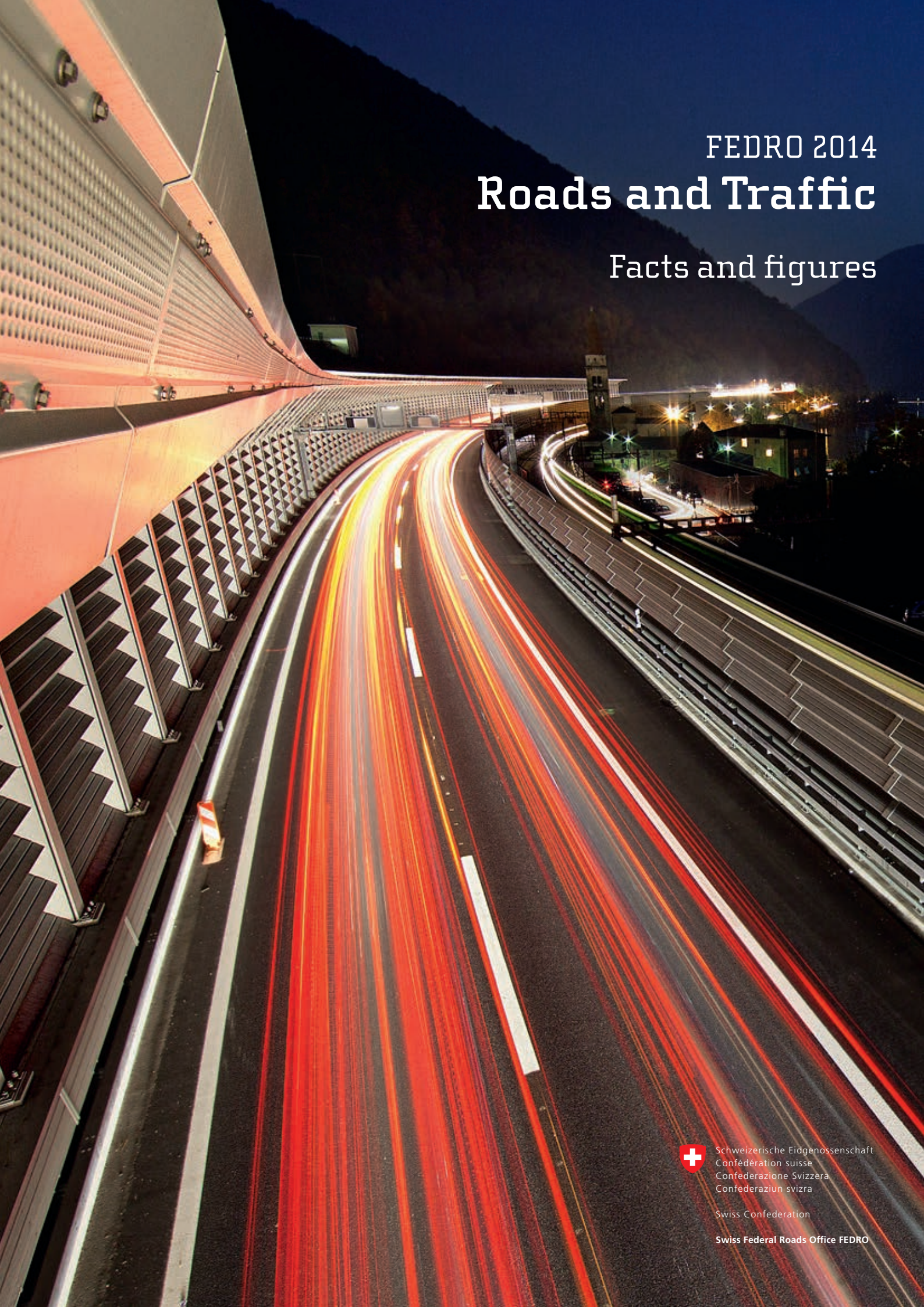


FEDRO 2014

Roads and Traffic

Facts and figures

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Swiss Federal Roads Office FEDRO

Contents

Cover photo
Motorway near Bissone (canton of Ticino) – special barriers significantly reduce the level of noise exposure for nearby residents (photo: Jacques Perler).

Editorial

Dear Reader,

The 2014 edition of "Roads and Traffic – Facts and figures" focuses on some lesser known aspects of motorway operation in Switzerland. Well maintained and safe roads are something we take for granted. This report focuses on the activities that are required in order to guarantee the daily functionality of a safe motorway network. One article deals with the personnel responsible for motorway maintenance: they perform their often hazardous tasks in all weather conditions. Hats off to the employees of the regional units in bright orange clothing. ▸ page 8
The motorway network numbers around 400 entrance and exit roads that connect it to other roads. FEDRO specialists have to plan cycle lanes with the utmost care. ▸ page 4
A lot of effort has recently been devoted to enhancing the safety of road tunnels, and has led to the installation of a heat detection system at the southern entrance to the Gotthard road tunnel. This system reduces fire risk in the tunnel by preventing heavy goods vehicles from entering it if any of their components are overheated. ▸ page 12
The stretch between the Härkingen and Wiggertal junctions is one of the most important in the motorway network: here, the north-south and east-west axes temporarily share the same route. In the past three years, intensive work has been carried out between these two junctions, not only during the day, but also at night. This type of work calls for meticulous preparation, careful coordination of all involved players, and an understanding on the part of nearby residents. ▸ page 20
Whenever a road accident occurs, it is recorded in the official statistics, which include cause and circumstances, number of involved vehicles and location of the accident. Thus FEDRO specialists can identify accident black spots and the owners (federal government, cantons, municipalities). No road can be entirely safe if drivers lose control of their vehicle because they are speeding or not paying attention. The fact that the number of licences confiscated due to drink driving and speeding is on the decline, and the number of fatalities on our roads fell sharply again in 2013, indicates that our road safety policy is taking effect. ▸ page 36

I very much hope you will find this year's report both interesting and informative.
Rudolf Dieterle, Director of the Swiss Federal Roads Office (FEDRO)

Important contribution of human-powered mobility

Switzerland's transport policy includes the promotion of human-powered mobility. Increasing the share of non-motorised transport is an essential factor for sustainable road transport.

The reliable and secure provision of goods and services is a trademark of Switzerland. It is also a prerequisite for our high quality of life and the success of the country's economy. The federal government, cantons and municipalities ensure that everyone has access to an efficient transport network, and thus to mobility, in all parts of the country.

Human-powered mobility is a significant factor here, both in everyday and in leisure-time transport. It is by far the most extensive transport network in the country, with thousands of kilometres of pavements, footpaths and bicycle lanes for everyday transport and more than 60,000 kilometres of hiking routes and more than 8,000 kilometres of marked cycle routes.

The hidden form of mass transport

It is not only the existing infrastructure, but also the traffic volume that demonstrates how important human-powered mobility is for Switzerland's road transport system (cf. Figure 1). Almost half of all daily journeys are travelled on foot or by bicycle, and in terms of time spent on the move, human-powered mobility accounts for 42.2 percent. It is only in terms of distance travelled that human-powered mobility is by its nature surpassed by private motorised transport and public transport, the strengths of which lie in medium- to long-distance travel.

The most sustainable form of passenger transport

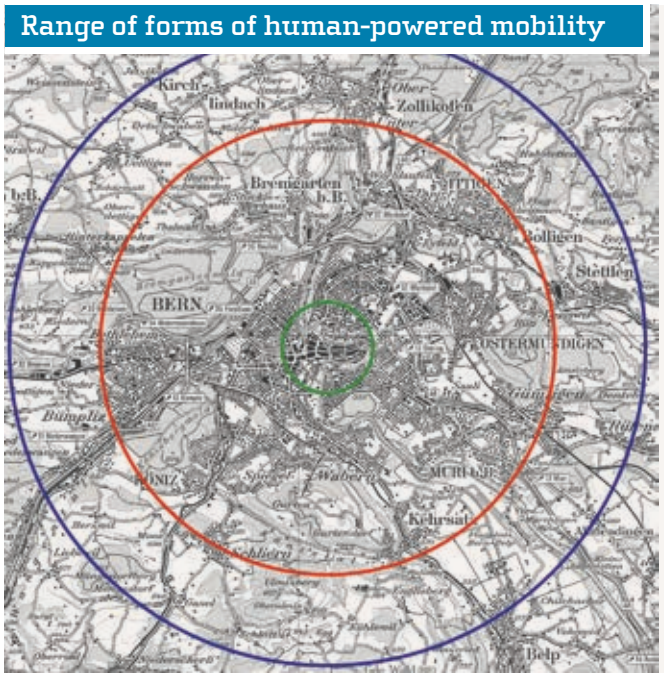
Human-powered mobility is not only a central factor for the smooth functioning of our country's transport system. Its increased use also brings additional benefits in that it ideally meets practically all the demands of future mobility: it does not produce CO_2 and other emissions, it is ideal for use in residential areas, protects resources and saves energy, and it is inexpensive, healthy and available for everyone round the clock.

Potential by no means fully exploited

Human-powered mobility is above all ideal for short journeys of up to around 15 minutes, i.e. up to 1 kilometre on foot, 5 kilometres by bicycle and 7 kilometres by e-bike (cf. Figures 2 and 3). This applies to human-powered mobility as an autonomous form (door-to-door) as well as to its use in combination with other forms of transport. In Switzerland, every second journey by car and almost 80 percent of all journeys by bus and tram are shorter than 5 kilometres, and around 20 percent of all journeys by public transport are shorter than 1 kilometre. For these short distances there is still a great deal of unexploited potential for the use of human-powered transport, especially cycling.

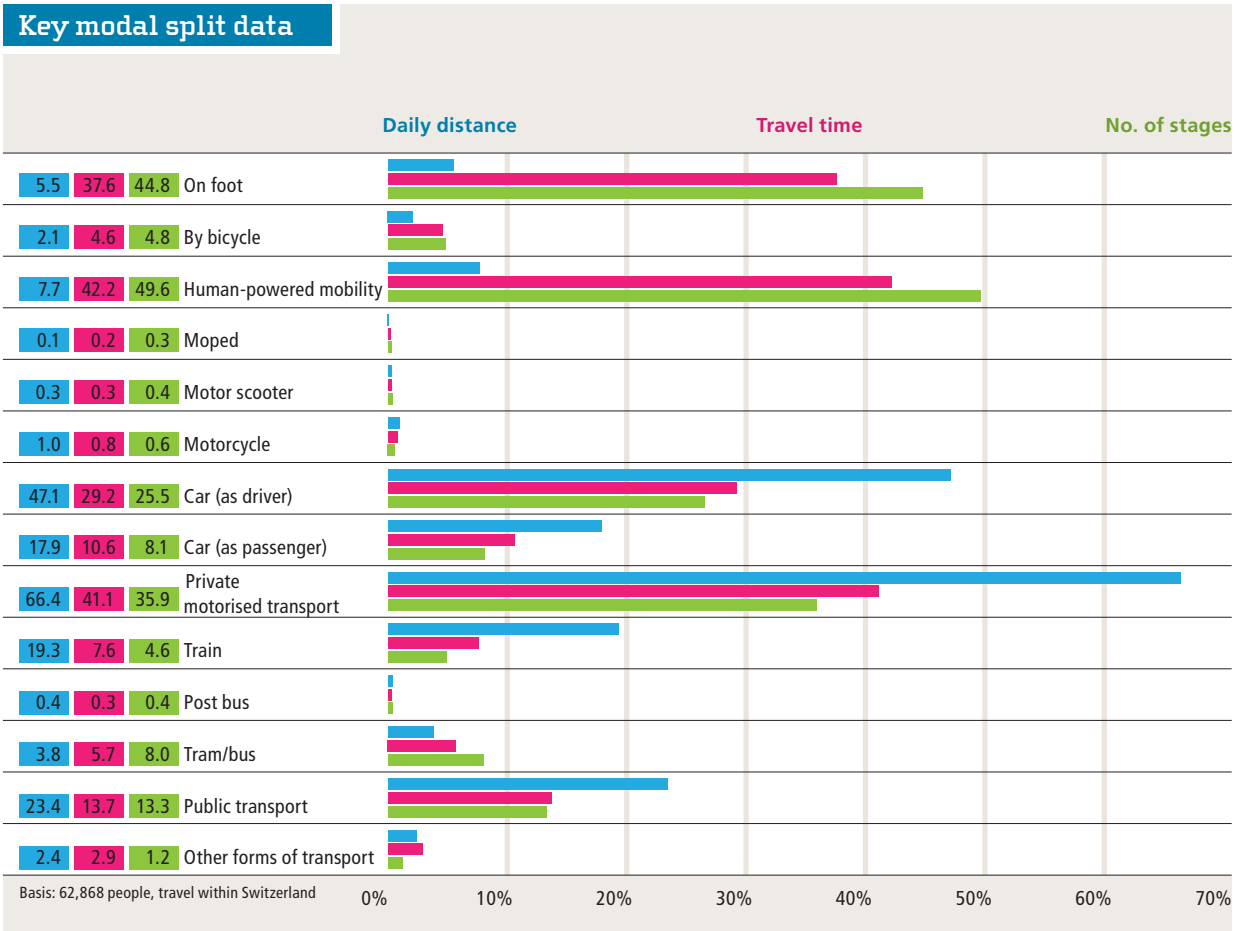
To exploit this potential it is essential to provide attractive, safe and well-integrated networks for human-powered mobility, as well as reliable signposting, the best possible connections to other forms of transport and auxiliary facilities such as secure and convenient locations for parking bicycles.

Range of forms of human-powered mobility



Range of forms of human-powered mobility, e.g. in the agglomerations of Bern and Geneva: green: 1 km = up to 15 minutes on foot; red: 5 km = up to 20 minutes by bicycle; blue: 7 km.

Key modal split data



Source: Federal Statistical Office/Federal Office for Spatial Development (2012): Mobility in Switzerland. Results of the 2010 mobility and transport micro-consensus, p. 48

Peaceful coexistence of cars and bicycles

The Federal Council wants to meet the mobility requirements in Switzerland in a sustainable manner. Here, one of its goals is to make high-speed roads compatible with human-powered mobility.

Motorway junctions are stretches of road that have a high conflict potential. Here, types of traffic with greatly differing speeds and requirements come together: this is where bicycles, cars and heavy goods vehicles cross paths. Planning and operating these segments is a particularly demanding task for the Federal Roads Office (FEDRO). In very limited space, safe passage has to be assured for cyclists, the volume of private motorised traffic has to be controlled and the needs of public transport have to be taken into account.

A publication produced by the Swiss Cycling Conference and co-financed by FEDRO, "Cycling in the vicinity of high-speed roads", describes how bicycle traffic should be integrated into such junctions and what needs to be taken into account during the planning stage. In addition, the Federal Council has set itself the goal of increasing the proportion of human-powered mobility in the private transport segment. There is still considerable potential: human-powered mobility can help improve the traffic system, ease the burden on the environment (air quality, noise, CO_2 emissions) and promote public health. It also fosters "green tourism" and reduces public as well as private expenditure on mobility. The ultimate goal is for human-powered mobility to evolve into an equal third pillar alongside private motorised transport and public transport.

