



DIGITAL SYSTEMS
MOBILITY AND SYSTEMS



Steering the Future: An Overview of Current and Upcoming Regulations in Automated Driving

Version 1.0

Jenny Lundahl

RISE Report 2024:63

Steering the Future: An Overview of Current and Upcoming Regulations in Automated Driving

Version 1.0

Jenny Lundahl

DRIVE : SWEDEN

With support from

VINNOVA
Sweden's Innovation Agency

 **Swedish
Energy Agency**

FORMAS 

Strategic
innovation
programmes

Abstract

Steering the Future: An Overview of Current and Upcoming Regulations in Automated Driving

This report provides an overview of current and upcoming legal frameworks and instruments relevant for automated vehicles (AV) and automated driving (AD). It is the second version of this overview, which will be updated every six months as long as the project 'Network Automated Driving Regulations' runs. Next version of the overview can be expected in January 2025. In this version, legislation as of August 2024 has been considered.

Laws and regulations play a vital role in the safe and efficient integration of AVs into our transportation system. They can ensure that we maximise the benefits of the new technology while minimising the downside risks and help to build public trust in the technology.

Vehicles are sold on an international market and much of the traffic crosses national borders. Therefore, harmonised rules are needed, at least to some extent. Regulatory developments around AD are ongoing at international level and regional level within Europe, and this has already resulted in some new regulations. More will come within the next few years. Knowledge of international and EU regulations as well as ongoing and planned regulatory initiatives that affect the development and use of AVs is important for actors in the AV space to follow.

The shift towards AD is disruptive and complex, not least from a regulatory perspective. AVs need partly different requirements than previous vehicles, necessitating the development of new vehicle regulations and traffic rules. AVs must be able to interact safely with other road users (not least unprotected road users) in various traffic situations and driving conditions; anticipate and detect risks and drive with a margin of safety to prevent accidents and injuries; and follow traffic rules. (It is even likely that some traffic rules will have to be written differently than today.) 'Vehicle regulations' set requirements for how the vehicles should be designed and function, while 'traffic rules' set requirements for how road users should behave in traffic. In AD, it is the vehicle and not the driver that must follow traffic rules. This means that the AV must be designed to comply with traffic rules. This needs to be considered from a regulatory perspective. At the same time, users of AVs may need to have different traffic rules for how they should behave in relation to these vehicles. The legislator also needs to consider this.

Key words: automated driving, autonomous driving, automated vehicles, autonomous vehicles, regulatory development, regulatory landscape

RISE Research Institutes of Sweden AB

RISE Report 2024:63

ISBN: 978-91-89971-24-0

Gothenburg 2024

Contents

Abstract.....	3
Contents.....	4
Foreword	5
Terminology.....	6
1 Introduction.....	10
1.1 Background and purpose.....	10
1.2 Methodology	11
1.3 Scope and delimitations.....	11
1.4 Structure of the report	12
2 Automated driving and automation levels.....	13
3 Legal frameworks and instruments for automated vehicles and their use	16
3.1 Legislation affecting automated driving is international, regional and national	16
3.2 Who decides which rules in relation to vehicles and their use?	16
3.3 UNECE and its working groups WP.1 and WP.29.....	19
3.3.1 About UNECE.....	19
3.3.2 UNECE working groups relevant for automated driving.....	19
3.3.3 UNECE activities on automated driving	20
3.4 International conventions and agreements administered by UNECE	26
3.4.1 The 1949 and 1968 conventions on road traffic	26
3.4.2 The 1958 and 1998 agreements on technical vehicle regulations	27
3.5 EU regulations on vehicles and related topics.....	29
3.5.1 EU vehicle regulations.....	29
3.5.2 EU rules on machinery	31
3.5.3 EU rules for AI systems	33
3.5.4 EU driving license rules.....	37
4 National legislative initiatives for automated driving.....	39
4.1 Sweden.....	39
4.2 Germany	41
4.3 Finland.....	41
4.4 France	43
4.5 Norway.....	44
4.6 The United Kingdom	45

Foreword

Sweden has 17 strategic innovation programmes funded by the Swedish innovation agency Vinnova, Formas (a research council for sustainable development) and the Swedish Energy Agency. The overall task of the innovation programmes is to create conditions for sustainable solutions to global societal challenges and increased international competitiveness in their respective areas.¹ Drive Sweden² is one of these programmes. Drive Sweden comprises members from academia, industry and society and is hosted at Lindholmen Science Park. Together, the members work on challenges associated with the next generation of mobility systems for people and goods.

This report results from work done within the project 'Network Automated Driving Regulations'. It provides an overview of current and upcoming regulations relevant to automated vehicles and automated driving. This report is the second version of the overview. A new version can be expected in January 2025. The report versions are numbered 0.5 (initial), 1.0, 2.0, 3.0 (final), where higher numbers indicate more refined versions. In this version, legislation as of August 2024 has been considered.

The project brings together industry, authorities, and research at quarterly roundtables to enable dialogue and exchange experiences and knowledge that can help support companies to move forward in the AD arena in terms of technology development, testing, and implementation. Additionally, these roundtables provide valuable insights to authorities on how the industry reasons and interprets regulations, and allow authorities to provide input to industry and research. Outcome of the project can also support a smoother collaboration among actors both internationally and within Sweden. Furthermore, the project aims to: bring clarity to issues related to the interpretation of current and upcoming AD regulations; monitor new international and EU regulatory initiatives; proactively influence international and Swedish legislation; and prepare for infrastructure adaptation.

The project is funded by Vinnova (grant no. 2023-01169) through Drive Sweden and by the partners. It runs from June 2023 until May 2025 under the direction of RISE Research Institutes of Sweden AB (RISE). The following entities work in the project: Trafikverket, Transportstyrelsen, Aptiv AB, Applied Autonomy AS, Mobility Sweden, Scania AB, Volvo Cars AB, Einride AB, Keolis AB (participated until November 2023), Klimator AB, Kognic AB, Nobina AB, Statens väg- och transportforskningsinstitut (VTI), Asta Zero AB (from December 2023) and Västtrafik AB (from December 2023).

If you want to know more about the project or the report, please contact jenny.lundahl@ri.se.

The analysis and conclusions in the report reflect those of the author. This means that other parties or participants may have different views.

Gothenburg in October 2024

The author

¹ <https://www.vinnova.se/en/m/strategic-innovation-programmes/>.

² <https://www.drivesweden.net/en>.

Terminology

This section with the tables below describes the terminology (terms and definitions) used in the report. Terms described here may have different meanings in other contexts, and terms with particular meanings elsewhere, e.g. in laws, standards, etc., may not have that meaning here. Abbreviations are also indicated below.

Term	Definition
Automated driving	Refers to when an automated vehicle is driven by its automated driving system.
Automated driving system	<p>a) A vehicle system that uses both hardware and software to exercise dynamic control of a vehicle on a sustained basis. (Source: Amendment to Article 1 of 1968 Vienna Convention on Road Traffic)</p> <p>b) The hardware and software that are collectively capable of performing the entire DDT on a sustained basis, regardless of whether it is limited to a specific operational design domain (ODD); this term is used specifically to describe a Level 3, 4, or 5 driving automation system. (Source: The SAE J3016 standard, revised version 2021-04, [developed jointly between SAE International and ISO], equivalent to ISO/SAE DPAS 22736)</p>
Automated lane keeping system	A system which is activated by the driver and which keeps the vehicle within its lane for travelling speed of 130 km/h or less by controlling the lateral and longitudinal movements of the vehicle for extended periods without the need for further driver input. (Source: UNECE WP.29 UN Regulation No. 157)
Automated vehicle	A vehicle equipped with an automated driving system.
Highly automated vehicle	A vehicle equipped with an automated driving system. This automated driving system operates within a specific operational design domain for some or all of the journey, without the need for human intervention as a fall-back to ensure road safety. (Source: UNECE/WP.1 Resolution on the deployment of highly and fully automated vehicles in road traffic)
Fully automated vehicle	A vehicle equipped with an automated driving system. This automated driving system operates

	<p>without any operational design domain limitations for some or all of the journey, without the need for human intervention as a fall-back to ensure road safety.</p> <p>(Source: UNECE/WP.1 Resolution on the deployment of highly and fully automated vehicles in road traffic)</p>
Dynamic control	<p>This refers to carrying out all the real-time operational and tactical functions required to move the vehicle. This includes controlling the vehicle's lateral and longitudinal motion, monitoring the road, responding to events in the road traffic, and planning and signalling for manoeuvres.</p> <p>(Source: Amendment to Article 1 of 1968 Vienna Convention on Road Traffic)</p>
Dynamic driving task	<p>a) The control and execution of all longitudinal and lateral movements of the vehicle.</p> <p>(Source: UNECE/WP.29 UN Regulation No. 157)</p> <p>b) All of 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, and including, without limitation, the following subtasks:</p> <ol style="list-style-type: none"> 1. Lateral vehicle motion control via steering (operational). 2. Longitudinal vehicle motion control via acceleration and deceleration (operational). 3. Monitoring the driving environment via object and event detection, recognition, classification, and response preparation (operational and tactical). 4. Object and event response execution (operational and tactical). 5. Maneuver planning (tactical). 6. Enhancing conspicuity via lighting, sounding the horn, signaling, gesturing, etc. (tactical). <p>(Source: The SAE J3016 standard, revised version 2021-04, [developed jointly between SAE International and ISO], equivalent to ISO/SAE DPAS 22736)</p>
GNSS receiver (or GPS receiver etc.)	<p>A device capable of receiving signals from global satellite navigation systems (GNSS), i.e. satellite navigation systems with global coverage (GPS, GLONASS, BeiDou, Galileo, etc.). These systems use satellites to provide geopositioning information for various applications, including vehicles.</p>

Operational design domain	<p>a) The environmental, geographic, time-of-day, traffic, infrastructure, weather and other conditions under which an automated driving system is specifically designed to function. (Source: UNECE/WP.1 Resolution on the deployment of highly and fully automated vehicles in road traffic)</p> <p>b) [...] the automated lane keeping system defines the specific operating conditions (e.g. environmental, geographic, time-of-day, traffic, infrastructure, speed range, weather and other conditions) within the boundaries fixed by this regulation under which the automated lane keeping system is designed to operate without any intervention by the driver. (Source: UNECE/WP.29 UN Regulation No. 157, ALKS)</p> <p>c) Operating conditions under which a given driving automation system or feature thereof is specifically designed to function, including, but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics. (Source: SAE J3016 standard, revised version 2021-04, [developed jointly between SAE and ISO], equivalent to ISO/SAE DPAS 22736)</p>
Traffic rule	A legal rule that determines the behaviour of road users in traffic. A traffic rule originates from a traffic regulation or other legislation.
Transition demand	<p>a) An instruction from the automated driving system to the driver to take over dynamic control. (Source: UNECE/WP.1 resolution on safety considerations for activities other than driving undertaken by drivers when automated driving systems issuing transition demands exercise dynamic control)</p> <p>b) A logical and intuitive procedure to transfer the Dynamic Driving Task (DDT) from the system (automated control) to the human driver (manual control). This request is given from the system to the human driver. (Source: UNECE/WP.29 UN Regulation No. 157)</p>
Vehicle regulation	Vehicle regulations set (technical or functional) requirements for how a vehicle should be designed and function.

Abbreviations and acronyms	
AD	Automated driving / autonomous driving
ADAS	Advanced driver assistance system
ADS	Automated driving system
AI	Artificial intelligence
ALKS	Automated lane keeping system
AV	Automated vehicle / autonomous vehicle
DDT	Dynamic driving task
EC	European Commission
EU	European Union
GNSS	Global navigation satellite system
ISO	International Organization for Standardization
ODD	Operational design domain
OTA	Over-the-air software update
SAE	SAE International, previously Society of Automotive Engineers
UN	United Nations
UNECE	United Nations Economic Commission for Europe
WP.1	Global Forum for Road Traffic Safety (working group under UNECE)
WP.29	World Forum for Harmonization of Vehicle Regulations (working group under UNECE)

1 Introduction

1.1 Background and purpose

Automated driving (AD) has the potential to revolutionise our way of travelling and significantly improve traffic safety. At the same time, the new technology may bring new safety challenges to road traffic. It is important to address these challenges to ensure a safe and successful introduction of automated vehicles (AVs) into the transportation system.

Laws and regulations play a vital role in the safe and efficient integration of AVs into our transportation system. They can also help to build public trust in this new technology while ensuring that its deployment does not compromise on safety or efficiency.

AVs will only gain wide acceptance in society if safety is guaranteed. Therefore, safety is an important prerequisite for further promoting the development of AD technology and its use in traffic. Implementing AD in all traffic environments will require amendments to legislation, at least in many countries. It is important for actors in the AV space to be informed and involved in the regulatory work.

