uses, such as carrying passengers or freight. Moreover, Tier 2 requirements would vary depending on the relevant use case (with different requirements for passenger services compared to goods transport).

13.94 We now provisionally propose that Tier 1 duties should include remote supervision, maintenance, insurance and reporting requirements.

Remote supervision

13.95 In Consultation Paper 2 we proposed a requirement that vehicles be adequately supervised. By this, we meant that operators should know where their vehicles are and (if stopped in inappropriate places) should remove them. Supervision would not necessarily require a human sitting in a control room, though this is the approach of many developers.

13.96 Since remote supervision relies on connectivity, there must be consistent, undelayed transmission. Operators will need to develop effective system failure protocols. They should also provide staff with training, health checks, regular scheduled breaks and limits on working hours.

13.97 At present, we do not know enough about how remote operation will work to set specific requirements. Initially, these issues should be addressed in the operator's safety case. However, as the industry develops, the licensing agency will need to develop best practice and provide guidance. Furthermore, the legislation should be sufficiently flexible to allow specific minimum standards to be set out in regulations.

Maintenance

13.98 In Consultation Paper 2 we proposed that licensed operators should be under a legal obligation to ensure roadworthiness. Therefore, when applying for a licence, they should demonstrate adequate arrangements for maintaining vehicles and operating systems in a fit and serviceable condition.

13.99 Some maintenance issues (such a tyre tread and working lights) are familiar from conventional driving. However, many maintenance issues will be new, including keeping sensors clean and aligned, installing software updates and maintaining cyber security. These issues are likely to require specialist understanding and technical skills.

13.100 At present we are not in a position to distinguish between conventional and new repair and maintenance requirements. The two may be interlinked, as where replacing a broken windscreen requires realignment of the sensors, or changing a tyre affects a tyre sensor. To err on the side of caution, we think that, initially, the licensed operator should be legally responsible for all maintenance. However, this would be subject to a regulation-making power to delegate some responsibilities to the registered keeper, if safety permits.

13.101 We envisage that the content of this broad duty will be specified by guidance including best practice examples taken from industry.

Insurance

13.102 It is currently an offence for a person to use a motor vehicle on a road or other public place unless it is covered by an insurance policy.[756] In Consultation Paper 2 we proposed that the legislation should clarify that operators are "users" for this purpose. In other words, an operator would commit a criminal offence if one of its vehicles were to be on a road or public place without insurance. Most consultees (83%) agreed, though some suggested that insurance obligations should be rethought in the light of the new services.

13.103 Given the importance of insurance, we think that, as a starting point, operators should ensure that their vehicles carry appropriate insurance. However, this would be subject to the regulation-making power, which could be used to allow the obligation to be transferred to others (such as the registered keeper).

[756] Road Traffic Act 1988, s 143(1)(a).

Reporting requirements

13.104 In Consultation Paper 2, we proposed that HARPS licensed providers should be subject to the duty to report accidents in section 170 of the Road Traffic Act 1988. This was seen as uncontroversial and drew widespread agreement.

13.105 There was more discussion of our proposal that operators should also report "near misses". We noted the current obligation under section 20(1) of the Public Passenger Vehicles Act 1981, which requires PSV operators to report "any failure or damage of a nature calculated to affect the safety" of occupants or other road users. This extends to failures which could have caused injury in addition to those which did.

13.106 We provisionally proposed that HARPS operators should report untoward events, together with background information about miles travelled. Most people (71%) supported the proposal on the ground that it would help learning within the industry. However, concerns were expressed about commercial confidentiality and how an untoward event would be defined.[757]

13.107 In Chapter 5 we discuss the importance of ensuring that automated vehicles increase safety rather than reduce it. In Chapter 10 we provisionally proposed that scheme regulators should be under a statutory duty to devise measures to compare the safety of automated and conventional vehicles. They will need sufficient powers to collect the required data. As much of this information will rest with the operator rather than ADSE, it is crucial that operators are under a duty to respond to the regulator's requests.

---

757 CP2 Analysis, paras 4.135 to 4.144.

Consultation Question 40.

13.108 We provisionally propose that, irrespective of the nature of the vehicle, a licensed operator should be under a duty to:

(1) supervise the vehicle;

(2) maintain the vehicle;

(3) insure the vehicle;

(4) install safety-critical updates and maintain cybersecurity; and

(5) report accidents and untoward events (as defined by the regulator).

Do you agree?

Consultation Question 41.

13.109 We provisionally propose that legislation should include a regulation-making power by which some or all of these duties could be transferred to the registered keeper or owner, if it was shown that it was appropriate to do so.

Do you agree?

Operator duties: Tier 2

13.110 Although supervision, maintenance, insurance and reporting would apply to all those who operated NIUCs, other duties would only apply to HARPS operators, who carry passengers as a commercial service. These include accessibility, safeguarding passengers and giving price information.

Accessibility

13.111 Older and disabled persons are among those with the most to gain from the introduction of highly automated driving technology. In Consultation Paper 2 we highlighted the importance of embedding accessibility standards into the regulatory framework for HARPS from the start. We drew attention to the many roles of drivers beyond driving (like helping passengers on and off vehicles, or to carry heavy shopping for example). Bruce Mehler of MIT noted:

> "There may well be a role for a fully self-driving vehicle service that includes a human assistant that is there to assist a customer in the ways indicated but who has no driving takeover responsibility, i.e. they may be a lower skilled but otherwise potentially very key human to human support individual."

13.112 Section 29 of the Equality Act 2010 imposes duties on those providing services to the public (including listed land transport providers) not to discriminate and to make reasonable adjustments for people with disabilities. We provisionally proposed to extend these duties to HARPS operators. This received widespread agreement: 83% of respondents said yes and no-one said no. Of those that answered "other", most mentioned the need to avoid stifling innovation.

13.113 In our analysis of responses, we confirmed that we would proceed with this provisional proposal as part of our reforms. The requirement to make reasonable adjustments and avoid discrimination are important safeguards in the development of new self-driving technologies.

13.114 Responses to our second consultation also supported the introduction of national minimum standards, both for vehicle design and the whole HARPS user experience.

13.115 We would like to ensure the development of such national minimum standards actively promotes accessibility and takes into account the lived experience of disabled and older persons. To that end, we provisionally propose that the Secretary of State should be obliged to consult the Equalities and Human Rights Commission as well as disabled representative groups prior to setting any national minimum standards on HARPS. We seek views on whether an accessibility advisory panel should be formed. This could include a duty to re-consult the panel at set intervals to ensure requirements keep pace with developing evidence of technical feasibility and changing needs.

Consultation Question 42.

13.116 We welcome views on how accessibility standards for Highly Automated Road Passenger Services (HARPS) might be developed.

13.117 We provisionally propose that:

(1) an accessibility advisory panel should be formed to include:

(a) the Equalities and Human Rights Commission; and

(b) representative groups for disabled and older persons;

(2) the Secretary of State should be obliged to consult with the accessibility advisory panel prior to setting any national minimum standards on HARPS;

(3) there should be a duty to periodically re-consult the accessibility advisory panel at set intervals to ensure requirements keep pace with developing evidence of technical feasibility and changing needs.

Do you agree?

13.118 We welcome views on what the set interval for periodically re-consulting the accessibility advisory panel should be.

Safeguarding passengers

13.119 In Consultation Paper 2 we proposed that HARPS operators should take reasonable steps to safeguard passengers from assaults, abuse and harassment while using their services. We thought that safeguarding would be required to encourage public use and acceptance and allay fears of being alone in an enclosed space with a stranger.

13.120 The issue divided opinions. While some respondents saw safeguarding as crucial, others thought that operators should not be held responsible for assaults by other passengers.[758] In our analysis of responses, we commented that there are still many difficulties in how passengers can be safeguarded in a shared space without a driver present. Concerns over sharing have been exacerbated by the COVID-19 crisis, which could indicate that initial deployment of automated vehicles might be in smaller "pods" rather than larger shared vehicles.

13.121 The issue is clearly important to the development of shared automated passenger services, but we are not in a position to propose a solution at this time. The onus will be on operators proposing to offer shared passenger services to show how the public can be reassured that the service is safe.

Price information

13.122 In Consultation Paper 2 we noted that taxi fares are often regulated while private hire fares are not. This is because consumers who hail a taxi in the street or take the first taxi at a rank often lack information to make price comparisons, whereas those who pre-book can shop around. We did not propose that HARPS fares should be regulated in the same way as taxis. Instead, we thought that clear and comparable price information should be available to consumers before they book. We asked if the HARPS regulator should have power to issue guidance about this. Of the 58 people who engaged with this question, 40 (69%) agreed; 18 (31%) said other and no-one said no. There was less consensus, however, about how this obligation should be enforced.

13.123 Ensuring clear and comparable price information is clearly important to the development of automated passenger transport. However, we are not in a position to propose how the obligation should be enforced until we know more about how the market will develop.

Freight services

13.124 We envisage that other "Tier 2" duties may also apply to freight services, where it is particularly important to ensure that vehicles are not overloaded, and that loads are distributed evenly and are properly secured.

13.125 In discussion, representatives of the freight industry raised questions about cabs and trailers. At present, it is unclear whether self-driving technology will apply only to the cab, or whether trailers will also contain automated features. Nor do we know how far it might be possible to automate the process of coupling and uncoupling cabs and

[758] For discussion, see CP2 Analysis of Responses, para 4.123.

trailers. The process may require direct or remote supervision and it could raise safety concerns.

13.126 Again, we think it may well be important to impose Tier 2 duties on those who operate automated freight services. As we noted at the outset, we have not consulted on freight-specific requirements because our terms of reference focus on passenger transport. Standards for freight require separate analysis and consultation, building on Tier 1 requirements.

Who should administer the operator licensing system?

13.127 In Consultation Paper 2 we explained that we were not well placed to decide who should administer the operator licensing system. We suggested two possible agencies: the Traffic Commissioners or the same regulator which administers the AV safety assurance scheme.

13.128 The advantage of placing responsibility on the Traffic Commissioners is that they could draw on their experience of administering the PSV and goods vehicle operator licensing schemes. It would also mean that an operator which ran both automated and conventional services would only need to deal with one body, which could reduce the costs of applying for licences.

13.129 The alternative would be to place responsibility on the in-use safety assurance regulator, outlined in Chapter 10. This agency would be well placed to develop expertise in the challenges of automated driving. It would also be in a position to resolve problems of demarcation between the two schemes. An example might be where the sensor proved faulty and dispute arose between the ADSE and the operator about whose fault it was, with the operator claiming that the sensor was defective and the ADSE claiming it was not maintained properly. It would also mean that the flexible regulatory sanctions set out in Chapter 11 could apply to both ADSEs and operators.

13.130 In Consultation Paper 2 we sought views on this issue. This drew a variety of responses. Several consultees saw the Traffic Commissioners as the natural fit, with considerable experience of dealing with the incidents which cause concern. The Office of the Traffic Commissioner commented that for many issues “there is little practical difference” between using automated and conventional vehicles, as “the vehicles share a great deal of common components”. Furthermore, operators may well rely upon both types of vehicle. Therefore

> Splitting the regulation across several bodies presents an additional risk to ensure safety standards are maintained and would create a disproportionate burden on industry.

13.131 Those who argued for a new body, however, saw the challenges of automated driving as fundamentally different, requiring an innovate approach. Others mentioned bringing a variety of expertise together within new collaborative structures.

13.132 It is difficult to evaluate the strength of these two approaches without a greater understanding of how NUICs will be used, or how far remote operation will raise new and different challenges. We continue to have an open mind on this issue and would welcome further observations.

Consultation Question 43.

13.133 We welcome views on who should administer the operator licensing scheme.

Chapter 14: Criminal offences by ADSEs and their senior managers

14.1 In Chapter 11 we provisionally proposed a system of regulatory sanctions designed to promote safety. When things go wrong, the regulator would liaise with the Automated Driving System Entity (or ADSE). The focus would be on identifying the problem and fixing it so that it does not happen again, rather than on blame. This contrasts with the current emphasis on blaming and criminalising human drivers, especially when they cause deaths or serious injuries.

14.2 However, criminal sanctions are appropriate if an ADSE is guilty of serious wrongdoing, such as lying about safety tests. Where this wrongdoing is associated with deaths or serious injury, that offence becomes aggravated. In Consultation Paper 1 we asked

> whether the Law Commissions should review the possibility of one or more new corporate offences, where wrongs by a developer of automated driving systems result in death or serious injury.[759]

14.3 The great majority of consultees (79 out of 94) thought that we should review possible offences. However, the issue is controversial: four developers and manufacturers disagreed. [760]

14.4 Given the majority support, we have reviewed the existing offences and set out their strengths and weaknesses in Appendix 4. In this chapter, we make proposals for four inter-related new offences.

14.5 The offences would apply where an ADSE failed to provide information or misled the safety regulator. An offence would be committed by the ADSE as a corporate body, subject to a due diligence defence. An offence would also be committed by senior managers, where the conduct took place with their consent or connivance or was attributable to their neglect. Where the wrongdoing was associated with a death or serious injury, higher penalties would apply.

14.6 Here we look briefly at the strengths and weaknesses of existing offences in this area. We explain why we think that new offences are necessary and what their aims would be. We then analyse how misconduct of the type we are considering is criminalised in other high-risk industries. Finally, we set out what we think the key aspects of new offences should be and ask for views.

---

759 CP1, CQ 33.

760 Analysis of Responses to CP1, para 7.171. See the responses of Five AI, SMMT, BMW Group UK and Uber.

Offences of causing death or injury by driving

14.7 There are currently eight separate "aggravated" offences of causing death or serious injury while driving. Six relate to causing death, either by dangerous driving;[761] careless driving;[762] careless driving under the influence of drink or drugs;[763] or while uninsured; unlicensed; or disqualified.[764] There are also two offences of causing serious injury, which relate to dangerous driving[765] and driving while disqualified.[766]

14.8 In addition, where a vehicle is taken without authority, higher penalties apply if an accident occurs. Where it leads to a death, in England and Wales the maximum penalty is 14 years' imprisonment.[767] In Scotland, should a vehicle taken without authority be driven in a criminally reckless fashion causing death, a conviction of common law culpable homicide does not have a maximum penalty.

14.9 Prison sentences are common. In England and Wales, in the 10 years from 2009 to 2018, 3,214 people were sentenced to imprisonment for causing death or serious injury by driving.[768] Research has shown that the public support even harsher sentences.[769]

14.10 The trend is towards increasing both the spread of these offences and the level of sentence. In 2016 the UK Government consulted on a new offence of causing serious injury by careless driving. It also proposed to increase the maximum penalty for causing death by dangerous driving or by driving under the influence of drink or drugs from 14 years to life imprisonment. These proposals were widely supported.[770] In

---

761 Road Traffic Act 1988, s 1.

762 Road Traffic Act 1988, s 2B.

763 Road Traffic Act 1988, s 3A.

764 Road Traffic Act 1988, ss 3ZB(a) and 3ZC.

765 Road Traffic Act 1988, s 1A.

766 Road Traffic Act 1988, s 3ZD.

767 Theft Act 1968, s 12A.

768 Ministry of Justice, *Criminal Justice system statistics quarterly: outcomes by offences data tool* (December 2018), https://www.gov.uk/government/statistics/criminal-justice-system-statistics-quarterly-december-2018. In relation to Scotland there were 27,504 convictions in 2018-19 for motor vehicle offences, of which around 89% resulted in a fine, 4% in a community payback order, 4% in an admonition, and 1.5% in a prison sentence: p 68 "Criminal Proceedings in Scotland, 2018-19 https://www.gov.scot/publications/criminal-proceedings-scotland-2018-19/pages/42/. For a discussion, see ch 5.

769 Sentencing Advisory Panel, "Attitudes to the sentencing of offences involving death by driving", Research Report 5 (2008). For discussion see Background Paper 2, para 2.25. Similarly, in response to the Government's 2016 consultation, 70% of respondents supported increasing the maximum sentence for causing death by dangerous driving from 14 years to life imprisonment: https://www.gov.uk/government/consultations/driving-offences-and-penalties-relating-to-causing-death-or-serious-injury.

770 UK Government, Consultation outcome: Driving offences and penalties relating to causing death or serious injury, https://www.gov.uk/government/consultations/driving-offences-and-penalties-relating-to-causing-death-or-serious-injury.

September 2020, the Government announced that legislation to implement these changes would be introduced early in 2021.[771]

14.11 We discussed these offences in a background paper to Consultation Paper 1.[772] We concluded that the offences only apply to human drivers. They would not apply to a user-in-charge, even if the user was uninsured or disqualified.

14.12 In other words, where a death or serious injury is caused by an automated vehicle (AV) driving itself, the current process of blame, prosecution and imprisonment will no longer apply. This is the right approach where no wrongdoing has occurred. As we discussed in Chapter 5, a potential benefit of AVs is that they will reduce road injuries - but they cannot be expected to eliminate them. An AV may function as intended and still cause an injury. However, where the manufacturer or developer has suppressed information or misled the scheme, the criminal law has a part to play.

The relationship between safety assurance and criminal offences

14.13 In our provisional view, the role of new offences should be to complement the safety assurance scheme. There are two broad approaches to safety assurance, at opposite ends of a spectrum.

(1) *A relatively tight safety assurance system,* coupled with third party testing. From the perspective of an ADSE and its management, this provides a degree of certainty. If they comply with the system, carry out all tests on the prescribed checklist of tests and act honestly throughout, they will not be blamed for an adverse outcome.

(2) *Leaving safety to the developer*: the developer decides what tests to carry out and how safe is safe enough, on the understanding that when things go wrong the developer bears the responsibility.

14.14 We are proposing an agile safety assurance scheme that over time would become increasingly prescriptive. The corollary is that an ADSE that complied honestly with all the requirements should not be blamed for an adverse outcome or face criminal penalties.

14.15 However, as we discussed in Chapter 7, regulators will rely heavily on a safety case submitted by the ADSE. It is imperative that this safety case provides an honest account of the tests done and the results obtained. Any misrepresentations or non-disclosures within the safety case would be a breach of the trust placed in the ADSE. And if these failures result in a death or serious injury, we think that would justify serious criminal penalties.

REASONS FOR CRIMINAL LIABILITY

14.16 We think that the regulator should have the power to apply a range of sanctions to an ADSE that are primarily regulatory in nature. However, it seems to us that criminal

---

771 https://www.bbc.co.uk/news/uk-54141729.

772 Background Paper 2, https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2018/11/Compiled-background-paper-document.pdf.

offences for ADSEs that mislead the safety assurance regulator are necessary for at least six reasons. In our view, new offences are needed:

(1) To deter ADSEs from compromising safety standards to gain a competitive advantage. For example, ADSEs might suppress poor test results; install a "defeat device" so that the software performed better in tests than in real life;[773] or disable safety-critical features.

(2) To fill the "accountability gap" left by existing offences. As we discuss in Appendix 4 and outline below, several offences would already apply to an ADSE which caused a death, but there are gaps in accountability, particularly for non-fatal accidents.

(3) To encourage the active involvement of senior management in ensuring the safety of ADSs. In response to Consultation Paper 1, several consultees emphasised the importance of holding senior management personally accountable for instituting an open and transparent safety culture.[774]

(4) To avoid a "radical asymmetry" between the treatment of human drivers and ADSEs.[775] As we have seen, drivers are often imprisoned for causing death or serious injury and demand for more severe penalties is high.[776] From the victim's perspective, whether the injury was caused by an AV or a human driver may make little difference to the desire to see severe penalties applied, particularly as the circumstances may appear very similar.

(5) As a counterweight to the asymmetry of information held by the ADSE compared to the regulator. ADSs are a novel technology and the ADSE, at least initially, will possess a more detailed understanding of how they work than the regulator. To redress this imbalance, we think both misrepresentations *and* certain non-disclosures by the ADSE should attract criminal liability.

(6) To allocate moral blame, which is a key purpose of criminal penalties.[777] The demand for more driving offences for causing death or serious injury (coupled

---

773 CP1 analysis of responses, para 7.152. An example of this risk is the "Dieselgate" scandal which saw Volkswagen exposed in 2015 as having installed illegal "defeat devices" in cars manufactured in Germany to evade emissions standards. The scandal shows the importance of having criminal offences capable of capturing such wrongdoing: it was not until 2019 that a former Volkswagen CEO and four other senior executives charged with fraud in Germany: https://www.independent.co.uk/news/business/news/volkswagen-ceo-martin-winterkorn-fraud-charges-germany-a8870541.html.

774 See, for example, the responses of Sally Kyd, Ageas, Kennedys, Thatcham and ABI, Chartered Institution of Highways and Transportation, Aviva, Senators of the College of Justice and Jacob Hardy.

775 This point was made strongly by Gowling WLG in their response to CP1. See analysis, paras 7.154 to 7.164.

776 A UK Government consultation in December 2016 consulted on increasing sentences for dangerous driving (from 14 years to life imprisonment) (70% supported this proposal) and supporting a new offence of causing serious injury by careless driving (90% support): https://consult.justice.gov.uk/digital-communications/driving-offences-causing-death-or-serious-injury/results/consultation-response-on-driving-offences.pdf.

777 MC Materni, "Criminal Punishment and the Pursuit of Justice" (2013) 2 Br J Am Leg Studies. p 278.

with increasing penalties) demonstrates public desire to punish wrongdoing in the driving context. As the weight of support for a review of the law in this area shows, this desire will continue in an automated world.

14.17 We also acknowledge that there are risks in attaching criminal liability to wrongdoing by ADSEs. These include:

(1) Stifling innovation by criminalising risk-taking that is an inevitable part of developing new technology.[778] We seek to address this by only criminalising behaviour that clearly undermines the safety assurance scheme.

(2) Unfairly penalising ADSEs for problems that are an inevitable part of the development process. With any technology, there is a risk that it may cause harm. Such accidents will not always be due to wrongdoing. We attempt to recognise this by focusing on openness and transparency. We are wary of imposing penalties on mere negligence, as juries may infer negligence from hindsight, assuming that if something has gone wrong, someone must be at fault.

(3) Treating AVs differently from other high-risk industries, or ADSEs differently from other corporations. We have therefore looked across different industries to ensure that ADSEs are not treated more harshly than other manufacturers and developers. We also highlight that the Law Commission has recently begun a project on corporate criminal responsibility.[779]

(4) Unintentionally encouraging senior management to cover up, rather than expose, wrongdoing.[780] We seek to avoid this by proposing a defence for corporations who have acted with due diligence.

Aims of new offences

14.18 Our main concern is that some ADSEs might act dishonestly in their approach to safety assurance. In particular they may:

(1) not carry out all the tests required;

(2) misreport test results;

(3) supress poor test results;

(4) install defeat devices, which make a system respond differently in tests than in real life; and

(5) obtain confidential information about test scenarios, and then game the system by training only for the test and not for real life.[781]

---

778 BMW Group and Direct Line Group response to CP1.

779 https://www.lawcom.gov.uk/project/corporate-criminal-liability/.

780 Peter Brown response to CP1.

781 The culpability of senior managers is discussed below, at paras 14.97 to 4.98.

14.19 The main purpose of the new offences would be to prevent this sort of serious wrongdoing that actively undermines the safety assurance scheme. They would apply to both the ADSE as a corporate entity, which would have a defence if it showed that it and its management "took reasonable precautions and exercised all due diligence" to prevent the wrongdoing. It would also apply to senior managers, where the offence was committed with their consent or connivance or attributable to their neglect.

14.20 This is different from criminalising negligence, which might include failing to carry out additional tests. If, in retrospect, a failure to perform additional tests appeared grossly negligent, other offences might be available. For example, the conduct might amount to corporate manslaughter, gross negligence manslaughter, culpable homicide or a breach of section 3 of the Health and Safety at Work Act 1974.[782] However, an ADSE which had complied fully with the requirements of the scheme would be able to use this in its defence.

14.21 Our proposed new offences would apply to the ADSE. They would not apply to other suppliers or subcontractors (such as a sensor manufacturer who supplied a faulty sensor). However, suppliers or subcontractors may be guilty of the other offences.

EXISTING OFFENCES: AN "ACCOUNTABILITY GAP"

14.22 Some offences already apply to the behaviour we wish to discourage. In Appendix 3 we provide details of the following eight offences:

- exposing the public to risks to health and safety, contrary to section 3 of the Health and Safety at Work etc (HSW) Act 1974 (UK-wide);
- consenting to, conniving in or negligently failing to prevent a breach of section 3, contrary to section 37 of the HSW Act 1974 (UK-wide);
- making a false representation with a view to gain, contrary to section 2 of the Fraud Act 2006 (England, Wales and Northern Ireland only);
- failing to disclose information with a view to gain, contrary to section 3 of the Fraud Act 2006 (England, Wales and Northern Ireland only);
- corporate manslaughter (England, Wales and Northern Ireland only)/corporate homicide (Scotland only);
- unlawful act manslaughter (England and Wales only);
- gross negligence manslaughter (England and Wales only); and
- culpable homicide (Scotland only).

14.23 Here we look briefly at the main strengths and weaknesses of these offences.

782 These offences are considered in Background Paper 2, published alongside Consultation Paper 1, https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2018/11/Compiled-background-paper-document.pdf.

Section 3 Health and Safety at Work etc (HSW) Act 1974

14.24 Section 3 of the HSW Act 1974 imposes a duty on employers to ensure that the public is not exposed to health and safety risks. This duty complements the duty under section 2 of the Act not to expose employees to risks. It provides that:

(1) employers must conduct their undertaking in such a way as to ensure;

(2) so far as is reasonably practicable;

(3) that persons not in their employment who may be affected are not exposed to risks to health or safety.

14.25 Section 33 of the HSW Act 1974 provides that a breach of this duty is a criminal offence.

14.26 As we explain in Appendix 4, this is an extremely broad offence. Potentially, it is the most-suited to capturing the kind of wrongdoing we are targeting. However, it is rarely applied in the road traffic context. Furthermore, the penalty of a maximum two years' imprisonment is relatively light, especially when compared to offences of causing death or serious injury by driving.

Section 37 of the Health and Safety at Work etc Act 1974

14.27 Section 37 of the HSW Act 1974 may also apply in this context. It applies when:

(1) an HSW Act offence is committed by a body corporate;

(2) with consent, connivance, or neglect by a director, manager, secretary or other officer.

14.28 Section 37 effectively allocates secondary, personal liability to senior management of a corporation following a breach of section 3 of the HSW Act by the corporation.

14.29 We think this is a helpful example of a way to hold senior management personally liable for wrongdoing by a corporation. It is not limited to consent or connivance, but also covers neglect. Again, however, it has not been applied in a road traffic context. Furthermore, the penalty is a fine or imprisonment of up to two years (or both). This may be too light to cover serious wrongdoing that leads to death or serious injury.

Section 2 of the Fraud Act 2006

14.30 Section 2(1) makes it an offence in England and Wales[783] if a person:

(a) dishonestly makes a false representation, and

(b) intends, by making the representation—

---

783 The Scots common law offence of fraud is not discussed here. Although it is at least as wide as the Fraud Act, s 2, it is unlikely that, given its specifically Scottish application, prosecution under it would deter the behaviour we are concerned with. Furthermore, it would not appear an appropriate foundation for the statutory offence we contemplate, which we think should be identical in Scotland, England and Wales.

(i) to make a gain for himself or another, or

(ii) to cause loss to another or to expose another to a risk of loss.

14.31 A representation is false if "it is untrue or misleading" and "the person making it knows that it is, or might be, untrue or misleading".[784]

14.32 This offers an example of how to criminalise misrepresentations. However, as discussed below, it is difficult to bring a prosecution under it against a corporate entity, as it requires proof of what the corporation "knows" and "intends". This involves attributing to a company the knowledge and intent of a director or senior manager.

Section 3 of the Fraud Act 2006

14.33 Section 3(1) of the Fraud Act 2006 also makes it an offence in England and Wales if someone:

(a) dishonestly fails to disclose to another person information which he is under a legal duty to disclose, and

(b) intends, by failing to disclose the information—

(i) to make a gain for himself or another, or

(ii) to cause loss to another or to expose another to a risk of loss.

14.34 This offence criminalises non-disclosures where a person is under a legal duty to disclose information. However, as with misrepresentations, it requires proof of what the corporation "intends".

Corporate manslaughter/homicide

14.35 Under section 1(1) to (3) of the Corporate Manslaughter and Corporate Homicide Act 2007, an organisation is guilty of corporate manslaughter or corporate homicide if the "way in which its activities are managed or organised":

(1) causes a person's death; and

(2) amounts to a gross breach of a relevant duty of care owed by the organisation to the deceased; and

(3) the way in which its activities are managed or organised by "senior management" is a "substantial element" of the breach.

14.36 This demonstrates a way of holding corporations accountable for wrongdoing of their employees. However, it only applies to deaths, not serious injuries. Also, as Celia Wells points out, most companies convicted of corporate manslaughter have been small or medium-sized. It is easier to point to failings by senior managers where individual directors are intimately involved in day-to-day decisions than in large

---

784 Finance Act 2006, s2(2)(a) to (b).

companies with complex management structures, where senior managers are insulated from such decisions.[785]

Unlawful act manslaughter

14.37 This common law offence in England and Wales consists of three main elements:

(1) There must be an unlawful act, which is itself dangerous (in the sense that the risk of some physical harm must be objectively foreseeable)

(2) The act must cause death.[786]

(3) The act must be intentional or subjectively reckless: mere negligence is not enough.[787]

14.38 The offence shows one method of holding individuals or corporations accountable when the defendant has committed a wrongful act that causes death. However, it tends to be applied to violent acts (such as assault) rather than to dishonest ones (such as non-disclosure).

Gross negligence manslaughter: England and Wales

14.39 Gross negligence manslaughter applies in England and Wales and consists of five elements:[788]

(1) The defendant owed a duty of care to the victim;

(2) The defendant negligently breached that duty;

(3) It was reasonably foreseeable that the breach would give rise to a serious and obvious risk of death. This is an objective question, based on the knowledge available to the defendant at the time of the breach. The court cannot impute to the defendant knowledge that would have been obtained had there been no breach of duty;[789]

(4) The death of the victim was caused by the breach; and

(5) In the jury's view, the defendant's conduct was "so bad as to be criminal."

14.40 The offence makes individuals liable for gross negligence that results in death. It is a very general offence, which relies on the jury's view of what is "so bad as to be criminal". Inevitably, the jury will view actions with hindsight, in the light of the tragedy

---

785 C Wells, "Corporate Criminal Liability: A Ten-Year Review" (2014) Crim LR 849.

786 *DPP v Newbury* [1977] AC 500, 507 by Lord Salmon.

787 *Andrews v DPP* [1937] AC 567, 585; D Ormerod and K Laird, *Smith and Hogan's Criminal Law* (14th ed 2015) p 628.

788 *R v Adomako* [1995] 1 AC 171, p 187.

789 *R v Rose (Honey Maria)* [2018] QB 328. See also Judge Mark Lucraft QC (ed), *Archbold: Criminal Pleading, Evidence and Practice 2019* (67th ed 2018) paras 19 to 123; D Ormerod QC (Hon) and D Perry QC (eds), *Blackstone's Criminal Practice 2019* (2018) para B1.68.

that has occurred. Consternation in the medical profession following the conviction of a doctor for gross negligence manslaughter in 2016 after a child died in her care in hospital prompted both the Williams and the GMC (Hamilton) review.[790] These developments have caused concern within the medical profession, where "many doctors feel unfairly vulnerable to criminal and regulatory proceedings should they make a mistake which leads to a patient being harmed". [791]

Culpable homicide: Scotland

14.41 Culpable homicide is a Scots law offence. It is defined as "the killing of human beings in all circumstances, short of murder, where the criminal law attaches a relevant measure of blame to the person who kills".[792]

14.42 Blame is attached where:

(1) the conduct was directed intentionally in some way against the victim; or

(2) the conduct was so grave in its recklessness as to injury that it should be criminalised.[793]

14.43 A company may be charged with culpable homicide but for the company to be found guilty the criminal mind and actions of an individual must be attributed to the company.[794] That individual must be an employee, director or agent with delegated powers and responsibilities.

14.44 The Culpable Homicide (Scotland) Bill 2020 has recently been introduced into the Scottish Parliament.[795] If enacted, the statutory offences contained within the Bill would sit alongside the existing common law offence of culpable homicide.

14.45 Both the existing and potentially new statutory offence apply to both individuals and corporations.[796]

---

790 See *R v Bawa-Garba* [2016] EWCA Crim 1841 discussed in Appendix 3.

791 Independent review of gross negligence manslaughter and culpable homicide (Chair, Leslie Hamilton) for the General Medical Council, June 2019 at p 5: https://www.gmc-uk.org/-/media/documents/independent-review-of-gross-negligence-manslaughter-and-culpable-homicide---final-report_pd-78716610.pdf

792 Lord Justice-General Rodger in *Drury v HMA* 2001 SLT 1013 at [13].

793 *McAngus v HM Advocate* 2009 JC 137 at [29] (High Court of Justiciary – five judge bench).

794 *Transco Plc v HMA* 2004 JC 29 at [62] by Lord Hamilton.

795 https://beta.parliament.scot/-/media/files/legislation/bills/current-bills/culpable-homicide-scotland-bill/introduced/bill-as-introduced-culpable-homicide-scotland-bill.pdf.

796 Scottish Parliament, *Culpable Homicide (Scotland) Bill: Policy Memorandum*, paras 7 to 9.

The "accountability gap"

Limited applicability to serious injury

14.46 One of the shortcomings of the existing legal framework is that four out of the eight potentially applicable offences[797] only apply to wrongdoing that results in death. The current law consequently excludes wrongdoing by ADSEs that leads to serious but non-fatal injury.

Difficulty of holding corporations accountable, particularly large corporations

14.47 Corporations are separate legal persons that are subject to civil and criminal laws. However, the applicability of criminal offences to corporations is usually limited by the "identification principle".[798] In England and Wales, to establish the mental element necessary for most criminal offences, one needs to show that an individual who was the "directing mind" of the corporation directed the commission of the offence.[799]

14.48 This means corporations are generally not guilty of offences committed by low-level employees unless they were at least encouraged or assisted by senior managers. In large corporations, such senior officers are often far removed from day-to-day operations, making it difficult to show any connection between the "directing mind" of the corporation and the alleged offence.[800]

14.49 In Scots law it is sufficient that a person with duly delegated powers of the body has both the criminal mental state and commits the criminal act.[801] However if one individual in the company has the criminal mental state but another individual commits the wrongful act, it is not possible for the company to be criminally liable. So, for example, if one person falsified information which another person used for gain, the corporation would not be guilty of an offence.

