Second exploitation workshop - collaboration with other H2020 projects

Deliverable 1.3

Second exploitation workshop - collaboration with other H2020 projects

Work package 1, Deliverable 1.3

Please refer to this report as follows:
Filtness, A., Thomas, P, Wijermars, W., Talbot, R., Magrin, A **(2016) Second exploitation workshop - collaboration with other H2020 projects, Deliverable 1.3 of the H2020 project SafetyCube.**

Grant agreement No 633485 - SafetyCube - H2020-MG-2014-2015/ H2020-MG-2014_TwoStages

Project Coordinator:
Professor Pete Thomas, Transport Safety Research Centre, Loughborough Design School, Loughborough University, Ashby Road, Loughborough, LE11 3TU, UK

Project Start date: 01/05/2015

Duration: 36 months

Organisation name of lead contractor for this deliverable:
Loughborough University, UK LOUGH

Report Author(s):
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Wijermars, W (SWOV); Netherlands

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Project co-funded by the by the Horizon 2020 Framework Programme of the European Union
Version: Final
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Co-funded by the Horizon 2020
Framework Programme of the European Union

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Executive summary

SafetyCube was one of five projects to be funded under the H2020 Topic MG-3.4-2014 Traffic Safety Analysis and Integrated Approach towards the Safety of Vulnerable Road Users. The five projects were invited by the European Commission to explore the possibilities to cooperate with regards to technical work and dissemination.

The technical work of the five projects has been diverse but collaborations, when appropriate, have taken place between SafetyCube and other projects (PROSPECT, InDeV, XCYCLE, SENIORS). In particular SafetyCube and InDeV worked closely together to gather information on the costs of crashes in European countries.

The collaborative activities that took place during the final two years of the SafetyCube project are summarised as follows:

- Specific Joint Work Package meetings with InDeV in relation to the estimation of accident costs
- Joint session at 5th International Cycling Safety Conference, Bologna November 2016
- Joint session at the 1st European conference for Results from road transport research in H2020 projects, Brussels November 2017
- Joint Session at Transport Research Arena Conference, Vienna April 2018
- Invitations to other projects to join the midterm workshop and DSS launch
- Invitations to attend and take part in the poster exhibition of the SafetyCube Conference, Vienna March 2018

1 Introduction

1.1 SAFETYCUBE

Safety CaUsation, Benefits and Efficiency (SafetyCube) is a European Commission supported Horizon 2020 project with the objective of developing an innovative road safety Decision Support System (DSS) that will enable policy-makers and stakeholders to select and implement the most appropriate strategies, measures and cost-effective approaches to reduce casualties of all road user types and all severities.
SafetyCube aims to:

1. develop new analysis methods for (a) Priority setting, (b) Evaluating the effectiveness of measures (c) Monitoring serious injuries and assessing their socio-economic costs (d) Cost-benefit analysis taking account of human and material costs
2. apply these methods to safety data to identify the key accident causation mechanisms, risk factors and the most cost-effective measures for fatally and seriously injured casualties
3. develop an operational framework to ensure the project facilities can be accessed and updated beyond the completion of SafetyCube
4. enhance the European Road Safety Observatory and work with road safety stakeholders to ensure the results of the project can be implemented as widely as possible

The core of the project is a comprehensive analysis of accident risks and the effectiveness and cost-benefit of safety measures focusing on road users, infrastructure, vehicles and injuries framed within a systems approach with road safety stakeholders at the national level, EU and beyond having involvement at all stages.

1.1.1 Work Package 1

WP1 deals with the overall coordination of the project and the administrative work required for monitoring the progress of the project.

WP1 comprises a single task, Project Management, which runs continuously through the duration of the project. It is conducted by the Project Coordinator, Loughborough University (LOUGH), and comprises the following activities:

<u>Provision of administrative and contractual infrastructure for project partners</u>

- Liaison with European Commission concerning any contract amendments
- Preparation of Consortium Agreement and any amendments
- Periodic and final project reporting to European Commission
- Distribution of project partner payments
- Routine monitoring of partner time and budget expenditure

<u>Coordination of project activities</u>

- Chair of project Steering Committee
- Maintaining focus on project objectives
- Monitoring of project progress against time-plan, adjustments to activities as required
- Scrutiny of dependencies between Work Packages, identification of obstacles and opportunities

<u>Communication</u>

- Routine communication with European Commission as required
- Communication between partners – direction of project, achievements and progress
- Coordination of annual project plenary meeting
- Representing the Project to the external reviewers
- Coordination of end of project conference

• Representing project to external groups including related H2020 and national projects

Quality Assurance

The Coordinator is responsible for managing the project procedures to ensure the quality of the results and deliverables. A quality assurance procedure has been established to ensure that each deliverable conforms to the specifications laid down in the Work Package descriptions and fully addresses the project objectives to advance the state of knowledge concerning accident causation, risks and the effectiveness of measures. Every member of the partnership is invited to support this QA process, as established in the Deliverable Review Process document. External reviews will also be conducted by external expert for those deliverables considered fundamental. Members of the group will also be invited to conduct an annual review of the progress of the full project against the work plan and expected quality criteria.

