DESIRE

Designs for **I**nterurban **R**oad pricing schemes in **E**urope

Contract number: **2000 – CM.10501**

Project number: **2000 – 10501**

Project acronym: **DESIRE**

WP 3: Case Studies

Task 3.2: Case Study Switzerland

Prefinal version

Authors: **Andrea Felix, René Neuenschwander**

Task Leader: **RAPP AG**

Partners **RAPP AG, ECOPLAN**

Version: **V 4.0**

Date: **13/02/2002**

Project funded by the European Community under the "Competitive and Sustainable Growth" Programme (1998-2002)

Table of Contents

Abbreviations

Abbr.

Meaning

ATT

Alpine Transit Toll

BALT

Bilateral Agreement on Land Transport

CARDME

Concerted Action for Research on Demand management in Europe

CEN

Comité européen de normalisation

DETEC (UVEK)

Federal Department of Environment, Transport, Energy and Communication

DESIRE

Designs for Interurban Road pricing schemes in Europe

DSRC

Dedicated Short Range Communication

EFC

Electronic Fee Collection

FCA (OZD)

Federal Customs Administration - Oberzolldirektion

FEDRO (ASTRA)

Federal Road Office - Bundesamt für Strassen

GPS

Global Positioning System

HGV

Heavy Goods Vehicle

IRPS
Inter-urban Road Pricing

LCV
Light commercial vehicles

LSVA
Leistungsabhängige Schwerverkehrsabgabe

LVC
Long vehicles counters

MLW
Maximum loaden weight

NEAT
Neue Alpen Transversale (see also NRLA)

NRLA
New Rail Link through the Alps

OBU
On Board Unit

SBB
Swiss Federal Railway – Schweizerische Bundesbahnen

SCA (EZV)
Swiss Costumes Authority – Eidgenössische Zollverwaltung

SFSO (BFS)
Swiss Federal Statistical Office

SSM
Self-Service Machine

SVG
Strassenverkehrsgesetz

SVAG

Schwerverkerhsabgabegesetz

SVAV

Schwerverkerhsabgabeverordnung

TERN

Trans-European Road Network

UKV

Unaccompanied combined transport (Unbegleiteter kombinierter Verkehr)

VRV

Verkehrsregelnverordnung

VSAI

Vereinigung schweizerischer Automobilimporteure – Swiss association of vehicle importers

WIM

Weight In Motion

Index of Figures and Tables

Index of Tables

Executive Summary

INTRODUCTION AND BACKGROUND

Objectives and main pillars of the Swiss transport policy today

The actual Swiss transport policy can be summarised as follows:

- **Harmonisation with Europe:** Realise the bilateral agreements (including the Land Transport Agreement) between the EU and Switzerland, improve connections with Trans-European network, harmonise the standards. With the **Land Transport Agreement**, the EU member states recognize Switzerland's aim of shifting goods from road to rail and the related instruments, in particular the distance-related Heavy Vehicle Fee LSVA.
- **Greater emphasis on cost allocation and fair charging:** Introduction of the distance related heavy vehicle fee LSVA. In September 1998, the people voted in favour of the introduction of a distance-related Heavy Vehicle Fee (LSVA). This implements the polluter pays principle and ensures that road haulage reflects the true costs.
- **Modern rail infrastructure:** In November 1998, the people and Cantons approved the modernization of the railway infrastructure. With investments of around 30 billion francs, the first and second stages of „Bahn 2000" (Rail 2000), the NEAT-Network with two new base tunnels through the Gotthard and the Lötschberg, the connection of east and west Switzerland to the European high speed rail network and the noise reduction measures on Swiss railways will be completed over the next 20 years.
- **Efficient rail service:** Implement fully the railway reform and prepare additional steps towards more rail competition. Use optimally the existing railway capacity. In March 1998, parliament passed the railway reform. It entered into force on 1st January 1999 and brings competition into the Swiss railway system. The railways now have the necessary flexibility and entrepreneurial freedom to enable them to compete with road transport in the future transport market.
- **Protecting the Alps:** Provide attractive rail services, especially for transalpine goods transport and therefore support unaccompanied combined transport and the Rolling Highway.
- **Maintaining a high-performance road system:** Completion of the motorway network and increase maintenance, propose solutions to avoid congestion on saturated motorway sections. The Federal Roads Office develops therefore a national road transport and traffic telematics strategy.
- **Solve traffic problems in urban areas:** The actual financing of (public) urban transport is questioned. Agglomerations ask for a stronger involvement of the Federal level. New infrastructure may be necessary to avoid congestion but possibly in combination with new financing mechanisms (urban road pricing).
- **Qualitative progress in air transport:** Liberalise market access and support a sustainable aviation infrastructure (including the 5th stage of extension of Zurich airport).
- **More stringent use of resources:** Continue the programme Energy 2000, introduce stricter exhaust requirements, co-ordinate better with land use planning.

Present state of affairs

On January 1st, 2001 the distance-related Swiss Heavy Vehicle Fee LSVA replaced the existing flat-rate heavy traffic tax and covers all heavy vehicles over 3.5 tonnes carrying either goods or passengers.

Being the first nation-wide implementation of a kilometre charging Electronic Fee Collection (EFC) system, the LSVA marks a major step towards fair and efficient road pricing.

The collection system for the Swiss LSVA has successfully started operation. Overall, the timely start proceeded without major technical or organisational problems.

Taxation and financing of roads

The Confederation makes considerable financial contributions to the road network: these are mainly towards investments in the construction and maintenance of the national roads and the construction of main roads. It also contributes to the operation of the national road network. The remaining road network costs are borne by the cantons and the municipalities. The Confederation is financing around 87% of the total cost of the motorway network, the remaining cost are financed by the Cantons.

Revenue and expenditure for construction and maintenance of the road network are summarised in the Highways Account, which is published annually. In 2000, 3.387 billion CHF were spent on the Swiss road network. The revenue required comes principally from contributions made by road users.

The funds for the construction, maintenance and operation of the national roads derive from earmarked special financing fed from the following sources:

- Half of the gross revenue from fuel taxes;
- The entire surtax charged on fuels;
- The former flat-rate heavy vehicle tax;
- Revenue from motorway tolls for private cars (vignette).

DETAILS OF LSVA SYSTEM

In the following table the essentials of the collection system for the Swiss Heavy vehicle fee LSVA are summarised:

Objectives of systems	– Demand Management – Reduce Alpine Transit Traffic – Achieve a Modal Shift from Road to Rail
Pricing scheme	Area Tolling
Subject of the fee	The LSVA applies to all domestic and foreign heavy vehicles and trailers for goods or passenger transport with a maximum laden weight in excess of 3.5t.
Basis for assessment	The LSVA will be levied according to the following main criteria: – the number of kilometres covered on all public roads in Switzerland – the maximum permissible laden weight – the emission category of the heavy goods vehicle The tariff depends on the emission values of the vehicle.
Liable person	The registered owner of a vehicle - with foreign vehicles additionally the driver - is liable to the tax. The responsibility for the declaration and for the proper function of the equipment is with the liable person.
Recording of the fee base	The fee collection is based on the principle of self-declaration. The liable person is obliged to actively participate. For domestic vehicles the installation of an on-board unit is mandatory. Foreign vehicles can optionally be equipped with an OBU. Foreign vehicles basically are using a ticket fetched at self-service machines.
Tariff	For the years 2001 – 2004 the following values are applicable: – Fee category 1: (Emission class Euro 0) 2.0 cts. per tonne-kilometre – Fee category 2: (Emission class Euro I) 1.68 cts. per tonne-kilometre – Fee category 3: (Emission classes Euro II and III) 1.42 cts. per tonne-kilometre For 2005 the Federal council will set new rates, taking technical developments into account. The maximum rate is fixed by 2.75 cts. per tonne-kilometre.
Special regulations	For the following vehicles and types of transport there are special regulations: – Travel in unaccompanied combined traffic, road/rail or road/ship (Unbegleiteter kombinierter Verkehr; UKV) – Transport of logs/raw wood – Transport of unpacked milk and livestock from agriculture
Exceptions	Coaches, motor homes, and industrial or communal tractors and service vehicles pay a flat fee (no distance relationship). Agricultural and public transport vehicles, ambulances and vehicles of the armed forces, of the police, etc. are completely exempt from the LSVA. The LSVA ordinances foresee further flat-rate exceptions and total exemptions.

Political process and acceptance of the Swiss LSVA

The LSVA cleared its final political hurdle in September 1998 with a surprisingly large mandate: 57% of Swiss citizens voted for the new fee. This was the successful completion of a 20-year marathon.

The success of the LSVA is due to an extraordinary situation, a unique window of political opportunity, where environmental considerations (avoid lorry transit) were combined with transport and regional considerations (assure the finance for NRLA) and economical and political arguments (avoid opposition against the agreements Switzerland/EU). Last but not least, the success is also due to the fact that HGV taxation and the problem of the external costs of transport have been on the agenda for a long time and people got familiar with it.

Institutional solution

The Swiss Customs Administration (Eidgenössische Oberzolldirektion, OZD) was in charge of the implementation of the LSVA and operates now the system as well.

The levy of the LSVA is embedded in the normal customs procedures at the border. Intensive training of the personal and instruction material was necessary for a smoothly implementation of this new task.

Expenses and revenues

Costs of system

The whole planing, development and procurement of equipment and implemention of the LSVA system occurred about 192 Mio. EURO. In this amount 87 Mio EURO for the procurement of the rather costly OBU (about 800 EURO per unit) is included.

The OBU is distributed free of charge to domestic and foreign vehicle owners until 2004. The installation costs of up to about 300 EURO have to be carried by the vehicle owner.

Expected costs of operation and maintenance

The yearly operational costs will be about 16 Mio. €.

In addition, the depreciation of the investments over a period of 7 years amounts to about 12.5 Mio. EURO of yearly amortisation costs.

Expected revenues

Assumed revenues until 2004 when the tariff level can be lifted the first time amounts to 500 – 600 Mio EURO per year.

From 2008 when the highest fee level (2.75 cts / tkm in average) can be charged the assumed revenues will be up to 1000 Mio EURO per year.

Interoperability

Interoperability with other / future EFC systems in Europe was an important prerequisite for the Swiss LSVA system from the outset.

Switzerland therefore pressed actively for the technical implementation of the charging standards to be harmonised: both in the EU coordinatory organ for fee collection in road traffic, CARDME (Concerted Action for Research on Demand management in Europe), and in the European Standardisation Organisation, CEN (Comité européen de normalisation).

The Swiss system is in accordance with the CEN DSRC 5.8 GHz pre-standards. This has created the basis for an option of one-sided interoperability. Basically, the Swiss OBU TRIPON can be used abroad for all systems in accordance with the CEN DSRC 5.8 GHz standards. Contractual agreements and procedural hamonisation are a prerequiste, as is a software update on the TRIPON to accomodate the specific requirements of the foreign fee collection system. On the other hand, foreign devices cannot be used for the LSVA, because some extra functionality is required to allow recording throughout Switzerland (e.g. an electrical interface to the vehicle Tachograph for the registration of the kilometres driven).

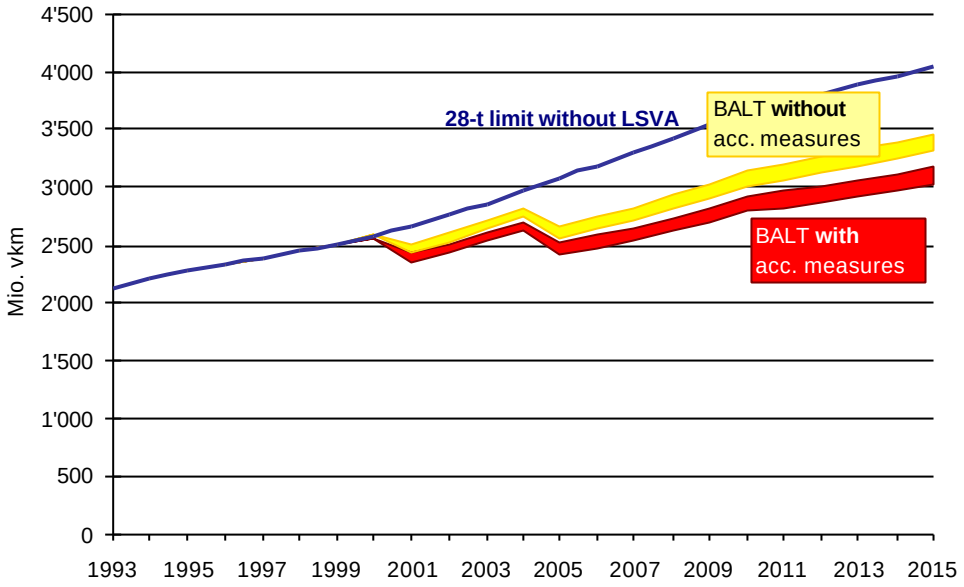
EFFECTS OF THE LSVA

Expected effects

Expected effects on traffic and transport volumes

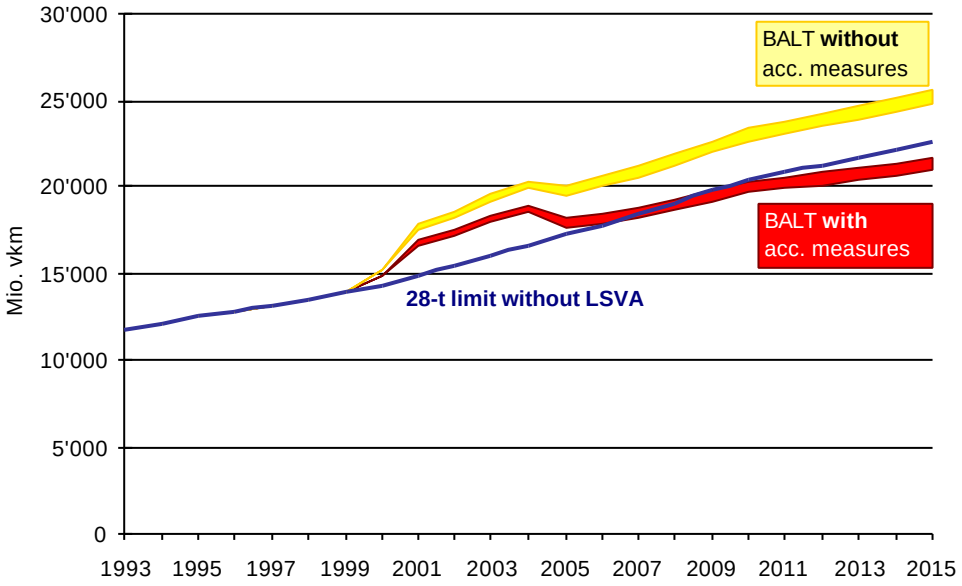
Fehler! Verweisquelle konnte nicht gefunden werden. gives an overview of the estimated effects of the different scenarios on total traffic volume of road freight transport in Switzerland. In the reference scenario a steady growth leads almost to a duplication of traffic volume in the period from 1993 until 2015. Compared to the 'old' transport policy, the BALT-regime brings about a growth stop between 2000 and 2005 and a considerably slower growth in traffic volumes (vkm) in Switzerland until 2015. This environmentally desirable development is independent of the introduction or the success of the accompanying measures in the rail sector. Certainly, traffic volume decreases even more if the measures taken lead to the full expected effect of transferring freight from road to rail. However, in order to protect the Alps from ever growing freight traffic on the Alpine corridors, the success of the accompanying measures are highly important.

Figure 0-1: Total traffic volume of road freight transport (domestic, import/export and transit traffic; Mio. vkm)



The transport volume (tkm) under the BALT-regime temporarily increases compared to the reference scenario. After 2005, however, the transport volume in Switzerland is expected to be roughly the same as in the reference scenario under the assumption of successful accompanying measures. This development reflects the productivity effect made possible by the rise of the weight limit.

Figure 0-2: Total transport volume of road freight transport (domestic, import/export and transit traffic; Mio. tkm)



Expected impacts of the LSVA on the transport sector

a) Adaptations in the road freight transport sector

- The introduction of the LSVA will increases the pressure to rise the payload. In particular empty trips become very expensive. This pressure will strengthen the existing concentration process within the road freight transport sector. Only large companies with 100 lorries or more and with broad internal logistic services are able to produce with a sufficiently high use to capacity of their fleet. As a consequence, the structure of the road freight transport sector will dramatically change: Small haulier companies will disappear to a large part from the market, logistic services are getting more important, and the productivity of the freight transport sector will increase.
- A second effect concerns the structure of the vehicle fleet: The LSVA sets a strong incentive to use "clean" vehicles and thus to renew the fleet. The differentiation of the fee between EURO-classes is sufficiently high to make it profitable in many cases to replace older HGV with new HGV fulfilling the EURO II / III norms. This tendency is strengthened by the adaptation of the weight limit which will rise step by step from 28t to 40t. Additionally, it can be expected that hauliers will optimise the composition of their fleet with respect to the total permitted weight of their HGV.

b) International competitiveness

- Basically, the LSVA will not affect in a noticeable way the international competitiveness of Swiss hauliers: Domestic as well as foreign HGV have to pay exactly the same fee per kilometre driven. This has been predicted for domestic as well as import/export or transit trips.
- Similarly, the LSVA will not affect the choice of location of the haulier companies within Switzerland.
- If other countries in Europe will introduce a distance related pricing scheme for HGV in the future, there may even be a "first-mover advantage" for Swiss hauliers who had to adapt to this new type of charge earlier on.

c) Effects on employment

It is expected that the combined introduction of the LSVA together with a higher national weight limit will reduce employment in the freight transport sector compared to a reference scenario. The main reason is the stepwise increase of the weight limit from 28t to 40t. It has been estimated that in 2010 employment in the hauliers sector will be several 10'000 jobs less compared to the reference scenario (28t limit, night and Sunday ban on driving, former flat HGV tax). But because of the expected general growth in this sector employment will still slightly increase in absolute terms. This loss of jobs is the other side of the expected productivity effect caused by the LSVA and especially by the higher weight limit.

Observed effects during introduction

Procurement process / plan

The procurement processes and tender offers were compliant with WTO-regulations.

All system components, i.e. the on-board units, the DSRC-beacons, background-system, and the enforcement stations have been procured separately. This is a remarkable strategy, since it required a very detailed specification of the one common interface shared by all of these components, namely the CEN/ISO standard 5.8 GHz DSRC link. Such a specification was only possible due to recent advances in DSRC standardisation.

Effects on telematics industry

During and after the implementation, the few effects which could be observed were small in magnitude., e.g. manufactures and suppliers of freight and fleet management increased their advertisement. Much bigger impacts were expected e.g. development of add on equipment etc.

Effects on transport industry

During 2001 considerable effects on the fleet composition could be observed, a huge renewal and change of the Swiss vehicles took place.

The VSAI (Association of Swiss Automobile Importers) sales statistics for the period 1997 to 2000 provide a clue: according to these statistics, the sale of delivery vehicles in 2000 was up by an average of 15 % on previous years (1997 up by 11 %, 1998 up by 19 %). It is therefore not possible to speak of a clear shift from HGV to light commercial vehicles, at least on the basis of new vehicle sales, especially if we consider that the sale of HGVs increased in average by a dramatic 45% in the same year. With this development (which has not continued in 2001 for understandable reasons) the move towards low-emission vehicles fleets suffered a setback. At the same time a clear trend towards heavier vehicles could be observed.

Observed effects during first year after introduction

Observations on traffic and transport volumes

a) Traffic situation in general

During 2001 three problems related to traffic volumes on Swiss roads caused big headlines inside and outside Switzerland:

- On several days during the whole year, the traffic at the border stations of BWA and Chiasso collapsed.
- Similar gridlock occurred on A2 motorway on the transit route over the Gotthard on several days as well.
- Closure of Gotthard tunnel after fire incident on October, 24th

The regular collapse at the motorway border stations had nothing to do with the levy of the LSVA. The border-station of Basel-Weil Autobahn is at the limits of its capacity, handling a daily load of 2000 to 2500 truck transits in the direction of Germany and 1500 to 2000 into Switzerland. The situation in Chiasso is very similar and due to the lack of space for expansion, the possibilities for improvement are limited.

b) Traffic situation at fee collation points on first days of operation

Introduction of the heavy vehicle fee on the first Tuesday of 2001 caused no significant delays or congestion at Swiss customs posts along the country's border.

c) Crossborder traffic in general

Corssborder traffic has generally increased since last year. Exact figures, taking account of the different effects (change of the national weight limit, detour traffic because of congestion at the BWA / shift to smaller border-stations) are not available yet.

In Chiasso 570'000 vehicles crossed the boarder northbound which reflects an increase of 5.8 %, the southbound traffic increased to 396'000 vehicles, which is 8 % more then in the previous year. The average increase in crossborder traffic is about 3-5 %.

d) Detour traffic / shift along the frontiers

Shift along the frontiers

A reduction in the heavy vehicle traffic on the Swiss side of the frontier between Basel and Koblenz was clearly evident. This decrease could be largely traced back to a shift in traffic to the road network north of the Rhine. It is likely, though it cannot yet be proven owing to a lack of counting points, that re-routing effects are also to be found on the south bank of Lake Geneva (certainly insignificant according to information from the customs authority), in the Rhine valley and in Tessin. In relation to the total amount of traffic, however, such shifts are not relevant.

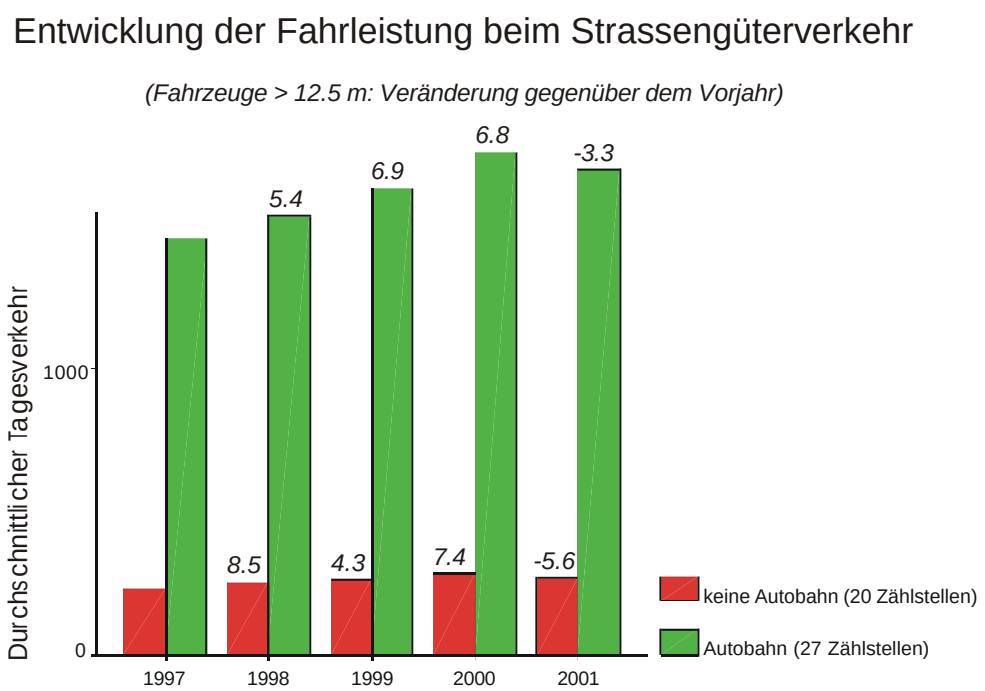
Traffic shift inside the Swiss border

The reduction in traffic revealed at individual counting points can be attributed with a greater or lesser degree of probability to the fact that drivers chose a shorter route. This is clearly apparent, for example, at counting point No 142 at Zofingen, where a decline of 5.4 % was revealed (January to July 2001 compared with January to July 2000). It is highly probable that this effect was the result of drivers choosing a clearly shorter route. In order not to diminish the plausibility of the results of the study, certain counting points, where the fall in traffic was clearly connected to the choice of a shorter route, were not taken into account in the overall assessment. The option - interesting in itself - of including the routes to which the traffic had (presumably) shifted, was unfortunately impossible, owing to a lack of LVCs. With the "by-passed" counting points left out of consideration, as stated, the idea that the trend

towards a reduction in kilometre performance was due to the LSVA was certainly weakened but not refuted. One glance at the traffic counters, which are not installed on motorways, confirms this trend; although the problem of revised itineraries hardly arises in the case of the latter, heavy vehicle traffic tends to be on the decline there as well. Generally speaking, after the "by-passed" traffic counters have been left out of the equation, the results show a fall in kilometre performance of 3.3 % on the motorways and 5.6 % on other roads (see Figure 0-3)

The results of a first assessment of the LVC (Long Vehicles Counters) figures were unequivocal. While traffic in both classes steadily increased between 1997 and 2000, with average growth rates of 6 % for class 4 and around 5 % for class 3, the corresponding period in 2001 saw a clear 4 % decrease in traffic. This provisional finding called for closer analysis. In particular, it was necessary to determine whether the result was influenced by the change in the choice of routes. In fact, closer examination reveals that such change does have certain influence. On the one hand, traffic takes alternative routes along the frontiers, the drivers being prepared to travel slightly longer distances; and on the other hand traffic leaves, or no longer uses, the major road network, as shorter alternative routes are to be found on the minor roads, and by taking them, drivers are able to save on the LSVA.

Figure 0-3: Changes in number of class 4 (>12.5 m) vehicles



[ARE, (2001)]

Fact: In the first year after its introduction, the LSVA has not merely counteracted the trend towards growth in road haulage traffic, it has even produced a slight decrease in kilometre performance across the whole of Switzerland.

e) Traffic situation on transit route Basel – Chiasso

Development January – October 2001[1]

The HGV transit traffic on the Gotthardtunnel route increased last year approximately 8 % on average. About 4600 HGVs passed the Gotthardtunnel daily in January 2001 (working days only, both directions), and by July, this number had grown on peak days to 5500 HGVs.

Observation about shrift from road to rail

Rail / SBB Cargo

According to information from the Swiss Federal Railway (SBB), freight carried by the SBB in the first half of 2001 had the effect of raising transport performance (measured in ton-km) by 1 %. This is no indication of a shift of traffic to rail; the increase in question could have occurred as a result of the greater efficiency achieved in the road transport sector. It is interesting to note the above-average growth of 8.7 % in internal traffic. Since the increase in the national weight limit has played a significantly smaller role in this field than in that of importing/exporting or transit traffic, this growth can be taken as an indication that the LSVA has succeeded in producing more significant effects here.

Use of Rolling Highway (Rollende Landstrasse)

Since the introduction of the LSVA a slight increase has been recognised, but it is quite difficult to detect the extent to which the increased number of transported vehicles is due to the LSVA.

Observation on LSVA collection system

a) System performance

The introduction of the LSVA on January 1, 2001, took place without any problems worth noting. Much to the surprise of many, there was neither increased queuing at the Swiss border stations nor protests or lack of co-operation by drivers.

OBU – TRIPON and DSRC road side equipment

The OBU and DSRC beacons are working to the full satisfaction of the system operator and users. Certainly, there were some minor start-up problems, but no important flaws have been discovered.

More than 50'000 TRIPON have been installed since June 2000. Less than 5 % of OBU's have been returned because of reported problems. Considering the harsh operating environment this represents an excellent figure that exceeds expectations. The failure rate of the DSRC communication is less than 0.1%.

[1] Due to the closure of the Gotthard tunnel from 24.10.2001 until 21.12.2001no figures for this period are available.

Background system

Despite a short background system breakdown lasting about an hour on March 29th, 2001 no significant problems were reported.

Declaration and billing process

Initially billing was 2 months late because at a late stage in the introductory phase it was discovered that the vehicle data in the data base were partially incomplete or incorrect. This required a lot of manual interventions and time consuming clarifications. Since this delay, the system has caught up on the backlog of transactions and all invoices are going out now in time.

b) Exploitation of contingents

Against all exceptions, the contingents for 40-tonne trips relating to unladen vehicles and light loads were not exploited for the year 2001.

c) Enforcement and Security

At the moment no data is available about enforcement and security matters.

Observations at the roadside shows that this proves the efficiency of such simple but effective enforcement tools like the small LCD-lamps of the OBU to show the status of operation and the trailer declaration. It is very rare that trailers are not declared - easy detection and "social" checking mechanisms work to good effect.

d) Special regulations

The handling of the special regulations caused no operational problems. But special regulations offer a certain potential to fraud of the system.

e) Revenues

The revenues for the first year of operation of the LSVA were estimated at 600 Mio EURO (ca. 900 Million CHF).

The effective collected amount for the year 2001 will reach this estimations quite exact. Domestic vehicles generated about 430 - 450 Mio EURO (ca. 650 Million CHF) which is about 70% of the total amount, the revenues of foreign vehicles will be close to 130 Mio. Euro (ca. 200 Million CHF).

These figures include the refunds for UKV and wood transport is not yet considered.

Observed effects on transport industry

a) Fleet composition

The transport industry has adapted the fleet composition to the LSVA tariff: High-emission trucks have been replaced by new low emission vehicles. Also, the vehicle sizes have been adapted to the goods that are regularly transported (e.g. a carrier buying special low weight trucks if he runs a business transporting paper towels). This process has been noticeable well before the start date of the LSVA. In Switzerland the truck sales have been booming in the year 2000.

Regarding the light commercial vehicles the trends are still the same as in the previous years. There was still not a disproportionate increase in imported LCVs in comparison with matriculated LCVs during the year 2000

b) Structure changing and logistics

Freight and fleet management activities have been increased in order to maximise the load factor. The trucking industry has been thoroughly shuffled. Trucking firms have merged or are co-operating in other forms in order to get a better chance for return freights.

In the key information survey interviews it was mentioned, that nearly one third of the small companies have been disappeared or merged. This figure must be verified by more detailed investigations.

c) Increased efficiency

Two indicators suggest that the main reason for the observed growth in kilometre performance is:

- The higher weight limit allows the transport of more goods with a kilometre performance that remains the same or even falls.
- The restructuring that occurred in the run-up to the introduction of the LSVA, together with logistical improvements (freight and fleet management), led to a clear reduction in the number of empty runs.

d) Transport sector / commercial prices

Transport cost has risen with the introduction of the LSVA. Mostly the LSVA is included in the tariffs, very seldom the LSVA is explicitly shown on the invoices.

No significant changes of retail prices could be detected yet. But more detailed investigation are needed.

1 Introduction

On 1st January 2001 the Swiss distance-related Heavy Vehicle Fee LSVA replaced the existing flat-rate heavy traffic fee and covers all heavy vehicles over 3.5 tonnes carrying either goods or passengers.

The LSVA is levied according to the following main criteria:

- the number of kilometres covered on all public roads in Switzerland;
- the maximum permissible laden weight;
- the emission category of the heavy goods vehicle.

Being the first nation-wide implementation of a kilometre charging electronic fee collection system, the distance-related LSVA marks a major progress towards fair and efficient road pricing.

The Swiss Case Study offered the unique opportunity to elaborate a case study covering all phases (pre-analyse, concept phase and implementation) of this interesting project.

Therefore the Swiss case study covers the political process, the legal framework and the technical approach as well as the expected and observed economic and social impacts. Special attention is given to the first practical experiences and effects of the LSVA of the new collection system.

2 National Context

2.1 Introduction and background

2.1.1 Short history of Swiss transport policy

The national transport policy of Switzerland before the 1970s can be characterised by an unsolved state of competition between road and rail. Both modes had their own legislation, infrastructure planning system and financing method. A comprehensive mode integrating co-ordination on the national level was missing. In 1972, the Federal council recognised the necessity of a new approach and commissioned the elaboration of a Swiss overall transport concept (GVK-CH[2]). In 1977, this concept was completed. It postulated four new main principles:

- Co-ordination and planning (the extension of the road and rail network should be better co-ordinated and based on general objectives of transport policy);
- Long term cost recovery (first mentioning of user pays principle to cover the social cost of transport);
- Effective division of tasks between road and rail (clear division of responsibilities and competence between the federal, cantonal and municipal institutional level);
- Guaranteeing the financing (creating a fund to finance public transport, financing roads from excise taxes and user charges).

In the 1988 referendum on the “Principles of a co-ordinated transport policy”, the Swiss people decided against these new principles and their integration in the Constitution. Nevertheless, the transport policy discussion of the 1980s and 90s was largely influenced by the proposals of the overall transport concept. This influence is reflected within the priorities of action that were defined by the federal government at the beginning of the 1990s:

- Improvement of the transport system, especially of public transport (realisation of the concepts Rail 2000 and AlpTransit, completion of the motorway network, support of transport in agglomerations);
- More market economy and measures to support the user-pays principle (prolongation and new design of the heavy vehicle charge, examination of the financing mechanisms of public transport, liberalisation of air traffic, CO_2-charge);
- Technical and control measures in order to support a more environment-friendly transport system;

[2] GVK-CH : Gesamtverkehrskonzeption Schweiz.

These three priorities were in the centre of the political discussion during the 90s. Their influence is reflected in several important public votes on the future transport policy of Switzerland, as for example the approval of the new transalpine rail tunnels (1992/1998), the rising of the fuel excise taxes (1993), the “Alpeninitiative” (1994) which limited the transalpine traffic with HGV and, of course, the approval of the Swiss Heavy Vehicle Fee LSVA (1994/1998).

Thereby, the discussion and provision of estimates of external costs of transport played a role not to be underestimated. For instance, the level of the future mileage dependent heavy vehicle fee was strongly influenced by existing estimates of external costs of road freight transport. In chapter 3.2.2 we summarise the Swiss tradition of monetary valuation of external effects of transport.

2.1.2 Objectives and main pillars of the Swiss transport policy today

At the end of 1999 the Federal Department of Environment, Transport, Energy and Communication (DETEC) formulated a new Department strategy. This strategy confirms the approach of the last 20 years to co-ordinate transport policy between modes and goes a step further as the notion of sustainable transport policy moves in the centre of interest. For the transport sector the strategy formulates **general objectives** with respect to environment, economy and society:

Ecological sustainability:

- Reduction of environmental pollution (air pollutants, noise, use of land and landscape) on a level which is harmless in the long term;
- Reduction of energy use, especially of non-renewable energy.

Economic sustainability:

- Provide an efficient transport infrastructure;
- Operate the transport system efficiently and support more competition;
- Increase cost recovery of transport;
- Optimal use of the existing infrastructure;
- Competitive transport enterprises.

Social sustainability:

- Basic supply of transport services in the whole country (service public);
- Consideration for people with difficult access to transport services;
- Protection of health and reduction of the number of accidents;
- Fair behaviour of transport enterprises.

On this basis, the DETEC derived the following **main objectives** for transport policy:

- Environment-friendly (ecology), efficient (economy) and fair (social point of view) regulation of mobility;
- Realise a co-ordinated transport policy by a multi-modal co-ordination and taking account of other policy fields;
- Use all technical possibilities in order to optimise the use of infrastructure;
- Co-ordinate Swiss transport policy with European transport policy;
- Achieve full cost recovery of transport modes including the internalisation of external costs and by compensating services in the interest of country-wide basic supply of transport services;
- Increase the modal share of public transport and slow traffic;
- Ensure the high safety standards of transport.

Taking account of these objectives the main areas of the actual Swiss transport policy can be summarised as follows:

- **Harmonisation with Europe:** Realise the bilateral agreements (including the Land Transport Agreement) between the EU and Switzerland, improve connections with Trans-European network, harmonise the standards. With the **Land Transport Agreement**, the EU member states recognize Switzerland's aim of shifting goods from road to rail and the related instruments, in particular the distance-related Heavy Vehicle Fee LSVA.
- **Greater emphasis on cost allocation and fair charging:** Introduction of the distance related Heavy Vehicle Fee LSVA. In September 1998, the people voted in favour of the introduction of the LSVA. This implements the polluter pays principle and ensures that road haulage reflects the true costs.
- **Modern rail infrastructure:** In November 1998, the people and Cantons approved the modernization of the railway infrastructure. With investments of around 30 billion francs, the first and second stages of „Bahn 2000" (Rail 2000), the NEAT-Network with two new base tunnels through the Gotthard and the Lötschberg, the connection of east and west Switzerland to the European high speed rail network and the noise reduction measures on Swiss railways will be completed over the next 20 years.
- **Efficient rail service:** Implement fully the railway reform and prepare additional steps towards more rail competition. Use optimally the existing railway capacity. In March 1998, parliament passed the railway reform. It entered into force on 1st January 1999 and brings competition into the Swiss railway system. The railways now have the necessary flexibility and entrepreneurial freedom to enable them to compete with road transport in the future transport market.
- **Protecting the Alps:** Provide attractive rail services, especially for transalpine goods transport and therefore support unaccompanied combined transport and the Rolling Highway.
- **Maintaining a high-performance road system:** Completion of the motorway network and increase maintenance, propose solutions to avoid congestion on saturated motorway

sections. The Federal Roads Office develops therefore a national road transport and traffic telematics strategy.

- **Solve traffic problems in urban areas:** The actual financing of (public) urban transport is questioned. Agglomerations ask for a stronger involvement of the Federal level. New infrastructure may be necessary to avoid congestion but possibly in combination with new financing mechanisms (urban road pricing).
- **Qualitative progress in air transport:** Liberalise market access and support a sustainable aviation infrastructure (including the 5th stage of extension of Zurich airport).
- **More stringent use of resources:** Continue the programme Energy 2000, introduce stricter exhaust requirements, co-ordinate better with land use planning.

2.2 Present state of affairs

On January 1st, 2001 the distance-related Swiss Heavy Vehicle Fee LSVA replaced the existing flat-rate heavy traffic tax and covers all heavy vehicles over 3.5 tonnes carrying either goods or passengers.

Being the first nation-wide implementation of a kilometre charging Electronic Fee Collection (EFC) system, the LSVA marks a major step towards fair and efficient road pricing.

The collection system for the Swiss LSVA has successfully started operation. Overall, the timely start proceeded without major technical or organisational problems.

The LSVA applies the **polluter pays principle** in road traffic: whoever drives more must pay more. The LSVA is based on the number of kilometres covered on Swiss territory, it is comprehensive and non-discriminatory and payable by both Swiss and foreign vehicles.

The LSVA heads the list of transport policy instruments for achieving the traffic transfer objective of the Land Transport Agreement with the EU. The marked increase in the cost of road transport creates an economic incentive to make more use of rail. The shift of as much heavy traffic as possible from road to rail is indispensable if the increased traffic of the future is to be mastered in an environmentally acceptable way.

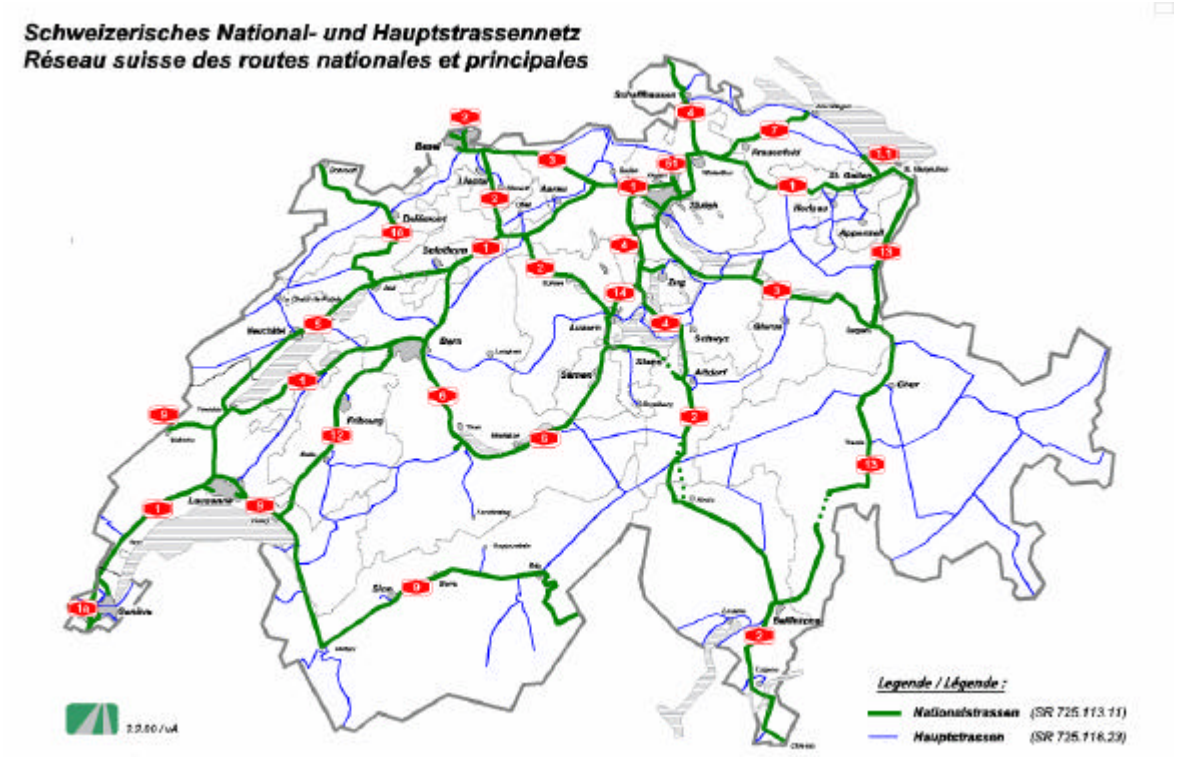
2.2.1 Traffic and road network

a) Transport infrastructure

The Swiss transport network is one of the densest in the world. In parallel with the constantly increasing traffic volumes, it has been continually expanded in recent decades and will continue to grow in future. Since individual mobility is currently conducted primarily on the roads, the public transport services will take the brunt of the challenge in the coming years. They will have to provide an attractive range of services if the national traffic flows are to be optimised.

Road

Figure 2-1: Motorway and main roads in Switzerland [3]



[ASTRA; Internet a]

The Swiss road network is 71'000 km long, 1'857 km (2.6%) of which are national roads (motorways; 1'638 kms in operation), 18'300 kms (25.8%) are cantonal roads and 51'200 kms (72.1%) are municipal roads. Of the cantonal roads, 2,300 kms are trunk roads.

