The SaveCAP project: Cyclist and pedestrian protection

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TNO

savecap

carhs.

BGS

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

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)**

10% of fatalities are **and 40%** **(2009 figures Berlin)**

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**

Steps taken so far

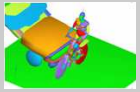
2012

2011

2010

Step 1: Specifications airbag and sensor system

Accident Analysis



Computer simulation of cyclists' kinematics

Accident reconstruction tests

2009

Cyclist models

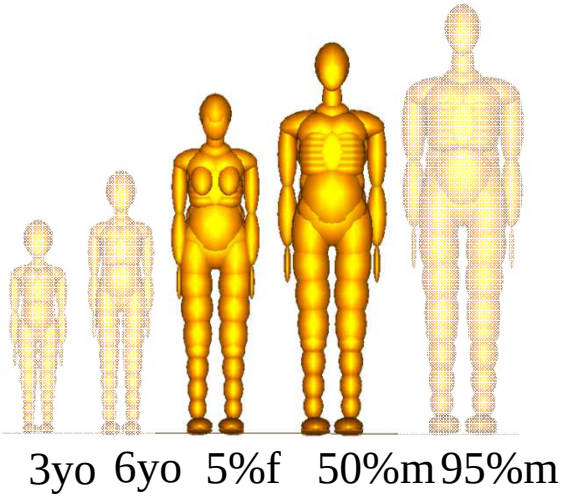
- 2 different anthropometries
  - Dutch male
  - Small female

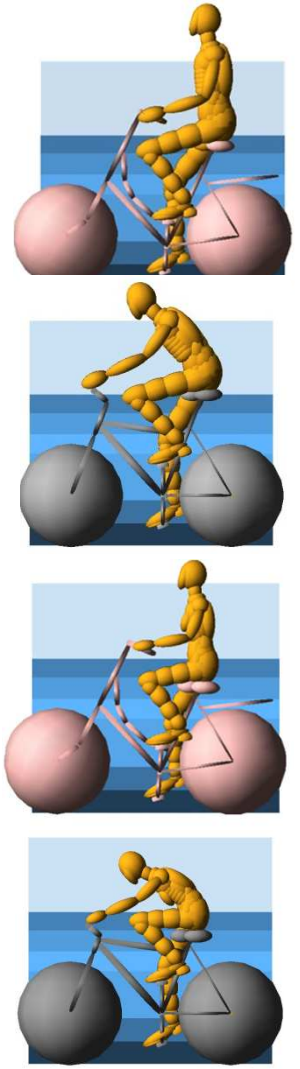
Bicycle models

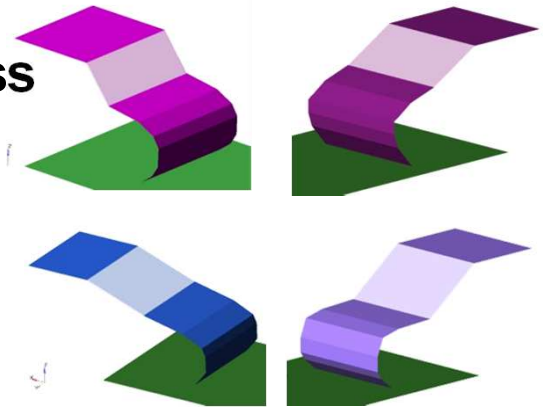
- Hybrid bicycle & granny bicycle
- Representative geometry & mass
- Steering motion possible
- Realistic wheel & front fork stiffness

4 Vehicle front categories

- Small / large bonnet
- Small / large windscreen angle







Computer simulations – Parameter variations

Vehicle type

- **geometry variation inside each vehicle class**
- **no variation in vehicle stiffness**
- **no variations in vehicle mass (1300 kg)**

Human reaction (driver & bicyclist)