Risk management

The Coordinator has the responsibility to maintain the project risk management plan. The first version of the plan is included in the Proposal. Should any unexpected high impact events occur during the course of the project the plan may need further updating. The plan is expected to represent the responses needed by the project team should adverse events occur that impact on the success of the project. The coordinator will establish a monitoring procedure to detect problems at an early stage in sufficient time to react optimally.

Legal and ethical issues

Legal questions may arise at any time during the project. Normally these may be difficulties with legal changes affecting partners, changes of legal status or financial issues. There may be some aspects of the project that initiate ethical considerations although none have been identified at the current time. Many of these issues may need to be addressed under the guidelines laid down in the Consortium Agreement and some may need amendments to the Grant Agreement. The Project Coordinator will ensure there is sufficient legal oversight of the project to enable all of these issues to be addressed properly, maintain full communication with the relevant project partners and where necessary the European Commission, and will ensure that obstacles are addressed rapidly and efficiently by the project team.

During the project contract finalisation phase the SafetyCube team were informed of four other research projects to be funded under the same topic MG-3.4-2014 Traffic Safety Analysis and Integrated Approach towards the Safety of Vulnerable Road Users and were invited to explore opportunities for synergies and collaboration. The projects and Co-ordinating organisations are as follows:

InDeV	In-Depth understanding of accident causation for Vulnerable road users	Lund University, SE
PROSPECT	PROactive Safety for PEdestrians and CyclisTs	IDIADA, ES
SENIORS	Safety-ENhancing Innovations for Older Road userS	BASt, DE
XCYCLE	Advanced measures to reduce cyclists' fatalities and increase comfort in the interaction with motorised vehicles	University of Bologna, IT

1.2 PURPOSE OF THIS DELIVERABLE

The SafetyCube project team has conducted liaison activities with the four other MG 3.4 projects during the project. Initial activities were described in Deliverable 1.1. The current brief management report describes the further engagement between the SafetyCube team and the other projects. It does not report on any further engagement between the projects that does not involve SafetyCube.

2 Summary of project liaison activities

This chapter describes the inter-project engagement activities undertaken by the SafetyCube team in years 2 and 3 of the project and the outcomes in terms of project synergies.

Liaison activities between SafetyCube and other projects have taken place using a top down approach, based on interaction between Project Coordinators, and a bottom up approach based on communications between project partners.

As a result of the activities outlined in Deliverable 1.1 a strong working relationship has been formed between SafetyCube and **InDeV** - In-Depth understanding of accident causation for Vulnerable road users - (Aliaksei Laureshyn, Lund University). This has resulted in joint effort on technical work for both projects. The established working relationship with other projects has also been maintained through engagement in SafetyCube stakeholder interaction activities.

2.1 SYNERGIES BETWEEN SAFETYCUBE AND INDEV TECHNICAL WORK

Both SafetyCube and InDeV planned to collect information on costs of crashes in different European countries. To make sure decision makers have the best available information and to prevent sending two similar questionnaires to crash costs experts in different countries, it was decided to join efforts. Researchers from SafetyCube and InDeV formed a working group that was responsible for developing and distributing a questionnaire for collecting information on cost of crashes in 32 European countries. The working group (Figure 1-1) had two physical meetings and several phone meetings to discuss the development of the questionnaire and distribution of tasks.

Figure 2-1 Joint working group consisting of SafetyCube and InDeV partners (Wim Wijnen and Rune Elvik are not in the picture).

Figure 1-1 shows the workflow for the joint InDeV-SafetyCube survey. On the basis of the information needs from both SafetyCube and InDeV, a questionnaire was designed. The SafetyCube literature review of international guidelines was used to determine for which cost components and cost items information should be collected and which possible methods should be distinguished. Using the SafetyCube framework, InDeV subsequently designed a first version of the Excel questionnaire that was discussed and adapted with input from SafetyCube.

SafetyCube and InDeV together identified crash cost experts in all 32 European countries (28 EU member states + Iceland, Serbia, Norway and Switzerland) for which we wanted to collect crash cost information. At the request of InDeV, a number of non-EU countries were also included, however within SafetyCube we focus only on the European countries. The countries were subsequently distributed among the SafetyCube and InDeV partners that were involved in the relevant Tasks and partners were asked to search for information on crash cost in the countries they were responsible for. On the basis of the available information, the responsible partner pre-filled the questionnaire for the relevant country and contacted the crash cost expert to check and complete the information. Finally, a first round of validation was performed with a few key indicators (e.g. percentage of GDP of total crash costs) and the respective experts were contacted again in case of suspected errors. As the InDeV project has a focus on vulnerable road users, selected experts were asked for possible additional cost information for this subgroup of road crashes.