[BAV, Internet a]

The numbers below for the Swiss highway network correspond to the length of the Swiss national motorway network. Not all but the large majority of these motorways belong to the TERN (Trans European Road Network, see Figure 2-2).

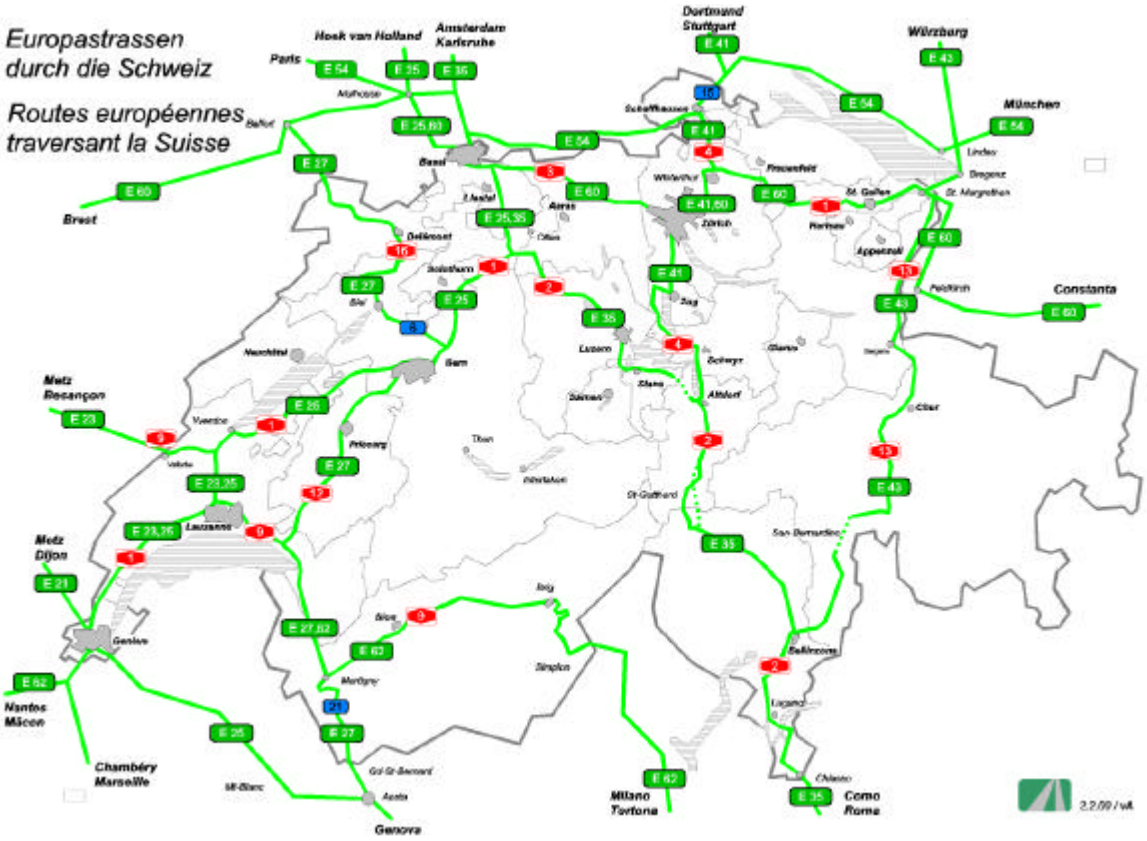
Table 2-1: Length of roads in Switzerland

	Motorway network	All roads
Length in year 2000	1'638.0 km	71.211 km
Evolution from 1989 to 2000	plus 147.0 km	plus 193 km
Future length in 2010	1'856.7 km	- km

[ASTRA (2001a]

[3] Nationalstrassen are national motorways, Hauptstrassen are main roads

Figure 2-2: European trunk roads through Switzerland (TERN)

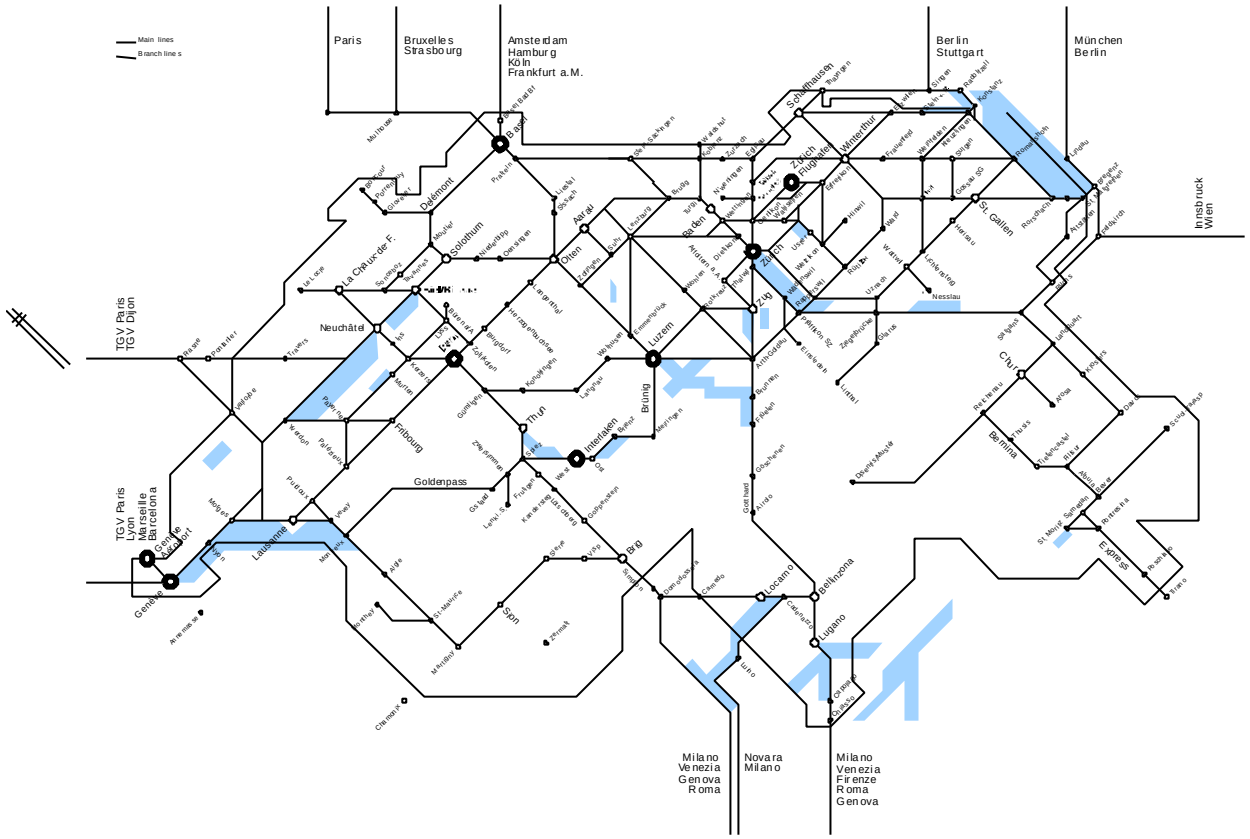


[ASTRA; Internet a]

Rail

The following figure shows the complete Railway network in Switzerland and all the links to the European Network as well.

Figure 2-3: Railway network in Switzerland



[SBB (2001)]

The network of Swiss Federal Railway (SBB) measures nearly 3000 Km. Private or semi-governmental operators maintain a network of 725 Km of standard gauge and more than 1300 Km of narrow gauge.

The are tow companies offering a rolling highway service (Rola, Rollende Landstrasse) on the rail. The old-established company HUPAC is mainly operating on the Gotthard route and got terminals for accompanied transport in Freiburg i.Breisgau, Basel, Lugano and Novara close to Milano.

On the 10th of June 2001 RAlpin AG started operating a second link via Lötschberg. RAlpin AG is a joint venture between the BLS, SBB and Hupac Intermodal AG and users the same terminals in Germany and Italy. The Lötschberg roll-on, roll-off corridor permits a maximum legal corner height of 4 metres and 2.50 m width vehicles in the accompanied transport of HGV. The weight limit for the HGV's is 44 tonnes. From 2002 it will be possible to transport 105'000 shipments (HGV with trailer or tractor with semi-trailer) per year. The capacity can be extended after the opening of Lötschberg base tunnel in 2007 up to 350'000 units.

Alternative Transport Modes

Inland waterways

The Rhine, navigable from Basel to the North Sea, is the one and only inland waterway access to Switzerland.

The navigable stretch in Switzerland measures only a few Km from Basel to Augst – Whylen. In particular the ports of Basel, Schweizehallle / Birsfelden and Kaiseraugst are rather important for the import of oil, carbon, building material and other bulk goods.

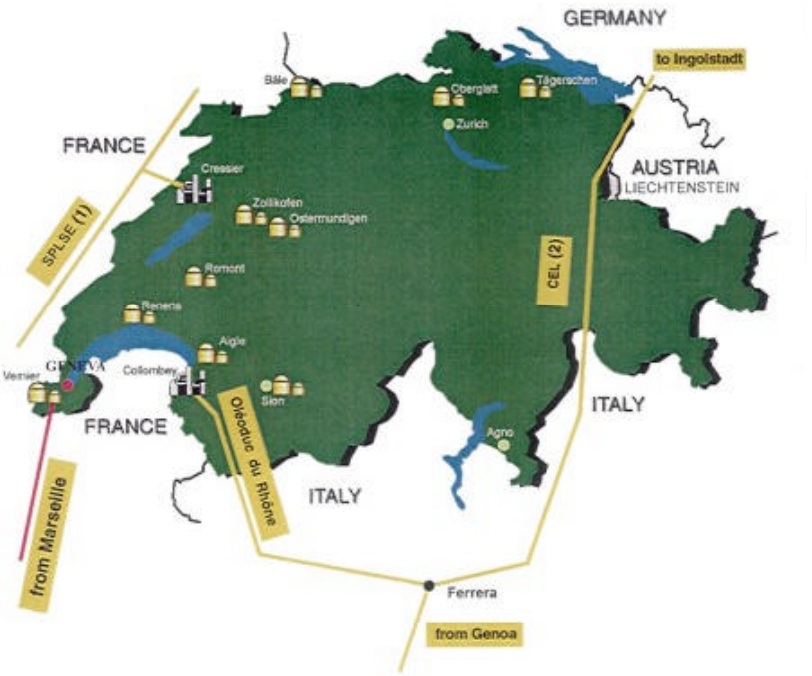
Figure 2-4: Inland waterways in Switzerland

Pipelines

The two refineries in Collombey and Cressier cover nearly 50 % of the Switzerland requirements on oil products. Together they process 5.0 million crude oil into different products like light and heavy fuel oil, kerosene, petrol an diesel.

The oil-pipeline from Italy crossing Switzerland to Germany is since 1997 not anymore in operation.

Figure 2-5: Oil pipelines in Switzerland



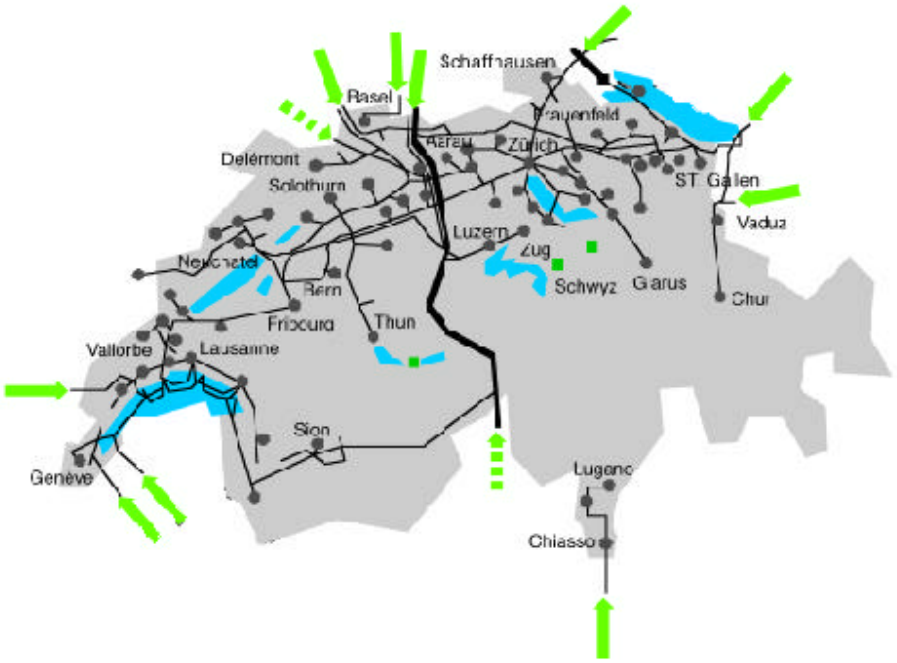
(1) SPLSE: Société du pipeline sud-européen

(2) CEL: Central European Line (out of order since march 1997)

[TAMOIL, Internet]

There are several gas pipelines in Switzerland, supplying cities and industry with natural gas.

Figure 2-6: Gas pipelines in Switzerland



[Swissgas (2001)]

b) Traffic and Transport Data

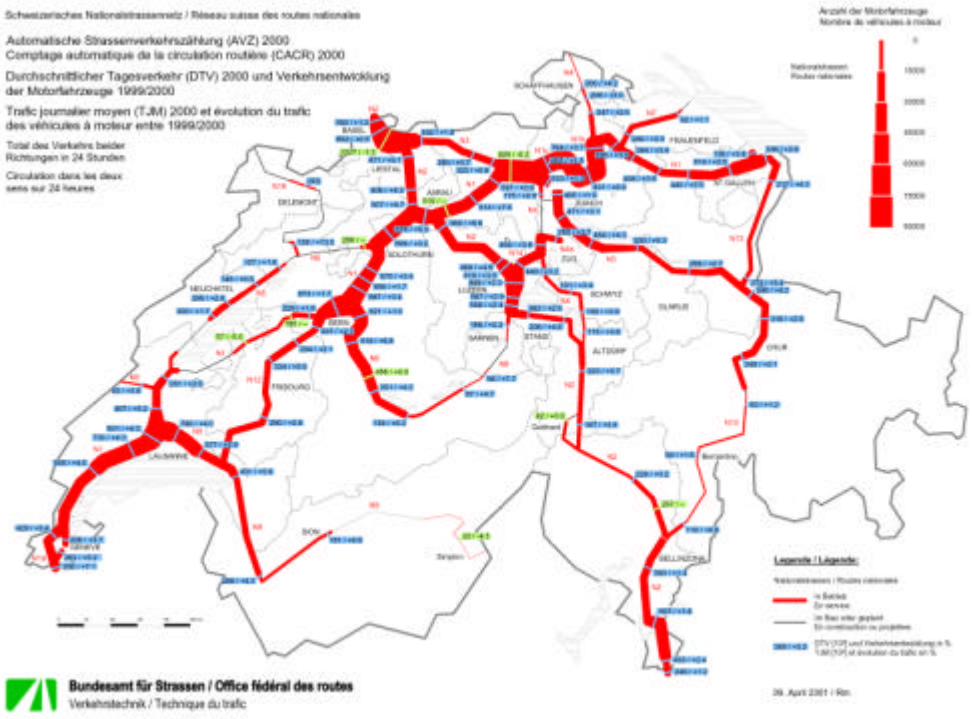
Traffic Volumes

Road network use (all roads): The following numbers are the summary for all heavy goods vehicles with an allowed total weight over 3.5 tons. For internal and export/import goods traffic the numbers for the year 1999 are estimates (ECOPLAN, 1999). The numbers for 2010 stem from the same source (assuming the introduction of the Swiss LSVA, the introduction of the 40t weight limit and measures to support rail goods transport). For transalpine transit transport the numbers for 1999 are based on Bureau for Transport Studies (2000).

	domestic	**export/import**	**transit**
Number of HGV veh-km in 1999	1.843 Mio.	452 Mio	227 Mio.
Evolution from 1993 to 1999:	plus 201 Mio.	plus 79 Mio.	plus 106 Mio.
Traffic forecast for 2010:	2.279 Mio	426 Mio.	148 Mio.

The following figure shows the use of the Swiss motorway network for all vehicles in 2000 including the changes compared with the previous year.

Figure 2-7: Use of Swiss motorway network in 2000



[ASTRA, Internet b]

Share of heavy goods vehicles / light commercial vehicles

The share of heavy goods vehicles / light commercial vehicles changed during the last few years as follow:

Table 2-2: Share of vehicles

	Light commercial vehicles (<3.5t)	Change in %	Light semi-trailer trucks (<3.5t)	Change in %	Trucks (>3.5t)	Change in %	Semi-trailer trucks (>3.5t)	Change in %
1990	196'845	-	1'728	-	49'346	-	4'214	-
1991	202'403	2.82%	1'754	1.50%	49'108	-0.48%	4'381	3.96%
1992	202'510	0.05%	1'735	-1.08%	47'898	-2.46%	4'468	1.99%
1993	200'625	-0.93%	1'720	-0.86%	46'617	-2.67%	4'529	1.37%
1994	203'373	1.37%	1'732	0.70%	46'496	-0.26%	4'684	3.42%
1995	209'253	2.89%	1'764	1.85%	46'335	-0.35%	5'000	6.75%
1996	210'676	0.68%	1'887	6.97%	45'377	-2.07%	5'079	1.58%
1997	212'150	0.70%	1'922	1.85%	44'805	-1.26%	5'322	4.78%
1998	215'501	1.58%	1'973	2.65%	44'370	-0.97%	5'536	4.02%
1999	221'510	2.79%	2'053	4.05%	44'564	0.44%	5'827	5.26%
2000	227'316	2.62%	2'061	0.39%	43'009	-3.49%	6'132	5.23%
2001	233'920	2.91%	2'070	0.44%	42'653	-0.83%	6'603	7.68%

[BFS, (2001 a)]

Swiss Federal Statistical Office (SFSO) publishes yearly the date analysed per the end of September of the previous year.

The average increase of light commercial vehicles (LCV) since 1999 was constant about 3 % per year. Changing within the category of the light semi-trailer trucks (MLW < 3.5t) is because of the small number of vehicles of little importance.

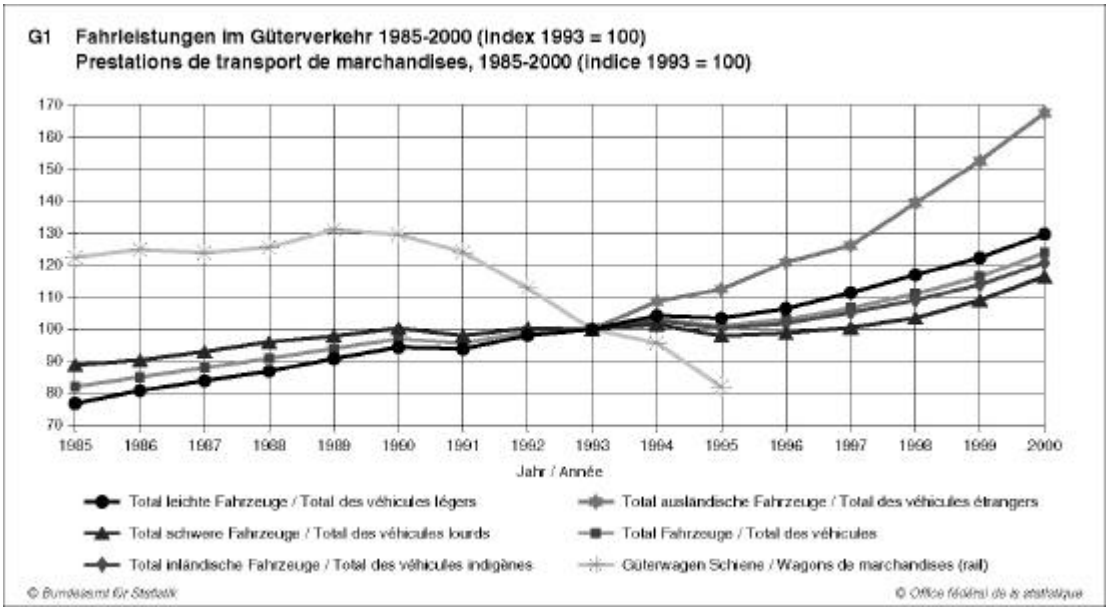
Regarding the HGV it is remarkable that the stock of trucks was reduced by end of September 2000 by nearly 1500 vehicles (approx. 3.5% reduction). This tendency continues with less occurrence in 2001. The main reason for this effect is for sure the introduction of the LSVA.

Semi-trailers on the other hand shows since 1999 an annually increase-rate of more than 5%, in particular the huge increase of nearly 8% since September 2000 is supposed to have a direct relation to the lift of the national weight limit from 28 tons to 34 tons.

Driving performance in freight transport

The following diagram shows the development of driving performance (Km) in freight transport from 1985 to 2000 in Switzerland.

Figure 2-8: Driving performance in freight transport in Switzerland 1985 - 2000



[BFS, (2001b)]

The total driving performance increases since 1995 in average up to 4.5% yearly.

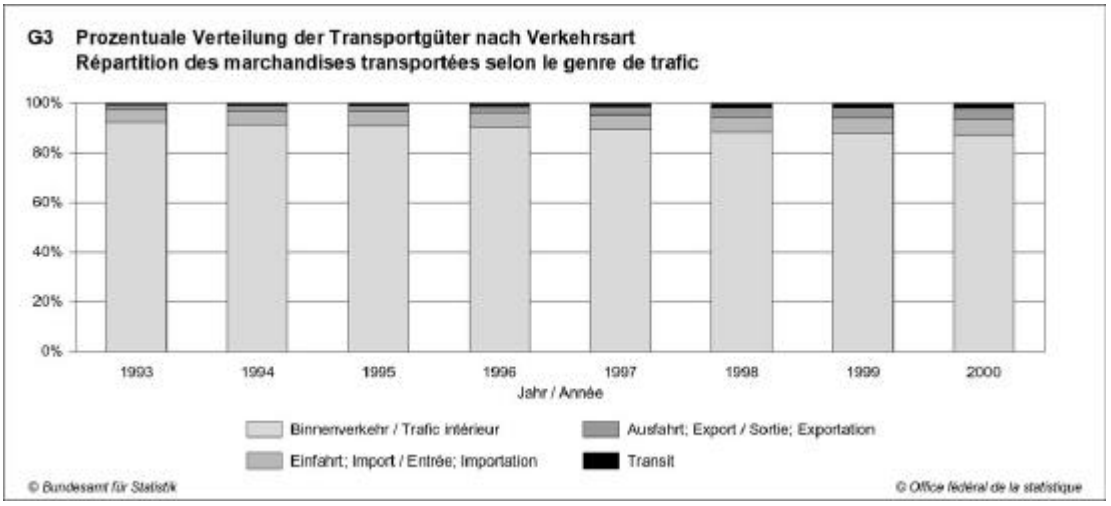
The yearly increase rate 1995-2000 for domestic vehicles amounts to 4.1%, the one of foreign vehicles is slightly higher with 11%. But the foreign vehicles cause less than 10% (1995: 7.3%, 2000: 8.9%) of the total driving performance in Switzerland. [BFS, (2001 b)]

Share of traffic modes

The following diagram shows the share of transported volumes in tonnes splited by the traffic modes:

- Domestic traffic
- Import
- Export
- Transit

Figure 2-9: Share transported volumes splited by traffic modes

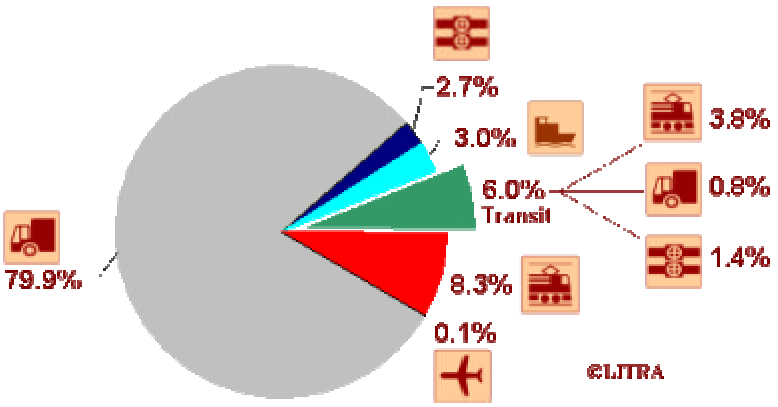


[BFS, (2001 b)]

Transport Volumes

The following diagrams show the share of road, train, inland waterways, pipelines, and air freight for Switzerland in 1999.

Figure 2-10: Modal split with respect to tons of goods transported

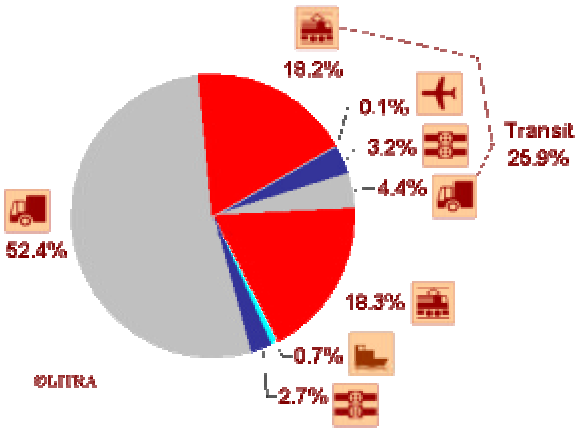


[LITRA, Internet a]

The transported volumes (domestic and transit) are clearly dominated by road (80.7%) and rail (12.1%). Only 6% all transported volumes are in transit-transport.

Focusing on the modal split in ton-kilometers the dominance of the road transport sector is slightly smaller, but still amounts to more than 50 % of the ton-kilometers. The share of the rail is close to 40 %. Air freight, inland waterways and pipelines play a minor roll.

Figure 2-11: Modal split in tonne-kilometres



[LITRA, Internet a]

The following tables show the transport volumes in domestic freight transport in Switzerland for the years 1993 and 2000. The values for the year 2000 are official forecasts (see ECO-PLAN (1999)).

Domestic freight traffic volumes:

Table 2-3: Domestic freight traffic in 1993

	Road	Railways	Totall	Road	Therefrom with a total weight of			
NST/R-chapters of goods	Mio. tkm	Mio. tkm	Mio. tkm	Mio. Vkm	3.5 - 12t	12 - 18t	18 - 26t	26-28t
0 Agriculture, wood	774.0	234.4	1'008.4	153.9	16.0	63.9	20.9	53.0
1 Foodstuffs, fodder	1'647.8	283.1	1'930.9	308.0	35.8	150.9	24.2	97.0
2 Solid mineral fuels	7.0	5.9	12.9	1.3	0.0	0.8	0.2	0.4
3 Crude petrol., petrol. prod.	658.1	358.2	1'016.2	88.6	1.5	28.4	2.7	56.0
4 Ores, steel waste	92.3	167.9	260.2	23.6	1.4	9.6	4.7	7.8
5 Metal products	339.5	143.7	483.2	64.8	10.2	28.9	7.7	18.0
6 Building materials	2'170.5	637.7	2'808.2	380.6	14.4	102.3	97.7	166.2
7 Fertilisers	49.8	20.5	70.4	5.5	0.0	2.3	0.1	3.1
8 Chemical products	370.5	110.6	481.2	66.7	9.1	29.9	7.3	20.4
9 Vehicles, machines, others	1'975.1	403.8	2'378.9	549.2	95.4	243.2	64.8	145.7
Sum domestic traffic	**8'084.9**	**2'365.6**	**10'450.6**	**1'642.0**	**183.9**	**660.2**	**230.3**	**567.6**

Table 2-4: Domestic freight traffic in 2000

	Road	Railways	Total	Road	Therefrom with a total weight of			
NST/R-chapters of goods	Mio. tkm	Mio. tkm	Mio. tkm	Mio. Vkm	3.5 - 12t	12 - 18t	18 - 26t	26-28t
0 Agriculture, wood	891.7	265.0	1'156.7	176.1	18.3	73.2	23.9	60.7
1 Foodstuffs, fodder	1'898.4	320.0	2'218.4	352.3	41.0	172.6	27.7	111.0
2 Solid mineral fuels	8.1	6.7	14.8	1.5	0.0	0.9	0.2	0.4
3 Crude petrol., petrol. prod.	758.1	405.0	1'163.1	101.4	1.7	32.5	3.1	64.0
4 Ores, steel waste	106.4	189.8	296.2	26.9	1.7	11.0	5.4	8.9
5 Metal products	391.2	162.5	553.6	74.1	11.6	33.0	8.8	20.6
6 Building materials	2'500.5	721.0	3'221.4	435.4	16.5	117.0	111.8	190.1
7 Fertilisers	57.4	23.2	80.6	6.3	0.0	2.7	0.1	3.5
8 Chemical products	426.9	125.1	551.9	76.3	10.4	34.2	8.3	23.4
9 Vehicles, machines, others	2'275.4	456.5	2'731.9	628.2	109.1	278.3	74.2	166.6
Sum domestic traffic	**9'314.0**	**2'674.7**	**11'988.7**	**1'878.5**	**210.4**	**755.3**	**263.5**	**649.3**

Import / Export freight traffic volumes:

Table 2-5: Import/Export freight traffic in 1993

	Road	Railways	Totall	Road	Therefrom with a total weight of			
NST/R-chapters of goods	Mio. tkm	Mio. tkm	Mio. tkm	Mio. Vkm	3.5 - 12t	12 - 18t	18 - 26t	26-28t
0 Agriculture, wood	374.1	185.3	559.5	45.4	0.1	3.4	1.5	40.4
1 Foodstuffs, fodder	290.9	62.4	353.3	37.7	0.7	0.8	1.1	35.2
2 Solid mineral fuels	6.2	16.9	23.1	0.6	0.0	0.0	0.0	0.5
3 Crude petrol., petrol. prod.	94.1	442.0	536.1	5.1	0.0	0.0	0.0	5.1
4 Ores, steel waste	13.3	72.1	85.4	1.8	0.0	0.0	0.3	1.5
5 Metal products	221.7	222.6	444.4	26.8	0.0	1.1	0.8	24.9
6 Building materials	384.4	97.9	482.3	40.1	0.0	0.9	7.3	31.9
7 Fertilisers	10.5	28.0	38.6	1.3	0.4	0.4	0.0	0.5
8 Chemical products	364.8	200.3	565.2	46.8	0.3	2.1	1.8	42.6
9 Vehicles, machines, others	1'136.3	358.3	1'494.6	167.4	8.7	11.7	7.7	139.3
Sum import/export traffic	**2'896.5**	**1'686.0**	**4'582.5**	**372.9**	**10.1**	**20.4**	**20.5**	**321.9**

Table 2-6: Import/Export freight traffic in 2000

	Road	Railways	Totall	Road	Therefrom with a total weight of			
NST/R-chapters of goods	Mio. tkm	Mio. tkm	Mio. tkm	Mio. Vkm	3.5 - 12t	12 - 18t	18 - 26t	26-28t
0 Agriculture, wood	470.9	213.8	684.8	56.7	0.1	4.2	1.9	50.5
1 Foodstuffs, fodder	366.2	71.9	438.2	47.1	0.8	0.9	1.3	44.0
2 Solid mineral fuels	7.8	19.5	27.3	0.7	0.0	0.0	0.0	0.6
3 Crude petrol., petrol. prod.	118.5	510.0	628.5	6.4	0.0	0.0	0.0	6.4
4 Ores, steel waste	16.7	83.2	99.9	2.2	0.0	0.0	0.4	1.9
5 Metal products	279.1	256.9	536.0	33.5	0.0	1.3	1.0	31.1
6 Building materials	483.9	113.0	596.9	50.2	0.0	1.1	9.1	39.9
7 Fertilisers	13.3	32.3	45.6	1.6	0.4	0.5	0.0	0.7
8 Chemical products	459.2	231.2	690.4	58.5	0.3	2.7	2.2	53.2
9 Vehicles, machines, others	1'430.3	413.4	1'843.7	209.2	10.9	14.6	9.7	174.1
Sum import/export traffic	**3'646.0**	**1'945.2**	**5'591.2**	**466.1**	**12.7**	**25.5**	**25.6**	**402.4**

Transit freight traffic volumes:

Table 2-7: Transit freight traffic in 1993

	Road	Railways	Totall	Road	Therefrom with a total weight of			
NST/R-chapters of goods	Mio. tkm	Mio. tkm	Mio. tkm	Mio. Vkm	3.5 - 12t	12 - 18t	18 - 26t	26-28t
0 Agriculture, wood	35.7	164.8	200.5	5.7	0.0	0.4	0.2	5.1
1 Foodstuffs, fodder	19.0	76.0	95.0	3.1	0.1	0.1	0.1	2.9
2 Solid mineral fuels	0.1	25.6	25.6	0.0	0.0	0.0	0.0	0.0
3 Crude petrol., petrol. prod.	0.2	10.2	10.4	0.0	0.0	0.0	0.0	0.0
4 Ores, steel waste	1.0	175.4	176.4	0.3	0.0	0.0	0.0	0.2
5 Metal products	15.3	622.7	638.0	1.0	0.0	0.0	0.0	0.9
6 Building materials	4.4	430.7	435.1	1.1	0.0	0.0	0.2	0.9
7 Fertilisers	0.0	12.5	12.5	0.0	0.0	0.0	0.0	0.0
8 Chemical products	26.8	142.9	169.6	3.2	0.0	0.1	0.1	2.9
9 Vehicles, machines, others	706.7	2'060.1	2'766.8	106.6	5.5	7.4	4.9	88.7
Sum transit traffic	**809.2**	**3'720.7**	**4'529.9**	**120.9**	**5.6**	**8.1**	**5.6**	**101.6**

Table 2-8: Transit freight traffic in 2000

	Road	Railways	Totall	Road	Therefrom with a total weight of			
NST/R-chapters of goods	Mio. tkm	Mio. tkm	Mio. tkm	Mio. Vkm	3.5 - 12t	12 - 18t	18 - 26t	26-28t
0 Agriculture, wood	60.8	190.5	251.3	10.5	0.0	0.8	0.3	9.3
1 Foodstuffs, fodder	32.5	87.8	120.3	5.7	0.1	0.1	0.2	5.4
2 Solid mineral fuels	0.1	29.5	29.6	0.0	0.0	0.0	0.0	0.0
3 Crude petrol., petrol. prod.	0.4	11.7	12.1	0.0	0.0	0.0	0.0	0.0
4 Ores, steel waste	1.7	202.8	204.5	0.5	0.0	0.0	0.1	0.4
5 Metal products	26.1	719.8	745.9	1.8	0.0	0.1	0.1	1.7
6 Building materials	7.6	497.9	505.4	2.0	0.0	0.0	0.4	1.6
7 Fertilisers	0.0	14.4	14.5	0.0	0.0	0.0	0.0	0.0
8 Chemical products	45.6	165.2	210.8	5.9	0.0	0.3	0.2	5.4
9 Vehicles, machines, others	1'204.8	2'381.3	3'586.1	196.0	10.2	13.7	9.0	163.2
Sum transit traffic	**1'379.5**	**4'300.9**	**5'680.5**	**222.5**	**10.3**	**15.0**	**10.3**	**186.9**

c) Transport Regulations

Ban on Transport:

Ban on Sunday and night driving[4]: With the exception of passenger vehicles, there is a ban on transport on Sundays and general public holidays concerning:

- motor vehicles with a total authorised weight exceeding 3.5 tons;
- articulated vehicles with a total authorised towing weight exceeding 5 tons;
- vehicles with a trailer with a total authorised weight exceeding 3.5 tons.

Moreover, there is a year-round ban on night-time driving concerning these vehicles from 10pm to 5am.

Exemptions: Exemptions may only be granted for emergencies (unavoidable journey on a Sunday or at night). Applications for exemptions must be submitted to the canton of domicile, or to the canton of origin of the journey subject to approval. In the event of journeys originating abroad, the journey subject to approval begins in the canton of entry into Switzerland.

[ASTRA, Internet c]

Cabotage (inland traffic) : Inland traffic with foreign vehicles is prohibited. If used in for-profit transport of passengers or goods picked up and set down in Switzerland, and provided Swiss custom laws do not permit such transports with foreign vehicles, both motor vehicles and trailers must have Swiss vehicle documents and license plates.

[ASTRA, Internet c]

Driver regulations:

Working, driving and rest-time regulations for professional drivers: Working, driving and rest-time regulations for professional drivers are based on two articles in the Road Transport Act (SVG, articles 56 and 103) and are fixed in an ordinance released in 1995[5],.

The following basic rules apply:

- Daily driving time must not exceed 9 hours, with an absolute maximum of 10 hours a day on a maximum of two days a week;
- Driving time in two weeks must not exceed 90 hours;
- The weekly maximum working time of a Swiss chauffeur may amount to 46 hours (excepting overtime);
- A break of a minimum duration of 45 minutes (which may be subdivided) must be taken after a maximum of 4 hours' driving time;

[4] Art. 91 SR 741.11 Verkehrsregelnverordnung vom 13. November 1962.

[5] SR 822.221 Chauffeurverordnung von 19. Juni 1995, (Regulation of 19 June 1995 on working and rest time for professional drivers of motor vehicles 1).

- The minimum daily rest time is 11 continuous hours; this period may be shortened to 9 hours three times a week (with a duty of compensation);
- The normal weekly rest time must be 45 continuous hours.

[ASTRA, Internet c]

Minimum training level for drivers of road transport vehicles: Even thus far, based upon the Vienna Convention of 1968 regarding frontier-crossing freight transport with heavy motor vehicles, many European states have only allowed entry to drivers of a minimum age of 21 years, or drivers in possession of the Federal License of Professional Competence as a driver of heavy vehicles (Eidg. Fähigkeitsausweis als Lastwagenführer) carrying corresponding proof with them.

The European Union regulation adopted along with the Convention on Land Transport has created the possibility of awarding the required certificate of qualifications following the completion of a training course that is reduced in comparison with training as a driver of heavy vehicles, and provided the driver's age is a minimum of 18 years.

Moreover, it will be possible to admit persons to the Category D driving test who have completed specific training as a driver of buses and coaches for passenger transport, but who do not have proof of experience as a driver of heavy vehicles. The minimum age for this category is 21 years.

[ASTRA, Internet c]

Vehicle regulations:

Permissible dimension and weights: The permissible dimensions, weights and axle loads for vehicles travelling in Switzerland are contained in Articles 64-67 of the Traffic Rules Decree (VRV[6]) dated November 13, 1962.

These provisions are based on the principles of Article 9 of the Road Transport Act (SVG[7]) of December 19, 1958. This law is subject to the reservation of, inter alia, signalled restrictions being placed on the width, height, weight and axis loads of vehicles in each case.

In accordance with the bilateral agreements with the EU (overland transport agreement), Switzerland will be extending the weight limit for road transport and adapting it to the European standard. This is to take place in several stages:

- As of 1 January 2001, the maximum permissible weight is to be raised from the former 28 tonnes to 34 tonnes (vehicle combinations).
- As of 1 January 2005, the maximum permissible weight is to be raised to 40 tonnes (vehicle combinations).
- For a period of 4 years - from January 2001 to December 2004 - a limited volume of vehicles with a maximum operating weight of 40 tonnes will be permitted. For freight vehicles

[6] SR 741.11 Verkehrsregelnverordnung vom 13. November 1962.

bearing EU licence plates, 300,000 quota permits p.a. will be available for 2001 and 2002, and 400,000 p.a. for 2003 and 2004.

- For a period of 4 years - from 2001 to 2004 - 220,000 quota permits will be issued for unladen vehicles and those carrying light loads (maximum operating weight, 28 tonnes) in transit through the Alps, at preferential lump-sum rates (instead of the capacity-based heavy-goods vehicle fee, transport companies will pay a reduced lump sum).

[ASTRA, Internet c]

Periodical vehicle testing: As in the other European countries, vehicles registered in Switzerland must also be tested periodically by the competent authorities. The scope of the test and the time-limits are laid down in Article 33 of the decree dated June 19, 1995 on the technical requirements for road vehicles (VTS [8]).

In conjunction with the bilateral agreements between Switzerland and the EU - particularly with the national transport agreement - Switzerland undertook to introduce, two years after the agreements come into effect, the annual testing obligation for lorries, heavy articulated motor vehicles and goods trailers having a total weight of over 3.5 metric tons.

The competent authorities for the tests are the cantonal road transport offices or, as applicable, the motor vehicle inspection agencies.

2.2.2 Taxation and financing

a) Vehicle taxation and fuel tax

Revenue and expenditure for construction and maintenance of the road network are summarised in the Highways Account, which is published annually. In 2000, 3.387 billion CHF were spent on the Swiss road network. The revenue required comes principally from contributions made by road users.

The funds for the construction, maintenance and operation of the national roads derive from earmarked special financing fed from the following sources:

- Half of the gross revenue from fuel taxes;
- The entire surtax charged on fuels[9];
- The former flat-rate heavy vehicle tax;
- Revenue from motorway tolls for private cars (vignette).

---

[7] SR 741.01 Strassenverkehrsgesetz vom 19. Dezember 1958.

[8] SR 741.41 Verordnung vom 19. Juni 1995 über die technischen Anforderungen an Strassenfahrzeuge (VTS).

[9] SR 725.116.2, Bundesgesetz über die Verwendung der zweckgebundenen Mineralölsteuer vom 22. März 1985. Federal law covering the use of earmarked oil tax.

b) Financing of infrastructure and operation / maintenance

The Confederation makes considerable financial contributions to the road network: these are mainly towards investments in the construction and maintenance of the national roads and the construction of main roads. It also contributes to the operation of the national road network. The remaining road network costs are borne by the cantons and the municipalities. The Confederation is financing around 87% of the total cost of the motorway network, the remaining cost are financed by the Cantons.

In 2000 CHF 3.72 billion flowed into the fund for the construction, maintenance and operation of the national roads, CHF 1.475 billion coming from the fuel tax, CHF 2.003 billion from the surtax on fuels and 0.268 billion from the motorway tolls (vignette). From this fund CHF 2.026 billion were spent on the national roads, CHF 230 million on the main roads and 1.131 in other earmarked projects. The fund therefore has a reserve. [ASTRA, 2001]

Each new section of motorway in Switzerland is already financed when it is opened, and the road users pay for the network themselves. To put it simply, these two statements characterise the way in which the Swiss motorway network is financed.

