Review of stakeholder feedback from Midterm Workshop
Deliverable 2.5

SafetyCube

Review of stakeholder feedback from Midterm Workshop

Deliverable Number 2.5

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SAFER, SE.

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Executive Summary

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.

This report describes the presentation of project outputs to stakeholders at the project midterm workshop. A one day workshop with 38 stakeholders was held on September 27, 2016 in Brussels. Feedback was given in the areas of data collection and coding methodologies, DSS structure and operation, and applications of the DSS. In all areas there were concrete suggestions from the stakeholders. Ensuring that the stakeholders shape the tool will ensure that it will be used.

The SafetyCube DSS allows the user to query a database of road safety information based on crash risk factors, safety measures, and crash scenarios. The tool was still at the prototype level and features for cost benefit analysis and information on serious injuries will be incorporated into the DSS in the second half of the. It is important to note that the DSS is not planned to be a hub for statistical database searches regarding crash statistics.

The users expressed positive expectations for the tool and identified enhancements and improvements to the system and underlying data. There were no comments that questioned the basic approach and no needs to radically shift the development activities were identified.

The audience suggested that the most critical audience for the DSS is the technical advisor or individuals undertaking technical analyses for decision makers. It is important to provide high level information to the user so even non-technical stakeholders are able to gain from the tool. The use of synopses to provide summary information is a useful compromise but the strength of the SafetyCube Decision Support is in technical data collected in the coded studies. These coded studies allow for faster referencing of important data.

The level of details needed in a DSS that would satisfy all potential stakeholders is a challenge for the SafetyCube team but good progress is being made. The use of synopses – summary reports of general topics in the gathered data - was one approach developed by the group to facilitate the knowledge transfer without overloading the user with text heavy documents.

1 Introduction

This introduction will describe the project SafetyCube and its aims. It also intends to give an overview of the purpose of this deliverable.

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 2

Work Package 2 is focused on dissemination and implementation of SafetyCube results. It also has the goal to create an efficient network of stakeholders whose consultation will help identify user needs for the European road safety Decision Support System as well as priorities for road safety or "hot topics" to be used to focus research activities. Throughout the project, the stakeholders will provide data, knowledge, and experiences to assist in identifying road accident risk factors in addition to directing the project's research priorities.

1.2 PURPOSE OF THIS DELIVERABLE

The purpose of this report is to document and analyse the input from stakeholders present at the MidTerm Workshop. The workshop was held in September 2016, month 17 of a 36 month project. There were 38 attendees representing industry, nongovernmental organisations (NGOs), government institutions, and the research community.

The overall objective of the meeting was to present the project findings at the time of the workshop and to ensure the project is achieving the needs of the stakeholders. Three activities for the workshop were identified:

1. Present the developments in the SafetyCube project that are the foundation for a Decision Support System (DSS).
2. Present the proposed structure and interface of the DSS.
3. Provide specific examples of the application of the DSS

These main presentation activities led to stakeholder interactions that could then be analysed by the SafetyCube team to plan further activities in the project.

The report describes the workshop structure in Chapter 2, and then gives a review of discussion topics. The comments could be grouped into project methodology (Chapter 3), DSS implementation (Chapter 4), and potential applications of the DSS (Chapter 5). A general discussion of the workshop results is given in Chapter 6. The results of

the workshop described in this deliverable are important inputs to the technical work packages (WP3-Wp8) of the project.

2 Workshop Implementation

This chapter describes the structure of the first SafetyCube midterm workshop and first presentation of the Decision Support System. The day was planned to introduce the results of the first half of the project and allow stakeholders to provide their input on the prototype of a new analysis tool for road safety.

The workshop took place on September 27th 2016 in Brussels. The SafetyCube project had already identified a core group of stakeholders from government, industry, research, and consumer organizations covering the three road safety pillars: vehicle, infrastructure, road user. This core group was contacted early to identify the most convenient date for the workshop. The SafetyCube mailing list (approximately 400 users) and partner networks were used to invite a wide range of stakeholders and potential users of the SafetyCube outputs. The final participant list can be found in Appendix A. There were 38 participants from the original 39 registered delegates. The agenda for the meeting is provided in Appendix B.

The stakeholders were given an introduction to the project objectives and structure by the coordinator, Pete Thomas (Appendix C). The vision of the DSS was exemplified by the presentation of Rune Elvik (Appendix D), where he demonstrated how evidence of road safety risk - and how it is presented - is important for political decisions. The subsequent presentations from Heike Martensen (Appendix E) and George Yannis (Appendix F) then provided the scientific basis and computer implementation of the SafetyCube research. These presentations described how the studies on road safety were identified and coded in a relational database. This database created the library of information that can be dynamically searched in the DSS. The concept of the DSS was presented to the audience as a tool that can be queried using risk factors, road safety measures, and crash scenarios as possible "entry points" to the tool. A planned feature for the DSS, a Cost Benefit Analysis (CBA) tool, was presented by Heike Martensen as a future module being developed for the DSS (Appendix G). Walter Niewöhner (Appendix H) described the structure of the crash scenarios that were used in the DSS. Eva Aigner-Breuss and Eleonora Papadimitriou started the practical demonstrations and group discussions by discussing how road user behaviour and infrastructure elements were analysed in the project (Appendix I).

The practical demonstrations were conducted in two groups, focussing on either road user behaviour or infrastructure, where the DSS was presented and stakeholders could pose general or topic specific questions. The prototype DSS could not fully demonstrate all the features of the final system and the stakeholders had "guided tours" to show how different query strategies could be used to identify road safety risks and how the data was presented. These "guided tours" were static implementations of the DSS outside its final web based implementation.

The workshop was summarized in a final plenary session where a summary of the group activities and open discussion of the project plans and stakeholder comments was held.

3 SafetyCube Methodology

This chapter describes the comments from the stakeholders reflecting the methodological foundation for SafetyCube.

SafetyCube is built on the basic desire to connect road safety risk factors with potential measures (or solutions). The core activity is to collect and store the data in an accessible format. The stakeholders raised questions regarding the basic methodology throughout the workshop. The presentation explained how studies were gathered and coded in three domains: road user behaviour, infrastructure, and vehicle. The discussion questions, comments, and responses are reported in Appendix J. The main type of question was related to the source of the reference material. The audience was concerned about the age and source of the technical data. The SafetyCube team explained that the most reliable sources, peer reviewed journal articles, were the preferred source of data. More recent studies were the focus and English language publications led to a bias to European and US studies. National reports were difficult to include if they were not in English but often these larger reports are also documented in journals. Future development of the DSS could contain other languages. There was a concern that the DSS may introduce biased impressions of some measures if one domain has 10 studies on a countermeasure but only 1 is found in another domain. This could lead to a conclusion that the domain with more solutions is the only one to investigate further. The DSS will contain synopses which can provide more information than may be contained in the coded studies. The SafetyCube team also identified the goal to have the DSS lead the stakeholder to all possible countermeasures addressing the three pillars (or domains) for a road safety risk factor.

The Cost Benefit Analysis was a concern for the stakeholders. The disparity in costs among the countries reporting CBA studies makes it difficult to generalize actual costs in Europe. The tool is being developed to allow user specific data to be entered to address national differences. The CBA is still under development and was not the focus of the h

The SafetyCube described how it is possible to use particular crash configurations as a way to investigate a road safety problem. There may be a reoccurring crash type that a stakeholder wishes to address but the specific risk factors may be numerous or even unknown to the stakeholder. The concept of accident scenarios are used by SafetyCube to allow the user to query the system and begin exploring the risks and measures related to specific crash types. The accident scenarios used in SafetyCube are not copied directly from other well known national systems like NHTSA (US) or GIDAS (Germany) data collection programs. SafetyCube created a subset of the existing scenarios, grouping as many topics into main headings. The goal was to reduce the complexity of the tool and guide the user to the appropriate studies as quickly as possible.

