



# **Auswirkungen des automatisierten Fahrens; Erkenntnisse und Massnahmen aus Sicht des ASTRA**

**Effets de la conduite automatisée - Conclusions et mesures  
du point de vue de l'OFROU**

**Impacts of automated driving - Insights and measures from  
the viewpoint of FEDRO**

**Bundesamt für Strassen ASTRA**

**Forschungsprojekt ASTRA 2017/004 auf Antrag des Bundesamtes für  
Strassen (ASTRA)**

**Oktober 2020**

**1691**

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Distribution: Swiss Association of Road and Transportation Experts (VSS)

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## Summary

### “Impacts of automated driving” research package

Digitalisation will fundamentally transform mobility over the next few years and in the coming decades. Automated driving is likely to have a particularly strong influence on developments. The use of automated vehicles will give rise to considerable opportunities as well as risks – which of these will predominate will largely depend on whether the vehicles are used collectively or individually.

The Swiss Federal Roads Office (FEDRO) has been focusing on these new challenges for a number of years already, during which time it developed, initiated and implemented a research package called “Impacts of automated driving”. The insights gained from this research make it clear that the government cannot simply leave the introduction of automated vehicles up to the market. The findings obtained from this research make it clear that the government cannot simply leave the introduction of automated vehicles up to the market. In order to successfully manage the introduction of automated driving it will have to implement regulatory measures at an early stage and carefully monitor the ongoing developments.

The framework for action presented here summarises the main findings of the six research projects from the point of view of the federal authority responsible for road infrastructure and private road transport, from which principles for action and potential measures are derived. The report is addressed primarily to the Federal Roads Office (FEDRO) and secondarily to other units of the Federal Administration. The framework for action also informs other stakeholders about the ideas guiding FEDRO in the introduction of automated driving. A synthesis report on the research package<sup>3</sup> plus the final reports on each sub-project are available separately.<sup>4</sup>

### Insights and principles for action

#### Penetration of vehicle fleet to take longer than expected

The studies show that the penetration of the vehicle fleet with highly and fully automated vehicles will take longer than previously anticipated. Between 40 and 70 percent of road vehicles will still be operated by human beings in 2050; the variance depends on the underlying assumptions made. This broad range shows that the rate of fleet penetration can be influenced.

Thus, Switzerland must expect a lengthy period during which conventionally operated vehicles and vehicles with varying degrees of automation will have to coexist on the roads in and outside of built-up areas. In built-up areas, the problem of mixed traffic, with pedestrians, cyclists and users of other two-wheeled vehicles, will pose a lasting challenge. In both cases, solutions will have to be found that permit safe and efficient travel for all road users.

#### Automated vehicles can give rise to significantly more traffic

The use of automated vehicles is highly attractive and in the case of automated taxis it is also economical. However, if their use is not managed, it could give rise to an enormous increase in traffic, which towns and cities will not be able to handle. To prevent such a development, it will be necessary to promote the collective use of highly automated vehicles. Furthermore, effective instruments for influencing mobility demand will be required.

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<sup>3</sup> Impacts of automated driving; sub-project 1: use scenarios and impacts

<sup>4</sup> Impacts of automated driving. [www.mobilityplatform.ch](http://www.mobilityplatform.ch)

### **Bottlenecks on the road network will persist**

In order to benefit from the potential of automated vehicles for more efficient use of the road network, a high penetration of the fleet of automated vehicles will be required. However, not until 2050 will the degree of penetration be sufficient to eliminate the foreseeable bottlenecks on the road network. The achievable capacity increases and higher proportion of collectively used automated vehicles will temporarily ease the congestion problems on the motorways and national roads to some extent, even despite further overall growth in traffic volume. However, they will not eliminate bottlenecks altogether. The step-by-step introduction of automated vehicles on the motorways/national roads will also require a greater degree of operational flexibility. For both these reasons, further targeted expansion of the network will be needed.

### **New types of collective mobility services will create opportunities**

Digitalisation and automation will enable new, attractive forms of collective mobility, which will permit significantly more efficient traffic management and potentially fewer privately owned automated vehicles. This means that commercial collective mobility services with highly automated vehicles will have to be licensed and comprehensively integrated into the multimodal mobility system.

### **Strong competition for conventional public transport services**

The use of automated vehicles will make private mobility more attractive and affordable. Collectively used, automated taxi fleets will become serious competitors for providers of conventional public transport services, in densely populated areas as well as elsewhere. To remain competitive, public transport services will have to consistently exploit the potentials of digitalisation and automation so that they can become more efficient and further develop their range of services. As a support measure, the public sector will have to introduce efficient management tools and foster the competitiveness of collectively used mobility services.

