Pedestrian Protection in Europe

The Potential of Car Design and Impact Testing

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Fatality Rates in Europe *  

* Data from Greece and Portugal not available
Fatality Rates for Pedestrians (Europe, USA, Japan)
Source: IRTAD-data

Pedestrians in Europe per 1 Mill. Inhabitants
Pedestrians in the USA per 1 Mill. Inhabitants
Pedestrians in Japan per 1 Mill. Inhabitants
Pedestrian Fatalities per Mill. Inhabitants
Source: German National Statistics

Year
- 1980
- 1984
- 1988
- 1992
- 1996
- 2000

- all ages
- till 6 years
- from 6 to 15 years
- over 65 years

* Reduction from 1980 data
Severely Injured Pedestrians per Mill. Inhabitants
Source: German National Statistics

-63%* -77%* -58%* -61%*

* Reduction from 1980 data
Trend of the European Pedestrian Fatalities and the Draft Phase-In

- Target of European Commision: 30% Reduction of the fatalities

30%-Reduction of fatalities expected (based on 1999 data)

Source: IRTAD-Data
Pedestrian Accidents in Germany
Comparison of the German National Data 2000 with the GIDAS data (n=415)

Sources: German National Data 2000
GIDAS (German In-Depth Accident Study) 1999-2001
Age Groups in Pedestrians Accidents

Source: German National Data 2000
Injuries and Contact Zones for AIS 2+ injuries
(n = 116 Injuries from 53 Pedestrians)

Source: GIDAS
Frequency of contacts for AIS 2+ - injuries, all body regions
(front-to-pedestrian impacts, only passenger cars, all impact speeds)

<table>
<thead>
<tr>
<th>Contact zones</th>
<th>GIDAS 100% = 116 injuries</th>
<th>IHRA (Europe) 100% = 1460 injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parts of vehicle</strong></td>
<td>share</td>
<td>share</td>
</tr>
<tr>
<td>front bumper</td>
<td>28%</td>
<td>21%</td>
</tr>
<tr>
<td>front panel and headlamps</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>bonnet leading edge</td>
<td>3%</td>
<td>10%</td>
</tr>
<tr>
<td>bonnet</td>
<td>8%</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Subtotal for vehicle front</strong></td>
<td>44%</td>
<td>49%</td>
</tr>
<tr>
<td>windscreen and frame</td>
<td>18%</td>
<td>24%</td>
</tr>
<tr>
<td>ground surface</td>
<td>27%</td>
<td>13%</td>
</tr>
<tr>
<td>others</td>
<td>11%</td>
<td>14%</td>
</tr>
</tbody>
</table>
## Frequency of contacts for AIS 2+ - injuries, head and face

*front-to-pedestrian impacts, only passenger cars, all impact speeds*

<table>
<thead>
<tr>
<th>Contact zones</th>
<th>GIDAS 100% = 45 injuries</th>
<th>IHRA (Europe) 100% = 512 injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parts of vehicle</strong></td>
<td>share</td>
<td>share</td>
</tr>
<tr>
<td>front bumper</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>front panel and headlamps</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>bonnet leading edge</td>
<td>0%</td>
<td>0,2%</td>
</tr>
<tr>
<td>bonnet</td>
<td>6%</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Subtotal for vehicle front</strong></td>
<td>6%</td>
<td>17,2%</td>
</tr>
<tr>
<td>windscreen and frame</td>
<td>35%</td>
<td>51%</td>
</tr>
<tr>
<td>ground surface</td>
<td>49%</td>
<td>22%</td>
</tr>
<tr>
<td>others</td>
<td>10%</td>
<td>9,8%</td>
</tr>
</tbody>
</table>
Number of Contacts in Different Zones for AIS 1+ Head Injuries
Source: GIDAS
## Frequency of contacts for AIS 2+ - injuries, lower extremities

(front-to-pedestrian impacts, only passenger cars, all impact speeds)

