



CARING FOR PEDESTRIAN AND BICYCLISTS; VOLVO CARS AND VRU:S

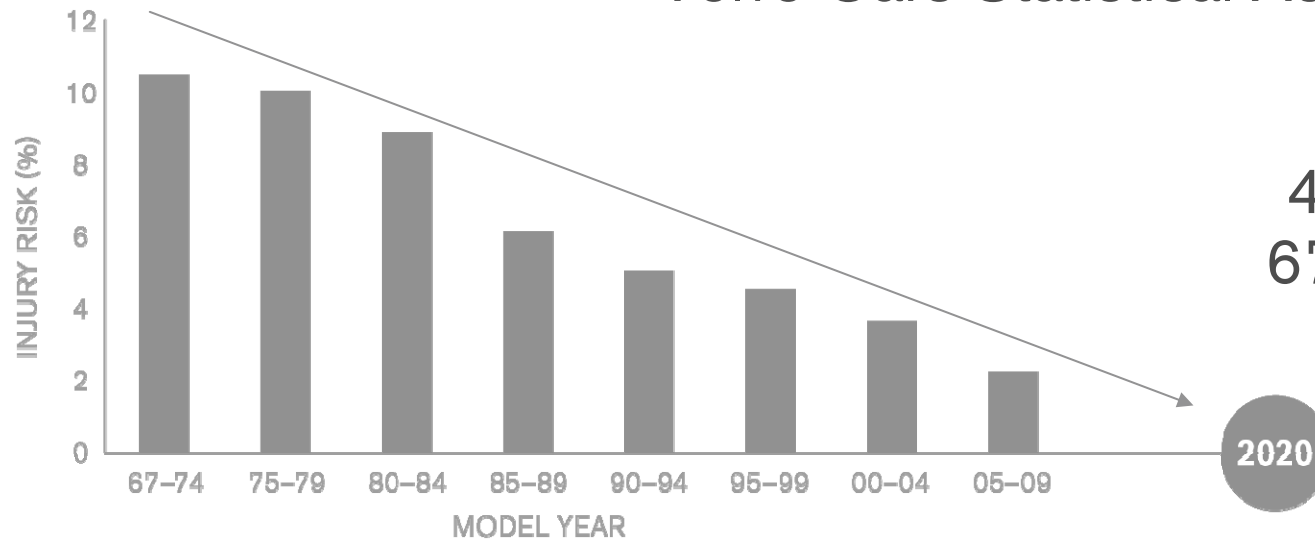


Magdalena Lindman
Volvo Cars Safety Centre

KNOWLEDGE DRIVEN RESULTS TOWARDS OUR VISION



Volvo Cars Statistical Accident Database



to date:
40.217 accidents
67.042 occupants



ref.: Isaksson-Hellman I and Norin H, "How Thirty Years of Focused Safety Development has Influenced Injury Outcome in Volvo Cars", 49th AAAM Annual Scientific Conference, Boston, USA, 2005.

VOLVO CARS PEDESTRIAN ACCIDENT DATABASE



ref: Lindman, M., Jakobsson, L., Jonsson, S., 2011.
**Pedestrians interacting with a passenger car,
a study of real world accidents.** Proc of IRCOBI,
Krakow, Poland, 2011: IRC-11-61.



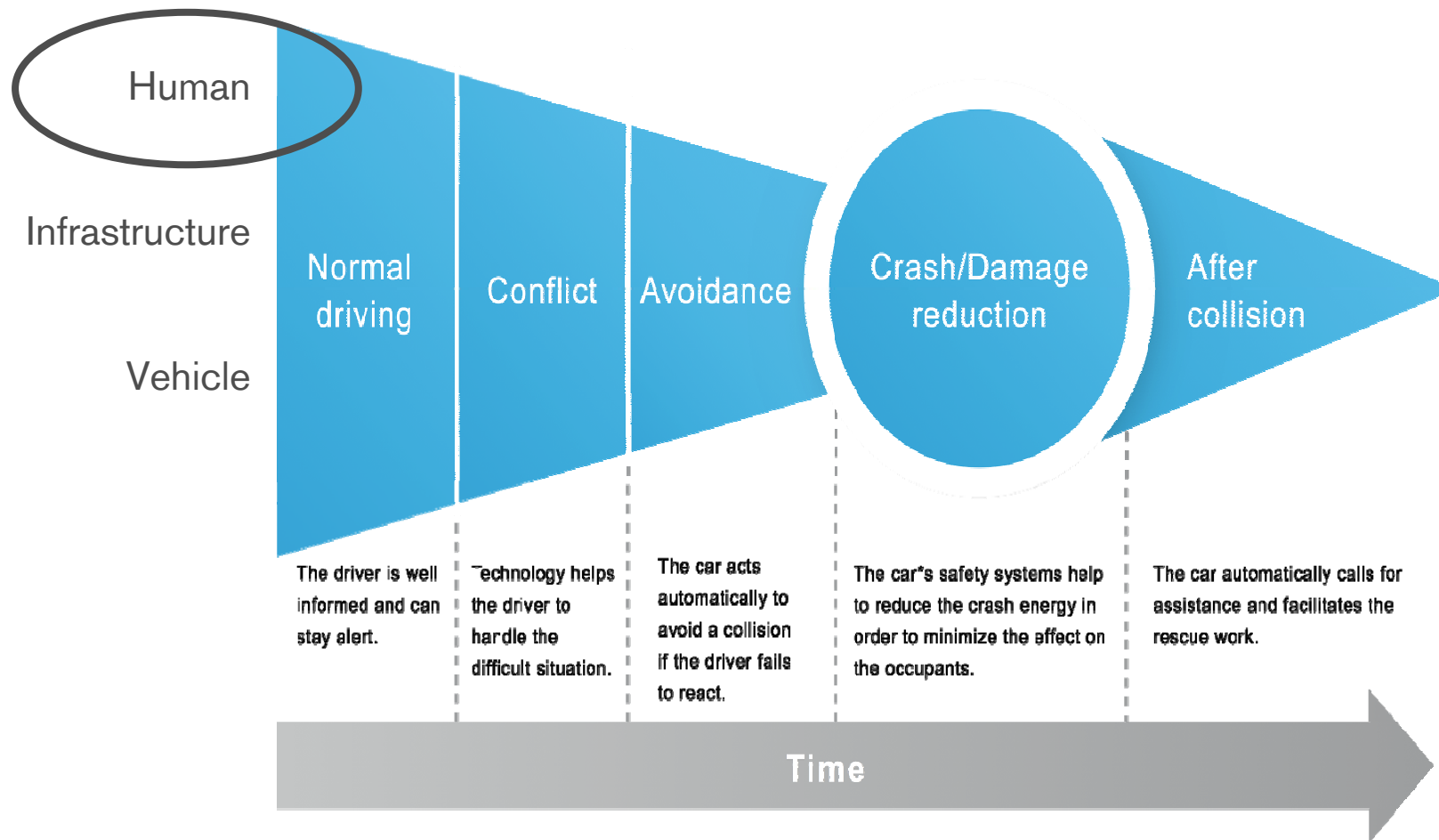
Information on:

- pre-crash scenario
- the crash
- the pedestrian
- the car
- the driver

Collection criteria: Modern Volvo cars, accidents since year 2000 in Sweden

To date: 359 pedestrians

VOLVO CARS APPROACH TO SAFETY



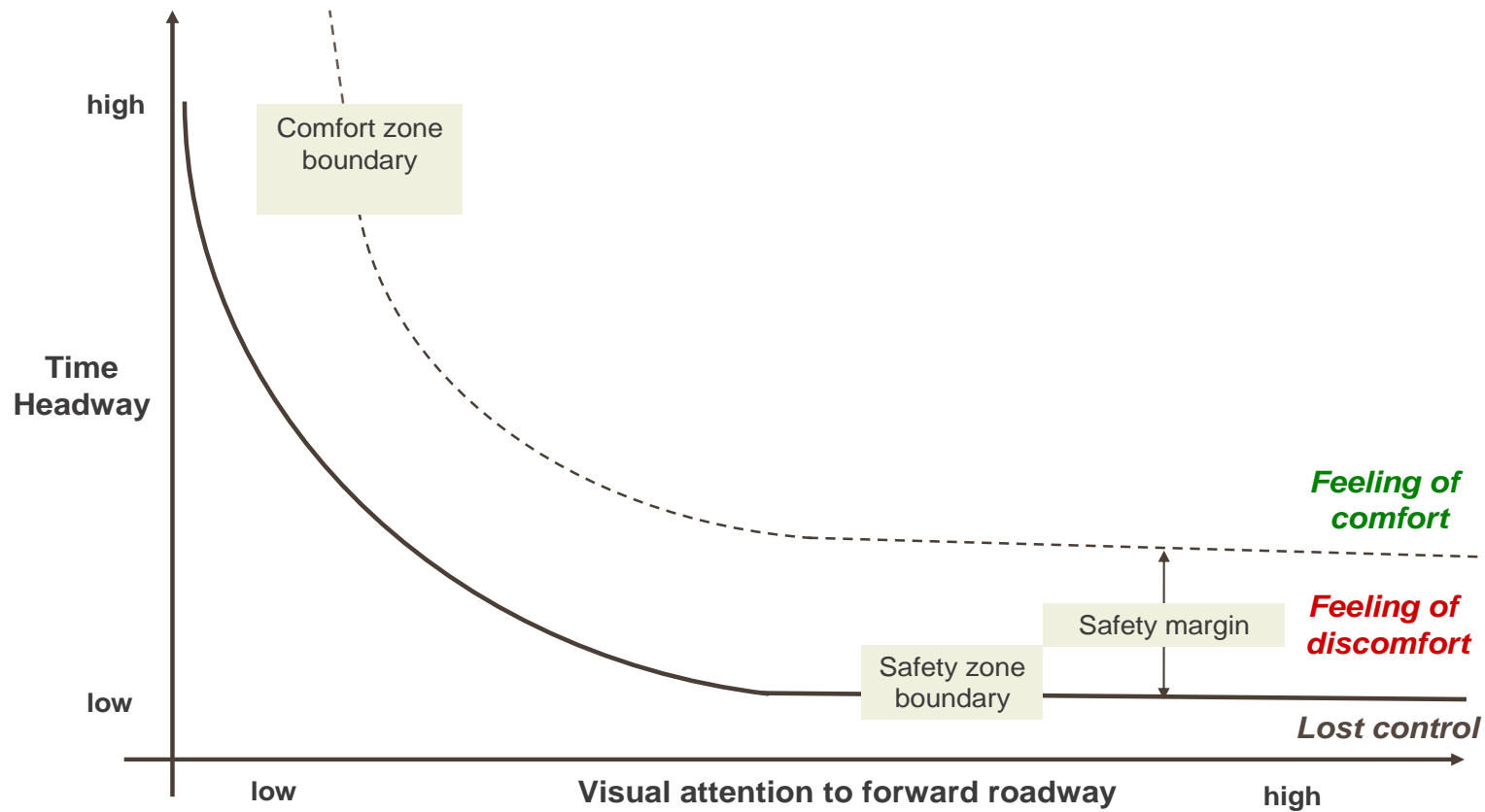
DRIVER BEHAVIOUR



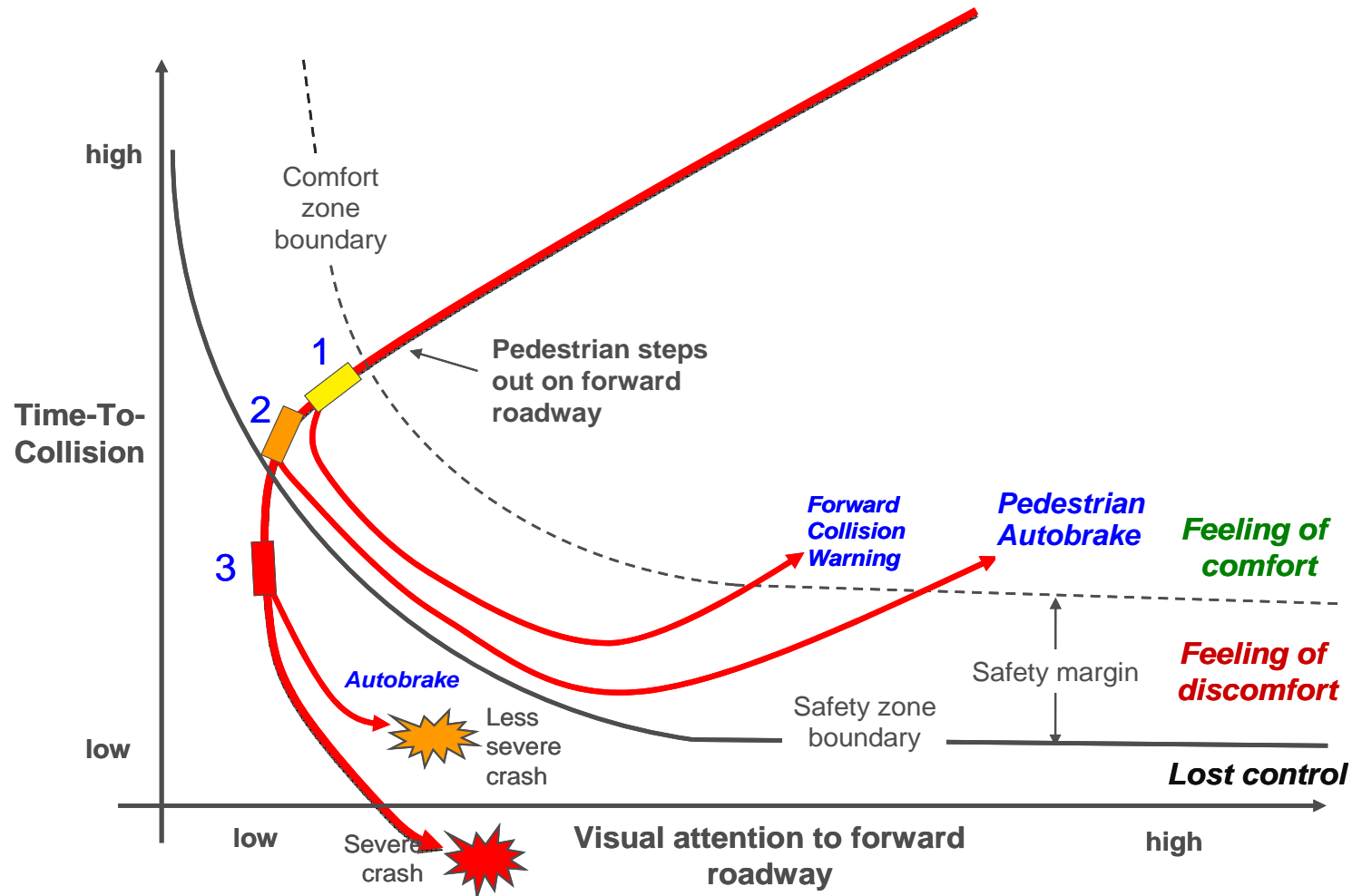
DRIVER BEHAVIOUR - A FRAMEWORK



Ljung Aust, M. and Engström, J.(2011) 'A conceptual framework for requirement specification and evaluation of active safety functions', Theoretical Issues in Ergonomics Science, 12: 1, 44 — 65,



EXAMPLE: VRU DETECTION AND AUTOBRAKE



VISUAL ATTENTION IN A CAR-PEDESTRIAN SITUATION