### **Growing importance of ride pooling**

Increasing the vehicle occupancy rate, for example through ride pooling, is a key approach to managing mobility with automated vehicles. As yet there are no simulation models for developing successful business models. Also, the degree of acceptance of ride pooling will have to increase greatly in order to bring together sufficiently large numbers of potential passengers for ride pooling or an on-demand service.

### **Additional data broaden the perspectives for traffic management**

Automated vehicles generate new and comprehensive sets of data. Data relating to the movement of vehicles and the desired destination of their occupants are of particular interest. These data sets, combined with the possibility of remotely influencing automated vehicles, open up new potential for predictive, more effective traffic management. This potential has to be used across all modes of transport.

### **Not a major impetus for further urban sprawl**

In Switzerland, approximately a third of commuters do work while commuting that could not be done in a car. Furthermore, the analysis shows that the distance and duration of a typical commuter's journey and the portion travelled on a motorway are not suited to working in a car.

This means that, in a small and mountainous country like Switzerland, the potential for using commuting time (or other travel time) spent in an automated vehicle to do work is correspondingly low. Automated driving in Switzerland is therefore unlikely to become a major impetus for further urban sprawl into rural areas. This is something that will nonetheless need to be monitored.

### **Strong dynamics and uncertainties call for agility**

At the present time it is not possible to draw any truly reliable conclusions regarding the impacts of automated driving. The statements in the report represent substantiated approximations. When confronting these uncertainties, all involved players have to demonstrate a high degree of agility and periodically review the robustness of the assumptions made.



In order to be able to define appropriate framework conditions and formulate pertinent regulations, the authorities concerned need to be able to gain practical experience with the deployment of (highly) automated vehicles on Switzerland's roads.

## **Target scenario for the positive development of mobility with automated vehicles**

The target scenario represents a desirable vision for a road transport system with automated vehicles in the timeframe up to 2050. Its focus is on traffic-related issues surrounding automated driving. Other important aspects such as energy efficiency and climate protection were deliberately excluded, partly so as to keep the complexity of the target scenario within reasonable bounds, but also due to the firm conviction that managing the various traffic-related issues will require significant increases in efficiency, which will similarly benefit the climate and energy efficiency.

### **Automated driving is possible**

In 2050, automated and electronically networked vehicles will be in use in Switzerland in both the passenger and goods transport segments. The self-learning, collectively operated data network will deliver the necessary data and information for the safe operation of these vehicles. In the event of disruptions to automated operation, pre-prepared fallback modes will apply.

### **Coexistence of all road users assured**

The consistent promotion of collectively used automated vehicles will give rise to a rapid renewal of the vehicle fleet, and the period in which mixed traffic travels on the motorways and national roads will be shortened. With increased fleet penetration, capacity utilisation on these roads will be significantly better and road safety will be enhanced substantially.

In urban areas, mixed traffic with pedestrians, cyclists and users of other two-wheeled vehicles will pose a special ongoing challenge. Here, special rules will apply for automated vehicles which will take account of the high density and diversity of road users.

All road users will be sensitised to the special aspects of automated vehicles and will possess the information needed to safely share the roads with them. To counter the higher risk during the introductory phase, traffic will be more closely monitored and, where necessary, direct corrective action will be taken.

### **Significant number of automated vehicles will be used collectively**

New ride pooling software will support the breakthrough of collectively used taxi services with automated vehicles. These new, independently operated on-demand services will be so convenient and affordable that only few people will use automated vehicles for private purposes. This "commercial collective transport" will establish itself as a third form of mobility positioned between private and conventional public transport and will be comprehensively integrated into multimodal mobility.

### **Elimination of the worst bottlenecks on the motorway/national roads network**

In accordance with the federal infrastructure programme, the most severely congested sections of the motorway/national roads network will be widened. The resulting additional traffic lanes will be reserved right from the start for high-occupancy automated vehicles. If bottleneck problems should arise again, only high-occupancy automated vehicles will be permitted on congested sections of the network.

### **Transformation will strengthen public transport**

Conventional public transport will systematically use digitalisation and automation to continuously improve the range of services and cut production costs. The railways will become the number one choice for long-distance and combined transport. In both urban and rural areas, smaller but much more flexible and need-based services will supplement, and to some extent also replace, the previously existing services.

The authorities will closely monitor price development for transport services. If the gap between individual and collective transport widens, they will intervene. The productivity effects arising from automation will offer advantages here, as they provide a means of gradually internalising the external costs of transport. Increased taxes and levies will be used to influence the population's mobility behaviour to the benefit of everyone.

