Ernvall-Kelkka-Olkkonen:

"Crash Violence" within the Traffic System in Finland
Objectives:

1. Crash violence and the scope
2. Research data and methods
3. Results:
   - crash types
   - injury mechanisms and body areas
   - influence of speed
   - vehicle safety
4. Conclusions and recommendations
The goal of traffic system according to Finnish ”mission zero”

Traffic system should be such that each road user would survive alive in traffic, if he or she:

- observes traffic regulations and safety recommendations
- even commits a human error.
Crash violence

Those outcomes, injuries and fatalities, of crashes which have occurred, although the drivers have
• obeyed traffic regulations,
• operated without any risky manoeuvres
• or committed only a human error,

can be interpreted as crash violence of traffic system
Research data

Original sample:

1163 fatalities in two-vehicle crashes and single vehicle accidents occurred on the Finnish two-lane rural (outsides towns and villages) main road network of 11800 km and investigated detailed by Accident Investigation Teams in 1996-2003
Final sample:

524 fatalities (45 %) of the total sample. Only fatalities from those crashes in which the parties were operated "correctly".

Number of crashes: 442, vehicles: 849, occupants: 1417

Reasons for disqualification:

• alcohol (BAC > 0.5 per mille) and drugs
• exceeding of actual speed limit (> 20 km/h)
• lack of safety belt use
• suiside or sudden fit of illness
• lack of valid driving licence
Fatalities by crash types:

- Meeting accidents          302  ( 58%)
- Crossing acc.                66  ( 13%)
- Overtaking acc.              59  ( 11%)

- Passenger car-passenger car  ca. 56%
- Passenger car-heavy vehicle   ca. 38%
- Single vehicle acc.          ca. 7%
Meeting accident

**carrying to opposite lane**
42%, dry or wet road  
head-on/side impact: 98%/2%

**lost driving control**
46%, slippery or icy road  
head-on/side impact: 45%/52%
Injury mechanisms in meeting accidents in a 80 km/h speed zone

- Impact
- Impact and penetration
- Crushed vehicle
- Penetration by external parts
- Pressed against seat belt
- Other mechanism

PC-PC vs PC-HV
# Fatalities by body regions

<table>
<thead>
<tr>
<th>Body area</th>
<th>Impact</th>
<th>Impact +penetration</th>
<th>Crushed veh.</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Head</strong></td>
<td>27</td>
<td>31.8</td>
<td>73</td>
<td>27.8</td>
</tr>
<tr>
<td><strong>Back</strong></td>
<td>13</td>
<td>15.3</td>
<td>30</td>
<td>11.4</td>
</tr>
<tr>
<td><strong>Chest</strong></td>
<td>17</td>
<td>20.0</td>
<td>66</td>
<td>25.1</td>
</tr>
<tr>
<td>Abdomen and hips</td>
<td>1</td>
<td>1.2</td>
<td>10</td>
<td>3.8</td>
</tr>
<tr>
<td><strong>Limbs</strong></td>
<td>1</td>
<td>1.2</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Multi</strong></td>
<td>1</td>
<td>1.2</td>
<td>7</td>
<td>2.7</td>
</tr>
<tr>
<td><strong>Other or unknown</strong></td>
<td>25</td>
<td>29.4</td>
<td>74</td>
<td>28.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>85</strong></td>
<td><strong>100.0</strong></td>
<td><strong>263</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Delta-v (km/h) and severity of consequences for all occupants in fatal head-on collision accidents, n=573 occupants.
Distribution of delta-v and severity of consequences for occupants in fatal head-on collision accidents, n=573 occupants
Vehicle Safety

• **Airbags saved 25 % of drivers and occupants**
• Positive influence of **ESP (ESC)** would have been 15 %
• Positive influence of **Driver alertness systems** would have been 15 %
• Newer car models are continuously getting safer compared to their predictors
Conclusions and recommendations

Traffic system does not support enough road users to survive alive in traffic

- The risk to be involved in high-speed meeting, overtaking and crossing crashes must be reduced or prevented with median barriers and roundabouts
- Speed limit systems should be developed towards safer speeds and lower deviation of used speeds
- The use of automatic speed adaptation systems and speed limiters should increase and support
- The quality of road maintenance must improve especially in winter
- Vehicle primary and secondary safety research and development important