IMPACT OF e-SAFETY APPLICATIONS ON CYCLISTS’ SAFETY

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Cyclists’ safety (1/2)

- Cyclists in EU make around 50 mln trips per day
- Cyclists are anyway VRUs
  - High casualty rate
  - Lack of external protection toward other road users
- In 2009, in EU-19 countries
  - Around 2,100 cyclists killed in road accidents
  - Around 7% of all fatalities
Cyclists’ safety

Deaths in traffic accidents involving at least a bicycle per million inhabitants in Europe (CARE, 2012)
How to improve cyclists’ safety

• Separating bicycles from motorized vehicles (e.g. cycling paths)
• Reducing vehicles’ speed (e.g. 30 kph zones)
• With physical protections (e.g. helmet)

• Using ICT systems (e-safety applications)
  ▫ SafeCycle project – www.safecycle.eu
e-safety applications

- For cyclists
- For bicycles

**Impact of e-Safety Applications**

**BlinkHelmet**
Idea (Giovanni Doci, Italy)

**Airbag for cyclists**
Idea (Hövding, Sweden)

**Copenhagen Wheel**
Prototype

**Hindsight 35**
Prototype

**Light Lane**
Existing - patent has been applied for

**Self powered Laser**
Idea
e-safety applications

- For other vehicles
- For web or nomadic devices

Airbag ter bescherming van fietsers
In development [TNO – APROSYS]

NextGenITS
In development

http://www.youtube.com/watch?v=SPxJfDYJc

Citizens Connect
Existing: Boston, USA

Fietsrouteplanner Gent
Existing: Gent

See-Mi
Existing (Copenhagen, London)

Popradar – blind spot
Existing
Objective and methodology

- Assessing the impact on safety of cyclists of e-safety applications
- Due to lack of analysis and real case tests on apps for cyclists, the assessment was based on literature review of impacts on safety of similar measures
- A CBA has been realised for 11 applications
  - Comparison of results in 4 EU countries: Netherlands, Italy, Belgium, Czech Rep.
# Selected applications

<table>
<thead>
<tr>
<th>Bicycle</th>
<th>Other vehicles</th>
<th>Infrastructure</th>
<th>Internet &amp; nomadic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical problems</td>
<td>HindSight35</td>
<td>Countdown traffic lights</td>
<td>Route planner</td>
</tr>
<tr>
<td>Street projection</td>
<td>Light Lane Bike</td>
<td>Traffic Eye Zürich</td>
<td>Routeplanner Gent</td>
</tr>
<tr>
<td>Visibility</td>
<td>Bicycle braking light</td>
<td>Visibility</td>
<td>Monitoring &amp; action</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LED-Mark</td>
<td>Citizens connect (nomadic)</td>
</tr>
<tr>
<td></td>
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<tr>
<td><strong>Airbag</strong></td>
<td>Car airbag for cyclists</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>ISA – Intelligent Speed Adaptation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td>LEXGUARD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assessment of benefits (1/2)

- Reductions of social costs due to reduction of cycling accidents, injuries and fatalities
- Crash Reduction Factors (CRFs) were used to estimate the potential benefits of the apps
  - Reference was made to effects of similar measures
  - CRFs considered the same for the 4 countries
Assessment of benefits (2/2)

- Social costs of traffic accidents
  - Official national data for 2002

<table>
<thead>
<tr>
<th>Cost (€)</th>
<th>Netherl.</th>
<th>Belgium</th>
<th>Italy</th>
<th>Czech Rep.</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident</td>
<td>19,000</td>
<td>16,000</td>
<td>14,000</td>
<td>4,800</td>
<td>13,450</td>
</tr>
<tr>
<td>Injury</td>
<td>236,000</td>
<td>249,000</td>
<td>183,000</td>
<td>67,100</td>
<td>183,775</td>
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<tr>
<td>Fatality</td>
<td>1,782,000</td>
<td>1,369,000</td>
<td>1,430,000</td>
<td>495,000</td>
<td>1,336,500</td>
</tr>
</tbody>
</table>

Benefits\(^i\) = \text{SC}_{A}^{i} \cdot \text{CRF}_{A} \cdot N_{A}^{i} + \text{SC}_{I}^{i} \cdot \text{CRF}_{I} \cdot N_{I}^{i} + \text{SC}_{F}^{i} \cdot \text{CRF}_{F} \cdot N_{F}^{i}

Impact of e-Safety Applications on Cyclists’ Safety
Assessment of costs

- Costs given by the sum of implementation and maintenance costs
  - Maintenance costs considered equal to 10% of implementation costs per year

\[
\text{Implementation Costs}_i = \text{Unit Cost} \cdot \text{Unit Number}_i
\]
Benefit Cost ratio

- Ratio between actualised benefits and costs
- Expected duration of applications considered equal to 10 years
- Benefits and costs actualised considering an interest rate equal to 10%
Results: LEXGUARD

