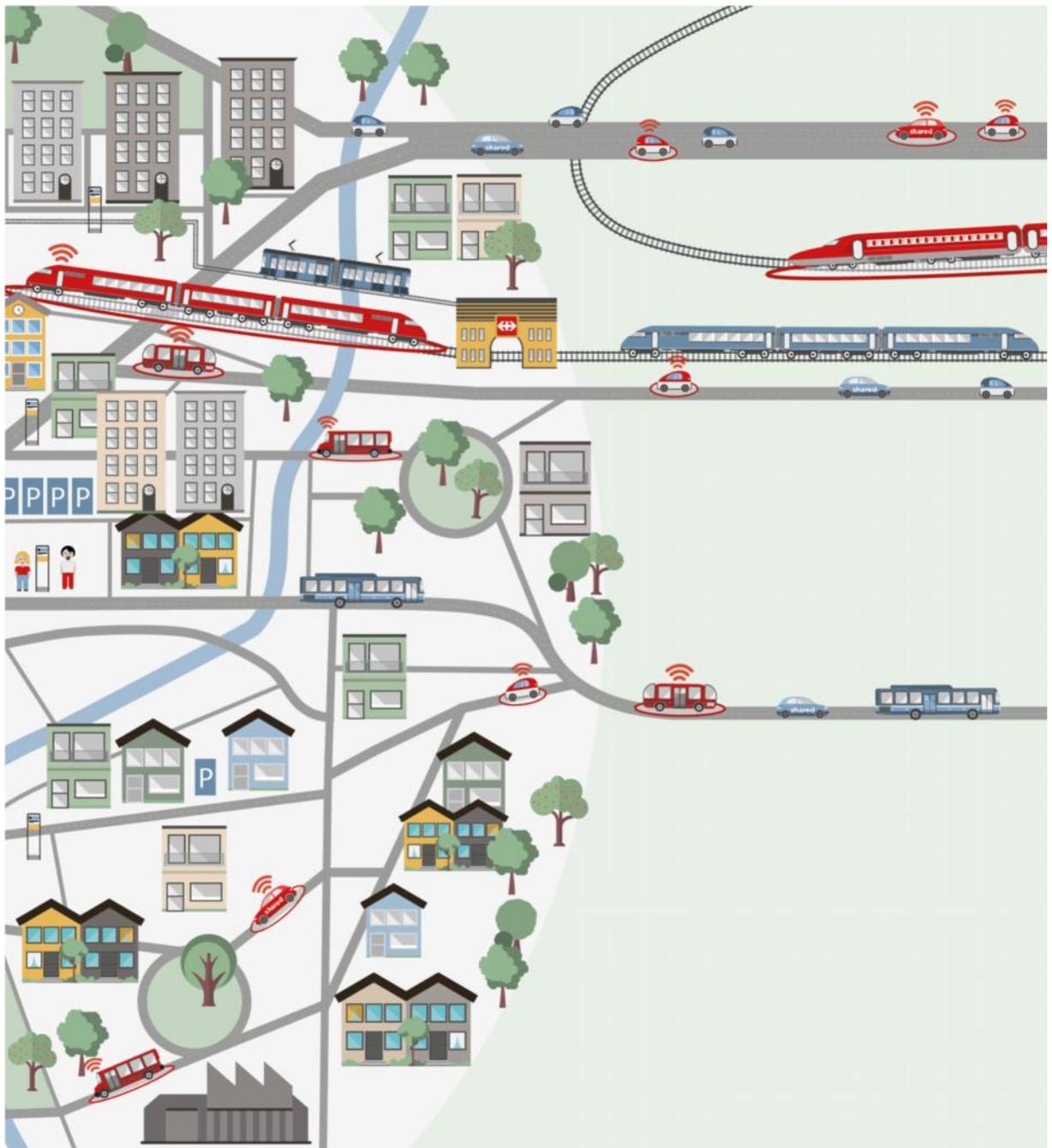


BaslerFonds, Swiss Association of Cities, and Additional Partners

Use of Automated Vehicles in Everyday Life - Potential Applications and Effects in Switzerland

Final Report Basic Analysis (Phase A)
Final Version 10/24/2017



Summary

With EBP's support, the BaslerFonds, the Swiss Association of Cities, four cities, four cantons, several transportation agencies and other institutions are working on a study titled "Using Automated Vehicles in Everyday Life - Potential Applications and Effects in Switzerland". The focus of the study is on the possible applications for everyday mobility in Switzerland.

The basic report on potential applications and effects in Switzerland is now available. Among other things, this shows how automated driving in Switzerland is likely to develop in the coming years. The findings form the essential basis for the in-depth work in the upcoming second phase of the study.