### **Predictive traffic management**

In Switzerland, traffic management is carried out by neutral, non-profit-oriented authorities. The use of transport services across all carriers and road networks will be optimised through predictive traffic management. All road users will thus benefit to an equal extent from the resulting improvements.

### **Agility on the part of government and stakeholders**

The transport system is internationally coordinated. Cross-border transport and the smooth introduction of automated vehicles will be possible. The authorities will continuously gain practical experience with automated vehicles on the public road network. This will enable them to formulate sensible, effective measures and regulations as needed.

## **Fields of action**

To steer the use of automated vehicles in the direction of the envisioned scenario, action is needed in a number of fields. The fields of action focus on the activities of the public authorities in the thematic areas addressed by the sub-projects of the research package. Other important aspects such as climate protection, energy efficiency and the promotion of certain technologies are not the subject of the considerations here.

Politicians and the relevant authorities need to take action in the following five areas.

- **Facilitating the introduction of automated vehicles:** The use of automated vehicles in Switzerland must be made possible at an early stage. This calls for the creation of the appropriate regulatory framework and its harmonisation with the needs of society. Parallel to this, the authorities responsible must create the infrastructure-related and operational conditions enabling the use of automated vehicles. This includes initiating the data network to be jointly operated with other involved players for the purpose of providing the required data. This field of action forms the basis for all other government actions.
- **Securing mixed traffic management and shortening the mixed traffic phase:** Switzerland has to anticipate a lengthy period of mixed traffic on its motorways and national roads. In residential areas, automated vehicles will have to permanently come to terms with pedestrians and users of two-wheeled vehicles. The necessary preparations will have to be made for ensuring the safe and smooth coexistence of all road users. At the same time, the framework conditions have to be created that facilitate the fastest possible penetration of Switzerland's fleet of (highly) automated vehicles.
- **Promoting collective use and its integration into the overall transport system:** Automated vehicles should be used collectively to the greatest possible extent. The existing regulatory framework has to be adapted so that it enables the development of new forms of collective transport in both the private and public transport segments. At the same time, the public authorities have to create favourable framework conditions for the integration of collectively used automated vehicles into the overall transport system.
- **Exploiting potential for the efficient use of road infrastructure:** The potential of automated vehicles for increasing the efficient use of the existing road infrastructure has to be consistently exploited. This calls for the highest possible penetration of Switzerland's fleet of highly automated vehicles, especially on the motorways and national roads. To support fleet penetration, the motorway/national roads network must offer the necessary operational flexibility. The additional data and information acquired on automated vehicles have to be applied to the expansion and

operation of a predictive, comprehensive, interdisciplinary traffic management system.

- **Using new types of services to support conventional public transport:** Where traffic flows can be readily combined, rail transport has to be further expanded. For the further development of fully integrated mobility, incentives need to be created promoting the enhancement and potential substitution of existing services in conventional public transport with new, more need-based and economical solutions. At the same time, the public authorities must ensure that mobility does not become even more affordable through the use of automated vehicles, and that the price gap between individual and collective transport does not widen. Authorities must use the revenue from taxes and levies to manage traffic more effectively.

Given the dynamic environment and significant uncertainties associated with automated driving, the implementation of measures requires a **high degree of agility**. This means experimenting responsibly, acting swiftly and taking remedial actions where necessary without delay.

## Measures

The measures for each field of action are listed below by topic:

### Facilitating the introduction of automated vehicles

- Ensure cooperation, create foundations, prepare regulations
- Inform and involve the general population
- Facilitate networking/cooperative driving
- Provide the necessary digital infrastructure for automated driving

### Securing mixed traffic management and shortening the mixed traffic phase

- Ensure smooth traffic flow and road safety during the mixed traffic phase
- Speed up the penetration of the fleet of automated vehicles

### Promoting collective use and its integration into the overall transport system

- Foster the collective use of automated vehicles
- Integrate new types of transport use into multimodal mobility

### Exploiting potential for the efficient use of road infrastructure

- Eliminate remaining bottlenecks, increase operational flexibility
- Further develop a predictive traffic management system

### Supporting public transport

- Expand and improve conventional public transport services
- Introduce effective pricing systems

### Demonstrating a high degree of agility

- Ensure agility in procedures and legislation
- Carry out practical tests involving highly automated vehicles under Swiss conditions

## Need for research

A need for additional research on automated driving has been identified in the fields of traffic safety and functional capacity, public acceptance and traffic modelling.

## Conclusions

The introduction of automated vehicles is inevitable; it will be a lengthy process and will give rise to a challenging interim phase. However, over the long term the benefits will outweigh the drawbacks. Switzerland has to adopt a predictive approach to the changing circumstances. The framework for action acts as an orientation aid for this purpose.