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STRATEGIC DIRECTION SESSION ST1

**CHALLENGES FOR THE SUSTAINABLE
DEVELOPMENT OF ROAD SYSTEMS**

Swiss Federal Roads Office
www.astra.admin.ch

1. INTRODUCTION

The Swiss Confederation is implementing major changes concerning the financing of roads infrastructures. This fits into the reorganization of the tasks distribution and the financial equalization concerning many areas. This report only deals with the consequences affecting the roads network.

The agreed basic principle is to let the Confederation take over all the national roads (mainly motorways).

The first part of the report describes the overall impact of this project on the way roads are financed.

This is associated with the implementation of a new traffic control system which, at its national level, is to be entirely managed by the Confederation. This subject will be dealt with in chapter three.

On the other hand, along with this new financial equalization and tasks distribution, the Confederation has set up an infrastructure fund as a new financing tool for roads. But although national roads are the targeted beneficiaries of this fund, it will also be used for cities, main regional roads and mountain areas.

2. THE REORGANIZATION OF THE FINANCIAL EQUALIZATION AND TASKS DISTRIBUTION (RFET) AND ITS CONSEQUENCES ON THE SWISS FEDERAL ROADS OFFICE (FEDRO)

2.1. The Swiss financial equalization – Cornerstone of federalism

The financial equalization is a major cornerstone of cohesion in Swiss federalism. It mainly serves to balance the different financial capacities of the cantons. For this purpose, a vertical financial adjustment is applied, i.e. the Confederation, as upper-level community, supports the cantons as subordinated communities. Three different measures are available: first, quotas from the federal receipts are allocated to the cantons; secondly, cantons are subsidized for operating costs or investments; thirdly, some tasks are transferred from the cantons onto the Confederation.

2.2. Increasing costs and duplicated tasks – a new start is needed

In 1958 the financial equalization was introduced into the Constitution. But although the federal payments to the cantons have greatly increased since then – in 2000, they amounted to one fourth of all the Federal expenses – the financial differences between the cantons could not be leveled out, especially those related to fiscal charges.

In 1991, the flaws of the financial equalization system became obvious. Therefore, in 1994, thirteen years ago, the reorganization of the financial equalization and tasks distribution (RFET) between the Confederation and cantons was tackled.

The main goals of the RFET comprise reducing the differences between financially strong and financially weak cantons, as well as the creation of more efficient and more economical structures for co-operation between the Confederation and cantons. In order to increase the scope of action of the cantons, these should have freer means at their

disposal instead of project-tied contributions. Besides, the Confederation should pay off special expenses not only due to the topography of the mountain areas, but also those caused by social-demographical reasons in center cantons.

On November 28th 2004, the RFET – and thus one of the largest and most important reform projects of Swiss federalism – was accepted at a Swiss national vote with 64,4% of yes-votes.

2.3. Consequences of the RFET on the Swiss Federal Roads Office (FEDRO)

Soon after the launch of the overall RFET project, the road system appeared to become a cornerstone of the project. National roads involve, up till now, a partnership between the Confederation and cantons. The cantons are owners, contracting authorities and operators of their road networks. However, the major part of financing comes from the Confederation (the Federal funds amount in average to 87% of construction costs and heavy maintenance, and 67% of regular operating maintenance).

The national road management system in effect so far entails cost increases and tasks duplication. Especially as cantons would feel themselves driven to neglect tasks which they deem important for them, and instead tend to prioritize those which released federal subsidies.

Starting from January 1st 2008, the RFET transfers to the Confederation the full responsibility for the national road network, both the task execution as well as financing. Thus enforcing the following principle: He who pays must be fully responsible for the task and must be granted the appropriate authority.

This authority shift from the cantons to the Confederation means that the Confederation will actually fulfill the functions of owner and contracting authority for the national roads. This also includes: specifying projects requirements; managing projects carried out by third parties; establishing the requirements for planning and construction works; managing bids; deciding on assignments and negotiating contracts; controlling management (audits) at all levels; following-up of the building sites; taking delivery of the works and monitoring tasks under guarantee.