As described, virtually no *general* tax revenue is used for financing the motorway network, for most of the necessary funding comes from net income from oil tax and from customs duty on fuels, in accordance with Article 86 of the Federal Constitution and the provisions of the federal law governing the use of earmarked revenue from oil tax. Another source of funding is the proceeds from the sale of motorway stickers ("vignettes").

Up to the end of 1998, a total of almost CHF 52 billion had been spent on the construction of motorways. This figure includes maintenance, operation, repairs and administration. By the time it is completed, the network will probably have cost around CHF 70 billion.

A closer look at the costs reveals that construction work has - of course - become significantly more expensive over the past four decades: for example, while the average cost per kilometre of motorway from Lausanne to Geneva, which was opened in 1964 on the occasion of the Swiss EXPO, was CHF 12.8 million, this figure had risen to CHF 237 million CHF for a section in Basel (in the north-west of the country) by the beginning of the 1990s.

2.2.3 Overview of existing an planned systems

a) Existing system

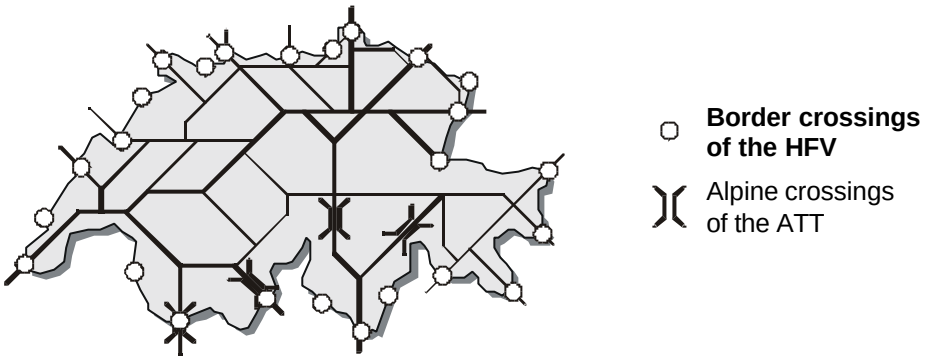
On January 1st, 2001 the distance-related Swiss Heavy Vehicles Fee LSVA replaced the existing flat-rate heavy traffic tax and covers all heavy vehicles over 3.5 tonnes carrying either goods or passengers.

Being the first nation-wide implementation of a kilometre charging Electronic Fee Collection (EFC) system, the LSVA marks a major step towards fair and efficient road pricing.

b) Planned toll: Alpine Transit Toll (ATT)

The Alpine Transit Toll (ATT) is not yet introduced and would be levied upon every Alpine crossing of heavy goods vehicles (HGV) with more than 3.5t for the passage of Gotthard, San Bernardino, Simplon and Grand St. Bernhard. The ATT is similar to the common passage tolls at special locations such as mountain passes, bridges or tunnels. After having approved the bilateral agreement on land transport with the European Union, the possible introduction of an ATT takes only a back seat on the actual political agenda. First, the new transalpine railway tunnels will have to be opened (Lötschberg 2007, Gotthard 2013). Only if after the opening of these railway tunnels, the shift of transalpine freight transport from road to railways should not be big enough, the discussion on an additional ATT may get more drive again.

Figure 2-12 Possible passages for Alpine Transit Toll (ATT)



2.2.4 Details of each system

In this section the essentials of the collection system for the Swiss Heavy vehicle fee LSVA are summarised. A more detailed description is given in chapter 3.

Objectives of systems	– Demand Management – Reduce Alpine Transit Traffic – Achieve a Modal Shift from Road to Rail
Pricing scheme	Area Tolling
Subject of the fee	The LSVA applies to all domestic and foreign heavy vehicles and trailers for goods or passenger transport with a maximum laden weight in excess of 3.5t.
Basis for assessment	The LSVA will be levied according to the following main criteria: – the number of kilometres covered on all public roads in Switzerland – the maximum permissible laden weight – the emission category of the heavy goods vehicle The tariff depends on the emission values of the vehicle.
Liable person	The registered owner of a vehicle - with foreign vehicles additionally the driver - is liable to the tax. The responsibility for the declaration and for the proper function of the equipment is with the liable person.
Recording of the fee base	The fee collection is based on the principle of self-declaration. The liable person is obliged to actively participate. For domestic vehicles the installation of an on-board unit is mandatory. Foreign vehicles can optionally be equipped with an OBU. Foreign vehicles basically are using a ticket fetched at self-service machines.
Tariff	For the years 2001 – 2004 the following values are applicable: – Fee category 1: (Emission class Euro 0) 2.0 cts. per tonne-kilometre – Fee category 2: (Emission class Euro I) 1.68 cts. per tonne-kilometre – Fee category 3: (Emission classes Euro II and III) 1.42 cts. per tonne-kilometre For 2005 the Federal council will set new rates, taking technical developments into account. The maximum rate is fixed by 2.75 cts. per tonne-kilometre.
Special regulations	For the following vehicles and types of transport there are special regulations: – Travel in unaccompanied combined traffic, road/rail or road/ship (Unbegleiteter kombinierter Verkehr; UKV) – Transport of logs/raw wood – Transport of unpacked milk and livestock from agriculture
Exceptions	Coaches, motor homes, and industrial or communal tractors and service vehicles pay a flat fee (no distance relationship). Agricultural and public transport vehicles, ambulances and vehicles of the armed forces, of the police, etc. are completely exempt from the LSVA. The LSVA ordinances foresee further flat-rate exceptions and total exemptions.

2.3 Likely Developments

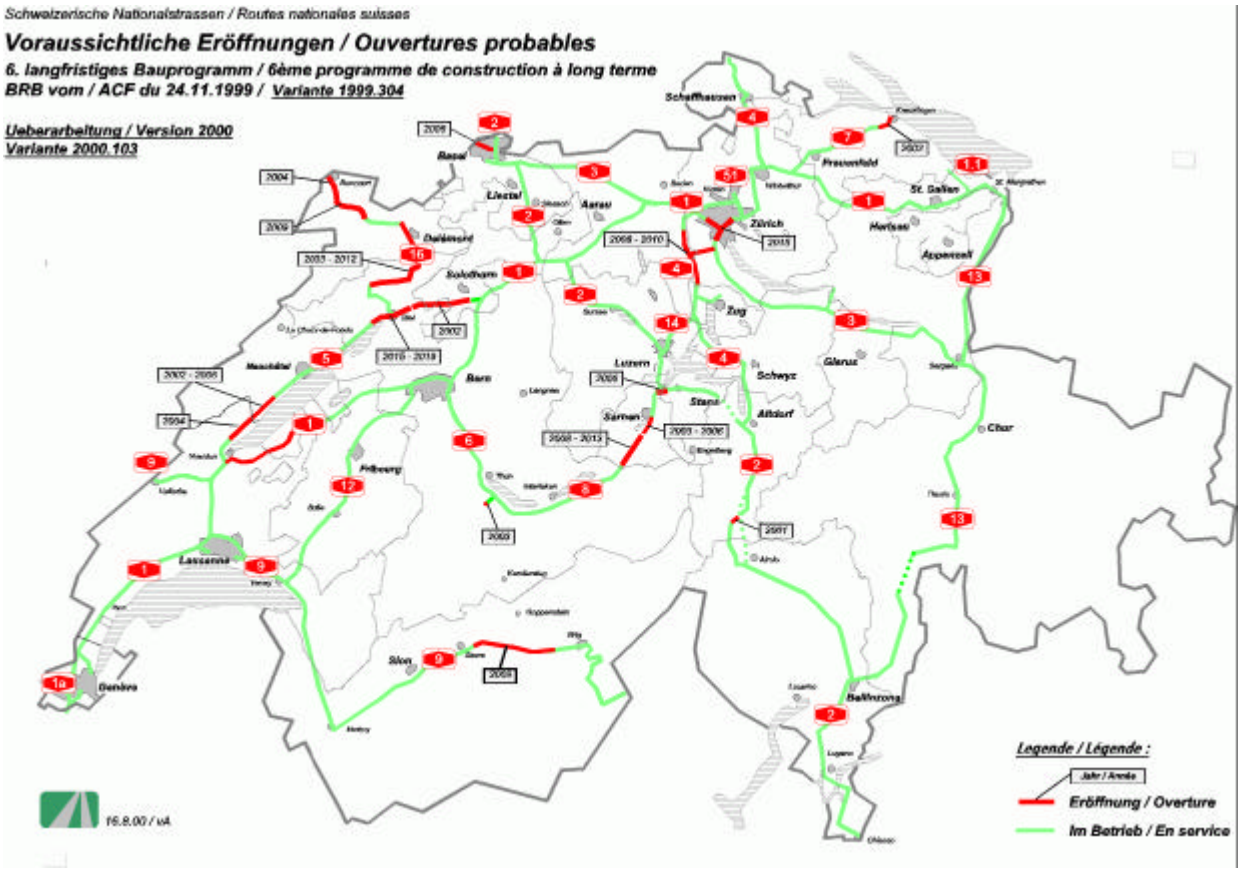
2.3.1 Traffic and road network

a) Completion of road and rail network

As the following Figure 2-13 shows main parts of the Swiss motorway network are in operation. Some important completions will be built in the next 10 to 20 years. The main political discussion today concerns two points

- The question of capacity enhancements within the existing network (additional lanes on those sections that are used to capacity limits, e.g. between Zurich and Berne)
- The incorporation of new sections into the Swiss motorway network (the “National Road Network”).

Figure 2-13 Long term construction programme



[ASTRA; Internet a]

b) RAIL 2000 / New Rail Link through the Alps (NRLA)

For decades traffic by road has been increasing faster than that by rail. In order to end this trend the Federal Commission for a Swiss Integral Concept of Transport recommended the expansion of the rail network in 1977. Thus, “new main rail axes” are to be built between Lausanne and St. Gallen as well as between Basel and Olten.

However, this concept was felt in political discussion to be too narrow since it did not allow any network-wide revaluation. As a result the Federal Council had the RAIL 2000 concept drafted. The costs were originally estimated as being CHF 5.4 billion (1985 price basis). On 6th December 1987 the electorate approved RAIL 2000.

When it came to realising the project it transpired that the original estimate was likely to be massively exceeded. Thus, RAIL 2000 was redrafted in 1993 and it was decided that realisation would proceed in phases. The costs ceiling for the first two phases is CHF 13.4 billion, CHF 7.5 billion for the first and CHF 5.9 billion for the second. The CHF 7.5 billion for the first phase equals the CHF 5.4 billion approved by the people in 1987 for the entire concept (after accounting for inflation).

RAIL 2000 is one of the four large-scale railway projects that were approved in a vote by the people and the cantons on 29th November 1998. The other projects are the New Rail Link through the Alps (NRLA), the connection of Eastern and Western Switzerland to the European high-speed network and noise reduction measures on the Swiss railways.

Figure 2-14: Transit corridors including the NRLA and access lines

[BAV; Internet a]

c) Railway's Reform

Context: Public transport structures have grown in the past, though they must now be adapted to the requirements of a modern transport system. The framework conditions for public transport must be comprehensively modernised so that the Swiss Federal Railways (SBB) and the licensed transport enterprises can work more productively and perform their services more efficiently. The Railways Reform, which entered into force on 1st January 1999, ensures this fundamental change. It is one of the most important preconditions to ensure that public transport in Switzerland is strengthened and wins an increased share of the market. The Railways Reform is, moreover, the domestic political condition for the implementation of free access in goods transport agreed in the new Land Transport Agreement between Switzerland and the European Union.

Aims: The main aim of the Railways Reform is to increase productivity and efficiency in public transport and to improve the costs-benefit ratio. To these ends the Railways Reform introduces elements of competition into the public transport system - above all with the advent of free access in goods transport. The railways are to act in a more entrepreneurial manner in order to exploit the market potential and provide customer-orientated services. Optimal services at minimal cost are the order of the day. The Railways Reform is also to create a division between political and entrepreneurial functions. The responsibility of the rail enterprises and the State is to be clearly delineated. This implies more entrepreneurial scope for the railways but more entrepreneurial responsibility. Finally, the Railways Reform also aims to introduce transparency into the financing of public transport as well as improving control of expenditure.

Measures: The Railways Reform includes measures that apply to all railway enterprises and some that concern only the Swiss Federal Railways (SBB).

Measures applying to all railway enterprises:

- The introduction of free access in goods transport and in irregular passenger trans-port: in return for a fee - the train path price - a railway enterprise may use the rail network of another railway. This creates competition between the indivi dual railway enterprises.
- The separation of the infrastructure and transport sectors in terms of ac-counting and organisation brings increased transparency in the performance of services: performance-inhibiting cross subsidies disappear.
- The introduction of the commissioning principle for all types of traffic: in future the railways shall only provide those services that either cover their costs or are commissioned in advance by the State. In this way, only the uncovered costs agreed in advance between a railway enterprise and the Confederation or the Can-tons will be compensated; there will no longer be any subsequent deficit coverage. Since the commissioning principle was already introduced in 1996 for regional passenger traffic, this principle is now to be applied to all railway services under the Railways Reform.
- The liberalisation of goods transport: goods transport is to be fundamentally exposed to the forces of the free market and should be able to survive without state compensation. However, the State continues to have the possibility of securing a basic service by com-

missioning goods transport services, depending on how the framework conditions develop.

Specific measures for the Swiss Federal Railways (SBB):

- Separating the political and entrepreneurial tasks: under the “Performance Agreement”, the “Appropriation for Payment” (financing of the infrastructure) and the “Owner Strategy” the Confederation stipulates to the Swiss Federal Railways (SBB) the political and financial duties, though the responsibility for the operational management of the enterprise remains with the SBB. The Performance Agreement contains the entrepreneurial objectives while the Owner Strategy covers the strategic aims of the Confederation as owner of the Swiss Federal Railways
- The transformation of the SBB from a public institution to a PLC (public limited company) regulated by special law: the separation of the political and entrepreneurial functions are thus ensured. For matters of sovereign tasks in the areas of planning permission, safety supervision and network access the Federal Office for Transport is therefore now responsible.
- The refinancing of the SBB: the SBB debts have been written off so that, on 1st January 1999, entrepreneurial independence was able to commence without a debit balance.

Outlook: The Railways Reform is a process, an ongoing reform. The experience obtained with the measures in force since 1st January 1999 is to be carefully monitored and analysed before further steps are taken. This pragmatic procedure takes the changing framework conditions into account, in particular, the developments in Europe. The future of the railway, especially in goods transport, must be co-ordinated on a Europe-wide basis if the Swiss railways are to have a chance on the intensely competitive European goods transport market. Possible elements of the next package of measures are, for example, the harmonisation of the finance flows (equality of the licensed transport enterprises and the Swiss Federal Railways in the financing of infrastructure and rolling stock), a decrease in the proliferation of regulations in public transport or the consideration of the legal separation of infrastructure and traffic.

[BAV; Internet a]

2.3.2 Changes in taxation and fuel tax

Former Heavy Vehicle Tax (HVT): The LSVA replaces the since 1985 existing flat tax for heavy goods vehicles. All HGV and trailers with a maximum laden weight extending 3.5 t, which were circulating on public roads, were subject to this time related flat fee.

Domestic vehicles paid an annually tax (see Table 2-9), **foreign vehicles** paid a daily flat fee of 25 CHF. All rates were doubled in 2000.

The fee level for domestic vehicles was until the end of 1999 as follows:

Table 2-9 Fee level of former HVT for domestic vehicles

	Vehicle type and scale of weights		Amount
a	**For HGV**		
	1.	From over 3,5 to 12 t	1300 CHF
	2.	From over 12 to 18 t	4000 CHF
	3.	From over 18 to 26 t	6000 CHF
	4.	over 26 t	8000 CHF
b.	**For trailers**		
	1.	From over 3,5 bis 8 t	1300 CHF
	2.	From over 8 bis 10 t	3000 CHF
	3.	over 10 t	4000 CHF
c.	**Coaches**		1300 CHF.

With the LSVA the charges for domestic vehicles extent to 5-10 times more than it was in the year 1999. For a foreign vehicle e.g. the transit trip Basel – Chiasso costs nowadays nearly 300 CHF, which is in average 5 times more than in 2000. Fuel and vehicle taxation did not change at all since the introduction of the LSVA and there are also no adaptation planed.

2.3.3 Future road pricing systems

After the successful introduction of the LSVA on 1st of January 2001 no further road pricing system are in planning at the moment. Of increasing importance is the debate about the future financing of urban transport. A new report of a high-level group of politicians and experts proposes the introduction of multi-modal funds to finance the urban transport systems in Switzerland with different regional and national sources of revenues going into these funds. In summer 2001, a heavy discussion was launched on the question if urban road pricing should also contribute to such urban transport funds.

2.4 Comparison to decision tree regarding the basic forms of IRPS

In Deliverable 2 of the DESIRE project a decision tree giving support to derive the preferred basic form of IRPS has been presented. The application of this decision tree for Switzerland gives the following results:

- The **financial needs** for new road infrastructure are **not going beyond the capabilities of the State**. On the contrary, the revenues of fuel taxes earmarked to the main road network (motorways and main interregional roads) did even exceed the financial needs for this part of the road network.
- The **density of the road network** is generally high, especially in the Swiss "Mittelland" – the area going from the western to the eastern part of Switzerland and located between the Alps and the Jura. In this area there is no clear dividing line between urban and rural areas. There are often parallel roads of different quality. Correspondingly an integrated transport planning approach is needed. With respect to interurban road pricing the conclusions are, that a country-wide approach has to be based on **DAREA** – distance-dependent area pricing. Distance-dependent network pricing (NET) is only conceivable on transalpine corridors, where diversion of traffic to other roads is difficult. There was an important discussion in Switzerland on the question if transalpine freight traffic on roads should additionally be charged with a transalpine tunnel charge. In the bilateral agreement with the EU such charges are not foreseen, at least as long as transalpine road freight traffic is not exceeding certain limits. In case of difficulties in transalpine traffic, the bilateral Land Transport Agreement between Switzerland and the EU includes a unilateral fiscal safeguard clause. According to this, Switzerland can raise the transit price by 12.5 per cent if less than two thirds of the rail capacity has been used for a period of ten weeks. The use of this instrument is limited to a maximum duration of 12 months and to twice within five years.
- In the case of the Swiss distance dependent heavy vehicle fee, the government rated high the aspect of organisational efficiency. Therefore, a great part of the IRPS-functions were concentrated under the same roof. Although some of the functions were delegated to private entities (retailing and installation of OB-equipment and installation of road side equipment) the main operating functions (debiting and payment, collection of revenues, enforcement of revenues) remain in the hands of the Swiss Customs Authority, which is the overall operator of the system. Perceived risks of productive inefficiency of this solution (compared to a private operator) are rather low.
- As the operation of the Swiss heavy vehicle fee remains in public hands, the "risk of capture" of the government obviously is low.

2.5 Issues related to alternative technical systems

In Deliverable 2 of the DESIRE project a second general tool to analyse the feasibility of different basic forms of IRPS as well as the basic institutional solutions was developed. The results of the application of this Excel tool for Switzerland are summarise below. Table 2-10 shows the short term feasibility of IRPS in Switzerland.

Table 2-10 Short term feasibility of IRPS in Switzerland

			DAREA	NET	PERM	COR	PAS	PUB	MIX	PRI
A1	Legal restraints for HGV road pricing on EU level	yes								
		no								
A2	Legal restraints for HGV road pricing on national level	high		-2		-2	-1			-2
		low								
A3	Need for institutional change	high		-2		-1			-1	-1
		low						1		
B1	Density of existing road network and detour traffic	high	1	-2	-2		-1			
		medium								
		low								
B2	Regional differences of density of road network	high	1	-2	-1	1	1			
		low								
B3	Importance of transit traffic	high	-1			1	1			
		low								
C1	Motorway tolling culture	high								
		low		-1			-1			
C2	Flexibility towards institutional change	high	1	1	1	1	1		1	1
		low								
C3	Experience with private operators	high								
		low						1	-1	-2
D1	Financial needs	important								
		unimportant								
D2	Environmental concern	important	1		-1	-1	-1			-1
		unimportant								
D3	Congestion sensibility	important		1	-1	1	1			-1
		unimportant								
D4	Determination to introduce fair competition among modes	important	1	1	-1	-1	-1			
		unimportant								

Comment: The negative values in the red coloured cells indicate potential problems for short term feasibility, whereby values of "-2" indicates stronger restriction of feasibility than "-1". The table first of all shows only DAREA together with an all public institutional solution is feasible in the short term in Switzerland. All other forms have more or less problems to be implemented in the short term. From the legal point of view (A-criteria), PERM and PAS are mainly feasible. NET and COR do have important legal restraints on the national level. NET would have some important advantages with respect to the possible objectives of IRPS (D-criteria) but these potential advantages are more than compensated by disadvantages on the geographical level (B-criteria).

The "Non-go" criteria have not been used so far. They will play the distinctive role in the following analysis about long-term feasibility, however (Table 2-11). Red are those cells where a -2 value from table 1 is multiplied with a "1" for "Non-go". Thus, a red cell tells us: The state of this criterion (row) prevents this IRPS/model (column) from being introduced even in the medium and long run. We first would have to change the state of this criterion. The orange cells are those where a -1 value from the "Country specific assessment" table was multiplied with a "1" for "Non-go". This means that the feasibility is partly restricted.

Table 2-11: Long term feasibility of IRPS in Switzerland

		DAREA	NET	PERM	COR	PAS	PUB	MIX	PRI
A2	high								
	low								
D2	important								
	unimportant								
D3	important								
	unimportant								
		feasible	not feasible	partly problematic	not feasible	partly problematic	feasible	feasible	not feasible

Comment: The long term feasibility of basic forms of IRPS in Switzerland is mainly determined by the legal situation. NET and COR are not feasible without adaptations of the national constitution, as well as the institutional solution PRI. Not astonishingly, DAREA has no restrictions of feasibility, a consequence of the introduction of the distance dependent heavy vehicle fee.

2.6 Issues related to alternative institutional and financial arrangements

Because the LSVA system started operation on January 1st, 2001 no alternative institutional or financial arrangements are in discussion or even planned at the moment.

2.7 Issues related to interoperability

Interoperability with other / future EFC systems in Europe was an important prerequisite for the Swiss LSVA system from the outset.

Switzerland therefore pressed actively for the technical implementation of the charging standards to be harmonised: both in the EU coordinatory organ for fee collection in road traffic, CARDME (Concerted Action for Research on Demand management in Europe), and in the European Standardisation Organisation, CEN (Comité européen de normalisation).

The Swiss system is in accordance with the CEN DSRC 5.8 GHz pre-standards. This has created the basis for an option of one-sided interoperability. Basically, the Swiss OBU TRIPON can be used abroad for all systems in accordance with the CEN DSRC 5.8 GHz standards. Contractual agreements and procedural harmonisation are a prerequiste, as is a software update on the TRIPON to accommodate the specific requirements of the foreign fee colection system. On the other hand, foreign devices cannot be used for the LSVA, because some extra functionality is required to allow recording throughout Switzerland (e.g. an electrical interface to the vehicle tachograph for the registration of the kilometres driven).

2.8 Conclusion of National context

Tages-Anzeiger · Mittwoch, 3. Januar 2001

LSVA: Start geglückt

Erstmals ist am Dienstag die neue Leistungsabhängige Schwerverkehrsabgabe (LSVA) erhoben worden.

Chiasso. – An den Grenzüb- ckelte sich das Verf- niger problemlos ten Blockaden gen die Einfü

"LSVA: Successful start": Headline in the "Tages Anzeiger" of January 3rd 2001.

After the first year of operation this headline is still correct. The system for the collection of the Swiss Heavy Vehicle Fee LSVA is working very well, but with room for improvements of some of the operational processes.

Being the first nation-wide implementation of a kilometre charging EFC system, the LSVA marks a major step towards fair and efficient road pricing.

3 Swiss Heavy Vehicle Fee LSVA

3.1 Description

3.1.1 Legal Framework

On 20.2.1994 the people and the cantons of Switzerland accepted the constitution article 36^{quater} [10]. concerning the distance-related Heavy Vehicles Fee LSVA This constitutional obligation is implemented by a federal law about the LSVA [11], which was adopted by both chambers of the parliament in December 1997. A referendum against the law was called. In the subsequent plebiscite on September 27, 1998, the Swiss people adopted the law with a large majority.

Article 85 of the Swiss constitution (former article 36) states that a fee can be introduced at the national level insofar the heavy vehicle traffic causes costs to the general public that are not covered by other charges and taxes. In the LSVA law of 19th December 1997 it is specified what is meant by these uncovered costs, namely the uncovered infrastructure costs and the balance of external costs of heavy vehicle traffic over the external benefits. Article 85 additionally states that the net revenue of the LSVA has to be used to cover the cost related to road traffic and that the cantons will participate at the net revenue as well (thereby considering special impacts on mountain and peripheral regions).

The implementation of the LSVA is put in more concrete terms through the ordinance on the distance-dependent LSVA of March 6, 2000 [12].

3.1.2 LSVA Collection System

a) Process of collection

The LSVA applies to all domestic and foreign heavy vehicles and trailers for goods or passenger transport with a maximum laden weight in excess of 3.5t.

[10] New number of article is 85

[11] SR 641.81 Bundesgesetz über eine leistungsabhängige Schwerverkehrsabgabe (Schwerverkehrsabgabegesetz, SVAG) vom 19. Dezember 1997.

[12] SR 641.811 Verordnung über eine leistungsabhängige Schwerverkehrsabgabe (Schwerverkehrsabgabeverordnung, SVAV) vom 6. März 2000.

The LSVA is levied according to the following main criteria:

- the number of kilometres covered on all public roads in Switzerland;
- the maximum permissible laden weight;
- the emission category of the heavy goods vehicle.

The **kilometres** covered in Switzerland are determined from the tachograph reading. A tachograph is available in practically all vehicles subject to the LSVA.

The **weight** relevant for the fee determination is obtained from the maximum laden weights according to the registration documents of the vehicle. Trailers are not separate fee objects but are assessed together with the pulling vehicle. The relevant weight of the vehicle combination is calculated by adding the maximum laden weights (MLW) of the pulling vehicle and of the trailer (respectively for articulated lorries the unladen weight of the pulling vehicle plus the MLW of the trailer). Should this sum exceed the MLW of the vehicle train or exceed the national weight limit of 34 tonnes, the respective limit applies. The relevant weight defined by these rules is identical to the weight actually permissible for vehicle combinations on Swiss roads.

The **emission category** is determined from the standardised EURO emission value of the vehicle.

Tariff level: the tariff in Swiss Francs (CHF) per ton of relevant weight and kilometre driven in Switzerland (tkm) is differentiated according to the emission category (air pollutants) of the trucks. In the period 2001 to 2004 the highest tariff of 0.02 CHF / tkm (level 1) is applied for trucks that only meet the EURO 0 requirements. The level 2 for EURO I trucks amounts to 0.0168 CHF / tkm, the level 3 tariff (EURO II/III) to 0.0142 CHF / tkm. The tariff will further increase in the year 2005 and reach its final average level of 0.0275 CHF / tkm as soon as Switzerland opens the first of the two rail base tunnels through the Alps. With this clause it is made sure that Switzerland offers an attractive rail alternative for transalpine road freight transport facing the high LSVA.

Figure 3-1: Two exemplifying calculations for the determination of the LSVA

Tariff, differentiated for emission class		Kilometres driven in Switzerland		Relevant weight of tractor + trailer		Amount of HVF
2,00 Cts (Emission class 1)	X	320 km	X	34,0 t	=	**217,60 CHF**
1,42 Cts (Emission class 3)	X	4 500 km	X	7,5 t	=	**479,25 CHF**

First example: Foreign vehicle transiting Switzerland

Second example: Domestic light commercial vehicles that has driven 4500 km in the current month

Declaration: Domestic vehicle owners monthly declare the fee parameters (distances and weights) to the Customs Authority, OZD. The Customs authority processes the data, determines the amount due, invoices the vehicle owner, and collects the fee.

Foreign vehicles declare their trip data at the border crossings when leaving Switzerland. The fee may be settled periodically via a petrol card or via an account held by the foreign vehicle owner at the Customs Authority. Immediate cash payment is also possible. About 20 000 foreign vehicles cross the borders each day. For them liability to the fee starts and ends at the Swiss border.

The basic fee collection processes are equal to all, irrespective of the vehicle origin (domestic or foreign) and of the recording tools used. Self declaration is adopted as the basic principle of the fee determination.

b) Domestic users

The on-board unit - trademark TRIPON® records the required trip data automatically. The kilometres driven on Swiss territory are recorded by means of an electrical connection to the tachograph. The distance recording is complemented with a global positioning system (GPS) and with a movement sensor to make sure that the tachograph signal is not intentionally interrupted or falsified. A Dedicated short Range Communication (DSRC) airlink is used to switch the recording of the kilometres on or off when passing the border. Radio beacons (i.e. antennas) are installed over the carriageways at the locations concerned.

In addition to the DSRC airlink, the on-board unit is equipped with small lights visible from the outside in order to perform remote checks from some distance. These lights indicate whether the unit is operational and whether a trailer is declared.

Figure 3-2: TRIPON drivers-view

Figure 3-3: TRIPON outside-view

The TRIPON is a compulsory equipment for all domestic vehicles. Under certain circumstances exceptions can be granted. Foreign vehicles may also use the on-board unit.

The actual number of equipped users is:

- Domestic vehicles:

  All Swiss vehicles, ca. 50'000 units (Base: 31.12.2001)
- Foreign vehicles, optional equipment:

  1’775 units already installed and initialised (Base: 31.12.2001)

The TRIPON has to be fixed to the windscreen. The antennas for DSRC and for GPS are already integrated into the unit. An authorised garage installs, inspects and approves the unit and enters the calibration data. Subsequently the fee collection authorities register the vehicle and issue a chipcard with the registration data for initialising the on-board unit. In addition, the vehicle owner receives chipcards to periodically read out the recorded data.

The rather costly units, about 800 EURO, is distributed free of charge to domestic and foreign vehicle owners until 2004. The installation costs of up to about 300 EURO have to be carried by the vehicle owner. The Swiss OBU is manufactured by the Swiss consortium Fela / ASCOM.

A short-range microwave communication link is used to switch the recording of the kilometres of the OBU on or off when passing the border. This special microwave communication link is known under the acronym DSRC (Dedicated Short Range Communication) and is standardised for electronic fee collection in Europe.

A total of 82 border crossings have been equipped with DSRC beacons and the concerning additional infrastructure. The beacons used for the Swiss LSVA are operating with the standardised CEN DSRC 5.8 GHz airlink. The DSRC road-side equipment at the border crossings consists of:

- Beacons (single and multilane configurations);
- A beacon control computer;
- Equipment to check the successful communication between the beacons and the OBU.

The beacons are managed by the beacon control computer at the site, only this control unit is connected to an IT central back-office system.

Figure 3-4: Multilane installation in Riehen

Figure 3-5: Check of successful DSRC

The beacon installations at the 82 border crossings consists of

- 92 singlelane configuration
- 104 multilane configuration equipped with:
  - 104 transmitting antennas
  - 916 receiving antennas

The supplier of the DSRC system is the Austrian Company KAPSCH, the beacons are from the Norwegian Company Q-free.

c) Foreign users

For foreign vehicles: the identification card (ID-Card) to be used at self-service machines (SSM). The identification card (ID-Card) is issued at the first entry. The card provides for self-service on entry and simplifies the processes on exit. The driver notifies his entry at a self-service machine by introducing his card and declares the relevant data (mileage reading, trailer status, payment mode) on entry. He receives a printed ticket.

The design of the man-machine interface of the SSM allows unassisted operation by the drivers already at the first time. Drivers can choose among 35 languages.

Figure 3-6: LSVA ID-Card

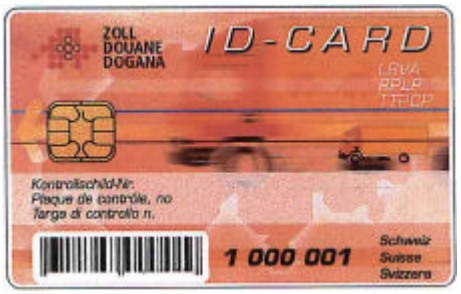


Figure 3-7: Self-service machines

A total of 162 self-service machine have been installed at 97 border crossings.

All the SSM are connected to the IT back office by a wide area network, which guaranties an availability of higher than 99 %. In case of a transmission failure the SSM works off-line. In case of a complete breakdown, the customs offices will automatically swap to a manual, forms based solution.

According to the average heavy vehicle traffic most border stations are equipped only with one or two self-service machines. On all big border stations in particular the motorway border crossing in Basel Weil Autobahn, Basel St-Louis, Chiasso Brodega and Bardonnex up to 13 SSM are installed.

The whole declaration process takes less than 2 minutes, regular users spend less than 30 seconds to obtain their LSVA ticket, encompassing the declaration of the relevant data and the printing of the ticket. The registration of the foreign vehicles started in the beginning of August 2000. By the end of December 2001 approximately 210'000 vehicles have been registered.

The supplier of the self-service machine is the German Company GSI, Gesellschaft für Systemtechnik und Informatik mbH, Salem.

d) Excemptions and special regulations

The following - Swiss and foreign – vehicles are excempted from the fee:

- Military vehicles – either with military or with civil number plates with a M+ sticker;
- Police vehicles, vehicles of oil fire/spill/chemical pollute brigades and ambulances;

- Vehicles transporting people on the basis of a license;
- Agricultural vehicles with green number plates;
- Vehicles with Swiss one-day number plates;
- Vehicles with Swiss dealer plates;
- Vehicles of driving schools which are used exclusively for this purpose an which are matriculated in a registered driving school;
- Veteran vehicles which are registered in the vehicle certificate as such;
- Vehicles with electric propulsion;
- Caravans and trailers for transporting goods of showmen and circuses;
- Caterpillar vehicles;
- Transport axles (one-axle vehicles).

For the following vehicles and types of transport there are special regulations:

- Travel in unaccompanied traffic, road/rail or road/ship (Unbegleiteter kombinierter Verkehr; UKV) :[13] Reimbursements are given for vehicles owners which carry out travels in unaccompanied combined traffic (UKV) road/rail or road/ship. This is valid for containers with minimum size of 5.5 x 2.1 meters (or 18 x 7 feet). Assessments of vehicles using UKV will be the same as with “normal” vehicles, which means that they have an OBU or to register at the self-service machines at the border crossings. Since the transport distance to an from UKV terminals to the border are not always easy to check, reimbursement will be made of a distance of approximately 40 kilometres. The following amounts are applies:
  - For containers and trailers from artics between 5.5 and 6.1 meters(or 18 to 20 feet): CHF 20.-
  - Containers and trailers from artics above 6.1 meters (or 20 feet): CHF 25.-

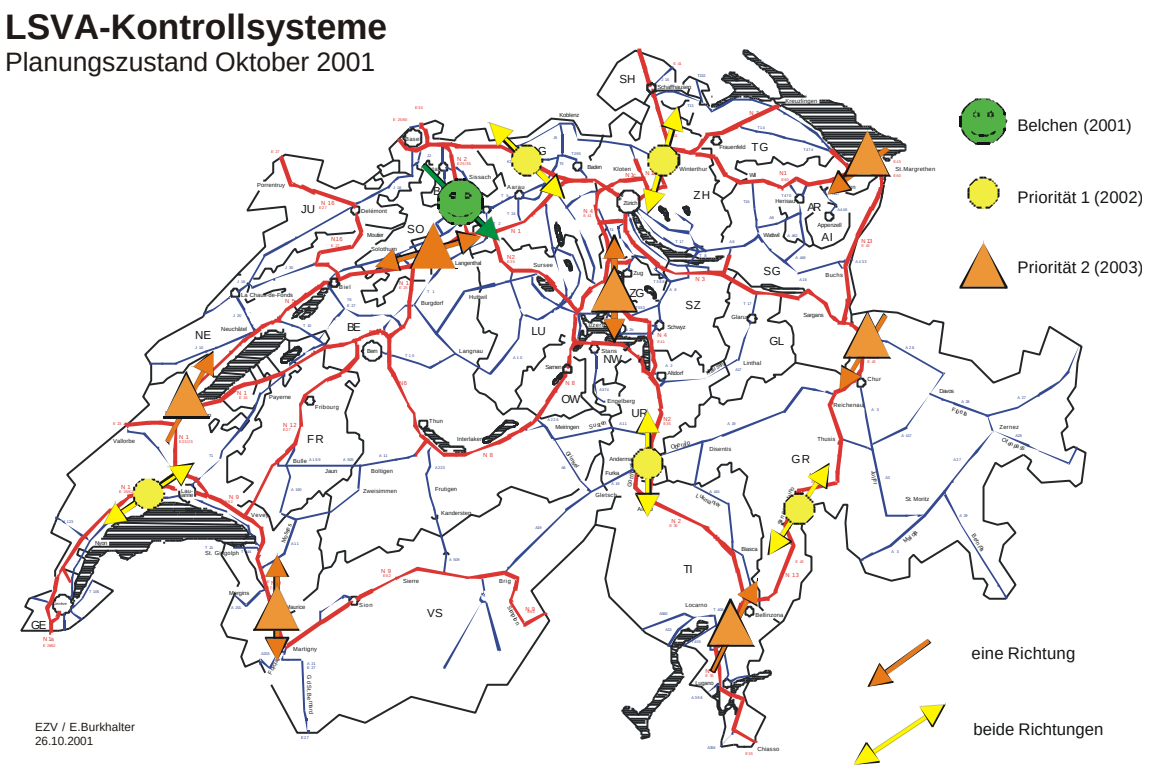
  Reimbursements have to be claimed at the SCA.
- Transport of logs/raw wood:[14] Owners of vehicles suitable for transporting logs/woods, used to transport logs or industry/energy or left-over wood, can claim a reimbursement of CHF 1.30 per m^3 wood transported. Reimbursements have to be claimed at the SCA.
- Transport of unpacked milk and livestock from agriculture: In the case of tank trucks for transporting milk or of vehicles for the transport of livestock which are used exclusively for agricultural purposes, the fee is 75% of the “normal” rates. This regulation does not apply vehicles which transport horses.

[13] SR 641.811.22 Verordnung über die Rückerstattung der Schwerverkehrsabgabe für Transporte im Vor- und Nachlauf des unbegleiteten kombinierten Verkehrs vom 1. September 2000.

e) Enforcement

Domestic vehicles can drive for a long time within Switzerland, possibly never passing the border. Hence, some vehicles hardly ever a border where the correctness of their recorded data is checked. Checks in the interior of the country are indispensable in order to enforce a correct declaration. These checks will take place at fixed or mobile enforcement stations. The moving traffic is not influenced since the checks are done via the DSRC air-link and by making use of the externally visible lamps of the OBU. Vehicles with an wrong declaration, e.g. with a missing trailer declaration, can be identified and sued. Figure 3-8 shows the state of implementation of the fixed enforcement stations. At the end of the year 2001, one enforcement station (Belchen) is already in operation.

Figure 3-8: Existing (green) and planned (yellow, orange) fixed enforcement stations



[EZV, 2001]

Foreign vehicles pass borders after comparatively short distances. Therefore they are subject to frequent checks without any further measures. Nevertheless, data from the enforcement stations will also be used to check the declared trip data of these vehicles.

[14] SR 641.811.31 Verordnung über die Rückerstattung der Schwerverkehrsabgabe für Rohholztransporte vom 16. Oktober 2000.

f) Interoperability

Interoperability with other / future EFC systems in Europe was an important prerequisite for the Swiss LSVA system from the outset.

Switzerland therefore pressed actively for the technical implementation of the charging standards to be harmonised: both in the EU coordinatory organ for fee collection in road traffic, CARDME (Concerted Action for Research on Demand management in Europe), and in the European Standardisation Organisation, CEN (Comité européen de normalisation).

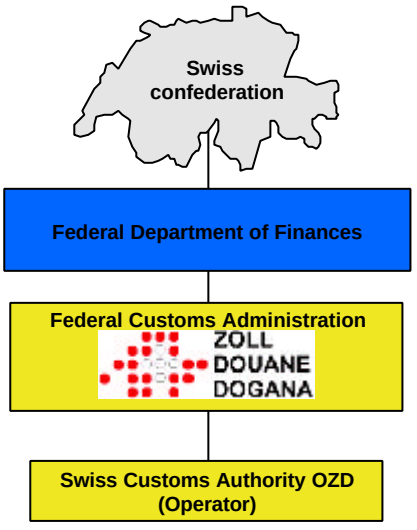
The Swiss system is in accordance with the CEN DSRC 5.8 GHz pre-standards. This has created the basis for an option of one-sided interoperability. Basically, the Swiss OBU TRIPON can be used abroad for all systems in accordance with the CEN DSRC 5.8 GHz standards. Contractual agreements and procedural hamonisation are a prerequiste, as is a software update on the TRIPON to accomodate the specific requirements of the foreign fee collection system. On the other hand, foreign devices cannot be used for the LSVA, because some extra functionality is required to allow recording throughout Switzerland (e.g. an electrical interface to the vehicle Tachograph for the registration of the kilometres driven).

3.1.3 Institutional solution / Organisation

a) Institutional solution

The Swiss Customs Administration (Eidgenössische Oberzolldirektion, OZD) was in charge of the implementation of the LSVA and operates now the system as well.

