

# **THE SWISS DISTANCE RELATED HEAVY VEHICLE FEE (LSVA) – A NOVEL APPROACH TO AREA-WIDE ROAD CHARGING**

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## **ABSTRACT**

Since the beginning of 2001 an electronic fee collection system (EFC) for kilometre charging for heavy vehicles in Switzerland is in operation. The fee (called LSVA) is levied on vehicles exceeding 3.5 tonnes of authorised weight and is proportional to the distance driven on all roads. The fee additionally depends on the maximum laden weight and on the emission values of the vehicle. LSVA is collected with the help of sophisticated on-board units that make use of a variety of technologies including DSRC and GPS. The vehicle tachograph is employed as the basic technology for distance registration. The LSVA has three goals: (1) the external costs of freight transport are being internalised; (2) it will help to finance the project of the new transalpine railroad tunnels; (3) it is an important instrument for encouraging the transfer of goods from road to rail. The paper tells how the EFC system functions and to what an extent the goals of the LSVA system have been met.

## **KEY WORDS**

ROAD PRICING / ELECTRONIC FEE COLLECTION / HEAVY GOODS VEHICLES /  
TRANSPORT POLICY

## **1. THE TRAFFIC SITUATION IN SWITZERLAND AND THE GOALS OF THE LSVA**

Two trends are shaping goods transport in Europe: the total quantity is rapidly growing, and an ever-increasing fraction of it is being transported by road.

Between 1970 and 1997 the transport performance of heavy goods traffic in the 15 EU countries tripled, from 412 billion to 1200 billion tkm. At the same time, the road share of the total freight transported increased from 48 to 73 per cent. For various reasons the railways became increasingly less able to compete. In the EU countries they had to accept a decrease in transport performance of about 15 per cent, to 240 billion tkm between 1970 and 1997. Their share of the total goods transported in the EU shrunk accordingly. Today, it is only about 14 per cent.

All forecasts indicate that goods transport in the EU and Switzerland will increase further by several per cent annually. This growth of road traffic is contrary to public opinion in Switzerland. In several public referendums the Swiss voters expressed the will to transfer goods traffic from road to rail. In autumn 1998 the population approved by a large majority both the Swiss distance-related Heavy Vehicles Fee, called LSVA (Leistungsabhaengige Schwerverkehrsabgabe) and the use of 2/3 of its income for financing major railway projects including two new railway tunnels across the Alps. This use of the income was one reason for the acceptance of the LSVA. It was considered to be in line with the general objective of transferring an increasing part of heavy goods transport from road to

rail. The special efforts in favour of the rail are absolutely essential, because Switzerland had to concede higher weight-limits for heavy goods vehicles in parallel to the introduction of the LSVA. ( from 28 to 34 tons in 2001 and to 40 tons in 2005). The lift of the weight limit has been a concession of Switzerland during the negotiations of the bilateral agreements with the EU. Another objective of the LSVA is the introduction of the principle of internalising external costs of transport.

Figure 1 shows the development of the performance in Swiss goods transport by road with and without the new measures (LSVA and weight limit 34/40 tons)