In the scope of these additional tasks, the Swiss Federal Roads Office (FEDRO) must reorganize, structure and strengthen its human resources. The plans are that today's budget for some 170 employees will increase to reach over 400 employees.

The FEDRO is in the lucky situation not to have to start recruiting from scratch; it can resort to highly qualified specialists from the cantonal roads offices. Because the new organization cuts off certain tasks from the cantons, like for instance the task of contracting authority, this will free up human resources. It is agreed upon with the cantons that their employees will have priority as the FEDRO needs to hire personnel. However in the long term, the FEDRO will need fewer personnel for the national roads than there is presently in all the cantons.

2.4. The FEDRO sets up five affiliates

The FEDRO experiences drastic changes, and not only in terms of human resources. In order to achieve its new tasks, the Federal Office for Roads creates five branches. The competencies are carefully divided between the head office and the five regional offices,

each with 25 to 45 employees. The branch areas are geographically defined and the branch locations are selected in such a way that on the one hand a fair local proximity facilitates the tasks fulfillment and on the other hand a sufficient volume of commitments allows an economically efficient work.

The branches will be in charge of managing projects and will thus exert the traditional functions of contracting authority, but they will be also in charge of management controlling through the responsible organizations. On the other hand, the following strategic activities fall on the head office: defining the national roads network (type, size, capacity), specifying the technical requirements, ensuring the financing as well as controlling the access and use of the network.

Today the cantons take care of the roads operating maintenance within their borders. Under the RFET, the whole network is divided into 11 zones called "territorial units". It is expected that the cantons sharing the same territorial unit will come together within a responsible organization which will achieve this task (maintenance) by means of service agreements on behalf of the Confederation. Besides operating maintenance, the responsible organizations should also be in charge of heavier, non project-related maintenance, in other words, building work which can be completed without expensive planning costs and with rather modest financial means.

2.5. Transfer of competencies concerning traffic management

The responsibility for traffic management lies at present primarily with the cantons and, depending upon cantons, is shared between civil engineers and the police. The RFET also grants more authority to the Confederation in this regard, but limited to the national roads network. Traffic management includes directing and controlling the traffic as well as dispatching motoring information. For this purpose the Confederation will develop a traffic management center, a traffic data center and a motoring information center.

The FEDRO is currently acquiring surfaces necessary to the seat of the Head Office, proceeding to the installation and furnishing of the buildings for its five branches and gradually hiring additional personnel, so that the Office can be operational with its new tasks for the scheduled date when the RPT is up and running – probably on 1 January 2008.

3. THE SWISS TRANSPORT MASTERPLAN ITS-CH 2012 AND THE TRAFFIC MANAGEMENT PROJECT VM-CH

3.1. The ITS-CH 2012 Transport Telematics Master Plan

3.1.1. Using transport telematics in support of traffic management

The ITS-CH 2012 Master Plan defines the ideal situation for the distant future, with 2012 the approximate timeline. It shows how the use of transport telematic applications on public roads can help fulfill the transport policy goals of the Federal Department of the Environment, Transport, Energy and Communications (DETEC), and defines what the Confederation has to provide in the longer term in terms of road transport telematics. ITS stands for "Intelligent Transport Systems" and is the internationally recognized acronym for transport telematics. Under the Master Plan:

- the Confederation coordinates – insofar as national interests are involved – the transport telematics activities of the cantons, cities, districts and individuals;
- the Confederation ensures the establishment of national road traffic management, the main functions of which are network management, traffic routing, traffic regulation and traffic information;
- the Confederation provides support for multimodal traffic information;
- the Confederation sets the requisite framework and establishes the necessary conditions (standardization, etc.) for the deployment, maintenance and operation of transport telematic systems;
- the Confederation may participate in the development and testing of transport telematic applications, insofar as they contribute to sustainable mobility as defined in the Confederation's goals.