Figure 3-9: Institutional solution Switzerland



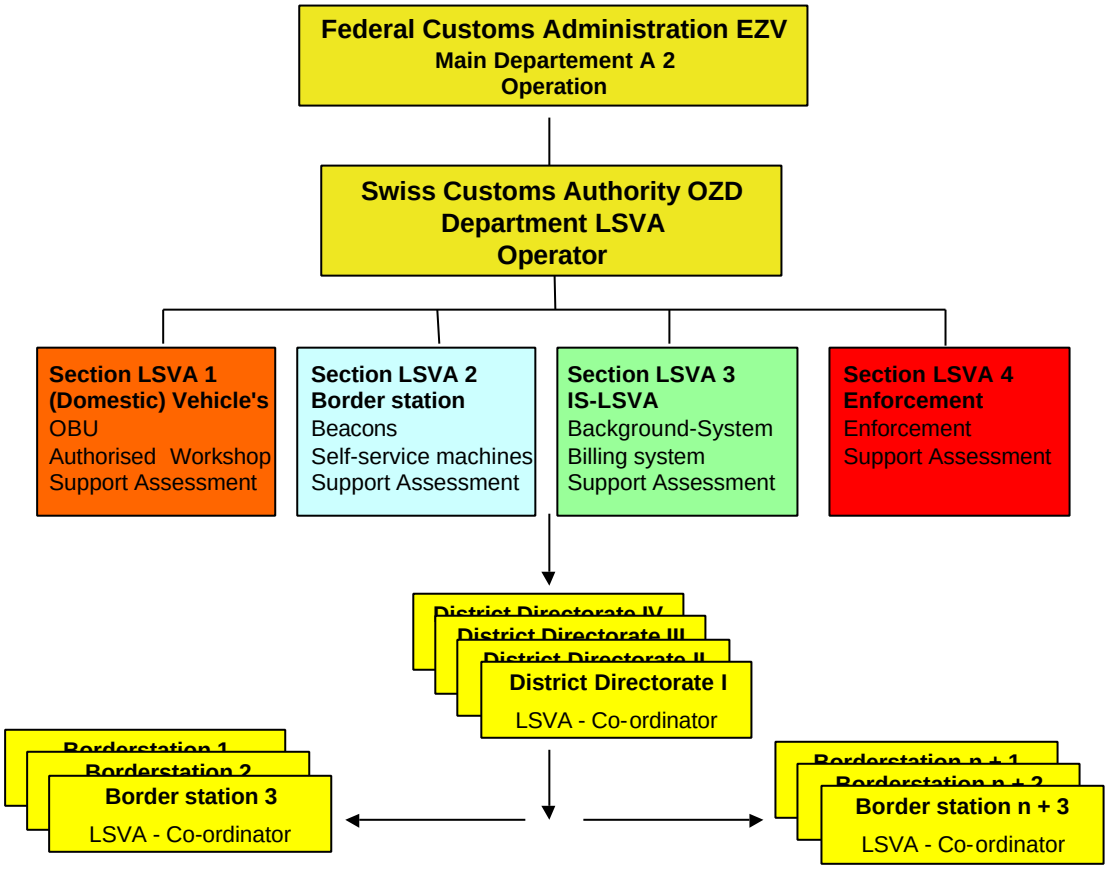
The levy of the LSVA is embedded in the normal customs procedures at the border. Intensive training of the personal and instruction material was necessary for a smoothly implementation of this new task.

b) Organisation

About 60 people are working at the headquarter and backoffice in Berne. Some 100 additional people have been recruited for the new tasks at the border.

The actual organigram of the LSVA-organisation looks as follows:

Figure 3-10: Organisation chart of LSVA – collection system



3.1.4 Expenses and revenues

a) Costs of system

The costs for the whole LSVA collection system amounts to:

Pre-analyses and preparation phase	8 Mio EURO
Development (System, OBU, Data processing)	24 Mio EURO
Road side equipment and Backgroundsystem	73 Mio EURO
Procurement cost of OBU's	87 Mio EURO
Total	**192 Mio EURO**

The rather costly OBU, about 800 EURO, is distributed free of charge to domestic and foreign vehicle owners until 2004. The installation costs of up to about 300 EURO have to be carried by the vehicle owner.

b) Estimated costs of operation and maintenance

The yearly operational costs on the side of the Swiss Confederation are estimated be about 16 Mio. EURO.

This amount comprises the expenditures for operation, maintenance, and additional personnel. Good estimates on the expenses that arises on the side of the cantons cannot yet be given. The expenses of the customs and the cantons will be reimbursed. In addition, the depreciation of the investments over a period of 7 years amounts to about 12.5 Mio. EURO of yearly amortisation costs.

c) Estimated revenues

Assumed revenues until 2004 when the tariff level can be lifted the first time 500 – 600 Mio EURO per year.

From 2008 when the highest fee level (2.75 cts / tkm) can be charged the assumed revenues will be up to 1000 Mio EURO per year.

More detail about revenues can be found at the end of chapter 4.1.2.

3.1.5 Distribution and use of the revenues

The distribution and use of the revenues is settled in article 19 of the SVAG (see chap. 3.1.1).

a) Contribution to Cantons for road building and maintenance

One third of the revenues is allocated to the cantons. The cantons use this earmarked funds mainly for financing the uncovered cost of road traffic.

The distribution between the cantons is based on:

- Length of the public roads in the canton;
- Costs of operation and maintenance of the roads;
- Population of the canton;
- Cantonal vehicle taxes.

The negative impacts on the peripheral regions is also taken into account. The definition of the peripheral regions is in accordance with the Federal Law about support on investment in mountain-regions of 21. September1997 [15].

b) Confederation; Modernisation of Railway (Rail 2000 and NEAT)

Two thirds of the revenues remain with Swiss confederation. According to the temporary provisions in article 196 of the new Swiss Constitution[16] this money will mainly be used for the financing of the railway - projects like Rail 2000, the New Railway Link thorough the Alps (NRLA) (see chapter 2.3.1), the access the European high-speed network or noise reduction projects.

The LSVA will contribute approximately 16 billion CHF to this public transport projects, which is about 50 % of the total planed costs of 30.5 billion CHF.

3.1.6 Safeguard clause

In case of not reaching the desired modal split between road and railway transalpine freight transport, the Land Transport Agreement between Switzerland and the EU includes a unilateral fiscal safeguard clause. According to this, Switzerland can raise the transit price by 12.5 per cent if less than two thirds of the rail capacity has been used for a period of ten weeks. The use of this instrument is limited to a maximum duration of 12 months and to twice within five years. As discussed in chapter 2, the implementation of this safeguard clause could be achieved by periodically introducing an additional Alpine Transit Toll (ATT) for every Alpine crossing of heavy goods vehicles (HGV) with more than 3.5t.

---

[15] SR 901.1 Bundesgesetz über Investitionshilfe für Berggebiete (IHG) vom 21. März 1997.

[16] SR 101 Bundesverfassung der Schweizerischen Eidgenossenschaft vom 18. April 1999

3.1.7 New weight limit and contingents

It is important to realise that with the introduction of LSVA in Switzerland the allowed weight limit for trucks is increased: The substantial increase of the costs of road freight transport caused by the LSVA is lowered by the fact that Switzerland abandons the existing 28 tons weight limit for heavy goods vehicles and introduces stepwise a weight limit of 40 tons.

- As of 1 January 2001, the maximum permissible weight is to be raised from the current 28 tonnes to 34 tons (vehicle combinations).
- As of 1 January 2005, the maximum permissible weight is to be raised to 40 tons (vehicle combinations).

In ECOPLAN (1999 a) the impacts of the LSVA and of the increase of the maximum weight of heavy vehicles on productivity and costs have been analysed in detail. For the different types of freight traffic the following conclusions are drawn:

- In the case of inland road freight transport a slight price increase seems plausible because the fee overcompensates the productivity effect caused by the higher average weight of the trucks.
- The opposite holds for import-/export freight transport. Here, a drop in road freight transport costs is predicted.

Additionally, for a period of 4 years - from January 2001 to December 2004 - a limited volume of vehicles with a maximum operating weight of 40 tonnes will be permitted. For freight vehicles bearing EU licence plates, 300,000 quota permits p.a. will be available for 2001 and 2002, and 400,000 p.a. for 2003 and 2004.

For a period of 4 years - from 2001 to 2004 - 220,000 quota permits will be issued for unladen vehicles and those carrying light loads (maximum operating weight, 28 tonnes) in transit through the Alps, at preferential lump-sum rates (instead of the capacity-based heavy-goods vehicle fee, transport companies will pay a reduced lump sum).

For foreign road hauliers the following quota rules are effective:

40-tonne quota permits for import/export and transit journeys:

- Half of the quotas for 40-tonne transports will be used for import/export journeys, and half for transit journeys.
- For import/export transport, a permit covers an inward and an outward journey, with loading or unloading of goods on Swiss territory. A transit permit covers one journey through Swiss territory from border to border, without loading or unloading of goods inside Switzerland.
- For motor vehicles with EU licence plates, quota permits have to be applied for in the country in which the vehicle is registered.

Unladen vehicles and light loads:

- Permits for unladen vehicles and those carrying light loads (maximum operating weight of 28 tonnes) each cover one journey through the Alps (from border to border, without loading or unloading goods inside Switzerland).
- For motor vehicles with EU licence plates, quota permits have to be applied for in the country in which the vehicle is registered.

For Swiss transport companies quotas are implemented according to the following rules:

Contingents / Quotas for 40-tonne domestic road freight transports:

- Responsibility for the issue of a permit lies with the road traffic authority or motor vehicle licensing office in the canton in which the vehicle has been registered.
- Permits for domestic transport will be issued in the form of day passes allowing one or more journeys within Switzerland (with loading or unloading of goods) on a specified day and with a specified vehicle. Since one day pass is equivalent to three quota permits, a total of 50,000 day passes p.a. will be at the disposal of the cantonal authorities in the first two years. This figure will be increased by one-third in 2003 and 2004.
- The fee per day pass will be CHF 25 in 2001 and 2002, and CHF 55 in 2003 and 2004. This is payable in addition to the capacity-based heavy goods vehicle fee and will be invoiced at the same time as the day pass is issued.
- The following regulations apply with respect to the use of quota permits for 40-tonne transports:
  - The total weights (including maximum load) as stated in the vehicle licence may not be exceeded. This means that the registered maximum load of the vehicle must always be greater than 34 tonnes.
  - In accordance with practice in the past, no tolerance will be allowed for any vehicles that are found to be over the maximum permissible operating weight upon inspection.

Contingents / Quotas for import/export and transit permits for 40-tonne transports:

- Responsibility for issuing permits lies with the licensing section of the Swiss Federal Roads Authority. Applications should be sent to the address indicated below.
- For import/export transport, a permit covers an inward and an outward journey with loading or unloading on Swiss territory within two months after the date of issue. For the inward and outward journeys, neither the origin nor the destination have to be identical. A transit permit covers one journey through Swiss territory from border to border without loading or unloading inside Switzerland. For these border-crossing journeys by vehicles registered in Switzerland, a total of 150,000 permits p.a. will be available in the first two years.
- The fee per permit will be CHF 25 in 2001 and 2002, and CHF 55 in 2003 and 2004. This is payable in addition to the capacity-based heavy goods vehicle fee and will be invoiced at the same time as the day pass is issued.

- One twelfth of the annual quota will be available each month. If a monthly quota is not fully utilised, those permits that are still available will be carried forward to the next month.
- Single permits and «subscriptions« may be applied for from the Swiss authorities:
  - The initial application form may be used for obtaining one or more permits, which will then be issued as a package and forwarded by mail.
  - A «subscription« may be requested for regularly recurring transports. Here it is necessary to submit an application for a specified number of permits that will be issued each month. Applicants should indicate the desired duration of their subscription (maximum, 6 consecutive months).
  - 20% of the monthly quota will be reserved for these subscriptions. A subscription can only be accepted if the portion of the current monthly quota and the advance reservation portion of the quota for the following month have not yet been used up.
  - If the prerequisites for a subscription are met, the permits concerned will be issued for the current month within the normal processing period. Permits for the following month will be issued within the first ten days of the month.

Permits for unladen vehicles and light loads:

- 22,000 permits are available at preferential lump-sum rates for motor vehicles registered in Switzerland for journeys through the Alps with unladen vehicles or light loads (maximum operating weight, 28 tonnes).
- Permits for journeys with unladen vehicles and light loads may only be used:
  - for transit through the Alps (from border to border, without loading or unloading goods in Switzerland and only if the Alps are crossed);
  - if the operating weight of the vehicle or combination does not exceed 28 tonnes;
  - for a single journey.
- Transport companies wishing to make use of quotas for journeys with unladen vehicles or light loads should send their applications to the address indicated below.
- One twelfth of the annual quota will be available per month. If the quota for a given month is not fully utilised, the remaining permits will be carried over to the next month.
- Single permits and «subscriptions« may be applied for from the authorities:
  - The initial application form may be used for obtaining one or more permits, which will then be issued as a package and forwarded by mail.
  - A «subscription« may be requested for regularly recurring transports. Here it is necessary to submit an application for a specified number of permits that will be issued each month. Applicants should indicate the desired duration of their subscription (maximum, 6 consecutive months).
  - 20% of the monthly quota will be reserved for these subscriptions. A subscription can only be accepted if the portion of the current monthly quota and the advance reservation portion of the quota for the following month have not yet been used up.

– If the prerequisites for a subscription are met, the permits concerned will be issued for the current month within the normal processing period. Permits for the following month will be issued within the first ten days of the month.

Receipt and processing of applications:

- Applications for permits will be processed in the order in which they are received.
- In order to ensure fair distribution of permits, the Swiss Federal Roads Authority is entitled to limit the number of permits to be issued to an applicant if the quantity applied for is clearly not in proportion to his vehicle fleet or the quantity of permits still available.
- Applications for permits must be submitted to the issuing authority by 12 noon at least two weekdays before commencement of the transport concerned. Application forms must be completed in full, otherwise they will not be accepted. Saturdays do not count as weekdays.
- Applications will be rejected if the form has not been completed in full, if they are not submitted on time, if the prerequisites are not met or if the quota for the required permit is not yet available or has already been exhausted.

Utilisation of permits:

- In principle, permits issued by the authorities are valid for a period of two months after their date of issue. However, at the turn of each year, permits issued before the end of the year remain valid until 10 January of the new year.
- Permits may not be returned, nor may they be passed on to other transport companies. No refunds will be made for unused permits. Once a subscription has been approved, it may not be cancelled, and the obligation to pay for the entire subscription comes into effect when the first permit is issued (an invoice will be included with each mailing).
- Permits may only be used for vehicle combinations for which the applicant is the registered vehicle holder. If a permit covers a number of different transports (40-tonne permits for import/export and domestic transports), the transport company is allowed to change trailers.
- The details requested on the permit must be entered before commencement of the journey.
- Permits must be shown at each border and stamped by a customs officer.

Situation with respect to already existing permits:

Under certain circumstances, transports with vehicles weighing more than the legally permissible maximum may be permitted independently of the new quota system. The most important of these exceptions concern:

- Journeys involving unaccompanied combined transport with an operating weight of up to 44 tonnes. The relevant provisions were liberalised as of 1 January 2001 (revision of Article 83 of the Traffic Regulations Ordinance);
- Journeys across borders or to border regions in vehicles with a maximum operating weight of 40 tonnes. The relevant directives on transports across borders with non-

conform vehicles dated 27 June 1997 remain in effect together with their new annexes dated 10 July 2000. The regulations governing journeys to border regions will cease to be effective on 1 January 2005 following the introduction of the 40-tonne limit;

- Transport of inseparable goods, and transfer and use of exceptional vehicles. These permits will continue to exist.

The prerequisites for the issue of the above special permits, as well as of quota permits, are determined by the type of permit concerned and are independent of one another. As is the case today, however, some overlapping may occur, as the following example illustrates: if in the case of transport of inseparable goods it is only the permissible operating weight that is exceeded (and not the dimensions as well), and if this is not greater than 40 tonnes, then the transport company may apply for both a special permit in accordance with Article 78 of the Traffic Regulations Ordinance, as well as a 40-tonne quota permit.

3.2 Political process, acceptance and pricing principles

3.2.1 The political process and acceptance of the Swiss LSVA in a historical perspective

The Distance-related Heavy Vehicle Fee (LSVA) cleared its final political hurdle in September 1998 with a surprisingly large mandate: 57 per cent of Swiss citizens voted for the new fee. This was the successful completion of a 20-year marathon. It might be surprising that a fee like the LSVA can be introduced in a country where all major political decisions are taken in public votes (referenda). The acceptance of the LSVA is due to a political window of opportunity, which created a win-win situation:

- The LSVA is an instrument for „Getting the prices right", i.e. making the users and polluters pay for the costs they cause. The user- and polluter-pays-principle is well accepted in the public and in environmental politics in Switzerland.
- The LSVA allowed to increase the weight limit with limited environmental impacts, which was a prerequisite for the land transport agreement with the EU and the whole package of agreements with the EU altogether.
- The LSVA provides important parts of the funding for the New Alpine Rail Tunnels which again are necessary to achieve a modal shift from road to rail.

In order to understand this situation, we shortly go back to the long history of the LSVA: As early as 1978, the Swiss parliament gave the Federal Council the mandate to create a legislative basis for an HGV fee. The main argument in favour of this was provided by the high uncovered costs of goods transport on the road. Two years later, the Federal Council presented their proposal. This included a distance-related fee, differentiated according to weight and distance travelled. It quickly became apparent that it was still too early for this kind of solution. After an extensive debate, Parliament decided on a fixed annual fee of between 500 and 3000 Swiss francs (the rates have since been increased to 1300-8000 Swiss francs).

A popular initiative launched from the „green" side which wanted to introduce a distance or performance related tax was rejected by a majority of 66% of the voters in 1986. Time was not ready for this new pricing instrument and the „wrong" political side stood behind the initiative.

Since the article on the FLSVA was limited for a time of 10 years, the government had to submit a new proposal to the Parliament in the mid nineties. The government proposed to refine the fee in a way to achieve better incentive effects for a modal shift and more fairness with respect to the distances performed. This time, the public vote was a success because the proposal came from the government and because the proposed amendment of the Swiss constitution only stated that the Confederation *can* levy a fee in order to cover the costs from trucks to society which are not otherwise covered. This was, for the first time in Switzerland, that the principle of internalisation was embodied in legal grounds. It is interesting to note that

in the public debate preceding the vote the cost recovery principle (which is more a fairness criteria) was more important than the pricing principle (the efficiency consideration).

The real political obstacle was however the law, following the constitutional article, which fixed the level of the fee and was therefore much more specific. It was challenged in a referendum but the LSVA was accepted with a majority of 57%. In March 2000, the detailed ordinance was decided by the national government. It set the final green light for the introduction in 2001.

The success of the LSVA was an important success on the way towards „getting the prices right" and a breakthrough for the internalisation as a principle. Nevertheless, the votes on this subject were dominated by other arguments and the term „external costs" even avoided by the advocates of the tax. Two main other arguments were decisive for the success of the LSVA in the public vote:

- The revenues, according to the constitution, should be used to cover the external costs (a principle which was not very well detailed and could mean everything from a compensation of victims directly or via tax reductions or simply keeping the money in the treasury to compensate for expenses in the field of environment and health). When the financing problems of the New Alpine rail tunnels (NEAT) emerged, it was decided - again in a public vote - that two thirds of the revenue was used to pay the NEAT. This new way to use the revenues was important for political acceptance, since the NEAT were quite popular as means to shift freight transport from road to rail and to improve at the same time the passenger transport connections to Italy.
- A second major plus for acceptability was the link with the bilateral agreement on land transport. Since the European Union clearly wanted to abolish the 28-ton weight limit, a compensating instrument was necessary to avoid a flood of trucks trough the Swiss Alps. Therefore, the LSVA was essential to avoid a strong opposition from the Alpine Cantons and the ecologists against the transport agreement - and, since all the seven sectoral agreements are interlinked - against the whole package of sectoral agreements between Switzerland and the European Union signed in 1999. This link led even to a very strong support of the industrial associations for the LSVA because industry wished to avoid any risk of a failure of the bilateral agreement. The agreement was considered as a key factor for the future development of the Swiss economy.

To summarise, the success of the LSVA is due to an extraordinary situation, a unique window of political opportunity, where environmental considerations (avoid lorry transit) were combined with transport and regional considerations (assure the finance for NART) and economical and political arguments (avoid opposition against the agreements Switzerland/EU). Last but not least, the success is also due to the fact that lorry taxation and the problem of the external costs of transport have been on the agenda for a long time and people got familiar with it.

Table 3-1 summarises the major milestones towards the new mileage dependent Swiss LSVA and gives and outlook of future major steps.

Table 3-1: Milestones of the Swiss heavy vehicle fee and related fields

1984, 26 February The electorate approves the fixed HGV fee (59 per cent vote yes). 1986, 7 December The popular initiative for a Distance-related Heavy Vehicle Fee is rejected (64 per cent vote no). 1992, 2 May The EU and Switzerland sign the Transit Agreement, which is valid for 12 years. Switzerland commits herself to building the New Trans alpine Railway Axis (NEAT), and to promoting combined road/rail transport. The EU accepts the 28-tonne limit for heavy goods vehicles. 1992, 27 September The Swiss approve the building of the NEAT (64 per cent vote yes). 1994, 20 February The Swiss people approve the constitutional basis for a distance-related Heavy Vehicle Fee (67 per cent vote yes). They also decide in favour of the Alpine Protection Initiative (by a majority of 52 per cent). This calls for a shift of transalpine goods transport to rail, and limits the extension of the motorways in the Alps: provisions that are now part of the Federal Constitution (basic law).	1998, 23 January In Kloten, the negotiating delegations of the EU and Switzerland agree on a compromise for the over-land transport sector. This forms the basis for the sectorial Land Transport Agreement. 1998, 27 September The Swiss people approve the introduction of the distance-related Heavy Vehicle Fee (57 per cent vote yes). 1998, 29 November The Swiss people are in favour of modernising the Swiss railways. At the polls they approve proposed financing of 30 billion Swiss francs in total. This also provides a new basis for the funding of the NEAT. 1999, 1 January The Swiss railway reform comes into force. Access to the rail network for goods transport is opened up for a usage charge. 1999, 21 June Luxembourg, Switzerland and the EU sign the seven sectorial agreements.	2001, 1 January The first phase of the LSVA is introduced. The weight limit for HGVs is increased to 34 tonnes. 2005, 1 January The LSVA is increased. In Switzerland, the 40-tonne limit applies generally. 2006/2007, The first NEAT tunnel (Lötschberg) is scheduled to open. The third phase of the LSVA is introduced. 2012/2013 The second NEAT tunnel (Gotthard) is scheduled to open.

[DETEC (2000)Page 22]

3.2.2 Long tradition of external costs calculations in Switzerland

An important reason why the LSVA is explicitly founded on external cost and benefit figures is the fact that the assessment of the environmental and accident costs of transport has a rather long tradition in Switzerland. The monetary valuation of the adverse effects of road transport on the environment and human health has been subject of different projects within National Research Programmes, but also in studies commissioned by the Federal Department of Environment, Transport, Energy and Communication (see box below). Thus, scientifically well-founded arguments justifying an adjustment and an increase in taxation of heavy vehicle traffic were available in Switzerland.

Estimates of external costs and benefits in Switzerland

In 1977, the Integral Concept for Transport (in German: Gesamtverkehrskonzeption, see EVED 1978 and Walter 1998) asked for an identification, monetarisation and internalisation of external effects of transport. A decade later, a system of indicators for social costs and benefits was published (GVF 1988). It was then decided to start the monetary evaluation of external effects, however limited to those areas where the identification of the physical effects seemed rather easy and the assignment of monetary values not too difficult. The study on the external cost of traffic accidents (ECOPLAN 1991) was the first study published, followed by studies on damages to buildings (Infras 1992) and on noise (Infraconsult 1992). At the same time, studies of the National Research Programme 25 "Cities and Transport" (NRP 25) were published and showed the comparatively high external costs of transport in urban areas (ECOPLAN 1992b, Infras 1992, Jeanrenaud et al. 1993).

Joint study of the ministry and the NRP 25 (ECOPLAN 1992a) extensively dealt with external benefits. The study came to the same conclusion as most other publication about this issue. It showed that external benefits of transport are almost irrelevant because almost all of the (large!) benefits of transport are transmitted through market mechanisms.

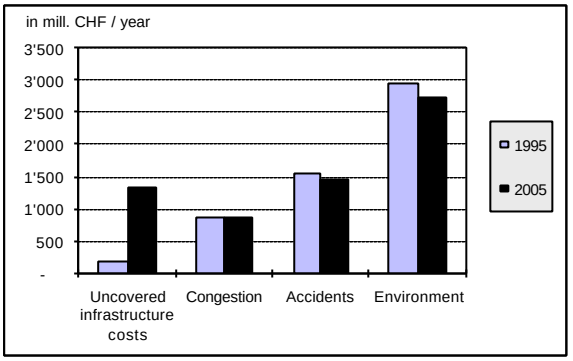
In the following years, various up-dates of these studies have been carried out and a project investigating the health effects of air pollution (ECOPLAN 1996) has been added. An important result of this scientifically very well founded new bottom-up assessment was that the external health costs of air pollution were estimated to be substantially higher than the accident costs. This is particularly true for the lorries, due to their emissions of particulate matter (PM10 and PM2.5).[17]

Studies on the costs of climate change (Infras et al. 1994) and on congestion (Infras 1998) have not fully been integrated into the framework of "official" external costs regularly published by the Ministry. In the National Research Programme 41 Transport and Environment a project (Maibach et al. 1999) presented updated figures as well as forecasts for the year 2005. The results for the uncovered infrastructure costs and the total external costs per year are reproduced below.

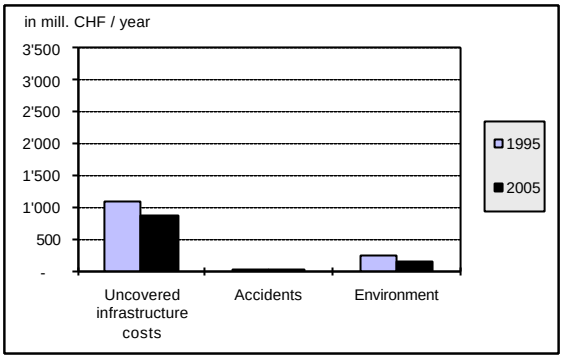
‘

[17] An important progress in this field was a study carried out on behalf of the World Health Organisation WHO and its Ministerial Conference in London in June 1999 (Sommer et al. 1999; Seethaler 1999). The study assessed the health costs due to road traffic-related air pollution. Three mixed teams with specialists from Switzerland, Austria and France for air pollution, epidemiology economy respectively, established a commonly agreed methodology for all the three fields just mentioned starting from the Swiss study of 1996. It was shown that the health costs due to air pollution (from all sources) amount to about 1.1% up to 5.5% of GDP in the three countries. For Switzerland, the costs are about 6.7 billion CHF per year, and a share of about 3.5 billion CHF is attributable to road traffic.

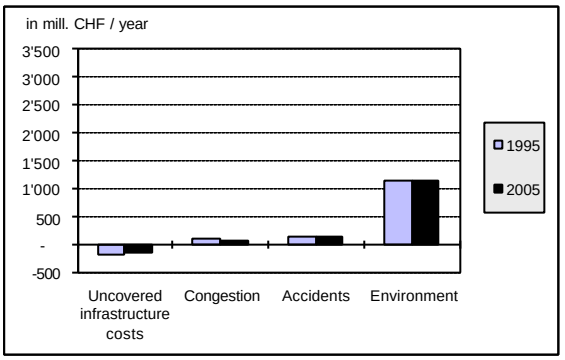
*Uncovered infrastructure costs and external costs of **road passenger** transport*



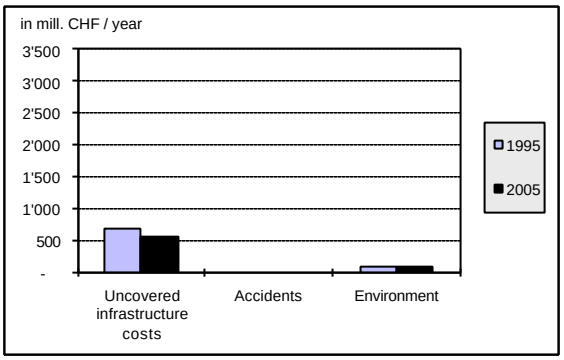
*Uncovered infrastructure costs and external costs of **rail passenger** transport*



*Uncovered infrastructure costs and external costs of **road freight** transport*



*Uncovered infrastructure costs and external costs of **rail freight** transport*



The external costs of accidents, environmental and human health effects are estimated at almost 5'800 million CHF for road transport and 380 million CHF for rail transport. Because of the much higher total annual mileage (i.e. vehicle kilometres driven) passenger road transport contributes a higher share to the total external costs of road transport though the costs per vehicle kilometre are of course substantially higher in the case of freight transport. The costs of congestion are estimated at 995 million CHF. The total external and congestion costs amount to about 2 % of the Gross Domestic Product (GDP). The order of magnitude of this figure is confirmed by other studies on external costs of transport (e.g. Infras and IWW 2000).

In the case of uncovered infrastructure costs the comparison between the two modes road and rail transport shows a completely different result: Whereas they are estimated at more about 1'825 million CHF - and further 935 million CHF are paid by taxpayers for non profitable services called "public service obligation" - for rail transport in the year 1995, the revenues from road transport (first of all fuel and vehicle taxes) and the costs for road infrastructure have been well-balanced in the year 1995: Both amount to about 6'600 million CHF. A deterioration is expected for the year 2005 because of increasing road infrastructure costs (8'600 million CHF per year) on the one hand and lower revenues first of all from the fuel taxes on the other hand. The latter effect is caused by fuel efficiency improvements achieved by the car manufacturers. In the case of road freight transport it is assessed that the revenues from the LSVA will not only cover by far the attributable infrastructure costs but also the total external costs caused by road freight transport.[18] Therefore, the additional need for action refers to passenger and not to freight transport.

For rail transport a slight improvement, i.e. a decrease of uncovered infrastructure costs, is expected because of efficiency gains resulting from the ongoing liberalisation process in rail transport.

18 The revenues from the LSVA are not contained in the figures.

In the studies described in the box above total and not the marginal external costs have been estimated. The level of the LSVA has originally been derived from these estimates of total external costs on the one hand, and the total annual transport performance of heavy vehicles on the other hand. Compared to existing taxes and charges in the European countries, the level of the LSVA is high as the following example shows: After the year 2001 a 40 t truck of the EURO 0 class will have to pay 0.8 CHF per kilometre driven within Switzerland. This rate corresponds to an increase of the diesel tax by approx. 2 CHF / litre.

3.2.3 The Swiss LSVA in the view of economic pricing principles

In the last years a number of projects have developed and applied pricing principles for the transport sector (e.g. Jansson and Lindberg 1997, the Concerted Action on Transport Pricing Research Integration (CAPRI) of the Commission, ECOPLAN (1999 b), High Level Group on Infrastructure Charging 1999). In this research work a pricing approach is advocated that is founded on neoclassical welfare economics and therefore stresses the relevance of short-run marginal costs as a basis for pricing. The ”price-relevant marginal costs” consist of three different parties:

- Producer costs (e.g. road wear and tear, reconstruction of road surfaces);
- User costs (e.g. congestion costs);
- External costs (e.g. costs of air pollution and noise).

Below we discuss some of the main features of the LSVA in the light of the findings in the recent work on transport pricing principles for road freight transport.[19]

The base for the calculation of the LSVA

The majority of the price-relevant costs depend on the mileage (e.g. costs of road wear and tear, costs of air pollution). Correspondingly, the introduction of an electronic kilometre charging system is considered as an appropriate pricing tool to reflect the marginal costs of road freight transport. Against this background, the distance-dependency of the LSVA is probably the core advantage of this pricing instrument compared to other available instruments.

Beside the mileage, the total weight of heavy vehicles is the second central basis for the calculation of the fee to be paid by the owners of the vehicles. It is well known that the weight influences some of the price-relevant costs. Heavier trucks cause, for example, higher CO_2-emissions because of the generally higher fuel consumption compared to lighter vehicles. However, the relation between the weight of the vehicle and the level of the price-relevant costs caused is in most cases not as simple as assumed by the LSVA. In the case of infra-

[19] See SUTER S. and WALTER F. (2001).

structure costs, for example, the axle configuration has a larger impact than the pure weight of the truck (see Jansson and Lindberg 1997).

The LSVA to be paid increases proportionally with the permitted total vehicle weight. This puts certain categories of heavier trucks (e.g. a truck with trailer of 40 tons and 3+2 axles as frequently used vehicle in international transport) at a disadvantage compared to lighter trucks as this difference can in most cases not fully be justified by the differences in the price-relevant costs caused.

Differentiation of the LSVA

One result of the analysis of the different types of price-relevant costs is that the costs caused per kilometre driven strongly differ depending on a number of impact factors like the following ones:

- time (e.g. influence on the costs of congestion and of noise);
- place, region (e.g. influence on costs of air pollution);
- emission technology of the vehicle (e.g. influence on the energy consumption/CO_2-emissions);
- vehicle and road type (e.g. influence on the costs of road wear and tear).

Only a highly differentiated pricing instrument is able to implement these requirements of the pricing principles for road freight transport. On the other hand, the stronger the pricing instrument is differentiated, the higher are its implementation costs. A compromise has to be found. The question is whether the LSVA can be considered to be a good compromise.

The differentiation of the LSVA is limited to the emission technology with regard to air pollutants, i.e. to different EURO norms. The extent of differentiation does not depend on the differences between the emission factors of the three technology categories which would be the most appropriate basis for price differentiation. For political reasons another approach has been chosen. The level and the structure of the LSVA was an issue of debate between the European Commission and the Swiss Government in the negotiations on a bilateral agreement between the European Union and Switzerland. It was agreed that the fee level can differ for different types of trucks but only within a spread of +/- 15% from a weighted[20] average fee level. It is this average level that is fixed in the bilateral agreement. The LSVA sets an incentive to use cleaner trucks but looking at the current differences of emission factors between EURO 0, EURO I and EURO II/III, the maximum spread of +/- 15% favours the most polluting trucks.

The LSVA does not include a higher fee level in densely populated, or otherwise sensitive areas where several price-relevant costs are substantially higher than in an "average situation" (see ECOPLAN 1999).

[20] Weighted means here that the shares of vehicle kilometres per emission category are taken into account.

The level of the LSVA

According to the legal grounds of the LSVA the intention of the fee is rather a kind of total cost recovery: The relevant article in the law on the LSVA says that the revenues from the LSVA must not exceed the uncovered infrastructure costs and the external costs of heavy vehicle traffic.[21] The LSVA implements some kind of average rather than marginal cost pricing. It is well known that in the cases of the three price-relevant cost categories mentioned above marginal costs may substantially differ from average costs. Against this background, the price signals of the LSVA do certainly not claim to be optimal in the sense of the pricing theory. It is difficult to judge this "systematic deviation" from optimum price signals:

- Despite progress made in the valuation of externalities from transport the uncertainties with regard to monetary values are still considerable. A practical pricing scheme oriented at marginal cost pricing would be confronted with the fact that the optimum price signals can hardly be derived.
- The cost-functions (i.e. the relationship between the traffic volume and the short-run external costs) differ between the types of externalities. These functions determine whether estimates based on average costs over- or underestimate the price-relevant marginal costs. In the case of noise, for example, marginal external costs tend to be lower than average external costs whereas the opposite is true for certain air pollutants.

Finally, the LSVA level was a compromise between what was acceptable to the transport ministers of the EU member states and what was necessary to assure an incentive to keep the number of lorries as low as possible in order to avoid a strong opposition of the ecologists and the alpine regions in Switzerland. The final outcome of the negotiations was a maximum charge of a transit journey through Switzerland from Basle to Chiasso (i.e. 200 EURO per passage). This maximum corresponds with the LSVA for a 40 t truck driving the same distance.

One could even say that in the end the standard price approach as known e.g. from Baumol and Oates 1978 became more important than the idea of internalising external costs in the argumentation line of Pigou. In the standard price approach the price level of a pricing scheme is not derived from detailed marginal cost estimates but rather from well-defined targets that are to be achieved by the pricing scheme, i.e. through the reactions of the relevant actors on the changes in the price signals. In the case of the LSVA this means that the fee level was finally defined in a way that the incentive effect of the LSVA is big enough to make (transalpine) road freight transport switch to rail services. The external cost estimates as basis for the definition of the fee level lost a considerable part of the importance they certainly had in the early stages of the discussion about the introduction of a LSVA.

[21] It should be noticed that the fee level has solely been derived from external cost estimates because the Swiss Road Account does not show any uncovered infrastructure costs of heavy vehicles altogether. Some types have an under-recovery but this is overcompensated by the over-recovery of other types of heavy vehicles.

The impact: environmental objectives

In the fields of Alpine transit, the environmental concerns are particularly high, and they were also expressed by Swiss people when they accepted the Alpine Initiative in 1994. From this vote a target value concerning the number of trucks crossing the Swiss Alpine corridors has been derived. The target value lies substantially below the actual number of transalpine HGV trips. Analyses in different EU research projects (e.g. PETS, STEMM) have shown that this target will neither be achieved with the LSVA nor would it be if the LSVA were purely based on short-run marginal external costs. Therefore, a long list of accompanying measures such as subsidies for combined transport and for attractive Rolling Motorway Services were decided, and still, it is rather optimistic to assume that the targets of the Alpine Initiative will be met in time.

This fact also reveals the political or practical limits of the ”pure” internalisation approach derived from marginal cost pricing theory when high transport volumes and a rather ”limited number of sufferers from externalities” are combined. This combination leads to price levels that do not change road transport volumes in a way that people and government might judge the remaining road transport volumes as acceptable. In this situation sustainability and/or existence value considerations (see Neuenschwander et al. 1998) should accompany the ”pure” internalisation approach.

From the analysis above we conclude that the Swiss heavy vehicle fee does not correspond with a number of requirements of marginal cost pricing principles as derived from a welfare economic approach. One might even argue that the deviations from a theoretically optimal pricing scheme might be as large as in the case of a fuel tax which causes substantially less implementation costs. We find two arguments that speak against this conclusion. The first is only valid for the specific Swiss case and therefore less important in a more general view than the second one:

- The argumentation of the low implementation costs does not go for the Swiss case because of the high level of a fuel tax that would correspond with the LSVA. An additional tax on diesel of as much as 2-3 CHF cannot be implemented without extensive border controls. One would have to ensure that trucks leave Switzerland only with full fuel tanks. And the large price difference to the other European countries would make fuel smuggling profitable.
- In the discussion above we analysed the LSVA along a narrow pricing or internalisation approach. The strong and pure foundation on neoclassical welfare economics of pricing in transport is not uncontested. Some authors claim ”that there should be the possibility left to put an internalisation strategy into a broader context of policy goals and strategies than is presented by the narrow fairness/efficiency philosophy behind neoclassics” (Rothengatter in Christensen et al. 1998). Policy goals of internalisation can then be:
  - optimal use of existing capacity;
  - abolishing subsidies which are not justified by public good characteristics of the transport system;

- allocation of the costs to the agent who is responsible for their production (polluter-pays-principle);
- achieving defined long-term environmental/safety quality standards;
- better balance of regional development;
- better balance of social development;
- developing new markets and new technology with lower consumption of natural resources.

Without going into detail it is obvious that the LSVA is very suitable to contribute to some of these objectives and shows advantages compared to a fuel taxation. It is in this light that, according to our view, the LSVA should be judged.

4 Effects of the LSVA

4.1 Expected effects

We have shown in the preceding chapter 3.2 that the acceptance of the LSVA is certainly due to a political window of opportunity. The following points have been especially mentioned:

- The user- and polluter-pays-principle which is well accepted in the public and in environmental politics in Switzerland.
- The LSVA is part of a whole package: together with the introduction of the LSVA the weight limit is increased, which was a prerequisite for the land transport agreement with the EU and the whole package of agreements with the EU altogether.
- The LSVA provides important parts of the funding for the New Alpine Rail Tunnels which again are necessary to achieve a modal shift from road to rail.

Apart from this generally favourable set-up, ex-ante estimates of the expected effects of the LSVA on transport volumes and the economy as a whole were certainly also a major pillar to win the referendum. The Federal Department of Environment, Transport, Energy and Communications (DETEC) carried out several major studies on the expected effects of the LSVA. Several Cantons followed this strategy and ordered additional studies about the expected effects on cantonal level.

These studies have predicted that the introduction of the kilometre-dependent LSVA and the simultaneous increase of the weight limit

- are in line with the overall Swiss transport policy
- will reduce the road performance of road freight transport;
- will cause major structural adaptations in the road freight transport sector and increase its overall productivity;
- will not increase the unemployment rate;
- will have only minor impacts on consumer product prices.

During the political dispute before the referendum the supporters of the LSVA based their arguments heavily on these results of the ex-ante studies. And it was difficult for the opponents to develop economic arguments against the LSVA.

In the following sub-sections we summarise some of the results of the studies on the expected effects of the Swiss LSVA, mainly for two reasons:

- their importance for the acceptance of the LSVA;
- until today only rudimentary data on the real effects are available. As described in chapter 3.1 the level of the LSVA will rise substantially in 2005, reaching its final level probably 2007. We therefore have to base a major part of our analysis of the effects of the Swiss LSVA on ex-ante estimates.

4.1.1 Expected effects on traffic and transport volumes [22]

In this section we discuss the expected effects of the Swiss LSVA on traffic and transport volumes in Switzerland, differentiating between domestic, import/export and transit freight transport.

a) Reference scenario

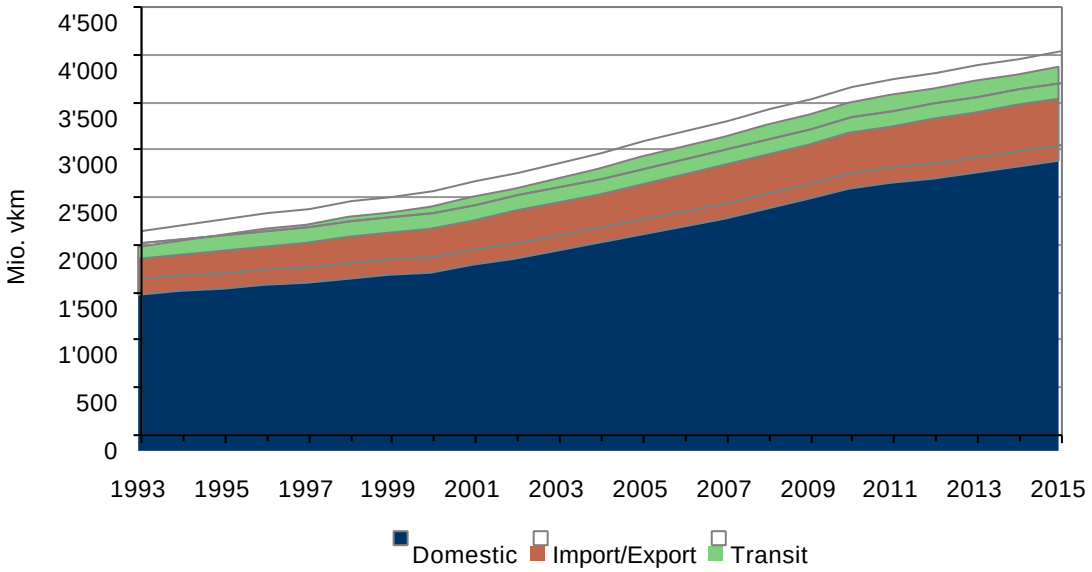
Prior to the discussion of expected effects of the LSVA the development of road freight transport volumes until 2015 had to be estimated in a so-called *reference scenario*, i.e. a scenario in which the most important principles of Swiss transport policy remain unchanged.

