

Summary

The transport sector is becoming increasingly connected, digitalised and automated. Technical developments of vehicles with automatic driving systems that are taking over more and more of the driver's job are making rapid progress, as is the development of business models and services which include automated vehicles. Both Swedish and international regulations relating to transport mainly came into being at a time when all vehicles were driven manually. Therefore, they are not intended for or adapted to highly or fully automated driving.

The job of this committee has been to consider and submit constitutional proposals with a view to creating a better legal framework for the introduction of automated driving of vehicles on public roads. As a starting point, Sweden must accept – as far as possible – rapid introduction of vehicles with automated functions as part of a wider context in which the entire transport sector is facing major changes. In the opinion of the committee, multi-stage development of regulations is required to deal with developments in the field of automated, electrified and digitised mobility so that this development can take place in a safe, sustainable manner. The committee's proposals are intended to commence adaptation of the regulations so that these do not impede the development of new solutions for enhanced attainment of transport policy targets.

One difficulty regarding this work has involved developing a regulation for a phenomenon that is not yet available on the market, namely fully automated vehicles capable of replacing the driver. The committee has attempted to suggest solutions that provide enhanced opportunities for testing and introducing advanced automated functions in vehicles in the short term, as well as certain fully automated vehicles. However, these solutions can primarily be used even when a broader introduction becomes possible.

1. The proposals in brief

The following proposals are presented to facilitate gradual introduction of automated vehicles to the market:

1. **Tests** involving higher levels of automated driving will be facilitated by changes to the Ordinance (2017:309) on autonomous vehicle tests.
 - a) Tests involving automated vehicles currently require permits in accordance with the Ordinance on autonomous vehicle tests. To get a permit, the vehicle used must be approved for driving on roads, and it is necessary to assess whether this activity is safe in terms of where, when and how the tests are to be implemented. These rules will be retained.
 - b) For *vehicles that must have a driver with a EU-harmonised driving licence*, the presence of a driver is still mandatory. This is applicable to class I mopeds, motorcycles, cars, lorries and buses. However, redefining the term “driver” provides new opportunities for tests of more advanced automated functions.
 - c) For *vehicles with a national eligibility requirement*, such as class II mopeds, agricultural tractors, road machine vehicles and all-terrain vehicles, a condition to have a driver *can* be made to get a license if this is deemed necessary for safety reasons or other interests worthy of protection. This paves the way for trials without drivers.
 - d) Automatic operation of *class II automated road machines* is permitted on roads or cycle paths without a test permit at speeds not exceeding 20 kilometres an hour, and on footpaths at walking pace. The Swedish Transport Agency must decide on special provisions applicable nationally for such vehicles. Highway authorities may make decisions on the use of vehicles on roads, such as prohibiting access or enforcing use of specific carriageways, reduced speeds or permitting vehicles to be used only at certain times of the day. These vehicles must be labelled for identity reasons.
2. **New definitions are being introduced** for automated vehicles, vehicles being driven automatically and class II automated road

machines. The term “road user” will be adjusted to include drivers at a distance from the vehicle.

3. A new law and a new ordinance on automated traffic are proposed, to include the following.
 - a) *A new definition will be introduced for “drivers”.* According to this, a driver may drive a vehicle while inside or outside the vehicle, or control it remotely. A driver may drive multiple vehicles, and a vehicle may have multiple drivers. This means that a driver can drive multiple vehicles in platooning, for example, or when rearranging vehicles. Test permits are normally required.
 - b) *The driver’s obligations will be regulated.* A driver must not be held criminally responsible for the tasks performed by the automatic driving system during automated driving. In other words, the driver must have no monitoring responsibility during automated driving. However, the driver is obliged to take over the driving manually if the vehicle’s driving system so requests, provided that the vehicle is designed in a manner which renders it incapable of performing the task independently. That said, the driver must remain responsible for tasks that the automatic driving system is (as yet) incapable of performing, such as putting seatbelts on children under the age of 15 and securing loads.
 - c) *The automated vehicle requirements will be regulated.* A vehicle that is designed to be able to handle all situations arising on the roads during automated driving without the assistance of a driver must be able to stop safely if a situation arises that the driving system is unable to handle in any other way. Certain provisions which facilitate stopping and controlling of the vehicle will be introduced.
 - d) *Owner responsibility will be introduced.* During automated driving, the owner of the vehicle is responsible for ensuring that the vehicle is operated in accordance with applicable road traffic provisions. There will be a shift in penalties for traffic offences that are committed when a vehicle has been operated in contravention of the rules during automated driving. When a vehicle is operated in contravention of the provisions of the

Road Traffic Ordinance during automated driving, it is therefore proposed that the owner will have to pay a penalty which is approximately equivalent to the fines that a driver would have had to pay for a similar traffic offence. As for other road traffic, compliance with the road traffic rules must be checked by police officers or vehicle inspectors and it is proposed that the Swedish Transport Agency should decide on penalties.

- e) A person considered to be the driver during automated driving must be authorised to drive the vehicle and meet sobriety requirements, among other things.
- f) New crimes will be introduced,
 - *gross negligence during automated driving on the roads*, for anyone who uses an automated vehicle in a manner that jeopardises the lives or property of others.
 - *unlawful driving and unauthorised operation of a vehicle during automated driving*, for any driver who does not have the right authority to operate the vehicle during automated driving, and for anyone who employs, designates or uses such a driver or permits anyone who is not licensed to act as a driver during automated driving.
 - *drink-driving during automated driving*. There must be two severity levels to this crime; standard drink-driving, and aggravated drink-driving.
- g) A requirement for data storage is proposed for automated vehicles that are designed to be operated in both automatic and manual mode. It is proposed that the data stored should include the vehicle's identity and the times when automated driving is activated and deactivated and when the vehicle has requested that the driver should take over driving. It must also be possible to store the speed of the vehicle in the event of a specific incident. It is proposed that this data should be stored for no more than six months. On registration, the manufacturer/importer must apply for a permit to store the data and notify a storage officer.