14.50 Five of the offences considered in this review are limited by the identification principle.[802] Furthermore, corporations cannot be guilty of gross negligence manslaughter.[803] Instead, the offence of corporate manslaughter applies. This circumvents the identification principle by holding corporations liable if a senior manager's failings were a "substantial element"[804] of the corporation's breach of duty

---

797 The offences are corporate manslaughter/ corporate homicide, unlawful act manslaughter, gross negligence manslaughter and culpable homicide.

798 *Salomon v A Salomon & Co Ltd* [1896] UKHL 1; Criminal Justice Act 1925, s 33(3) and Interpretation Acts 1889 to 1978.

799 *Tesco v Nattrass* [1972] AC 153.

800 Bryan Cave Leighton Paisner, "Corporate Criminal Liability – Perspectives from the US, UK and France" (2018) https://www.jdsupra.com/legalnews/corporate-criminal-liability-97539/.

801 *Transco plc v HMA* 2004 JC 29 at [62] by Lord Hamilton.

802 Fraud Act 2006, ss 2 and 3, unlawful act manslaughter and culpable homicide.

803 Corporate Manslaughter and Corporate Homicide Act 2007, s 20. Though the Scots law offence of culpable homicide can apply to corporations as it is unaffected by s.20.

804 Corporate Manslaughter and Corporate Homicide Act 2007, s 1(1) to (3).

that resulted in death. However, its effectiveness in doing so, particularly in respect of larger corporations, has been questioned.[805]

Difficulty of holding senior management accountable

14.51 In addition to difficulties in prosecuting corporations, it may also be difficult to convict senior managers. Again, this reflects the difficulty of showing that senior employees knew of or participated in the wrongdoing, especially in larger corporations.

14.52 Three of the offences (section 37 of the HSW Act 1974 and sections 2 and 3 of the Fraud Act 2006) provide specific mechanisms for holding senior management accountable. For these offences, a senior manager is liable if the offences occurred with their “consent” or “connivance”.[806] In addition, under section 37 of the HSW Act, a senior manager may also be held liable if the wrongdoing took place due to their “neglect”.[807]

Law Commission corporate criminal responsibility project

14.53 Concerns have been raised over the effectiveness of current laws in criminalising corporate entities (especially when they commit economic crime). The Law Commission has been asked by the UK Government to draft an Options Paper, in which the Commission will analyse the effectiveness of the law governing corporate criminal liability and where it could be improved. The Commission will canvass various options for reforming the law of England and Wales to ensure that corporate entities can be held appropriately and fairly to account. The Commission is aiming to publish the Options Paper in in late 2021 and will work with the Government on next steps, including the potential for a full Law Commission project on Corporate Criminal Liability.[808]

14.54 We make the current proposals without prejudice to wider issues of corporate criminal responsibility.

Outcome of review of existing offences

14.55 We think that the existing offences give rise to an accountability gap if applied in the automated driving context. All the offences have weaknesses that might make it difficult to hold an ADSE accountable for the wrongdoing we provisionally consider should be deterred and punished. We consequently think that new offences are needed. However, we do not suggest disapplying any of the existing offences.

CRIMINAL LIABILITY IN OTHER HIGH-RISK INDUSTRIES

14.56 As part of our review, we have considered how criminal liability is allocated in other high-risk industries where a corporation misleads the regulator. Below we examine the

---

805 C Wells, “Corporate Criminal Liability: A Ten-Year Review” (2014) *Crim LR* 849, at pp 853 to 4. For a discussion of the policy underlying corporate crime, see C Wells, *Corporations and Criminal Responsibility* (2nd ed 2001). See also responses from Sally Kyd, Cycling UK and the CPS to CP1.

806 Health and Safety at Work etc Act 1974, s 37; Fraud Act 2006, s 12.

807 Health and Safety at Work etc Act 1974, s 37.

808 The Corporate Criminal Liability project will pertain to the law of England and Wales only.

offences that apply in the pharmaceutical industry, the aviation industry and the nuclear industry. We think that the offences in the Human Medicines Regulations 2012 provide particularly useful examples.

Pharmaceutical industry

14.57 The agency responsible for regulating the pharmaceutical industry and authorising medicinal products is the Medicines and Healthcare Products Regulatory Agency (MHRA).[809] The UK framework for authorising medicinal products is found in the Human Medicines Regulations 2012,[810] which the MHRA is responsible for enforcing.[811]

14.58 The 2012 Regulations contain specific offences relating to non-disclosures and misrepresentations during the authorisation process. There appear to be seven different ways for a producer of medicinal products to commit an offence by a non-disclosure or misrepresentation during the process.

14.59 Regulation 95 criminalises certain non-disclosures: it makes it an offence to "fail to provide" information "relevant to the evaluation of the safety, quality or efficacy of the product" to the regulator. It also prohibits certain misrepresentations: it is an offence to provide information "relevant to the evaluation of the safety, quality or efficacy of the product but that is false or misleading" in a material particular. The penalty on indictment is a fine or up to two years' imprisonment (or both).[812]

14.60 Regulation 101(3) provides a defence if the person can show that they "took all reasonable precautions and exercised all due diligence to avoid commission of that offence".

14.61 Additionally, the MHRA can issue notices under regulation 30(1) should it require more information to determine an application – it is an offence to make a misrepresentation in response.[813]

Strengths

14.62 A key advantage of using regulation 95 as a framework for new AV offences is that both non-disclosures and "false and misleading" misrepresentations are prohibited. The offence applies where the non-disclosed or misrepresented information is

---

809 The MHRA was formed in 2003 from a merger of the Medicines Control Agency and the Medical Devices Agency: http://dbpedia.org/page/Medicines_and_Healthcare_products_Regulatory_Agency.

810 Human Medicines Regulations S1 2012 No 1916. The Regulations were introduced to consolidate medicines legislation. They repealed most of the Medicines Act 1968 and around 200 statutory instruments: MHRA, *Post-implementation Review of the Human Medicines Regulations 2012: Final Report – August 2017* (2017), p 2.

811 MHRA, *Post-implementation Review of the Human Medicines Regulations 2012: Final Report – August 2017* (2017), p 1.

812 Human Medicines Regulations SI 2012 No 1916, reg 99.

813 Under reg 34(2), it is an offence to "knowingly give false information in response to a notice under regulation 30(1)". Reg 30(2) empowers the MHRA to require that specific information is provided within a specified period. Under reg 34(3), it is also an offence to fail to comply with the terms of a notice without "reasonable excuse".

relevant to “the evaluation of safety, quality or efficacy”. Borrowing such language would reflect our emphasis on safety and provide guidance to ADSEs as to what information they should provide to avoid committing an offence.

14.63 Secondly, the 2012 Regulations provide for corporate criminal responsibility. Regulation 95 applies to “persons”, whether individual or corporate.[814] Regulation 100 then states:

> If a breach of regulation 95… is committed by a person acting as employee or agent, the employer or principal of that person is guilty of the same offences and is liable to be proceeded against and punished accordingly.

14.64 This is a significant exception to the identification principle in England and Wales. It effectively imposes vicarious liability on corporations for any relevant non-disclosure or misrepresentation committed by employees, subject to a due diligence defence.

14.65 The provision of a due diligence defence is also helpful. It provides a defence to any defendant who “took all reasonable precautions and exercised all due diligence to avoid commission of that offence”. This would avoid placing on onerous burden on ADSEs.

Weaknesses

14.66 The maximum penalty is not very severe, being two years’ imprisonment. The maximum penalty fails to reflect the serious harm that may be caused in some circumstances.

14.67 There is also a lack of information about how regulation 95 works in practice. In 2017 the MHRA conducted a post-implementation review of the 2012 Regulations, but regulation 95 was not discussed in the review.[815] It is also unclear how far similar offences under previous legislation were enforced.[816]

Aviation industry

14.68 The primary regulator of the UK’s aviation industry is the Civil Aviation Authority (CAA). Any individual or corporation that wishes to operate an aircraft for commercial air transport needs both an Air Operator Certificate (AOC) and an Operator Licence from the CAA.[817]

---

814 *Salomon v A Salomon & Co Ltd* [1897] AC 22; and Interpretation Acts 1889 to 1978.

815 MHRA, *Post-implementation Review of the Human Medicines Regulations 2012: Final Report – August 2017* (2017). We have not located any academic literature on Regulation 95.

816 Under the Medicines Act 1968, it was an offence to provide information that was “known to be a false in a material particular” if the licensing authority requires further information in respect of an application (s 45(6)). It was also an offence to fail to comply with this request “without reasonable excuse” (s 45(7)). However, it was not an offence to provide false information or to fail to disclose certain information: such conduct only provided grounds for the suspension, revocation or variation of a licence: s 28(3)(a), s 28(4)(a).

817 Airlines based in the Channel Islands or the Isle of Man must hold an Air Transport Licence (ATL) instead of an Operating Licence.

14.69 The legislative framework is set out in the two Civil Aviation Acts (1982 and 2012) together with secondary legislation. The framework contains two offences of providing false information to the CAA.[818]

(1) It is an offence to make "false representations" to acquire, renew or vary an AOC.[819]

(2) The CAA has power to require information from holders of both AOCs and Operator Licences. It is an offence to "knowingly or recklessly [furnish] information which is false in a material particular" in response.[820]

14.70 The penalty on indictment is a fine or up to two years' imprisonment (or both).[821]

14.71 Senior managers may be found guilty of these offences if they were committed with their consent or connivance, or were attributable to their neglect. Section 99(1) of the Civil Aviation Act 1982 states:

> Where an offence to which this subsection applies has been committed by a body corporate and is proved to have been committed with the consent or connivance of or to be attributable to any neglect on the part of any director, manager, secretary or other similar officer of the body corporate or any person who was purporting to act in any such capacity, he as well as the body corporate shall be guilty of that offence…

14.72 This mechanism is equivalent to section 37 of the HSW Act 1974.

Nuclear industry

14.73 The Office for Nuclear Regulation (ONR) is the principal regulator for the nuclear industry. The Energy Act 2013 regulates how the ONR grants licences to generate and distribute energy. Section 105 of the 2013 Act contains two offences relating to the provision of "false information and deception." First, it is an offence to make a false statement either that the "person knows to be false" or "recklessly" when providing information to obtain a licence or that is otherwise required by the Energy Act 2013.[822] Second, it is an offence to "make a false entry in a relevant document", intentionally or with intent to deceive.[823]

14.74 Again, the penalty on indictment is a fine or up to two years' imprisonment (or both).[824]

---

818 The CAA is also responsible for licensing airports. Under s 50 of the Civil Aviation Act 2012, the CAA can require information needed to perform its functions from a prospective or current licence holder. However, failure to comply with notices to provide the correct information results in civil, not criminal, penalties: Civil Aviation Act 2012, ss 51 to 52.

819 Air Navigation Order 2016, s 256(c).

820 Civil Aviation Act 1982, s 84(4).

821 Civil Aviation Act 1982, s 84(a) to (b); s 67(6)(a) to (b).

822 Energy Act 2013, s 105(1).

823 Energy Act 2013, s 105(3).

824 Energy Act 2013, s 105(7).

14.75 The Energy Act 2013 follows the approach of aviation towards senior managers, who are guilty of offences committed with their consent or connivance, or attributable to their neglect. Paragraph 7 of Schedule 10 states:

> (1) Where an offence committed by a body corporate is proved—
>
> > (a) to have been committed with the consent or connivance of an officer of the body corporate, or
> >
> > (b) to be attributable to neglect on the part of an officer of the body corporate,
>
> that officer (as well as the body corporate) is guilty of the offence and is liable to be proceeded against and dealt with accordingly.

Enforcement

14.76 In these high-risk industries, offences are prosecuted by the relevant regulator. Between 2005 and 2013, the Civil Aviation Authority brought 163 prosecutions with all but 14 succeeding.[825] Between 2017 to 2019, it brought 21 successful prosecutions.[826] Most convictions result in a fine rather than imprisonment.

14.77 The 2018/19 annual report of the Medicines and Healthcare Products Regulatory Agency states that "we have had eight successful prosecutions this year, with 17 defendants convicted and sentenced, often to terms of imprisonment. We have also obtained confiscation orders worth over £450,000".[827] These relate to offences generally, not just information-related offences.

14.78 Since its establishment in 2011, the Office for Nuclear Regulation has pursued four prosecutions, which all resulted in convictions.[828] However, none related to false or misleading information. The defendants, all corporations, were prosecuted under HSW Act 1974, the Lifting Operations and Lifting Equipment Regulations 1998 and the Work at Height Regulations 2005. The penalties in each case were fines.

KEY COMPONENTS OF THE NEW OFFENCES

14.79 As discussed in Chapter 7, the safety assurance scheme will rely crucially on the ADSE to submit a safety case. All those involved in the process need to be honest, open and accurate in putting the case together.

---

825 CAA, Enforcement Actions, https://www.caa.co.uk/Data-and-analysis/Data-for-passengers/Complaints-and-enforcement/Enforcement-actions/.

826 CAA, Successful Prosecutions: https://www.caa.co.uk/uploadedFiles/CAA/Content/Related_Information/Our_work/CAA%20Prosecutions%202018-2019.pdf; https://www.caa.co.uk/uploadedFiles/CAA/Content/Related_Information/Our_work/CAA%20Prosecutions%202016-2017.pdf; https://www.caa.co.uk/uploadedFiles/CAA/Content/Related_Information/Our_work/CAA%20Prosecutions%202017-2018.pdf.

827 MHRA, Annual Report and Accounts (2018/19), p 25.

828 ONR, Prosecutions, news.onr.org.uk/category/enforcement-action/prosecutions/.

14.80 We provisionally consider that this need should be underlined by new criminal offences. These offences would apply where an ADSE omits relevant information or includes misleading information in its safety case, or in responding to the regulator's requests for information. Where this leads to death or serious injury, the offence should carry a higher penalty.

14.81 The offences applicable in other high-risk industries provide a variety of templates for how this could be done.

Non-disclosure and misrepresentations

14.82 We provisionally consider the new criminal offences should capture both misrepresentations and non-disclosures. At least in the early stages, the safety assurance regulator will possess significantly less knowledge about the vehicle than the ADSE. The onus will be on the ADSE to share safety-critical information, including tests that show potential problems.

14.83 As we have seen, the offences applicable to the pharmaceutical, aviation and nuclear industries all apply to misrepresentations. Regulation 95 of the Human Medicines Regulations 2012 also applies to non-disclosures: it is an offence to "fail to provide" information "relevant to the evaluation of the safety, quality or efficacy of the product" to the regulator. We see this as a useful precedent.

14.84 In an AV context, we do not think is necessary to criminalise all non-disclosures relevant to "efficacy". However, given the risks associated with the suppression of test results, we provisionally propose that it should be a criminal offence to fail to provide information that is relevant to the regulator's evaluation of safety of the ADS or the vehicle as a whole. It should also be an offence to make representations which are "false or misleading in a material particular".

Culpability

14.85 In the aviation industry and nuclear industry, the defendant must have made the misrepresentation or non-disclosure "knowingly or recklessly".

14.86 By contrast, Regulation 95 of the Human Medicines Regulations 2012 applies to all non-disclosures and misrepresentations. This is subject to the due diligence defence, set out in Regulation 101(3). The onus is on the defendant to show that they "took all reasonable precautions and exercised all due diligence to avoid commission of that offence".

14.87 Our provisional proposal is to follow the approach of the Human Medicines Regulations 2012. It is extremely difficult to show that an employee "knew" that a statement was wrong, and even more difficult to show what an organisation did or did not know. Our aim is to promote a safety culture which takes all reasonable precautions to ensure that safety relevant information is disclosed fully and accurately. The crucial element here is the organisation's diligence in ensuring full disclosure, rather than any individual's knowledge.

14.88 Due diligence defences are relatively common in regulatory crimes. For example, one is available for breaches of "the general safety requirement" found in General Product

Safety Regulations 2005.[829] They are well understood and focus attention on what an organisation can do to enhance an open, safety-oriented culture.

Aggravated offence for death or serious injury

14.89 In our view, higher penalties should be available when death or serious injury has occurred. This would avoid creating a "radical asymmetry" between the treatment of human drivers and ADSEs. As we have seen, human drivers face a variety of aggravated offences where their wrongdoing caused death or serious injury.

14.90 Where a company is prosecuted, imprisonment is not an option: one cannot imprison a company. However, if the directors of an ADSE were shown to have suppressed safety-critical information, and someone died as a result, the public would demand greater penalties than the maximum two-year sentence available for breach of Regulation 95 of the Human Medicines Regulations 2012.

14.91 The offences we have looked at in other high-risk industries in the UK do not provide for increased sentences in the event of serious harm. This contrasts with the position in the United States aviation industry for example, where falsifying or concealing a material fact will attract higher penalties depending on the harm caused. If the wrongdoing results in death, the maximum penalty is life imprisonment.[830]

The causal relationship between false information and harm

14.92 One difficult issue is how to establish a causal relationship between the wrong (the misrepresentation or non-disclosure) and the harm (the serious injury or death). The wrong may be committed many years before the harm occurs and be carried out in a quite different setting. We would not wish to be over-inclusive: if, for example, an ADSE suppressed poor test results about how its technology performed at night, it would be wrong to hold the ADSE responsible for a death during the day. This is true even if, had the regulator been aware of the poor test results, the ADS would not have been classified as self-driving and the harm would not have occurred.

14.93 However, it would be too narrow to require that the suppressed test result deal with exactly the same scenario as the one that caused the death. If, for example, the poor test result indicated two scenarios where the vehicle's sensors performed poorly at night (concerning a cyclist and a pedestrian) this would indicate a more general problem with night driving. The aggravated offence should apply if the vehicle struck a tree during the night, and the vehicle occupants died.

14.94 We have been interested to see the approach to causation taken in the legislation applying to the US aviation industry. This applies a higher penalty:

> If, by reason of the failure of the part to operate as represented, the part to which the offense is related is the proximate cause of a malfunction or failure that results in the death of any person.[831]

---

829 Reg 29, see discussion in Appendix 3.

830 Title 18, United States Code, s 38. For discussion, see Appendix 3.

831 Title 18, United States Code, s 38(b)(3).

14.95 In other words, it is not necessary to show a direct causal link between falsifying or concealing a material fact and the death. However, the false and concealed information must mean that a part does not operate as represented. That part must then be the proximate cause of a malfunction or failure which results in death.

14.96 The reference to a "part" would not be appropriate to AVs, where the problem is more likely to relate to software rather than a physical part. However, we have borrowed the concept of a two-stage process. We provisionally propose that the representation or non-disclosure should increase the risk of an adverse incident of the type that caused the death or serious injury.

Accountability of corporations and senior management

14.97 The offence we have in mind would apply directly to the ADSE as a corporate body. However, senior managers should also be liable if they fail to exercise due diligence to prevent the misrepresentation or non-disclosure from taking place. This would focus the minds of senior managers on implementing a safety-first culture, operating on the basis of openness and transparency.

14.98 In the UK aviation, nuclear and pharmaceutical industries, senior management is liable for offences attributable not only to their "consent or connivance" but also to their "neglect".[832] Such liability is also provided for in the health and safety at work context.[833] In our view, a similar provision should be included in the new offence. Neglect in this context refers to negligence in failing to ensure that the information submitted to regulator is accurate, not to more general negligence in failing to carry out tests. We envisage that a senior manager will sign the safety case to state that the information given is complete and accurate. When they do so, it is important that they should have taken care to ensure that this statement is correct. Our proposed offence will emphasise the need for care in this area.

Accountability of individual employees and agents

14.99 Existing criminal offences already cover some cases where junior staff may be guilty of serious wrongdoing. For example if a team leader deliberately lies for material gain they could be prosecuted under the Fraud Act 2006. In extreme cases, a manslaughter offence may be appropriate. The liability of junior staff is a controversial area, which we explore in more depth in Appendix 4.

14.100 In the pharmaceutical industry, the regulation 95 offence applies not only to corporations and senior managers but also to individual employees and agents. We have concerns about imposing liability on lower level employees in this way. We wish to encourage an open and transparent culture, which relies on safe systems - not to criminalise junior staff who make errors under pressure. On the other hand we recognise the difficulty of determining culpability according to the position that someone holds rather than their conduct. That could result in two persons doing the same thing (for example, concealing poor results) having different penalties because of their different seniority. We ask consultees for their views.

---

832 Civil Aviation Act 1982, s 99(1); Energy Act 2013, Sch 10.

833 Health and Safety at Work etc Act 1974, s 37.

Avoiding "data-dumps": presenting the safety case

14.101 Correcting the imbalance of information held by the ADSE and the safety assurance scheme will be important to the efficiency of the scheme. However, we also want to deter ADSEs submitting "data dumps" that make it difficult to properly assess the safety case and to identify non-disclosures and misrepresentations.

14.102 In 2014, we reviewed the law of insurance contracts.[834] One of our suggested reforms was that the "duty of disclosure" should be replaced with a "duty of fair presentation" which requires the insured give a "fair presentation of the risk" before the contract is entered.[835] This became section 3 of Part 2 of the Insurance Act 2015.

14.103 Section 3(3)(b) of the Insurance Act 2015 requires that the relevant information must be provided by the insured to an insurer in a manner "reasonably clear and accessible to a prudent insurer". Failure to satisfy this requirement is a breach of the duty of fair presentation.[836]

14.104 This aspect was aimed at changing the old law, which permitted "policyholders to overwhelm the insurer with a large amount of undigested information".[837] We said that

> whether this requirement has been breached will be highly fact specific: an underwriter's "data dump" may be an insured's "detailed risk information". We do not see this duty as relating to the amount of information. Instead it is about the need to structure, index and signpost the information which is given.[838]

14.105 We seek views on whether an ADSE should be under a similar duty to present information in a clear and accessible form. This would require an ADSE to structure, index and signpost crucial safety information so that it was not lost in thousands of pages of appendices. However, we would see failures to structure, index or signpost information as less serious than non-disclosures or misrepresentations. For example, the offence could be subject to a maximum penalty of one year's imprisonment.

Enforcement powers

14.106 Enforcement of the new offences should be primarily the role of the new safety assurance scheme. However, we think that the Crown Prosecution Service (CPS) in England and Wales, and the Procurator Fiscal in Scotland, could also have the power to bring prosecutions. In England and Wales, both the HSE and the CPS have the

---

834 The Law Commission of England and Wales and the Scottish Law Commission, *Insurance Contract Law: Business Disclosure; Warranties; Insurers' Remedies for Fraudulent Claims; and Late Payment* (2014) Law Com No 353 and Scot Law Com No 238, https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2015/03/lc353_insurance-contract-law.pdf (Final Report).

835 Above, Ch 3 to Ch 10.

836 Above, para 7.41.

837 Above, para 7.42.

838 Above, para 7.43.

power to prosecute health and safety offences.[839] However in practice the CPS generally chooses to bring charges only when manslaughter or other serious criminal offences have also occurred.[840] In Scotland, the Procurator Fiscal is wholly responsible for prosecution decisions. The Health and Safety Division of the Procurator Fiscal, liaising with enforcing authorities, deals with health and safety cases, while the role of the Health and Safety Executive is to investigate and report possible offences.

839 The HSE cannot investigate or prosecute individual or corporate manslaughter, or any other criminal offences outside its health and safety remit. See HSE, Investigation, https://www.hse.gov.uk/enforce/enforcementguide/wrdeaths/investigation.htm#P4_750, para 2.

840 Above, para 5.

Consultation Question 44.

14.107 We provisionally propose that:

(1) it should be a criminal offence for an ADSE to omit safety-relevant information or include misleading information when putting a vehicle forward for classification as self-driving or responding to information requests from the regulator;

(2) the offence should apply to senior managers (where it was attributable to the manager's consent, connivance or neglect);

(3) the offence should not apply to more junior employees;

(4) the offence should carry a higher sentence if it is associated with a death or serious injury;

(5) the offence should be prosecuted in England and Wales by either the regulator or the Crown Prosecution Service and in Scotland by the Procurator Fiscal.

Do you agree?

Consultation Question 45.

14.108 We seek views on the following proposed offences.

Offence A: non-disclosure and misleading information in the safety case

When putting forward a vehicle for classification as self-driving, it would be a criminal offence for the ADSE to

(1) fail to provide information to the regulator; or

(2) provide information to the regulator that is false or misleading in a material particular

where that information is relevant to the evaluation of the safety of the ADS or the vehicle.

The ADSE would have a defence if it could show that it took reasonable precautions and exercised all due diligence to prevent the wrongdoing.

The penalty would be an unlimited fine.

Offence B: non-disclosure and misleading information in responding to requests

When a regulator requests specific information from an ADSE (whether before or after deployment), it would be a criminal offence for the ADSE to

(1) fail to provide information to the regulator; or

(2) provide information to the regulator that is false or misleading in a material particular

where that information is relevant to the evaluation of the safety of the ADS or the vehicle.

The ADSE would have a defence if it could show that it took reasonable precautions and exercised all due diligence to prevent the wrongdoing.

The penalty would be an unlimited fine.

Offence C: offences by senior management

Where offence A and/or offence B committed by a body corporate is proved—

(3) to have been committed with the consent or connivance of an officer of the body corporate; or

(4) to be attributable to neglect on the part of an officer of the body corporate,

then that officer is guilty of the offence.

An officer includes any director, manager, secretary or other similar officer or any person who was purporting to act in any such capacity.

We see this as equivalent to offences under the Human Medicines Regulations 2012 and General Product Safety Regulations 2005, which carry a penalty of a fine and/or a maximum two years' imprisonment.

Offence D: aggravated offences in the event of death or serious injury following non-disclosure or provision of misleading information to the AV safety regulator

Where a corporation or person commits Offences A to C, that offence is aggravated where the misrepresentation or non-disclosure:

(5) related to an increased risk of a type of adverse incident; and

(6) an adverse incident of that type occurred; and

(7) the adverse incident caused a death or serious injury.

We see this as equivalent to the offence of causing death by dangerous driving, which carries a penalty of an unlimited fine and/or a maximum of 14 years' imprisonment.

A duty to present information in a clear and accessible form

Consultation Question 46.

14.109 We welcome views on whether an ADSE should be under a duty to present information in a clear and accessible form, in which safety-critical information is indexed and signposted.

Chapter 15: New wrongful interference offences

15.1 There is great public concern in relation to the potential for interference with automated vehicles (AVs). In CP1 we asked whether the existing criminal law is adequate to deter and penalise wrongful or unauthorised interference. AVs' reliance on their ancillary systems (such as sensors, software, and communication systems) exposes them to more types of interference with serious consequences. AV interference offences could range from those as sophisticated as computer hacking to those as simple as spray painting the vehicle's sensors. Both forms of behaviour present a new way to endanger passengers and pedestrians.

15.2 Our analysis of consultees' responses concluded that most conceivable forms of interference are already criminal offences. To ensure a comprehensive scheme with a strong deterrent effect, only three relatively minor amendments to the existing statutory offences are required. Cybersecurity is outside our terms of reference, but we note that the Computer Misuse Act 1990 would cover hacking offences involving an ADS.[841]

15.3 In addition, we set out a proposed aggravated offence where interference with automated vehicles causes death or serious injury.

AMENDING THE EXISTING LAW

15.4 Following on from the strong support of consultees for our CP1 proposals, we propose the extension of the following offences:

(1) that tampering with brakes or "other mechanisms" under section 25 of the Road Traffic Act 1988 include tampering with any part of the vehicle's system;

(2) that taking a conveyance without authority under section 12 of the Theft Act 1968 cover all motor vehicles; and

(3) that unlawful interference with vehicles and traffic signs under section 22A of the Road Traffic Act 1988 extend to Scotland.

Tampering with the mechanism

15.5 Under section 25 of the Road Traffic Act 1988, it is an offence to get on to a motor vehicle or to tamper with "the brake or other part of its mechanism" while the vehicle is on a road or in a local authority parking place, without lawful authority or reasonable cause. This offence extends to England, Scotland, and Wales. In CP1 we noted that this offence might be useful where section 22A (dangerous interference, outlined below) does not apply, and the damage does not amount to criminal damage.

841 As noted in CP1, paras 8.49 to 8.55.

15.6 “Tampering” is not defined by the Act and has the ordinary meaning of “interfering with something without lawful authority or so as to cause damage”,[842] but must amount to “something more than mere touching”.[843]

15.7 “Mechanism” is undefined and is not usually contested in proceedings.[844] In CP1, we asked consultees whether legislative amendment is necessary to clarify that “mechanism” includes sensors. A strong majority (65%) agreed. The Senators of the College of Justice[845] observed that:

> ‘Other mechanism’ could be read as being related to brakes (read *ejusdem generis*) and therefore on this interpretative approach sensors would not be covered as they are not brakes or a form of brakes. In these circumstances to avoid doubt (and endless arguments) the section should be amended to make it explicit that it is a crime to tamper with sensors.

Consultees also pointed out that “mechanism” could be interpreted as being limited to physical apparatus, which may unduly restrict the tampering offence to hardware and exclude software, including that within the physical envelope of the vehicle.

15.8 We agree with consultees that the offence should include any part of the vehicle’s system. A broad approach that makes express reference to the critical systems would avoid the need to list all types of equipment and mechanisms.

15.9 A separate question is whether the offence should be further extended to include parts physically separate from the AV. Some consultees suggested that the offence should include any infrastructure on which AVs rely to function; for example networks, beacons, or the data held within the system. By way of analogy, unlawfully or maliciously damaging or tampering with railway infrastructure serving trains is a criminal offence in England and Wales.[846] In Scotland this appears to be covered by the general common law offences of malicious mischief or culpable and reckless conduct. We note that an extended offence would remain limited by the justifications of “lawful authority” and “reasonable cause”. We welcome views on this suggestion.

---

842 *JS (A Child) v DPP* [2017] 4 WLR 102 at [14].

843 Above.

844 See para 8.30 of CP1.

845 The Senators of the College of Justice are the Court of Session judges in Scotland.

846 Offences Against the Person Act 1861, s 32 and Malicious Damage Act 1861, s 35.

Consultation Question 47.

15.10 We provisionally propose that legislative amendment should clarify that the tampering offence in section 25 of the Road Traffic Act 1988 applies to anything that is physically part of a vehicle and any software installed within it.

Do you agree ?

Consultation Question 48.

15.11 We welcome views on whether the tampering offence should apply to external infrastructure required for the operation of the AV.

Unauthorised vehicle taking: England and Wales

15.12 In England and Wales, joyriding is prohibited by section 12 of the Theft Act 1968:

> A person shall be guilty of an offence if, without having the consent of the owner or other lawful authority, he takes any conveyance for his own or another's use or, knowing that any conveyance has been taken without such authority, drives it or allows himself to be carried in or on it.

15.13 Joyriding has its own statutory offence in England and Wales because, in England and Wales (but not in Scotland), theft requires proof of an intention to deprive the owner of the property permanently.[847] This can be hard to establish in cases of joyriding, where the vehicle may only be taken temporarily.

15.14 "Conveyance" means anything constructed for the carriage of a person, including any motor vehicle with a driving seat.[848] However, "conveyance" excludes anything constructed for use only by the control of a person not carried in or on it; for example, a pram.[849] This presents two problems in the AV context. First, some AVs may be constructed for the carriage of goods, and not be intended to carry people at all. Secondly, some AVs may be designed and licensed to only carry passengers and may not have a driving seat. One example would be if a group of people picked up an automated pizza delivery vehicle and put it in a ludicrous place, such as on the top of a bus shelter. Under the current law, this would not appear to be a criminal offence.

15.15 To ensure application of the offence to all AVs, in CP1 we proposed to extend the application of section 12 to any motor vehicle, even those without driving seats. A great majority of consultees (87%) agreed with our proposal. In light of the

[847] Theft Act 1968, s 1(1). In Scotland, intent permanently to deprive is not required (*Black v Carmichael* 1992 SLT 897).

[848] *Wilkinson's Road Traffic Offences* (28th ed 2017) para 15-06.

[849] Theft Act 1968, s 12(7).

overwhelming support from consultees, and the fact that there has been no new case law or developments on this topic since CP1, we maintain our proposal.

Unauthorised vehicle taking: Scotland

15.16 The equivalent offence in Scotland of taking and driving away without consent under section 178 of the Road Traffic Act 1988 applies to all motor vehicles. Section 178(2) creates a defence where the accused acted in the reasonable belief that the owner would have given consent if asked for it. It is not dependent on carrying a person and will apply to remote control vehicles, and therefore does not need amendment.

15.17 In addition, "joyriding" in Scotland has been held to be theft at common law.[850] Theft in Scots law involves the taking of control and possession of a tangible moveable item from its owner or custodier without their consent and with the intention to deprive the owner or custodier of it (a) permanently or (b) indefinitely or (c) for a nefarious purpose.[851] The defence in section 178(2) does not apply and generally the common law is used more frequently than the statutory offence. As such, the pizza delivery vehicle example above would be likely to qualify as a "nefarious purpose" and be prosecuted in Scotland under the common law of theft.

15.18 We therefore propose no change to Scottish law on unauthorised vehicle taking.

Causing danger to road users

15.19 In England and Wales, section 22A of the Road Traffic Act 1988 sets out a broad offence of causing danger to road users:

> A person is guilty of an offence if he intentionally and without lawful authority or reasonable cause:
>
> (a) causes anything to be on or over a road, or
>
> (b) interferes with a motor vehicle, trailer or cycle, or
>
> (c) interferes (directly or indirectly) with traffic equipment,
>
> in such circumstances that it would be obvious to a reasonable person (whose knowledge includes that of the person interfering)[852] that to do so would be dangerous.

15.20 This is a very general offence, which would include many of the dangerous behaviours thought to be of concern, such as defacing traffic signs or white lines. It would also include interfering with the vehicle itself by, for example, blocking a sensor or using lasers to confuse a light detection and ranging (LIDAR) system,[853] if this was an

---

850 *Kivlin v Milne* 1974 SLT (Notes) 2.

851 G H Gordon, *The Criminal Law of Scotland, Volume II* (4th edn by J Chalmers and F Leverick, 2016), paras 21.46 to 21.50.

852 Road Traffic Act 1988, s.22A(2).

853 The Laser Misuse (Vehicles) Act 2018 creates a new offence of "shinning or directing a laser beam towards a vehicle". Although the Act was motivated by concerns about lasers being shone at aircraft, it covers a wide

obviously dangerous thing to do. We consider that the expression “traffic equipment” is wide enough to include infrastructure external to an AV but required for its operation.