The change towards AD is disruptive and complex, not least from a regulatory perspective. AVs need partly different requirements than previous vehicles. It is thus necessary to develop new vehicle regulations and traffic rules. AVs must, among other things, be able to interact safely with other road users (not least unprotected road users) in different traffic situations and under different driving conditions; anticipate and detect risks and drive with a margin of safety to prevent accidents and injuries; and follow traffic rules. It is even likely that some traffic rules will have to be written in a different way than today.

Traffic rules are largely the same in different countries, as they are based on international conventions that Sweden and many other countries have ratified. Although many traffic rules will be the same for AD as for manual driving, some special rules may be required, e.g. rules on when a physical driver is required, but it may also be necessary to adapt certain rules that are currently aimed at physical drivers and road users in order to ensure road safety.

For example, in Article 7 of the Vienna Convention on Road Traffic it is stated that a driver, pedestrian and/or other road user must behave in a way that does not cause danger or obstruction in traffic and avoid all behaviour that can cause damage to persons or to public or private property. This is a basic provision that all road users must consider in order to avoid road accidents. In Sweden, we have introduced a rule of this kind in Chapter 2, Section 1 of the road traffic ordinance (trafikförordning [1998:1276]). The rule calls on the road user's common sense; he or she must have a moral and ethical sense of how he or she should behave. How do you program a computer to follow a rule that is so indefinite? It is not unlikely that more detailed traffic rules may be needed in the future.

Vehicles are sold on an international market and much of the traffic goes across national borders. Harmonised rules are therefore needed, at least to some extent. A development

of regulations at international level and EU level is ongoing and has already resulted in some new regulations. More will come within the next few years.

1.2 Methodology

In the project Network Automated Driving Regulations, representatives from industry actors, authorities, and research institutes meet at quarterly roundtables to discuss and exchange experiences about current and upcoming AD regulations and their implications. The purpose is, among other things, to gain a better understanding of current regulations and ongoing regulatory initiatives, how they affect the development and deployment of AVs, and the role of the regulations in ensuring the safety of these vehicles and acceptance from users and society at large.

When the actors gather around the table, knowledge transfer can take place between them, and we can also gain more knowledge together, for instance, about which regulations our society needs to integrate AVs safely into the transportation system. Such collaborations can contribute to the development of policy and regulations. For example, the outcome of these discussions can lead to suggestions for discussions at the UN or EU level, as well as suggestions to the Government Offices of Sweden, ensuring Swedish regulations are on par with international and EU regulations.

In parallel with the round table discussions, we continuously follow the development of UN/EU/SE regulations relevant for AVs and AD. This we do through contact with people who actively participate in the regulatory work as well as reading the relevant documents that come out of the work.

1.3 Scope and delimitations

It is not feasible to cover everything in this overview of current regulations and upcoming regulatory initiatives relevant for AD. The report is therefore subject to limitations.

In our project, the focus is mainly on UNECE and EU regulations, and the development of Swedish legislation. This report therefore describes the basis of who regulates what in terms of AVs and AD (UNECE/EU/national level), recent or ongoing regulatory initiatives in several areas that affect AVs and AD, e.g. rules on type-approval requirements, traffic rules, driving license rules, etc. The overview also includes information about the regulatory work in some European countries (limited to a few).

This report is the second version of the overview of AD regulations, which we will regularly release as part of the project. The overview will be updated approximately every six months throughout the project's duration. A new version can be expected in January 2025. The scope of the overview may differ to some extent between different versions.

1.4 Structure of the report

The rest of the report is structured as follows:

- Chapter 2 explains what AD is and the different automation levels.
- Chapter 3 describes current regulations and upcoming regulatory initiatives relevant to AVs and AD at the UN and EU levels.
- Chapter 4 briefly describes a few national legislative initiatives related to AD (Sweden, Norway, Finland, Germany, France, and the United Kingdom).

2 Automated driving and automation levels

This chapter describes what automated driving (AD) is, how automated vehicles (AVs) operate, automation levels, etc. This section of the report has been included to explain some basics but also to remind readers of the important distinction between AD and lower levels of automation, such as driving with advanced driver assistance system (ADAS). Although such systems assist the driver, they still constitute manual driving. (Terms and definitions can be found here: Terminology.)

In a traditional vehicle driven by a driver, it is the driver's task to adapt the driving to the surroundings, e.g. reducing speed in bad weather conditions with poor visibility. AVs, on the other hand, must be able to adapt their driving based on their surroundings. AVs are equipped with an automated driving system (ADS) that can independently control and drive the vehicle during all or part of the journey. AD is when the vehicle is driven by the ADS. To navigate safely on the roads, AVs (more precisely, the ADS) use different types of equipment such as GNSS receivers, sensors, cameras, radars, lidars, etc.

Although significant technological progress has taken place in the field of AVs, there are still many challenges to overcome before they can operate universally in all areas and weather conditions. Today, AVs are typically designed to operate within specific conditions, setting the limits of where they can be used in automated mode. The specific operating conditions can relate to e.g. location, time-of-day, traffic, infrastructure, speed range, weather and other conditions that can impact the driving situation. These specific operating conditions constitute the operational design domain (ODD) in which the ADS should be able to perform the entire dynamic driving task (DDT) on a sustained basis.

Since 2014, SAE International has, in its taxonomy SAE J3016, divided AD functions into six different automation levels from 0 to 5 (as shown in Figure 1 below).

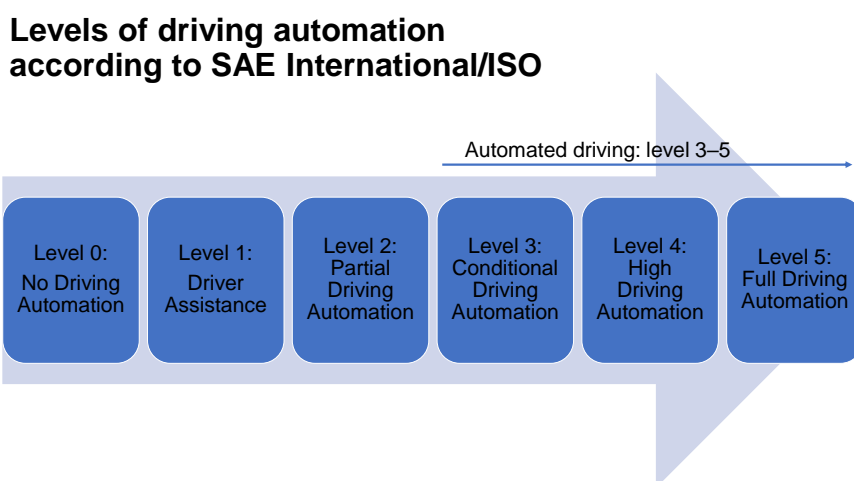


Figure 1: Levels of driving automation according to SAE International/ISO. The levels apply to the driving automation feature(s) that are engaged in any given instance of on-road operation of an equipped vehicle. As such, although a given vehicle may be equipped with a driving automation system that is capable of delivering multiple driving automation features that perform at different levels, the level of driving automation exhibited in any given instance is determined by the feature(s) that are engaged.

The purpose of the taxonomy is to provide a standardised taxonomy and functional definitions for the different levels of automation. It is not intended nor used for regulatory purposes. Updates to the taxonomy have been released approximately every two years. For the latest version³, released in 2021, SAE International worked together with the International Organization for Standardization (ISO) to revise the taxonomy. The SAE J3016 standard revised version 2021-04 is equivalent to ISO/SAE DPAS 22736 (this standard will be replaced by ISO/SAE AWI TS 22736, which is under development).

The taxonomy has, since 2014, been widely spread and increasingly accepted internationally. However, it has turned out to be difficult to define the exact boundaries between the automation levels and to define who should do what – the ADS vs. the human – at these different levels. Thus, even after several revisions of the taxonomy, there is still a lack of clarity. What makes it difficult to define this clearly enough today is that the technology is still under development, and we still have limited experience in using this new technology. As the technology continues to evolve and we learn more about its capabilities and limitations, it will probably be easier to define what to expect from the technology and to what extent different AD functions will rely on human input or actions. So, although the taxonomy can already be useful to facilitate understanding of vehicle automation and the possible role of the human in this context, it is not usually referred to directly in legislation, as is sometimes the case with international standards.

According to SAE J3016, AD starts at level 3. But at this level vehicles and drivers are still interdependent. The technology has the capacity to drive by its own, but the driver needs to take over in certain situations/journeys, when the ADS requests this. The ADS should be able to decide on its own when this is needed; the driver should not have to monitor this, just be receptive and available for a request to take control (so-called transition demand). At level 4, the ADS should be able to deal with more by itself, but even at this level the ADS needs some human input or actions in some cases. At level 5, the ADS should be able to independently handle every type of journey that a physical driver can handle (i.e. all different driving environments and traffic situations).

Level 2 is advanced driver assistance systems (ADAS), which assist the driver but are not built to handle driving on their own. A driver is needed to constantly monitor and correct the driving when necessary. From a user perspective, this technology can be difficult to distinguish from AD, as the experience may feel like the vehicle is driving by itself. This can lead to overconfidence in the technology, which can be very dangerous. There are discussions in some countries about how manufacturers should be allowed to market such vehicles to reduce the risk of consumers being misled about the technology's capabilities.

AD has often been defined as when the vehicle is driven by an ADS that performs the entire DDT on a sustained basis even if the ADS may need human assistance in some situations while operating within its ODD. For example, an ADS may be designed to issue a request to intervene to a human in charge when it encounters certain events or conditions. However, it should be mentioned that there is a recent discussion in some countries about not calling it AD if a human needs to be brought into the loop under any

³ SAE International (2021). Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles, available at: www.sae.org/standards/content/j3016_202104/.

time of the DDT within the ODD. In that case, the question is how to define AD instead and in which future we can expect to see AVs with that capability. There are experts who say that we will never, at least not in the foreseeable future, see AVs that do not under any circumstances need to bring a human into the loop. Only time will tell.

3 Legal frameworks and instruments for automated vehicles and their use

This chapter briefly summarises decision-making entities, working groups, legal frameworks, and regulations at the UN and EU levels relevant to AVs and their use.

3.1 Legislation affecting automated driving is international, regional and national

Rules about vehicles and their use are decided at different levels – global, regional (EU) and national:

- **Global level:** International conventions and agreements, UN regulations based on those legal instruments, and global policy documents such as UN resolutions or UN framework documents, covering type-approval requirements, traffic rules, etc.
- **EU level:** EU regulations and directives regarding e.g. type-approval requirements, driving license rules, product safety and product liability rules, traffic insurance rules, etc.
- **National level:** National vehicle regulations not covered by UN or EU regulations, national/local traffic rules, national driving license rules (based on international conventions and EU rules), national rules on product liability (based on EU rules), criminal liability, national rules on traffic insurance (based on EU rules), rules for trial operations with AVs, etc.

3.2 Who decides which rules in relation to vehicles and their use?

As mentioned in the previous section, rules about vehicles and their use are decided at different levels – global, regional (EU) and national levels.

The EU and the EU member states have shared authority in terms of regulation in the field of transport (Article 4.2 g of the Treaty on the Functioning of the European Union, 'TFEU'). (Note that changes to current EU regulations can only be made by the EU legislator.) In addition, the EU as well as individual EU countries are contracting parties to international agreements on vehicle regulations that UNECE administers. Individual EU countries (but not the EU itself) are also convention countries to the international road traffic conventions (with traffic rules) that are administered by the UNECE.

Vehicle regulations, which set technical requirements for vehicles and their equipment, are determined primarily at international level by the UNECE and at regional level by the EU. Both the UNECE and the EU have already adopted some vehicle regulations for AVs and their equipment. The EU is a contracting party to both the 1958 and 1998 agreements on technical vehicle regulations administered by the UNECE. The EU adopts the UN vehicle regulations annexed to the agreements. However, the EU can

decide on vehicle regulations not covered by the UN vehicle regulations. Individual EU countries can also decide on vehicle regulations not covered by either UN or EU vehicle regulations.

Most of our Swedish **traffic rules** originate from international conventions on road traffic: the 1949 Geneva Convention on Road Traffic and the 1968 Vienna Convention on Road Traffic. The EU is not a contracting party to these conventions. However, most EU countries are contracting parties to the conventions.

Driving license rules are essentially harmonised at EU level (and are in turn based on basic driving license rules in the Vienna convention). Thus, our Swedish legislation⁴ builds on EU directives. Find out more in section 3.5.4.

