How close to zero car fatalities can we get?

Anders Lie

Gordon Moore in 1965 said; "Change will never be this slow again"
The Vision Zero Swedish parliament (1997)

- Long term target is that no one should be killed or receive long term disability

Volvo Cars Vision 2020 (2007)

“Our vision is that by 2020 no-one should be killed or seriously injured in a new Volvo car”

The Vision Zero European Commission (2011)

“By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.”

Vision Zero model for safe traffic

A safe road transport system

Safe speed

Safe vehicle
Criteria:
• Five-star rated by Euro NCAP
• Electronic Stability Control (ESC)

Safe road
Criteria:
• Four-star rated by Euro RAP

Safe road user
Criteria:
• Wears seat belt
• Complies with speed limits
• Sober

Biomechanical limits that the road user can tolerate without sustaining severe injuries

The vehicle:
• High NCAP score
• ESC

The vehicle supports the driver to:
• Use the seat belt
• Comply with speed limits
• Not drive when impaired
Crashworthiness - fatality risk for car occupants

Cars with year of introduction 1995-2004 colliding with other cars

- Relativ risk of fatality
- Year of introduction
- 1985-1994
- 1995-2004
- 2005-2014
- -43%
- -76%
- -86%

Folksam
Effects of high Euro NCAP score (study 2010)

Euro NCAP occupant protection
Points/stars (pre 2009 style)

Almost 70% fatality risk reduction

Relative risk
All injuries
Severe and fatal injuries
Fatal injuries
## Effects of ESC, two Swedish studies

<table>
<thead>
<tr>
<th>Category</th>
<th>Study 2005</th>
<th>Study 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>All crashes excluding rear end</td>
<td></td>
<td>97.5%</td>
</tr>
<tr>
<td>All crashes excluding rear end, car occupants</td>
<td></td>
<td></td>
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<tr>
<td>Serious/fatal crashes excluding rear end</td>
<td></td>
<td></td>
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<tr>
<td>Serious/fatal crashes excluding rear end, car occupants</td>
<td></td>
<td></td>
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<tr>
<td>Single, oncoming and overtaking crashes</td>
<td></td>
<td></td>
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<tr>
<td>Serious/fatal single, oncoming and overtaking crashes</td>
<td></td>
<td></td>
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<tr>
<td>Serious/fatal single crashes</td>
<td></td>
<td></td>
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<tr>
<td>Serious/fatal single/oncoming/overtaking crashes, dry surface</td>
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<td></td>
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<tr>
<td>Serious/fatal single/oncoming/overtaking crashes, wet surface</td>
<td></td>
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<tr>
<td>Serious/fatal single/oncoming/overtaking crashes, ice/snow surface</td>
<td></td>
<td></td>
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<tr>
<td>Fatal loss-of-control</td>
<td></td>
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<tr>
<td>Fatal loss-of-control (excluding non conformities)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Photo. Arnold Odermatt
The effect of Seat Belt Reminders

Road side observations, Europe

Increase of seat belt use 82,2 +/- 8,6%

Fatal crashes, Sweden
The effect of Lane Departure Warning

Without LDW

- Head-on and single: 68%
- Rear-end: 32%

With LDW

- Head-on and single: 32%

→ -53%

(70-120 km/h no snow or ice)

The effectiveness of lane departure warning systems – a reduction in real-world passenger car injury crashes

Simon Sternlund, Johan Strandroth, Matteo Rizzi, Anders Lie & Claes Tingvall

Traffic Injury Prevention
Proportion of car mileage driven on Swedish roads with ESC, SBR and AEB city 2000-2025
Fatalities in vehicles (Sweden)
Clear results in EU

• It is estimated that 2/3 of the reduction in road fatalities comes from replacement of the car fleet

• Better results than reduction of heart attacks during the same period
Joint effort to define boundary conditions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Passive</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head-on</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Side</td>
<td>55</td>
<td>15</td>
</tr>
<tr>
<td>Rear-end</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Large animals</td>
<td>80</td>
<td>30</td>
</tr>
</tbody>
</table>
Relative fatal and serious injury-ratio for car occupants on different road types

