Norbert Schindler, Vladimir Slezak

Siemens Electronic Tolling

Finding an Optimal Tolling Approach in Slovakia

e-Toll Slovakia, 13. september 2006
Nationwide Tolling Schemes in Europe

City Tolling Schemes ("Congestion Charging")

Relevant Directives in the European Union

Overview of Tolling Technology Trends

Siemens and its Leadership in Electronic Tolling

Suitable Tolling Approaches in Slovakia
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Suitable Tolling Approaches in Slovakia
Distance-Based Tolling
( LSVA = “Leistungsabhängige Schwerverkehrsabgabe” )
► Law for “LSVA” passed in 1998 for tolling on all roads
► System start: January 1st, 2001
► For Trucks > 3.5 tons; ~ 60,000 OBUs
► avg. price / km: 65 Eurocents or 1.6 cents / ton / km

Commercial Issues
► Contract award (1999): Fela/Ascom; CAPEX ~ € 200 million
► Operation costs ~ 5% (€ 35 million / year)
► ~ 750 MEUR revenues generated per year
► LSVA makes for 20% of the overall transport costs

Satellite and Microwave Technologies Used
► Distance measured by odometer (tachograph) connection
► GPS verifies the distances, recorded on a “smart-card”
► Microwave used for enforcement and at the borders

Siemens won contract for supply of new OBU generation
Open Road Tolling on Motorways and Highways
- System start: on January 1st, 2005 (16 months delayed)
- For Trucks > 12 tons; 1.3 Million users (520,000 OBUs)
- avg. price / km: 12.4 Eurocents or 0.3 cents / ton / km
- ~ 12,000 km Motorway Network; ~ 5,000 Toll Segments
- > 80% of all trucks use OBU; 3,500 roadside terminals

Commercial Issues
- Contract award (2002): TollCollect; CAPEX “way over €1b”
- Operation costs ~20% (€ 600 million / year)
- almost € 3 Billion revenues generated per year
- Penalty for delays still open, government wants € 4.5 billion

GPS / GSM Technology
- Satellite technology has proven to be very reliable
- System (i.e. road network) is easily expandable
- Delays due to underestimated system integration efforts
- Dual system (manual booking) is very complex & expensive

Siemens supplies over 300,000 OBUs to TollCollect
ASFiNAG Streckennetz

Open Road Tolling on Motorways and Highways
- System start on January 1st, 2004
- For Trucks & Buses > 3.5 tons (~ 500,000 active OBUs)
- avg. price/km: 22 Eurocents or 0.6 cents / ton / km
- ~ 2,000 km Tolled Network; ~ 800 Toll Segments
- ~ 45% of tolling revenue generated by foreigner users

Commercial Issues
- Contract award (2002): Autostrade; valued at € 747 million
- Operation costs ~15%
- ~ € 770 million revenues generated per year
- ASFiNAG purchased “Europass” for € 208 million in 2005

Microwave Technology
- Local Austrian supplier purchased companies in Germany and Sweden with the technology, making some adaptations
- Major effort in building 800 gantries (building permits needed for digging data and power lines to all the gantries)
- Project started on time, 18 months after contract award
Preparation of “Taxes” for all Trucks on all Roads

Lorry Road User Charging ("LRUC")
- Distance-Based Tolling for Trucks > 3.5 tons
- Road usage fees based on truck category, type of road, and time of day (i.e., higher fees during rush hour)
- Not a tolling scheme, but a tax-refund scheme forcing foreign trucks to pay (since they didn't pay U.K. fuel taxes)
- Was planned for introduction 2007-2008, then cancelled since the combination with fuel taxation was too costly, also becoming obsolete through the new EU directive
- Only satellite-based solutions were short-listed

Tender Process
- 3 Tenders for Charging Data, Enforcement, Central System
- For each Lot, 3 applicants selected for “Final Invitation to Negotiate”: Siemens, IBM, Capita, Serco, TraCS, BT*
- Anticipated revenues about € 5 billion per year
- Anticipated costs € 3 - 4 Billion (with 10 years operation)

* British Telecom pulled out, upon which T-Systems and Autostrade were invited to take their place

Tolling on all roads for all vehicles now being evaluated!
Technology Preference (Microwave) Reflected in Tender