3.1.2. Scope of the Master Plan

The Master Plan's *geographical* scope is the entire territory of Switzerland (including its integration into international transportation, communication and information networks). In terms of *jurisdiction*, the master plan covers the Confederation's areas of authority as defined by national law and describes national traffic management tasks, including the provision of national traffic information (on construction, maintenance and operation) and activities to support and enable multimodal traffic information. It also describes the Confederation's role in the application of transport telematic systems to improve traffic safety, protect the environment and collect fees electronically.

As it relates to traffic, the Master Plan covers traffic on public roads used by motor vehicles, including public transportation by road (tram and bus), non-motorized traffic and pedestrians, and rail traffic insofar as information services relating to several transport operators are concerned. VM-CH, on the other hand, is limited to national roads.

In terms of *equipment*, the Master Plan considers the installation, maintenance and operation of information and communication technology-related equipment in vehicles, on public roads and in central facilities.

3.1.3. The RFET as a prerequisite for the implementation of the Master Plan

Under the RFET, as of 1 January 2008 the Confederation will bear sole financial and implementing responsibility for the construction (except as concerns the network already decided on), upgrade, maintenance and operation of the about 2000 km of national roads. Operating the national roads includes not only operational maintenance but also traffic management, which comprises network management, traffic routing and traffic information. Under the RFET, traffic management must be operational in Switzerland when the RFET enters into force on 1 January 2008.

The RFET is thus an important prerequisite for the implementation of the ITS-CH 2012 Master Plan. It lays the legal groundwork for the VM-CH project. Under the planned revision of the Road Traffic Act, traffic on national roads will in future be managed by the Confederation irrespective of cantonal borders. In this respect, a distinction must be made between the traffic management tasks that fall to the Confederation as the national road operator and the enforcements tasks (enforcement of traffic regulations) that fall to the cantonal police authorities.

3.1.4. Amendments to the Road Traffic Act

One consequence of the RFET is that several articles of the Road Traffic Act have been amended.

By virtue of its newly assigned tasks, the Confederation is responsible for traffic management on national roads. This means that it will establish and operate a national data exchange and a national traffic management centre. It will provide traffic information for road users, the cantons and the operators of other modes of transportation). The Confederation is not obliged to perform these tasks and functions itself; it may delegate them to the cantons or to others, as the case may be.

The cantons and the operators of other modes of transportation must be able to take part in the VDV-CH and in traffic information. This will allow for nationwide synergies that further justify the costs incurred. The Confederation is responsible for financing the system.

The Confederation is responsible for traffic management on the national roads, but the cantons are responsible for secondary roads, even those that are relevant to traffic management on national roads. The cantons draw up the relevant VMPs, which are approved by the Confederation.

As part of their enforcement duties, the cantonal police authorities are responsible for controlling heavy goods vehicles (HGV) on all roads, including national roads.

3.2. The Traffic Management Project VM-CH

The purpose of FEDRO's Traffic Management Switzerland (VM-CH) project is to give effect to basic components of the ITS-CH 2012 Master Plan and to take advantage of the opportunities afforded by the new RFET legal framework. The strategic goal is to be in a position to implement VM-CH by 1 January 2008 on the basis of the legal principles then in force.

VM-CH was drawn up on the basis of the ITS-CH 2012 vision, on the one hand, and the situation as it stood in 2005, on the other. The target situation for 2012 had to be formulated and a baseline situation for 2008 conceptualized in the light of what was feasible from the legal, technical and financial points of view and of the framework conditions defined by existing systems and structures. The baseline situation encompasses the traffic management functions to be implemented in 2006 and 2007 with a view to the initial implementation of VM-CH in 2008 and that will therefore subsequently serve to take further action towards the 2012 target situation.

3.2.1. The 2008 baseline situation

For the 2008 baseline situation, the following basic requirements must be met and part projects implemented:

(1) General FEDRO requirements such as action principles

The basic requirements include general FEDRO requirements. These are binding written provisions relating to national road traffic management planning and operational processes. They comprise in particular:

- the principles for defining the content of VMPs and of the ad hoc measures to be taken;
- instructions on how to establish VMPs;
- guidelines for ensuring that traffic information is consistent, and handbooks for cooperation between the partners in the various processes.

