# Fahrerassistenz und Serienentwicklung

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# Overview



- Introduction
- Pedestrian Detection with Full Auto Brake
- Future Collision Avoidance System
- Towards Automated Driving

# Introduction





# The Volvo Heritage …



"Cars are driven by people.

The guiding principle behind everything we make at Volvo,

therefore is and must remain - Safety."

*Assar Gabrielsson & Gustaf Larson*
- the founders of Volvo

# Our direction

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We design cars

- that do not crash.
- that can on-demand drive automatically.

by providing

- word-class collision avoidance and protective technologies
- intuitive and accurate support for uncomplicated driving




# A knowledge driven process of Real-Life Safety

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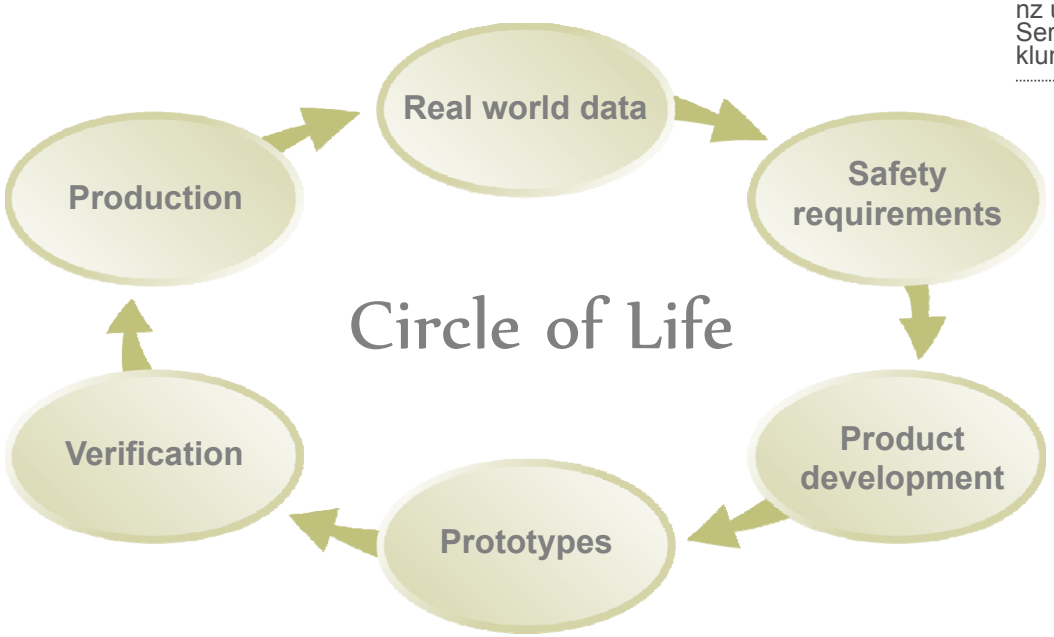
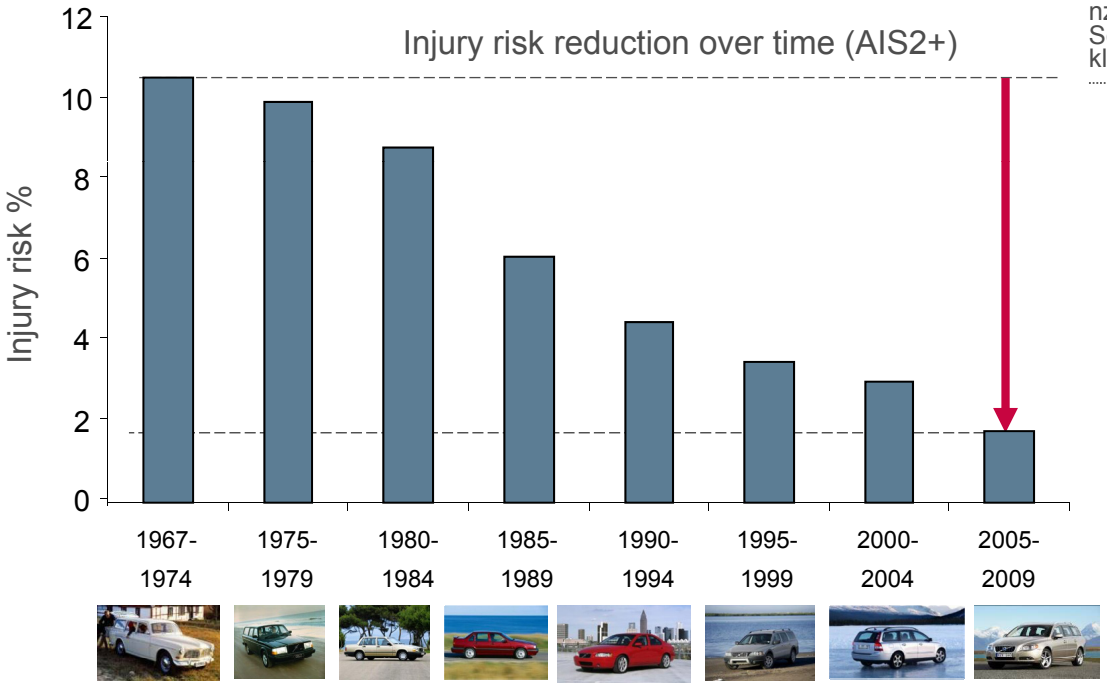


