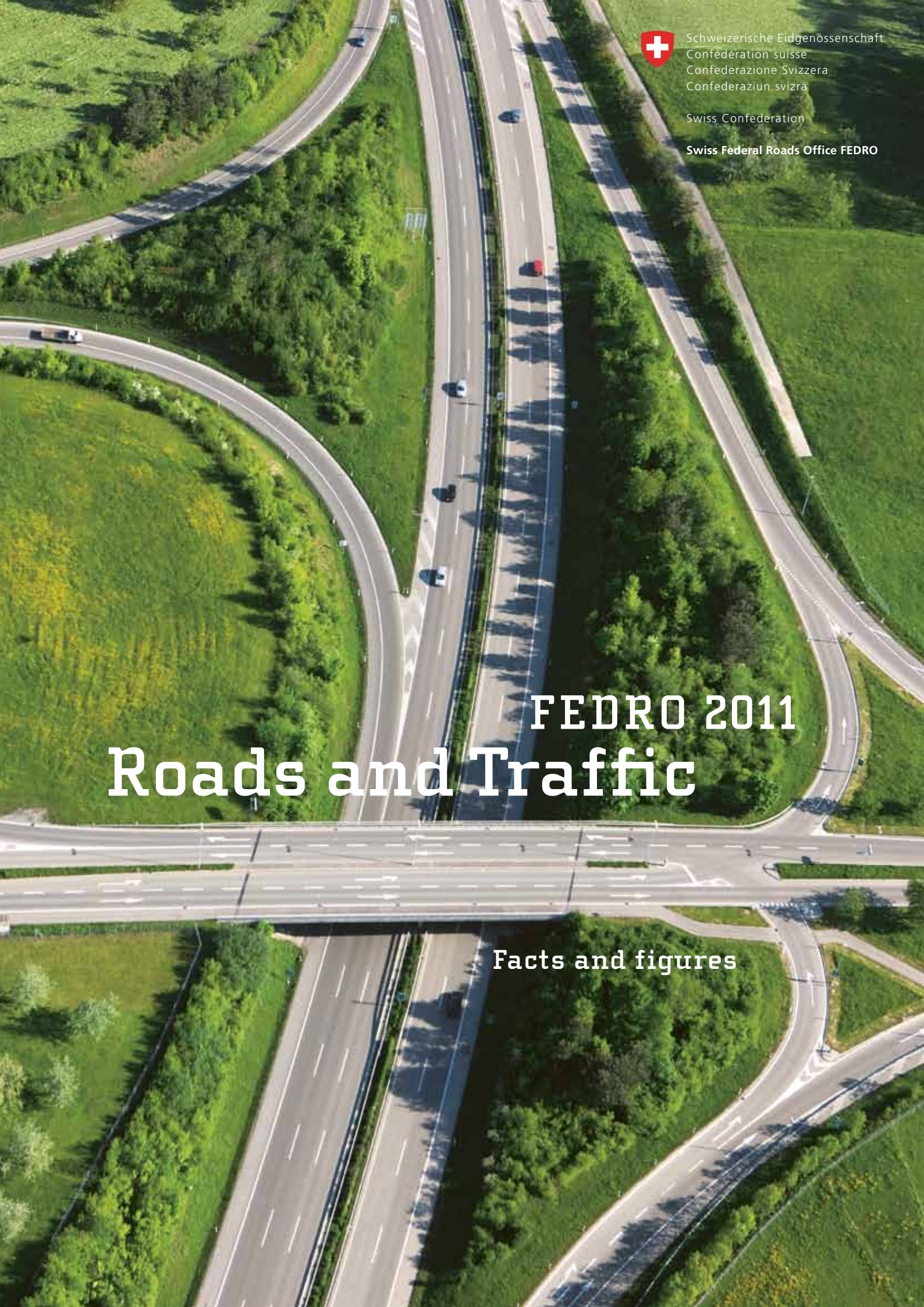

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Cover photo: motorway near Rorschach.

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Editorial

Rudolf Dieterle

Dear Reader,

During 2010, the number of kilometres travelled by vehicles on Switzerland's motorways was higher than ever before ▸ page 28, we witnessed a veritable boom in electric bikes on our roads ▸ page 36, and the number of road accident fatalities fell once again ▸ page 43.

These are just three of the many developments we are able to report on in this year's edition of "Roads and Traffic" – developments which underscore the fact that Switzerland is on the move and mobility is undergoing constant change.

And the Swiss Federal Roads Office (FEDRO) itself is not standing still either: ever ready to respond to new developments and face new challenges, we have given our annual report a completely new look.

In addition to numerous tables and graphs, this year's "Roads and Traffic" contains a variety of articles on priority topics which FEDRO has been focusing on during the past year. These include the issue of the future financing of our motorways ▸ page 4, the debate on the renovation of the Gotthard road tunnel ▸ page 8, the protection of our motorways against natural disasters ▸ page 18 and the current status of the vehicle fleet in Switzerland ▸ page 29.

I hope that you will find the 2011 edition of "Roads and Traffic" both interesting and informative!

Rudolf Dieterle
Director of the
Swiss Federal Roads Office (FEDRO)

Financing gaps in the roads sector

As a consequence of the increasing costs for the operation, maintenance and expansion of our motorways, the gap between income and expenditure is visibly widening.

The Federal Council is therefore proposing that the price of the motorway sticker (vignette) should be increased now, and the oil tax surcharge should be raised at a later date.

The financing of the motorways is secured for the time being, but there is clearly a need for action in the medium to long term since expenditure is already exceeding the available revenue from the Special Fund for the Financing of Road Transport. This means that reserves are being depleted. As of the end of 2010 these amounted to 2.783 billion Swiss francs, but according to calculations by FEDRO they will have fallen to below 1 billion by the end of 2014.

There are several reasons for this trend:

Operation and maintenance: In order to preserve the substance of the existing network and guarantee its smooth and efficient operation, large amounts have to be invested for surface renovation, cleaning, operational and safety equipment, and traffic information systems.

Expansion of existing motorways: Noise protection structures, wildlife corridors, new safety standards, increasing demands on tunnel safety and the restructuring of junctions all give rise to higher costs.

Inflation: The costs for the construction, operation and maintenance of motorways are constantly increasing as a result of inflation, but for many years now these higher costs have not been offset through an increase in revenue. The last adjustment of the oil tax was made in 1993, and the associated surcharge has remained unchanged since 1994.

New federal resolution on the motorway network: Within the framework of the review of the federal resolution on the motorway network, almost 400 kilometres of existing roads are to be incorporated into the motorway network as of the beginning of 2014. This move would additionally burden the Special Fund for the Financing of Road Transport by around 6 billion Swiss francs in the next 20 years.

Elimination of bottlenecks: An additional widening of the A1 motorway is under consideration on the stretch between Morges and Ecublens and in the Glatt Valley. These two projects would require additional funding to the tune of around 5.4 billion Swiss francs.

Contributions towards major railway projects: The Fund for the Financing of Public Transport, which was created in 1998, secures the financing of major railway projects. It receives some of its rev-

Infrastructure Fund

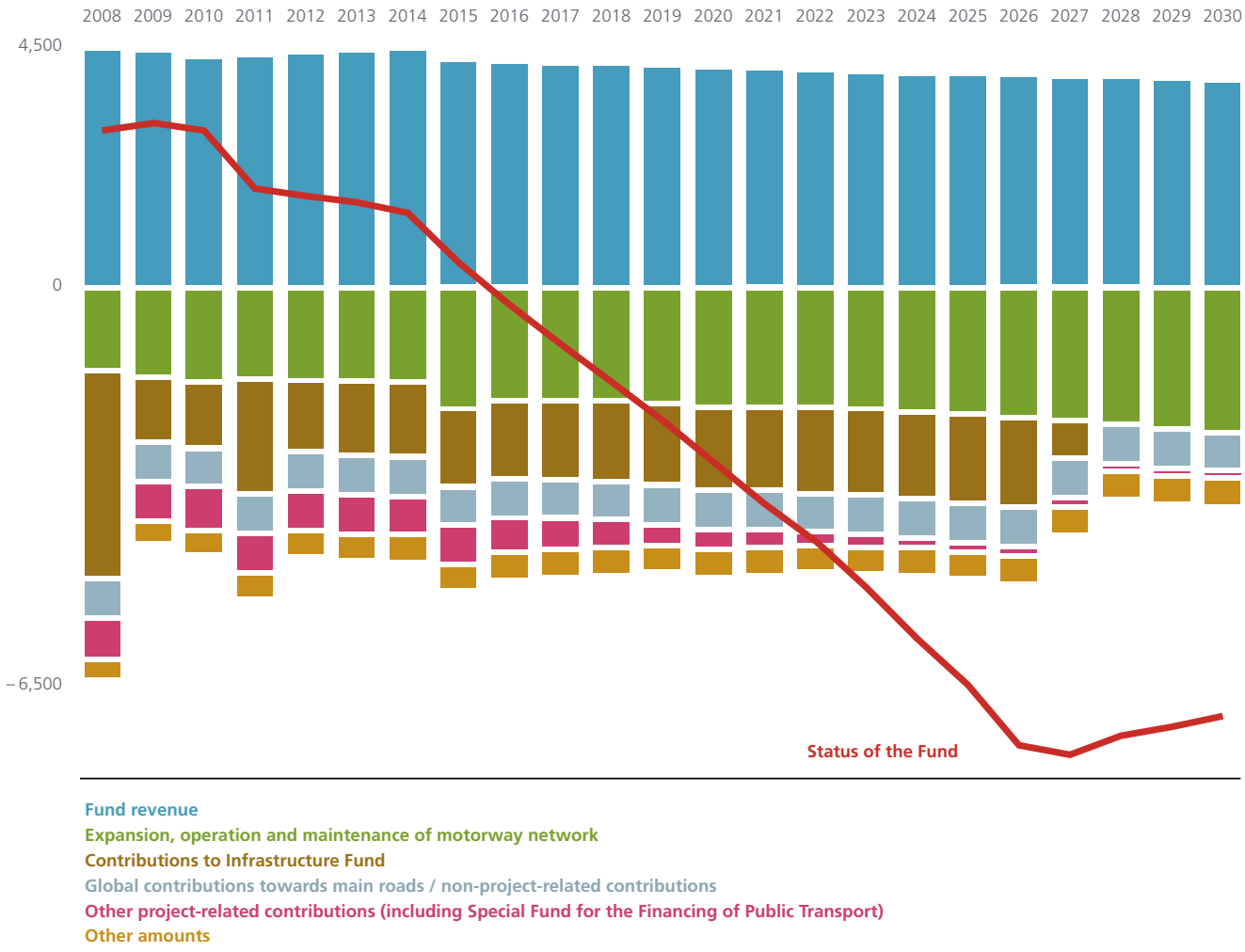
Constant growth in the traffic volume (an increase by 20 percent is expected by 2030) gives rise to bottlenecks and ever increasing congestion. This especially applies to heavily frequented major routes and the main agglomerations (Geneva, Lausanne, Bern, Lucerne, Basel, Zurich, Winterthur, St Gall, Lugano).

The federal government is well aware of this problematic situation and introduced the Infrastructure Fund as a means of securing the long-term availability of funding for the completion of the motorway network and the elimination of bottlenecks. At the same time it supports the main agglomerations with the financing of effective measures, as well as mountain and outlying regions by providing additional contributions towards main roads.

The Infrastructure Fund currently contains 20.8 billion Swiss francs, of which 5.5 billion will be available over the next 20 years for the elimination of bottlenecks on the motorway network, and 8.5 billion for the completion of the originally planned network. The Infrastructure Fund receives 990 million Swiss francs per annum from the Special Fund for the Financing of Road Transport. The duration of the Infrastructure Fund is 20 years.

Special Fund for the Financing of Road Transport: anticipated income and expenditure

Basis scenario with unchanged revenue (in million Swiss francs)



A shortfall is already apparent even for normal demand, but the situation becomes even more serious with the foreseeable requirements resulting from additional tasks, which are not covered now and will not be financiable with the current level of revenue. This means that a financing gap will arise.

enue from the Special Fund for the Financing of Road Transport ("NEAT" segment). The original plan was for these contributions to be discontinued from 2023 onwards, but within the scope of the Railway 2030 project the possibility of continuing the contributions for railway projects is now being considered. If the annual contribution of around 300 million Swiss francs were to be continued, this would additionally burden the Fund for the Financing of Road Transport to the tune of around 3 billion Swiss francs up to 2027.

Decreasing revenue: Although the population and their mobility requirements are continuing to increase, revenue for the Special Fund for the Financing of Road Transport will fall over the medium to long term due to declining specific fuel consumption.

