



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Swiss Federal Roads Office FEDRO

ROADS AND TRAFFIC 2019

Developments, facts and figures

Contents

Cover photo

The 4.2-kilometre Eyholz tunnel in the canton of Valais is the only stretch of the motorway/national roads network that was completed in 2018.

Editorial	3	Wildlife bridges	
Highlights of the year	4	Safe passage for wildlife as well as road users	33
Tunnel safety		Swiss-EU Land Transport Agreement	
Tunnel safety is of the highest priority	6	Road transport: Switzerland with same rights and obligations	34
Installations for operational and traffic safety	7	Completion of network	
Tunnel cleaning to enhance safety	8	Development of the motorway/national roads network	35
Night-time closures for periodical tunnel inspections	9	Motorway construction	
Bridge safety		2.4 billion Swiss francs for construction, expansion and maintenance	36
30 million Swiss francs a year for inspections of the motorway/national roads network	10	Five major projects on the motorway/national roads network	37
Concrete and protection against corrosion	11	Gotthard road tunnel	
Heavy vehicle inspections		Approval procedure for 2nd Gotthard road tunnel is on track	38
10th anniversary of opening of Ripshausen heavy vehicle inspection centre	12	Key FEDRO data	39
Research concept		Motorway/national roads network	
Better use of research in the roads sector	14	Eyholz tunnel in Valais was the only new motorway stretch opened in 2018	40
108 ongoing research projects	15	The Swiss motorway/national roads network	41
Automated driving		Transalpine goods traffic	
Automated and networked vehicles: FEDRO pointing the way forwards	16	Number of heavy goods vehicles crossing the Alps down again in 2018	42
Availability of the motorways/national roads		Accumulated distance	
Smooth traffic flow on the network	18	Accumulated distance unchanged, but traffic jam hours down by two percent	43
Traffic flow		Traffic volume 2018	
Better use of existing infrastructure, or “slower can be quicker”	20	Map of traffic volume on the motorway network	44
FEDRO and traffic management		Vehicle statistics 2018	
Traffic management – FEDRO at the helm	22	49,493 more motor vehicles on Switzerland’s roads	46
Working together with cantonal police and Viasuisse	23	4.5 percent fewer new cars than in the previous year	47
Algorithms in traffic		Accident statistics 2018	
Traffic algorithms calculate the most efficient speeds	24	Road accidents in 2018: increase in accidents involving electric bicycles	48
Mobility pricing		Administrative measures 2018	
Mobility pricing: model testing in the canton of Zug	26	Fewer licences confiscated in 2018	50
Risk management		Financing	
Active approach to risks and opportunities	27	Finance flows for the two road transport funds	52
Protection against forces of nature		Organisational chart	
Rockfall on the Axen route – an example of how natural hazards are dealt with	28	Organisational chart of the Federal Roads Office (FEDRO)	54
Emergency call system		Addresses	55
eCall – the automatic emergency call system	30	Publishing details	58
Navigation system			
Galileo – not just a navigation system	31		
Electric mobility			
Proportion of electric cars to be increased to 15 percent by 2022	32		



Dear Reader,

Ensuring the safety of all road users is of the utmost importance to us. When we speak of traffic regulations, we are talking about road safety. When a stretch of motorway is renovated, the safety of road users as well as that of the roadwork site personnel is of the highest priority. When we address human-powered mobility, its integration into the road network and complex traffic situations is often based on safety aspects.

Safety is also a key issue for FEDRO in tunnels and on bridges on the motorway/national roads network. We do not accept any compromises.

We have achieved a high degree of road safety and are among the leaders in Europe in this regard. However, the increasing traffic volume is giving rise to major challenges to safety on roads in general. One of FEDRO's duties is to keep traffic flowing as smoothly as possible and find ways to improve it on stretches where congestion still occurs. This, too, can make our roads safer. In this context, our traffic management centre in Emmenbrücke works closely together with the cantonal police forces and Viasuisse.

Safety measures also include protecting the network against natural hazards and identifying risks that need to be minimised. Risk management also opens up opportunities that benefit FEDRO and all road users. Last but not least, we promote research in the field of road traffic, including options for enhancing road safety. With a view to future developments, we are currently revising our research concept.

These are a few examples of issues you will find addressed in this year's edition of "Roads & Traffic", which underscores the diversity of our present-day and future activities. We look forward to the major tasks ahead that will encompass infrastructure, financing, vehicles and data management in the interest of road users. We hope you will find this annual report, which focuses on private mobility and the complex range of FEDRO's activities, interesting and informative.

Jürg Röthlisberger
Director of the Swiss Federal Roads Office (FEDRO)

Highlights of the year

27 June 2018

National transport plan

Adoption by the Federal Council of the road infrastructure segment of the national transport plan – a federal planning instrument that is constantly being updated. The aim here is to ensure that the long-term development of the motorway infrastructure can be coordinated with the defined spatial planning targets.

23 September 2018

Comprehensive network of cycle routes to reduce accidents

73.6 percent of voters accepted the proposed federal resolution on cycle routes. This was a direct counterproposal to the withdrawn "Velo-Initiative". The federal government can now define the principles for cycle route networks, as well as support and coordinate measures on the part of the cantons, municipalities and other involved players.



30 November 2018

General project for the widening of the Bern/Wankdorf-Schönbühl stretch

Approval by the Federal Council of the general project for widening the stretch between Bern/Wankdorf and Schönbühl to six and eight lanes respectively. Costs: around 474 million Swiss francs. Work is scheduled to commence in 2027.

1 May 2018

17 May 2018

Third report on public procurement

In 2017, FEDRO carried out 3,042 procurements totalling more than 1.4 billion Swiss francs, compared with 3,063 totalling 1.5 billion Swiss francs in the previous year. As in the past, in terms of value FEDRO based a large proportion of its procurements (79 percent of the total value) on competitive tenders, notably for services relating to planning and project development in the construction sector, management support for owners and developers, roadworks, signalling and IT services.

14 September 2018

Further development of the motorway network

Adoption by the Federal Council of the Strategic Motorway Development Programme (STEP). Up until 2030, the Federal Council aims to initiate expansion projects on the motorway/national roads network costing a total of around 14.8 billion Swiss francs. The aim here is to reduce congestion on the motorways and national roads.

10 October 2018

Measures for improving traffic flow

Proposal by the Federal Council to also introduce legal measures in order to improve traffic flow and enhance the level of road safety. These include introducing a legal obligation to form an emergency lane and regulations governing overtaking on the right on motorways. A corresponding consultation procedure was held.





14 December 2018
Mandatory accompaniment of L-drivers under the age of 20

With effect from 1 January 2021, people under the age of 20 who obtain a learner's licence will have to complete a twelve-month learning phase. The advantage of this extension to the period of driving instruction is that the risk of accidents after learners have passed the practical driving test can be reduced if they have been accompanied on a greater number of journeys.

1 January 2019

Requirement of medical examination as of the age of 75

Entry into effect of the raising of the age limit for medical examinations for drivers. According to the new regulation, holders of driving licences for cars and motorcycles will now only have to undergo a medical examination every two years after the age of 75. The previous age limit was 70.

7 March 2019

Designation of suppliers of charging stations at motorway rest areas

By providing charging stations at motorway rest areas, the federal government is making a contribution towards the availability of optimal recharging facilities for electric vehicles. The 100 rest areas are to be divided among five (out of a total of eight) bidders (private investors and operating companies).

17 December 2018

Lorenzo Cascioni new Vice Director

Appointment of Lorenzo Cascioni (54) as new Vice Director. With effect from 1 May 2019 he will take over as head of the Road Traffic Division. He had previously been head of the Strategic Management Support section at the Federal Chancellery since 2006. His predecessor as Vice Director, Werner Jeger, is to take over as Road Safety Officer.

1 April 2019

18 December 2018
Common road map for the promotion of electric mobility

At the invitation of Federal Councillor Doris Leuthard, representatives of the automotive, electricity, real estate and vehicle fleet segments and their respective industry associations, together with representatives of the federal government, cantons and municipalities, signed a declaration aimed at promoting electric mobility. The aim behind this move is to increase the proportion of registered electric vehicles to 15 percent by 2022.

1 January 2019

New head of DETEC

Change of leadership at the Federal Department of the Environment, Transport, Energy and Communications (DETEC). The new head of DETEC (and thus of FEDRO) is Simonetta Sommaruga. She takes over from Federal Councillor Doris Leuthard, who had been head of DETEC since 2010.



1 February 2019

Discontinuation of specification of "automatic transmission" in driving licences

As of 1 February 2019, anyone who passes the practical driving test in a vehicle with automatic transmission is also permitted to drive vehicles with manual transmission. The specification of "automatic transmission" will no longer be entered in driving licences. Holders of driving licences issued prior to the above date may ask the relevant road traffic authority to delete this restriction.

Tunnel safety is of the highest priority

Statistically speaking, the tunnels on the motorway/national roads network are safer than the open stretches. If an incident occurs inside a tunnel, however, road users have to be able to escape to a safe zone as quickly as possible. FEDRO is continually working to improve escape routes as well as ventilation, traffic signs and energy supply in tunnels.



Safety shaft in the Viamala tunnel on the A13 expressway in the canton of Grisons.

As the figures for 2018 show, there were 54,000 accidents on Switzerland's roads, 7,800 of which occurred on the motorways/national roads and "only" a very small number in tunnels. Thus, the level of tunnel safety on the motorway/national roads network is very high. There are various reasons why this is the case: in tunnels the speed limit is lower, in many tunnels heavy goods vehicles are prohibited from overtaking, lighting is on permanently and the lanes are not affected by rainfall or ice formation. On the other hand, both the construction and operating costs of tunnels are many times higher than those for open stretches and bridges.

If there is a fire in a tunnel, road users are exposed to the risk of smoke developing. Major fires in the past, for example in the Gotthard road tunnel in 2001, prompted efforts to improve guidelines and standards relating to tunnel safety. FEDRO produced directives concerning motorway tunnel safety requirements, together with other regulations and guidelines, for example governing ventilation in tunnels. In addition, it also adapted SIA Standard 197/2, which applies to the planning of road tunnels.

1.55 billion Swiss francs for tunnel safety up to 2025

Commencing in 2010, the level of safety with respect to escape routes, ventilation, signalling of safety installations and redundant energy supply in the 252 tunnels on the motorway/national roads network was examined and where necessary improved. The majority of tunnels now meet the specified criteria: escape routes, 83 percent; ventilation, 86 percent; signalling of safety installations, 94 percent; energy supply, 93 percent. According to the tunnel safety implementation programme, all tunnels on the motorway/national roads network have to meet the new requirements by 2025. The status of implementation is updated annually in the interim programme reports and posted on the Internet. The costs for improving tunnel safety will amount to approximately 1.55 billion Swiss francs. A billion Swiss francs were already invested in the period from 2010 to 2018.

www.astra.admin.ch/tunnel-safety

Installations for operational and traffic safety

Tunnels on the motorways and national roads are equipped with comprehensive operating and safety installations, plus indicated emergency exits. The aim here is to ensure safe passage during normal operation and rapid escape in the event of an incident.

Emergency exits, which lead from the main tunnel to safety zones and thus permit rapid escape, are a major factor for tunnel safety. According to the relevant specification, emergency exits in twin-tube tunnels (i.e. with one-way traffic) must be installed every 300 metres. In single-tube tunnels (i.e. with two-way traffic), the specified interval can be between 150 and 500 metres, depending on the longitudinal gradient.

Emergency exits must be indicated with luminous green signs, which display flashing lights in the event of an incident. The emergency exit from the main tunnel normally leads to an escape shaft and on to the exterior of the tunnel or the neighbouring tube, and thus to a safety zone.

Smoke extraction

The ventilation directive (FEDRO 13001) stipulates which type of ventilation system has to be installed in a given tunnel. In the event of a fire, the ventilation system has to keep the area affected by smoke as short as possible in order to protect people in the tunnel from exposure to smoke and toxic gases. Tunnels longer than 1 kilometre have to be equipped with a ventilation system with smoke extraction so that concentrations of toxic fumes can be swiftly removed from the tunnel.

Energy supply and lighting

Tunnels on the motorways and national roads are supplied with electricity redundantly by two separate providers. If a power failure should nonetheless occur, a battery-powered emergency supply is available for one hour for the most important installations. This means, for example, that lighting in the escape routes remains available during the initial state of the emergency.

Tunnels are equipped with dimmable overhead lighting. During bright daylight conditions, the lighting is switched on at the portals. This enables drivers' eyes to adjust to the light conditions inside the tunnel, where the lighting is weaker than at the entrance to the tunnel.

SOS recesses are installed in tunnels at intervals of 150 metres. They are each equipped with two fire extinguishers and an emergency phone that is connected directly with the traffic police. These recesses, which are marked in orange, are not safe locations and if there is a fire they do not provide protection against smoke and fumes.

Tunnels are monitored with the aid of video systems. In this way, police and traffic management centres can quickly implement measures in the event of an incident and also have detailed information at their disposal concerning the cause, location and extent of the incident. In addition, automatic or individual announcements by the police can be received via car radio on VHF or DAB+.



An emergency exit from the Viamala tunnel leading to the safety shaft.

Tunnel cleaning to enhance safety

As part of the operational maintenance programme, motorway/national road tunnels are cleaned twice a year. This improves the visibility of the various safety elements and simultaneously enhances operational safety, helps preserve the structural substance and gives the tunnel a cared-for appearance.

The operation of the motorways/national roads is secured by eleven regional offices, as a rule cantonal civil engineering departments, which act on behalf of FEDRO on the basis of service level agreements. Cleaning the motorways/national roads costs around 50 million Swiss francs a year, with tunnels accounting for 15 million. The major tunnel cleaning programme is carried out each year during the spring. Pre-scheduled night-time closures are used for this purpose, during which other maintenance work is carried out. Where necessary, a second, less comprehensive tunnel cleaning programme is carried out in the autumn.

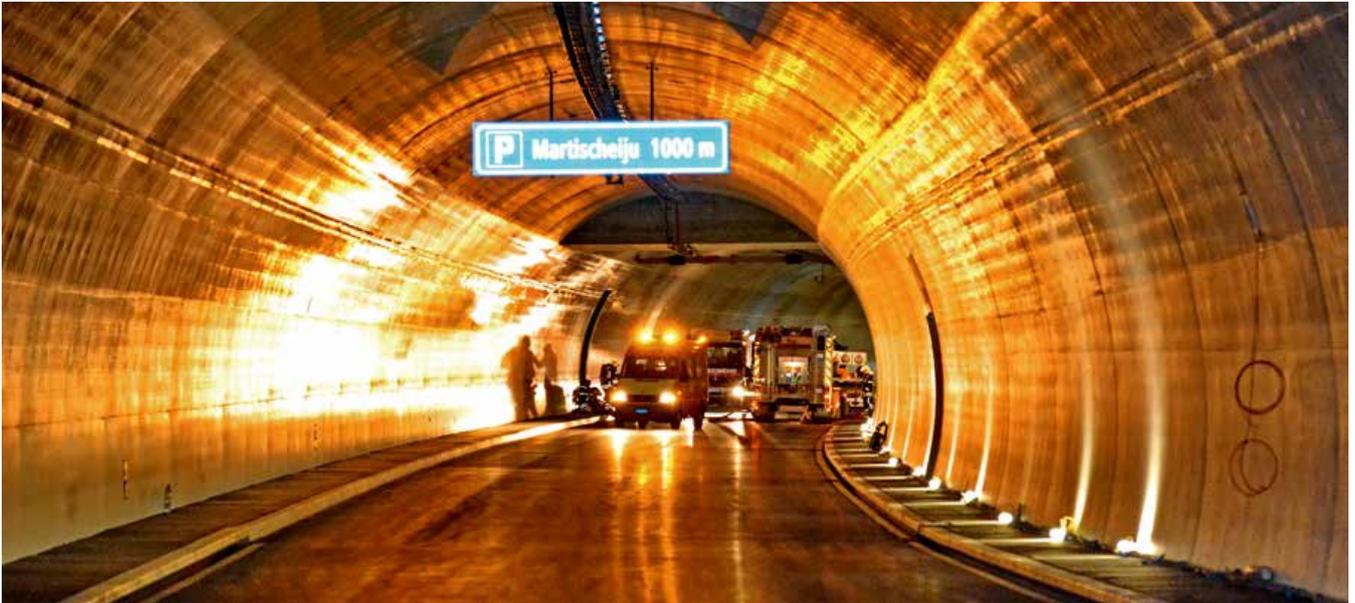
Environmental protection regulations

The nature of the tunnel cleaning operations is defined and specified in FEDRO directive 16220, which regulates the cleaning of the operating and safety installations, the washing of the walls in order to enhance visibility and give the tunnel a well-cared-for appearance, and the cleaning of the drainage facilities.

During the cleaning process, care is taken to assure compliance with the applicable provisions governing the protection of the environment and bodies of water. Only cleaning agents that meet the relevant legal provisions may be used. Due to material that is lost during transport (for example, straw or gravel that ends up in the shafts and pipelines), the cleaning of drainage systems is particularly work-intensive. During periods of hot, dry weather, the dried-up siphons also have to be replenished with water in order to prevent the potential spread of burning hazardous liquids into the drain pipe system.



Cleaning of the walls in the Murgwald tunnel on the A3 along the Walensee lake in the canton of St Gallen.



Inspection work in the Turtmann tunnel on the A9 in the canton of Valais.

Night-time closures for periodical tunnel inspections

One of the reasons for monitoring tunnel structures is to track their condition and take any measures that may be necessary. Full and interim inspections are carried out alongside control measurements and function checks. In addition, permanent observations and special inspections have to be carried out.

The main purposes of tunnel inspections are to visually check the condition of the structure, carry out the controls specified in the monitoring plan and assess the overall condition of the tunnel. By periodically carrying out careful inspections it is possible to detect any changes in the structural substance that may have occurred. In order to ensure that access to the motorways/national roads remains available with as little restriction as possible, most inspections are carried out during night-time closures.

Defined planning procedure

Full inspections are carried out every five years, as a rule by a mandated engineering bureau. These are implemented in accordance with a clearly defined, standardised plan that is conceived so that the results of the respective inspections can be compared with one another. In this way, any increase in damage can be readily identified.

A full inspection enables specialists to assess the condition of the structural substance. The inspectors assess the structure as a whole, as well as each component in detail. The components are classified into status categories 1 to 5 (cf. pp. 10–11), and the findings are documented in a report on the full inspection. Any identified damage is recorded in a damage plan, which FEDRO uses as the basis for introducing any necessary measures and initiating renovation projects.

Interim inspections are carried out annually by the responsible regional office and serve the purpose of detecting deviations from the required status. Control measurements are carried out in accordance with the monitoring and maintenance schedule.

Targeted observation is a permanent task that is carried out by the regional offices within the scope of their operational duties. It includes following up on observations communicated by third parties.

Special inspections are only required if a change in status is observed but cannot be precisely classified.