The DSS will use keywords reported by the coding staff in the SafetyCube project. The stakeholders were concerned about alternative spellings and variations of words for similar concepts. Text based searches will be limited to terms coded by the SafetyCube researchers.

An interesting feature of the DSS is that the objective facts available in a central registry can reduce the use of "mantra" where specific problems and measures are addressed using previous experience. The availability of scientific evidence will reduce the occurrence of "we always did it like this" approaches.

4 Decision Support System Structure

The stakeholder impressions and suggestions for enhancing the SafetyCube DSS are presented in this chapter.

There was a significant amount of time assigned to the presentation of the DSS design and function during the workshop. The DSS is the main output from the project and its successful implementation after the project is based on how the stakeholder can successfully interact with it. There was considerable discussion on the design and function of the DSS system. The software is web-based which reduces the need to download and install programs on local computers. The central webserver also assures that the latest results are available to all users. The discussion topics at the workshop are summarised in Appendix K.

The points raised by the stakeholders focused on the areas of text based search and on the presentation of information. There were questions raised about the search possibility of specific words like "truck" and "pedelec". These terms are sensitive to the coders keyword choice (see Chapter 3) and on the SafetyCube glossary. There will be a full glossary developed in SafetyCube and all variations that are foreseen will be addressed. It is also dependent on where the terms are reported, as "truck" may appear in both measures and risks for example. The development team cautioned that free text searches can lead to inappropriate results if implemented incorrectly and this was not intended as the main use of the DSS.

The stakeholders were interested in how the filters could be applied to the search terms such as time of day. There are filters already anticipated to sort search results by road user or road use type. Additional filters will be difficult to apply but the glossary should help in selecting appropriate keywords. The way the user progresses through the filter process was also of interest as the software allows the user to reduce the risk factors to a certain grouping and then safety measures could automatically be selected that address these risks. SafetyCube received feedback on how it would be useful for the system to save intermediate results could be stored for the user during the process. For example as crashes related to heavy trucks are investigated, the search may be refined to address time of day and road type. The ability to review how the search results change between steps can be important to the user.

Suggestions for how the result tables are presented by the DSS were offered by the stakeholders. There was interest in how the results could be prioritised in the tables and the team will investigate how year of study or effectiveness of a countermeasure could be used to rank and present results. Other suggestions included "mouse over" possibilities like providing links to PDF documents or pop-up windows.

There was a discussion on the type and access to statistical data in the DSS. The system will use "synopses" as a method to summarize an overview of a topic with numerous references. These synopses could contain figures that present the information to the user and provide overviews of the information without the need to read all the text. The SafetyCube team will investigate different presentation and table structures that can assist the stakeholders when reviewing the query results. It is recognized that SafetyCube can provide the basis for presentations to stakeholders and decision makers. The use of standard figures for crashes per year, road type, etc. should be readily available to a DSS user.

5 Application of SafetyCube Results

The stakeholders discussed topics related to how the DSS would be used by themselves or other users. The general discussion points are provided in Appendix L.

There were questions and comments regarding who the tool would be most useful for. While the tool is intended to be useful for all stakeholders, the audience suggested that very high level stakeholders (such and politicians and advisory board members) would not likely be hands-on users. The main users were likely to be the technical advisers to the decision makers as they are the ones collecting and analysing the information and making recommendations to their superiors. There was a comment that the tool developers should resist making the tool too specific as this may create too much detail for high level decision makers.

There was a comment that the tool is too biased towards the researcher and not necessarily for the decision maker. This comment was most likely directed to the quantitative details available in the database. This seemed to reflect that a "text heavy" output describing complex statistical results output would be difficult for senior managers to quickly process if it is not well structured. Informative graphics would be a good support to the text. The available resources in SafetyCube were limited and it may not be possible to incorporate graphic presentations in all cases. Presentation of the results is a key feature for the users and it is good that results are summarized in tables that can be explored further by the user, but not all information needs to be presented at once. The SafetyCube synopsis structure was developed in a way to introduce different layers of information for the user. The initial summary of the topic addressed in the synopses should cue the reader to continue further in the document if they need more details, otherwise they may be satisfied with the information and not need to read further. Synopses are "summaries of summaries" and should be sufficient for high level decision makers while reviewing individual coded studies may be the goal of most technical advisors, engineers, and researchers.

The role of the DSS with regards to different application types raised an important point. There were questions regarding the use of SafetyCube results when governments are considering larger programs. The group pointed out that SafetyCube is focused on the results of individual studies of risks and measures and broad programs could not be addressed by the DSS. The SafetyCube team indicated that other tools, like ERSO, would be better choices for analysis of broader scope.

One stakeholder indicated that the CBA tool may be the most useful part of the SafetyCube DSS.

6 Summary

The SafetyCube methodology and Decision Support System were presented in a workshop to 38 stakeholders spanning a range of stakeholders. The workshop included guided tours of the first DSS prototype for infrastructure and road user behaviour applications. One stakeholder was pleased that the scientific knowledge in the European transport sector could be shared with stakeholders outside the project group. There was some concern that the abundance of American studies suggested a lack of European competence. The concern was not shared by all in the room and may reflect the publication culture of the different continents. The language issue also favoured American studies over the multilingual publishing traditions in Europe.

The approach of SafetyCube will need some time to penetrate into the population of potential users. The concept of studies and synopses is good for disseminating and educating stakeholders, however the challenge is creating enough synopses and identifying enough studies for coding so that the DSS is well populated with topics for all potential users. The information need to fully populate the DSS with all foreseeable information is beyond the scope of the current project and highlighted the aspect of maintaining and hosting after the project ends. The ambition is to provide a tool with open access to all possible users following project completion. Ensuring the quality of the data (uniform coding and synopsis submissions) is not trivial and it is not desirable to allow unrestricted uploads of data. The group is investigating possibilities for funding upgrades and maintenance after the project is completed. Discussions are underway with potential sponsors and all options are being explored. One proposal was to provide free access to the tool but a user profile to save and recall previous search results would require some type of subscription.

Language used in the tool was one minor discussion point. Although the tool is based on English language articles, other languages could foreseeably be entered into a future system with financial support. English language summaries and synopses of diverse language reports are possible if the quality of the reviewer is assured access to the original report may not be applicable for every stakeholder. There was also a recommendation to avoid the use of "accident" and use "crash". There are some that would say the term "accident" implies the event could not be avoided and results in an implicit acceptance of the problem. Crash is more neutral and is one outcome of a safety critical event.

The group favoured releasing the tool as soon as possible to get the stakeholder feedback. There was also anticipation of the Cost Benefit Analysis in future releases. The customisation of the CBA to local inputs was considered a prerequisite for acceptance of the tool.

The feedback from the stakeholders confirmed the message in Rune Elvik's presentation (Appendix D). The decision makers have the opportunity to make better decisions when information on road safety risks are available as objective facts. These facts also make the public acceptance of the decision easier when there is evidence supporting the decision and the solution is justified for a documented problem.

7 Application to the Project

The results of the SafetyCube midterm workshop provide a useful framework for further developing the DSS. The feedback was very positive and there are anticipated users for the system as soon as it can be released. The SafetyCube DSS development team will be working on the system during 2017 and will release the system when finished with internal quality assurance and a sufficient database of information has been developed.

Feedback was given in the area of data collection and coding methodologies, DSS structure and operation, and applications of the DSS system. In all areas, there were concrete suggestions from the stakeholders. Ensuring that the stakeholders needs are addressed when designing the user interface will ensure that it will be used outside the project group. The approach taken in SafetyCube - continuous consultation with the stakeholders - will hopefully avoid the potential problem of the project outputs being ignored once the project is completed.