Securing the financing of all tasks

To ensure that we continue to have a safe and efficient motorway network at our disposal in the future, its financing needs to be placed on a sound footing. Further improvements in terms of efficiency and effectiveness of the associated tasks cannot suffice on their own, and this means we have to find additional sources of revenue for the Special Fund for the Financing of Road Transport. The Federal Council is proposing a two-stage solution:

Stage 1_ Increase in the price of the motorway sticker

The price of the motorway sticker (vignette) is to be increased from 40 to 100 Swiss francs a year, and at the same time a 2-month sticker is to be introduced that costs 40 Swiss francs. The increased revenue is to be used for financing the almost 400 kilometres of existing roads that are to be incorporated into the motorway network following the amendment of the federal resolution on the motorway network (cf. box below) and will be operated and maintained by the federal government with effect from 2014. The new motorway sticker regime is to take effect as soon as the reserves of the above Fund fall below 1 billion Swiss francs. In the view of the Federal Council, this amendment is appropriate because the motorway network will be expanded and has undergone significant improvements since the price of the sticker was last increased in 1995.

Stage 2 _ Increase in oil tax surcharge

With an increase in the oil tax surcharge the aim is to meet the constantly growing normal demand and secure the financing of foreseeable additional expenditure. A corresponding proposal is expected to be submitted to Parliament in 2015. The last adjustment of the oil tax surcharge took place in 1974, and in view of accrued inflation it has been devalued by around 50 percent. The Federal Council therefore feels that an adjustment would be acceptable

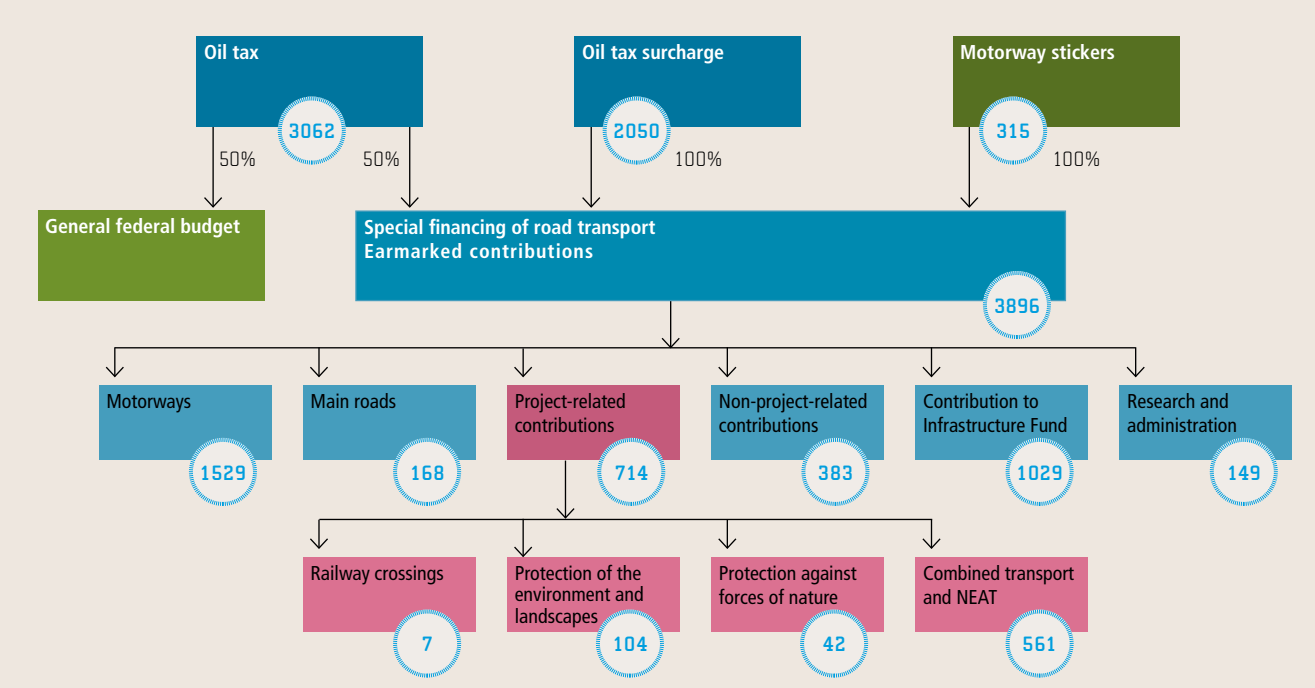
New federal resolution on the motorway network

The layout of the existing motorway network is primarily based on the 1960 federal resolution on the motorway network. In the meantime, this resolution no longer meets current or future needs. Over the past 10 years, more than 30 petitions calling for the incorporation of cantonal roads into the motorway network have been submitted to Parliament, and in view of this the network has been subjected to a comprehensive review.

Within the scope of the "Transport" sectoral plan adopted by the Federal Council on 26 April 2006, the functional criteria were defined that have to be met for a road to qualify as a stretch of motorway. These criteria are based on the objectives of the federal government's transport, regional and spatial planning policies. The most important requirements are as follows: routes for international transit traffic, routes connecting Switzerland with its neighbouring countries, routes connecting Swiss agglomerations, and routes to major tourism regions and cantonal capitals. Thus the basis was created for the consistent development of the motorway network, culminating in an amendment to the federal resolution on the motorway network. In specific terms, the amendment means that existing cantonal roads with a combined length of around 400 kilometres will be incorporated into the motorway network.

Flows of funds in 2010

(in million Swiss francs)



The Special Fund for the Financing of Road Transport is financed from half the oil tax revenue, the revenue from the oil tax surcharge and the net proceeds from sales of motorway stickers. Oil tax is currently around 45 cents per litre of fuel (last adjustment, 1993), and the oil tax surcharge is approximately 30 cents per litre of fuel (last adjustment, 1974). The price of the motorway sticker is 40 Swiss francs a year (unchanged since 1995).

Expenditure, 2008 to 2010

		2008	2009	2010
Motorways	Property, plant, equipment and intangible assets, inventory (global budget); maintenance, expansion	1,118	1,162	1,214
	Operational maintenance, including protective structures	301	302	315
Infrastructure Fund	Annual deposit	837	990	1,029
	Extraordinary initial deposit	2,600		
Main roads		163	165	168
Project-related contributions	Railway crossings, separation of traffic (FOT)	7	5	7
	Carriage of HGVs by rail, carriage of cars by rail and NEAT (FOT)	590	565	561
	Protection of environment and landscapes (road traffic)	86	91	104
	Protection of other roads against forces of nature	34	52	42
Non-project-related contributions	General contributions to roads, offsetting	380	381	375
	International transalpine routes/cantons without motorways	8	8	8
Research/administration		134	134	149
Total expenditure		**6,130**	**3,810**	**3,972**

A brief photo tour of the safety installations in the Gotthard road tunnel

The Gotthard road tunnel has been in operation for around 30 years, during which time well over 160 million vehicles have driven through it. In the period from 2020 to 2025, this vital link in the north-south transit route through the Swiss Alps will have to undergo comprehensive renovation. At the end of 2010 the Federal Council presented its outline plan for this immense task, triggering intensive public debate on this issue. This would appear to be a suitable occasion for going on a photographic tour of the tunnel through its ventilation shafts, intersections, emergency bays and safety shafts.

Technical installations that can save lives

The gas canisters (top left) contain 24,000 litres of nitrogen. If a fire should occur in a transformer room, it is immediately filled with gas. Nitrogen suppresses oxygen and thus prevents the spread of fire. Battery systems (top right) have been installed at nine locations in the tunnel. In the event of a power failure, they guarantee an autonomous supply of electricity for up to two hours. In the event of a fire, the huge extractor fans (bottom) in the ventilation system remove smoke from the tunnel. Twice a year the tunnel wall is cleansed with special machines (centre).

Photos: Canton of Uri Office for Motorway Operation

On duty round the clock:
Gotthard tunnel fire brigade and rescue service

The Gotthard tunnel fire brigade and rescue service is operated by a team of approximately 40 military logistics specialists on the basis of a service level agreement with FEDRO. It can be summoned by the Uri cantonal police from the tunnel operations centre in Göschenen (top left), and has to be ready for action within three minutes after the alarm has been raised. It provides fire fighting, oil damage prevention and rescue services, and has 16 specially equipped vehicles at its disposal, including two 18-tonne fire engines that are able to turn around on the spot in the tunnel.

Safety shaft running alongside the road tunnel

The Gotthard tunnel is equipped with a safety shaft that is 2.6 to 3.2 metres wide, approximately the same height and 16.322 kilometres in length, and which runs parallel to the main tunnel. The fire brigade and rescue service can access this shaft with its smallest vehicles. There is an intersection between the safety shaft and the main tunnel every 250 metres. These intersections cover an area of more than 20 square metres and have enough space for around 50 people. The safety tunnel and intersections are ventilated with a separate system, which secures the necessary air pressure to prevent smoke from entering in the event of a fire in the main tunnel.

www.afbn.ch/Disposition-du-tunnel.22.0.html?&L=0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Use of asphalt on Switzerland's motorways

The surfaces of Switzerland's motorways comprise around 25 million tonnes of asphalt – a substance made of sand, stones and bitumen. There are eight different types of asphalt: some absorb noise more effectively, some handle weight better than others, and others are permeable to water.

If we take a close look at the asphalt surfaces of our motorways, we can see that there are several different layers. This method of multiple layering is applied in order to make the road surface as durable as possible. One does not need to be a construction engineer to work out that our motorways have to be able to withstand enormous loads: the weight of motor vehicles and the vibrations they create place huge demands on road surfaces, and of course these loads intensify in line with the increasing traffic volume. In order to counter these physical forces, a certain amount of layering is unavoidable.

Five percent bitumen

Asphalt comprises around 95 percent gravel and sand, and 5 percent bitumen. Motorways require a special gravel / sand granulation: in the support and bonding layers, i.e. the second and third highest layers of the asphalt surface, the granulation is between 0 and 22 millimetres. The term "granulation" refers to the maximum diameter of a single piece of gravel. The top layer, which forms the actual surface, is very finely structured, with a maximum granulation of 8 millimetres.

Bitumen is the bonding agent in asphalt. It is obtained from oil, and is the material that makes asphalt black. In addition to bitumen, a polymer is mixed into the asphalt in order to make it elastic. One of the most important factors in surfacing roads with asphalt is the meteorological temperature (cf. table on page 17).

25 million tonnes of asphalt on our motorways

One cubic metre of motorway surface weights around 2.5 tonnes. With an area of 30 million square metres, a total of 18 million tonnes of surface have been laid since 1960. But if we take the fact into account that both the uppermost layer and in many cases the base, too, have had to be replaced in the meantime, the total quantity of asphalt laid on our motorways is around 25 million tonnes.

Bitumen is not the same as tar

Tar is a bonding agent that is obtained from coal. It is brownish in colour and has a strong, sweetish smell. The word "tar" is widely used to describe the surface of roads, even though its use has been banned since the 1980s because of its highly harmful effects on health.

The bonding agent that is used in asphalt today is bitumen, which differs from tar in that it is an oil derivative. It is the primary extract from the oil refining process. Unlike tar, it is black, does not have a strong smell, and can also be safely re-used. Motorway asphalt can contain a proportion of recycled material of between 30 and 60 percent.

This trailer contains equipment with which the acoustic properties of road surfaces can be measured in great detail.

The bonding agent that is used in asphalt today is bitumen, which differs from tar in that it is an oil derivative.

- The cavity structure in an asphalt surface is an important factor with respect to noise absorption.
- Cross-section of asphalt layers on a motorway.

Eight different types of asphalt

As a rule, eight types of asphalt are used for surfacing our motorways: two each for the support and bonding layers, and four for the uppermost (surface) layer. The types to be used depend on the required strength and specific demands to be placed on the surface (noise absorption, use in tunnels, engineering structures, open stretches).

Industrial production of asphalt

In Switzerland there are around 40 companies that produce asphalt. In most cases these are also road construction companies which possess their own surface preparation equipment, and are members of the Swiss Association of Bitumen Manufacturers (SMI).

The decisive factor in the production of asphalt is the temperature of the material: the optimal degree of bonding can only be achieved when both the gravel / sand mixture and the bitumen are heated to between 150 and 180 degrees C.

The high temperatures required for producing asphalt are now being placed in question for ecological reasons (CO_2 emissions), and efforts are currently being made by researchers and players in the industry to find ways of producing asphalt at lower temperatures without a reduction in quality. According to Hans-Peter Beyeler, a FEDRO engineer specialising in asphalt, it is likely that we will be able to produce asphalt at a temperature of around 100 degrees C within the next five years.

Focus on noise reduction

In addition to reducing CO_2 emissions, research is also being carried out into noise reduction. Here the focus is on surface properties and texture. At a speed of 120 km/h, an average motor car generates a noise level of 80 decibels, which is primarily caused by the contact between the tyres and the road surface. The higher the speed of the vehicle, the more the engine noise retreats into the background. Researchers are currently examining the question of how large the apertures or empty spaces in the asphalt need to be so that the noise generated by the tyres can be absorbed to the greatest possible extent. For this purpose, measurements are currently being carried out on test stretches of road.