30 million Swiss francs a year for inspections of the motorway/national roads network

Road bridges are complex structures. They are exposed to environmental influences such as water, temperature fluctuations and wind, as well as damage caused through the use of salt in winter. Periodical inspections are therefore an integral part of the maintenance programmes of road owners. FEDRO invests around 30 million Swiss francs a year for inspections of the infrastructure on the motorway/national roads network.

It is the duty of FEDRO to ensure the safety of road users, as well as to guarantee the availability of the motorway/national roads network. Bridges are exposed to particular wear and tear from heavy traffic loads and various environmental influences in the ageing process and therefore need to undergo periodical inspections. The results of these status assessments form the basis for the planning of any measures that may be required. The growing volume of traffic, heavier loads and new technological developments may lead to steps being taken to reinforce road bridges.

Status assessments and follow-up static tests are carried out in accordance with SIA Standard 269 (Maintenance of Engineering Structures), which describes the required general examination, visual controls and inspections. It also sets out the specifications for detailed examinations, in-depth investigations, laboratory tests and subsequent computational verification.

Inspections every five years

In the same way as for tunnels, bridges on the motorway/national roads network have to be inspected every five years by specialised engineers. The inspections are carried out on the basis of uniform criteria. FEDRO carries out a detailed status assessment and examination every ten years. It verifies the quality of the inspections and the completeness of the inventory both internally and through an external bureau. Closures of bridges for inspection purposes are rarely required.

As of 2017, there were 9,366 engineering structures on the motorway/national roads network. The replacement value of these structures is 23.28 billion Swiss francs.

www.astra.admin.ch/network-status

Condition of engineering structures in 2017*

1	26 %	Good	No or only minor damage.
2	63 %	Satisfactory	Insignificant damage, no impacts in terms of safety and performance, but potential to develop into category 3.
3	10 %	Sufficient	Moderately severe damage, no impacts in terms of safety; needs to be closely monitored.
4	1%	Critical	Severe damage, no impact in terms of stability or traffic safety; needs attention in the medium term.
5	0%	Poor	Urgent measures required, for example replacement of transition joints or individual elements, installation of temporary support structures, imposition of weight restrictions.

* Engineering structures include bridges, tunnels, covered stretches, wildlife corridors, retaining walls

Concrete and protection against corrosion

As a rule, bridges on the motorway/national roads network are constructed of concrete. For their durability, protection against corrosion is of the utmost importance. Negative influences include surface moisture, water flow and salt water ingress. Special attention has to be paid to these aspects when assessing a bridge's condition.

The high density and chemical composition of concrete protects the steel reinforcements. This protective capacity is weakened by the formation of cracks, chemical reactions with CO₂ and the ingress of salt water, creating potential for the internal steel reinforcements to rust. Visual inspections therefore have to especially focus on the following aspects:

- seals, transition joints and drainage facilities
- signs of erosion
- formation of fissures on the concrete components
- existing erosion of the reinforcements, cracks and spallings in the concrete, exposed steel reinforcements
- deformations

Excessive fissure formation can be a sign of overstrain. In the case of steel and composite (steel and concrete) bridges, the protection of the steel structure against corrosion has to be inspected. For a detailed condition assessment, the following types of damage have to be quantified:

- CO₂ influencing factors
- salt penetration
- status of the concrete's chemical composition

- microscopic examination of the concrete
- widespread corrosion detection
- measurement monitoring
- structural analysis of the bridge

To quantify the condition of a bridge, drilling samples, calculation of pH levels, geo-radar examinations and potential field measurements have to be carried out. In addition, the uppermost concrete layer has to be exposed down to the reinforcement bars. In the case of composite (steel and concrete), steel, oblique and suspension bridges, more intensive examinations (x-ray, ultrasound, magnetic induction) may be required.

The costs for visual inspection are fairly moderate, but they are correspondingly higher if more detailed assessments are required. FEDRO carefully plans the deployment of financial resources by weighing up the costs of status assessments against the costs of comprehensive renovation.



Bridge at the "Court" junction on the A16 "Transjurane" motorway.

Statistics: Condition of engineering structures on the entire motorway/national roads network (1,858.9 kilometres)

Status category	Engineering structures and tunnels
1	2,503
2	6,006
3	923
4	133
5	4
Total	9,569

10th anniversary of opening of Ripshausen heavy vehicle inspection centre

The Ripshausen heavy vehicle inspection centre near Erstfeld (canton of Uri) was opened on 9 September 2009. Since then, the Uri police have been inspecting HGVs, delivery vehicles and buses on behalf of FEDRO. They carry out random inspections of drivers, vehicles and freight.

Ripshausen is one of six heavy vehicle inspection centres in Switzerland. It was opened in 2009 as the fourth centre after Unterrealta (2004), Schaffhausen (2007) and Ostermundigen (2008). The St Maurice and Mesolcina inspection centres were completed in 2012 and 2018 respectively. Ripshausen is situated directly on the Gotthard axis, along which around 780,000 HGVs travel each year. The Gotthard is the most important north-south route for HGVs; Ripshausen is thus by far the largest inspection centre in the country. Heavy vehicle inspections form an integral part of Switzerland's road transport safety concept. At Ripshausen, inspections are carried out in order to ensure that heavy vehicles entering the Gotthard road tunnel are in road-worthy condition so that the roads can be kept as safe as possible. The construction of Ripshausen heavy vehicle inspection centre cost 70 million Swiss francs. The centre currently employs around 50 personnel. Its annual operating costs are 6 million Swiss francs. The centre comprises three covered inspection lanes plus a testing facility. It is similar to the vehicle testing centre of a cantonal road traffic authority and is equipped with automatic vehicle data detection and offices, plus lounges for drivers.

In 2018, 15,558 vehicles (HGVs, buses, delivery vehicles) were diverted from the motorway for inspection. Irregularities were detected in 5,830 vehicles, and 2,483 of these had to be temporarily detained at the centre. The inspections also examine the condition of the drivers as well as their compliance with the specified working hours and rest periods. Vehicle inspections focus on technical aspects: faulty brakes, tyres and chassis are the most commonly detected shortcomings, and in most cases these have to be remedied before the vehicle is allowed to proceed. The inspectors also check vehicle loads and whether they are correctly secured. When a vehicle enters the centre it drives past an automated measurement and weighing facility. This means that its data have already been recorded when it enters the inspection lane. If there are no

detected shortcomings, the inspection takes between ten and twenty minutes; but, if problems are detected, the vehicle may have to be detained for several days. The waiting area, which can accommodate 495 HGVs, also fulfils an important function if there are too many vehicles on the approach to the Gotthard road tunnel.

28,683 vehicles inspected in 2018

There are six heavy vehicle inspection centres in Switzerland: Schaffhausen, Unterrealta (Grisons), Ripshausen (Uri), Ostermundigen (Bern), St-Maurice (Valais) and Mesolcina (Grisons). In 2018, a total of 28,683 vehicles were inspected at these centres (see table). 9,786 irregularities were detected, and 3,138 vehicles were prohibited from continuing their journey. Police forces also carry out random roadside inspections. In 2018, out of a total of 61,776 inspections, 10,492 irregularities were detected, and 2,052 vehicles were prohibited from continuing their journey.

www.astra.admin.ch/hgv-inspections

No. of inspected vehicles (HGVs, semi-trailers, delivery vehicles, buses)

Whole of Switzerland	2014	2015	2016	2017	2018
Inspection centres	27,554	30,085	30,048	27,790	28,683
<i>Of which buses</i>	437	494	496	534	516
Vehicles with irregularities	9,631	10,119	9,464	9,596	9,786
Vehicles detained	2,486	2,780	3,127	3,145	3,138
Roadside inspections	66,711	66,320	67,828	65,849	61,776
<i>Of which buses</i>	1,685	1,848	2,155	1,934	1,852
Vehicles with irregularities	12,214	12,150	12,377	10,815	10,492
Vehicles detained	3,133	2,944	2,734	2,347	2,052



1



2



3



4

Ripshausen/Erstfeld heavy vehicle inspection centre (canton of Uri). 1) Holding zone for feeding HGVs into the Gotthard road tunnel. 2) Insufficiently secured load. 3) The three inspection lanes. 4) Vehicle data are recorded automatically.

Better use of research in the roads sector

FEDRO is reorienting the organisation and content of its research in the roads sector. Five workgroups are developing the specified thematic priorities. The aim is to attach greater importance to road research. The new concept is to be introduced in 2020.

FEDRO's duties and objectives are clearly defined: to constantly improve the technical quality of the country's roads and guarantee their availability, to keep traffic flowing as smoothly as possible and to enhance the safety of our roads for all users.

The aim of the research is to directly implement findings and incorporate them into road transport policy. To secure the long-term benefits of its research, FEDRO is currently reorienting its overall concept.

FEDRO wants greater attention to be paid to its strategic areas of focus and the quality of its research projects to be further improved.

Workgroups instead of fields of research

The existing fields of research are to be replaced by the following five workgroups:

- Engineering structures, tunnels, geotechnology
- Transport routes and the environment
- Traffic planning and technology
- Mobility 4.0
- People and vehicles

This reorganisation ensures that all the relevant fields of research for FEDRO will be covered. In addition, a research commission is to be created which will support the FEDRO research management team with the specification of its strategic orientation. The commission will ensure that the various requirements of FEDRO relating to the development of the new research concept will be fully taken into account.

www.aramis.admin.ch



Research projects also focus on the concrete used in engineering structures: Graitery tunnel on the "Transjurane" motorway in north-west Switzerland.



Research is also required for the development of high-performance sealing, for example in the Visp tunnel (shown here).

108 ongoing research projects

FEDRO is currently implementing 108 road-related research projects. They concern areas such as infrastructure, road safety, traffic management and future mobility.

“New forms of human-powered mobility” / “Transport of the future” / “Continuous strain measurement with fibre optics in roads” / “Prevention of alkaline aggregate reaction in concrete” / “Impacts of automated driving”: these are examples of research projects being implemented on behalf of FEDRO and now nearing completion.

With the reorganisation, FEDRO will draw up a concept every four years and allocate specific research priorities to the various workgroups. The latter will then clarify the specific research requirements for the selected topics and subsequently provide FEDRO with an overview of the proposed research projects. FEDRO will then examine these proposals and define the detailed research programme and budget allocation. The workgroups will also be able to put forward their own ideas for research within the scope of an allocated budget.

FEDRO will outsource the research projects to external specialised companies, research organisations, Federal Institutes of Technology, etc. Each research project will be accompanied by a support commission comprising specialists from FEDRO and

from private companies, universities, etc. For projects relating to road safety, the Swiss Council for Accident Prevention (bfu) will also be represented in the commission.

Swiss Association of Road and Traffic Experts (VSS) and Swiss Association of Transport Engineers and Experts (SVI)

Road research cannot take place without the inclusion of expert bodies. FEDRO works closely together with the Swiss Association of Road and Traffic Experts (VSS) and the Swiss Association of Transport Engineers and Experts (SVI).

The VSS is mainly involved in the preparation of road transport standards and also carries out research on behalf of FEDRO for the revision of existing ones. It will also pass on its findings and experiences to the individual workgroups.

Automated and networked vehicles: FEDRO pointing the way forwards

FEDRO is attaching a high degree of priority to the promotion of projects and pilot trials relating to automated, networked driving. It is working closely together with authorities at home and abroad in order to ensure that the most uniform framework conditions possible can be created for Switzerland without delay.

With regard to automated driving, a total of 6 categories have been defined. In category 0, (non-automated), the driver is fully responsible for the operation of the vehicle. In the next three categories the system increasingly takes over the driving tasks. In category 4 (highly automated), no driver is required under certain conditions, while in the highest category (5, fully automated) there is no need for a driver at all.

Licensed trials since 2015

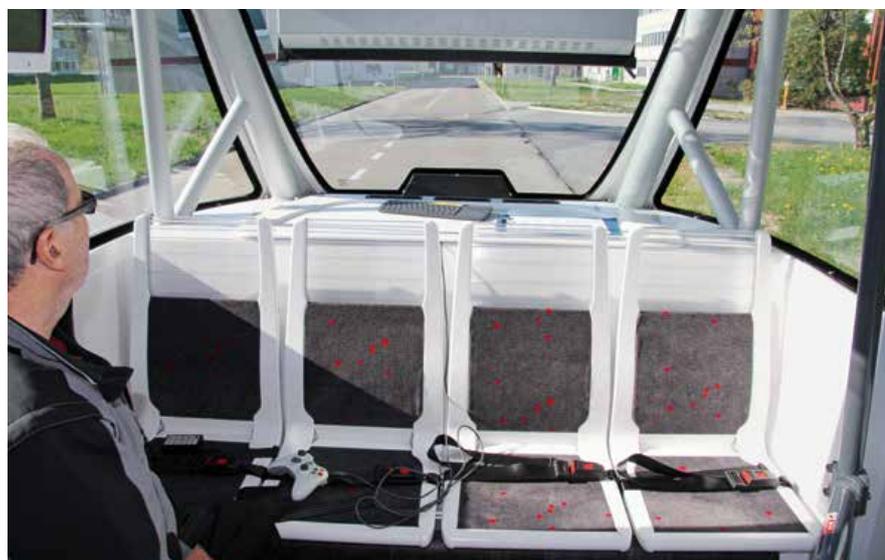
On behalf of the Federal Department of the Environment, Transport, Energy and Communications (DETEC), FEDRO is responsible for assessing requests to carry out pilot trials with automated vehicles and for actively supporting them. In this way it is able to obtain findings relating to new forms of mobility. Every trial provides insights into a development in the mobility sector that is still in its infancy. In order for a pilot trial to be authorised, it is necessary to define the new findings it is expected to yield.

For its assessment of licensing applications, FEDRO is working together with the Federal Office of Communications (OFCOM), as well as with the Federal Office of Transport (FOT) when public transport vehicles are to be involved. For a trial to be approved, it is necessary to also incorporate the various local authorities (road owners, cantonal police, cantonal road traffic authority, etc.).

The first licensed trial in Switzerland was organised by Swisscom and took place in Zurich in 2015. This involved a passenger car which was equipped with additional sensors and driven through the city over a ten-day period. A variety of other trials have since been conducted in Switzerland.

Completed trials:

- 2015: Swisscom, Zurich, passenger car
- 2016: SwissPost, Bern/Solothurn, delivery robot
- 2016: PostAuto, Sion, shuttle bus (version 1)
- 2017: SwissPost, nationwide, delivery robots



The shuttle bus operated by TPF in Fribourg no longer needs a steering wheel.

Ongoing trials:

- Since 2017: PostAuto, Sion, shuttle bus (version 2)
- Since 2017: TPF, Fribourg-Marly, shuttle bus
- Since 2018: VBSH, Neuhausen am Rheinfahl, shuttle bus
- Since 2018: TPG, Geneva-Meyrin, shuttle bus
- Since 2018: Swiss Federal Railways, Zug, shuttle bus

Licenses for conducting pilot trials are valid for a limited period of time. As a rule, applications are requested and approved for approximately two years. Organisers of trials are required to submit semi-annual interim reports, plus a final report (describing the findings and experiences) within six months after completion of the trial. These reports are published on FEDRO's website and thus made available to the general public (cf. link in box). In this way, interested parties wishing to conduct their own trial are able to obtain information about the current status of knowledge, which they can use as the basis for preparing new trials and obtaining further-reaching findings.

Like learner drivers taking their first lessons

From today's perspective it can be stated that the trialled vehicles are nowhere near ready to drive themselves autonomously from A to B. They behave like learner drivers taking their first lessons, and still have great difficulty with road traffic and mastering the many complex situations they encounter. The presence of a driver (who monitors the vehicle and the traffic situation) is still absolutely essential. He or she has to be able to stop the vehicle in emergency situations.

The trial organisers have to bear all the associated costs themselves. But through the trials they are able to gain valuable findings with the new technological developments, as well as with respect to the behaviour of their personnel and clients. Here a high level of acceptance has been ascertained.

What next?

Automated driving is an ever-present topic in the media. It is clear that the vehicles being brought into circulation today are becoming ever smarter. They are being equipped with ever more driver assistance systems. However, how quickly and in which direction automated driving will evolve cannot be reliably predicted today.

FEDRO is monitoring developments throughout the world and working closely together with authorities in other countries. With ongoing technological developments, applications for new types of trials will have to be assessed. It is foreseeable, however, that vehicles will be brought into circulation in which the problems that are known today will have been solved so that it will be possible to conduct trials of significantly higher complexity in a variety of traffic situations.

Adaptation of the Federal Road Traffic Act

In accordance with current national and international legislation, in all vehicles a driver must be present who is responsible for all operational tasks. But with increasing levels of automation, drivers will hand over more and more responsibility to the vehicle's operating system. In view of this, the UN Economic Commission for Europe (UNECE) in Geneva has for a number of years been preparing the necessary legal bases relating to vehicle technology and operation. If a breakthrough is achieved, Switzerland and the EU member states will have to adapt their legislation to the new circumstances.

Through a partial revision of the Federal Road Traffic Act it is intended to empower the Federal Council to enact the necessary legal bases without delay by amending the respective ordinances. This would make it possible for vehicles in automation categories 3 and 4 (only those with a driver) to be put into circulation in Switzerland in an orderly manner.

In order to make it possible to conduct pilot trials with intelligent vehicles more efficiently, the licensing competence is to be transferred from DETEC to FEDRO. Furthermore, FEDRO is to be empowered to delegate trials with a regional character to the involved canton. The consultation procedure regarding the partial revision of the Federal Road Traffic Act will be held in 2019.

www.astra.admin.ch/intelligent-mobility

Smooth traffic flow on the network

Most of the time, traffic on the motorway/national roads network flows smoothly and without disruption. This statement contrasts somewhat with the commonly held view of the daily traffic situation in Switzerland.

On more than two-thirds of the network, traffic normally flows smoothly, regardless of the time of day. Traffic jams and congestion mostly occur in the vicinity of the major agglomerations, though here, too, traffic flows smoothly much of the time. The general perception is in fact distorted because traffic bulletins are normally broadcast during the peak travel periods in the morning and evening.

These periods can be fairly precisely defined on the basis of typical daily traffic volume figures. The peak periods on the motorway/national roads network are between 6.30 and 9 a.m. and

4.30 and 7 p.m. If no serious accidents occur, traffic mostly flows without disruption during the rest of the day.

If the total traffic volume were to be evenly distributed throughout the full 24 hours, it would undoubtedly be possible to travel everywhere smoothly and without traffic jams.

On certain stretches of the network, traffic comes to a standstill during peak periods on almost every weekday as well as at weekends. This is particularly the case on the Zurich northern bypass (Zurich-Winterthur) and in the Limmattal, Bern,



Congestion near Effretikon (Zurich).

Lausanne and Geneva regions. Today the available capacities in the major agglomerations are fully stretched during peak travel periods.



Traffic jam on the A2 near Lugano North.

No. of traffic-jam-free days in 2017	
Zurich northern bypass (Zurich-Winterthur)	14
Limmattal region	25
Bern	79
Lausanne	82
Geneva	82

How are traffic jams hours calculated?