(2) Technical and other standards and guidelines

The basic requirements also comprise:

- technical and other standards for the system's harmonization, such as Swiss traffic management and transport telematics standards (SN);
- guidelines on the use of pull-off lanes (currently being drafted by FEDRO), variable message displays, etc;
- quality standards for traffic data.

(3) Monitoring traffic quality using on-line data

The VMZ-CH will use on-line data to monitor the quality of traffic on the entire national road network, thus laying the analytical groundwork for unified traffic management over a large area. This is the only means of routing and regulating traffic correctly and reliably over large distances.

(4) Calculating travel times

Travel times for all traffic will be calculated by advanced detection techniques. A comparison between the resulting travel times and those obtained when traffic is unhindered will lead to more accurate assessments of traffic quality and help detect incidents, thereby enhancing the quality of traffic information. This technology is compatible with data protection concerns, in that the data remain anonymous.

(5) Video streaming

In order to monitor traffic at key points on the national road network and to consolidate the traffic overview generated from the on-line counters and traffic information, the VMZ-CH will have access to selected video images. The technology selected – video streaming – combines the advantage of moving video images (with a slight time lag and somewhat poorer picture quality) with a reduced need for bandwidth.

(6) Traffic information of uniform quality

In order to supplement police and other traffic reports, systematically collected on-line data (see point 3 above) will be used to generate more reliable traffic information of uniform quality. Information will also be provided as required on recommended detours. Traffic information pertaining to the national road network will be purchased from content providers via service agreements or directly generated within the VMZ-CH. It will be communicated to road users via service providers.

(7) VM for construction sites and operational maintenance

Road Maintenance Management Tools are used for the systematic and optimal planning and management of traffic around road works. Those in charge of the Road maintenance Planning will have a designated technical planner in the VMZ-CH, and will also be able to

rely on standardised processes and instruments and make efficient use of nationwide experience.

(8) Action Principles for operation and Traffic management plans (VMP)

Operational traffic management is guided by generally applicable action principles that are to be implemented by all those responsible for national road traffic management.

The action principles:

- are designed to enhance network safety, capacity and reliability;
- describe the relationship with traffic demand in the light of national road capacity, reliability and / or safety and are therefore a key component of VM-CH;
- serve as a generally valid basis on which to establish the content of VMPs for specific places and foreseeable incidents on the national roads and relevant road network;
- serve as a generally valid basis for decisions concerning ad hoc measures on high-capacity roads and on the relevant road network. An estimated 75% of VM measures are ad hoc measures.

Based on the Action Principles the Traffic management plans provide pre-determined instructions for the action to be taken when a specific event occurs, in particular a foreseeable incident for which plans can be made, on certain network segments. They specify the steps to be taken once the incident has occurred and how the players involved are to communicate and in what order. As a rule, VMPs are detailed and specific enough to allow for automated or part-automated processes.

VMPs thus lay the groundwork for the operational decision, using on-line data, to activate devices such as variable signals, variable direction signs and variable message displays, and to provide further information.

The 2008 baseline situation covers all national and international VMPs throughout Switzerland. The VMPs are drawn up by FEDRO and decided on by the VMZ-CH. For technical reasons, however, they are implemented for the most part by cantonal routing units (KLZ). After 2008 responsibility for implementing VMPs can gradually be transferred from the KLZs to the VMZ-Rs or the VMZ-CH.

Local / regional VMPs will be developed for heavily traveled sections of road in the entire area comprising the national road network and the relevant network; the existing operational conditions of the cantons will be reviewed to that end. The cantonal VMPs for the relevant network are approved by the Confederation. The VMPs will be established in close agreement with the cantons).

(9) The north-south axis: Motorway A2 Basel-Chiasso

VM-CH functions along the north-south Transit Motorway A2 will be incorporated into the VMZ-CH as required for the purposes of central management and whenever technically feasible by 2008.