In the past few years, FEDRO has been carrying out pioneering work in determining the key acoustic properties of various types of motorway surfaces: network-wide measurements of this kind have never before been carried out anywhere in the world (cf. photo on page 15).

Definition of thresholds: The data relating to the properties of road surfaces are being incorporated into the planning of maintenance works on the motorway network, and limit levels are being defined for grooves and longitudinal profiles, as well as for degree of grip on motorways.

Examination of 6,400 kilometres of road

In 2009, FEDRO examined the surfaces of Switzerland's motorways. With the aid of a variety of special vehicles, it determined the condition of the surface of each lane in the motorway network, i.e. a total of 6,400 kilometres of road. This project resulted in the collection of detailed data, including:

- Visual condition of surface
- Longitudinal and lateral profile
- Degree of grip of the various surfaces
- Key acoustic properties
- Surface texture

Required temperatures for laying asphalt surfaces

Asphalt layer	Minimum ambient temperature	Time of year
Top layer (3 cm)	At least 15 °C	Summer
8 cm bonding layer	Not below 5 °C	March to November
8 cm support layer	Not below 5 °C	March to November
Foundation	Above freezing	

Structure of motorway asphalt

	Granulation	Layer density
Top layer	0 to 8 mm	3 cm
Bonding layer	0 to 22 mm	8 cm
Support layer	0 to 22 mm	8 cm
Foundation	Gravel/sand compound	6 to 15 cm

Exact structure depends on traffic volume.

The most important types of asphalt surfaces

There are various types of asphalt surfaces that are used according to the specific requirements. If there are no special requirements in terms of noise level and permeability, standard surfaces are used, namely stone mastic asphalt and asphalt concrete.

If the asphalt is to be laid in the vicinity of, or in, a built-up area and therefore needs to be quieter, special low-noise surfaces are used on stretches along which noise-prevention barriers cannot be constructed. These surfaces have a high noise absorption capacity which is achieved through the degree of porosity (proportion of empty spaces), the bonding of the pores and the density of the layer. However, their useful life is shorter than that of standard surfaces.

Porous asphalt (formerly known as drainage asphalt) is also used as a low-noise surface thanks to its high level of porosity and its cavity structure.

Raw asphalt – a semi-porous surface with acoustic advantages – is also used in such circumstances.

There are also concrete surfaces on Switzerland's motorways. In the past, because of their long useful life these were laid along very heavily frequented stretches on which the noise factor was of no importance.

Mastic asphalt is used on motorway bridges, since this type of surface is impermeable to water.

Finally, there are elastic asphalt surfaces which are currently being tested in Holland and Scandinavia. The idea here is that the elasticity of the surface is to fulfil the same purpose as that of tyres: low rolling resistance and a high degree of grip.

Forests along motorways: protection as well as hazard

Forests along motorways generally form a protective belt, but at the same time trees can be a hazard to motorists.

Approximately 25 percent of the motorway network is bordered by forest or passes through forested areas. Forests perform a protective function in that they help prevent rockfalls, landslides and avalanches, and tree roots stabilise banks and slopes. But on the other hand, if trees are too close to the road or are situated on steep slopes above it, under certain conditions they can represent a danger to road users.

This problem is acknowledged in Article 49 of the Federal Motorways Act, which stipulates that motorways and their technical installations must be maintained and operated in such a manner as to guarantee the smooth and safe flow of traffic, and that accessibility to the network must be as unrestricted as possible.

Three different management zones

Forests along motorways therefore have to be appropriately managed, and for this purpose three different zones have been defined (cf. diagram and photo on next page).

A protective forest zone forms a protective belt and has to be kept at a sufficient distance from the motorway itself. It has to be managed so that it remains compact and stable. FEDRO is only responsible for the management (including financing) of such zones if the forest is officially classified as a motorway protection zone.

In a safety management zone, trees and branches are removed if they represent a hazard to road users. Generally speaking, a strip of land with a width equivalent to the height of a tall tree has to be kept free of trees.

Responsibility for safety management

	Width of clearance strip	Responsibility
Protective forest		FEDRO
Safety management zone	Height of 1 tree	FEDRO
Greenery maintenance, visibility	Approx. 5 metres	Regional Unit

In other words, the forest has to be managed so that a layered effect is achieved (cf. diagram). But creating a layered profile also has its drawbacks: the yield from forestry operations is lower and a zone is created in which trees have to be periodically cut back, which gives rise to considerable financial outlay. On the other hand, once a layered profile has been established, interruptions of traffic flow and accidents caused by falling trees and branches can be almost entirely ruled out.

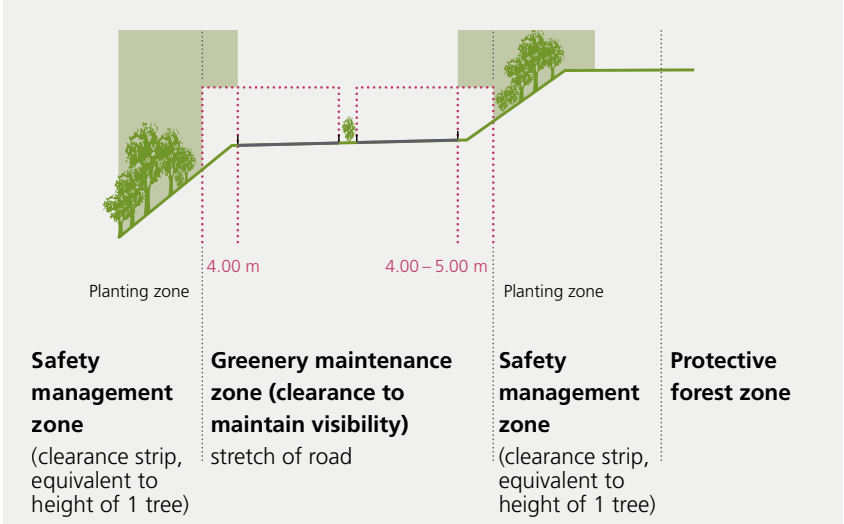
In a greenery maintenance zone, certain types of flora have to be kept so that the soil remains stable and is therefore not exposed to the risk of erosion. Here it is important to ensure that plants do not hamper the vision of road users.

Management of forests along motorways so that damage caused by rockfalls, landslides, etc., can be prevented.

The eleven Regional Units created by FEDRO are responsible for the management of forests along motorway stretches, as well as for the maintenance and clearance of banks and areas of greenery. As a rule, the proceeds from the management of forests along stretches of motorway are negligible, and are limited to the sale of timber, the proceeds from which are used to help offset the costs. The more complex the management of forest areas becomes (e.g. through the need for helicopter operations), the higher the costs, and this results in a deficit, in which case the costs have to be shared by the involved parties in accordance with a defined key.

The three forestry management zones alongside a motorway.

Management zones (schematic depiction)



Forest and rock clearance along the Brünig route

As owner of the motorway network, the federal government is responsible for providing safe infrastructure. This includes protecting motorways against natural hazards such as rockfalls, avalanches and landslides: a complex task, as we can see from the example of forest and rock clearance along the Brünig route.

In case dangerous material is loosened from a rock face, a layer of sand protects the road and steel sheets are used to protect the safety barriers.

In order to protect road users from rockfalls, measures to secure the slopes along the Brünig route (a stretch of second and third category motorway between the Bernese Oberland and central Switzerland) are carried out on a periodical basis. The tasks include annual rock clearance (which only hampers traffic to a limited extent) on the one hand, while on the other hand the schedule of measures to protect against natural hazards calls for the implementation of more comprehensive measures every three years – and these were carried out in May this year.

The work was carried out by Regional Unit I (civil engineering department of the canton of Bern) over a period of two weeks along the stretch between Balmhof and Gnoll, and the costs amounted to around 300,000 Swiss francs. In the same way as along the Brünig route, periodical clearance operations are necessary along motorways in all mountain regions of Switzerland.

Working in difficult terrain requires the deployment of specialists. Mountain guides are deployed for rock clearance since only they possess the necessary skills for working in safety on steep rock faces. Approximately 150 cubic metres of rocks and stones that represented a threat to traffic had to be cleared along the Brünig route, and this called for a high level of expertise as well as a great deal of experience in assessing the dangers posed by rock faces.

200 cubic metres of sand to protect the road surface

In order to ensure that falling rocks and stones could not damage the road surface, comprehensive precautionary measures had to be taken. These included the delivery of 200 cubic metres of sand and gravel to cover and protect the surface, plus thick steel sheets to be used as shields to protect the safety barriers. But an incident occurred despite these precautionary measures: a large boulder crashed through the layer of sand and gravel and created a 70-centimetre crater in the asphalt. Fortunately no one was hurt, but the road had to be closed to traffic.

Management of protective forest

In this forested region it was also necessary to manage the protective forest alongside the motorway. This task involves a variety of activities, the most important of which concerns the preservation of forest on steep slopes in order to protect the motorway against rockfalls and avalanches. The principle here is that the forest has to be managed so that it can rejuvenate itself, and this means that some trees have to be felled so that enough light is available to permit natural reforestation and there is enough space for the new trees to develop.

For FEDRO, the main goal is to secure the existence of a stable area of forest along the motorway with the necessary quantity of strong and healthy trees. On this occasion, around 120 cubic metres of timber were felled, primarily spruce and beech trees.

The clearance of rock faces is a highly specialised task that requires the skill of experienced rock climbers.

165,000 plants for an erosion prevention project on the Simplon

Structures to protect against avalanches were installed in the 1980s on the slopes above Simplon village on the Glatthorn, but due to damage and deterioration they are now in need of major repairs. A project with a pioneering character aimed at preventing erosion was initiated in summer 2010 and is being continued in summer 2011.

Each winter the Glatthorn poses a significant threat for the route through the Simplon (a category 3 motorway). Following a series of avalanches, complex protection structures were installed during the 1980s, but 20 years later damage was detected which required major repairs to the foundations and support structures. By contrast, the high degree of erosion to which the steep slopes of the Glatthorn are susceptible remains a serious problem. Erosion represents a threat to the structures that protect against avalanches, and thus to the area of protective forest and ultimately to people using the motorway several hundred metres further down.

Collected on the Glatthorn, cultivated on the Albula

In order to get this erosion under control, FEDRO initiated a soil stabilisation project encompassing an area of 25,000 square metres on the Glatthorn, and which is to cost around 3 million Swiss francs.

Seeds from native plants, which are of course able to cope with the local conditions, were harvested on the Simplon by a horticultural company and subsequently cultivated at high altitude in the Albula region. In the course of trials carried out in the period from 2003 to 2005, seeds were obtained from these plants, and at the same time seedlings were precultivated. These were then planted on the steepest slopes of the Glatthorn so that the root system of the plants could spread as quickly as possible and thus stabilise the soil. During 2010 around 80,000 seedlings were planted on these slopes, and a further 85,000 were added this year.

On the other less steep slopes, seeds were sown in the conventional manner and coconut matting was laid in order to protect them from the effects of rain and wind.

Finally, a special netting was anchored in place over the entire area in order to protect the young plants from damage by wild animals.

An initial assessment of the progress of this project indicates that the plants can be expected to flourish. A small meteorological station is also to be installed on the Glatthorn so that it will be possible to monitor the progress of this pioneering project under the influence of the local weather conditions.

Avalanche protection barriers on the Glatthorn.
Coconut matting and special netting protect the young plants from damage by wild animals and from erosion.

1,9 billion Swiss francs for motorway construction, expansion and maintenance

The federal government is to invest around 1.9 billion Swiss francs in the motorway network in 2011. Of this amount, 740 million have been budgeted for the construction of new stretches, and more than 1.1 billion will be spent on the expansion and maintenance of the existing network.

79 million Swiss francs will be used for eliminating bottlenecks, commencing with the stretch between Härkingen and Wiggertal. Parliament approved the necessary credit facilities during the winter 2010 session, and Federal Councillor Doris Leuthard (head of the Department of the Environment, Transport, Energy and Communications, DETEC) has approved the various construction programmes.

Construction of new stretches:

Here the priorities concern the continuation of construction projects that are already in progress:

- A9 in Upper Valais
- A16 (Transjurane) in the cantons of Bern and Jura
- Eastern segment of the Biel bypass (A5)
- Brünigstrasse (A8) in the canton of Obwalden (Lungern tunnel)
- Prättigauerstrasse in the canton of Grisons (continuation of the main activities associated with the Saas and Küblis tunnel projects, and the stretch between Pagrüeg and Mezzaselva)
- A5, Serrières

In accordance with the effective financing requirement, a total of 740 million Swiss francs is available for the construction of new stretches of motorway to complete the originally planned network. The amounts concerned will be provided from the Infrastructure Fund (cf. box on page 4). The largest credits have been allocated to the following cantons: Bern, 201 million Swiss francs; Valais, 167 million; Jura, 135 million; Grisons, 56 million; Zurich, 44 million; Obwalden, 42 million; Neuchâtel, 36 million.
Approximately forty percent of the credit facility will be spent on projects in the French-speaking part of the country. The completion of the planned network is to remain a shared responsibility between the federal government and the cantons, even after the entry into effect of the redistribution of financial responsibility and the accompanying division of duties: as before, the cantons assume responsibility for development, while FEDRO is the supervisory authority.