Product liability rules and product safety rules are mainly developed at EU level, e.g. Directive 2001/95/EC⁵ on general product safety and Directive 85/374/EEC⁶ concerning liability for defective products (which is currently undergoing revision and will likely be replaced by a new directive soon). Hence, our Swedish legislation⁷ builds on the EU directives in this area.

Criminal law traditionally belongs to the national level (but as in other areas of law, national criminal law can be subject to international influence and for certain phenomena there are international criminal law conventions). In Sweden, traffic crimes and traffic offences are mainly regulated by the Traffic Offenses Act⁸ and the Traffic Ordinance⁹. Certain provisions in the Criminal Code¹⁰ can also apply to traffic situations, such as causing the death of another person. In the Government Office's memorandum Ds 2021:28¹¹, the criminal law provisions are analysed in relation to automated driving, including the need for new criminal law provisions.

Rules on liability for traffic damage and traffic insurance: Our Swedish legislation on liability and compensation for damages resulting from motor vehicle traffic, as well as on compulsory traffic insurance, was issued in 1975¹². This legislation has since been adapted to EU directives. EU law in this area has gradually developed through several directives. Directive 2009/103/EC¹³ currently applies, which was

⁴ Körkortslag (1998:488) and körkortsförordning (1998:980).

⁵ Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety.

⁶ Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products.

⁷ Produktsäkerhetslag (2004:451) and produktansvarslag (1992:18).

⁸ Lag (1951:649) om straff för vissa trafikbrott.

⁹ Trafikförordning (1998:1276).

¹⁰ Brottsbalk (1962:700).

¹¹ Ministry of Rural Affairs and Infrastructure (Landsbygds- och infrastrukturdepartementet, previously Infrastrukturdepartementet) (2021). Ansvarsfrågan vid automatiserad körning samt nya regler i syfte att främja en ökad användning av geostaket, Ds 2021:28, available at:

www.regeringen.se/contentassets/5a3eda60c80b4b5e9d19fb56352259cc/ansvarsfragan-vid-automatiserad-korning-samt-nya-regler-i-syfte-att-framja-en-okad-anvandning-av-geostaket/.

¹² Trafikskadelag (1975:1410) and trafikförsäkringsförordning (1976:359).

¹³ Directive 2009/103/EC of the European Parliament and of the Council of 16 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability.

amended by the new directive (EU) 2021/2118¹⁴ on 24 November 2021.

The figures below provide an overview of the legal landscape for vehicles and their use with a division into different pieces of legislation at different levels (UN/EU/SE levels).

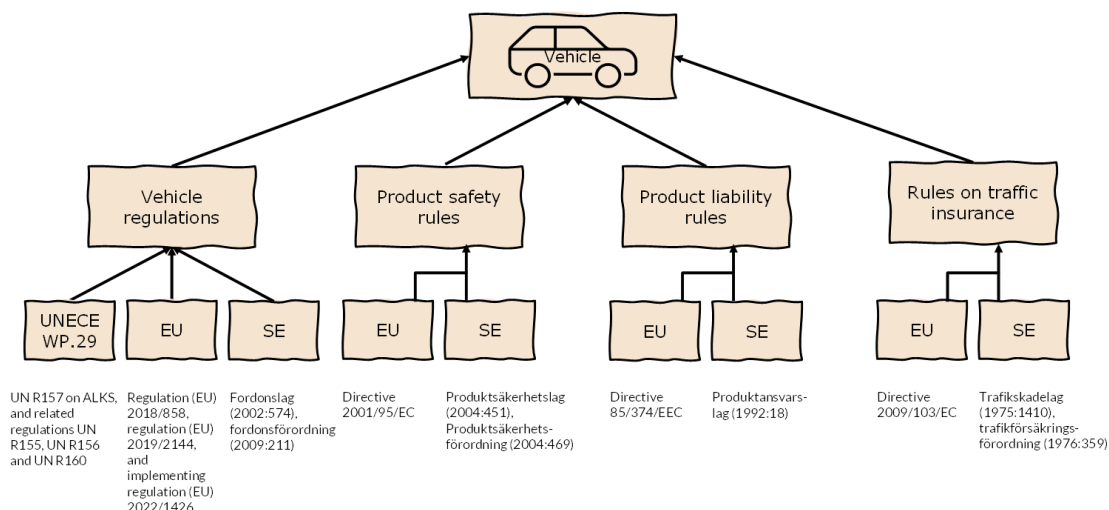


Figure 2 (above): The figure illustrates the legal and regulatory landscape for vehicles with a division into different pieces of legislation at different levels (UN/EU/SE levels). There are many alternative ways that could illustrate this. The illustration is also not exhaustive in terms of the various legislation that affects how vehicles must be designed and equipped. (See Figure 3 below for legislation governing the vehicle user and owner.)

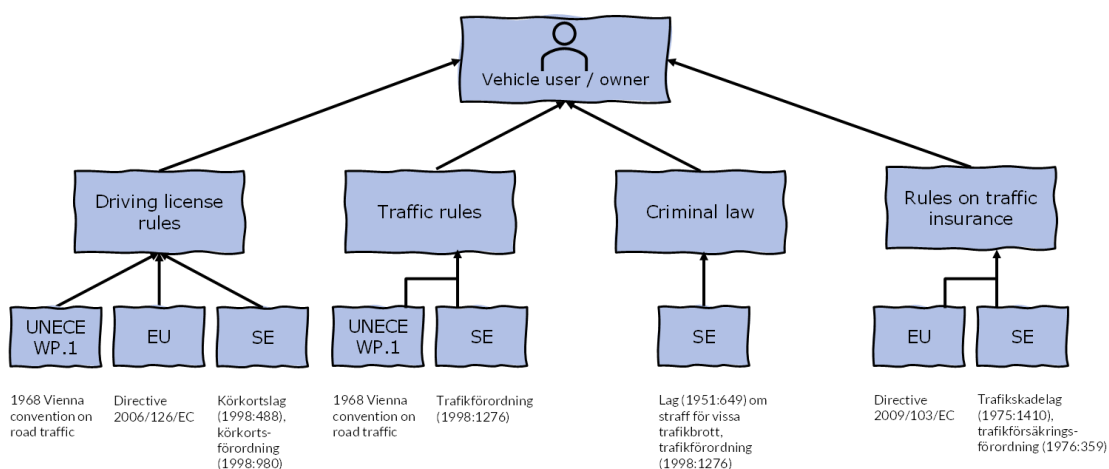


Figure 3 (above): This figure illustrates legislation that governs the user or the owner of a vehicle (e.g. traffic rules that govern the behaviour of road users in traffic, requirements for drivers, etc.) with a division into different pieces of legislation at different levels (UN/EU/SE levels). There are many alternative ways that could illustrate this. The illustration is also not exhaustive in terms of applicable legislation. (See Figure 2 above for legislation governing how vehicles must be designed and equipped.)

¹⁴ Directive (EU) 2021/2118 of the European Parliament and of the Council of 24 November 2021 amending Directive 2009/103/EC relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability.

3.3 UNECE and its working groups WP.1 and WP.29

3.3.1 About UNECE

At global level, the United Nations Economic Commission for Europe (UNECE) plays a crucial role in shaping the future of AD.

The UNECE was established in 1947 by the United Nations Economic and Social Council (ECOSOC). It is one of five regional commissions of the United Nations. UNECE's primary goal is to promote pan-European economic integration. It includes 56 member states in Europe, North America, and Asia, but all interested UN member states may participate in the work of UNECE. The UNECE facilitates greater economic integration and cooperation among its member countries and promotes sustainable development and economic prosperity through policy dialogue, negotiation of international legal instruments, development of regulations and norms, exchange and application of best practices, as well as economic and technical expertise.

3.3.2 UNECE working groups relevant for automated driving

In the UNECE, under the Inland Transport Committee (the UN platform for inland transport to efficiently address global and regional needs), there are several working groups, of which the most important for AD are:

- The Global Forum for Road Traffic Safety (WP.1)
- The World Forum for Harmonization of Vehicle Regulations (WP.29).

WP.1 is the working group for road safety that develops the traffic rules, while WP.29 is the working group that develops rules for vehicles and systems, so-called vehicle regulations. The development of vehicles and vehicle systems means that the rules must also develop over time.

Under these working groups there are dedicated subsidiary working groups or expert groups:

- Under WP.1:
 - Group of Experts on Road Signs and Signals
 - Group of Experts on drafting a new legal instrument on the use of automated vehicles in traffic
- Under WP.29:
 - GRE Lighting and Light-Signalling
 - GRVA Automated/Autonomous and Connected Vehicles
 - GRBP Noise and Tyres
 - GRPE Pollution and Energy
 - GRSG General Safety Provisions
 - GRSP Passive Safety

Working Party on Automated/Autonomous and Connected Vehicles (GRVA) is the main working party preparing draft regulations, guidance documents, and interpretation

documents for adoption by its parent body WP.29. GRVA deals with safety provisions related to the dynamics of vehicles (braking, steering), ADAS, ADS, and cyber security provisions. The group supervises around 8 informal work groups (IWGs) and task forces.

IWGs under GRVA work on specific aspects of AVs:

- IWG on Functional Requirements for Automated and Autonomous Vehicles (FRAV)
- IWG on Validation Methods for Automated Driving (VMAD)
- IWG on Event Data Recorder (EDR) / Data Storage Systems for Automated Driving (DSSAD)
- IWG on Advanced Emergency Braking Systems (AEBS)
- IWG on Automatically Commanded Steering Function (ACSF)
- IWG on International Whole Vehicle Type Approval (IWVTA)
- IWG on Database for Exchange of Type Approval documentation (DETA)
- IWG on Cyber Security and Over-The-Air Software Updates (CS/OTA).

Recently, a new IWG on ADS has been established to work on a regulation for ADS, i.e. the development of a UN Global Technical Regulation and a UN Regulation on ADS by June 2026.

3.3.3 UNECE activities on automated driving

UNECE's actions on vehicle automation include policy dialogue, negotiation of international legal instruments, development of regulations and norms, and exchange and application of best practices as well as economic and technical expertise. The sections below provide an overview of WP.1 and WP.29 activities relevant to AD. The information is compiled from meeting documents published on the UNECE's official website and supplementary information from Swedish participants involved in UNECE work. (A list for quick access to important documents related to UNECE activities on AD can be found on the UNECE website here: [Automated driving | UNECE.](#))

3.3.3.1 WP.1 activities

As already mentioned, WP.1 administers international conventions on road traffic that were drafted at a time when automated vehicles were not yet thought of. The Inland Transport Committee (ITC) of UNECE, at its annual meetings, has regularly highlighted the importance of WP.1 developing new institutional strategies on the issue of more advanced vehicle automation vis-à-vis the driver's role, and scaling up and accelerating legislative initiatives and other automated, connected and automated vehicle initiatives aimed at improving road safety; to enable the future safe coexistence of automated and traditionally driven vehicles on roads; and their interaction with other road users and infrastructure, environmental protection, energy efficiency and traffic management.

WP.1 adopted in 2018 a resolution on the introduction of highly or fully automated vehicles in road traffic (see section 3.3.3.3). In addition, WP.1 adopted in 2022 a resolution on safety considerations regarding non-driver activities when a vehicle is driven in an automated manner (see section 3.3.3.4). These resolutions complement the

Geneva and Vienna conventions and provide guidance for the convention countries on the safe introduction of such vehicles into traffic.

In 2021, WP.1 also adopted amendments to the Vienna convention to enable the use of ADS. Previously, Article 8 required a physical driver to control the vehicle, but with new definitions in Article 1 and the addition of Article 34 bis, the requirement for a physical driver can now be waived if the vehicle meets technical requirements and national traffic regulations. (Already in 2016, a new paragraph 5 bis was also introduced in Article 8 to enable the use, under certain conditions, of vehicle systems that influence the way vehicles are driven, such as driver assistance systems like ADAS.)

To strengthen global harmonisation, WP.1 has begun a work to develop a new ‘Legal instrument on the use of Automated Vehicles in traffic’ (LIAV), which is expected to complement the Geneva and Vienna conventions. The legal instrument should specifically aim to ensure road safety, in particular the safety of vulnerable road users. A Group of Experts (GoE on LIAV, LIAV GE or GE.3) has been established to propose a draft of the new legal instrument. One of their tasks is to identify traffic safety challenges related to the use of AVs, as the new legal instrument should address them. The expert group is also working on a line-by-line review of the existing international legal instruments on road traffic (the 1949 and 1968 conventions, and the 2018 and 2022 resolutions) to assess any gaps in these instruments. For instance, they are examining whether a provision is ambiguous when it applies to ADS, if it compromises road user safety when it applies to ADS, or if it prevents the use of ADS in international road traffic. Once in place, the new legal instrument will affect both international traffic (enabling) and countries’ national traffic regulations.