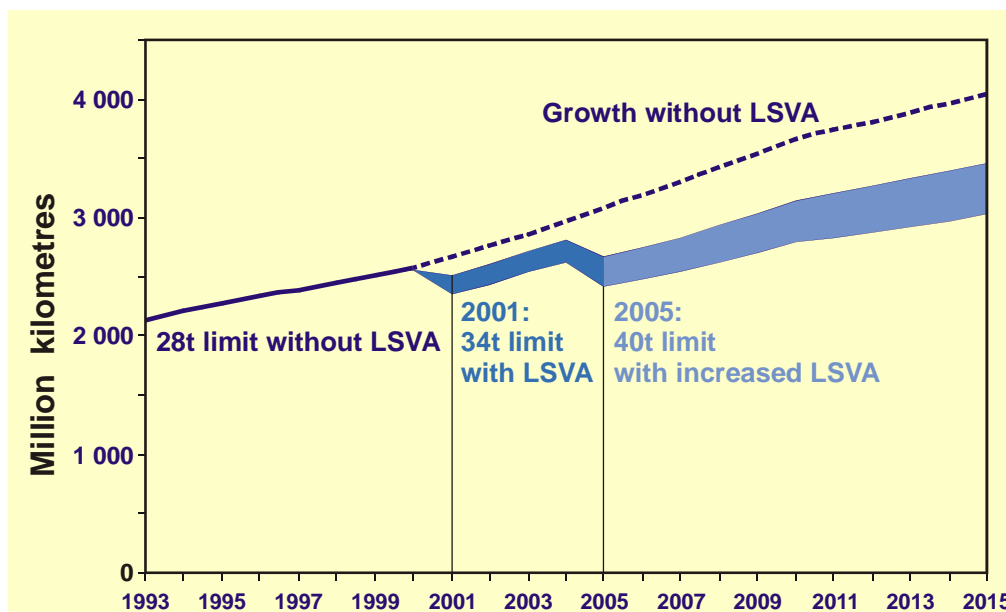


Figure 1 – Evolution of HGV Traffic in Switzerland with and without LSVA and lift of weight limit

## 2. THE PARAMETERS OF THE HEAVY VEHICLE FEE (LSVA)

The LSVA applies to vehicles for freight transport with a total weight of more than 3.5 tonnes. The fee is calculated according to three criteria:

- The kilometres travelled on Swiss roads;
- The highest authorised total weight;
- The pollutants emitted by the vehicle.

To determine the fee, the distance travelled in Switzerland (in kilometres) is multiplied by the weight of the vehicle (in tonnes). The tonne-kilometres calculated are then multiplied by the rate of the fee. Here it is not the weight during the operation that is important, but the highest authorised weight according to the vehicle license. The use of the continually changing operating weight would have been impracticable. This solution also provides for an additional incentive to use the vehicle to the fullest capacity and to avoid empty trips if possible.

The rates of the fee depend on the emission category of the vehicle. The following rates apply for the years 2001-2004:

- Fee category 1 (corresponding to Euro 0): 2.0 centimes per tonne-kilometre (approx. 2.5 US cent per tkm)

- Fee category 2 (corresponding to Euro I): 1.68 centimes per tonne-kilometre
- Fee category 3 (corresponding to Euro II and III): 1.42 centimes per tonne-kilometre.

For the year 2005 when the weight limit will be lifted to 40 tons the Swiss Federal Council will set new rates, taking technical developments into account. To belong to the cheapest emission category, a vehicle will then have to demonstrate considerably lower pollutant values than today (e.g. Euro IV).

### 3. THE ELECTRONIC FEE COLLECTION SYSTEM OF THE SWISS LSVA

#### 3.1 The LSVA Collection procedures

The LSVA is levied by the Swiss Federal Customs Authority (FCA). In the recording procedure, although not in the calculation of the fee, domestic and foreign vehicles are treated differently (Figure 2).

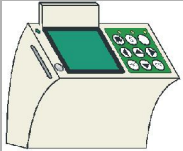



Domestic vehicles	Foreign vehicles
<p><b>Mandatory equipped with:</b></p>  <p><b>On Board Unit</b></p>	<p><b>Voluntarily equipped with:</b></p>  <p><b>On Board Unit</b></p>
<p><b>In approved exceptional cases:</b></p>  <p><b>Log-Book &amp; TAG</b></p>	<p><b>In principle using:</b></p>  <p><b>ID-Card &amp; Self-service Machine</b></p>

Figure 2 – LSVA procedures for domestic and foreign vehicles

#### 3.2 The LSVA On-Board Unit

The levying of the fee is only possible through the use of a well-functioning on-board unit OBU (Figure 3). The following functions are provided for:

- automatic recording of the kilometres travelled (using tachograph signals, Figure 4)
- automatic activation and deactivation at the national border through DSRC (Dedicated Short Range Communication)
- monitoring tachograph functioning using GPS and a movement sensor
- monitoring border crossing using GPS
- trailer recognition using a sensor.