Maintenance and expansion

Parliament has approved a total of 1.134 billion Swiss francs for financing the expansion and maintenance of motorway stretches already in operation. The required resources are to be provided from the Special Fund for the Financing of Road Transport. Investments are to be carried in a total of 600 projects, of which 140 are currently being implemented and 460 are in the planning stage. In 2011, the main tasks are to be initiated for the following three maintenance projects:

- A1 Zurich: safety shaft in the Milchbuck tunnel
- A2 Ticino: stretch between Melide and Gentile
- A9 Vaud: stretch between Chexbres and Montreux

Elimination of bottlenecks

For 2011, Parliament has approved a total of 79 million Swiss francs to finance projects relating to the elimination of bottlenecks. Most of this credit is to be used for financing the already initiated widening of the A4 in the canton of Zug to six lanes (stretch from Blegi to Rütihof), and for the expansion of the stretch of the A1 / A2 between Härkingen and Wiggertal, which is to commence in 2011.

To obtain more detailed information (in German, French or Italian) about the main construction projects on the Swiss motorway network, please visit www.autobahnschweiz.ch.

Three new tunnels in the cantons of Jura, Bern and Grisons

Three new motorway tunnels will be opened to traffic during 2011: the Saas tunnel in Prättigau (canton of Grisons), the Moutier tunnel on the A16 in the canton of Bern, and the Neu-Bois tunnel in the canton of Jura.

With the completion of these three tunnels, the total number on the Swiss motorway network will reach 223. The 2,600-metre Saas tunnel in Prättigau (Grisons) is a single-tube construction, and is also equipped with a safety shaft. For the construction of the Moutier tunnel in the canton of Bern, numerous geological problems had to be overcome. When drilling commenced in 2003, it had to be aborted because it was discovered that the sandstone was of poorer quality than expected and was thus highly unstable. This resulted in a delay in construction as well as significantly higher costs.

The new motorway tunnels

A28: Saas (Grisons)	A16: Moutier tunnel (Bern)	A16: Neu-Bois tunnel (Jura)
1 tube + 1 safety shaft	2 tubes	2 tubes
Length: 2,600 m	Length: 1,200 m	Length: 975 m
Opened to traffic: October 2011	Opened to traffic: November 2011	Opened to traffic: 2011
Costs: 125 million Swiss francs	Costs: 360 million Swiss francs	Costs: 110 million Swiss francs

Installation of safety equipment

Although Switzerland's motorway tunnels are among the safest in the world, they nonetheless have to be constantly modernised and retrofitted with safety installations. A total of around 1.2 billion Swiss francs still needs to be spent on our motorway tunnels in order to ensure that they all meet the latest standards. The retrofitting of tunnels is carried out within the scope of normal maintenance work, and the main installation work has been scheduled for the period from 2012 to 2016. In order to meet this schedule, the necessary detailed plans will have to be completed in good time and the required financing will also have to be available.

The retrofitting of tunnels is to be based on the following list of priorities:

1. Clear indication of safety installations: easily recognisable signs, optical guidance facilities, clearly marked escape routes and well-lit exits.
2. Ventilation: installation of ventilation systems and extraction channels for the controlled compression and extraction of smoke and fumes.
3. Escape routes in tunnels with high traffic volumes.
4. Escape routes in tunnels with low traffic volumes.

▼ The Neu-Bois tunnel on the A16 (Jura) – an important new tunnel on the Swiss motorway network.

▼▸ Creujenat viaduct near the Neu-Bois tunnel on the A16 (Jura).

Major roadworks in 2011

1 _ Complete renovation of the Bern bypass

10-kilometre stretch with more than 50 engineering structures ------ Main tasks: March to November 2010 and 2011 ------ Including reconstruction of Wankdorf junction (additional entrance and exit roads) ------ All work to be carried out while maintaining full traffic flow (100,000 vehicles a day) ------ Reduction from three lanes to two in the direction of Zurich ------ Feed-in system at Neufeld and Forsthaus ------ Speed limit of 60 km/h along the entire roadworks stretch

2 _ Replacement of Stadtergasse bridge near Sargans

Complete renovation of a 15-kilometre stretch of the A3 / A13 ------ Widening of centre strip ------ Replacement of Stadtergasse motorway bridge between Sargans and Mels ------ Excavation of 325-tonne bridge with the aid of a special crane ------ Installation of new 400-tonne bridge ------ Total costs: 250 million Swiss francs ------ No interruption to Swiss Federal Railways timetable thanks to night-time work

5 _

3 _ Noise protection barriers on the stretch between Melide and Bissone

Construction of barriers on the slopes, along the sides and along the centre strip ------ Installation of noise-absorbing surface ------ Duration of project: 2008 to 2011 ------ 80 % of the work had been completed as of May 2011; completion scheduled for October 2011 ------ Cost of noise protection barriers: approximately 70 million Swiss francs ------ Work on dam near Melida completed: Costs, 19 million Swiss francs

4 _ Complete renovation of Cityring bypass, Lucerne

Projects: Lehnen viaduct to the north, 600-metre Reussport tunnel, Senti bridges with access road to city centre, 1.5-kilometre Sonnenberg tunnel to the south ------ Duration of projects: 2009 to 2013 ------ Main tasks: Structural renovation; noise protection measures; renewal of control centres and drainage system ------ Comprehensive renovation of operational and safety installations ------ Main tasks to be carried out between 2011 and 2012 (mostly at night) ------ Costs: approximately 400 million Swiss francs

4 _

1 _

5 _ Resurfacing of Lausanne bypass

7.7 kilometres between Villars-Ste-Croix and Vennes ------ 90,000 vehicles per day ------ Section in the direction of Vevey: early to mid-August 2011 ------ Section in the direction of Geneva: mid-September to the end of October 2011 ------ Work to be carried out during 5 to 6 nights a week ------ Resurfacing includes Blécherette and Vennes entrance and exit roads

2 _

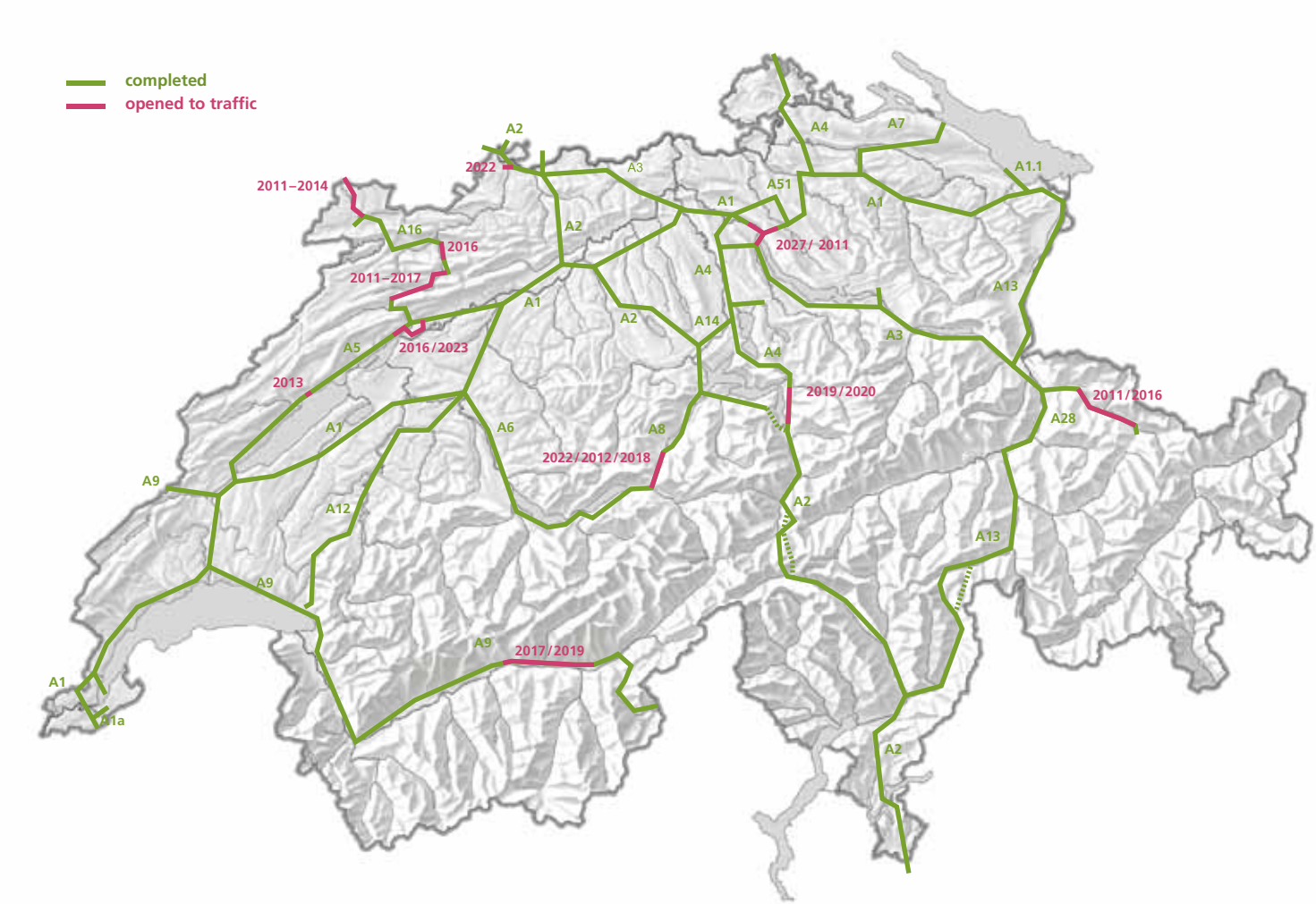
3 _

1,790.1 kilometres of motorway completed

When it is completed according to existing plans, the Swiss motorway network will comprise 1,892.5 kilometres. In 2010, a 1.4-kilometre stretch between Giswil and Ewil (canton of Obwalden) was officially opened to traffic. This means that a total of 1,790.1 kilometres of motorway are now in operation, which is equivalent to 94.6 percent of the planned network.
The motorway network will be expanded by 11.2 kilometres in 2011. The stretches concerned are in the cantons of Bern, Grisons, Jura and Zurich.

Four stretches to be opened in 2011

Motorway	Canton	Stretch	6-lane	4-lane	2-lane
A1	Zurich	Hardturm – Letten (Pfingstweidstrasse)	2.8 km		
A16	Bern	Moutier Ost – Court		1.2 km	
A16	Jura	Jura border – Bure		4.6 km	
A28	Grisons	Saas bypass			2.6 km



The Swiss motorway network

The table below shows the lengths of the stretches of motorway by category.

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			29.7	37.1	105.5	110.9	1.9		11.1	11.1			148.2	159.1
Bern			13.2	13.2	124.4	136.7			43.8	62.6	19.4	19.4	200.8	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			18.8	31.1	13.3	1.0	33.9	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			90.8	112.1	27.9		162.3	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					20.7				8.2	47.9			28.9	47.9
Total	1.2		80.7	88.1	1,324.3	1,400.2	1.9		270.5	341.3	111.5	62.9	1,790.1	1,892.5

Vehicles covered an accumulated distance of 25 billion kilometres in 2010

Vehicles covered an accumulated distance of 25,161,000,000 kilometres on Switzerland's motorways in 2010 – an increase by 2.6 percent versus 2009.

The traffic volume on Switzerland's motorway network is measured at approximately 160 stations. In 2010, an accumulated total of exactly 25,161 million kilometres was recorded, which corresponds to an increase by 2.6 percent versus 2009. The mean annual increase over the past ten years is 2.2 percent.
Heavy vehicles alone accounted for 1,508 million vehicle kilometres in the year under review, which represents an increase by 6.4 percent versus the prior year.

Year	Million vehicle km	Increase
2009	24,527	+ 2.6 %
2010	25,61	+ 2.6 %

If we take a look at the figures for individual measuring stations (cf. map on right), we can see that the level recorded at Wallisellen (canton of Zurich) is particularly high. As was the case in 2009, this measuring station recorded the highest number of vehicles (140,282), followed once again by Muttenz Hard (Baselland) and the Baregg tunnel near Baden (Aargau), both of which recorded sharp increases in traffic volume (by 1.32 and 1.39 percent respectively).