So the reference scenario is characterized by the following three elements:

- 28-tonne limit for heavy goods vehicles;
- Ban on Sunday and night-time driving for heavy goods vehicles;
- Flat tax for heavy goods vehicles.

The development of Swiss road freight traffic in the reference scenario is displayed in the following figure.

Figure 4-1: Development of Swiss road freight traffic in reference scenario (1993-2015)



[22] Major source for this section is: Bureau for Transport Studies (1999), Die verkehrlichen Auswirkungen des bilateralen Landverkehrsabkommens zwischen der Schweiz und der Europäischen Union auf den Strassen- und Schienengüterverkehr (GVF Report 2/99), Bern.

The reference scenario shows two principal tendencies:

- A steady growth in road freight transport: The performance of this sector increases from 2'100 million vehicle kilometres in 1993 to slightly more than 4'000 million in the year 2015. This means almost a duplication of traffic.

  Sticking to the 28-tonne limit for HGV without introducing the LSVA is obviously not a suitable measure to reduce the growth rate of road freight traffic.

- Domestic traffic plays a dominating role regarding the performance of the sector: In 2001, it accounts for about 73% of the overall performance. Import/export accounts for 18%; transit traffic for only 9%.

  Transit (transalpine) traffic certainly plays a significant role with regard to the modal shift from road to rail as stipulated in the constitutional article on the protection of the Alps. With regard to the general environmental effects (pollution, noise) of road transport in Switzerland, however, the development of domestic traffic is much more important.

In the next few sections, we want to analyse the effects of two major changes in Swiss transport policy. The new regulations are codified in the Swiss legislation as well as in the bilateral agreement on land transport (BALT) between Switzerland and the EU. The measures in question are:

- Rise of the maximum permissible laden weight of HGV from 28 t to 34 t in the year 2001 and to 40 t in the year 2005.
- Introduction of the LSVA, i.e. a distance-related heavy vehicle fee covering the whole road network of Switzerland (for details see Table 4-1).

b) Impact analysis model

The 'chain of effects' from the rise of the maximum permissible laden weight and from the concurrent introduction of a performance-related heavy vehicle fee towards a change of transport volumes is quite complicated in reality. The simplified impact analysis model used for calculating the following estimations can be described as follows:

First, there is an increase in productivity, basically due to two effects:

- adjustment of the fleet of vehicles (employment of larger, up to 40-tonne vehicles);
- improvement of the average utilisation of vehicles (less deadheads and/or increase in net tonnage).

This productivity effect leads to a decrease in transport costs.

Second, there is a reverse price effect due to the introduction of the LSVA: an increase in transport costs.

These two contrary effects result in a total change of transport costs that might be positive or negative. Subsequently, transport demand will alter according to the change of transport costs, which finally results in a change of road freight transport volumes in Switzerland.

These effects have been analysed with the following results:

- After the introduction of the 40-tonne limit by the year 2005, the average net tonnage of domestic traffic amounts to 5.6 t to 6.1 t; in the reference scenario, this value is only 5 t in the same year. The productivity improvement is even more considerable in the case of import/export traffic.

  As a result of the increase in average net tonnage, transport costs are expected to decrease 11%-18% for domestic traffic and 20%-26% for import/export traffic, respectively.

- On the other hand, the introduction of the LSVA results in increasing transport costs. As mentioned in previous chapters, the rate of the heavy vehicle fee depends on the maximum permissible laden weight and the emission category of the vehicle as well as on the kilometres driven. The current and future rates of the LSVA are shown in the following table:

Table 4-1: LSVA rates for different emission categories of the vehicle per vkm and tonne

Vehicle category	2001	2002	2003	2004	2005	2007	2010	2015
∅ LSVA (Rp. per vkm and tonne)[23]					2.47	2.75	2.75	2.75
for cleanest vehicle category	1.42	1.42	1.42	1.42	2.29	2.34	2.34	2.63
for 2nd cleanest vehicle category	1.68	1.68	1.68	1.68	2.56	2.73	2.69	2.90
for all other vehicle categories	2.00	2.00	2.00	2.00	2.84	3.12	3.04	3.16
max. perm. Laden weight in CH	34 t				40 t			

Table 4-2 shows the net change of transport costs for domestic traffic after the introduction of the LSVA. Because of the high uncertainty concerning the productivity effect due to the increase in net tonnage, two different scenarios have been calculated.

[23] 1 Rp = CHF 0.01 = € 0.0068 (as of January 2002).

Table 4-2: Productivity effect, savings, LSVA and net change of transport costs for domestic transport

	Scenario **low increase** in net tonnage Compared to reference scenario				Scenario **high increase** in net tonnage compared to reference scenario			
year	Product. effect	savings	LSVA	net change of trsp. costs	product. effect	savings	LSVA	net change of trsp. costs
2001	+9.5%	-8.3%	+12.1%	+3.8%	+15.4%	-12.8%	+11.7%	-1.1%
2005	+12.9%	-11.2%	+18.1%	+7.0%	+22.4%	-17.8%	+17.3%	-0.6%
2007	+12.9%	-11.1%	+20.2%	+9.1%	+22.3%	-17.8%	+19.3%	+1.5%
2015	+12.8%	-11.0%	+20.1%	+9.1%	+22.1%	-17.7%	+19.2%	+1.5%

The results show that the net cost effect of the introduction of the LSVA and a concurrent rise of the maximum permissible laden weight depends to a great extent on the future net tonnage.

- With a very conservative estimation of the productivity effect (scenario low increase in net tonnage), one can expect a net transport cost increase between 4% (2001) and 9% (2015).
- With a higher productivity effect (scenario high increase in net tonnage), the savings and additional LSVA charges cancel each other out. We can expect a slight net price reduction (-1.1%) in the year 2001 but a small additional burden (+1.5%) in the year 2015.

For import/export traffic, the cost savings due to the productivity change dominate. One balance, on can expect - still depending on the future net tonnage - a net relief of -6% to -10% in the year 2001 and -4% to -11% in the year 2015.

The change of road transport costs influences traffic volumes on road and rail. Price elasticities of traffic demand are necessary in order to calculate new traffic demand on road and rail. To this end, the following elasticities are used: [24].

[24] These elasticities have been derived already by ECOPLAN (1998), Auswirkungen der leistungsabhängigen Schwerverkehrsabgabe (LSVA) und der Ablösung der Gewichtslimite im Strassengüterverkehr, GVF-Auftrag Nr. 287.

Table 4-3: Direct price elasticity of transport demand E (xROAD/pROAD)

NST/R chapters	Domestic traffic		Import/export traffic	
	lower bound	upper bound	lower bound	upper bound
0 Agriculture, forestry	-0.325	-0.650	-0.600	-1.200
1 Foodstuffs, animal fodder, oil seeds	-0.250	-0.500	-0.400	-0.800
2 Solid mineral fuels	-0.350	-0.700	-0.600	-1.200
3 Crude petroleum, petroleum products	-0.400	-0.800	-0.600	-1.200
4 Iron ore, iron and steel waste	-0.425	-0.850	-0.700	-1.400
5 Metal products	-0.425	-0.850	-0.700	-1.400
6 Cement, minerals	-0.450	-0.900	-0.700	-1.400
7 Fertilizers	-0.350	-0.700	-0.600	-1.200
8 Chemicals, paper	-0.225	-0.450	-0.400	-0.800
9 Transport equipment, glass, textiles, misc.	-0.125	-0.300	-0.200	-0.500

Table 4-4: Cross-price elasticity of transport demand E (xRAIL/pROAD)

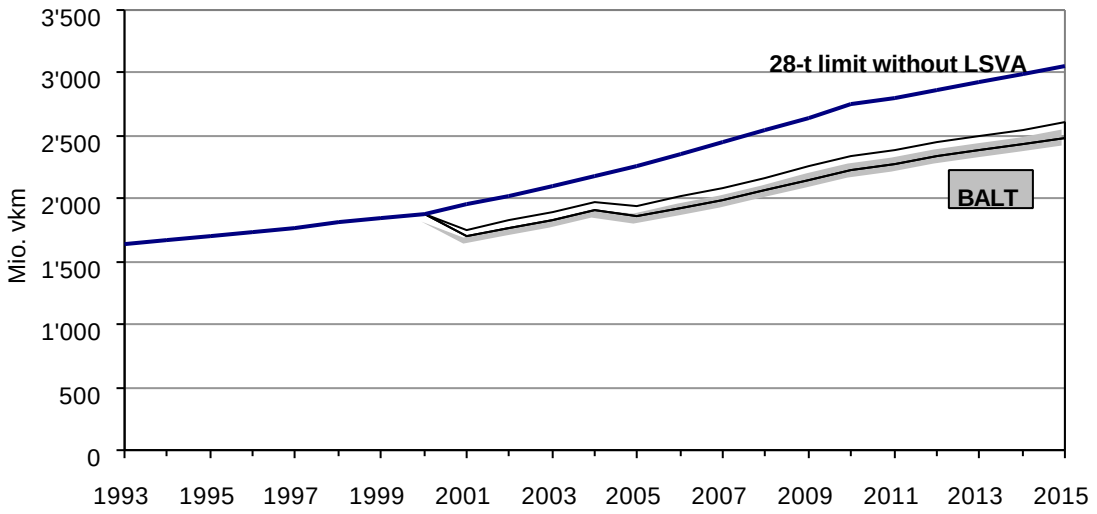
NST/R chapters	Domestic and import/export traffic	
	lower bound	upper bound
0 Agriculture, forestry	0.400	0.800
1 Foodstuffs, animal fodder, oil seeds	0.700	1.400
2 Solid mineral fuels	0.100	0.200
3 Crude petroleum, petroleum products	0.400	0.800
4 Iron ore, iron and steel waste	0.100	0.200
5 Metal products	0.500	1.000
6 Cement, minerals	0.900	1.800
7 Fertilizers	0.200	0.400
8 Chemicals, paper	0.300	0.600
9 Transport equipment, glass, textiles, misc.	0.500	1.000

c) Expected effects on domestic freight traffic

Compared to the reference scenario as described above, the Bilateral Agreement on Land Transport (BALT) -regime (stepwise rise of weight limit and introduction of LSVA) leads to a considerable predicted decrease in traffic volume (vkm).

As shown in Figure 4-2, contrary to the reference scenario, the traffic volume can be virtually stabilised on the year 2000 level until 2005 under the BALT-regime. Only after 2005, a new increase is predicted; nevertheless, the development remains clearly below the reference scenario values (-15% to -19%).

Figure 4-2: Traffic volume of domestic road freight transport (Mio. vkm)



On the other hand, the development of transport volume (tkm) is virtually the same in the reference scenario and under the BALT-regime (see Figure 4-3). This is the consequence of the average higher net tonnage per journey.

Figure 4-3: Transport volume of domestic road freight transport (Mio. tkm)

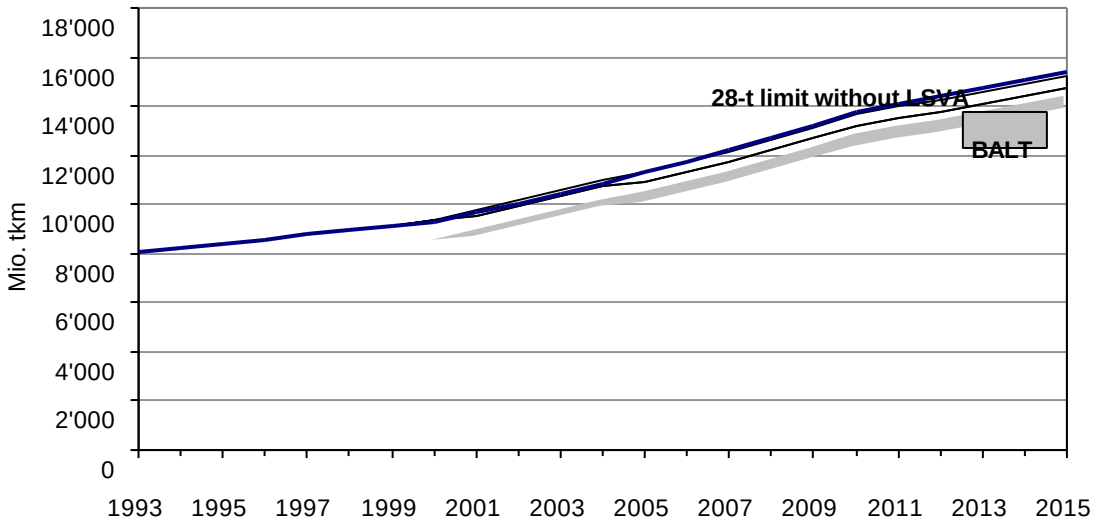
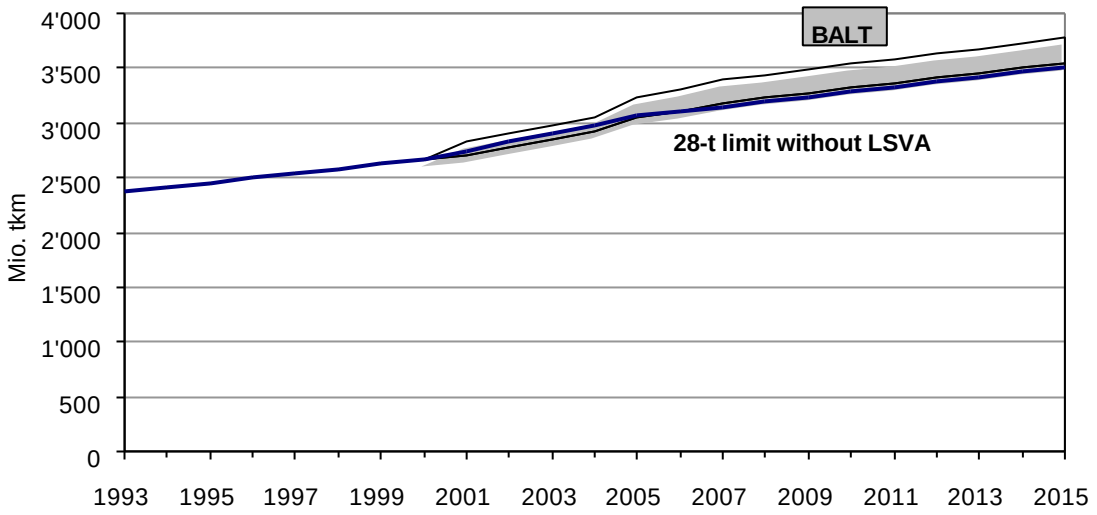


Figure 4-4 shows the development of the transport volume of rail freight transport. Under the BALT-regime - together with a low growth in net tonnage - rail can slightly increase its modal split share in comparison with the reference scenario. Assuming a high growth in net tonnage, rail suffers a temporary loss during the transition period until 2005.

Figure 4-4: Transport volume of domestic rail freight transport (Mio. tkm)



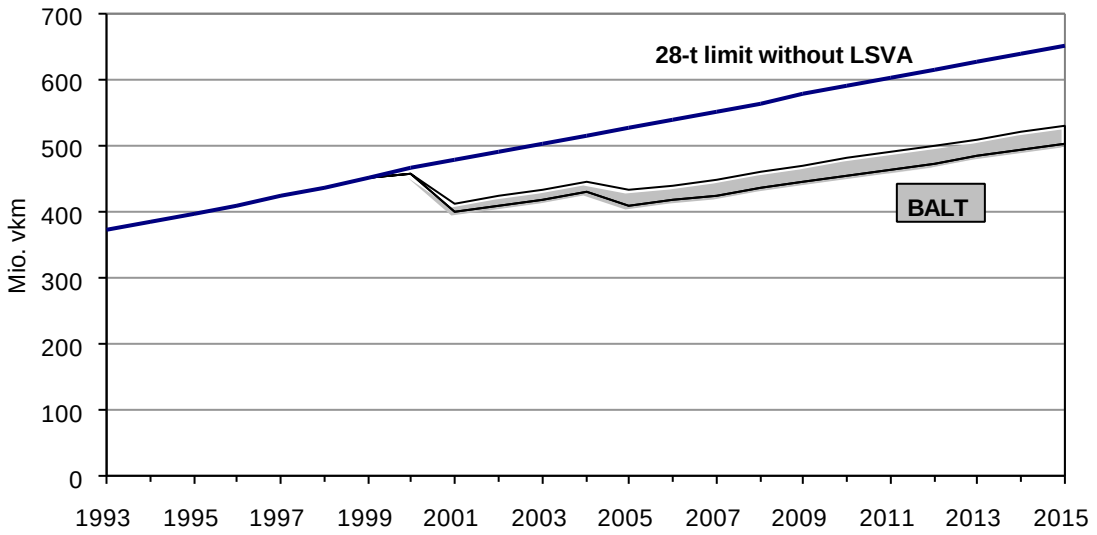
In summary, the estimated developments in domestic road and rail freight transport until 2005 are as follows:

- Road traffic volume is expected to shrink compared to the reference scenario by 14% to 18%. This change has to be considered as significant, especially with regard to the positive effects on pollution and noise emission.
- As for road transport volume, however, there is no significant difference between the BALT-regime and the reference scenario.
- Rail transport volume is expected to keep its market share. If the accompanying measures are successful, rail can even improve its share in the long run.

d) Expected effects on import/export freight traffic

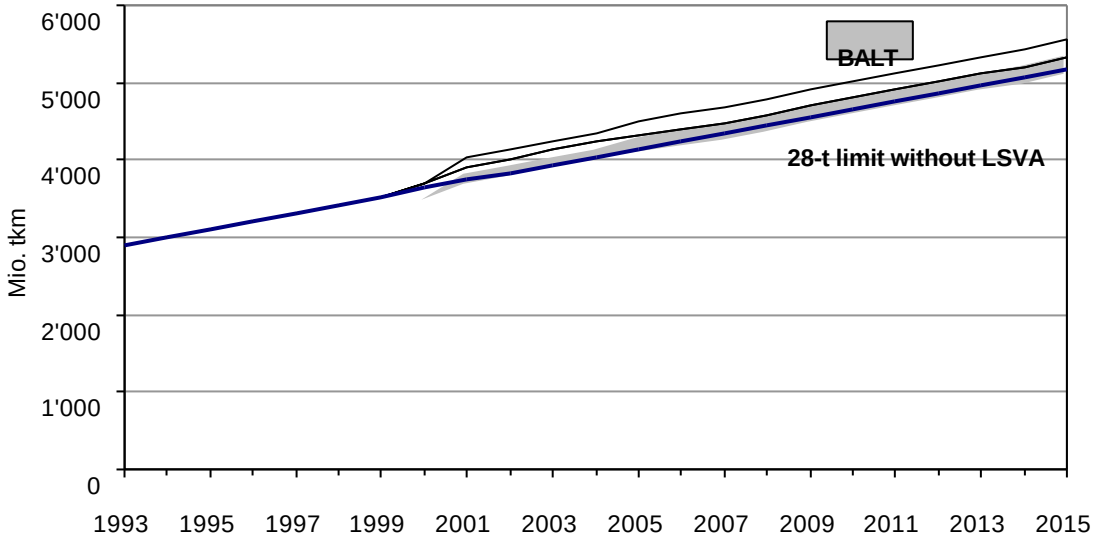
The predicted decrease in traffic volume compared with the reference scenario is more pronounced in import/export traffic than in domestic traffic. Even in the year 2005, traffic volume is just slightly higher than in 1993, i.e. about 100 Mio. vkm below the predicted traffic volume in the reference scenario (see Figure 4-5).

Figure 4-5: Traffic volume of import/export road freight transport (Mio. vkm)



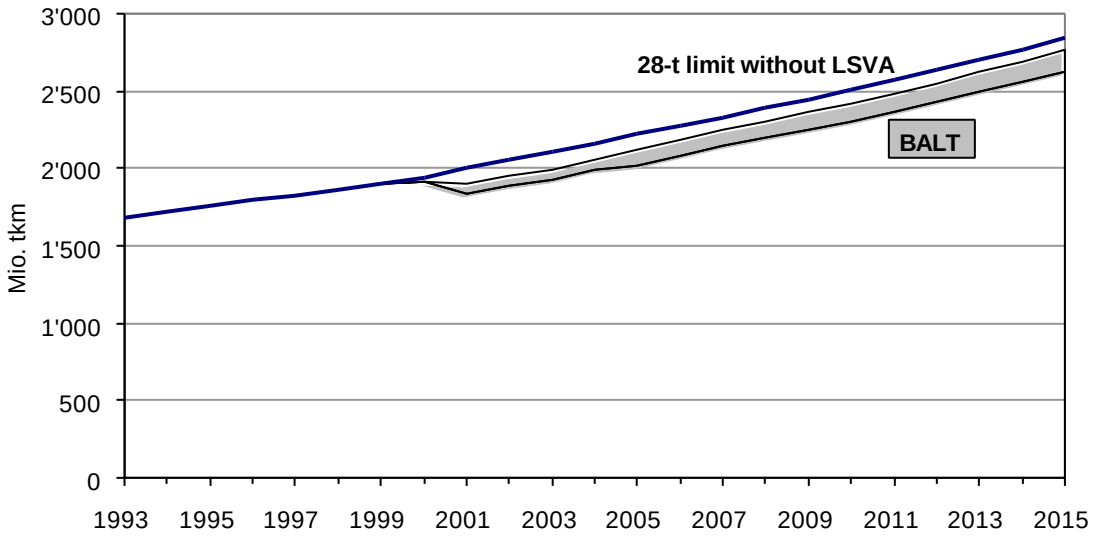
Instead of the decline in traffic volume, the transport volume increases compared to the reference scenario (see Figure 4-6). This is mainly due to the productivity effect (higher net tonnage per journey).

Figure 4-6: Transport volume of import/export road freight transport (Mio. tkm)



As far as import/export rail freight traffic is concerned, the productivity effect in the road transport sector cannot be compensated for by the introduction of the LSVA. Therefore, lower prices for road freight transport lead to a deteriorating market share of rail import/export freight traffic (see Figure 4-7).

Figure 4-7: Transport volume of import/export rail freight transport (Mio. tkm)



To sum up, the estimated effects of the BALT-regime on import/export road and rail freight transport until 2005 are as follows:

- Road traffic volume is expected to decline compared to the reference scenario by 18%-22%.
- Road transport volume, however, is expected to be 4%-9% higher than in the reference scenario.
- Rail transport volume is expected to grow slower as a result of sinking transport costs for road transport. In comparison with the reference scenario, rail will carry 4%-9% less goods.

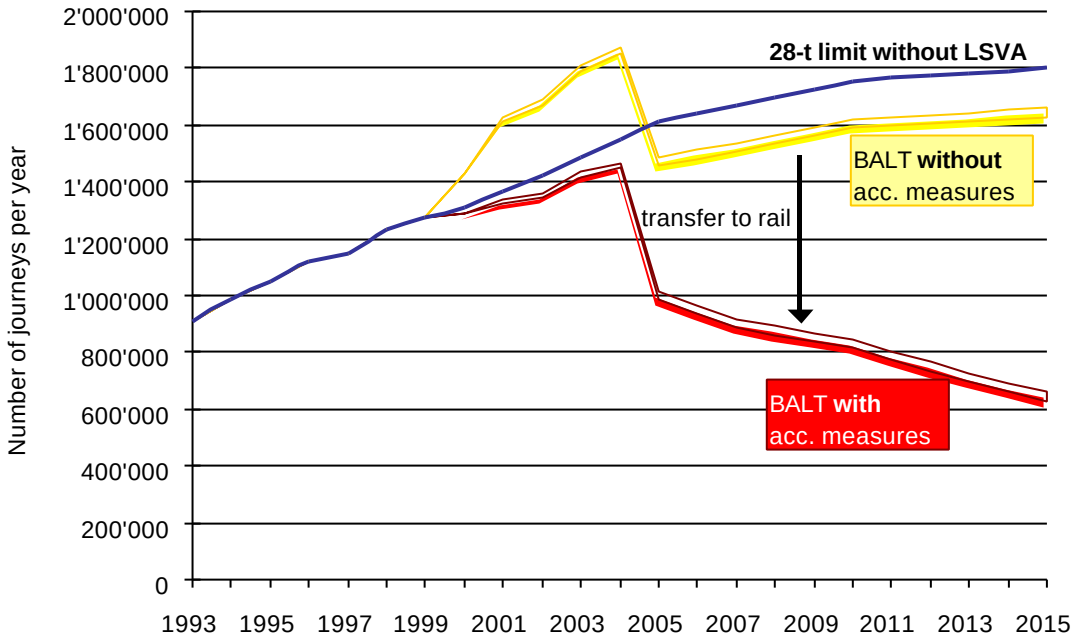
e) Expected effects on transalpine freight traffic

The effects of the bilateral agreement on land transport (BALT) on transalpine freight traffic are presented in Figure 4-8. There are two different BALT scenarios depending on whether the planned transfer from road to rail can be fully achieved or not. To this end, the Swiss government intended to take a variety of accompanying measures concerning the rail sector. According to the estimations, the following statements can be made.

- In the long run, the BALT-regime reduces the number of journeys on transalpine roads. This holds even under the unlikely assumption that no accompanying measures were taken or that they failed completely.
- Should the transfer from road to rail fulfil the expectations to the predicted extent, the growth trend can be broken in the year 2001 and the traffic volume be reduced from 2005 onwards. The number of journeys across the Alps will gradually drop in the following years and will amount to 600’000 - 800’000 journeys in 2010-2015.

- In the transition period (2000-2004) a growth in the number of transalpine journeys can not be avoided.

Figure 4-8: Transalpine road freight traffic (Number of journeys per year)



Whereas in Figure 4-8 the total number of transalpine journeys included also domestic and import/export journeys, the next two figures show only traffic and transport volumes of transalpine transit traffic, i.e. traffic whose origin and destination are outside of Switzerland.

Figure 4-9 shows the predicted development of traffic volume of transalpine transit traffic. In the reference scenario, traffic volume increases constantly to about 330 Mio. vkm, which is almost three times as much as in 1994. However, under the BALT-regime, there is a strong decline in traffic volume after the year 2004, if the transfer of freight transport from road to rail can be achieved as predicted. Even without accompanying measures in the rail sector, traffic volume would not exceed the reference scenario after the year 2005. Only in the transition period (2001-2004; 34-tonnes limit), a temporary rise of transalpine transit road freight traffic has to be accepted, no matter how well the implementation of the accompanying measures works.

As for transport volumes, the development under the BALT-regime exceeds growth in the reference scenario at least until the year 2010. This is mainly due to the higher weight limit (34 t as from 2001; 40 t as from 2005), which leads to an increasing net tonnage (see Figure 4-10).

Figure 4-9: Traffic volume of transalpine transit road freight traffic (Mio. vkm)

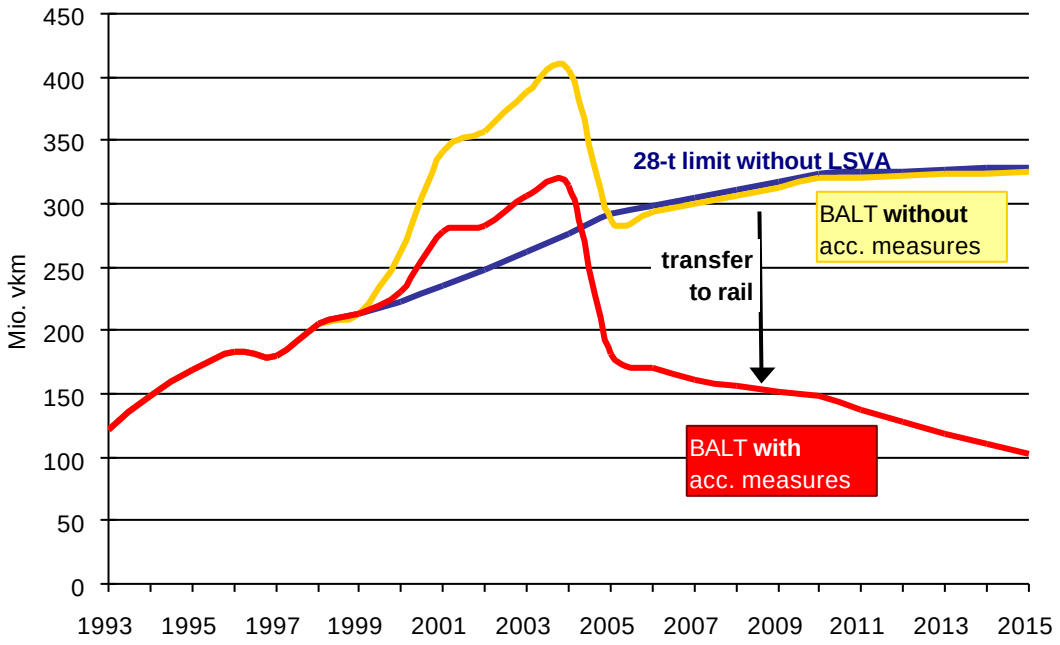
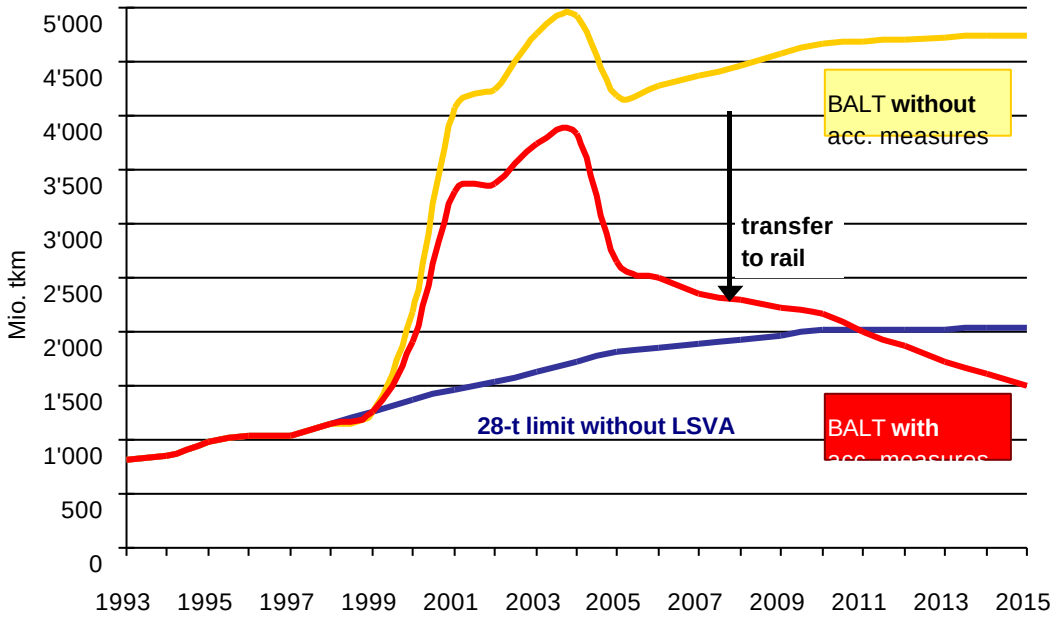


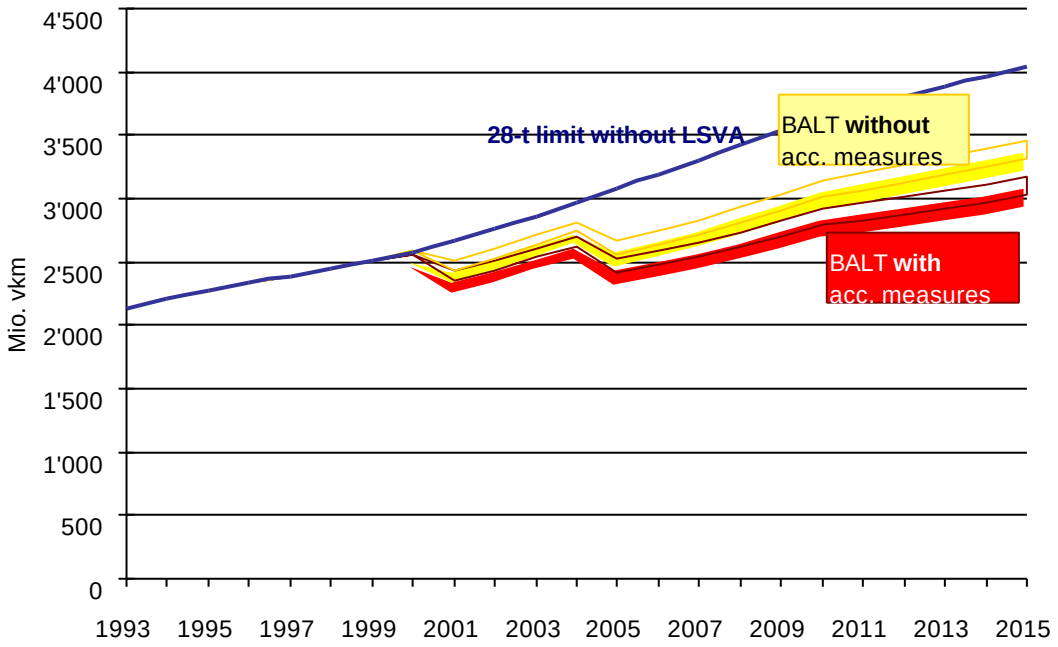
Figure 4-10: Transport volume of transalpine transit road freight traffic (Mio. tkm)



f) Summary of the expected effects on Swiss freight traffic

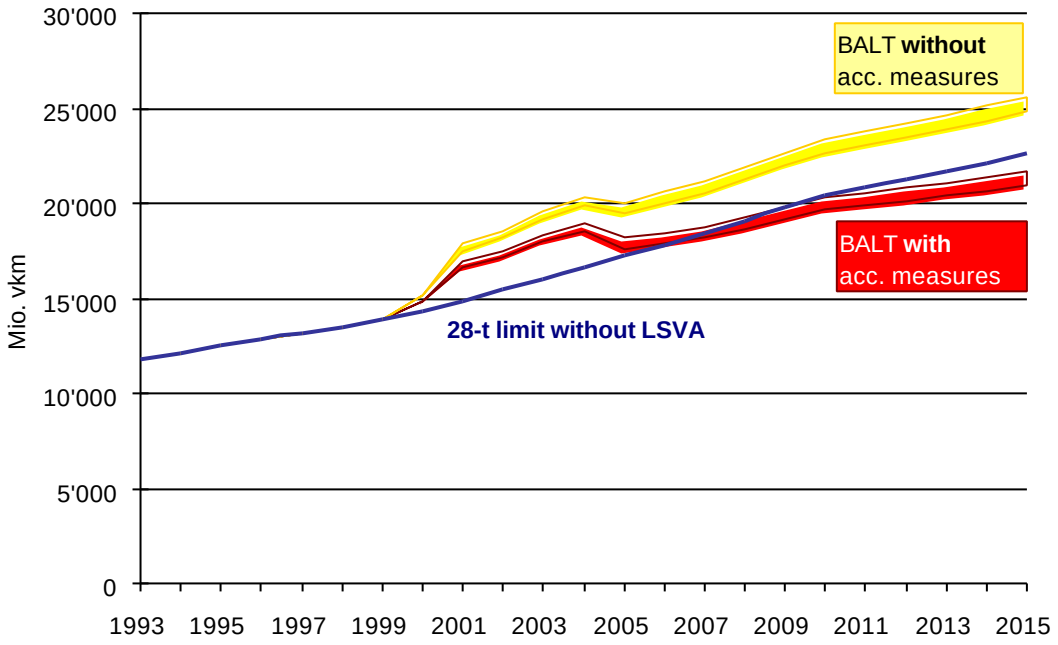
Figure 4-11 gives an overview of the estimated effects of the different scenarios on total traffic volume of road freight transport in Switzerland. In the reference scenario a steady growth leads almost to a duplication of traffic volume in the period from 1993 until 2015. Compared to the 'old' transport policy, the BALT-regime brings about a growth stop between 2000 and 2005 and a considerably slower growth in traffic volumes (vkm) in Switzerland until 2015. This environmentally desirable development is independent of the introduction or the success of the accompanying measures in the rail sector. Certainly, traffic volume decreases even more if the measures taken lead to the full expected effect of transferring freight from road to rail. However, in order to protect the Alps from ever growing freight traffic on the Alpine corridors, the success of the accompanying measures are highly important.

Figure 4-11: Total traffic volume of road freight transport (domestic, import/export and transit traffic; Mio. vkm)



The transport volume (tkm) under the BALT-regime temporarily increases compared to the reference scenario (see Figure 4-12). After 2005, however, the transport volume in Switzerland is expected to be roughly the same as in the reference scenario under the assumption of successful accompanying measures. This development reflects the productivity effect made possible by the rise of the weight limit.

Figure 4-12: Total transport volume of road freight transport (domestic, import/export and transit traffic; Mio. tkm)



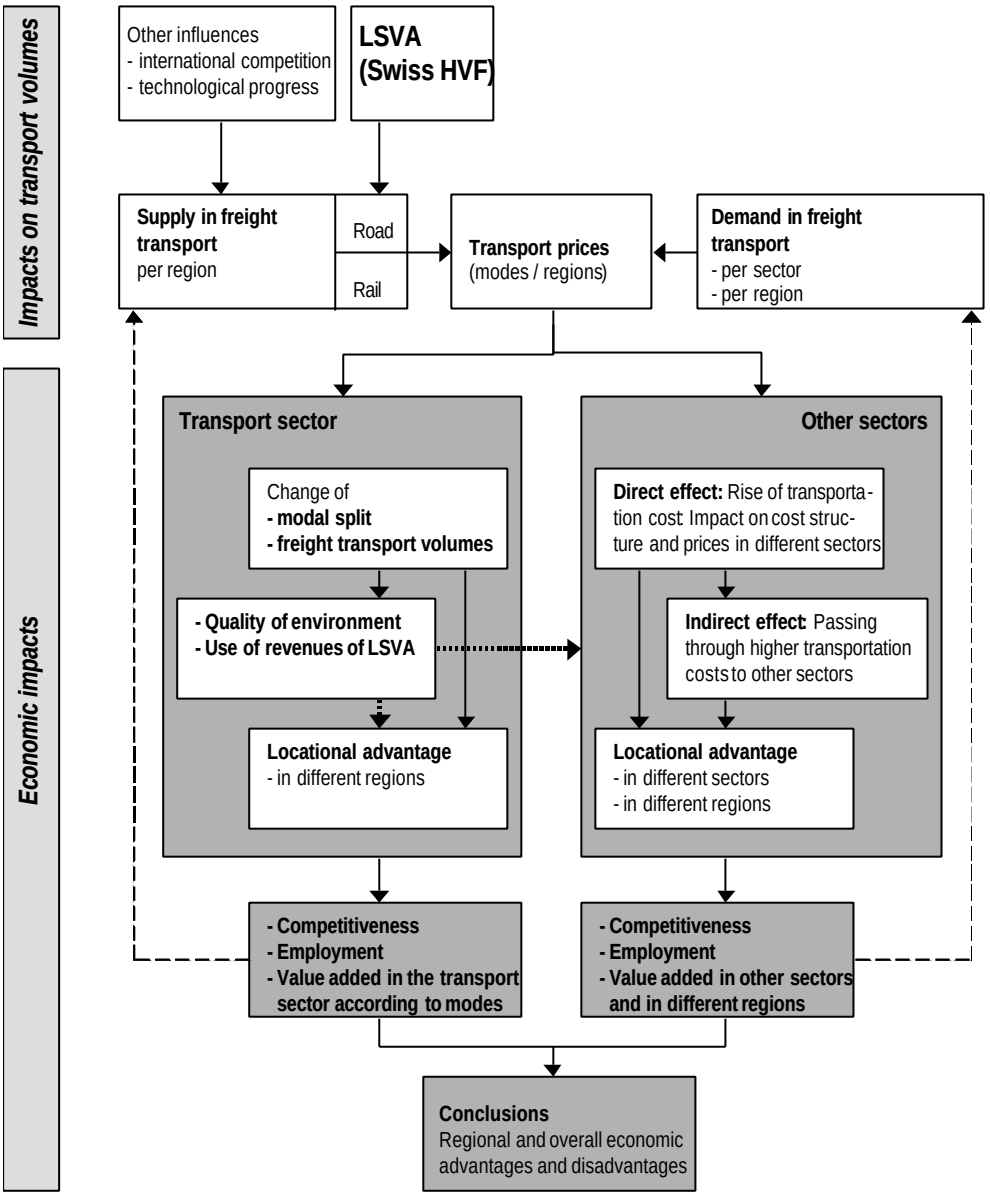
4.1.2 Economic effects [25]

a) Methodological basis

The basis for the ex-ante estimation of the economic effects of the LSVA is a model showing the possible impacts on different levels (Figure 4-13).

[25] The major source for this section is: Bureau for Transport Studies (1998), Auswirkungen der leistungsabhängigen Schwerverkehrsabgabe (LSVA) und der Ablösung der Gewichtslimite im Strassengüterverkehr (GVF-Auftrag Nr. 287), Bern.