Appendix A. Participant list

First name	Surname	Organisation
Eva	Aigner-Breuss	KfV
Juliette	Anselot	GOCA
Luana	Bidasca	European Transport Safety Council
William	Bird	European Commission
Stijn	Daniels	Belgian Road Safety Institute
Stijn	Dhondt	Flemish Foundation on Traffic Knowlegde (Vlaamse Stichting Verkeerskunde)
Konstandinos	Diamandouros	European Union Road Federation
Kallistratos	Dionelis	ASECAP
Rune	Elvik	Institute of Transport Economics
Ashleigh	Filtness	Loughborough University
Niels	Janssen	Agentschap Wegen en Verkeer
Graziella	Jost	European Transport Safety Council
Susanne	Kaiser	KfV
Ludo	Kluppels	BRSI
Franck	Leopold	LAB
Klaus	Machata	KfV
Alice	Magrin	Loughborough university
Adina	Marciano	RSA - Israel
Heike	Martensen	BSRI
Jeannot	Mersch	FEVR
Walter	Niewöhner	DEKRA Automobil GmbH
Eleonora	Papadimitriou	National Technical University of Athens
Greta	Remy	Flemish Government (Vlaamse Overheid)
Christiane	Ruiz de Arcaute	Police Fédérale - Federale Politie
María Teresa	Sanz Villegas	European Commission - DG Move
Renaud	Sarrazin	BRRC
Stephen	Stacey	EuroRAP
Pete	Thomas	Loughborough University
Robert	Thomson	SAFER/Chalmes
Griet	Van Belleghem	Vrije Universiteit Brussel
Wouter	Van den Berghe	BRSI
Maura	van Strijp	SWOV Institute for Road Safety Research
Grégory	Vandenbulcke-Plasschaert	Federal Road Police
Veneta	Vassileva	ACEM
Wendy	Weijermars	SWOV
Marcus	Wisch	BASt
George	Yannis	National Technical University of Athens

Appendix B. Agenda

Road Safety Workshop:
First Viewing of the
SafetyCube Decision Support System
Venue: BRSI
Chaussée de Haecht 1405
1130 Brussels,
September 27, 2016
9 a.m. – 16:00 pm

Purpose: Illustrate how existing road safety knowledge can be collected, structured and distilled into the SafetyCube Decision Support System (DSS) that can be queried in terms of safety risk factors and potential countermeasures, including crash scenarios. Key road safety stakeholders will have the opportunity to watch the methodology followed and test the SafetyCube DSS prototype, allowing vivid discussion for its further improvement.

Agenda

9:00-10:00	Registration Session Chair: **Robert Thomson**, SAFER
10:00-10:30	Overview of SafetyCube Project: **Pete Thomas**, Univ. Loughborough The European Commission Road Safety Vision **William Bird**, DG-Research
10:30-11:00	"Inspiration and Implementation" How SafetyCube DSS will lift road safety Rune Elvik, TOI
11:00-11:30	The scientific basis of the SafetyCube Decision Support System Heike Martensen, BRSI
11:30-11:45	Coffee Break
11:45-12:30	The SafetyCube Decision Support System prototype: **George Yannis**, NTUA
12:30-13:15	Lunch Break
13:15-14:00	Cost-benefit Information in the DSS, **Heike Martensen**, BRSI Accident Scenaria – **Walter Niewöhner,** DEKRA Overview of afternoon session
14:00-15:30	SafetyCube DSS parameters and examples: Behaviour - **Eva Aigner-Breuss**, KFV; Infrastructure – **Eleonora Papadimitriou**, NTUA SafetyCube DSS Stakeholder Feedback: **All Participants**
15:30-16:00	Closing Comments, European Commission: **Maria-Teresa Sanz-Villegas,** DG Move Road Map for DSS development / Regrouping and Summary **Klaus Machata**, KFV, **Pete Thomas**, Univ. Loughborough
16:00	Adjourn

Appendix C. SafetyCube project overview – Pete Thomas

SafetyCube

Safety CaUsation, Benefits and Efficiency

www.SafetyCube-project.eu

Stakeholder workshop

Brussels, 27 September 2016

Co-funded by the Horizon 2020
Framework Programme of the European Union

9/27/2016

SafetyCube concept

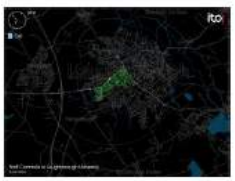
- Problem
  - *Evidence based road safety policies are becoming more usual and there is much better availability of national data and state of the art knowledge*
  - *Effective road safety policies need good information about accident risk factors and about measures*
- SafetyCube will meet this need by generating new knowledge about **accident risk factors** and the **effectiveness of measures** relevant to Europe
- It will structure this information so it can be readily accessed at both top level and in-depth to meet the needs of all stakeholders

What is a risk?

- "Risk factor" denotes any factor that contributes to accidents or injuries – problem areas.
- There are risk factors related to all elements of the road system and the interactions between these elements.
- The importance of a risk factor can be defined as the size of the contribution it makes to accidents or injuries.

What is a measure?

- A measure is any action intended to reduce the numbers of accidents or injuries.
  - *May reduce the risk of a crash*
  - *May reduce the risk of injury*
  - *May reduce exposure to risk*



Challenges of the evidence based approach

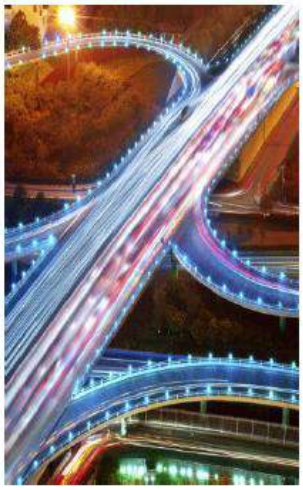
- Do we have a comprehensive method to identify risks?
  - *Road, road users and vehicles*
- Do we have a comparable method to evaluate measures?
  - *Road, road users and vehicles*
- How do we estimate the likely casualty reduction of a measure that has not been introduced to the real-world?
- Do we have a comprehensive method to evaluate cost-effectiveness?
- How do we handle the situation where there are many measures of effectiveness but they disagree?

Accessing the evidence base

- Much of the evidence on risks and measures is in the research literature – how can it be brought together?
- How can we assess transferability of measures from one country to another?
- How can the available information and data be synthesised?

SafetyCube DSS Objectives

The SafetyCube DSS objective
is to provide the European and Global road safety community
a user friendly, web-based, interactive Decision Support Tool
to properly substantiate their road safety decisions
for the actions, measures, programmes, policies and strategies
to be implemented at local, regional, national, European and international level.



The main contents of the SafetyCube DSS concern:

- road accident risk factors and problems
- road safety measures
- best estimate of casualty reduction effectiveness
- cost-benefit evaluation
- all related analytic background

Special focus is given to linking road safety problems with related countermeasures.

SafetyCube DSS Users

- **Public Authorities**
  local, regional, national, European and international
- **Industry**
  Infrastructure, Vehicle, Insurance, Technology
- **Research Institutes**
- **Non Governmental Organisations**
- **Mass media**

The SafetyCube DSS is intended to have **a life well beyond the end of the SafetyCube** research project. Furthermore, it will be developed in a form that can readily be incorporated within the existing European Road Safety Observatory of the European Commission DG-MOVE.

What have we already achieved?

- Mid-point of SafetyCube
- Consulted many different stakeholders
- Already reviewed and summarised many hundreds of studies on crash risks
- Developed an outline of the SafetyCube DSS and it's functionality
- Progressed well with work on serious injuries
- Preparing for the second half of the project

We need your feedback

- Mid-point in project
- Confirmation of progress
- What do you think about the DSS?
- How would you use it?
- What information will be most useful?
- How can we improve it?