# Knowledge - delivering safety to customers

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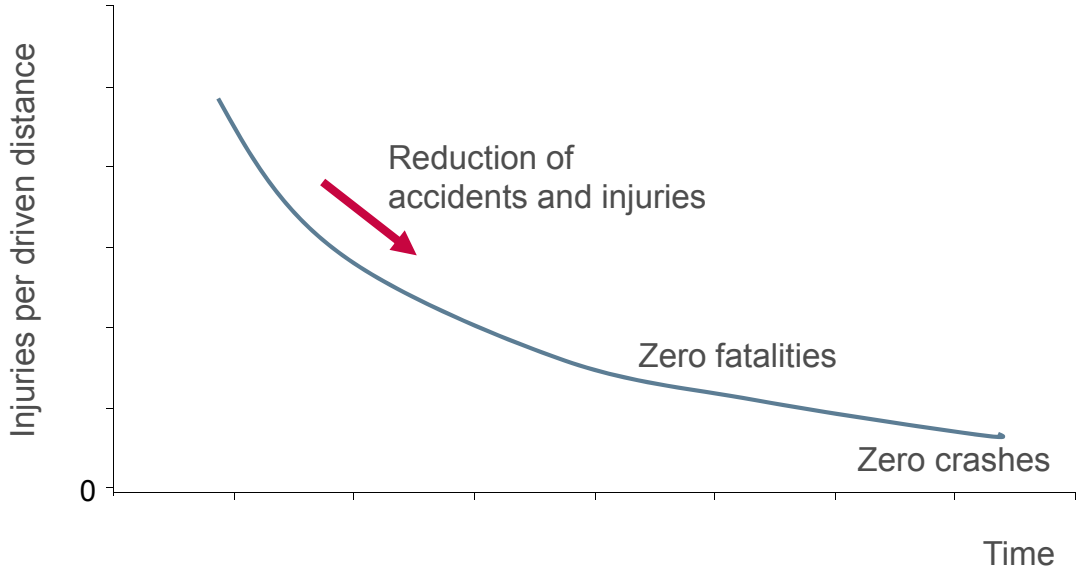
# Knowledge - delivering safety to customers

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# The real challenge – knowing the driver

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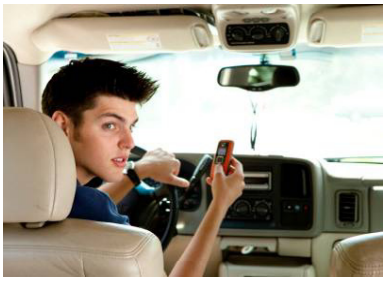




# European Field-Operational-Test (EuroFOT)

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- Perform multiple coordinated tests of Intelligent Vehicle Systems with ordinary drivers in real traffic.
- Investigate performance, driver behaviour and user acceptance.
- Assess the impacts on safety, efficiency and the environment, based on road data.