15.21 In response to CP1, some consultees were concerned that the section 22A offence is overly broad and might criminalise legitimate actions (such as repairs and development). The offence has two safeguards in place to confine it to only the most unreasonable behaviour. First, the offence is subject to the justifications of “lawful authority” or “reasonable excuse”. "Lawful authority” would protect developers, mechanics, and other individuals who are legally authorised to interfere with the vehicle. “Reasonable cause” would protect those without formal authority whose actions should not be criminalised. We discuss at the end of this chapter whether those exceptions from liability are cumulative or alternative, and seek views on the need for an additional “approved work” defence.

15.22 Secondly, the offence only covers interferences that are objectively dangerous. “Dangerous” refers to the danger of injury or serious damage to property, and carries its natural meaning. In determining what is objectively dangerous, the court may consider any circumstances known to the accused.

15.23 While section 22A does not extend to Scotland, the Scottish common law offence of culpable and reckless conduct creates an equivalent offence to section 22A.[854] A conviction for culpable and reckless conduct requires the conduct to be “deliberately done in the face of potential danger to another or others in complete disregard of the consequences for him or them”.[855] There is no need to demonstrate intent to cause injury nor does injury need to be caused.[856]

15.24 For example, in *MacPhail v Clark*, a farmer set fire to a field for a legitimate purpose. The farmer was however convicted of culpable and reckless endangerment for omitting to act when smoke from the field blew onto the road. The smoke on the road caused a vehicle to stop and another vehicle then collided with the stopped vehicle, pushing the stopped vehicle down an embankment and injuring those inside.[857] The shows that the offence is a flexible one, and would likely be sufficient to criminalise cases where an individual interferes with an AV in a dangerous manner. Similar to section 22A, the offence focuses on intent and dangerousness.

15.25 Notwithstanding the operation of the Scots common law, in CP1 we asked whether section 22A should be extended to Scotland. Of the 86 who replied, three quarters agreed and of the remainder, only one person dissented. The arguments for extending section 22A into Scots law include: (1) greater harmonisation between Scots law and

---

variety of vehicles, including trains, ships and motor vehicles (s 1(6)). However, the offence only applies if the laser beam “dazzles or distracts, or is likely to dazzle or distract, a person with control of the vehicle” (s 1(1)(b), emphasis added). This means that it would not apply to an automated vehicle without a person in control.

854 Also known as reckless endangerment to the lieges.

855 *Robertson v Klos* 2006 SCCR. 52 at paragraph 14; HM Advocate v Harris 1993 SCCR 559 at 566B.

856 *HM Advocate v Harris* 1993 JC 150; David Smith and William M'Neill (1842) 1 Broun 240 at 244, per Lord Justice-Clerk Hope.

857 1983 SLT (Sh Ct) 37.

that of England and Wales in relation to AVs; (2) development of a consistent body of case law across Scotland, England and Wales, which would be desirable for ensuring AVs are regulated consistently across Great Britain; (3) clarification for lay persons that interference with an automated vehicle and the infrastructure on which it relies is unlawful; and (4) creation of a straightforward avenue for prosecutors.

15.26 The advantages of extending section 22A to Scotland become more apparent when considered alongside our proposal (discussed below) to create a new aggravated offence of wrongful interference causing death or serious injury. We also take these arguments to support the extension of section 22A not only to AVs in Scots law but also to conventional vehicles, though the latter lie beyond our present remit. Overall, we think that a comprehensive and accessible statutory scheme in both jurisdictions would best protect the safety of AV users and the public.

15.27 In light of the above, we maintain our proposal that section 22A should be extended to Scotland.

NEW AGGRAVATED OFFENCE OF CAUSING DEATH BY WRONGFUL INTERFERENCE

15.28 In CP1 we asked whether there should be an aggravated offence of causing death or serious injury by wrongful interference with vehicles, the road, or traffic equipment contrary to section 22A of the Road Traffic Act 1988, where the chain of causation involves an AV. A broad consensus in favour of such an offence was expressed by consultees.[858] The main argument in favour of a new aggravated offence is the need to deter potentially dangerous behaviour such as interfering with white lines, road signs or traffic lights.[859]

15.29 In the event of a death (and assuming no intention to kill) the charges currently available would be involuntary manslaughter in England and Wales and culpable homicide in Scotland. These are common law offences, based on court decisions. We set these out below and conclude that a statutory aggravated offence would be preferable.

15.30 We also set out in more detail the elements of the proposed offence and consider whether an "approved work" attempted repairs defence should apply.

An explanation of mental states

15.31 Criminal offences often require proof of a guilty mind. The standard required differs depending on the offence. Often the most serious crimes which carry the highest stigma, such as murder, require proof of intent: that the accused meant to carry out the act they carried out, and meant for the act to have the sort of consequences that it had. For murder, in England and Wales, an intention to cause death or serious injury is required; such intention can be inferred from foresight that death or serious injury

858 Out of the 87 consultees who responded, 62 (71%) agreed, 10 (11%) disagreed and 15 said 'other' - Analysis of responses to CP1 at paragraph 7.143.

859 CP1 Analysis at para 7.144.

was a virtual certainty resulting from the conduct. There are also less culpable mental states of recklessness and negligence.

15.32 In England and Wales a person is reckless if they take a risk when they are aware of the risk and it is unreasonable to take it in the circumstances as that person understands them to be.[860] In Scots law recklessness has a different meaning. In general, it is not defined by reference to the knowledge or mental state of the person accused of the offence. Instead it is a characterisation of the conduct of that person that is charged as an offence. The starting point is that the conduct must give rise to actual injury or danger of injury. If that is present the conduct is reckless; it reaches a level beyond mere negligence and becomes criminal.[861] The greater the danger the more likely the conduct is to be criminally reckless rather than merely negligent. Such an objective meaning of recklessness for common law offences has also been reflected in Scottish courts' interpretation of recklessness where the concept appears in UK statutory offences.[862]

15.33 Negligence in the law of England and Wales means that a reasonable person in the defendant's position would be aware of a risk.[863] Some criminal offences, in particular gross negligence manslaughter, require gross negligence, explained in paragraph 15.38 below. In modern Scots law, there are also two types of negligence.[864] The first is simply "negligence", which refers to a failure to meet an accepted standard of care. Proving that an individual acted negligently is sufficient to prove a guilty mind for the purposes of conviction under some statutory offences.[865] The second is "gross negligence". This has also been referred to as "wicked or criminal negligence".[866] This is a significantly more culpable level of negligence and must be proven for convictions of common law offences, such as culpable homicide.[867] It can overlap with recklessness where that is required for a common law offence.[868]

---

860 *R v G* [2003] UKHL 50.

861 *HMA v Harris* (above) following Lord Justice Clerk Aitchison in *Paton v HM Adv* 1936 JC 19. In obiter (passing) remarks Lord Justice-Clerk Aitchison used the words "gross or wicked negligence" to mean the same as "criminal negligence". In the context of a charge of (lawful) culpable homicide "wicked negligence" must be contrasted with the more serious "wicked recklessness" which is one of the possible guilty mental states for the crime of murder in Scots law. In both cases the word "wicked" can be seen as indicating that the negligence is morally reprehensive and therefore serious. However the word is never further defined in directions to juries and is used usually in the context of a murder charge.

862 *Allan v Patterson* 1980 JC 57 (reckless driving under the original wording of sections 1 and 2 of the Road Traffic Act 1988).

863 *McCrone v Riding* [1938] 1 All ER 157 at p 158; McAlhone and Wortley, *Criminal Law: The Fundamentals* (4 Ed. 2016), para 3-037,

864 G H Gordon, *The Criminal Law Of Scotland, Volume II* (4th edn by J Chalmers and F Leverick, 2016) at 31.03(3); Stair Memorial Encyclopaedia, *Criminal Law (2nd Reissue 2020)* Vol II (5), para 80.

865 *Waugh v Campbell* 1920 JC 1 at 5 (Lord Salvesen).

866 *Paton v HM Advocate* 1936 S.L.T. 298 at 299 as per Lord Justice-Clerk (Aitchison).

867 G H Gordon (above); Stair Memorial Encyclopaedia (above). The level of negligence required for culpable homicide in Scots law is discussed in paragraphs 15.43 to 15.49 below.

868 PR Ferguson and C McDiarmid, *Scots Criminal Law: A Critical Analysis* (2nd edn, 2014) para. 6.17.1.

Manslaughter under the law of England and Wales

15.34 Two different types of involuntary manslaughter under the law of England and Wales are relevant: "unlawful act manslaughter" and "gross negligence manslaughter".

Unlawful act manslaughter

15.35 Unlawful act manslaughter has three main elements. For the offence to be committed, there must be an unlawful act[869] which is itself dangerous (in the sense that the risk of some physical harm must be objectively foreseeable) and which causes death. It is controversial whether unlawful act manslaughter should be based on a breach of section 22A of the 1988 Act, due to the difference in the envisaged mental state of the offender.[870]

15.36 The offence under section 22A can be committed in three ways: by causing anything to be on or over a road; by interfering with a motor vehicle; or by interfering with traffic signs or other equipment. The act must be: (1) done intentionally and without lawful authority or reasonable cause; and (2) in such circumstances that it would be obvious to a reasonable person that to do so would be dangerous. The threshold mental state required to satisfy section 22 is a low one; an act of interference must be intended, but the defendant need not have intended or been reckless as to its consequences. The action does not necessarily involve gross negligence or conduct that is "truly exceptionally bad" (see gross negligence manslaughter below).

15.37 In *R v Meeking*[871] the defendant was found guilty of unlawful act manslaughter following a breach of section 22A, where her interference caused a death. The defendant was a passenger in a car, driven by her husband. During an argument, she suddenly put the handbrake on, causing the car to collide with another vehicle. Her husband was killed. The defendant appealed, arguing that the section applied only to vehicles when stationary and that it required an alteration of the structure of the vehicle. The Court of Appeal rejected this argument and upheld the conviction on the basis that "interference" should bear its ordinary meaning and on that basis the jury was entitled to find the section satisfied.

Gross negligence manslaughter in the law of England and Wales

15.38 Gross negligence manslaughter is a broad offence with the potential to cover a wide range of circumstances, which allows it to adapt to the context of new technology, but also creates uncertainty. The offence of gross negligence manslaughter consists of five elements.[872]

(1) The defendant owed a duty of care to the victim.

---

869 The phrase 'unlawful act' connotes an act as opposed to an omission. In *Lowe* [1973] QB 702, the offence of wilful neglect of a child under the Children and Young Persons Act 1933 s 1 was held to be insufficient for unlawful act manslaughter.

870 A Ashworth, Case Comment [2013] Criminal Law Review 333.

871 [2012] EWCA Crim 641; [2012] 1 WLR 3349.

872 *R v Adomako* [1995] 1 AC 171, 187.

(2) The defendant negligently breached that duty.

(3) It was reasonably foreseeable that the breach would give rise to a serious and obvious risk of death.

This is an objective question, based on the knowledge available to the defendant at the time of the breach. The court cannot impute to the defendant knowledge that would have been obtained had there been no breach of duty.[873]

(4) The death of the victim was caused by the breach.

(5) In the jury's view, the defendant's conduct was so bad as to be criminal.

The Court of Appeal has advised that the jury should be asked whether the behaviour was "truly exceptionally bad", and such a departure from the required standard that it is criminal.[874]

15.39 Gross negligence manslaughter would apply to users of AVs. It is well established that road users owe duties of care to each other. Duties of care are also owed by those who service vehicles.[875] This means that the offence could apply to all those who are grossly negligent in installing (or failing to install) software, in servicing vehicles, or in interfering with vehicles or roads. It could also apply to individual software developers.

15.40 Unlike unlawful act manslaughter, gross negligence manslaughter can be committed by omission and requires no positive act.[876] For a professional defendant, the required standard of performance is that of a reasonably competent professional.

15.41 Whether the duty has been breached will depend on the circumstances. The generality of gross negligence manslaughter allows it to adapt to new technologies and new dangers. The weakness of the offence is its uncertainty. Karl Laird comments that although prosecutions for gross negligence manslaughter are rare, they have generated a large volume of appeals, many of which involve health care professionals.[877] Adapting this case law to automated vehicles is likely to generate new questions.

15.42 Given the infrequency of gross negligence manslaughter cases we think that public safety would be best served by a tailored statutory offence which eliminates any uncertainty as to the treatment of deaths or serious injury resulting from wrongful

---

873 *R v Rose (Honey Maria*) [2018] QB 328. See also Judge Mark Lucraft QC (ed), Archbold: Criminal Pleading, Evidence and Practice 2019 (67th ed 2018) para 19-123; D Ormerod QC (Hon) and D Perry QC (eds), Blackstone's Criminal Practice 2019 (2018) para B1.68.

874 *R v Sellu* [2016] EWCA Crim 1716.

875 In *R v Yaqoob* [2005] EWCA Crim 2169 [34], the Court of Appeal held that it was open to a jury to find that a partner in a taxi firm was under a duty to inspect and maintain vehicles which went beyond MOT and council requirements

876 In *R v Adomako* [1995] 1 AC 171, 187, Lord Mackay stated: 'the essence of the matter… is whether… the conduct of the defendant was so bad in all the circumstances as to amount… to a criminal act or omission' (emphasis added).

877 K Laird, "The evolution of gross negligence manslaughter" (2018) 1 Archbold Review 6, at p 7. See *R v Rudling* [2016] EWCA Crim 741; Rose [2017] EWCA Crim 1168.

interference with AVs. We propose that there should be a new aggravated offence in England and Wales of wrongfully interfering with an AV, the road, or traffic equipment contrary to section 22A of the Road Traffic Act 1988, where the interference results in an AV causing death or serious injury.

Culpable homicide in Scots law

15.43 Culpable homicide is the equivalent relevant offence under Scots law. Culpable homicide occurs with activity which causes death and where the guilty mind for murder is absent but where the activity is criminally culpable. Consequently the offence is capable of covering a wide scope of death-causing activity. The common feature of such activity appears to be either (a) that the conduct was directed intentionally in some way against the victim or (b) that the conduct was so grave in its recklessness as to injury that it should be criminalised.[878] It follows that a great variety of activity can - at least in theory - be covered by the offence.

Lawful act culpable homicide

15.44 Lawful act culpable homicide occurs when a person accidentally causes the death of another while acting with gross negligence or recklessness. Recklessness is deemed a worse standard of behaviour than mere negligence or carelessness, yet not as bad as the "wicked recklessness" characteristic of murder.

15.45 The mental standard required for lawful act culpable homicide is "an utter disregard of what the consequences of the act in question may be so far as the public are concerned" or "recklessness so high as to involve a criminal indifference to the consequences for the public generally."[879] The test for lawful act culpable homicide is thus, in essence, a test of recklessness.

15.46 As such, similarly to manslaughter in English law, culpable homicide can be committed by the performance of a lawful act without an intent to cause serious injury.[880] However, Scots law differs by using a standard or recklessness and not negligence, which avoids the need to establish a duty of care and subsequent breach. Instead, Scots law focusses on whether in their conduct the accused demonstrated reckless indifference to the consequences of that conduct. This broader approach suggests that lawful act culpable homicide has a potentially wide scope.[881]

Unlawful act culpable homicide

15.47 Culpable homicide is also committed when criminal conduct results unexpectedly in death. Unlawful act culpable homicide typically concerns assault or fire-raising. There are uncertainties as to which offences can form the basis of unlawful act culpable

---

878 *MacAngus v HM Advocate* 2009 JC 137, [29] (High Court of Justiciary).

879 *Quinn v Cunningham* 1956 JC 22 at pp 24 to 25 (Lord Justice-General Clyde). This aspect of Quinn was not overruled in *HM Adv v Harris* 1993 SCCR 559. This formulation has since been endorsed by the High Court in *Cameron v Maguire* 1999 JC 63 at 66 (Opinion of the Court per Lord Marnoch); and *Transco plc v HM Advocate* 2004 JC 29 at 34 (Lord Osborne).

880 G H Gordon, *The Criminal Law of Scotland, Volume II* (4th edn by J Chalmers and F Leverick, 2016), para. 31.03.

881 We note that lawful act culpable homicide prosecutions are rare: *Purcell* 2008 SLT 44.

homicide: whether it is restricted to the most serious unlawful acts, or requires an intention to cause personal injury. It is possible that commission of the offence of culpable and reckless conduct (outlined above) which results in death may amount to the offence of culpable homicide.[882]

15.48 The Scots law offence of culpable homicide would be likely to criminalise a death caused by a wrongful interference with an AV. An individual is liable for the offence regardless of whether they intended to cause harm. Even if wrongful interference were not to qualify as an unlawful act, liability is based on demonstrating that an individual was recklessly indifferent to the harmful consequences of their interference. The focus on recklessness also provides a middle ground between ordinary negligence and gross negligence. This means that an objectively dangerous interference with an AV which causes death will lead to a conviction of culpable homicide.

15.49 However, for the sake of consistency between the two jurisdictions, as well as accessibility and clarity, we think that if a new aggravated offence is created in England and Wales, it should apply to Scotland also. This follows on from our proposal above to extend Section 22A to Scotland. We seek views on this below.

Outlining the proposed offence

15.50 Conventional vehicles are outside of our terms of reference. We therefore limit our proposal to cases where an automated vehicle is involved in the chain of causation between the act and the death or serious injury. For example, if the defendant removed a traffic sign, which led an automated vehicle to collide with a pedestrian who died, the offence would apply.

15.51 As discussed in the context of extending section 22A to Scotland above, the proposed aggravated offence based on section 22A will have several safeguards to restrict its broad scope. It does not apply where the interference has “lawful authority” or “reasonable cause”, an issue to which we return later in this chapter. It applies only where the act is objectively dangerous. It also carries the requirement of intending the act, though not necessarily its consequences; this is discussed further below.

15.52 We believe a new aggravated offence is desirable to meet public demands for accountability and deter individuals from wrongful interference. We seek views.

[882] See Lindsay Farmer, ‘*MacAngus (Kevin) v HM Advocate*: “Practical, but nonetheless principled”?’ 2009 Edin LR 502 at 506.1.

Consultation Question 49.

15.53 We provisionally propose that there should be an aggravated offence of wrongfully interfering with an AV, the road, or traffic equipment contrary to section 22A of the Road Traffic Act 1988, where the interference results in an AV causing death or serious injury, in:

(1) England and Wales; and

(2) Scotland.

Do you agree?

Mental standard: intent to interfere

15.54 In our view, the mental standard of our proposed offence should mirror that of section 22A: the act of interference which forms the basis of the offence must be intentional, but there need not be an intent to bring about the consequences of that act, nor a subjective appreciation of the risk of those consequences. This would remove any need for an aggravated offence of causing death or serious injury by tampering with a vehicle contrary to section 25 (outlined above). The tampering offence does not require intentional interference. The tampering offence is less serious and in our view should not attract the stigma and stricter penalties of an aggravated offence.

Consultation Question 50.

15.55 We provisionally propose that the appropriate mental element for the aggravated offence is intent to interfere with a vehicle, the road or traffic equipment.

Do you agree?

An “approved work” defence?

15.56 Section 22A makes it a criminal offence for any person to interfere “intentionally and without lawful authority or reasonable cause” with a motor vehicle or trailer, or traffic equipment (such as traffic signs) in a manner that a reasonable observer would regard as causing danger to persons or property on or near a road.

15.57 There is, however, some scope for debate as to whether the two exceptions to liability, lawful authority and reasonable cause, are cumulative or alternative. On one view, the section is only intended to criminalise actions taken without lawful authority for which there is also no reasonable cause, such as a vandal damaging brakes or side mirrors. It would not criminalise an owner or their mechanic’s bungled attempts at repair or maintenance or reasonable enhancement. An alternative view is that it should not be sufficient, for a defendant to escape liability, that they were authorised to make alterations to a vehicle if they have made an alteration that renders it objectively dangerous, unless the defendant also had reasonable cause for doing what they did.

15.58 Following this view, the section could be interpreted so as to criminalise the installation of software intended to improve the functioning of some aspect of the vehicle but which was not absolutely necessary. If the installation made the AV malfunction, causing death or serious injury, the installer might be prosecuted for the proposed aggravated offence on the basis that there was no "reasonable cause" for the installation. We are not aware of any judicial consideration of or decision upon this issue, which is potentially brought more sharply into focus by the proposed creation of an aggravated version of section 22A applying to AVs, with more severe penalties.

15.59 We prefer the first view set out and see "lawful authority" and "reasonable cause" as separate restrictions on the scope of the offence.[883] But it is nevertheless an untested matter of interpretation of section 22A.

15.60 One way in which protection might be given to bona fide work is by providing in addition for an "approved work" defence. This would create an exception to liability where the AV manufacturer or Automated Driving System Entity (ADSE) had approved the work that was carried out. That approval could take different forms. For example the manufacturer might have provided a list of repair or maintenance operations that could be carried out by a person not approved by the manufacturer.[884] Alternatively, the manufacturer might have been contacted concerning a problem with the vehicle and have approved the course of action which was thereafter followed.

15.61 A concern that we have with this proposal is that the suggested amendment would be unnecessary if our preferred view of the current legal position is correct and that its introduction might strengthen the argument for the contrary interpretation. We seek views.

Consultation Question 51.

15.62 We seek views on whether an approved work defence for repair or maintenance operations authorised by a vehicle manufacturer or Automated Driving System Entity is desirable.

883 The aim of s 22A appears to have been to carry over the railway interference offence in the Offences Against the Person Act 1861 s 32 to roads: see Criminal Law Revision Committee, 14th Report (1980) Cmnd 7844, paras. 192-198; and *The Road User and the Law*, (1989) Cm 576, paras. 3.2-3.4. However, the wording was modernised; instead of the requirement in the 1861 Act that the interference be "unlawful and malicious", s 22A provides that the placement or interference must be "without lawful authority or reasonable cause."

884 These might for example be set out in the vehicle's operating manual.

Chapter 16: Civil liability

16.1 In this chapter, we look at civil liability. The Automated and Electric Vehicles Act 2018 (AEV Act) introduced reforms to smooth the path to compensation for those injured by self-driving vehicles. Broadly speaking, the AEV Act requires the insurer to pay a victim for any damage caused by a vehicle when driving itself.[885] The insurer may then bring a secondary claim against anyone else responsible for the accident.

16.2 In Consultation Paper 1, we looked in detail at these provisions and sought views from consultees on whether any changes were needed. There was significant support for the principles behind the AEV Act, coupled with concerns about some of its details. In response to our questions, consultees raised issues about contributory negligence, causation, data retention, uninsured vehicles and secondary claims. We set out these views in our Analysis of Responses and summarise them briefly below.

16.3 Our provisional conclusion is that the AEV Act is “good enough for now”. Its provisions are sufficient to meet the Act’s objective, which is to ensure that victims are compensated without undue legal wrangling. We do not see a need for statutory reform at this stage. Instead, issues of contributory negligence and causation are best reviewed in the light of experience of how the Act works in practice.

16.4 The AEV Act allows insurers to bring secondary claims, which might include a claim against a producer for faulty software. Consultees described these claims as raising new challenges for the law of product liability. However, secondary claims are not essential to achieve the objectives of this project, to compensate victims and to ensure safety. Although there is a need to adapt the law of product liability to deal with the challenges of software, we think this should be done in respect of all products, not simply automated vehicles (AVs).

16.5 It is important to ensure that victims would be compensated for accidents involving uninsured vehicles which are self-driving. We hope that the Government and Motor Insurers’ Bureau can come to an agreement on this issue. The AEV Act also raises difficult issues of data retention, which we discuss in Chapter 17.

LIABILITY UNDER THE AUTOMATED AND ELECTRIC VEHICLES ACT 2018

16.6 As we outlined in our first Consultation Paper, the AEV Act creates a new form of liability for accidents caused by AVs when driving themselves.[886]

16.7 For conventional vehicles, liability rests with the person (usually the driver) whose negligent act or omission has caused the accident. A driver must take out compulsory

885 S 2(3) of the AEV Act 2018 sets out the meaning of "damage" for the purposes of the Act. It covers death, personal injury and most types of property damage. However it does not cover damage to the automated vehicle itself or pure economic loss.

886 Automated Vehicles: A Joint preliminary consultation paper (2018) Law Commission Consultation Paper No 240; Scottish Law Commission Discussion Paper No 166 (CP1), paras 6.13 to 6.28.

third-party motor insurance "in respect of any liability which may be incurred by him… caused by, or arising out of, the use of the vehicle".[887] Where an insured driver causes an accident in a conventional vehicle, the insurance indemnifies the driver for their liability to those who are killed or injured or who suffer damage to their property.

16.8 The AEV Act takes a radically different approach. Rather than requiring insurers to indemnify drivers against their own existing liability, it imposes a new form of direct liability on insurers. Section 2(1) states that:

(1) Where—

(a) an accident is caused by an automated vehicle when driving itself,

(b) the vehicle is insured at the time of the accident, and

(c) an insured person or any other person suffers damage as a result of the accident,

the insurer is liable for that damage.

16.9 This means that, where an accident is caused by a vehicle which is driving itself under the terms of the Act, the insurer is directly liable for the damage. Notably, section 2 liability covers damage suffered by the "insured person", unlike compulsory third-party motor insurance for conventional vehicles which covers damage to third parties but not losses suffered by the driver. To prevent disputes about whether the driver or the automated driving system (ADS) was controlling the vehicle at the time of the accident, the driver's liability and the insurer's liability under section 2 must be insured under the same policy.[888]

16.10 Once the insurer has settled a claim with the injured party it may then reclaim damages from any other party liable for the accident to the extent that the other party is liable to the injured party.[889] The other parties may include other drivers or the vehicle manufacturer.

16.11 The AEV Act leaves many issues to the courts. Recently, the Singapore Academy of Law's Law Reform Committee praised the UK as "bold" and an "international frontrunner" in passing the AEV Act, but criticised the Act for failing to "address the underlying legal issues".[890] The Committee noted that the AEV Act leaves questions of

---

887 Road Traffic Act 1988, s 145(3). There are exceptions for vehicles owned by the Crown and other public bodies (Road Traffic Act 1988, s 144(2)). Under s 144A it is also an offence to keep a vehicle which does not meet the insurance requirements.

888 AEV Act 2018, sched, para 19(2) amends s 145 of the RTA 1988. It provides that the policy required by s 145 "must also provide for the insurer's obligations to the insured person under s 2(1)" of the AEV Act 2018.

889 AEV Act 2018, s 5(1).

890 Singapore Academy of Law Reform Committee*, Report on the Attribution of Civil Liability for Accidents Involving Autonomous Cars* (September 2020), para 5.27.

causation and secondary liability to be decided by the courts on a case-by-case basis.[891]

16.12 We agree that the AEV Act does not, of itself, provide a complete set of answers to questions of civil liability surrounding AVs. It will need to be supplemented by other statutes and the common law. However, the primary aim of the Act is to ensure that those who suffer damage caused by AVs can be rapidly compensated. In Consultation Paper 1, we expressed the provisional view that the AEV Act provides the necessary statutory basis to achieve this aim. We sought views on whether particular issues required further clarification.[892]

16.13 After reviewing the responses, we reached the tentative conclusion that the scheme for compensation created by the AEV Act is "good enough for now".[893] In other words, reform is not a priority at this stage, though the Act's workings will need to be reviewed in light of practical experience.

16.14 Here we look at three issues with the Act which raised concerns. The first is how the legal concepts of contributory negligence and causation will apply to claims under the AEV Act. The second is the need to retain data to enable insurers to detect fraud and defend claims. The third is the current lack of provision for victims of accidents involving uninsured AVs.

Contributory negligence and causation

16.15 Our first Consultation Paper explored potential issues in applying the legal concepts of contributory negligence and causation to claims under the AEV Act.[894]

16.16 We noted that under section 3(1) of the AEV Act, where an accident was to any extent the fault of the injured party, the normal principles of contributory negligence will apply. This means that compensation will be reduced to the extent that the court thinks just and equitable. However, the way in which the AEV Act achieves this result is complex. It requires the court to imagine two counter-factual situations: first, that the claim is brought against someone other than the insurer,[895] and secondly that the insurer is at fault because of the behaviour of the automated vehicle.[896] We asked consultees whether these provisions were sufficiently clear.

16.17 In respect of causation, we explained that for liability to arise under section 2(1), the accident must be "caused by" the AV.

891 Above, para 5.27.

892 Automated Vehicles: A Joint preliminary consultation paper (2018) Law Commission Consultation Paper No 240; Scottish Law Commission Discussion Paper No 166 ("CP1"), para 6.3.

893 CP1, para 6.133.

894 CP1, paras 6.29 to 6.51.

895 AEV Act 2018, s 3(1).

896 AEV Act 2018, s 6(3).

16.18 However, there is debate about how far causation implies some element of fault.[897] We gave the example of an AV swerving to avoid an erratic cyclist and hitting a parked car; in such a case, a court might identify the AV as having caused the accident, even though the fault lay with the cyclist.[898] The Singapore Academy of Law's Law Reform Committee have expressed a further concern that, by implying that an AV may "cause" accidents, the statute might be considered to have the unintended effect of conferring a "limited form of legal personality" onto an AV.[899] We sought views on whether further guidance or clarification was needed, or whether the issue of causation should be left to the courts to resolve on a case-by-case basis.

16.19 On both questions, the views of respondents were split.

16.20 On contributory negligence, most insurers thought that the sections were fit for purpose. For example, the Motor Accident Solicitors Society wrote that though the relevant sections were "quite convoluted", the intention was clear and "would enable the courts to draw reasonable parallels under existing contributory negligence case law".[900] Other respondents, however, considered the sections to be overly complex.[901] Andrew Caitlin, who was among those arguing in favour of redrafting, described the sections as "confusing and borderline anthropomorphic".[902]

16.21 On the issue of causation, most insurers felt there was a need for guidance while many lawyers wished to leave the issue to the courts.[903] The first group emphasised that uncertainty over causation would make it more difficult to price the risk, while the second group saw the courts as able to make fact-sensitive decisions. Alex Glassbrook wrote that courts were in fact *better* placed to decide causation than the legislator because fact-sensitive issues could not be effectively determined on a "general, predictive basis".[904]

16.22 Having reviewed these responses, our provisional conclusion is that while there may be a need for review and clarification, this decision should not be taken now. Instead,

---

897 While this wording would seem to imply strict liability, there is some uncertainty as to whether courts might introduce some element of fault through the causation test. The AEV Act leaves the meaning of causation to the courts, applying the general principles developed in cases concerning civil liability.

898 Courts do not apply a rigid formula. As a starting point, they often ask whether an outcome would have occurred "but for" its putative cause, but even events which meet this test may not be held to be causative if they are too remote or other events intervene. Lord Justice Sedley stated in *Smith v Youth Justice Board* [2010] EWCA Civ 99, [2010] 2 WLUK 463 at [31] that "causation is, in essence, a question of fairness" and that "a succession of consequences which in fact and in logic is infinite will be halted by the law when it becomes unfair to let it continue". Decisions on causation therefore frequently involve "a value judgment on responsibility": *Kuwait Airways Corp v Iraq Airways Co* [2002] UKHL 19, [2002] 2 AC 883 at [74] (Lord Nicholls). It is accordingly uncertain how courts faced with claims resulting from accidents involving AVs might resolve complex issues of causation.

899 Singapore Academy of Law Reform Committee*, Report on the Attribution of Civil Liability for Accidents Involving Autonomous Cars* (September 2020), para 5.27.

900 CP1 Analysis of Responses, para 6.12.

901 CP1 Analysis of Responses, paras 6.18 to 6.21.

902 CP1 Analysis of Responses, paras 6.19.

903 CP1 Analysis of Responses, para 6.24.

904 CP1 Analysis of Responses, para 6.38

the question should be reconsidered after AVs have been deployed, so that decision-makers can take account of practical experience. As we stated in our first Consultation Paper, no-one can foresee the full effect of automated vehicles, or the many different possible circumstances surrounding the accidents that might result. Moreover, it is difficult to predict to how the courts will apply legal tests to factual situations which have not yet occurred.

16.23 We therefore provisionally propose that the provisions on contributory negligence and causation in the AEV Act 2018 should be left as they are until more evidence can be gathered on their effectiveness. We ask consultees if they agree with this approach.

Consultation Question 52.

16.24 We provisionally propose that the way the Automated and Electric Vehicles Act 2018 deals with contributory negligence and causation is:

(1) adequate at this stage; and

(2) should be reviewed by the UK Government in the light of practical experience.

Do you agree?

Data retention

16.25 In their responses to Consultation Paper 1, many consultees expressed significant concerns about data retention.[905]

16.26 In Consultation Paper 1, we noted that insurers would require vehicle-collected data in order to defend claims and identify fraud. Data would be required to enable insurers to verify that the vehicle was in the alleged location, was driving itself, and that the alleged damage occurred.

16.27 However, the volume of data generated by AVs may be too much to store for the full limitation period.[906] We asked if a claimant should only be permitted to bring a claim under the AEV Act if they notified the police or the insurer about the alleged incident within a set period, so that data could be retained. This issue was highly controversial. While most insurers and insurance solicitors welcomed a notification requirement, many lawyers thought that it was wrong to change limitation periods just for AVs.[907]

16.28 To reflect the importance of data retention, and to address the complexity of the issues, we consider this topic separately in Chapter 17.

---

905 CP1 Analysis of Responses, paras 6.44 to 6.77.

906 As we outlined in CP1 at paras 6.52 to 6.53, this will usually be three years from the date of the accident or, in a personal injury case, from the date the injured person had knowledge of the possibility of a claim. However, the limitation period can be longer in some circumstances.

907 CP1 Analysis of Responses, para 6.66.

Uninsured vehicles

16.29 As we noted in Consultation Paper 1, liability under section 2 of the AEV Act only arises where the vehicle is insured or is exempt from compulsory motor insurance. Liability for insurers under section 2(1) arises only where "the vehicle is insured at the time of the accident".[908] Section 2(2) places liability for uninsured vehicles on the owner of the vehicle, but only applies where vehicles are exempt from statutory insurance requirements because they are owned by the Crown or by public bodies.[909]

16.30 Although using a vehicle without insurance is a criminal offence,[910] some users might fail to insure AVs, just as users fail to insure conventional vehicles. They might obtain insurance sufficient for a conventional vehicle without the self-driving addition. Under the current law, this would result in a gap in compensating victims for accidents caused by uninsured AVs. For accidents involving conventional vehicles, the Motor Insurers' Bureau (MIB) steps in as an insurer of last resort. However, for the MIB agreements to apply, there must be a claim against the untraced or uninsured person, which the MIB then pays.[911] This cannot apply to the AEV Act provisions, since under section 2(1) the liability does not arise at all where the vehicle is uninsured.