- **no human reaction included**

Vehicle velocity

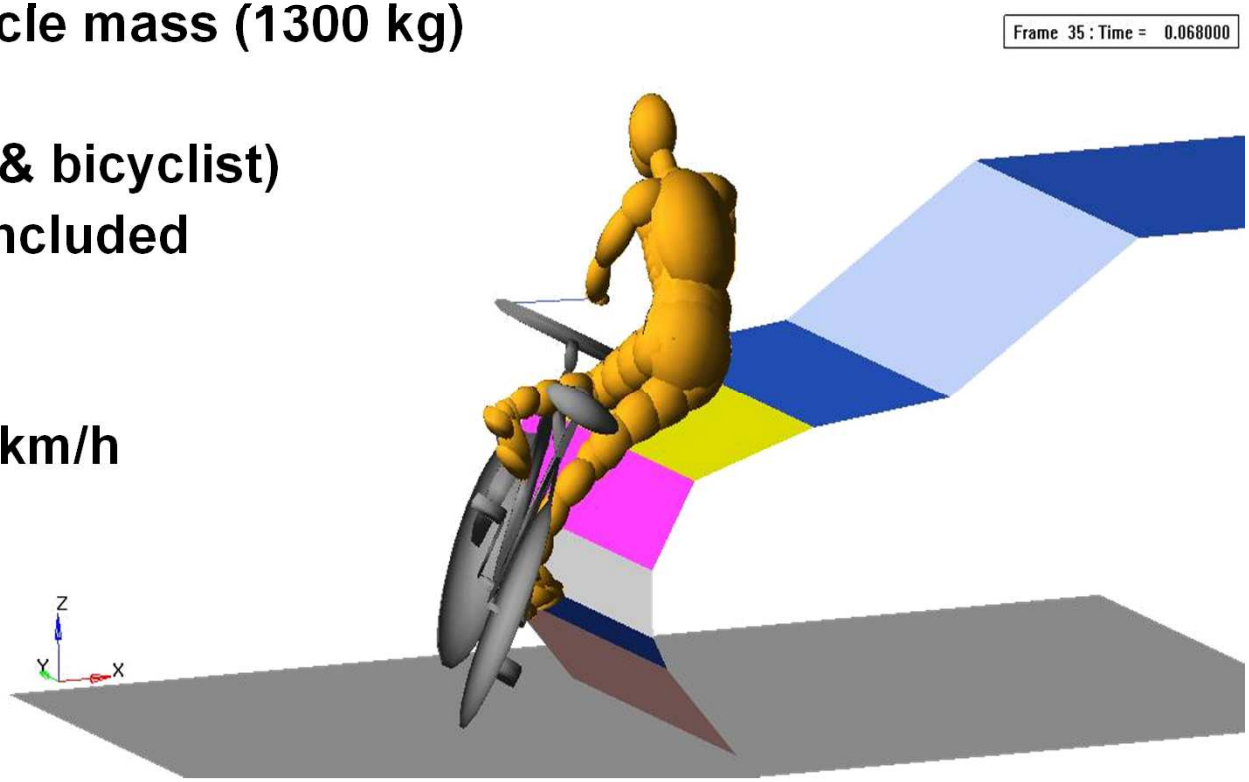
- **30, 40, 50, 60, 70, 80 km/h**

Cyclist velocity

- **18 km/h**

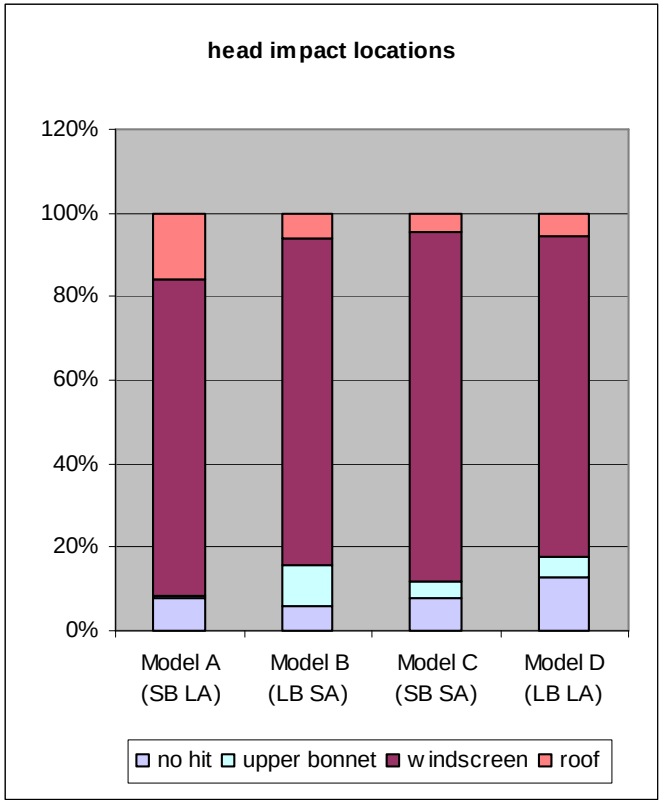
Cyclist posture

- **follows from bicycle type**

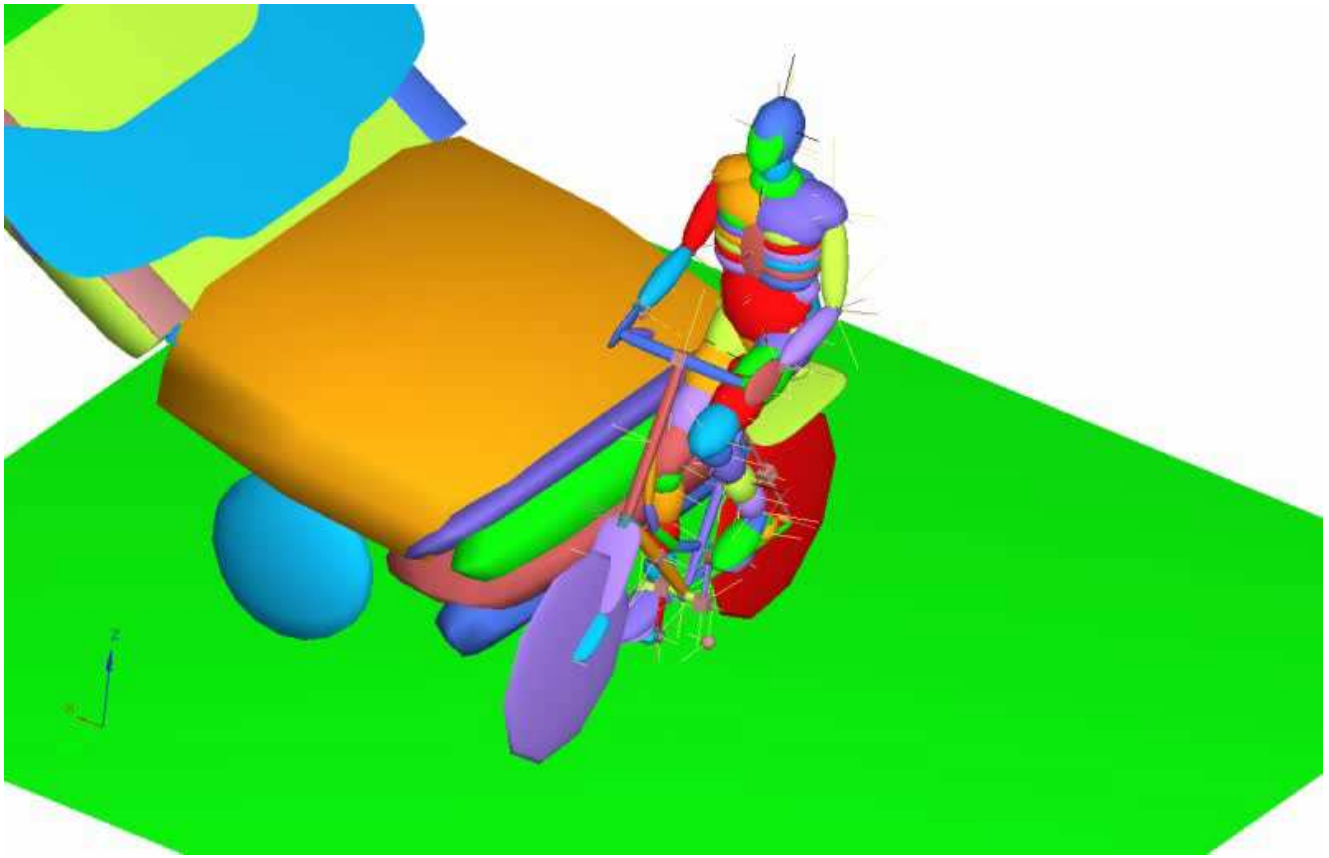


Computer simulations – general findings

- **Cyclists hit the car higher than pedestrians**