# State of the Art Volvo Technologies (V40)

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City Safety

Collision Warning with Auto Brake

Pedestrian Detection

Adaptive Cruise Control

Queue Assist

Lane Departure Warning (LDW)

**Lane Keeping Aid (LKA)**

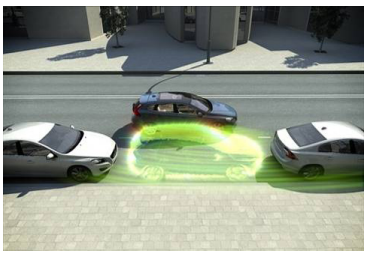
Driver Alert Control (DAC)

Blind Spot Information System (BLIS)

**Traffic Sign Information**

**Automatic Head Beam Control**

**Park Assist Pilot**





# IIHS Report on City Safety

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**VOLVO XC60 CITY SAFETY**

| | claim frequency | |
|---|---|---|
| vs. other midsize luxury SUVs | | |
| Property damage liability | -27% | Struck vehicle |
| Bodily injury liability | -51% | Struck vehicle |
| Collision | -22% | Own vehicle |

INSURANCE INSTITUTE FOR HIGHWAY SAFETY

"This is our first real-world look at an advanced crash avoidance technology, and the findings are encouraging," says Adrian Lund, president of HLDI and the Institute. "City Safety is helping XC60 drivers avoid the kinds of front-to-rear, low-speed crashes that frequently happen on congested roads."

# Development Strategy

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We want to be best in safety and deliver world-first technologies.

For this we cannnot fully depend on others.

We buy sensors and actuators from different suppliers and:

- specify our required sensor system
- design our own system solution
- develop our own sensor fusion system;
- develop our own functions for active safety and driver support.




# Pedestrian Detection with Full Auto Brake

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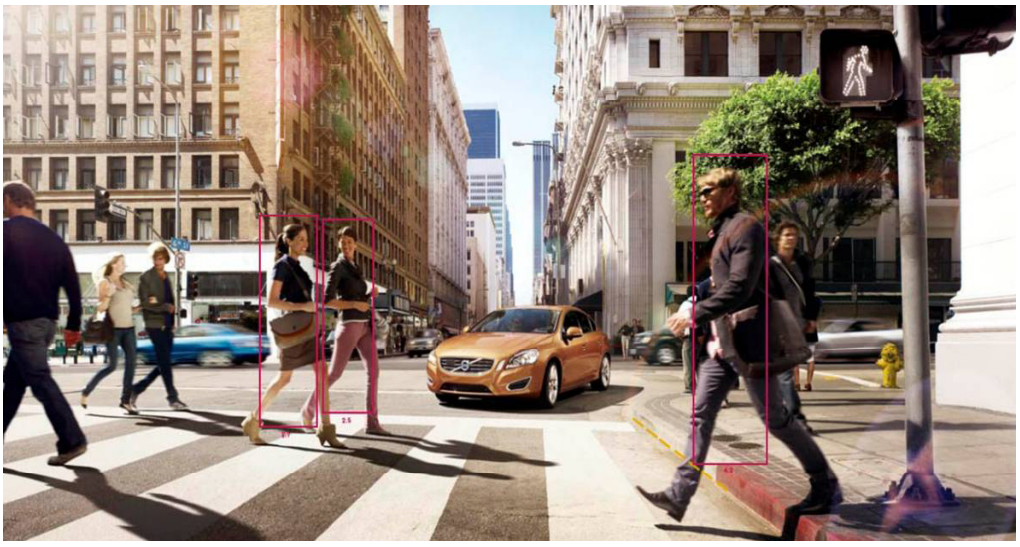


# Accident Statistics



Sweden: 16% of traffic fatalities were pedestrians. 11% of seriously injured persons were pedestrians.
(Vägverket, 2008)

Germany: 13% of traffic accident fatalities were pedestrians.
(*2002 SAE2004-21-0056)*