Increase at Gubrist, decrease at Schönbühl

The sharpest increase in traffic volume (6.89 percent) was recorded at the Weiningen / Gubrist station, which moved up the ladder from 9th place to 4th, while a falling tendency was noted at Schönbühl (Grauholz station, canton of Bern). Here a 0.1 percent decrease in the traffic volume had already been recorded in 2009, but the figure for 2010 was down by 2.31 percent. The fact that many road users use alternative routes in order to avoid the major roadworks site on the Bern bypass is a possible explanation for this downward trend, though the measuring stations in the area generally indicate a slight decrease in traffic in the Bern area.
As one of the new measuring stations to be put into operation in 2010, Reussport tunnel (Lucerne) recorded more than 91,000 vehicles to take 10th place in the table.

Traffic volume

		2009	2010	Change in %
A1				
ZH	Wallisellen	138,937	140,282	**0.97**
AG	Baden, Baregg tunnel	118,339	119,981	**1.39**
ZH	Weiningen, Gubrist	100,528	102,340	**1.80**
VD	Crissier	99,647	100,834	**1.09**
ZH	Brüttisellen Nord	97,310	98,821	**1.67**
BE	Schönbühl, Grauholz	100,732	98,046	**– 2.31**
VD	Renens	91,722	94,081	**2.57**
AG	Oftringen	90,662	90,343	**– 0.35**
A2				
BL	Muttenz, Hard	124,577	126,225	**1.32**
LU	Lucerne, Reussport tunnel	–	91,864	–

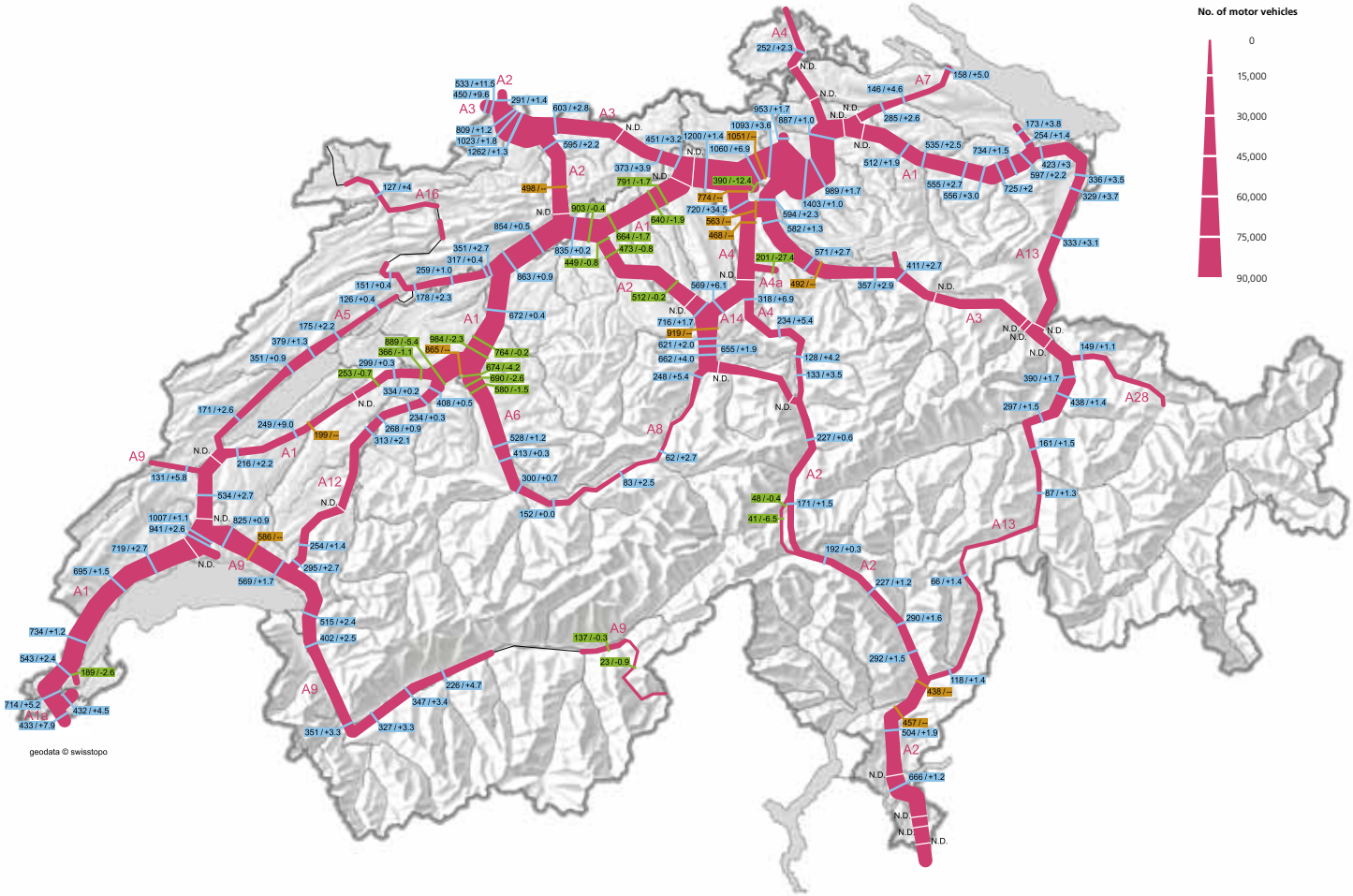
Seven million vehicles a day on Switzerland's motorways

FEDRO records traffic frequencies on Switzerland's motorways at 177 stations. In 2010, an average of seven million vehicles a day (both directions) was recorded by these automatic traffic counting stations.

Vehicles are automatically counted at stations throughout the motorway network, which record all vehicles travelling in both directions during a 24-hour period. The map below shows the average daily traffic volume recorded at these stations. This is the mean figure calculated from all the 24-hour traffic volume figures measured for every day of the year.

Monitoring and recording of traffic volume and its trends provide information that is essential for devising future traffic and environment policies at the federal, cantonal and municipal levels. The ordinance attached to the Swiss Federal Statistics Act dated 30 June 1993 forms the corresponding legal basis.

www.verkehrsdaten.ch



Increase in transalpine heavy goods traffic

In 2010, a total of 1.26 million heavy goods vehicles crossed through the Swiss Alps, which represents an increase by 6.5 percent (or 77,000 journeys) versus 2009 and is a clear reflection of the economic recovery.

The trends on the individual transalpine routes vary considerably. While the increase on the Gotthard (which is by far the most important route through the Alps) was slightly below average at 4.8 percent, the number of vehicles crossing via the San Bernardino (the second most important route) increased by 12.4 percent. The sharpest increase (15.9 percent) was recorded on the Simplon route, although the level here was still comparatively low: in 2009, the volume of heavy goods traffic on this route had fallen by 16.4 percent. The increase on the Grand St Bernard route was 5 percent in 2010.

In the second half of 2010, there were no days at all on which a "red phase" (temporary closure) was required. The only short-term closures occurred on one day at the beginning of December due to a snow storm and applied to heavy goods vehicles on the A13 (San Bernardino), and on the A2 between Erstfeld and Bellinzona.

The renewed increase in the volume of heavy goods traffic in 2010 is mainly attributable to the economic recovery throughout Europe, which set in towards the middle of 2009 and continued in 2010.

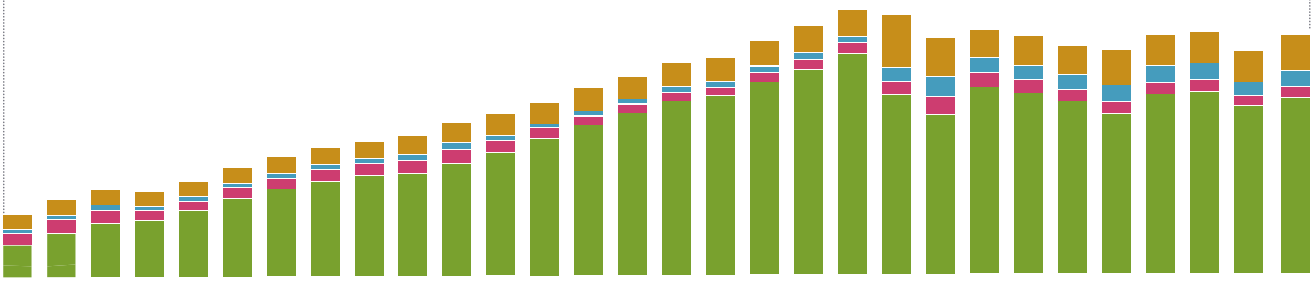
The growth rate on the Brenner route in Austria was 5.5 percent, which is one percentage point lower than the average in Switzerland.

Transalpine goods traffic, 1981 to 2010

(numbers of heavy goods vehicles)

1981
73,000
11,000
57,000
171,000
312,000

	2006	2007	2008	2009	2010
San Bernardino	185,097	161,948	163,429	165,717	186,251
Simplon	82,025	82,087	81,940	68,502	79,361
Grand St. Bernard	57,650	55,102	56,759	45,633	47,925
Gotthard	855,618	963,388	972,688	900,150	943,230
Total	1,180,390	1,262,525	1,274,816	1,180,002	1,256,767



1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Elimination of bottlenecks on the motorway network

Society's need for mobility is constantly growing, and as a result Switzerland's transport infrastructure is becoming increasingly overburdened, particularly in and around the country's main cities and agglomerations.

Bottlenecks on roads and motorways not only give rise to traffic jams and the associated inconvenience, they also result in major costs. Each year, congestion results in around 10,000 hours of traffic jams on the motorway network alone, and the time that is thus lost gives rise to costs amounting to millions of Swiss francs. It is one of the duties of FEDRO to identify bottlenecks on the motorway network as early as possible and take the necessary steps to eliminate them.

Smoothly functioning transport networks, and thus uninterrupted connections between all regions of the country, are of the utmost importance, both for national unity as well as for the country's economy. Efficient and ecologically compatible transport infrastructure is a prerequisite for the smooth functioning of the Swiss economy, especially in the main agglomerations.

Step-by-step elimination of bottlenecks

The Infrastructure Fund Act, which entered into force on 1 January 2008, is to provide the federal government with a total of 20.8 billion Swiss francs over a period of 20 years from the Special Fund for the Financing of Road Transport, to secure the necessary degree of efficient and environmentally compatible mobility. Around a quarter of this amount (5.5 billion Swiss francs) has been earmarked for the elimination of bottlenecks on the motorway network, which is to be effected on a step-by-step basis within the framework of a special programme. The Federal Council submitted its initial programme to Parliament for approval at the end of 2009. This programme lists those stretches of the motorway network which will be overburdened to an unacceptable extent in the future, and outlines the structural measures that will be required for eliminating these bottlenecks. The problem is that the required expenditure would exceed the available financial resources several times over, and in view of this the existing projects have had to be subjected to a strict prioritisation process in which the Federal Council has allocated the projects to four modules.

Module 1 encompasses the most urgent projects for eliminating the most severe bottlenecks, and the planning of these projects is now nearing completion. These include the widening of the stretches between Härkingen and Wiggertal, Blegi and Rütihof and the Zurich northern bypass to 6 lanes, as well as urgent widening measures near Crissier. Parliament approved the funding for these projects in autumn 2010.

Modules 2 and 3 encompass other carefully assessed projects, which are to be planned in greater detail and subjected to a renewed prioritisation process by the time of the next petition for the approval of funding in 2014. The Federal Council regards the projects in module 2 to be of higher priority than those in module 3. From today's perspective, the financing of the projects in modules 1 and 2 with the earmarked funding of 5.5 billion Swiss francs is feasible. The planning of the projects allocated to module 4 will not be pursued further.