(10) Traffic data exchange (VDV-CH)

The traffic data exchange (VDV-CH) is the communication infrastructure backbone of all VM-CH partners. It will be built on tried and tested internet technology. The physical infrastructure will be rented from providers and will be protected from unauthorized external access by virtual private network (VPN) technology.

(11) Organization and the VMZ-CH

The VMZ-CH has overall responsibility for monitoring and routing traffic on the national road network, using appropriate means of visualization, management tools and service systems. The VMZ-CH can thus scan the traffic situation on the entire national road network using different types of access and manage, route and regulate traffic on the national road network indirectly or directly. In particular, it can activate national/international VMPs on the basis of comprehensive, real-time information on the traffic situation. The aim is to distribute tasks between the various players as per the 2012 target situation as early as 2008.

3.2.2. The 2012 target situation

The 2012 target situation requires that the 2008 situation be further developed as follows:

- further centralization of operational traffic management,
- general refinement of the content of VM functions in the light of experience;
- physical expansion, in response to the worsening situation at problem points, of the area in which individual VM functions are applied on the national road network;
- further automatisation using telematics systems, as called for by experience and technical developments.

Glossary and abbreviations

KLZ (VM)	Cantonal routing unit (with VM functions): only KLZs with operational traffic management functions are involved. The KLZ's service personnel are responsible for traffic-influencing measures within a prescribed area (usually the territory of a canton). KLZs are equipped with the necessary technical facilities (work stations, display monitors, counters, data storage units and a connection to the VDV-CH) and are housed in a building (with a specific postal address). Depending on the range of tasks they are given, individual KLZs may be designated as police intervention centres, operations centres, alarm centres, etc.
FCD	Floating Car Data (traffic data on movements collected from individual vehicles)
Relevant network	Network of relevance for national road VM: these are essentially cantonal, in some instances city or district, and, as in the case of the Grand St. Bernard tunnel, private main roads that have a strong mutual influence on national roads, in particular when an incident occurs.
VMZ-R	Regional Traffic Management Centre: VMZ-R staff are responsible for traffic-influencing measures on the national road network within the area (region) covered by the VMZ-R. The VMZ-R is equipped with the necessary technical facilities (work stations, display monitors, counters, data storage units and a connection to the VDV-CH).
VDV-CH	VM-CH traffic data exchange
VI-CH	VM-CH traffic information on the national road network and the relevant network
VIZ-CH	VM-CH traffic information centre
VM	See Traffic management
VMP	See Traffic management plan
VM-CH	Traffic Management Switzerland. This is understood to refer to traffic management on the Swiss national road network and on the relevant network.

VMZ-CH	Swiss Traffic Management Centre (also known as the National Traffic Management Centre): VMZ-CH service staff is responsible for traffic-influencing measures on the Swiss national road network. The VMZ-CH is equipped with the necessary technical facilities (work stations, display monitors, counters, data storage units and a connection to the VDV-CH). Some of the VMZ-CH's tasks may be delegated to an VMZ-R within the framework of a management or manager concept.
Traffic management (VM)	All planning, technical, organizational and legal measures aimed at ensuring optimal traffic flows in time and space for users, operators and other parties.
Traffic management plan (VMP)	Traffic management plans stipulate the action and measures to be taken, who has the authority to take them and in what order, in respect of traffic incidents related to specific places or events.
TUZ	Technical subcentre (not part of VM-CH, listed for the sake of completeness)

4. INFRASTRUCTURE FUND

4.1. Current system

4.1.1. Income (origin of resources)

The Confederation collects the following incomes related to road traffic:

Income (2004)	Million CHF	Available for roads
Net revenue from oil tax	2'926	1'463
Oil tax surcharge on motor fuels	1'979	1'979
Customs duties on imported motor vehicles	235	–
Motorway stickers	274	274
Performance-related Heavy-Vehicle Fee	694	–
Portion of the VAT	77	–
Total	6'185	3'716

A large part of the income is tied to specific assignments. This is credited to the Special Financing for Road Traffic (SFRT) and entered with the expenditures.