Figure 4-13: Model of the economic effects of the LSVA



The studies of the expected economic effects of the LSVA followed the structure of Figure 4-13. The main parts of analysis are the following:

1. **General set-up:** Starting points of a sound impact assessment are the following
   - Supply of freight transport: The supply of two modes – road and rail – has to be considered, especially taking account of the performance (vehicle kilometers) and existing charges and subsidies.
   - Demand for freight transport: Important aspects of the demand are the volumes transported (in tons) and ton kilometers. A differentiation according to sectors and regions is necessary as well.
   - Freight transport prices: Transport prices are the result of supply and demand in freight transport. They may differ according to mode and region. The price of road freight

transport rises because of the introduction of the LSVA. The extent of the price increase depends on how much of the costs of the LSVA the hauliers can pass through to transport demand.

2. **Impacts on the transport sector:**
   - **Modal split and transport volumes:** What will be the shift of demand from road freight transport to the other competing mode, i.e. to rail transport? To answer this question differentiated data are needed about the quality and capacity of rail transport per region. The effect can be roughly estimated using cross price elasticities. The other effect of the price increase on road freight transport is to directly reduce transport volume. This "decline effect" can be assessed with the direct price elasticity.
   - **Competitiveness, employment and value added in the transport sector:** Impacts on employment and value added can be estimated with the help of economic indices (employees per tkm, employees per vehicle-kilometre). The magnitude of the shift between road and rail transport may serve as an indicator for competitiveness. A potential increase in productivity induced by the LSVA also has to be considered (e.g. less empty trips, higher average loadings, better logistics).
3. **Impacts on other sectors:**
   - **Direct effect:** The direct effect corresponds with the impact of the LSVA on the cost and price structure of all transport using sectors. These impacts vary between different sectors and regions. Sectors with a transport intensity above average and regions where firms in these sectors are located will be most affected.
   - **Indirect effect:** The higher costs of road freight transport will partly be passed through to ancillary sectors and to customers of other sectors. To estimate the magnitude of this indirect effect input-output calculations are necessary.
   - **Influence on locational advantages:** There are two main effects that influence locational advantage. First, there is the influence of regionally varying higher costs of road freight transport. Second, the use of the revenues from the LSVA as well as a better environmental quality caused by the LSVA may have positive effects on locational advantages.
   - **Competitiveness, employment and value added:** The effects mentioned above may influence competitiveness, employment and the value added in the different sectors. In the existing ex-ante assessments of the LSVA this has been done in a qualitative way. A quantitative assessment of the impact on these variables would require a multisectoral model.

Conclusions: At the end, all the effects have to be summarized in an overall economic assessment of the impacts of the LSVA.

In the following sections we summarize the most important results of the ex-ante estimates of the economic effects of the LSVA according to the structure of the above model. We do not discuss the general set-up any more as this has been done in chapter 2 of this report. With respect to the effects of the LSVA on transport volumes and modal split we refer to chapter 4.1.1.

b) Expected impacts of the LSVA on the transport sector

The extensive analysis of the expected effects of the LSVA on the transport sector in Switzerland can be summarised according to the following three points:

- Adaptations in the road freight transport sector;
- International competitiveness;
- Effects on employment.

1. Adaptations in the road freight transport sector

– The introduction of a distance dependent area pricing in the form of the LSVA increases the pressure to rise the payload. In particular empty trips become very expensive. This pressure will strengthen the existing concentration process within the road freight transport sector. Several interviewees in the Swiss key informant survey have confirmed this forecast. Only large companies with 100 lorries or more and with broad internal logistic services are able to produce with a sufficiently high use to capacity of their fleet. As a consequence, the structure of the road freight transport sector will dramatically change: Small haulier companies will disappear to a large part from the market, logistic services are getting more important, and the productivity of the freight transport sector will increase.

– A second effect concerns the structure of the vehicle fleet: As expected in the ex-ante studies, the LSVA sets a strong incentive to use “clean” vehicles and thus to renew the fleet. The differentiation of the fee between EURO-classes is sufficiently high to make it profitable in many cases to replace older lorries with new lorries fulfilling the EURO II / III norms. This tendency is strengthened by the adaptation of the weight limit which will rise step by step from 28t to 40t. Additionally, it can be expected that hauliers will optimise the composition of their fleet with respect to the total permitted weight of their lorries. Already in the year 2000 (before the introduction of the LSVA) several hauliers have reduced the permitted total weight of some of their trucks in order to pay less LSVA.

2. International competitiveness

– Basically, the LSVA will not affect in a noticeable way the international competitiveness of Swiss hauliers: Domestic as well as foreign lorries have to pay exactly the same fee per kilometre driven. This has been predicted for domestic as well as import/export or transit trips. The interviews conducted within this case study have confirmed this assessment, showing that other factors (national wage level, national level of regulations, and fixed vehicle taxes) are determining the international competitiveness of the haulier sector.

– Similarly, the LSVA will not affect the choice of location of the haulier companies within Switzerland.

– If other countries in Europe will introduce a distance related pricing scheme for heavy goods vehicles in the future, there may even be a “first-mover advantage” for Swiss hauliers who had to adapt to this new type of charge earlier on.

3. Effects on employment

It is expected that the combined introduction of the LSVA together with a higher weight limit will reduce employment in the freight transport sector compared to a reference scenario. The main reason is the stepwise increase of the weight limit from 28t to 40t. It has been estimated that in 2010 employment in the hauliers sector will be several 10’000 jobs less compared to the reference scenario. But because of the expected general growth in this sector employment will still slightly increase in absolute terms. This loss of jobs is the other side of the expected productivity effect caused by the LSVA (see point 1) and especially by the higher weight limit. It has to be remembered that compared to the reference scenario the introduction of the LSVA and the higher weight limit will not reduce the performance of the road freight transport sector in terms of ton kilometres.

c) Impacts on sectors with high transport intensity

The results of the existing ex-ante studies about the economic impacts of the LSVA on other sectors are summarized according to the following points:

- Transport intensities of sectors;
- Maximal impact of the LSVA alone;
- Effects of the higher weight limit and additional measures.

1. Transport intensities of sectors

To analyse the effects of the LSVA on the cost structure and the product prices of single sectors knowledge about the freight transport intensity of these sectors is needed. The transport intensity is defined as the ratio between the sector specific freight transport costs and the total turnover of a sector. For Switzerland, Table 4-5 shows the direct and indirect road freight transport intensity for those sectors with a relatively high transport intensity.[26] For all other sectors the transport intensity is estimated to be below 1%. The influence of the LSVA on these sectors can be ignored.

[26] The direct transport intensity corresponds to the demand of the sector itself for road freight transport, the indirect transport intensity corresponds to the share of road freight transport services included in the products of ancillary industries.

Table 4-5: Estimates of the direct and total road freight transport intensity for different sectors in Switzerland (for the year 1990)

	Direct transport intensity	Direct and indirect transport intensity
Petroleum products	4%	8%
Building materials	4%	8%
Paper pulp and paper production	3%	6%
Wholesale trade	3%	4%
Foodstuffs, fodder, beverage	2.5%	4%
Wood products, sawmills	2%	4%
Printers, Graphics	2%	4%
Ores, metal products	1.5%	4%
Construction	1.5%	3.5%
Chemical products	1.5%	3.5%
Glass factory, ceramics	1.5%	3.5%
Restaurants, Hotels	1.5%	3%
Plastic industry, rubber	1.5%	3%
Vehicles, machinery	1%	2.5%

Maximal impact of the LSVA alone

Using the transport intensities of Table 4-5 the upper bound of possible cost effects of the LSVA can be estimated for transport-intensive sectors. For this the following assumptions have been made:

- The LSVA is fully passed through from the transport sector to other sectors.
- Possible shifts from road to rail are ignored.
- The productivity effect of the increase of the weight limit (from 28t to 40t) is ignored.

Using these assumptions the ex-ante estimates of the maximal possible cost increase caused by the LSVA are summarised in Table 4-6.

Table 4-6: Maximal direct and total cost increase caused by the LSVA in sectors with high transport intensity.

LSVA: 0.025 CHF per vkm and per tonne of permitted total weight	Maximal direct cost increase	Maximal direct and indirect cost increase
Petroleum products	0.8%	1.6%
Building materials	0.8%	1.6%
Paper pulp and paper production	0.6%	1.2%
Wholesale trade	0.6%	0.8%
Foodstuffs, fodder, beverage	0.5%	0.8%
Wood products, sawmills	0.4%	0.8%
Printers, Graphics	0.4%	0.8%
Ores, metal products	0.3%	0.8%
Construction	0.3%	0.7%
Chemical products	0.3%	0.7%
Glass factory, ceramics	0.3%	0.7%
Restaurants, hotels	0.3%	0.6%
Plastic industry, rubber	0.3%	0.6%
Vehicles, machinery	0.2%	0.5%

Table 4-6 shows that with a maximal shift of the LSVA to other sectors and fully considering possible indirect effects three sectors have an increase of average production costs of more than 1%. For petroleum products, building materials and paper pulp the maximal cost increase is between 1.2 and 1.6%. For all other sectors with a high road freight transport intensity the maximal cost increase is below 1%. These estimates of the maximal cost increase is based on a fee level as it will be reached in the year 2005. In 2001, the first year of the introduction of the LSVA, the average fee level is markedly lower (0.0168 instead of 0.025 CHF per tonne and kilometre).

Overall, we can conclude that the LSVA has only a minor effect on production costs compared to other factors such as exchange rates, wage level, productivity effects, or the general economic growth. In most sectors it will hardly be noticeable.

Effects of the higher weight limit and additional measures supporting railways

In Table 4-6 we did not take into account that together with the introduction of the LSVA the weight limit for lorries has been increased (from 28t to 34t in 2001, respectively 40t in 2005). Additionally, the Swiss government decided upon a number of accompanying measures supporting the rail sector (especially the two new transalpine rail tunnels). Both types of measures will reduce the cost increase caused by the LSVA. Table 4-2 in section 4.1.1 shows for domestic transport that taking account of the higher weight limit more or less offsets the LSVA effect, at least if we assume a rather high increase of the net tonnage. Already with a low increase of the net tonnage the increase of road freight transport costs caused by the LSVA is more than cut by half.

This is all the more true for import/export and for transit traffic where the productivity effect of the higher weight limit more than offsets the cost increase effect of the LSVA, even in the case of small effect on average net tonnage.

Conclusions:

- The introduction of the package "LSVA – higher weight limit – supporting measures for railways" will cause almost no increase of overall freight transport costs in Switzerland. This is especially the case for import/export and transit freight transport, where on average even a decrease of freight transport cost can be expected. As a consequence, the impacts of the LSVA and the higher weight limit on the production costs of other sectors - or more generally on the competitiveness of the Swiss economy – are hardly noticeable and in tendency even slightly positive, especially for export or import oriented sectors.
- This general conclusion may not be true in every single case. For example, there are quite a lot of products that will not profit from the higher weight limit, simply because they are too light or because they are mostly transported as piece goods. As for the road freight transport sector, structural adaptation effects may also be expected for other sectors. We mention especially those sectors where transport logistics are an important production factor, e.g. the wholesale and retail industry.
- The analysis of the economic effects of the LSVA can not be transferred one to one to other European countries. Apart from Switzerland, Europe has generally introduced the 40t limit. A package – LSVA together with a higher weight limit – has therefore only been possible in Switzerland. That's why we put stress on the estimates of the expected effects of the LSVA alone. But as shown, also in this case the overall economic effects in the sense of higher production costs are rather low and mainly restricted to some of the most transport intensive sectors.

d) Impacts on peripheral regions

During the political debate the possible impacts of the LSVA on peripheral regions were often mentioned as an argument against the introduction of the LSVA. Mountain regions argued that they would be at a disadvantage because in their regions

- the distance of an average transport trip is longer;
- the accessibility by train is less good than on average;
- the share of sectors with a high transport intensity is above-average.

To analyse the possible regional effects of the LSVA, Switzerland has been divided in 106 regions (with 39 rural regions). The results of the analysis show that the fears of peripheral regions are in most cases not justified:

- The average distance of a road freight transport trip is only in 10 of 39 rural regions above the Swiss average.
- In general, rural or mountain regions do not have an above-average share of export/import oriented sectors or of sectors with a high transport intensity although there are

some exceptions to this rule (e.g. the transport- and import/export intensive aluminium plant “Alusuisse” which is situated in the canton of Wallis).

- An additional argument is the possible “protection effect” caused by the LSVA and which in some cases may be relevant, especially for mountain regions. For example, in the last years the imports of wood from other abroad to build the Swiss “chalet” – a house basically constructed with wood – have strongly grown. It has been estimated that with the LSVA the competitiveness of the domestic wood sector may rise again.

Box: The case of Wallis

The Swiss canton of Wallis is situated in the South-West of the country, bordering on France and Italy. Wallis is a mountainous region with numerous sparsely populated small side valleys; everything is concentrated in the main valley (“Rhone Valley”). The effects of the introduction of the LSVA and the concurrent rise of the weight limit for HGV on this peripheral region can be summarized as follows:

In Wallis, the **price level of road freight transport** is very low due to strong competition among hauliers. That is why the introduction of the LSVA causes an above-average increase in freight transport costs in this region. The expected ‘cost effect’ of the LSVA in the canton of Wallis amounts to 21%, which is well above the Swiss average of 18.6%. This is equivalent to a burden of approximately 48 Mio CHF per year from 2005 onwards.

On the other hand, there is a **productivity effect** caused by the introduction of the 40-tonne limit, better logistics and less deadheads. However, with 17.5% this effect is below average in Wallis: it compensates 83% of the cost effect and amounts to roughly 40 Mio CHF. The reasons for this below-average productivity effect are to be found in the topographic and economic characteristics of Wallis:

- The accessibility of the side valleys in the mountainous region for 40-tonne heavy goods vehicles is limited due to road conditions and legal restrictions. However, already today about 3’500 special permissions are issued for transports with over 28-tonne vehicles in these valleys.
- More decisive is the fact that demand for 40-tonne transports in the side valleys is limited. Besides the current special-permission journeys, additional transport demand can be expected only from construction, forestry and some individual factories. In other sectors of the economy, the demand for goods, necessary for a significant productivity effect, is hardly sufficient.

Because of the potential disadvantages, cantons with a high share of mountainous and peripheral regions get an above-average **refund of the LSVA revenues** from the central government. Here, the canton of Wallis is expected to receive about 50 Mio. CHF from the year 2005 onwards.

On balance, the total benefits for Wallis (productivity effect and refund of revenues) noticeably exceed the cost effect caused by the LSVA.

e) Impacts on revenues

Apart from the box on the Canton of Wallis the discussion of the economic effects of the LSVA neglected the fact that the LSVA will generate substantial revenues. As we have shown in chapter 3 these transfers to the state are used to finance the construction of the new transalpine railway tunnels (two third of revenues) and for the cantons (one third of the revenues) [27].

The gross revenues from the LSVA have been estimated to be of the magnitude of 890 Million CHF in the year 2001 and slightly increasing until 2004. From these 890 Million around 100 Million CHF are expected revenues from a restricted number of trips with 40t lorries (contingent for 40t vehicles) and from a restricted number of empty or light transports (which have to pay a lower flat rate).

In 2005 the level of the LSVA will markedly rise and correspondingly, the expected gross revenues will be around 1'450 Million CHF. Table 4-7 summarises the expected gross revenues from the LSVA per year.

Table 4-7: Estimated gross revenues from the LSVA in Million CHF

Year	Expected gross revenues per year in Million CHF
2001	890
2002	902
2003	940
2004	960
2005	1'453
2007	1'682
2010	1'836
2015	1'979

[27] Interestingly, the cantons do not get the same amount per capita. Cantons with an above-average share of mountain or peripheral regions get a substantial higher amount per capita. Although the fears of these cantons against the LSVA have proven not to be justified, it was worth it.

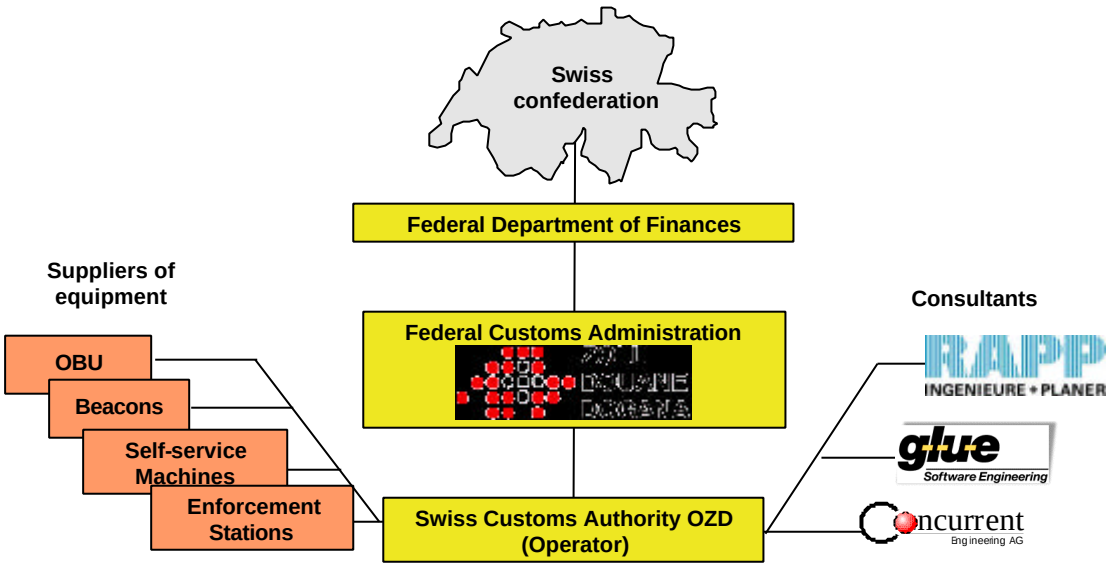
4.2 Observation during introduction

4.2.1 Organisation of implementation process

Federal Customs Administration (OZD) was appointed for the implementation and operation of the LSVA.

The following Figure 4-14 shows the organisational structure adopted during the implementation process:

Figure 4-14: Institutional organisation of LSVA – project team



Affected federal and cantonal institutions, representatives of the transport business, and expert consultants were involved in the project (see figure). Until the end of 2000 about 70 persons were involved in the different working groups of the LSVA project. The additional staff required for operation of the system are included in this figure.

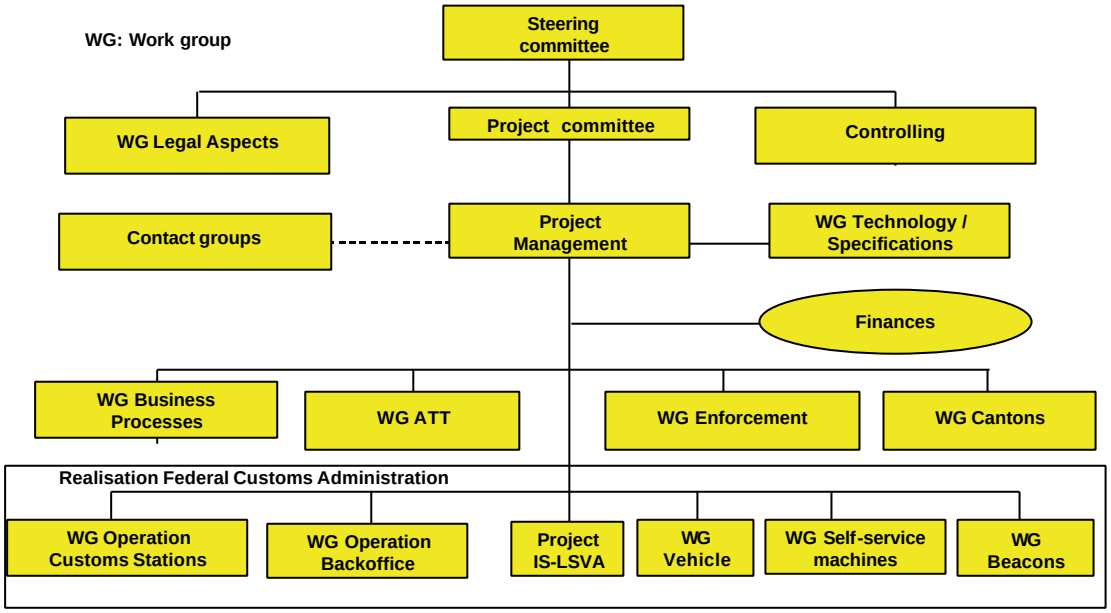
In 1998, during the concept phase of the project, the foundations for the procurement of the system components and for the organisational and institutional implementation were laid. In this phase, the guidelines of the pre-analysis undertaken in 1997 were detailed and recorded in a number of concept reports. At the same time, the terms of references for the technical components were drafted and the calls for tenders for the procurement of these components were issued in rapid succession early in 1999.

The offers for most of the system components had been evaluated and the suppliers had been determined by the end of 1999. This milestone of the project marked the formal start of the „realisation phase“.

There was a close co-operation between the different sectors for the realisation, from the production and installation of the technical equipment through the preparation of operational and organisational procedures, to the drawing up of the required regulations and implementing orders.

The information flow between the many people involved in the project working groups (WG), and between the affected institutions, was ensured by an adequate project organisation (see Figure 4-15) with an efficient project management group that could decide and act timely, with a project committee supported by all involved parties, and a formal steering committee that assures the contact to the Federal Council.

Figure 4-15: Organisation of the LSVA project – team in the realisation phase 1999/2000



4.2.2 Procurement process / plan

All system components, i.e. the on-board units, the DSRC-beacons, background-system, and the enforcement stations have been procured separately. This is a remarkable strategy, since it required a very detailed specification of the one common interface shared by all of these components, namely the CEN/ISO standard 5.8 GHz DSRC link. Such a specification was only possible due to recent advances in DSRC standardisation. The LSVA project has, together with the manufacturers, developed a very detailed down-to-bit-level specification for the complete DSRC link as used in the LSVA. The specification is available for any interested

party. Enabling interoperability is one of the main duties assigned to the project. Hence, a very open policy is followed for all interfaces.

The procurement processes and tender offers were compliant with WTO-regulations

But perhaps the most interesting part of the procurement process was the tender for a newly developed OBU for the Swiss LSVA. In summer 1997, the LSVA-project contracted three manufacturers to develop prototype on-board units. The three different units were delivered in January 1998 and were subjected to practical testing until April. The prototypes had basically implemented the LSVA as described above and all units recorded the LSVA data in accordance with the specification. However, in some cases, different technological solutions were offered for some processes. Hence, the technology tests were not intended to compare the products of different manufacturers but to individually optimise the technological solution for each process step.

Based on the test results and detailed consideration of the operational processes, the most suitable technologies for the LSVA project were selected. The manufacturers of the prototypes were then invited to modify their on-board units according to the technologies determined during the testing phase. At the same time, decisions were also finalised for the detailed processes to collect the fee. The on-board unit manufacturers were then required to implement the given processes using the selected technologies. Two manufacturing consortia participated in this last development step aimed at producing on-board units for extended field testing. The units had to be in a development stage suitable for series production.

Some border stations in northern Switzerland (around the cities of Basel and Schaffhausen) were equipped with the required road-side infrastructure at the end of 1998. Whilst, several haulage companies provided vehicles equipped for the tests - a total of about 90 vehicles were placed in daily commercial operation. The field tests, including extensive laboratory testing, were running between January and April 1999. Initially, the on-board units of both consortia were tested but by the end of April, the consortium of the companies ASCOM and Fela were awarded the contract to produce the 60 000 units required initially.

The units produced by this consortium were tested more thoroughly and were further optimised. Field testing of steadily improved equipment continued until mass production and installation of the on-board units began.

The complex fee collection processes of the LSVA required thorough testing so that flawless operation of the units in the harsh vehicle environment could be guaranteed. Besides scrutinising the units against the high technical demands, the project also emphasises a comfortable and comprehensible handling of the OBU. Although the LSVA understandably is not very popular with the vehicle owners and the drivers, they collaborate with the project constructively and intensively. It is in the interest of all parties to ensure that the collection of the LSVA is as simple and comfortable as possible.

A second batch of 20'000 OBUs with some minor design modifications was ordered at the end of 2000.

Interview Supplier, Fela, Deissenhofen

Mr. J. Uhlmann, CEO Traffic Telematics Department

System design, technical approach and first experiences are quite satisfying with the LSVA.

Tribute in Europe is remarkable, also the decision to use “road pricing money” for the financing of the new Railway Link across the Alps is accepted quite well.

In general the acceptance of the LSVA in Switzerland and abroad is very good. Reasons for this can be found in the large support in the Swiss population nevertheless also because of the approval of the introduction of LSVA by the vote of 27.09.1998.

The target aims of the LSVA are OK, but the achievement of objectives is not very satisfying at the moment. One of the reasons might be, that the tariff level is still too low to effect e.g. a remarkable shift from road to rail.

The production of the OBU was a big challenge for Fela. The 60'000 units had to be produced under high time pressure. On one hand the number ordered did not allow to set up a full automatic production line and on the other hand it was too big for a totally manual manufacturing process. Therefore a semi automatic-process was chosen and the OBUs were produced in several factories all over Switzerland.

A big challenge was also the mandatory equipment. From the suppliers point of view, this means that the OBU has to fit in any kind of vehicle, from the oldest to the newest vehicle! It’s not possible to define a limitation like ‘the OBU can only be attached to the CAN-BUS’ etc.

Interoperability within Europe must also be an aim with very high priority.

4.2.3 Introduction problems and solutions

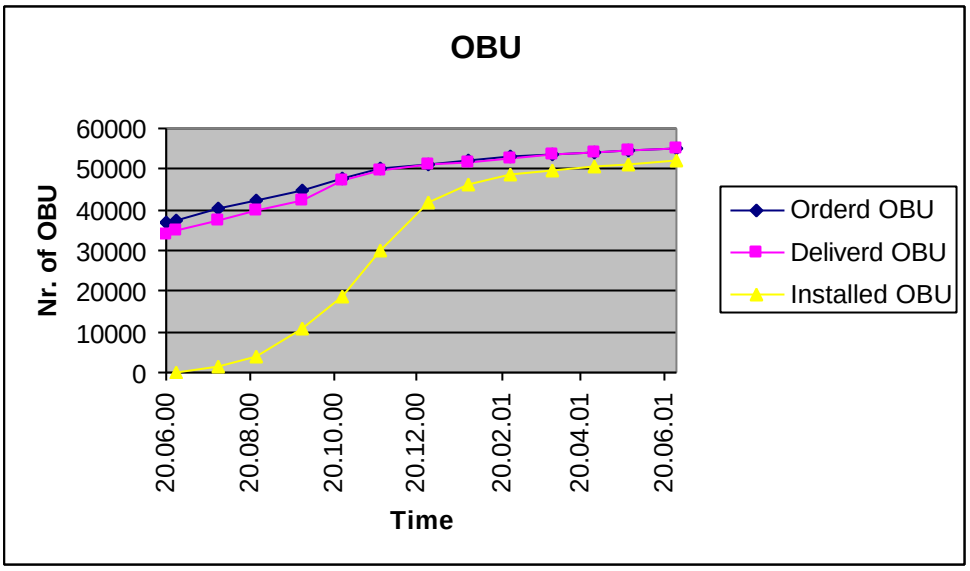
a) OBU

The delivery of the OBU to the authorised workshops started in June 2000 and by the end of June, the first 215 vehicles were equipped with an OBU. By the end of the year, nearly 42000 OBU were installed.

Due to time pressures and limited capacity in the workshop, it was not possible to equip all vehicles until the end of 2000. The maximum capacity would have been about 10'000 per month. Out of logistical and organisational matters it was not possible to exploit this capacity during the remaining time for installation. Two more things have to mentioned here. Because the OBU is given for free, no additional incentive for “early bird” installation of the OBU could be offered. Since beginning of the year 2000 sufficient “OBU fixtures” and all necessary confectioned cables (connection to tachograph, etc) were available, so that the vehicles could be prepared for the proper installation and of the OBU. Disfortunately only limited number of vehicle owners took advantage of this and waited delivery of the OBU itself.

But nevertheless, the workshop did an excellent job, even though the expenditure was underestimated in certain cases, which was one of the reasons why some Swiss vehicles were not equipped by January the 1st.

Figure 4-16: Installation of OBU



For those approximately 5000 trucks that were not equipped with an OBU by the first of January 2001, a non-bureaucratic solution was found by extending the time limit for installation to the end of January and, in a few special cases, to the end of February. Instead, these trucks were using log-books during this limited period.

b) Road-side equipment at border stations

All border-stations were equipped with the necessary road-side equipment within the time limit.

Testing and tuning of the system was also finished by the end of December 2000. Although, some fine-tuning of the beacons was done within the first few weeks of operation.

c) Vehicle data

Domestic vehicles

Some problems occurred with the data transferred from the cantonal registration offices.

The vehicle data were partially incomplete or incorrect and had to be reviewed and completed and corrected which required a lot of manual interventions and time consuming clarifications. This caused some delay in billing the first period, but the delay was regained in the mean time.

Foreign vehicles

The registration of foreign vehicles started at the beginning of August 2000and, by the end of December 2001, approximately 50'000 vehicles had been registered.

The early start of the registration took away a lot of pressure during the first day of operation and avoided long queues at the registration counters in January 2001.

d) Background-system

The hard-ware of the background and billing system was delivered punctually and was put into operation without problems.

The programming of the very complex software was successful, despite a very high time-pressure. All necessary applications were ready at system start, however, the optimisation-process is still going on.

4.2.4 Effects on the telematics industry

During the implementation, the few effects which could be observed were small in magnitude., e.g. manufactures and suppliers of freight and fleet management increased their advertisement.

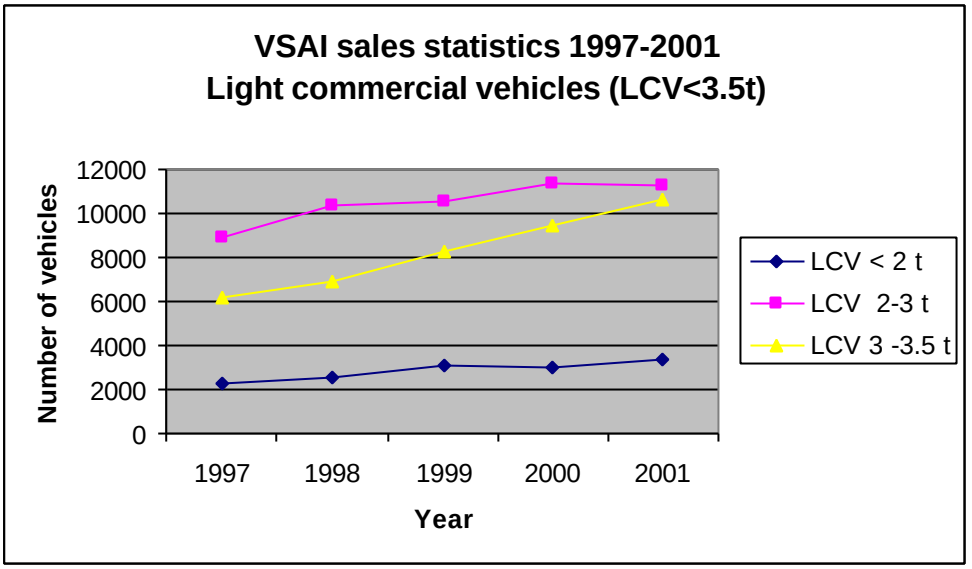
The Swiss market is also probably too small for new products and service that could take advantage of the on-board and roadside equipment for the levy of the LSVA.

4.2.5 Effects on transport industry

a) Effects on fleet composition

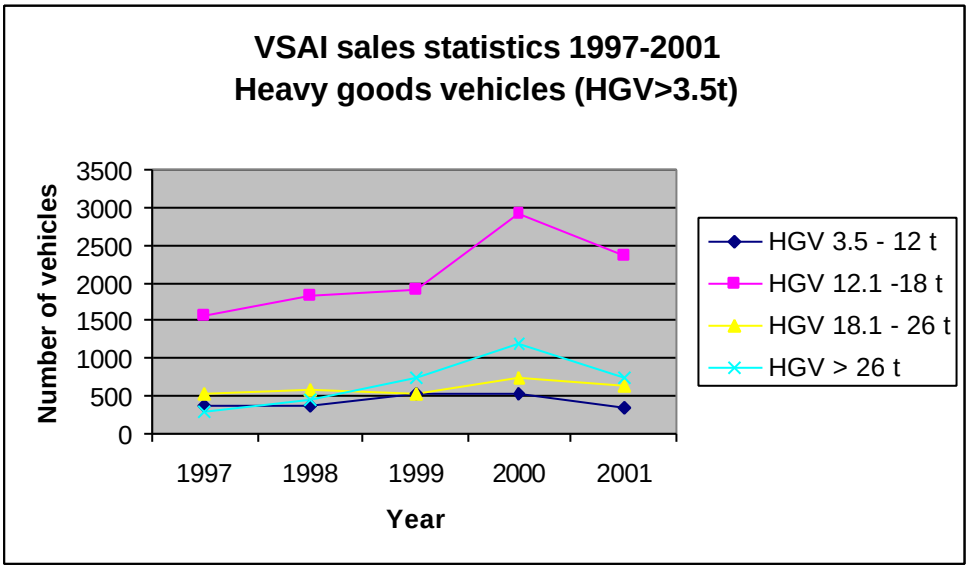
The VSAI (Association of Swiss Automobile Importers) sales statistics for the period 1997 to 2000 provide a clue: according to these statistics, the sale of delivery vehicles in 2000 was up by an average of 15 % on previous years (1997 up by 11 %, 1998 up by 19 %, see Figure 4-17). It is therefore not possible to speak of a clear shift from HGV to light commercial vehicles, at least on the basis of new vehicle sales, especially if we consider that the sale of heavy goods vehicles increased in average by a dramatic 45% in the same year (see Figure 4-18). With this development (which has not continued in 2001 for understandable reasons) the move towards low-emission vehicles fleets appears to have suffered a setback and at the same time, Figure 4-18 reveals a clear trend towards heavier vehicles. [Balmer, (2001)]

Figure 4-17: VSAI Sell-statistic 1997-2001; Light commercial vehicles (LCV <3.5t)



In 2001 the trends are still pretty the same and the figures are comparable to the previous years.

Figure 4-18 VSAI Sell-statistic 1997-2000; Heavy goods vehicles (HGV > 3.5t)



In all categories of the HGVs a dramatic decline of ordered vehicles could be observed in 2001.

b) Changes of vehicles payload (loading capacity)

During a limited period in autumn 2001 was it possible for in Switzerland matriculated vehicles to reduce the maximal permissible payload to the effective used or necessary loading capacity. There were several limitations like the vehicles had be owned by the vehicle owner already for at least 2 years (matriculated before 1. January 1999) and the adaptation of the payload was not reversible later on again.

Quite a lot of vehicles owners took advantage of this option, but disfortunately no statistical data is available.

c) Effects on the structure of road freight transport industry

Freight and fleet management activities have been increased in order to maximise the load factor. The trucking industry has been thoroughly shuffled. Trucking firms have merged or are co-operating in other forms in order to get a better chance for return freights.

In the key information survey interviews it was mentioned, that nearly one third of the small companies disappeared or merged during 2001. That would mean that nearly 2000 small companies (less than 10 vehicles) were effected by structural changes because of the LSVA. This figure must be verified by more detailed investigations.

4.3 Observation during first year after introduction

4.3.1 Methodology

Main sources for the elaboration of this chapter were:

- Information and data from the Swiss observatory "Monitoring flankierende Massnahmen"

  The DETEC has installed a project team "Monitoring flankierende Massnahmen" (MFM; Monitoring accompanying measures) – to control the conversion of the law on switching goods transport from road to rail[28] and the effectiveness of road and rail-related accompanying measures.

  The project team constantly analyses and completes the raised data bases, develops an early recognition system for risks on the roads and rails, and checks if there are further measures necessary, to achieve the transfer target.

  Every two years, the project group drafts a "displacement report" to hand over to the federal councils. A first evaluation of the effectiveness of the measures taken so far will be published in a report in spring 2002.
- Assessable and verified data[29] from the Swiss Federal Statistical Offices, the Federal Road Office and Swiss Customs Authority;
- Official press communiqués and press reviews;
- Extended DESIRE Key Informant Survey with specific Interviews regarding the impacts and effects of the new LSVA.

  A detailed list of the interview-partners and the results of the Swiss Key Informant Survey is summarised in the Annex A

  The additional information from the interviews is integrated in the Case Study in the form of "Comment Boxes".

[28] SR 740.1 Bundesgesetz vom 8. Oktober 1999 zur Verlagerung von alpenquerendem Güterschwerverkehr auf die Schiene (Verkehrsverlagerungsgesetz)

[29] Disfortunately is the data of the LSVA background system not yet assessable.

4.3.2 Observations on traffic volumes

a) Traffic situation in general

During 2001 three problems related to traffic volumes on Swiss roads caused big headlines inside and outside Switzerland:

- On several days during the whole year, the traffic at the border stations of BWA and Chiasso collapsed.
- Similar gridlock occurred on A2 motorway on the transit route over the Gotthard on several days as well.
- Closure of Gotthard tunnel after fire incident on October, 24th

The regular collapse at the motorway border stations had nothing to do with the levy of the LSVA. The border-station of Basel-Weil is at the limits of its capacity, handling a daily load of 2000 to 2500 truck transits in the direction of Germany and 1500 to 2000 into Switzerland. The situation in Chiasso is very similar and due to the lack of space for expansion, the possibilities for improvement are limited.

Since June 2001, a task force "Steuerungsgruppe Optimierung Schwerverkehr A2" has been in charge and elaborates proposals for improvement and management of the HGV traffic at the border-stations and on the transit route A2. The first of these measures have already been realised in Basel (traffic control and management system on the A5 from Germany towards Switzerland) and Chiasso (improved management of the parking areas)

The closure of the Gotthard road tunnel had far-reaching consequences for road traffic in Switzerland and Europe. On an average day, some 18,700 vehicles pass through the tunnel. Following the accident, private vehicles were deviated across the Alpine passes and HGVs were deviated to other suitable routes.. These alternative routes were indicated early to transit traffic via variable message signs along A2.

The railways reacted very quickly, expanding their services. Swiss Federal Rail (SBB) has reactivated road-to-rail services for private vehicles between Göschenen and Airolo. Rolling Highway services for HGVs operated by SBB Cargo, RAlpin and Hupac have also been increased to transport up to 200 vehicles per day via Lötschberg/Simplon and a temporary service between Brunnen and Lugano started operation on November the 7th.

On December 21th the Gotthard tunnel was reopened.. For safety reasons, a traffic management system enables the minimum distance between heavy vehicles to be increased in the tunnels, alternating one-way traffic for trucks in long tunnels and speed reduction for trucks in tunnels and on access ramps. The capacity of the tunnel is now limited at 3500 HGV per day.

General observations regarding the LSVA are that routings are adapted in order to minimise the distance travelled in Switzerland. If there are parallel itineraries on both sides of the Swiss border there is a tendency for the route in the neighbouring country to be selected.

However, since maximum permissible weight restrictions for vehicles on Swiss roads were changed (from 28 tons to 34 tons with 40 tons permitted in the neighbouring countries) at the same time as the LSVA was introduced, there is still a significant increase of European truck traffic crossing Switzerland.

b) Traffic situation at fee collation points on first days of operation

Introduction of the heavy vehicle fee on the first Tuesday of 2001 caused no significant delays or congestion at Swiss customs posts along the country's border.

According to the Swiss Customs Authority, only about 2,000 trucks crossed the Swiss-Italian border on that day, roughly half the normal traffic frequency. Whether the LSVA facilities for registering distance travelled and collecting the fee will permit smooth processing when traffic returns to normal will become evident only toward mid-January.

Also in Basel at the two large border stations Basel Weil Autobahn (BWA) and Basel-St. Louis (BASLA) the introduction of the LSVA created no particular problems either.

In retrospect, the start of the LSVA can be considered a full success. Several factors were responsible for the smooth start of the whole system. One of the biggest advantages was surely the relatively low traffic volume during the first 2 weeks of January. Due to this drivers and customs personal could gain familiarity with the new system and procedures.

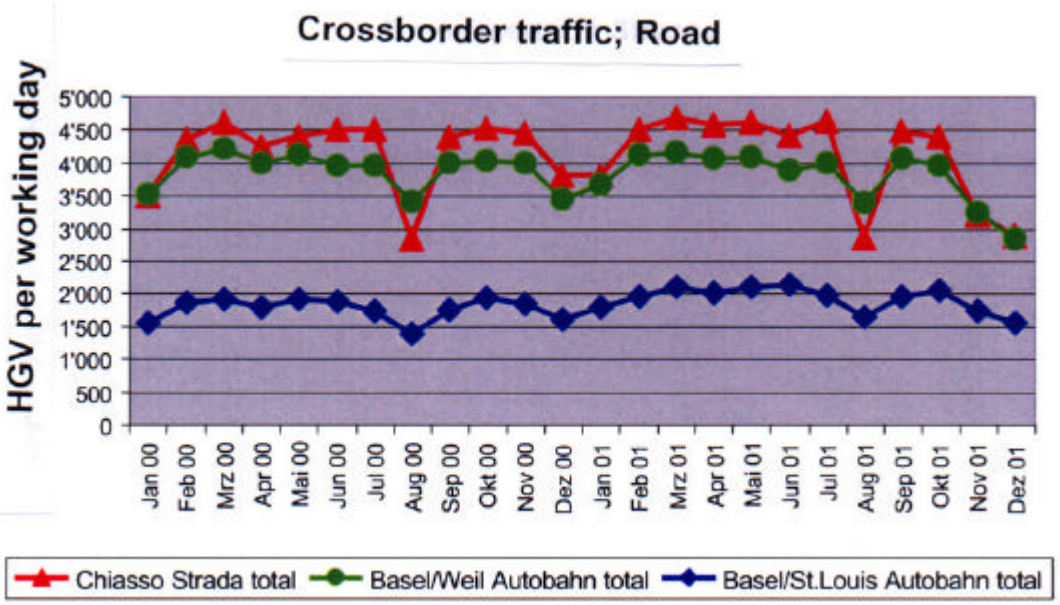
c) Crossborder traffic in general

Corssborder traffic has generally increased since last year. Exact figures, taking account of the different effects (change of the national weight limit, detour traffic because of congestion at the BWA / shift to smaller border-stations, etc.) are not available yet. The Table 4-8 shows some figures levied by SCA at the main border stations in Basel (Basel Weil Autobahn and Basel-St.Louis) and Chiasso.