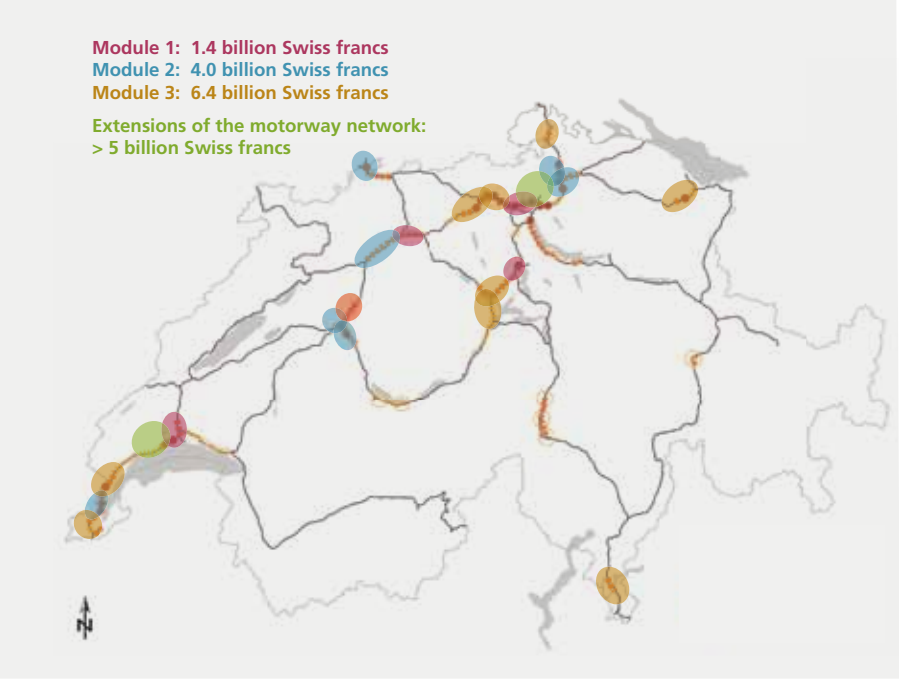
The four top priority projects

In accordance with the priorities defined by the Federal Council concerning the elimination of bottlenecks, the following four projects allocated to module 1 are to be implemented without delay:

Crissier (canton of Vaud), phase 1: 120 million Swiss francs

Measures are to be taken to ease congestion at the Ecublens – Villars-Ste Croix junction (Vaud), as well as to separate critical traffic flows (Crissier bottleneck).

Current allocation of bottlenecks to modules



Widening of the Härkingen-Wiggertal stretch (cantons of Solothurn and Aargau) to 6 lanes: 165 million Swiss francs

Here the entire stretch is to be widened to three lanes in each direction. To accomplish this, a variety of structural measures are required: various underpasses will have to be extended, and one overpass will have to be demolished and replaced with a new one. In addition, a number of retaining walls will either have to be constructed or relocated. At the same time, the existing structures will have to be renovated or repaired, and noise protection will have to be improved by constructing new barriers and a low-noise road surface.

Widening of the Zurich northern bypass to 6 lanes: 940 million Swiss francs

Here the plans are to widen the open stretches to three lanes in each direction and add a new 3-kilometre tube to the Gubrist tunnel with three lanes in the direction of Bern / Basel. Other measures include optimising the Weiningen junction, constructing a new Zurich – Affoltern junction, covering over an approximately 580-metre stretch of the motorway between Katzensee and Horensteinstrasse, and constructing a number of motorway drainwater treatment plants.

Widening of the stretch between Blegi and Rütihof (canton of Zug) to 6 lanes: 135 million Swiss francs

Between Lucerne and Zug it is essential for the planned measures to be implemented without delay in order to prevent the high levels of congestion that are anticipated for this stretch of motorway. As a result of the opening of the A4 stretch that passes near Knonaueramt, traffic from the A4 and A14 is now brought together on the stretch between Lucerne and Zug. To ease this situation, the stretch between Blegi and Rütihof (canton of Zug) is being widened to 6 lanes.

More detailed studies in six regions

For the second request for funding which the Federal Council wants to submit to Parliament in 2014, in-depth studies are currently being carried out in the following six regions:

- Geneva
- Lausanne
- Bern
- Zurich / Winterthur
- St. Gall
- Lugano / Melide / Bissone

For further information (in German, French and Italian) please visit: www.astra.admin.ch/autobahnschweiz/03002/index.html?lang=de

Speed control over a certain distance instead of on-the-spot: testing of a new system

In January 2011, FEDRO began to test the world's first distance-based speed control system, including driver recognition. Here it is the average speed over a certain distance that is measured, instead of at a specific location.

Although the method of distance-based speed control is not new and is already being successfully used in the Netherlands, Austria and Italy, the Swiss version is a world première from the point of view of the accompanying legislation. In those countries in which a distance-based speed control system is in use, the principle of vehicle holder liability applies, i.e. it is the holder who has to pay the fine and who is identified on the basis of the vehicle licence plate. But in Switzerland it is the driver who is liable, and this means the police have to prove that the person driving the vehicle has committed the offence. For this purpose, in Switzerland with the new distance-based control system a photo will be taken which, in the same way as with conventional systems, shows the face of the driver as well as the vehicle licence plate.

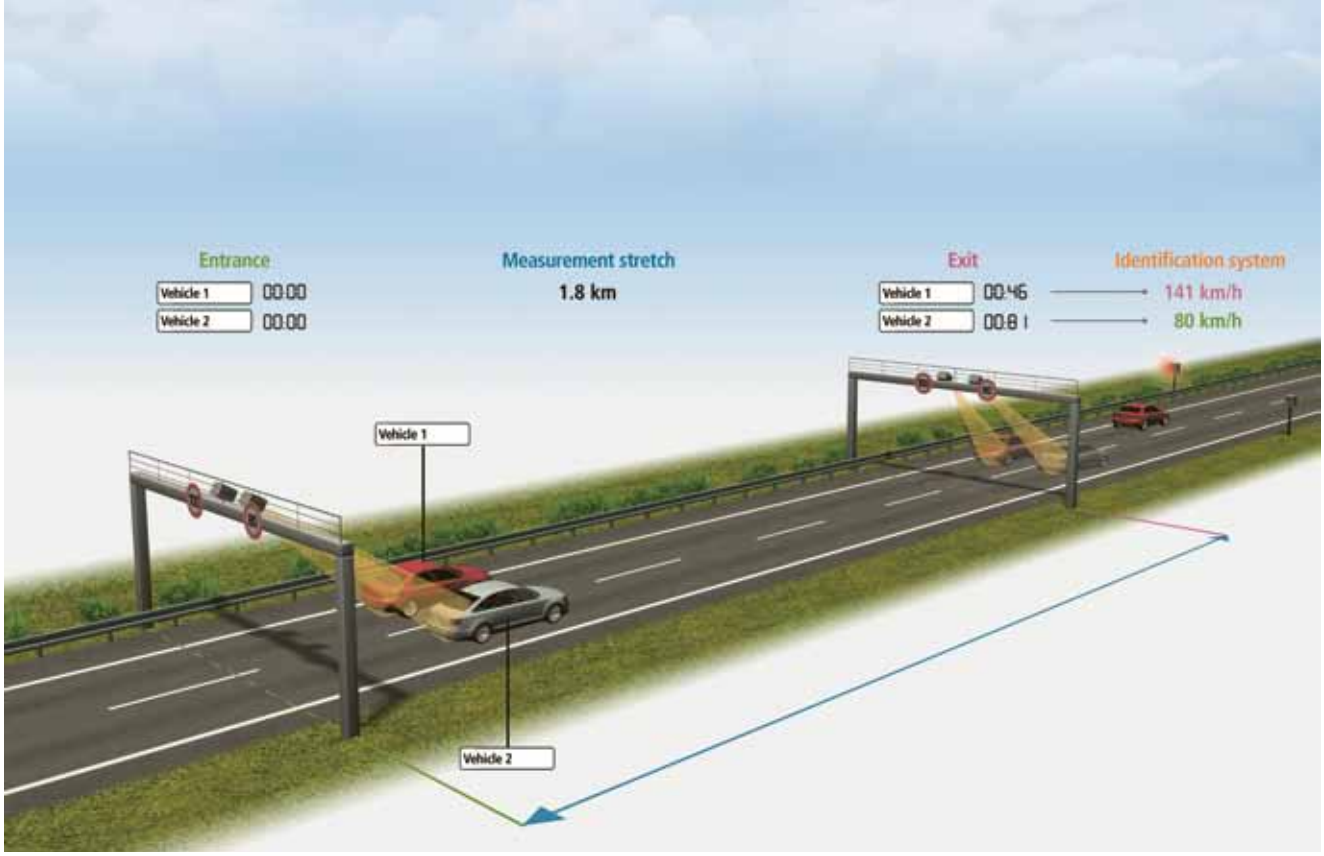
The distance-based control system functions as follows: all vehicles which pass the starting point are photographed from behind. The camera records the licence plate, codes it and transmits the coded data to a computer together with a time stamp.
There is a second camera at the other end of the stretch, which again records the licence plate and transmits the data to the computer for comparison. The data from both points are then compared almost instantaneously, and if there is a hit the computer calculates the time that has elapsed between the first and second photo.

More homogeneous traffic flow

Distance-based speed control systems monitor the average speed of vehicles over a specific stretch. This means it is no longer possible for drivers to brake sharply before they pass a radar device, and then speed up again as soon as they have passed it. Manoeuvres of this kind frequently give rise to a concertina effect, which can result in traffic jams and, in the worst case, collisions. With the distance-based speed control system, traffic flow will be rendered more homogeneous.

Arisdorf tunnel and stretch between Aigle and Bex

To test the system, FEDRO selected two different types of location: a stretch of tunnel with highly heterogeneous traffic and a dynamic speed indicator, and an open stretch on which the speed limit is 120 km/h. The chosen locations were the Arisdorf tunnel on the A2 in the canton of Basel-Landschaft – a major north-south axis – and a stretch on the A9 between Aigle and Bex in the canton of Vaud, on which a relatively high number of speeding offences and accidents occur. In addition to these two fixed locations, a semi-portable system is also in use which can be used at motorway roadwork sites.



Example of a distance-based speed control system.

The distance is recorded in the system and is based on an official measurement by the Federal Office for Metrology (METRAS). The average speed is calculated on the basis of the distance over time formula and compared with the specified speed limit for the vehicle category concerned. If the vehicle has been travelling too fast, a command is sent to the evidence camera which then takes a photo of the driver.

Since vehicles are still in motion, the comparison has to be made within 0.4 seconds, otherwise the vehicle concerned will have already passed the evidence camera.

Identification of vehicle category

Since speed limits vary according to the type of vehicle, the identification of vehicle category is an essential factor. The speed limit for HGVs and cars with trailers is 80 km/h, while coaches are not permitted to exceed 100 km/h. In order to identify the category to which a vehicle belongs, laser scanners are used which generate a three-dimensional image.

The system is already in use, but is still being tested. An external company has been entrusted with the task of verifying its effectiveness.

Recording equipment at the entrance and exit of the Arisdorf tunnel.

Electric bikes: convenient, fast and ecological mobility

Electric bikes are becoming increasingly popular in Switzerland. Since 2005, sales have doubled every year, and thanks to the support provided by an electric motor, e-bikes are suitable for use by everyone.

E-bikes for fitness and fun.

Electric bikes (also referred to as electric mopeds, e-bikes) are bicycles equipped with an electric motor. Sales of these vehicles are currently booming: in 2005, around 1,800 were sold in Switzerland, compared with 35,000 in 2010.

Uphill with the greatest of ease

Electric bikes are classified as mopeds. They take the form of conventional bicycles but are equipped with a small electric motor and a battery that is usually attached to the frame. As soon as the pedals are operated, the electric motor kicks in and thus makes cycling easier. As a rule, the motor automatically adjusts itself to the pedal frequency of the cyclist: the harder a cyclist pedals, the higher the speeds that can be attained with an electric bike. With the latest models, speeds of up to 50 km/h can be reached with relatively little effort. In the case of e-bikes with pedal support up to a certain speed, the motor automatically cuts out when the specified speed is reached. The motor is powered by a battery which is attached to the frame and can be recharged in any standard power point. Depending on the selected output, a fully charged battery has a range of up to 80 kilometres, and the power consumption of an electric bike is barely 1 kilowatt hour per 100 kilometres.

E-bikes are increasingly being used in towns and cities, as well as rural areas.

From convenience to lifestyle

Initially, electric bikes were little more than conventional bicycles with a certain amount of pedal support. Manufacturers struggled with problems associated with memory effect and the short range of batteries, and focused on traditional bicycle design with the over-50s as their main target group.

But today, the industry produces a broad range of models designed to appeal to users of all ages. Electric bikes offer a fast form of mobility over short distances and in urban traffic. For people working in the services sector and in town centres, the fact that e-bikes mean they can cycle without sweating so much and do not have to search for parking spaces are very strong arguments. E-bikes are also an ideal solution for people who are perhaps not as fit as they used to be, but still want to be physically active. And the latest models, which focus more on speed and technology, as well as attractive design, are appealing to a public that is increasingly aware of trends and lifestyle.

Could e-bikers represent a new type of traffic hazard?

Electric bikes are compact, fast, versatile and silent, but precisely in dense urban traffic these advantages could also quickly become a hazard. Drivers could underestimate the speed of what appears to be a normal bicycle and respond unpredictably if they are suddenly overtaken by an e-bike. Similarly, cyclists could be taken by surprise if they are overtaken by an almost silent e-bike in close proximity. And in their turn, e-bike riders sometimes overestimate their own riding skills or underestimate their own speed and required braking distance. At present there is no requirement for e-bike riders to wear a helmet.