Human-powered mobility guidelines for FEDRO

To enable FEDRO to carry out its planning in line with this objective, in 2013 it employed a specialist in the field of human-powered mobility. His mandate is to define standards for managing human-powered mobility in the vicinity of motorway junctions, to provide the necessary training for project heads, and to examine and evaluate selected projects from the point of view of human-powered mobility. In 2015, FEDRO plans to introduce a comprehensive set of guidelines for the management of human-powered mobility.

"Veloverkehr im Einflussbereich von Hochleistungsstrassen": This brochure contains recommendations for regulating bicycle traffic near motorway connections.

Eight lanes for motorists, two for human-powered mobility (N1/N6 junction at Bern–Wankdorf).

Maintenance is essential, otherwise even the best human-powered mobility infrastructure is worthless (N28, Küblis).

Cyclists have to be careful not to stray onto the motorway (N2, Schwarzwald Bridge, Basel).

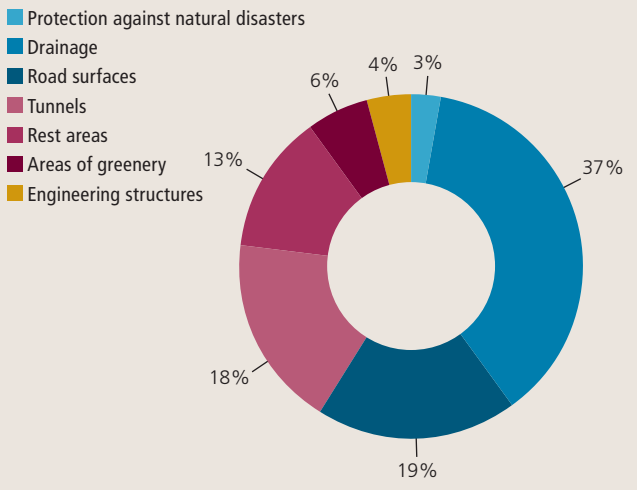
Working to maintain the motorway network

Daily maintenance on the motorway network is an essential task. Work is carried out by crews in brightly-coloured clothing.

The Federal Roads Office (FEDRO) operates the 1,811.6 kilometres of motorway on behalf of the federal government. The network comprises four-to-seven-lane motorways, plus expressways and main roads for which the federal government is responsible.

Operational maintenance on this network costs around 335 million Swiss francs a year (cf. page 9). The federal government concludes service level agreements with the cantons or with the eleven regional units formed for this purpose, most of which evolved from cantonal civil engineering departments or offices.

Cleaning costs



45 depots and 850 employees

Each regional unit is responsible for a defined zone. Their work is carried out via 45 depots containing the necessary vehicles, material and tools, plus workshops for carrying out minor repairs.

The eleven regional units cover the entire country and employ around 850 staff. These are the people road users see on our motorways and national roads dressed in brightly-coloured clothing.

Emergency services

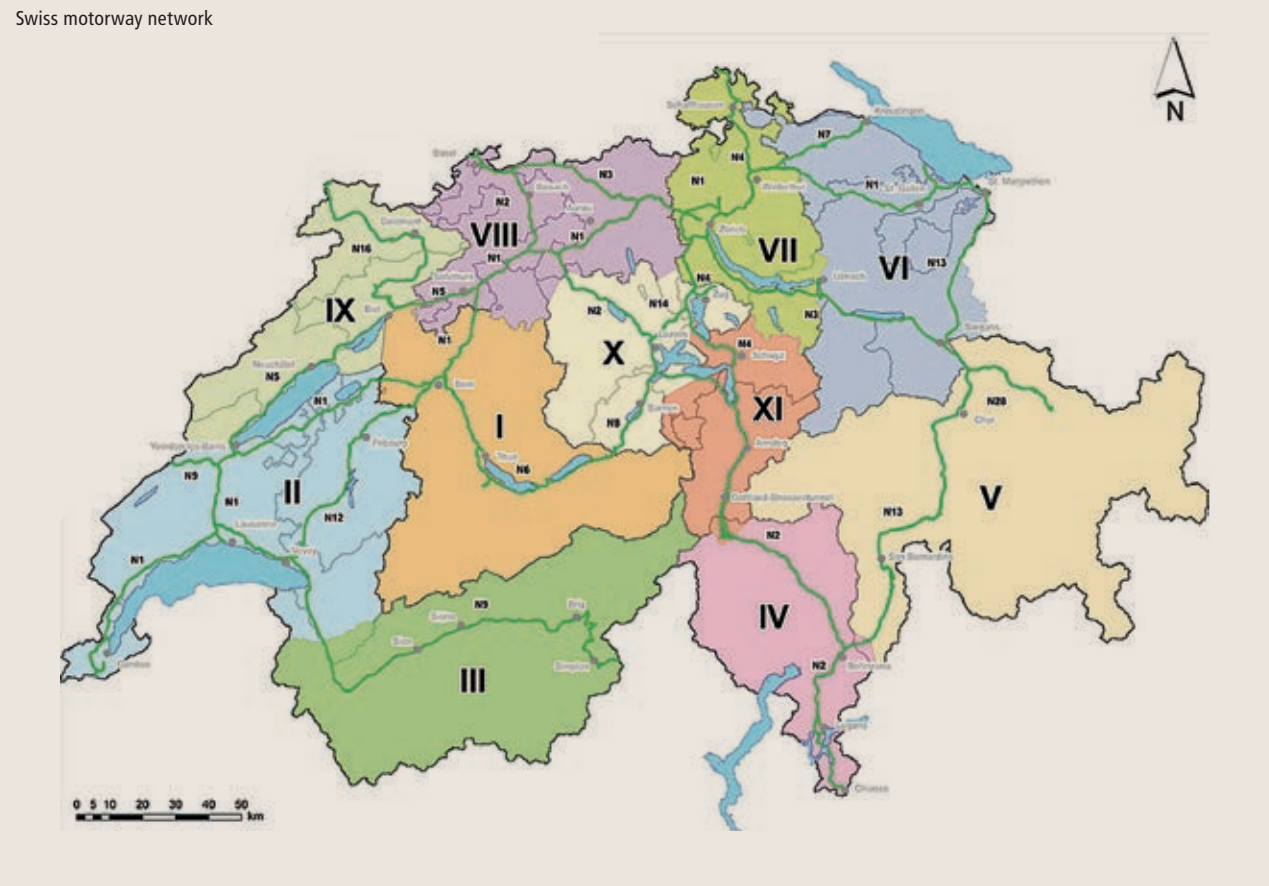
Operational maintenance includes emergency services which are responsible for fire fighting, etc., in the two major tunnels, namely the Gotthard road tunnel and the San Bernardino tunnel.

Responsibility of the eleven regional units for the cantons

RU I	Canton of Bern
RU II	Cantons of Geneva, Fribourg, Vaud
RU III	Canton of Valais
RU IV	Canton of Ticino
RU V	Canton of Grisons
RU VI	Cantons of Thurgau, St Gallen, Glarus, Appenzell Innerrhoden, Appenzell Ausserrhoden
RU VII	Cantons of Zurich and Schaffhausen
RU VIII	Cantons of Aargau, Baselland, Solothurn (the only public limited company)
RU IX	Cantons of Neuchâtel, Jura, Bern (Bernese Jura, A16 motorway)
RU X	Cantons of Lucerne, Zug, Obwalden, Nidwalden
RU XI	Cantons of Uri, Schwyz, Ticino

The eleven regional units and their areas of responsibility

Swiss motorway network



Operation and maintenance organisation: FEDRO (5 regional offices) | 11 regional units (mandated cantonal civil engineering offices) | 45 service points | 850 employees

Operational maintenance cost 335 million Swiss francs in 2013

Since 2008, most of the expenditure by the regional units on operational maintenance of the motorways/national roads has been calculated on the basis of services provided. For example, remuneration for road cleaning is based on total expenditure, not hours worked. This method results in annual savings to the tune of tens of millions versus the practice that was standard prior to the introduction of the redistribution of financial responsibility.

In 2013, operational maintenance cost around 335 million Swiss francs, 72 percent of which was paid to the regional units on a lump sum basis. Payment is based on services precisely defined in the respective agreements. Here a distinction is made between five types of service (see list on the right). With a proportion of 36 percent, maintenance of operating and safety installations forms the largest service category.

Costs of the five operational maintenance services in 2013

- Operating and safety equipment: 88 million Swiss francs
- Cleaning: 57 million
- Snow and ice clearance: 48 million
- Greenery maintenance: 38 million
- Technical services: 12 million

Maintenance of small structures (also referred to as non-project-related structural maintenance) accounts for around 16 percent of the total costs. This mainly involves minor construction work with a short duration and a limited budget. General services and emergency services in the two major tunnels account for the remainder of the costs.

Focus on safety and preservation of value

Maintenance, repairs, cleaning and preservation of value are the main duties. Safety of road users is the principal objective.

The specific tasks of the motorway maintenance and operating services are extremely diverse, as are the activities of the personnel at the various depots. Employees frequently have to overcome major challenges as the result of adverse weather conditions and proximity to traffic. The main duties of maintenance crews and operating personnel are as follows:

- Inspection, maintenance and repair of operating and safety installations.
- Installation, inspection and repair of safety barriers, road signs and signalling systems, road markings and barriers at construction sites.
- Cleaning operations: traffic lanes, greenery zones, rest areas and service stations, engineering structures, debris resulting from storms, etc., as well as tunnels and drainage systems.
- Greenery maintenance
- Snow and ice clearance
- Repair and clearance work following accidents and storms
- Non-project-related structural maintenance: minor repairs to road surfaces, safety barriers, etc.

Safety

Securing construction sites and ensuring the safety of construction and maintenance crews, as well as of all road users in the vicinity of roadwork sites, are among the most important duties of the regional units. Whenever a roadwork site has to be set up on a motorway, the personnel from the corresponding regional unit are always involved. Their duties include the installation of temporary traffic signals and barriers. Experience has shown that roadwork sites with a short duration normally represent a greater risk to safety, because road users are not accustomed to the changed situation.

Vehicles at the motorway depot near Wankdorf (Bern).

Salt silo, motorway depot near Spiez


Nationalstrassen
Betrieb
Tiefbauamt
des Kantons Bern
18

Heat sensors to prevent breakdowns of HGVs in the Gotthard

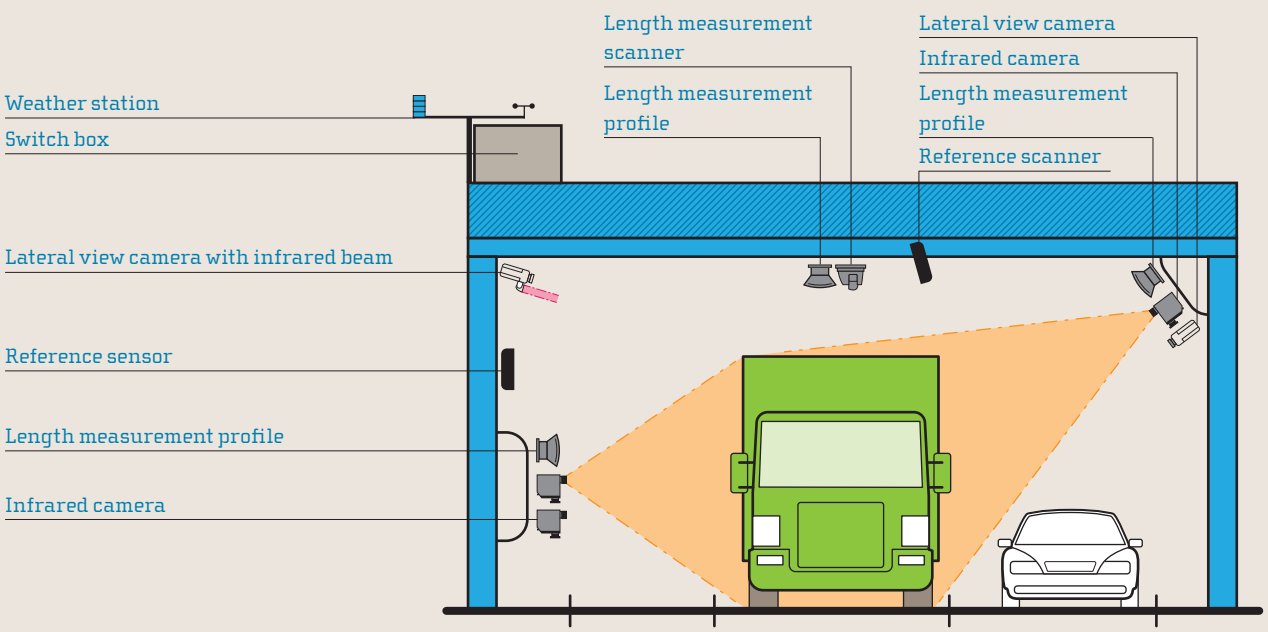
A heat sensor system located 800 metres before the entrance to the Gotthard road tunnel "scans" approaching heavy goods vehicles. If overheated components are detected,the vehicle is prevented from entering the tunnel.

In the wake of the fire that occurred in the Gotthard tunnel in 2001, all motorway tunnels with a length of over 600 metres were inspected, and immediate measures were implemented (signalling systems, guidance facilities, lighting) as necessary. Since then, the Federal Roads Office (FEDRO) has invested around 300 million Swiss francs in efforts to enhance tunnel safety, in addition to its spending on normal tunnel maintenance.

After a period of intensive preparation, the new SIA standards – which describe the safety installations that are required in tunnels – entered into effect on 1 October 2004. These standards apply to new tunnels, as well as to the maintenance and modification of existing ones so that they subsequently comply with the new requirements.

FEDRO is currently engaged in upgrading the safety installations in older tunnels within the scope of available funding. In the period up to 2018, it will be investing around 1.2 billion Swiss francs to enhance the level of safety in motorway tunnels. Here it is attaching the highest priority to the adaptation of signalling and guidance systems, followed by the modification of ventilation systems and the implementation of structural measures such as safety shafts.

Diagram of heat detection system in Airolo



Heat sensors "scan" heavy goods vehicles as they approach the tunnel near Airolo.

In addition to these measures, in 2013 FEDRO installed a heat sensor system at the southern entrance to the Gotthard tunnel, by means of which it is now possible to detect HGVs that represent a hazard due to an overheated component such as a turbocharger or exhaust system. By pulling over such HGVs before they enter the tunnel it is possible to avoid a situation in which they could break down, cause a traffic jam or even catch fire in the tunnel.

In operation since March 2013

Heat sensor systems had already been installed at the entrance to the Fréjus and Mont Blanc tunnels in 2002, though the maximum drive-through speed was only 10 km/h. The pilot system installed in Airolo, however, is able to "scan" heavy goods vehicles travelling at up to 80 km/h, and this means it does not interfere with traffic flow at the southern entrance to the Gotthard.