<table>
<thead>
<tr>
<th>Contact zones</th>
<th>GIDAS 100% = 55 injuries</th>
<th>IHRA (Europe) 100% = 572 injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parts of vehicle</strong></td>
<td>share</td>
<td>share</td>
</tr>
<tr>
<td>front bumper</td>
<td>all</td>
<td>61%</td>
</tr>
<tr>
<td></td>
<td>lower leg</td>
<td>46%</td>
</tr>
<tr>
<td></td>
<td>knee</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>femur</td>
<td>2%</td>
</tr>
<tr>
<td>front panel and headlamps</td>
<td>9%</td>
<td>6%</td>
</tr>
<tr>
<td>bonnet leading edge</td>
<td>all</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>pelvis</td>
<td>4%</td>
</tr>
<tr>
<td>bonnet</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Subtotal for vehicle front</strong></td>
<td>82%</td>
<td>81%</td>
</tr>
<tr>
<td>windscreen and frame</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>ground surface</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>others</td>
<td>16%</td>
<td>14%</td>
</tr>
</tbody>
</table>

*including 5% “others”
Distribution of Vehicle Types in Pedestrian Accidents (AIS1+)
Source: GIDAS

- Passenger Cars: 75%
- Light trucks / Mini Buses: 3%
- Trucks, etc.: 6%
- Motorcycles: 1%
- Bicycles: 1%
- Off - Road Vehicles: 1%
- Unknown: 10%

Legend:
- Passenger Cars
- Off - Road Vehicles
- Light trucks / Mini Buses
- Trucks, etc.
- Motorcycles
- Bicycles
- Unknown
Impact Locations in Car-to-Pedestrian Accidents (AIS1+)
Source: GIDAS

- Front: 54%
- Side: 29%
- Rear: 5%
- Unknown/Other: 12%
Potential to Reduce Serious Injuries in the GIDAS data, AIS 2+, all body regions

Potential at the car front of about 18%
ACEA-phase 1 = 14.5% Potential left = 3.2%

Contact zones, potential of the EEVC-test 17.7%

- front-bumper: 11.3%
- bonnet: 3.2%
- front panel, headlamps: 2.0%
- bonnet leading edge: 1.2%

Rest: 25% injured by car (62%)

- Rest: 40% frontal impacts (54%) n=116 injuries

- Rest: 75% passenger cars (75%)

- All vehicles 100%

Factors of reduction

- Ground and other contacts: 38%
- Others than front: 46%
- Other vehicles: 25%
Potential to Reduce Serious Head Injuries in the GIDAS data, AIS 2+

Contact zones, potential of the EEVC-test 2.4%

- Windscreen and frame: 14.0%
- Front bumper: 0%
- Bonnet: 2.4%
- Front panel, headlamps: 0%
- Bonnet leading edge: 0%

Rest: 16%, injured by car (41%)
Rest: 40%, frontal impacts (54%), n=45 injuries
Rest: 75%, passenger cars (75%)

All vehicles: 100%

Factors of reduction

Ground and other contacts: 59%
Others than front: 46%
Other vehicles: 25%
Potential to Reduce Serious Injuries in the IHRA data, AIS 2+, all body regions

Potential at the car front of about 27%

ACEA-phase 1 = 19.7% Potential left = 7.1%

- Windscreen and frame 13.2%
- Front-bumper 11.5%
- Bonnet 8.2%
- Front panel, headlamps 1.6%
- Bonnet leading edge 5.5%

Contact zones, potential of the EEVC-test 26.8%

- Rest: 40% injured by car (73%)
- Rest: 55% $V_0 < 60 \text{ km/h}$ (74%) n=1460 injuries
- Rest: 75% passenger cars (75%)
- All vehicles 100%

Factors of reduction
- Ground and other contacts 27%
- Catastrophic impacts $>60 \text{ km/h}$ 26%
- Other vehicles 25%
Potential to Reduce Serious Head Injuries in the IHRA data, AIS 2+

Contact zones, potential of the EEVC-test 9.5%

Potential at the car front of about 9%
ACEA-phase 1 = 8.9%
Potential left = 0.6%

- Windscreen and frame 28.5%
- Front-bumper 0%
- Bonnet 8.9%
- Front panel, headlamps 0.5%
- Bonnet leading edge 0.1%

rest: 38% injured by car (68%)
rest: 55% $V_o < 60$ km/h (74%)
$n=512$ injuries
rest: 75% passenger cars (75%)
all vehicles 100%