Initial Position

Automated driving today is primarily technology and industry driven. Assured knowledge about the effects on travel behavior, the entire traffic situation, the spatial development or the infrastructure needs are largely missing. The FEDRO submitted its report "Automated driving - consequences and transportation-policy implications" in December 2016. The report focuses on the National Highways and barely covers subordinate networks and public transportation. For planners in cities and cantons, as well as for the public transportation agencies, central questions arise in these areas in particular: What impact do automated vehicles have on the capacity of the transportation network infrastructure? Do we need new infrastructures? What legal adjustments will be necessary? What are the roles and responsibilities of the public sector? Who owns the data produced by AVs? Which mobility offers meet market opportunities?

Numerous driving assistance systems are already commonplace in everyday travel, such as adaptive cruise control on motorways, and braking, parking, and lane-keeping assistance. Some car manufacturers have developed highly automated highway chauffeurs and are now working on motorway and park pilots who can fully autonomously drive in a given environment. Railways have long been using driverless trains on isolated and well-defined routes, such as the Skymetro hover train at Zurich Airport or the M2 Metro Line in Lausanne. In long-distance and regional traffic, however, there is still no fully automated application available worldwide.

The technological possibilities are already well advanced. However, automated driving in Switzerland is prohibited today without a special permit. The licenses are aimed at selected groups and are limited to test routes - for example, the driverless mini-buses in Sion and Zug, and soon in Fribourg, Schaffhausen and Bern.

Possible Development in Switzerland

The starting point for assessing future development is complex: the requirements from a technical, legal and infrastructure perspective are extensive. Different trends are driving innovation (demographic development, increasing security needs, innovation dynamics), while others are inhibiting (privacy protection). Depending on future values, development will also run in different directions.

Based on a storyline, the study shows a development path with six states, which today are considered to be plausible from a technical point of view. Which sequence will actually occur depends among other things on technical developments, a legal framework, social acceptance and political decisions.

It is assumed that no isolated solutions are sought in Switzerland but rather that developments from other European countries will be adopted, especially for motorized individual transportation. In public transportation, however, it is quite conceivable that Switzerland will decisively influence international developments or even assume a precursor role.

Motorized private transportation is expected to undergo a gradual development from conventional self-directed vehicles to complete automation. The necessary approvals to sell vehicles will be broadened technically and applied in different settings - from a special permit for test tracks, to individual developers via the temporary release of test routes for users with a corresponding approved vehicle, to general approval in the overall network. Automated vehicles are likely to prevail first on the highways and then in urban areas. As a closed system, highways are comparatively simpler: structural separation of directions, conflicts only occur with regard to lane changes, there are no other modes of transportation, and the development of assistance systems has already progressed. In urban areas, the situation is much more complex than in other areas due to mixed traffic and high traffic volumes. Today's detection technologies still have difficulties in detecting moving objects, especially at higher speeds. However, the coverage of radio data networks in urban areas is significantly better than in rural areas.

Before automated cars drive on Swiss roads, the legislation on vehicle approval must be adjusted. The Road Traffic Act today takes for granted that every vehicle has a driver who is constantly in control of the vehicle. However, first the Vienna Convention on Road Traffic has to be adapted. Efforts for this are in progress. In the near future, automated driving systems may be approved, as long as they can be overridden by the driver at any time. However, a completely self-driving car can then still not be approved. There is also a need for action in the area of liability legislation: instead of human crash causes, programming and system errors are now coming to the forefront.

In rail-bound public transportation, the transition to automation is less complex than in road transportation: the vehicles travel on fixed routes, are already integrated in higher-level control systems and are procured and renewed as fleets. However, how quickly automated driving makes its way is also dependent on vehicle generations: the rolling stock in public transportation is used much longer than in private transportation.

The coexistence of different modes of transportation is increasing, especially in the urban areas: it will no longer be possible to differentiate only between pedestrian, bicycle, public and motorized individual transportation. In motorized transportation, a distinction must be made between the different degrees of automation, their requirements and the regulations in the traffic area. There will be new hybrid forms between public transportation and motorized individual transportation.

Decisive for the market penetration of private vehicles are individual additional benefits (increased traffic safety, time gained through the freedom to practice alternative activities while driving, or increased travel comfort due to reduced responsibility) but also the additional costs (equipment with expensive sensors, increasing communication costs).

Vehicles will for a long time be able to deliver more than what they are allowed to deliver. In other words, despite the technological prerequisites it is not possible to anticipate the rapid spread of automated vehicles - neither in public transportation nor in motorized individual transportation.

The market situation will be shaped for years by numerous actors. Despite competitive conditions and some hurdles, it can be assumed that cooperation will be inevitable because of the different competencies. Throughout the development, the study attributes an important role to

vehicle manufacturers and navigation providers, but also to transportation agencies and vehicle oversight authorities. Official geodata producers, data analysts and mobility providers will also gain in importance. Last but not least, the transportation authorities on all jurisdictional levels are becoming ever more important. The population expects regulations to increase safety and efficiency, as well as government agencies have the potential to control and evaluate data.

Opportunities and Challenges

From the perspective of the cantons and cities, automated vehicles offer numerous opportunities: efficiency and space gains in parking space, capacity gains on roads, new possibilities for traffic control, the development of mobility-as-a-service offers (the combination of various public and private transportation services, organized via a platform), increased accessibility thanks to new services. So, what do the authorities have to do to exploit such opportunities?