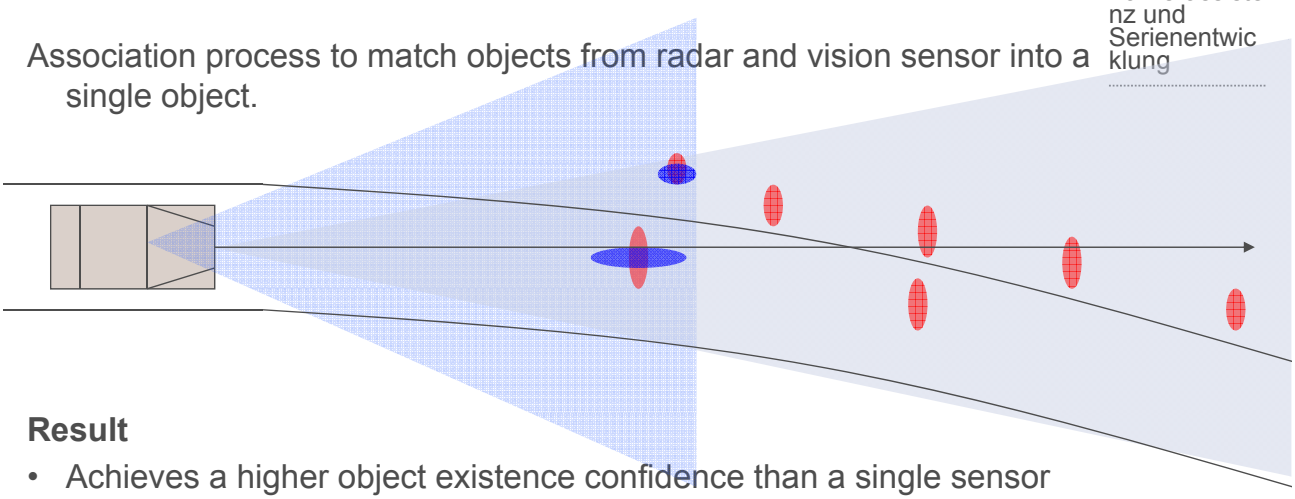
USA: 11 % of traffic fatalities (4,700 people).
(Traffic Safety Facts 2007, NHTSA, DOT HS 810 994)



# Sensor Fusion



Association process to match objects from radar and vision sensor into a single object.



**Result**

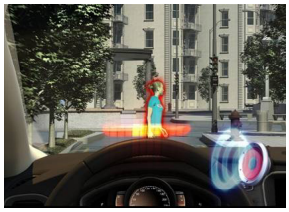
- Achieves a higher object existence confidence than a single sensor system
- Allows activation on stationary vehicles by discrimination of stationary objects (poles, mailboxes….) reducing false activation frequency.
- Provides enhanced data for the objects-lateral position, extension and range.

# Test – Robustness Requirements



In order to verify requirement a large field test was initiated where data has been collected from different parts of the world using correct sensor hardware

Data has been recorded using expeditions, taxis, local dealers etc.

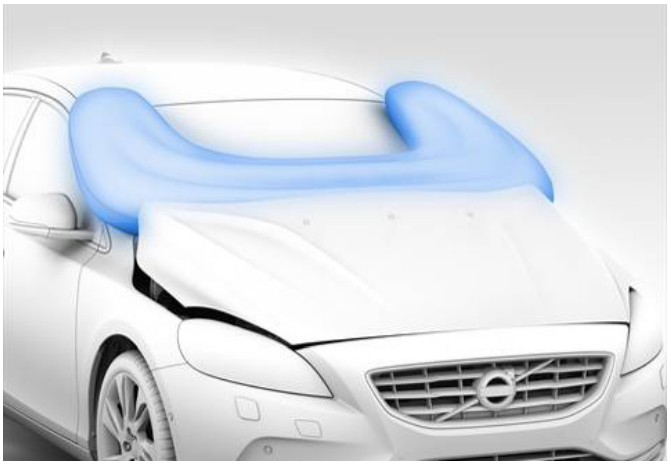




# Pedestrian Airbag Technology



In some cases where an accident cannot be avoided, we can still protect the pedestrian