The system was put into operation in March 2013 and cost two million Swiss francs. It is able to simultaneously measure the temperature of several components of passing HGVs, and prevents them from entering the tunnel if it detects any excess temperatures. The system in Airolo measures the temperature of the engine, brake system, tyres, wheel bearings and exhaust system, and in this respect it is the first of its kind in the world. If it detects any overheated components in an HGV, it automatically switches the traffic lights to red and the vehicle concerned is then pulled off the road. At the same time it sends a message to the safety personnel. After carrying out more detailed temperature measurements, specialised mechanics then subject the vehicle to a close inspection.

Laser device and video cameras

The heat sensor system in Airolo is equipped with a laser device that depicts the various dimensions of HGVs, from which the most important information about each vehicle can be obtained: category, length, height and width, as well as speed. The system also uses two infrared cameras that measure the temperature of the various vehicle components, and is also equipped with a video camera that records a lateral view of the approaching vehicle. All these devices are connected to a server via fibre-optics cable.

Genuine problem detected in 26 out of 216 cases

In 2013, around 445,000 heavy goods vehicles passed through the Gotthard road tunnel from south to north and were "scanned" by the heat sensor system in Airolo. Between March and December that year, the system triggered 216 alarms, though a genuine overheating problem was subsequently identified in only 26 cases. Even so, this means that 26 HGVs representing a potential hazard were prevented from entering the tunnel.

Plan to install heat detection system at the northern portal

The development of the heat detection system in Airolo was initiated in 2007. During this early phase, a mobile system was used at the northern portal of the Gotthard road tunnel, where temperature measurements were carried out on HGVs in transit (approximately 7,700 vehicles). The results demonstrated that it was possible to simultaneously measure the temperature of the engine, tyres, wheel bearings and exhaust system.

In a second phase in 2010, the FEDRO regional office in Bellinzona installed a prototype of the system in use today at a distance of 800 metres from the southern entrance to the tunnel, and this was trialled for a full year.

Following the positive experience with the system in Airolo, the installation of a second facility at the northern portal is now under consideration.

Second dispatch to Parliament regarding the elimination of bottlenecks

To ensure that the motorway network continues to function smoothly, eliminating the worst bottlenecks is absolutely essential. In February 2014, the Federal Council submitted its second dispatch to Parliament regarding its programme to eliminate bottlenecks, with an investment volume of almost a billion Swiss francs.

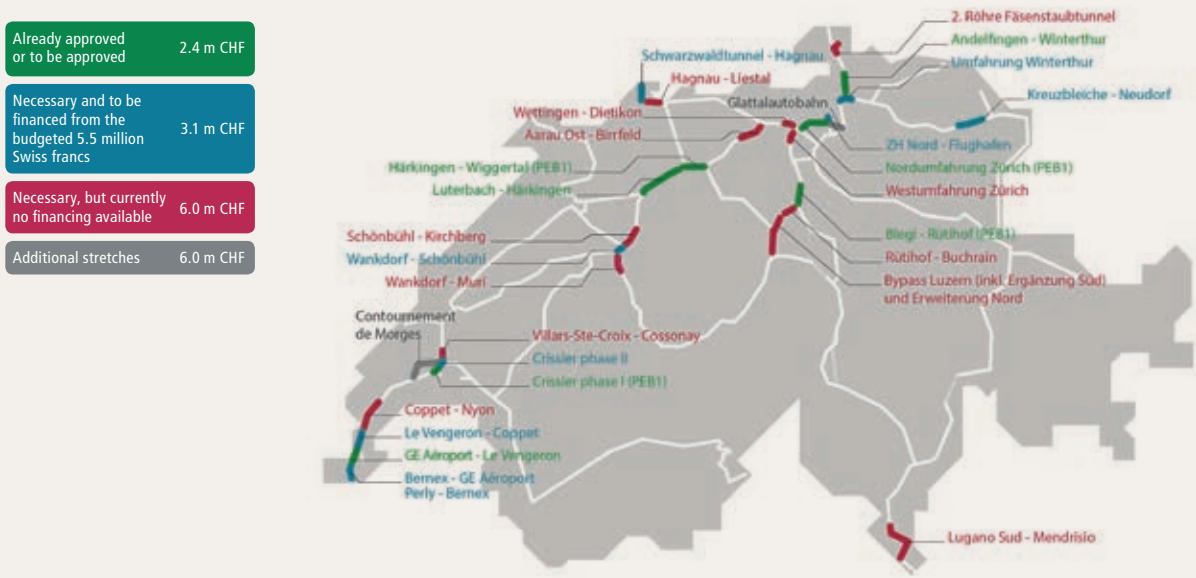
The volume of traffic on the motorway network has more than doubled in the past twenty years, and many stretches are now reaching their capacity limit. A total of 5.5 billion Swiss francs is available in the Infrastructure Fund for eliminating the most severe bottlenecks. In 2009, in response to the first dispatch to Parliament an initial tranche of 1.4 billion Swiss francs was approved for widening the stretches between Härkingen and Wiggertal, Blegi and Rütihof and the Zurich northern bypass, and for eliminating the bottleneck near Crissier.

Widening of three further stretches

In February 2014, the Federal Council petitioned Parliament to approve a second tranche in the amount of 995 million Swiss francs for eliminating the bottlenecks between Geneva Airport and Le Vengeron, Luterbach and Härkingen, and Andelfingen and Winterthur. In each case, the aim is to widen the existing stretch, and additional measures are to be implemented in the vicinity of Crissier at a cost of around 40 million Swiss francs.

Elimination of bottlenecks on the motorway network

Programme proposed in Dispatch to Parliament dated 26 February 2014



Road widening projects in agglomerations

It is planned to use the remainder of the total available funding of 5.5 billion Swiss francs for various other road widening projects in the agglomerations in which the traffic volume is particularly heavy, namely Geneva, Basel, St Gallen, Winterthur and Zurich Airport.

Glattal stretch and Morges bypass pose special problems

The Infrastructure Fund cannot be used for financing the elimination of all bottlenecks on Switzerland's motorway network. In the Glattal and Lausanne/Morges regions, a widening of the existing stretches will not be sufficient, and this means that new stretches will have to be constructed.

The A1 in the Zurich/Glattal region is already frequently subjected to severe congestion today. The existing stretch contains numerous engineering structures, as well as connecting roads and junctions, and has to handle a very high volume of traffic. Widening the existing stretch would not secure the necessary increase in capacity, even with a significantly higher budget.

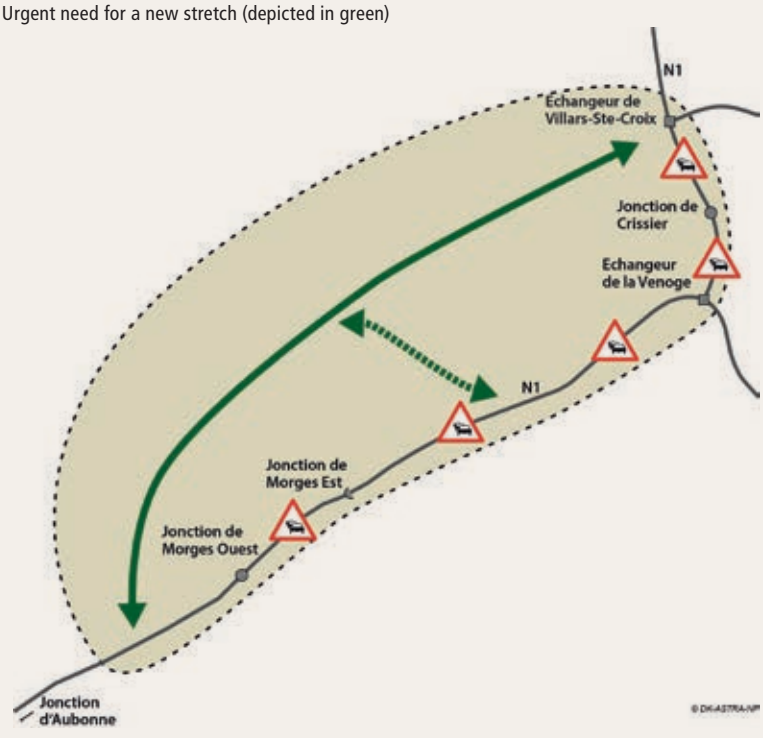
And in the Lausanne/Morges region, too, the existing stretch of the N1 will be severely congested by 2020 (cf. diagram and text in box).

Implementation now uncertain

The federal government had originally expressed the intention to include this new stretch in the motorway network, but the rejection by the Swiss electorate of the proposed increase in the price of the motorway sticker means that this project has had to be put on ice.

Bottleneck on the Lausanne–Morges stretch

Urgent need for a new stretch (depicted in green)



Working together with the cantons and municipalities

Together with the involved cantons and municipalities, the Network Planning division at FEDRO carried out a comprehensive study of the Lausanne/Morges stretch. From the findings it became apparent that, from an urban development point of view and because of the high degree of intervention in developed zones that would be required, it will not be possible to widen the existing stretch. In view of this, it will be necessary to construct a new segment between Villars-Ste-Croix and the Morges–Aubonne stretch.

Motorway planning process and involved players

The motorway network is defined by Parliament (federal resolution on the motorway network). If the incorporation of a new stretch into the network is proposed, Parliament has to adopt a corresponding amendment to the above resolution.

Since 1960, it has done so on four occasions:
- Gotthard road tunnel (alternative to the mountain pass which is closed during the winter)
- Northern and western Zurich bypasses
- A16 across the Jura
- A28 in Prättigau (Landquart to Klosters – Selfranga, loading station for carriage of motor vehicles by train through the Vereina tunnel)

In addition, the Rawil tunnel (on the stretch between Wimmis and Sion) was removed from the network in 1986.

The most recently proposed amendment to the federal resolution on the motorway network, calling for the incorporation of 400 kilometres of cantonal roads, was blocked at the end of 2013 (rejection of the referendum on the increase in the price of the motorway sticker).
The Federal Roads Office (FEDRO) is responsible for formulating the strategic decision-making principles for the further development of the motorway network, and thus for preparing any amendment to the federal network resolution that may be required. Within FEDRO, these tasks are carried out by the personnel of the Network Planning division. Their specific mandate is to determine whether the existing motorway network will continue to meet the future demands in terms of functionality, road safety and accessibility, or whether it may need to be expanded. Based on traffic statistics and forecasts regarding the development of the traffic volume, they also set out to identify those stretches that are likely to reach their capacity limit in the future.

They then proceed as follows:
- If a bottleneck has been identified as such, they initially evaluate the various potential solutions and determine which ones are to be given further consideration. They then select the most suitable solution in overall terms with the aid of a comprehensive exclusion and assessment procedure. Representatives of the involved cantons, municipalities and regional organisations are incorporated into the project as members of either official or technical committees. The next step is to organise a public consultation procedure in order to obtain input from citizens' organisations, political parties, environmental associations, residential associations and other local interest groups (cf. "The network planning environment" diagram). In all studies, operational solutions within the framework of traffic management, and/or examples of solutions adopted by other forms of transport, are examined. If alteration or expansion projects are found to be in line with the declared objectives over the long term, the project study phase is brought to a close and the Director of FEDRO entrusts the Road Infrastructure division with the task of preparing a general project.

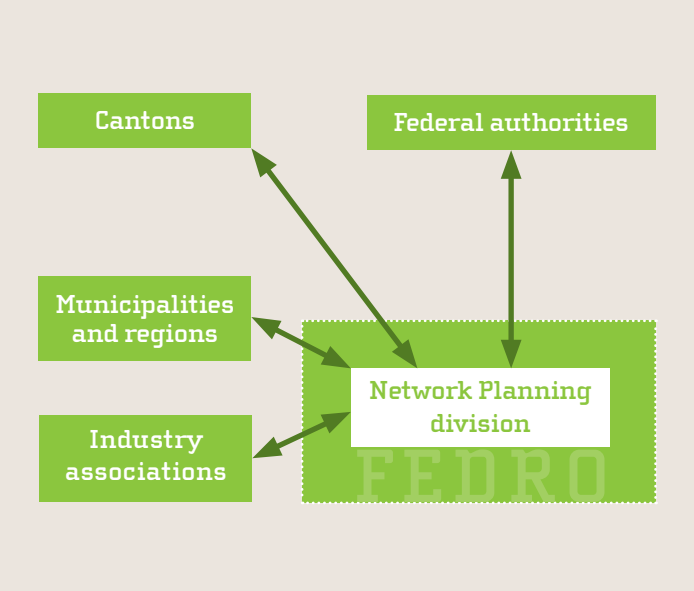
- Within the scope of the general project, the Road Infrastructure division examines the selected option in greater depth. Here, for example, the precise route and the connections to secondary roads are defined. Each general project has to be approved by the Federal Council. Beforehand, however, the involved federal authorities and other Departments have an opportunity to comment on the project in the respective consultation and joint reporting procedures.

- After a general project has been officially approved, the planning is then intensified within the scope of an implementation project, in which the layout of the stretch is defined in a binding manner for the involved land owners.

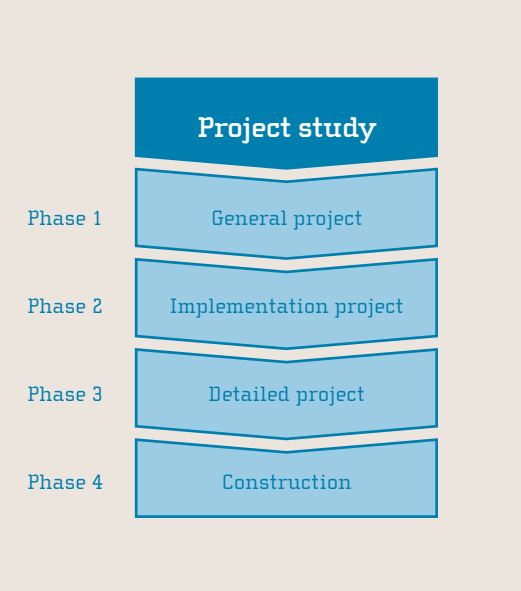
- The main purpose here is to carry out clarifications and negotiations regarding the acquisition of land. Each implementation project has to be approved by the Federal Department of the Environment, Transport, Energy and Communications (DETEC). The next step is to publicise the project so that the involved citizens and organisations have an opportunity to submit their comments and/or objections. Objections are dealt with by the Federal Administrative Court, and if they are rejected, appeals may be lodged with the Federal Supreme Court.

- The final phase concerns the implementation of detailed projects. Here, all activities within the scope of the construction project are defined in detail so that calls for tenders can be issued and construction work can go ahead.

