LSVA
the Swiss Heavy Vehicle Fee System (HVF)

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1. The basic concepts of Swiss HVF
Policy Issues

- The HVF (Heavy Vehicle Fee) is a key element on the Swiss road map to a sustainable transport policy.
- A large proportion of the tax shall be used to modernise the railway network and make it more attractive for heavy goods transport (building the NEAT). A smaller proportion of the tax shall be used for the road network maintenance.
- The trend towards an ever-increasing number of lorries on the roads shall be broken.
- The HVF means that pollution and damage caused by heavy vehicle will increasingly be paid for by the polluters.

⇒ Fee shall be based on driven km and authorised weight
System Concept

- All driven km within Switzerland have to be taken from the legally well regulated vehicles tachograph.
- One piece OBU mandatory for all domestic lorries.
- Simple and comfortable manual system for non-equipped users (foreign lorries).
- High level of system and OBU redundancy.
- Use of DSRC for border crossing and enforcement.
- DSRC tag solution for exempt vehicles.
- Data transfer between back office and OBU via smart card with full end to end security (no GSM in use).
- Manual enforcement based on visible light bars.
- Additional enforcement based on DSRC and LPR.
Fee Concept

- **distance dependant fee on all Swiss roads** (not only motorways).
- **tariff level based on emission class.**
- **fee depends on highest authorised weight** - including trailer if attached (not on number of axles).
- **vehicle from 3.5 tons up.**
Realisation

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1994</td>
<td>General law (Swiss constitution) and prototype tender.</td>
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<tr>
<td>1995</td>
<td>Selection of 5 companies to develop and demonstrate system solutions (OBU’s, roadside, data handling).</td>
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<tr>
<td>1997</td>
<td>LSVA legislation. Selection of three companies for real system tests. OZD (Operator) starts back office project.</td>
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<tr>
<td>1999</td>
<td>FELA chosen as best supplier. OBU production, tests and approvals. Large scale field trial. Implementation of full security. Development of the workshop equipment.</td>
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<td>2001</td>
<td>1st January, start of LSVA system without problems.</td>
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<tr>
<td>2002</td>
<td>Implementing additional system features (private data access, internet declaration, new OBU features).</td>
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System Overview

1) TRIPON®
2) DSRC
3) GPS
4) Data
5) Taxation Office
European Issues

- Foreign vehicles will be treated the same way as domestic ones. Thus the fee follows the principle of non-discrimination.
- Foreign truck holders can also get an OBU for free.
- Swiss OBU is fully interoperable with the Austrian System.
- Efforts to reach interoperability in different EFC systems are heavily supported.
- EU has expressly recognised the main goal of Swiss transport policy. The Swiss policy is in line with the EU “White Book 2001.”
- EU Research project activities: ENTERPRICE, INITIATIVE, RCI (ERTICO), CARDME.
Results in Switzerland

- The whole system is running smoothly and is fully accepted.
- Expected revenue of € 500 Mio per year fully reached.
- Low operating cost around 5% per year (150 people).
- Structural changes in the transport industry and renovation of the lorry fleets have been triggered.
- Developments in the railways made possible (Alp transit).
- The trend towards an ever-increasing number of lorries on the roads is broken. www.are.admin.ch/are/en/verkehr/alpinfo
- Very low price rising of daily goods has been seen (more efficient transports).
FELA’s Contribution

- Active participation in whole system design.
- Design and realisation of system security concept.
- Delivering system CA and smart cards.
- OBU concept and development of HW and SW.
- Manufacturing 80'000 pcs of TRIPON® OBU’s, administer the OBU pool, running the hotline, recycling and repair.
- Development and manufacturing of TAG’s (exemptions)
- Development of the workshop equipment (HW / SW).
- Training the workshop’s people and running the hotline.
- Development of the mobile enforcement system.
- Support for background system design.
The Company

The FELA Group was founded in 1967 and consists of 3 business units today:

- Traffic Telematics (45 people)
- Engineering & General Contracting
- Printed Circuit Board Manufacturing

Headquarter of FELA Management AG
2. \textit{TRIPON}® the OBU
TRIPON® Basic Concept

- All in one concept (single housing).
- Easy installation in less than 2 hours.
- Most reliable and trustworthy distance recording.
- Redundant recording of fee relevant data.
- Full transparency of data recording.
- Full privacy of the recorded data.
- Absolute secure data transfer.
- Simple to handle.