In addition, WP.1 is working on other topics in relation to AVs. One topic is safety considerations for the remote management of AVs which do not require a human driver inside the vehicle. Another topic is human factors (human behaviour, abilities, limitations) to be considered for the safe deployment of AVs.

Summary of WP.1 activities and outcomes relevant for AD:

- Amendments to the 1968 Vienna convention on road traffic in 2021.
- A resolution on the deployment of highly and fully automated vehicles in road traffic (non-binding guidelines) adopted in 2018.
- A resolution on safety considerations for activities other than driving undertaken by drivers when automated driving systems issuing transition demands exercise dynamic control (SAE level 3) adopted in 2022.
- Ongoing: drafting a new legal instrument for the safe use of AVs (with the aim to complement the Geneva and Vienna conventions).

3.3.3.2 WP.29 activities

WP.29 has adopted rules on uniform requirements for certain AD functions (Regulation No. 157 on ALKS), and for cyber security and software updates (Regulations No. 155 and 156). The harmonisation of technical provisions and/or guidance and resolutions for automated/autonomous vehicles is conducted within the contexts of both the 1958 agreement and 1998 agreement (find out more about these agreements in section 3.4.2).

GRVA under WP.29 is working on various topics related to AVs, such as functional requirements for AVs, validating ADS, a new assessment/test method, cyber security and OTA-issues, etc.

Within GRVA, a regulatory approach for ADS is being developed. The aim is to deliver a UN regulation for ADS to WP.29 by June 2026, as well as a UN global technical regulation for ADS with the same delivery date to WP.29. The informal document WP.29-191-30/Rev.1 outlines the regulatory approach for ADS. It summarises discussions and consensus among stakeholders, emphasising the need for regulation by 2026. Key points include the creation of a new organisational structure to work on ADS regulation. This involves developing the regulation text (purpose, scope, definition, general requirements, performance requirements, test procedures) by a common group (Informal Working Group on ADS – IWG on ADS) using existing documents as a basis. Additionally, workshops will be organised to ensure progress. A collaborative approach will be used involving all contracting parties (of both agreements). Through this coordinated, efficient, and inclusive process, they intend to meet the 2026 deadline.

Summary of WP.29 activities and outcomes relevant for AVs:

- WP.29 Framework Document on Automated Vehicles (FDAV) (there are also outcomes under FDAV, e.g. documents on functional requirements for AVs, a new assessment test method, etc.).
- UN regulations (rules on technical requirements):
 - UN Regulation No. 79 (on technologies supporting the driver regarding lane keeping and lane changes on motorways)
 - UN Regulation No. 155 (cyber security)
 - UN Regulation No. 156 (software updates)
 - UN Regulation No. 157 (Automated Lane Keeping Systems, ALKS)
 - UN Regulation No. 160 (Event Data Recorder, EDR).
- Ongoing:
 - EDR performance elements for AD and also a regulation on Data Storage System for Automated Driving (DSSAD)
 - Development of a UN Global Technical Regulation and a UN Regulation on ADS.
 - New Assessment/Test Method for Automated Driving.
 - Artificial Intelligence in the context of vehicles regulations.

Additionally, WP.29 is working on a UN Regulation on uniform provisions concerning the approval of vehicles with regard to Driver Control Assistance Systems (DCAS). DCAS are a subset of ADAS. These systems assist the human driver in performing vehicle dynamic control via sustained lateral and longitudinal motion-control support, but do not completely take over the dynamic driving task (DDT). DCAS only assist the driver but never replace the driver, thus the responsibility for control of the vehicle remains with the driver.

3.3.3.3 WP.1 Resolution on the deployment of highly and fully automated vehicles in road traffic

This WP.1 resolution, adopted in 2018, provides guidance on the deployment of highly and fully automated vehicles in road traffic. The resolution, which is non-binding, is intended to guide contracting parties to the Geneva and Vienna conventions on road traffic, with respect to the safe deployment of highly and fully automated vehicles in road traffic.

The resolution recognises the continuous progress of automotive and digital technologies, which could improve road safety, including through the deployment of highly and fully automated vehicles in road traffic. It also recognises the potential for innovative safety technologies to improve social well-being by preventing motor vehicle accidents.

The resolution provides complementary recommendations supporting the road safety principles of the conventions on road traffic to facilitate the safe, global deployment of highly and fully automated vehicles in road traffic. It takes into consideration the role of human beings in the context of these vehicles, and it offers recommendations at a global level to achieve a safe interaction between highly and fully automated vehicles and all road users. It is supposed to evolve as technology develops and as experience and evidence accumulate regarding the use of highly and fully automated vehicles in road traffic.

3.3.3.4 WP.1 Resolution on safety considerations for activities other than driving

This resolution on safety considerations regarding non-driver activities when a vehicle is driven in an automated manner was adopted by WP.1 in September 2022. It was submitted by several countries, including Canada, Finland, France, Germany, Japan, Luxembourg, Netherlands, Sweden, and the United Kingdom.

The resolution applies to vehicles equipped with automated driving systems that issue transition demands, expecting the human driver to intervene. The resolution does not explicitly mention the level of automation, but since it is applicable to systems where the human driver is expected to take over control when a transition demand is issued this typically means level 3 automation (as defined jointly by SAE International and ISO).

The resolution provides guidelines for drivers when automated driving systems are in control. It advises drivers to refrain from performing activities other than driving if those activities impede the take-over of dynamic control when a transition demand is issued. It also advises drivers to refrain from interfering with automated driving systems in a way that could compromise the safe functioning of the systems and road safety in general.

3.3.3.5 WP.29 Framework document for AVs

WP.29 adopted a (revised) Framework Document for Automated/Autonomous Vehicles (FDAV) in 2019. The document's primary purpose is to provide guidance to WP.29 and its subsidiary working parties (GRs) by identifying key principles for the safety and

security of AVs of levels 3 and higher. The document also defines the work priorities for WP.29 and indicates the deliverables, timelines and working arrangements for certain work products related to those priorities.

WP.29 recognises that AVs must be placed on the market in a way that reassures road users of their safety. WP.29 seeks to avoid poor performance of AVs by creating a framework to help deliver safe and secure AVs, and to promote collaboration and communication among those involved in their development and oversight.

The document defines a safety vision, key safety elements, and provides guidance to the working parties of WP.29 as well as a program of work priorities and activities. The level of safety to be ensured by AVs implies that ‘an automated/autonomous vehicle shall not cause any non-tolerable risk’, meaning that automated/autonomous vehicle systems, under their automated mode ([ODD/OD]), shall not cause any traffic accidents resulting in injury or death that are reasonably foreseeable and preventable. Based on this principle, the framework sets out a series of vehicle safety topics to be considered to ensure safety.

The framework establishes that the technical provisions for AVs shall be performance-based and technology neutral, based on the current state-of-the-art while avoiding restricting future innovation. They shall take into account existing standards/guidelines of the contracting parties and in standardisation bodies as well as previous work and reference documents agreed in the UNECE.

The document is supposed to be reviewed and updated once a year, if necessary. The basis document has been revised twice (in 2019 and 2020) and the table with the detailed work priorities has also been updated twice (in 2021 and 2023).

3.3.3.6 UN Regulation No. 157 on ALKS

The UN Regulation No. 157 on automated lane keeping systems (ALKS) was adopted in June 2020 (in force since January 2021) as the first international type-approval requirements for AD functions. It is a UN Regulation annexed to the 1958 agreement (explained above in section 3.4.2).

This regulation sets requirements for ALKS. Such AD functions correspond to SAE level 3 automation¹⁵, but the scope of this particular type-approval regulation is (currently) limited to certain road conditions: highway like roads, where pedestrians and cyclists are prohibited, and which, by design, are equipped with a physical separation that divides the traffic moving in opposite directions. Initially, the function was also only allowed to be used at speeds up to 60 km/h, but after an amendment to the regulation it now allows the function to be used at speeds up to 130 km/h. At first the regulation only applied to cars and vans, but it was later extended to heavy vehicles as well (trucks, buses, coaches). Previously it was not allowed to change lanes, but later an amendment was adopted so that lane changes will be allowed. In summary, this regulation has undergone several important changes since it was introduced. We can therefore expect more updates to come, as WP.29 is continuously working on the issue.

¹⁵ SAE level 3 ‘conditional driving automation’ is the step from assisted driving to automated driving. It is when the vehicle is capable of driving itself in certain scenarios, but a human driver must be ready to intervene as and when required.

ALKS allows the driver to hand over the DDT to the system (freeing him/her to do other things until alerted otherwise). Once activated, the ALKS is in primary control of the vehicle. However, the driver must be in a position to respond to a transition demand from the system. The driver should be able to take back control within a defined period of time if prompted to do so by the system. The regulation specifies how the DDT shall be safely handed back from the system to the driver, including the capability for the vehicle to come to a stop in case the driver does not respond appropriately.

On-board displays used by the driver for activities other than driving shall be automatically suspended as soon as the system issues a transition demand.

The regulation requires a driver availability recognition system, which control both the driver's presence and availability to take back control of the vehicle.

It also sets requirements for the use of a 'black box' (Data Storage System for Automated Driving, DSSAD) and the retrievability of data in the event of a crash.

It also sets requirements for cyber security and software updates in compliance with the UN regulations UN R155 and UN R156 (explained below).

3.3.3.7 UN Regulations No. 155 and 156 on cyber security and software updates

Simultaneously with the adoption of the new regulation on ALKS in June 2020, WP.29 adopted two other regulations: UN Regulations No. 155 and 156 which deal with cyber security requirements and software updates respectively.

The UNECE's press release in relation to the adoption of these regulations in 2020 stated that cars today contain up to 150 electronic control units and approximately 100 million lines of software code, which is expected to be 300 million lines of software code by the year 2030, and with this comes significant cyber security risks as hackers may attempt to get access to electronic systems and data, which poses a threat to both vehicle safety and consumer privacy. The UN regulations on cyber security and software updates will help to manage these risks. The regulations came into force in January 2021.

Within the EU, the UN regulation No. 155 is mandatory for all new vehicle types from July 2022 and mandatory for all new vehicles manufactured from July 2024.

UN Regulation No. 156 deals with software updates and software update management. This regulation covers requirements for vehicle and component software updates, but also for Software Update Management System (SUMS). The regulation ensures that software updates (with or without hardware changes/upgrades) can be performed at any point of time during the lifetime of the vehicles.

3.4 International conventions and agreements administered by UNECE

Technical requirements for vehicles and international traffic rules are agreed by member states of the UN in the framework of the UN conventions and agreements administered by the UNECE:

- The 1949 Geneva Convention on Road Traffic (admin by WP.1)
- The 1968 Vienna Convention on Road Traffic (admin by WP.1)
- The 1968 Convention on Road Signs and Signals (admin by WP.1)
- The 1958 and 1998 agreements on technical vehicle regulations (both admin by WP.29)
- The 1997 agreement on periodical technical inspection of vehicles (admin by WP.29)
- The 1957 agreement on transport of dangerous goods (admin by WP.15).

3.4.1 The 1949 and 1968 conventions on road traffic

The Vienna and Geneva conventions on road traffic contain basic rules for road traffic, drivers, vehicles, driving licenses and road signs and signals. The purpose is to facilitate international road traffic and increase traffic safety. A country that has acceded to the conventions undertakes to ensure that the national road traffic legislation complies in all essential respects with the rules of the conventions. Most of our Swedish traffic rules, driver's license rules, road signs and signals originate from these conventions. Sweden is a contracting party to both conventions.

The Geneva Convention on Road Traffic of 1949 was signed on 19 September 1949 and came into effect on 26 March 1952. The convention promotes the development and safety of international road traffic by establishing certain uniform rules among the contracting parties. It addresses minimum mechanical and safety equipment needed to be on board and defines an identification mark to identify the origin of the vehicle. It further emphasises that every contracting party should recognise the domestic driving permits issued by other contracting parties.

The Vienna Convention on Road Traffic of 1968 was signed in Vienna on 8 November 1968 and came into effect on 21 May 1977. It aims to facilitate international road traffic and increase road safety through the adoption of uniform traffic rules. It contains provisions on the rules of the road, the conditions for the admission of motor vehicles and trailers to international traffic, the drivers of motor vehicles in international traffic, and conditions for the admission of cycles and mopeds to international traffic. Between the signatory countries the Vienna convention replaces the previous Geneva convention (Article 48 of the Vienna convention). Most European countries have ratified the Vienna convention (but how the convention is interpreted in terms of AD differs between countries).

These conventions were drafted at a time when automated driving systems that could replace the driver's tasks were not yet envisaged. In 2016, amendments were made to the Vienna convention to allow ADAS. In 2021, further amendments were made to enable

AD. The amendment means that an ADS can drive a vehicle instead of a human. Previously, the convention stated that ‘Every driver shall at all times be able to control his vehicle’.