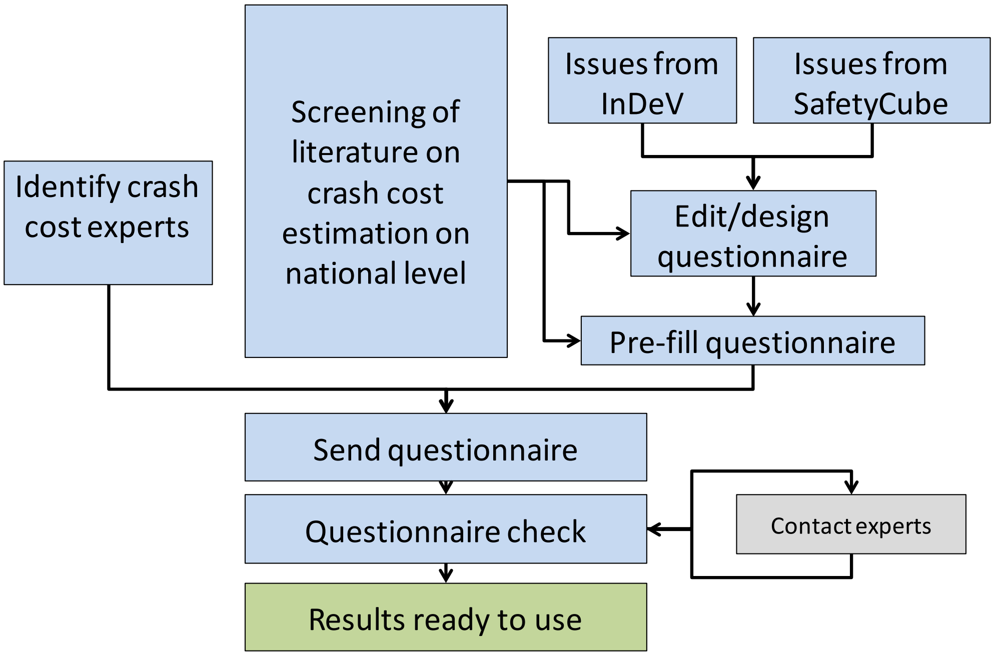

Figure 2-2 Workflow for joint InDeV-SafetyCube Survey (© InDeV)

The joint work did not include analyses of the collected information. The analyses were conducted in the two projects separately. InDeV focused on a comparison of calculations between countries with emphasis on the definition of injury categories, components included, methods applied, databases used, the consideration of VRU and underreporting. Results are reported in InDeV Deliverable 5.1 (Kasnatscheew, A., et al., 2016). SafetyCube focused on providing various cost estimates - e.g. total costs as a percentage of GDP, costs per fatality, costs per serious injury- for different countries. Results are reported in Deliverables 3.2 (Wijnen, W. et al., 2017) and Deliverable 7.3 (Schoeters et al., 2017). In addition to cost estimates for different countries, Deliverable 3.2 also provides guidelines for the estimation of crash costs as well as comparable estimates based on value transfer.

Deliverable 7.3 focuses on costs related to serious road injuries and also covers a more detailed analysis of medical costs, costs related to production loss and human costs of serious road injuries.

2.2 OTHER PROJECTS PARTICIPATION IN SAFETYCUBE STAKEHOLDER ACTIVITIES

Representatives of the MG 3.4 projects were invited to attend and take part in the SafetyCube dissemination and stakeholder consultation exercises. Although not all were available to attend events, SENIORS was represented at the midterm workshop where the concept of the SafetyCube Decision Support System (DSS) was first presented and representatives from PROSPECT attended the DSS official launch. In addition representatives from XCYCLE, PROSPECT and SENIORS attended the final conference and took part in the poster exhibition (See Appendix 1).

Figure 3: Poster Exhibition, SafetyCube Conference, Vienna 2018

2.3 JOINT EXTERNAL ACTIVITES

2.3.1 International Cycling Safety Conference 2016 – Joint MG 3.4 projects session

The MG 3.4 projects were invited to present in a session of the 5th International Cycling Safety Conference, Bologna, 2-4 November 2016. Presenters were asked to talk about the aspects of their work that relate to cycle safety and the session was entitled "Cycling Safety in EU-Funded Projects". The presentations were as follows:

- InDeV Project, Aliaksei Laureshyn – Department of Technology & Society, Faculty of Engineering, Lund University
- SENIORS Project, Marcus Wish - Passive Safety, Biochemanics, Federal Highway Research Institute (BASt)
- PROSPECT Project, Andrè Aparicio – Advance Driver Assistance Systems, IDIADA
- XCYCLE Project, Nicolò Decarli & Gabriele Prati – Alma Mater Studiorum University of Bologna

- SafetyCube Project, Pete Thomas – Safe and Smart Mobility Research Cluster, Loughborough University