16.31 The Government and the MIB are in ongoing discussions about amendments to the MIB agreements to compensate victims of accidents caused by AVs driving themselves while uninsured. In our provisional view measures ensuring victims of uninsured AVs receive compensation need to be in place before any vehicle is listed as capable of safely driving itself under section 1 of the AEV Act. Allowing an AV on the road before victims of uninsured drivers are covered would undermine the AEV Act's aim of ensuring compensation for victims.

Consultation Question 53.

16.32 We provisionally propose that measures should be put in place to compensate the victims of accidents caused by uninsured AVs.

Do you agree?

CLAIMS AGAINST PRODUCERS UNDER THE CONSUMER PROTECTION ACT 1987

16.33 While the AEV Act aims to facilitate quick and smooth compensation for victims, final responsibility for AV accidents may be allocated by secondary claims brought by the insurer.

16.34 In Consultation Paper 1, we explored the different kinds of secondary claims which may arise. For example, the insurer may claim against the driver of another vehicle where their negligence was also a cause of the accident. Significantly, insurers may

908 AEV Act 2018, s 2(1)(b).

909 AEV Act 2018, s 2(1)(c).

910 Road Traffic Act 1988, s 143(1)(a).

911 The MIB Untraced Drivers Agreement (2017) refers to a "person alleged to be liable" (para 3).

also claim against producers in negligence, or under the strict liability regime created by the Consumer Protection Act 1987 (the 1987 Act).

16.35 We explained that litigation over manufacturers' liability would not play a significant role in compensating victims, in setting standards or in allocating blame for defective vehicles. Instead, these functions would be fulfilled, respectively, by claims under the AEV Act, regulation and the criminal justice system. We therefore concluded that a general review of producer liability was not a priority at this stage.[912]

Product liability for defective software

16.36 One difficult question is whether the 1987 Act applies to defective software installed into AVs. In particular, do over-the-air software updates sold without a physical medium fall within the definition of a "product"? Section 1(2) of the 1987 Act defines a product as "any goods or electricity" including:

> a product which is comprised in another product, whether by virtue of being a component part or raw material or otherwise.

16.37 In the past, the Court of Appeal has held that while software supplied in a physical medium can be considered a product, software supplied intangibly cannot.[913] This means that the software installed in the original vehicle is covered by the 1987 Act, but questions remain over software supplied over the air. Particular difficulties arise where the vehicle and the software update are produced by different entities.[914]

16.38 Consultees also identified a range of other difficulties which might arise for claimants attempting to use the 1987 Act to recover for damage caused by software failures. Allen & Overy LLP pointed to the difficulties of proving defects where an algorithm's decision-making was opaque.[915] NFU Mutual questioned more broadly whether the Act's definition of "defect"– that the safety of the product is "not such as persons generally are entitled to expect" – could be applied to AVs. Since consumers are only beginning to use AVs and they "represent a significant transformation [of] the nature of motor vehicles", there is no prior experience on which consumers may build their expectation of safety.[916] Even if claimants can identify a defect, the Faculty of Advocates noted that they may struggle to establish causation due to the complexity of neural networks.[917] FOIL questioned whether the limitation period of 10 years from the date the product is put into circulation[918] was appropriate for AVs, especially in cases where software updates issued after that point cause a defect in the product.[919]

912 CP1, paras 6.115 to 6.116.

913 *St Albans CDC v International Computers Ltd* [1996] 4 All ER 481.

914 CP1, para 6.75.

915 CP1 Analysis of Responses, paras 6.102 to 6.103.

916 Response by National Farmers' Union Mutual Insurance Society.

917 CP1 Analysis of Responses, paras 6.100 to 6.101.

918 1987 Act, sched 1(1).

919 CP1 Analysis of Responses, para 6.86.

16.39 In Consultation Paper 1, we asked if there was a need to review the way that that product liability law applies to defective software within AVs. Most consultees (61%) thought that there was.[920] However, many consultees pointed out that issues about software liability are not confined to vehicles but arise in many different industries: vehicles are not fundamentally different from other products in this regard. Several consultees referred us to the (then forthcoming) work of the European Commission's Expert Group on this issue.

The European Commission Group of Experts on Liability and New Technologies

16.40 In November 2019 the European Commission's Expert Group on Liability and New Technologies published its report on liability for emerging digital technologies.[921] Among other things, the Expert Group considered how emerging digital technologies might challenge existing civil compensation regimes within the member states, including the harmonised product liability regime. They found that "some key concepts underpinning the EU regime, as adopted in 1985, are today an inadequate match for the potential risks of emerging digital technologies".[922]

16.41 The Group noted the uncertainty over whether software is a product, particularly where it is not embedded within a physical medium. More generally, the Group explained that emerging technologies challenge the distinction between products and services upon which the product liability regime rests. This was particularly true for AI systems, where "products and services permanently interact and a sharp separation between them is unfeasible".[923]

16.42 The Group also identified issues in applying the concept of defectiveness. They considered that "the interconnectivity of products and systems makes it harder to identify defectiveness". Furthermore, the "complexity and opacity of emerging digital technologies complicate chances for the victim to discover and prove the defect and prove causation".[924] They pointed out that sophisticated self-learning AI systems also raise broader questions about whether "unpredictable deviations in the decision-making path" can properly be considered defects.[925]

16.43 Finally, the Group considered that the multitude of actors contributing to the design and functioning of an AI system, as well as the need for continual upgrades after circulation, "dilutes the traditional role of a producer". [926]

---

920 CP1 Analysis of Responses, para 6.78.

921 European Commission Expert Group on Liability and New Technologies - New Technologies formation, *Liability for Artificial Intelligence and other emerging digital technologies* (November 2019).

922 Above, p 27.

923 Above, p 27.

924 Above, p 28.

925 Above, p 28.

926 Above, p 27.

The need for general reform

16.44 In our Analysis of Responses to Consultation Paper 1, we concluded "there does appear to be a need to review the way that product liability law applies to pure software". However, we thought that this should be done generally, rather than simply for AVs.[927]

16.45 After considering the European Commission Expert Group's report on Liability and New Technologies, our view remains unchanged. A clear law of product liability is not essential for the safe introduction of AVs. The issue is, in the end, a matter of allocating resources between insurers and producers. Often both sides will be able to resolve matters without recourse to the law, through (for example) partnerships between insurers and manufacturers. Therefore, we are not making any recommendations to reform the law of product liability in the course of this project.

16.46 However, a clear law of product liability for software is desirable, not only for AVs but across many industries. We hope that the Government initiates a more general review to reform this area of law. This general review of the law of software liability would appear to be a suitable project for one or both Law Commissions.

Consultation Question 54.

16.47 We provisionally propose that:

(1) product liability law should be reviewed to take account of the challenges of emerging technologies;

(2) any review should cover product liability as a whole, rather than be confined to automated vehicles: It should not, therefore, form part of this project on automated vehicles.

Do you agree?

[927] CP1 Analysis of Responses, para 6.135.

Chapter 17: Access to data

17.1 As the RAND Corporation has observed, automated vehicles (AVs) "produce huge amounts of data".[928] In response to our first consultation paper, many respondents raised questions about how that data should be stored, processed and shared with insurers, highway authorities and regulators.[929]

17.2 Under our terms of reference, issues of "data protection and privacy" are predominantly outside the scope of this project. However, some issues concerning data are integral to the proposals made in this paper.

17.3 In Chapters 5 and 11 we discussed the need to collect metrics to compare AVs with conventional driving on both leading and lagging measures. This will require large but anonymised datasets.

17.4 In addition to this anonymised information to improve safety for the future, third parties will also require information about specific vehicles for the purposes of establishing liability. For example:

(1) Under our proposals on investigating infractions, a registered keeper who receives a notice of intended prosecution needs to know if the ADS was engaged at the time of the incident.

(2) Where a driver, user-in-charge or registered keeper states that the vehicle was driving itself at the time of the incident, the police need access to the data to confirm that this is true.

(3) Insurers require data to process claims under the Automated and Electric Vehicles (AEV) Act 2018. Insurers need to know whether the vehicle was present at the time and place of the alleged incident, whether the ADS was engaged and how the incident occurred.

(4) If a specialist investigation branch is established, the branch will need data to investigate high-profile accidents.

(5) The safety in-use regulator has the task of learning from incidents to prevent them from occurring again and applying regulatory sanctions in response to specific incidents to ensure accountability.

(6) In Chapter 14 we propose a possible new offence where failures in a safety case result in death or serious injury. This requires a detailed investigation of specific incidents, including access to data.

17.5 These six cases raise issues about how to balance privacy concerns against other public interests. Often, information about where a vehicle was at a particular time will

---

928 RAND Corporation, *Measuring Automated Vehicle Safety, Forging a Framework*, 2018, p 50.

929 CP1 Analysis of responses, para 2.32.

be personal data, protected by the General Data Protection Regulation 2016/679 (GDPR). On the other hand, without such data it will often be difficult to assign liability or learn from problems. The GDPR often sets a fine line. Although data controllers must retain all necessary data, they must not retain data that is unnecessary.

17.6 This chapter is not concerned with all data issues. Instead it focuses on a limited set of questions. What data is necessary to enable our proposals to work in practice? And how can this data be collected, stored and disseminated in a way which is compatible with the GDPR and which safeguards privacy?

17.7 To keep this chapter short and readable, the legal background to data protection law is set out in Appendix 4. Readers are referred to Appendix 4 for more detail of the law.

CURRENT EU AND UNECE INITIATIVES ON EVENT DATA RECORDERS

17.8 There are currently several initiatives at EU and UNECE level to improve data recording by all vehicles, not simply those that are self-driving. However, as we shall see, these initiatives have taken privacy very seriously. They are designed to allow policymakers to understand patterns of accidents, but not to investigate any particular accident or to assign criminal or civil liability. As discussed below, data collected using event data recorders (EDRs) would for example not show whether an ADS was engaged in a particular vehicle at a particular time.

The EU General Safety Regulation 2019

17.9 The Revised General Safety Regulation (2019/2144) is part of the EU's goal to reduce fatalities and serious injuries to "close to zero" by 2050. The Regulation was adopted in November 2019[930] and introduces new safety requirements for vehicles.

17.10 One requirement is that new motor vehicles will be equipped with event data recorders (EDRs) to record collision data. However, this is only for the generic purpose of road safety analysis. As Article 6(4)(d) states, data should be made available to national authorities "only for the purpose of accident research and analysis, including for the purposes of type approval of systems and components and in compliance with [GDPR]".

17.11 The Regulation lists the information which will be recorded, including "the vehicle's speed, braking, position and tilt of the vehicle on the road". It also records use of eCall to alert the emergency services "and relevant input parameters of the on-board active safety and accident avoidance systems".[931]

17.12 However, the data must be anonymous. It must not be possible to identify "the owner or the holder of a particular vehicle on the basis of the stored data".[932] The recorder may record the make and model, but not the part of the Vehicle Identification Number that allows an individual vehicle to be identified. Under Article 6(5):

930 As the Regulation comes into force from 6 July 2022 it is not part of the law of England and Wales or Scots law by virtue of the European Union (Withdrawal) Act 2018.

931 Article 6(4).

932 Article 6(5).

> An event data recorder shall not be capable of recording and storing the last four digits of the vehicle indicator section of the vehicle identification number or any other information which could allow the individual vehicle itself, its owner or holder, to be identified.

The proposed UN Regulation

17.13 The UNECE is also discussing a UN Regulation on event data recorders. The "Proposal for a new UN Regulation on Event Data Recorders" as of 1 July 2020 sets out its current thinking on EDRs but has not yet been agreed.[933]

17.14 The draft Regulation follows the thinking behind the EU General Safety Regulation by specifically excluding data which could generate privacy concerns. This includes "VIN, associated vehicle details, location/positioning data, information of the driver, and date and time of an event".[934] It also excludes audio and video data.[935] Data collection requirements on these points are left to domestic law.

17.15 Not all collisions will trigger the EDR. Generally, for a collision to be recorded it must involve a sharp deceleration (defined as losing 8 km/h within 150 milliseconds or less). Most events will be written over, unless the data is locked. And for data to be locked, the deceleration must be even greater: usually a loss of 25 km/h within 150 milliseconds, or when the airbag is deployed.

17.16 These triggers would not be sensitive enough to pick up so called "soft brushes" or "soft object collisions". In other words, the EDR may not be triggered if the vehicle collides with something with a much lower mass, such as where a lorry collides with a small vehicle, or a small vehicle collides with a motorcycle, bicycle or pedestrian.

17.17 Nor would an EDR record collisions indirectly caused by unnecessary stopping. An example would be where an AV stops sharply and unnecessarily on a motorway, causing one or more of the vehicles behind it to collide with each other. In their work to support the UNECE, Allianz mention a case in their database in which the policyholder skidded due to a driving error and came to a halt without a collision.[936] Five to ten seconds later two following vehicles collided with each other. In some multiple pile-ups, other vehicles can then crash 10 seconds after that.

Conclusion on event data recorders

17.18 EDRs will be placed in both conventional and self-driving vehicles. The data are likely to be particularly useful in analysing patterns of problems and in comparing metrics between AVs and human drivers. However, under the current state of technology,

---

933 The draft UN Regulation is available at https://wiki.unece.org/pages/viewpage.action?pageId=106299857.

934 Draft UN Regulation, Para 1.3.

935 Draft UN Regulation Para 2.11.

936 Kreutner and others, *Needs and Requirements of EDR for Automated Vehicles – Analysis based on Insurance Claims Reported to Allianz Germany* (Allianz Study), p 11, https://wiki.unece.org/pages/viewpage.action?pageId=94047321&preview=/94047321/97648763/EDR-DSSAD-05-03%20(Allianz)%20EDR%26DSSAD%20Data%20Needs.pdf.

there are many incidents which EDRs will not record. In particular, they will often fail to record collisions with vulnerable road users, such as cyclists and pedestrians.

17.19 Furthermore, EDRs cannot be used to investigate individual accidents. As conceived by the proposed EDR Regulation, they will not allow the police or regulators to impose sanctions arising from a particular event. Nor will they enable insurers to handle a claim.

DATA STORAGE SYSTEMS FOR AUTOMATED DRIVING (DSSAD)

17.20 AVs will need to store more data than is captured by EDRs alone. The UN Regulation on Automated Lane Keeping Systems (ALKS) requires vehicles to have an additional system to store data.[937] This is referred to as the Data Storage System for Automated Driving or "DSSAD".

17.21 The ALKS Regulation states that "each vehicle equipped with ALKS shall be fitted with a DSSAD" that meets the specified requirements. However, this is "without prejudice to national and regional laws governing access to data, privacy and data protection".[938]

17.22 The DSSAD records each time the ALKS is activated or deactivated, or issues a transition demand. It also records when the vehicle is "involved in a detected collision".[939] However, there are no requirements about which collisions should be detected. Our understanding is that, at least initially, collision detection systems in ALKS will be similar to those in conventional cars and will also require a sharp deceleration.

17.23 For each of the recorded elements, the DSSAD must record "at least" a date and time stamp. It should also record the "reason for the occurrence" (such as whether the transition demand was planned, unplanned or due to a system failure). Finally, the DSSAD must record the software version in use at the time.

17.24 Significantly, the ALKS Regulation does not require the DSSAD to record location. We understand that adding GPS co-ordinates to the time stamp is technically feasible, and was discussed by the Informal Working Group prior to the proposal for a Regulation.[940] However, location data was omitted due to privacy concerns. Below we consider why location data is needed to make our proposals work, and how far it might be permitted by privacy law.

---

937 Agreed on 24 June 2020 and available at https://undocs.org/ECE/TRANS/WP.29/2020/81 ("ALKS Regulation"). For further discussion, see Ch 3.

938 UN Regulation 157 on uniform provision concerning the approval of vehicles with regards to Automated lane Keeping System ECE/TRANS/WP.29/2020/81 (25 June 2020) (ALKS Regulation), para 8.1.

939 ALKS Regulation, para 8.2.1

940 Allianz Study, p 5.

17.25 The use made of DSSAD data is left to the contracting states. Paragraph 8.4.1 provides that "DSSAD data shall be available subject to requirements of national and regional law".

17.26 One crucial question is how long the data should be stored for. At present, this is left to national law. However, a footnote to paragraph 8.4.1 based on a quantitative study done by Japan suggests that data need only be stored for "2500 timestamps", which corresponds to approximately 6 months of use. Once the storage limits of the DSSAD are exceeded, existing data may be overwritten following "a first in first out procedure". However, this must respect "the relevant requirements for data availability".[941] In other words, it is open to the UK to require data to be stored for more than six months by, for example, being uploaded onto a server. We consider below for how long data should be stored.

THE NEED FOR LOCATION DATA

17.27 We have reached the provisional conclusion that location data is necessary for our proposed AV safety assurance scheme to work. As we have seen, existing collision detection systems are unlikely to record collisions in which a vehicle collides with something much smaller than itself, such as a motorcycle, bicycle or pedestrian. Nor will they record incidents where the AV was not directly involved in the collision.

17.28 We are concerned that unless AV data storage systems record the location at which an ADS was engaged, it may be difficult to assign civil or criminal responsibility for some collisions, especially those involving vulnerable road users. We illustrate this with two examples: one involving criminal or regulatory investigations and the other involving an insurance claim.

Criminal and regulatory investigations

17.29 Our first example is taken from the Department for Transport's Call for Evidence on ALKS.[942] A vehicle with self-driving capability is on a motorway when it gives a glancing blow to a motorcyclist. The motorcyclist is knocked from their bike and seriously injured. The vehicle then proceeds on its way, failing to stop.[943]

17.30 In these circumstances, it is important to know whether the ADS was engaged at the time of the blow. If it was not engaged, the driver is likely to be guilty of serious criminal offences. The driver has not only failed to stop after an accident but may have caused serious injury by dangerous driving. The driver could be facing a prison sentence.

17.31 However, if the ADS was engaged, the user-in-charge will not have committed an offence. Instead, it is important to investigate the incident and take measures to prevent it from happening again. It is possible that the incident reveals problems with the ADSE's safety case. In some cases, the problems may be so serious that the ADSE could be facing penalties (or at the extreme, criminal proceedings).

---

941 ALKS Regulation, para 8.4.2.

942 CCAV, Safe Use of Automated Lane Keeping System (ALKS): Call for Evidence (August 2020).

943 Above, para 3.29.

17.32 In this type of case, the collision itself is unlikely to have been detected. Therefore, the only indication of whether the ADS was engaged at the time of the blow will be from the DSSAD. This records when the ADS was activated and deactivated with a time stamp. The time stamp would then need to be checked against police evidence from the incident.

17.33 When the police attend the scene they know *where* the incident occurred, but may have only a general indication of *when* it took place. There are likely to be eye witnesses - but witnesses are notoriously unreliable in giving precise times. The only reliable evidence would be the time the first call to the emergency services about the incident was logged. Any delay from passers-by in telephoning would lead to a window of uncertainty during which it will be difficult to know who was driving.

17.34 This allows for the possibility of dishonesty. A driver who injures a vulnerable road user (and is facing possible imprisonment) might be tempted to engage the ADS immediately and leave the scene. The driver could then (wrongly) blame the ADS for what happened. If a dishonest driver were to act fast enough, we do not think the DSSAD (as currently configured) would be able to provide sufficient data to prove beyond reasonable doubt that a human was driving. However, if location data and a time stamp of the transition were collected, the data would show that the driver had switched the ADS immediately following the accident at the scene.

17.35 For the driver to be held accountable, it has to be proved beyond reasonable doubt that they were driving. Likewise, imposing penalties on the ADSE is only possible if, on the balance of probabilities, the ADSE was engaged. Without location data, it is difficult to prove either ADS or driver responsibility, which creates a liability gap.

Dealing with insurance claims

17.36 The second example concerns an insurance claim. The insurer receives a claim alleging that a self-driving vehicle stopped for no reason. The vehicle behind was shunted by a third vehicle behind it, causing six people to suffer whiplash injuries. The claim was made after considerable delay and the owner cannot recall that the vehicle was ever at the scene.

17.37 In response to Consultation Paper 1, several insurers expressed concern about the increased risk of fraud in these circumstances. The Forum of Insurance Lawyers thought that "such a claim would be very difficult if not impossible to defend without data from the automated vehicle".[944]

17.38 At present, insurers rely heavily on evidence from the insured driver. However, users-in-charge may provide less evidence to help defend claims. In some cases, they may be the victim making the claim. In others, they may not have noticed what occurred. And more generally, users-in-charge will have less incentive to defend claims, as their own reputation as drivers and their no-claims bonuses will not be at stake. In these circumstances, insurers were keen to have data from the vehicle.

17.39 In Consultation Paper 1, we commented that insurers would use vehicle-collected data to verify that the vehicle was at the alleged location and was driving itself. At the

[944] Analysis of Responses, para 6.63.

time, the Association of British Insurers was in discussion with vehicle manufacturers to preserve a limited list of essential data to assess claims. The aim was to include, among other things, data on whether the ADS was engaged, linked to a time stamp *and* a GPS location.[945]

17.40 When victims make claims, they are unlikely to be exact about the time, but can be expected to be more accurate about the location. We would be concerned that without location data to show whether the vehicle was at the scene it might be difficult to distinguish between genuine and fraudulent claims.

Data collection without a user-in-charge

17.41 These two examples assume a conventional vehicle with a user-in-charge in the vehicle. In the case of a non-user-in-charge vehicle, we think the operator will also need to know where its vehicles are at all times. Standards will need to be developed to retain at least some of this data.

17.42 An example of this type of service would be ride-hailing vehicles that can travel empty to pick up passengers. The sharing of location data is a familiar feature in current business models picking up passengers, such as Uber, Lyft or Didi for example.

17.43 We have not considered the full implications of data retention by vehicles that do not have a user-in-charge at this stage. The issue will need to be addressed when the challenges of remote operation become clearer.

LOCATION DATA AND PRIVACY CONCERNS

17.44 As we understand it, it is technically feasible for the DSSAD to include a location stamp for each time the ADS was activated or deactivated, or each time a transition demand was made. The reason why location data are not currently included in the ALKS Regulation is that they raise privacy concerns.

17.45 Several recent reports have highlighted privacy concerns associated with AVs. In September 2020, an Expert Group convened by the European Commission published a report on the Ethics of Connected and Autonomous Vehicles.[946] The report underlined that privacy is a key issue, raising ethical principles of human dignity and personal autonomy.[947] In January 2020, the European Data Protection Board consulted on guidelines for processing data "in the context of connected vehicles and

---

945 CP1 paras 6.54 and 6.56, referring to Thatcham/ABI, *Regulating Automated Driving* (July 2017) Annex B, p 32.

946 European Commission Horizon 2020 Commission Expert Group (E03659). *Ethics of Connected and Automated Vehicles: recommendations on road safety, privacy, fairness, explainability and responsibility* (2020), at https://ec.europa.eu/info/sites/info/files/research_and_innovation/ethics_of_connected_and_automated_vehicles_report.pdf.

947 Above, p 35.

mobility-related applications”.[948] It emphasised the sensitivity of location data which is “particularly revealing of life habits”.[949]

Location data under the GDPR

17.46 We accept that privacy is a key concern and that location data is particularly sensitive. However, we do not think that location data is incompatible with the GDPR. We discuss this issue in depth in Appendix 4 and summarise our argument below.

17.47 The GDPR applies to personal data. Location data would be personal data if it indicates where a particular person was on a given day. Furthermore, in some circumstances, location data might fall within the “special categories of personal data” given additional protection under the GDPR.

17.48 Under GDPR Art 9, the special categories are:

> … personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person’s sex life or sexual orientation.

17.49 Location data has the potential to reveal these categories of information by showing a pattern of places visited. This may reveal information about, for example, a person’s religion (through visits to a place of worship); or health (through hospital visits); or sex life (through visits to a lover).

17.50 However, even if location data falls within a special category it may still be collected and processed. As we explain in Appendix 4, collecting special category data is permitted if the controller has both a lawful basis under Article 6 of the GDPR[950] and meets one or more of the 10 special conditions listed in Article 9. Several of the Article 9 special conditions would justify the collection of location data within a DSSAD.

(1) Under Article 9(1)(f) of the GDPR, processing is allowed if it is “necessary for the establishment, exercise or defence of legal claims or whenever courts are acting in their judicial capacity”. This would cover both examples set out above. In the first, information is necessary to prosecute (or defend) a criminal offence. In the second, the insurer needs location data to defend a legal claim under the AEV Act 2018.

(2) Under Article 9(2)(g) of the GDPR, processing is permitted if it is “necessary for reasons of substantial public interest”. What counts as the public interest is then specified in Schedule 1 of the Data Protection Act 2018. As we explain in Appendix 4, several paragraphs of the Data Protection Act 2018 may be relevant. For example:

---

948 EDPB, Guidelines 1/2020, at https://edpb.europa.eu/our-work-tools/public-consultations-art-704/2020/guidelines-12020-processing-personal-data-context_en.

949 EDPB, Guidelines 1/2020, paras 59 to 63.

950 We discuss some of the legal bases below, in the context of sharing data with insurers.

(a) Paragraph 6 applies to public functions. This would apply if an AV Road Incident Investigation Branch were established under statute as we discuss in Chapter 11. The Branch would be permitted to access DSSAD data where this was "necessary for reasons of a substantial public interest", such as learning lessons from high profile AV incidents.

(b) Paragraph 8 applies where processing special category data is necessary "for the purposes of identifying or keeping under review the existence or absence of equality of opportunity or treatment between groups of people". In Chapter 5 we discussed the need to monitor whether AVs imposed increased risks on some groups, such as vulnerable road users with protected characteristics. As AV collisions with vulnerable road users will not necessarily be recorded by EDRs, it might be necessary, in some circumstances, to process location data for that purpose.

17.51 However, there is a need for special safeguards where data reveals a criminal offence. Under Article 10 of the GDPR, private controllers may only process such data if it is authorised by law "providing for appropriate safeguards for the rights and freedoms of data subjects". The EDPB emphasises that strong security measures are required.[951]

17.52 In our view, collecting location data within the DSSAD can be compatible with the GDPR. However, as we discuss below, safeguards will be required to ensure that the information is only used by those with a legitimate interest in it.

ePrivacy Directive

17.53 The ePrivacy Directive[952] was enacted 18 years ago, to complement the Data Protection Directive,[953] which has since been replaced by the GDPR. It may soon be replaced itself, as the EU Commission recognises that it has not "kept pace with technological developments, resulting in a void of protection of communications conveyed through new services".[954] The EU Commission presented a proposed Regulation to replace the ePrivacy Directive in January 2017[955] but to date Member States have been unable to agree a text.

17.54 The ePrivacy Directive regulates "publicly available electronic communications services in public communications networks".[956] It applies to "terminal equipment". This is undefined in the ePrivacy Directive itself and the 2003 Regulations, but other directives define "terminal equipment" as:

---

951 EDPB, Guidelines 1/2020, paras 64 to 65.

952 Directive 2002/58/EC, implemented in domestic law by the Privacy and Electronic Communications (EC Directive) Regulations 2003 (as amended) (SI 2003 No. 2426).

953 Directive 95/46/EC.

954 The Explanatory Memorandum to the Proposed Regulation.

955 Available at https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52017PC0010&from=EN.

956 Art 3(1).

> equipment directly or indirectly connected to the interface of a public telecommunications network to send, process or receive information; in either case (direct or indirect), the connection may be made by wire, optical fibre or electromagnetically; a connection is indirect if equipment is placed between the terminal and the interface of the network.[957]

17.55 If an AV is connected to a public telephone network (using 4G connectivity for example) it may well fall within this definition. However, the drafters clearly did not have AVs in mind when the Directive was passed. At the time, the typical terminal equipment was a telephone handset. Appendix 4 summarises the provisions of the ePrivacy Directive and considers their application to our proposed data retention scheme.

17.56 The Directive contains specific safeguards for location data. Article 9(1) of the ePrivacy Directive and regulation 14(1) of the 2003 Regulations provides that location data of users of publicly available electronic communications services may only be processed when:

(1) it is anonymised; or

(2) users provide informed consent, "to the extent and for the duration necessary for the provision of a value added service". Such consent can be withdrawn at any time.

17.57 Unlike the GDPR, neither the ePrivacy Directive nor the 2003 Regulations permit location data to be processed for other purposes, such as criminal investigations. Instead, the issue is left to the national laws of member states.

17.58 The ePrivacy Directive allows member states to "adopt legislative measures to restrict the scope of the rights and obligations" in Article 9, provided the restriction meets the specified tests. Under Article 15(1), the restriction must constitute:

> a necessary, appropriate and proportionate measure within a democratic society to safeguard national security (i.e. State security), defence, public security, and the prevention, investigation, detection and prosecution of criminal offences or of unauthorised use of the electronic communication system.

17.59 The list of permitted purposes is exhaustive, and "strictly" interpreted. The Court of Justice of the European Union (CJEU) has stressed that one cannot "permit the exception to that obligation of principle … to become the rule".[958] Access to data must correspond "genuinely and strictly" to one of those purposes.[959] Furthermore, the exception for criminal investigation must retain only targeted to data for the purpose of

[957] Commission Directive 2008/63/EC, Art 1(a).

[958] Case C-203/15 *Tele2 Sverige* at para 89.

[959] Case C-207/16 *Ministerio Fiscal* at para 52.

fighting *serious* crime.[960] The exception for crime could not be used to resolve civil cases or to apply civil sanctions to an ADSE.

17.60 However, there is also an exception for public security, which has not yet been tested or defined. In our view, public security would justify targeted and proportionate measures to prevent serious injuries to vulnerable road users.

17.61 Following the end of the transition period, the ePrivacy Directive will no longer apply in Great Britain. However, the UK will continue to exchange data with the EU.[961] It is therefore important to continue to respect the principles underlying EU data protection law.

17.62 In our view, recording location data within the DSSAD and using that data in a proportionate way to investigate road traffic accidents would comply with underlying principles. The ePrivacy Directive was not drafted with AVs in mind and was not intended to prevent location data from being retained at all without consent. It was always intended that location data could be used where they were "necessary, appropriate and proportionate" to investigate criminal offences or to protect public security.

17.63 Indeed, without location data we doubt that full self-driving would become possible. Unless one can prove beyond reasonable doubt whether an ADS was engaged at the time and place of an incident, drivers and ADSEs will not be held accountable for their actions.

17.64 We propose that the Government should work within the UNECE to ensure that DSSADs record the location at which an ADS is activated and deactivated. Similarly, any national scheme to approve an ADS should require this type of location data to be collected, subject to appropriate safeguards. Furthermore, in the absence of a clear way to discover whether the ADS was engaged at the time of injury to vulnerable road users, a system should not be categorised as self-driving.

---

960 Case C-203/15 *Tele2 Sverige* at para 108.

961 The UK is currently seeking an "adequacy decision" from the EU under the GDPR and the Law Enforcement Directive, which would allow the continued free flow of personal data from the EU to the UK. Personal data protection is "adequate" where it is equivalent to that of the EU. The factors which the Commission takes into consideration when assessing adequacy are set out in Art 45 of the GDPR.

Consultation Question 55.

17.65 We provisionally propose that:

(1) for a vehicle to be classified as self-driving, it needs to record the location as well as the time at which the ADS is activated and deactivated;

(2) the Government should work within the UNECE to ensure data storage systems for automated driving record these data; and

(3) any national system to approve an ADS should require these data to be collected, subject to safeguards.

Do you agree?

SHARING DATA WITH INSURERS

17.66 Under the GDPR, all those who process personal data must have a lawful basis for doing so. This means that an ADSE may only share personal data with an insurer if it can point to one of the six lawful bases set out in Article 6(1) of the GDPR. We discuss these in Appendix 4.

17.67 Sharing data with insurers is likely to fall within Article 6(1)(f): processing is necessary for the legitimate interests of a third party. However, this basis involves a balancing act. The legitimate interests of the third party can be "overridden by the interests or fundamental rights and freedoms of the data subject", especially where the data subject is a child. The ADSE would need to balance the interests of insurer and victim against those of the data subject.

17.68 From the ADSE's point of view, it would be simpler to fall within Article 6(1)(c). This applies where "processing is necessary for compliance with a legal obligation to which the controller is subject". However, for this basis to apply, legislation would need to impose a duty on those controlling AV data to disclose them to insurers where this was necessary to decide claims accurately and fairly.

17.69 A second reason to impose a duty on data controllers to release data to insurers is that a legal obligation to release data would prevent potential abuse of the market. In discussions, fears were raised that ADSEs would force customers to take out insurance with the ADSE-nominated insurer by refusing to release data to others. Such behaviour has the potential to be anti-competitive, driving up the cost of insurance for customers.

17.70 For these two reasons, we provisionally propose that legislation should impose a duty on data controllers to disclose necessary data to AV insurers.

Consultation Question 56.

17.71 We provisionally propose that legislation should impose a duty on those controlling AV data to disclose data to insurers, where the data is necessary to decide claims fairly and accurately.

Do you agree?

HOW LONG SHOULD DATA BE RETAINED FOR?

17.72 As we have seen, discussions within the group drafting the ALKS regulation referred to timestamp specifications of 2500 timestamps and to 6 months of use. Germany has nationally required data to be retained for six months.[962] However, it is open to the UK to require data to be stored for longer by being uploaded onto a server.

17.73 In Consultation Paper 1 we explained that under the AEV Act the limitation period is usually three years, but could be longer. Generally, for personal injuries, a claimant must bring an action within three years from the date of the accident or from the date the injured person had knowledge of the possibility of a claim.[963] The time limit for property damage is three years from the date of the accident.[964]

17.74 However, the limitation period can be longer in some circumstances. If the injured person dies, the limitation period is three years following their death, or from their personal representative's knowledge of the possibility of a claim.[965] If the injured person was a child, the limitation period would begin to run from the date they reach the age of 18 in England and Wales and 16 in Scotland. If the injured person was under a disability, the limitation period would run from the time they were no longer under the disability (or else in England and Wales the end of their life).[966]

17.75 In Consultation Paper 1 we expressed concern that it would not be possible to store all data throughout the limitation period. We suggested that an injured person might

962 Section 63(a) 1 of the Strassenverkehrsgesetz, "StVG" requires out that certain information must be stored by a vehicle with a "highly" or "fully automated driving function" (see discussion in chapters 4 and 7). Section 63a (4) provides that the data required under 63a(1) is to be deleted after six months unless a vehicle is involved in an event set out in StVG 7 (1) (eg where someone has been killed or injured) in which case the data must be stored for three years.

963 England and Wales: para 11 of the schedule to the AEV Act 2018 inserts a new section 11B into the Limitation Act 1980. The relevant provision is s 11B(2)(b). Scotland: para 3 of the schedule inserts s 18ZA into the Prescription and Limitation (Scotland) Act 1973: see s 18ZA(2)(b).