The Network Planning environment



Motorway planning



Increasing traffic volume places high demands on the structure of roads

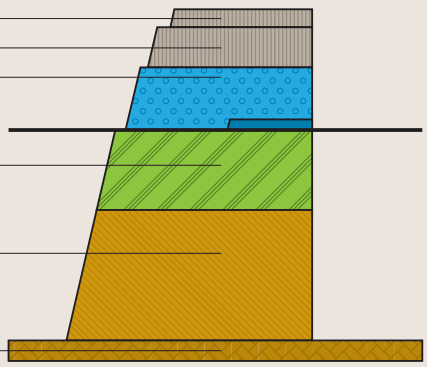
In view of their high traffic volume, motorways are classified as high-performance roads. The substructure therefore has to be correspondingly robust (up to 1.8 metres thick).

The daily traffic volume on the A1 near Lausanne is around 80,000 vehicles, in Basel it is 120,000 and in Zurich it is as high as 140,000. These are average daily traffic volumes based on figures obtained by FEDRO from its network of traffic counting stations.

Road construction experts calculate with the aid of load or transit categories ranging from T1 to T6. The higher the transit category, the higher the traffic volume – and the more robust the structure of a motorway stretch needs to be. The difference between average traffic volumes on motorways and cantonal roads is striking: the average daily traffic volume on the motorway network is around 30,000 vehicles, compared with just 3,000 on the country's cantonal roads. This means that the layers on a motorway stretch have to be approximately 1 metre thicker than those on the average main road (see below). The density of the utilised material and the method of construction are the same for both types of road.

The layers of a road

Material	Layer	Motorway	Cantonal road
Asphalt	Surface	3 cm	3 cm
Asphalt	Bonding layer	8 cm	6.5 cm
Asphalt	Support layer	8 cm	6.5 cm
Asphalt	Bonded foundation	8 cm	–
Gravel	Foundation	60 to 80 cm	30 to 50 cm
Soil, gravel	Top soil	85 cm	20 to 30 cm



Asphalt layers on a motorway.

Structure and method of construction of a motorway stretch

The substructure and asphalt surface of a motorway comprise six layers with a total thickness of 1.8 metres.
A description of the four stages of motorway construction also explains how the substructure and surface are formed:

The first step is the excavation work. The height profile of the road can only be made level through a combination of extraction and backfilling. This eliminates any abrupt upward or downward slopes. Hollows have to be levelled by filling them with soil, which then has to be compressed.

In the second step the topsoil layer has to be prepared. This layer forms the base of the road and is up to 85 centimetres thick.

– Here the surface has to be levelled and subsequently compressed using special machines. Compression prevents the formation of any hollows that would need to be subsequently filled and also ensures that a smooth and stable base is formed for the construction of the layers.

The third step concerns the formation of the two support layers.

– The lower layer is the foundation, which consists of gravel sand and is between 60 and 80 centimetres thick.
– The upper layer is the bonded foundation layer, which contains a bonding agent to give it the necessary strength and stability. This layer is 6 to 8 centimetres thick.

The fourth and final step concerns the construction of the three surface layers (asphalting or concreting).

– The lower (support) layer is 8 centimetres thick.
– The bonded layer is up to 8 centimetres thick.
– The cover layer is 3 centimetres thick.

Dimensions

4 lanes encompass a total width of 23 metres. A motorway lane is 3.5 metres wide, which means that the total width of a four-lane stretch (including two emergency lanes plus a centre strip) is 23 metres.

37 tonnes per linear metre: For a four-lane motorway, the following quantities of materials are required per linear metre:
– 22 tonnes of gravel sand
– 15 tonnes of surface material
– 1.5 HGV journeys are required to supply the 37 tonnes of material per linear metre.

The asphalt that is used is a mixture of gravel sand (93 percent) and bitumen (7 percent), to which polymers are added, which make the asphalt more elastic and resistant.

The diameter of the granulation of the gravel in the bitumen must not exceed 22 millimetres.

Use of recycled materials: Nowadays, roads are constructed or repaired using recycled materials that have been extracted from existing roads that have been broken up:
– **Surface:** Up to 50 percent recycled material
– **Foundation:** Up to 80 percent recycled material

Shift work on motorways

At motorway construction sites, work has to be carried out with the least possible interference to traffic flow. Shift work is often required in order to shorten the duration of road works.

Motorways are highly frequented stretches with an average daily traffic volume of around 30,000 vehicles. Peak levels of 120,000 vehicles around Basel and 140,000 around Zurich underscore how important it is for maintenance and expansion work to be carried out quickly while maintaining the same high standard.

Two shifts during the day

On the motorways, working in two shifts during the day is standard practice. Night work is required when the involved stretch is so important that closing it during the day would result in major economic consequences for an entire region (cf. page 22). Work was already carried out in shifts when the construction of the motorway network was initiated in 1960 – for example, whenever complex processes called for uninterrupted activity.

Criteria for deciding to work in shifts

The decision whether to work in shifts at motorway construction sites is influenced by a variety of factors, but the following five criteria always apply, which are prioritised in accordance with the corresponding requirements and objectives:

Shortest possible construction time: Speed is essential when it comes to road works, in order to prevent undue interference with traffic flow. It is therefore often necessary to work efficiently in shifts so that construction can be completed more quickly. By working at night it is possible to reduce the overall duration of a construction phase by 25 to 30 percent. Incentive systems ensure that contractors work quickly and efficiently.

Minimum interference with traffic flow: Road works always go hand in hand with traffic delays, so working quickly is essential in order to minimise interference with traffic flow. For this purpose, the hours of daylight are fully utilised. This lengthens the overall working day and the work can be scheduled to be carried out in two shifts. For FEDRO the following principle applies: as soon as road work interferes with traffic flow, it is to be carried out in shifts. Lane closures should be avoided.

Compliance with labour law

When work is being carried out on the motorway network, it goes without saying that the provisions of labour law have to be complied with. This is the responsibility of the involved companies.

Since night work had to be carried out at a construction site on the Lucerne bypass during the past two years, the State Secretariat for Economic Affairs (SECO) had to issue a corresponding permit in the form of a general licence for all involved companies, as is the case for all projects of this nature. In addition, a report had to be submitted to the cantonal employment office every three months stating how many people worked night shifts. And in order to ensure that supplies could be delivered at night, the involved transport companies were also granted special permits.

Night work on a motorway.

Costs. Shift work always results in higher costs. In each case it is therefore necessary to weigh up the additional costs against the greater benefits of completing the work more quickly. On average, night shifts increase the costs by around 20 percent.

Maximum safety for workers as well as road users. Some tasks can be carried out more easily and safely when there is little or no traffic on the road. Also, road users are not additionally endangered due to activities involving large construction machines. On the other hand, work safety is to some extent negatively influenced after dark due to the reduced visibility.

High quality: Structures are equipped with the highest-quality technology, operating and safety equipment in order to secure their smooth and reliable function over the long term.

Road work can be carried out while traffic continues to flow on four lanes at 80 km/h.

Shift work at two major construction sites

The renovation of Lucerne "Cityring" (2009 to 2012) and the work on the renovation and widening to 6 lanes of the Härkingen and Wiggertal junctions (completed in autumn 2014) are examples of the different ways in which shift work is organised.

Lucerne ring road ("Cityring")

Negotiations on the organisation of construction work and traffic management were already initiated in 2005 between the city and the canton of Lucerne, and the federal government. The complete closure of the stretch that runs through the city was out of the question, because the negative economic impacts for Lucerne and the region would have been unacceptable. At around 90,000 vehicles a day, the traffic volume in Lucerne is very high – most of it is regional "destination-source" traffic. It was therefore decided that work should primarily be carried out at night, so that traffic would largely be able to flow normally during the day. Night work on the Lucerne ring road resulted in additional costs of more than 100 million Swiss francs, with total costs amounting to 400 million. If the stretch had been completely closed to traffic, work would probably have been completed a year earlier.

The main reasons for the additional costs were as follows:

- Increased expenditure for planning, structural measures, installation of a logistics centre, plus additional operating and safety equipment.
- Each night, two lanes were closed for construction work. Each morning, crews had to clear the construction site and remove the material and machines. They also had to clean the site and inspect the safety installations.
- Work was carried out during three nights a week and on weekends. Between 50 and 100 personnel participated in night shifts.
- Night work also had consequences for suppliers of materials, and night shifts were required in the involved asphalt and cement factories.

Stretch between Härkingen and Wiggertal junctions

The stretch between the Härkingen and Wiggertal junctions on the A1 motorway was widened from four to six lanes in the period from May 2012 until autumn 2014. The objective here was to eliminate the bottleneck along this nine-kilometre stretch. Preparatory work was initiated in October 2011, and the main construction work commenced in May 2012. All six lanes were opened to traffic in September 2014. The revitalisation of an 850-metre stretch of the Wigger river is to be completed by summer 2015. This body of water, which had been previously straightened, is to be widened and restored to its natural course. This is being done to compensate for the loss of cultivated land resulting from the construction project.

Communication

Shift and night work always mean more noise for nearby residents. In view of this, communication is an essential aspect of construction projects at all levels: management, crews, suppliers, involved authorities, and especially residents in the region. Normally, local residents receive a personal letter informing them about impending major projects. Experts explain that informing and involving nearby residents is a decisive factor when it comes to acceptance of unavoidable noise emissions.

Asphalting at night on a motorway.

A period of around 600 working days was scheduled for the main tasks, but work was in fact completed earlier than expected, despite a number of days of adverse weather. On average, around 100 personnel worked at this construction site, though for the construction of the large retaining wall on the south side near the River Aare, and other concrete structures, up to 200 personnel were required. The retaining wall had to be built in order to attain the necessary width for the six lanes.

Lane closures at night only

Along this nine-kilometre construction site, shift work did not take the form that is common in industrial companies, e.g. where one shift hands over to another. Instead, the idea was to utilise daylight to the greatest possible extent, depending on the season. Those crews who were responsible for demolition and excavation work carried out their tasks in the morning and early afternoon, while those responsible for laying pipelines and concreting generally worked in the late afternoon and evening. This meant that contractors had to carefully plan their various activities.

Generally speaking, no reduction in the number of lanes was required: two lanes in each direction were always kept open to traffic, though the speed limit was reduced to 80 km/h. However, if a particular task meant that one or more lanes had to be closed, work was carried out at night in order to minimise interference to traffic flow.

Night work was carried out on around 120 of the total of approximately 600 work days. The activities primarily concerned traffic diversions, measurements, markings, installation of pipelines and ducts, and installation of traffic signals.

Service stations

Another problem associated with the widening of the Härkingen to Wiggertal stretch concerns the two service stations (Gunzgen Nord and Gunzgen South), which have to be closed for 9 weeks. At the same time, these service station areas have to be renovated during peak travel periods. Here the personnel planning of the operators of the service stations was taken into account.

Everything was proceeding on schedule as of May 2014, despite the harsh 2011/2012 winter and bad weather conditions in spring 2013, and the project is therefore expected to be completed on time.

Major roadworks on the motorways in 2014

1_A9: Renovation of Chillon viaduct

Renovation of the structural joints of the viaduct --- reinforced concreting --- replacement of road surface on lakeside viaduct --- filling of fissures in concrete surface beneath the bridge --- work to be carried out between April and October 2014, during which time 4 lanes on the hillside viaduct will be open to traffic and a speed limit of 60 km/h will apply --- costs in 2014, around 16 million Swiss francs.

2_A9: Total renovation in the vicinity of Sion

Comprehensive renovation of A9 stretch between Conthey–Vétroz and Uvrier --- duration, 2013 to 2016 --- 11 km, 3 junctions, 4 bridges, 17 over- and underpasses, 2 service stations, 1 tunnel --- average daily traffic volume, 33,000 vehicles --- complete alteration of "Sion-ouest" junction, 2 new roundabouts opened to traffic in autumn 2013 --- work in 2014 includes first main construction stage with renovation of lanes and in Champsec tunnel --- total costs, 156 million Swiss francs.

3_A2: Stretch from Acheregg to Beckenried

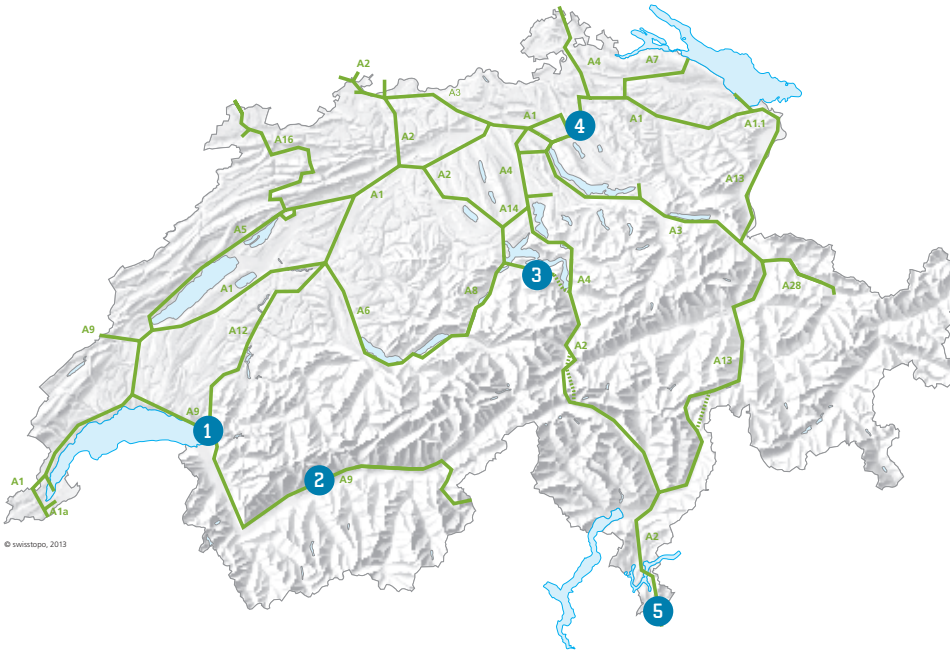
12 km, work to be carried out in 3 stages --- duration, 2013 to 2017 --- renovation of surfaces --- repair work on bridges and underpasses --- extension of noise prevention barriers --- replacement of drainage system --- replacement of operating and safety equipment --- average daily traffic volume, 35,000 vehicles --- costs, approx. 278 million Swiss francs.

4_A1: Repair work on Töss bridge (Effretikon to Winterthur Ohringen stretch)

Repair work on Töss bridge between Winter Töss and Winterthur Wülflingen junctions --- preliminary measure as part of the maintenance project on the stretch between Effretikon and Winterthur Ohringen --- bridge was first opened to traffic in 1967 --- duration of repair work, March 2014 to September 2015 --- no closure of lanes --- nature of repair work: strengthening of static properties of bridge and abutments, replacement of road surface and seal, replacement of expansion joints --- use of dynamic traffic control signals, "Pro tec" safety equipment and video-based traffic monitoring --- total cost, 10 million Swiss francs.