THE DRIVER & THE VRU BEHAVIOUR



VRU BEHAVIOUR IN 2012



“..teens and young adult pedestrians using headphones with injuries and fatal outcomes are described and have increased over the last 3 years.

..The danger in using headphones as a pedestrian may be explained by two phenomena: auditory masking of outside stimuli (environmental isolation) and distraction (inattentional blindness).”

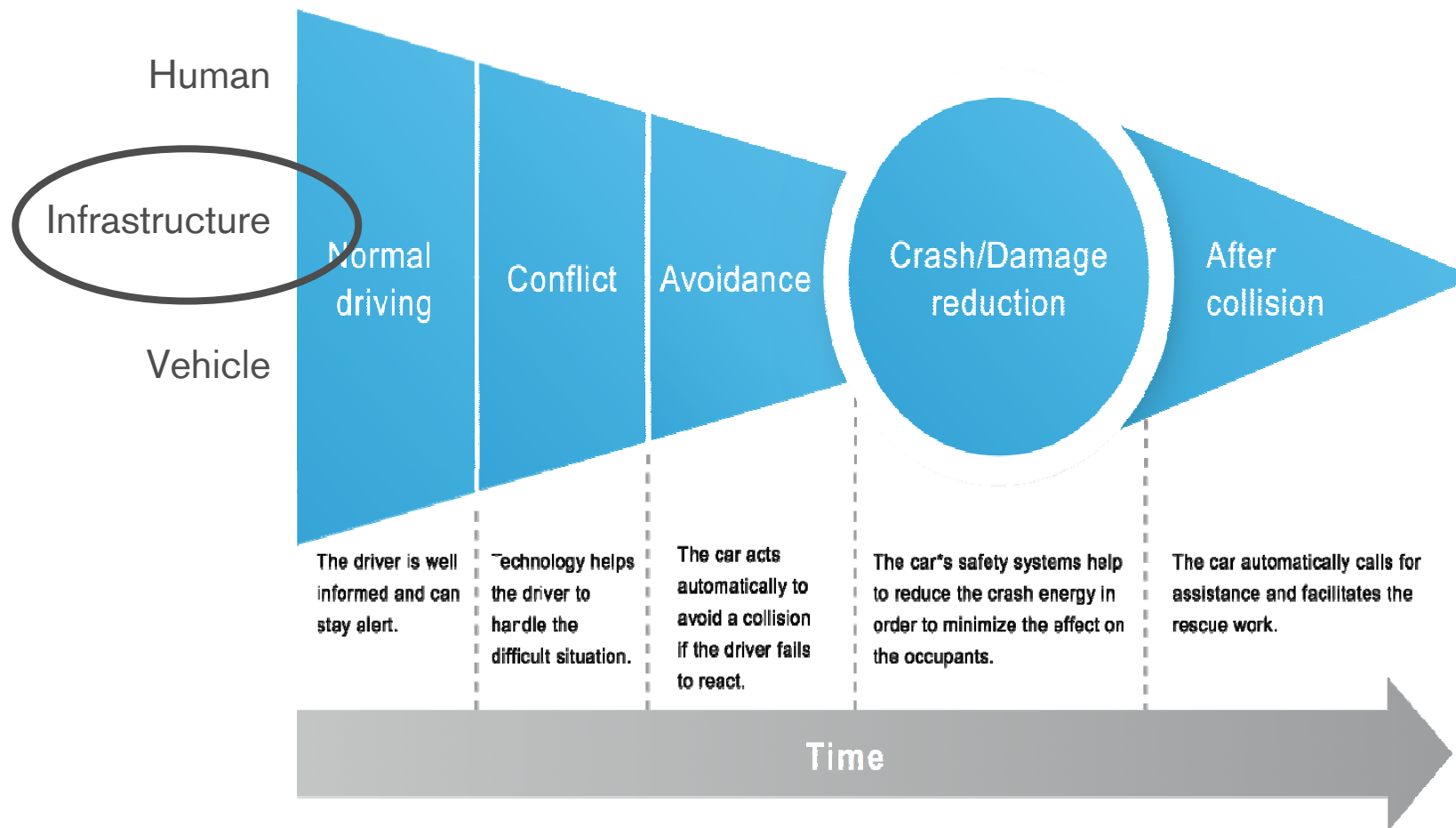
Lichtenstein, R. et.al., (2011), **Headphone use and pedestrian injury and death in the United States.**, <http://injuryprevention.bmj.com/content/early/recent>



..& in Sweden?
VRU's using nomadic devices – a prestudy.

