CATS: Cyclist-AEB Testing System

Car – bicyclist accident analysis and bicyclist dummy development
SafetyAssist: CATS (Heiko Schebdat, GME & Sjef van Montfort, TNO)

Introduction

- Cyclist safety raising issue in Europe

![Graph showing total road fatalities and percentage cyclist fatalities from 2000 to 2014.](image)
Objective of CATS (Cyclist-AEB Testing System) project:

- Prepare the introduction of a protocol for consumer tests of Cyclist-AEB systems on board passenger cars.
- Propose a test setup (incl. hardware) and test protocol for Cyclist-AEB systems based on technical/scientific considerations.
- Base the tests on analysis of most relevant cyclist accident scenarios in EU countries.

Timing:
- Start: 2014 Q2
- Finish: 2016 Q1

In this presentation, the results of the accidentology WP are reported, prioritizing the cyclist-to-car accident scenarios. Also the latest status of dummy and propulsion system will be shown.
Project approach:

1. Accident Analysis
2. Test scenario definition
3. Dummy development
4. Propulsion system development
5. Verification & Testing

A: Partners
B: Test-houses
Accidentology approach

- Study databases for 6 European countries;
- Select severe car-to-cyclists accidents --> fatalities, seriously injured;
- Provide overview of distinguished accident scenarios;
- Determine the distribution of scenarios in the different countries;
- Prioritize scenarios & indicate how many fatalities and seriously injured are covered.
Distinguished car-to-cyclist scenarios

Crossing
- C1
- C2

Turning
- T1
- T2
- T3
- T4
- T5

Longitudinal / Oncoming
- L1
- L2
- On

Remaining / Others
- Re

Remarks:
- Definitions based on EU main land traffic directions and position on road.
- Bicycle can be on road or bicycle lane.
- Crossing is not limited to intersections.

Check if all relevant scenarios are covered
Prioritization of scenarios:

- What fraction of fatal and severe accidents is covered by the different scenarios?
- All countries equally weighted*:

* Italy not included due to limited amount data sets not being representative.
Prioritization of scenarios:

- Weight the results according to # cyclist fatalities per million inhabitants:

<table>
<thead>
<tr>
<th>Country</th>
<th># road fatalities per million inhabitants</th>
<th># cyclist fatalities per million inhabitants</th>
<th>Weighting [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>62</td>
<td>2,8</td>
<td>11%</td>
</tr>
<tr>
<td>Germany</td>
<td>45</td>
<td>6,0</td>
<td>26%</td>
</tr>
<tr>
<td>Italy*</td>
<td>68</td>
<td>5,4</td>
<td>-</td>
</tr>
<tr>
<td>Netherlands</td>
<td>32</td>
<td>9,2</td>
<td>38%</td>
</tr>
<tr>
<td>Sweden</td>
<td>28</td>
<td>3,6</td>
<td>15%</td>
</tr>
<tr>
<td>UK</td>
<td>30</td>
<td>2,3</td>
<td>10%</td>
</tr>
</tbody>
</table>

* Italy not included due to limited amount data sets not being representative.
Prioritization of scenarios:

- What fraction of fatal and severe accidents is covered by the different scenarios?
- Weight the results according to # cyclist fatalities per million inhabitants*:

![Percentage Chart]

* Italy not included due to limited amount of data sets not being representative.
Conclusions:

- C1, C2 and L in all countries dominant.
- The scenarios C1, C2 and L together cover already between 78% (fatal) and 63% (seriously injured):

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C1+C2</th>
<th>C1+C2+L</th>
<th>C1+C2+L+On</th>
<th>C1+C2+L+On+T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean K</td>
<td>25%</td>
<td>54%</td>
<td>78%</td>
<td>85%</td>
<td>87%</td>
</tr>
<tr>
<td>mean S</td>
<td>28%</td>
<td>56%</td>
<td>63%</td>
<td>70%</td>
<td>75%</td>
</tr>
</tbody>
</table>

* Italy not included due to limited amount data sets not being representative.
Next steps accidentology & scenario definition:

- Selection of scenarios for which a test protocol is developed.

