1 Introduction ................................................................. 1
  1.1 Safety in Road Traffic ............................................. 1
  1.2 Accident Statistics ............................................... 4
  1.3 Pedestrian Protection ............................................. 8
  1.4 Objective and Methodological Approach ...................... 11
  References ............................................................... 12

2 State of Scientific and Technical Knowledge on Pre-crash
  Evaluation ............................................................... 17
  2.1 Methodological Aspects of Evaluation ......................... 17
  2.2 System Responses Available for Evaluation ................. 19
  2.3 Retrospective and Prospective Evaluation .................... 22
  2.4 Data Sources for Evaluation .................................... 24
  2.5 Methods of Prospective Evaluation ............................ 28
  2.6 Methods of Prospective Case-by-Case Analysis ................ 31
  2.7 Methods for Modeling Different Parts of Driver, Vehicle,
       and Environment ................................................... 35
  2.8 Summary and Conclusion ......................................... 43
  References ............................................................... 44

3 Approach to Integrated Safety Evaluation: Preventive
  Pedestrian Protection .................................................. 49
  3.1 Process Chain for Quantitative Evaluation
       of the Pre-crash Phase .......................................... 49
  3.2 Reference Scenarios for Pedestrian Accidents ............... 52
  3.3 Functional Demonstrator of a Preventive Pedestrian
       Protection System ................................................... 54
  3.4 Simulation of Vehicle-Pedestrian Interaction ............... 56
### 4 Methodological Findings on Research on Driver Behavior
4.1 Objective ........................................... 67
4.2 Test Design and Subject Sample ......................... 68
4.2.1 Overall Design ..................................... 68
4.3 Acceptance of the System in Specific Situations ......... 77
4.4 Driver Behavior in Highly Critical Situations .......... 83
4.5 Conclusion ........................................... 88
References ............................................. 89

### 5 Probabilistic Modeling of Pedestrian Injury Severity
5.1 Objective and Research Questions ....................... 91
5.2 Data and Statistical Methods .......................... 93
5.2.1 Study Data Characteristics ......................... 93
5.2.2 Coding of Target Variables ........................ 94
5.2.3 Coding of Explanatory Variables ................... 95
5.2.4 Treatment of Missing Data .......................... 96
5.2.5 Statistical Models and Methods ...................... 97
5.2.6 Verifying Plausibility of Injury Probability Models .. 101
5.3 Prediction of Injury and Fatality Probability .............. 104
5.3.1 Univariate Models and Analysis of Potential
Confounders ............................................. 104
5.3.2 Multivariate Analysis: MAIS or ISS
as Injury Scale .......................................... 116
5.3.3 Multivariate Versus Univariate Analysis .......... 126
5.3.4 Investigation of Special Subgroups ................. 130
5.4 Plausibility Check and Indications for Implementation ... 132
5.4.1 Probability Models for ISS and Fatalities .......... 132
5.4.2 Implications and Conclusion on Plausibility ....... 137
5.5 Conclusion ........................................... 138
References ............................................. 140

### 6 Integrated Evaluation of Preventive Pedestrian Protection
6.1 Design of Virtual Simulation Experiments: System
Versus Reference ........................................ 143
6.2 Virtually Changed Vehicle Geometry .................... 146
6.3 Efficacy of Preventive Pedestrian Protection .......... 148
6.4 Efficacy of System “Warning” ........................ 150
6.5 Efficacy of System “Warning and Brake Assist” ....... 155
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.6 Efficacy of System “Automatic Braking”</td>
<td>158</td>
</tr>
<tr>
<td>6.7 Efficacy of System “Warning, Brake Assist, Automatic Braking”</td>
<td>162</td>
</tr>
<tr>
<td>6.8 Comparison of Warning and Intervention</td>
<td>166</td>
</tr>
<tr>
<td>6.9 Conclusion</td>
<td>168</td>
</tr>
<tr>
<td>References</td>
<td>170</td>
</tr>
<tr>
<td>7 Conclusion and Outlook</td>
<td>171</td>
</tr>
<tr>
<td>Appendix A</td>
<td>179</td>
</tr>
</tbody>
</table>
Development of a Methodology for the Evaluation of Active Safety using the Example of Preventive Pedestrian Protection
Helmer, Th.
2015, XV, 195 p. 71 illus., 2 illus. in color., Hardcover
ISBN: 978-3-319-12888-7