4. Infrastructure for automated driving

- a) Existing authorisations, road signs and information signs can be used to meet most regulatory needs arising in respect of local road traffic regulations, but some further options linked with automated driving have been deemed necessary. It is proposed that road owners should have the opportunity to order or prohibit automated driving in certain lanes or on certain carriageways. Two new mandatory signs and two symbols are proposed for automated driving.
 - b) An option for the Swedish Transport Agency to prescribe that the announcement of new or amended regulations must include information that facilitates *geographical positioning through specification of coordinates* or similar will be introduced in the Ordinance on electronic announcement of certain road traffic regulations.
 - c) Responsibility for the website for electronic announcement of road traffic regulations will be transferred from the Swedish Transport Agency to the Swedish Transport Administration.
5. It is proposed that the rules in the Road Traffic Ordinance, the Road Signs Ordinance and the Camera Surveillance Act should be adjusted for automated driving.

A more detailed description of the proposals is presented below, following a more general section on starting points for the work and longer-term development.

2. Starting points and time perspectives

Starting points

Proposals only when special regulation is necessary

The issues and areas that affect automated vehicles affect other vehicles as well to a great extent. Many regulations are already technology-neutral regarding vehicles' level of automation. The committee has merely submitted proposals for the elements where it is felt that special regulation is necessary for automated vehicles.

The areas that have been excepted and so are not discussed in greater detail here are those whereby rules or conditions are applicable in the same way regardless of the level of automation, and those that need to be discussed in a cohesive and more general context than is possible and appropriate in this case. Issues relating to the government undertaking regarding the digitisation of the transport system or the availability of, access to and use of data connected to vehicles are just a few examples.

Regarding certain other areas, the regulations are already designed to be technology-neutral and do not directly impede market introduction of automated vehicles. One example is the civil liability systems, which are deemed to be able to meet the need for financial compensation in the event of harm caused by vehicles, regardless of automation level. As for motor insurance, the Swedish system is formulated in such a way that the mandatory insurance follows the vehicle and the insurance is a responsibility for the vehicle's owner. Although insurance models and concepts may need to be altered in the long term, motor insurance is expected to be applicable to all vehicles regardless of automation level. No proposals for changes to the regulations are submitted in respect of these areas, either. However, there may be a need to monitor development in areas that should be discussed at a more general level so that interests in promoting automation with respect to vehicles are considered.

For some other areas, it is too early to provide any proposals on formulation of the national legislation. This includes consideration of how training for licensing and professional skills are to be formulated in respect of automated vehicles. New elements may be needed for vehicles that are partly automated regarding both standard driver training and professional driver training. For example, development of driving automated vehicles in convoy may affect the need for training and licensing. Boundaries may be erased or moved for certain regulations, e.g. regarding taxi operations in relation to the hire or sharing of vehicles, publicly funded travel in relation to new mobility concepts involving automated driving as one element, and the public undertaking as regards infrastructure in relation to private undertakings. A review should take place in these areas within three to five years, or when the introduction of such vehicles has made a little more progress. This is also an issue that is the subject of international discussion, and changes may be proposed within the

framework for a new Directive on Driving Licences or the Professional Qualifications Directive.

Regarding driving licences, opportunities for people with physical disabilities to use road vehicles may be extended in that the automatic systems will be able to take over driving completely and compensate for physical disabilities or human shortcomings in a manner that is not possible at present. It can already be stated that the EU's third Directive on Driving Licences prevents some groups of individuals with physical disabilities from benefiting from the new driver aid technologies that have been developed. Sweden can help to bring about a change in this respect and ensure that more groups are given the opportunity for exemption and adaptation of vehicles in accordance with the development of technology. The legislation in respect of community-funded travel such as car allowances, parking permits or mobility services is not technology-neutral, either. This needs to be reviewed when driverless vehicles are permitted on a more general level and if the rules for driving licence conditions are amended. In other words, all these issues should be reviewed more thoroughly when automation and mobility services have developed in a way that will make this possible.

Concerning the infrastructure, certain changes are proposed with respect to authorisations for road owners, for example. However, it is too early in this area as well to propose solutions relating to the use of road capacity, the need for parking and rearranging areas or specific adaptations to the infrastructure, for example.

The next five years

In the short term, over the next five years, the Swedish regulations should be adapted to prepare for automated driving and facilitate the introduction of highly or fully automated vehicles (essentially corresponding to SAE levels 4–5¹). During this time, it is primarily a matter of facilitating the market introduction of certain automated vehicles and facilitating trials of advanced automated functions for driving in convoy (platooning), freight transport and passenger transport.

¹ SAE is a US-based global organisation for engineers that produces standards for engineers in a variety of industrial fields, primarily in the field of transport (such as autonomous vehicles and aircraft). Among other things, the organisation has devised levels for autonomous vehicles that have been disseminated widely on an international level; see chapter 3, section 2.

The more general constitutional amendments for a regulation that can be applied regardless of vehicle automation levels and a shift in penalties for automated driving as proposed by the committee may, in the opinion of the committee, primarily be applied even when broader introduction of automated vehicles becomes possible.

Furthermore, the committee proposes further analyses and facilitation of the trials and demonstration projects that are needed to facilitate introduction. Efforts are also needed for various stakeholders to work in cooperation and devise concepts for holistic solutions for freight transport and passenger transport in urban and rural areas that may assist with attainment of important transport and community targets.

In the longer term

A great deal of effort will be needed, primarily at authority level, to facilitate market introduction of automated vehicles at a high level. In the first instance, this will involve continuing to participate in ongoing international efforts in a constructive manner and, at a later stage, introducing and adapting vehicle-related regulations and general recommendations in a manner that promotes the development of automation and digitisation of the transport system. Forthcoming work regarding a new Directive on Driving Licences, the use of data, and trials and rules for vehicles with automated driving functions are some issues that will have a major influence on development, and these are discussed below.

Besides the changes to international regulations that will have direct repercussions for Swedish provisions, a great number of national regulations – relating to matters such as community-funded travel, public transport and regulations relating to taxis, hire car operations and infrastructure – that will need to be reviewed in the event of a broader market introduction. A decision will also need to be made on the government's undertakings concerning the digitisation of road information, etc. Applicable statutes should be reviewed again when it becomes possible to introduce driverless driving of vehicles on the roads.