Sales of electric bikes in Switzerland

2005	2006	2007	2008	2009	2010
1,792	3,181	5,825	11,631	23,886	approx. 35,000

Source of Swiss sales figures: www.newride.ch

Approval and traffic safety

FEDRO is the authority that is responsible for the approval of electric bikes. In principle, bicycles that are equipped with an electric motor and a battery are classified as mopeds. The basis for allocation to this category is the definition formulated in the Ordinance on technical requirements on road vehicles dated 19 June 1995, according to which the requirements relating to the construction and equipment of mopeds apply to electric bicycles. Certain exemptions currently apply to mopeds powered by an electric motor. For example, for approval purposes and with respect to requirements, light mopeds with pedal support up to 25 km/h and a maximum nominal output of 250 watts are regarded as bicycles. This means a helmet is not required, and people over 16 can operate this type of vehicle without a driving licence.

FEDRO wants to adapt the currently valid regulations to reflect recent technological developments, and is proposing a corresponding amendment to road traffic legislation (see box on right), which is to enter into force on 1 January 2012.

In principle, bicycles that are equipped with an electric motor and a battery are classified as mopeds.

Proposed new regulations for electric bikes

Electric bikes are becoming increasingly popular, and the range of products on the market is being constantly expanded. This means that the risk of accidents is also increasing. In view of this, the federal government wants to adapt the existing regulations to reflect the changing requirements. The proposals are that, in future, it must be possible to equip light electric bikes with a pushing and starting aid, and a bicycle helmet is to be declared compulsory for faster e-bike models. A public consultation procedure was initiated in spring 2011, and will be concluded on 15 August 2011.

As before, electric bikes are to be classified as mopeds, i.e. single-seater two-wheelers with a maximum output of 1,000 watts. In order to reflect the latest technological developments and increase the level of safety, the federal government is proposing the following amendments within the scope of the revision of the Ordinance on technical requirements on road vehicles and the Ordinance on traffic regulations:

"Light mopeds": it must be possible to equip electric bikes which provide pedal support up to 25 km/h and have a motor with a maximum output of 250 watts with a pushing and starting aid, which makes it easier for the rider to set the vehicle in motion. For safety reasons, wearing a bicycle helmet is recommended, but is not compulsory.

"Electric mopeds with an output up to 500 watts": The speed that can be obtained by electric bikes with an output up to 500 watts using pedal support may not exceed 45 kilometres per hour. Using the electric motor only (i.e. without the use of the pedals), the maximum speed attainable by these vehicles may not exceed 20 kilometres per hour. Riders of these electric bikes are required to wear an officially tested and approved bicycle helmet. These electric bikes are currently classified as mopeds with exemptions, and require a moped licence plate. In the future they are to be classified in sub-category "Electric mopeds with low output", and the requirement of a moped licence plate will continue to apply.

"Other mopeds": Here, too, the speed that can be obtained using pedal support is to be limited to 45 km/h. As before, the speed these mopeds may attain using the motor only is limited to 30 km/h. Helmets have been compulsory for more than 20 years. Vehicles in this category are mopeds with an electric motor output up to 1,000 watts, and in the case of vehicles with a combustion engine, the capacity is limited to 50 cc. As before, the requirement of a moped licence plate will continue to apply.







E-bike models are now available to suit a broad variety of requirements.

Number of registered cars surpasses 4 million for the first time

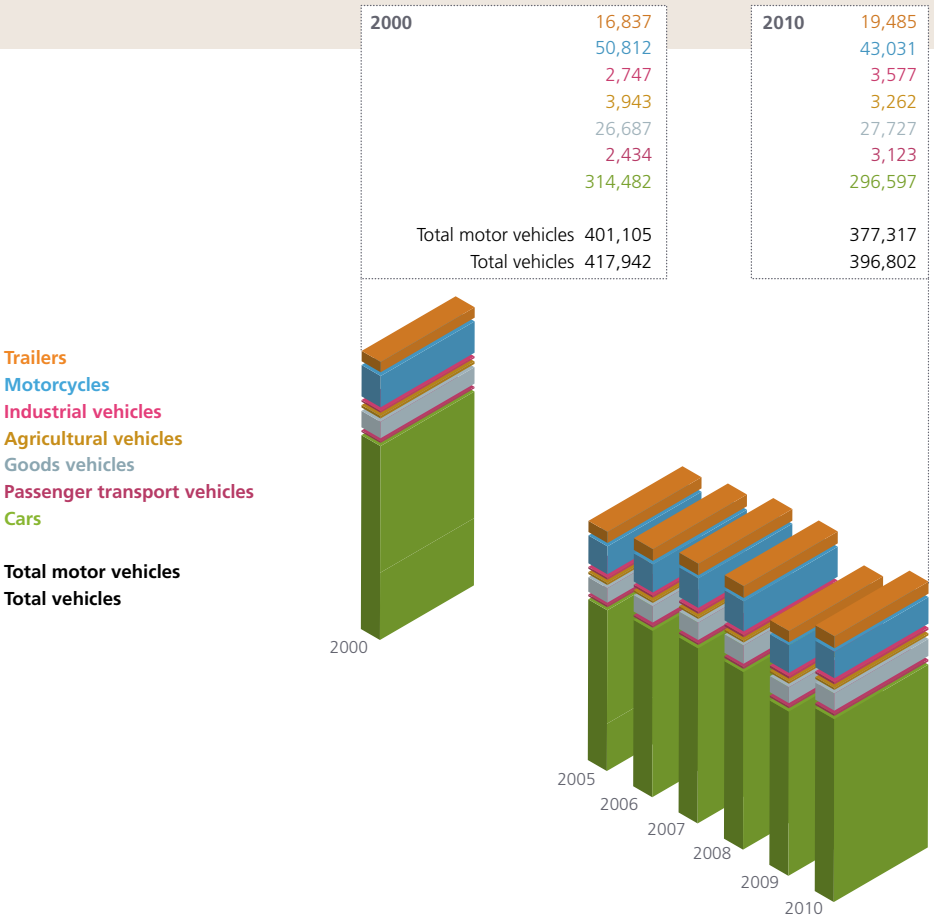
In 2010, more than 5.4 million motor vehicles were registered in Switzerland – 42 percent more than in 1990. The number of registered cars surpassed the 4-million threshold in 2009, and has now reached 4.1 million. The composition of the growing vehicle fleet is shifting in favour of motorcycles and cars with diesel or hybrid motors.

In the area of goods transport, utility vehicles are continuing to gain in importance.

Inventory of motor vehicles in Switzerland

	Motor vehicles Total	Cars	Passenger transport vehicles	Goods vehicles	Agricultural vehicles	Industrial vehicles	Motorcycles	Mopeds
Total	**5,359,955**	**4,075,825**	**52,751**	**335,200**	**186,485**	**58,492**	**651,202**	**164,541**
Lake Geneva region	**994,073**	**768,796**	**9,815**	**57,766**	**23,417**	**9,381**	**124,898**	**13,846**
Vaud	463,186	366,762	4,712	25,633	13,520	3,626	48,933	8,496
Valais	243,166	185,530	2,543	15,836	8,336	4,063	26,858	2,715
Geneva	287,721	216,504	2,560	16,297	1,561	1,692	49,107	2,635
Central plateau	**1,214,309**	**903,614**	**13,638**	**75,640**	**59,515**	**14,451**	**147,451**	**45,166**
Bern	670,515	480,990	8,174	44,725	37,869	9,196	89,561	27,015
Fribourg	198,321	154,180	1,965	11,334	9,732	1,869	19,241	5,806
Solothurn	181,565	139,864	1,647	10,912	5,265	1,659	22,218	8,599
Neuchâtel	112,917	89,980	1,396	5,802	3,025	1,073	11,641	2,196
Jura	50,991	38,600	456	2,867	3,624	654	4,790	1,550
Northwest Switzerland	**702,320**	**543,696**	**6,118**	**46,423**	**17,181**	**5,688**	**83,214**	**22,179**
Basel-Stadt	84,209	66,077	728	7,512	172	646	9,074	2,755
Basel-Landschaft	177,631	138,195	1,521	11,372	3,752	1,419	21,372	5,328
Aargau	440,480	339,424	3,869	27,539	13,257	3,623	52,768	14,096
Zurich	**849,622**	**669,381**	**8,137**	**51,768**	**15,569**	**8,606**	**96,161**	**16,796**
Eastern Switzerland	**791,693**	**585,641**	**7,830**	**51,687**	**41,955**	**12,038**	**92,542**	**22,479**
Glarus	27,578	20,651	235	1,946	1,367	545	2,834	761
Schaffhausen	54,389	40,311	590	3,323	2,777	624	6,764	1,590
Appenzell Ausserrhoden	37,612	27,580	354	1,939	2,274	498	4,967	1,314
Appenzell Innerrhoden	11,968	8,286	78	667	1,208	205	1,524	492
St. Gall	327,467	246,075	3,086	20,881	14,481	4,208	38,736	9,584
Grisons	139,977	100,122	1,671	10,576	9,528	3,533	14,547	2,866
Thurgau	192,702	142,616	1,816	12,355	10,320	2,425	23,170	5,872
Central Switzerland	**532,737**	**400,190**	**5,124**	**33,126**	**24,989**	**5,657**	**63,651**	**14,972**
Lucerne	252,567	185,867	2,486	16,157	13,559	2,324	32,174	7,787
Uri	24,112	17,699	280	1,374	1,249	424	3,086	713
Schwyz	112,971	86,245	958	6,545	5,036	1,408	12,779	2,891
Obwalden	27,458	19,542	300	1,762	1,961	425	3,468	1,315
Nidwalden	31,520	23,874	320	1,549	1,304	292	4,181	1,015
Zug	84,109	66,963	780	5,739	1,880	784	7,963	1,251
Ticino	**275,029**	**204,462**	**2,085**	**18,757**	**3,850**	**2,593**	**43,282**	**28,897**
Federal administration	**172**	**45**	**4**	**33**	**9**	**78**	**3**	**206**

Vehicle registration statistics



Motor car statistics

	2000	2006	2007	2008	2009	2010
Type						
Limousine	227,171	197,913	202,321	200,399	184,590	199,688
Station wagon	75,673	60,602	68,861	764,502	72,948	88,052
Convertible	11,638	11,233	12,790	11,070	8,940	8,857
Engine capacity (cc)						
Below 1,000	12,413	8,015	9,503	10,160	10,817	9,463
1,000 to 1,399	53,275	46,635	49,584	60,689	67,525	83,629
1,400 to 1,799	85,039	58,533	65,298	69,945	65,009	77,754
1,800 to 1,999	86,388	82,328	88,486	84,019	72,452	75,218
2,000 to 2,499	36,459	30,287	26,609	24,010	19,588	19,358
2,500 to 2,999	22,535	24,216	25,339	23,804	20,562	19,944
3,000 and over	18,309	19,725	19,134	15,320	10,468	11,030
Electric motor	64	9	19	24	57	201
Gear mechanism						
Automatic	81,916	73,889	73,703	69,641	57,705	60,183
Manual	232,566	193,841	204,336	209,869	198,694	222,670
Hydrostatic		39	56	34	45	301
Others		1,979	5,877	8,400	10,034	13,714
Fuel						
Petrol	285,407	185,807	185,055	189,151	182,174	200,576
Petrol and battery		1,271	3,220	3,091	3,899	4,246
Diesel	28,983	80,857	92,333	93,366	78,755	90,547
Others	92	1,813	3,364	2,363	1,650	1,228
Drive						
Four-wheel drive	54,742	67,022	73,700	71,722	69,343	82,849
Rear-wheel drive	34,635	19,840	21,929	22,288	18,685	18,790
Front-wheel drive	225,105	182,835	188,297	193,942	178,430	194,929
Others		51	46	19	20	29
Total	**314,482**	**269,748**	**283,972**	**975,971**	**266,478**	**269,597**

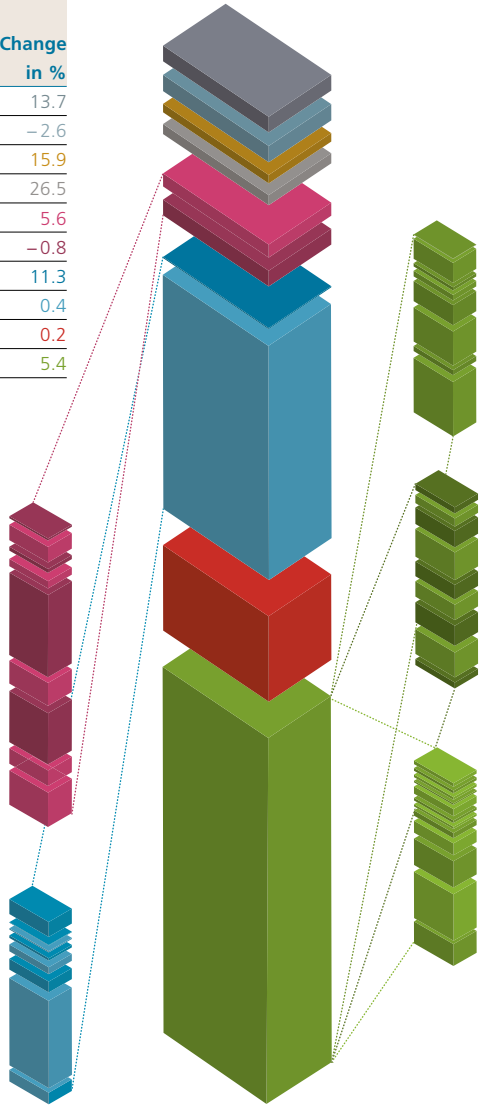
Number of withdrawn driving licences up by 5.4 percent

During 2010, a total of 78,986 drivers had to hand in their licence – around 4,000 (or 5.4 percent) more than in 2009. The number of confiscated licences due to speeding was higher than ever before, while contrary to the trend over the past few years the figure for driving under the influence of alcohol rose again.