Traffic jam hours are calculated on the basis of Viasuisse traffic bulletins. Most of these are recorded manually, i.e. no nationwide realtime data are available for automatically processing and generating traffic bulletins. The data contained in the relevant database are processed in a separate computer program in which the traffic jam hours are calculated.

Manual input is carried out by the following organisations:

- The central Viasuisse bureau in Biel/Bienne (traffic jam reports)
- The local Viasuisse bureau in Dielsdorf (traffic jam reports for the agglomeration of Zurich)
- The National Traffic Management Centre operated by FEDRO in Emmenbrücke (traffic jams, roadwork sites, reports relating to traffic management)
- The control centres of the cantonal police forces (traffic jam reports)

The cantons carry out the tasks associated with traffic information and traffic jam reports on behalf of FEDRO. The National Traffic Management Centre is responsible for supervising the proper performance of these tasks. All the involved organisations create the data in the same format, which means that they can be exchanged at any time with the National Traffic Management Centre and the control centres of the cantonal police forces. The reliability of the reported traffic jam hours greatly depends on the available options for accurately assessing the traffic situation on the network. If a disruption is not detected, the data cannot be included in the statistics. Also, if the clearance of a traffic jam is detected too late, this can contribute towards an over-estimation of the number of traffic jam hours. In order to improve the quality of data input, the methodology and system are subject to ongoing improvements by all the involved organisations.

Better use of existing infrastructure, or “slower can be quicker”

The motorways and national roads are often congested during peak travel times. Traffic jams in the mornings and evenings are a common occurrence. Expanding the infrastructure is extremely expensive. It is therefore crucial to utilise the existing roads as efficiently as possible.

Switzerland’s population has risen sharply in the past few decades. This has resulted in increased housing development and expansions of the existing transport infrastructure. Despite the expansion of public transport services and targeted promotion of human-powered mobility, the volume of road traffic has nevertheless continued to grow. These developments are having a particularly strong impact on the motorway/national roads network. The expansion of the network cannot keep pace with the increasing mobility requirements. This means that the existing infrastructure has to be used more efficiently, i.e. more vehicles and people must be transported from A to B on the same stretches of road.



The emergency lanes near Muri (canton of Bern) are to be temporarily opened to traffic during peak periods.

Management of traffic flow

According to traffic experts, a two-lane motorway can handle up to 4,000 vehicles an hour. This number can be increased if traffic flow is efficiently managed. In other words, the speed limit needs to be lowered so that more vehicles can be accommodated.

This is already being successfully accomplished on certain highly frequented stretches through the use of speed coordination and hazard warning systems. In periods of heavy traffic, the speed limit is gradually reduced to 80 km/h by means of dynamic signalling displays. The result is that all vehicles travel at the same speed, which reduces takeover manoeuvres and associated traffic disruptions. This in turn means that more vehicles can travel along the stretch concerned during the same period of time without causing a traffic jam. More of these systems are to be put into use in the next few years.

Temporary use of emergency lanes

The existing capacity can be increased without the need for expansion if vehicles are permitted to temporarily use the emergency lane. In this way, an additional lane can be made available between two nearby junctions during peak traffic periods. However, emergency lanes are there for safety reasons (e.g. in the event of a breakdown) and are also required for maintenance purposes. So, their use as an additional lane is only permissible during certain limited periods.

The loss of a “safety” element is compensated through the use of technical installations such as dynamic signalling displays indicating lower speed limits, traffic lights, video monitoring systems, etc. There are currently plans to permit the temporary use of emergency lanes on ten stretches, but its implementation is time-intensive due to the necessary legal steps that have to be taken in advance.

Avoiding peak periods

Congestion occurs on the motorways/national roads during peak travel periods, i.e. in the morning and evening, especially in the major urban centres. Otherwise, traffic normally flows smoothly and without disruptions, and capacities are not fully utilised. These free capacities should be better utilised by encouraging travel at other times of day. This would require a fundamental change of living and working habits. This represents a challenge for FEDRO and other authorities and policy-makers. Awareness must be raised in the population about mobility behaviour. By introducing flexible working hours and adapting school schedules, employers and educational institutions can also help create the necessary conditions for more effectively spreading traffic flows throughout the day.

Overtaking bans for HGVs on certain stretches

When HGVs decide to overtake, this results in a reduction in travel speed in the left-hand lane. On uphill stretches or when the traffic volume is high, this causes disruptions to traffic flow. Furthermore, the distances between vehicles are shortened and, especially in tunnels, drivers’ view of traffic signals can be blocked, which can result in hazardous situations. To prevent this, overtaking bans for HGVs have been introduced on critical stretches of the network. The aim here is to keep traffic flowing more smoothly and enable more vehicles to use the stretch concerned without disruption.

Reduction of number of vehicles on the roads

Traffic flow can also be improved by reducing the number of vehicles on the roads. The available options here include:

Car pooling: By sharing vehicles, more people would be able to travel along a given stretch. This form of mobility can only function if enough drivers can be found who are willing to share their vehicle, and if enough people are prepared to travel as passengers instead of driving their own car. In 2017, DETEC initiated a car pooling trial for all its units, under the leadership of FEDRO.

Motorway access management: To prevent congestion, traffic can be fed in to the motorway with the aid of traffic lights. The aim here is to only allow as many vehicles to enter the motorway as the traffic volume permits. This keeps traffic flowing smoothly and prevents disruptions.

Stretches on which the temporary use of emergency lanes is planned

Canton	Project
Bern	N6 Wankdorf–Muri
Baselland/ Aargau	N2/N3 Pratteln–Liestal–Rheinfelden junction
Lucerne/ Zug	N14 Blegi–Rütihof
Vaud	N1 Villars-Ste-Croix–Cossonay
Vaud	N1 La Sarraz–Chavornay
Vaud	N9 Lausanne-Vennes–Belmont
Vaud	N1 Aubonne–Morges-East
Zurich	N1 Winterthur Töss–Winterthur Wülflingen
Zurich	N3 Wädenswil–Richterswil
Zurich	N1 Zurich East–Brüttisellen junction

Traffic management – FEDRO at the helm

FEDRO is responsible not only for the construction and maintenance of the motorway/national roads network, but also for its operation. Here, one of its tasks is to influence traffic in a targeted and coordinated manner so that it flows as smoothly as possible.

FEDRO's objectives include the enhancement of road safety by reducing the number of accidents and traffic jams. In order to achieve these goals it operates a traffic management system in the form of the National Traffic Management Centre, which was opened in 2008 and currently employs 27 staff. It is situated in Emmenbrücke (canton of Lucerne).

Traffic management encompasses the following areas of activity: steering, directing, controlling and providing information. Steering involves the diversion of traffic via alternative routes, for example to avoid trouble spots. This takes place in the form of recommendations or rerouting. The term "directing" refers to influencing traffic along a given stretch. Here the measures may include speed limits, signalling of hazards, temporary use of emergency lanes, traffic lane management. Traffic flow can also be influenced by extending the duration of green traffic lights. On motorways this involves the use of traffic feed-in systems (on congested stretches) or diversion of traffic to local roads. Information is provided via traffic bulletins and variable text display devices.

Traffic management measures have to be selected carefully and adequately coordinated. Furthermore, the relevant personnel at the federal and cantonal levels need to know what has to be done in a given traffic situation. For this purpose, FEDRO draws up management plans together with the involved cantons. These plans specify the measures that are required in certain situations and who is responsible for implementing them, so that traffic flow can be kept as smooth and safe as possible.

At the operational level, the National Traffic Management Centre permanently records and assesses the traffic situation, and orders the necessary measures to be taken in advance or in order to deal with incidents.



The National Traffic Management Centre in Emmenbrücke (canton of Lucerne), which belongs to FEDRO.

Holding zones for heavy vehicles

In the event of an accident or congestion on the north-south transit axes, heavy goods traffic can be held back in order to improve traffic flow for other road users. For this purpose, holding zones for heavy vehicles have been created which can be activated by the National Traffic Management Centre as required. At the same time, operators of heavy goods vehicles receive information about the option of carriage by rail.

In the future, technological developments in the transport sector will also open up new promising potentials with respect to traffic management. For example, automated driving could pave the way for the more efficient use of the motorway/national roads network.

Working together with cantonal police and Viasuisse

The National Traffic Management Centre, located in Emmenbrücke (canton of Lucerne), is the hub of operational management for traffic on Switzerland's motorways and national roads. It does whatever is necessary to keep traffic flowing and coordinates between the various bodies responsible for road traffic, from police to Viasuisse.

Police are responsible for the initial safety-relevant intervention following road accidents, vehicle breakdowns, weather-related incidents and natural disasters. The measures they may take in dealing with these situations include, for example, information bulletins and traffic diversions. But what happens after that? The initial actions taken by police often have to be followed or accompanied by other traffic management measures. On Swiss motorways and national roads, these measures are ultimately under the responsibility of FEDRO, as are the measures necessary to relieve congestion and traffic jams on the roads.

The National Traffic Management Centre is a unit of FEDRO and is the operational control centre for traffic management. The traffic operators at the centre continuously monitor and analyse road traffic. They verify traffic reports and, based on traffic management plans, they decide what, if any, response

measures need to be taken. These measures may include, for example, re-routing of traffic by means of major diversions, permitting the temporary use of emergency lanes and cross-over or two-way traffic in tunnels or on open roads, and, in particular, informing road users accordingly.

The federal government has mandated Viasuisse with the task of communicating information about the traffic situation and the measures ordered by the National Traffic Management Centre. This information is dispersed via radio and TV, the Radio Data System (RDS), the Traffic Message Channel (TMC) and the Internet. The various parties involved share information with each other through the network of the national traffic data organisation of Switzerland. This ensures a uniform, collective database, which is an important condition for utilising the available traffic data in the best possible way.



The National Traffic Management Centre in Emmenbrücke (canton of Lucerne), which belongs to FEDRO: in the foreground, cantonal police motorcycles.

Traffic algorithms calculate the most efficient speeds

How does an intelligent traffic management system know what driving speeds it should post? Algorithms and manual operations both play a role in influencing traffic on the motorway and national roads network.

Traffic is dynamic and inhomogeneous. No situation is identical to another. Traffic on Switzerland's motorways and national roads can be influenced by means of dynamic variable signalling. Depending on the situation, the current maximum speed limit, hazard warnings, temporary use of emergency lanes, temporary bans on overtaking for heavy goods vehicles, diversions and other traffic information can be communicated to road users. Signalling is adjusted according to the situation and traffic. Road users are not aware of the complex, technical reasons that ultimately determine variable signalling.

Electronic data processing and technical algorithms are at work in the background. These take the form of a set of rules to be followed in recurring problem-solving operations. Different algorithms are used depending on the purpose of the traffic management measure in question. The algorithms used in traffic

management help achieve an optimal flow of traffic for road users overall, depending on the situation. This approach considers the entire system, not individual road users.

Being informed about the traffic situation is a requirement

A basic requirement for variable signalling is knowing what the traffic situation is like on location. Detectors measure various parameters of traffic flow. This information is automatically processed and analysed, and from this the signalling requirements are derived. Signalling to coordinate speed limits and hazard warnings alerting drivers to upcoming traffic jams are calculated and implemented on a fully automated basis. Signals can also be enabled manually, such as in the case of roadwork sites.

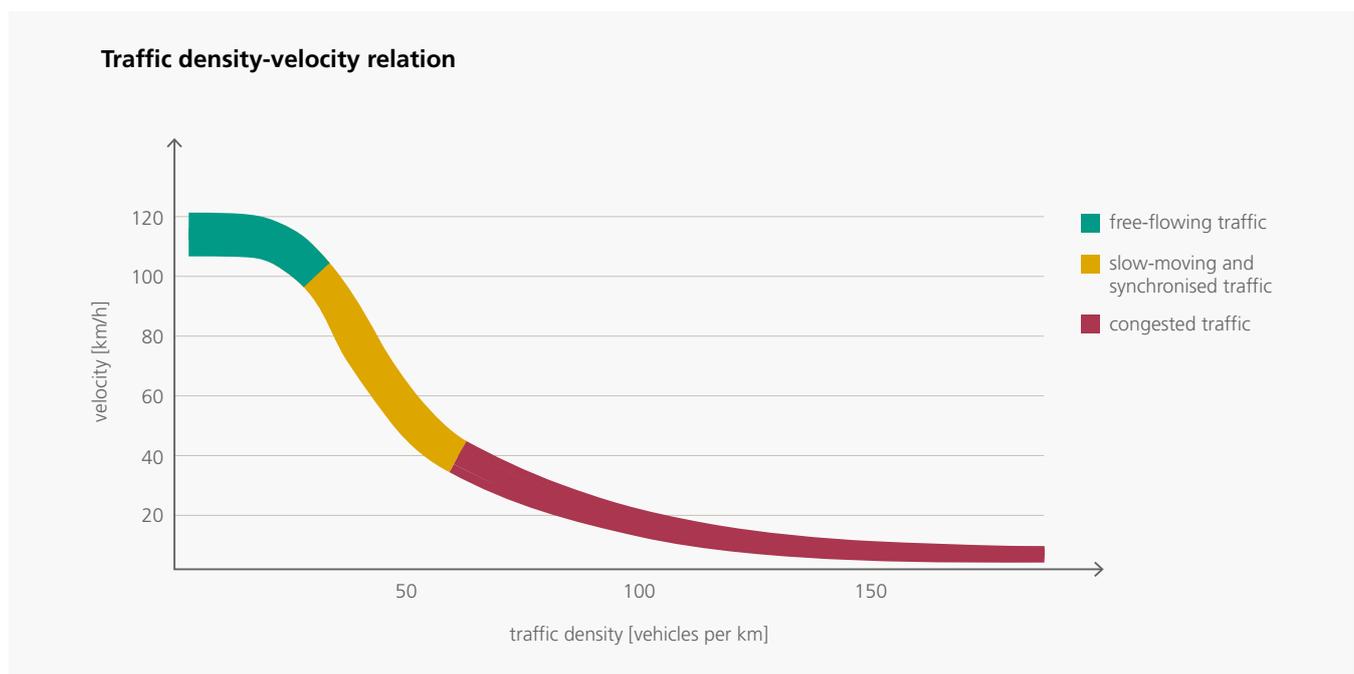


Diagram showing how traffic flow changes when traffic density increases.

To prevent signalling over short stretches from changing too frequently or contradictions in signalling, the individual calculated requirements are coordinated with one another and an overall state of operation is derived.

Traffic status

Traffic flows can be categorised into three different status levels. For example, an algorithm for coordinating speed limits is based on this three-level model of traffic status. The simplest case is that of “free-flowing traffic”, which requires no intervention.

In “synchronised traffic”, many interactions are occurring among the various road users. Driving speeds are aligning, the number of vehicles on a given stretch is steadily increasing, and the flow of traffic is reaching its capacity limits. Shock waves of congestion seemingly build up out of nowhere (“accordion effect”), or traffic may even come to a complete standstill (“traffic jam”).

As congestion builds, the throughput of vehicles travelling on the road declines, and a traffic back-up forms. Scientific studies have shown that after a breakdown in traffic flow, the maximum capacity of the road stretch in question is around 10 to 30 percent lower than before the traffic breakdown. The stretch does not regain its full capacity potential until after there is an interim period of free-flowing traffic.

Goal of traffic management

The purpose of the algorithms for harmonising speed limits is to avoid a breakdown in traffic flow from the perspective of the traffic system as a whole and thus keep traffic flowing at a high level.

The success of this depends on the calibration of the algorithms and the behaviour of road users.

Bird’s-eye view

The result of harmonising speed limits over a given stretch of road is most easily exemplified by travel time. In order for as many vehicles as possible to pass a cross-section of road, traffic must be as regular and homogeneous as possible. This may mean that the travel time for some road users is prolonged, but the collective travel time of all road users is reduced.

Individual road users compare the traffic situation at the time of signalisation with the traffic situation recognisable directly in their field of view. However, the direct, subjective perception of a traffic situation by an individual road user (“frog’s-eye view”) differs from the optimal solution for all road users in the system as a whole (“bird’s-eye view”).

Harmonising algorithm logic

For historical reasons, the traffic management systems in use today on Switzerland’s network of motorways and national roads apply different algorithms and traffic steering philosophies. FEDRO did not take over responsibility for the motorways and national roads and their traffic management from the cantons until 2008. Since then, it has operated the National Traffic Management Centre in Emmenbrücke. Harmonising traffic rule logic and algorithms is an essential step in standardising the existing traffic management systems. Standardising the systems will permit an efficient traffic management that keeps traffic flowing smoothly. In 2018, FEDRO published a directive on this; until then there had been no uniform national standards. FEDRO Directive 15019 bundles together the applicable technical specifications, including those for the algorithms, and thus fills an important gap in the harmonisation effort. FEDRO is committed to further promoting traffic management. In particular, the potential of traffic-dependent signalisation is to be better exploited.

Mobility pricing: model testing in the canton of Zug

Those who use the roads and railways should pay for their use accordingly. That is the principle behind mobility pricing. How does mobility pricing influence traffic? Can it help relieve congestion on roads and in public transport? How high must the pricing per kilometre be to achieve the desired effect? These questions were examined in model testing conducted on behalf of FEDRO in the canton of Zug.

The results of the model testing are expected to be available in the second half of 2019. Mobility pricing has the potential to ease congestion during peak periods and enable the more efficient use of road and railway capacities. The Federal Council asked the Federal Department of the Environment, Transport, Energy and Communications (DETEC) to study the effects of mobility pricing, taking the canton of Zug as an example and applying a theoretical impact analysis based on traffic model calculations. The Federal Council defined several basic principles to serve as framework conditions. First and foremost, on balance no additional costs were to result for road and public transport users, meaning that the revenue generated by mobility pricing must be compensated elsewhere. This could be achieved, for example, by eliminating the motorway sticker ("Vignette") or reducing fuel taxes. In spring of 2018, a team of specialists led by FEDRO commenced work on the project. The goal of the impact analysis, taking the canton of Zug as

an example, was to provide information about the effects of mobility pricing on traffic, commerce and the environment: What tariffs would be practicable and when should they be applied? To what degree can the volume of traffic be reduced at peak times? How much less time would be spent in traffic jams as a consequence? What effect would a high per-kilometre mobility price in the urban agglomeration have on the businesses there? Does mobility pricing encourage urban sprawl?

The final report on the testing, which is scheduled to be published in the second half of 2019, will provide answers to these and other questions. The Federal Council will then decide on what steps to take next with regard to mobility pricing in Switzerland.

www.astra.admin.ch/mobility-pricing

Influencing mobility demand

In the concept report on mobility pricing issued in 2016, the Federal Council explained its understanding of mobility pricing and what it wants to achieve with it – mobility pricing is to be an instrument for solving capacity problems in Switzerland's transport systems. The intention is not to increase the overall costs of mobility in future, but for it to be paid for in a different way. The Federal Council also sees it as important that mobility pricing encompasses all forms of transport, as the roads and railways complement each other as means of transport and both are at the limits of their capacity in the city centres and urban agglomerations. In the Federal Council's view, however, mobility pricing alone will not suffice to relieve congestion and bottlenecks to the extent required during peak periods. Further measures are

also essential, such as flexible working models, changes to school classroom schedules, home offices, car pooling and car sharing. In the summer of 2016, the Federal Council mandated the Federal Department of the Environment, Transport, Energy and Communications (DETEC) with the task of liaising with interested cantons and regions to examine the feasibility of pilot trials for mobility pricing. In the discussions that followed, it was concluded that conditions are not suitable for pilot trials at present. The canton of Zug therefore agreed to make its overall cantonal transport model available as a basis for FEDRO to perform a theoretical impact analysis of mobility pricing and its consequences, so as to gain further concrete insights into the issue as per the Federal Council's mandate.