As shown in the storyline, several agencies play a central role in the successful development of automated driving. The federal and cantonal vehicle oversight authorities must be able to define the approval of automated vehicles. Due to the software dependency of future vehicle systems, it would hardly be possible for them under current conditions to issue the guarantee of the required safety levels by the model approval procedure. Therefore, the guarantee of product safety should increasingly be the responsibility of the manufacturer. At the same time, a countrywide vehicle registration system is required, which defines certain parameters for software-related adjustments to the vehicle and clarifies the conditions under which a vehicle is to be re-examined.

Furthermore, automated vehicles in Switzerland will rely on an adequate data transmission infrastructure. In addition, the transportation infrastructure is supposed to require sufficient halting possibilities for any fallback procedures (for example, continuous breakdown lanes on motorways), road markings and traffic signals must be visible or detectable under any weather conditions. Different scenarios are being discussed in Switzerland. In order to exploit the potential of automation as aspired by public agencies, the digital infrastructure would have to be adapted. For example, traffic light systems would have to be equipped with two-way communication and the traffic management centers would have to be equipped with the necessary hardware and software. Furthermore, the inner-city streetscapes must at best be adapted to the requirements of mixed traffic between automated and non-automated vehicles and other road users.

The transportation authorities are required to define in a timely manner the necessary regulations that would authorize the use of (or much later possibly the obligation to use) automated driving features on the road network and the coexistence of non-automated traffic. Coordination and cooperation with manufacturers and suppliers will be one of the biggest challenges for the authorities over the next few years. With the achievement of the state of full automation, the authorities will continue to play an important role. According to the study, the volume of traffic will increase without steering measures, as various driving demand effects overlap: now empty runs are possible, new transportation options are created, and even users without a driving license can ride alone in automated vehicles. Authorities could intervene with various transportation planning, technical and political measures and correct any undesirable developments. For example, in zones where high traffic levels regularly lead to congestion, the use of fully automated vehicle systems for suitably equipped vehicles could become mandatory. It is conceivable that the vehicles are overridden by an intelligent traffic management to optimize the traffic flow. At a certain point in time, only highly automated vehicles could be allowed. The situational adjustment of the driving speed to the traffic condition would enable an optimization

of the traffic flow and efficiency increases. Discussions on maintaining bus and tram line services, tolls, parking fees, access restrictions for inner cities, subsidies of pooled services, and the prevention of empty runs etc. will take place. To what extent such measures will be implemented will ultimately depend on the respective national, cantonal and municipal transportation policy.

The study notes that Switzerland could play a pioneering role in automated public transportation. For the time being, road-bound public transportation is gaining new perspectives, especially in local traffic, thanks to full automation. In the longer term, there is the possibility of making mobility more demand-driven and eliminating existing bundling through courses and lines.

The possibility of self-driving vehicles in private and public transportation also opens up new possibilities for the organization of transportation chains. For example, fully automated vehicles can automatically change their location between trips with passengers. They could also be used by multiple drivers. New forms of hybridization between public transportation and motorized individual transportation are emerging, which in turn will result in new development perspectives, forms of supply and definitions of motor vehicle and public transportation. A change in the modal split is the likely consequence. The integration of various services and means of transportation is a key success factor for public transportation. Complexity requires long-term planning, which leads to correspondingly long lead times. In addition, the service life of rolling stock and infrastructure is very long.

The study assumes a tightening of competition between motorized individual transportation and public transportation. Hybrid forms play a special role. Their characteristics and the possible influence on conventional public transportation should be examined in more detail during the in-depth phase. Linked to the reorganization of the transportation chain is the combination of public and private transportation services as well as various forms of transportation via a platform that organizes routes and regulates payment through a single account. For public transportation agencies, this raises questions as to whether they can take advantage of the opportunity to provide such mobility services ("mobility as a service").

Conclusion

The examination of the storyline and the six states leads to different insights. The extensive, fundamental assumptions of the study already show just how diverse the future of automated driving in Switzerland might actually be.

Ultimately, we have to discuss as a society the benefits of automated driving, and what unwanted developments we want to avoid. The benefits of automated vehicles, such as safety and efficiency gains, will not develop spontaneously; the general conditions must be implemented gradually and effectively. If this does not happen, the automated vehicle has the potential to paralyze individual (urban) transportation through traffic growth. The political will to design is therefore of central importance. Without proper incremental regulations which are introduced proactively mal-developments such as increasing congestion and traffic disruption are foreseeable.

Outlook for Phase B

The basic analysis has reached a first stage of ongoing research. Based on the first findings, there are now numerous connecting factors to go on. According to the research concept, analysis in six areas is planned for Phase B: transportation technology, traffic and data security, opportunities and challenges in public transportation, the challenges for cities and agglomerations, resources / environment / climate, and freight transportation and city logistics.