2.3.2 1st European conference – Results from road transport research in H2020 projects – joint session

In November 2017, for the first time, a conference was organised by ERTAC-EGVIA with the support of the European Commission to disseminate the results from road transport research in H2020 projects. The MG3.4 projects took place in a joint session entitled 'Safety' and the following presentations were given:

- SafetyCube – Safety CaUsation, Benefits and Efficiency - Rachel Talbot, Loughborough University
- XCYCLE – Advanced measures to reduce cyclists' fatalities and increase comfort in the integration with motorised vehicles - Luca Pietrantoni, University of Bologna
- PROSPECT – PROactive Safety for Pedestrians and CyclisTs - Ilona Cieslik, IDIADA
- InDeV – In-Depth understanding of accident causation for Vulnerable road users - Tom Brijs, Hasselt University
- SENIORS – Safety-Enhancing Innovations for Older Road userS, Marcus Wisch, BASt.

2.3.3 TRA 2018 SafetyCube & InDev invited session

The organisers of the TRA 2018 conference invited members of SafetyCube and InDev to participate in an invited session on "European road safety policy: Towards evidence-based decision making, especially for vulnerable road users!" The session took place on Thursday 19th April 08:30 – 10:00. Presentations were as follows

- Evidence-based decision making in road safety & the role of the European Commission - William Bird, EC
- The potential of safety performance indicators in Road Safety Management - Rune Elvik, TOI, SafetyCube
- New ways in evidence-based decision-making: The SafetyCube project - Pete Thomas, Loughborough University, SafetyCube
- Economic evaluation of road safety measures - Wouter Van den Berghe, VIAS, SafetyCube
- The SafetyCube European Road Safety Decision Support System - George Yannis, NTUA, SafetyCube
- Measuring the Road User. The challenges of quantifying human related risk factors and measures - Susanne Kaiser, KFV, SafetyCube
- Surrogate safety measures, theory, application, examples – Aliaksei Laureshyn, LU, InDev
- Technical tools for safety data collection – Mette Kathrine Larsen, AAU, InDev
- VRU accident costs – Anatolij Kasnatscheew, BASt, InDev
- Handbook of VRU study methods – Kris Brijs, Hasselt University, InDev

3 Conclusion

The technical work of the five 'safety' projects has been diverse but collaborations, when appropriate, have taken place between SafetyCube and other projects supported under the H2020 Topic MG-3.4-2014 Traffic Safety Analysis and Integrated Approach towards the Safety of Vulnerable Road Users. The work of SafetyCube was most closely aligned to that of InDev and both projects worked together to gather data on the cost of crashes in the EU. This deliverable has described the collaborative activities that took place during the final two years of the SafetyCube project and these are summarised below:

A series of joint activities have been conducted including

- Specific Joint Work Package meetings with InDeV in relation to the estimation of accident costs
- Joint session at 5th International Cycling Safety Conference, Bologna November 2016
- Joint session at the 1st European conference for Results from road transport research in H2020 projects, Brussels November 2017
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- Invitations to attend and take part in the poster exhibition of the SafetyCube Conference, Vienna March 2018

References

Kasnatscheew, A. Heinl, F., Schoenebeck, S. Lerner, M. Hosta, P. (2016) *Review of European Accident Cost Calculation Methods – With Regard to Vulnerable Road Users.* Deliverable 5.1 of the H2020 project InDeV.

Schoeters, A., Wijnen ,W., Carnis, L., Weijermars, W., Elvik, R., Johannsen, H., Van den Berghe, W., Filtness, A. and Daniels, S. (2017), *Costs related to serious injuries*, Deliverable 7.3 of the H2020 project SafetyCube.

Wijnen, W., Weijermars, W., Van den Berghe, W., Schoeters, A., Bauer, R., Carnis, L., Elvik, R., Theofilatos, A., Filtness, A., Reed, S., Perez, C., and Martensen, H. (2017), *Crash cost estimates for European countries*, Deliverable 3.2 of the H2020 project SafetyCube.

Appendix 1: Posters from MG3.4 projects at SafetyCube conference

List of posters:

XCYCLE	project overview
PROSPECT	project overview AUDI mobil driving demonstrator Automotive radar
SENIORS	project overview

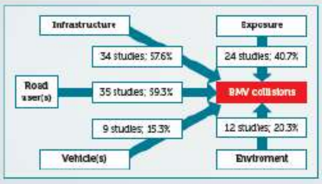
XCYCLE: Advanced measures to reduce cyclists' fatalities and increase comfort in the interaction with motorised vehicles