- **Windscreen = main impact location for all cyclists**
- **Influence of velocities, bicycle orientations and bicycle – cyclist combination is bigger than influence of car geometry**
- **Female on hybrid bicycle obtains higher accelerations than male on granny bicycle**
- **Lower bonnet (BLE) and lower cars in general result in lower pelvis and head accelerations**



Computer simulations



Steps taken so far & on-going steps

2012

2011

2010

2009

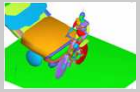
Step 2: Development, field test

System development based on project specifications

Sensor Field Test

Step 1: Specifications airbag and sensor system

Accident Analysis



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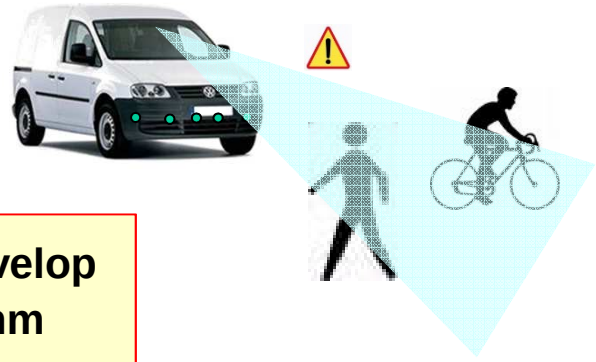
Sensor Field Test (SFT) setup