International efforts

Sweden should continue its efforts to adapt the international regulations so that market introduction of higher levels of automated vehicles becomes possible, in a safe and sustainable way.

Given the work going on at an international level in matters such as automated vehicles and digitisation and data issues, it is likely that major amendments to regulations and recommendations will be made within five to ten years. In the opinion of the committee, Sweden needs to continue to further adapt its regulations in line with the amendment of international regulations.

Transport policy targets and automated vehicles

To assist with the meeting of transport policy targets, automated driving must – if possible – be introduced in a manner that markedly contributes to a sustainable transport system in which the environment, climate, road safety, noise and good accessibility for all are considered. However, automation is merely one element in the further changes that are happening in society. One focus of the work on this may be that the technical solutions devised should be used to facilitate and assist people in their daily life, and the committee's job is primarily to prepare and facilitate the introduction of automated vehicles.

3. An international context

The 1968 Vienna Convention on Road Traffic, which was ratified by Sweden, includes the fundamental rules for road traffic, drivers, vehicles and driving licenses on which the EU's regulations – and hence Sweden's regulations as well – are based. The Vienna Convention's provisions stating that every vehicle on the road must have a driver and that the driver must have control of the vehicle is what may primarily be considered to constitute an obstacle to higher levels of automated vehicles. Amendments to the Convention were introduced in 2016 which permitted certain automated functions if there is a driver who is capable and prepared to take over the driving and who can control this. Efforts are in progress within the scope of UNECE's Global Forum for Road Traffic Safety (WP.1) to allow road use of

automated vehicles at higher levels according to the classification provided by SAE; see the description in chapter 3. However, there is presently a requirement in the affiliated countries – including Sweden – to have a driver for every vehicle operating on the road. UNECE also has a world forum, WP.29, UNECE/GRRF, which devises technical rules for vehicles known as the Vehicle Regulations.

Intensive efforts are also in progress within the EU to facilitate the introduction of automated and connected vehicles. How larger-scale trials and cross-border tests of automated driving and connected vehicles can be promoted is the primary topic of discussion. Although there are no express requirements for drivers for every road vehicle, the third Directive on Driving Licences includes an implicit requirement to have a driver². The licensing rules in the Directive on Driving Licences are in turn based on the provisions on driving licences in the Vienna Convention on Road Traffic, which also contains provisions on which vehicles require special licences.

The harmonised provisions in the EU's Directive on Driving Licences have been introduced via Sweden's provisions relating to driving licences. These in turn are based on the provisions on driving licences in UNECE's Conventions on Road Traffic. Given these rules, there is currently no scope to amend or permit exceptions to the applicable provisions on driving licences for vehicles that require a driving licence in accordance with the Directive on Driving Licences, nor would it be appropriate to do so. Therefore, the committee proposes no amendments to this element in the short term. When proposals on a new Directive on Driving Licences and other efforts with a bearing on automated driving have been announced over the next few years, Sweden's work on this should include addressing issues relating to automated vehicles and resolving these on an international level.

Regarding vehicles that are regulated nationally in terms of driver authorisations, the committee believes that Sweden's scope for action and interpretation is greater than in areas where the requirements relating to driving licences are harmonised. It is proposed that cautious introduction of fully automated vehicles should be possible for these, often slow, vehicles, most of which are used in national traffic.

² European Parliament and Council directive 2006/126/EC of 20 December 2006 on driving licenses, the third Directive on Driving Licenses

4. Terminology

The committee has used the term “driver” throughout to denote a person who operates a vehicle. The term “driver” is discussed in greater detail below.

“Automated vehicles” is used as a term to denote a motor vehicle that can be operated by an automatic driving system. “Automatic driving system” refers to a system that can control and operate a vehicle independently.

“Automated driving” is used to denote when an automatic driving system can independently control and operate a vehicle. This function may be limited to certain roads (specified roads, motorways, etc.) or certain criteria (driving in traffic jams, touring, etc.). If a vehicle is designed such that it requires monitoring by and assistance from a driver to drive safely or handle certain situations while driving, this should not be regarded as automated driving. Instead, it is to be regarded as a vehicle with advanced driver aid technology.

The term “operate” is not defined, but is used mostly in a general sense, i.e. not in any strict legal sense or according to practice as to who is operating the vehicle. For example, a vehicle may be operated by one driver (or more), or by an automatic driving system.

5. Trials with automated driverless driving

According to the Ordinance (2017:309) on autonomous vehicle trials, permits are required for trials with vehicles that are not approved in any other way for driving on the road. To be granted a permit for automated vehicle trials, there is currently a requirement for a driver to be present.

The provision stating that there must be a licensed driver in or outside the vehicle must be retained until further notice regarding trials involving cars, lorries, buses, motorcycles and class I mopeds.

Other automated vehicles covered by the ordinance, namely class II mopeds, tractors, road machines and all-terrain vehicles, it is proposed that the mandatory requirement to have a driver is deleted. This means that driverless vehicle trials of this type can be implemented, provided that other licensing requirements are met.

We also propose an exception to the requirement for a licence for trials for the new class II automated public works vehicle type.

6. Introduction of some automated vehicles

The revised amendments for trials mean that certain slow, fully automated vehicles can be used during trials or introduced as an initial option for testing fully automated vehicles on the roads.

If a vehicle is designed such that it requires monitoring by and assistance from a driver to drive safely or handle certain situations while driving, this should not be regarded as automated driving. Instead, it is to be regarded as a vehicle with advanced driver aid technology. This is the case with many of the vehicles with automated functions that have been announced by the industry.

This proposal means that automated class II road machines may be driven on the roads without a licence, regardless of whether they have a driver. Authorisation will be introduced to allow the Swedish Transport Agency to decide on further rules on the operation of these vehicles on roads.

Examples of automated class II road machines that may be introduced to the market include automated works vehicles for construction and maintenance, such as gritters on cycle paths and slow goods vehicles that are defined as class II road machines. Remote control of tools for construction, maintenance, surveying, etc. is common at present. In the opinion of the committee, the development of tools that operate independently, perhaps along a preprogrammed route, is not far away. Being able to use automated machines to grit cycle paths at night, for example, may offer major benefits.