The EU itself is not as a contracting party to these conventions, but most EU countries are contracting parties.

It should also be mentioned that there are legal instruments on road signs and signals. To the 1949 Geneva Convention on Road Traffic there is a Protocol on Road Signs and Signals of 19 September 1949. The 1968 Vienna Convention on Road Traffic addresses the topic of road signs and signals to some extent, but there is also a specific convention dedicated to this topic – the Convention on Road Signs and Signals, which was also signed in Vienna on 8 November 1968, and entered into force on 6 June 1978. This convention is about standardising the signing system for road traffic (road signs, traffic lights, and road markings) in use internationally. The convention revised and substantially extended the earlier Protocol on Road Signs and Signals. It recognises that international uniformity of road signs, signals, symbols, and road markings is necessary in order to facilitate international road traffic and to increase road safety.

Over the years there have also been several European agreements that supplement the conventions.

3.4.2 The 1958 and 1998 agreements on technical vehicle regulations

There are essentially two different systems for vehicle approval before vehicles are placed on the market: type-approval and self-certification. These different systems/regimes govern the vehicle approval processes. The UNECE administers two international agreements that regulate these systems: the 1958 agreement¹⁶, which regulates the type-approval system, and the 1998 agreement¹⁷, which regulates the self-certification regime.

Type-approval vs. self-certification:

- Type-approval: The type-approval system is used for instance in EU countries. The type-approval authority evaluates the vehicle and certifies that it is safe. (The remaining risk level for the assessed vehicle is considered acceptable for its entry into service. Still, the manufacturer’s responsibility for the overall vehicle safety remains throughout the vehicle’s service life.) A type-approval proves that a vehicle (or component, system or device) type meets the applicable technical requirements. When a type-approval is obtained the automaker can bring out the new model.
- Self-certification: The self-certification regime is used in e.g. the United States. The vehicle manufacturer certifies that the vehicle is safe (self-certification). (This basically means that it is the automaker who decides if the vehicle is safe,

¹⁶ UN 1958 Agreement concerning the Adoption of Uniform Technical Prescriptions 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 Prescriptions.

¹⁷ UN 1998 Agreement concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles.

i.e. that it meets the vehicle standards.) The role of the authorities is to act when it does not work, through sanctions or claims for damages, etc.

The 1958 agreement and annexed UN(ECE) regulations:

- This is an agreement concerning the adoption of uniform technical prescriptions 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 prescriptions.
- This enables governments (the contracting parties) to grant and accept type-approvals issued in accordance with UN regulations.
- There are 167 UN regulations adopted so far.
- 57 contracting parties, e.g. the EU, Sweden, France, Germany, the United Kingdom and Japan (not the United States and Canada).

The 1998 agreement and global technical regulations:

- This is an agreement concerning establishing of global technical regulations (GTRs) for wheeled vehicles, equipment, and parts which can be fitted and/or be used on wheeled vehicles.
- GTRs provide a way to establish test procedures and performance requirements for use outside of type-approval systems, e.g. under self-certification regimes.
- There are 23 GTRs adopted so far.
- 36 contracting parties, e.g. the EU, Sweden, France, Germany, United Kingdom, Japan, the United States and Canada.

In Sweden, there are regulations on the approval of vehicles (type-approval and individual approval) in the Vehicle Act (fordonslagen 2002:574) and the associated ordinance (fordonsförordningen 2009:211). The Swedish Transport Agency (Transportstyrelsen) is the authority responsible for approval of vehicles in Sweden. The Swedish Transport Agency is authorised to issue and, where appropriate, revoke certificates of approval.

A type-approval can be in accordance with EU legislation (EU type-approval), in accordance with UN(ECE)-regulations (ECE type-approval) or as national type-approval. A type-approval can thus be international or national. An ECE type-approval is only for parts of a vehicle and not for the whole vehicle. Each part has its own regulations and must be adopted by the convention country in order to apply nationally. There are currently more than 160 UN regulations. The EU and Sweden have not adopted all these UN regulations. EU type-approval can refer to parts or to a whole vehicle. However, some parts in the EU type-approved vehicle may be ECE type-approved. EU member states recognise a type-approval granted by another member state. Thus, a vehicle that is EU type-approved in one EU country can be sold in all EU countries.

The UNECE (WP.29) has already developed some vehicle regulations in relation to automated and connected vehicles (see sections 3.3.3.6 and 3.3.3.7). Work is also ongoing to develop and deliver a UN Regulation for ADS as well as a UN GTR for ADS by 2026.

3.5 EU regulations on vehicles and related topics

3.5.1 EU vehicle regulations

EU type-approvals are to an increasing extent regulated by EU regulations instead of EU directives in order for the application of the rules to be as direct and harmonised as possible between EU countries.¹⁸

On 4 July 2018, a new framework regulation entered into force within the EU regarding the approval and market control of vehicles – Regulation (EU) 2018/858¹⁹. It applies from September 2020 and replaces the previous framework directive 2007/46.

On 5 January 2020, a new regulation – Regulation (EU) 2019/2144²⁰ – came into force. This is the so-called General Safety Regulation (GSR) which amends Regulation (EU) 2018/858 and updates the EU type-approval requirements with the aim to ensure the general safety of vehicles and the protection of vulnerable road users. The GSR thus sets minimum safety standards for motor vehicles and their trailers in the EU. It applies to new vehicle types from 6 July 2022, and to all new vehicles from 7 July 2024. It sets requirements for some advanced vehicle systems (e.g. intelligent speed assistance, driver drowsiness and attention warning, event data recorder, etc.) that must be present in all motor vehicle categories and also specific requirements relating to certain motor vehicle categories. The GSR also contains rules for type-approval of AVs in the EU. However, it is currently limited to small series of a maximum of 1,500 vehicles per model and year. The GSR mandates the EC to adopt more detailed rules for the type-approval of AVs.

Uniform procedures and technical specifications for the type-approval of the ADS of fully automated vehicles in the EU was adopted by the EC on 5 August 2022 in the implementing regulation (EU) 2022/1426 on type-approval of ADS of fully automated

¹⁸ EU directives and EU regulations are both types of legislation used by the EU, but they work in different ways. EU regulations become directly applicable in the same way at the same time in all EU countries, while EU directives must be implemented in national law in each country and the countries usually have some flexibility in how they implement the rules if they achieve the intended outcome. An EU regulation thus is a binding legislative act that must be applied in its entirety across the EU and each member state must ensure their domestic laws do not conflict with the regulation. However, certain national regulations that supplement the EU regulation are sometimes needed, for example to designate which authority should have a certain task.

¹⁹ 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.

²⁰ Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council and Commission Regulations (EC) No 631/2009, (EU) No 406/2010, (EU) No 672/2010, (EU) No 1003/2010, (EU) No 1005/2010, (EU) No 1008/2010, (EU) No 1009/2010, (EU) No 19/2011, (EU) No 109/2011, (EU) No 458/2011, (EU) No 65/2012, (EU) No 130/2012, (EU) No 347/2012, (EU) No 351/2012, (EU) No 1230/2012 and (EU) 2015/166.

vehicles²¹. As explained in the preamble of the regulation, the approval of ADS of AVs (not fully automated) should not be covered by the implementing regulation, as it is intended to cover them with a reference to UN regulation No. 157 on ALKS).

The EU definitions of automated and fully automated vehicles can be found in Articles 3.21–22 of the GSR:

- A ‘fully automated vehicle’ means a motor vehicle that has been designed and constructed to move autonomously without any driver supervision.
- An ‘automated vehicle’ means a motor vehicle 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.

Subject to the provisions of Regulation (EU) 2018/858 and any relevant EU legislation, the implementing regulation is without prejudice to the right of EU member states to regulate the circulation and the safety of operation of fully automated vehicles in traffic and the safety of operation of those vehicles in local transport services. This is explained in the preamble.

The scope of the type-approval in accordance with the implementation regulation is to be reviewed regularly to add use cases as needed (stated in the preamble). The scope is currently limited to the following use cases:

- a) Fully automated vehicles (incl. dual mode vehicles) designed and constructed for the carriage of passengers or carriage of goods on a predefined area.
- b) ‘Hub to hub’: fully AVs (incl. dual mode vehicles) designed and constructed for the carriage of passengers or carriage of goods on a predefined route with fixed start and end points of a journey/trip.
- c) ‘Automated valet parking’: dual mode vehicles with a fully automated driving mode for parking applications within predefined parking facilities.

For the whole-vehicle type-approval of fully automated vehicles, the type-approval of their ADS under the implementing regulation should be complemented with the requirements set out in Annex II, Part I, Appendix 1 of Regulation (EU) 2018/858. The current EC type-approval for AVs does not cover all motor vehicle categories. Put simplistically, it covers cars and trucks but not buses.²²

²¹ Commission implementing regulation (EU) 2022/1426 of 5 August 2022 laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type-approval of the automated driving system (ADS) of fully automated vehicles.

²² Vehicles can be categorised in different ways for different purposes. For example, vehicles are divided into different categories for type-approval purposes. In EU type-approval, the main categories of vehicles are category M (vehicles carrying passengers), category N (vehicles carrying goods), category L (2- and 3-wheel vehicles and quadricycles), category T (agricultural and forestry tractors and their trailers), and category O (consists of trailers). In this classification, a passenger car belongs to category M1, and a bus belongs to category M2 or M3, depending on the weight. Vehicles can also be divided into different categories for driving license purposes. In Sweden, for example, the categories range from AM (for mopeds) to DE, each with specific age requirements and entitlements. For example, a passenger car falls under category B, and a heavy bus falls under category D. So vehicles can be categorised for different regulatory purposes and the categories may not directly correspond to each other.

In the preamble to regulation 2022/1426, it is stated that the EC shall work to further develop and adopt requirements for the EU whole vehicle type-approval of fully automated vehicles produced in unlimited series by July 2024. However, this has not yet been accomplished. Currently, there are no type-approved vehicles under the existing regulations for fully automated vehicles in small series. Consequently, the rules have not been evaluated. The EC is also questioning the necessity for new rules for unlimited series when there are still no vehicles type-approved in small series. However, the EC has an ambition to release updated rules regarding Automated Valet Parking (or Automated Parking System) for passenger cars in unlimited series.

Also, a guidance document²³ for the interpretation of the current type-approval rules has been released. It provides support for interpretation and guidance on the requirements and is intended for both manufacturers and technical services/approval authorities.

3.5.2 EU rules on machinery

A motor vehicle is basically a machine. It is equipped with several parts, an engine, and a control unit. Yet, the term ‘machinery’ encompasses a wider spectrum. While all motor vehicles can be considered machines, not all machines are vehicles. For example, a washing machine is a machine but not a vehicle.

In terms of regulation, a distinction is made between vehicles and machines. The Machinery Directive²⁴ does not apply to motor vehicles and their trailers covered by type-approval, with the exception of machinery fitted to those vehicles. However, the application of the regulations can depend on the specific use case and location of the product. This will be explained in more detail below.

Vehicle regulations generally apply to motor vehicles and their trailers intended to be driven on public roads. The regulations set requirements for the safety and environmental performance of such road vehicles. The relevant regulations for AVs have been described in previous sections of this report.

The Machinery Directive is an EU directive concerning machinery and certain parts of machinery. The directive aims at harmonising the health and safety requirements to guarantee a high level of protection for EU workers and citizens, while ensuring the free circulation of machinery on the EU market. The directive applies to machinery products that are placed on the market for the first time.

A ‘machine’ is a composite unit that has at least one moving part and is powered by one or more energy sources. A machine can have a motor with its own energy source, for example energy from a battery; be connected to one or more external energy sources such as electricity or compressed air; use mechanical energy that comes from other equipment; be powered by natural energy sources such as wind or hydropower. A machine is not a composite unit operated by direct power from a human or animal and

²³ Ciuffo, B., Dona, R., Galassi, M.C., Giannotti, W., Sollima, C., Terzuoli, F. and Vass, S. (2024). Interpretation of EU Regulation 2022/1426 on the Type Approval of Automated Driving Systems, Publications Office of the European Union, Luxembourg, 2024, JRC136417, doi:10.2760/86028.