Figure 3 - LSVA On-Board Unit (OBU) front and rear side

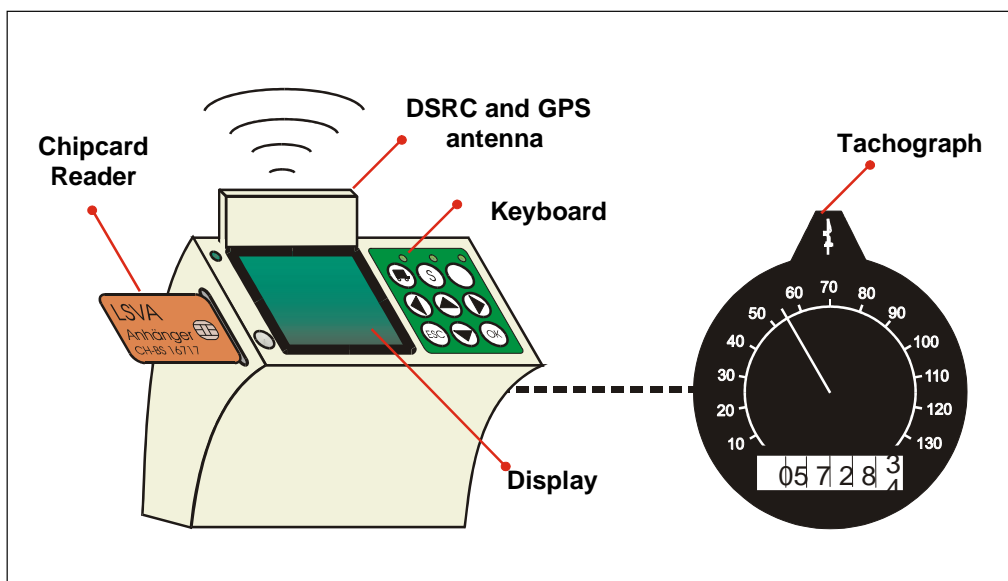


Figure 4 – LSVA On-Board Unit and Tachograph

### 3.3 Domestic vehicles

The vehicles are fitted with a mandatory On-Board Unit (OBU). The OBU is coupled to the tachograph and records the kilometres travelled. If the vehicle travels over the border, a DSRC beacon fitted above the road deactivates the registration (Figure 5). On returning into Swiss territory, the beacon reactivates the recording. The parameters for charging are either stored directly in to the OBU during the initialisation process (highest authorised weight and emission category of the vehicle), or can be entered by the driver (trailer weight upon coupling or uncoupling of a trailer). The OBU records all the data to determine the fee tariff.

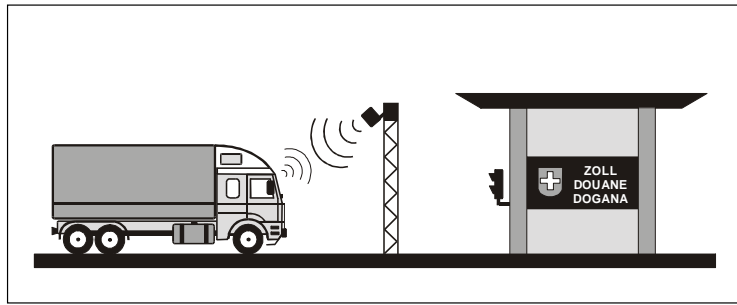


Figure 5 – DSRC Communication at Swiss border

The vehicle owner who is subject to the fee registers the data each month on a chipcard. He or she then forwards the data to Customs, either sending the chipcard itself (by post) or electronically (via Internet). The Customs authorities check the plausibility of the data, calculate the fee and send the monthly invoice to the vehicle owner.