7. A new law relating to automated vehicles

A new law relating to automated driving will be introduced. This law must have three subareas; one relating to the driver, one relating to penalties and one relating to data storage.

Terms and definitions

New terms will be introduced to facilitate regulation and introduction of automated driving.

- *Automated vehicle*, which refers to a motor vehicle or a cycle (certain vehicles that are defined as cycles are motorized, such as

electric wheelchairs or balance vehicles) which is operated entirely or partly by an automated driving system.

- *Automated driving* is when a vehicle is operated by an automated driving system without needing a driver in or outside the vehicle.
- *Automatic driving system* refers to a system that, when activated, can control the driving of the vehicle, including lateral and longitudinal control, and independently perform the dynamic driving task.
- *Automated class II road machines* relate to class II road machines that are operated by a fully or partly automated driving system.
- *The term road user* will be adjusted to include drivers who operate and control vehicles remotely, e.g. using a remote control, and who are not on the road. This term must therefore be defined to relate to “anyone travelling or otherwise present on a road or in a vehicle on a road or off-road, and anyone travelling off-road *plus drivers of vehicles present on a road or off-road*”.
- *Driver*. A driver is a human. A definition of the role of the driver will be introduced which means that a driver may be in or outside the vehicle, operate vehicles using a remote control and operate multiple vehicles simultaneously. Furthermore, a vehicle may have more than one driver.

All road driving using vehicles with automated functions is already possible, provided that

1. there is a driver in or outside the vehicle, and
2. the vehicle is approved or has an exemption or other licence for road driving.

A new term for “drivers”

The technology for automated driving is currently not developed sufficiently to replace all the tasks of a driver in all respects. In the opinion of the committee, EU law does not yet permit vehicles without drivers, at least insofar as requirements are in place for specific driving licenses in accordance with EU regulations. Therefore, the

requirement for drivers in vehicles where licensing is regulated in accordance with the provisions of the Directive on Driving Licenses should be retained.

The main rule in the proposal is therefore that a vehicle must have a driver while being driven automatically. However, there are major opportunities for trials and the introduction of advanced automatic functions due to the national interpretation of the term “driver” that is being introduced.

The term “driver”

The committee proposes a definition of the term “driver” on the basis of current Swedish practice, among other things. According to the proposal, a driver is a human. A driver may operate one or more vehicles simultaneously. A driver may be in or outside the vehicle, which means that a vehicle may be operated by remote control (operated remotely), when the driver is either in the immediate vicinity of the vehicle or at a distance from it, if this can be deemed safe during a risk analysis. The interpretation means that convoy trials with a driver in the first vehicle, but not in the following vehicles, are possible. Furthermore, this interpretation paves the way for rearranging of vehicles where a driver operates or controls multiple vehicles simultaneously, e.g. when parking or otherwise moving vehicles. This also paves the way for other trials where a driver can control vehicles from a location other than a driver’s seat. This does of course assume that this can be done safely in accordance with the other conditions and rules laid down for trials or other road driving.

Professional traffic and the term “driver”

The regulations on professional freight and passenger transport are largely harmonised within the EU. The investigation will submit no proposals on these elements, but assumes that Sweden will work to encourage the devising of joint rules within the EU that promote development of innovations and new market solutions relating to professional traffic. Among other things, this relates to the development of rules on driving and rest times in the case of automated driving.

The national interpretation of the term “driver” that is proposed means that relatively far-reaching automated vehicle trials are possible, and that – for example – convoy trials with a driver in the first vehicle only who is operating the entire convoy will be possible when the technology has made sufficient progress and this is deemed to be sufficiently safe. It will also be possible to test and introduce other far-reaching automated driving functions, such as remote control and rearranging of vehicles and automated docking in loading bays or parking spaces.

New distribution of responsibilities

According to the proposal, there should normally be one driver for one automated vehicle even when this is operated automatically (i.e. when there is no need for any human to take over or provide guarantees). However, this is a kind of “engineered driving” with limited obligations and responsibilities. During automated driving, such a driver must meet the applicable requirements for the vehicle in question regarding licensing (driving license and any professional authorization), sobriety and other requirements to be able to maintain a basic ability to perform the tasks for which the driver is responsible as specified below. This is no less important for vehicles that assume that a driver will take over driving at any time or in certain situations.

The following is proposed for automated driving:

1. The driver is responsible for
 - a) meeting driver requirements for the vehicle in question (the right licensing, sobriety, etc.),
 - b) taking over driving when the vehicle requests during automated driving that the driver should take over or intervene, provided that the vehicle is designed in a manner which renders it incapable of resolving the situation independently, and
 - c) performing the tasks for which the driver is already responsible at present and that an automatic driving system cannot take over and perform. These tasks will remain in place with unamended regulations. This may include ensuring that child-

ren under 15 have the right protective equipment (such as seatbelts), ensuring that the vehicle is loaded correctly or meeting certain obligations following an accident.

- d) During manual driving, communication equipment must not be used in a manner that affects driving in a harmful way. During automated driving, the driver has no tasks to perform regarding the dynamic driving. Therefore, during automated driving drivers may spend time doing other things such as using mobile phones or other distracting tasks. The provision stating that a driver must not use a handheld mobile phone or other communication equipment, which came into force on 1 February 2018, will therefore be adapted so that it is not applicable during automated driving.

2. The owner's responsibility

- a) in the case of vehicles that have no driver, the owner must stand responsible for ensuring that the vehicle is operated in accordance with applicable road traffic provisions during automated driving.
- b) even if there is a driver, the owner must take responsibility for ensuring compliance with road traffic rules during automated driving. A penalty will be introduced to replace the fines that may be imposed on drivers when breaching road traffic rules. Certain options for adjusting penalties under certain circumstances on which the infringement is based (crime, illness, effect) will be introduced.
- c) a vehicle that is capable during automated driving of handling all situations arising without the help of a driver must be able to stop in a safe manner if the situation cannot be handled by the driving system in any other way.

