Q3) How should road users be charged?
Q4) How should enforcement operate?
Q8) How can privacy be ensured?

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Copenhagen

Road Pricing: The Way Forward Conference
Workshop 2B Technology Options
24-25 Feb 2004 London
Tested charging system
AKTA – purpose and background

- 200 + 200 + 100 car users try virtual road-pricing systems
- Real money (total of 0-150 Euro, up to 1,000 Euro), 16-20 weeks
- In addition questionnaires, focus groups, background interviews (bigger sample)
- AKTA-SP on 300 participants before round 2 and round 3
The GPS unit used
One driver, one week
Coverage: No. Of trips pr road
## GPS problems

<table>
<thead>
<tr>
<th>Duration of signal problem</th>
<th>Expected reasons (ordered after revealed importance)</th>
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</thead>
<tbody>
<tr>
<td>Short term (&lt; 5min)</td>
<td>- Satellite signal problems (1)</td>
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<tr>
<td></td>
<td>- Driving through tunnels (2)</td>
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<td></td>
<td>- Parking in underground garages (2)</td>
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<td>- Parking in multi-story garages on ground (3)</td>
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<td>- Parking in places with roofs (3)</td>
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<td>- Driving in roads with high buildings (4)</td>
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<td></td>
<td>- Driving in roads with no sky visibility due to trees (4)</td>
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<td></td>
<td>- Boot time for taximeter (5)</td>
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<td>- Use of mobile phones close to receiver (5)</td>
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<td></td>
<td>- Acquisition time for GPS (6)</td>
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<td></td>
<td>- Minor taximeter errors (7)</td>
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<tr>
<td>Long term (&gt; 5 min)</td>
<td>- Installation problems (1)</td>
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<tr>
<td></td>
<td>- Taximeter malfunctioning (2)</td>
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<tr>
<td></td>
<td>- Weather conditions (3)</td>
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<td></td>
<td>- Transport on ferries (4)</td>
</tr>
</tbody>
</table>
Power consumption

- Active
  - 300 mA

- 10 min after ignition is turned off
  - 70 mA

- 56 hours after ignition is turned off
  - 0 mA
Problems experienced by users

46% of the participants had experienced technical problems, of which:

14% experienced that the unit stopped working.
5% experienced that the battery was discharged (total fall out). This was mainly due to faulty installations, e.g. the power was taken from the headlights.
5% experienced that the unit did not show the pricing level – but worked none-the-less.
5% had a non-functional unit at average at a given time during the experiment, where all participants were contacted.
Post-processing data

- Indicated an unreasonable large change in speed or location (> |10m/sek/sek|)
- Indicated an unreasonable high speed (>200 km/h).
- Was fluctuating due to no or very little movement at all (< 5km/h)
Distance driven before unit in function
Issues not handled by trial

- Enforcement
- Updating of software and hardware on the charging unit in the cars
- Handling changes of zones
- Handling changes of charges
- Installation in old cars
- Installation in difficult cars (reception problems, unstable power supply etc.)
- Service and repair of broken units
- Handling units that is broken, but the car driver does not know or does not care
- Payment
- Handling of non-equipped users
What is meant by enforcement of a GPS based system?

• Everyone is paying for their trip?
• Everyone (who should have) has the equipment?
• All equipment is working properly?
• Or?
Scale

- Nationwide vs one-city vs highway
- Obligatory vs voluntary
- Exemptions vs no exemptions
- Or?
Paying

- Prepaid card
- Postpayment by card
- Mobile communication
- DSRC at petrol stations
GPS

• GPS precision
  – In meters
  – Availability
    • No of satellites
    • Other disturbances
  – Start up time

• Map precision
  – In meters
  – Correctness
  – Updating

• Taxation errors
  – Due to map errors
  – Due to technical errors
  – Due to signal errors
  – Due to time errors
    – Calibration
    – Jumps (Daylight)
  – Due to tax changes
Enforcement (and payment)

- Mobile communication once a month
- LED in window (Swiss system)
- DSRC check points
- Smart cards (prepaid or postpayment)
- Or?
Surveillance?

- Not a big problem !!!
  - No central registration
  - And it happens everywhere
  - Video cameras
  - Bank accounts & mobile phones
  - Public registers, etc.
  - “Big Brother” is something TV-stations and newspapers focus on – not ordinary people
Results of high congestion charge

Charge in payment period vs. Charge in Control period

- **Round 1**
- **Round 2**
- **Round 3**

**Trend round**

Road Pricing: The Way

24-25 Feb 2004 London
AKTA – Preliminary conclusions
Reports available primo 2004

- Pricing level shall be high
- Only few ready to change behaviour
- Rp influence *others* the most
- Commuting trips difficult to change
- Congestion pricing unpopular
- Rp should be nationwide
- No fear of surveillance and speed control
- Fear of new tax instrument
- Revenue to public transport/improvement of traffic safety