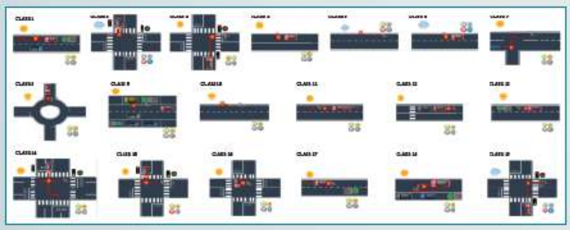
Related topic: MG-3.4-2014 Traffic safety analysis and integrated approach towards the safety of Vulnerable Road Users.
Project key words: cyclists, traffic safety, detection systems, behavioural evaluation, user-centred approach.
Duration: 42 months (May 2015 - Nov 2018) - Coordinator: University of Bologna, Italy

RESULTS OF THE PROJECT

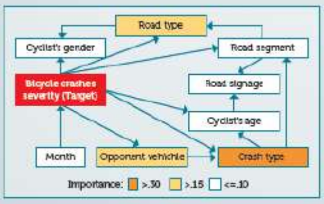
Objective 1 Traffic safety analysis

We found the main factors contributing to Bicycle-Motorised Vehicle (B-MV) collisions.
We analyzed crash data on B-MV collisions from 10 European Countries.
We identified key features of cyclist crashes using latent class analysis and association rule mining. 19 types of bicycle crashes analysing 500.000 accidents.



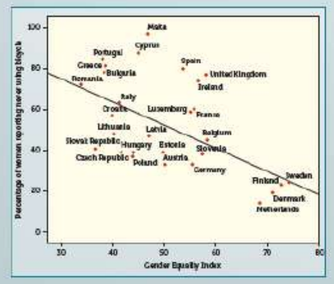


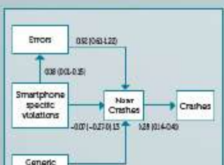
CHAID decision tree technique was employed to establish the relationship between severity of bicycle crashes and factors related to:
- **crash characteristics** (type of collision and opponent vehicle);
- **infrastructure characteristics** (road type, road signage, pavement type, and type of road segment);
- **cyclists (gender and age)**;
- **environmental factors**.



Bayesian network analysis identified: **crash type (0.31)**, **road type (0.19)**, and **type of opponent vehicle (0.18)** as the most important predictors of severity of bicycle crashes.

We investigated the relationship between composite indicator of Gender Equality Index and women's participation in transport cycling across the 28 member states of the European Union.
The effect of gender equality varied across different indicators, with the strongest effect size found for time.
We analyzed errors and violations among cyclists and how "persuasive design"
and traffic infrastructures might reduce unsafe behaviours.





▲ Bayesian estimates for each path of the model (95% credible intervals are reporting in parentheses).

A cyclist violating the red-light in an observation site

Objective 2 Development of an in-vehicle and on-bike system

We identified major determinants of acceptance of Pedestrian and Cyclist Detection System and Emergency Braking (PCDS + EBR). According to VRUITS, "the estimates for PCDS+EBR showed the maximum reduction of **7.5% on all road fatalities and 5.8% on all road injuries** which came down to an estimate of over **2,100 fatalities and over 62,900 injuries** saved per year in the EU-28".

A driving simulator in Leeds has been programmed with common **cycle-to-truck conflict scenarios. A set of HMI recommendations has been derived covering both visual and acoustic aspects.** Results show that design should encourage checking of the relevant mirror when a cyclist was alongside the truck.

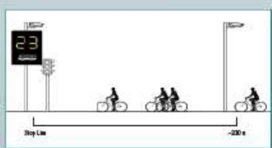
We developed sensor requirements on a truck based on right turn scenarios simulation.

We developed a UWB localization system consisting of active tags mounted on bikes and anchor nodes mounted on a vehicle. An **on-bike device** with audio warnings was tested in a semi-controlled field study in Bologna.

Objective 3 Development of an infrastructured-based system

Video recordings and trajectory data have been analysed in Braunschweig.
Goal: predicting critical situations between right-turning motorists and crossing cyclists before they occur.
Results are basis for detection of atypical behaviour and patterns in data material→input for development of predictive algorithms.

Green wave reduces risk of red light violation for bicycles.
We developed adaptive traffic controller algorithm for "green wave for cyclists"
Increases comfort and therefore stimulates modal shift.
Bicycles will form platoons, which increases visibility.



▲ Stabilised adaptive control dynamics.

Co-funded by the Horizon 2020 programme of the European Union
Project contract number: 635975

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

Potential impact of the project
- Reducing Bycicle-Motorized Vehicle collison critical scenarios in the urban environment (blind spots in right and left turn, waiting time at intersections and red-light skipping behaviours by cyclists).
- Enabling the users to undertake the right pattern of actions in critical situations: multi-modality warnings, intuitive HMI designs (e.g. bird-eyed view).
- Effective tools for education and training aimed at changing behaviours and risk perceptions of different type of road users (cyclists, car/HGV drivers) in a changing context (e-bikes, CAD).
- Innovative analytical methods to investigate contributing factors of collisions involving VRUs in different European countries > new challenges (interactions between cyclists and electric or autonomous vehicles).
- Environmental, health and economic impact - cycling as an active and sustainable mode (promotion of cycling by increasing "perception of safety").