Contact

- **www.SafetyCube-project.eu**

- Pete Thomas
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- United Kingdom
- Tel: +44 (0)1509 226931

Appendix D. Inspiration and Implementation" How SafetyCube DSS will lift road safety – Rune Elvik

SafetyCube

SafetyCube Workshop

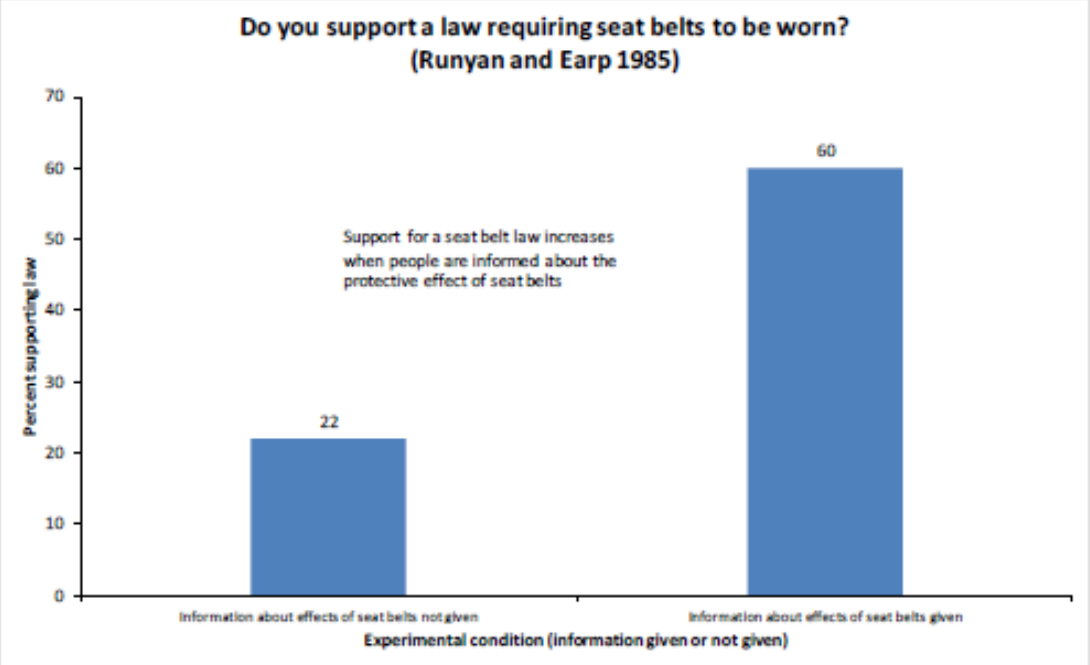
Brussels, September 27, 2016

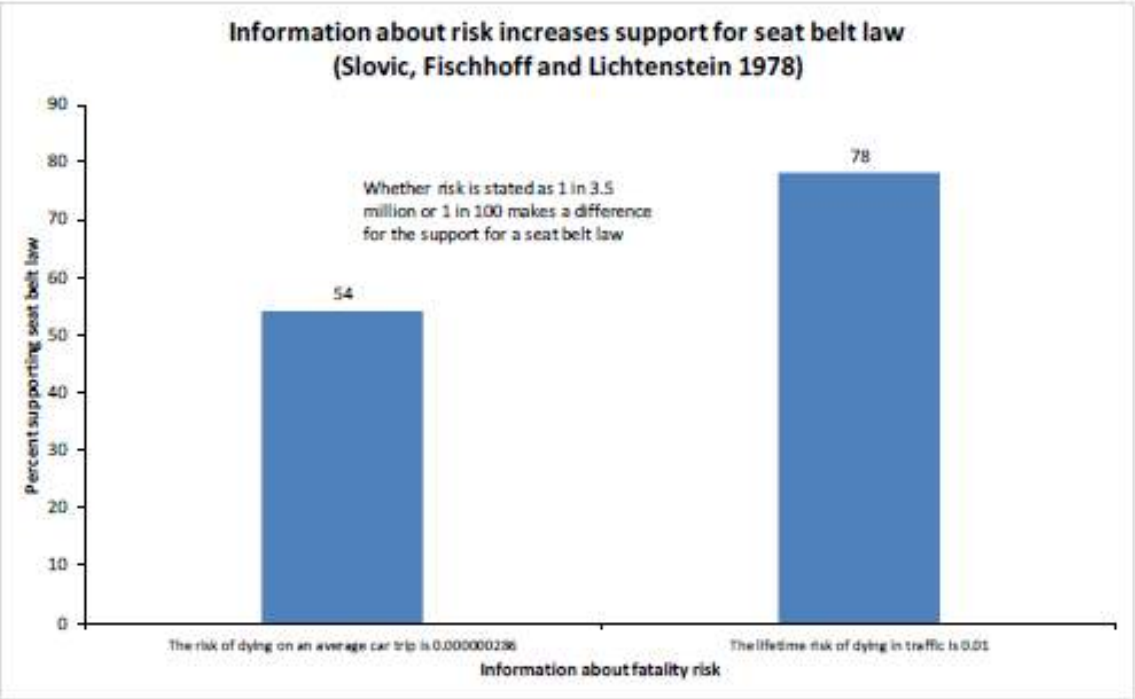
Co-funded by the Horizon 2020 Framework Programme of the European Union

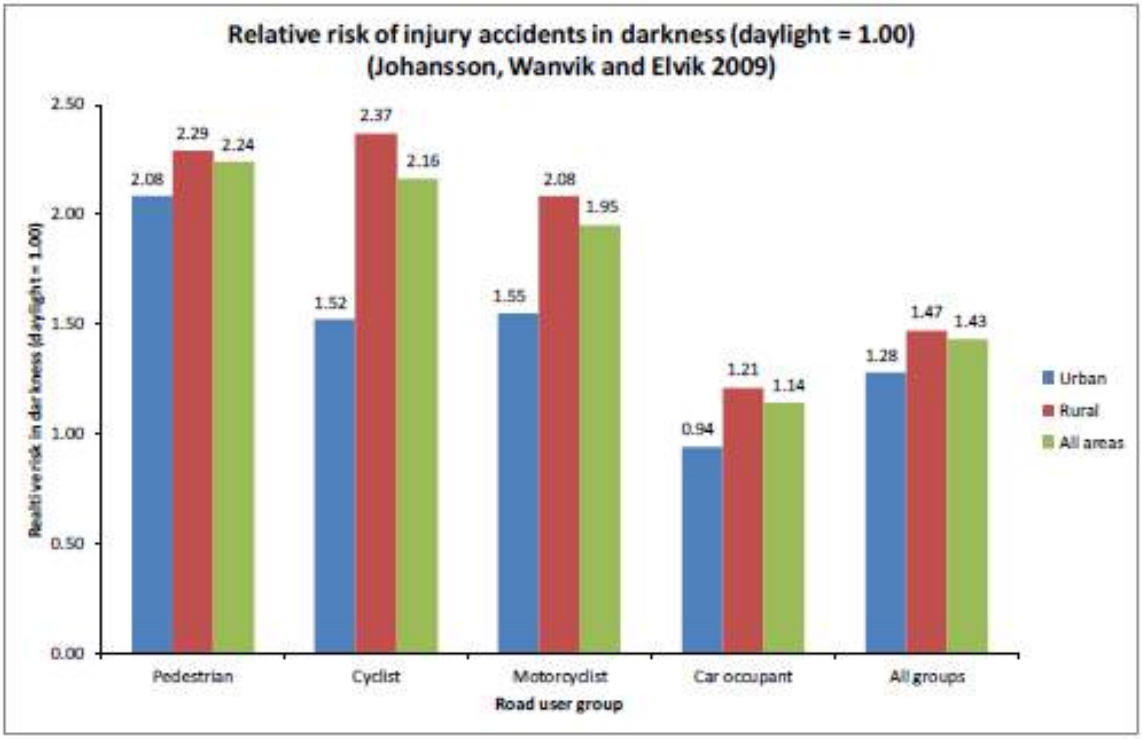
9/27/2016

Knowledge is inspirational

- In 1962, the Norwegian Ministry of Justice wrote the following in a White Paper to the Norwegian Parliament:
- *"It is important to take great care in planning road safety measures in order to successfully prevent accidents. … However, a rational use of road safety measures is still not possible. Too little is known about the real causes of accidents to select the best measures for preventing them."*
- Could such a statement have been made today?
- Most probably not – and definitely not when the SafetyCube Decision Support System is in place