- Tender for Trucks > 3.5t, but legislation passed for > 12t
- ~ 2,000 km Road Network, ~ 850 Toll Segments
- 2-Phase approach, allowing time to build microwave gantries
- Only 4 offers made, none evaluated, 3 formally disqualified
- Second most expensive offer selected (€ 757 million)
- Highly intransparent tender, still being debated at the courts
- Construction work not yet started, launch date fully open
“Anders Betalen voor Mobiliteit” (Paying Differently for Mobility, based on existing € 7 billion tax revenues)

- In 2005, legislation passed for evaluating the introduction of road-usage fees for all vehicles on all roads in Holland
- Market evaluation by National Platform, recommends “proven technology”, only satellite-based solutions selected
- 51 Companies pre-qualified for “market consultations,” from which 11 were selected for “cost monitor” evaluation
- In 2006, four Companies were chosen to evaluate overall costs of system development, supply, & organization

Siemens confirms meeting goal of 2.2 Billion EUR for supply as well as annual operation costs of 5%
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Suitable Tolling Approaches in Slovakia
Highly Innovative (and Controversial) City Charge

► Introduced on February 17th, 2003
► Daily fee set at £5, raised to £8 on July 4th, 2005
► Payment online, per phone, SMS, or at special outlets
► Fines start at £50, after 2 weeks £100, after 1 month £150
► Special discounts for those living within the zone

Results
► Traffic delays reduced by 30%
► Reduction of traffic by 15% (60,000 less vehicles)
► Average speed in zone increased from 13 km/h to 18 km/h
► 50-60% of car drivers moved to public transportation

Commercial Issues
► annual operating costs £64 million
► £160 million revenues (£138 million for charges, £22 million for penalties)
   which are re-invested into the transportation system
► Transport for London: “congestion charging was contributing the equivalent of £50 million of net transport benefits to London’s economy per year”
2006 Stockholm City Center Congestion Charge

Siemens Electronic Tolling: A Clever Move!

2006 Stockholm City Center Congestion Charge

Trial Operation

- Trial period was from January 3rd to July 31, 2006
- 450,000 vehicles equipped with microwave tags
- Charge from 6:30 - 18:30 on Weekdays
- Fee of € 1.1, 1.6, 2.2, depending on time zone
- 25km² area, with 18 bi-directional payment portals

Results

- Reduction of traffic by 20-25%
- Queue times down 30-50%
- 14% decreased emissions
- Generally well-accepted by the public

Commercial Issues

- In 2003, Congestion charge trial proposed by city council
- Contract award (July 2004): IBM; CAPEX ~ € 400 million
- ~ € 150 million revenues expected per year

Referendum to be held on September 17th, 2006!
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Suitable Tolling Approaches in Slovakia
High Diversity in Europe Makes Interoperability a Major Issue in the Future!

- Microwave-based systems are not compatible.
- Austrian and German OBUs don’t work abroad.

The EU Directive 2004-52/EC*
Recommendation for Satellite-Based Tolling

(6) The electronic toll systems **should be interoperable** and based on open and public standards, available on a non-discriminatory basis to all system suppliers.

(8) In particular, owing to their great flexibility and versatility, application of the **new satellite positioning (GNSS)** and **mobile communications (GSM/GPRS)** technologies to electronic toll systems **may serve to meet the requirements** of the new road-charging policies planned at Community and Member State level.

**Article 2**
Technological Solutions
3. It is **recommended that new electronic toll systems** brought into service after the adoption of this Directive use the **satellite positioning and mobile communications technologies**
Tolling on all Roads –
Now Fully Supported by European Legislation

DIRECTIVE 2006/38/EC OF THE EUROPEAN PARLIAMENT AND
OF THE COUNCIL of 17 May 2006
amending Directive 1999/62/EC on the charging of heavy goods
vehicles for the use of certain infrastructures

(6) International road transport operations are concentrated on the
trans-European road transport network. Furthermore, the proper
functioning of the internal market is vital to commercial transport.
Consequently, the Community framework should apply to
commercial transport on the trans-European road network as
defined in Decision No 1692/96/EC of the European Parliament and
of the Council of 23 July 1996 on Community guidelines for the
development of the trans-European transport network (6). Member
States should, in accordance with the principle of subsidiarity,
be free to apply tolls and/or user charges on roads other than
those on the trans-European road network, in compliance with
the Treaty. … The same requirements should apply to cases where
a Member State maintains or introduces tolls and/or user charges on
roads not forming part of the trans-European road network, for
example on parallel roads, with a view to managing traffic flows.

Hungary just announced its intention to introduce road
user charging for trucks > 7.5 tons on its entire transit
route network, already starting in January 2007!
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Suitable Tolling Approaches in Slovakia
Major Components for a Complete Tolling System
Satellite-Based Tolling Is About to Take Off!