964 England and Wales: Limitation Act 1980 s 11B(2)(a). Scotland: Prescription and Limitation (Scotland) Act 1973, s 18ZA(2)(a).

965 England and Wales: Limitation Act 1980, s 11B(5). Scotland: Prescription and Limitation (Scotland) Act 1973, s 18ZA(7); Age of Legal Capacity (Scotland) Act 1991, s 1(2). This only applies if the person dies within 3 years of either the accident or their date of knowledge of the claim.

966 England and Wales: Limitation Act 1980, s 28. Scotland: Prescription and Limitation (Scotland) Act 1973, ss 17(3) and 18(3).

be required to notify the police or the injurer about the alleged incident within a shorter period, so that data could be preserved.[967]

17.76 Although this received support from insurers, it was widely opposed by legal and claimant groups. It was thought unjust to have different requirements for different victims. Furthermore, victims might have good reasons for the delay. As the Association of Personal Injury Lawyers said:

> There might be good reasons why a claimant does not notify police or their insurer within a set period. They may not have the capacity to do so. They might be under a mistaken belief the injury was not serious, only to find out later that it was life changing.[968]

17.77 We accept that it would be wrong to restrict victims' rights to claim simply because of the difficulties of storing data.

17.78 For now, we think that Government should err on the side of caution. If data is stored for too long it can always be deleted. If, however, data is stored for too short a time, it cannot be regained. We would not wish problems to arise from the initial deployment of AVs simply because data was not available to resolve disputes.

17.79 In our view, ADSEs behind the first generation of vehicles listed as able to drive themselves should work on the basis that DSSAD data will be stored for three years (the normal limitation period). This does not mean that the small number of claims which have not been identified in three years but are subject to a longer limitation period will be prevented from proceeding. However, these claims will be more difficult to prove or disprove. This has to be balanced against the large burden and cost of storing large masses of data for many years. We think that in most such instances, the insurer would have been notified that an accident took place within 3 years, even if the court action has not been commenced.

17.80 The issue should then be reviewed in the light of experience. If after a few years the practical difficulties of data storage become too great, it may be possible to reduce this period in the light of practical experience.

---

967 CP1, para 6.60, Consultation Question 17.

968 Analysis of Responses, para 6.66.

Consultation Question 57.

17.81 We provisionally propose that:

(1) initially, DSSAD data from self-driving vehicles should be stored for three years; and

(2) the issue should be reviewed in the light of experience.

Do you agree?

RECORDING AND RETAINING COLLISION-SPECIFIC DATA

17.82 So far we have considered data collected in the absence of a detected collision. Here we consider what data it might be useful to retain once the EDR has detected a collision.

17.83 As background to its work on this issue, the UNECE convened an informal working group (known as IWG EDR/DSSAD). The group operated under the aegis of the 1998 Agreement on UN Global Technical Regulations and was therefore able to take a broad international approach, including the United States and China for example, as well as UNECE contracting parties.

17.84 Two studies provided background research for the group: one from the German insurance company Allianz, and one from the US National Highway Traffic Safety Administration (NHTSA). These reports looked in more detail at what information might be needed to investigate and understand collisions, drawing on existing databases.

17.85 The current US standard is that EDR should hold information from 5 seconds before the crash. A NHTSA study suggests that 5 seconds is too short to cover much of the data needed to understand a crash. For example, in around a third of accidents, the driver initiated braking before the 5 second window – but the EDR did not tell investigators how long before. Based on a naturalistic driving study which placed specialised recorders in 100 vehicles for a year, NHTSA concluded that 20 seconds of pre-crash data would be needed in order to understand 90% of accidents.[969]

17.86 Allianz reach a similar conclusion: only 42% of motor accidents involving a personal injury could be resolved with an EDR designed according to current US standards.[970] Allianz reported that the AHEAD group, which advises the Informal Working Party, recommended that for automated systems, data should be recorded from 30 seconds before the collision to 10 seconds afterwards.

[969] NHTSA, "Results of Event Data Recorders Pre-Crash Duration Study" (August 2018) p 6.

[970] Allianz Study, p 15.

17.87 One question is how far event data recorders should keep video feeds. Allianz highlighted several cases where claims could only be full resolved with 360-degree camera feeds. Video recordings are particularly important where the perpetrator of the collision leaves the scene – for example where the AV is forced to take evasive action due to a third party's sudden lane change.[971] Under the AEV Act 2018, insurers will wish to identify third parties at fault to bring a claim against them. They will be therefore be looking for a camera evidence of the number plate of other vehicles which may have been at fault.

17.88 The UNECE has not yet come to a decision on these issues. The questions posed are often technical and we have not ourselves reached a conclusion on exactly which data surrounding a collision should be stored. However, it will become crucial to understand and learn from collisions involving AVs. We would hope that data will be available to allow this to be done.

ACCOUNTABILITY

17.89 Collecting location and video feed data clearly raises significant privacy concerns. There is a danger that it might be used inappropriately for commercial practices, such as microtargeting of advertisements, or fall into the wrong hands. Alex Glassbrook has drawn attention to the work of the "Berlin Group", an international working group on data protection.[972] The group identified many risks, including:

(1) *Unauthorised secondary use*: for example, controllers might sell data to commercial organisations.

(2) *Lack of control*: for example, data might be accessed by others using the vehicle.

(3) *Lack of accountability*: with too many different people involved in data retention and processing.

17.90 The GDPR already includes duties and sanctions to prevent unauthorised use and third party access. As we discuss in Appendix 4, responsibility rests with the person controlling the data (the controller). Article 5(2) of the GDPR states that "the controller shall be responsible for, and be able to demonstrate compliance" with the statutory principles of processing personal data. Under Article 24(1), the controller must:

> implement appropriate technical and organisational measures to ensure and to be able to demonstrate that processing is performed in accordance with this Regulation.

17.91 The measures must be reviewed and updated where necessary. Article 25 sees these technical and organisational measures as embedding data protection principles into the process by "design and default".

17.92 However, there is always a risk that data controllers might fail to understand the law. Therefore, the GDPR also encourages trade associations and representative bodies

---

971 Allianz Study, p 14.

972 A Glassbrook, *A Practical Guide to the Law of Driverless Cars* (2nd ed 2019) pp 170 to 172.

to establish guidance about good data handling, through codes of conduct and accreditation schemes. At present, there is no code of practice on how ADSEs should store, protect and release data to ensure that it does not fall into the wrong hands.

17.93 Given the scale and sensitivity of AV data, it is crucial that ADSEs take care of it appropriately. In our view, when an ADSE applies for categorisation of an AV with an ADS as self-driving, the ADSE should include a section on data protection in their safety case. This should spell out in detail how data will be recorded, stored and accessed. It should also include precautions against data breaches.[973] The safety case will need to be scrutinised by the regulator before a vehicle can be listed as self-driving.

17.94 In time we would hope that good practice will emerge, which can be included within an industry code of practice.

Consultation Question 58.

17.95 We provisionally propose that:

(1) when an ADSE applies for categorisation of its vehicle types as self-driving, it should present the regulator with details on how data will be recorded, stored, accessed and protected;

(2) the regulator should only categorise a system as self-driving if it is satisfied that that the ADSE has systems to abide by its obligations under the GDPR.

Do you agree?

973 In addition to outlining their data protection approach in a safety case, ADSEs will have to be otherwise in compliance with data protection law.

Chapter 18: Consultation Questions

CHAPTER 4: SELF-DRIVING AND HUMAN INTERVENTION

Consultation Question 1 (Paragraph 4.114)

18.1 We provisionally propose that:

(1) a vehicle should not be classified as self-driving if, with the ADS engaged, the user-in-charge needs to monitor the driving environment, the vehicle or the way it drives;

(2) it is nevertheless compatible with self-driving to require the user-in-charge to respond to a clear and timely transition demand which:

(a) cuts out any non-driving related screen use;

(b) provides clear visual, audio and haptic signals; and

(c) gives sufficient time to gain situational awareness;

(3) to be classified as self-driving, the vehicle must be safe enough even if the human user does not intervene in response to any event except a clear and timely transition demand.

Do you agree?

Consultation Question 2 (Paragraph 4.115)

18.2 We welcome views on whether self-driving features should be designed to ensure that they can be used by people with hearing loss.

CHAPTER 5: HOW SAFE IS SAFE ENOUGH?

Consultation Question 3 (Paragraph 5.118)

18.3 We provisionally propose that the decision whether a vehicle is sufficiently safe to "safely drive itself" should be made by the Secretary of State, as informed by advice from a specialist regulator.

Do you agree?

Consultation Question 4 (Paragraph 5.119)

18.4 We welcome observations on which of the following standards is most appropriate when assessing the safety of automated vehicles:

(a) as safe as a competent and careful human driver;

(b) as safe as a human driver who does not cause a fault accident;

(c) overall, safer than the average human driver.

Consultation Question 5 (Paragraph 5.120)

18.5 We welcome observations on how automated vehicles can be made as safe as reasonably practicable.

Consultation Question 6 (Paragraph 5.121)

18.6 We welcome practical suggestions for how AV regulators can fulfil their public sector equality duty.

CHAPTER 7: ASSESSING SAFETY PRE-DEPLOYMENT

Consultation Question 7 (Paragraph 7.99)

18.7 We provisionally propose that:

(1) safety assessment should use a variety of techniques;

(2) manufacturers/developers should submit a safety case to regulators showing why they believe that the automated driving system is safe;

(3) regulators should:

(a) provide guidelines for what is in the safety case;

(b) audit the safety case;

(c) prepare guidance for manufacturers and developers on preferred standards; and

(d) carry out at least some independent tests.

Do you agree?

Consultation Question 8 (Paragraph 7.100)

18.8 We seek views on whether an approval authority that intends to use a scenario database as part of the testing procedure should consult road user groups on the range of scenarios to be included.

CHAPTER 8: INITIAL APPROVALS AND CATEGORISATION – PROPOSALS

Consultation Question 9 (Paragraph 8.17)

18.9 We provisionally propose that:

(1) unauthorised automated driving systems should be prohibited; and

(2) this should be subject to an exemption procedure by which the Secretary of State may authorise unauthorised systems to be used in tests and trials.

Do you agree?

Consultation Question 10 (Paragraph 8.25)

18.10 We provisionally propose that:

(1) the Government should establish a domestic scheme to approve automated driving systems (ADSs) for use on roads in Great Britain (a "national ADS approval scheme");

(2) manufacturers should have a free choice to apply for approval under either the UNECE system of international type approvals or through the national scheme;

(3) developers should be able to submit an ADS for national approval, even if they are not responsible for manufacturing the whole vehicle.

Do you agree?

Consultation Question 11 (Paragraph 8.43)

18.11 We provisionally propose that:

(1) an ADS approval scheme should be established through regulation under the Road Traffic Act 1988, without further legislative reform;

(2) an ADS should be defined as a combination of software, hardware and sensors, which can be installed in a "type" of vehicle;

(3) when an ADS is approved, the approval should be accompanied by specifications for:

(a) the type of vehicle in which it can be installed; and

(b) how the ADS is installed within the vehicle;

(4) where an ADS is installed in a pre-registered vehicle, an example vehicle should be submitted to the regulator for approval of the installation.

Do you agree?

Consultation Question 12 (Paragraph 8.44)

18.12 We invite observations on the appeal process in regulation 19 of the Road Vehicles (Approval) Regulations 2020, including:

(1) how it works in practice; and

(2) how well it is suited to the proposed national ADS approval scheme.

Consultation Question 13 (Paragraph 8.71)

18.13 We provisionally propose that:

(1) once an ADS has received type approval at either international or domestic level, an Automated Driving System Entity (ADSE) would need to submit the vehicle to the UK safety regulator for categorisation as able to safely drive itself;

(2) the safety regulator should make a recommendation to the Secretary of State for how the vehicle should be classified;

(3) it should be open to the safety regulator to recommend that an ADS-enabled vehicle is classified in one of three ways: as not self-driving but driver assistance; as self-driving only with a user-in-charge; or as self-driving without a user-in-charge;

(4) the safety regulator should only recommend classification as self-driving (either with or without a user-in-charge) if it is satisfied that:

(a) an ADSE is registered as taking responsibility for the system;

(b) the ADSE was closely involved in assessing safety and creating the safety case; and

(c) the ADSE has sufficient funds accessible to the regulator to respond to improvement notices, to pay fines and to organise a recall.

Do you agree?

Consultation Question 14 (Paragraph 8.77)

18.14 We provisionally propose that a new legislative framework should provide regulation-making powers to specify:

(a) who should assess whether a vehicle is capable of self-driving;

(b) the procedure for doing so; and

(c) criteria for doing so.

Do you agree?

Consultation Question 15 (Paragraph 8.78)

18.15 We seek views on whether the new legislation should include provisions for appeals against a categorisation decision. If so, should these be similar to those in regulation 19 of the Road Vehicles (Approval) Regulations 2020?

Consultation Question 16 (Paragraph 8.83)

18.16 We seek views on whether the regulator that classifies vehicles as self-driving should have power to allow their deployment in limited numbers, so as to gather further data on their safety in real world conditions.

CHAPTER 10: ASSURING SAFETY IN USE

Consultation Question 17 (Paragraph 10.82)

18.17 We provisionally propose that legislation should establish a scheme to assure the safety of automated driving systems following deployment, giving scheme regulators enhanced responsibilities and powers.

Do you agree?

Consultation Question 18 (Paragraph 10.83)

18.18 We provisionally propose that the enhanced scheme should give regulators the following responsibilities and powers:

(1) scheme regulators should be responsible for comparing the safety of automated and conventional vehicles using a range of measures;

(2) to do this the regulator should have power to collect information on:

(a) leading measures (instances of bad driving which could have led to harm) and

(b) lagging measures (outcomes which led to actual harm);

(3) regulators should have power to require an ADSE:

(a) to update software where an update is needed to ensure safety and continued compliance with the law;

(b) to keep maps up-to-date, where an AV relies on maps to ensure safety and compliance with the law;

(c) to communicate information about an ADS to users in a clear and effective way, including where necessary through training.

Do you agree?

Consultation Question 19 (Paragraph 10.84)

18.19 We welcome views on the following issues:

(1) Should scheme regulators be empowered to approve software updates that apply only within the UK, without requiring the manufacturer to return to the original type approval authority?

(2) Should the scheme should also deal with cybersecurity?

(3) Are other powers needed? (Note that data is discussed in Chapter 17.)

Consultation Question 20 (Paragraph 10.100)

18.20 Should the authority administering the scheme to assure safety while automated vehicles are in use be kept separate from type approval authorities (as is already the case)? Alternatively, should both functions be combined in a single body?

Consultation Question 21 (Paragraph 10.101)

18.21 What formal mechanisms could be used to ensure that the regulator administering the scheme is open to external views (such as duties to consult or an advisory committee)?

CHAPTER 11: INVESTIGATING TRAFFIC INFRACTIONS AND COLLISIONS

Consultation Question 22 (Paragraph 11.24)

18.22 We provisionally propose that a statutory scheme to assure AVs in-use should:

(1) investigate safety-related traffic infractions (such as exceeding the speed limit; running red lights; or careless or dangerous driving);

(2) investigate other traffic infractions, including those subject to penalty charge notices;

(3) if fault lies with the ADSE, apply a flexible range of regulatory sanctions.

Do you agree?

Consultation Question 23 (Paragraph 11.53)

18.23 We provisionally propose that the regulator which assures the safety of AVs in-use should have powers to impose the following sanctions on ADSEs:

(1) informal and formal warnings;

(2) fines;

(3) redress orders;

(4) compliance orders;

(5) suspension of authorisation;

(6) withdrawal of authorisation; and

(7) recommendation of attendance at a restorative conference.

Do you agree?

Consultation Question 24 (Paragraph 11.54)

18.24 We provisionally propose that the legislation should provide the regulator with discretion over:

(1) the amount of any monetary penalty; and

(2) the steps which should be taken to prevent re-occurrence of a breach.

Do you agree?

Consultation Question 25 (Paragraph 11.69)

18.25 We provisionally propose that a specialist incident investigation unit should be established:

(1) to analyse data on collisions involving automated vehicles;

(2) to investigate the most serious, complex or high-profile collisions; and

(3) to make recommendations to improve safety without allocating blame.

Do you agree?

Consultation Question 26 (Paragraph 11.82)

18.26 We provisionally propose that the UK Government should establish a forum for collaboration on the application of road rules to self-driving vehicles.

Do you agree?

Consultation Question 27 (Paragraph 11.83)

18.27 We welcome views on:

(1) the issues the forum should consider;

(2) the composition of the forum; and

(3) its processes for public engagement.

CHAPTER 12: THE USER-IN-CHARGE

Consultation Question 28 (Paragraph 12.24)

18.28 We provisionally propose that that the user-in-charge:

(1) should be defined as an individual in position to operate the controls of a vehicle while an ADS is engaged and who is either in the vehicle or in direct sight of the vehicle; and

(2) is not a driver while the ADS is engaged, and would not be liable for any criminal offence or civil penalty (such as a parking ticket) which arises out of dynamic driving.

Do you agree?

Consultation Question 29 (Paragraph 12.37)

18.29 We provisionally propose that following the end of the transition demand period:

(1) the user-in-charge should re-acquire the legal obligations of a driver, whether or not they have taken control of the vehicle; and

(2) if, following a failure to respond to a transition demand, the vehicle stops in a manner which constitutes a criminal offence, the user-in-charge should be considered a driver and should therefore be liable for that offence.

Do you agree?

Consultation Question 30 (Paragraph 12.45)

18.30 We seek views on whether a person with a provisional licence should be allowed to act as a user-in-charge, if accompanied by an approved driving instructor in a vehicle with dual controls.

Consultation Question 31 (Paragraph 12.53)

18.31 We provisionally propose that legislation should create new offences of:

(1) using an automated vehicle as an unfit or unqualified user-in-charge; and

(2) causing or permitting the use of an automated vehicle by an unfit or unqualified user-in-charge.

Do you agree?

Consultation Question 32 (Paragraph 12.59)

18.32 We provisionally propose that persons carried without a user-in-charge should be guilty of a criminal offence. Do you agree?

Consultation Question 33 (Paragraph 12.60)

18.33 We seek views on whether the new proposed offence of being carried without a user-in-charge should only apply if the person:

(1) knew that the vehicle did not have a user-in-charge; and

(2) knew or ought to have known that a user-in-charge was required.

Consultation Question 34 (Paragraph 12.66)

18.34 We provisionally propose that a user-in-charge who takes over control of the vehicle:

(1) should be considered a driver; but

(2) should have a specific defence to a criminal offence if, given the actions of the ADS, a competent and careful driver could not have avoided the offence.

Do you agree? If not, we welcome views on alternative legal tests.

Consultation Question 35 (Paragraph 12.94)

18.35 We provisionally propose that the user-in-charge should be liable for criminal offences which do not arise from the dynamic driving task, including those related to:

(1) insurance;

(2) maintaining the vehicle in a roadworthy condition (including installing safety critical software updates);

(3) parking;

(4) duties following accidents to provide information and report accidents to the police; and

(5) ensuring child passengers wear seatbelts.

Do you agree?

Consultation Question 36 (Paragraph 12.95)

18.36 We provisionally propose that the legislation should include a regulation-making power to clarify those roadworthiness failings which are (and those which are not) the responsibility of the user-in-charge.

Do you agree?

CHAPTER 13: REMOTE OPERATION: NO USER-IN-CHARGE VEHICLES

Consultation Question 37 (Paragraph 13.67)

18.37 We provisionally propose that:

(1) where an individual is exercising latitudinal and longitudinal control (steering and braking) over a vehicle remotely, that should not be regarded as a form of "self-driving"; and

(2) where lateral and longitudinal control are exercised by an ADS, all other forms of remote operation should be regulated as "self-driving".

Do you agree?

18.38 We welcome views on whether the current definition of when a vehicle "drives itself" under the Automated and Electric Vehicles Act 2018 should be amended to deal with some forms of remote operation which may involve a degree of "monitoring".

Consultation Question 38 (Paragraph 13.86)

18.39 We provisionally propose that:

(4) the regulation of self-driving vehicles should distinguish between an Automated Driving System Entity (which vouches for the design of the system) and an operator (responsible for the operation of individual vehicles);

(5) all vehicles authorised for use on roads or other public places with no user-in-charge should either:

(a) be operated by a licensed operator; or

(b) be covered by a contract with a licensed operator for supervision and maintenance services;

(6) it should be a criminal offence to use a NUIC vehicle on a road or other public place unless it is operated by a licensed operator or is covered by a contract with a licensed operator for supervision and maintenance services.

Do you agree?

Consultation Question 39 (Paragraph 13.92)

18.40 We welcome views on whether NUIC operators should be required to demonstrate professional competence through a safety management system, as set out in a safety case.

Consultation Question 40 (Paragraph 13.108)

18.41 We provisionally propose that, irrespective of the nature of the vehicle, a licensed operator should be under a duty to:

(1) supervise the vehicle;

(2) maintain the vehicle;

(3) insure the vehicle;

(4) install safety-critical updates and maintain cybersecurity; and

(5) report accidents and untoward events (as defined by the regulator).

Do you agree?

Consultation Question 41 (Paragraph 13.109)

18.42 We provisionally propose that legislation should include a regulation-making power by which some or all of these duties could be transferred to the registered keeper or owner, if it was shown that it was appropriate to do so.

Do you agree?

Consultation Question 42 (Paragraph 13.116)

18.43 We welcome views on how accessibility standards for Highly Automated Road Passenger Services (HARPS) might be developed.

18.44 We provisionally propose that:

(1) an accessibility advisory panel should be formed to include:

(a) the Equalities and Human Rights Commission; and

(b) representative groups for disabled and older persons;

(2) the Secretary of State should be obliged to consult with the accessibility advisory panel prior to setting any national minimum standards on HARPS;

(3) there should be a duty to periodically re-consult the accessibility advisory panel at set intervals to ensure requirements keep pace with developing evidence of technical feasibility and changing needs.

Do you agree?

We welcome views on what the set interval for periodically re-consulting the accessibility advisory panel should be.

Consultation Question 43 (Paragraph 13.133)

18.45 We welcome views on who should administer the operator licensing scheme.

CHAPTER 14: CRIMINAL OFFENCES BY ADSES AND THEIR SENIOR MANAGERS

Consultation Question 44 (Paragraph 14.107)

18.46 We provisionally propose that:

(1) it should be a criminal offence for an ADSE to omit safety-relevant information or include misleading information when putting a vehicle forward for classification as self-driving or responding to information requests from the regulator;

(2) the offence should apply to senior managers (where it was attributable to the manager's consent, connivance or neglect);

(3) the offence should not apply to more junior employees;

(4) the offence should carry a higher sentence if it is associated with a death or serious injury;

(5) the offence should be prosecuted in England and Wales by either the regulator or the Crown Prosecution Service and in Scotland by the Procurator Fiscal.

Do you agree?

Consultation Question 45 (Paragraph 14.108)

18.47 We seek views on the following proposed offences.

Offence A: non-disclosure and misleading information in the safety case

When putting forward a vehicle for classification as self-driving, it would be a criminal offence for the ADSE to

(1) fail to provide information to the regulator; or

(2) provide information to the regulator that is false or misleading in a material particular

where that information is relevant to the evaluation of the safety of the ADS or the vehicle.

The ADSE would have a defence if it could show that it took reasonable precautions and exercised all due diligence to prevent the wrongdoing.

The penalty would be an unlimited fine.

Offence B: non-disclosure and misleading information in responding to requests

When a regulator requests specific information from an ADSE (whether before or after deployment), it would be a criminal offence for the ADSE to

(1) fail to provide information to the regulator; or

(2) provide information to the regulator that is false or misleading in a material particular

where that information is relevant to the evaluation of the safety of the ADS or the vehicle.

The ADSE would have a defence if it could show that it took reasonable precautions and exercised all due diligence to prevent the wrongdoing.

The penalty would be an unlimited fine.

Offence C: offences by senior management

Where offence A and/or offence B committed by a body corporate is proved—

(3) to have been committed with the consent or connivance of an officer of the body corporate; or

(4) to be attributable to neglect on the part of an officer of the body corporate,

then that officer is guilty of the offence.

An officer includes any director, manager, secretary or other similar officer or any person who was purporting to act in any such capacity.

We see this as equivalent to offences under the Human Medicines Regulations 2012 and General Product Safety Regulations 2005, which carry a penalty of a fine and/or a maximum two years' imprisonment.

Offence D: aggravated offences in the event of death or serious injury following non-disclosure or provision of misleading information to the AV safety regulator

Where a corporation or person commits Offences A to C, that offence is aggravated where the misrepresentation or non-disclosure:

(5) related to an increased risk of a type of adverse incident; and

(6) an adverse incident of that type occurred; and

(7) the adverse incident caused a death or serious injury.

We see this as equivalent to the offence of causing death by dangerous driving, which carries a penalty of an unlimited fine and/or a maximum of 14 years' imprisonment.

Consultation Question 46 (Paragraph 14.109)

18.48 We welcome views on whether an ADSE should be under a duty to present information in a clear and accessible form, in which safety-critical information is indexed and signposted.

CHAPTER 15: NEW WRONGFUL INTERFERENCE OFFENCES

Consultation Question 47 (Paragraph 15.10)

18.49 We provisionally propose that legislative amendment should clarify that the tampering offence in section 25 of the Road Traffic Act 1988 applies to anything that is physically part of a vehicle and any software installed within it.

Do you agree ?

Consultation Question 48 (Paragraph 15.11)

18.50 We welcome views on whether the tampering offence should apply to external infrastructure required for the operation of the AV.

Consultation Question 49 (Paragraph 15.53)

18.51 We provisionally propose that there should be an aggravated offence of wrongfully interfering with an AV, the road, or traffic equipment contrary to section 22A of the Road Traffic Act 1988, where the interference results in an AV causing death or serious injury, in:

(1) England and Wales; and

(2) Scotland.

Do you agree?

Consultation Question 50 (Paragraph 15.55)

18.52 We provisionally propose that the appropriate mental element for the aggravated offence is intent to interfere with a vehicle, the road or traffic equipment.

Do you agree?

Consultation Question 51 (Paragraph 15.62)

18.53 We seek views on whether an approved work defence for repair or maintenance operations authorised by a vehicle manufacturer or Automated Driving System Entity is desirable.

CHAPTER 16: CIVIL LIABILITY

Consultation Question 52 (Paragraph 16.24)

18.54 We provisionally propose that the way the Automated and Electric Vehicles Act 2018 deals with contributory negligence and causation is:

(1) adequate at this stage; and

(2) should be reviewed by the UK Government in the light of practical experience.

Do you agree?

Consultation Question 53 (Paragraph 16.32)

18.55 We provisionally propose that measures should be put in place to compensate the victims of accidents caused by uninsured AVs.

Do you agree?

Consultation Question 54 (Paragraph 16.47)

18.56 We provisionally propose that:

(1) product liability law should be reviewed to take account of the challenges of emerging technologies;

(2) any review should cover product liability as a whole, rather than be confined to automated vehicles; it should not, therefore, form part of this project on automated vehicles.

Do you agree?

CHAPTER 17: ACCESS TO DATA

Consultation Question 55 (Paragraph 17.65)

18.57 We provisionally propose that:

(1) for a vehicle to be classified as self-driving, it needs to record the location as well as the time at which the ADS is activated and deactivated;

(2) the Government should work within the UNECE to ensure data storage systems for automated driving record these data; and

(3) any national system to approve an ADS should require these data to be collected, subject to safeguards.

Do you agree?

Consultation Question 56 (Paragraph 17.71)

18.58 We provisionally propose that legislation should impose a duty on those controlling AV data to disclose data to insurers, where the data is necessary to decide claims fairly and accurately.

Do you agree?

Consultation Question 57 (Paragraph 17.81)

18.59 We provisionally propose that:

(1) initially, DSSAD data from self-driving vehicles should be stored for three years; and

(2) the issue should be reviewed in the light of experience.

Do you agree?

Consultation Question 58 (Paragraph 17.95)

18.60 We provisionally propose that:

(1) when an ADSE applies for categorisation of its vehicle types as self-driving, it should present the regulator with details on how data will be recorded, stored, accessed and protected;

(2) the regulator should only categorise a system as self-driving if it is satisfied that that the ADSE has systems to abide by its obligations under the GDPR.

Do you agree?

Appendix 1: Acknowledgements

1.1 We would like to thank the following organisations, groups and people who have met with us during the course of the project.

PUBLIC SECTOR

1.2 Centre for Connected and Autonomous Vehicles (CCAV), Centre for Data Ethics and Innovation (CDEI), Centre for the Fourth Industrial Revolution Israel, Crown Prosecution Service (CPS), Department for Business, Department for Infrastructure (Northern Ireland), DENATRAN National Traffic Department (Brazil), Department for Transport (DfT), Disability Equality Scotland, Disabled Motoring UK, Disabled Persons Transport Advisory Committee (DPTAC), DPD, Driver and Vehicle Licensing Agency (DVLA), Driver and Vehicle Standards Agency (DVSA), Energy and Industrial Strategy (BEIS), Health and Safety Executive (HSE), Highways England, Information Commissioner's Office (ICO), Innovate UK, International Vehicle Standards (IVS), Israel Innovation Authority, ITS (Japan), Ministry of Justice Israel, Ministry of Transportation and Road Safety (Israel), National Police Agency (Japan), Medicines and Healthcare products Regulatory Agency (MHRA), Met Office, Metropolitan Police, Mobility and Access Committee for Scotland (MACS), National Physical Laboratory, National Transport Commission (Australia), Office for Low Emission Vehicles (DfT), Office for Low Emission Vehicles (Olev), Office for Product Safety and Standards, Office of the Secretary of State for Scotland, Oxfordshire County Council, Parliamentary Advisory Council on Transport Safety, Parliamentary Advisory Council for Transport Safety (PACTS), Police Scotland, Polis Network, Federal Roads Office, Switzerland FEDRO, Singapore Land Transport Authority, The Highlands and Islands Transport Partnership (HITRANS), Traffic Commissioners for Great Britain, Transport Canada, Transport for Greater Manchester (TfGM), Transport for Greater Manchester (TfGM), Transport for London (TfL), Transport for NSW, Transport for West Midlands (TfWM), Transport Scotland, UK Research and Innovation, Urban Transport Group, Vehicle Certification Agency (VCA), Welsh Government, World Economic Forum. Zenzic.

PRIVATE SECTOR

1.3 Autonomous Drivers Alliance (ADA), Automated Driving Insurer Group (ADIG), Autonomous Intelligent Driving (AID, now part of Argo AI), Addison Lee, Addleshaw Goddard LLP, Adelard, Anxiety UK, AppyWay, Association of British Insurers (ABI), Australia and New Zealand Driverless Vehicle Initiative (ADVI), Autokab, AVIVA, Bosch, BP, BMW, Brake, British Insurance Brokers' Association (BIBA), British Parking Association (BPA), British Standards Institution (BSI), British Vehicle Rental and Leasing Association (BVRLA), Stephen Brookes MBE, Burges Salmon LLP, Burness Paull LLP, Campaign for Better Transport, CAPRI consortium, CertiCAV, Chartered Institute of Highways and Transportation (CIHT), Chipside, Bill Clare, Lord Tim Clement-Jones CBE, Commission on the Future of Mobility, Connected and Autonomous POD on-Road Implementation (CAPRI), Daimler AG, Darwin AI, Deloitte, Drive U, DRIVEN consortium, DriveNow, Royal Academy of Engineering, Ecomotion, Edge Case Research, ENDEAVOUR Consortium, FiveAI, Freight Transport

Association, Future Coders, Gemserv, Giles Bailey (TravelSpirit Foundation), Goggo Network, Guide Dogs, Guy Carpenter & Company, Heathrow Airport (Heathrow Pods team), Hogan Lovells, Intel, International Association of Traffic and Safety Sciences (IATSS), InMotion ventures, Connected Places Catapult, Joint Research Centre (JRC), KPMG, London Living Labs, MaaS Global (Whim), Mitchell Gingrich (Autonomous Consulting), Mobile Programming LLC, Mobileye, MobOx, Paul Moorby OBE, Motor Insurers' Bureau (MIB), National Express, International Organization of Motor Vehicle Manufacturers (OICA), OmniCAV, Ottopia, P3, PA Consulting, Polis Network, RAC Foundation, Realising Accountable Intelligent Systems (RAInS), Reed Mobility, Research Institute for Disabled Consumers (RiDC), Road Haulage Association (RHA), SAFE, SafeKids, Society of Motor Manufacturers and Traders (SMMT), Squire Patton Boggs LLP, Streetwise,RTA Communication Systems, Sustrans, Tech UK, Technova Inc, techUK, Tesla, Thatcham Research, Tim Marlow Ltd, The Automated Driving Insurance Group (ADIG), Towards Identifying and closing Gaps in Assurance of Autonomous Road vehicles Project (TIGARS), Transport Research Laboratory (TRL), Uber ATG (now part of Aurora), Unite the Union, University College London (UCL), Vianova, Volvo, Walking and Cycling Alliance, Warwick Manufacturing Group (WMG), Waymo, Wayve.

ACADEMICS AND LAWYERS

1.4 Assuring Autonomy International Programme (University of York), Shahab Gholizadehdastjerd (Brunel University), Kweku Aggrey-Orleans (Barrister, 12 King's Bench Walk), Prof Gary Burnett (University of Nottingham), Michael Cameron (New Zealand Law Foundation), Prof Oliver Carsten (University of Leeds), Dr Matthew Channon (University of Exeter), Dr Chris Elliott, Dr Charles Fox (University of Lincoln), Alex Glassbrook (Temple Garden Chambers), Keri Grieman (The Alan Turing Institute), Andrew Higgs (Setfords Solicitors), Prof Christopher Hodges (University of Oxford), Prof Takeyoshi Imai (University of Japan) Dr Geoff Keeling (University of Bristol), Dr Siddartha Khastgir (WMG, University of Warwick), Dr Johannes Kester (Transport Studies Unit – University of Oxford), Prof Sally Kyd Cunningham (University of Leicester), Dr Mark Leiser (University of Leicester), Prof Roger Mackett (University College London), Lucy McCormick (Henderson Chambers), Dr Bruce Mehler (MIT), Prof Paul Newman (University of Oxford and Oxbotica), Dr Kyriaki Noussia (Exeter University), Dr Micheál Ó Floinn (University of Glasgow), Prof Richard Percival (University of Sheffield), Dr Bryan Reimer (MIT), Mathias N. Schubert (Attorney at Law, Germany), Prof Neville Stanton (University of Southampton), Dr Chris Tennant (London School of Economics), Prof Bryant Walker Smith (University of South Carolina), Prof Rebecca Williams (University of Oxford), Dr Adam Wyner (Swansea University), Xinyi Wu (University of Edinburgh).

