Holland: VRU paradise goes for the next safety level

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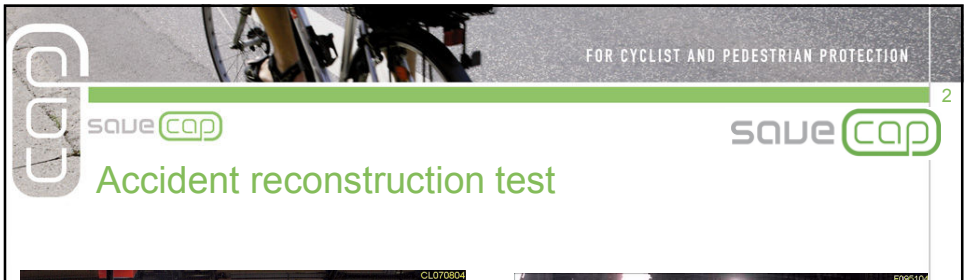
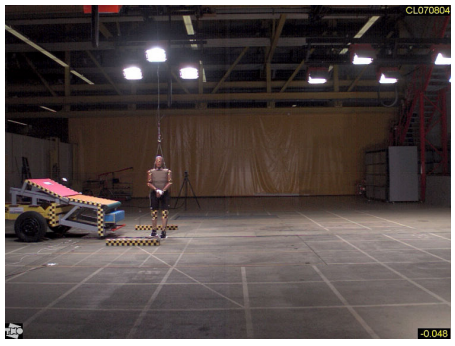
R. Fredriksson; E. Rosén; J. Olsson – Autoliv Reserach - S



Accident reconstruction test



Source: Aprosys

$V_{cyclist}$=12,5 km/h
$V_{vehicle}$=50 km/h

contact: stefanie.dehair@tno.nl

savecap

Aim SaveCAP project

- **Development of Vulnerable Road Users protection measures**

- Project commissioned by
  - the Dutch Ministry of Infrastructure and Environment
- and also supported by
  - the Swedish Government

- Project partners:

TNO Autoliv Centraal beheer achmea Fietsersbond

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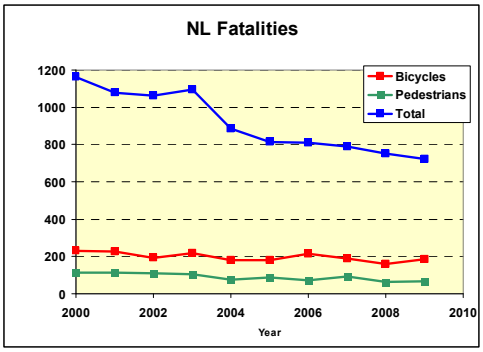
Project background (1)



Only the complete package will work

- Training
- Infrastructure
- Cyclist visibility and detectability and personal protection
- **Vulnerable Road Users (VRU) friendliness of the vehicle**

35% of fatalities are  **and 25%**  **(2009 figures Amsterdam)**

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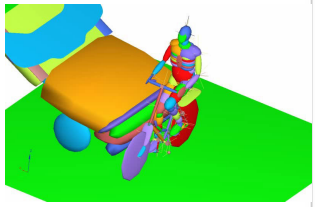
Project background (2)

- Conclusions of previous TNO work
  - Cyclists hit higher with their head on the windshield than pedestrians
  - Countermeasures for pedestrians are not always as beneficial for cyclists.

- Potential solutions (VRU protection measures)
  - Automatic braking
  - Airbag covering major injurious parts of the windshield and pillars



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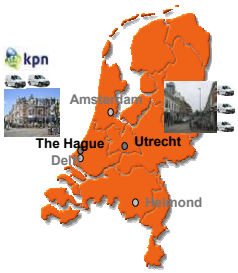
Steps taken so far & way to go



2012

Introduction in vehicle fleet

Broad EU support

EU Project AsPeCSS

Step 3: Demonstration of Proof of Concept

Proof that increased pedestrian and cyclist safety is within reach with the current vehicle fleet

2011

System testing in (pre)crash laboratory

Step 2: Development, field test

System development based on project specifications

Sensor Field Test

2010

Step 1: Specifications airbag and sensor system

2009

Accident Analysis

Computer simulation of cyclists' kinematics

Accident reconstruction tests

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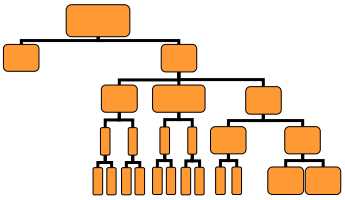
Type of accident cases in NL

Data used

- Dutch database (BRON) enriched with German database (GIDAS)



Approach

1. Target group determination
2. Matrix parameter analysis

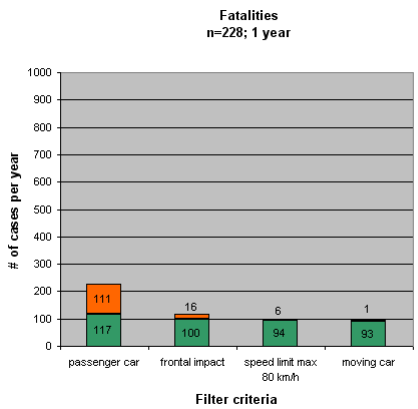
Parameters taken into account

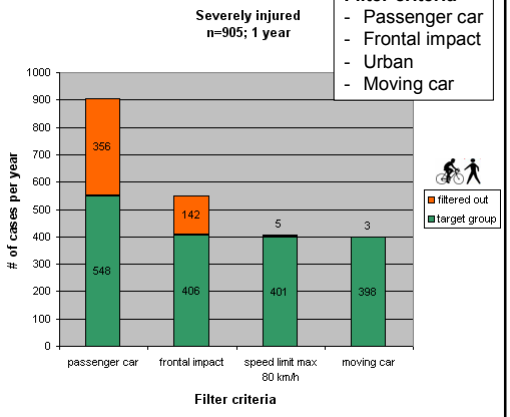
- Velocity
- Age
- Car braking (deceleration level)
- Head injury level
- Impact location
- Lighting conditions
- Percipitation