Lead Trivector, [ref partners: VTI, Volvo Cars, the Swedish Transport Administration and the University of Lund]

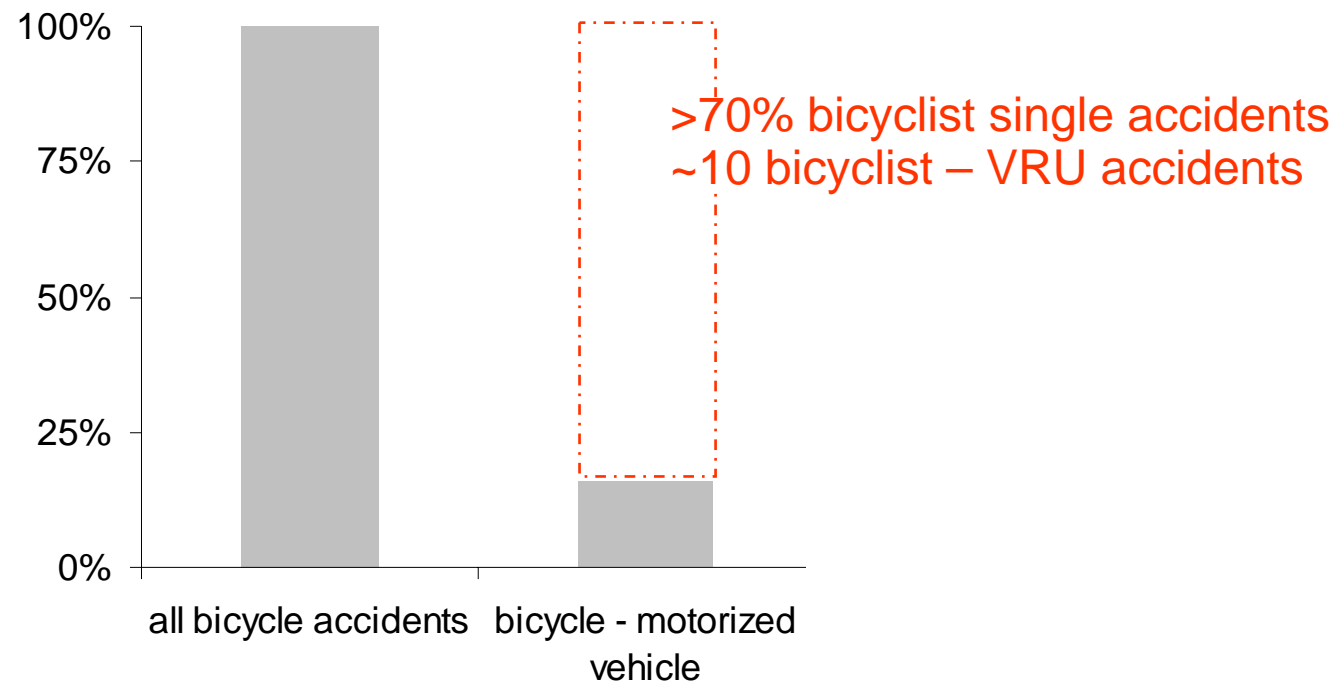
VOLVO CARS APPROACH TO SAFETY



BICYCLIST ACCIDENTS

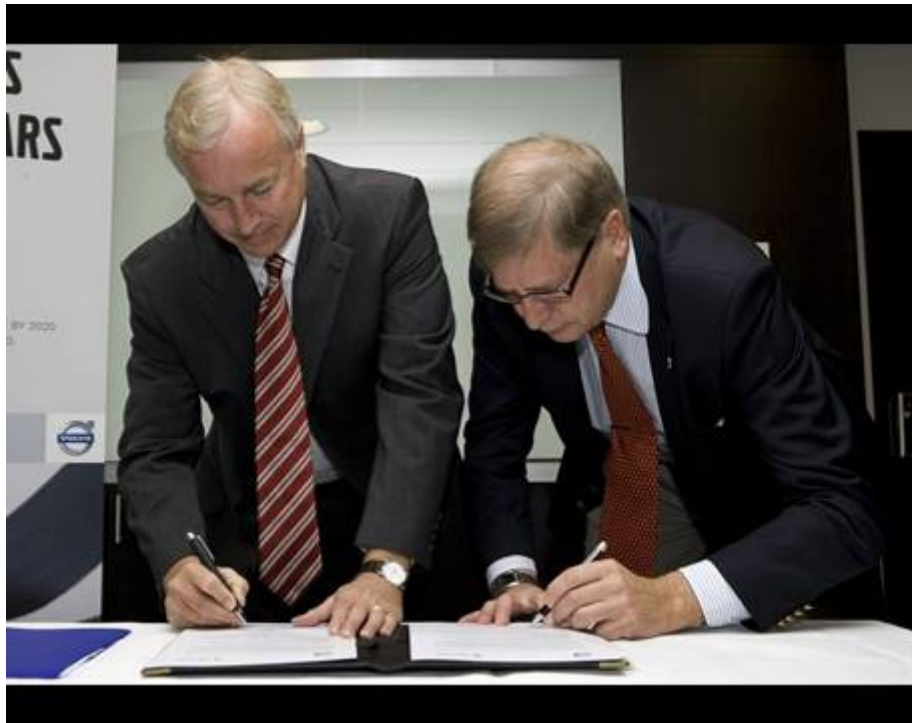


→ ~20% of all [hospital registred] bicyclist accidents occur with motorized vehicles



ref.: Thulin, H and Niska, A, (2009) **Tema Cycle – Injured cyclists. Analysis based on hospital registered injury information from STRADA.** VTI rapport 644

CO-OPERATION



Volvo Cars' President and CEO and the Swedish Road Administration's Director signing declaration of intent.

Volvo Car Corporation and the Swedish National Road Administration work together to avoid or lessen the effects of road accidents.