CONFERENCES AND WORKING GROUPS

1.5 The team has also participated in the following conferences: the Knowledge Transfer Network's Modelling and Simulations for CAVs competition (23 March 2018, London); The Dutch Ministry of Infrastructure and Water Management's Innovation in Transportation, facing the legal challenges ahead (9 February 2018, The Hague), CARTRE and SCOUT's Interactive Symposium on Research & Innovation for Connected and Automated Driving in Europe (19-20 April 2018, Vienna), The Future of Transportation World Conference (19-20 June 2018, Cologne), TaaS Technology

Conference (9-10 July 2018, Coventry), Federated Logic Conference 2018 – Summit on Machine Learning meets Formal Methods (13 July 2018, Oxford), SAE International's Connect2Car Executive Leadership Forum (September 5-6 2018, San Jose CA); The Whitehall & Industry Group's Autonomous Vehicles Workshop (14 September 2018, Birmingham); 6th Annual Smart Mobility Summit (29-30 October 2018, Tel Aviv); and CAV Scotland 2018 (31 October-1 November, Edinburgh), techUK and MobOx event (22 November 2018, Oxford), ITS (UK) Summit 2018 (27 November 2018, Bristol), Council of Europe (28 November 2018, Strasbourg).

1.6 Consumer Electronics Show (CES) 2019 (8-12 January 2019, Las Vegas), Meridian: Mapping the Road to Cyber-Secure Self-Driving Vehicles (5 February 2019, Warwick), Safety Critical Systems Club (SCSC) Symposium (5-7 February 2019, Bristol), MOVE conference (12-13 February 2019, London), SCSC Evolution of a Safety Assurance Case Workshop (4 April 2019, London), Westminster Insight Conference: Preparing the UK for CAVs (26 April 2019, London), The National Assembly for Wales' Economy, Infrastructure and Skills Committee meeting (1 May 2019, Cardiff), CAVEAT AV and Ethics CCAV Meeting (10 May 2019, London), Institute of Advanced Legal Studies (IALS) Impact and Law Reform Conference (11 June 2019, London), SCSC Learning from Accident Investigations Workshop (13 June 2019, London), Exploring the Power and Promise of AI and Robotics (18 June 2019, London), Institution of Mechanical Engineers: Automated and Autonomous Vehicles: Overcoming Engineering Challenges for Future Mobility (20 June 2019, Nuneaton), Connected Places Catapult - MUSICC Symposium (24 June 2019, Milton Keynes), Royal Academy of Engineering: Safety and Ethics of Autonomous Systems (2 July 2019, London), UK Insurer Safe Automated Driving Initiative Launch (11 September 2019, Nuneaton), DAC Beachcroft and Legalign Global: Automated Breakfast Seminar (20 September 2019, London), International Longevity Centre (1 October 2019, London), AVIVA Automated Vehicles Working Group Roundtable (1 October 2019, Thatcham), SMMT 16th Annual Automotive In-House Lawyers' Seminar (3 October 2019, London), BSI CAV Strategic Advisory Board Meeting (14 October 2019, London), BPA Annual Conference (17 October 2019), ITS Summit (17 October 2019, Conventry), DPTAC TRO Conference (23 October 2019, teleconference), Smart Mobility Summit 2019 (26 October 2019, Tel Aviv), BPA Local Authorities Meeting (South Central Group) (14 November 2019, Bedford), CAV Scotland (13 November 2019, Glasgow),, Council of Europe – Judicial Committee (15 November 2019, Berlin), BPA North Local Authorities Meeting (19 November 2019, Durham), Multi User Scenario Catalogue for Connected and Autonomous Vehicles (MUSICC) Symposium (26 November, Milton Keynes), Assuring Autonomy programme, University of York, Toolkit for Responsible & Ethical Automated Driving (TREAD) Workshop (27 November, York), BPA Local Authorities Annual Meeting (29 November 2019, Bath), BPA London Authorities Meeting (3 December 2019, London), PACTS Meeting (20 December 2019, London).

1.7 CES Conference 2020 (7 to 11 January 2020, Las Vegas), TRB Conference (11 to 18 January, Washington DC), Future Mobility Symposium (14 January 2020, Manchester), Inclusive Mobility Forum (5 January 2020, Milton Keynes) MOVE Conference (11 to 12 February 2020, London), IBA Munich Conference (14 February 2020, teleconference), IATSS Autonomous Driving Symposium(25 February 2020, Tokyo, Japan), SMMT CAV Forum (18 March 2020, 14 July 2020 and 25 November 2020), ADVI Webinar (28 May 2020, Teleconference), CertiCAV IAG Workshop (9

June 2020, teleconference), Automated Driving Insurer Group (ADIG) Meeting (8 July 2020, teleconference), Israel Ministry of Justice and C4IR AV Seminar (18 August 2020, teleconference), Drive Sweden Forum: Transformation of the Mobility System – A Global Challenge (9 September 2020, teleconference), CCAV ALKS Webinar (18 September 2020, teleconference), Zenzic: Safety Case Guidance Workshop: Security and Assurance (9 October 2020, teleconference), CertiCAV Engagement Session 2: HAV Assurance Requirements, Goals, & Strategy Webinar (12 November 2020, teleconference), Thatcham ALKS Webinar 12 November 2020, teleconference), (CoMotion LA (17 November 2020, teleconference), SMMT's CAV Forum (25 November 2020, teleconference), CENEX Conference (18 December 2020, teleconference), Financial Times – Future of the Car Summit (4 December 2020).

1.8 We are grateful to the UNECE Global Forum for Road Traffic Safety (WP.1) and the UNECE World Forum for the Harmonization of Vehicle Regulations (WP.29) for the opportunity to participate in their joint session (18 February 2019, Geneva), and to present our work at WP.1's 77th session (September 2018, Geneva) and 79th session (September 2019, Geneva). We are also grateful for the opportunity to regularly participate in the meetings of WP.1 and the UNECE's Informal Group of Experts on Automated Driving (IGEAD) since 2019. We would also like to thank the European Commission's Joint Research Centre (JRC) for inviting us to their Technical Workshops on new approaches for automated vehicle certification since 2019. We are also grateful the Council of Europe for inviting us to provide expert evidence at two sessions in November 2018 and November 2019.

1.9 We also like to express thanks to the following groups for hosting and organising roundtables for the project: Burges Salmon LLP (23 January 2019, London), MoBox and Oxfordshire Country Council (16 January 2019, Oxford), techUK (25 January 2019, London), PACTS (28 January 2019, London), Appy Parking (7 August 2019, London), MoBox (19 November 2019, Oxford).

Appendix 2: Roads and other public places

THE MEANING OF A ROAD

2.1 Section 1(b) of the AEV Act 2018 sets out that the Secretary of State must prepare, and keep up to date, a list of all motor vehicles that

> may lawfully be used when driving themselves, in at least some circumstances or situations, *on roads or other public places* in Great Britain.

2.2 Some road traffic provisions (such as the main driving offences) apply to a "road or other public place" whilst others, such as the vehicles construction and use offences, apply only to a road.

Definition of a road in England and Wales

2.3 The Road Traffic Act 1988 defines a road as "any highway and any other road to which the public has access, and includes bridges over which a road passes".[974] This definition is echoed in other statutes, including the Public Passenger Vehicles Act 1981.[975]

2.4 In 1998, the House of Lords considered these words in joined appeals concerning accidents in car parks: *Clark v General Accident Fire and Life Assurance Corporation Plc* and *Cutter v Eagle Star Insurance Co Ltd*.[976] Lord Clyde hesitated to formulate a comprehensive definition of a road but thought that "some guidance should be found by considering its physical character and the function which it exists to serve".[977] As far as the physical character of a road was concerned:

> It should always be possible to ascertain the sides of a road or to have them ascertained. Its location should be identifiable as a route or way. It will often have a prepared surface and have been manufactured or constructed. But it may simply have developed by the repeated passage of traffic over the same area of land. It may be continuous, like a circular route, or it may come to a termination, as in the case of a cul-de-sac.[978]

2.5 As far as function is concerned:

---

974 The Road Traffic Act 1988, s 192.

975 Public Passenger Vehicles Act 1981, s 82. See also Goods Vehicles (Licensing of Operators) Act 1995, s 58; Road Traffic Offenders Act 1988, s 98; and Transport Act 1982, s 75.

976 [1999] RTR 153; [1998] 1 WLR 1647.

977 *Clarke v General Accident Fire and Life Assurance Corporation Plc and Cutter v Eagle Star Insurance Co Ltd [Conjoined Appeals]* [1999] RTR 153, [1998] 1 WLR 1647, pp 1652 to 1653.

978 Above, p 1652.

> Essentially a road serves as a means of access. It leads from one place to another and constitutes a route whereby travellers may move conveniently between the places to which and from which it leads.[979]

On this basis, a car park is not a road but may have roads within it.

The next question is whether the public has access to the road. In *Clarke,* Lord Clyde approved an earlier case which stated:

> There must be, as matter of fact, walking or driving by the public on the road, and such walking or driving must be lawfully performed—that is to say, must be permitted or allowed, either expressly or implicitly, by the person or persons to whom the road belongs.[980]

2.6 The issue of public access has been considered in two further cases, concerning airport roads and a university campus.

2.7 In *DPP v Cargo Handling Ltd,* the roads in question led to Heathrow Airport. They were owned by the British Airport Authority and an order prevented vehicles from driving on the roads "except for the purpose of the conveyance of persons or goods to or from any premises situated on or adjacent to those roads". The Court of Appeal held that it was irrelevant whether the roads were maintainable at public expense. The question was whether the public had access.[981] On the facts, it was found that the public did have access: users of the airport did not constitute a special class distinct from members of the general public.[982]

2.8 *Cowan v DPP* concerned a university campus.[983] Mr Justice Mitting applied a two-part test. To show public access, the prosecution must prove that:

(1) the public in general, and not a special class of members of the public, have access to the road concerned; and

(2) they had this at least by the tolerance of the road's owner.[984]

2.9 The judge then commented:

> There are no doubt many campuses upon which members of the public are accustomed to exercise their dogs, or simply to go for a walk themselves. In

979 Above, pp 1652 to 1653.

980 *Clarke v General Accident Fire and Life Assurance Corporation Plc and Cutter v Eagle Star Insurance Co Ltd [Conjoined Appeals]* [1999] RTR 153, [1998] 1 WLR 1647, p 1652, citing *Harrison v Hill*, 1932 JC 13, p 16.

981 *DPP v Cargo Handling Ltd* [1991] 12 WLUK 4, [1992] RTR 318, at [21] per Leggatt LJ, Owen J agreeing.

982 Above, at [27] to [29] per Leggatt LJ, Owen J agreeing, citing *DPP v Vivier* [1991] 4 All ER 18 at p 24 by Simon Brown J.

983 *Cowan v DPP* [2013] EWHC 192 (Admin), [2013] All ER (D) 116 (Jan).

984 Above, at [9] per Mitting J, citing *Deacon v AT* [1976] RTR 244 by May J.

that event, evidence of such use … would amply satisfy the first of the two requirements.[985]

2.10 However, on the facts there was no such evidence.[986] It was held that students, staff or visitors to the University were not to be treated as members of the public.[987]

DEFINITION OF A ROAD IN SCOTLAND

2.11 The definition of a "road" is slightly different in Scotland. Section 192(1) of the Road Traffic Act 1988 refers to "any road within the meaning of the Roads (Scotland) Act 1984 and any other way to which the public has access, and includes bridges over which a road passes".[988]

2.12 Meanwhile, the Roads (Scotland) Act 1984 defines a road as:

> any way (other than a waterway) over which there is a public right of passage (by whatever means) and whether subject to a toll or not and includes the road's verge, and any bridge (whether permanent or temporary) over which, or tunnel through which, the road passes and any reference to a road includes a part thereof.[989]

2.13 Therefore in Scotland, a road is a way (which has been described judicially as "an area in which some form of travel takes place"[990]), either with a public right of passage over it, or to which the public has access. The public "having access" means either:

> lawful access, either under some right or through tolerance of the lawful possessor,[991] or

> unlawful access not obtained through overcoming a physical obstruction or in defiance of an express or implied prohibition.[992]

---

985 Above, at [11] by Mitting J.

986 *Cowan v DPP* [2013] EWHC 192 (Admin), [2013] All ER (D) 116 (Jan), at [19] per Mitting J.

987 Above, at [17] and [18] by Mitting J.

988 The Scottish definition is arguably the broader one, with certain types of location (eg car parks, and farm accesses) being more likely to be classed as a road than would be the case in England and Wales.

989 Roads (Scotland) Act 1984, s 151(1).

990 *Aird v Vannet* 1999 JC 205 at 206-7. In a slightly more recent case it has been said: "The word 'way' is defined in the standard dictionaries by using expressions such as 'passage', 'means of passage', 'path' or 'track'. The essential idea appears to be that a way is a course of travel: a means of passage from one place to another." (*Hamilton v Dumfries and Galloway Council (No 2)* 2009 SC 277 at 292, para. [45] (Extra Division).

991 *Teale v Macleod 2008* SCCR 12 at para [6] following *Harrison v Hill* 1932 JC 13 at 16 (Lord Justice General Clyde).

992 Teale v Macleod 2008 SCCR 12 at paras [7] and [9] following *Harrison v Hill* 1932 JC 13 at 17 (Lord Sands).

2.14 Where there is a right of public passage that right extends across each and every part of the road.[993] However, this does not mean that in practice a person or vehicle will necessarily be able to travel over all parts of it. For example, there may be an overhanging hedge or a wall which prevents travel on some parts.[994] Nor does it mean that all classes of use are permitted on all roads. Correspondingly, a road is divided into different components, some for different categories of user.[995]

Where the public right of passage is by vehicle[996] (but not just by pedal cycle) the road is a carriageway.

Where it is by pedal cycle (whether or not there is also a right of passage on foot), the road is a cycle track.

Where the public right of passage is by foot only, the road is either a footway (where it is associated with a carriageway, eg as a pavement) or a footpath.

2.15 In practice, the question of whether somewhere is a road or not tends to be fact-specific.[997] Scottish courts have found that various areas are ways.

A parking area next to a public house accessed from a road where the local roads authority had a duty to maintain the area and which area was used by the public to gain access to properties adjoining the area.[998]

A car ferry deck where there is a ramp leading from the quayside onto the deck at the time.[999]

2.16 But a garden adjacent to a car park was found not to be a way.[1000]

---

993 “Road" means "any way ... over which there is a public right of passage". That means that if it is a road, there is a public right of passage over it – if there is no public right of passage over the road, it is not a road within the meaning of the [Roads (Scotland) Act 1984]. The definition does not contemplate that there may be a public right of passage over part only of a road. There is a public right of passage over the whole road, which includes a part of the road, such as the verge”: Lord Glennie in Hamilton v Nairn [2009] CSOH 163, at para 14.

994 *David Runciman and Sons v Scottish Borders Council* 2003 SLT 1405 (overhanging hedge); *Leafrealm Land Ltd v City of Edinburgh Council* [2020] CSOH 34 (wall).

995 See s 151(2) of the Roads (Scotland) Act 1984.

996 S 151(1) of the Roads (Scotland) Act 1984 defines vehicle as a “vehicle of any description and includes a machine or implement of any kind drawn or propelled along roads (whether or not by mechanical power)”.

997 “We agree that a ‘way’ is an area in which some form of travel takes place. This is plain from study of the definitions of the word in the Shorter Oxford Dictionary. Whether such an area is or is not a way is essentially a question of fact.”: *Aird v Vannett* 1999 JC 205 at 206. Also: “I would hesitate to formulate a comprehensive definition whereby a place may be identified as a road, but some guidance should be found by considering its physical character and the function which it exists to serve.”: *Clarke v Kato* [1998] 1 WLR 1647 at 1652F (Lord Clyde).

998 *Beatty v Scott* 1991 SLT 873.

999 *Dick v Walkingshaw* 1994 SLT 1254.

1000 *Young v Carmichael* 1993 SLT 167.

PUBLIC PLACE

2.17 Some offences may be committed on a road or other public place. In this context, "public place" means:

a place where members of the public might be expected to be found and over which they might be expected to be passing;[1001] or

a place to which members of the public, even if only a special section of the public, are invited to use;[1002] or

a place which is actually used, without demur by the landowner or proprietor (or lawful occupier) by the public generally.[1003]

2.18 As we outlined in Consultation Paper 1, our focus is on a regulatory framework for automated vehicles which operate on Britain's existing road network. We have not assumed that new dedicated roads will be built for these vehicles. Nor have we proposed new investment in the road infrastructure to cater for such vehicles. A different legal regime might apply if automated vehicles were confined to dedicated roads.

1001 *Brown v Braid* 1985 SLT 37.

1002 *Vannet v Burns* 1998 SCCR 414

1003 *Yates v Murray* 2004 JC 16 at 21.

Appendix 3: Corporate criminal responsibility and automated vehicles

INTRODUCTION

3.1 In Consultation Paper 1 we asked if we should review the possibility of one or more new corporate offences where wrongs by an automated vehicle (AV) developer result in death or serious injury. The great majority of consultees thought that we should. As a result, in Chapter 14 we provisionally propose new offences aimed at holding ADSEs accountable for misleading the safety assurance regulators.

3.2 In this appendix, we set out the background work to this review, including an analysis of the existing law and possible models used in other industries or jurisdictions.

3.3 The appendix builds on the work set out Background Paper 2, published alongside Consultation Paper 1. In Background Paper 2 we discussed the offences of causing death or serious injury by driving in some depth and concluded that they would no longer apply to automated vehicles (AVs). We then looked (briefly) at involuntary homicide offences; at the duty of safety in the General Product Safety Regulations 2005; and at offences based on a "failure to prevent", along the lines of the Bribery Act 2010.

3.4 In this Appendix we add to that analysis. We cover several offences which we did not discuss before, including offences under the Health and Safety at Work etc Act 1974 and the Fraud Act 2006. We are also interested in the approach taken in other high-risk industries (discussed in Chapter 14 itself) and in other jurisdictions, particularly California, Australia and the Council of Europe. Apart from these examples, however, most jurisdictions do not appear to have publicly considered this issue yet.

EXISTING OFFENCES

3.5 Here we provide a more detailed review of the existing law, covering eight offences:

(1) section 3 of the Health and Safety at Work etc Act 1974 (UK-wide);

(2) section 37 of the Health and Safety at Work etc Act 1974 (UK-wide);

(3) section 2 of the Fraud Act 2006 (England, Wales, and Northern Ireland only);

(4) section 3 of the Fraud Act 2006 (England, Wales, and Northern Ireland only);

(5) corporate manslaughter (England, Wales and Northern Ireland only)/corporate homicide (Scotland only);

(6) unlawful act manslaughter (England and Wales only);

(7) gross negligence manslaughter (England and Wales only); and

(8) culpable homicide (Scotland only).

3.6 Only four of these offences were discussed in Background Paper 2 (5 to 8). We did not discuss offences 1 to 4.

Section 3 of the Health and Safety at Work etc Act 1974

3.7 We did not discuss the Health and Safety at Work etc Act 1974 (HSW Act) in Consultation Paper 1. However, Burges Salmon LLP drew attention to the potential relevance of the Act to our work. Our analysis of the HSW Act offences in this paper is consequently more detailed than for offences considered later.

3.8 The HSW Act is best known for section 2, which places a duty on employers to ensure the health and safety of their employees. Section 3 then places another duty on employers towards the public more generally. Section 3 provides that:

(1) employers must conduct their undertaking in such a way as to ensure

(2) so far as is reasonably practicable

(3) that persons not in their employment who may be affected are not exposed to risks to health or safety.

3.9 Section 33 of the HSW Act provides that a breach of this duty is a criminal offence.

Advantages

Covers non-fatal injuries

3.10 One advantage of section 3 is that it covers non-fatal injuries.[1004] This is because the duty concerns the creation of a risk of harm, rather than the causation of a specific accident.[1005] The risks that must be avoided are "material risks to health and safety, which any reasonable person would appreciate and take steps to guard against".[1006]

Breadth of the duty

3.11 The section 3 duty is owed by employers to anyone who may be affected by their "undertaking". The victim does not have to be in the workplace, or in the same place as the defendant's "undertaking".[1007] The fact that the Metropolitan Police were found guilty of breaches of section 3 following the shooting of Jean Charles de Menezes[1008] shows that the duty extends to a wide variety of contexts.

1004 *R v Chargot Ltd* [2008] UKHL 73, [2009] ICR 263 at [30], *R v EGS Ltd* [2009] EWCA Crim 1942 at [28] and *Tangerine Confectionery Ltd and Veolia ES (UK) Ltd v R* [2011] EWCA Crim 2015 at [12].

1005 *BOC Distribution Services v Health and Safety Executive* [1995] JPIL 128.

1006 *R v Chargot Ltd* [2008] UKHL 73, [2009] ICR 263 at [27].

1007 *Sterling-Winthrop Group Ltd v Allan* (1987) SCCR 25.

1008 Jean Charles de Menezes was misidentified as a terrorist suspect. *R v Office for the Commissioner of the Police of the Metropolis* (unreported). Relatives of de Menendez subsequently brought an unsuccessful application in the European Court of Human Rights: *Da Silva v United Kingdom* (2016) 63 EHRR 12.

Circumvents the identification principle

3.12 Many corporate criminal offences are constrained by the "identification principle", which means that the corporation can only be liable if one or more individuals constituting the "directing mind" of the corporation committed the offence.[1009] However, this principle does not limit the section 3 duty: the Court of Appeal has held that an employer cannot avoid liability by arguing that senior management was not involved in the offence, having taken all reasonable care to delegate supervision of the work in question.[1010]

Disadvantages

Meaning of "so far as is reasonably practicable"?

3.13 Section 3 is qualified: the duty-bearer must prevent exposure to such risks "so far as is reasonably practicable" (SFAIRP). SFAIRP is not defined in statute but "reasonably practicable" has been defined as a:

> narrower term than 'physically possible' … a computation must be made by the owner in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other, and that, if it be shown that there is a gross disproportion between them – the risk being insignificant in relation to the sacrifice – the defendants discharge the onus on them.[1011]

3.14 Under section 40 of the HSW Act, the onus is on the defendant to establish that it had done everything "reasonably practicable".[1012]

3.15 One concern about this passage in *Edwards* is the emphasis on "gross disproportion". It could be interpreted as requiring an employer to take disproportionate steps, so long as the steps were not "grossly" disproportionate. Burges Salmon LLP felt that this could be unfair and could stifle innovation.[1013]

3.16 We have considered the caselaw, academic literature and guidance on the meaning of SFAIRP. The court's approach to SFAIRP is contextual, requiring the sacrifice in time, trouble and expense to have been significantly disproportionate to the nature of the risk in all the circumstances before the defendant can negate liability.

3.17 In a House of Lords[1014] judgment five years after *Edwards,* Lord Reid stated:

1009 *Tesco v Nattrass* [1972] AC 153.

1010 *R v British Steel plc* [1995] 1 WLR 1356 followed in *R v Gateway Foodmarkets Ltd* [1997] 3 All ER 78. See also *R v Mersey Docks and Harbour Co* (1995) 16 Cr App Rep (S) 860; *R v Upper Bay Ltd* [2010] EWCA Crim 495, (2010) Times, 28 April.

1011 *Edwards v National Coal Board* [1949] 1 All ER 743, Asquith LJ. following *Sharp v Coltness Iron Co.* 1937 SC (HL) 68 at 75 (Lord Atkin).

1012 *R v Chargot Ltd* [2008] UKHL 73, [2009] 1 WLR 1 per Lord Hope of Craighead at [21].

1013 Burges Salmon LLP response to CP1.

1014 *Marshall v Gotham Co Ltd* [1954] AC 360.

> I think it enough to say if a precaution is practicable it must be taken unless in the whole circumstances that would be unreasonable and as men's lives may be at stake it should not lightly be held that to take a practicable precaution is unreasonable.[1015]

3.18 In other words, although the duty is an onerous one, the duty-bearer is not obliged to take "unreasonable" steps. Lord Keith held that there was "no general rule or test that can safely be relied on for measuring the discharge of such a duty", but that he:

> …could not, as at present advised, accept … that the measure of an employer's liability can satisfactorily be determined by having regard solely to the proportion which the risk to be apprehended bears to the sacrifice in money, time or trouble involved in meeting the risk.[1016]

3.19 This shows the court will take a contextual approach accounting for a range of factors when considering SFAIRP. This has been confirmed in several later Court of Appeal[1017] and Supreme Court cases.[1018]

3.20 The meaning of "reasonably practicable" was considered as recently as 2020 by the High Court.[1019] The judge held that the defendant can only show that it took all steps SFAIRP to prevent exposure to the risk if the sacrifice "substantially outweighed" the quantum of risk:

> Otherwise, references to this being an "onerous" duty on the Defendant would be substantially watered down. In my judgment, this is not what was intended by the legislation, the policy of which is to put safety first and not provide the employer with an easy escape avenue but rather a "long stop" defence in very limited circumstances.[1020]

3.21 Charlesworth on Negligence states that "'practicable' is not the same as 'possible' but involves some qualification of what is possible". It then endorses the formulation provided in *Baker* which draws parallels with the common law standard of care.[1021]

3.22 The Health and Safety Executive (HSE) has produced guidance on the meaning of SFAIRP.[1022] It describes *Edwards* as the "key case". It makes clear that the disproportionality between the quantum of risk to the "sacrifice" must be "gross" for the

---

1015 *Marshall v Gotham Co Ltd* [1954] AC 360, at p 373

1016 Above, at p 378.

1017 *R v Nelson Group Services (Maintenance Ltd)* [1999] 1 WLR 1526 pp 1027H to 1028A; *R v Tangerine Confectionery Ltd* [2011] EWCA Crim 2015 [36].

1018 *Baker v Quantum Group* [2011] UKSC 17, at [82] to [84].

1019 *M Lee Walsh v CP Hart & sons Ltd* [2020] EWHC 37.

1020 Above, para 45.

1021 At paras 13-130 to 13-135.

1022 HSE, Principles and guidelines to assist HSE in its judgements that duty-holders have reduced risk as low as reasonably practicable https://www.hse.gov.uk/risk/theory/alarp1.htm.

defendant to show that they took all steps SFAIRP to avert the risk.[1023] It states that "the Courts will look at all the relevant circumstances of the particular case when reaching decisions".[1024]

3.23 The guidance does not frame SFAIRP as placing a positive duty on duty-bearers to take disproportionate steps. However, it does suggest that the duty might amount to an onerous burden on ADSEs. It also suggests that what sacrifices are proportionate should partially be determined by reference to "comparable circumstances elsewhere to that kind of hazard or in that particular industry". This standard is difficult to apply to a new industry.

3.24 Our conclusion is that section 3 does not require the duty-bearer to take disproportionate steps.[1025] However, the standard is onerous. It is also uncertain. When faced with a tragic case, juries might react emotively, without appreciating the inherent risks of all motor transport, including AVs.

A real risk

3.25 Under section 3, actual harm is not required: it is sufficient to show that there was a possibility of harm.[1026]

3.26 The House of Lords has held that there must have been a "real risk" rather one that was "purely hypothetical", which is "material" and not "trivial or fanciful".[1027] Lord Hope said that the law "does not aim to create an environment that is entirely risk free" and that "risk" means "a material risk to health and safety, which any reasonable person would appreciate and take steps to guard against".[1028] Furthermore the Court of Appeal has held that the risk must be one that is "unacceptable", which excludes "the trivial risks of everyday life".[1029]

Not intended for the road traffic context

3.27 HSE guidance sets out circumstances where the HSE should be involved following accidents involving vehicles. Generally, the focus is on accidents that occur at the workplace or involve work-related driving.[1030] According to the HSE guidance, health and safety at work legislation generally should not be enforced in respect of road

---

1023 HSE, Principles and guidelines to assist HSE in its judgements that duty-holders have reduced risk as low as reasonably practicable https://www.hse.gov.uk/risk/theory/alarp1.htm.

1024 Above.

1025 In other words, steps which while practicable are in the particular circumstances unreasonable: *Baker v Quantum Clothing Group Ltd* [2011] 1 WLR 1003 - Lord Mance JSC at [82] to [83], Lord Dyson JSC at [129] in relation to SFAIRP in s 29 of the Factories Act 1961.

1026 *R v Board of Trustees of the Science Museum* [1993] 3 All ER 853.

1027 *R v Chargot Ltd (t/a Contract Services)* [2008] UKHL 7, at [9].

1028 Above, at [27].

1029 *R v Porter (James Godfrey)* [2008] EWCA Crim 1271, [21].

1030 HSE's role in the investigation of work-related road accidents and advice on responding to enquiries on managing work-related road safety, para 3 at https://www.hse.gov.uk/foi/internalops/oms/002.htm traffic accidents when more specific and detailed legislation applies.[1031] Furthermore, HSE guidance expressly states that accidents involving roadworthiness of vehicles are a matter for the police, rather than the HSE.[1032]

3.28 Health and safety legislation is not currently relied upon in road traffic accidents relating to defective vehicles that involve safety risks to the public.[1033]

Low penalties

3.29 Finally, a conviction under section 3 does not attract heavy penalties. The maximum sentence is an unlimited fine or two years' imprisonment on indictment, or six months' imprisonment if tried summarily.[1034] These maximum penalties appear low if death or serious injury has been caused. Clearly, as most prosecutions are brought against corporate bodies (which cannot be imprisoned), fines are the most common penalty for breach of section 3.[1035]

Section 37 of the Health and Safety at Work etc Act 1974

3.30 Section 37 of the HSW Act applies when:

(1) an HSW Act offence is committed by a body corporate

(2) with consent, connivance, or neglect by a director, manager, secretary or other officer.

3.31 Section 37 effectively allocates secondary, personal criminal liability to senior managers following a breach of section 3 by the corporation.

Advantages

Covers senior management

3.32 Section 37 does not apply to all managers, but only to those in positions of real authority with the power to decide policy.[1036] However, the label attached to an individual's role is not determinative of their liability: it depends on the degree of authority and responsibility that the person had within the company.[1037]

1031 HSE's role in the investigation of work-related road accidents and advice on responding to enquiries on managing work-related road safety, para 19, at https://www.hse.gov.uk/foi/internalops/oms/002.htm.

1032 Above.

1033 In a meeting on 16 April 2020, Alan Craddock of the HSE confirmed that when the HSW Act it is applied to road accidents, this is usually where the accident involved an employee who was travelling for work-related purposes.

1034 HSW Act 1974, Sch 3A. For offences committed before 12 March 2015, the fine was limited to £20,000. The fine is now unlimited. Sentencing Council, *Health and Safety Offences, Corporate Manslaughter and Food Safety and Hygiene Offences Definitive Guideline* (February 2016), p 13.

1035 Meeting with Alan Craddock, 16 April 2020.

1036 *R v Boal* [1992] 3 All ER 177.

1037 Ara Dobson, "Section 37 of the Health and Safety at Work Act 1974 – re-invigorated", (2013) 55(2) *International Journal of Law and Management*, 141, p 147.

3.33 This personal responsibility has led some academics to argue that section 37 is more effective than corporate manslaughter in compelling corporations to ensure safety.[1038] The offence has the potential to incentivise senior managers to take personal responsibility to ensure AV safety.

Does not require direct participation

3.34 Section 37 does not require senior management to have directly participated in the wrongdoing. "Consent" can be found if the defendant was "well aware of what is going on and agrees to it".[1039] Furthermore, "connivance" is proven if the defendant "is equally well aware of what is going on" but their agreement is tacit: they did not actively encourage the wrongdoing but let it happen without saying anything.[1040] Finally, "neglect" occurs if the defendant ought to have been aware of the material facts that would have put the defendant on inquiry and ought to have led them to take certain steps to determine whether the appropriate safety procedures were in place.[1041]

3.35 None of these variations of the fault element requires proof that senior managers participated directly in the wrongdoing.

Fewer evidential difficulties than manslaughter offences

3.36 Additionally, prosecutions under section 37 are more successful than prosecutions for both corporate manslaughter/corporate homicide and gross negligence manslaughter. One reason appears to be that the fault element is easier for prosecutors to prove.[1042]

Disadvantages

Used against small rather than large corporations

3.37 Prosecutions under section 37 are more likely to be brought against senior management of smaller, rather than larger, corporations.[1043] According to Alexandra Dobson:

> this may mean that they are less well managed and potentially more dangerous but it may also point to the difficulty of attributing consent, connivance or neglect where the Board are at a distance from ground level activities.[1044]

1038 S Antrobus, "*The criminal liability of directors for health and safety breaches and manslaughter*", (2013) 4 *Criminal Law Review* 309, p 321.

1039 *Huckerby v Elliot* [1970] 1 All E.R. 189 at 194 per Ashworth J. In that case the court was concerned with section 305(3) of the Customs and Excise Act 1952.

1040 *Huckerby v Elliot* [1970] 1 All E.R. 189 at 194 per Ashworth J.

1041 *R v P* [2008] IRC 96; [2007] EWCA 1937 [12] to [15].

1042 Alexandra Dobson, "Section 37 of the Health and Safety at Work Act 1974 – re-invigorated", (2013) 55(2) *International Journal of Law and Management*, 141, p 144; Simon Antrobus, *The criminal liability of directors for health and safety breaches and manslaughter*, (2013) 4 Criminal Law Review 309, pp 309 to 310, 317.

1043 Above, p 145.

1044 Above, p 147.

3.38 Consequently, a risk of relying on section 37 in this context is that senior managers within large automotive manufacturers will be protected from liability and will not be incentivised to ensure AV safety.

Relatively low penalties

3.39 Section 37 attracts relatively low penalties. The officer may be imprisoned for up to two years. In England and Wales, the maximum penalty is now an unlimited fine and in Scotland the maximum penalty is a fine up to £20,000.

Conclusion: offences under the HSW Act 1974

3.40 The HSW Act 1974 has played a major part in ensuring safety at the workplace and beyond for over 45 years. It would not be right for us to attempt to exempt AV developers from its provisions. All those involved in developing ADSEs need to be aware of their duties under the HSW Act 1974.

3.41 However, the SFAIRP principle is general and uncertain. It is insufficiently precise to target the type of wrongdoing with the greatest potential to undermine the safety assurance system for AVs.

Sections 2 and 3 of the Fraud Act 2006

3.42 Section 1 of the Fraud Act 2006 (FA 2006) sets out the offence of fraud. There are three ways of committing the offence. Two of these would be relevant in an AV context, if an ADSE were to misrepresent or suppress safety relevant information.