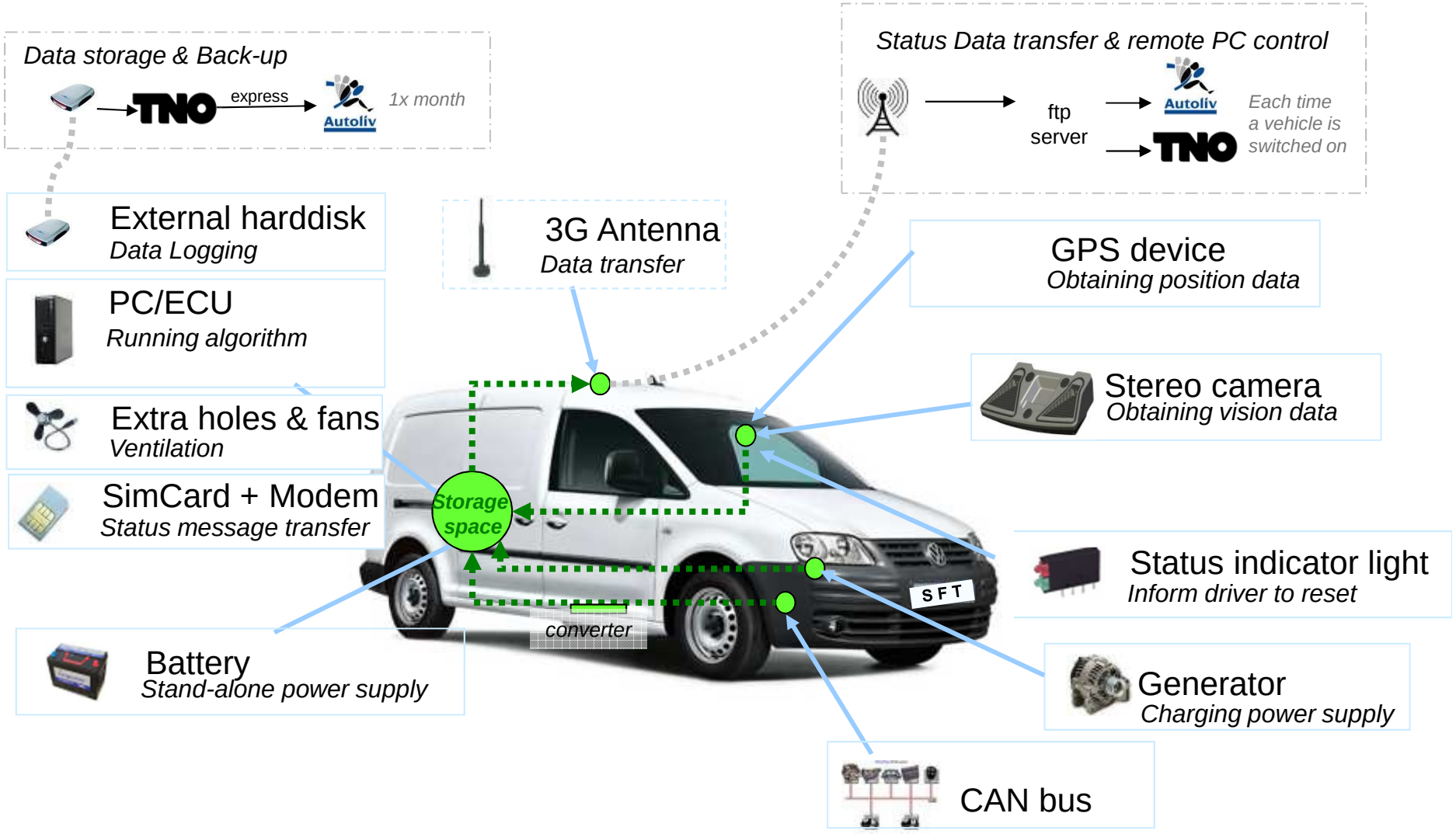


Capture video data of critical situations in order to develop sensor algorithm to optimize airbag trigger algorithm

- 5 equipped vehicles
  - ONLY Stereo camera, GPS, yawrate
  - NO Airbag, contact sensor, Active Braking
- collecting data in all weather conditions
- vehicles of KPN service fleet
- Volkswagen Caddy
- ~20.000 km/year
- Each vehicle has 1 driver