Active approach to risks and opportunities

Thanks to systematic risk management, FEDRO is able to identify a broad variety of risks at an early stage and thus reduce them to an acceptable level. At the same time, when preparing projects FEDRO emphasises the need to take account of opportunities and utilise these wherever possible. Risk and opportunity management is an essential instrument for FEDRO to accomplish its tasks and achieve its objectives.

Risk management is an essential instrument. It provides an overview of the current risk situation and facilitates the early implementation of the necessary measures. In order to be able to identify the importance of the various risks, the probability of their occurrence as well as their potential impacts have to be assessed. The determination of probability of occurrence is carried out within the federal administration on the basis of uniform criteria. The potential impacts are examined and described on the basis of the following dimensions: financial consequences, injuries, damage to reputation, negative effects on business processes, environmental impacts. For each relevant dimension a scale ranging from low to very high is used for classifying potential impacts. In the past few years, FEDRO identified ten strategic risks each year.

During the performance of its tasks, FEDRO cannot rule out risks entirely. It is prepared to consciously accept and manage risks in situations in which this is unavoidable. In keeping with the principle of the careful deployment of federal financial resources, FEDRO aims to keep risks as low as possible. Decisions regarding the implementation of measures are taken on the basis of cost-benefit deliberations. As of the end of 2018, 23 measures had been implemented in order to minimise identified risks.

Opportunities are incorporated into project planning in the same way as risks. Opportunities as well as risks can arise in all the cited dimensions and with varying degrees of probability of occurrence.

Continuity management

Business continuity management is an integral part of integrated risk management, and it focuses on incidents. Its purpose is to minimise the impacts of a given incident on critical services and business processes. FEDRO has prepared the corresponding action plans and trialled the associated processes.

Development of a risk management system

FEDRO's risk management system is embedded in the overlying system operated by the Federal Department of the Environment, Transport, Energy and Communications (DETEC) This ensures that FEDRO's risks are incorporated into the overall federal risk assessment process. Strategic risks are defined and consolidated once a year at both the divisional (bottom-up) and the management (top-down) level, and measures are specified where necessary. The management of FEDRO is responsible for monitoring the implementation of these measures.

In addition, risks are also systematically identified and monitored at the operational level in construction and IT projects. Operational risk management is also supplemented with the identification of opportunities. At the process level, the internal control system is a central element for the minimisation of risks.

Rockfall on the Axen route – an example of how natural hazards are dealt with

On 26 December 2018, a large rockfall occurred above the Axen route in the canton of Uri. No one was injured and the road was not damaged, but it nonetheless had to be closed for safety reasons – an example of FEDRO's approach to natural hazards.

At 7.30 a.m. on 26 December 2018 the Uri cantonal police received a report that a rockfall had occurred on the Axen route (N4) near the northern portal of the Zingel tunnel. Fortunately, no one had been injured. Although around 50 cubic metres of rock had fallen, which is equivalent to the volume of a garage for a passenger car, neither the tunnel portal nor the gallery itself had been damaged. Nonetheless, the Axen route between Sisikon and Flüelen had to be closed immediately for safety reasons, because the risk of further rockfalls could not be ruled out. The stretch was only reopened to traffic once specialists had declared it safe after a thorough inspection had been carried out and the debris had been completely cleared.

One-sixth of the motorway/national roads network is exposed to natural hazards

Like the Axen route, numerous stretches of the motorway/national roads network run through zones susceptible to natural hazards, mainly due to the topographic circumstances. Currently, around 300 of the network's total of more than 1,850 kilometres are exposed to natural hazards such as mudslides, landslides, avalanches and rockfalls. This means that the protection of the infrastructure and the people who use it is of the utmost importance for FEDRO.

In 2008, in cooperation with the Federal Office for the Environment (FOEN), the National Natural Hazards Platform (PLANAT), the cantons and universities, FEDRO launched a project concerning the management of natural hazards on the motorways and national roads.

Risk identification and assessment

As a first step, FEDRO prepared hazard warning maps for the entire network showing which hazards exist, and where. These risks then have to be assessed as thoroughly and accurately as possible. The next step is to define the necessary protective measures, as well as the action to be taken in the event of a disaster and to repair any resulting damage.



Thanks to structural measures, a tunnel entrance on the Axen route was left undamaged by the rockfall.

The protective measures may be structural or organisational in nature. Structural measures include special meshes to prevent rockfalls, or debris retention basins. One of the main organisational measures concerns the precautionary closure of a stretch, for example due to the risk of an avalanche. The cost-benefit ratio (based on marginal cost considerations) is a decisive factor for the choice of a given measure.

The average annual costs for the protection of the motorways and national roads against natural hazards (identification of risks, analyses, plus construction, maintenance and operation of protective installations) run into tens of millions, with annual fluctuations depending on the extent to which protective structures need to be renovated or replaced.

Back to the Axen rockfall...

The rockfall that occurred on the Axen route on 26 December 2018 was by no means unexpected. The region is recognised as a source of hazards and protective measures have been implemented along this route. The emergency services (police, fire brigade, ambulance), plus the Canton of Uri Office for Motorway Operation and FEDRO, are well prepared. A geologist was already on site on the morning of 26 December 2018, so even though this was a public holiday it was possible to carry out a comprehensive assessment of the situation without delay. During the morning, specialists inspected the affected zone from a helicopter. In this way it was ascertained that, with the implementation of rudimentary measures, the stretch could be opened to traffic again as soon as the debris had been cleared. The clearance operation was carried out efficiently by a private transport company. The Axen route was reopened to traffic at 4.30 p.m. – just nine hours after the occurrence of the rockfall. This incident provides a good example of how FEDRO deals with natural hazards.

Occurrence of a second rockfall

The Axen route had to be closed again on Friday 11 January 2019 due to another rockfall, this time in the vicinity of the southern portal of the Zingel tunnel. The volume of rock was relatively low this time (around five cubic metres). By way of comparison, a four-axle tipper with a total weight of 32 tonnes has a loading volume of twelve cubic metres. Once again, no one had been injured. The stretch was reopened to traffic shortly after midnight.

Risk areas: Walensee, Axen, Brünig, Simplon

To prevent rockfalls at specific exposed locations, FEDRO closely monitors the development of fissures and crevices in the rock face. The stretches concerned are the Walensee (A3), Axen (A4), Brünig (A8) and Simplon (A9). Sensors and motion detectors permanently monitor changes in the crevices and thus provide an indication of the stability of the rock face. Ideally, in this way rockfalls can be prevented by taking appropriate action or implementing emergency measures (for example, closure of the stretch concerned). The total costs for the operation of these monitoring systems are around 100,000 Swiss francs a year.

Three steps in the risk management process for natural hazards

1. Risk analysis

What happens where, and how frequently? What is the extent of the resulting damage? Hazard warning maps are one of the instruments that can be used here.

2. Risk assessment

What has to be protected? Where are protective measures required, and where not?

3. Planning of measures

What specifically needs to be done in order to reduce the level of risk in endangered areas?

www.astra.admin.ch/natural-hazards



The fire brigade can also respond more quickly thanks to eCall.

eCall – the automatic emergency call system

In spring 2018, the automatic emergency call system, eCall, was declared mandatory for newly registered passenger cars and delivery vehicles. In the event of an incident, these vehicles automatically transmit an emergency call that is received at the nearest control centre. Thanks to eCall, rescue organisations can respond more rapidly to accidents and other incidents.

On 31 March 2018 the automatic emergency call system, eCall, was declared mandatory for newly registered passenger cars and delivery vehicles throughout Europe. It is based on the standardised European emergency call number 112 and is triggered automatically by the vehicle in the event of a serious incident. It can also be activated manually.

When activated, the system calls the nearest emergency response centre, which also receives information about the incident, including the time and location, as well as the type of vehicle. This enables the emergency response centre to dispatch the necessary crew quickly and efficiently. Thanks to this system, the number of fatalities and serious injuries on our roads can be further reduced.

To identify the exact time and location of the incident, eCall requires a satellite navigation receiver and a mobile communication module for the transmission of the data. Unlike a smartphone, the module (which is equipped with a “sleeping” SIM card) only dials into a mobile phone network if eCall triggers an emergency call. This means the vehicle cannot be tracked via eCall.

In accordance with the relevant bilateral agreement with the EU, eCall is also being installed in vehicles in Switzerland, where the system automatically connects to local emergency response centres. The involved police forces are currently making preparations to receive additional data from eCall. FEDRO is assisting the relevant authorities and monitoring the international development of the system.

Vehicle manufacturers and insurers have already been providing emergency call services and other types of aid. While “third-party eCall” functions via mobile phone networks, eCall uses the standard emergency call number, 112. Communication via this number takes precedence over all other mobile connections and thus functions even when the mobile phone networks are working at full capacity. To avoid confusion with “third-party eCall”, eCall is designated “eCall112”. Although “third-party eCall” may still be installed in newly registered vehicles in addition to “eCall112”, only one of these systems may be activated at a time.

Galileo – not just a navigation system

The European satellite navigation system, “Galileo”, is nearing completion. Its development is scheduled to be completed by 2020. Switzerland is also involved in the development and operation of this system.

Satellite navigation systems such as Galileo will soon be having a decisive influence on a variety of sectors. High-precision satellite signals are, for example, a prerequisite for driver assistance systems in both the road and rail transport sector. These systems help make transport more efficient as well as safer. In the aviation sector, satellite technology already plays a major role today. The low-flight networks permit flying in poor visibility conditions, for example, and thanks to Galileo this will be possible under even more difficult conditions.

Galileo was conceived as a civilian and independent alternative to the military satellite navigation systems of the USA (“GPS”) and Russia (“Glonass”). The completion of Galileo, with a total of 30 satellites in orbit round the Earth, is scheduled for 2020. Some of its services have been publicly available since 2016. Users of mobile phones equipped with the necessary receiver already benefit – knowingly or otherwise – from high-precision Galileo signals.

Uses in the forestry, agriculture and energy sectors

Galileo technology is not solely intended for use in the transport sector. It can also be used for improving the accuracy of surveying activities, which can facilitate the more sustainable management of forests. In the agriculture sector, it can also reduce water consumption and the use of fertilisers.

The Galileo satellites will also have an impact on future energy supply. The highly accurate time signals can be used for coordinating effective electricity production in real time. This will enhance network stability and reduce potential overproduction.

Galileo is an EU infrastructure project. Switzerland is involved in the financing of its development and operation. FEDRO is coordinating Switzerland’s participation in the project, which has been regulated in a cooperation agreement that secures Switzerland’s access to the various system services as well as its involvement in the main administrative bodies. The agreement also secures access for Swiss companies and research organisations to Galileo-related bidding procedures.



The new satellite navigation system, Galileo, will make traffic safer and more efficient: “Weyermannshaus” motorway junction on the Bern western bypass.

Proportion of electric cars to be increased to 15 percent by 2022

In order to increase the proportion of electric cars, the Federal Department of the Environment, Transport, Energy and Communications (DETEC) has agreed on an “Electric Mobility Roadmap” with numerous companies and industry associations. The goal here is to increase the share of newly registered electric vehicles to 15 percent by 2022.

The “Electric Mobility Roadmap” that was proposed by DETEC was concluded in December 2018. More than 50 organisations and companies from a variety of sectors were involved in its development and finalisation. It lists specific measures in the areas of successful market development of vehicles and optimal recharging infrastructure, plus incentives and framework conditions.

a highly-promising measure. FEDRO issued a call for tenders for five packages encompassing 20 locations each throughout the country. From the total of eight bidders, five were awarded the mandate of operating the fast-charging stations in the respective rest areas. The first stations are expected to be ready for operation from 2020.

The federal government is to implement a variety of measures to promote the development of recharging stations and electric mobility. The planned installation of fast-charging stations in 100 rest areas along the motorway/national roads network is

www.astra.admin.ch/electric-mobility



Rest areas (without restaurants) and service areas (with restaurants) where fast-charging stations are planned or already installed.

Safe passage for wildlife as well as road users

Wild animals use the routes – wildlife corridors – they have always been accustomed to. But our roads often intersect with these and thus prevent wild animals from using them. In order to preserve these corridors, FEDRO has constructed thirty large wildlife bridges over the motorway/national roads network, plus numerous smaller underpasses.

The thirty large wildlife bridges, many of which are up to 50 metres wide, provide a safe passage across motorways and national roads for animals such as red deer, roe deer and wild boar. In addition, numerous smaller underpasses have been constructed for animals such as badgers, foxes, squirrels and weasels. Since the early 1990s, when studies began to focus on the environmental impacts of roads, wildlife passages have been integrated into the planning and construction of motorways and national roads. Studies showed that animals make frequent use of these passages: 10 to 25 crossings a day, or between 3,600 and 9,000 a year, depending on the location.

Thus it soon became clear that these passages are beneficial for wild animals. In addition to the thirty existing wildlife bridges, two more are currently under construction, in Cornol (near Delémont, canton of Jura) and Claro (near Bellinzona, canton of Ticino). The construction of four more is scheduled to commence in 2020: in Rohr-Hunzenschwil (canton of Aargau), Neuenkirch (canton of Lucerne), Knutwil/Sursee (canton of Lucerne) and Langnau bei Reiden (canton of Lucerne). In the medium term, there will be 41 wildlife bridges on the motorway/national roads network.

Protecting wildlife and the network

In 2001, DETEC drew up a set of guidelines and a renovation programme for wildlife bridges in collaboration with FEDRO. Each year, around 9,000 roe deer, 4,000 red deer and 600 wild boar are killed in road traffic. Fences protect the motorway/national roads network and in combination with wildlife bridges they also increase the safety of animals as well as road users. In accordance with the Federal Council's 2012 "Swiss Biodiversity" strategy and the "Biodiversity Action Plan", the intention is to avoid additional obstacles for wildlife, reduce the impact of the existing obstacles and provide wildlife with safer corridors.

FEDRO directive 18008, "Crossing aids for wild animals", implements the Federal Council's strategy by constructing or renovating wildlife bridges. A study conducted by FEDRO showed that it is possible to make the existing bridges and underpasses on the motorway/national roads network usable for smaller wild animals too, at little extra cost. This can often be done by planting bushes and hedges that guide wild animals to the nearest crossing.

FEDRO operates a database for engineering structures on the network that help protect wild animals. When these structures need to be renovated, the protection of wildlife is duly taken into account. In order to maintain wildlife corridors over the long term, coordination with the cantons regarding their structure and zoning plans is essential.



Wildlife bridge near Mex (canton of Vaud), north west of Lausanne.

Road transport: Switzerland with same rights and obligations

The Land Transport Agreement of 1999 between Switzerland and the European Union (EU) opens up to Switzerland the market for the transport of persons and goods by road and rail in Europe. As a result, barriers to market access were dismantled and comparable conditions for competition created for companies in both Switzerland and the EU.

The Land Transport Agreement is one of the seven agreements that Switzerland concluded with the EU in 1999, known collectively as “Bilaterals I”. It was accepted by the Swiss electorate in a referendum. The agreement consolidates Switzerland’s long-term cooperation with the EU in the road and rail transport sectors and ensures the continuation of Switzerland’s policy of transferring freight for transit through Switzerland from road to rail within the European context. The agreement eliminates technical barriers, facilitates access for Swiss road haulage companies to the European transport market, and creates comparable conditions for competition between Switzerland and the EU.

With regard to heavy-duty transport, upholding the ban on night and Sunday traffic in Switzerland, as well as the introduction and recognition of the distance-related heavy vehicle fee, form cornerstones of the agreement. The agreement is based on the principle of non-discrimination.

As a result of the agreement, various standards in the area of professional admission, social legislation concerning HGV drivers, as well as technical standards and weight limits for HGVs have been harmonised to a large degree. The agreement works in accordance with the principle of equivalence of legislations of the contracting parties, or the equivalence principle. The rules do not necessarily have to be identical but their effect and scope must fully correspond.

Legislation governing working and rest times for professional drivers

At the EU level, legislation governing working and rest times for drivers of goods vehicles are standardised and as a result of the agreement harmonised between Switzerland and the EU. Switzerland has aligned its legal provisions in the Work and Rest-time Ordinance with EU guidelines. This is expected to ensure that the same rules apply for all professional drivers in the context of cross-border transport and in particular that the same provisions concerning social protection apply.

The provisions governing driving times, for example, stipulate in particular the maximum daily and weekly driving times, breaks, and the minimum daily and weekly rest times. An important instrument for checking adherence to stipulated working and rest times is the tachograph, which records times automatically.

The intelligent tachograph

New EU rules have led to the introduction of the “intelligent tachograph” in the EU as of 15 June 2019. This latest generation of tachograph integrates new technical developments and is expected to improve monitoring compliance with the rules governing work and rest times. To ensure that Swiss haulage operators can continue to have the freest possible access to the European road transport market, the new tachographs were introduced in Switzerland at the same time as they were in the EU.

The Federal Office of Transport (FOT) lead manages the Swiss-EU Land Transport Agreement. FEDRO, the Directorate of European Affairs (DEA) and the Federal Customs Administration (FCA) are also active in implementing the agreement.

Timeline of the Land Transport Agreement

- **21 June 1999:** Signing of the agreement (within the framework of Bilaterals I).
- **21 May 2000:** The Swiss electorate approve the agreement in the referendum on Bilaterals I (with 67.2% in favour).
- **1 June 2002:** The agreement comes into force.
- **2005–2017:** Amendments to the heavy vehicle fee (in 2005, 2008, 2009, 2012, 2017).

Development of the motorway/ national roads network

In 1960, Parliament passed a resolution defining the layout of the motorway/national roads network. In the meantime, 1,858.9 kilometres are now in operation, leaving a further 33.6 kilometres to be constructed. FEDRO is the supervisory authority for the completion of the network, while the involved cantons are responsible for its development.

The federal resolution concerning the motorway/national roads network was formally adopted on 21 June 1960. Parliament defined the routes to be constructed by the federal government, and since then only minor adjustments have been made.

Today, 59 years later we can safely say that the defined layout is still in line with present-day needs. The network links the major urban centres and provides the necessary transit routes. The original concept has proved to be largely successful, even if some stretches are now reaching the limits of their capacity.

Close to completion

The federal resolution defines a total of 1,892.5 kilometres, which means a further 33.6 kilometres still have to be constructed. The stretches concerned lie in seven regions: A1/A3 in Zurich ("Stadt-Y"), A3 in Basel (railway station to Gellert), A4 in Schwyz (new Axen route"), A5 in Biel (western link), A9 in Upper Valais, A8 on the Brünig and A28 in Prättigau.