3.43 Section 2(1) makes it an offence if a person:

> (a) dishonestly makes a false representation, and
>
> (b) intends, by making the representation—
>
> > (i) to make a gain for himself or another, or
> >
> > (ii) to cause loss to another or to expose another to a risk of loss.

3.44 A representation is false if "it is untrue or misleading" and "the person making it knows that it is, or might be, untrue or misleading".[1045]

3.45 Section 3(1) of the FA 2006 makes it an offence if someone:

> (a) dishonestly fails to disclose to another person information which he is under a legal duty to disclose, and
>
> (b) intends, by failing to disclose the information—
>
> > (i) to make a gain for himself or another, or

[1045] Fraud Act 2006, s 2(2)(a) to (b).

(ii) to cause loss to another or to expose another to a risk of loss.

3.46 It is not enough that the defendant made a misrepresentation or failed to disclose information that is legally required: they must have done so dishonestly, with intent either to make a gain or expose another to loss (or risk of loss).[1046]

Advantages

Could capture serious wrongdoing that undermines safety assurance scheme

3.47 A key advantage of relying on these offences in this context is that they could capture the kind of serious wrongdoing that would jeopardise the integrity of the safety assurance scheme. In Chapter 14 we explain why we think both misrepresentations and non-disclosure of safety relevant information should be criminalised.

3.48 Misrepresentations are covered by section 2 of the FA 2006. This means that ADSEs could commit an offence under section 2 if they made a false representation to the regulator, intending to make a gain for the company (by, for example, putting an AV on the market). Section 2(5) makes it clear that representations made to systems and devices, rather than directly to a human, are covered.

3.49 Non-disclosures are also an offence under section 3. For example, an ADSE would commit an offence if it dishonestly failed to provide information to the safety assurance scheme which it was legally obliged to provide.

3.50 Furthermore, the Fraud Act 2006 appears to be versatile and able to capture various different forms of wrongdoing: its scope is not limited to financial crimes. In its post-legislative assessment, the Ministry of Justice said that the Act had helped enable "effective and diverse prosecutions" and capture the "challenges of developing technology".[1047]

Does not require proof of injury

3.51 No actual harm is required as the focus is the defendant's conduct.[1048] Although the fault element of each offence is met if the defendant intended to cause a loss to another, no actual loss need be caused.

Significant penalties available

3.52 Following a conviction on indictment, section 1(3) impose penalties of a maximum of 10 years' imprisonment and/or an unlimited fine. These are significantly higher penalties than those available under the HSW Act.

1046 In *Ivey v Genting Casinos* [2017] UKSC 67, [2018] AC 391 the Court overturned the two-part test for dishonesty set out in *R v Ghosh* [1982] QB 1053. The jury must now establish the actual state of the individual's knowledge or belief as to the facts and then determine whether their conduct was honest or dishonest by the (objective) standards of ordinary decent people. This removes the subjective requirement that the defendant must appreciate that what he has done is, by those standards, dishonest.

1047 MoJ, *Post-legislative assessment of the Fraud Act 2006 Memorandum to the Justice Select Committee* (June 2012), pp 5 to 6.

1048 https://www.cps.gov.uk/legal-guidance/fraud-act-2006.

3.53 Finally, section 12 provides a mechanism for holding senior management accountable:

> (2) If the offence is proved to have been committed with the consent or connivance of—
>
> > (a) a director, manager, secretary or other similar officer of the body corporate, or
> >
> > (b) a person who was purporting to act in any such capacity,
>
> he (as well as the body corporate) is guilty of the offence and liable to be proceeded against and punished accordingly.

3.54 The reference to consent and connivance is similar to section 37 of the HSW Act. However, there is no reference to "neglect", reflecting the different nature of the offences.

Disadvantages

Liability for non-disclosures requires a legal duty to disclose

3.55 Liability for non-disclosures under section 3 would be contingent on the ADSE being under a "legal duty" to disclose the information it failed to disclose. The "legal duty" does not need to be a duty that has arisen as a matter of criminal law. Instead, whether a relevant "legal duty" exists is a question of fact decided by the jury.[1049] The duty may derive from statute, contract, custom or from a fiduciary relationship.[1050]

3.56 From a law reform perspective, it is therefore possible to apply section 3 by creating a statutory duty to disclose information. The Law Commission took this approach in its 2016 report on Bills of Sale. Under the law of bills of sale, where a borrower uses a car as security for a "logbook loan", the lender may take possession of the car if the borrower defaults on the loan. This causes particular problems where the borrower sells the car to someone else without disclosing the logbook loan. To ensure that section 3 of the FA 2006 would apply in these circumstances, the Law Commission recommended new legislation imposing a legal duty on borrowers to disclose a goods mortgage when selling goods.[1051]

3.57 For section 3 to capture non-disclosures to the safety assurance regulator a duty would need to be created to require an ADSE to disclose information to the regulator.

Corporate convictions limited by the identification principle

3.58 The Fraud Act 2006 is directed towards individual fraudsters and their conniving managers. Convictions against corporate entitles are limited by the identification principle: a person who is the directing mind of the organisation must be shown to be

---

1049 CPS, *Guidance: The Fraud Act 2006*, https://www.cps.gov.uk/legal-guidance/fraud-act-2006.

1050 Law Commission, Final Report: Fraud (July 2002) Law Com No 276, para 7.28.

1051 Law Commission, Bills of Sale (2016) Law Com No 369, paras 8.46 to 8.54.

dishonest and have the required intention. This has been criticised as barrier to holding corporations, particularly large corporations, liable for corporate fraud.[1052]

Corporate manslaughter and corporate homicide

3.59 The Corporate Manslaughter and Corporate Homicide Act 2007 created parallel offences of corporate manslaughter in England and Wales and corporate homicide in Scotland. We previously considered these offences in Background Paper 2.[1053]

3.60 Under section 1(1)-(3) of the 2007 Act, an organisation is guilty of corporate manslaughter or corporate homicide if the "way in which its activities are managed or organised":

(1) causes a person's death;

(2) and amounts to a gross breach of a relevant duty of care owed by the organisation to the deceased;

(3) the way in which its activities are managed or organised by its senior management is a substantial element in the breach.

3.61 "Senior management" is defined in section 1(4) of the 2007 Act. It includes those at board level ("persons who play significant roles in the making of decisions about how the whole or a substantial part of its activities are to be managed or organised"). It also includes managers who play significant roles in the "actual managing or organising of the whole or a substantial part of those activities."

3.62 The trial judge must decide whether the organisation owed the deceased a duty of care. Section 2(5) states that "the judge must make any findings of fact necessary to decide that question". However, the jury must then decide if there was a gross breach of the duty.

Advantages

Aimed at holding corporations criminally liable

3.63 A key benefit of corporate manslaughter and corporate homicide is that they were enacted with the purpose of holding corporate entities criminally responsible for their wrongdoing. The offence was introduced in part to implement the Law Commission's 1996 recommendations[1054] regarding the creation of a "corporate killing" offence to address the difficulty of bringing prosecutions for gross negligence manslaughter against corporations due to the identification principle.[1055]

1052 https://www.burges-salmon.com/news-and-insight/legal-updates/disputes/corporate-fraud-in-the-uk-is-reform-of-the-directing-mind-and-will-test-imminent/.

1053 Background Paper 2 to CP1, paras 2.75 to 2.93.

1054 Final Report on Involuntary Manslaughter (1996) Law Com No 237, p 46.

1055 *Tesco v Nattrass* [1972] AC 153.

Available penalties

3.64 Imprisonment is not an available penalty for these offences as they apply only to corporations. However, the penalties are significant: there is no limit on the fine that can be imposed[1056] and the court can impose a "publicity order" requiring the organisation to publicise "in a specified manner" the conviction and fine.[1057]

Disadvantages

Limitation to wrongdoing that causes death

3.65 Corporate manslaughter and corporate homicide do not extend to non-fatal injuries.

Low prosecution rates, particularly against big businesses

3.66 Prosecutions are infrequent. Between 2008 to 2017, only 25 charges for corporate manslaughter were brought in England and Wales with 20 resulting in a conviction.[1058] There have been no prosecutions under the 2007 Act in Scotland since its introduction.[1059]

3.67 Defendants are overwhelmingly small or medium enterprises. This reflects the need to prove that failings by senior management were a "substantial element" of the breach. As Celia Wells points out, it is easier to identify failings by senior managers where individual directors are intimately involved in day-to-day decisions than in large companies with complex management structures, where senior managers are insulated from such difficult decisions.[1060] This weakness of corporate manslaughter and corporate homicide was emphasised by many consultees in their responses to Consultation Paper 1.[1061]

Gross negligence standard

3.68 Reliance on the "gross negligence" standard also may prove unhelpful in the AV context. Section 1(4)(b) states that (emphasis added):

> a breach of a duty of care by an organisation is a "gross" breach if the conduct alleged to amount to a breach of that duty falls *far below what can reasonably be expected of the organisation in the circumstances.*

3.69 The court must direct a jury to distinguish between very serious errors which may not meet the threshold and conduct that is "truly exceptionally bad".[1062] The 2007 Act sets

---

1056 Corporate Manslaughter and Corporate Homicide Act 2007, s 1(6).

1057 Corporate Manslaughter and Corporate Homicide Act 2007, s 10.

1058 CPS, *Corporate Manslaughter Statistics,* https://www.cps.gov.uk/sites/default/files/documents/publications/disclosure_6_1.pdf.

1059 Culpable Homicide (Scotland) Bill, Policy Memorandum (SP Bill 75-PM) (2020), para 24.

1060 C Wells, "Corporate Criminal Liability: A Ten-Year Review" (2014) *Crim LR* 849, at pp 853 to 4. For a discussion of the policy underlying corporate crime, see C Wells, *Corporations and Criminal Responsibility* (2nd ed 2001).

1061 See, for example, the response of Sally Kyd, Cycling UK and the CPS to CP1.

1062 *R v Sellu* [2016] EWCA Crim 1716.

out a list of factors for the jury to consider, most of which relate to health and safety legislation. However, “this does not prevent the jury from having regard to any other matters they consider relevant”.[1063]

3.70 This introduces uncertainty. ADSEs may not know the specific actions they must take to avoid liability. Juries may also fail to understand what can reasonably be expected of an ADSE and might be swayed by an emotive reaction to the tragedy in front of them.

Attaches to corporations only

3.71 Finally, the offences apply to corporations only. This “insulates individual directors or managers from participatory liability in the offence”.[1064] Although senior management may still indirectly be incentivised to ensure safety to avoid the corporation incurring financial and reputational damage, the offences do not directly hold senior managers personally liable.

Unlawful act manslaughter

3.72 We considered unlawful act manslaughter in England and Wales in Background Paper 2 to Consultation Paper 1.[1065] The offence has three main elements: there must be an unlawful act, which is itself dangerous (in the sense that the risk of some physical harm must be objectively foreseeable) and which causes death.[1066]

Advantages

Could apply to senior management and all other employees

3.73 A strength of unlawful act manslaughter is that it applies to individuals and so could extend to both senior management and lower-level employees.

Does not rely on negligence standard

3.74 Relying on unlawful act manslaughter would not give rise to the same issues as corporate manslaughter in that it does not rely on a gross negligence standard.

Disadvantages

Limitation to wrongdoing that causes death

3.75 A disadvantage of unlawful act manslaughter is that it does not encompass non-fatal injuries.[1067]

[1063] Corporate Manslaughter and Corporate Homicide Act 2007, s 8.

[1064] Celia Wells, “Corporate Criminal Liability: A Ten Year Review” (2014) *Criminal Law Review* 849, at pp 853 to 4.

[1065] Paras 2.35 to 2.51

[1066] *DPP v Newbury* [1977] AC 500, 507 by Lord Salmon.

[1067] Analysis of responses, para 7.152.

Requires the commission of an unlawful act

3.76 A further weakness of this offence is that it requires the commission of an "unlawful act". This risks an accountability gap where the wrongdoing of the ADSE that causes death is not recognised by existing law as an unlawful act.

Does not cover omissions

3.77 An additional weakness of unlawful act manslaughter is that it does not extend to omissions.

Gross negligence manslaughter

3.78 The English and Welsh offence of gross negligence manslaughter was also considered in Background Paper 2.[1068] It consists of the following five elements:[1069]

(1) The defendant owed a duty of care to the victim;

(2) The defendant negligently breached that duty;

(3) It was reasonably foreseeable that the breach would give rise to a serious and obvious risk of death. This is an objective question, based on the knowledge available to the defendant at the time of the breach. The court cannot impute to the defendant's knowledge that would have been obtained had there been no breach of duty;[1070]

(4) The death of the victim was caused by the breach; and

(5) In the jury's view, the defendant's conduct was "so bad as to be criminal".

3.79 The offence applies only to individuals, not corporations. Its application to corporations was abolished by section 20 of the Corporate Manslaughter and Corporate Homicide Act 2007.

Advantages

Covers omissions

3.80 Gross negligence manslaughter extends to omissions.[1071] This means the offence could, for example, encompass a gross failure of senior managers to take steps to ensure the safety of an ADS.

1068 Background Paper 2 to CP1, paras 2.52 to 2.64.

1069 *R v Adomako* [1995] 1 AC 171, p 187.

1070 *R v Rose (Honey Maria)* [2018] QB 328. See also Judge Mark Lucraft QC (ed), *Archbold: Criminal Pleading, Evidence and Practice 2019* (67th ed 2018) paras 19 to 123; D Ormerod QC (Hon) and D Perry QC (eds), *Blackstone's Criminal Practice 2019* (2018) para B1.68.

1071 *R v Adomako* [1995] 1 AC 171, p 187.

Disadvantages

Unclear threshold

3.81 Gross negligence manslaughter uses the same "gross negligence" standard applicable to corporate manslaughter. The jury must decide if the defendant's conduct was "truly exceptionally bad".[1072] This might fail to provide sufficient guidance to AV developers and leave them open to an emotional jury response.

Scapegoating individuals for organisational failures

3.82 In a medical setting, the case of *R v Bawa-Garba* has raised considerable concern. Dr Bawa-Garba was convicted of gross negligence manslaughter after a child died in her care in hospital. The prosecution relied on several failures, including failure to review a chest x-ray and failure to ensure the child was given appropriate antibiotics timeously.[1073] Meanwhile, defence counsel presented evidence about the complexities of the case in circumstances where the doctor had worked a double shift without any breaks and faced problems with the computer system.[1074]

3.83 Given that the death occurred in a "ward that was crowded and under-staffed and the staff under great pressure", many doctors felt that "Dr Bawa-Garba had been made a scapegoat for staff shortages and other systemic failings in the NHS".[1075]

3.84 In response, the Minister commissioned the Williams review on gross negligence manslaughter in healthcare. The review was not asked to look at the substantive law but at the way it was applied.[1076] The review recommended "revised guidance to… prosecutorial bodies and a clearer understanding of the bar for gross negligence manslaughter in law". [1077] It emphasised the need to consider "systemic issues and human factors" before prosecuting health professionals. [1078]

3.85 It has been suggested, however, that the problem lies with the underlying law, rather than with the way it has been applied. JR Spencer doubts that the review's recommendations on guidance can resolve the issue:

> It is impossible to predict in advance of verdict whether, on any given set of facts, "gross" negligence is present. If, as in the *Bawa-Garba* case, the jury thinks a simple error of professional judgement satisfies the test, the result is a conviction: appeal proof, if the jury was properly directed.[1079]

1072 *R v Sellu* [2016] EWCA Crim 1716.

1073 *R v Bawa-Garba* [2016] EWCA Crim 1841 at [13].

1074 Above, [18].

1075 JR Spencer, "Prosecuting medical professionals for manslaughter" (2019) 2 *Archbold Review* 9.

1076 Above, p 15.

1077 Norman Williams, *Gross negligence manslaughter in healthcare* (2018) at p 7.

1078 Above.

1079 JR Spencer, "Prosecuting medical professionals for manslaughter" (2019) 2 *Archbold Review*, p 15.

3.86 In consultation, Unite the Union also raised concerns about scapegoating individuals. They felt that there was a disproportionate risk to lower level employees, such as software engineers and coders, even when wrongdoing was sanctioned at the highest level of management.[1080]

Limitation to wrongdoing that causes death

3.87 Another disadvantage of gross negligence manslaughter is that it does not encompass non-fatal injuries.[1081]

Culpable homicide

3.88 Culpable homicide is a Scottish common law offence. It is defined as "the killing of human beings in all circumstances, short of murder, where the criminal law attaches a relevant measure of blame to the person who kills".[1082] It occurs where conduct causes death and, even though the fault element for murder is absent, the activity is criminally culpable. Consequently, the offence is capable of covering a wide scope of death-causing conduct. The common feature of such conduct is either (a) that the conduct was directed intentionally in some way against the victim; or (b) that the conduct was so grave in its recklessness as to injury that it should be criminalised.[1083] It follows that a great variety of activity can - at least in theory - be covered by the offence."

3.89 The Culpable Homicide (Scotland) Bill 2020[1084] has recently been introduced into the Scottish Parliament. If enacted, the statutory offences contained within the Bill would sit alongside the existing common law offence of culpable homicide. It would apply to both individuals and corporations.[1085]

Advantages

High level of culpability required

3.90 The fault element required for culpable homicide is currently described as "gross negligence" or "recklessness". This has been defined as requiring "gross and palpable carelessness"[1086] or a "gross or wicked, or criminal negligence, something amounting, or at any rate analogous to a criminal indifference to the consequences" and "a complete disregard of the potential dangers or possible consequences".[1087]

1080 See Electric Vehicles, Autonomous Technology and Future Mobility (February 2018), p 24.

1081 Analysis of responses to CP1, para 7.152.

1082 Lord Justice-General Rodger in *Drury v HMA* 2001 SLT 1013, at [13].

1083 *Drury v HMA* 2001 SLT 1013, [13]; *MacAngus v HM Advocate* 2009 JC 137 at [29].

1084 https://beta.parliament.scot/-/media/files/legislation/bills/current-bills/culpable-homicide-scotland-bill/introduced/bill-as-introduced-culpable-homicide-scotland-bill.pdf.

1085 Scottish Parliament, *Culpable Homicide (Scotland) Bill: Policy Memorandum, paras 7 to 9.*

1086 *HMA v Cranston* 1931 JC 28.

1087 *Sutherland v HM Advocate* (1994) SCCR 80.

3.91 The Culpable Homicide Bill explicitly provides that the offence can be committed either through recklessness *or* gross negligence. Recklessness would be established if:

> that person is, or ought to be, aware of an obvious and serious risk that acting in a particular manner will bring about the death of another person but nonetheless acts in that manner where no reasonable person would do so.[1088]

3.92 Section 3 of the Bill defines gross negligence as when a natural person acts in a way which amounts to a gross breach of a duty of care to another and that breach causes that person's death. What amounts to a gross breach of a duty is determined by "whether the breach falls far below what could reasonably have been expected".[1089]

3.93 Either under the common law offence or the potential statutory offence a high level of culpability is required for liability.

Culpable Homicide (Scotland) Bill 2020 would make it easier to hold corporations liable

3.94 The Bill seeks to remedy the difficulties of prosecuting corporations both under the common law offence and under the offence of corporate homicide, which requires that a senior manager's actions are a "substantial element" of the breach. It would allow for corporations to be held vicariously criminally liable[1090] for the actions of anyone who is "employee, contractor, consultant, shareholder, director, partner or have any other relationship with the non-natural person".[1091] A corporation would be guilty of causing death by gross negligence if "its" acts or omissions amounted to a "gross" breach of a duty of care owed by the organisation to the deceased.

3.95 Additionally, section 2(3) of the Bill introduces the concept of "aggregation". This is where an organisation would be guilty of an offence if acts done by several responsible persons, when considered together, are sufficient to constitute an offence. This may make it easier to hold corporations accountable for reckless or grossly negligent systemic failings that resulted in death. The politicians backing the Bill claim this should deter corporations from adopting lax practices that would otherwise be a breach of health and safety regulations.[1092]

Disadvantages

Does not apply to non-fatal injuries

3.96 A disadvantage of culpable homicide is that it does not apply to non-fatal injuries.

1088 The Bill, s 2(1).

1089 The Bill, s 5.

1090 The Bill, s 2(2).

1091 The Bill, s 8(2).

1092 See Policy Memo at para 11; Draft Bill consultation paper at pp 6 to 7 and 17: https://www.parliament.scot/S5MembersBills/CULPABLE_HOMICIDE_draft_4-_with_UPDATED_extended_deadline.pdf.

Currently limited by the identification principle

3.97 Culpable homicide is ultimately currently limited by the identification principle[1093] and it is not clear if the Bill will become law.

Unclear when the offence will be used

3.98 Road traffic deaths cases in Scotland are typically prosecuted as statutory offences. Although prosecutions for culpable homicide in such cases still occur in the road traffic context, the Crown has a great of discretion when deciding whether to prosecute for murder or for culpable homicide, and whether to accept a plea of guilty to culpable homicide where murder has been charged.[1094]

3.99 A significant amount of discretion is also left to the jury. In many cases the trial judge may leave to the jury the possibility of returning a verdict of guilty of culpable homicide as an alternative to murder. When the options presented to the jury are culpable homicide or a statutory offence, the degree of negligence or recklessness necessary is usually a question for the jury to determine from their view of the facts of the case.[1095]

ALTERNATIVE OPTIONS FOR REFORM

3.100 In Background Paper 2 we briefly considered two potential reform models. These were the "failure to prevent" model and the "general safety duty" model.[1096] Below we consider the strengths and weakness of each model in more detail.

3.101 We then consider possible models from other jurisdictions, including proposals from the Australian National Transport Commission and the Council of Europe and Californian regulations. We also describe offences applicable to the aviation industry in the US when an aircraft manufacturer has misled the regulator. This has informed our thinking on some of the elements of the new offences we propose.

A new "failure to prevent" offence

3.102 Two relatively new offences impose criminal liability on corporations for their "failure to prevent" financial crime. A key example is section 7 of the Bribery Act 2010,[1097] which is based on Law Commission recommendations.[1098] It states that:

> A relevant commercial organisation ("C") is guilty of an offence under this section if a person ("A") associated with C bribes another person intending—

1093 *Transco v HMA (No1)* 2004 JC 29. The identification principle in Scotland appears to be broader than that in England and Wales. For identification it is sufficient that any person with delegated responsibility to act on behalf of the body commits the *actus reus* while holding the necessary *mens rea* in the exercise of that delegated responsibility.

1094 Background Paper 2 to CP1, para 2.65.

1095 Background Paper 2 to CP1, para 2.65 and 2.72.

1096 Background Paper 2 to CP1, para 2.102 to para 2.109.

1097 See also sections 45 and 46 of the Criminal Finances Act 2017.

1098 Reforming Bribery (2008), Law Com No 313.

to obtain or retain business for C, or

to obtain or retain an advantage in the conduct of business for C.

C has a defence if it proves that it "had in place adequate procedures designed to prevent persons associated with C from undertaking such conduct".

An employee of C is presumed to be an associate of C (section 8). Other persons performing services for or on behalf of C such as agents or subsidiaries can be associates also.

3.103 This model has been also used in the Criminal Finances Act 2017 to criminalise failure to prevent the facilitation of tax evasion.

Advantages

Imposes responsibility on the corporation

3.104 While the principal liability lies with the employee, if the employee incurs liability, the corporation can then be held liable as a result of their association with the employee. A House of Lords Select Committee stated in its 2019 review of the Bribery Act 2010 that it is "an unprecedented way of enlisting the support of those most susceptible to being involved in the offence and most able to aid in its prevention".[1099]

3.105 This could prove helpful in the AV context as it could help incentivise an ADSE's senior managers to actively seek to prevent wrongdoing by its employees.

Penalties incentivise active participation by senior management

3.106 Some of the penalties available are also aimed at incentivising senior management to prevent wrongdoing. For example, under the Bribery Act 2010, if the offence of a corporation is proved to have been carried out with the consent or connivance of a director, manager, secretary, partner or similar office, the senior officer in question will be liable.[1100] Directors can be disqualified for up to 15 years.[1101]

Recognises that corporations may benefit from wrongdoing

3.107 The justification for failure to prevent offences is that, as corporations benefit from the wrongdoing in question, they should be under a duty to prevent it.[1102] This is also true in the AV context: as ADSEs may acquire a competitive advantage by misleading the safety assurance scheme, senior managers may need an incentive to prevent wrongdoing.

[1099] House of Lords Select Committee on the Bribery Act 2010, *Report of Session 2017-2019, The Bribery Act 2010: post-legislative scrutiny* (March 2019) HL Paper 30, para 71.

[1100] Bribery Act 2010, s 14(2).

[1101] Company Directors Disqualification Act 1986, s 2(3)(b).

[1102] C Wells, "Corporate Failure to Prevent Economic Crime - A Proposal" [2017] *Criminal Law Review* 426; House of Lords Select Committee on the Bribery Act 2010, *Report of Session 2017-2019, The Bribery Act 2010: post-legislative scrutiny* (March 2019) HL Paper 30, para 167.

Avoids limitations of the identification principle

3.108 Another benefit of this model is that it circumvents the limitations of the identification principle. The corporation does not need to have been actively involved in the employee's wrongdoing to be held liable for it.

Defences available

3.109 Another strength of this model is that defences are available for each offence. This could avoid placing an unduly onerous burden on ADSEs.

Disadvantages

Requires the commission of wrongdoing by an "associated person"

3.110 One disadvantage of using this model is that it requires an "associated person" (that is, an employee) to have committed an underlying offence. This reflects that the model was developed to encourage corporations to prevent employees from committing financial wrongs that are already recognised as offences.

3.111 The model is consequently potentially unsuited to an AV context where the conduct of an "associated person" in relation to the safety assurance scheme may not in itself be an offence under the current law.

Extends only to corporations

3.112 Another disadvantage of relying on this model is that liability extends only to the corporation. Although it is aimed at incentivising senior managers to prevent wrongdoing, it ultimately does not provide for their personal liability (although it may lead to director disqualification).

Not prescriptive

3.113 The defences provided encourage the corporation to establish "adequate" or "reasonable" procedures to prevent the commission of the underlying offence. However, the offences do not *require* the corporation to establish such procedures.[1103]

3.114 Nor does the legislation set out what specific procedures are required. Some suggestions are made in official guidance.[1104] For example, Ministry of Justice guidance sets out six principles to guide corporations who are seeking to establish "adequate procedures" to prevent bribery.[1105] However, a House of Lords Select Committee reviewing the Act criticised the guidance for not being specific enough.[1106]

[1103] House of Lords Select Committee on the Bribery Act 2010, *Report of Session 2017-2019, The Bribery Act 2010: post-legislative scrutiny* (March 2019) HL Paper 30, para 176. The position is different in France, where corporations are under a positive obligation to "prevent corruption" by establishing a "appropriate internal ABC risk management framework: France's Sapin II law; House of Lords Select Committee on the Bribery Act 2010, *Report of Session 2017-2019, The Bribery Act 2010: post-legislative scrutiny* (March 2019) HL Paper 30, paras 176 to 177.

[1104] Ministry of Justice, *The Bribery Act 2010: Guidance* (2011), pp 20 to 31.

[1105] Ministry of Justice, *The Bribery Act 2010: Guidance* (2011), pp 20 to 31.

[1106] House of Lords Select Committee on the Bribery Act 2010, *Report of Session 2017-2019, The Bribery Act 2010: post-legislative scrutiny* (March 2019) HL Paper 30, p 194.

They highlighted that this is particularly detrimental to SMEs that are less likely to have their own legal advisers than larger companies.[1107]

3.115 In the AV context, guidance could provide some clarity as to the procedures ADSEs should establish. However, there is a risk that a failure to prevent offence would provide insufficient guidance to ADSEs (especially small ones). This is unhelpful to ADSEs that wish to ensure they take the necessary steps to avoid liability. It may also lead to an overly-cautious approach being taken by some ADSEs that stifles innovation.

Circularity of "adequate procedures"

3.116 The "failure to prevent" model as enshrined by section 7 of the Bribery Act 2010 has been criticised for the circularity of the defence. This is because:

> the wording in effect provided no defence, because the fact that bribery had taken place ex hypothesi proved that the procedures in place, however robust, were inadequate.[1108]

3.117 Although the House of Lords Select Committee did not recommend that the defence is amended in their 2019 review of the Bribery Act 2010, they recommended that the accompanying guidance is amended to clarify that "adequate" means "reasonable".[1109]

The duty of safety under the General Product Safety Regulations 2005

3.118 A "general duty of safety" is found in EU law under the General Product Safety Directive 2001.[1110] This was enacted into UK law through the General Product Safety Regulations 2005 (GPSR).[1111] Regulation 5 sets out a "general safety requirement" for producers which require them only to sell and supply safe products. Regulation 9 also establishes additional obligations for "producers" and "distributors" to relating the recall of products that are unsafe.

3.119 Regulation 20 then provides that breaches of regulation 5 and regulation 9 can give rise to nine separate offences.

3.120 In Background Paper 2 we said that the GPSR has a residual role: it does not apply to products already covered by specific EU requirements.[1112] We said that the GPSR is of limited relevance as AVs are subject to the safety requirements within the UNECE type approval regime.[1113] However, three consultees suggested that the GPSR may

---

1107 House of Lords Select Committee on the Bribery Act 2010, *Report of Session 2017-2019, The Bribery Act 2010: post-legislative scrutiny* (March 2019) HL Paper 30, p 188.

1108 Above, para 199.

1109 Above, para 211.

1110 Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety.

1111 General Product Safety Regulations 2005 SI No 1803.

1112 Reg 3.

1113 CP1, para 7.120.

be applicable.[1114] We consequently agreed to extend our review of the law to include the GPSR.[1115]

3.121 As we have seen, Automated Lane Keeping Systems (ALKS) are subject to UNECE type approval. Other systems may not be covered by regulations in this way, so in theory, the GPSR could govern the safety of an AV. However, by the time that AVs are ready for deployment, they are likely to be governed by a type approval regime.

3.122 Even if the general safety requirement does not apply directly, it could still serve as a model for a new offence.[1116] We therefore set out the advantages and disadvantages of the GPSR below.

Advantages

Imposes a primary duty onto producers

3.123 The GPSR directly imposes a primary duty on producers to sell and supply only safe products. This means that the corporation and/or senior management may be liable for breach of the duty, even if an employee has not separately committed a criminal offence. As a result, the GPSR avoids a key limitation of the "failure to prevent" model.

Focus on safety

3.124 Another benefit of the GPSR model is that it reflects our emphasis on safety. The definition of "safe product" found in the GPSR is flexible and context-sensitive. Relying on a similar standard would allow for any legal definition of safety to align with safety standards that emerge from a new safety assurance scheme and industry best practice.

Defence

3.125 Additionally, a strength of the GPSR model is that a defence is available. This is as a producer has a defence to any of the offences under the GPSR if they can show that they took all reasonable steps and exercised all due diligence to avoid committing the offence.[1117]

Mechanism for holding senior management liable

3.126 The GPSR model also provides a mechanism for holding senior management personally liable. Proceedings can be brought against "any director, manager, secretary or other similar officer of the body corporate" if the producer or distributor is a corporation and the wrongdoing was committed due to the defendant's "consent, connivance or neglect".[1118] This is very similar to section 37 of the HSW Act 1974.

1114 SMMT, DAC Beachcroft and BMW Group response to CP1.

1115 Analysis of Reponses to CP1, para 7.171.

1116 It is also important to note that the GPSR may not apply to "pure software" sold separately from a physical product: we discuss this issue in detail in CP1 in relation to the Consumer Protection Act 1987 at paras 6.70 to 6.75 of CP1.

1117 GPSR, reg 29. If the defendant claims to have relied on information supplied by another person, the defence is only available if it was reasonable to rely on that information.

1118 GPSR, reg 31(2).

Disadvantages

Not prescriptive

3.127 A general safety duty is likely to be too vague to provide ADSEs with sufficient guidance. The duty contained in the GPSR is not prescriptive and does not clearly set out the conduct that producers must refrain from to avoid liability. A similar duty in the AV context could penalise the ADSE for inevitable problems.

Low penalties

3.128 The GPSR carries relatively low penalties. A breach of the "general safety requirement" under regulation 5 may attract a maximum sentence of 12 months in prison, a fine of £20,000 or both.[1119] Breaches of regulation 9 also carry a maximum sentence of three months' imprisonment, a fine of £5,000 or both.[1120]

A general duty of safety: Australian National Transport Commission proposals

3.129 In Consultation Paper 1 we referenced work conducted by the National Transport Commission (NTC) in Australia on the laws surrounding automated driving.[1121] Our proposed ADSE concept was heavily influenced by NTC recommendations.[1122]

3.130 In Australia, the National Transport Commission (NTC) has suggested that every ADSE should be subject to a general duty of safety.[1123] When an ADS causes injury or narrowly misses causing injury, the national body responsible for safety assurance would investigate. It would then determine whether the risk could reasonably have been managed and whether the duty holder knew, or ought to reasonably have known, about the risk and ways of managing it.[1124] The NTC states that detailed consideration of penalties will be undertaken once a preferred policy option has been agreed.[1125] Imprisonment is being considered as one possible penalty.[1126] The NTC pointed out that criminal sanctions for ADSEs would require consultation with, among others, the Attorneys-Generals of state governments.

1119 GPSR, reg 5 and 20(1).

1120 GPSR, reg 9 and 20(4).

1121 See, for example, CP1, paras 3.42 to 3.45.

1122 CP1, paras 4.107 to 4.126.

1123 NTC Australia, "Safety Assurance for Automated Driving Systems Consultation Regulation Impact Statement" (May 2018), pp 31 and 32.

1124 Above, pp 31 and 32.

1125 Above, p 31.

1126 NTC Australia, "Changing driving laws to support automated vehicles, Policy Paper" (May 2018), para 8.2.2. NTC point out that criminal sanctions on the Automated Driving System Entities are outside the scope of their project and would require consultation with, among others, the Attorneys-Generals of state governments.

Advantages

Imposes a primary duty onto ADSEs

3.131 This duty would place a primary duty on ADSEs to ensure safety. Again this shows how this model avoids a key limitation of the "failure to prevent" model.

ADSE concept imported from NTC proposals

3.132 We borrowed the ADSE concept from NTC proposals.[1127] If the NTC continues to promote a general duty of safety, adopting a similar approach would promote consistency at an international level.

Links to safety assurance scheme

3.133 Another benefit of using this duty as a model would be that it reflects our emphasis on safety, and that it is placed on the ADSE, linking it closely to the safety assurance scheme.