TRA
TRANSPORT RESEARCH ARENA
VIENNA 2018
A digital era for transport
solutions for society, economy and environment
Advancing active safety towards the protection of Vulnerable Road Users by evolution of ADAS solutions that meet real-world deployment challenges: The project PROSPECT
Objectives and Motivations
• Accidents involving pedestrians and cyclists still remain as a pending issue for road safety.
• VRU fatalities account for 30% of road fatalities in the EU (Source: WHO, 2015).
• Most of accidents are caused by the driver being in-alert or misinterpreting the situation.
• Active safety systems have potential to reduce these numbers.
• First generation of AEB systems that avoid and mitigate VRU accidents are in the market: RADAR, mono/stereo cameras.
• PROSPECT aims to significantly improve the effectiveness of active VRU safety systems by (i) expanding scope of scenarios addressed (ii) improving AEB system performance (iii) proposing new validation and testing methodologies.
Methods and Steps
1 Traffic accidents study
2 Use cases & demonstrators specification
3 Advanced VRU sensing & modelling
4 Actuation & control strategies
5 Sensor fusion & integration
6 Test protocol & validation
EURO NCAP
www.euroncap.com
Results and Examples
(a) Bosch Demonstrator car
(b) Continental Demonstrator car
(c) Daimler Demonstrator car
(d) Audi Mobile driving simulator
(e) Advanced 4a testing tools and testing protocols
BOSCH
bast
DAIMLER
vti
TOYOTA
TNO
Ilona Cieslik, Applus IDIADA, Spain
Johann Stoll, Audi AG, Germany
Fabian Flohr, Daimler AG, Germany
Thomas Wimmer, 4activeSystems, Austria
Julia Bräutigan, Bundesanstalt für Straßenwesen, Germany
Maxim Arbitmann, Continental Teves, Germany
Martin Kunert, Robert Bosch, Germany
Dariu Gavrila, University of Amsterdam, the Netherlands
PROSPECT
Horizon 2020 Programme
#tra2018

The research leading to the results of this work has received funding from the European Community's Eighth Framework Program (Horizon2020) under grant agreement n° 634149 for the PROSPECT project.
The PROSPECT consortium members express their gratitude to the European Commission for selecting and supporting this project.

PROSPECT
Proactive Safety for Pedestrians and Cyclists

AUDI mobil driving demonstrator

Objectives

Audi will conduct experiments to investigate the interaction of the driver, system and VRU in critical situations in a real car environment using its mobile driving demonstrator.

With the new Audi mobile driving demonstrator we can achieve:

- Demonstrate new and innovative vehicle functions to media and customers
- Testing of driver's behavior and acceptance without endangering passengers or vehicle
- Engineering of new driving assistance systems (virtual development)
- Market research and customer training

Content

The Audi mobile driving simulator is based on:

- Motion platform to reduce simulator sickness
- Impression of the feeling of steering and braking
- Seatbelt pretensioning

Engineering within PROSPECT

- Two additional monitors for a better side view to improve demonstration of crossing cyclists
- Hardware modification, additional computers
- Software cyclist simulation model
- Adaption of the trajectory simulation to the Audi simulator
- Implementation of free driving with cyclist's in the city

Fig. 1 impression of Audi mobil driving demonstrator

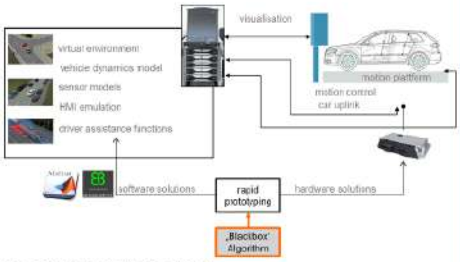


Fig. 2 Rapid prototyping system

Theoretical Background and focus of the study

The German in-depth data base GIDAS shows a predominant type of car-to-cyclist accidents:

A driver approaching a non-signalized intersection or T-junction with a cyclist crossing from a bicycle lane (see Fig. 1).

Fig. 1 Absolute Frequency of collisions depending on driver's task and orientation of the cyclist direction (from driver's point of view)

Inappropriate top-down selection may explain both

1) Drivers turning right fail to manage situations with a cyclist from the right more often than drivers turning left:

   Drivers turning right may fail to look into the cyclist's direction, only selectively looking for cars approaching from the left due to inappropriate expectations, whereas drivers turning left have to split their attentional focus between both sides.

2) Drivers turning right fail to manage situations with a cyclist from the right more often than with a cyclist from the left:

   Drivers turning right may fail to look into the direction of the cyclist crossing from the right, thus the cyclist appears entirely outside the drivers' field of view. If the cyclist appears within the field of view (e.g. cyclist crossing from the left) reflexive bottom-up selection may prevent drivers from colliding with that cyclist and thus reduce the overall frequency of collisions.