⇒ High user acceptance is most important!
TRIPON® CH-OBU1

- Graphic Display 64x128 Pixel.
- Keypad, with total of 10 keys.
- Chip card interface.
- Infrared link, for service and private use.
- Enforcement Display to the outside.
- Tamper switch and enforcement display.
- Built in trailer sensor system.
- Built in DSRC link (CEN TC278).
- Built in GPS (12 Channels).
- Built in sensor system for battery operation (degraded modes).
TRIPON® new features
2003

- Free data access trough IR port.
- Free use of NMEA output.
- Data view and internet declaration
  PC-SW for private data handling,
  data export and fleet management.
- GSM declaration add on.
Data Transfer Extensions

6) Declaration Card
7) GSM or on board PC
8) Private Office PC
9) Internet
TRIPON® EU-OBU

- 2002-2003: Start of Development of an interoperable GNSS/CN OBU named TRIPON® EU for Switzerland, Germany, Austria and UK.

- Additional Features include:
  - Full CAN interface
  - Gyro for dead reckoning
  - GSM/GPRS link
  - IR-DSRC communication link
  - Embedded Linux for multi tolling applications
3.

FELA’s enhanced HVF concept
Why enhance HVF?

There are many reasons why to introduce a HVF. Motorway tolling is the classical means for financing B.O.T. projects, but

- not for modernisation of haulage taxing
- not to gain environmental effects
- not to achieve a sustainable transport policy
- not to reduce traffic problems

Trip dependant "booking" of motorways is not feasible. "Booking" of any other roads is simply not possible.

⇒ concept of "HVF plus"
Key Points “HVF plus”

- The Swiss HVF has proven to be very powerful and effective.

⇒ Keep the basic principle of km/weight charging within an area!

- Add a feature for special rates for first class motorways, bridges, tunnels or city areas.

- Technically spoken: This can be done by GNSS/CN (within limits) or more simply through proven DSRC technology.

- This will result in highly automatic (cost efficient) operations for main and occasional user schemes.
Main Scheme

Vehicle subject to toll

GPS

Data transfer, wireless or via privat PC (chipcard)

TRIPON counts km and recognises motorway

Server

Trip data

Operator’s office

- Registration
- CRM
- Accounting

Position

Trip data

Trip data

Contract data

Bill and payment

Vehicle owner

Work shop
- installation
- initialisation
- maintenance

Contract and OBU

DSRC broadcast beacons (roadside)
Occasional User Scheme

- pay at exit of country
- cash or cards
- pass back tag (optional)

Vehicle subject to toll

- get vehicle data
- distributes tag

DSRC tag collects beacon information

- contract data
- payment records

Operator's office

- Registration
- CRM
- Accounting

Server

registration office

- contract and OBU

DSRC broadcast beacons (roadside)

DSRC tag collects beacon information

- entry data
- check-in at POS

Vehicle subject to toll

- check-out
- pay at exit of country
- cash or cards
- pass back tag (optional)

trip data

check-in at POS

- insert tag
- type in odometer count

Motorway information

Server

- contract and OBU

Operator's office

- Registration
- CRM
- Accounting

Server

Vehicle subject to toll

- check-out
- pay at exit of country
- cash or cards
- pass back tag (optional)

trip data

Vehicle subject to toll

- check-in at POS
- insert tag
- type in odometer count

Motorway information

Server
4. Final conclusions
Summary

- The enhanced HVF’s concept is based on the original Swiss HVF.
- It consists of a Main Scheme (MS) and an Occasional User Scheme (OUS).
- The MS uses an OBU with Tacho, DSRC, GNSS/CN.
- The OUS is very easy to use and leads to absolute no discrimination.
- It allows interoperability with Austria, Switzerland, Spain, UK, Germany and more to come.
- Interoperable for DSRC based tunnel/bridge tolls.
- MS and OUS are proven to be fraud resistant.
Conclusions

- The original Swiss HVF scheme is the ideal solution for a sustainable transport policy.
- The option for special motorway tariffs adds more flexibility (e.g. for local B.O.T. roads).
- The occasional user scheme is feasible and recognised to be non-discriminatory by the EU.
- The system is user friendly for lorry drivers.
- Prove of concept since 2001 in Switzerland.
- Technology and equipment are available and proven.
- Operation cost is low.
The future in Europe!

FELA is working towards road pricing system solutions that will not go to look like this!

With multifunctional OBU’s, based on proven technologies and proven system architectures, interoperability (on a technical level) is absolutely possible.
thank you for your attention

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