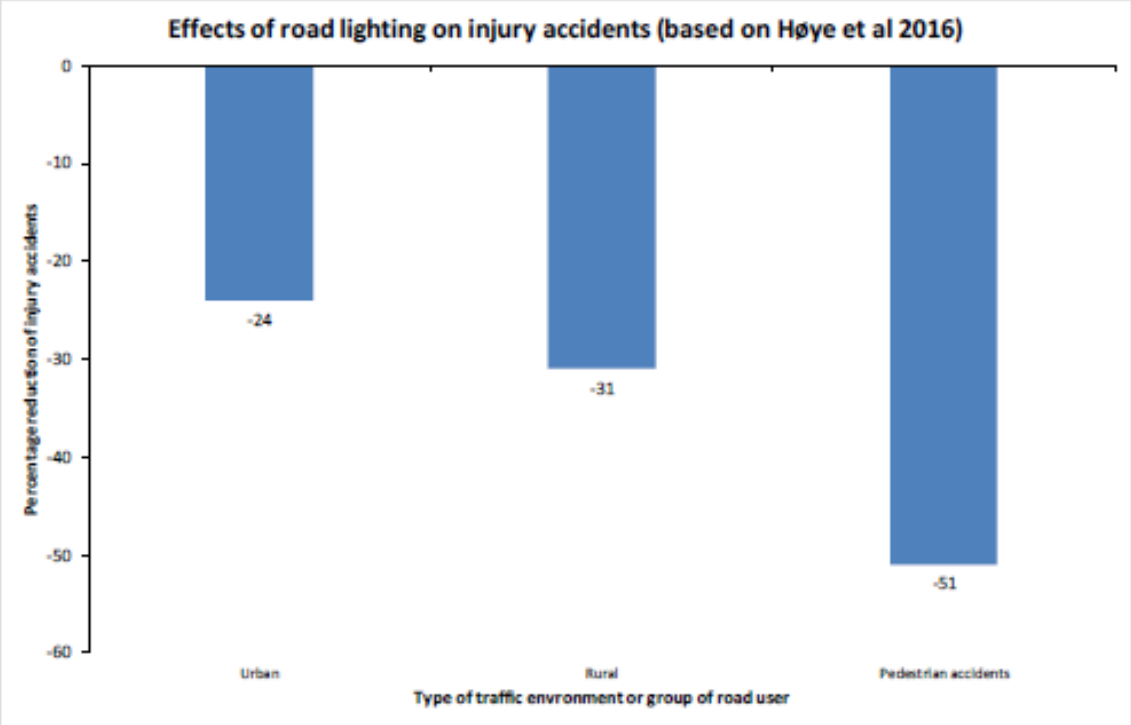



Information about risk increases support for seat belt law
(Slovic, Fischhoff and Lichtenstein 1978)
Percent supporting seat belt law
90
80
70
60
50
40
30
20
10
0
Whether risk is stated as 1 in 3.5 million or 1 in 100 makes a difference for the support for a seat belt law
54
78
The risk of dying on an average car trip is 0.000000286
The lifetime risk of dying in traffic is 0.01
Information about fatality risk


Relative risk of injury accidents in darkness (daylight = 1.00)
(Johansson, Wanvik and Elvik 2009)
Relative risk in darkness (daylight = 1.00)
2.50
2.00
1.50
1.00
0.50
0.00
2.08
2.29
2.24
1.52
2.37
2.16
1.55
2.08
1.95
0.94
1.21
1.14
1.28
1.47
1.43
Pedestrian
Cyclist
Motorcyclist
Car occupant
All groups
Road user group
Urban
Rural
All areas

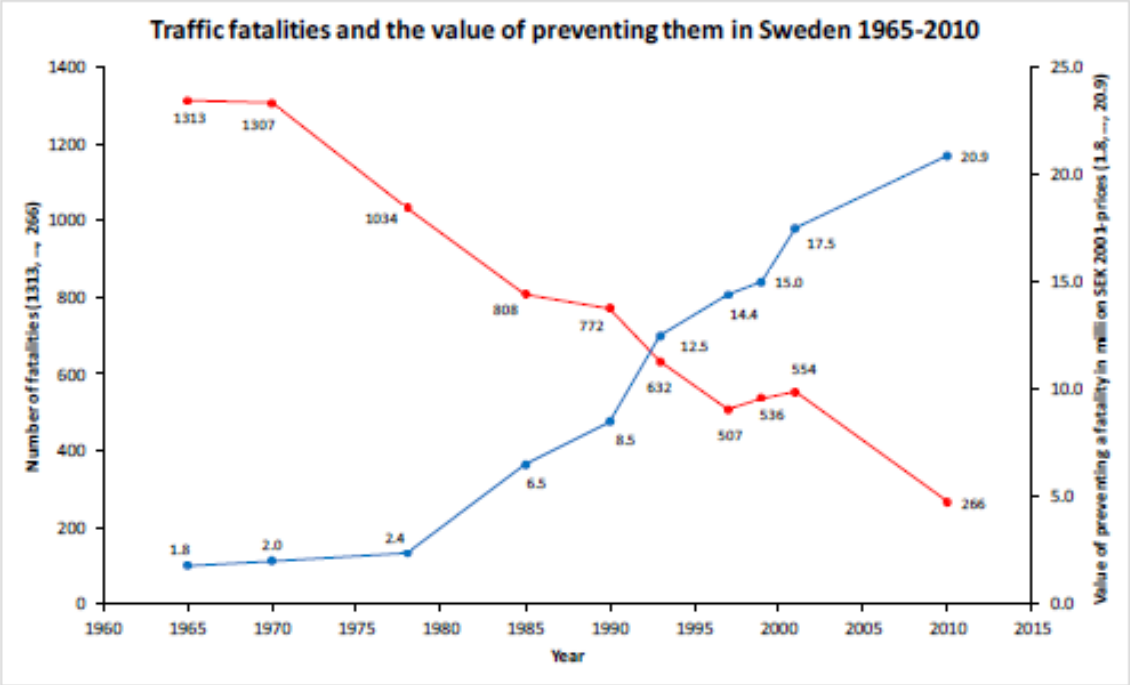
What do these examples tell us?