Until 2007 the cantons were responsible for the motorways/national roads, while the federal government acted as the supervisory authority. With the redistribution of financial responsibility and the accompanying division of duties the ownership of the network was transferred to the federal government. But in order to preserve the continuity of the network completion projects, it was decided that the cantons would retain responsibility and the federal government would continue to function as supervisory authority. The remaining projects for the completion of the originally defined network are expected to be completed by 2034.

Within the scope of the Fund for Financing Motorway and Agglomeration Traffic, approximately 400 kilometres are to be added to the network. The amended resolution will enter into force on 1 January 2020.



The shell of the Grosseya tunnel near Visp, part of the new stretch of the A9.

2.4 billion Swiss francs for construction, expansion and maintenance

The federal government is to invest around 2.4 billion Swiss francs in the motorway/national roads network in 2019. 260 million have been budgeted for the construction of new stretches, 1.572 billion will be spent on the expansion and maintenance of the existing network and 210 million for the elimination of bottlenecks.

The approximately 2.4 billion Swiss francs will come from the Fund for Financing Motorway and Agglomeration Traffic. In addition, the federal government will invest around 378 million Swiss francs in the operation of the network. DETEC has approved the proposed construction programme for 2019.

Work on the following maintenance projects is to commence in 2019:

- A1 Bern: Kirchberg to Kriegstetten
- A1 Aargau: Reusstal to Neuenhof
- A1 Zurich: Zurich East junction to Effretikon
- A2 Lucerne: Reiden to Sursee
- A2 Nidwalden: Lucerne/Nidwalden border to Hergiswil
- A2 Uri: Amsteg to Göschenen
- A2 Uri: Gotthard Pass North
- A13 Grisons: Avers to Bärenburg to Zillis
- A13 Grisons: Sufers to Traversa South Gallery
- A13 Grisons: Hinterrhein North to Cassanawald South
- A16 Bern: Tavannes to Bözingenfeld
- A16 Jura: Porrentruy to Delémont

Maintenance work on the following stretches will be continued in 2019:

- A1 Zurich: Zurich Unterstrass to Zurich East (Schwamendingen enclosure)
- A2 Basel-Stadt: Basel eastern ring road
- A2 Basel-Landschaft: Schänzli
- A2 Solothurn/Basellandschaft: Belchen renovation tunnel
- A2 Ticino: Airolo to Quinto
- A2 Ticino: Giornico heavy vehicle inspection centre
- A3 St Gallen: Murg to Walenstadt
- A4 Schwyz: Küssnacht to Brunnen
- A5 Neuchâtel: Colombier to Cornaux
- A6 Bern: Thun North to Spiez
- A9 Vaud: Vennes to Chexbres
- A9 Valais: Martigny and environs

Elimination of bottlenecks

A total of 210 million Swiss francs has been earmarked for the elimination of bottlenecks in 2019. Most of this will be spent on the widening of the Zurich northern bypass (A1) to 6 lanes.

Completion of the network

A total of 260 million Swiss francs has been budgeted for the completion of the network. The largest credits have been allocated to the following cantons: Valais, 112 million; Bern, 22 million; Jura, 9 million; Schwyz, 4 million; Obwalden, 4 million. Approximately 77 percent of the funding for the completion of the network will be used for projects in Western Switzerland and Upper Valais.

Only a few stretches still have to be constructed (approx. 35 kilometres). Responsibility for the completion of the network will be shared by the federal government and the cantons as before: the cantons are responsibility for development, while FEDRO is the supervisory authority.

FEDRO will also be spending around 378 million Swiss francs on the operational maintenance of the network. This includes winter services, greenery maintenance, repairing damage caused by accidents, general cleaning tasks.

www.swiss-motorways.ch

Five major projects on the motorway/national roads network



A2 – New heavy vehicle inspection centre in Giornico

Construction of a heavy vehicle inspection centre with multiple service area in Giornico (canton of Ticino) / objectives: intensification of heavy vehicle inspections and controlled feed-in of HGVs in transit / duration, 2018 to 2022 / renovation of industrial site in accordance with applicable legal provisions, demolition of existing buildings / construction of new motorway junction / continuation of work on new underpasses / handover of heavy vehicle inspection centre at the end of 2022 / costs: approx. 250 million Swiss francs.



A1 – Modification of Grand-Saconnex junction

Work to commence during 2019 / construction of a cable-stayed bridge / alteration of north and south intersections / modification of access roads and parallel lanes along the motorway / adaptation of stretch to accommodate future widening / complete maintenance of stretch between Hall 6 and Vengeron intersection / duration: 2019 to 2023 / total costs: 240 million Swiss francs.



A2 – Lucerne–Hergiswil

Maintenance of stretch between Lucerne and Hergiswil / duration: 2019 to 2021 / replacement and resurfacing of traffic lanes / improvement of noise abatement measures / adaptation of drainage to current requirements / replacement of operating and safety installations / reinforcement of Lopper tunnel to protect against earthquakes and damage due to collisions / emergency lane to be converted for use as third traffic lane between A8/A2 junction and entrance road to Hergiswil / costs: approx. 121 million Swiss francs.



A1 – Kirchberg–Kriegstetten

Comprehensive renovation of A1 between Kirchberg and Kriegstetten / duration: 2019 to 2021 / renovation of 8-kilometre stretch / replacement and resurfacing of traffic lanes / replacement of operating and safety installations / maintenance of engineering structures / renovation of two noise prevention barriers / lengthening of entry and exit lanes at Chölfeld service area / improvement of drainage system / diversion and renaturalisation of Oberholz brook / construction of 2 new drain-water treatment plants / costs: approx. 166 million Swiss francs.



A1 – Maintenance of St. Gallen urban expressway

Comprehensive maintenance of St. Gallen urban expressway between Winkeln and Neu-dorf, including Kreuzbleiche and St. Finden junctions / replacement of operating and safety installations / construction of 4 new drain-water treatment plants / extension of service life of existing infrastructure (as preparation for the later St. Gallen bottleneck elimination project (work to commence in 2031 at the earliest, scheduled completion, 2040) / total costs: approx. 500 million Swiss francs.

These five construction projects are examples of FEDRO's approximately 800 ongoing maintenance projects.

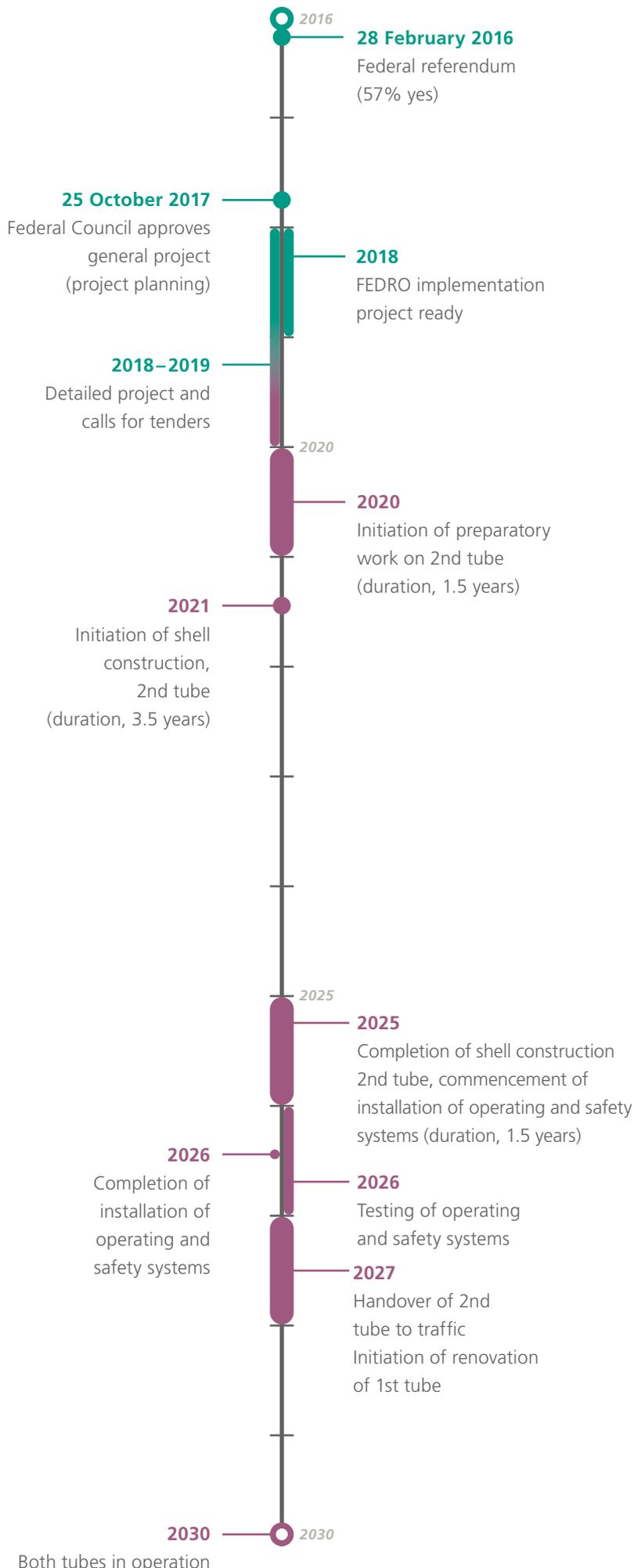
Approval procedure for 2nd Gotthard road tunnel is on track

The approval procedure for the 2nd Gotthard tube is proceeding as planned. Following the public presentation of the plans in May 2018, the preliminary procedure will be concluded in mid-2019. The planning approval ruling is to be announced during the winter.

Following the completion of the implementation project, the planning and approval procedures are proceeding according to schedule. The public presentation of the implementation project was carried out in May 2018 in the involved municipalities. Thanks to intensive cooperation and punctual input from the local residents, environmental organisations and third parties regarding the development of the implementation project, it was possible to take account of various concerns and innovative proposals and thus find acceptable solutions for all involved parties. This is reflected in the low number of objections (14 in all), some of which have since been clarified and withdrawn. The preliminary procedure, in which the various federal authorities are able to comment on the implementation project, is currently in progress. The DETEC General Secretariat is responsible for this phase. DETEC will rule on the planning approval within six months after the preliminary procedure has been concluded.

In December 2018, the contracts with the project developers were signed following the completion of public procurement procedures. The main mandates for the development of the project, installation of the operating and safety equipment and roofing of the Airolo section have been awarded, and the development of the detailed projects and initial submission documentation for their implementation are assured. If the planning approval decision is announced on time, preliminary work should commence in 2020.

www.astra.admin.ch/gotthard



Facts, figures, statistics

582 employees

10 locations **People**

39 IT systems

Data 5,510 managed datasets

Replacement value of motorway/national roads network: **82.5 billion Swiss francs**

Expenditure: 4.26 billion Swiss francs Finance

Investment in infrastructure: **2.4 billion Swiss francs**

Length of motorway/national roads network: **1,858.9 kilometres**

Connections: 390 Tunnels: 252

Infrastructure Large-scale wildlife corridors: **34**

Bridges: **3,500** (main axes and overpasses)

Drainage water treatment plants: 118

Junctions: 45 Service areas (restaurants): **48** (ownership by cantons)

Rest areas (picnic): 110 Construction projects: **737**

Concluded construction contracts in 2018: **2,970**

Traffic counting stations: 320 Vehicles

Vehicle kilometres on the network: **27 billion**

Highest average daily traffic volume: **144,000 vehicles (Wallisellen)**

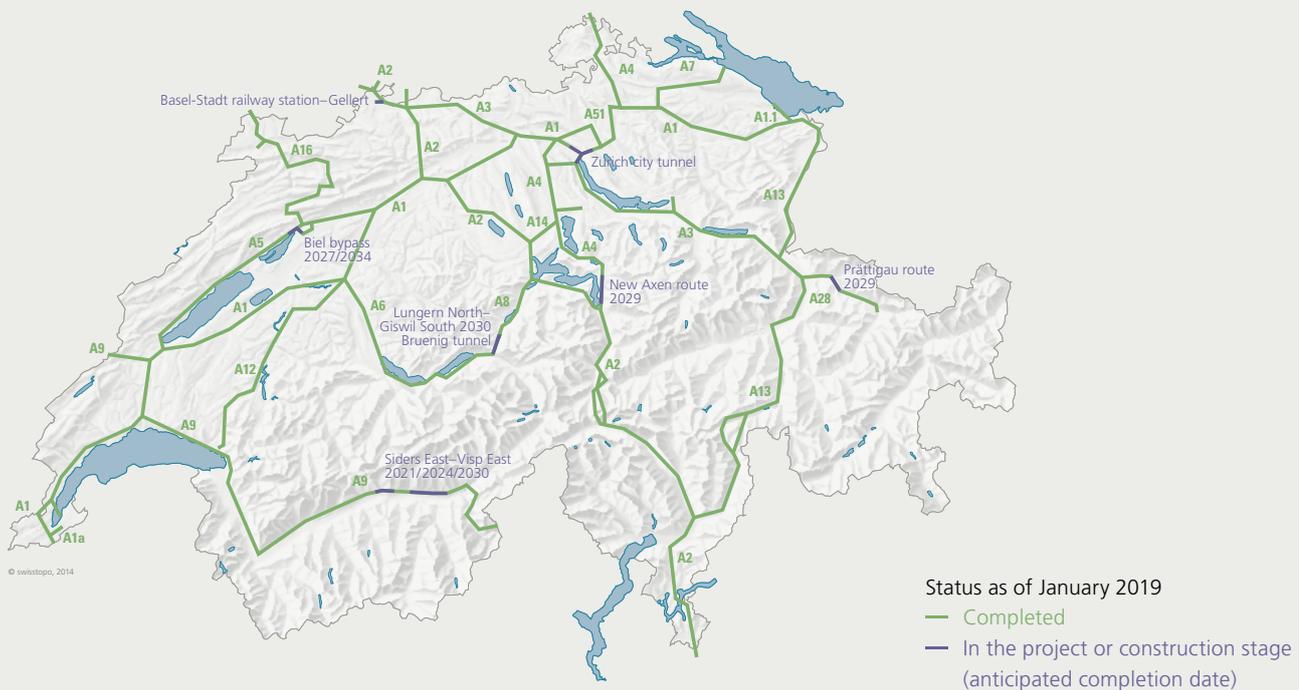
HGVs via main transalpine routes: **941,000**

Heavy vehicle inspection centres: **6**

Construction sites: 105

Eyholz tunnel in Valais was the only new motorway stretch opened in 2018

Only one new stretch of the motorway/national roads network was opened in 2018: the Eyholz tunnel on the A9 near Visp (canton of Valais). This stretch is 4.2 kilometres long and comprises 4 lanes. The total length of the network is now 1,858.9 kilometres, leaving a further 33.6 kilometres to be constructed. The construction of four additional new stretches is currently in progress: on the A9, in the cantons of Valais, Schwyz (new Axen route), Obwalden (Kaiserstuhl) and Grisons (Prättigau). No stretches are scheduled for completion in 2019. As of 1 January 2020, however, the network will be expanded by around 400 kilometres following the integration of a number of sections of cantonal roads, the importance of which has grown significantly due to the sharp increase in traffic volume. When these stretches are transferred to the federal government, the maintenance costs will also be covered at the federal level.



2018: opening of one stretch with a new tunnel (total: 252 tunnels on the motorway/national roads network)

Motorway	Canton	Stretch	No. of tubes	4 lanes	Costs (Swiss francs)
A9	VS	Visp West–Visp East (Eyholz tunnel)	2	4.2 km	670 million

The Swiss motorway/ national roads network

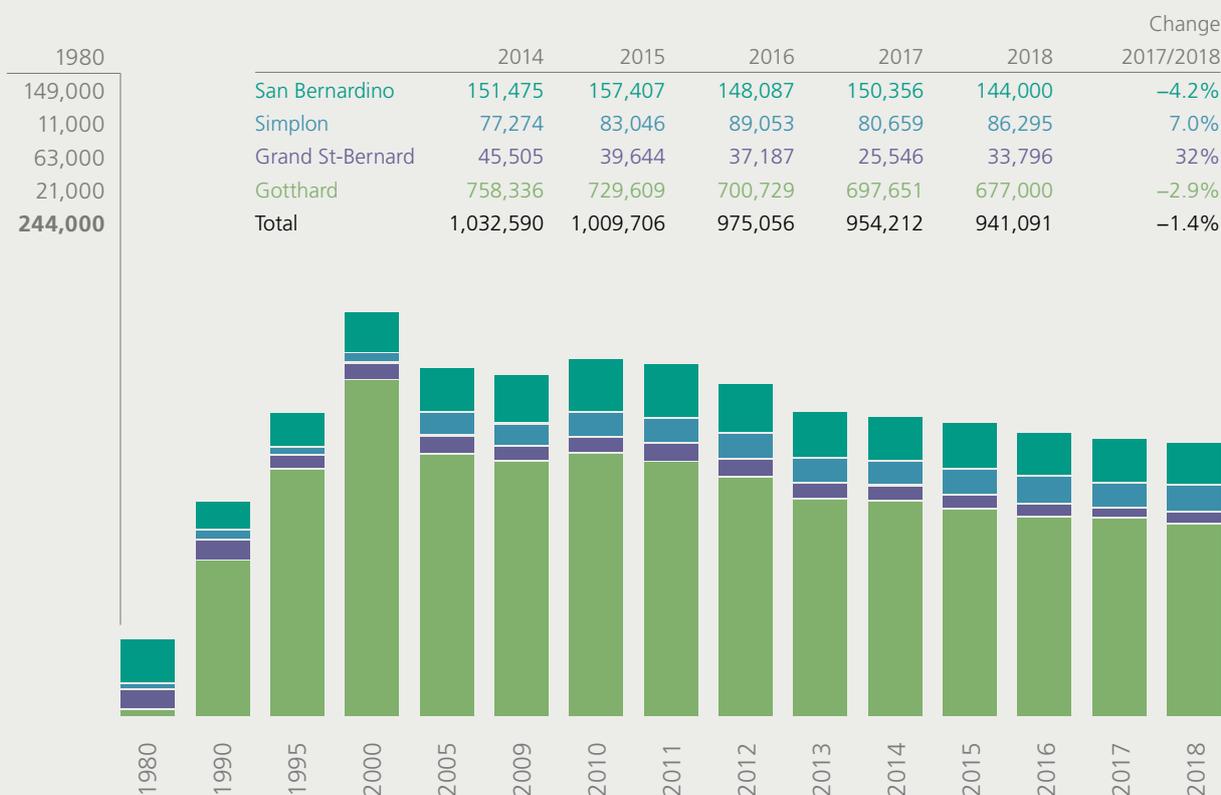
Total length by road category (km)

	8-lane	7-lane	6-lane	5-lane	4-lane	3-lane	2-lane	Mixed- traffic roads	Total
	in use	in use	in use	in use	in use	in use	in use	in use	in use
Zurich	1.2		31.3		116.6	1.9			151.0
Bern			13.2	3.1	136.4		51.0	19.4	223.1
Lucerne			2.6	2.7	53.2				58.5
Uri					37.1		16.3	16.1	69.5
Schwyz				2.7	40.5		2.2	4.3	49.7
Obwalden					1.8		22.3	13.3	37.4
Nidwalden					22.9		2.9		25.8
Glarus					16.6				16.6
Zug			6.0		11.7				17.7
Fribourg					84.2				84.2
Solothurn			6.5	5.4	31.9				43.8
Basel-Stadt			3.5		6.0				9.5
Basel-Landschaft			9.5	3.3	17.4				30.2
Schaffhausen							17.2		17.2
St Gallen				4.3	135.5				139.8
Grisons					43.6		97.7	27.9	169.2
Aargau		1.2	14.0	1.7	82.4				99.3
Thurgau					42.8				42.8
Ticino			7.3	18.0	82.7		30.9		138.9
Vaud	0.6		2.8	5.7	183.4		12.8		205.3
Valais					71.3		15.6	28.6	111.3
Neuchâtel					34.6		3.0	1.9	39.5
Geneva					27.2				27.2
Jura					35.4		11.8		47.2
Total	1.8	1.2	96.7	46.9	1,315.2	1.9	283.7	111.5	1,858.9

As of the end of 2018, the length of the Swiss motorway/national roads network was 1,858.9 kilometres. The 1960 resolution of the Federal Council called for a total of 1,892.5 kilometres. This means that a further 33.6 kilometres have yet to be opened in order to complete the planned network. In 2018, a 4.2-kilometre stretch was completed: Eyholz tunnel to the east of Visp (canton of Valais) – cf. page 40.