- Satellite-Based Telematic Applications
- We are here
- Satellite-Based Tolling
- Electronic Tolling (Microwave & IR)
- Manual Tolling (Toll Booths)

Satellite-Based Tolling: A Clever Move!

Customer Base vs. Time:

- 1960
- 1980
- 1990
- 2000
- 2010

Galileo will be introduced
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Siemens is More Than Just a Technology Leader

World Leader in Technology Solutions and Services
- Turnover > 75 Billion Euro in 2005
- Investment > 5 Billion Euro annually on R&D
- Over 30,000 Software Engineers

Trusted Partner in the Public Sector
- Knowledge and experience to prove complete solution
- The ability to ensure the delivery of complex projects
- Delivery of complex service contracts around the world

Siemens is a Leader in Slovakia
- Sales of 236 Million EUR (8,8 BSKK), > 8000 Employed
- Technology supply to Orange, T-Mobile, Slovak Telecom
- Complex Automation and Control Projects (e.g. US Steel)

Innovation and Leadership in Tolling Solutions
- Experience in Tolling > 10 Years, Around the World
- Market leader of Satellite-Based On Board Units (OBU)
- Hybrid-OBU which detects both µW and Satellite toll links
The "Puget Sound" Project in Seattle, USA
Satellite-Based Toll System Proven in an Urban Environment

- **8,000** road segments (> 30% than the toll system in Germany)
- **Intelligent road pricing**, with a flexible tariff structure
- **Web-portal available** for customer and participants
- Distance-based and section-based calculation of miles travelled
- Identification of toll routes via GPS only, **no additional roadside infrastructure needed**, yielding an **accuracy > 98%**
- Software updates, changes to road segments and tariffs can be done **remotely**
Hybrid System Developed and Tested in Australia

Features Demonstrated:

- **Complete hybrid solution**, supporting satellite-based and microwave-based toll calculation
- Integration into existing (microwave) environment
- **Fully flexible tariffs**, based on time of day, class of road, and vehicle category
- **Distance-based tracking** is also implemented
- **99,74% recognition rate** (without infrastructure)
- Tolled road network can be modified overnight
- **Internet interface** allows users to view routes travelled all details about cost of road usage
Siemens Technology Received the Highest Marks
After Extensive Trials in the United Kingdom

Lorry Road User Charging – Proof of Solution
► Siemens was one of only three companies selected for system performance demonstrations for Charging Data Services and Central Services, the 2 Lots Siemens made an offer, in 2005
► Over 30 formal tests conducted over several months
► Customer states: “Siemens scored 100% on the test metrics”
► Motorway section recognition rate: 99.57%
► Non-motorway section recognition rate: 99.35%
► GPS-based distance calculation shown to be significantly better than odometer (< 1% as opposed to 4% accuracy)

Transport for London – Trials for Distance-Based Charging
► Siemens was among 14 technology suppliers invited in 2006 for intensive performance evaluations in the City Center of London
► 4,000 sections defined, some as short as 5 meters
► Siemens implemented innovative algorithms based on graph theory to calculate sections to achieve an accuracy of 99.8%
► In spite of “urban canyons” (blind spots in GPS reception), all sections recognized
Congestion Charging in London – Western Extension Implemented by Siemens

Contract Award October 2005, Launch in February 2007

- 870 high-accuracy license plate recognition cameras
- Innovative system architecture to reduce data traffic
- No new fiber-optic cable infrastructure necessary
- Integration into the existing back-office system

Ken Livingston, Major of London
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A Slovak Approach to Nationwide Electronic Tolling

Siemens Electronic Tolling

A Clever Move!

Transparent & technology-independent tender process

Reduce risks & increase efficiency by fast & stepwise introduction of tolls, starting with the heaviest vehicles causing largest costs (including foreign transit traffic)

Avoid diverting traffic and increase revenues by including comprehensive road network from the start

Easy user access (plug & play approach), flexible & transparent payment schemes (via internet, SMS, etc)

Ensure low operational costs by ease of extendibility

State authority should be a key stakeholder to insure fast implementation (e.g. legislation) and share risks

Being Prepared for the (near) Future

System should be flexible to changes in road network & tariff schemes, also enabling congestion charging

Provide a technology platform supporting telematic services (to improve safety and efficiency of road network), creating a technology impulse in Slovakia

Interoperability within Europe, being ready for Galileo
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