The SFRT is a financial account of the Confederation. It is a dependant fund which is credited with the project-tied incomes and debited with the road expenditures. The purpose of the SFRT is to compare the traffic-tied contributions against the amounts actually spent in favor of traffic. Income surplus from the oil tax is credited to the SFRT and exceeding expenses are debited from it. This should ensure a sustainable financing of these tasks.

4.1.2. Expenditure (allocation of resources)

Resources are allocated as follows:

Expenditure (2004)	Million CHF
National roads	2'106
Main roads	195
Technical measures (587 million CHF for combined transport and NEAT)	745
Non-technical measures	497
Administration	39
Total	3'582

As expenditure shows, national roads represent its major part. An income surplus of CHF 135 million was credited to the Special Financing for Road Traffic account (reserves).

Income having exceeded the expenditure in the course of these last years, the reserves of the SFRT have steadily increased. These are expected to reach approximately 4.3 billion CHF by the end of 2007.

4.2. Amendment motivated by current issues

Delayed completion of the network due to the financial situation of the Confederation: in spite of the theoretical income surplus obtained by the SFRT during the last years, these amounts have not been actually completely available. Indeed, the shortage of federal resources contributed, among others, to financial cuts in expenditure for national roads and income was allocated differently.

The functionality of the national roads network is in danger: the growth of the traffic creates bottlenecks in trouble spots of the national roads network. If specific means are not urgently released to contend this issue, the entire network runs the risk to fail being functional.

Aggravating traffic problems in populated areas: the ever-increasing traffic volume causes more and more problems in the cities and urban areas, resulting in traffic-jams. Still, cities do not have sufficient financial means to solve these local and regional problems that have a direct negative impact on the main road and railway networks.

4.3. The infrastructure fund

4.3.1. Objectives

The infrastructure fund is intended to solve the current issues by pursuing the following goals:

- Consolidate planning and financing
- Ensure long-term financing
- Create new resources for the urban traffic, including non road-oriented traffic
- Set priorities for the allocation of the limited resources
- Reduce the reserves of the Special Financing for Road Traffic

4.3.2. Allocation

The infrastructure fund sets priorities at the national level in the roads sector : the purpose is to complete the construction of the national roads network, eliminate the bottlenecks and improve traffic infrastructure (including public transport) in the cities. The Parliament has planned the following contributions to reach this goal:

Task / purpose	CHF
Completion of the national roads network	8,5 billion
Elimination of bottlenecks in the national roads network	5,5 billion
Improvement of the transport infrastructure in the urban areas	6,0 billion
Subsidizing main roads in mountain areas and outlying regions	0,8 billion
Total (2008–2027)	20,8 billion

The infrastructure fund will thus make resources from the SFRT available for projects in the cities and urban areas, concerning roads as well as public transportation.

4.3.3. Financing of the infrastructure fund

The infrastructure fund will be fed by project-tied contributions drawn from the oil tax and the motorway stickers. A first income of 2.6 billion CHF is granted using the reserves of the SFRT. Since the major part of these amounts is actually a federal “debt” contracted in favor of the SFRT, the Confederation will have to take the necessary resources out of its treasury or on the money market.

For the remainder, the fund will then be fed by annual contributions from the SFRT (and thus from project-tied incomes). According to current forecasts, these will amount to approximately 1 billion CHF. When creating the fund, the Parliament decided to endow it with a total credit of 20.8 billion CHF.

The infrastructure fund should not be involved in debt. Its duration is limited to twenty years.

4.3.4. External financing of the fund

The infrastructure fund is based on a reorganization of the FSRT. It will be used to finance the completion of the roads network, the guarantee of its functionality and a selection of city traffic projects, whereas the FSRT will remain in charge of the operating tasks, maintenance and refitting of these roads as well as the subsidizing of the main roads and the technical and non-technical contributions.

4.4. Main figures concerning the national and main roads network (2005)

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|---|----------|
| • National roads operational on Dec. 31 st | 1,758 km |
| • National roads to be completed | 134 km |
| • Number of tunnels in the national roads network | ≈ 200 |
| • Number of bridges in the national roads network | ≈ 3,000 |
| • Main roads | 2,282 km |