Source: NL data; BRON enriched with GIDAS

Target group determination (data filtering)

Filter criteria
- Passenger car
- Frontal impact
- Urban
- Moving car





Fatalities: 228 cases → **93 cases**

Sev. Injured: 905 cases → **398 cases**

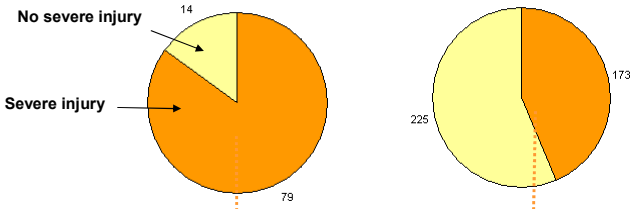
Source: NL data; BRON enriched with GIDAS

Head injury & head impact location

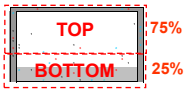
Fatalities
N=93; 1 year

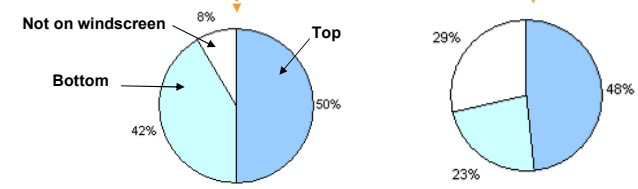
Severely injured
N=398; 1 year

Head injury level



Head impact location on WindScreen





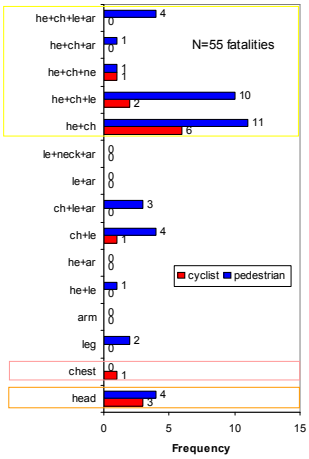
N=79; 1 year

N=173; 1 year

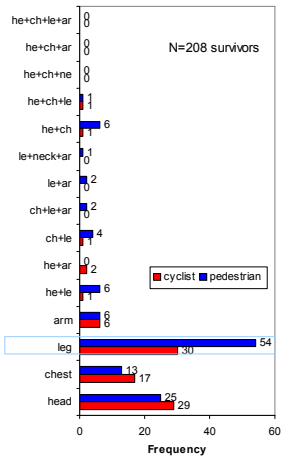
Source: GIDAS 1999-2008

Combination of AIS3+ injured body regions

Fatalities



Severely injured



Fatality rate:

- **80% VRUs with AIS3+ head and chest injury**
- **11% VRUs with AIS3+ head injury**
- **3% VRUs with AIS3+ chest injury**

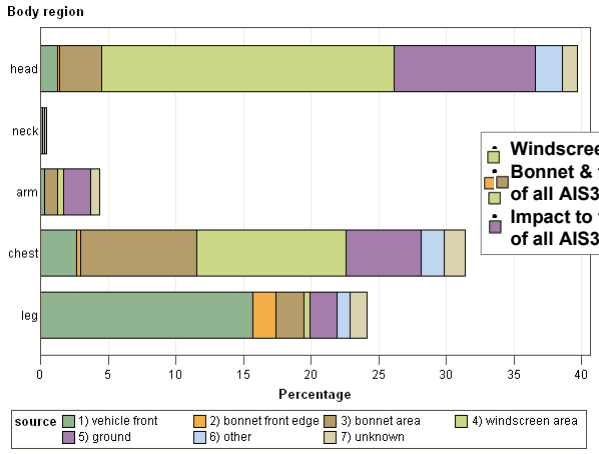
Severely injured

- **60% pedestrians with AIS3+ leg injury**
- **20% cyclists with AIS3+ leg injury**

Head = head + face
Chest = thorax, abdomen, spine

Source: GIDAS 1999-2008

Injury combination & causation



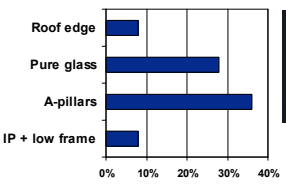
- **Windscreen area is main injury source**
- **Bonnet & full windscreen area adress 60% of all AIS3+ head and chest injuries,**
- **Impact to the ground constituted to 20% of all AIS3+ injuries.**

All AIS3+ body regions

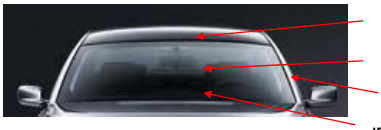
Source: GIDAS 1999-2008

Where do VRUs hit the windscreen

Pedestrian

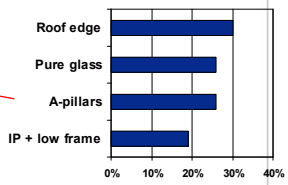


Severely injured
Head impact point



Bicyclist

(Preliminary results)



Conclusions

- SaveCAP: improving safety for cyclists and pedestrians in car impacts
- Countermeasure protecting either AIS3+ head or chest injuries would reduce fatality risk
- Cyclists suffer less from severe leg injury than pedestrians (car impact location)
- Windscreen area is the main injury source for all VRUs.
- Ground impact accounts for a minor share of all AIS3+ injuries
- Continuing work will offer close-to-accident information (worldwide missing so far), with positive impact on future developments for VRU protection