3. Responsibilities of manufacturers and product officers

- a) Information must be included in the road traffic register which states the identity of the storage controller (normally the

vehicle manufacturer or importer) for any vehicle that is designed to be operated both manually and automatically³. When such a vehicle is registered, the person submitting the application for registration must at the same time apply for a permit to store personal data and specify who the storage controller is.

- b) No amendments are proposed regarding product liability, which is also considered to include the software incorporated so that it becomes part of a product. Product liability is deemed to be sufficiently extensive with the current rules. The more advanced the automatic systems that are included in a product are, the more extensive this liability will become, particularly if defects in these may result in a loss of life or health.
- c) Guarantee obligations or other undertakings mean that anyone who provides an automated vehicle can accept more far-reaching financial liability for the vehicle and its systems than is currently the case. For example, compensation for financial loss on the part of the owner or user (such as penalties) can be determined by agreement. It is thought to be important for consumers and other purchasers or users of these vehicles to make sure of what would happen in the event of defect in the vehicle's systems, but also of the service life of the systems and how upgrading and disposal on scrapping, for example, should take place.

³ Work is currently in progress at the Ministry of Enterprise and Innovation on reviewing the Road Traffic Register Act (2001:558). It is reported that a new law relating to vehicle rules and the use of vehicles will be proposed before long.

The role of the driver in automated driving

The proposed definition of the role of the driver, where a driver may be in or outside the vehicle, operate the vehicle by remote control and operate multiple vehicles simultaneously, along with the fact that a vehicle may have more than one driver, raises questions on the role of the driver in automated driving.

According to the proposal, most vehicles with automated functions must have a driver. This is generally applicable to vehicles to which an EU-harmonised driving licence requirement is applicable, such as cars, buses and motorcycles. There may also be driver requirements in accordance with permits for trials for vehicles with national licensing requirements, such as class II mopeds (25 kilometres an hour) and tractors. In these cases, the driver holds responsibility for driving even when this is automated. If a vehicle is operated fully automatically, i.e. without a driver in accordance with a permit for trials, or if the vehicle is otherwise approved for operation on roads, the owner must stand responsible for its operation.

It is important to distinguish between tasks that can be performed by both a physical driver and an automated driving system and tasks that can only be performed by a physical driver. The driver must have the right licence and otherwise be capable of driving in the case of automated driving where the driver is expected to take over driving on certain occasions, when the automated system is unable to perform tasks, or where the driver is expected to monitor driving. The driver – if one is present – may spend time doing other things to a certain extent while the automated driving system is active and handling driving. However, during automated driving the driver must bear responsibility for taking over driving when so requested by the vehicle, provided that the vehicle is not designed to be able to handle the situation without assistance.

Responsibility for certain tasks that the driving system is unable to handle also remains with the driver during automated driving, i.e. tasks that can only be performed by a physical person at present. The tasks for which the driver is already responsible at present and that an automated driving system cannot perform should remain in place, with unamended regulations. This may involve checking that children have protective equipment or meeting certain obligations after an accident.

However, the driver has no obligation to be prepared constantly to take over driving, but only after the driving system requests this.

Penalties introduced for vehicle owners

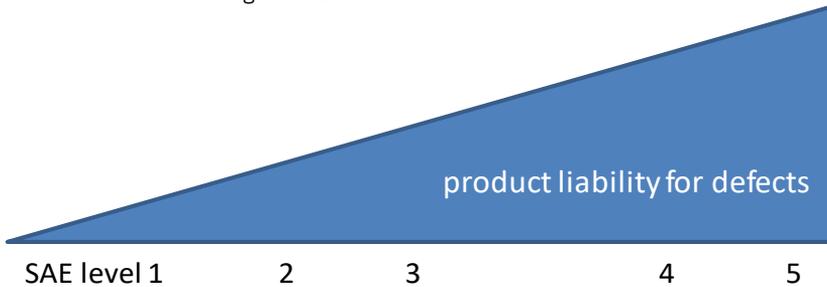
Manual and automated driving will be mixed on most streets and roads in the foreseeable future. Therefore, the same rules should apply to the operation of vehicles regardless of the degree of automation. If there is no driver who can stand responsible for compliance with road traffic rules, financial liability for any offences should be introduced. Therefore, a provision will be introduced concerning penalties for the owners of motor vehicles during automated driving, when the vehicle is operated in contravention of the provisions of the Road Traffic Ordinance.

In other words, the vehicle owner must stand responsible for the vehicle's offences during automated driving. If the vehicle commits an offence during automated driving, the vehicle's owner must pay a penalty. This penalty is intended to replace the fines that may be imposed on drivers if offences are committed. Claims for damages may be filed against vehicle manufacturers in the event of insurance cases or accidents, for example.

Breaches of applicable rules may of course be due to the fact that the vehicle's driving system is not designed to cope with all situations that may arise, or to some kind of defect in the system. Current product liability involves far-reaching liability for defects in the vehicle's technical systems, for example. The proposal includes no amendment to the liability for faulty products. That said, it may be stated that the manufacturer's field of liability will increase considerably as driving automation is extended. Figure 1 shows how product liability for defects in respect of the dynamic driving task (accelerating, braking and turning) will increase when these tasks are taken by the driving system.

Figure 1 **Product liability for defects**

An estimate of how liability for dynamic driving work will be transferred to the manufacturer at various levels of automation according to SAE.



Source: Own picture

When the technology takes over the driver's tasks to an increased extent, the driver's opportunities to influence driving and take responsibility to a corresponding level will be reduced. Instead, we will see a corresponding increase in product liability for defects in the system; see Figure 1.

8. New crimes

The driver's obligation to take over driving

In the case of vehicles that can be operated both manually and automatically, and where the vehicle is designed to require the assistance of a driver in certain situations, an obligation for the driver to take over driving when so requested by the vehicle will be introduced.

Gross negligence during automated driving on the roads

Although the driving systems for automated driving will normally be designed to be law-abiding and drive carefully, the systems may have the opportunity to make choices for the user that put others at risk. Anyone using the vehicle may also manipulate a vehicle so that they can be driven in contravention of speed limits, for example, or select automated driving even where this is not appropriate. This may

involve incorrectly installing an automated driving function at home, hijacking a vehicle (some hijacking cases may also constitute terrorist incidents), using vehicles without necessary control, manipulating vehicle systems, etc. A new crime, gross negligence during automated driving on the roads, will be introduced to prosecute such incidents.