Started: November 2010

Equipment layout



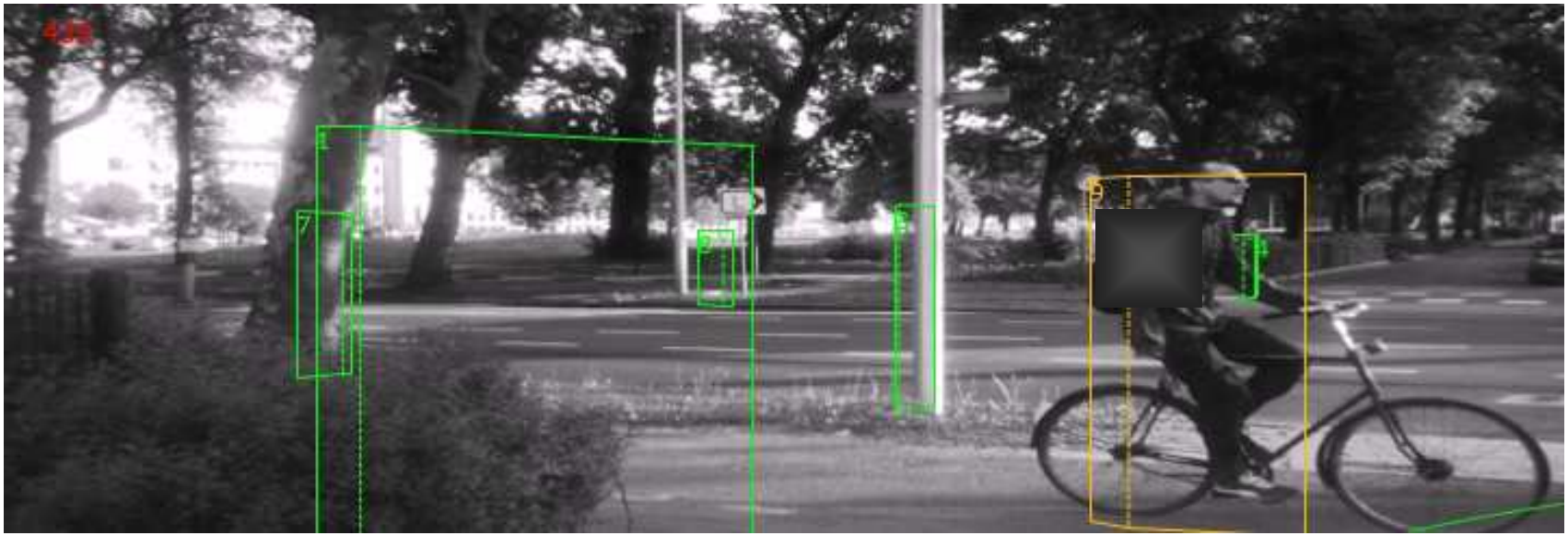
Preliminary results: Sequence 1

Sensor: critical situation
Reality: critical situation

Preliminary results: Sequence 2

Sensor: difficult situation
Reality: non critical situation

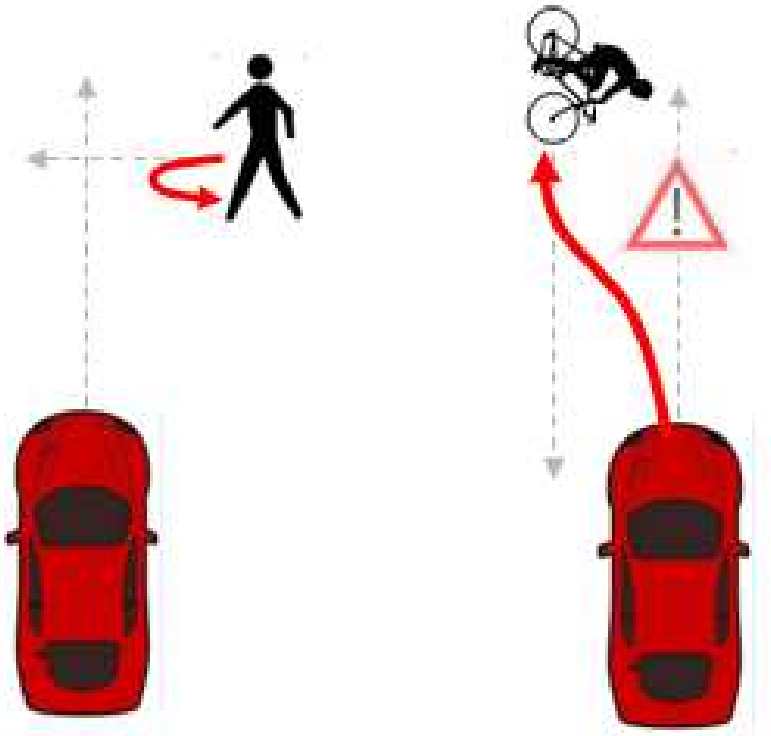
Example from SFT (1)



Example from SFT (2)

Robustness

- Minimise number of false triggers
- Correctly handle safe unexpected realistic situations



Steps taken so far & way to go

2012

2011

2010

2009

Step 3: Demonstration of Proof of Concept

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

System testing in (pre)crash laboratory

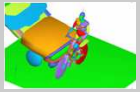
Step 2: Development, field test

System development based on project specifications

Sensor Field Test

Step 1: Specifications airbag and sensor system

Accident Analysis



Computer simulation of cyclists' kinematics

Accident reconstruction tests

Tests in Sweden

Full-scale dummy tests
- Reference tests
- Airbag tests

Component tests

Cyclist & Vehicle

Steps taken so far & way to go

2012

Introduction in the vehicle fleet

Continue research

Inform EU, NCAP

EU Project AsPeCSS

2011

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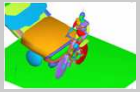

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Full Scale tests in Helmond (Sept 2012)

PreCrash tests in Helmond (Okt 2012)

VRU Safety Days (7 and 8 Nov 2012)

- **ASPECSS Workshop (7)**
- **International Cyclist Safety Conference (7&8)**
- **Demonstration of project results (includes crash test) (8)**


FOR CYCLIST AND PEDESTRIAN PROTECTION
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