Disadvantages

Not prescriptive

3.134 In its current form this duty is vague. The NTC has defined the duty as "an overarching and positive general duty… to ensure the safety of automated driving system so far as reasonably practicable"[1128] and a duty "to not expose individual to a risk of death, serious injury or harm".[1129] The NTC explicitly states that this duty is not intended to be prescriptive.[1130]

Uses standard of reasonably practicable

3.135 Another issue is that one of the definitions given by the NTC relies on the SFAIRP standard. The risk that this standard might place too onerous of a burden on ADSEs is set out above in relation to section 3 of the HSW Act. The problem is that even if AVs have a positive risk balance, with a lower level of casualties than human driven vehicles, there will still be some casualties. It is not appropriate to criminalise developers for the inevitable consequence of introducing AVs onto the roads.

Work by the Council of Europe

3.136 In October 2018 the Council of Europe launched a two-year project on criminal liability and automated vehicles.[1131] The European Committee on Crime Problems (ECCP) is

---

1127 NTC Australia, *Regulatory options to assure automated vehicle safety in Australia*, Discussion Paper (June 2017).

1128 NTC Australia, "Safety Assurance for Automated Driving Systems Consultation Regulation Impact Statement" (May 2018), p 31.

1129 NTC Australia, "Changing driving laws to support automated vehicles, Policy Paper" (May 2018), para 8.2, p 61.

1130 Above, para 8.2, p 61.

1131 Council of Europe, European Committee on Crime Problems, "Concept paper: artificial intelligence and criminal law responsibility in Council of Europe member states - the case of automated vehicles" (October 2018).

running the project. This project is part of a wider review by the Council of Europe and the ECCP on the law surrounding artificial intelligence.

3.137 The four objectives of the project are to determine:[1132]

(1) "the current scope and substance of relevant national criminal legislation and international law pertaining to the use of automated vehicles (or other AI deployment)";

(2) "where certain conduct has been or should be prohibited and criminalised";

(3) "the principles and norms of attribution and accountability for natural or legal persons for harm caused by automated vehicles (or other AI deployment)"; and

(4) "the scope and substance of an international legal instrument to provide common standards for the criminal law aspects of autonomous technologies and harm caused by artificially intelligent decision-making processes, in particular automated vehicles".

3.138 The scope of the project includes corporate criminal liability and liability issues arising "in all stages of development and utilisation of automated vehicles".[1133]

3.139 In November 2019 the ECCP published its assessment of answers to a questionnaire distributed to Council of Europe members.[1134] A preliminary finding was that a Council of Europe instrument on "artificial intelligence and criminal justice" should be produced.[1135] The analysis also stated that:

> only a few member States have prepared or already adopted general legislation which may affect criminal liability when humans hand over the steering wheel to driving assistants, in particular with regard to requirements for negligence.[1136]

3.140 Furthermore, the analysis found that:

> in most member States, traffic crimes do not fall within the schemes of corporate liability. This may trigger questions as to the scope of producers' liability when driving assistants replace human drivers. Possibly certain serious offences, such as those threatening life and limb, ought to be adapted so that they can apply to the corporate body responsible for the actions of the

---

1132 Council of Europe, European Committee on Crime Problems, "Concept paper: artificial intelligence and criminal law responsibility in Council of Europe member states - the case of automated vehicles" (October 2018), p 8.

1133 Above, pp 6 to 7.

1134 Council of Europe, European Committee on Crime Problems, "Assessment of the answers to the questionnaire on artificial intelligence and criminal justice (using the example of Automated Driving)" (November 2019).

1135 Above, p 4.

1136 Above, p 4.

vehicle. Again one underlying issue is the question of whether (every type of) risk taking should trigger criminal liability.[1137]

3.141 It then recommended "updates or new concepts of liability, including corporate liability, be it criminal, civil or administrative according to the national legal system".[1138]

3.142 It is clear from the responses that debate on this issue is still at the early stages. Most Council of Europe states have not yet considered issues of criminal liability and AVs. We look forward to reading any further material produced by the project and hope that we can consider its findings in our final report.[1139]

California

3.143 Two aspects of Californian law on automated driving relate to the criminal responsibility of ADS developers. Californian law does not use the ADSE concept.

3.144 Division 16.6[1140] of the California Vehicle Code regulates "autonomous vehicles" and requires the Department of Motor Vehicles to issue regulations relating to testing and deployment. Three sets of regulations have been issued pursuant to this duty,[1141] all of which require a manufacturer to apply for a permit for testing or deploying automated vehicles.

3.145 Section 227.16(b) of the California Vehicle Code provides that:

> each document identifying autonomous vehicles for testing shall be signed by a person authorized by the manufacturer to bind the manufacturer, under penalty of perjury under the laws of the State of California.

3.146 Section 228.06(e)(4) then provides that plans or reports submitted regarding a permit for deployment "shall be signed and dated under penalty of perjury, by the party completing the plan or report, certifying the correctness of its contents".

3.147 This means that it is an offence for the authorised person to commit perjury in their application for a testing or deployment permit. Section 118 of California Penal Code provides that perjury is "an intentionally false statement relating to a material matter, providing it was not made in good faith". It is a felony offence that carries a penalty of up to four years imprisonment.

1137 Council of Europe, European Committee on Crime Problems, "Assessment of the answers to the questionnaire on artificial intelligence and criminal justice (using the example of Automated Driving)" (November 2019), p 10.

1138 Above, p 13.

1139 The working group was due to meet in October 2019 and January/February 2020 to consider the findings of the questionnaire, and to "start working on CoE / CDPC instrument". This was to be followed by a "International Conference on common criminal law standards relating to harm caused by automated vehicles (or other AI deployment)" in June 2020. A draft instrument was to be finalised by the working group in September/October 2020. However, it is unclear if further progress has been made. See: https://rm.coe.int/cdpc-2019-5-working-group-on-ai-and-criminal-law-work-plan/1680925b9c.

1140 Autonomous Vehicles [38750 – 38755].

1141 https://www.vox.com/2018/2/26/17053898/driverless-cars-self-driving-california-dmv-remote-operated-autonomous-testing.

Aviation industry regulation in the United States

3.148 In the United States the aviation industry is regulated by the Federal Aviation Administration (FAA). The Aircraft Safety Act 2000 section 506 created criminal offences relating to fraud within the aviation industry. The relevant provision is set out in Title 18 of the United States Code. Section 38(a)(1) of Title 18 provides that:

> Whoever, in or affecting interstate or foreign commerce, *knowingly and with the intent* to defraud—
>
> > (A) falsifies or conceals a material fact concerning any aircraft or space vehicle part;
> >
> > (B) makes any materially fraudulent representation concerning any aircraft or space vehicle part; or
> >
> > (C) makes or uses any materially false writing, entry, certification, document, record, data plate, label, or electronic communication concerning any aircraft or space vehicle part;
>
> shall be punished under section 38(b).

3.149 Section 38(a)(3) then makes it an offence to attempt or conspire to commit these offences. Section 38(b) then sets out the applicable penalties, which depend on the context and harm caused by the offence:

> (1) Aviation quality. If the offense relates to the aviation quality of a part and the part is installed in an aircraft or space vehicle, a fine of not more than $500,000, imprisonment for not more than 15 years, or both.
>
> (2) Failure to operate as represented. If, by reason of the failure of the part to operate as represented, the part to which the offense is related is the proximate cause of a malfunction or failure that results in serious bodily injury (as defined in section 1365), a fine of not more than $1,000,000, imprisonment for not more than 20 years, or both.
>
> (3) Failure resulting in death. If, by reason of the failure of the part to operate as represented, the part to which the offense is related is the proximate cause of a malfunction or failure that results in the death of any person, a fine of not more than $1,000,000, imprisonment for any term of years or life, or both.
>
> (4) Other circumstance. In the case of an offense under section 38(a) not described in paragraph (1), (2), or (3) of this subsection, a fine under this title, imprisonment for not more than 10 years, or both.

3.150 Section 38(b)(5) also provides penalties in cases of corporate criminal responsibility:

> If the offense is committed by an organization, a fine of not more than—
>
> > (A) $10,000,000 in the case of an offense described in paragraph (1) or (4); and

(B) $20,000,000 in the case of an offense described in paragraph (2) or (3).

Advantages

3.151 One interesting aspect of these offences is that the severity of the penalties available are connected to the harm caused. For example, if the aircraft part fails and it is the "proximate cause of a malfunction or failure that results in the death" this can attract fine of up to $1,000,000 to and/or imprisonment of up to a life sentence.[1142] Notably, the defendant's conduct does not have to be the cause of the part failure: the conduct simply must relate to the part in question. In a new offence for ADSEs the available penalties could also be contingent on the harm caused.

3.152 Another strength of this model is that section 38(b)(5) provides for higher fines of up to $20,000,000 if the offence is committed by an organisation. A new offence could also provide for enhanced penalties for corporations.

3.153 Furthermore, the language of "material" and "false" is used. This is the same language used in offences applicable in high-risk industries in the UK, as we explained in Chapter 14.

3.154 Finally, the culpability of the defendant is relevant to whether liability can be established: they must have acted knowingly and with intent to defraud.

Disadvantages

3.155 No defences are available to the offences. In the automated driving context, this approach would be too punitive.

3.156 Convictions for these offences are rare in aviation accidents in the United States even when they resulted in death or serious injury.[1143]

Other jurisdictions

3.157 We have not identified any other jurisdictions that are publicly considering the specific criminal liability issues discussed in this chapter. We will continue to look to other jurisdictions in formulating our final recommendations.

LESSONS FROM THIS REVIEW

3.158 Our discussion considers two issues that are not easy to disentangle. The first question is what conduct and harm should trigger liability. The second question is how to allocate liability between the corporate entity and its senior manager or employees. Different offences take different approaches to this issue.

3.159 In Chapter 5 we propose that the overall casualty rate of AVs must be lower than that of human drivers before they are allowed onto the road. However, AVs will still cause some casualties (even if fewer casualties than human drivers). That is an inevitable part of the enterprise. It would be wrong to criminalise developers simply because a death or serious injury has occurred. It will also be difficult for a jury to decide, when

---

[1142] Comparatively, if the offence relates to an "aviation quality of a part" can lead to a fine of up to $500,000 and/or up to 15 years imprisonment.

[1143] https://www.aviationpros.com/home/article/10387646/justice-delayed-usa-vs-sabre-tech.

faced with a tragic case, whether the outcome was the result of negligence or gross negligence, or simply an inevitable consequence of allowing AVs onto the roads.

3.160 Instead, our focus has been on criminalising serious wrongdoing, where the ADSE fails to act honestly and openly by, for example, suppressing poor test results, misrepresenting the tests they have carried out or installing a "defeat device" to cause the vehicle to behave differently in tests that in real life. To this end, we note the way that the Fraud Act 2006 criminalises non-disclosures and misrepresentations. We also note the due diligence defence used in many regulatory offences and in the GPSR.

3.161 It would not be right as part of this project to exempt AV developers from general offences that cover all undertakings, such as corporate manslaughter, gross negligence manslaughter or breaches of section 3 of the HSW Act 1974. However, we would not wish to see these offences being used widely against ADSEs. Instead, the emphasis should be on incentivising ADSEs to co-operate fully with the safety assurance regulators, providing full openness and transparency in their dealings with the scheme.

3.162 The review points to an accountability gap in the event of serious injuries. The offences we have looked at tend to divide between relatively minor offences of creating the risk of injury, and extremely serious offences which follow from a death. Unlike the offence of causing serious injury by dangerous driving, the criminal offences we have considered do not adequately reflect the harm caused by serious but non-fatal injuries. The offences applicable to the US aviation industry appear more finely attuned to the harm that follows from an offence.

3.163 In many areas of life, when things go wrong, difficult policy decisions arise about how far to proceed against corporate entities, against senior managers or against individuals. This is context specific and we do not attempt to draw any general principles.

3.164 However, in an AV context, we think that primary liability should lie with the ADSE as an organisation. It is also crucial that senior managers face at least some personal liability in the event of serious wrongdoing. Even if prosecutions are extremely rare, the possibility of prosecution focuses the minds of senior managers on how to ensure a transparent and open safety culture. By contrast, we would be concerned about creating new criminal sanctions that would fall mainly on low-level employees, irrespective of the organisational pressures they were under at the time.

3.165 The results of our review are set out in Chapter 14.

Appendix 4: Data protection: the legal background

4.1 This appendix summarises key elements of the law of data protection and considers how they apply to automated vehicles. It looks at:

(1) the General Data Protection Regulation (GDPR) 2016/679;

(2) Directive 2002/58/EC (the ePrivacy Directive);

(3) the proposed replacement to the e-Privacy Directive (the Proposed Regulation); and

(4) the BSI working draft on standards for data collection in AVs used in UK road trials, for inclusion in PAS 1882.

THE GENERAL DATA PROTECTION REGULATION (GDPR)

Personal data

4.2 Under EU law, personal data is protected by the GDPR. Although the GDPR has direct effect, it has been supplemented and tailored to the UK by the Data Protection Act 2018. Both the GDPR and the Act came into effect in May 2018.

4.3 To be compatible with the GDPR, personal data must be processed:

(1) in accordance with a lawful basis;

(2) in accordance with an additional special condition where the personal data is part of a special category;

(3) in a manner which accords with the seven principles for data processing; and

(4) in a manner which respects the individual rights conferred by the GDPR.

What is personal data?

4.4 "Personal data" is defined as "any information relating to an identified or identifiable natural person".[1144] The Information Commissioner's Office (ICO) explain that this involves two separate tests.

(1) Is it possible to identify an individual from the information, either directly or indirectly?[1145]

[1144] GDPR Art 4(1).

[1145] Under GDPR Art 4(1) an identifiable natural person is one "who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person".

(2) Does the information "relate" to the individual? ICO explains that this might depend on a range of "including the content of the information, the purpose or purposes for which you are processing it and the likely impact or effect of that processing on the individual".[1146]

4.5 Not all data generated by automated vehicles will be personal data. However, much of the data will meet these tests. For example, data linked to a vehicle registration number or VIN could be used (indirectly) to identify the registered keeper through the DVLA; location data could identify a person's home; and a camera feed will identify a person's face (which, as the GDPR puts it, is specific to their physical identity). Furthermore, information would "relate" to a person if it revealed where someone was at a given time, what they were doing, or how they were driving.

Lawful bases for personal data processing

4.6 The GDPR places obligations on those who control and process personal data. All those who process personal data must have a lawful basis for doing so. Article 6(1) of the GDPR recognises six possible lawful bases, which ICO describes in the following terms:

(a) **Consent:** the individual has given clear consent for you to process their personal data for a specific purpose.[1147]

(b) **Contract:** the processing is necessary for a contract you have with the individual, or because they have asked you to take specific steps before entering into a contract.

(c) **Legal obligation:** the processing is necessary for you to comply with the law.

(d) **Vital interests:** the processing is necessary to protect someone's life.

(e) **Public task:** the processing is necessary for you to perform a task in the public interest or for your official functions, and the task or function has a clear basis in law.

(f) **Legitimate interests:** the processing is necessary for your legitimate interests or the legitimate interests of a third party, unless there is a good reason to protect the individual's personal data which overrides those legitimate interests.

[1146] See https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/key-definitions/what-is-personal-data/ (last visited 29 September 2020).

[1147] In relation to the consent basis, the European Commission Horizon 2020 Commission Expert Group has stressed the need for policymakers to ensure consent is voluntary and informed. Models of consent should include agile and continuous consent options, and refusal to consent must not result in a denial of service. E03659. *Ethics of Connected and Automated Vehicles: recommendations on road safety, privacy, fairness, explainability and responsibility* (2020), ch 2 available at https://ec.europa.eu/info/sites/info/files/research_and_innovation/ethics_of_connected_and_automated_vehicles_report.pdf (last visited 28 September 2020).

4.7 Given the quantities and variety of data that ADSEs and HARPS operators will hold, processing may be justified under any of these grounds. However, some grounds will appear particular relevant:

(1) Ground (c) permits processing which "is necessary for compliance with a legal obligation to which the controller is subject".[1148]

(2) Ground (e) permits processing which is "necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller".[1149]

4.8 Under Article 6(3), both the obligation (in Ground (c)) or the task (in Ground (e)) must be "laid down by law". This can include common law obligations. Recital 41 confirms that there does not have to be an explicit statutory obligation, as long as the application of the law is foreseeable to those individuals subject to it.

4.9 On the other hand, given the concerns of data controllers, we can see advantages in being explicit on the face of the statute. On this basis, the statue would set out obligations to hold data and to carry out public tasks.

Special conditions for processing special personal data

4.10 Some "special categories of personal data" are given additional protection. Under GDPR Article 9, the special categories are:

> … personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation.

4.11 Automated vehicles will generate data which falls into one or more of these special categories. The EDBP has emphasised the sensitivity of location data, in particular which is "particularly revealing of life habits". Such data could (for example) reveal sensitive information about religion (through the place of worship) or about sexual orientation (through places visited). Vehicles also use biometric data (for example) to enable access to the vehicle or to give access to the driver's profile settings.[1150]

4.12 It is only lawful for a controller to process special category data if the controller has both a lawful basis under Article 6 of the GDPR **and** meets one or more of the 10 special conditions listed in Article 9. Two of the special conditions are particularly relevant. First, one of the special conditions concerns insurance claims. Under Article 9(1)(f) processing is allowed if it is "necessary for the establishment, exercise or defence of legal claims or whenever courts are acting in their judicial capacity".

4.13 Secondly, under Article 9(2)(g), processing is permitted if it is "necessary for reasons of substantial public interest". This broad test is further specified by Schedule 1 of the

---

[1148] GDPR Art 6(1)(c).

[1149] GDPR Art 6(1)(e).

[1150] EDPB, Guidelines 1/2020, paras 59 to 63.

Data Protection Act 2018, which in Part 2 sets out conditions for substantial public interest. The relevant conditions are as follows.

(1) **Unlawful acts**: the processing is necessary for the purposes of the prevention or detection of an unlawful act;[1151] *and* the processing is necessary for reasons of a substantial public interest (paragraph 10).

This condition is not limited to *criminally* unlawful acts. The aspects of our data collection scheme focusing on the detection of civil wrongs would satisfy this condition.

(2) **Public functions**: the processing is necessary for the exercise of a public function, including as conferred by statute; *and* the processing is necessary for reasons of a substantial public interest (paragraph 6).

Our proposed data scheme will be enacted in legislation. The Safety Assurance Scheme, in particular, will involve the exercise of public functions by a government department. The processing required pursuant to the Safety Assurance Scheme will therefore satisfy this condition.

(3) **Justice**: the processing is necessary for the administration of justice, or the exercise of a function of Parliament (paragraph 7).

The "administration of justice" is not further defined. It is unclear whether it would include aspects of our scheme which involve envisaged civil claims; for example, the recording of accident data so that a claim can be brought in future.

(4) **Equality**: the processing of a specified category of data is necessary for equality purposes, such categories including, for example, health data (paragraph 8).

This condition would apply to data processing for the purpose of monitoring the accessibility of AVs.

(5) **Public protection**: the processing is necessary to protect members of the public against, amongst others, unfitness or incompetence, or failures in services provided by a body; *and* the processing is necessary for reasons of a substantial public interest (paragraph 11).

Arguably, the collection of "near miss" data is necessary to detect unfitness or failures in service, in order to protect the public prior to an accident taking place.

4.14 Finally, there are special safeguards where data reveals a criminal offence. Under Article 10, private controllers may only process such data if it is authorised by law "providing for appropriate safeguards for the rights and freedoms of data subjects". The EDPB emphasises that strong security measures are required.[1152]

[1151] And the prevention or detection would be prejudiced if consent were sought.

[1152] EDPB, Guidelines 1/2020, paras 64 to 65.

The principles

4.15 The GDPR sets out seven key principles. In summary, Article 5(1) requires that personal data shall be:

(a) processed lawfully, fairly and in a transparent manner;

(b) collected for specified, explicit and legitimate purposes;

(c) adequate, relevant and limited to what is necessary;

(d) accurate and, where necessary, kept up to date;

(e) kept in a form which permits identification of data subjects for no longer than is necessary;

(f) processed in a manner that ensures appropriate security of the personal data.

4.16 As these provisions show, there is a strong emphasis on discarding unnecessary data. Data should only be collected, kept and processed if it is necessary for a specified purpose. Controllers will need to understand which personal AV data is necessary and which data is not necessary.

Individual rights

4.17 The GDPR provides individuals with 9 specified rights over their personal data. ICO lists these as follows.

(1) The right to be informed.

(2) The right of access.

(3) The right to rectification.

(4) The right to erasure.

(5) The right to restrict processing.

(6) The right to data portability.

(7) The right to object.

(8) Rights in relation to automated decision-making and profiling.

4.18 Some of these rights may be highly relevant to in-vehicle data. For example, TRL's report to the EU on Access to In-Vehicle Data and Resources highlights that many vehicle owners may want their personal data to be deleted when they sell the vehicle. Under Article 17 (the right to erasure) the data subject has

> the right to obtain from the controller the erasure of personal data concerning him or her without undue delay.

4.19 The right is not absolute and must fall within one of the listed grounds. In this example, the right would probably apply if the controller was only holding information on the basis of consent (and the consent was withdrawn)[1153] or if it is no longer necessary.[1154] However, the right would not apply if the controller needed it to comply with a legal obligation.

4.20 Vehicle owners may also wish to move from one third party supplier to another (where for example they wish to contract with a different firm for vehicle supervision). Where the data subject had given the information to the controller (which they hold through consent or for the performance of the contract) this might engage the right to "data portability". Under Article 20(1):

> The data subject shall have the right to receive the personal data concerning him or her, which he or she has provided to a controller, in a structured, commonly used and machine-readable format and have the right to transmit those data to another controller…

4.21 Clearly, data controllers will need to think carefully about how these general rights might apply to all the various categories of data they hold. They will need to distinguish between personal and non-personal data. They will also need to distinguish between data which is held by consent (or for the purposes of a contract they have with the individual) and data which is necessary to discharge legal obligations or tasks in the public interest. With so much data involved, these considerations may be complex. They will then have to consider what structured, machine-readable format is commonly used.

4.22 However, most of the issues are outside the scope of our project. Automated vehicles generate more data than most products, but often the issues of privacy are not qualitatively different. In many cases, it is simply a question of applying the provisions of the GDPR to the specifics at hand.

Accountability

4.23 Accountability is one of the guiding principles of the GDPR. As Article 5(2) puts it "the controller shall be responsible for, and be able to demonstrate compliance" with the statutory principles of processing personal data. Under Article 24(1), the controller must:

> implement appropriate technical and organisational measures to ensure and to be able to demonstrate that processing is performed in accordance with this Regulation.

4.24 The measures must be reviewed and updated where necessary. Article 25 sees these technical and organisational measures as embedding data protection principles into the process by "design and default".

[1153] GDPR Art 17(1)(b).

[1154] GDPR Art 17(1)(a).

4.25 ICO gives considerable guidance on this, alongside guidance on how to complete data protection impact assessments. It also stresses the need to record and report data breaches.

Codes and accreditation schemes

4.26 The GDPR encourages trade associations and representative bodies to encourage good data handling, through codes of conduct and accreditation schemes (under Articles 40 to 43). ICO describes these provisions in the following terms:

> Under the GDPR, trade associations and representative bodies may draw up codes of conduct covering topics such as fair and transparent processing, pseudonymisation, and the exercise of people's rights.
>
> In addition, supervisory authorities or accredited certification bodies can issue certification of the data protection compliance of products and services.
>
> Both codes of conduct and certification are voluntary, but they are an excellent way of verifying and demonstrating that you comply with the GDPR.

4.27 Alex Glassbrook identifies a gap in that there is no code of practice dealing with the data protection issues arising from CAVs.[1155] In time it will be important to encourage representative bodies to promote good practice in this area.

ICO consultation

4.28 Under Article 36(4) of the GDPR, the UK government must consult its Data Protection Authority (ICO) "during the preparation of a proposal for a legislative measure to be adopted by a national parliament … which relates to processing". If the Government chooses to implement our proposals, it will need to seek ICO's views on proposed AV legislation to comply with Article 36(4).

4.29 Government guidance clarifies the scope of Article 36(4).[1156] The obligation to consult applies to "all relevant policy proposals for legislation adopted by a national parliament", and "all public sector officials" are obliged to comply. An enquiry form is provided, to be filled out by officials and sent to ICO to begin the consultation process.

4.30 To "meet the spirit" of the requirement, early engagement by policy leads is encouraged; a recommended timetable is to allow "a minimum of 12 weeks from initial contact with the ICO to finalisation of their policy proposals". The Government is not bound by ICO's views but must take them into account.

EPRIVACY DIRECTIVE

4.31 Our proposed data retention scheme seeks to ensure that incidents can be properly investigated. Such investigation requires the retention of location data, particularly since a key issue in determining liability will be whether the automated system was

---

[1155] A Glassbrook, *A Practical Guide to the Law of Driverless Cars* (2nd ed 2019) p 170.

[1156] Available at https://www.gov.uk/government/publications/guidance-on-the-application-of-article-364-of-the-general-data-protection-regulation-gdpr/guidance-on-the-application-of-article-364-of-the-general-data-protection-regulation-gdpr.

switched on at the time of collision. This raises the question of whether retention is permitted under EU law. Our view is that our scheme is a legitimate public security measure for the purposes of Directive 2002/58/EC ("the ePrivacy Directive").

4.32 The ePrivacy Directive was enacted 18 years ago, to complement the Data Protection Directive,[1157] which has since been replaced by the GDPR. It may soon be replaced itself, as the EU Commission recognises that it has not "kept pace with technological developments, resulting in a void of protection of communications conveyed through new services".[1158] The EU Commission presented a proposed Regulation to replace the ePrivacy Directive on 10 January 2017[1159] which was adopted by the European Parliament on 26 October 2017. The intention was for the proposed Regulation to come into effect concurrently to the GDPR, but to date Member States have been unable to agree the text.

4.33 This section summarises the provisions of the ePrivacy Directive and considers their application to our proposed data retention scheme.

Summary of provisions

Scope

4.34 The ePrivacy Directive applies to "terminal equipment". Although this is undefined in the Directive, Article 3(1) of the ePrivacy Directive states that the Directive applies only to "publicly available electronic communications services in public communications networks".

4.35 Article 1 of Commission Directive 2008/63/EC defines "terminal equipment" as including "equipment directly or indirectly connected to the interface of a public telecommunications network to send, process or receive information." The ICO website states in relation to terminal equipment: "This refers to the device a cookie is placed on – typically a computer or mobile device, but also other equipment such as wearable technology, smart TVs, and connected devices including the 'Internet of Things'".[1160]

4.36 An ADS connected to the 4G system or other "public telecommunications network" to communicate with other road users and infrastructure is "terminal equipment" within the scope of the ePrivacy Directive, whether in whole or in relation to the part of the ADS actively involved in transmission.

Confidentiality obligation

4.37 Pursuant to Article 5(3) of the ePrivacy Directive, there are 3 bases for gaining access to information stored in the terminal equipment of a user:

1157 Directive 95/46/EC.

1158 The Explanatory Memorandum to the Proposed Regulation.

1159 Available at https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52017PC0010&from=EN (last visited 24 March 2020).

1160 ICO website.

(1) the user does not refuse, having been provided with clear and comprehensive information about the purposes of the processing;

(2) the access is for the sole purpose of transmission over an electronic network; or

(3) the access is strictly necessary in order to provide an information society service requested by the user.

4.38 User is defined as "any natural person using a publicly available electronic communications service".

Location data

4.39 Article 9(1) provides that location data of users of publicly available electronic communications services may only be processed when:

(1) it is anonymised; or

(2) users provide informed consent, "to the extent and for the duration necessary for the provision of a value added service". Such consent can be withdrawn at any time. The consent obligation is more stringent in this Article than in relation to the confidentiality obligation above.

Restriction

4.40 Article 15(1) of the Directive allows restriction by legislative measures where necessary and proportionate for a permitted purpose, including "to safeguard national security (ie State security), defence, public security, and the prevention, investigation, detection and prosecution of criminal offences or of unauthorised use of the electronic communication system".

4.41 The list of permitted purposes is exhaustive, and "strictly" interpreted, since "That provision cannot … permit the exception to that obligation of principle … to become the rule".[1161] Access to data must correspond "genuinely and strictly" to one of those purposes.[1162] Article 15 must be balanced with Article 7 (right to privacy) and Article 8 (right to protection of personal data) of the Charter;[1163] and the balancing exercise in the context of the criminal offence purpose has led the Court to hold that only *serious* crimes may justify restriction.[1164]

4.42 Case C-203/15 *Tele2 Sverige* was a challenge to an order by the Swedish Post and Telecom Authority requiring a telecommunications operator to retain traffic and location data in relation to its users. The CJEU noted that the measure involved "general and indiscriminate retention of all traffic and location data … with no exceptions" (para 97) and "makes it possible to trace and identify the source of a communication and its destination, to identify the date, time, duration and type of a communication, to identify users' communication equipment, and to establish the

1161 Case C-203/15 *Tele2 Sverige* at para 89.

1162 Case C-207/16 *Ministerio Fiscal* at para 52.

1163 Case C-203/15 *Tele2 Sverige* at para 93.

1164 Above, at para 102.

location of mobile communication equipment" (para 98). It held that this constituted a serious interference with fundamental rights, and could therefore only be justified by the objective of fighting *serious* crime (para 102). Since no specific serious crime was identified, and data retention was not restricted to a specific class of user or a specific geographical area, the measure was not strictly necessary in accordance with Article 15 (para 107).

4.43 The CJEU set out the requirements for legislation to accord with Article 15. The measure must:

(1) Involve the *targeted* retention of data for the purpose of fighting *serious* crime; provided the retention is limited to what is strictly necessary in relation to specific categories of data, means of communication, persons concerned and the retention period adopted (para 108).

(2) Set out clear and precise rules and impose safeguards to protect against the risk of misuse (para 109).

(3) Establish a connection between the data retained and the objective pursued (para 110).

(4) Be based on objective evidence as to what data may reveal a link with serious criminal offences, and set limits on the basis of that evidence; for example, geographical limits may be set where in certain geographical areas there is a high risk of certain serious offences (para 111).

Application to our proposed scheme

4.44 Under the Automated and Electric Vehicle Act 2018, insurers are strictly liable to compensate the victim if an automated vehicle causes and accident. This means that if they receive a claim from an alleged victim, they need to have access to data about whether the vehicle was present at the time and place the alleged injury took place.

4.45 Under our proposals, developers would be required to store, process and provide access to information generated by an ADS for a variety of reasons. In particular, data is needed to:

- deal with civil claims, so as to compensate victims;
- support criminal investigations by the police;
- support non-criminal investigations under our safety assurance scheme with the purpose of improving safety and setting appropriate regulatory sanctions; and
- provide base line information including about distance travelled and the operational design domain, to put incident data and other safety metrics collected in context.

4.46 Since our scheme involves retention of data irrespective of user consent, Articles 5 and 9 of the ePrivacy Directive will need to be restricted. While the CJEU has interpreted Article 15 strictly, we are of the view that the courts would take into account the different context of automated vehicles to allow restriction. The drafters of the ePrivacy Directive in 2002 could not have envisioned the possibility of automatic vehicles, or the data collection implications of this unprecedented technology. Thus far, CJEU case law has focused on the restriction purpose of criminal investigations, and the public security purpose has remained untested.

4.47 Automated vehicles have new and specific public security implications. Unlike in the *Tele2 Sverige* case, our scheme does not seek to catch out undefined offences unrelated to the terminal equipment itself, through indiscriminate data retention. Rather, we seek to collect data on the use of new technology in order to ensure the safety and proper investigation of that technology.

PROPOSED EPRIVACY REGULATION

4.48 The EU Commission presented a proposed Regulation to replace the ePrivacy Directive on 10 January 2017[1165] ("Proposed Regulation"), which was adopted by the European Parliament on 26 October 2017. The intention was for the Proposed Regulation to come into effect concurrently to the GDPR, but to date Member States have been unable to agree the text.

4.49 Even if the Proposed Regulation is agreed and replaces the ePrivacy Directive, our scheme will not be affected, since it will be capable of restriction on the same grounds as outlined above. The Explanatory Notes clarify that the proposal is not intended to substantially change EU data retention law; it "maintains the substance of Article 15 of the ePrivacy Directive and aligns it with specific wording of Article 23 of the GDPR".

4.50 As such, if our data scheme restricts EU obligations in compliance with Article 15 of the ePrivacy Directive, at first sight it will also comply with the Regulation when agreed, since the provisions for restriction of the obligations in the public interest are intended to be the same in substance.

4.51 The most recent version is that proposed by the Presidency of the Council of the EU on 13 April 2018.[1166] Similarly to the Directive, the Proposed Regulation guarantees the confidentiality of electronic communications data (Article 5), and permits processing pursuant to Article 6 only if necessary to achieve transmission of the communication, or necessary to maintain security or detect technical faults in the transmission of communications.

NATIONAL STANDARDS FOR TRIALS

4.52 Finally, as background to this discussion, we note that the BSI is developing standards for data collection in AVs used in UK road trials, in PAS 1882.[1167] A working

---

1165 Available at https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52017PC0010&from=EN).

1166 Available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_7820_2018_INIT&qid=1596017608001&from=EN.

1167 PAS 1882 Data collection and management for automated vehicle trials – Specification. Its scope "specifies requirements for the collection, storage and sharing of information during automated vehicle trials and advanced trials in the UK for the purpose of promoting best practice in incident investigation."

draft was out for public comment in July and August, received 168 comments and is being revised. It is due to be published on 13 January 2021.[1168]

4.53 In the working draft, it was suggested that data collection would be triggered by any injury, damage to property[1169] or a "near miss".[1170] Further, the trialling organisation would record all data "relevant to an investigation of an incident",[1171] including location data and video sensor communication.[1172] Data would be recorded at least one minute prior and following an event.[1173]

4.54 The working draft suggests trialling organisations could be required to prepare their own information management plans[1174] and specify the time period during which the data is retained.[1175] It further provides that data is to be shared with the police, emergency services, insurance companies, and stakeholders with a legal interest in information.[1176]

1168 See https://standardsdevelopment.bsigroup.com/projects/2019-03951#/section

1169 Para 3.4.

1170 Para 3.13. A near miss is defined as an incident which had the potential to result in injury or damage but for driver intervention.

1171 Para 5.2.3.

1172 Para 4.5.

1173 Para 4.4.1.

1174 Para 4.2.1.

1175 Para 5.1.7.

1176 Para 5.1.1.