ADAC accident research – accident analysis based simulation of the most dangerous scenarios
ADAC accident research

The ADAC accident research is a co-operational project of ADAC airmedical service and ADAC technical centre.

ADAC aired service
app. 54,000 flight missions per year with ~48,000 patients
handles app. 4,500 road accidents p.a.
3,200 accidents stored in the data base of ADAC accident research
Dataset completed by the co-operation of many partners
Motivation

- Active systems for the prevention of accidents and the mitigation play an increasing roll
- People ask for tests and results of real life experiences
- Idea: Simulation could handle complex accident scenarios and help to develop testing procedures

Objective

- Providing technical advice and competent information about testing scenarios with ADAS available on the market.
- Reliable comparative tests that are based on standardised test criteria
>20% of the ADAC accident research cases are crossing, joining or turning accidents
<table>
<thead>
<tr>
<th>Accident type</th>
<th>Ranking (Federal Statistical Office of Germany[3])</th>
<th>Ranking (ADAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of control accident</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Turning accident</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Accident joining/crossing traffic</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Road-crossing accident</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Accident caused by parked/stopped vehicle</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Head-on, rear-end, sideswipe</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Other accidents</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>
The most common accident type within the ADAC accident research database is Type 141. For this study the most often accident type in crossing/joining accidents (302) is used:

Joining into traffic, turning left; main traffic from the left

<table>
<thead>
<tr>
<th>Accident type</th>
<th>Accident type</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>141</td>
<td>Loss of control accident</td>
<td>318</td>
</tr>
<tr>
<td>101</td>
<td>Loss of control accident</td>
<td>231</td>
</tr>
<tr>
<td>102</td>
<td>Loss of control accident</td>
<td>214</td>
</tr>
<tr>
<td>681</td>
<td>Head-on, rear-end, sideswipe accident</td>
<td>120</td>
</tr>
<tr>
<td>211</td>
<td>Turning accident</td>
<td>115</td>
</tr>
<tr>
<td>302</td>
<td>Accident joining/crossing</td>
<td>99</td>
</tr>
<tr>
<td>301</td>
<td>Accident joining/crossing</td>
<td>75</td>
</tr>
<tr>
<td>321</td>
<td>Accident joining/crossing</td>
<td>65</td>
</tr>
</tbody>
</table>

Table 3.3: Most frequent accident type numbers [20, end of May 2015]

[4] Institut für Straßenverkehr Köln; ISK, Unfalltypenkatalog, 2010

Figure 3.4: Selected accident type numbers [4]
### Parameter mapping – accident to test scenario

<table>
<thead>
<tr>
<th>ASIL-Bestimmung</th>
<th>Level</th>
<th>Erläuterung</th>
<th>resultierender ASIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Einbiegen/Kreuzen-Unfälle</td>
<td>Severity</td>
<td>S3</td>
<td>2/3 aller Verletzungen sind schwere, 6 % tödliche und 29 % leichte /20° -&gt; Überleben ist wahrscheinlich</td>
</tr>
<tr>
<td></td>
<td>Exposure</td>
<td>E4</td>
<td>bezüglich Dauer der Situation E3, bezüglich Frequenz der Situation E4 -&gt; E4 ist plausibler</td>
</tr>
<tr>
<td></td>
<td>Controllability</td>
<td>C3</td>
<td>Die wenigsten Autofahrer sind in der Lage, eine derartige Unfallsituation zu kontrollieren und ohne Schaden davonzukommen</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Erläuterung</th>
<th>resultierender ASIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbige-Unfall</td>
<td>Severity</td>
<td>S3</td>
<td>79 % aller Verletzungen sind schwere, 13 % tödliche und 8 % leichte /20° -&gt; Überleben ist wahrscheinlich</td>
</tr>
<tr>
<td></td>
<td>Exposure</td>
<td>E4</td>
<td>bezüglich Dauer der Situation E3, bezüglich Frequenz der Situation E4 -&gt; E4 ist plausibler</td>
</tr>
<tr>
<td></td>
<td>Controllability</td>
<td>C3</td>
<td>Weniger als 90 % aller Fahrer sind in der Lage, eine derartige Unfallsituation zu kontrollieren und ohne Schaden davonzukommen</td>
</tr>
</tbody>
</table>

Tabelle 3.6: ASIL-Bestimmung Einbiegen/Kreuzen-Unfälle (Unfalltypnummern 301, 302 und 321)
Simulation scenario – type of accident 302

Key parameters

- Location: extra-urban
- Number of vehicles involved: 2
- Road condition: dry
- Road intersecting angle (reference point: driver with right of way): 75°-90°
- Visibility impaired: no
- Downward / upward gradient of minor road vs. major road: 0 - plane
- Irregular pavement: no
- Degree of curvature / road 1 vs. major road: 0°-5°
- Degree of curvature / road 2: 0°
- Number of lanes (incl. turn lanes) / road 1: 2
- Number of lanes (incl. turn lanes) / road 2: 2
- Signs: Right of way
- Behaviour of driver with right of way: braking
- Braking force applied, if any: moderate – up to approx. 75%
- Speed limit / road 1: 71-100kph
- Speed limit / road 2: 30-50kph
- Vehicle class: family
- Time of day: 15-18 hours (summer)
- Light conditions: daylight
Simulation scenario – type of accident 302

Szenario 1 – base scenario
Simulation scenario – type of accident 302

Szenario 2 – street variations

- ruts
- angle
- traffic sign
Simulation scenario – type of accident 302

Szenario 2 – obstacle
Simulation scenario – type of accident 302

Szenario 4 – driver assistance
Simulation scenario – type of accident 302

Szenario 5 – V2V Communication

- obstacle
- no obstacle

V2I
Results

- 5 base scenarios for the crossing situation at every specific geometry

- worst case scenario (obstacle)
Summary and Outlook

Summary
ADAC testing procedure and assessment could be developed with simulation techniques
the testing scenarios are real life (accident) based

Outlook
Future test scenarios and safety discussions will be supported by simulations
Thank You