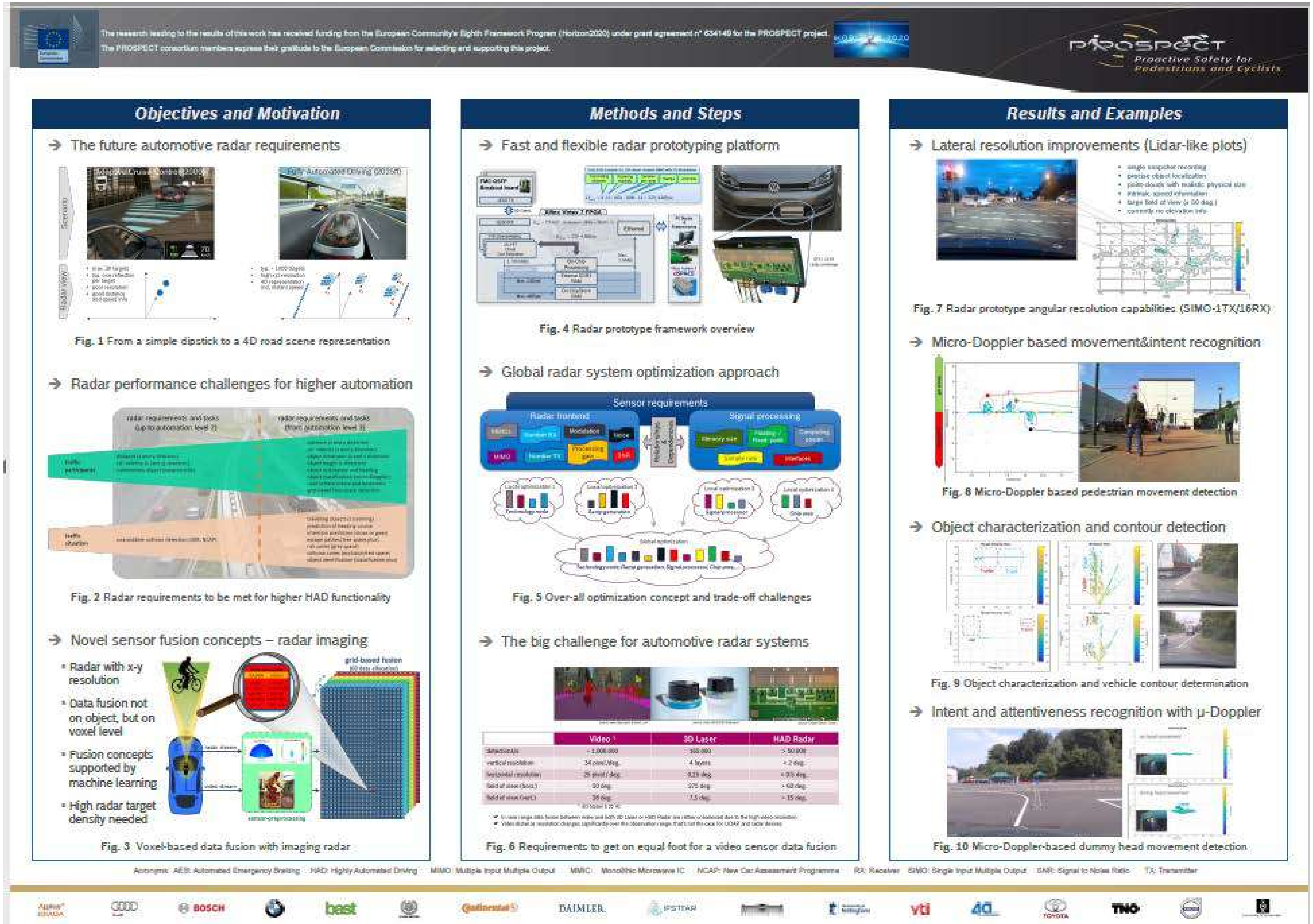
Fig. 2 Independent variables varied within the study: On top "salience of the cyclist (low, high)" and at the bottom "competing stimuli" (yes, no)

However, drivers turning right still collide quite frequently with cyclists from the left, though the chance of the cyclist being able to capture the driver's attention is increased due to the bottom-up selection. The ability of cyclists within the field of view to capture attention might be reduced by either

a) low salience of the cyclist (physical stimulus properties such as intensity, size and background contrast) (see Fig. 2) or

b) driver focuses heavily on approaching cars from the left (inattentional blindness paradigm) (see Fig. 2)

Aim of this study is to examine the role of sensory conspicuity of cyclists within the drivers' detection of cyclists in specific scenarios.