- Information about risk is important and useful in identifying target groups for road safety measures
- Support for the use of road safety measures increases when people are informed about their effects
- Patterns in risk may help us predict patterns in the effect of road safety measures, thus:
- Road lighting should be more effective for pedestrians than for car occupants
- Road lighting should be more effective in rural areas than in urban areas



Knowledge and ambitions grow in paralell

- Knowledge about both risk factors and road safety measures is growing rapidly
- It is an increasing challenge to effectively access this growing body of knowledge
- The SafetyCube Decision Support System will provide easy access to a greater amount of knowledge relevant for road safety policy than any existing policy support system
- Success in improving road safety is self-reinforcing and increases the ambitions for further improvement



The prospects are great

- We are witnessing a rapid growth in knowledge and technological innovations promising to deliver great improvements in road safety
- It is more important than ever to be updated on these developments to harvest their benefits for road safety
- Our ambition is that the SafetyCube Decision Support System should become the first source a policy maker consults to learn about how best to improve road safety

Appendix E. The scientific basis of the SafetyCube Decision Support System – Heike Martensen

Niewöhner, W

SafetyCube

Decision Support System: The Scientific Basis

SafetyCube midterm-workshop Brussels, 27 September 2016

Co-funded by the Horizon 2020
Framework Programme of the European Union

9/27/2016

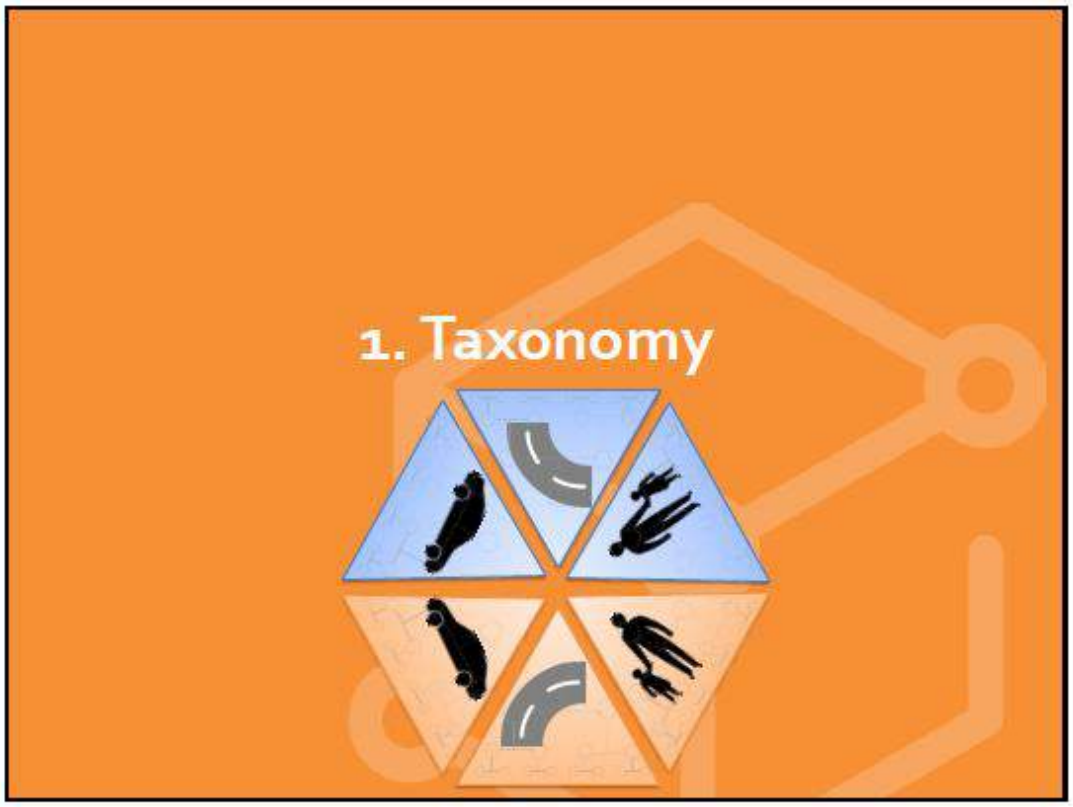
SafetyCube DSS

Road Safety Decision Support System

- Risks
- Measures

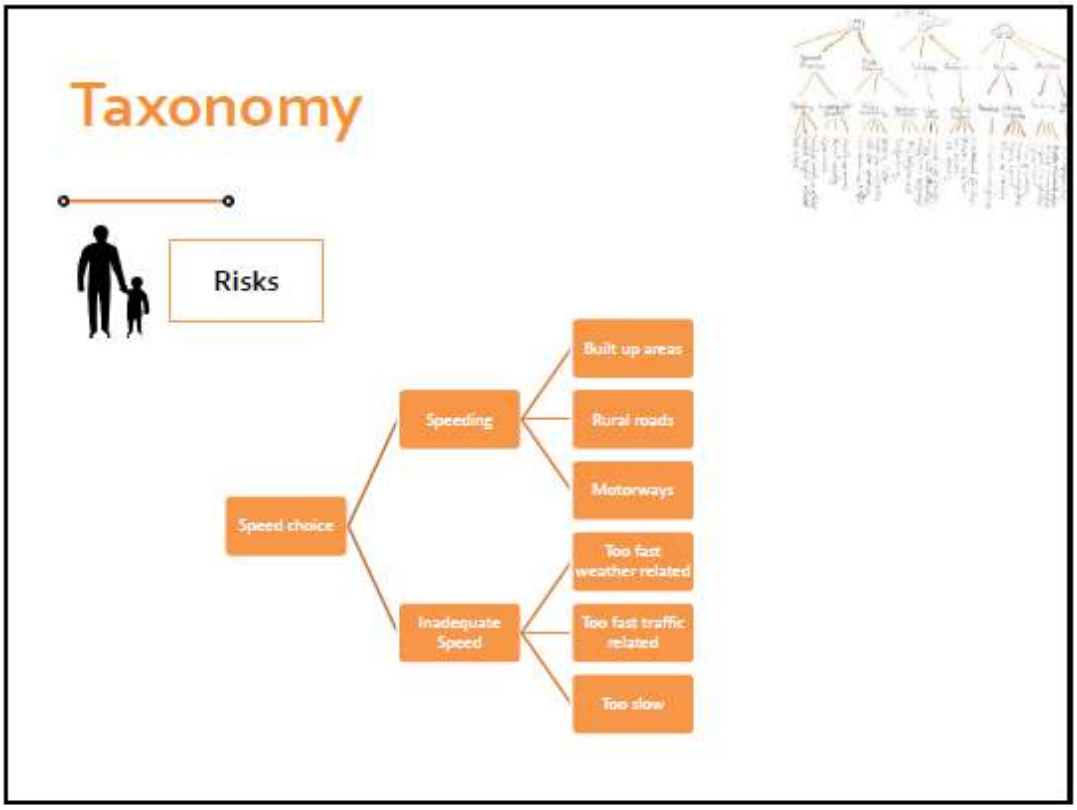
Taxonomy	Repository	Synopsis	Prioritisation