The proposal means that anyone who uses an automated vehicle intentionally or grossly negligently in a manner that places the lives or property of others at risk is to be sentenced to imprisonment for a maximum of two years for gross negligence during automated driving on the roads.

It is also proposed that it should be possible to revoke a driving licence if the holder of the driving licence is guilty of gross negligence during automated driving on the roads.

Unlawful driving and unauthorised operation of a vehicle during automated driving

It is proposed that the provisions relating to unlawful driving or unauthorised operation of vehicles in section 3 of the Road Traffic Offences Act should be applied in a similar fashion to drivers during automated driving, and to anyone who employs, designates or uses such a driver or permits anyone who is not licensed to act as a driver during automated driving.

The proposal means that anyone who uses an automated vehicle without being licensed to do so may be held liable for this.

Drink-driving during automated driving

The requirement for sobriety must be maintained for drivers during automated driving as well, which is why a provision on this will be introduced in the new law. Responsibility for certain tasks remains with the driver – if a driver is present – during automated driving. Among other things, the driver must be capable to take over or assist with the operation of the vehicle at the vehicle's request (e.g. moving the vehicle or ordering the vehicle to move if it has stopped in an inappropriate location). Certain tasks also remain with the driver in the event of accidents, for example. Therefore, the driver is deemed

to need a basic ability to handle the journey. This means that the driver must be licensed and otherwise capable of driving.

It is proposed that any driver of an automated vehicle during automated driving should not be allowed to consume alcoholic drinks in quantities that result in a blood alcohol concentration of at least 0.02% or 0.10 milligrams per litre of breath. If the driver has had a blood alcohol concentration of at least 0.10% or 0.50 milligrams per litre of breath, or if the driver is otherwise considerably affected by alcohol or any other substance, the crime is to be regarded as aggravated. The driver should then be sentenced to imprisonment for a maximum of two years for aggravated drink-driving during automated driving.

It is also proposed that it should be possible to revoke a driving licence if the holder of the driving licence is guilty of drink-driving or aggravated drink-driving during automated driving.

Drivers' liabilities in the event of road traffic accidents

According to section 5 of the Road Traffic Offences Act, a driver must have specific obligations following an accident. Current technology assumes that the driver is in the vehicle or in its immediate vicinity. With automated driving, the driver may be far away; in a control room, for example. This means that the condition "leave the scene" does not work with remote drivers. Therefore, a new provision is required which indicates what a remote driver should do. Firstly, the vehicle needs to stay on scene, regardless of fault, until the driver/owner orders it to do otherwise. The driver must also ensure that the measures required because of the road traffic accident are undertaken. This may, for example, involve ensuring that the vehicle is not impeding other traffic. Certain other provisions that are applicable in the event of traffic accidents will be more difficult to maintain, e.g. requiring a driver to set out a warning triangle. However, this is a requirement that cannot be maintained even now; if a driver is seriously injured in an accident, for example. A remote driver must also be obliged to get in touch with the police to provide details about the accident.

9. Collection and storage of data in automated vehicles

Given the introduction of penalties and provisions relating to the driver's liability, sector-specific regulations are required for personal data with a view to investigating liability (both criminal and civil) during automated driving. Following an incident or accident, or contravention of road traffic rules, there is a need to clarify whether a driver or an automatic driving system was operating the vehicle at the time. Thus, the purpose of collecting and storing data should be to facilitate personal data processing to investigate legal liability if a vehicle can be operated both manually and automatically. As little data as possible is to be stored, and it must only be stored for the necessary time, to protect the individual's privacy and integrity. Therefore, information on the vehicle's location must not be collected.

Therefore, certain information on driving must be collected and stored for an automated vehicle that is designed to be operated manually by a driver and automatically by an automatic driving system. Personal data may be processed for the purposes of preventing, detecting, investigating or prosecuting crimes and so that individuals can exercise their rights in civil cases.

An obligation will be introduced for anyone who has manufactured or provided such an automated vehicle to collect and store data on the following:

- activation and deactivation of automated driving
- the vehicle's requests to the driver to switch from automated driving to manual driving, and
- error messages from the vehicle during automated driving.

For each of the details referred to above, the vehicle's identity and the time of the incident must be collected and stored at the same time. In the event of a specific incident such as a road traffic accident, information on the vehicle's speed must also be collected. It is proposed that the data, as a rule, should be stored outside the vehicle within the European Economic Area (EEA), but be available to access in Sweden. This data may be stored in the vehicle for a short time while awaiting transfer. Vehicle manufacturers may instruct others to carry out storage.

When a vehicle is registered with the road traffic register, a decision must be made at the same time on who is to collect, store and issue the data on request (the storage controller). The vehicle manufacturer must collect and store the data. The vehicle manufacturer will be the storage controller, and is therefore the personal data controller as well. In this respect, an importer of vehicles is equivalent to a manufacturer of vehicles. A licence is required to collect and store personal data, and some requirements must be met but the licence holder. If data is not collected and stored, use of the vehicle during automated driving must not be permitted.

The personal data must be stored for six months from the date on which the data was collected. One and the same storage time must apply to the data. When the data is no longer needed, it must be deleted by the vehicle manufacturer (storage controller), unless a request has been made by the competent authorities to issue the data but the data has not yet been issued. In this case, the data must instead be erased as soon as it has been issued.

Vehicle manufacturers must undertake necessary and appropriate technical, organisational and administrative measures to protect the data. These measures must aim to achieve a level of security that is appropriate in terms of the available technical options, the cost of implementing such measures, the specific risks involved in processing personal data and the sensitivity of the personal data processed. This is already specified in the EU's General Data Protection Regulation. The supervisory authority must have the opportunity to issue regulations on further protective measures. Rules on protection for confidentiality purposes relating to the storage controller may be necessary to enhance this protection.

The Swedish Data Protection Authority must control the vehicle manufacturers' collection and storage of data. The authority's current advisory powers are appropriate and sufficient for this purpose. The government or the authority designated by the government may issue further regulations on data, data processing and data storage by the storage controller.