PROSPECT
Proactive Safety for Pedestrians and Cyclists
Objectives and Motivation
The future automotive radar requirements
Fig. 1 From a simple dipstick to a 4D road scene representation
Radar performance challenges for higher automation
Fig. 2 Radar requirements to be met for higher HAD functionality
Novel sensor fusion concepts – radar imaging
Radar with x-y resolution
Data fusion not on object, but on voxel level
Fusion concepts supported by machine learning
High radar target density needed
Fig. 3 Voxel-based data fusion with imaging radar
Methods and Steps
Fast and flexible radar prototyping platform
Fig. 4 Radar prototype framework overview
Global radar system optimization approach
Sensor requirements
Radar frontend
Signal processing
Fig. 5 Over-all optimization concept and trade-off challenges
The big challenge for automotive radar systems
Video
3D Laser
HAD Radar
Fig. 6 Requirements to get on equal foot for a video sensor data fusion
Results and Examples
Lateral resolution improvements (Lidar-like plots)
Fig. 7 Radar prototype angular resolution capabilities (SIMO-1TX/16RX)
Micro-Doppler based movement&intent recognition
Fig. 8 Micro-Doppler based pedestrian movement detection
Object characterization and contour detection
Fig. 9 Object characterization and vehicle contour determination
Intent and attentiveness recognition with µ-Doppler
Fig. 10 Micro-Doppler-based dummy head movement detection
Acronyms: AEB: Automated Emergency Braking HAD: Highly Automated Driving MIMO: Multiple Input Multiple Output MMIC: Monolithic Microwave IC NCAP: New Car Assessment Programme RX: Receiver SIMO: Single Input Multiple Output SNR: Signal to Noise Ratio TX: Transmitter
BOSCH
bast
DAIMLER
vti
TNO

SENIORS

SAFETY ENHANCED INNOVATIONS FOR OLDER ROAD USERS

Abstract

A reduction of almost 48% of total fatalities has been achieved in Europe over recent years due to efforts put into road safety. This includes also a reduced number of elderly fatalities due to road accidents. However, among all the road fatalities, the proportion of elderly is steadily increasing.

Because society is aging demographically and being overweight is becoming more prevalent, the SENIORS (Safety ENhanced Innovations for Older Road userS) project aims to improve the safe mobility of the elderly and overweight persons, using an integrated approach that covers the main modes of transport.

This project primarily investigates and assesses the injury reduction in road traffic accidents that can be achieved through suitable tools, test and assessment procedures, as well as safety systems in the area of passive vehicle safety. The goal is to reduce the numbers of fatally and seriously injured older road users as car occupants and pedestrians as well as cyclists in collisions with passenger cars.

The new EATD used in SENIORS

The THOR dummy was tested in the generic rig

A new Thorax Injury Prediction Tool (TIPT) has been developed.

Pedestrian safety is a key area in SENIORS

3D printing to improve the safety of the elderly

In order to represent a population with increased vulnerability to injury a new Elderly Anthropomorphic Test Device (EATD) has been developed. The prototype EATD was developed with advanced 3D modelling and cutting-edge 3D printing techniques and materials. The 3D printing process has proven to be an invaluable tool in designing and developing crash dummies, but some areas need to be improved in terms of durability. The EATD anthropometric specifications developed were determined as 70-year old, female, and weighing approximately 73 kg with a stature of 1.61 metres.
The organs chosen to be represented in the Elderly ATD, are the liver and spleen. Research has shown that in the AIS ≥ 3 category, the liver was the most frequently injured organ in frontal, right side and far side crashes; this was followed by spleen trauma. In contrast, the spleen sustained the maximum number of injuries in left and near side impacts. More biofidelity in this region provides greater insight into potential injury criteria.
Additionally, the new EATD allows a more realistic assessment of one of the main risks of injury for elderly car occupants, thoracic injuries.

Improving correlation between component testing and HBM simulation

SENIORS also aims at enhancing the safety of elderly pedestrians and cyclists. Taking into account the latest accident data analyses, the existing pedestrian test tool for the assessment of lower extremity injuries has been improved, a new tool representing thoracic injuries has been prototyped and the headform test procedures have been revised towards the inclusion of cyclists.

FlexPLI is the current regulatory and NCAP tool but doesn't allow appropriate assessment in all cases. By means of comparative simulations with THUMS and different derivatives of the FlexPLI, the current tool was updated with a torso mass surrogate (UBM – upper body mass). A final validation by means of physical component testing was performed.

The FlexPLI-UBM shows an improved qualitative and quantitative correlation with HBM simulations. It can be used for the assessment of femur injuries addressing high frontend geometries and for an improved assessment of angled impact areas.

Generic test rig

SENIORS aims to provide improved methods to assess thoracic injury risk to elderly occupants. Paired simulations with a THOR dummy model and human body models (HBM) were used to develop improved thoracic injury risk functions. The simulation results provide data for injury criteria development in chest loading conditions that are underrepresented in Post-Mortem Human Surrogates (PMHS) test data sets that the currently proposed risk functions are based on. To support this approach a new simplified generic but representative sled test fixture and CAE model for testing and simulation were developed. This test set-up and model will serve as a new standard test environment for PMHS and volunteer tests as well as HBM simulations.

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