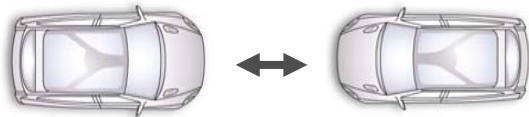
This is the thrust of the declaration of intent that Volvo Cars' President and CEO and the Swedish Road Administration's Director signed at the 8 September 2008.

SHARED RESPONSIBILITIES



Car manufacturers, governments and local authorities need a common view on the division of responsibilities.

Head-on accident situation:



< 80 km/h



> 80 km/h

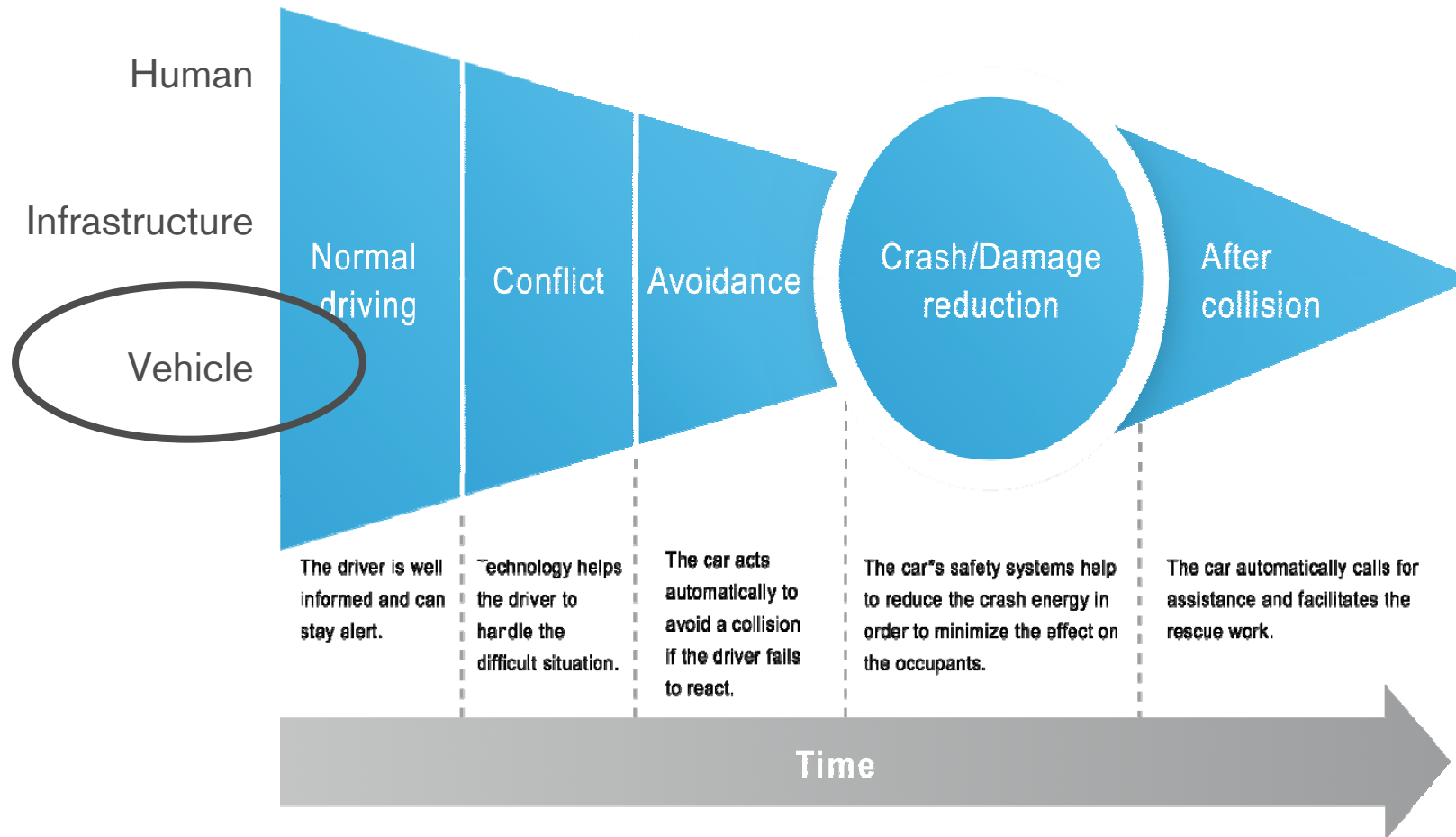


VRU accident situation:

- education
- infrastructure
- potential of vehicle safety systems



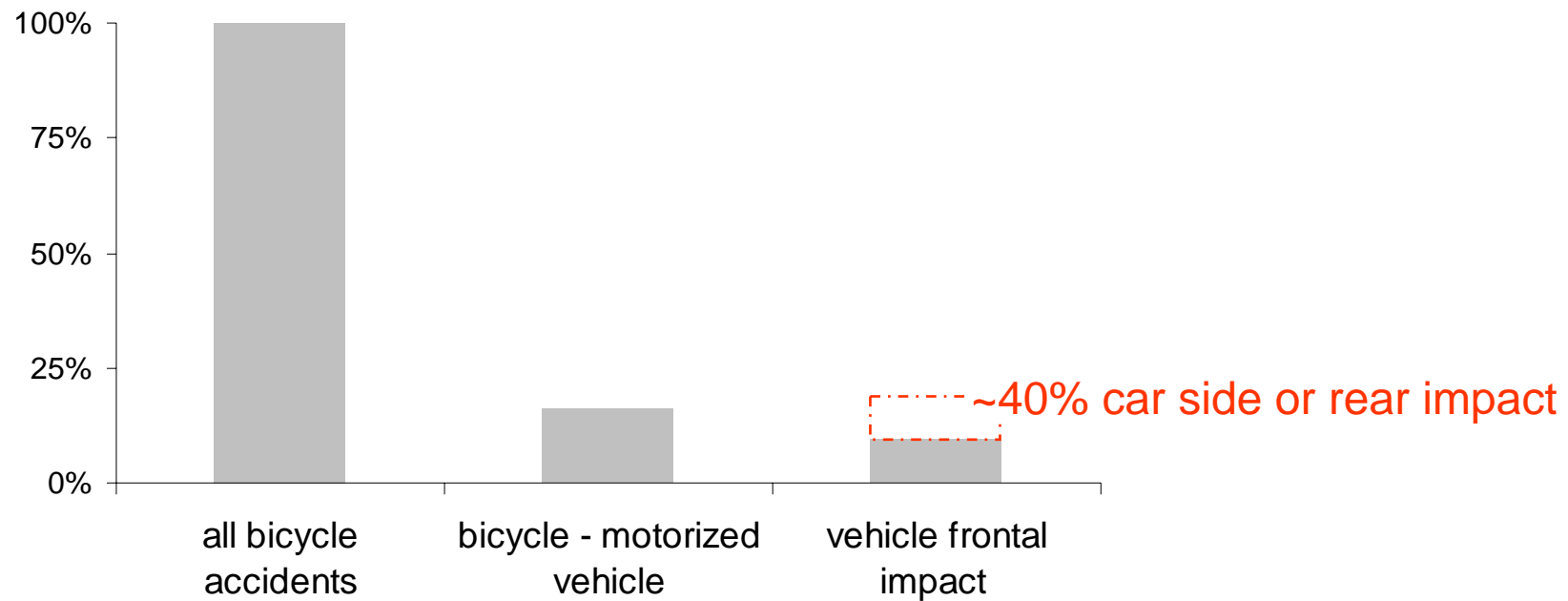
VOLVO CARS APPROACH TO SAFETY



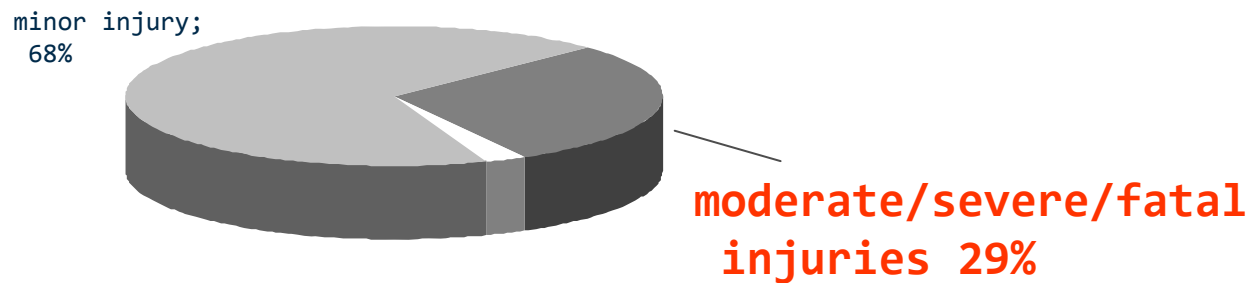
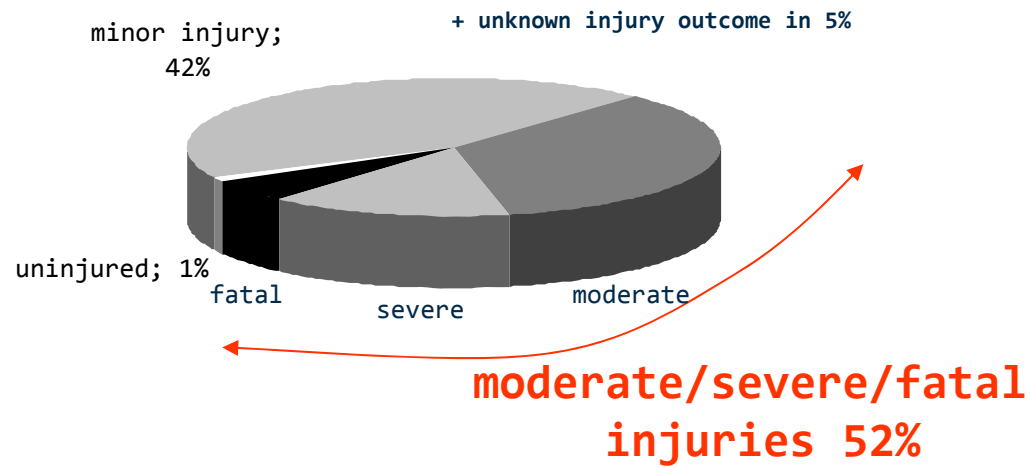
BICYCLIST ACCIDENTS



→ <10% of all bicyclist accidents occur with motorized vehicles having a frontal impact