In Chiasso 570'000 vehicles crossed the boarder northbound which reflects an increase of 5.8 %, the southbound traffic increased to 396'000 vehicles, which is 8 % more then in the previous year. The average increase in crossborder traffic will be about 3-5 %.

The following figure shows the development at the main border station in Basel and Chiasso.

Figure 4-19 Crossborder traffic at main border-stations



[ARE (2001)]

The following table is based on the date of the monthly report of ARE. The figures given are average working day figures (DTW; durchschnittlicher Werktags Verkehr) levied by the mentioned border stations. The analysis only covers the particular period from January to September of the two years. Because of the closure of the Gotthard tunnel at the end of October 2001 the figures in-between October and December are nor comparable.

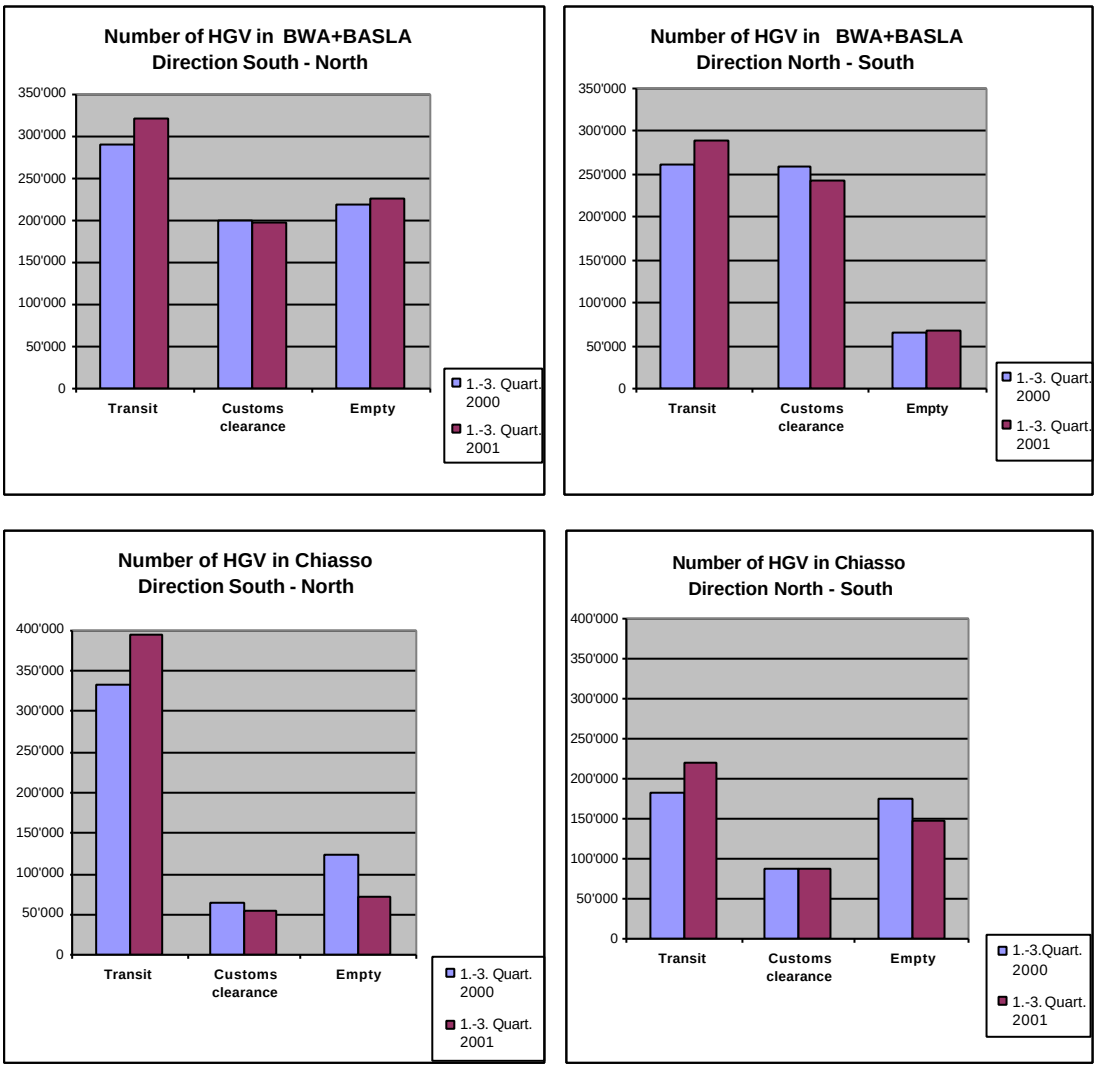
Table 4-8: Average traffic at the border stations in Basel and Chiasso

		Average Jan 2000 – Sept 2000	Average Jan 2001 – Sept 2001	Change in %
Chiasso	N-S	1871	2003	7.0%
	S-N	2272	2283	0.5%
	Total	**4144**	**4286**	**3.4%**
Basel Weil Autobahn	N-S	1934	1604	-17.1%
	S-N	2297	2330	1.5%
	Total	**4231**	**3934**	**-7.0%**
Basel – St. Louis	N-S	951	1032	8.5%
	S-N	809	938	16.0%
	Total	**1760**	**1970**	**11.9%**

[ARE (2001)]

The decrease at BWA (7% on average) has a direct relationship with the serious congestion on numerous days at BWA. Drivers with good local knowledge avoided BWA and crossed the border at BASLA or smaller surrounding border stations like Riehen Dorf or Riehen-Grenzacherstrasse.

Figure 4-20 Traffic volumes at the main border stations



d) Detour traffic / shift along the frontiers

The following section is mainly taken from an article of U. Balmer written for the November issue of Strasse und Verkehr, the montly magazine of the Swiss Association of Road and Traffic Experts.

Shift along the frontiers

A reduction in the heavy vehicle traffic on the Swiss side of the frontier between Basel and Koblenz was clearly evident. This decrease could be largely traced back to a shift in traffic to the road network north of the Rhine. It is likely, though it cannot yet be proven owing to a lack of counting points, that re-routing effects are also to be found on the south bank of Lake Geneva (certainly insignificant according to information from the customs authority), in the Rhine valley and in Tessin. In relation to the total amount of traffic, however, such shifts are not relevant.

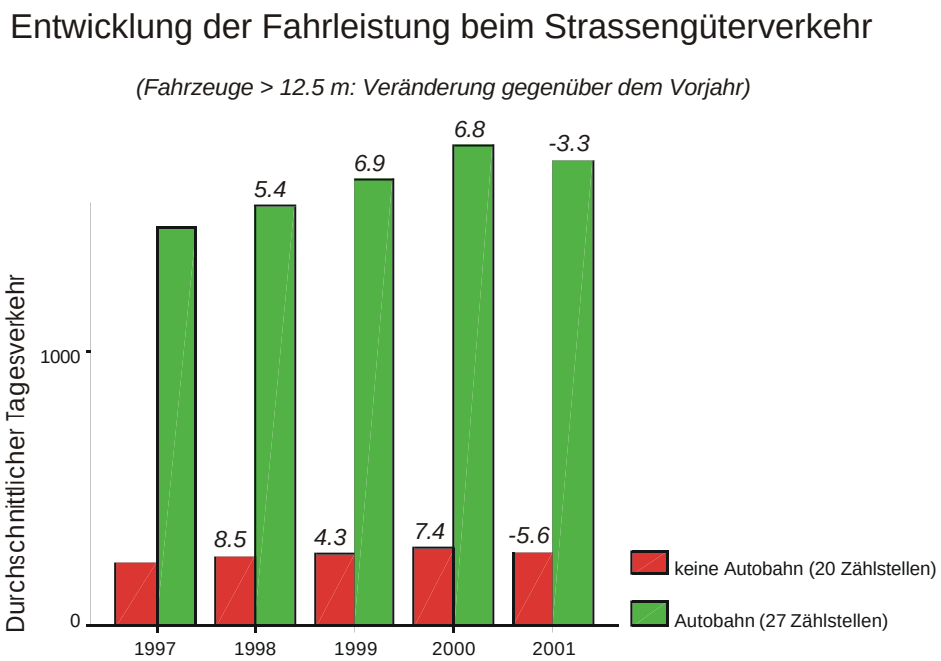
Traffic shift inside the Swiss border

The reduction in traffic revealed at individual counting points can be attributed with a greater or lesser degree of probability to the fact that drivers chose a shorter route. This is clearly apparent, for example, at counting point No 142 at Zofingen, where a decline of 5.4 % was revealed (January to July 2001 compared with January to July 2000). It is highly probable that this effect was the result of drivers choosing a clearly shorter route. In order not to diminish the plausibility of the results of the study, certain counting points, where the fall in traffic was clearly connected to the choice of a shorter route, were not taken into account in the overall assessment. The option - interesting in itself - of including the routes to which the traffic had (presumably) shifted, was unfortunately impossible, owing to a lack of LVCs. With the "by-passed" counting points left out of consideration, as stated, the idea that the trend towards a reduction in kilometre performance was due to the LSVA was certainly weakened but not refuted. One glance at the traffic counters, which are not installed on motorways, confirms this trend; although the problem of revised itineraries hardly arises in the case of the latter, heavy vehicle traffic tends to be on the decline there as well. Generally speaking, after the "by-passed" traffic counters have been left out of the equation, the results show a fall in kilometre performance of 3.3 % on the motorways and 5.6 % on other roads (see Figure 4-21).

The results of a first assessment of the LVC figures were unequivocal. While traffic in both classes steadily increased between 1997 and 2000, with average growth rates of 6 % for class 4 and around 5 % for class 3, the corresponding period in 2001 saw a clear 4 % decrease in traffic. This provisional finding called for closer analysis. In particular, it was necessary to determine whether the result was influenced by the change in the choice of routes. In fact, closer examination reveals that such change does have certain influence. On the one hand, traffic takes alternative routes along the frontiers, the drivers being prepared to travel

slightly longer distances; and on the other hand traffic leaves, or no longer uses, the major road network, as shorter alternative routes are to be found on the minor roads, and by taking them, drivers are able to save on the LSVA.

Figure 4-21 Changes in number of class 4 (>12.5 m) vehicles



[ARE, (2001)]

In order to compensate for the effect of this shift in traffic on the villages that bear the brunt of it, the cantons are entitled by law to a third of the net yield of the LSVA. They are thus provided with the means to cope more or less thoroughly with the negative effects of the increased traffic (or indeed all traffic!), for example, by introducing measures to limit traffic levels or for building by-pass roads.

In fact, during the first year after its introduction, the LSVA had not merely counteracted the trend towards growth in road haulage traffic, it has even produced a slight decrease in kilometre performance across the whole of Switzerland.

e) Traffic situation Transit route Basel – Chiasso

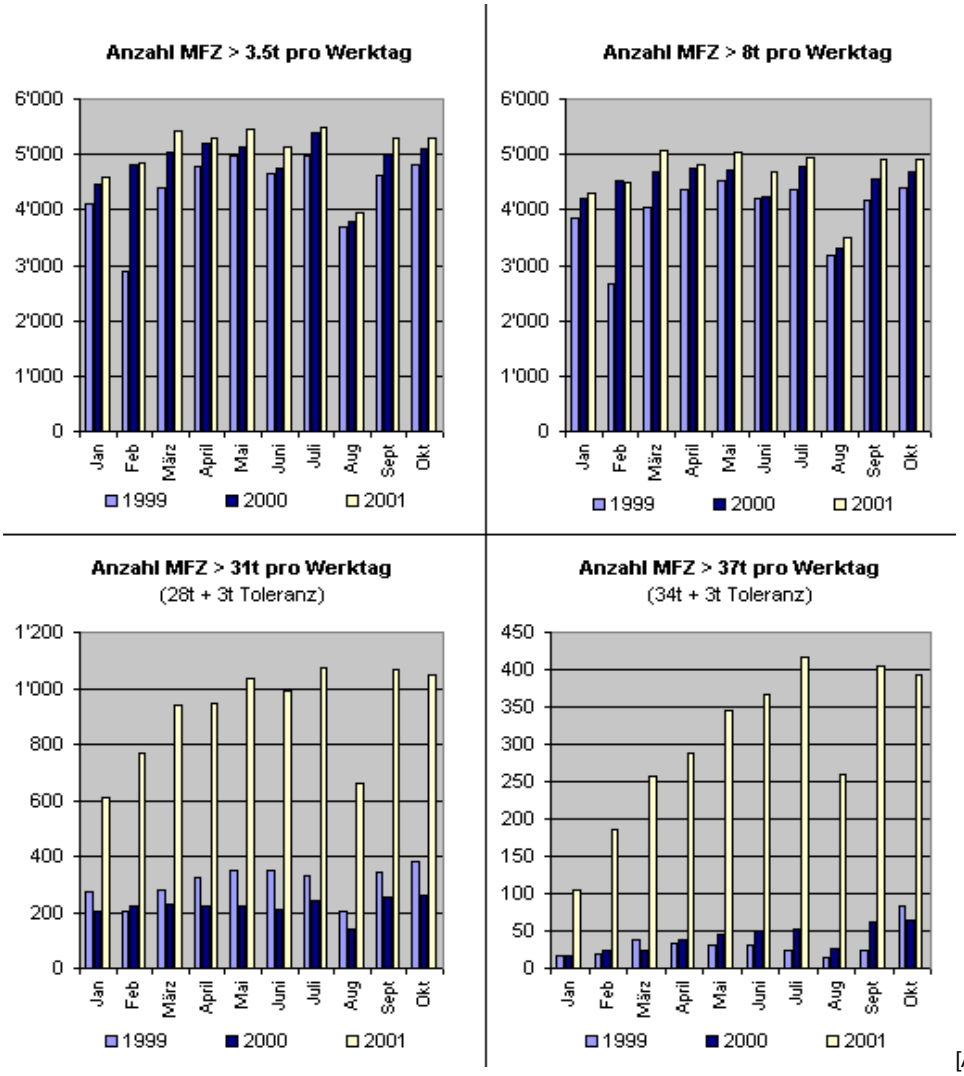
Development January – October 2001[30]

The HGV transit traffic on the Gotthardtunnel route increased last year approximately 8 % on average. About 4600 HGVs passed the Gotthardtunnel daily in January 2001 (working days only, both directions), and by July, this number had grown on peak days to 5500 HGVs.

In January about 13 % of the HGVs were heavier then 28 tons and 2 % surpassed the national weight, .limit of 34 tons (40 t contingents). This share grew until the end of July, increasing to 20 % (>28 t) and7.6 % (>34 t) respectively.

The following figure shows the results of the Weight In Motion (WIM) counter on working days at Erstfeld from 1999 to 2001 (both directions).

Figure 4-22 Number of vehicles according to weight classes

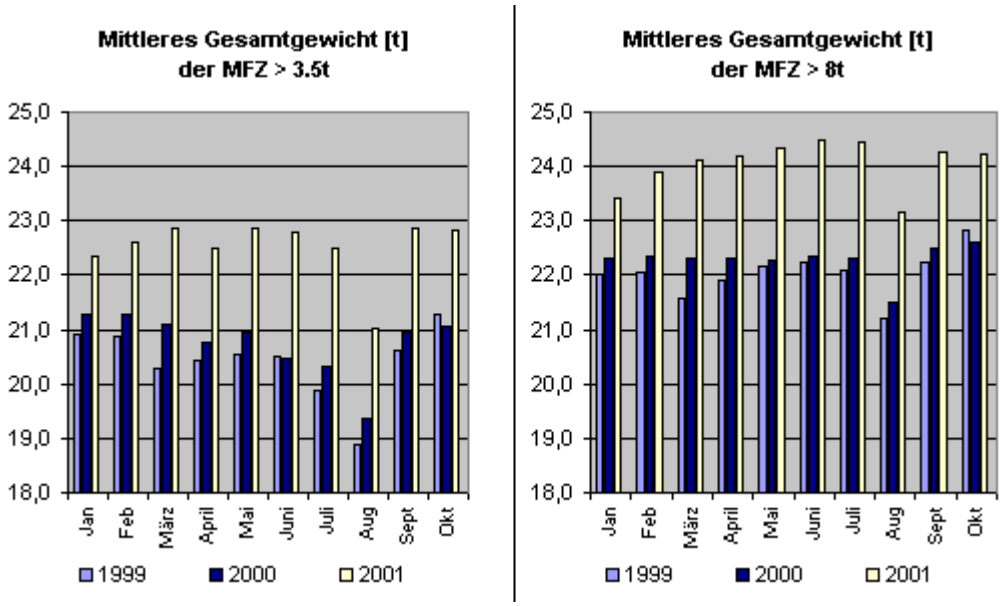


[ASTRA, Internet b]

[30] Due to the closure of the Gotthard tunnel from 24.10.2001 until 21.12.2001no figures for this period are available.

The average weight of vehicles over 3.5 t increased since 2000 by 8 % (ie. from 20.9 t to 22.6 t) in 2001. Whilst for vehicles over 8 t the average weight was 24.1 tons in 2001.

Figure 4-23 Average vehicles weights



[ASTRA, Internet b]

4.3.3 Observations concerning modal shifts from road to rail

Rail / SBB Cargo

According to information from the Swiss Federal Railway (SBB), freight carried by the SBB in the first half of 2001 had the effect of raising transport performance (measured in ton-km) by 1 %. This is no indication of a shift of traffic to rail; the increase in question could have occurred as a result of the greater efficiency achieved in the road transport sector (see below). It is interesting to note the above-average growth of 8.7 % in internal traffic. Since the increase in the national weight limit has played a significantly smaller role in this field than in that of importing/exporting or transit traffic, this growth can be taken as an indication that the LSVA has succeeded in producing more significant effects here.

[Balmer (2001)]

Interview SBB Cargo, Basel

Mr. J.-D. Blanc, Communication, Project Strategy LSVA

The LSVA is too isolated at the moment to achieve the aims set.

Further instruments or measures are necessary to achieve the aims, in particular the surrounding countries should introduce similar taxes. The LSVA system is efficient, fair and technically mature.

The growth in transit transport at the beginning of 2001 was arrested by the middle of the year as a result of a general economic slump. The inland transport was dominated by large volumes of heavy goods and some gain in the retail sector.

One of the main reasons the expected shift from road to rail didn't take place, was the simultaneous lift of the national weight limit from 28t to 34t. Due to the higher weight limit, heavy goods like gravel, mineral water, oil products can now be transported more economically on the road (again). The exact reasons have to be analysed.

The transport prices of SBB have not been lifted in general since the beginning off the year, only in certain sectors like retail have some adaptations taken place. But the willingness to pay for high quality service (time, reliability) is not yet exhausted.

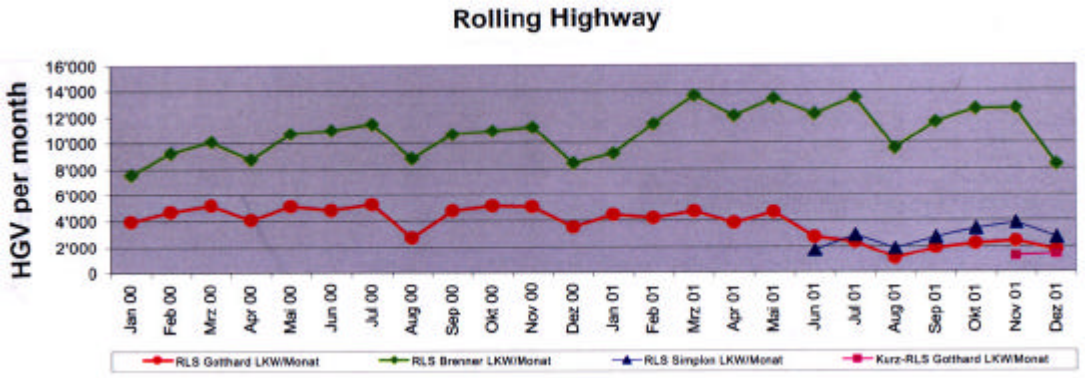
New products have been launched in June 2001 (Cargo Express) and will be launched next year (Cargo Domino).

Use of Rolling Highway (Rola, Rollende Landstrasse)

The most prominent alternative for vehicles in transit is the use of the Rolling Highway on Gotthard or Lötschberg.

Since the introduction a slight increase has been recognised, but it is quite difficult to detectthe extent to which the increased number of transported vehicles is due to the LSVA.

Figure 4-24 Utilisation Rolling Highway

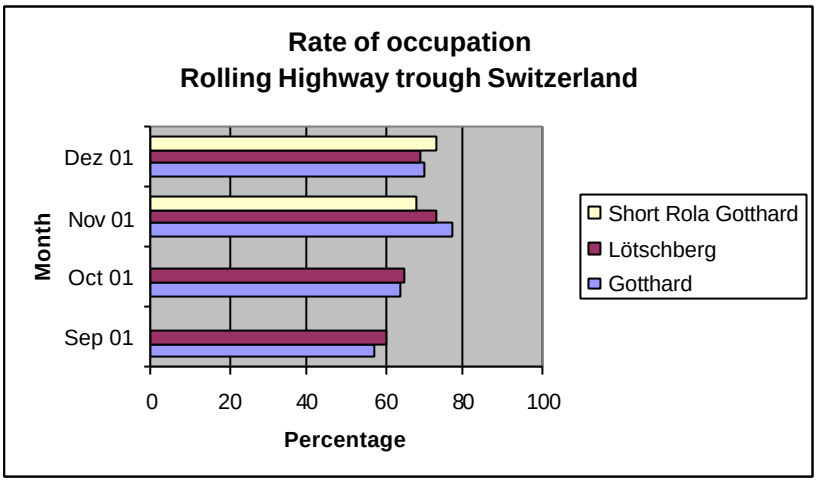


[ARE, 2001]

The opening of the new RAlpin Link via the Löschberg in June 2001 caused a reduction on the Gotthard link.

The following diagram shows the utilisation of the Rola before and after the closure of the Gotthard Tunnel after the fire of 24th of October. It's quite interesting that even after this event, the capacity is still not exploited.

Figure 4-25 Rate of occupation Rolling Highway



[ARE, 2001]

Interview RAlpin AG

Mr Carlo Degelo, CEO of RAlpin AG

Swiss LSVA is at the moment an island solution. In order to prevent detour traffic the polluter pays principle should be implemented in whole Europe. A harmonised "quality pricing" for freight transport in whole Europe would increase the competitively of rail freight transport. On the other hand, the quality of railway freight transport has to be improved markedly. The so called non discriminating "free access" is far away from reality. E.g. non national railway companies having big problems with border formalities in Switzerland. A separation of infrastructure and operation services would markedly reduce the discrimination potential.

Without the Swiss distance-related heavy vehicle fee, the supply of a Rolling Highway would not make sense. Thanks to the LSVA a price for the use of the Rolling Motorway can be asked for ensuring a reasonable cost recovery degree (in average one trip costs 550 CHF and gets additional subsidies of 300 CHF).

In the future the Rolling Motorway will extend the supply, offering two systems: a night train from Freiburg to Novara and daily sprinter trains from Freiburg i. Br. south do Domodossola with a trip time below 5 hours.

The importance of the just-in time (JIT) concept is a big chance for the Rolling Highway and also for combined transports, but only if railways are able to meet the schedules.

4.3.4 Observation on collection system

a) Key figures

The following table gives an overview of some key figures of the LSVA system:

Table 4-9: Key figures of the LSVA performance

Topic	Key figures
Equipped domestic vehicles	All Swiss vehicles, ca. 50'000 vehicles
Equipped foreign vehicles	1775
Registered foreign vehicles	213.743
Registered entry and exits at beacons	Ca. 2'200'000
Registered entry at self-service machines	Ca. 2'000'000
Contingents for 40 t vehicles	133.424 See separate chapter
Contingents for unladen vehicles and light loads	147'983 See separate chapter
Revenues (Jan 2001 – Dez 2001)	500 – 550 Mio EURO See separate chapter

b) System performance

The introduction of the LSVA on January 1, 2001, took place without any problems worth noting. The original budget of 250 Mio. CHF (160 Million Dollars) for the total investment (including system development, on-board units, road side equipment, and central IT system) has been maintained.

Much to the surprise of many, there was neither increased queuing at the Swiss border stations nor protests or lack of co-operation by drivers. This can be attributed to the professional attitude of the drivers. In order not to loose time, drivers of commercial vehicles are highly interested in smooth procedures and, hence, are to a large extent co-operative, well informed and well organised.

Interview Operator (Federal Customs Administration), Bern

Mr. Conrad Schranz, CEO Section LSVA 1 (equipped vehicles)

The Swiss LSVA is basically fair, but due quite low fee levels it's not yet possible to reach the political defines aims. A much better "political" performance can be expected from 2008 when the maximum fee levels can be charged.

The technical performance of the whole system is quite satisfying . Fore sure small problems occurred, in particular within the first week of operation, but none were jeopardising the running of the system and all of the could be solved without problems.

The punctual and smoothly start of the whole system was only possible by the excellent co-operation of all involved parties. A second important point was the highly motivated and well trained personal at the border who is responsible for the execution.

Some potential of improvements can be identified on the week-points of the system like the manual trailer declaration or the handling of the special regulations. This weak points were identified by analysing the first operational experiences.

There are several positive impacts on social aspects like working hours and traffic safety. Also the tachographs are better supervise because any kind of malfunction is immediately detected.

OBU - TRIPON

The OBU is working to the full satisfaction of the system operator and users. Certainly, there were some minor start-up problems , but no important flaws have been discovered.

The user-friendly man-machine interface supports a very simple handling of the OBU. No problems are known regarding the operation of the OBU in connection with the declaration of trailers and the reading out of data for the periodic declaration.

As mentioned above more than 50'000 TRIPON have been installed since June 2000. Although about 30 OBU's were completely destroyed in accidents, less than 5 % of OBU's have been returned as a result of reported problems. Considering the harsh operating environment, this represents an excellent figure that exceeds expectations.

DSRC Road side equipment

The table below shows the DSRC transaction statistics from the first 3 months of operation:

Table 4-10: Performance of beacons

	Nr. of DSRC transactions	Nr. of failed or not completed DSRC transactions	Percentage
January	124'358	6'343	5.1 %
February	150'737	1'491	1.0 %
March	179'214	1'377	0.77 %
Total	**454'309**	**9'211**	2 %

Concerning the quite high number of failed or not completed DSRC transactions in January some remarks must be added. The average failure rate of more than 5% can not be representative for the reliability of an “average” station. About 80% of the failures were generated at only 20 border crossings. The beacon system was tuned and adjusted during January. The much better performance afterwards reflects the success of these measures.

The figures of the last few weeks show a clear downward drift. The most recent results already show figures of 0.6%, and the target figure of less than 0.1 % failures should be reached quite soon.

Background system

Despite a short background system breakdown lasting about an hour on March 29th, 2001 no significant problems were reported.

On some applications the optimising process is still on going, but this is in the nature of IT systems in general.

Declaration and billing process

Initially billing was 2 months late because at a late stage in the introductory phase it was discovered that the vehicle data in the data base were partially incomplete or incorrect. This required a lot of manual interventions and time consuming clarifications.

Since this delay, the system has caught up on the backlog of transactions and all invoices are going out now in time.

After the first bills were issued,, about 1000 objections were raised. Most of these were insignificant and could be easy be clarified.

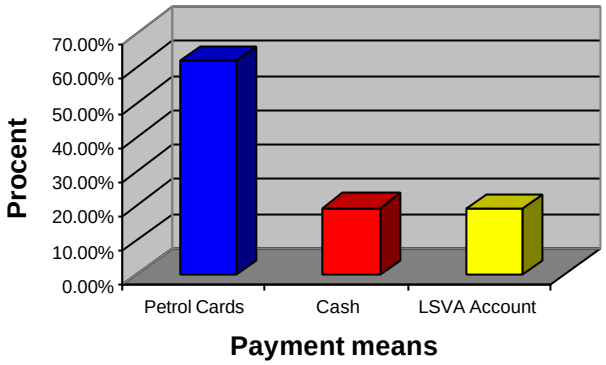
Table 4-11: Objections on billing

Objection	Source of mistake
Wrong address of vehicle owner	Incorrect / incomplete data bases. Mostly because changes were not reported to the cantonal matriculation office
Wrong EURO – class	Discrepancy between vehicle registration papers and stored date in the LSVA date base. Up to the introduction of the LSVA there was no / little significance if the date were always current.
Wrong maximum laden weight	Dito
Wrong declaration of trailer weight	Handling mistake of driver / vehicle owner.

c) Payment means of foreign vehicles

The following diagram gives a guesstimate of the payment means used by the foreign vehicles based on transactions at the border.

Figure 4-26 Payment means used by foreign vehicles



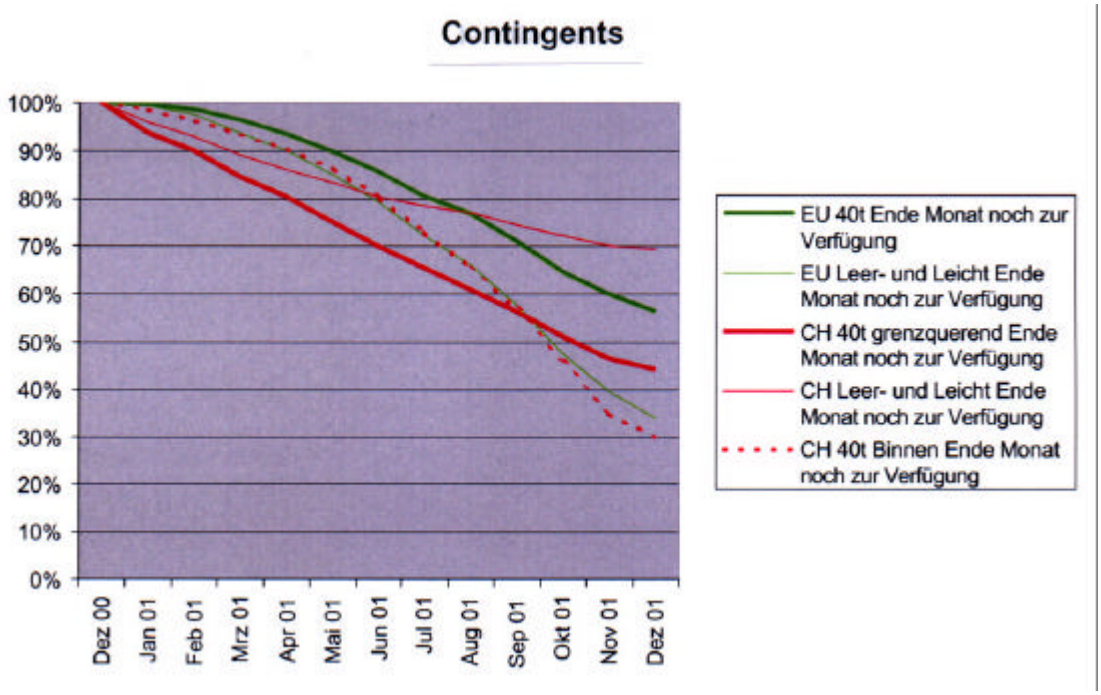
[EZV, (2001)]

The quite low rate of cash payment is one of the main reasons the traffic flow at the border station is not affected too much by the levy of the LSVA. Only a few drivers have to leave their vehicles to pay the LSVA, One more reason that the levy of LSVA is not responsible for congestion at the border.

d) Exploitation of contingents

Against all exceptions, the contingents for 40-tonne trips relating to unladen vehicles and light loads were not exploited for the year 2001. The following diagram shows the number of contingents that will expire.

Figure 4-27 Exploitation of contingents



e) Enforcement and Security

At the moment no data is available about enforcement and security matters.

Observations at the roadside shows that this proves the efficiency of such simple but effective enforcement tools like the small LCD-lamps of the OBU to show the status of operation and the trailer declaration. It is very rare that trailers are not declared - easy detection and “social” checking mechanisms work to good effect. Anyway, if the driver intentionally does not declare a trailer, the OBU recognises this, warns the driver and generates a logfile. By calculating the fee, the backoffice recognises the trailer - discrepancy and the maximal permissible weight is charged.

Interview Operator at border (Swiss Customs Authority), Basel

Mr. W. Hunziker, Head of Department

System, procedures and technical implementation cause no problems at all. All procedures at the border could easy be integrated into the existing procedures. Only few new staff was necessary.

A big effort was necessary for training the staff, but "revenue and expense" were in a good proportion.

Positive influence on motivation of staff.

To reach the political aims, the tariff level should be much higher.

Fraud attempts at the border station are very rare, in particular by entering Switzerland is rate even lower then by leaving Switzerland. Typical fraud attempts are obviously “mistakes” by declaring the kilometre reading or a wrong or missing trailer declaration.

During the whole year less than 100 offence were detected and prosecuted. The rate of spot-checking was quite high in the first weeks and is reduced now to 5 – 10 %, which seems to be sufficient. The mobile and wireless video –cameras used for checking the kilometre – reading of the tachograph is a very efficient tool.

Regarding the new weight limits also very few offences The new weight limit of 34 tons cause also no problems at all, but it is obviously that hauliers take advantage the 34 t plus the tolerance of 5% (tolerance of the balance).

Interview Cantonal Police Autority, Frauenfeld

Mr. M. Jacob, Head of traffic police

The LSVA is part of the Land Transport Agreement with the EU and should not be considered isolate. The LSVA is necessary, but the defined (political) aims are not reached yet. The LSVA should support the shift from road to rail and have some more positive effect regarding environment protection and road safety. Desirable aims on environmental issues by far not reached yet. To avoid detour traffic and fraud accompanying measures and more enforcement are necessary.

Gaps of the system and fraud fragile elements like special regulations and contingents should be reconsidered.

The canton of Thurgau in eastern Switzerland is on of the first cantons that increased systematically the checking rates for HGV. This “Schwerverkehrskontrollen” takes account of all necessary checks like driving-, working- and rest-hours, technical regulations and last but not least the correct declaration of the LSVA. The number of LSVA – offences is negligible.

More concerns causes the general increase “wild-west” behaviour on the roads. In particular also professional drives offend against traffic rules.

More concerns causes the general increase of offences against traffic rules, vehicle and driver regulations. This is a direct consequence of the very hard competition, price and time pressure in transport sector.

LSVA is just one piece of the Swiss transport policy puzzle. There is still more call for action and compensative measures to reach the settled aims in transport policy. Polluter pay principle should even become more efficient.

f) Special regulations

The handling of the special regulations caused no operational problems. But special regulations offer a certain potential to fraud of the system.

g) Revenues

The revenues for the first year of operation of the LSVA were estimated at 600 Mio EURO (ca. 900 Million CHF).

The effective collected amount for the year 2001 will reach this estimations quite exact. Domestic vehicles generated about 430 - 450 Mio EURO (ca. 650 Million CHF) which is about 70% of the total amount, the revenues of foreign vehicles will be close to 130 Mio. Euro (ca. 200 Million CHF).

These figures include the refunds for UKV and wood transport is not yet considered.

4.3.5 Observed effects on telematic industry

Freight and fleet management activities have been increased in order to maximise the load factor and to minimise the distance traveled in Switzerland. This systems works basically independent of the equipment for the levy of the LSVA. Therefore it is only possible to detect indirect influences of the LSVA.

At the moment, no add-on equipment to the Swiss OBU has been developed.. One of the reasons is supposed to be that the small market of approximately 60'000 units does not represent a viable business case for industrial production.

4.3.6 Observed effects on transport industry

a) Fleet composition

The transport industry has adapted the fleet composition to the LSVA tariff: High-emission trucks have been replaced by new low emission vehicles. Also, the vehicle sizes have been adapted to the goods that are regularly transported (e.g. a carrier buying special low weight trucks if he runs a business transporting paper towels). This process has been noticeable well before the start date of the LSVA. In Switzerland the truck sales have been booming in the year 2000 (see also chapter 4.2.5).

Regarding the light commercial vehicles the trends are still the same as in the previous years. There was still not a disproportionate increase in imported LCVs in comparison with matriculated LCVs during the year 2000

In particular, within the categories with a payload between 1.5 and 3 tons which are suitable for commercial goods transport, the increase of imported vehicles is 12 % which is lower than in the previous years (15 %). The number of matriculated LCVs increased from 6604 vehicles which reflects an average increase of 3 %, the same rate as in the previous years.

Therefore is still not possible to prove a significant shift from HGV towards LCV for commercial good transport as a result of the introduction of the LSVA fee. Certainly, some optimisation of the fleets took place, but not in the order of magnitude that was forecast by LSVA antagonists.

Within the transport sector the different handling of LCVs is still a hot issue and limited understanding that LCV are not subject to the LSVA is evident.

The following table shows the absolute and percentage change on the number of new HGVs ordered since 1997. The difference between 2000 and 2001 is quite significant. All sales figures for 2001 show a dramatic decline, which is a clear proof, that the renewal of the fleet took place prior to the implementation of the LSVA, particularly during 2000.

	HGV 3.5 - 12 t	Change %	HGV 12.1 -18 t	Change %	HGV 18.1 - 26 t	Change %	HGV > 26 t	Change %
1997	362	-	1571	-	539	-	291	-
1998	362	0.0%	1826	16.2%	584	8.3%	454	16.8%
1999	530	46.4%	1899	4.0%	541	-7.4%	737	14.9%
2000	530	0.0%	2907	53.1%	754	39.4%	1203	45.5%
2001	347	-34.5%	2354	-19.0%	738	-38.7%	738	-24.5%

[VSAI (2001)]

Some other side-effects could also be detected such as the example mentioned in BALMER (2001).

The company Zingg Transporte AG

The company Zingg Transporte AG in Hedingen carries refrigerated, deep-frozen and conventional shipments. In the year 2000 its Swiss operations represented around 6 million vehicle km with a fleet of vehicles liable to the heavy vehicle fee LSVA. As a result of a series of targeted measures, such as the further improvement of their service to customers, targeted acquisition of contracts, or the provision of "Smarts" for commuter trips by the drivers formerly been made in lorries, it was again possible to achieve a significant reduction in the proportion of empty runs. Together with the gain in productivity due to the higher national weight limit, it was possible to lower the total number of kilometres covered annually by around 5 %.

b) Structure changing and logistics

Freight and fleet management activities have been increased in order to maximise the load factor. The trucking industry has been thoroughly shuffled. Trucking firms have merged or are co-operating in other forms in order to get a better chance for return freights.

c) Increased efficiency

Two indicators suggest that the main reason for the observed growth in kilometre performance is::

- The higher weight limit allows the transport of more goods with a kilometre performance that remains the same or even falls.
- The restructuring that occurred in the run-up to the introduction of the LSVA, together with logistical improvements (freight and fleet management), led to a clear reduction in the number of empty runs.

[Balmer (2001)]

Interview MIGROS

Mr Peter Kiser, Chief Operations National

The introduction of the Swiss LSVA was under extreme time pressure, but a longer period of introduction wouldn't have helped much. The work of the operator (Swiss Customs Authority) during the period of introduction was not completely satisfying. The OBU's were not provided early enough (at least half a year before introduction would have been fair) and the support with respect to installation and instructions could have been improved.

The effects of the LSVA are manifold: First of all the tendency towards big haulier companies has been strongly enforced. In order to have a good use to capacity of the fleet (as little empty trips as possible) a haulier company now should have a volume of goods transport for at least 200 lorries. MIGROS itself having this volume and being responsible for the whole logistics works together with a lot of small companies that are getting very dependent of MIGROS as a client.

At the same time, there is an important incentive to renew the fleet (which again favours the big ones having the capital needed). MIGROS was renewing it's 500 lorries much faster than planned.

Interview Bäumle Steiner AG

Mr. Josef Steiner, General manger of Bäumle Steiner AG

The raising of the LSVA functions without remarkable problems. System components are working very fine and procedures are well defined.

The introduction had also positive side-effects for the hauliers, those who realised the chance could even take advantages of the new toll.

Tariffs and prices were at the beginning or the year quite good. The LSVA was a good reason for investments in the fleet and other modernisation within the company.

The collection system has some potential for improvements, e.g. an automatic trailer recognition, faster and easier declaration of the data etc.

Regarding the traffic policy it would be necessary that road hauliers, railways and economy should co operate better and more efficient. Partner-ships or joint-ventures The raising of the LSVA functions without remarkable problems. System components are working very fine and procedures are well defined.

d) Transport sector / commercial prices

The prices in transport sector have been adapted with the introduction of the LSVA. The tariff matrixes have been recalculated and also the ASTAG published recommendations how the LSVA should be take into consideration in the invoicing.

Mostly the LSVA is included in the tariff and the LSVA is not explicitly shown on the bill. Some exeptions are known, but in general it is quite difficult to split costs for the LSVA or shift the LSVA direct to the consumer. Some

Further increase of transport prices in 2002 are known, partly also argumented by the risen costs because of the LSVA in particular also for the additional administrative work related to the monthly declaration of the LSVA

Interview Galliker

Mr. Paul Malzach, Member of executive board

Introduction of the Swiss LSVA was under extreme time pressure, but the operator (Swiss Customs Administration) did and still does a great job. The data registered by the OBU are very useful for hauliers themselves (if they use them for monitoring and controlling purposes).

Overall the fee could be passed to the customers but the effects on the structure of the Swiss road transport industry are enormous: Only large companies with extremely good use to capacity of their fleet will survive in the long run. There is also an important impact on the renewal of the fleet. It is profitable to switch to EURO II / EURO III vehicles.

Technical acceptance of the system is good; the software has been and still is improved. A continuing instruction of the drivers is important.

Interview ASTAG, Bern

Mr. Hanspeter Tanner, vice-director; Mr Armin Lehmann, head of department

The Swiss Haulier Association places particular emphasis on "European solution for interurban road pricing for heavy vehicles". The Swiss LSVA is at the moment an island solution. There is a big need for European harmonisation.

The introduction of the Swiss LSVA was under extreme time pressure but overall the operator did a good job.

The Swiss LSVA had an influence on competition in road haulage. A clearing up of the structures is ongoing, with big haulage companies as winners. Small companies not reaching a high degree of use to capacity of their lorries are not competitive anymore. On the other hand, there is no noticeable shifting effect from road to rail in domestic transport.