Number of heavy goods vehicles crossing the Alps down again in 2018

The number of HGVs and semi-trailers travelling through the Alps continued to decline. In 2018, the total was 941,091, which is 13,000 (1.4 percent) fewer than in 2017. Thus, the downward trend observed in the past few years is persisting. The volume fell by 2.1 percent in 2017 and 3.4 percent in 2016. In 2018, the number of journeys fell less sharply than the quantity of goods transported by road (0.2 percent), a trend that is attributable to making better use of the vehicles' capacities. The Gotthard and the San Bernardino remain the most important transalpine routes through Switzerland. In 2018, the number of journeys was down 33 percent versus the figure recorded in 2000, the year in which the Heavy Vehicle Fee was introduced together with the framework conditions for the step-by-step increase in the weight limit of heavy goods vehicles to 40 tonnes.



Source: Federal Roads Office FEDRO

Accumulated distance unchanged, but traffic jam hours down by two percent

In 2018, the total accumulated distance travelled on Switzerland's motorways/national roads was 27.696 billion kilometres. Thus, the accumulated distance remained practically unchanged versus the previous year (+0.1 percent). By contrast, the number of traffic jam hours fell by two percent.

For the third time since 2016, more than 27 billion kilometres in distance travelled were recorded. The most heavily frequented stretches were those around the agglomerations (Zurich, Basel and Bern; cf. table below). As before, the heaviest traffic volume was recorded in the region of Wallisellen, near Zurich. However, for this region no measurement data are available for 2018 due to the roadwork sites on the Zurich northern bypass. The average daily traffic volume (DTV) in the Baregg tunnel near Baden was 130,370 vehicles in 2018, a slight decline versus 2017 (-1.4 percent). Heavy vehicles accounted for 1.598 billion kilometres (5.8 percent) of the total accumulated distance. In recent years, the proportion accounted for by heavy vehicles has only increased very slightly (+0.4 percent).

In 2018, the duration of traffic jams on the motorways and national roads totalled 25,366 hours (-2.0 percent versus 2017). This was the first reduction since 2008 and was above all recorded in the major agglomerations. It is too early to venture an explanation for this, because it cannot yet be placed in the context of a particular trend. The decrease seen on the Zurich northern bypass (144,000 vehicles a day) is particularly interesting, where a large-scale road widening project is currently in progress. Here, the total duration of traffic jams (6,241 hours) nevertheless fell by 7.5 percent. This could possibly be attributable to the reduction of the speed limit to 80 km/h in the vicinity of the roadwork sites. According to traffic experts, reduced speed limits can lead to smoother traffic flow in stretches subject to congestion.

Accumulated kilometres on the Swiss motorway/national roads network

Year	Billion km	+/- (in %)	Heavy vehicles, billion km	+/- (in %)
2013	25.170	-	1.506	-
2014	25.416	+1.0	1.543	+2.3
2015	26.484	+4.2	1.545	+0.2
2016	27.131	+2.4	1.567	+1.4
2017	27.680	+2.0	1.591	+1.6
2018	27.696	+0.1	1.598	+0.4

Number of traffic jam hours on Switzerland's motorway/national roads network

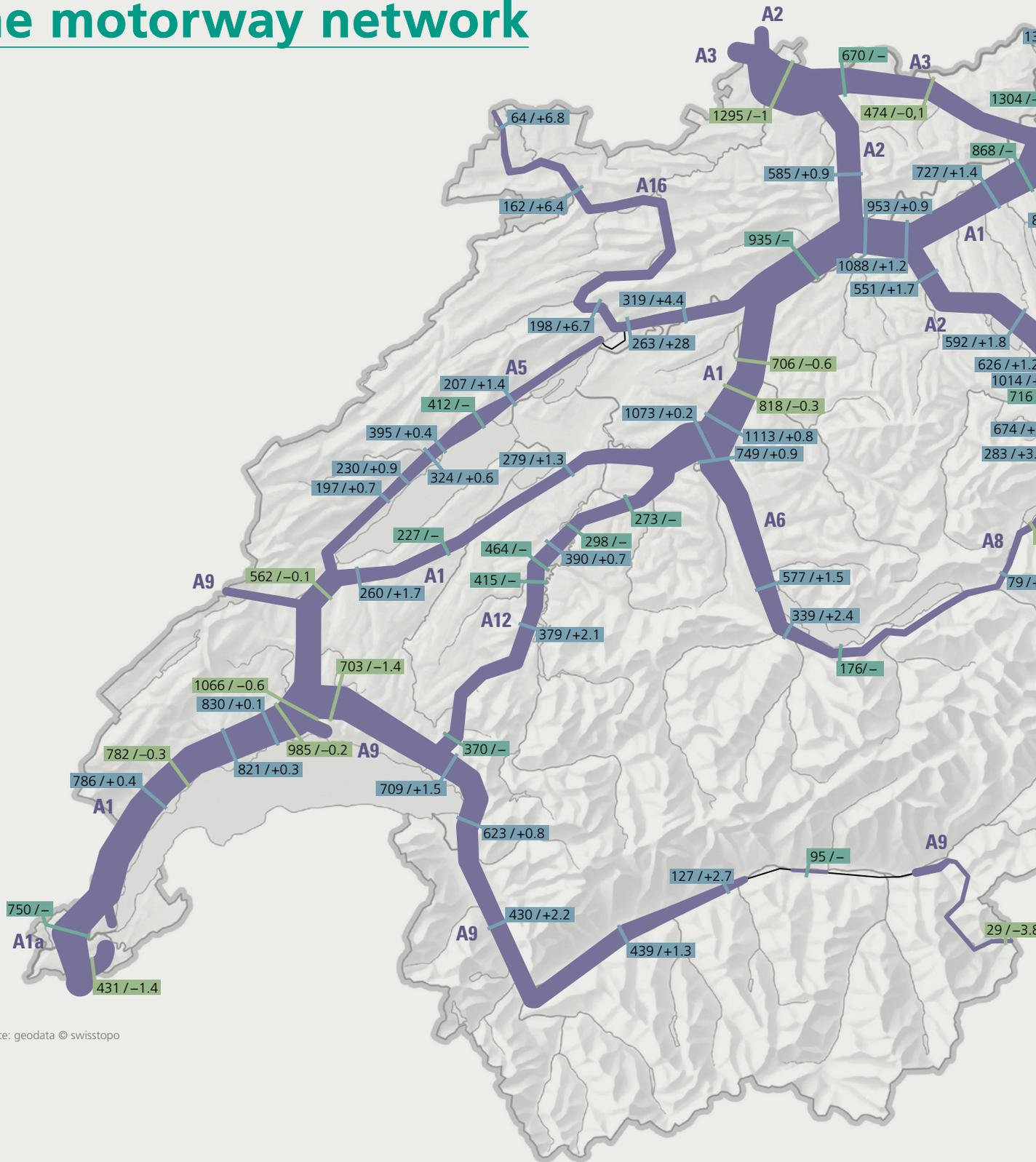
Causes	2016	2017	2018	+/- (in %)
Congestion	21,211	22,949	22,110	+8 / -4
Accidents	2,420	2,504	2,597	+3 / +4
Roadworks	356	236	393	-34 / +67
Other	79	167	266	+111 / +59
Total	24,066	25,842	25,366	+7 / -2

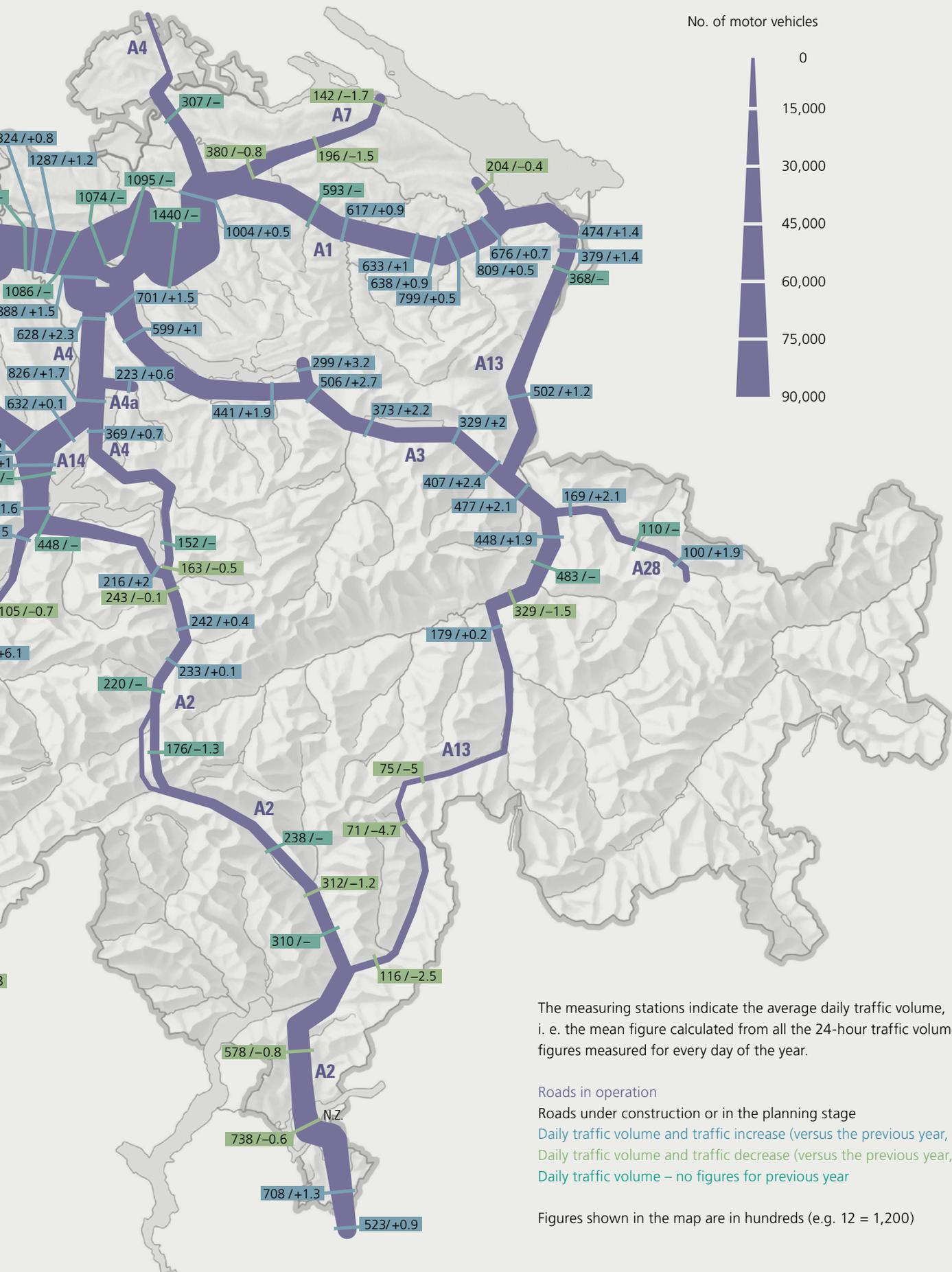
Highest daily traffic volume (no. of vehicles per day)

		2017	2018	+/- (in %)
ZH	Wallisellen (A1) ^{1*}	-	144,812	-
AG	Neuenhof (A1)	131,447	132,446	+0.8%
AG	Baden, Baregg tunnel (A1)	132,194	130,370	-1.4%
BL	Muttentz, Hard (A2)	130,867	129,505	-1.0%
BS	Basel, Gellert North (A2) ^{2**}	-	129,500	-
AG	Würenlos (A1)	127,108	128,670	+1.2%
BE	Schönbühl, Grauholz (A6)	110,414	111,297	+0.8%
ZH	Zurich northern bypass, Seebach (A1) ^{1*}	-	109,585	-
ZH	Weiningen, Gubrist (A1) ^{2*}	-	108,630	-
ZH	Zurich northern bypass, Affoltern (A1) ^{2*}	-	107,408	-
Elsewhere				
VD	Lausanne	107,281	106,588	-0.6%
GE	Geneva ^{2**}	-	75,000	-
TI	Lugano	74,264	73,815	-0.6%

¹ DTV 2015 ² DTV 2014
No (or only estimated) figures or percentages due to roadwork sites (*) or technical maintenance (**) of equipment.

Map of traffic volume on the motorway network







49,493 more motor vehicles on Switzerland's roads

2018 inventory of motor vehicles in Switzerland

	Motor vehicles (total) 2018	Motor vehicles (total) 2017	Increase versus 2017 (in percent)	Cars 2018	Petrol 2018	Diesel 2018	Hybrid drive 2018	Gas 2018
Total*	6,102,751	6,053,258	0.82%	4,602,688	3,114,726	1,374,246	79,737	11,038
Lake Geneva region	1,124,090	1,117,546	0.59%	857,938	598,891	237,808	16,071	1,702
Vaud	534,214	528,486	1.08%	417,188	287,554	118,307	8,500	1,221
Valais	287,039	285,841	0.42%	220,259	149,885	66,802	2,442	192
Geneva	302,837	303,219	-0.13%	220,491	161,452	52,699	5,129	289
Central plateau	1,367,147	1,363,935	0.24%	1,019,443	706,735	290,962	15,442	2,365
Bern	741,387	742,794	-0.19%	535,407	363,323	160,368	8,005	1,472
Fribourg	241,353	237,578	1.59%	186,371	130,949	50,989	3,525	252
Solothurn	204,343	203,796	0.27%	157,261	110,556	43,741	1,937	388
Neuchâtel	123,363	122,894	0.38%	96,989	69,749	25,419	1,388	151
Jura	56,701	56,873	-0.30%	43,415	32,158	10,445	587	102
Northwest Switzerland	791,447	783,116	1.06%	1,350,317	904,815	406,746	26,125	3,920
Basel-Stadt	87,096	86,113	1.14%	66,159	43,366	20,919	1,195	353
Basel-Landschaft	192,646	191,895	0.39%	148,410	103,092	41,504	2,551	466
Aargau	511,705	505,108	1.31%	395,038	269,658	115,421	7,020	1,018
Zurich	953,681	947,068	0.70%	740,710	488,699	228,902	15,359	2,083
Eastern Switzerland	925,901	910,770	1.66%	677,947	446,570	217,681	9,072	1,407
Glarus	32,178	31,522	2.08%	23,657	15,387	7,850	270	55
Schaffhausen	62,418	62,026	0.63%	45,710	31,358	13,291	658	145
Appenzell AR	43,421	43,378	0.10%	32,009	21,581	9,788	416	49
Appenzell IR	19,232	13,978	37.59%	9,736	6,499	3,054	116	6
St Gallen	374,758	372,121	0.71%	280,720	184,135	90,737	3,919	624
Grisons	159,228	157,002	1.42%	113,300	67,800	43,768	1,151	111
Thurgau	234,666	230,743	1.70%	172,815	119,810	49,193	2,542	417
Central Switzerland	633,089	623,862	1.48%	472,377	307,825	152,892	7,844	1,025
Lucerne	294,821	295,829	-0.34%	216,386	144,544	66,735	3,535	463
Uri	28,801	27,219	5.81%	20,016	12,828	6,953	174	12
Schwyz	132,854	131,953	0.68%	101,436	68,625	30,485	1,578	157
Obwalden	31,877	31,518	1.14%	22,624	14,448	7,656	359	29
Nidwalden	36,121	35,444	1.91%	26,892	17,856	8,363	493	31
Zug	108,615	101,899	6.59%	85,023	49,524	32,700	1,705	333
Ticino	307,396	306,961	0.14%	224,666	149,890	68,157	5,183	619

Although the number of newly registered vehicles fell in 2018, the total inventory of motorised road vehicles increased again by 49,493, or 1 percent versus 2017. This means that the total figure has increased by 33 percent since 2000, i.e. the number of newly registered vehicles continues to exceed that of vehicles taken out of

circulation. As of end of 2018, 6,102,751 vehicles were registered in Switzerland. Three-quarters of these were passenger cars, the number of which rose by 0.7 percent to 4,602,688.

