Dynamic Tolling

Next-generation traffic management allowing to reduce traffic congestion and increase environmental protection based on variable and dynamic toll tariffs
Kapsch TrafficCom: Road Traffic Telematics Solutions Portfolio

**Tolling Solutions**
- Highway tolling
- Area tolling
- E-Vignette
- Plaza tolling
- Toll enforcement

**Urban Traffic Solutions**
- City tolling
- Access restriction
- Low emission zones
- Open zone parking

**Safety & Security Solutions**
- Speed monitoring
- Weigh in motion
- Incident detection
- Traffic surveillance

**Add-on Applications**
# Kapsch TrafficCom – Snapshot

## Scope of business:
- Turn-key solutions, component sales and operations of road infrastructure related ITS / traffic telematics solutions (focus: electronic toll collection systems)
- 16 years of experience in electronic tolling (218 references in 35 countries)

## Offering:
- Development and manufacturing of core technologies, systems & products; system concept & planning; system implementation, integration & roll-out, technical operations (support & maintenance); commercial operations, financing

## Selected references:
- Truck tolling system A
- Truck tolling system CZ
- All vehicle tolling (Melbourne, AUS)

## Number of employees:
- 1000+ worldwide

## Locations:
- Headquarters in Vienna (Austria)
- Development centers in Austria, Argentina, Sweden and USA
- Sales offices in 23 countries
Agenda

- Project Overview 01
- Real-life Sample Systems 02
- Use Cases 03
- Simulation Studies 04
- Required Framework 05
Title: Dynamic Tolling
Scope: Feasibility of managing traffic on basis of toll tariffs
Partners: - Kapsch TrafficCom AG
         - Technical University Graz (Institute for Transport Research)
Duration: Nov 2008-Dec 2009
Work packages: 1) Study & Concept (Kapsch + TU Graz)
                2) Simulation (TU Graz)
                3) Demonstrator (Kapsch)
Funding: FFG (Austrian Research Promotion Agency)
         KWF (Carinthina fund for supporting the economy)
## Tolling Models

<table>
<thead>
<tr>
<th>TARIF</th>
<th>STATIC</th>
<th>VARIABLE</th>
<th>DYNAMIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fixed prices – same price over time</td>
<td>Variable (time depending) pricing scheme</td>
<td>Dynamic price model</td>
</tr>
<tr>
<td></td>
<td>Predictable prices</td>
<td>Predictable prices</td>
<td>Prices vary between min / max</td>
</tr>
<tr>
<td></td>
<td>No price-change</td>
<td>Price review after a defined time</td>
<td>Real-time price-change</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>Avoid trips</th>
<th>Avoid trips</th>
<th>Avoid trips</th>
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<tbody>
<tr>
<td></td>
<td>Influence transport mode choice</td>
<td>Influence route choice</td>
<td>Influence route choice</td>
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<tr>
<td></td>
<td></td>
<td>Influence departure time choice</td>
<td>Influence departure time choice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Influence transport mode choice</td>
<td>Influence transport mode choice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>Finance</th>
<th>Finance</th>
<th>Finance</th>
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<tbody>
<tr>
<td></td>
<td>(Congestion decrease)</td>
<td>Congestion decrease</td>
<td>Congestion decrease</td>
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<tr>
<td></td>
<td></td>
<td>Smoothing peak traffic</td>
<td>(real time) Traffic Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environment (general traffic</td>
<td>Environment (traffic decrease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decrease)</td>
<td>on demand)</td>
</tr>
</tbody>
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| EXAMPLES  | Austria, Germany, Italy, London      | Stockholm, Singapore                | HOT Lanes (USA)                |

Main focus of the research project
Effects and objectives of toll tariff based traffic management

Traffic Control / Demand Management
- Reduce congestion
- Guarantee level-of-service

Environmental Protection / Quality of Life
- Reduce air pollution (PM$_{10}$, CO$_2$, NO$_X$)
- Noise protection

Effects on road traffic:
- Decreasing traffic volume
- Better geographical distribution of traffic
- Better distribution of traffic time-wise

Road User:
- Avoid trip
- Choose different route
- Choose different departure time
- Choose different transport mode

Variable or dynamic adaptation of toll tariffs
Existing sample systems of toll tariff based traffic management

France A5 & A6
- Different static pricing on two alternative routes
- A5: ~70 km longer, new highway
- A6: older highway, often congestion

Stockholm City Tolling
- Variable pricing
- Goals: reduce traffic & manage peak traffic
- Traffic reduced by ~15 % (less congestion better air quality)

HOT Lane Tolling (US)
- Dynamic pricing
- Tariff depends on traffic density and/or speed
- Goals: controlling throughput & maximize income
### Use cases for toll tariff based traffic management

<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>Network tolling</th>
<th>Section Tolling</th>
<th>HOT lane tolling</th>
<th>City tolling</th>
<th>Low Emission Zones</th>
<th>Object tolling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic control / demand management</td>
<td>Load balancing of alternative routes</td>
<td>Controlling throughput a bottleneck sections</td>
<td>Controlling throughput on HOT lanes</td>
<td>Controlling access to city zones</td>
<td>Controlling throughput at bottleneck objects</td>
<td></td>
</tr>
<tr>
<td>Example: two highways going from A to B</td>
<td>Example: section with road works</td>
<td></td>
<td>Example: peak traffic into/out of city zone</td>
<td></td>
<td>Example: bridges &amp; tunnels</td>
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<table>
<thead>
<tr>
<th>Environment protection / improving quality of life</th>
<th>Reducing traffic on sensitive routes</th>
<th>Reducing traffic in sensitive zones</th>
</tr>
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<tbody>
<tr>
<td>Example: noise reduction at night time along a city highway</td>
<td>Example: general reduction of traffic in the entire city area</td>
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</table>
Simulation study 1: Load balancing on alternative routes

Variations of toll between Radstadt - Trautenfels ~ 55 km:

- **Toll = 0,00 € / km**
  - (64%-0%-36%)

- **Toll = 0,06 € / km**
  - (34%-0%-66%)

- **Toll = 0,22 € / km**
  - (5%-5%-90%)
Simulation study 2– Reducing traffic in low emission zone

Low Emission Zone radius 40 km:

- Toll=0,00 € / km (44% - 56%)
- Toll=0,06 € / km (64% - 36%)
- Toll=0,10 € / km (80% - 20%)
In the EU on the TEN tolls covering external costs are not allowed yet

The planned Euro-Vignette III directive would provide a basis for toll tariff-based traffic management (only for trucks, only on TEN roads)

Success Factors

• All vehicle tolling <> truck tolling: in order to be effective traffic management based on toll tariffs requires a high rate of users which are subject to toll (> all vehicle tolling)

• Sufficient road user information: easy-to-understand tariff model, full information (tariff information, traffic information, alternative route information etc.)

Technology

• Modern ETC systems already support variable and dynamic pricing

• Integration of ETC system and Traffic Management system is needed

• Advanced means for road user information are required (e.g. navigation systems displaying real-time tariffs and possible alternative routes)
Questions and discussions

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