5_A2: Alteration of Mendrisio junction

Separation of exit to Mendrisio from junction between A2 and cantonal road --- optimisation of traffic flow to and from motorway --- creation of new junctions --- complementary measures, including surface drainage, environmental protection measures, noise prevention barriers, renovation of 3,000 engineering structures --- roadwork site, 1.8 kilometres in length --- duration of work, from 2012 to 2017 --- total cost, 100 million Swiss francs. ------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Accident black spots

FEDRO has been compiling accident statistics since 2012. The recorded data facilitate the identification of accident black spots and thus support the efforts of road owners to improve the level of safety.

Switzerland's road accident statistics are based on the register compiled by FEDRO, which contains data relating to accidents on public roads. Accidents are recorded if at least one motorised or human-powered vehicle is involved, or a pedestrian and a device similar to a vehicle.

Uniform accident report forms to be completed by the relevant cantonal police force provide the details for the accident statistics. This makes it possible to compile statistics based on a broad range of criteria, including cause of accident, involved road users, resulting damage, etc.


Unfallaufnahmeprotokoll
Objektblatt
Allgemeine Angaben
Fahrzeug-Immatrikulation
Fahrzeugart
Angaben zum Fahrzeug
Anprall (max. 3)
Abblendlicht

Accident report form.

Accident black spots

By analysing these accident data it is possible to identify accident black spots. With effect from 1 July 2013, the Federal Road Traffic Act requires all public road owners, i.e. the federal government, cantons and municipalities, to analyse their network in order to identify accident black spots and draw up plans to eliminate them.

A location in a road network is classified as an accident black spot if, within a period of three years, the number of accidents involving injuries or fatalities exceeds a defined threshold within a specified zone. The size of the zone and the defined threshold vary according to the type of road.

For the period from 2010 to 2012, a total of 1,084 accident black spots were identified throughout the country, of which 110 are on the motorway/national roads network or entry/exit roads.

69 percent in built-up areas

An analysis of the identified accident black spots by type of road and location shows that a large proportion (69 percent) are to be found in built-up areas, while 28 percent are on rural stretches, and only 3 percent are on motorways and expressways. A report on the results of the process of identifying accident black-spots on motorways can be viewed on the FEDRO website (www.astra.admin.ch – report not available in English).

Trend in road safety from 1970 to 2012

1971: Introduction of requirement for the front seats of all cars to be fitted with seat belts.

1973: Introduction of a speed limit of 100 km/h outside built-up areas (until the end of 1975) and enforcement of a temporary speed limit of 100 km/h on motorways from 1973 to 1974.

1977: Definitive specification of a speed limit of 100 km/h outside built-up areas, and 130 km/h on motorways.

1980: Federal Council introduces a maximum permissible blood alcohol level of 0.08 percent and the requirement for the rear seats of cars to be fitted with seat belts.

1984: Introduction on a trial basis of a speed limit of 50 km/h in built-up areas, 80 km/h outside built-up areas and 120 km/h on motorways.

1990: Definitive introduction of a speed limit of 80 km/h outside built-up areas and 120 km/h on motorways. Adoption of a directive on the indication of traffic regulations in designated zones (e.g. 30 km/h speed limit in residential zones) in 1989.

1992: Decline in the number of fatalities in line with the reduction in accumulated travel distance. Possible factors here include the sharp increase in unemployment in Switzerland after 1991, which led to a reduction in commuter traffic, and the inauguration in 1990 of the comprehensive urban railway network in the Zurich region.

1994: Introduction in Switzerland of requirement for seatbelts to be worn on all seats in motor cars.

2002: Introduction of a variety of new road traffic regulations: requirement for children to be secured in all seats in cars fitted with seat belts; introduction of new Ordinance on residential/pedestrian zones (20 km/h speed limit) and 30 km/h zones; and recommendation that all motor vehicles should be driven with lights on during the day.

2005: Introduction on 1 January of maximum permissible blood alcohol content of 0.05 percent, more stringent regulations governing confiscation of driving licences (cascade system for repeat offenders), and provisional driving licence for new drivers, with compulsory further education.

2010: On 1 April, requirement of use of child safety seats extended to children under 12 who are less than 1.50 metres tall.

Road safety: a major success story

Despite an increase in the accumulated travel distance by 85 percent, the number of fatal accidents involving motor cars fell by around 90 percent in the period between 1970 and 2012. These figures indicate that measures introduced by the federal government to promote road safety (including traffic regulations and improvements to road infrastructure and vehicles) are having the desired effect: there are now far fewer road accidents despite an increase in the accumulated travel distance.

The above graph depicting the trend in passenger car safety compares two criteria in the period from 1970 to 2012:

- The trend in the total distance travelled by motor car (depicted as distance travelled by car per inhabitant)
- The number of fatalities in motor cars per 100,000 inhabitants

Sources: Swiss Federal Roads Office (FEDRO) | Swiss Federal Statistical Office (SFSO)
Swiss Advisory Centre for Accident Prevention (bfu)

Enhancing drivers' awareness for hazards

Two-phase instruction was introduced in December 2005 for new drivers. Following a detailed evaluation, Parliament voted to retain this system.

With effect from 2005, after passing the driving test, new drivers are only issued with a provisional driving licence. During a three-year probationary period they have to attend two compulsory further education courses and are subject to particularly stringent sanctions:

- Prolongation of probationary period by one year if their licence has been withdrawn
- Cancellation of the provisional driving licence if it has been withdrawn a second time

The aim of these measures is to reduce the number of accidents involving new drivers. They only receive a definitive driving licence if they have attended both courses and have completed the probationary period without having their provisional licence cancelled.

Accidents statistics relating to new drivers

The Swiss Advisory Centre for Accident Prevention (bfu) has analysed the accident statistics relating to new drivers: the decline in the number of accidents with injuries or fatalities caused by new drivers is significantly more pronounced than the average decline in all age categories. The difference is more than ten percent. Although it cannot be demonstrated scientifically that this decline is attributable to the two-phase driving instruction scheme, FEDRO is nonetheless convinced that it is a major contributing factor. However, the bfu has also identified certain shortcomings, which it believes are attributable to the demands placed on the implementation of the two-phase driving instruction scheme and the often relatively late attendance at the courses. It has therefore proposed certain improvements that are to be incorporated into the revision of the concept (cf. "Opera-3" below).

Content of further education courses

- How to more clearly identify hazards and avoid them
- Greater awareness of own capabilities
- Optimisation of traffic sense
- Learning to drive ecologically and more considerately

OPERA-3

OPERA-3 refers to a programme aimed at optimising the initial instruction phase in consideration of the Third EU Directive on Driving Licences. The initial phase encompasses driving instruction (theory and practice) and the driving test. In the OPERA-3 project, optimisation measures are being proposed for this initial instruction phase, though the goal is also to optimise the second phase and more effectively coordinate the first and second phases. The question of which regulations contained in the Third European Directive on Driving Licences should also be adopted by Switzerland is also being examined. This primarily concerns a harmonisation of driving licence categories, and applies in particular to motorcycle categories.

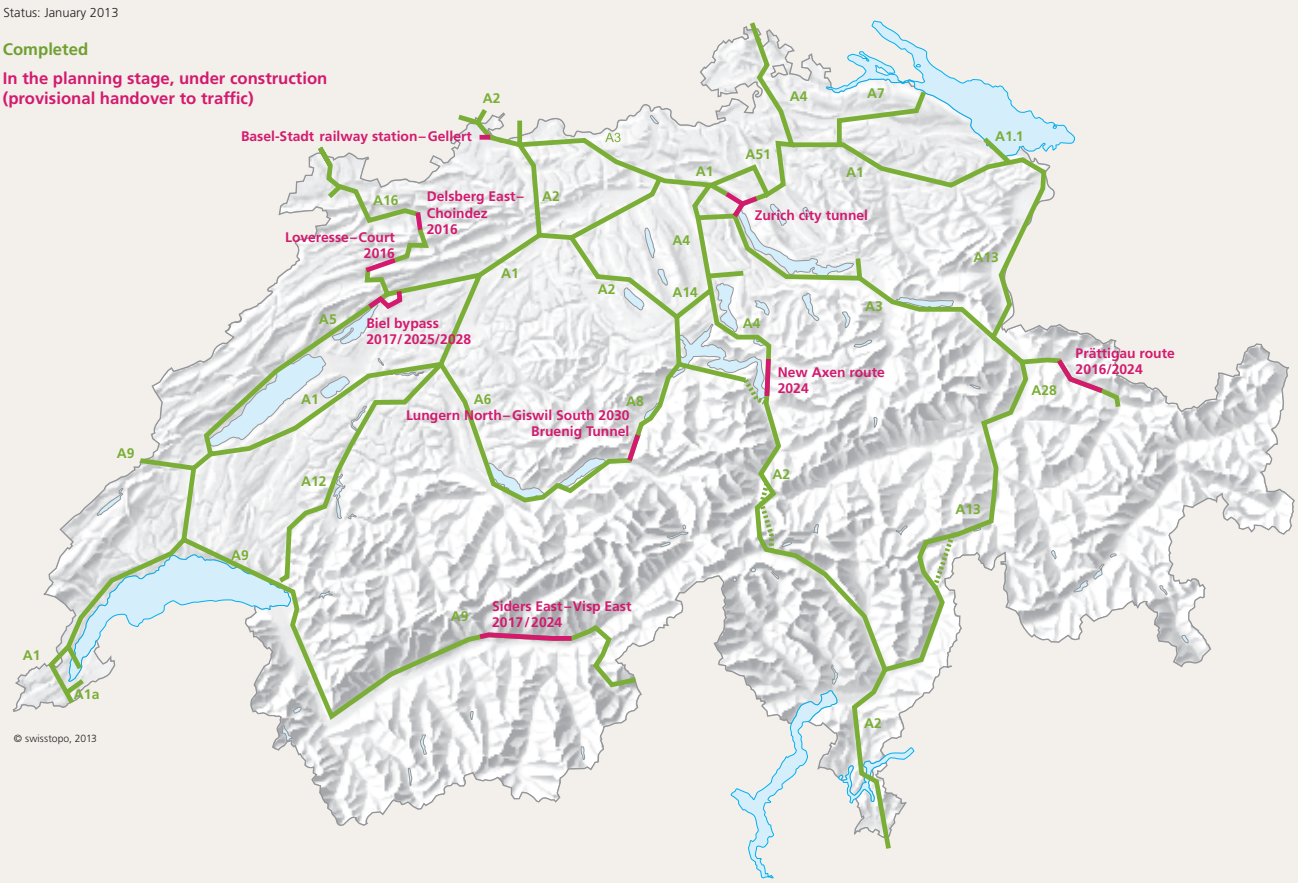
2011–2012 accident statistics: new drivers the main cause (cars and motorbikes)

Year	Total	With material damage only	With injuries	With fatalities	With severe injuries	With minor injuries
2011	8,363	5,380	2,983	41	564	2,378
2012	8,083	5,352	2,731	36	454	2,241

Facts and figures

Opening of a motorway stretch in the Jura region

In 2013, 3.1 kilometres of motorway were opened to traffic, namely on the A16 between Moutier and Court (Bernese Jura), bringing the total length of the motorway/national roads network to 1,811.6 kilometres. When it is completed, the network will have a total length of 1,892.5 kilometres.



2013: Opening of a new section on the A16:

Motorway	Canton	Stretch	2 lanes (km)	4 lanes (km)
A16	Bern	Moutier-Sud–Court	3.1	3.7

2014: Two stretches scheduled to be opened to traffic:

Motorway	Canton	Stretch	2 lanes (km)	4 lanes (km)
A5	Neuchâtel	Serrières to Areuse		1.7
A16	Jura	Bure to Pruntrut Ouest		8.8
A28	Grisons	Pagrüeg to Mezzaselva	1.4	

The Swiss motorway/national roads network

Total length by road category

(km)

	7-lane		6-lane		4-lane		3-lane		2-lane		Mixed-traffic roads		Total	
	in use	planned	in use	planned	in use	planned	in use	planned	in use	planned	in use	planned	in use	planned
Zurich			32.5	37.1	105.5	110.9	1.9		11.1	11.1			151.0	159.1
Bern			13.2	13.2	129.3	136.7			46.9	62.6	19.4	19.4	208.8	231.9
Lucerne			2.6	2.6	55.9	55.9							58.5	58.5
Uri					37.1	53.0			16.3	6,3	16.1	10.0	69.5	69.3
Schwyz					43.2	52.7			2.2		4.3		49.7	52.7
Obwalden					1.8	1.8			22.3	31.1	13.3	1.0	37.4	33.9
Nidwalden					22.9	22.9			2.9	0.9		2.0	25.8	25.8
Glarus					16.6	16.6							16.6	16.6
Zug					17.7	17.7							17.7	17.7
Fribourg					84.2	84.2							84.2	84.2
Solothurn					43.8	43.8							43.8	43.8
Basel-Stadt			3.5	3.5	6.0	8.0							9.5	11.5
Basel-Landschaft			9.5	9.5	20.7	20.7							30.2	30.2
Schaffhausen						1.9			17.2	17.2			17.2	19.1
St. Gall					139.8	139.8							139.8	139.8
Grisons					43.6	50.2			93.4	112.1	27.9		164.9	162.3
Aargau	1.2		11.5	11.5	86.6	87.8							99.3	99.3
Thurgau					42.8	47.3							42.8	47.3
Ticino			7.3	7.3	101.7	108.8			27.8	20.7			136.8	136.8
Vaud			3.4	3.4	189.1	189.8			12.8	12.8			205.3	206.0
Valais					60.1	89.6			15.6	15.6	28.6	28.6	104.3	133.8
Neuchâtel					32.9	32.9			3.0	3.0	1.9	1.9	37.8	37.8
Geneva					27.2	27.2							27.2	27.2
Jura					25.3				8.2	47.9			33.5	47.9
Total	1.2		83.5	88.1	1,333.8	1,400.2	1.9		279.7	341.3	111.5	62.9	1,811.6	1,892.5

The motorways comprising the Swiss network have between 2 and 7 lanes. The majority of stretches (1,333.8 km) are 4 lanes. The cantons with the most kilometres of motorway are Vaud (205 km), Bern (205 km) and Grisons (164.9 km). The "planned" columns in the table refer to the Federal Council's 1960 resolution concerning the motorway network. At that time, there was still no call for 7-lane motorways. In the meantime, however, a 1.2-kilometre stretch of 7-lane motorway exists in the canton of Aargau.