Electric drive 2018	Others 2018	Passenger transport vehicles 2018	HGVs, articulated vehicles, semi-trailers 2018	Utility vehicles up to 3.5 tonnes 2018	Agricultural vehicles 2018	Industrial vehicles 2018	Motorcycles 2018	Mopeds incl. fast electric bikes 2018	
								Total	of which e-bikes**
19,181	3,760	77,985	53,989	374,819	193,283	60,643	739,344	201,267	***
2,895	571	12,109	7,891	66,975	22,919	6,822	149,436	16,749	***
1,353	253	5,913	3,533	30,124	13,658	4,823	58,975	8,469	3,238
812	126	3,568	2,594	18,969	7,723	1,251	32,675	2,462	***
730	192	2,628	1,764	17,882	1,538	748	57,786	5,818	***
3,079	860	21,891	11,390	86,201	61,021	7,688	159,513	62,822	***
1,758	481	13,984	6,013	50,002	38,842	3,121	94,018	40,368	***
515	141	2,997	2,004	13,592	9,922	2,166	24,301	7,868	2,924
503	136	2,529	2,094	12,644	5,615	684	23,516	11,116	4,874
207	75	1,728	888	6,526	2,926	1,717	12,589	2,234	559
96	27	653	391	3,437	3,716	0	5,089	1,236	177
7,502	1,209	9,491	8,685	49,219	17,954	5,579	90,912	34,699	***
237	89	913	1,337	6,842	156	1,680	10,009	4,302	1,821
683	114	2,247	1,732	12,473	3,957	786	23,041	9,130	4,360
1,579	342	6,331	5,616	29,904	13,841	3,113	57,862	21,267	7,738
5,003	664	10,972	7,093	55,286	16,167	11,023	112,430	25,287	12,952
2,622	595	12,319	10,080	57,983	43,789	19,001	104,782	31,861	***
79	16	365	345	2,101	1,405	926	3,379	1,149	286
190	68	1,052	639	3,839	2,917	579	7,682	2,103	***
145	30	631	294	2,356	2,435	283	5,413	1,907	***
55	6	141	116	858	1,288	5,322	1,771	625	***
1,054	251	4,604	4,156	23,287	15,485	4,127	42,379	14,300	***
416	54	2,341	2,283	10,996	9,205	4,535	16,568	3,176	***
683	170	3,185	2,247	14,546	11,054	3,229	27,590	8,601	2,819
2,341	450	8,586	6,250	38,720	27,301	6,306	73,549	25,624	***
884	225	4,146	3,492	18,308	15,004	534	36,951	13,782	6,154
41	8	456	239	1,531	1,334	1,804	3,421	1,026	***
520	71	1,697	1,141	7,666	5,491	518	14,905	4,721	1,081
106	26	498	337	1,968	2,082	370	3,998	1,861	***
111	38	518	223	1,820	1,347	653	4,668	1,656	***
679	82	1,271	818	7,427	2,043	2,427	9,606	2,578	1,156
742	75	2,617	2,600	20,435	4,132	4,224	48,722	4,225	***

* Total; excluding mopeds and fast e-bikes ** Including other vehicles with an electric motor *** No cantonal statistics available
Source: Swiss Federal Statistical Office

A total of 395,413 newly registered motorised road vehicles were recorded in 2018 (17,414 or 4.2 percent fewer than in 2017). A reduction was first noted in 2016, but it intensified in 2018.

The most pronounced reduction in 2018 concerned agricultural vehicles (-11.4 percent). For the first time, fewer than 3,000 vehicles in this category were brought into circulation (2018: 2,930). The number of newly registered motorcycles also fell sharply (by 7.2 percent to 43,855). This was the lowest number since 2010.

4.5 percent fewer new cars than in the previous year

New registration of motor cars

	2008	2014	2015	2016	2017	2018
Total	287,971	304,083	327,143	319,331	315,032	300,887
Type						
Limousine	200,399	163,298	166,465	155,175	153,638	141,329
Station wagon	76,502	134,195	154,122	156,642	153,883	153,168
Convertible	11,070	6,590	6,556	7,514	7,511	6,390
Engine capacity (cc)						
Below 1,000	10,160	18,942	27,397	27,072	30,582	36,200
1,000–1,399	60,689	77,576	75,995	72,221	69,161	55,858
1,400–1,799	69,945	68,020	69,118	64,217	55,473	56,291
1,800–1,999	84,019	86,115	95,673	98,247	104,003	100,208
2,000–2,499	24,010	20,847	23,076	22,660	19,062	14,899
2,500–2,999	23,804	20,816	22,472	22,966	23,847	23,387
3,000 and over	15,320	9,819	9,530	8,423	7,975	8,633
Not specified	24	1,948	3,882	3,525	4,929	5,411
Gear mechanism						
Manual*	209,896	211,701	224,729	210,466	196,941	179,098
Automatic	69,641	73,709	84,352	90,496	98,955	103,055
Others**	8,434	18,673	18,062	18,369	19,136	18,734
Fuel						
Petrol	189,151	180,875	185,469	178,666	183,637	188,847
Diesel	93,366	113,304	127,899	125,595	113,848	90,360
Petrol & battery	3,091	6,165	7,676	9,949	11,564	14,563
Diesel & battery	1	728	1,109	638	282	869
Electric drive	24	1,948	3,882	3,525	4,929	5,411
Gas	1,136	1,041	1,080	944	769	805
Others	1,202	22	28	14	3	32
Drive						
Front-wheel drive	193,942	171,513	177,723	162,519	151,015	142,069
Rear-wheel drive	22,288	15,511	17,466	15,756	14,504	11,593
4x4	71,741	117,059	131,954	141,056	149,513	147,225
Output (kilowatts)						
Below 60	32,094	23,333	24,310	18,340	15,290	12,377
61–80	67,186	54,429	47,614	40,985	39,543	36,342
81–100	43,067	56,189	65,552	68,241	62,412	58,301
101–120	68,710	64,700	67,705	63,049	61,483	57,802
121–140	29,030	45,880	53,137	56,166	60,050	58,530
141–200	34,809	34,219	40,105	41,808	42,297	40,910
200 and over	13,009	25,252	28,682	30,737	33,950	36,621
Not specified	66	81	38	5	7	4
CO₂ emissions (g/km)						
0–50 g	53	2,603	5,523	5,522	7,211	7,579
51–100 g	369	20,277	30,405	32,720	25,696	20,431
101–150 g	68,465	161,607	182,648	198,195	194,190	170,331
151–200 g	123,439	86,482	74,468	67,140	74,275	85,431
201–250 g	37,915	11,865	9,605	7,347	6,351	9,946
251–300 g	10,782	1,865	2,156	2,791	2,567	3,344
301+ g	3,114	1,054	575	813	805	1,039
Unknown	43,834	18,330	21,763	4,803	3,937	2,786

* Includes dual clutch transmission and automatic transmission, ** For example, infinitely variable transmission
Source: Swiss Federal Statistical Office

Passenger cars represent the largest category of motorised road vehicles. In this category a total of 300,887 new registrations were recorded in 2018 (14,145 or 4.5 percent fewer than in 2017). Diesel models accounted for the sharpest decline (–20.6 percent). By contrast, the number of newly registered petrol-driven vehicles increased (+2.8 percent), as did registrations of hybrid and electric vehicles (+30.3 and +9.8 percent respectively).

No. of new vehicles put into circulation (all types)

	2008	2018
Cars	287,971	300,887
Passenger transport vehicles	3,224	5,611
Goods vehicles	29,706	37,538
Utility vehicles	24,491	32,941
HGVs	3,598	3,331
Articulated vehicles	14	11
Semi-trailers	1,603	1,255
Agricultural vehicles	3,227	2,930
Industrial vehicles	3,694	4,592
Motorcycles	48,774	43,855
Trailers	19,311	20,104
Total vehicles	395,907	415,517
Total motor vehicles	376,596	395,413

Source: Swiss Federal Statistical Office

Road accidents in 2018: increase in accidents involving electric bicycles

Last year, 233 people lost their lives in road accidents in Switzerland, 3 more than in 2017. The number of fatalities increased in the case of e-bike riders; the numbers for motorcyclists, cyclists and pedestrians fell.

Switzerland's annual road accident statistics are based on the register of road accidents kept by FEDRO. In 2018, a total of 233 people were killed in road accidents in Switzerland. Of these, 79 died as a result of accidents involving a car, 42 involving a motorcycle, 27 involving a bicycle and 12 involving an e-bike. 43 pedestrians lost their lives. The number of people seriously injured in road accidents increased by 6 percent to 3,873.

A breakdown of these numbers gives the following picture.

Passengers of private vehicles: In 2018, there was 1 more fatality than in 2017. A total of 79 passengers of private vehicles were killed. The total number of passengers seriously injured was 797.

Deaths on motorways and expressways: Fewer people lost their lives in accidents on motorways and expressways in Switzerland than in 2017. Fatalities totalled 23, which was 9 fewer than in 2017.

Pedestrians: The number of fatalities on footpaths declined last year against 2017. The proportion of elderly victims of road accidents fell significantly. Outside pedestrian zones, by contrast, 9 more people were killed in 2018 than in 2017. A total of 537 pedestrians were seriously injured, 1 more than in 2017.

Increase in fatal accidents involving e-bikes: The picture for accidents involving two-wheeled vehicles is mixed. While there were fewer deaths in accidents involving motorcycles and bicycles – 9 fewer motorcyclists (42) and 3 fewer cyclists (27) – the number of fatalities involving e-bikes increased from 7 in 2017 to 12 in 2018. The numbers of seriously injured were higher in 2018: 1,068 motorcyclists (up 2 percent), 877 cyclists (up 7 percent) and 309 e-bikers (up 38 percent).

Serious accidents involving e-bikers reached a new high in 2018 with 321 casualties (serious injuries and fatalities). Of these, 236 people were riding a standard e-bike and 85 a high-speed e-bike. The increase of 45 to a total of 106 seriously injured people aged 65 and older was especially high in 2018 in comparison with 2017.

www.accident-statistics.ch

All road accidents

Year	Total no. of accidents
2010	58,928
2011	54,269
2012	54,171
2013	53,052
2014	51,756
2015	53,235
2016	55,053
2017	56,112
2018	54,378

Accidents resulting in fatalities/injuries

	2017	2018
Fatalities	219	228
Serious injuries	3,427	3,640
<i>life-threatening injuries</i>	180	148
<i>severe injuries</i>	3,247	3,492
Minor injuries	14,153	14,165
Total	17,799	18,033

Serious injuries

	2017	2018
By form of transport		
Cars	781	797
Passenger transport vehicles	18	43
Goods transport vehicles	56	45
Motorcycles	1,047	1,068
Motor scooters	67	71
Electric bikes	224	309
Bicycles	818	877
Pedestrians	536	537
<i>on pedestrian crossings</i>	235	257
<i>elsewhere</i>	301	280
Others	107	126
Total	3,654	3,873
By assumed main cause		
Influence of alcohol	309	332
Speeding	426	415
Inattention/distracted	532	528
By type of road		
Motorways and expressways	239	235

Fatalities

	2017	2018
By form of transport		
Cars	78	79
Passenger transport vehicles	1	3
Goods transport vehicles	4	4
Motorcycles	51	42
Motor scooters	2	5
Electric bikes	7	12
Bicycles	30	27
Pedestrians	44	43
<i>on pedestrian crossings</i>	20	10
<i>elsewhere</i>	24	33
Others	13	18
Total	230	233
By assumed main cause		
Influence of alcohol	30	24
Speeding	33	37
Inattention/distracted	19	19
By type of road		
Motorways and expressways	32	23

Fewer licences confiscated in 2018

In 2018, approximately 80,000 drivers had their Swiss or foreign driving licence or learner's licence confiscated. This number is almost 6 percent lower than last year. The main reasons for licence confiscations are speeding and driving under the influence of alcohol.

The statistics on FEDRO's administrative measures (ADMAS) indicate that in 2018 the number of licence confiscations in Switzerland fell by 4,700 to 80,077 against the number for 2017. There were 1,304 cases where the driver's provisional licence was cancelled (8 fewer than in 2017).

Licences were confiscated in 27,503 cases for speeding (down 3 percent on the previous year) and in 13,090 cases for drink driving (down 4 percent). These figures indicate a continuation in the downward trend in licence confiscations for speeding offences and drink driving.

In 2018, there were 4,661 cases of licence confiscations for driving while under the influence of drugs (8 percent fewer than in 2017). Confiscations owing to drug addiction (2,515 cases) were down 22 percent.

In addition to the 80,077 confiscations of Swiss driving licences in 2018, recognition of foreign driving licences was revoked in a further 19,747 cases (down 5 percent). The most common reason was speeding (9,903 foreign licences revoked).

www.astra.admin.ch/admas-database

Administrative measures

	2017	2018	+/- (in %)
Measures imposed against drivers			
Warnings to holders of a learner's licence	370	298	-19.5
Warnings to holders of a driver's licence	48,735	47,403	-2.7
Withdrawal of learner's licence	3,443	3,340	-3.0
Withdrawal of driver's licence	77,574	73,063	-5.8
Of which withdrawal of provisional licence	6,380	6,088	-4.6
Cancellation of provisional driver's licence	1,312	1,304	-0.6
Refusal of learner's or driver's licence	3,128	3,050	-2.5
Refusal to accept a foreign driver's licence	20,816	19,747	-5.1
Instruction in road use	1,889	1,542	-18.4
New driving test	3,153	3,366	+6.8
Examination by specialised psychologists	4,611	4,516	-2.1
Special requirements	7,261	7,264	0.0

5.9 million licences to drive a private car

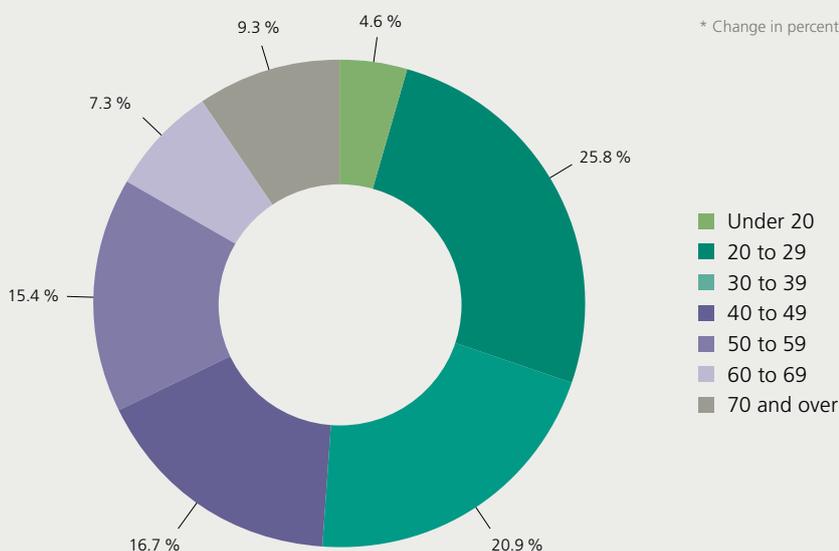
In 2018, approximately 5.9 million people in Switzerland held a provisional or unrestricted licence to drive a private car (category B), i.e. approximately 62,000 individuals (or more than 1 percent) more than in the previous year. This increase is related to population growth, the number of new drivers, and the exchange of foreign driving licences for Swiss licences. Approximately 54 percent of licensed drivers are men and 46 percent women.

Administrative measures

	2018	+/- (*)
Reasons for withdrawal		
Speeding offences	27,503	-3.3
Drink driving	13,090	-3.9
Inattention	7,760	-7.7
Failure to give way	4,223	-5.0
Failure to observe traffic signals	1,382	-0.1
Unlawful overtaking	1,677	-5.9
Other driving errors	4,887	-10.9
Alcohol addiction	1,279	-25.7
Influence of drugs	4,661	-7.6
Drug addiction	2,515	-22.0
Sickness or infirmity	5,716	-4.8
Other reasons	20,132	-8.8
Duration of withdrawal		
1 month	31,108	-4.7
2 months	1,333	-24.4
3 months	15,854	+1.7
4-6 months	6,810	-5.1
7-12 months	2,251	-6.1
More than 12 months	984	-5.3
Indefinite period	21,718	-9.9
Permanent withdrawal	19	-5.0

* Change in percent versus 2017

Withdrawn driving licences by age group



	2018	+/- (*)
Age of persons affected		
Under 20	3,690	-8.5
20 to 24	10,300	-7.0
25 to 29	10,354	-4.6
30 to 34	9,116	-2.8
35 to 39	7,595	-5.6
40 to 49	13,414	-7.2
50 to 59	12,302	-2.6
60 to 69	5,860	-0.5
70 and over	7,446	-11.0

Reasons for withdrawal or refusal of learner's/driver's licence

		+/-
Learner driving unaccompanied	415	+2.2
Driving error	2,136	-3.2
Drink driving	627	+1.6
Driving without a licence	2,579	-0.7
Failure to pass driving test	205	-1.0
Driving despite withdrawal of licence	168	-2.3
Theft	386	+6.6
Sickness or infirmity	121	+4.3
Other reasons	1,798	-17.3

Reasons for warnings

		+/-
Speeding	41,173	-2.2
Drink driving (> = 0.050 to 0.079%)	4,778	-8.8
Inattention	3,284	-1.5
Failure to give way	2,031	+0.5
Driving an unroadworthy vehicle	2,114	-4.6
Failure to observe traffic signals	1,024	+0.9
Unlawful overtaking	298	-11.3
Other reasons	7,465	-3.3

* Change in percent versus 2017

Finance flows for the two road transport funds

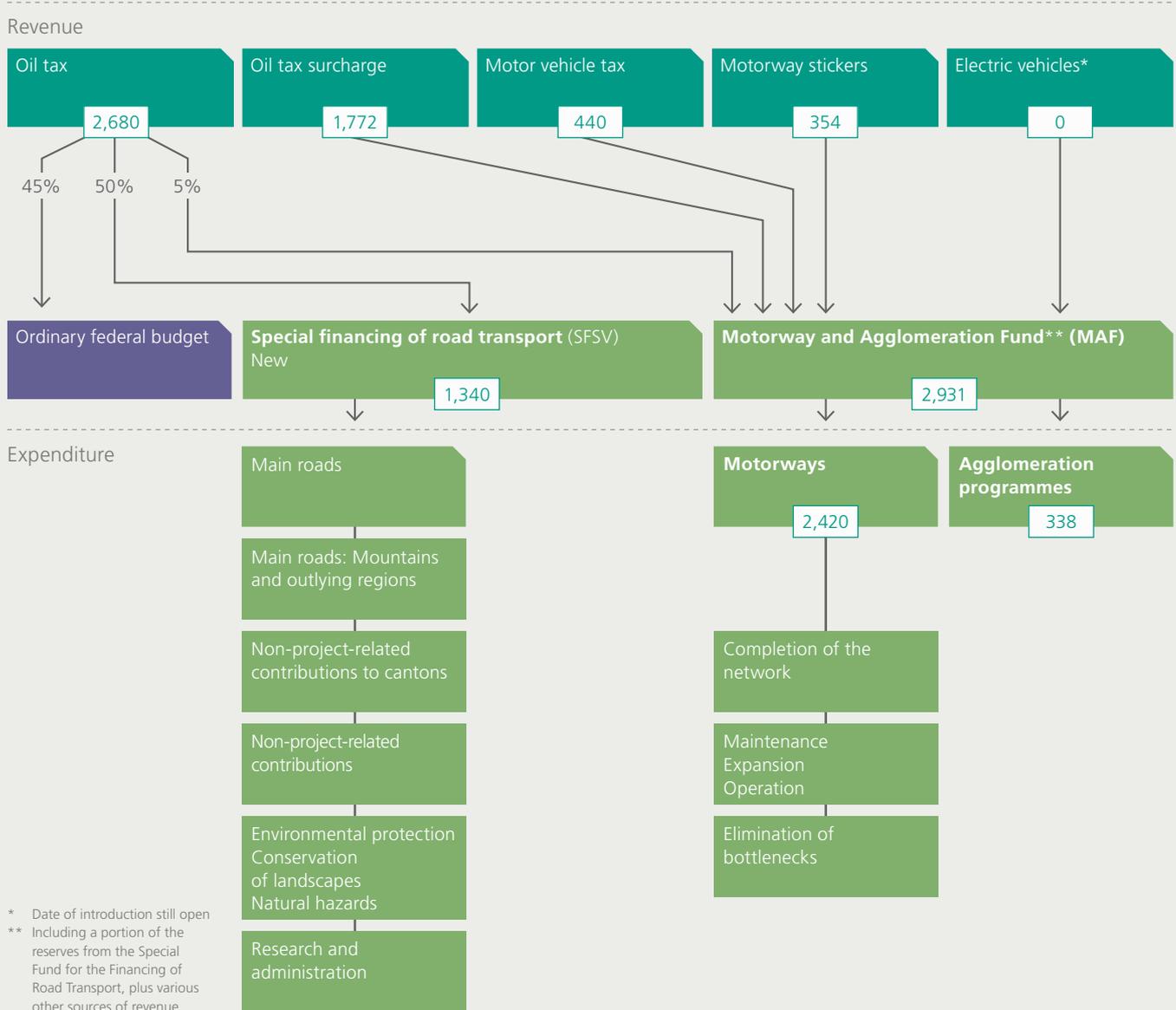
The Fund for Financing Motorway and Agglomeration Traffic finances the motorways and major projects in the agglomerations. The Fund for the Special Financing of Road Transport primarily supports cantonal road transport infrastructure.

completion of the network. All this expenditure is financed from the Fund for Financing Motorway and Agglomeration Traffic, which entered into effect on 1 January 2018. This move increases the degree of transparency, and also simplifies the short- and medium-term management of credit facilities.