- Determine test ranges for these scenarios such as:
  - Vehicle speeds
  - Bicycles speed
  - Presence of view blocking obstructions
  - Collision point on the vehicle
  - Size and posture of bicyclist

- Select parameters describing the level of light and precipitation.

- Use information available in databases (GIDAS – PCM), enriched with results from observation studies.
CATS project: Dummy & propulsion system development

- CATS consortium to define technical specification for bicycle, cyclist dummy and propulsion system.
- 4activeSystems GmbH to development of bicycle and cyclist dummy together with propulsion system meeting set requirements.

Development and verification workshops are ongoing:
- Development workshops focus on detailed development of bicycle and cyclist dummy.
- Verification workshops focus on feasibility of scenarios
### CATS project: Dummy & propulsion system development

- Align all bicycle and cyclist dummy requirements as much as possible with the pedestrian dummy:
  - Euro NCAP
  - vFSS
  - ISO/TC 22/WG 16 Active safety test

- Specify requirements on bicycle and cyclist dummy for:
  - Dimensions
  - Features
  - Sensing properties

<table>
<thead>
<tr>
<th></th>
<th>The Netherlands</th>
<th>Germany</th>
<th>UK</th>
<th>Spain</th>
<th>Sweden</th>
<th>France</th>
<th>Italy</th>
<th>EU</th>
<th>CATS (proposed)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Front reflector</strong></td>
<td>Yes, white</td>
<td>Yes, white</td>
<td>-</td>
<td>-</td>
<td>Yes, white</td>
<td>Yes, white</td>
<td>Yes</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Rear reflector</strong></td>
<td>Yes, red (0.35-0.5m from ground)</td>
<td>Yes, one red and one white angle</td>
<td>Yes, red</td>
<td>-</td>
<td>Yes, red</td>
<td>Yes, red</td>
<td>Yes, red</td>
<td>Yes, red</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Pedal reflectors</strong></td>
<td>Yes, yellow at front and rear</td>
<td>Yes, yellow at front and rear</td>
<td>Yes, amber</td>
<td>-</td>
<td>Yes, orange at front and rear</td>
<td>Yes, orange</td>
<td>Yes, both sides</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Wheel reflectors</strong></td>
<td>Yes, white or yellow</td>
<td>Yes, at least 2 yellow or a white stripe</td>
<td>-</td>
<td>-</td>
<td>Change or white side reflectors, only at night</td>
<td>Yes, orange</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Front light</strong></td>
<td>Yes, white, only at night/dark weather</td>
<td>Yes, white</td>
<td>-</td>
<td>-</td>
<td>Yes, red light only at night</td>
<td>Yes, yellow or white, only at night/dark weather</td>
<td>Yes, yellow or white</td>
<td>Yes, white or yellow</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Rear light</strong></td>
<td>Yes, red, only at night/dark weather</td>
<td>Yes, red (at least 250mm from ground)</td>
<td>Yes, only at night</td>
<td>-</td>
<td>Yes, head red light only at night</td>
<td>Yes, red, only at night/dark weather</td>
<td>Yes, red</td>
<td>Yes, red</td>
<td>✓</td>
</tr>
</tbody>
</table>
CATS project: Dummy & propulsion system development

- Align propulsion system requirements with AEB pedestrian as much as possible:
  - Euro NCAP
  - vFSS
  - ISO/TC 22/WG 16 Active safety test

- Specify requirements on:
  - General requirements
  - Dimensions
  - Dynamic properties
- Crossing
CATS project: Verification & testing

- Longitudinal
CATS project: Next steps

Next steps

- Fine tune sensor characteristics of dummy.
- Ensure impactability of dummy.
- Improve propulsion system for longitudinal scenario.
- Further verification of test protocol and dummy in development and verification workshops.

- Test protocol definition including specification of scenarios, dummy & propulsion system.
Thank you very much for your attention

- Heiko Schebdat, GME Vehicle Safety Integration, technical lead
  - Telephone +49 6142 7 69643
  - Email: Heiko.Schebdat@de.opel.com

- Sjef van Montfort, TNO Integrated Vehicle Safety, consultant
  - Telephone: +31 88 866 09 32
  - E-mail: Sjef.vanMontfort@tno.nl

- More info can be found on [www.tno.nl/cats](http://www.tno.nl/cats)