²⁴ Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC.

which ceases to function as soon as the power ceases, such as hand-operated lawnmowers, hand-operated drills, or hand-drawn carts.²⁵

Means of transport are, in general, excluded from the scope of the Machinery Directive, but machinery mounted on means of transport are subject to the Machinery Directive (Art. 1.2). Examples of machinery mounted on means of transport include, for example, loader cranes, tail lifts, tipper bodies, vehicle or trailer-mounted compressors, vehicle-mounted compaction systems, vehicle-mounted concrete mixers, skip loaders, powered winches, tippers, telescopic lifting arms and vehicle-mounted mobile elevating work platforms. Where such machinery is mounted on motor vehicles, trailers or tractors that are excluded from the scope of the Machinery Directive, the requirements of the Machinery Directive do not apply to the vehicle, trailer, or tractor itself. However, the requirements of the Machinery Directive apply both to the mounted machinery and to all aspects of the interface between the machinery and the chassis on which it is mounted which may affect the safe travel and operation of the machinery. Machinery mounted on means of transport is therefore distinguished from self-propelled mobile machinery such as, for example, self-propelled construction machinery or self-propelled agricultural machinery, which is subject to the Machinery Directive in its entirety.²⁶

If a truck has a lift to help load and unload heavy items, the type-approval regulations would apply to the truck as a whole, ensuring that the vehicle meets all relevant safety and environmental requirements, but the Machinery Directive would apply to the lift, ensuring that it meets essential health and safety requirements.

However, the application of the regulations (the vehicle regulations vs. the Machinery Directive) can depend on specific circumstances – the specific use case and location of the vehicle/machine.

It has been discussed that it would be easier to start the market introduction of AVs in enclosed areas than on the roads, since there are fewer rules that the vehicle needs to consider, and the environment is less complex. Traffic legislation in Sweden distinguishes between road/off-road and enclosed/non-enclosed areas (roads). Within an enclosed area, many traffic rules do not apply that would otherwise apply out on the road. There is also a difference concerning who shall determine whether a vehicle is safe to use. For vehicles to be used on the road, it is the Swedish Transport Agency, as the type-approval authority, that decides whether a vehicle is safe to use. This also applies to AD since the Swedish Transport Agency can grant permission for trial operations with AVs. Within enclosed areas, there is no authority that grants approval for the use of a vehicle/machine, rather, it is the manufacturer/employer who determines whether the vehicle/machine meets the safety requirements and ensures this. This can be accomplished by means of CE marking in accordance with the rules for machinery. The employer also has an obligation to ensure that the work environment is safe for the employees, which is supervised by the Swedish Work Environment Authority (Arbetsmiljöverket). Within enclosed areas there is therefore no authority that grants permission for the use of an AV, but the onus is on the manufacturer/employer to decide

²⁵ The Swedish Work Environment Authority's website, www.av.se/produktion-industri-och-logistik/maskiner-och-arbetsutrustning/maskiner/# (accessed on 2023-12-28).

²⁶ European Commission (2019). Guide to application of the Machinery Directive 2006/42/EC, Edition 2.2 – October 2019.

if it is safe to use. However, in the event of a workplace accident, the Swedish Work Environment Authority will investigate the accident.

Researchers have described a case where a bus on a regular basis is driven in both manual mode on public roads and in autonomous mode within an enclosed area (a bus depot). The bus would be type-approved for manual traffic with a driver (SAE levels 0-2), but not approved for automated road operation (SAE levels 4-5). During the span of a single day, the bus will therefore alternate between the regulations for enclosed (fenced depot) and non-enclosed (road) areas, between being automated and not automated. The bus was previously a legal 'static whole' but will now be tested based on two regulations, depending on its environment and level of autonomy at any given time. This is a completely new situation: that a bus is 'dynamically divisible' from a regulatory perspective, which has significance in terms of who shall decide whether the vehicle is safe to use in a certain environment. The conclusion of the researchers was that, in order to be considered safe in automated mode within the depot, the bus should be self-certified by means of CE marking according to the Machinery Directive.²⁷

Recently, the EU decided on a new Machinery Regulation, Regulation (EU) 2023/1230²⁸, after a several-year process to revise the Machinery Directive. The new regulation contains product requirements for machinery and related products and is aimed at manufacturers, distributors, and importers. The regulation harmonises the essential health and safety requirements for machinery in the EU, promotes the free movement of machinery, and ensures a high level of safety for workers and citizens. The regulation applies to means of transport by road that are not yet covered by a specific Union legal act (except in respect of risks that might arise from circulation on public roads). This means that vehicles that are not subject to EU type-approval under Regulation (EU) 167/2013, Regulation (EU) 168/2013 or approval under Regulation (EU) 2018/858 are covered by the Machinery Regulation.

The new regulation aims to better fit with the technological advances made in the last decade and is intended to give a new boost to the machinery sector. For instance, it considers artificial intelligence by setting requirements for machines that have fully or partially self-developing behaviour and that use machine learning methods. The manufacturer must engage a third party (notified body) who assesses whether such machines comply with the requirements. However, it is the manufacturer who ensures that a machine maintains its safety throughout its lifetime. Furthermore, requirements are placed on cyber security in machines. Also, the requirements for autonomous and remotely controlled mobile machines are clearer than before.

3.5.3 EU rules for AI systems

Artificial intelligence (AI) is a significant enabler for AD, aiding in various aspects, from data collection and analysis to decision-making and efficiency improvement. Many complex tasks that AVs handle to achieve high levels of automation can be addressed by using AI. Without AI, the vehicle's ADS must be pre-programmed to handle specific

²⁷ Andersson, K., Burden, H., and Stenberg, S. (2021). Self-certification of Autonomous Buses, RISE Report 2021:19.

²⁸ Regulation (EU) 2023/1230 of the European Parliament and of the Council of 14 June 2023 on machinery and repealing Directive 2006/42/EC of the European Parliament and of the Council and Council Directive 73/361/EEC.

situations. The problem is that many different situations can arise in road traffic. The ADS may be programmed to handle 100,000 situations, but if situation 100,001 occurs, the ADS cannot resolve the problem. Moreover, AI can potentially help AVs predict the behaviour of other road users, including unforeseeable actions, such as detecting potential collision opponents. Such predictive capabilities would allow AVs to take preemptive actions to avoid collisions and enhance overall road safety.

Within Europe, the EU is now regulating through hard law some of the principles of AI. The AI Act, Regulation EU 2024/1689²⁹, creates a legal framework for AI in the EU. This new law decides what an AI system is and what requirements it must meet before it can be placed on the market in Europe.

The AI Act defines what counts as an AI system and which risk category it belongs to with accompanying requirements. The aim is to promote a European development and use of AI that respects the EU values and rules on fundamental rights.

The AI Act was proposed by the European Commission³⁰ in April 2021 and agreed by the European Parliament and the Council in December 2023. It was formally adopted by Parliament in its March 2024 plenary session (with a corrigendum issued in April 2024) and the Council endorsed the final text in May 2024. It entered into force on 1 August 2024 (20 days after its publication in the EU's Official Journal). The application of the AI Act will be staged over two years, starting with the phasing out of the prohibited systems within six months. The Act requires the European Commission (EC) to issue implementing and delegated acts and guidelines.

The AI Act assigns applications of AI to different risk categories, with different degrees of regulation applying. Risk is defined as “the combination of the probability of an occurrence of harm and the severity of that harm”. AI systems that create an unacceptable risk are banned. These include manipulative AI, social scoring systems, biometric identification systems (limited exemptions for law enforcement purposes may apply under strict conditions) and emotion recognition in workplace and educational institutions (other than for medical or safety reasons). High-risk applications (applications that can have a detrimental impact on people's health, safety or on their fundamental rights)³¹ are subject to specific requirements, including implementation of

²⁹ Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act).

³⁰ Proposal for a Regulation laying down harmonised rules on AI (AI Act) (COM(2021) 206 final).

³¹ Together with a definition of ‘high-risk’, the AI Act sets out a methodology to help identifying high-risk AI systems. The risk classification is based on the intended purpose of the AI system, in line with the existing EU product safety legislation. This means that the classification of the risk depends on the function performed by the AI system and on the specific purpose and modalities for which the system is used. Annexed to the act is also list of use cases which are considered to be high-risk, which the Commission will update over time. One example on this list, which might be relevant for our project, is critical infrastructure in the field of road traffic. Systems on the high-risk list, that perform narrow procedural tasks, improve the result of previous human activities, do not influence human decisions or do purely preparatory tasks are not considered high-risk. However, an AI system shall always be considered high-risk if it performs profiling of natural persons.

appropriate technical and organisational measures, human oversight, exercise of control, monitoring, keeping automatically generated logs and assessing impact on fundamental rights. European harmonised standards will be developed for the high-risk requirements. Applications not explicitly banned or listed as high-risk are largely left unregulated. AI systems posing limited risks because of their lack of transparency will be subject to information and transparency requirements.

Under the AI Act, general purpose AI (GPAI) models are regulated separately from AI systems. GPAI models are also classified depending on their risk.

The AI Act imposes obligations throughout the entire value chain – from providers, importers and distributors to deployers of AI solutions within the EU, as well as persons adversely impacted by the use of an AI system placed on the market or put into service in the EU. A deployer is “any natural or legal person, public authority, agency or other body using an AI system under its authority except where the AI system is used in the course of a personal non-professional activity”.

Before placing a high-risk AI system on the EU market or otherwise putting it into service, providers must subject it to a conformity assessment and demonstrate that their system complies with the mandatory requirements for trustworthy AI (e.g. data quality, documentation and traceability, transparency, human oversight, accuracy, cybersecurity and robustness). The assessment must be repeated if the system or its purpose are substantially modified. Providers of high-risk AI systems will also have to implement quality and risk management systems to ensure their compliance with the new requirements and minimise risks for users and affected persons, even after a product is placed on the market.

Under the AI Act, the EC will establish the European AI Office to develop EU expertise and capabilities in the field of AI. The AI Act also establishes a European Artificial Intelligence Board (EAIB) composed of one representative per member state. The European Data Protection Supervisor (EDPS) will participate as observer and the AI Office will also attend without taking part in the votes. The EAIB will advise and assist the EC and the EU member states to facilitate the consistent and effective application of the AI Act. Moreover, the AI Act establishes an advisory forum to advise and provide technical expertise to the EAIB and the EC to contribute to their tasks under the AI Act. The membership of the advisory forum shall represent a balanced selection of stakeholders, including industry, start-ups, SMEs, civil society, and academia. The EC will also establish a scientific panel of independent experts to support the enforcement activities under the AI Act. Each EU member state must establish or designate at least one notifying authority and one market surveillance authority. In addition, the EC will set up an EU database for certain high-risk AI systems.

The AI Act is a horizontal legal framework, which means that its requirements should apply across all sectors. However, the horizontal nature of the Act requires full consistency with existing EU legislation applicable to sectors where high-risk AI systems are already used or likely to be used in the near future.

As regards high-risk AI systems which are safety components of products, the rules will be integrated into the existing sectoral safety legislation to ensure consistency, avoid duplications, and minimise additional burdens. As regards high-risk AI systems related to products covered by the New Legislative Framework (NLF) legislation (e.g. machinery,

medical devices, toys), the requirements for AI systems set out in the Act will be checked as part of the existing conformity assessment procedures under the relevant NLF legislation. The applicability of the requirements of the AI Act should thus not affect the specific logic, methodology or general structure of conformity assessment under the relevant specific NLF legislation. This approach is reflected in the interplay between the AI Act and the new Machinery Regulation (see section 3.5.2). While safety risks of AI systems ensuring safety functions in machinery are addressed by the requirements of the AI Act, certain specific requirements in the Machinery Regulation will ensure the safe integration of the AI system into the overall machinery, so as not to compromise the safety of the machinery as a whole.

As regards high-risk AI systems related to products covered by relevant Old Approach Legislation (e.g. aviation, cars), the AI Act will not directly apply. However, the ex-ante essential requirements for high-risk AI systems set out in the regulation will have to be considered when adopting relevant implementing or delegated legislation under those acts. This means that even if the AI Act does not directly cover AVs and their AI systems, despite its cross-sectoral approach, several of the requirements will likely also apply to AVs by being integrated into regulations for the type-approval of motor vehicles in the future. So, while motor vehicles are initially exempt from the AI Act, some of its requirements will still apply to them via other regulations.

The AI Act enshrines in EU law a definition of AI systems that is aligned with the work of international organisations working on AI, notably the revised definition agreed by the Organisation for Economic Co-operation and Development (OECD).³²

Under the AI Act, an AI system means “a machine-based system designed to operate with varying levels of autonomy, that may exhibit adaptiveness after deployment and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments”. This definition decides if a system is within the scope of the AI Act. The definition is not intended to cover simpler traditional software systems or programming approaches, and the EC has been tasked to develop guidelines on its application.

The AI Act applies primarily to providers and deployers putting AI systems into service or placing on the EU market and who have their place of establishment or who are located in the EU, as well as to deployers or providers of AI systems that are established in a third country, when the output produced by their systems is used in the EU.

