Costs and benefits of cooperative ITS for road authorities: the COBRA decision-support tool

Simon Ball, Transport Research Laboratory (UK)
COBRA project

- Decision support tool
- Deployment of co-operative systems
- Perspective of national road authorities
- Cost benefit analysis
COBRA project

- **COoperative Benefits for Road Authorities**

- **ERA-NET road programme**
  - “Mobility – Getting the most out of Intelligent Infrastructure” is a trans-national joint research programme that is cross-border funded by the Road Authorities of Belgium, Germany, Netherlands, Norway, Switzerland, and United Kingdom.

- Sept 2011 – Feb 2013
- 415K €

- **Partners:**
  - TNO (Netherlands), Project coordinator
  - TRL (UK), Project partner
  - AIT (Austria) Project partner
  - Vrije Universiteit (Netherlands), Subcontractor
Aims

• To help road authorities to position themselves to realise the potential offered by developments in Vehicle-to-Infrastructure cooperative systems.

• Costs and benefits of investments
  – Societal perspective
  – Business case (for road authority) perspective
Bundles

• Bundle 1, Local Dynamic Event Warnings
  – Hazardous locations / road works / traffic jam ahead / post-crash

• Bundle 2, In-vehicle Speed and Signage
  – In-vehicle signage / dynamic speed limits / Intelligent Speed Adaptation

• Bundle 3, Travel Information and Dynamic Route Guidance
  – Traffic info & recommended itinerary / multi-modal travel info / truck parking
# The COBRA Tool

## Scenario 1
- **Country**: Netherlands
- **Local dynamic event warnings**: Cellular
- **BM1 - Free RA app (Cellular)**: Medium
- **Aftermarket/Smartphone vehicle penetration curve**: Medium
- **OEM vehicle penetration curve**: Medium
- **Start year for deployment of wireless beacons roadside units**: 2012
- **End year for deployment of wireless beacons roadside units**: 2030
- **% of infrastructure equipped with wireless beacons roadside units in end year**: 2.5%
- **Wireless beacons roadside units investment scheme**: Linear
- **Include in-vehicle CAPEX costs?**: No
- **Include in-vehicle OPEX costs?**: No
- **Include infrastructure cost savings?**: No

## Scenario 2
- **Country**: United Kingdom
- **Local dynamic event warnings**: Cellular
- **BM1 - Free RA app (Cellular)**: Medium
- **Aftermarket/Smartphone vehicle penetration curve**: Medium
- **OEM vehicle penetration curve**: Medium
- **Start year for deployment of wireless beacons roadside units**: 2012
- **End year for deployment of wireless beacons roadside units**: 2030
- **% of infrastructure equipped with wireless beacons roadside units in end year**: 2.5%
- **Wireless beacons roadside units investment scheme**: Linear
- **Include in-vehicle CAPEX costs?**: No
- **Include in-vehicle OPEX costs?**: No
- **Include infrastructure cost savings?**: No
Societal problem cost
Estimated societal problem costs in the UK: 2012 and 2030
## Impact Assessment
Estimated impact of each bundle (at 100% deployment)

<table>
<thead>
<tr>
<th>Impact indicators</th>
<th>Bundle 1</th>
<th>Bundle 2</th>
<th>Bundle 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road Safety</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of fatalities</td>
<td>-7%</td>
<td>-7%</td>
<td>-4%</td>
</tr>
<tr>
<td>Number of non-fatal injuries</td>
<td>-8%</td>
<td>-5%</td>
<td>-5%</td>
</tr>
<tr>
<td>Number of injury accidents</td>
<td>-7%</td>
<td>-5%</td>
<td>-5%</td>
</tr>
<tr>
<td><strong>Travel time</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time spent travelling</td>
<td>+0%</td>
<td>+4%</td>
<td>-11%</td>
</tr>
<tr>
<td><strong>Fuel consumption</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petrol and Diesel</td>
<td>-1%</td>
<td>-4%</td>
<td>-10%</td>
</tr>
<tr>
<td><strong>Emissions</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CO\textsubscript{2}</td>
<td>+2%</td>
<td>-4%</td>
<td>-9%</td>
</tr>
<tr>
<td>NOx</td>
<td>-10%</td>
<td>-9%</td>
<td>-5%</td>
</tr>
<tr>
<td>Particulates (PM-2.5)</td>
<td>-1%</td>
<td>-10%</td>
<td>-</td>
</tr>
</tbody>
</table>
Overlap with existing infrastructure

Co-operative system

Bundle 1
Local Dynamic Event Warnings

Bundle 2
In-vehicle Speed and Signage

Bundle 3
Travel Information & Dynamic Route Guidance

Existing infrastructure

“Queue Protection”

“Managed Motorways”

“Roadside travel and routing information”
Hotspots

Cumulative percentage of travel time benefits

Percentage of network (taking sections with highest levels of travel time first)

Existing Infrastructure

Co-operative Systems
Example results: findings

• Key themes:
  – Weak case for roadside infrastructure for cooperative systems on motorways (i.e. wireless beacons) due to high cost*
  – Strong case for road authorities to become involved in delivering services based on smartphones**, particularly where third parties bear development costs
  – Example countries had high level of existing infrastructure
Further work

• Need to consider impacts of existing infrastructure alongside impacts of cooperative systems
• Tool can be updated with improved information on impacts
• Tool can be tailored to other countries with specific data and scenarios
• Other bundles
Contact

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