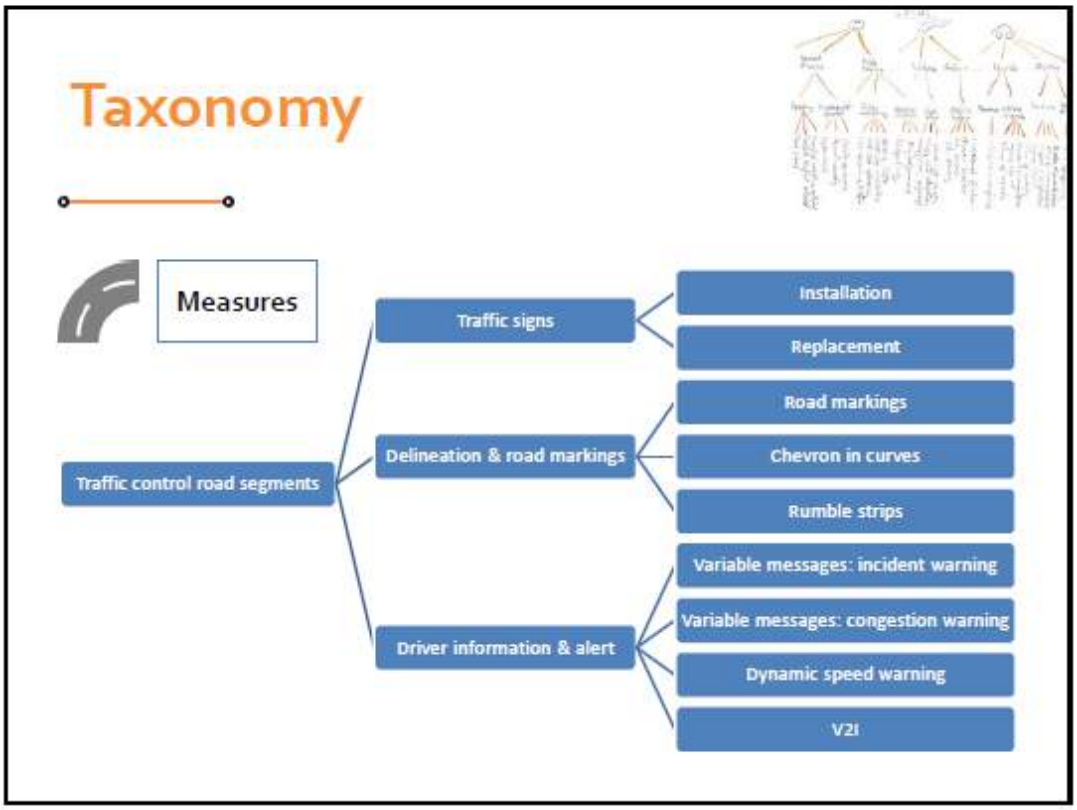


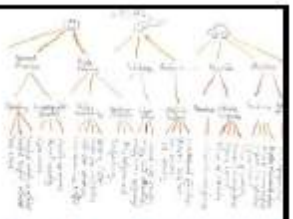
Taxonomy

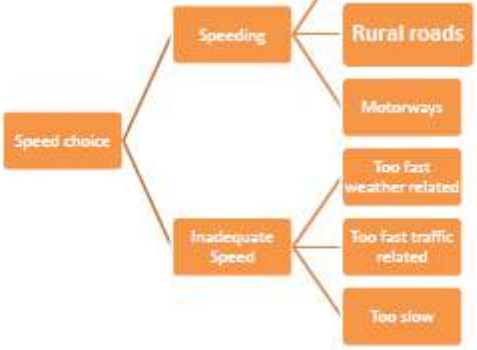
- Hierarchical
- 3 main AREAS
  - *Behaviour*
  - *Infrastructure*
  - *Vehicle*
- Risks & Measures


Taxonomy
Risks
Speed choice
Speeding
Built up areas
Rural roads
Motorways
Inadequate Speed
Too fast weather related
Too fast traffic related
Too slow


Taxonomy
Measures
Traffic control road segments
Traffic signs
Installation
Replacement
Delineation & road markings
Road markings
Chevron in curves
Rumble strips
Driver information & alert
Variable messages: incident warning
Variable messages: congestion warning
Dynamic speed warning
V2I

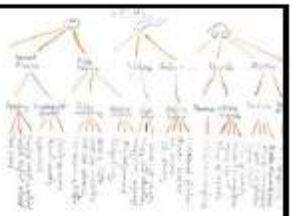
Taxonomy - linking





- Demerit point system
- Increase sanctions
- Speed awareness course
- Speed Campaign
- Zero tolerance/ reduction of tolerance
- Mobile speed enforcement
- Change Speed limits
- Speed Cameras
- Section control
- Variable traffic signs
- Dynamic speed warning - Smiley
- Speed humps
- Adaptiv cruise control
- ISA

Taxonomy - DSS



- Backbone of DSS
- Finding risks & measures
- Linking risks to measures
- Systems view
- Additional entry points:
  - *Linked to user-groups*
  - *Linked to accident scenarios*

Text Search	Risk Factors	Road Safety Measures	Road User Groups	Accident Scenarios
Search for your topic within the entire SafetyCube database of studies on road safety Risk factors and Measures	Search for a Risk Factor related to Behaviour, Infrastructure or Vehicle within the SafetyCube taxonomy of Risk Factors. The search results will also indicate Road Safety Measures for these Risk Factors	Search for a Measure related to Behaviour, Infrastructure or Vehicle within the SafetyCube taxonomy of Measures. The search results will also indicate Risk Factors related to the Measure	Search for Risk Factors and Measures related to different Road User Groups	Search for Risk Factors and Measures related to different Accident Scenarios

2. Repository

Repository

- Literature search
- Evaluation of studies
- Coding template
- Data-base

Repository
Literature Search

Literature search
- Lit. data base
- Key words
- Other sources
- # records identified

Screening abstracts
- Evaluate
- # relevant records

Full text download
- Download pdf
- Enter in list of papers

Evaluation full text
- Exclude
- Criteria
- Include
- Priority for coding
- Included in meta

Repository
Evaluation of Studies

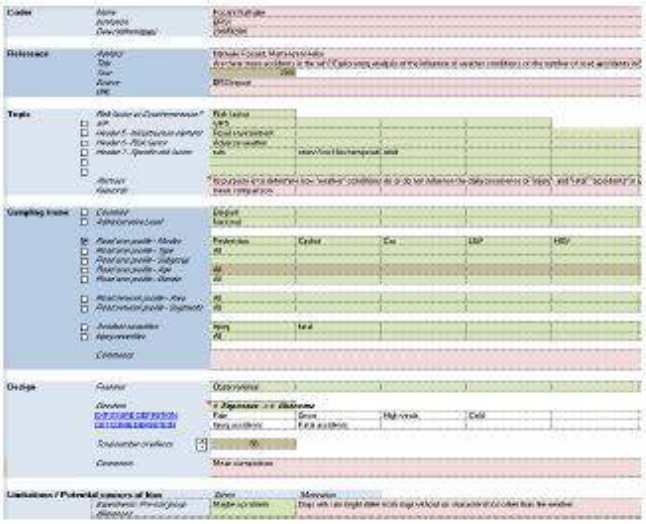
- Different study designs
- Different analyses types
- Essence
  - *Risk estimate*
  - *Safety effects*
- Biases

Repository
Evaluation of Studies

- Transferability
- Conditions
  - *Country*
  - *Road user type*
  - *Road type*
  - *Traffic conditions*
  - *Crash severity*

Repository
Coding template

Core info



Repository
Coding template

Core info

Sampling frame	☐ Countries	Belgium			
	☐ Administrative Level	National			
	☑ Road user profile - Modes	Pedestrian	Cyclist	Car	LGV
	☐ Road user profile - Type	All			
	☐ Road user profile - Subgroup				
	☐ Road user profile - Age	All			
	☐ Road user profile - Gender	All			
	☐ Road network profile - Area	All			
	☐ Road network profile - Segments	All			
	☐ Accident severities	Injury	Fatal		
	☐ Injury severities	All			
	Comments				
Design	Features	Observational			
	Direction	* Exposure -> * Outcome			
	EXPOSURE DEFINITION	Rain	Snow	High winds	Cold
	OUTCOME DEFINITION	Injury accidents	Fatal accidents		
	Total number of effects	56			
	Comments	Mean comparison			
Limitations / Potential sources of bias		Extent	Motivation		
	Experiments: Pre-trial group differences	Maybe a problem	Days with rain might differ from days without on characteristics other than		