³² In 2018, the OECD member countries started working on a definition of AI. Several years later they managed to agree on one. However, instead of defining “AI”, they chose to focus on “AI system”, since it is a more tangible and actionable concept, particularly in the context of policy making. In 2023, OECD member countries approved a revised version of the organisation’s definition of AI system: “An AI system is a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment”. Find out more on their website: <https://oecd.ai/en/wonk/ai-system-definition-update>.

The AI Act asks EU member states to set up regulatory sandboxes and allows testing high-risk AI systems in real-world to facilitate the development, training, testing and validation of innovative AI systems.

In addition to the AI Act, the EC has also proposed a directive, the AI Liability Directive³³, to establish uniform rules for certain aspects of non-contractual civil liability for damage caused with the involvement of AI systems. The proposal aims to address the specific difficulties of proof linked with AI to ensure that justified claims are not hindered. It creates a rebuttable presumption of causality, easing the burden of proof for victims to establish damage caused by an AI system. So, while the AI Act focuses on the prevention of harm caused by AI (i.e. ensuring that AI is developed safely), the AI Liability Directive focuses on providing redress following harm caused by AI. In parallel, the EC has also proposed³⁴ to revise the existing product liability directive (Directive 85/374/EEC)³⁵ that covers producer's no-fault liability for defective products.³⁶

3.5.4 EU driving license rules

Our Swedish driving license rules are largely based on EU's driving license directive(s). The EU's driving license rules have been progressively introduced through three directives in 1980, 1991, and 2006. The EU rules are in turn based on the provisions on driving licenses in the 1968 Vienna Convention on Road Traffic.

Among other things, the current EU directive from 2006³⁷ regulates different requirements for different driving licence categories, i.e. which driving licenses are required for a driver to drive certain motorised vehicles.

³³ Proposal for a Directive of the European Parliament and of the Council on adapting non-contractual civil liability rules to artificial intelligence (AI Liability Directive) (COM(2022) 496 final).

³⁴ Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on liability for defective products, COM(2022) 495 final.

³⁵ Council Directive 85/374/EEC on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products.

³⁶ EU product safety legislation aims to ensure that only safe products are placed on the EU internal market, by setting essential safety requirements. However, this type of legislation contains no specific provisions on liability and refers to the application of the product liability directive when a defective product causes damage. The two proposals – the new AI Liability Directive and the revision of the existing Product Liability Directive – aim to adapt liability rules to new digital technologies, including AI. The proposed revised Product Liability Directive will modernize existing harmonized non-fault-based liability regimes for manufacturers of defective products (also software and software updates, whether embedded or standalone, including AI systems), while the proposed AI Liability Directive will ensure broader protection for damage caused by AI systems by easing the burden of proof in claims brought under national fault-based liability regimes. It is not intended that there should be any overlap between claims brought under these.) Find out more in: De Luca, S. (2023). New Product Liability Directive. EPRS | European Parliamentary Research Service, available at: [www.europarl.europa.eu/RegData/etudes/BRIE/2023/739341/EPRS_BRI\(2023\)739341_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2023/739341/EPRS_BRI(2023)739341_EN.pdf).

³⁷ Directive 2006/126/EC of the European Parliament and of the Council of 20 December 2006 on driving licences.

In March 2023, the EC published a proposal³⁸ for a revised driver’s license directive which will replace the current directive from 2006. The revised directive contains new test rules that will prepare future drivers for, among other things, AD. The rules establish requirements in terms of knowledge, skills, and behaviour. According to the proposed requirements, drivers of all power driven vehicles must have sufficient knowledge on the usage of both ADAS and other automation aspects of a vehicle.

However, there is nothing in the proposal that suggests a physical driver will no longer be required for a motorised vehicle, even when it is driven in an automated manner. Therefore, it appears that the current requirement for every motor vehicle to have a driver will remain within the EU. Based on reasoning in the Swedish investigations SOU 2018:16³⁹ and Ds 2021:28⁴⁰, it is thus not possible to regulate in national legislation that the physical driver can be completely removed in relation to an AV. This is not to say that the driver of an AV could not have a different role, with different tasks and responsibilities, and be called something other than “driver”, and be somewhere other than inside the vehicle.

³⁸ Proposal for a Directive of the European Parliament and of the Council on driving licences, amending Directive (EU) 2022/2561 of the European Parliament and of the Council, Regulation (EU) 2018/1724 of the European Parliament and of the Council and repealing Directive 2006/126/EC of the European Parliament and of the Council and Commission Regulation (EU) No 383/2012 (COM(2023) 127 final).

³⁹ Utredningen om självkörande fordon på väg (2018). Vägen till självkörande fordon – introduktion, SOU 2018:16.

⁴⁰ Ministry of Rural Affairs and Infrastructure (Landsbygds- och infrastrukturdepartementet, previously Infrastrukturdepartementet) (2021). Ansvarsfrågan vid automatiserad körning samt nya regler i syfte att främja en ökad användning av geostaket, Ds 2021:28, available at www.regeringen.se/contentassets/5a3eda60c80b4b5e9d19fb56352259cc/ansvarsfragan-vid-automatiserad-korning-samt-nya-regler-i-syfte-att-framja-en-okad-anvandning-av-geostaket/.

4 National legislative initiatives for automated driving

Around the world, many countries are currently reviewing and adapting their national legislation to prepare for the introduction of AVs on public roads. This chapter provides some examples of such national legislative initiatives.

4.1 Sweden

In Sweden, legislation on trial operations with AVs was introduced in 2017. A permit from the Swedish Transport Agency (Transportstyrelsen) is required to conduct trial operations with AVs. A basic condition for obtaining a permit is that the applicant can prove that the trial operation will be conducted in a traffic-safe manner. This is done by showing that all safety risks associated with the test have been considered. The AD functions must be described and shown to be safe for those inside of the vehicle as well as those in the surroundings. To show that risks and control strategies have been analysed and set at a minimum level, a safety plan, a system and trial definition, and a risk analysis must be submitted. Trial operations with AVs is regulated in the Regulation on experimental activities with automated vehicles (förordning [2017:309] om försöksverksamhet med automatiserade fordon). In the Swedish Transport Agency's regulations and general advice on permission to conduct trials with automated vehicles (TSFS 2021:4, last amended by TSFS 2022:82) there are further provisions.

Going beyond tests, Sweden has, like many other countries, begun to rewrite the legislation for a wider adaptation of AD. In 2015, the Swedish government decided to appoint an inquiry to develop a legal framework to enable AD on Swedish roads. In 2016, the inquiry proposed legislation for test operations (see the report SOU 2016:28⁴¹). This legislation was introduced in 2017, as already mentioned. Later, in 2018, the inquiry also proposed legislation for the deployment of AD (up to level 5 automation) (see the report SOU 2018:16⁴²). After a referral process of the inquiry's proposal, the government decided to investigate the liability issues further, instead of submitting the proposal to the Parliament. The Government Offices then presented a slightly adjusted proposal in 2021 (see the report Ds 2021:28⁴³). This report was also sent out for consideration to relevant bodies.

⁴¹ Utredningen om självkörande fordon på väg (2016). Vägen till självkörande fordon – försöksverksamhet, SOU 2016:28.

⁴² Utredningen om självkörande fordon på väg (2018). Vägen till självkörande fordon – introduktion, SOU 2018:16.

⁴³ Ministry of Rural Affairs and Infrastructure (Landsbygds- och infrastrukturdepartementet, previously Infrastrukturdepartementet) (2021). Ansvarsfrågan vid automatiserad körning samt nya regler i syfte att främja en ökad användning av geostaket, Ds 2021:28, available at: www.regeringen.se/contentassets/5a3eda60c80b4b5e9d19fb56352259cc/ansvarsfragan-vid-automatiserad-korning-samt-nya-regler-i-syfte-att-framja-en-okad-anvandning-av-geostaket/.

About the proposal (from 2021):

- The proposed liability regime is quite similar to the liability regimes adopted in for instance Germany, France and the United Kingdom.
- In the proposal, a new driver role – ‘förare i beredskap’ (‘driver in readiness’⁴⁴) – is introduced. This is a new driver role with fewer but other tasks. According to the proposal, the driver in readiness should not be responsible for how the ADS performs the DDT, but he/she must take control if the ADS so requests. Failure to do so may result in criminal liability. The driver in readiness is defined as the person who activates the ADS or takes over the task for a vehicle where the ADS is already active. The task remains a responsibility until the ADS is deactivated or the task is taken over by another person. The driver in readiness may engage in activities other than monitoring the driving, if the activity does not prevent him or her from responding to a request from the ADS to take control. In conditional AD (level 3 automation as defined by SAE), it is not permitted to use a hand-held mobile phone (this does not apply to higher levels of automation – levels 4 and 5 as defined by SAE). The driver in readiness remains responsible for tasks that an ADS cannot (yet) perform, including ensuring that children have the correct safety equipment, that the vehicle is properly loaded, and that certain measures are taken after an accident.
- The owner of the vehicle should be responsible for traffic insurance of the vehicle and also for ensuring that traffic rules are complied with during AD. In the event of traffic offenses, a penalty fee is charged by the owner, unless the offense is due to error/malfunction of the ADS beyond the owner’s control. According to the motivation of the proposal, it was not reasonable to place the responsibility on the owner if the error that caused the AV not to follow the traffic rules was due to how the ADS was programmed by the manufacturer. However, ‘beyond the owner’s control’ excludes cases due to, for example, the owner failing to update the software of the ADS or manipulating it.
- Manufacturers, system developers, etc. are responsible for the vehicles being safe (vehicle safety and product safety) and have a financial responsibility for damages that result from a safety defect (in accordance with e.g. product liability, contractual law, etc.). Manufacturers are also responsible for the storing of certain data about the AD.

In October 2023, the Government Offices of Sweden sent out a new proposal on the AD topic, the memorandum ‘Promemoria Automatiserad körning’⁴⁵, for consideration by relevant bodies. In the report, new rules were proposed with the aim of clarifying that AVs that are type-approved according to Regulation (EU) 2022/1426 (see section 3.5.1) may only be driven where it is specifically permitted and that road authorities, i.e.

⁴⁴ Note that ‘driver in readiness’ is not an official translation of the term ‘förare i beredskap’ in the proposal. There is no official translation of the proposed term förare i beredskap.

⁴⁵ Ministry of Rural Affairs and Infrastructure (Landsbyggs- och infrastrukturdepartementet) (2021). Promemoria Automatiserad körning, available at: www.regeringen.se/contentassets/2d3a5c067d9f470f8dc190ab9cc1449a/promemoria-automatiserad-korning.pdf.

Trafikverket (the Swedish Transport Administration) and municipalities, should be mandated to regulate such places. The new rules were proposed to enter into force on 1 July 2024. (This has so far not happened.) What should happen to previous proposals, e.g. the proposed liability regime in either SOU 2018:16 or Ds 2021:28, was not mentioned in this new report. Instead, the report suggested that the current traffic and liability rules should remain. (That is not to say that the legislator would never come back to this question in the future.) During the referral process, the proposal encountered significant criticism from several relevant bodies. In particular, these bodies remarked that today's traffic and liability rules, which were not proposed to be changed in the report, assume a human driver. However, with AD, it is a system (the ADS) that drives the vehicle, which calls for new liability rules. There were also other issues in the proposal that they considered needed clarification or adjustments.

We are currently unaware of the Government Offices' plans regarding the progression of this matter. However, the Minister for Infrastructure and Housing invited the Swedish Transport Agency, the Swedish Transport Administration, organisations from the vehicle industry, as well as Drive Sweden and Strategic Vehicle Research and Innovation (FFI), to a roundtable discussion on 28 August 2024 to discuss the status of the development of AD technology and to provide their perspectives on the necessary actions going forward.

4.2 Germany

Germany was early in adapting its legislation to prepare for AD. Already in 2017, amendments were made to establish what rights and obligations a driver has when using AD functions. Provided that such functions meet certain requirements, a driver should be able to trust these functions, and when such functions are in operation, the driver may engage in other things than monitoring the driving. However, the driver is still obliged to take control when the ADS demands it, or when he/she realises, or should realise, due to obvious circumstances, that the ADS can no longer be used.

In 2021, new rules were also introduced to enable AD at level 4 in defined operating areas on public roads. This allows companies to deploy robotaxis and driverless delivery services on public roads. A technical supervisor ('Technische Aufsicht') is necessary. This is a natural person who can deactivate the ADS and enable driving manoeuvres from outside the vehicle. The defined operating area must be approved by the competent state authority. The manufacturer must submit a certification that the vehicle complies with the technical requirements. The German Federal Motor Transport Authority will check whether the vehicle meets the technical requirements. When the rules were introduced, there were no harmonised vehicle regulation covering level 4 automation, which is why Germany set its own technical requirements that would serve as an interim solution in the meantime.