2013 and 2014: Two new tunnels on the motorway network

Tunnel	Motorway/ national road	Stretch	No. of tubes	Length	Height	Costs (million Swiss francs)
Graitery (2013)	N16	Moutier-Sud–Court	1	2.472 km	5.2 m	162
Serrières (2014)	N5	Serrières–Areuse	2	1.2 km	5.2 m	117

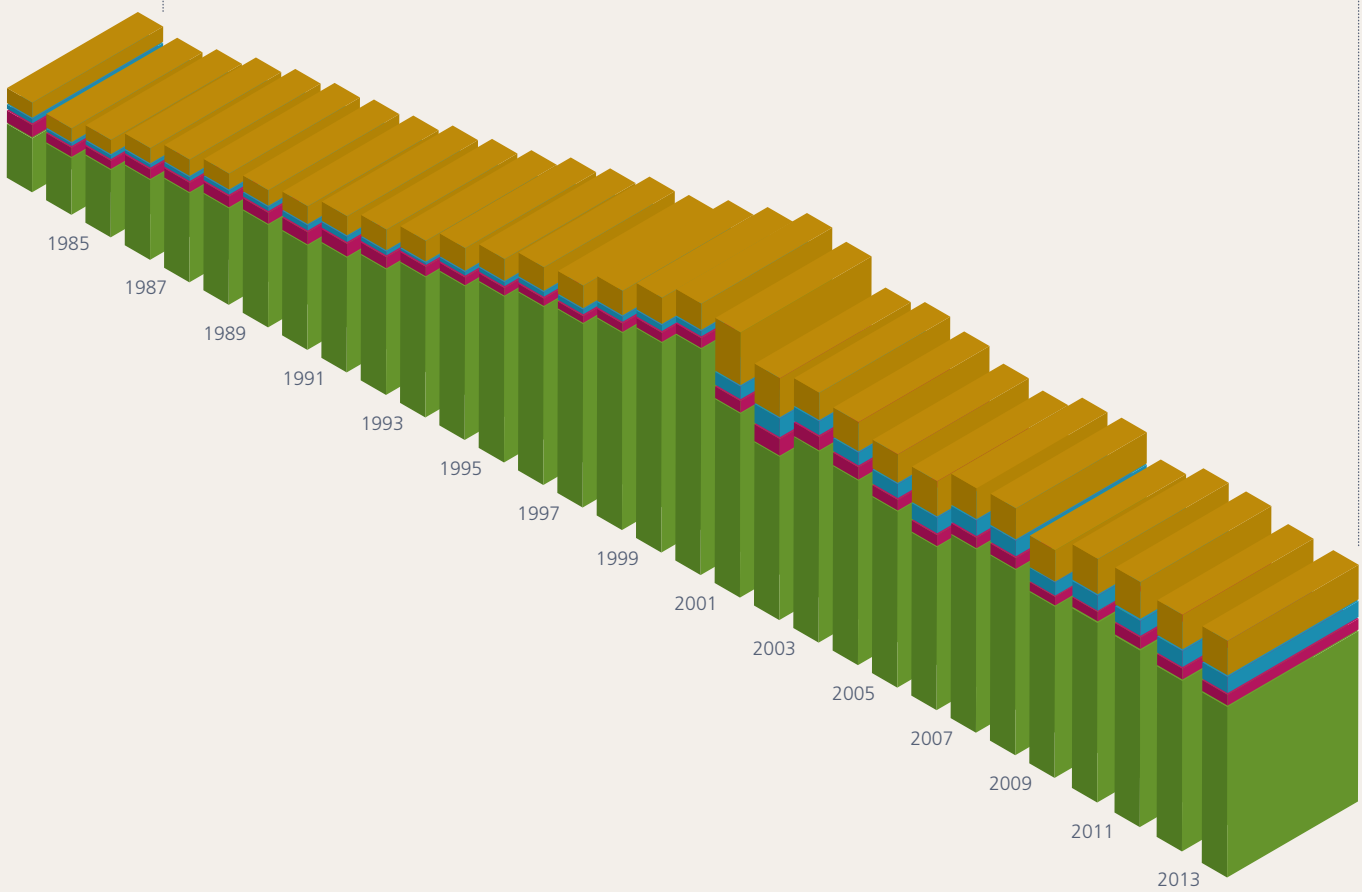
Number of HGVs crossing the Alps down by 5.4 percent in 2013

A total of 1,143,408 heavy goods vehicles crossed the Alps in 2013 (65,192 or 5.4 percent fewer than in 2012). The volume had already fallen by 3.2 percent in 2012. The figure is therefore slightly below the average of 1.25 million for the past ten years.

In 2013, a slight decline was recorded on all routes through the Alps. The sharpest drop was on the Grand St Bernard route, where the vehicle count was down by 11.4 percent versus 2012. The highest number of HGVs was recorded on the Gotthard route in 2013, namely 836,655.

1983
79,000
23,000
64,000
283,000
449,000

	2009	2010	2011	2012	2013
San Bernardino	165,717	186,251	193,639	182,318	177,133
Simplon	68,502	79,361	79,640	85,000	80,740
Grand St Bernard	45,633	47,925	57,883	55,194	48,880
Gotthard	900,150	943,230	927,332	896,283	836,655
Total	1,180,002	1,256,767	1,258,494	1,218,795	1,143,408



26 billion mark surpassed for the first time

In 2013, a total of 26.386 billion kilometres was travelled on Switzerland's motorways.

This figure corresponds to an increase by 1.7 percent (or 439 million vehicles) versus 2012. In previous years the increase had normally been around 2.7 percent.

The number of motor vehicles on the motorways is measured daily at 246 traffic counting stations. The recorded figures are used for calculating the average daily traffic volume, i.e. the average volume of traffic over a period of 24 hours every day of the year (cf. map on pages 34 and 35).

The number of kilometres driven on the entire Swiss road network in 2013 was 60.824 billion, which corresponds to a sharp increase by 2.4 percent versus 2012.

Traffic volume

(daily no. of vehicles)

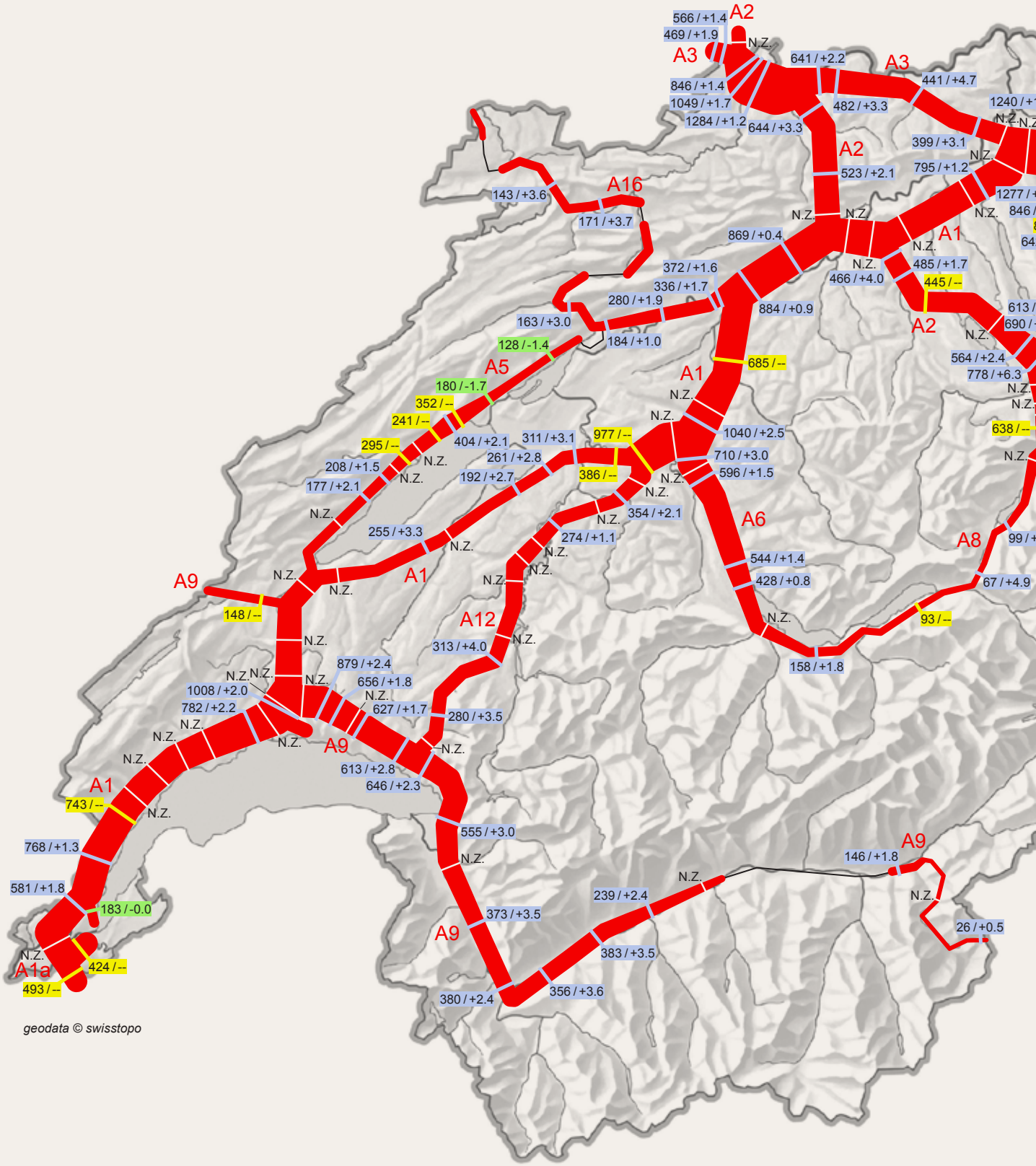
		2012	2013	Change in %
A1				
ZH	Wallisellen	140,845	142,242	**+1.0**
AG	Neuenhof	126,216	127,705	**+1.2**
AG	Baden, Baregg tunnel	122,751	123,957	**+1.7**
ZH	Zurich northern bypass, Seebach	108,266	109,122	**+0.8**
ZH	Zurich northern bypass, Affoltern	105,308	106,371	**+1.0**
VD	Preverenges	92,854	94,329	**+1.6**
ZH	Winterthur bypass	92,555	94,240	**+1.8**
A2				
BL	Muttenz, Hard	126,872	128,387	**+1.2**
BS	Basel, Gellert Nord	103,142	104,934	**+1.7**
A6				
BE	Schönbühl, Grauholz	101,468	104,038	**+2.5**

Travelled kilometres on the motorway network

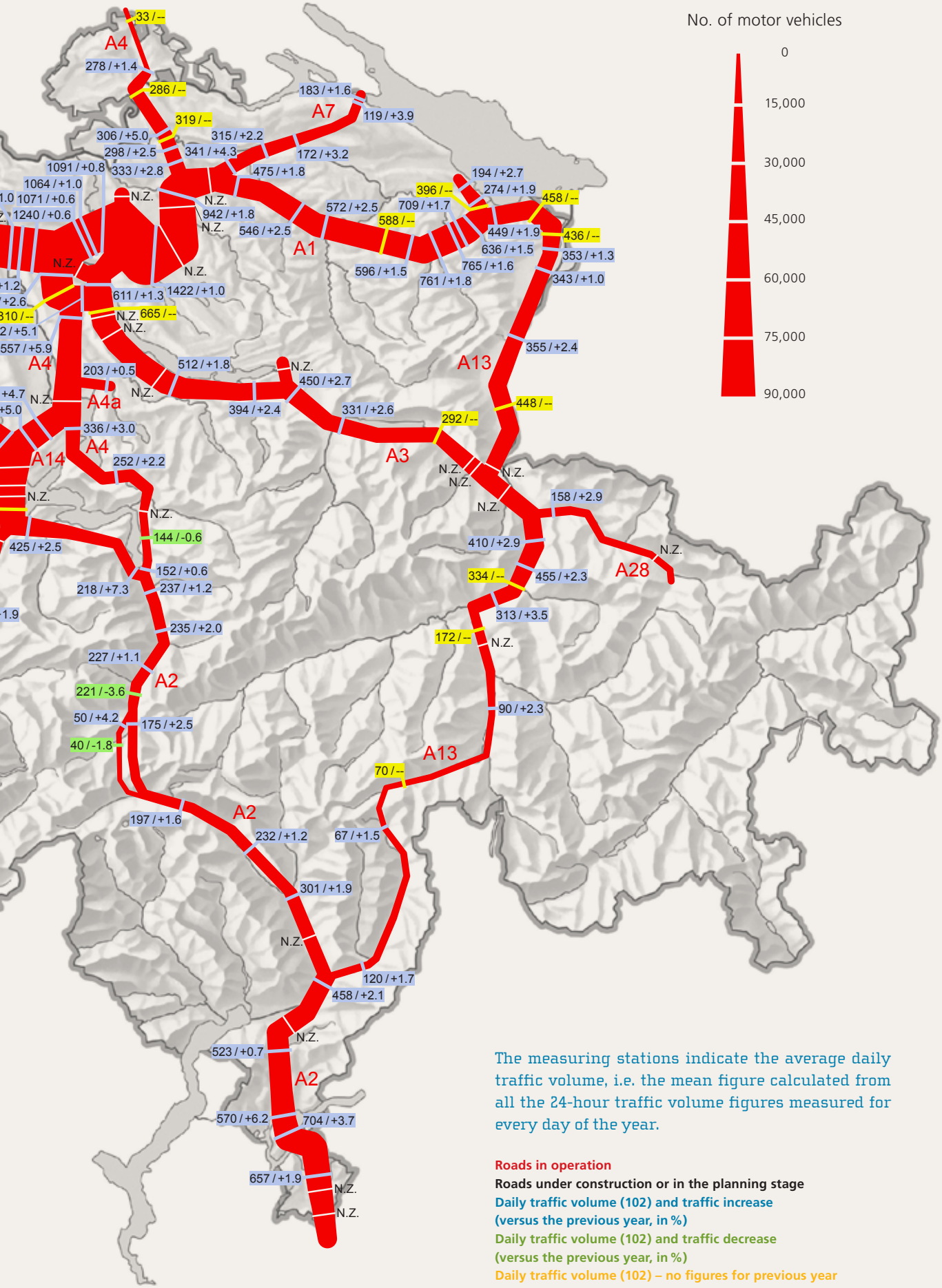
(billion km)

Year	Billion km	Change in %
2009	24.527	
2010	25.161	+2.6
2011	25.874	+2.8
2012	25.947	+0.28
2013	26.386	+1.7

Map of traffic volume on the motorway network in 2013



geodata © swisstopo



The measuring stations indicate the average daily traffic volume, i.e. the mean figure calculated from all the 24-hour traffic volume figures measured for every day of the year.

Roads in operation
Roads under construction or in the planning stage
Daily traffic volume (102) and traffic increase (versus the previous year, in %)
Daily traffic volume (102) and traffic decrease (versus the previous year, in %)
Daily traffic volume (102) – no figures for previous year

Figures shown on the map are in hundreds (e.g. 12 = 1,200)

Fatalities below 300 for first time since the 1940s

In 2013, accidents on Switzerland's roads resulted in 269 fatalities, which is 70 fewer than in 2012.

This figure means that the number of fatalities was well below 300 for the first time since the 1940s. 4,129 people were seriously injured in 2013, or 73 fewer than in the previous year.
The number of fatalities fell by 21 percent versus 2012, and the number of serious injuries by 2 percent. The positive trend that has been observed over the past few years therefore persisted in the year under review, and the number of serious accidents attributable to speeding and drink driving was also down.