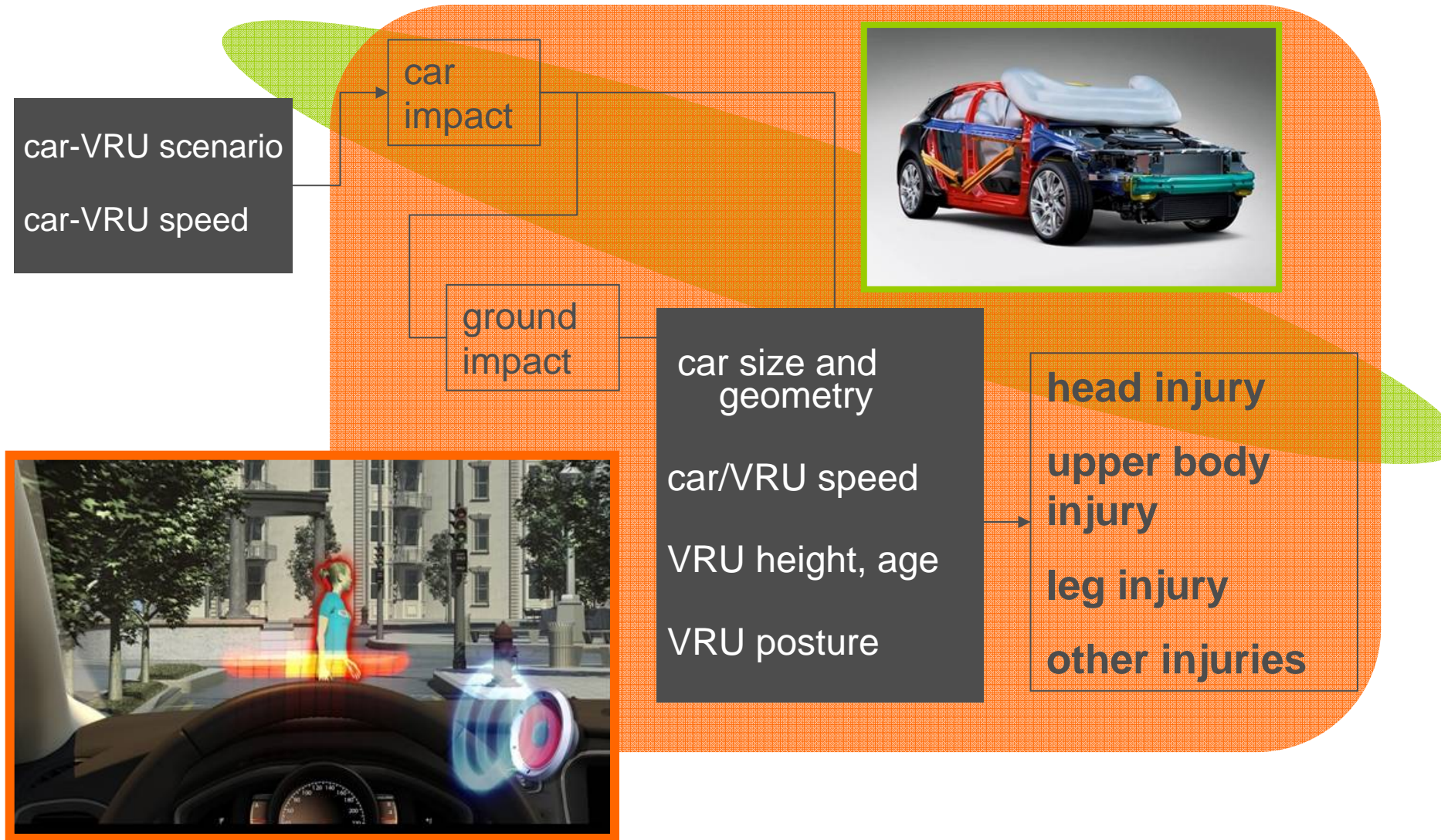


VRU MAXIMUM INJURY DISTRIBUTION IN ACCIDENTS WITH A VOLVO CAR IN SWEDEN



Volvo Car Bicycle Accident data provided by If Insurance Company P&C Ltd, for more information on similar data, see Irene Isaksson-Hellman (2012), **A Study of Bicycle and Passenger Car Collisions Based on Insurance Claims Data**, Proceedings of AAAM 2012

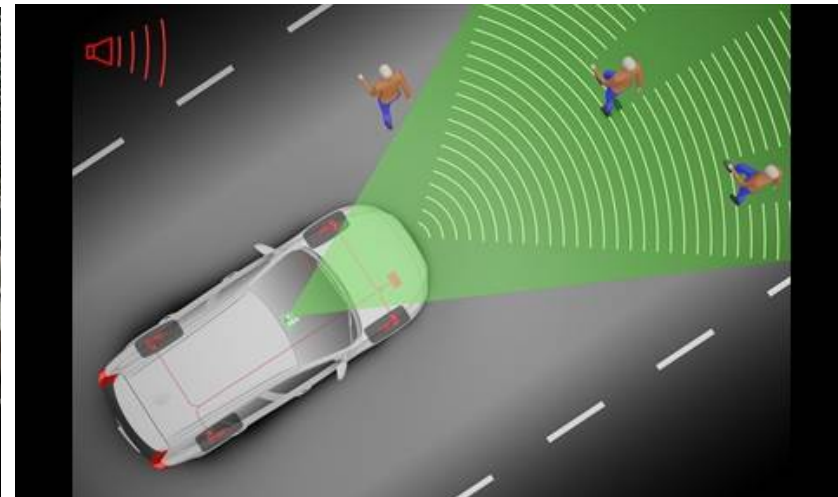
PREVENTING PEDESTRIAN INJURIES



Lindman, M., Ödblom, A., Bergvall, E., Eidehall, A., Svanberg, B., Lukaszewicz, T.,
2010. **Benefit Estimation Model for Pedestrian Auto Brake
Functionality.** ESAR, Hanover, Germany



PEDESTRIAN DETECTION & AUTOBRAKE



PEDESTRIAN DETECTION & AUTOBRAKE



VOLVO CARS TRAFFIC SIMULATOR (VCTS)



Modular simulation platform:

Traffic environment:

- Infrastructure
- Vehicles and pedestrians

Host vehicle:

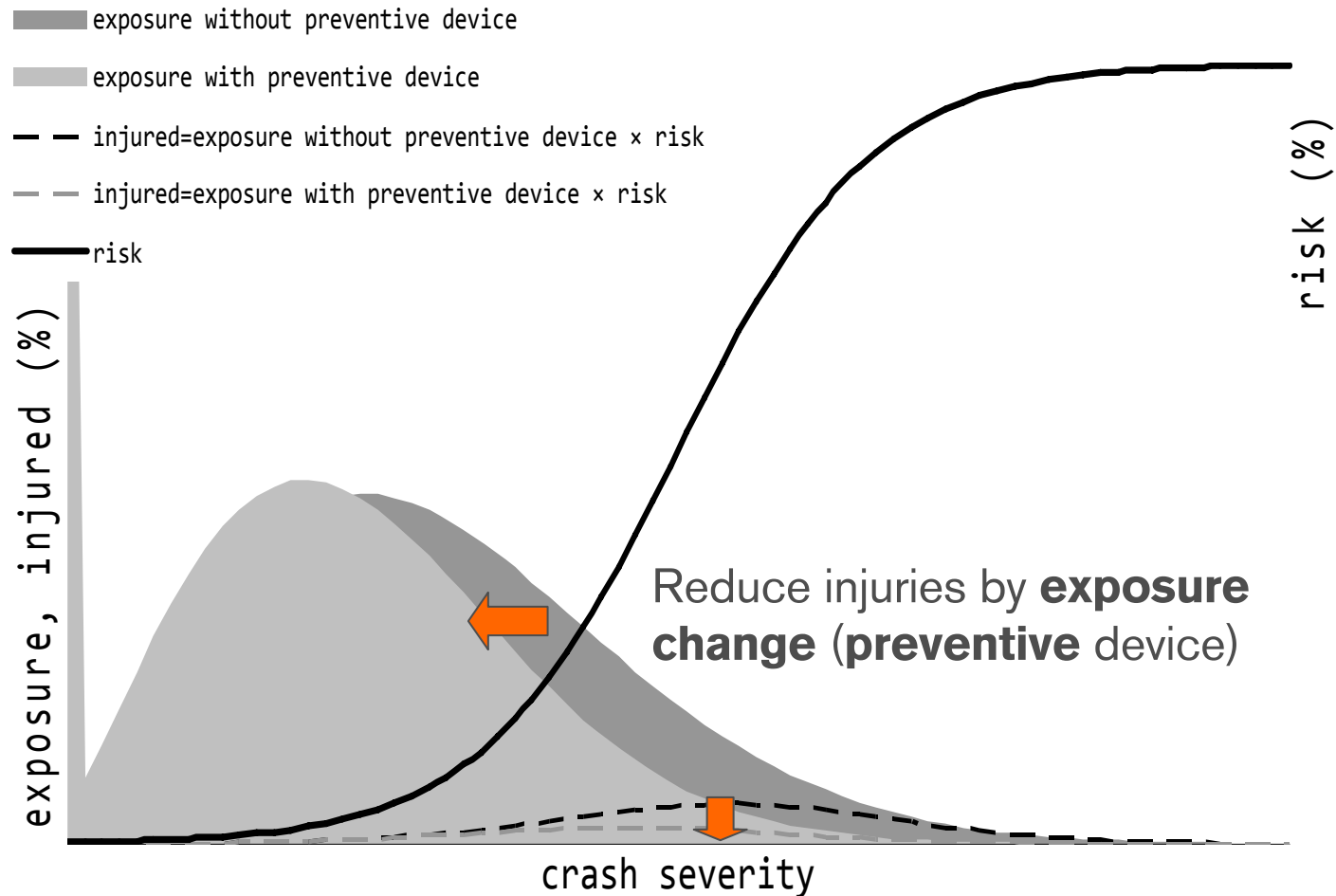
- Car model
- Sensor models
- **Preventive safety functions seamlessly integrated**