4.3 Finland

Finland has recently released a memorandum outlining necessary amendments to legislation for the deployment of AVs in traffic for public consultations. The memorandum contains the main lines for intended proposals, not any drafts for possible

paragraphs. Everything is still open, so the proposals may change at a later stage. The deadline for responses was on 17 May 2024. The next steps are to continue the preparations using the input from the public consultations. The aim is to deliver a government proposal for AD legislation to the Parliament during autumn 2025.

The memorandum includes proposals for new rules on the use of AVs (type-approved vehicles with ADS). The objective is to enable the widespread use of AVs on public roads in Finland and ensure a high level of road safety. The current situation in Finland is that a type-approved vehicle with an ADS may be used on public roads provided that there is a driver responsible for the driving. The proposal ensures that the regulation of vehicle technology and the regulation of the use of the vehicle in traffic will be compatible.

The proposal suggests that sanctions should be directed at the organisation behind the ADS, not the driver. For every AV, there must be a legal entity responsible (the same approach as in the UK). AVs will have to be registered as self-driving for the new (proposed) rules to apply. In the registration, it shall be noted which company is responsible. AVs that are not registered may only be used with a driver responsible for the driving.

The proposal distinguishes between AVs where there is still a person on board who can carry out the driver's duties if necessary and AVs that are remotely operated, provided that certain requirements are met. For AVs with a responsible person on board, a new driver role is proposed – driver-in-readiness. This person shall not be responsible for the driving but must be ready to take over control if the ADS requests it and be responsible for tasks other than driving, e.g. securing the load. (This proposed role and responsibilities are similar to the Swedish proposal DS 2021:28⁴⁶ and also to the UK approach regarding the user-in-charge role.) If there is no person on board who can act as a driver, certain functions are required such as general supervision of vehicle operation (including location information), general supervision of the vehicle interior, necessary assistance in case of faults and emergencies, and possibility of two-way communication between passengers and the remote operator. The remote operation centre must be located in Finland. The service provider must be authorised by the authorities to operate.

The proposal also addresses remote driving (not AD) by suggesting what should be required in relation to such driving.

The current legislation concerning testing of AVs in Finland has been in force since March 2023. Testing requires authorisation from the Transport and Communications Agency (Traficom), as well as specific test plates. There are possibilities to derogate from some requirements concerning the equipment and the structure of the vehicle for individual automated vehicles used for public transport on specific routes or areas and with maximum speed of 30 km/h. This also requires permission from Traficom.

⁴⁶ Ministry of Rural Affairs and Infrastructure (Landsbygds- och infrastrukturdepartementet, previously Infrastrukturdepartementet) (2021). Ansvarsfrågan vid automatiserad körning samt nya regler i syfte att främja en ökad användning av geostaket, Ds 2021:28, available at: www.regeringen.se/contentassets/5a3eda60c80b4b5e9d19fb56352259cc/ansvarsfragan-vid-automatiserad-korning-samt-nya-regler-i-syfte-att-framja-en-okad-anvandning-av-geostaket/.

4.4 France

France allows trial operations with AVs but has also adopted legislation for deployment of AVs.

The French trial operation authorisation process involves an application to the Ministry of Ecological Transition (Direction Générale de l'Energie et du Climat, DGEC), a questionnaire with about 90 questions summarising the main issues of the test.

In 2021, France introduced legislation to allow for more permanent operations of AVs on public roads. It sets definitions and general safety provisions for these systems, as well as requirements for the driver or the person in charge of remote intervention. It covers automation levels up to fully automated systems, provided the supervision of a person in charge of remote intervention and deployed on predefined paths/zones. Remote intervention is allowed for highly or fully automated vehicles, not for partially automated vehicles, and only upon system validation, safety demonstration and after an opinion of an approved notified body.

The provisions differ depending on the automation level:

- Partially automated vehicles: An on-board driver must be able to respond to a transition demand, respond to law enforcement orders and facilitate the passage of priority vehicles. Remote intervention is not allowed.
- Highly automated vehicles: The on-board driver must be able to respond to any request to take over, respond to law enforcement orders and facilitate the passage of priority vehicles. Remote intervention is allowed only if the system is validated by the service organiser, after safety demonstration and opinion of an approved qualified body. A remote operator can intervene in accordance with the system's conditions of use.
- Fully automated vehicles: On-board driver is not applicable. Remote intervention is allowed on the same terms as for highly automated vehicles.

The obligations of various actors and the liability regime are as follows:

- Driver: The rules discharge the driver of his/her criminal liability when the ADS operates in accordance with its conditions of use. When the ADS is active it performs the DDT. However, the driver must be ready to respond to a transition demand, follow summonses and instructions from law enforcement forces, facilitate the passage of vehicles of general interest and give way to priority vehicles of general interest.
- Vehicle manufacturer/agent: When the ADS is active, the vehicle manufacturer or its agent may be criminally liable for life-threatening infractions and may also bear the pecuniary liability for traffic fines in most cases.

According to information we have received, France is now working to update its legislation with the plan to have it ready in the fall of 2024.

4.5 Norway

The Norwegian Public Roads Administration (Statens vegvesen) (NPRA) has recently proposed a national strategy for AD⁴⁷. The proposed strategy has been sent to the Ministry of Transport (Samferdselsdepartementet), but we have no information as to whether it has been taken forward in any way.

In addition, Norway is in the process of making a legislative change to incorporate both the EU's type-approval rules on ADS as well as UN Regulation 157 on ALKS into national legislation. The NPRA believes that areas and routes for AD should not be defined in advance, as this will depend on the manufacturer's description of the ODD. NPRA recognises that new/changed legislation is needed to define new driver tasks and responsibilities, but they intend to solve this later.

The legislation on testing AVs (*Lov om utprøving av selvkjørende kjøretøy* and *Forskrift om utprøving av selvkjørende motorvogn*) provides the basis for the regulation of testing AD technology in Norway. Key points of the legislation and processes include:

- Anyone who wants to test an AV must send an application to NPRA. It is free of charge to apply. A decision can usually be expected within one month. Decisions can be appealed within three weeks.
- It is a criminal offense to carry out AD testing without a permit. A permit is required regardless of whether the testing takes place on or off the road (for instance, in a closed or private area), and regardless of who owns the test area. The use of ADS in EU type-approved motor vehicles that satisfy UN Regulation No. 157 or EU regulation 2022/1426 also requires a permit.
- Certain terms may be set in the permit for reasons such as traffic safety, accessibility for other road users, environmental impact, data security and privacy consequences.
- If the conditions for the test change, NPRA must be informed. Permits can be revoked or temporarily withdrawn if the road traffic conditions change, e.g. due to roadworks or other circumstances, or in the event of a breach of the terms of the permit.
- Testing is possible without a driver in the traditional driver's seat and also completely without a driver.
- The starting point is that all normal provisions in current regulations apply during testing, unless specific exemptions have been granted. The testing legislation authorises exemptions from provisions in the Road Traffic Act (vegtrafikkloven) or the Commercial Transport Act (yrkestransportloven), if deemed appropriate and necessary to carry out the test.
- Relevant police districts, road authorities, road owners, sign authorities, and the owners of any railway infrastructure must be given the opportunity to leave comments before permission is given for testing. This is particularly to shed light on matters of importance for traffic safety and accessibility, for example, whether special traffic regulations are necessary in connection with the test.

⁴⁷ Statens vegvesen (2024). Forslag til nasjonal strategi for automatisert vegtransport, available at: www.vegvesen.no/globalassets/fag/trafikk/its-portalen/forslag-til-nasjonal-strategi-for-automatisert-veittransport.pdf.

- Even if the applicant gets permission for testing, the road owner is not required to implement the traffic regulations that may be proposed in the application. It must be clarified with the relevant authorities and carried out in accordance with the current regulations for signage and traffic regulation. It is therefore appropriate that relevant bodies are informed and given the opportunity to comment before the application for testing is sent to NPRA. If there are significant changes in traffic regulations from what is stated in the application, the applicant must send supplementary information about this to NPRA before testing is initiated.
- The holder of the permit must take all measures necessary to prevent the vehicle from causing damage to life, health, the environment, or property, as well as carry out the test in accordance with current regulations and in accordance with the permit. If an accident or a potentially serious incident occurs, the holder of the permit must immediately investigate the accident and send the investigation to NPRA. NPRA is the supervisory authority and may carry out inspections and request access to documents and materials.
- After the test has been completed, the permit holder must submit a report on the test to NPRA (including a version of the report that can be made public). The purpose of the reporting is to increase the knowledge of both applicants and authorities about the effects of AD in traffic. It can also inform possible needs for infrastructure provision, urban planning, and planning of the transport system. There are recommendations on what the report should contain.

4.6 The United Kingdom

The United Kingdom (UK) has recently decided on new legislation for AVs. This comes after the UK government has been working to regulate AVs for several years to ensure their safe deployment on public roads in the UK. The extensive and thorough work, done in collaboration with industry and other stakeholders, helped bring the bill into law with the strongest cross-party support. The Automated Vehicles Act⁴⁸ became law on 20 May 2024. It provides a comprehensive legal framework for the deployment of AVs. It regulates the use of AVs on roads and in other public places and introduces other provisions related to vehicle automation. By setting clear safety and regulatory standards, the law aims to build public trust and acceptance of AV technology. The new law means that AVs can be rolled out on UK roads by 2026.

The Act is based on extensive policy development and analysis, including a 4-year review of regulation for AVs carried out by the Law Commissions of England and Wales in 2018–2021. It also builds on previous legislation (the Automated and Electric Vehicles Act 2018) which introduced definitions of AVs and their insurance liability. (Note that the UK uses the terms ‘automated vehicles’ and ‘self-driving’ in its legislation.)

A set of national safety principles will be established, detailing the safety expectations for AVs, to ensure that they achieve a level of safety equivalent to or higher than human-driven vehicles.

⁴⁸ Automated Vehicles Act 2024, www.legislation.gov.uk/ukpga/2024/10/contents.

The new act delivers a comprehensive legal framework which sets out who is liable for AVs. It identifies new legal entities responsible for the safety of ADS and creates a new legal status for a driver who has handed control of a vehicle to an ADS. It assures that drivers, while their vehicle is in AD mode, will not be held responsible for how the vehicle drives. Instead, corporations such as insurance providers, software developers and automotive manufacturers assumes this responsibility. The vehicle approval system will be supported by a completely independent incident investigation function. This is to promote the same culture of learning and continuous improvement as in the aviation industry. Companies will have ongoing obligations to keep their vehicles safe and ensure that they continue to drive in accordance with British laws. The Act creates licensed and regulated entities responsible for the operation of AVs. If the AV can operate without a driver in the vehicle, it requires a licensed operator to oversee the ride. If the service carries passengers, it will require an automated passenger transport permit for automated passenger transport or a license under existing schemes.

Authorisation for use of AD will determine whether vehicles are capable of safely and lawfully driving themselves without the need for a human to exercise control or monitor the road. The authorisation is to identify each self-driving feature in the vehicle and determine whether it meets the self-driving test. The authorisation must specify whether it is a 'user-in-charge' or 'no user-in-charge feature', how the feature is engaged or disengaged, and the locations and circumstances where the feature meets the self-driving test.

There are also legislative proposals in the UK which aim to make information about traffic regulation orders (TROs) available digitally and in a common format for use in AVs and other systems that facilitate driving vehicles on a road. The data would include e.g. speed limits, road closures and restrictions, location and times of use of bus lanes and parking bays.

Trials with AVs are ongoing in the UK. The UK has a code of practice which sets out a clear framework to support and promote the safe testing of AD technology.

Through our international collaboration programmes with academia, industry, and the public sector, we ensure the competitiveness of the Swedish business community on an international level and contribute to a sustainable society. Our 2,800 employees support and promote all manner of innovative processes, and our roughly 100 testbeds and demonstration facilities are instrumental in developing the future-proofing of products, technologies, and services. RISE Research Institutes of Sweden is fully owned by the Swedish state.

I internationell samverkan med akademi, näringsliv och offentlig sektor bidrar vi till ett konkurrenskraftigt näringsliv och ett hållbart samhälle. RISE 2 800 medarbetare driver och stöder alla typer av innovationsprocesser. Vi erbjuder ett 100-tal test- och demonstrationsmiljöer för framtidssäkra produkter, tekniker och tjänster. RISE Research Institutes of Sweden ägs av svenska staten.



RISE Research Institutes of Sweden AB
Box 857, 501 15 BORÅS
Telefon: 010-516 50 00
E-post: info@ri.se, Internet: www.ri.se

MOBILITY AND SYSTEMS
RISE Report 2024:63
ISBN: 978-91-89971-24-0