### 3.4 Foreign vehicles

The fitting of On-Board Units cannot be prescribed to foreign lorries. A vehicle owner may however fit it voluntarily. The OBUs are distributed free of charge to Swiss and foreign users alike until 2004. Foreign vehicles that are equipped with an OBU transmit the LSVA data to the central information system via the DSRC link whenever they cross the border. The vehicle owner must have an account with Swiss Customs.

The majority of foreign vehicles are not equipped with an OBU. For those, an identification chipcard (ID-card) is issued on the first entry into Switzerland. The fee parameters (highest authorised weight and emission category of the vehicle) are stored onto the ID-card and transmitted to the central information system. The driver then inserts the ID-card into the self-service machine on each entry into Switzerland and he declares the current kilometre reading of his tachograph (Figure 6). The self service machine issues a declaration slip whereon the driver writes the kilometre reading on exiting Switzerland. The kilometre declarations are randomly checked by Customs. The fee must be paid at the latest on leaving Switzerland, either in cash or using a petrol or credit card.



Figure 6 – Self-service machine and ID-card for users non equipped with OBU

### 3.5 The LSVA collection system in figures

On board units for domestic vehicles	53,000
On board units for foreign vehicles	1,700
ID cards for foreign vehicles	300,000
Transactions for foreign vehicles at border per year	1,800,000
Border stations with DSRC beacons	82
Single-lane beacons	101
Multi-lane beacons	101
Self-service machines	165
Enforcement stations (completed 2003)	21
Costs of on board units	90 M CHF
Cost of road side equipment and background system	150 M CHF
Total investment of Swiss Government	240 M CHF
Operating cost per year	24 M CHF
Total LSVA staff at Swiss Customs	120
Net LSVA income per year (2002)	773 M CHF
Collection costs in per cent of income	5-7 %

Table 1 – Figures of the LSVA collection system as at end of 2002  
(1 CHF = approx. 0.77 USD)

## 4. THE EFFECTS OF THE SWISS LSVA

The introduction of the LSVA did not give rise to any serious problems either in Switzerland or in the other countries. The new regime led to material changes especially in the road haulage sector.

### 4.1 Renovation of the lorry fleet

The fact that the amount of the fee depends on the weight and emissions of the individual lorry already resulted in a significant move towards renovation of the lorry fleet in the year before the LSVA was introduced. In total the sales of heavy goods vehicles increased by 45 per cent. As expected, there was a very strong increase in sales of lorries of over 26 tons authorised weight due to the effect of the higher national weight limit.

A shift to vehicles not subject to the LSVA (i.e. vehicles with a total weight below 3.5 tons) has evidently not occurred, as some people feared. At any rate, the traffic figures for the 3-3.5t category of vehicles, which would be the most suitable, has not increased any more than in the previous years.

### 4.2 Structural change in the transport industry

Indications are given by interviews held during a case study under the EU research project DESIRE. They cover observations collected when the fee was being introduced. The study revealed that the most important consequence was the concentration of the transport industry, either through mergers or through the closure of small companies. Larger fleet operators are able to manage their lorries more efficiently and in particular avoid empty



runs more easily. According to estimates, the lower limit for an effective transport logistics system is 50 lorries per company.

#### 4.3 Lower growth rate for HGV traffic

As representative results from automatic traffic counts show, the new traffic regime led to a definite break in the trend: annual increases of about 7 percent in road performance in previous years were followed by a drop of approximately 5 per cent in 2001 (Figure 7). A comparison of the half-year before and after the introduction shows a decrease in the first six months after the introduction, when the economic growth was still about the same as in the previous year. Although the slowing of the economy in the second half of the year strengthened the downward trend, it played a less important role than the impact of the new regime. The number of HGV has again diminished in 2002 (by about 2%). This drop has probably been caused by the receding economic situation.