Pleasing balance in two-wheeler segment

In 2013, 17 cyclists were killed on Switzerland's roads, compared with 28 in 2012, and 55 motorcyclists lost their lives, which was 19 fewer than in the previous year. The number of seriously injured motorcyclists and cyclists also fell versus the previous year, by 3 and 6 percent respectively.
This positive balance can partly be attributed to adverse weather conditions. The wintry conditions that prevailed until the end of April, together with the wet autumn and the onset of winter already in mid-October in the Alps, probably resulted in less use of motorbikes and bicycles than in the previous year. On the other hand, the implementation guidelines regarding the provision of infrastructure designed to increase the degree of safety for motorcyclists, together with other official measures, now also appear to be taking effect.
In view of the rapid boom in the electric bikes segment, the increase in the number of seriously injured users of these vehicles (+36) was not unexpected.

Pedestrians: mixed picture

In 2013, 69 pedestrians were killed on Switzerland's roads. Although this is six fewer than last year, it is nonetheless equivalent to a two percent increase in comparison with the average figure for the past five years. The number of serious injuries rose by five percent versus 2012, which is equivalent to a six percent increase in comparison with the five-year average.
The decline in the number of serious accidents on pedestrian crossings that was recorded in 2012 was not repeated in 2013. While the number of fatalities on pedestrian crossings was almost the same (+1), there were 17 more seriously injured pedestrians than in the previous year. The last time so many injuries on pedestrian crossings were recorded was in 2007.

Motorways: number of accidents down by 7 percent

The number of accidents on motorways and expressways resulting in fatalities and injuries fell by seven percent versus the previous year. A total of 1,834 accidents occurred in 2013, the lowest number since 1992. The pronounced decline versus 2012 can partly be attributed to the disastrous coach crash that occurred in Sierre that year. The 2013 figure nonetheless represents a welcome decline in the number of serious accidents on motorways and expressways when compared against the five-year average.

Accidents resulting in injuries and fatalities

	Accidents	Persons
Fatalities	257	269
	24	29
Severe injuries	3,859	4,129
	224	259
Minor injuries	13,357	17,250
	1,586	2,395
Total	**17,473**	**21,648**
	1,834	2,683
Change in % since 2012	–3.7	–4.0
	–7.0	–9.5

Accident statistics by road users

Pedestrians	2,362	
	12	
Driver/passenger(s), of which:	19,286	
	2,671	
in cars		10,775
		2,385
in heavy goods vehicles		118
		32
on motorcycles		3,715
		104
on bicycles		3,360
		2
in public transport		198
		0
in other forms of transport		1,120
		148
Total	**21,648**	
	2,683	
Change in % since 2012	–4.0	
	–9.5	

Types of accidents resulting in injuries and fatalities

	Total	Due to speeding	Due to drink driving
Skidding, single-vehicle accident	5,315	1,546	904
	701	221	66
Overtaking	839	35	37
	155	6	8
Rear-end collision	3,659	257	115
	917	79	24
Turning out of road	1,422	4	25
	5	0	0
Turning into road	2,120	12	28
	6	0	0
Crossing lane	922	7	20
	1	0	0
Head-on collision	675	161	63
	30	1	5
Parking accident	206	5	9
	3	1	0
Collision with pedestrian	2,100	55	67
	6	2	1
Collision with an animal	72	2	1
	1	0	0
Other accidents	143	6	5
	9	2	0
Total	**17,473**	**2,090**	**1,274**
	1,834	**312**	**104**
Change in % since 2012	–3.7	–4.0	–11.8
	–7.0	–5.2	–20.0

Overall Swiss road network
Motorways and expressways

5.69 million vehicles currently registered in Switzerland

2013 inventory of motor vehicles in Switzerland

	Motor vehicles (total)	Cars	Passenger transport vehicles	Goods vehicles	Agricultural vehicles	Industrial vehicles	Motorcycles	Mopeds
Total	**5,693,642**	**4,320,885**	**60,151**	**371,361**	**189,305**	**63,950**	**687,990**	**174,923**
Lake Geneva region	**1,052,408**	**812,395**	**10,514**	**63,930**	**23,121**	**9,888**	**132,560**	**13,337**
Vaud	494,475	391,740	5,029	28,542	13,712	3,834	51,618	7,624
Valais	263,102	201,380	2,937	17,895	7,874	4,392	28,624	2,576
Geneva	294,831	219,275	2,548	17,493	1,535	1,662	52,318	3,137
Central plateau	**1,286,800**	**957,296**	**15,676**	**84,369**	**60,231**	**15,650**	**153,578**	**49,002**
Bern	704,213	504,791	9,552	49,249	38,256	9,811	92,554	29,720
Fribourg	216,907	168,351	2,287	13,167	9,857	2,080	21,165	6,287
Solothurn	192,364	148,322	1,829	12,338	5,391	1,869	22,615	9,636
Neuchâtel	119,146	94,890	1,487	6,412	2,973	1,155	12,229	2,083
Jura	54,170	40,942	521	3,203	3,754	735	5,015	1,276
Northwest Switzerland	**742,750**	**573,798**	**7,176**	**50,387**	**17,627**	**6,178**	**87,584**	**25,014**
Basel-Stadt	85,609	66,805	766	7,817	167	638	9,416	3,847
Basel-Landschaft	183,349	142,222	1,794	12,282	3,843	1,541	21,667	6,179
Aargau	473,792	364,771	4,616	30,288	13,617	3,999	56,501	14,988
Zurich	**895,564**	**701,419**	**9,051**	**56,937**	**15,940**	**9,831**	**102,386**	**18,183**
Eastern Switzerland	**851,304**	**630,026**	**9,242**	**58,011**	**42,621**	**13,291**	**98,113**	**22,847**
Glarus	29,642	22,225	285	2,115	1,352	606	3,059	769
Schaffhausen	58,202	43,024	727	3,727	2,821	689	7,214	1,730
Appenzell Ausserrhoden	40,323	29,696	449	2,178	2,342	544	5,114	1,336
Appenzell Innerrhoden	12,731	8,808	89	783	1,214	227	1,610	476
St. Gall	352,182	264,860	3,585	23,553	14,882	4,695	40,607	9,881
Grisons	148,082	106,006	1,934	11,606	9,390	3,819	15,327	2,658
Thurgau	210,142	155,407	2,173	14,049	10,620	2,711	25,182	5,997
Central Switzerland	**573,299**	**430,845**	**6,200**	**36,975**	**25,817**	**6,277**	**67,185**	**16,863**
Lucerne	271,895	200,121	3,003	18,065	14,041	2,644	34,021	8,769
Uri	25,704	18,756	345	1,510	1,292	472	3,329	714
Schwyz	121,381	92,766	1,174	7,220	5,197	1,547	13,477	3,364
Obwalden	29,505	21,091	370	1,981	2,006	446	3,611	1,355
Nidwalden	33,446	25,341	397	1,755	1,311	317	4,325	1,109
Zug	91,368	72,770	911	6,444	1,970	851	8,422	1,552
Ticino	**291,517**	**215,106**	**2,292**	**20,752**	**3,948**	**2,835**	**46,584**	**29,552**
Federal administration	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**125**

Source: Swiss Federal Statistical Office

As of the end of 2013, 5.69 million vehicles were registered in Switzerland, or 88,000 more than in the previous year. The number of cars totalled 4.32 million, which represents an increase by around 70,000. The number of motor vehicles registered in Switzerland has more than doubled since 1980.

310,000 cars put into circulation

New registration of motor cars

	2003	2009	2010	2011	2012	2013
Type						
Limousine	194,274	184,590	199,688	206,969	196,221	174,544
Station wagon	63,027	72,948	88,052	111,628	128,957	127,985
Convertible	12,410	8,940	8,857	9,358	8,867	7,625
Engine capacity (cc)						
Below 1,000	7,371	10,817	9,463	9,653	13,548	18,907
1,000 to 1,399	43,614	67,525	83,629	97,643	89,272	80,098
1,400 to 1,799	65,151	65,009	77,754	85,228	78,913	75,025
1,800 to 1,999	78,548	72,452	75,218	81,249	94,510	84,036
2,000 to 2,499	33,588	19,588	19,358	21,875	23,217	21,540
2,500 to 2,999	23,190	20,562	19,944	21,121	21,434	19,429
3,000 and over	18,231	10,468	11,030	10,734	12,227	9,727
Electric motor	18	57	201	452	924	1,392
Gear mechanism						
Automatic	74,826	57,705	60,183	66,935	74,151	69,916
Manual	194,885	198,694	222,670	243,846	238,988	221,389
Hydrostatic		45	30	18	17	13
Others		10,034	13,714	17,156	20,889	18,836
Fuel						
Petrol	211,547	182,174	200,576	211,540	200,576	185,070
Petrol and battery		3,899	4,246	5,444	5,721	6,193
Diesel	57,912	78,755	90,547	109,324	124,911	115,656
Others	252	1,650	1,228	1,647	2,837	3,235
Drive						
Four-wheel drive	53,809	69,343	82,849	94,709	112,469	111,502
Rear-wheel drive	24,863	18,685	18,790	19,553	19,416	14,924
Front-wheel drive	191,039	178,430	194,929	213,637	202,075	183,698
Others		20	29	56	85	30
Total	**269,711**	**266,478**	**296,597**	**327,955**	**334,045**	**310,154**

Source: Swiss Federal Statistical Office

In 2013 a total of 310,000 new cars were put into circulation. This was 24,000 fewer than in the previous year. The number of new cars put into circulation has fluctuated since 1990. In 2000 and 2001 the figure was around 314,000. Then it remained below 300,000 until 2011 when it rose again to 327,000.

Vehicle registration statistics

	2003	2013
Cars	269,711	310,154
Passenger transport vehicles	2,691	4,138
Goods vehicles	20,987	32,633
Agricultural vehicles	3,269	3,583
Industrial vehicles	2,753	4,285
Motorcycles	48,856	47,324
Trailers	16,842	22,017
Total vehicles	**390,340**	**424,134**
Total motor vehicles	**373,198**	**402,117**

Source: Swiss Federal Statistical Office

In 2013 a total of 424,000 motor vehicles were put into circulation. This was around 6,000 fewer than in the previous year. The 2013 figure was the fourth highest since 1989.

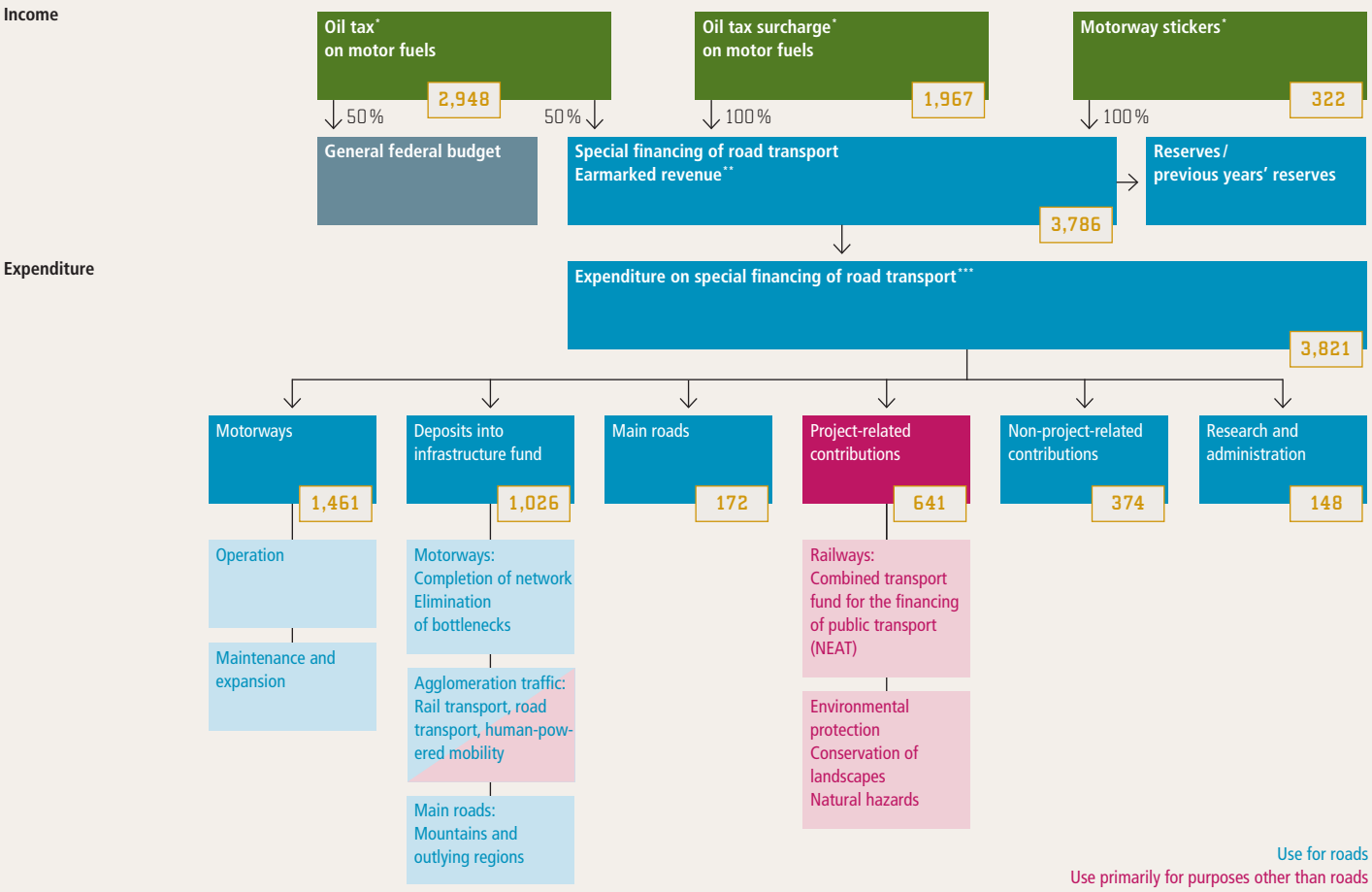
Special Fund for the Financing of Road Transport

At the federal level, expenditure relating to road transport is financed via the Special Fund for the Financing of Road Transport. This Fund comprises revenue that is earmarked for the financing of road transport projects. It is financed from oil tax revenue (50 percent), revenue from the oil tax surcharge (100 percent) and the net proceeds from sales of motorway stickers. The applicable official tax rates and fees are as follows: oil tax, 43.12 cents per litre of petrol and 45.87 cents per litre of diesel (unchanged since 1993); oil tax surcharge, 30 cents per litre (unchanged since 1974); motorway sticker ("Vignette"), 40 Swiss francs a year (unchanged since 1995).
The Fund is used for financing a variety of activities relating to road transport. In addition to financing the infrastructure owned by the federal government (i.e. motorway/national roads network), contributions are also paid to the cantons for their road infrastructure and other federal tasks relating to road transport (cf. "Project-related contributions" in the table below).