As a consequence of the LSVA, the whole structure of tariffs had to be adapted. The official tariffs of ASTAG are a good point of orientation, but in reality marked discounts on this tariff are given.

At the same time, there is an important incentive to renew the fleet in order to have cleaner vehicles (and paying less LSVA).

The technical acceptance of the system is good; the OBU functions well and is easy to operate for the drivers. The confidence into the system is rising. The operator did a very good job. An advantage is also that in the near future the haulage companies will be able to read the chip cards of the OBU themselves, which provides valuable additional information.

5 Conclusions


Tages-Anzeiger · Mittwoch, 3. Januar 2001

LSVA: Start geglückt

Erstmals ist am Dienstag die neue Leistungsabhängige Schwerverkehrsabgabe (LSVA) erhoben worden.

Chiasso. – An den Grenzüb-
ckelte sich das Verf-
niger problemlos
ten Blockaden
gen die Einfü
ben.

"LSVA: Successful start": Headline in the "Tages Anzeiger" of January 3rd 2001.

After the first year of operation this headline is still correct. The system for the collection of the Swiss Heavy Vehicle Fee LSVA is working very well, but with room for improvements of some of the operational processes.

After only one year of operation, it is difficult to give detailed information on the effects of the new fee on the traffic flow. Especially as the national weights limit has been raised from 28 to 34 tons simultaneously. Some changes of traffic flow along the border and within Switzerland canbe observed. Compared with the total traffic flow this changes are not significant. More important is that the introduction of the LSVA, has not merely counteracted the trend towards growth in road haulage traffic,but it has even produced a slight decrease in kilometre performance across the whole of Switzerland.

It is nevertheless already evident that the LSVA, or to be more precise the dependence of the fee on the emissions and the weight of the vehicle, incite the vehicle owners to adapt their vehicle fleets. During 2000 a huge renewal of the Swiss HGVs fleets took place, a clear trend towards more specialised fleets and more clean vehicles can be observed.

For several areas like the effects on employment or the impact on transport and retail prices the short term observation are not likely to be representative for the long term effects of the LSVA. More detailed and long period investigations must be carried out to assess these long term effects.

Some quantitative targets of the LSVA, in particular the shift from road to rail, have not yet been achieved.

Regarding the generalisation of the results of the Swiss Case Study some attention must be given to the specific context of the LSVA system, and issues such as the Swiss political system, geographic conditions and the fact that Switzerland is not member of the European Union. Nevertheless the experiences of Switzerland certainly serve as an important input to future IRPS projects.

6 Appendix A: Results from Swiss Key Informant Survey (KIS)

The aim of the interviews is to identify problems and possible solutions of the Swiss LSVA. The interview consists of nine question blocks (question blocks A – I). The results from these nine question blocks are summarized in the following nine sections.

6.1 A: Interviewees

The interviewees have been chosen in order to get a representative sample of observations of the impacts and effects of the new LSVA. Therefore interviews have been held with ten different experts representing most of the involved key actors (see figure 6-1 and table 6-1).

Figure 6-1: Number of interviewers per type of institution (question block A)

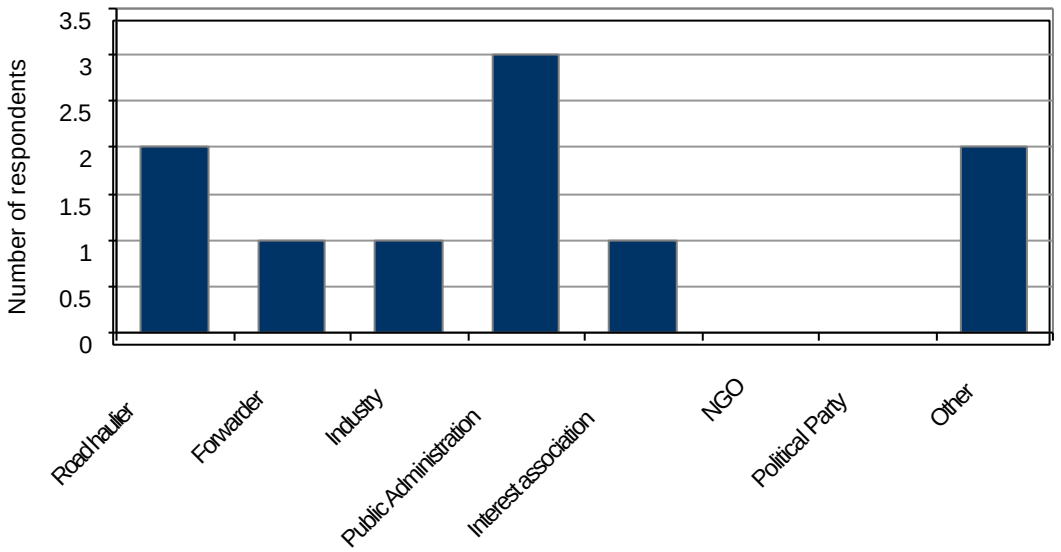


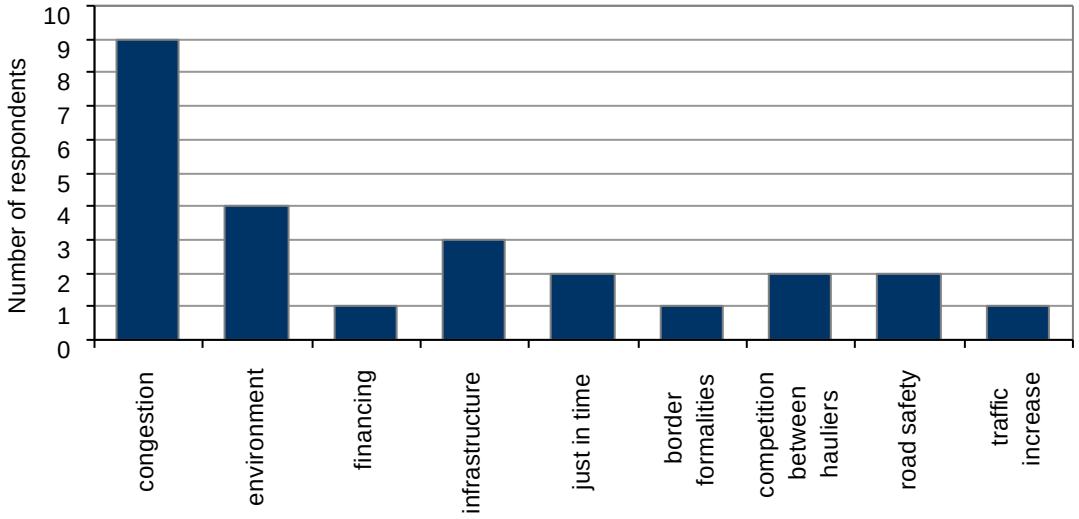
Table 6-1: Interviewees and their affiliations (question block A)

Key-Actor	Organisation	Person / Contact
Road haulier	One of the biggest haulier companies in Switzerland with large logistic services	Galliker Transport AG Paul Malzach (member of executive board) Kantonsstrasse 2 CH – 6246 Altishofen
Road haulier	Middle-sized road haulier	Bäumle Steiner Transport AG Josef Steiner (general manager) Im Chalch 611 CH – 4323 Wallbach
Forwarder	Biggest retail company in Switzerland As well forwarder, as industry, as haulier	MIGROS-Genossenschafts-Bund Peter Kiser (chief operations national) Heinrichstr. 216 CH – 8005 Zürich/ZH
Industry	FELA, OBU manufacturer	FELA Management AG Jürg Uhlmann (CEO traffic telematics department) Bsadingerstrasse 18 CH – 8253 Diessenhofen
Public Administration (Operator)	Swiss customs administration Operator	OZD / LSVA Conrad Schranz (CEO section LSVA 1) Gutenbergstrasse 40 CH – 3003 Bern
Public Administration (Operator)	Swiss customs administration Customs office (operator at border station)	Zollamt BWA, Zollinspektorat W. Hunziker (head of department) Postfach CH – 4019 Basel
Public Administration (traffic police)	Cantonal police authority Responsible for enforcement	Kantonale Polizeidirektion Mr. Jacob (head of traffic police) Zürcherstrasse 325 CH – 8500 Frauenfeld
Interest / professional association	Swiss road transport association Interest group of Swiss hauliers	ASTAG Schweizerischer Nutzfahrzeugverband Hanspeter Tanner (vice director) Armin Lehmann (head of department) Weissenbühlweg 3 CH – 3000 Bern 14
Other (Railway)	Representative of Swiss federal railway, Cargo division Rail haulier	SBB Cargo, Kommunikation SBB Cargo Jean-Daniel Blanc (communication, project strategy LSVA) Peter Merian-Strasse 90 CH – 4065 Basel
Other (Railway / Rolling Highway)	RAlpin AG / BLS (Lötschbergbahn), Cargo division Operator of the rolling motorway	RAlpin AG Carlo Degelo (CEO) Genfergasse 11 CH – 3001 Bern

6.2 B: Description of the problem

In the almost unanimous opinion of the interviewees the main problem arising from road freight transport is congestion (see figure 6-2). Two further problems of some importance are the external effects of road freight transport on the environment and the limited capacity of the road infrastructure.

Figure 6-2: Main issues arising from road freight transport as perceived by the interviewees (question B.1)



This assessment is corroborated by what the interviewees consider the main problems for road hauliers and their clients (see figure 6-3): Congestion is again the main issue, but for the road hauliers the increasing competition between hauliers and the high costs of delays in connection with just-in-time production are more important than environmental issues. As figure 6-4 shows the general public is not believed to be very well informed about these problems.

Figure 6-3: Main issues for road hauliers as perceived by the interviewees (quest. B.2)

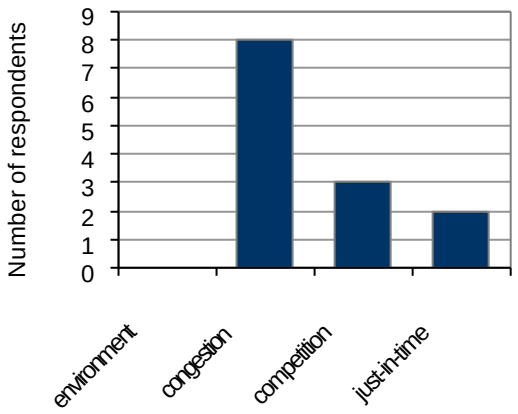
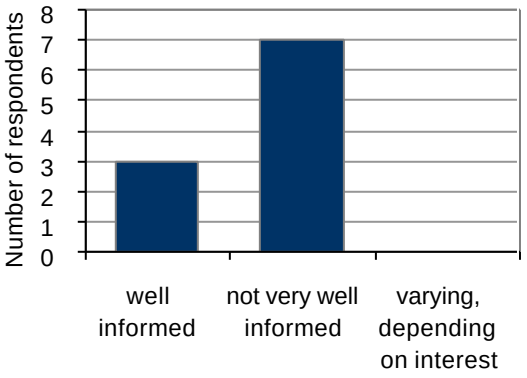


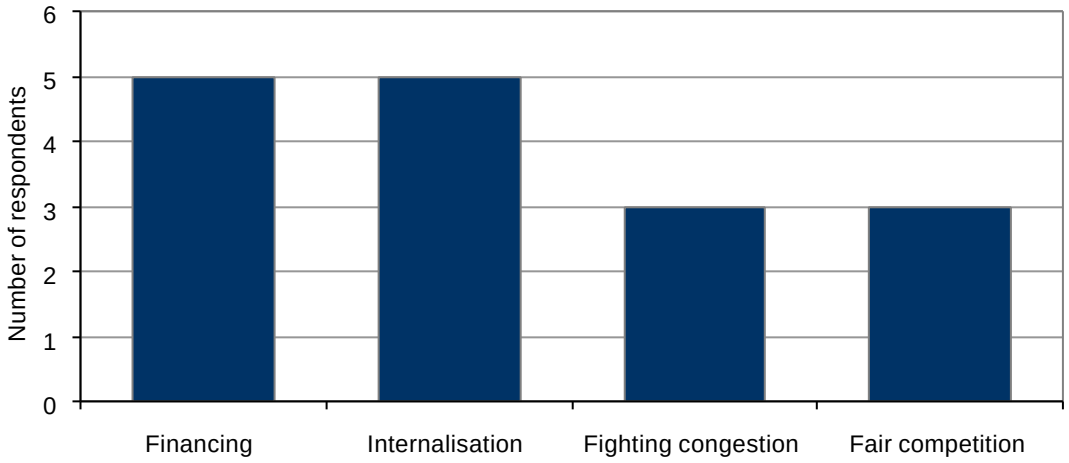
Figure 6-4: Awareness of these problems in the general public (question B.3)



6.3 C: Description of the LSVA

The Swiss government seems to have had several objectives to justify the introduction of the LSVA. In fact, the interviewees, who were allowed to name one or two out of four possibilities, could not reach a consensus (see figure 6-5): All four objectives are almost equally important, although the financing of new infrastructure (the new transalpine railway tunnels) and the internalisation of external effects seem to be slightly more important than fighting congestion and fair competition among transport modes.

Figure 6-5: Main objectives of the government justifying the introduction of the LSVA (question C.1)



The rest of question block C does not consist of questions, but, in fact, is information for the interviewee which is given to him in order to make sure that all interviewees are talking about the same system, i.e. the Swiss LSVA. This information is summarized in table 6-2.

Table 6-2: Characteristics of the Swiss LSVA (questions C.2 – C.8)

C.2 Basis for calculation of toll rate	Kilometres driven, maximum permitted total weight of trucks and trailers, EURO - emission categories
C.3 Incidence on road network	Whole road network
C.4 Incidence on vehicles	All vehicles above 3.5t
C.5 Time modulation / incidence	No time modulation
C.6 Application of revenues	Two thirds for rail infrastructure (new transalpine railway tunnels), one third earmarked for transport infrastructure to cantons
C.7 Exceptions	Lower fee (75%) for transport of milk and animals; refund for combined transports and transport of timber Army, fire brigade etc.
C.8 Compensations	No compensations

6.4 D: Evaluating the LSVA

In the opinion of the interviewees the Swiss LSVA is not effective, i.e. it does not achieve the specified goals (see figure 6-6). The main reason for this judgment is that the LSVA has so far not been able to shift goods transport from road to rail. Further reasons are the small fee level (which will rise in future years), the high operating costs, the negligible influence on congestion, the preference for an international instead of a national solution, and the fact that the shortest route is often not the safest one.

In contrast, the fairness of the system is considered to be rather high (see figure 6-7) although two experts perceived it to be very low. The advantages of the LSVA with respect to fairness are that the LSVA corresponds to the polluter pays principle. One expert believes the Swiss LSVA to be one of the fairest systems world-wide. A disadvantage is the distortion of competition. However, there is no consensus whether or not the LSVA is fair for the countryside and whether or not the fee level is presently too low.

Figure 6-6: Perceived effectiveness of the LSVA (question D.1)

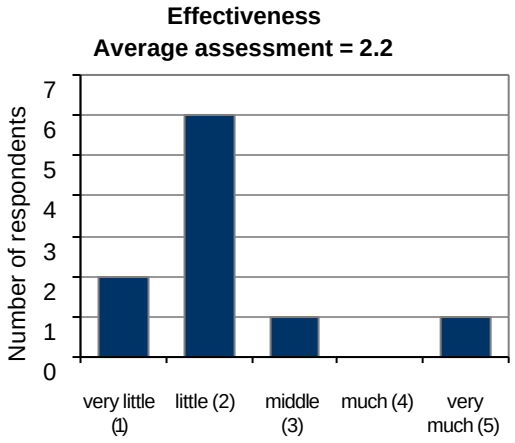
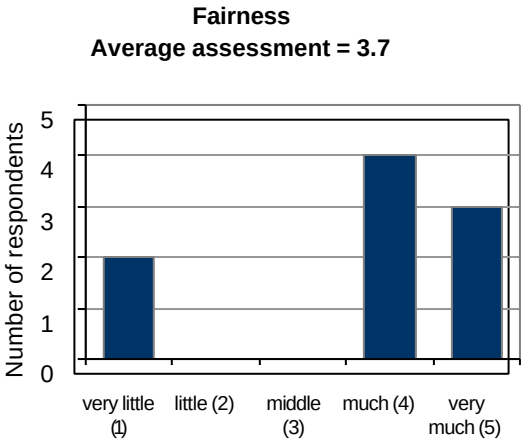


Figure 6-7: Perceived fairness of the LSVA (question D.2)



The LSVA is perceived to be very transparent (see figure 6-8) because the base of the calculation of the fees is clearly defined, because there is no time modulation of fees, and because special regulations are relatively scarce.

Finally, the LSVA seems to be rather immune against fraud or abuse (see figure 6-9). No system is absolutely safe against fraud, but the potential for fraud of the LSVA is limited. Nevertheless, wrong trailer declarations or manipulation of the tachograph are possible and the special regulations open up some opportunities for fraud. So far, however, the observed offences are marginal.

Based on this evaluation of the LSVA, six out of the ten experts recommend changes in the system (question D.5).

Figure 6-8: Perceived transparency of the LSVA (question D.3)

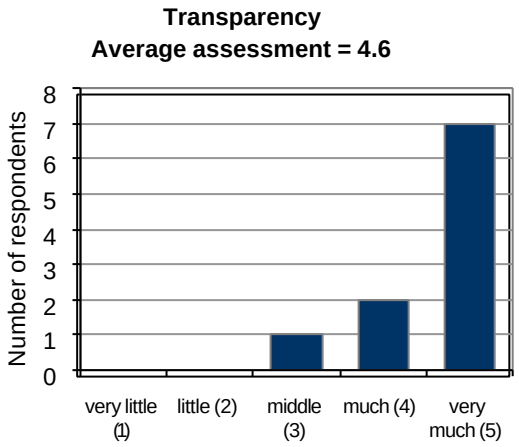
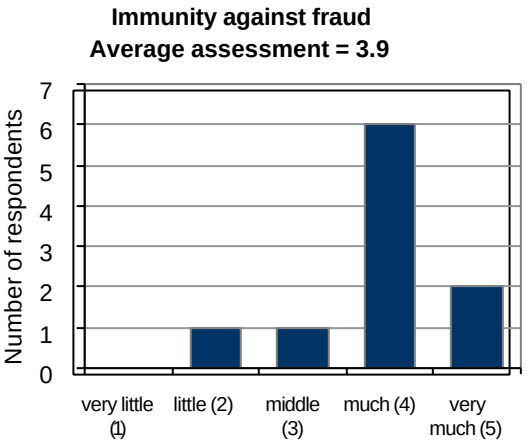


Figure 6-9: Perceived immunity against fraud of the LSVA (question D.2)



6.5 E: Elaborating / improving the LSVA

In question block E the main characteristics of the LSVA are analysed more closely. The usefulness of each of the main characteristics as presented in table 6-2 above (questions C.2 - C.8) is scrutinized and possible improvements are proposed.

The calculation basis (question E.1 or C.2) of the LSVA is the maximum permitted weight. Several experts have criticized this, but they made different proposals for improvement: One expert recommends that fees based on the payload would be more effective and fair, another expert suggests that fees should be based on the number of axles, and still another expert believes that charging by ton-kilometers would be the best approach. Furthermore, there is some risk of abuse because the trailer declaration is manual. One expert argues that automatic trailer declaration would be preferable. Finally, lower fees should be introduced for especially clean lorries, e.g. lorries with alternative fuels.[31]

In Switzerland the use of all roads is subject to the fee (question E.2 or C.3). Two experts oppose this element of the LSVA stating that it is against the European trend of charging only motorways. Thus they propose that different fees are introduced for different levels of road or even that only motorways and important secondary routes should be charged.

[31] This answer has been given to question E.6, although it belongs to question E.1.

All vehicles above 3.5t are subject to the fee (question E.3 or C.4). This seems to be a compromise as some experts think that this threshold is too high, others believe it is too low. Five experts argue that light semi-trailers and light commercial vehicles are not subject to the fee (which distorts competition) and thus that all commercial vehicles should be charged. In contrast, two experts state that the Swiss LSVA is not compatible with European trends. They conclude that only vehicles above 12t should be charged.

The Swiss LSVA provides for no time modulation (question E.4 or C.5). Most experts seem to go along with this scheme. Only one experts asks for higher fees during peak load times in order to fight congestion.

Two thirds of the revenues are used to finance the new alpine railway tunnels and one third is given to the cantons earmarked for transport infrastructure (question E.5 or C.6). While some experts seem to agree, others make opposing proposals: Two experts argue that a larger part of the revenues should be earmarked for maintenance and extensions of the *road* infrastructure, whereas another respondent states that instead of giving one third of the revenues to the cantons, these revenues should be used to improve combined transport (especially with respect to north-south freight flows and in order to build more terminals). Finally, another interviewee pleads for the allocation of the revenues to the improvement of the system, e.g. for automatic trailer recognition.

Regarding the Swiss regulation of exceptions (question E.6 or C.7) several experts argue that exceptions are unfair, not effective, not transparent and, in fact, only granted because of strong political lobbying of some interest groups. Therefore all exceptions should be given up – perhaps except those for combined transport. Concerning combined transport it might be useful to extend the refunds from containers to goods primarily transported with rail wagon loads. However, some interviewees believe that a few exceptions – possibly less than nowadays – are acceptable.

There have not been any comments to question E.7 or C.8 regarding compensations.

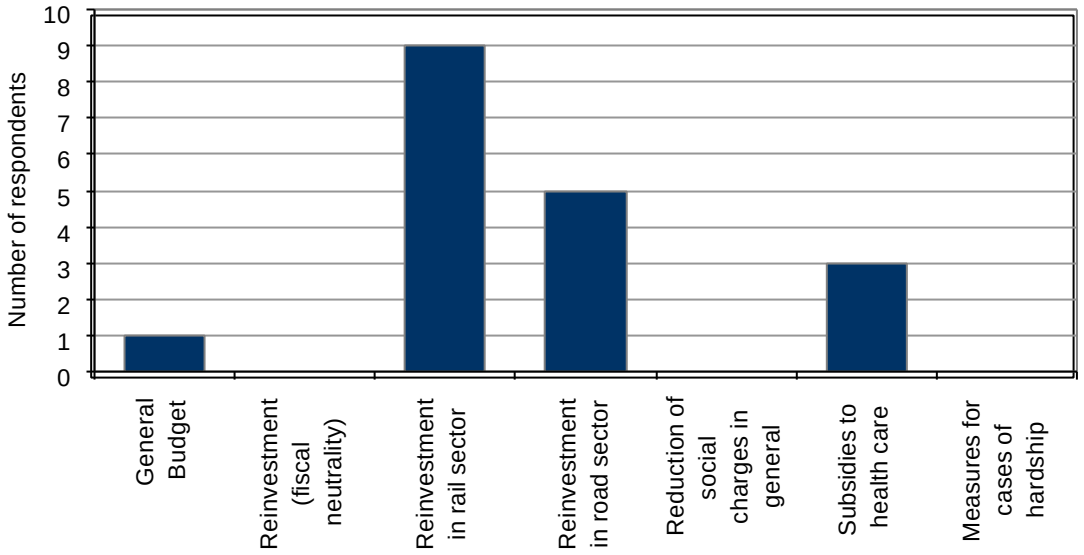
6.6 F: Clarifying opinions

In Switzerland the free use of interurban roads is *not* considered to be a basic right (8 times no, twice “I don’t know” in question F.1.1). For most experts the new LSVA is neither viewed as a second payment on top of congestion costs (7 times no, 3 times yes in question F.1.2). Therefore for the majority of respondents the LSVA is a justifiable fee and not an easy option for additional fund raising by the government (6 against 4 in question F.1.3).

The experts were also asked to specify for what purposes the revenues of the LSVA should be used (see figure 6-10). They were allowed to give multiple answers. There is almost universal agreement that the revenues should be used to finance rail projects (infrastructure and combined transport). Still half of the experts support the use for the road transport sector (maintenance and extension of the overall road network). Subsidies for the health care sys-

tem are only backed up by a minority of three experts. All other possible uses for the revenues are not acceptable.

Figure 6-10: For what purposes should LSVA revenues be used (question F.1.4)?



The advantages the LSVA has on the economy as a whole or on certain individuals or interest groups are discussed in question F.1.5. As a consequence of the Swiss LSVA the renewal of the fleet has sped up. Hence, much more environmental friendly lorries are in use now – to the benefit of all – and garages and vehicle importers can expect more sales. Since the fees are levied on the maximal permitted total weight, there are more incentives to drive fully loaded such that the transport system becomes more efficient. It follows that big firms – also being good partners to railways – are getting stronger while small inefficient firms fall out of the market. Furthermore, the LSVA can lead to less congestion and more safety on the roads and, of course, to more money for rail and road infrastructure.

In question block F.2 the impacts on the economy have been assessed. Most respondents believe that the combined and rail freight transport is only an inadequate alternative to road freight transport (see figure 6-11). There are still not enough loading platforms for combined transport. Railway companies have not yet exhausted their potential and should therefore improve their performance. Note, however, that the transport distance is relevant for efficient combined and rail transport. Since rail transport is slower, two experts believe that for short-distance transport rail companies stand no chance. In contrast, there are high growth rates in transit- and import-/export rail freight transport, but there is still room for improvements on the transit route Germany - Switzerland - Italy, in particular in Italy.

An important question is also who is most affected by the LSVA fee, or in other words are the hauliers able to pass on the burden on the industries and are the industries in turn able to hand on the higher costs to the consumers via higher prices. As figure 6-12 shows the con-

sumers are believed to be most affected. However, three respondents believed that all three are equally affected.

Figure 6-11: Is combined and rail freight transport an adequate alternative (quest. F.2.1)?

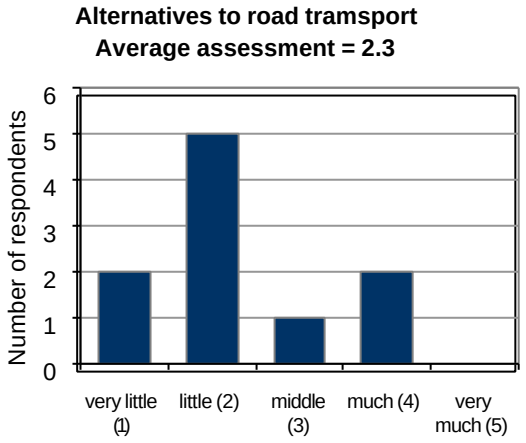
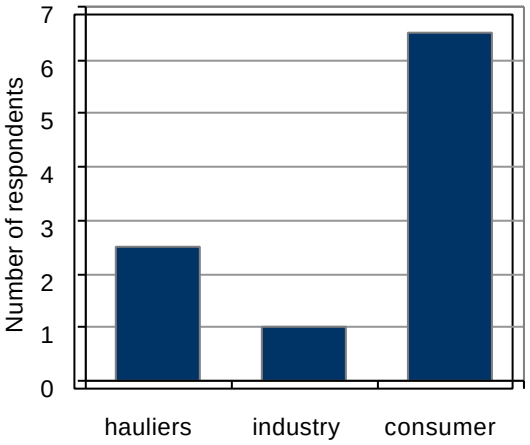


Figure 6-12: Who carries the main burden of the LSVA (question F.2.2)?



How is competition within the transport sector affected (question F.2.2)? The experts agree that the tendency towards bigger haulage companies has been strengthened since only big companies with strong logistics can survive because it is crucial to have as little empty trips as possible in order to minimize LSVA dues. For small companies fleet adaptation and professional fleet and freight management is mostly not possible. Hence, an independent company should at least have 50 or 200 lorries (according to two different experts, respectively). Although the LSVA favours rail transport, the shift from road to rail is marginal so far. The reason might be that railway companies did not enhance their supply significantly, such that the LSVA increased prices for rail transports as well. As mentioned, only for international freight transport there is marked growth in combined transports. Finally, one interviewee states that the impacts on the transport sector are basically only small.

6.7 G: Implementation of the LSVA

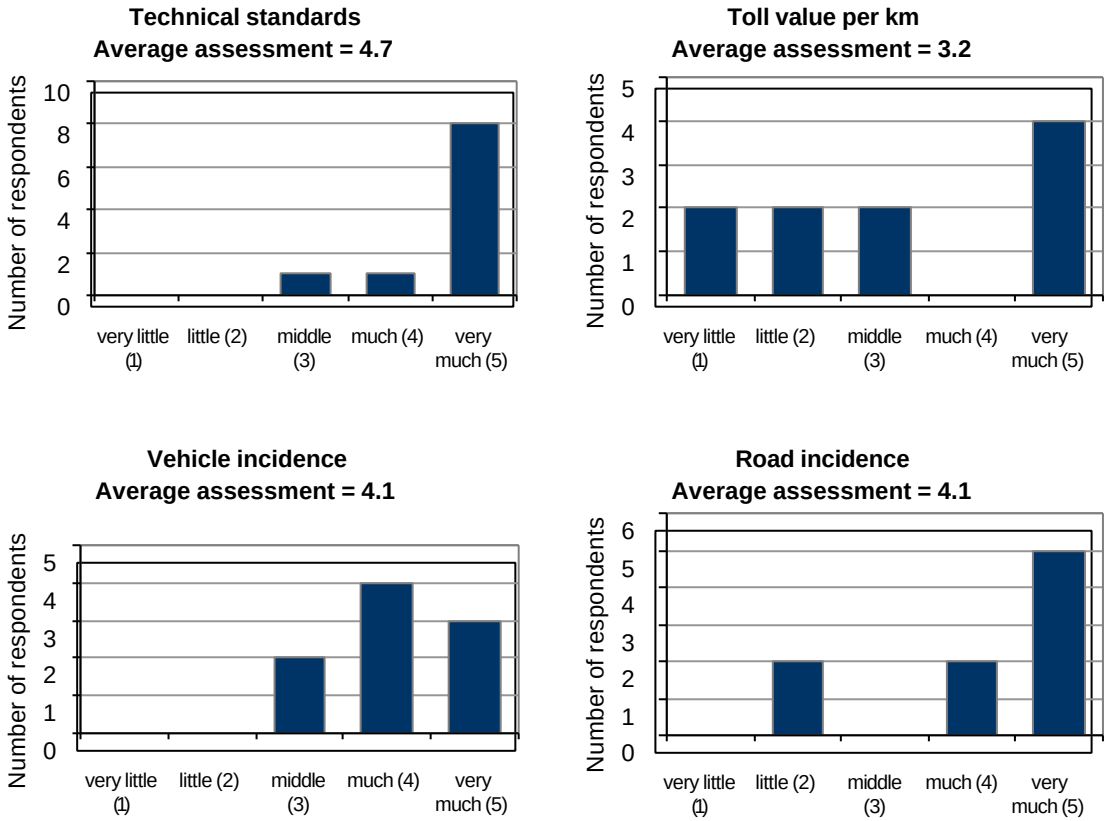
When the LSVA was introduced, the information was well communicated to all people (8 times yes, twice no in question G.1). The experts unanimously agree that a straightforward introduction of a LSVA is preferable to a stepwise procedure (10 votes for the straightforward way, zero for the stepwise procedure in question G.2). Hence, they applaud the introduction of the LSVA which was put into force in a direct way (only the fee level rises stepwise).

A possible strength of a LSVA is its simplicity. Therefore the experts were asked how much time the hauliers needed to prepare themselves for the LSVA (question G.3). Some respon-

dents stated that the introduction was time-consuming: One man-year was necessary for adaptations to the LSVA such that the year 2000 (the year before the introduction of the LSVA) was loaded with additional work. The installation of the OBU (one day per truck) was not relevant compared with administrative, logistic, and IT adaptations and fleet renewal. Nevertheless, one experts believes that overall the system is relatively simple.

In question G.4 the interviewees were asked how strongly they believe that a harmonization of LSVAs within Europe should be an aim (recognizing that it might be difficult to achieve). As figure 6-13 shows it turns out that harmonization is wished for. This holds especially true for technical standards, and in a somewhat smaller, but still high degree for vehicle and road incidence. The harmonization of the toll value per km is less important.

Figure 6-13: Should harmonization within Europe concerning technical standards, toll value per km, and vehicle and road incidence be an aim (question G.4)?



6.8 H: Alternative Approaches

Most experts argue that the LSVA is the best approach to the problems with road freight transport: Only 3 out of 10 believe that another approach would be better. Two experts suggest the introduction of a tunnel or an Alp transit tax (which would possibly be opposed by the

EU). Another expert proposes higher gas and oil taxes (on a European level). Higher gas and oil taxes, however, would be more difficult to implement as another expert claims. Still, the proponents of the LSVA argue that further measures are necessary to achieve a shift from road to rail. Furthermore, railways should offer much more freight capacity. It is also argued that the LSVA-approach is fair and correct and that no other approach is feasible in Switzerland.

6.9 I: Synthesis

In the final question block I the respondents were asked to recapitulate the main points of the interview. Below we summarize their statements.

The introduction of the Swiss LSVA was under extreme time pressure, but a longer period of introduction would not have helped much. Furthermore, the operator (Swiss Customs Authority) did and still does a great job (although one expert was not satisfied with their performance). The effects of the LSVA are manifold: The LSVA gives incentives to renew the lorry fleet and to switch to environmentally friendly lorries – the polluter pays principle was put into practice. Traffic safety has also increased slightly due to the LSVA. Although the fee could be passed on to the customers, the effects on the structure of the Swiss haulage industry are enormous: Only large companies (at least 50 or 200 lorries) with extremely good use of the capacity of their fleet will survive in the long run. Small companies not reaching a high degree of use of their capacity are no longer competitive. Furthermore, the big companies also have the advantage that they have the money needed for the renewal of their fleet.

However, there is no noticeable shift from road to rail in domestic transport although this was intended by the LSVA. There are several possible explanations to this fact. First, one of the main reasons is the simultaneous lift of the national weight limit for lorries from 28t to 34t. The higher weight limit has caused a marked productivity effect for the transport of heavy goods such as gravel, mineral water, potatoes, apples, and oil products. In fact, the road transport costs per kg have fallen for these goods in spite of the LSVA. Second, the quality of railway freight transport and the co-operation between road hauliers and railway companies are too low and must be improved markedly. Finally, the fee level which will rise in future years might not yet be high enough to cause a shift from road to rail. Nevertheless, without the LSVA, the supply of a Rolling Motorway would not make sense. Moreover, the use of the revenues from the LSVA for rail infrastructure is highly politically acceptable.

The aims of the LSVA have not yet been reached. However, it would be unfair to judge the effectiveness of LSVA before the fee has risen to its intended maximal level. There are also some weak points in the system such as manual trailer declaration or some of the special regulations. These shortcomings should be improved. But in general the acceptance of the LSVA in Switzerland and abroad is very good. However, the LSVA is an island solution which – in the opinion of the great majority – should be harmonized with the EU. In fact, the surrounding countries should introduce similar taxes in order to prevent detour traffic.

The technical acceptance of the system is very good and the confidence into this system is rising since the operator does a good job. The software has been improved and is still improving. The OBU functions well and the data registered by the OBU are very useful for hauliers themselves (if they use them for monitoring and controlling purposes). For the operator all procedures at the border could easily be integrated into the existing ones. The staff had to be enlarged only slightly and the LSVA had a positive influence on the motivation of the staff.

References

ARE (2001), Monitoring Flankiernde Massnahmen – Monatsinfo Stasse; Dezember 2001, Bern.

ASTRA (2001a)
Schweizerische Nationalstrassen Info 2001, Bern.

BALMER UELI (2001), Findings of the EU DESIRE project's Case Study on the LSVA Expected and actual effects on traffic and transport, Bern.

BAUMOL W J and OATES W E (1975), The Theory of Environmental Policy; Externalities, Public Outlays, and the Quality of Life, New Jersey, Prentice-Hall.

BFS (2000 b), Bundesamt für Statistik, Schweizerische Verkehrsstatistik 1996/2000, Neuchâtel.

BFS (2001 a), Bundesamt für Statistik, Motorfahrzeuge in der Schweiz, Bestand 30.9.2001, Neuchâtel.

BFS (2001 b), Bundesamt für Statistik, Gütertransport auf der Strasse; Fahrzeugkilometer, Tonnen, Tonnenkilometer: Zeitreihe 1985/93-2000, Daten vor der Einführung der LSVA, Neuchâtel.

CHRISTENSEN P, BEAUMONT H, DUNKERLY C, LINDBERG G, OTTERSTRÖM T, GYNTHER L, ROTHENGATTER W and DOLL C (1998), Internalisation of externalities: Appendix, D7 Pricing European Transport Systems (PETS), Leeds/Brussels.

DETEC (1998), Transportation yesterday, today, tomorrow, Bern: Bureau of Transport Studies of the Department of the Environment, Transport, Energy and Communication (DETEC), GVF-Bericht 1/98.

DETEC (2000), Fair and efficient, the Distance-related Heavy Vehicle Fee (LSVA) in Switzerland, Bern: Bureau of Transport Studies of the Department of the Environment, Transport, Energy and Communication (DETEC), GVF-Bericht 1/2000.

ECOPLAN (1991), Soziale Kosten von Verkehrsunfällen in der Schweiz, Bern: Dienst GVF/EVED, Bundesamt für Bildung und Wissenschaft.

ECOPLAN (1992 a), Der externe Nutzen des Verkehrs, Bern: Dienst GVF EVED/EDMZ.

ECOPLAN (1992 b), Externe Kosten im Agglomerationsverkehr, Fallbeispiel Region Bern, Projekt 15 B im Rahmen des Nationalen Forschungsprogramms 25 "Stadt und Verkehr, Bern/Zürich.

ECOPLAN (1996), Monetarisierung der verkehrsbedingten externen Gesundheitskosten, Synthesebericht, Bern: Dienst GVF EVED/EDMZ.

ECOPLAN (1999 a), Die verkehrlichen Auswirkungen des bilateralen Landverkehrsabkommens zwischen der Schweiz und der Europäischen Union auf den Strassen- und Schienengüterverkehr, GVF-Bericht 2/99, Bern: EDMZ.

ECOPLAN (1999 b), Transalpine Freight Case Study: Appendix, D10 Pricing European Transport Systems (PETS), Leeds/Brussels.

EVED (1978), Gesamtverkehrskonzeption GVK Schweiz, Bern: EDMZ.

GS UVEK / GVF (1999) Grenzquerender Strasengüterverkehr 1998 (GQGV 98), Bern, EDMZ

GVF (Stab für Gesamtverkehrsfragen) (1988), Indikatorensystem: soziale Kosten und Nutzen im Verkehr, GVF-Bericht 1/88, Bern: EDMZ.

HIGH LEVEL GROUP ON TRANSPORT INFRASTRUCTURE CHARGING (1999), Final Report on Estimating Transport Costs and div. sub reports, Brussels.

INFRACONSULT AG (1992), Soziale Kosten des Verkehrslärms in der Schweiz, Dienst GVF EVED, Bern: EDMZ.

INFRAS (1992), Gebäudeschäden durch verkehrsbedingte Luftverschmutzung, Bern: Dienst GVF EVED.

INFRAS (1992), Internalisieren der externen Kosten des Verkehrs, Fallbeispiel der Agglomeration Zürich, Nationales Forschungsprogramm 25 Stadt und Verkehr, Zürich.

INFRAS (1998), Staukosten in der Schweiz, Zürich.

INFRAS AG and IPSO (1994), Zahlungsbereitschaft für die Verhinderung einer globalen Klimaänderung, Sozioökonomische Energieforschung, Bern: EDMZ.

INFRAS and IWW (2000), External Effects of Transport, Project for UIC, Paris/Zürich/Karlsruhe.

JANSSON J O and LINDBERG G (1997), Transport Pricing Principles in Detail: Appendix, D2 Pricing European Transport Systems (PETS), Leeds/Brussels.

JEANRENAUD Claude, Nils SOGUEL, Pascal GROSCLAUDE and Marc-Alain STRITT (1993), Coûts sociaux du trafic urbain, Une évaluation monétaire pour la ville de Neuchâtel, NFP 25, Zürich.

MAIBACH M, SCHREYER C, BANFI S, ITEN R and DE HAAN P (1999), Faire und effiziente Preise im Verkehr, Ansätze für eine verursachergerechte Verkehrspolitik in der Schweiz, Bericht D3 des NFP 41 Verkehr und Umwelt, Bern: EDMZ.

NEUENSCHWANDER R, SUTER S AND WALTER F (1998), The economic effects of including external costs of road freight transport in infrastructure user charges - A case study for the Alps, in: EUROPEAN COMMISSION, DIRECTORATE-GENERAL FOR ECONOMIC AND FINANCIAL AFFAIRS (1998), Getting Environmental Policy Right, Reports and Studies, No 1, Brussels.

SCA - SWISS CUSTOMS AUTHORITY (1999), LSVA - in concrete terms, The Heavy Vehicle Fee / HVF: Background - Fees - Recommendations - Alternatives, Berne.

SEETHALER Rita (1999), Health Costs due to Road Traffic-related Air Pollution, An impact assessment project of Austria, France and Switzerland, Synthesis Report, Commissioned by: World Health Organization, Regional Office for Europe, Bern: EDMZ.

SOMMER Heini, Rita SEETHALER, Olivier CHANEL, Max HERRY, Serge MASSON, Jean-Christoph VERGNAUD (1999), Health Costs due to Road Traffic-related Air Pollution, An impact assessment project of Austria, France and Switzerland, Economic Evaluation, Technical Report on Economy, Commissioned by: World Health Organization, Regional Office for Europe, Bern: EDMZ.

SUTER Stefan and Felix WALTER (forcoming), A Policy Note on the Swiss Case of Heavy Vehicle Taxation, to be published in Journal of Transport Economics and Policy.

Internet-Sites

ASTRA, Internet a: http://www.astra.admin.ch

ASTRA, Internet b: http://www.verkehrsdaten.ch

ASTRA, Internet c: http://www.verkehr-schweiz.ch resp. http://www.swiss-traffic.ch

BAV; Internet a: http://www.bav.admin.ch/e/fs/fs_e.cfm

BAV; Internet b: http://www.bav.admin.ch, Glossar

EZV, Internet: http://www.zoll.admin.ch/d/steuern/lsva/lsva_d.htm)

LITRA, Internet: http://www.litra.ch

IRU, Internet: http://www.iru.org

TAMOLI, Internet: http://www.tamoil.ch