• Detection strips on the truck to warn for objects around the truck combined with warning signs inside the truck

• It solves blind spot accidents
Results: LEXGUARD

- Effects on blind spot accidents assumed similar to that of convex mirror
  - Elvik estimated a fatality decrease of 40%
- CRFs assumed:
  - Fatal accidents: -22%
  - Injury accidents: -22%
  - Other accidents: no effects
- Accidents with cyclists while turning left or right were considered
## Results: LEXGUARD

<table>
<thead>
<tr>
<th></th>
<th>Netherl.</th>
<th>Belgium</th>
<th>Italy</th>
<th>Czech</th>
<th>EU</th>
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</thead>
<tbody>
<tr>
<td>Accident</td>
<td>4,237</td>
<td>4,694</td>
<td>10,633</td>
<td>2,142</td>
<td>60,300</td>
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<tr>
<td>Injury</td>
<td>45</td>
<td>12</td>
<td>130</td>
<td>26</td>
<td>788</td>
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<tr>
<td>Fatality</td>
<td>20</td>
<td>8</td>
<td>34</td>
<td>10</td>
<td>156</td>
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<tr>
<td>Unit cost (€)</td>
<td>2,700</td>
<td>2,700</td>
<td>2,700</td>
<td>2,700</td>
<td>2,700</td>
</tr>
<tr>
<td>N° of veh</td>
<td>39,000</td>
<td>56,000</td>
<td>171,000</td>
<td>20,000</td>
<td>1,700,000</td>
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<tr>
<td>Costs (mln €)</td>
<td>712</td>
<td>1,022</td>
<td>3,121</td>
<td>365</td>
<td>31,024</td>
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<tr>
<td>Benefits (mln €)</td>
<td>63</td>
<td>39</td>
<td>97</td>
<td>9</td>
<td>477</td>
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<tr>
<td>CBA</td>
<td>0.09</td>
<td>0.04</td>
<td>0.03</td>
<td>0.02</td>
<td>0.02</td>
</tr>
</tbody>
</table>
Results: LIGHT LANE BIKE  

• A green laser projects a cycle lane behind the bicycle. The laser turns red when a vehicle is too close.

• It solves rear end collisions.
Results: LIGHT LANE BIKE

- Effects on rear end collisions assumed similar taillights for bicycles
  - Elvik estimated a fatality decrease of 80%
- CRFs assumed:
  - Fatal accidents: -40%
  - Injury accidents: -40%
  - Other accidents: -40%
- Rear end accidents with cyclists at night
## Results: LIGHT LANE BIKE

<table>
<thead>
<tr>
<th></th>
<th>Netherl.</th>
<th>Belgium</th>
<th>Italy</th>
<th>Czech</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident</td>
<td>776</td>
<td>866</td>
<td>2,809</td>
<td>648</td>
<td>12,760</td>
</tr>
<tr>
<td>Injury</td>
<td>720</td>
<td>866</td>
<td>2,384</td>
<td>635</td>
<td>13,324</td>
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<tr>
<td>Fatality</td>
<td>24</td>
<td>15</td>
<td>75</td>
<td>20</td>
<td>418</td>
</tr>
<tr>
<td>Unit cost (€)</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>N° of veh</td>
<td>16,000,000</td>
<td>5,500,000</td>
<td>27,000,000</td>
<td>5,200,000</td>
<td>224,000,000</td>
</tr>
<tr>
<td>Costs (mln €)</td>
<td>387</td>
<td>133</td>
<td>654</td>
<td>125</td>
<td>5,420</td>
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<tr>
<td>Benefits(mln €)</td>
<td>559</td>
<td>624</td>
<td>1,568</td>
<td>136</td>
<td>7,813</td>
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<tr>
<td>CBA</td>
<td>1.44</td>
<td>4.69</td>
<td>2.40</td>
<td>1.09</td>
<td>1.44</td>
</tr>
</tbody>
</table>
Synthesis of results (1/2)

Impact of e-Safety Applications on Cyclists' Safety

- BicycleAirbag
- BicycleBrakeLight
- HindsSight
- ISA
- Blind spot system trucks
- Routeplanner Gent
- Citizen Connect
- TrafficEyeZürich
- LedMark
- CountDownTrafficLight
- LightLane

Benefits (less accidents):
- Bicycle
- Other vehicle
- Infrastructure
- Internet

Costs (investment):
- min
- max

Graph showing the relationship between the benefits of less accidents and the costs of investment for various e-safety applications.
Conclusions

• Research on ITS and cycling is lacking
• Results obtained are a starting point
• They are a valid indication about
  ▫ the potential of e-safety applications for cyclists
  ▫ The differences existing between different contexts
• Future research should focus on demonstrations and FOTs
Thank you for the attention