Analysis of Dooring accidents and a proposal for a corresponding Driver Assistance System
Structure

- **Accidentology**
  - National statistic
  - In-Depth (GIDAS)
  - Derivation of cyclist stopping distance

- Proposal for Driver Assistance System
## Accident Analysis – National statistic

### Average Door]ing accidents per year extrapolated for Germany (2007-2016)

<table>
<thead>
<tr>
<th></th>
<th>Accidents</th>
<th>Killed</th>
<th>Seriously injured</th>
<th>Slightly injured</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>2209</td>
<td>1</td>
<td>283</td>
<td>1967</td>
</tr>
<tr>
<td><strong>Daylight</strong></td>
<td>1907</td>
<td>1</td>
<td>250</td>
<td>1692</td>
</tr>
<tr>
<td><strong>Dark / twilight</strong></td>
<td>303</td>
<td>0</td>
<td>33</td>
<td>275</td>
</tr>
</tbody>
</table>

### Main accident types

- 581
- 582

- [Diagram showing accident types]
Accident Analysis – In-Depth (GIDAS)

Results from GIDAS analysis for years 2000-2019

- In 95% of all accidents the involved vehicle type is passenger car
- 80% of Dooring accidents occur in daylight situations
- Around 80% of Dooring accidents occur on the vehicles driver side
Accident Analysis – In-Depth (GIDAS)

- Average bicycle speed is around 16 km/h
- 50% of all cyclist have an initial velocity prior to the crash between 15 and 20 km/h
- Around 95% of all cyclists have an initial velocity prior to the crash <= 25 km/h
Derivation of cyclist stopping distance

Assumptions:

- Bicycle speed $v_{\text{bicycle}} = 25 \text{ km/h}$
- Bicycle deceleration $a_{\text{bicycle}} = 3.5 \text{ m/s}^2$
  according to DIN EN ISO 4210-2
- Reaction time $t_{\text{reaction}} = 1.2 \text{ s}$

Calculations:

- Braking distance to standstill:
  \[ s_{\text{braking}} = 0.5 \times \frac{v_{\text{bicycle}}^2}{a_{\text{bicycle}}} = 6.9 \text{ m} \]
- Thinking distance:
  \[ s_{\text{reaction}} = t_{\text{reaction}} \times v_{\text{bicycle}} = 8.3 \text{ m} \]
- Stopping distance:
  \[ s_{\text{stop}} = s_{\text{reaction}} + s_{\text{braking}} = 15.2 \text{ m} \]

- Cyclist needs 15.2 m to reach standstill from an initial velocity of 25 km/h
Proposal for Driver Assistance System

Critical area up to 15m

Proposal:
- Speed adaptive critical area up to 15m with intensive warning of exiting car occupants or temporary blockade of the door
- Addressing lateral distance up to 1m
- Working under daylight as well as lowlight conditions
- Working on driver as well as front seat passenger side