The amount of annual expenditure for each specific area is decided by Parliament within the scope of its budget resolution. The annual differences between income and expenditure increase or decrease the reserves from the previous years.

In addition to the above Fund, an Infrastructure Fund was officially introduced in 2008, which is fed via deposits from the Special Fund for the Financing of Road Transport. The money deposited in the Infrastructure Fund is used for financing the motorways (completion, elimination of bottlenecks), transport infrastructure in towns and urban centres (private motorised transport, public transport, human-powered mobility) and main roads in the mountains and outlying regions. With the introduction of the Infrastructure Fund, the financing of the motorways is now shared between two dedicated funds.

Flows of funds in 2013 (in million Swiss francs)



* Net income
** Including miscellaneous income (23 million Swiss francs)
*** Figures taken from the national budget. Differences in totals may arise due to the rounding up or down of individual figures.

The duration of the Infrastructure Fund is limited to 20 years. For the financing of the expenditure to be covered via this fund, Parliament approved a total credit of 20.8 billion Swiss francs (price level as of 2005, excluding inflation and value-added tax). For the duration of the fund, Parliament approves its annual statements and – in line with the budget – the amounts of withdrawals from the fund for expenditure on individual projects. In addition, it decides on the annual deposits to be made to the fund within the scope of the federal budget. The Infrastructure Fund possesses a liquidity reserve, which increases or decreases depending on the annual difference between deposits and withdrawals.

Motorway Network and Agglomeration Traffic Fund

At the end of February 2014, the Federal Council initiated the consultation procedure regarding the creation of a Motorway Network and Agglomeration Traffic Fund for closing the financing gap, and for the strategic development programme for motorways/national roads (STEP). It is proposing a restructuring of the Special Fund for the Financing of Road Transport and the Infrastructure Fund, plus measures aimed at closing the impending financing gap. The report on the consultation procedure has been posted on the website of the Federal Administration (www.admin.ch → Aktuell → Vernehmlassungen – not available in English).

Special Fund for the Financing of Road Transport: Expenditure, 2011–2013 (in million Swiss francs)

		2011	2012	2013
Motorways/national roads	Operation	313	329	**353**
	Maintenance/expansion	1,171	1,213	**1,108**
Infrastructure Fund	Annual deposit	853	928	**1,026**
	Extraordinary deposit	850	–	**–**
Main roads	Contributions to cantons	166	168	**172**
Project-related contributions	Remuneration, combined transport; contributions for private railway sidings, terminals, etc.	250	180	**199**
	Fund for major railway projects (NEAT quarter)	279	265	**277**
	Environmental protection	97	102	**108**
	Protection of cultural heritage and landscapes	14	15	**15**
	Disaster prevention: protection against flooding	48	50	**41**
Non-project-related contributions to roads	General contributions to cantons	370	368	**367**
	Contributions to cantons without motorways	8	8	**7**
Research/administration		158	160	**148**
Total expenditure*		**4,576**	**3,784**	**3,821**

* Figures taken from the national budget. Differences in totals may arise due to the rounding up or down of minor amounts.

Withdrawals from the Infrastructure Fund, 2011–2013* (in million Swiss francs)

	2011	2012	2013
Completion of the motorway network	700	678	**67.9**
Elimination of bottlenecks on the motorways	48	76	**76.3**
Contributions to transport infrastructure in towns and urban centres	486	417	**416.9**
Contributions for main roads in the mountains and outlying regions	44	44	**44.4**
Total withdrawals/expenditure	**1,278**	**1,215**	**1,215.5**

* According to liquidity statement (figures rounded up or down).

75,699 licences confiscated in 2013: 0.7 percent fewer than in 2012

According to the administrative measures (ADMAS) statistics kept by the Swiss Federal Roads Office (FEDRO), 76,699 drivers had to surrender their licence in Switzerland in 2013 – 0.7 percent (or 497) fewer than in 2012.

Once again the main reasons were speeding and drink driving. Withdrawals due to speeding fell by a further 3.8 percent to 29,701. Here an all-time high for such withdrawals had been recorded in 2010.

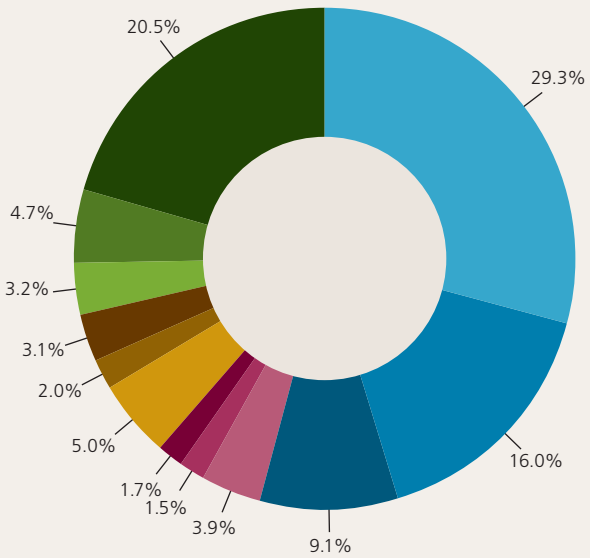
Administrative measures

	2012	2013	%*
Warnings to holders of a learner's licence	237	302	27.4
Warnings to holders of a driver's licence	49,208	47,658	–3.1
Withdrawal of learner's licence	3,095	3,083	–0.4
Withdrawal of driver's licence	76,196	75,699	–0.7
Of which withdrawal of provisional licence	7,498	7,278	–2.9
Cancellation of provisional driver's licence	1,760	1,711	–2.8
Refusal of learner's or driver's licence	3,494	3,550	1.6
Refusal to accept a foreign driver's licence	17,595	18,813	6.9
Instruction in road use	2,758	2,551	–7.5
New driving test	2,834	2,818	–0.6
Examination by specialised psychologists	4,098	4,505	9.9
Special requirements	5,038	5,358	6.4

* Change in percent

Reasons for withdrawal
(in percent)

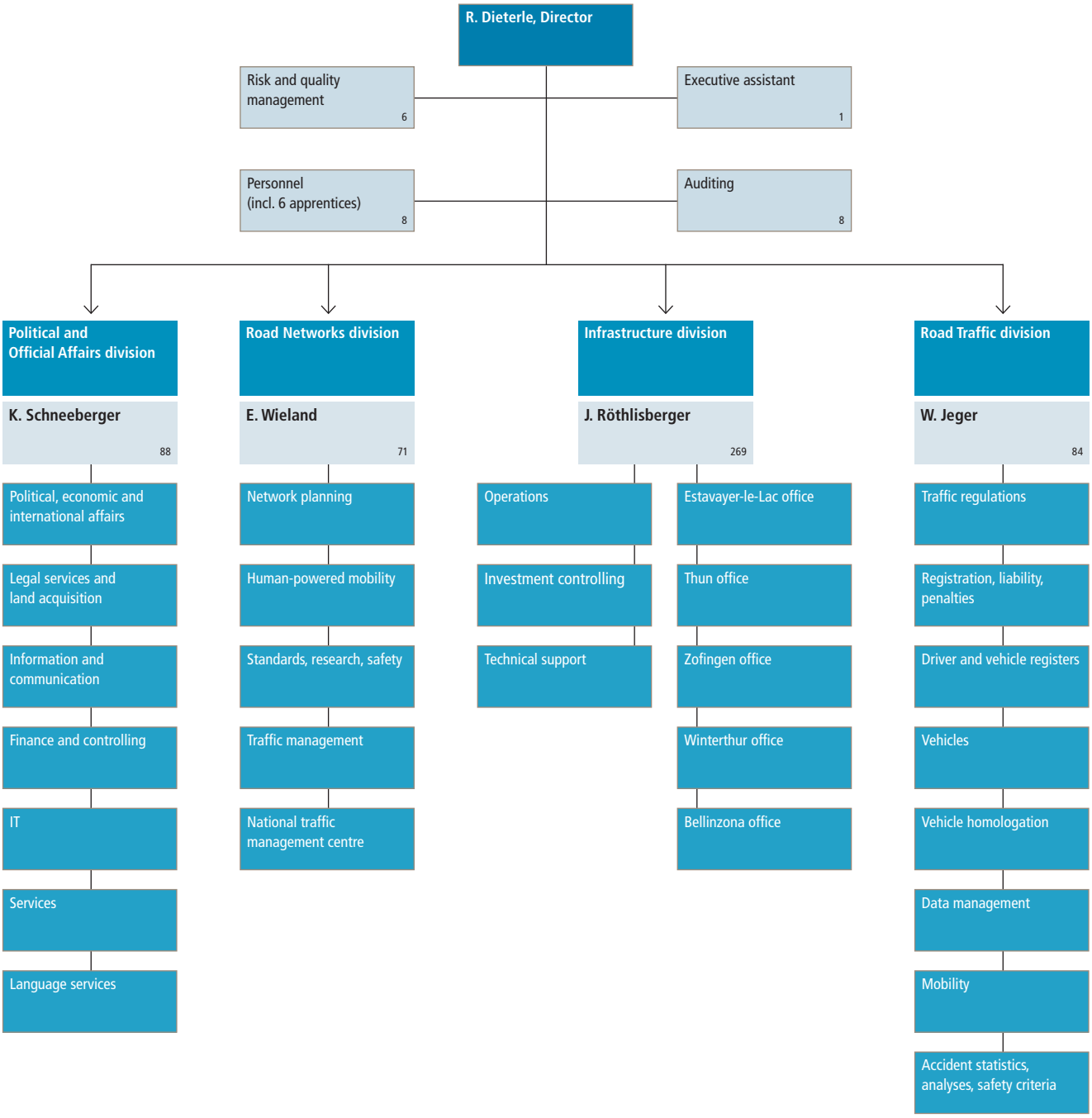
- Speeding
- Drink driving (> = 0.08%)
- Inattention
- Failure to give way
- Failure to observe traffic signals
- Unlawful overtaking
- Other driving errors
- Alcohol addiction
- Influence of medicaments or drugs
- Drug addiction
- Sickness or infirmity
- Other reasons



	2013	%*
Reasons for withdrawal		
Speeding offences	29,701	–3.8
Drink driving (> = 0.08%)	16,301	–4.7
Inattention	9,313	–1.8
Failure to give way	3,921	–4.5
Failure to observe traffic signals	1,531	3.4
Unlawful overtaking	1,748	–3.5
Other driving errors	5,139	8.0
Alcohol addiction	2,105	20.3
Influence of medicaments or drugs	3,187	12.4
Drug addiction	3,277	33.0
Sickness or infirmity	4,759	8.2
Other reasons	20,816	1.2
Duration of withdrawal		
1 month	30,554	–0.8
2 months	2,151	–6.4
3 months	16,244	–7.2
4–6 months	9,093	–6.8
7–12 months	3,136	–6.4
More than 12 months	1,290	–9.9
Indefinite period	19,420	15.1
Permanent withdrawal	41	–22.6
Age of persons affected		
Under 20	4,775	–9.6
20 to 24	12,124	–3.0
25 to 29	10,916	–0.1
30 to 34	9,036	5.8
35 to 39	7,587	1.0
40 to 49	15,884	2.0
50 to 59	11,053	3.2
60 to 69	5,290	7.6
70 and over	5,264	9.4
Reasons for withdrawal or refusal of learner's/driver's licence		
Learner driving unaccompanied	453	–0.4
Driving error	1,992	–2.4
Drink driving	849	–4.7
Driving without a licence	2,778	–6.6
Failure to pass driving test	202	–17.2
Driving despite withdrawal of licence	210	12.9
Theft	447	–22.3
Sickness or infirmity	147	–3.9
Other reasons	2,238	16.3
Reasons for warnings		
Speeding	39,728	4.4
Inattention	6,118	0.6
Failure to give way	3,899	–2.5
Driving an unroadworthy vehicle	2,148	–11.3
Failure to observe traffic signals	1,799	6.1
Unlawful overtaking	851	42.8
Other reasons	206	3.5
Drink driving (> = 0.050 to 0.079%)	6,323	3.3

* Change in percent versus 2012

Organisational chart of the Federal Roads Office (FEDRO)



Addresses of FEDRO and regional units

Head office
Swiss Federal Roads Office (FEDRO)
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CH 3003 Bern
Phone 058 462 94 11
Fax 058 463 23 03
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Postal address
Swiss Federal Roads Office (FEDRO)
3003 Bern

www.astra.admin.ch
www.autobahnschweiz.ch
www.verkehrsdaten.ch
www.unfalldaten.ch
www.truckinfo.ch

New location address for:
Road Traffic division
Swiss Federal Roads Office (FEDRO)
Weltpoststrasse 5
3015 Bern
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Swiss traffic management centre (VMZ-CH)
Swiss Federal Roads Office (FEDRO)
National traffic management centre
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Central / Northwest Switzerland
Swiss Federal Roads Office (FEDRO)
Zofingen office
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Ticino / Grisons
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Motorway maintenance Regional Units

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Civil Engineering Department of the Canton of Bern
Motorway maintenance depot, Spiez
Gesigen
3700 Spiez

Regional Unit II (cantons of Vaud, Fribourg, Geneva)
Place de la Riponne 10
1014 Lausanne

Regional Unit III (cantons of Valais and Vaud)
Department of Transport, Civil Engineering and Environment
Route des Iles / Les Ronquoz
1950 Sitten

Regional Unit IV (canton of Ticino)
Divisione delle Costruzioni
Area dell'esercizio della manutenzione
Via C. Ghiringhelli 19
6501 Bellinzona

Regional Unit V (canton of Grisons)
Grisons Civil Engineering Department
Grabenstrasse 30
7001 Chur

Regional Unit VI (cantons of St Gall, Thurgau, Appenzell IR, Appenzell AR)
Motorway Maintenance Department, Canton of St Gall
Martinsbruggstrasse 75b
9016 St. Gall

Regional Unit VII (cantons of Zurich and Schaffhausen)
Civil Engineering Department, Canton of Zurich
Walcheplatz 2
8090 Zurich

Regional Unit VIII (cantons of Basel-Stadt, Basel-Landschaft, Solothurn, Aargau)
NSNW AG
Northwest Switzerland Motorways
Netzenstrasse 1
4450 Sissach

Regional Unit IX (cantons of Neuchâtel, Jura and Bern)
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2001 Neuchâtel

Regional Unit X (cantons of Lucerne, Zug, Obwalden and Nidwalden)
zentras
West Central Switzerland Motorways
Flurweg 11
6020 Emmenbrücke

Regional Unit XI (cantons of Uri, Schwyz and Ticino)
Department of Motorway Operations
Werkhof
6454 Flüelen

Cantonal police headquarters

AG Polizeikommando
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BE Polizeikommando des Kantons Bern
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BL Polizei Basel-Landschaft
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BS Kantonspolizei Basel-Stadt
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GE Police Cantonale de Genève
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GL Polizeikommando des Kantons Glarus
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JU Police cantonale jurassienne
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Kommando
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NE Police cantonale neuchâteloise
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SG Kantonspolizei St. Gallen
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