Expenditure for the motorways/national roads encompasses operation, maintenance, expansion, elimination of bottlenecks and

Parliament decides how much may be withdrawn from the fund each year, which is not governed by the federal debt brake mechanism. The balance of any approved funding that is not utilised

Flows of funds in 2019 (in million Swiss francs) in accordance with 2019 budget



Figures taken from the federal budget 2019. Amounts in the totals may differ due to rounding up or down of the individual figures.

remains in the fund. This increases its liquidity and the resources remain available for use at a later date. This fund gives rise to greater flexibility and transparency and increases the long-term planning and implementation certainty for FEDRO's large-scale projects.

Composition of deposits:

- Oil tax surcharge (100 %)
- Motorway sticker (100 %)
- Vehicle tax (100%)
- Oil tax (currently 5%, as a rule 10 % as of 2020)
- Levy on electric vehicles (100 % – date of introduction as yet unspecified)

- Compensation from the cantons for the transfer of cantonal roads to the federal government as per the new federal resolution (from 2020)

Special Fund for the Financing of Road Transport: all transfer payments from a single source

This fund is the single source for all transfer payments in the road transport sector at the federal level, as well as for the administrative and research costs of FEDRO. It is financed from half the revenue from the oil tax and, where necessary, from vehicle tax revenue. As before, it is managed via the ordinary federal budget.

Deposits into the Fund for Financing Motorway and Agglomeration Traffic as of 2018 (in million Swiss francs)

	2016 C*	2017 C*	2018 C*	2019 B**
Oil tax surcharge	–	–	1,792	1,772
Vehicle tax	–	–	398	440
Motorway levy	–	–	349	354
CO ₂ reduction (passenger cars)	–	–	11	1
Oil tax (5%)	–	–	135	134
Temporary deposit from reserve (Special Fund for the Financing of Road Transport)	–	–	475	183
Revenue from third-party funding	–	–	36	47
Management income	–	–	10	0
Total deposits	–	–	3,206	2,931

Withdrawals from the Infrastructure Fund (2016–2017, in million Swiss francs) (as of 2018, from the Fund for Financing Motorway and Agglomeration Traffic)

	2016 C*	2017 C*	2018 C*	2019 B**
Operation of motorways/national roads	–	–	362	378
Expansion and maintenance of motorways/national roads	–	–	1,501	1,572
Completion of motorway/national roads network	384	254	190	260
Elimination of bottlenecks	131	180	168	210
Contributions towards transport infrastructure in urban centres	211	147	150	338
Contributions for main roads in mountainous and outlying regions	47	48	–	–
Total withdrawals/expenditure	773	629	2,371	2,758

* Charged
** Budgeted

Due to rounded up or down figures, minor differences may arise in the totals.

Organisational chart of the Federal Roads Office (FEDRO)

Valid from 1 May 2019



Addresses of FEDRO and regional units

Head office

Swiss Federal Roads Office (FEDRO)
Mühlestrasse 2, Ittigen
CH-3003 Bern
Phone 058 462 94 11
Fax 058 463 23 03
info@astra.admin.ch

Postal address
Swiss Federal Roads Office (FEDRO)
3003 Bern

www.astra.admin.ch
www.swiss-motorways.ch
www.astra.admin.ch/traffic-data
www.accident-statistics.ch
www.truckinfo.ch

Road Traffic Division

Swiss Federal Roads Office (FEDRO)
Weltpoststrasse 5
3015 Bern
Phone 058 462 94 11
Fax 058 463 23 03
info@astra.admin.ch

National Traffic Management Centre (VMZ-CH)

Swiss Federal Roads Office (FEDRO)
National traffic management centre
Rothenburgstrasse 25
6020 Emmenbrücke
Phone 058 482 83 11
Fax 058 482 83 12
vmz-ch@astra.admin.ch

Offices of the Infrastructure Division (construction, expansion and maintenance of the motorway network)

Western Switzerland

Office fédéral des routes (OFROU)
Filiale d' Estavayer-le-Lac
Place de la Gare 7
1470 Estavayer-le-Lac
Phone 058 461 87 11
Fax 058 461 87 90
estavayer@astra.admin.ch

Bern/Valais

Bundesamt für Strassen (ASTRA)
Thun office
Uttigenstrasse 54
3600 Thun
Phone 058 468 24 00
Fax 058 468 25 90
thun@astra.admin.ch

Central/Northwestern Switzerland

Swiss Federal Roads Office (FEDRO)
Zofingen office
Brühlstrasse 3
4800 Zofingen
Phone 058 482 75 11
Fax 058 482 75 90
zofingen@astra.admin.ch

Northeastern Switzerland

Swiss Federal Roads Office (FEDRO)
Winterthur office
Grüezfeldstrasse 41
8404 Winterthur
Phone 058 480 47 11
Fax 058 480 47 90
winterthur@astra.admin.ch

Ticino and Grisons

Ufficio federale delle strade (USTRA)
Bellinzona office
Via C. Pellandini 2
6500 Bellinzona
Phone 058 469 68 11
Fax 058 469 68 90
bellinzona@astra.admin.ch

Regional Units Motorway maintenance

Regional Unit I (canton of Bern)

Autobahnwerkhof Spiez
Industriestrasse 9
3700 Spiez

Regional Unit II (canton of Vaud, Fribourg, Geneva)

Place de la Riponne 10
1014 Lausanne

Regional Unit III (canton of Valais, Vaud)

Route des Iles 8
1950 Sitten

Regional Unit IV (canton of Ticino)

Divisione delle costruzioni
Area dell'esercizio della manutenzione
Via Franco Zorzi 13
6501 Bellinzona

Regional Unit V (canton of Grisons)

Grisons Civil Engineering
Grabenstrasse 30
7001 Chur

Regional Unit VI (canton of St Gallen, Thurgau, Appenzell IR, Appenzell AR)

Motorway Maintenance
Department, Canton of St Gallen
Martinsbruggstrasse 75b
9016 St. Gallen

Regional Unit VII (canton of Zurich, Schaffhausen)

Motorway Maintenance
Department, Canton of Zurich
Werkhofstrasse 1
8902 Urdorf

Regional Unit VIII (canton of Basel-Stadt, Basel-Landschaft, Solothurn, Aargau)

NSNW AG
Northwest Switzerland
Motorways
Netzenstrasse 1
4450 Sissach

Regional Unit IX (canton of Neuchâtel, Jura, Bern)

Rue J.-L.-Pourtalès 13
Case postale 2856
2001 Neuchâtel

Regional Unit X (canton of Lucerne, Zug, Obwalden, Nidwalden)

zentras
Rothenburgstrasse 19
6020 Emmenbrücke

Regional Unit XI (canton of Uri, Schwyz, Ticino)

Department of Motorway
Operations Werkhof
Allmendstrasse 1
6454 Flüelen

www.astra.admin.ch/regional-units

Cantonal police headquarters

AG Polizeikommando

Tellstrasse 85, 5004 Aarau
Phone 062 835 81 81, Fax 062 835 82 96

AI Kantonspolizei Appenzell-Innerrhoden

Unteres Ziel 20, 9050 Appenzell
Phone 071 788 95 00, Fax 071 788 95 08
info@kapo.ai.ch

AR Kantonspolizei Appenzell-Ausserrhoden

Schützenstrasse 1
9100 Herisau
Phone 071 343 66 66, Fax 071 343 66 99
info.kapo@ar.ch

BE Kantonspolizei Bern

Waisenhausplatz 32
Postfach 7571, 3001 Bern
Phone 031 634 41 11
polizei.kommando@police.be.ch

BL Polizei Basel-Landschaft

Rheinstrasse 25, 4410 Liestal
Phone 061 553 30 68, Fax 061 921 45 81
pol.kommunikation@bl.ch

BS Kantonspolizei Basel-Stadt Zentrale

Postfach, 4001 Basel
Phone 061 267 71 11
infopolizei@jsd.bs.ch

FR Police cantonale fribourgeoise

Place Notre-Dame 2, 1700 Fribourg
Phone 026 305 16 13, Fax 026 305 16 14
pressepolice@fr.ch
www.policefr.ch

GE Police Cantonale de Genève

Chemin de la Gravière 5, 1227 Acacias
Phone 022 427 81 11
presse@police.ge.ch
www.geneve.ch/police/contact

GL Polizeikommando des Kantons Glarus

Spielhof 12, Postfach 635, 8750 Glarus
Phone 055 645 66 66, Fax 055 645 66 77
kantonspolizei@gl.ch

GR Kantonspolizei Graubünden

Ringstrasse 2, 7000 Chur
Phone 081 257 71 11
info@kapo.gr.ch

JU Police cantonale jurassienne

Prés-Roses 1, 2800 Delémont
Phone 032 420 65 65, Fax 032 420 65 05
infopolice@jura.ch

LU Luzerner Polizei

Kasimir-Pfyffer-Strasse 26
Postfach, 6002 Luzern
Phone 041 248 81 17, Fax 041 240 39 01
polizei@lu.ch

NE Police Neuchâteloise

Rue des Poudrières 14, 2006 Neuchâtel
Phone 032 888 90 00, Fax 032 722 02 96
police.neuchatelaise@ne.ch

NW Kantonspolizei Nidwalden

Kreuzstrasse 1, Postfach 1242
6371 Stans
Phone 041 618 44 66, Fax 041 618 45 87
kantonspolizei@nw.ch

OW Kantonspolizei Obwalden

Foribach, 6061 Sarnen
Phone 041 666 65 00, Fax 041 666 65 15
www.ow.ch/kapo

SG Kantonspolizei St. Gallen

Klosterhof 12, 9001 St. Gallen
Phone 071 229 49 49, Fax 071 223 26 60
infokapo@kapo.sg.ch

SH Schaffhauser Polizei

Beckenstube 1, 8201 Schaffhausen
Phone 052 624 24 24, Fax 052 624 50 70
info@shpol.ch

SO Polizei Kanton Solothurn

Schanzmühle
Werkhofstrasse 33, 4503 Solothurn
Phone 032 627 71 11, Fax 032 627 72 12
info.polizei@kapo.so.ch

SZ Kantonspolizei Schwyz

Bahnhofstrasse 7, 6431 Schwyz
Phone 041 819 29 29, Fax 041 811 62 63

TG Kantonspolizei Thurgau

Zürcherstrasse 325, 8501 Frauenfeld
Phone 058 345 28 28
info@kapo.tg.ch
www.kapo.tg.ch

TI Polizia cantonale

Viale Officina 10, 6500 Bellinzona
Phone 0848 25 55 55
polizia@polca.ti.ch
www.ti.ch/di/pol/polizia-cantonale/

UR Kantonspolizei Uri

Tellsgasse 5, 6460 Altdorf
Phone 041 875 22 11, Fax 041 871 14 30
kantonspolizei@ur.ch
www.ur.ch/kapo

VD Police cantonale vaudoise

Route de la Blécherette 101,
1014 Lausanne
Phone 021 644 44 44, Fax 021 644 81 56
info.police@vd.ch

VS Police cantonale

Avenue de France 69, 1950 Sion
Phone 027 326 56 56, Fax 027 606 56 67
info@police.vs.ch
www.polizeiwallis.ch

ZG Zuger Polizei

An der Aa 4, 6300 Zug
Phone 041 728 41 41, Fax 041 728 41 79
info.polizei@zg.ch

ZH Kantonspolizei Zürich

Kasernenstrasse 29
Postfach, 8021 Zürich
Phone 044 247 22 11
info@kapo.zh.ch

Road traffic departments

AG Strassenverkehrsamt Kt. Aargau
Postfach, 5001 Aarau
Phone 062 886 23 23, Fax 062 886 22 00
stva@ag.ch
www.ag.ch/strassenverkehrsamt

AI Strassenverkehrsamt Kt. Appenzell-I.-Rh.
Brüggliweg 1, 9050 Appenzell
Phone 071 788 95 34, Fax 071 788 95 39
info@stva.ai.ch
www.stva.ai.ch

AR Strassenverkehrsamt Kt. Appenzell-A.-Rh.
Landsgemeindeplatz 5, 9043 Trogen
Phone 071 343 63 11, Fax 071 353 66 81
strassenverkehrsamt@ar.ch
www.stva.ar.ch

BE Strassenverkehrs- und Schifffahrtsamt
Kt. Bern
Schermenweg 5, 3001 Bern
Phone 031 635 80 80, Fax 031 635 80 80
info.svsa@pom.be.ch
www.be.ch/svsa

BL Motorfahrzeugkontrolle Kt. Basel-
Landschaft
Ergolzstrasse 1, 4414 Füllinsdorf
Phone 061 552 00 00, Fax 061 552 00 10
mfk@bl.ch

BS Motorfahrzeugkontrolle Kanton Basel-
Stadt
Clarastrasse 38, 4005 Basel
Phone 061 267 82 00, Fax 061 267 82 17
info.mfkbs@jds.bs.ch, www.mfk.bs.ch

FR Office de la circulation et de la navigation
du canton de Fribourg
Route de Tavel 10, 1707 Fribourg
Phone 026 484 55 55, Fax 026 484 55 56
info@ocn.ch, www.ocn.ch

GE Service cantonal des véhicules
Route de Veyrier 86, 1227 Carouge
Phone 022 388 30 30, Fax 022 388 30 11
vehicules@etat.ge.ch
www.geneve.ch/san

GL Strassenverkehrs- und Schifffahrtsamt
Mühleareal 17, 8762 Schwanden
Phone 055 646 54 00, Fax 055 646 54 01
stva@gl.ch
www.stva.gl.ch

GR Strassenverkehrsamt Kt. Graubünden
Postfach, 7001 Chur
Phone 081 257 80 00, Fax 081 252 90 08
info@stva.gr.ch, www.stva.gr.ch

JU Office des véhicules du canton du Jura
Route de la Communance 45,
2800 Delémont
Phone 032 420 71 20, Fax 032 420 71 25
ovj@jura.ch, www.jura.ch/ovj

LU Strassenverkehrsamt Kt. Luzern
Postfach 3970, 6002 Luzern 2
Phone 041 318 11 11
informationsstelle.stva@lu.ch
www.strassenverkehrsamt.lu.ch

NE Service des automobiles et de la
navigation du canton de Neuchâtel
Champs-Corbet 1, 2043 Boudevilliers
Phone 032 889 13 99, Fax 032 722 03 19
scan@ne.ch, www.scan-ne.ch

NW Verkehrssicherheitszentrum
Ob- und Nidwalden
Kreuzstrasse 2, 6371 Stans
Phone 041 618 41 41, Fax 041 618 41 87
info@vsz.ch, www.vsz.ch

OW Verkehrssicherheitszentrum
Ob- und Nidwalden
Polizeitgebäude/Foribach,
Postfach 1561, 6061 Sarnen
Phone 041 666 66 00, Fax 041 666 66 20
info@vsz.ch, www.vsz.ch

SG Strassenverkehrs- und Schifffahrtsamt
Kt. St. Gallen
Frongartenstrasse 5, 9001 St. Gallen
Phone 058 229 22 22, Fax 071 229 39 98
info@stva.sg.ch, www.stva.sg.ch

SH Strassenverkehrs- und Schifffahrtsamt
Kt. Schaffhausen
Rosengasse 8, 8200 Schaffhausen
Phone 052 632 76 02, Fax 052 632 78 11
strassenverkehrsamt@ktsh.ch
www.strassenverkehrsamt.sh.ch

SO Motorfahrzeugkontrolle Kanton
Solothurn
Gurzelenstrasse 3, 4512 Bellach
Phone 032 627 66 66, Fax 032 627 66 99
mfk@mfk.so.ch, www.mfk-so.ch

SZ Verkehrsamt Kanton Schwyz
Schlagstrasse 82, 6430 Schwyz
Phone 041 819 11 24, Fax 041 819 21 78
vasz@sz.ch, www.sz.ch/verkehrsamt

TG Strassenverkehrsamt des Kantons
Thurgau
Moosweg 7a, 8501 Frauenfeld
Phone 058 345 36 36, Fax 058 345 36 39
info@stva.tg.ch
www.strassenverkehrsamt.tg.ch

TI Sezione della circolazione Ticino
Ala Munda, 6528 Camorino
Phone 091 814 91 11, Fax 091 814 91 09
di-sc@ti.ch, www.ti.ch/circolazione

UR Amt für Strassen- und Schiffsverkehr Uri
Gotthardstrasse 77a, 6460 Altdorf
Phone 041 875 28 13, Fax 041 875 28 05
assv@ur.ch

VD Service des automobiles et
de la navigation du canton de Vaud
Avenue du Grey 110, 1014 Lausanne
Phone 021 316 82 10, Fax 021 316 82 11
info.auto@vd.ch, www.san.vd.ch

VS Dienststelle für Strassenverkehr und
Schifffahrt des Kanton Wallis
Avenue de France 71, 1950 Sitten
Phone 027 606 71 00, Fax 027 607 01 33
www.vs.ch/autos

ZG Strassenverkehrsamt Kanton Zug
Hinterbergstrasse 41, 6312 Steinhausen
Phone 041 728 47 11, Fax 041 728 47 27
info.stva@zg.ch
www.zg.ch/strassenverkehrsamt

ZH Strassenverkehrsamt Kanton Zürich
Uetlibergstrasse 301, 8036 Zürich
Phone 058 811 30 00, Fax 058 811 30 01
info.stva@zg.ch, www.stva.zh.ch

Publishing details

Publisher

Swiss Federal Roads Office (FEDRO)

Research and text

Swiss Federal Roads Office (FEDRO)

Photo credits

Swiss Federal Roads Office (FEDRO)

Orders

Swiss Federal Roads Office (FEDRO)

Swiss Federal Roads Office (FEDRO)

Federal Department of the
Environment, Transport, Energy
and Communications (DETEC)

3003 Bern

Phone 058 462 94 11

Fax 058 463 23 03

info@astra.admin.ch

www.astra.admin.ch

Layout

diff. Kommunikation AG, www.diff.ch



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Swiss Federal Roads Office FEDRO