# Future Collision Avoidance

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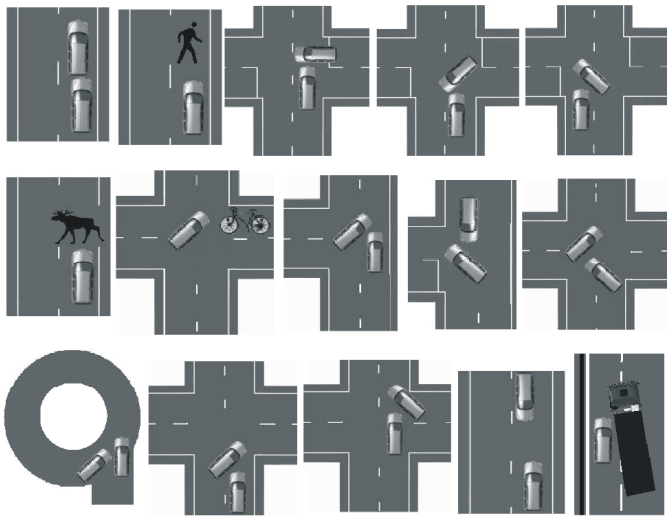
# State of the art

Current collision avoidance systems are tailored to specific scenarios.

In ongoing research we develop a system for general traffic scenarios.



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# Latest Developments



A mathematical framework that:

- decides on when to warn and intervene (*true positive*)
- without intervening during normal driving conditions (*false positive*).
- for *any* collision scenario,
- including steering interventions.



# Towards Automated Driving



# Trends in Driver Support

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- Parking Assistance Systems (PAS) take over part of the driving task. This started with informing the driver on available space, now vehicles can park semi-autonomously and soon it will be fully automatic.

- Adaptive Cruise Control (ACC) takes over part of the driving tasks braking and accelerating in typical motorway driving. It will keep a driver selected set-speed or follow a lead vehicle at a certain time-gap.

- ACC will be enhanced with map data, such that it can automatically select set-speed and adjust speed in curves. Automatic steering guidance will first be provided in low-speeds and later in higher speeds as well.

- *In this way the vehicle gradually takes over more and more driving tasks.*



# Towards the Automated Vehicle

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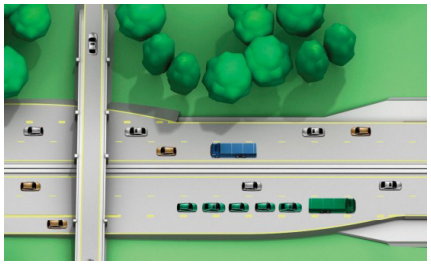
- It is obvious that the further development of collision avoidance and driver support technologies is stepwise leading towards automated vehicles.

- It potentially provides benefits in terms of:
  - Fuel consumption
  - Reduced congestion
  - Driver convenience

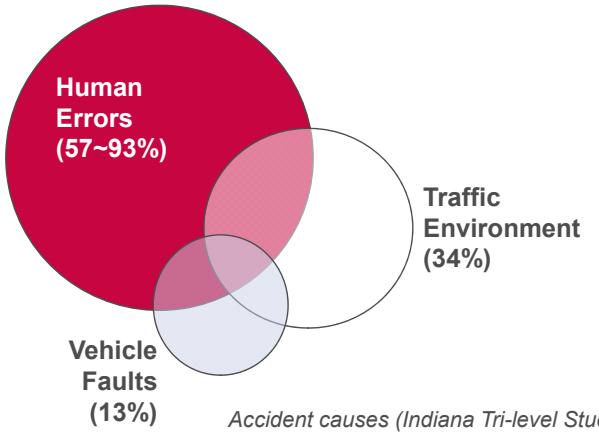


# Towards the Automated Vehicle



.. and improved traffic safety.

In almost all accidents human error plays a role, so with no driver in the loop there is a great potential to remove the most important accident causes.




*Accident causes (Indiana Tri-level Study, Treat et al.)*

**For these reasons we need to research how to best use these potentials.**



# Conclusions

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- Cars are driven by people. We believe in a future where vehicles do not crash.
- This requires putting the driver in focus and providing the personalized and intuitive support the driver needs.
- This will be developed based on our knowledge about drivers and the technology.
- Automated driving has a potential to address major transportation issues. We should therefore:
  - Research how to use this potential.
  - Avoid creating legal road blocks.