- 2 carriageways 100 km/h: 0.71
- 2 carriageways 90 km/h: 0.54
- 2 carriageways 80 km/h and speed cameras: 0.39
- Highway 120 km/h: 0.32
- 2+1 road 110 km/h: 0.27
- 2+1 road 100 km/h: 0.24
- Highway 110 km/h: 0.24
How close to zero car fatalities can we get with…

- Cars MY 2030 or later have a 5 stars (today’s system) Euro NCAP rating, standard AEB and AES (autonomous emergency steering)
- Median barriers in speed areas > 80 km/h and daily traffic > 4000 vehicles
- Roundabouts in urban intersections
- Safe road sides on speed areas > 80 km/h
Prevision of implementation of safety technologies on passenger cars

<table>
<thead>
<tr>
<th>Safety Technology</th>
<th>Target Population</th>
<th>Standard From MY Normal Implementation Rate</th>
<th>Standard From MY Fast Implementation Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESC</td>
<td>Loss-of-control crashes with over-steering. Violations excluded</td>
<td>2008</td>
<td>2008</td>
</tr>
<tr>
<td>SBR</td>
<td>Unrestrained occupants that would have survived with seat belt. Violations excluded</td>
<td>2009</td>
<td>2009</td>
</tr>
<tr>
<td>AEB city - FCW</td>
<td>Rear-end up to 50 km/h. Violations excluded</td>
<td>2020</td>
<td>2020</td>
</tr>
<tr>
<td>AEB interurban including large animals</td>
<td>Rear-end and wild life crashes, over 70 km/h. Violations excluded</td>
<td>2030</td>
<td>2025</td>
</tr>
<tr>
<td>AEB VRU - FCW</td>
<td>Pedestrians and cyclists hit by car fronts, excluding reversing crashes and cases with poor sight distance. Violations excluded</td>
<td>2030</td>
<td>2025</td>
</tr>
<tr>
<td>AEB rear VRU</td>
<td>Reversing crashes involving VRU. Violations excluded</td>
<td>2030</td>
<td>2025</td>
</tr>
<tr>
<td>AEB crossing</td>
<td>Crashes at intersections, where the crash opponent entered the intersection. Violations excluded</td>
<td>2030</td>
<td>2025</td>
</tr>
<tr>
<td>LDW - LKA</td>
<td>Lane departure on dry or wet roads with speed limit &gt; 60 km/h and visible road markings. Violations excluded</td>
<td>2030</td>
<td>2025</td>
</tr>
<tr>
<td>AES - Autonomous Emergency Steering</td>
<td>Crashes avoidable by swerving 1 meter, where possible. Violations excluded</td>
<td>2030</td>
<td>2025</td>
</tr>
</tbody>
</table>
Prognosis built on real-life fatal crashes
(Sweden performs in-depth analysis of all fatal crashes since 1998)
Number of killed car occupants in Sweden
Number of killed car occupants in Sweden

What do these crashes look like?
Which fatal crashes are left in 2060?

- 6 level crossings (5 w/o barriers)
- 5 extreme violations
- 3 head-on crashes with HGV, small overlap
- 2 disease-related cases
Summary

How close to zero car fatalities can we get?

• Very close, but we need the road infrastructure too

• With full implementation of current safety strategies for a safe road transport system we can get close to zero car fatalities by 2050

• We can get there even faster with (for instance) car scrapping programs

Gordon Moore in 1965 said; "Change will never be this slow again"
Teaser - how close to Zero can Volvo cars get?
Analysis of fatal crashes involving modern Volvo cars MY 2010 or later

• 16 killed car occupants under normal driving conditions since 2010
  2 fatalities/year

• Models: V70 (11), V60 (4), V40 (1)
• ESC, SBR and most of them with AEB city
• None of them with LKA/LDW, AEB interurban,

• 11 head-on collisions, 1 single-vehicle, 3 rear-end with HGV, 1 train

• 14 fatalities could have addressed by known vehicle safety technologies
Children killed in traffic 1956-2016
Thank you!

Swedish Transport Administration

anders.lie@trafikverket.se