Withdrawals of driving licences for longer than 12 months fell again from 1,699 to 1,601 (minus 6.1 percent), while by contrast 17.8 percent of the confiscated licences were withdrawn for an indefinite period (an increase by 20.7 percent). The more stringent regulations that were introduced in 2005 are continuing to have a noticeable effect.

Administrative measures

	2010	2009	Change in %
Special requirements	4,581	4,027	13.7
Instruction in road use	3,081	3,166	– 2.6
New driving test	2,399	2,069	15.9
Examination by specialised psychologists	3,037	2,399	26.5
Withdrawal of learner's licence	2,953	2,794	5.6
Refusal of learner's or driver's licence	3,362	3,390	– 0.8
Warnings to holders of a learner's licence	274	246	11.3
Warnings to holders of a driving licence	51,978	51,727	0.4
Refusal to accept a foreign driver's licence	18,369	18,323	0.2
Withdrawal of driver's licence	78,986	74,881	5.4



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

Sickness or infirmity	111
Theft	588
Driving despite withdrawal of licence	163
Failure to pass driving test	290
Driving without a licence	2,888
Drink driving	920
Driving error	2,009
Learner driving unaccompanied	441
Other reasons	1,498

Reasons for warnings

Drink driving (≥ 0,50–0,79‰)	6,746
Unlawful overtaking	231
Failure to observe traffic signals	632
Driving an unroadworthy vehicle	1,316
Failure to give way	2,719
Inattention	4,485
Speeding	43,074
Other reasons	6,000

Duration of withdrawal

Permanent withdrawal	47
Indefinite period	15,140
More than 12 months	1,682
7 to 12 months	3,644
4 to 6 months	10,158
3 months	18,791
2 months	2,440
1 month	32,319

Age of persons affected

70 and over	4,904
60 to 69	5,422
50 to 59	10,675
40 to 49	16,632
35 to 39	8,157
30 to 34	9,195
25 to 29	12,057
20 to 24	13,753
Under 20	3,426

Reasons for withdrawal

Sickness or infirmity	3,888
Drug addiction	2,443
Influence of medicaments or drugs	2,390
Alcohol addiction	1,493
Other driving errors	4,979
Unlawful overtaking	1,768
Failure to observe traffic signals	1,844
Failure to give way	4,149
Inattention	9,251
Drink driving (≥ 0.08‰)	18,371
Speeding offences	35,427
Other reasons	17,854

Lowest number of fatalities on Switzerland's motorways and expressways since 2005

In 2010, 38 people died as the result of road accidents on Switzerland's motorways and expressways, which is the lowest figure since 2005. This figure represents 1.2 percent of the total number of persons injured in accidents, of whom 86.1 percent suffered minor injuries, and 12.7 percent were seriously injured.

Overall Swiss road network
Motorways and expressways

Accidents resulting in injuries and fatalities

	Accidents	Persons
Fatalities	313	327
	34	38
Severe injuries	4,082	4,458
	295	384
Minor injuries	15,214	19,779
	1,756	2,607
Total	**19,609**	**24,564**
	2,085	3,029
Change in % since 2005	–9.7	–9.6
	0.0	+1.6

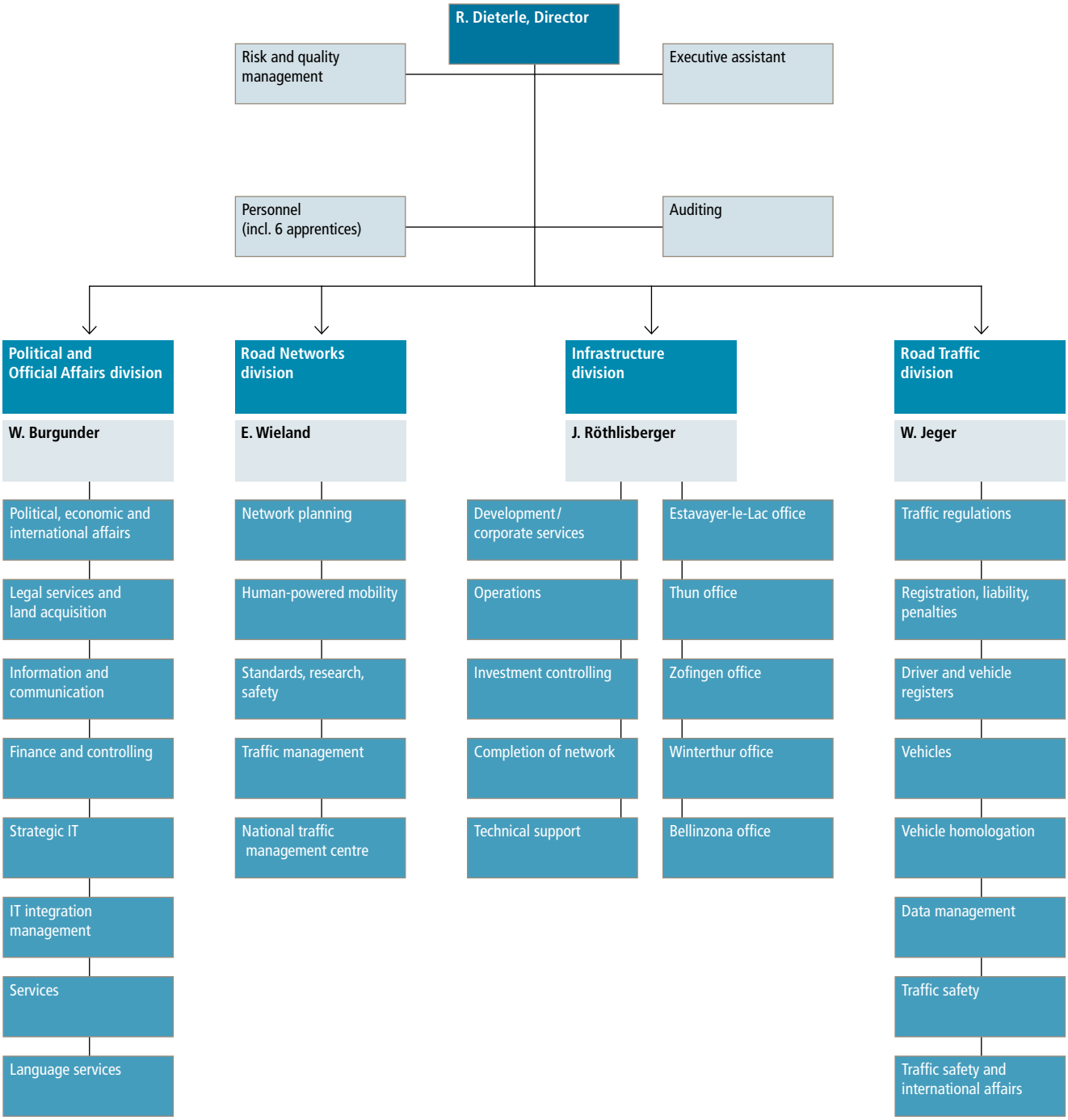
Accident statistics by road users

Pedestrians	2,524	
	24	
Driver/passenger(s), of which:	22,040	
	3,005	
in cars		12,802
		2,681
in heavy goods vehicles		119
		49
on motorcycles		4,359
		136
on bicycles		3,235
		5
in public transport		261
		0
in other forms of transport		1,264
		134
Total	**24,564**	
	3,029	
Change in % since 2005	–9.7	
	1.6	

Types of accidents resulting in injuries and fatalities

		Cause of accident	
	Total	Speeding	Alcohol
Skidding, single-vehicle accident	6,074	2,698	1,216
	965	465	115
Overtaking	875	68	47
	186	17	9
Rear-end collision	4,062	407	207
	855	117	36
Turning out of road	1,711	46	61
	5	1	0
Turning into road	2,251	79	71
	7	0	1
Crossing lane	1,058	54	46
	0	0	0
Head-on collision	833	257	101
	40	7	5
Parking accident	99	4	5
	1	1	0
Collision with pedestrian	2,254	147	154
	14	1	4
Collision with an animal	82	10	1
	2	2	0
Other accidents	310	6	20
	10	0	0
Total	**19,609**	**3,776**	**1,929**
	2,085	**611**	**170**
Change in % since 2005	–9.7	–15.4	–5.9
	0.0	–17.1	+3.0

Organisational chart of the Federal Roads Office (FEDRO)



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Postal address
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www.astra.admin.ch
www.autobahnschweiz.ch
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www.truckinfo.ch

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Swiss Federal Roads Office (FEDRO)
National traffic management centre
Rothenburgstrasse 15
6020 Emmenbrücke, Lucerne
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Central and Northwest Switzerland
Swiss Federal Roads Office (FEDRO)
Zofingen office
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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)
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Canton of St Gall
Martinsbruggstrasse 75b
9016 St. Gall

Regional Unit VII (cantons of Zurich and Schaffhausen)
Civil Engineering Department, Canton of Zurich
Stampfenbachstrasse 14
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Regional Unit VIII (cantons of Basel-Stadt, Basel-Landschaft, Solothurn, Aargau)
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Regional Unit XI (cantons of Uri, Schwyz and Ticino)
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SZ Cantonal Police Schwyz
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TG Cantonal Police Thurgau
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BS Motor Vehicle Inspection Office, Canton of
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Phone 041 618 41 41, Fax 041 618 41 87
info@vsz.ch, www.vsz.ch

OW Dept. of Traffic Safety,
Cantons of Obwalden and Nidwalden
Police Headquarters / Foribach,
P. O. Box 1561, 6061 Sarnen
Phone 041 666 66 00, Fax 041 666 66 20
info@vsz.ch, www.vsz.ch

SG Road Traffic and Water Transport Office,
Canton of St. Gall
St. Leonhardstrasse 40, 9001 St. Gallen
Phone 058 229 22 22, Fax 071 229 39 98
info@stva.sg.ch, www.stva.sg.ch

SH Road Traffic and Water Transport Office,
Canton of Schaffhausen
Rosengasse 8, 8200 Schaffhausen
Phone 052 632 71 11, Fax 052 632 78 11
strassenverkehrsamt@ktsh.ch
www.strassenverkehrsamt.sh.ch

SO Motor Vehicle Inspection Office,
Canton of Solothurn
Gurzelenstrasse 3, 4512 Bellach
Phone 032 627 66 66, Fax 032 627 66 99
mfk@mfk.so.ch, www.mfk-so.ch

SZ Road Traffic Dept., Canton of Schwyz
Schlagstrasse 82, 6430 Schwyz
Phone 041 819 11 24, Fax 041 819 21 78
va.mpd@sz.ch, www.sz.ch/verkehrsamt

TG Road Traffic Dept., Canton of Thurgau
Moosweg 7a, 8501 Frauenfeld
Phone 052 724 32 11, Fax 052 724 32 58
info@stva.tg.ch, www.Road Traffic Dept..tg.ch

TI Road Traffic Dept., Canton of Ticino
Ala Munda, 6528 Camorino
Phone 091 814 91 11, Fax 091 814 91 09
di-sc@ti.ch, www.ti.ch/circolazione

UR Road Traffic and Water Transport Office,
Canton of Uri
Gotthardstrasse 77a, 6460 Altdorf
Phone 041 875 22 44, Fax 041 875 28 05
www.ur.ch/assv

VD Road Traffic and Water Transport Office,
Canton of 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 Road Traffic and Water Transport Office,
Canton of Valais
Avenue de France 71, 1950 Sion
Phone 027 606 71 00, Fax 027 606 71 04
www.vs.ch/autos

ZG Road Traffic Dept., Canton of Zug
Hinterbergstrasse 41, 6312 Steinhausen
Phone 041 728 47 11, Fax 041 728 47 27
info.stva@sd.zg.ch, www.zug.ch/behoerden

ZH Road Traffic Dept., Canton of Zurich
Uetlibergstrasse 301, 8036 Zurich
Phone 058 811 30 00, Fax 058 811 30 01
info@stva.zh.ch, www.stva.zh.ch

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