10. Camera surveillance

The current provisions are not adapted for automated driving. This means that only the use of vehicle-mounted cameras that are present *to enhance the driver vision*, such as reverse cameras, are exempt from the scope of the Camera Surveillance Act, and hence from permit requirements. However, the outward-facing cameras in a modern vehicle will become even more necessary if the vehicle is to be operated by an automatic driving system. To become technology-neutral in this regard, the provisions relating to camera surveillance should therefore be amended so that the cameras present in an automated vehicle to be able to operate it are exempt from the scope of the Camera Surveillance Act.

Cameras facing into the passenger compartment should probably normally be used by consent, and possibly with an information sign in the passenger compartment. For cameras mounted in or on the vehicle for purposes other than facilitating operation, the same rules should apply as for other cameras on the vehicle.

11. Automated class II road machines

As stated above, options will be introduced to permit operation of automated class II road machines on roads, cycle paths and footpaths without a special permit for trials. The proposed definition of an automated class II public works vehicle is “a class II public works vehicle that is operated by an automatic driving system”. This comes under the general definition of a public works vehicle, namely “a motor vehicle that is designed primarily as a tool or for moving freight short distances”.

An automated class II public works vehicle without a permit for trials may not exceed 20 kilometres an hour (walking pace on footpaths). The Swedish Transport Agency may prescribe national rules on the operation of these vehicles, and municipalities and other road owners will be authorised to announce local road traffic regulations on their use, e.g. limiting their operation to certain cycle paths or special rules such as lower speeds or operation only at certain times of the day. There will be no registration requirements for certain automated vehicles that may be introduced. A labelling requirement will be introduced so that these vehicles can be identified.

The Swedish Transport Agency will be authorised to prescribe the more detailed provisions concerning the potentially necessary design, content and location of the label. This label should include information that facilitates identification of the vehicle and contact with its owner.

12. The Road Traffic Ordinance and Road Signs Ordinance will be adapted for automated driving

To make it possible to apply the provisions of the Road Traffic Ordinance during automated driving as well, a provision will be introduced stating that the provisions relating to traffic on roads and off-road shall also apply, where appropriate, to vehicles during automated driving. A rule will also be introduced stating that the provisions for road users in the Road Traffic Ordinance shall apply to automated vehicles, where appropriate.

The Road Signs Ordinance will also be amended so that provisions for road users and drivers shall apply to automated vehicles, where appropriate. The opinion of the committee is that the proposed amendments to the Road Signs Ordinance do not, in themselves, constitute any extended liability for the road owners to provide road users with guidance, control and information.

Professional transports

The regulations on professional freight and passenger transports are largely harmonised within the EU. The investigation will submit no proposals on these elements, but assumes that Sweden will work to encourage the devising of joint rules within the EU that promote development of innovations and new market solutions relating to professional traffic. Among other things, this relates to the development of rules on driving and rest times in the case of automated driving.

The national interpretation of the term “driver” that is proposed means that relatively far-reaching automated vehicle trials are possible, and that – for example – convoy trials with a driver in the first vehicle only who is operating the entire convoy will be possible

when the technology has made sufficient progress and this is deemed to be sufficiently safe. It will also be possible to test and introduce other far-reaching automated driving functions, such as remote control and rearranging of vehicles and automated docking in loading bays or parking spaces.

13. Infrastructure

Where should automated vehicles be operated?

It should be possible to operate automated vehicles, with permits for trials or approved for use on roads in any other manner, on roads in accordance with what is currently permitted for the type of vehicle, regardless of the level of automation.

It should be determined, within the scope of trials, where and how trials are to be carried out following consultation with the municipality and the road owner. Rules may be necessary in the form of local road traffic regulations for certain types of vehicle or certain types of traffic. Therefore, certain authorisations to introduce local road traffic regulations relating to automated vehicles which supplement the available options will be introduced.

The opinion of the committee is that the road infrastructure has a traffic capacity that is currently difficult to use. Although road traffic levels are very high at certain times, there are also times where roads and streets are very quiet. Partial use of the road network for freight transport or road maintenance at night, for example, may be difficult at present as the needs of drivers determine when most roadworks are carried out. Automation will facilitate operations such as gritting cycle paths at night, suspending certain road sections during certain quiet times for automated freight transport to town and city centres or trading estates with automated slow freight deliveries directly to the door in urban areas. Subjecting road traffic involving automated vehicles to certain time limits will allow the road capacity to be used more optimally and control traffic to avoid heavy goods vehicles having to drive through towns and cities. Permitting smaller, slow vehicles on footpaths and cycle paths under certain circumstances also provides opportunities to devise intermodal freight concepts, combining these vehicles with other forms of transport such as conventional lorries.

Automated class II road machines

An automated class II public works vehicle may be operated without a special permit for trials at speeds not exceeding 20 kilometres an hour all roads and in all areas where class II road machines may be operated at present. Normally, a permit for trials is required to travel at higher speeds, up to 30 kilometres an hour, or otherwise the vehicle must be approved for operation on roads at this speed.

General options for operating automated class II road machines at no more than 20 kilometres an hour on cycle paths and at walking pace on footpaths will be introduced. It is proposed that the provisions relating to pedestrians should also apply to automated class II road machines travelling at walking pace.

The Swedish Transport Agency may announce national regulations stating that automated class II road machines may travel speeds of up to 30 kilometres an hour, if this is deemed to be safe. The Swedish Transport Agency may also announce national regulations on the demands that can be specified when operating automated class II road machines, e.g. a specific maximum weight or size when operating on cycle paths or equipment to promote visibility and safety. The road owner may use local road traffic regulations to prescribe whether and how these vehicles may be operated, and that they should travel at speeds of less than 20 kilometres an hour, e.g. at walking pace.

Adaptation of the road infrastructure for automated vehicles

Driverless vehicles can only be introduced to a limited extent in the short term, and before the international regulations support the technology. The committees of the view that consistency, clear design and marking and digitised infrastructure information are important for this technology, but it may also facilitate matters for connected vehicles with automated functions in more general terms. However, further information is needed on what more specific, long-term infrastructure conditions may facilitate matters for vehicles with automated functions or advanced driver aids.