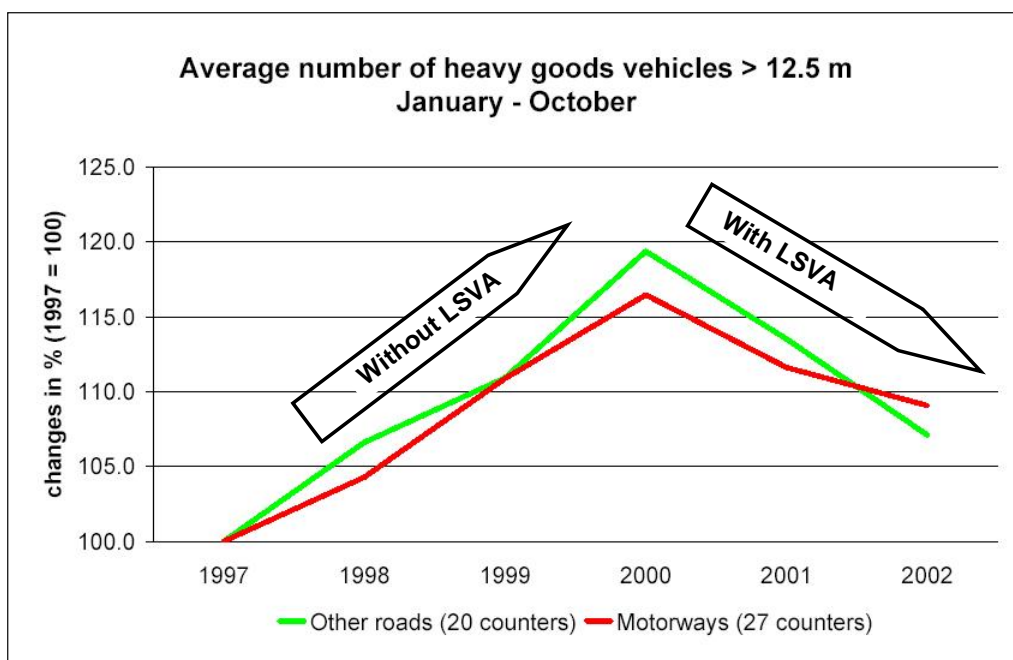


Figure 7 – Yearly growth rates before and after introduction of LSVA

#### 4.4 The effects on transalpine traffic

In transalpine traffic, the higher weight limit has a particularly strong effect because of the extremely high proportion of heavy goods vehicles and the long transport routes. The main function of the LSVA in the initial phase was therefore to offset the advantages of the higher weight limits in road transport. This seems to have been largely achieved. The amount of former detour traffic (caused by the lower Swiss weight limit of 28 tons) that has returned is significantly less than predicted.

#### 4.5 The effects on the railways

No significant influence could be measured so far on the performance of rail transport. The following facts need to be considered:

- The share of rail in goods transport in Switzerland is already one of the highest in the world. Nationwide, rail transport account for about one third of total goods transport; in

transit traffic across the Alps it amounts to even two thirds (measured in tkm). On such a high level it is difficult to get a higher share.

- The advantage for rail due to the introduction of the LSVA has been outbalanced by the higher weight limit. A considerable shift to rail is not expected before 2005 as a result of the higher LSVA rate and, in particular, the phasing-out of the transitional period with exceptions .
- Pricing measures can deploy their effects only if other conditions for the shift like reliability, overall transport time and simple procedures (which are often an obstacle in international rail transport) are met. To reach a higher market share, railways have to improve their productivity as well. With the construction of new railway infrastructure and the railway reform program, the necessary framework is established.

#### 4.6 Negligible effects on prices

As expected, the introduction of the LSVA did not lead to a general increase in prices. The national index for the cost of living rose by 0.1 per cent at most as a result of the LSVA.

### 5. CONCLUSIONS

The Swiss Heavy Goods Vehicle Fee LSVA is a success. There were practically no problems in introducing the fee and the EFC system has been running smoothly from the start. More important, the trend towards an ever-increasing number of lorries on the roads has been broken and a sustainable method for financing the important investments into railroads has been developed.

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