- Ground and other contacts 32%
- Catastrophic impacts > 60 km/h 26%
- Other vehicles 25%

Factors of reduction
Potential of the tests for ACEA-phase 1 and EEVC WG17

AIS 2+, all body regions

<table>
<thead>
<tr>
<th>Description</th>
<th>ACEA Phase 1</th>
<th>Potential left</th>
<th>Potential of EEVC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14.5 (19.7) %</td>
<td>3.2 (7.1) %</td>
<td>17.7 (26.8) %</td>
</tr>
<tr>
<td>Ground and other contacts</td>
<td>11.3 (11.5) %</td>
<td>3.2 (8.2) %</td>
<td>11.3 (11.5) %</td>
</tr>
</tbody>
</table>

AIS 2+, head and face

<table>
<thead>
<tr>
<th>Description</th>
<th>ACEA Phase 1</th>
<th>Potential left</th>
<th>Potential of EEVC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.4 (8.9) %</td>
<td>0 (0.1) %</td>
<td>2.4 (9.5) %</td>
</tr>
<tr>
<td>Ground and other contacts</td>
<td>0 (0) %</td>
<td>0 (0.5) %</td>
<td>0 (0.5) %</td>
</tr>
</tbody>
</table>

GIDAS (IHRA) data

21.10.2002 20
## Estimated Potentials of Pedestrian Protection Testing for Complete European Vehicle Fleet Exchange

<table>
<thead>
<tr>
<th></th>
<th>seriously injured</th>
<th>fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>European casualties 2000</td>
<td>74,494</td>
<td>6,143</td>
</tr>
<tr>
<td>GIDAS</td>
<td>8.8%</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>see fig. 16</td>
<td>see fig. 17</td>
</tr>
<tr>
<td></td>
<td>(17.7%/2)</td>
<td>(2.4%/5)</td>
</tr>
<tr>
<td>Potential from ACEA-Phase 1</td>
<td>5,363 (7.2%)</td>
<td>30 (0.5%)</td>
</tr>
<tr>
<td>Potential left</td>
<td>1,191 (1.6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total potential based on GIDAS-data for EEVC WG17</td>
<td>6,554</td>
<td>30</td>
</tr>
<tr>
<td>IHRA (Europe)</td>
<td>13.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td></td>
<td>see table 19</td>
<td>see table 20</td>
</tr>
<tr>
<td></td>
<td>(26.8%/2)</td>
<td>(9.5%/5)</td>
</tr>
<tr>
<td>Potential from ACEA-Phase 1</td>
<td>7,375 (9.9%)</td>
<td>110 (1.78%)</td>
</tr>
<tr>
<td>Potential left</td>
<td>2,607 (3.5%)</td>
<td>7 (0.12%)</td>
</tr>
<tr>
<td>Total potential based on IHRA-data for EEVC WG17</td>
<td>9,982</td>
<td>117</td>
</tr>
</tbody>
</table>
Estimated Potential ACEA-phase 1 (left) Compared to Estimated Potential for EEVC WG17 tests (right)

Potential of fatalities by ACEA-phase 1

Potential of fatalities by EEVC WG17
Reduced collision speed by using a brake-assistant

Decelerations with different brake-systems

- **Brake-Assistant**: v_k = 25 km/h
- **Experienced driver**: v_k = 35 km/h
- **Standard driver**: v_k = 40 km/h

Start of braking, v_0 = 50 km/h

Impact with pedestrian
Conclusions

• Internationally, the fatality rate in Europe with 14 pedestrians per mill. Inhabitants is the lowest in the world. (US 17, Japan 23)

• Based on this positive trend, the target of the EU-Commision to reduce the fatalities by 30% and the seriously injured by 17% will be reached in 2010 without having any regulation.

• The potential of the EEVC WG17 tests is less than 2% of the pedestrian fatalities and about 8-13% of the seriously injured.

• ACEA-phase 1 is a good compromise for all parties

• Upper Leg test / Adult head test have no potential to reach targets estimated by the Commission

• Accident avoidance is much more promising to reduce casualties