How the infrastructure needs to be adapted to support the automation and digitisation of the transport system should be investigated. The assignment or investigation should include reviewing the

need for generally applicable requirements via amendments to the Roads Act (1971:948), the Act (1998:814) with special rules concerning street cleaning and signage and the Planning and Building Act (2010:900), and to regulations in the field. It may also be necessary to adapt the recommendations in Vägar och gators utformning (VGU, Road and Street Design) in relation to automated vehicles.

Authorisations for road owners in the Road Traffic Ordinance

The starting point is that existing prohibition signs, commentary boards, etc. can be used also for vehicles that are operated automatically. This proposal means that road owners will have certain supplementary authorisations if special rules are needed for automated vehicles that cannot be addressed using existing rules. It may, for example, be valuable to be able to specify clearly that a road or carriageway can only be used by automated vehicles.

Existing rules and the rules currently being proposed mean that road owners will have opportunities to prohibit, restrict the use of or order the use of cycle paths, lanes or carriageways for automated motor vehicles and automated class II road machines. Road owners must also be able to make decisions on whether trials or activities involving automated vehicles are to be possible in more general terms on certain roads or carriageways or in certain areas. Two new road signs and two symbols will be introduced to support these options.

New road signs to be introduced

Two new road signs and two new symbols will be introduced.

- a) Mandatory carriageway or lane for automated motor vehicles with more than two wheels
- b) Mandatory carriageway or lane for automated class II road machines
- c) Symbol for automated motor vehicles with more than two wheels
- d) Symbol for automated class II road machines

Figure 2 Mandatory lane or carriageway for automated vehicles

Proposal for a new road sign for automated vehicles. For other vehicles, such as buses or tractors, can be used.



Source: Self-produced sign

Figure 3 Mandatory lane or carriageway for automated class II road machines

Proposal for a new road sign for automated class II road machines.



Source: Self-produced sign

Swedish Transport Agency's nationwide road traffic regulations database

As stated above, if automatic driving systems are to be developed it is extremely important to ensure that road markings and road signs are clear and the same all over the country, and that the same requirements relating to maintenance and condition, for example, are applied. Increased digitisation of road information and improvement of connection options may be just as important. More stringent demands of infrastructure systems should result from the fact that a relatively high proportion of road users may benefit from these changes over a long period.

In the short term, automated driving will not constitute a large proportion of road traffic. On the other hand, vehicles that are connected and use automated functions and positioning services will probably continue to increase rapidly. Various map services, information on factors such as speed limits and services that make it easier

for drivers to select routes are already provided by most newer vehicles. However, automated driving increases the need for more precise specification of where a map or rule starts and ends, for example.

The committee proposes making it mandatory to specify geographical coordinates or provide similar specifications in the nationwide road traffic regulations database with a view to making it easier to determine position, and for digital information applications that can be used by automated functions and vehicles. This requirement is applicable to new regulations or amendment of older ones. Swedish Transport Agency may announce more detailed regulations on the specification of coordinates in maps and how the regulations are to be announced to make them searchable and possible to process; e.g. how road traffic regulations are to be made machine-readable.

In Sweden, all road traffic regulations are published on a public website. The Swedish Transport Administration will take over the Swedish Transport Agency's responsibility for Svensk trafikföreskriftssamling (STFS) [the Swedish collection of road traffic regulations] website via an amendment to the Ordinance (2007:231) on electronic announcement of certain road traffic regulations.

14. How implementation of the proposals will influence the opportunities for automated driving

The proposals are intended to facilitate trials of the automated functions in vehicles that are to be driven on roads. Furthermore, a market introduction of such technology must be promoted. The committee describes below the opportunities for several types of traffic. It is assumed that all trials and market introductions will take place following thorough testing to ensure that they can take place safely, i.e. following testing in safe areas and after a risk assessment.

Platooning

It is already possible to implement trials with several fully or partly automated heavy (or other) vehicles in convoy (a platoon), if there is a driver in or outside the vehicles and there is a trial permit for the activity. When a section of road is opened for platooning, e.g. within

the scope of a trial, there should be a holistic solution for driving from the point of origin to the destination, considering factors such as the vehicles' location on the road, parking and logistics, as well as a risk assessment for the various elements being implemented.

The proposals involve clarification of the fact that a driver can control several vehicles, including remotely. This paves the way for trials with the driver in the first vehicle only, or operation by remote control, when the technology is mature enough to offer this.

Pods and shuttles

Trials involving shuttles for passenger transport may take place, provided that there is a driver and a permit for the trial. Such trials will commence this year. The proposed term “driver” and extended authorisation for municipalities (road owners) to prescribe the use of a certain road or carriageway for automated public transport, for example, expands these options. By way of example, the activities and trials in progress – in Europe and elsewhere – often take place on restricted and specific routes with a certain road or a special lane for the vehicles, often with limited other traffic.

Vehicles for road maintenance, surveying, etc.

Service vehicles and automated vehicles for roadworks may be used on roads by road maintenance authorities or municipalities when a permit for trials has been issued. The proposals mean that certain automated vehicles do not need permits (automated class II road machines) but may be operated in accordance with the rules applicable to class II road machines during roadworks, for example, at speeds not exceeding 20 kilometres an hour. These vehicles may also be operated on cycle paths (at speeds not exceeding 20 kilometres an hour) or on footpaths (at walking pace).

Rearranging of vehicles

The new term “driver” paves the way for a range of applications involving a driver controlling multiple vehicles remotely, e.g. when

vehicles are moved within a site or for parking, docking in loading bays, etc. Smaller, slow goods vehicles that are classified as road machines may operate on roads, cycle paths (at speeds not exceeding 20 kilometres an hour) or footpaths (at walking pace). These vehicles may also be fully automatically, without a driver. These vehicles may be driven at up to 30 kilometres an hour when a special permit is issued or pursuant to the Swedish Transport Agency's regulation relating to a specific road or road section. This may be of relevance for transport in sparsely populated areas, for example, where finding a good transport solution may otherwise be difficult. This also paves the way for increased transport during quiet times on the roads, such as nightly freight deliveries.