Driver behaviour model

THEORY: CHANGE IN CRASH SEVERITY (TO LOWER COLLISION SPEED) → INJURY REDUCTION



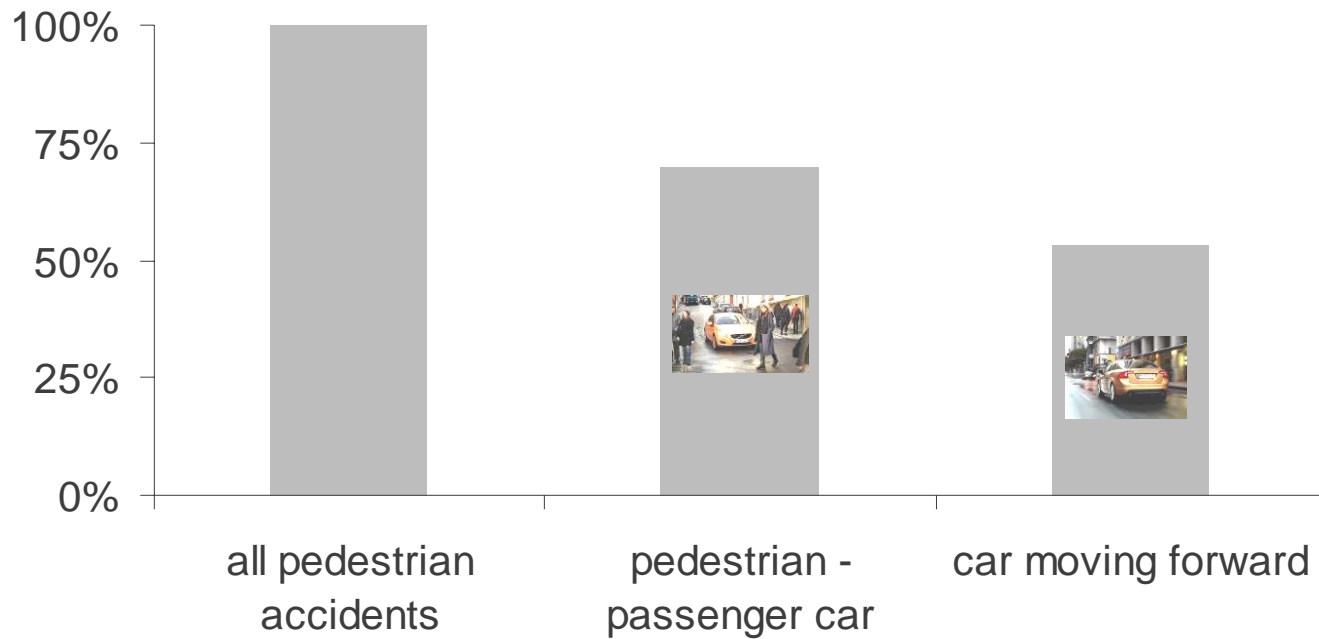
Korner, J., 1989. **A Method for Evaluating Occupant Protection by Correlating Accident Data with Laboratory Test Data.** SAE890747.



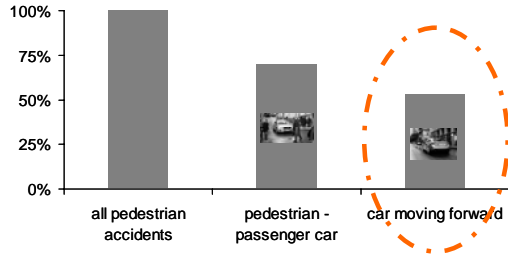
PEDSTRIAN ACCIDENTS



→ ~50% of all [police reported] pedestrian accidents occur with passenger cars driving forward

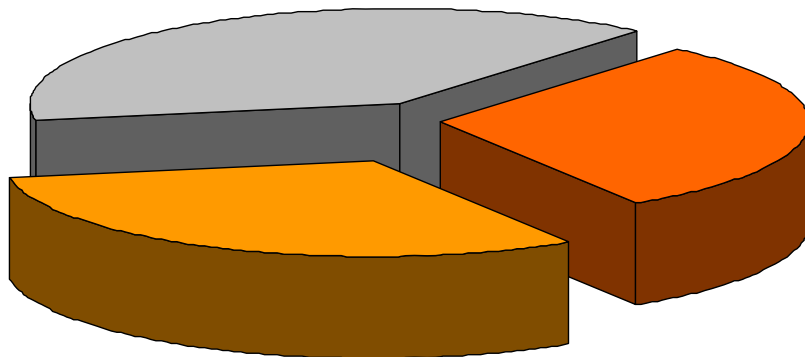


PREDICTED PEDSTRIAN ACCIDENT AND FATALITY REDUCTION WITH PEDESTRIAN DETECTION & AUTO BRAKE



PEDESTRIAN FATALITY REDUCTION

ACCIDENT REDUCTION



MITIGATION;
reduction of
impact speed
31%

AVOIDANCE; no
car-pedestrian
impact
30%



**Fatality
Reduction
24%**

Pedestrian Auto Brake

-potential;

- all car moving forward - accidents

-benefits predicted in

- **accident reduction** (reduced number of accidents, accidents with lower severity)
- **injury reduction, all body parts**



Pedestrian Airbag

-potential;

- injury risk reduction in certain car frontal impacts

-benefits predicted in

- **prevention of severe head and upper body injuries sustained at car impact**



..NEXT CHALLENGE