Repository
Coding template

Results

☐ Differences between effects	Effect 3	Effect 4	Effect 5	Effect 6
OUTCOME DEFINITION	Injury accidents	Injury accidents	Injury accidents	Injury a
Road user profile - Modes	Cyclist	Motorcyclist	Car	LGV
Rain - Test group	Normal day	Normal day	Normal day	Norma
Rain - Reference group	Rainy day	Rainy day	Rainy day	Rainy d
Measure of effect/association	Percent change	Percent change	Percent change	Percen
Specifications				
Estimate	-0,3420	-0,5470	0,0550	0,1750
Standard error of estimate				
Statistic [name(parameters)=x]				
p-value				
Sample size (x or n1=x1; n2=x2)	555 normal days; 702 rainy da	555 normal days; 702 rainy da	555 normal days; 702 rainy da	555 no
Confidence level	0,0500	0,0500	0,0500	0,0500
Lower limit				
Upper limit				
Adjustment variables/Covariates				
Conclusion	Significant positive effect on	Significant positive effect on	Significant negative effect or	Signific

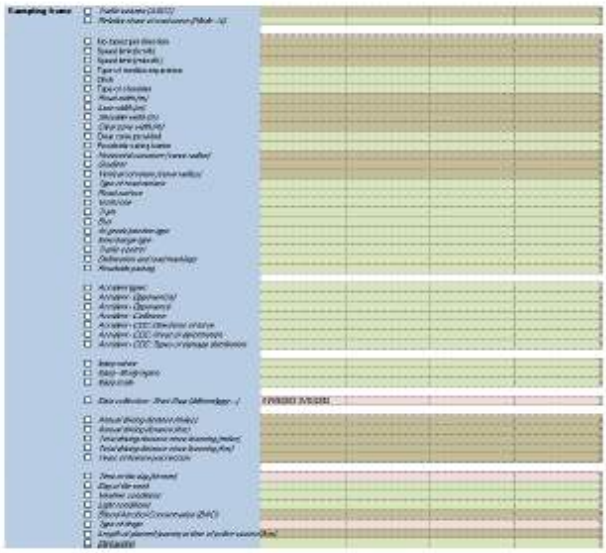
Repository
Coding template

Core info

Coder	Name	Ilenin Diogenidaale			
	Institution	BASU			
	Date (dd/mm/yyyy)	08/12/2013			
Reference	Authors	M.R. Bambach, R.J. Mitchell, R.H. Grzebieta, J. Olivier			
	Title	The effectiveness of helmets in bicycle collisions with motor vehicles: A case-co			
	Year	2013			
	Source	Accident Analysis and Prevention, 53, pp. 78-88			
	URL	doi: 10.1016/j.aap.2012.01.005			
Topic	Risk factor or Countermeasure?	Countermeasure			
☐	WP	WP8			
☐	Service	Passive Safety (VRU)			
☐	System				
☐					
☐					
☐					
	Abstract	There has been an ongoing debate in Australia and internationally regarding th			
	Keywords	bicycle helmets; head injury; case-control; bicycle collisions with motor vehicles			
Sampling frame	☐ Countries	Australia			
☐	Administrative Level	Regional			
☐	Road user profile - Modes	Cyclist			
☐	Road user profile - Type	Rider			
☐	Road user profile - Subgroup				
☐	Road user profile - Age				
☐	Road user profile - Gender	All			
☐	Road network profile - Area	Rural road	Urban road	Suburban road	
☐	Road network profile - Segments	All			
☐	Accident severities	Injury	Fatal		
☑	Injury severities	Hospital	AIS 3	AIS 4+	
	Comments	Region = New South Wales; Injury severities defined on the basis of Survival Ra			

Repository
Coding template

Flexible info



Repository
Coding template

Flexible info

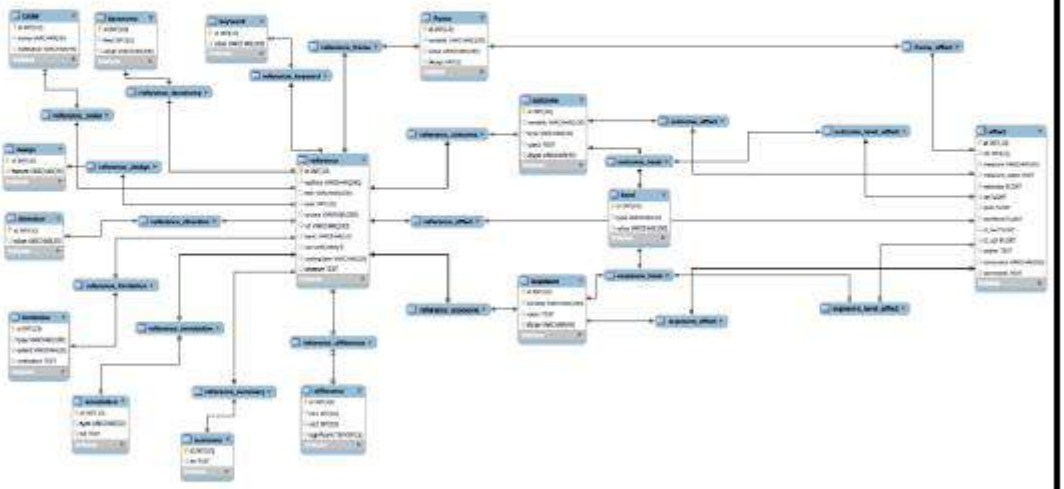
☐ Interchange type				
☐ Traffic control				
☐ Delineation and road markings				
☐ Roadside parking				
☐ Accident types				
☐ Accident - Opponent (a)	Motor vehicle (incl PTW)			
☐ Accident - Opponent b				
☐ Accident - Collisions				
☐ Accident - CDC: Directions of force				
☐ Accident - CDC: Areas of deformation				
☐ Accident - CDC: Types of damage distribution				
☑ Injury nature	Fracture	Internal	Open wound	
☐ Injury - Body region	Head			
☐ Injury scale	AIS			
☐ Data collection - Start-Stop (dd/mm/yyyy- ...)	2001-2009			

Repository
Coding template

Results

☐ Differences between effects	Effect 4	Effect 5	Effect 6	Effect 7
Injury severities	AIS 3	AIS 3; AIS 4+	Hospital	AIS 3
Injury nature	Fracture	Fracture	Internal	Internal
Injury - Cases	Hospital; Head	Hospital; Head	Hospital; Head	Hospital
Injury - Controls	Non-Head; Minor head	Non-Head; Minor head	Non-Head; Minor head	Non-Hea
Measure of effect/association	Odds ratio	Odds ratio	Odds ratio	Odds rat
Specifications	Odds for wearing a helmet	Odds for wearing a helmet	Odds for wearing a helmet	Odds for
Estimate	0,4370	0,2170	0,6260	0,3560
Standard error of estimate				
Statistic [name(parameters)=x]				
p-value	0,1710	<0.0001	0,0290	<0.0001
Sample size (x or n1=x1; n2=x2)	n (cyclist casualties)= 6745	n (cyclist casualties)= 6745	n (cyclist casualties)= 6745	n (cyclist
Confidence level	0,9500	0,9500	0,9500	0,9500
Lower limit	0,1300	0,1320	0,4080	0,2000
Upper limit	1,4660	0,3570	0,9610	0,6330
Adjustment variables/Covariates	Speed limit; Collision vehicle	Speed limit; Collision vehicle	Speed limit; Collision vehicle	Speed li
Conclusion	Non-significant effect on roa	Significant positive effect on	Significant positive effect on	Significa

Repository Database



3. Synopsis

Synopsis

- Key conclusion
- Overview
- Scientific summary
- Supporting background

Synopsis

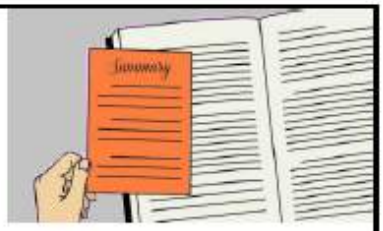
- Key conclusion

Synopsis

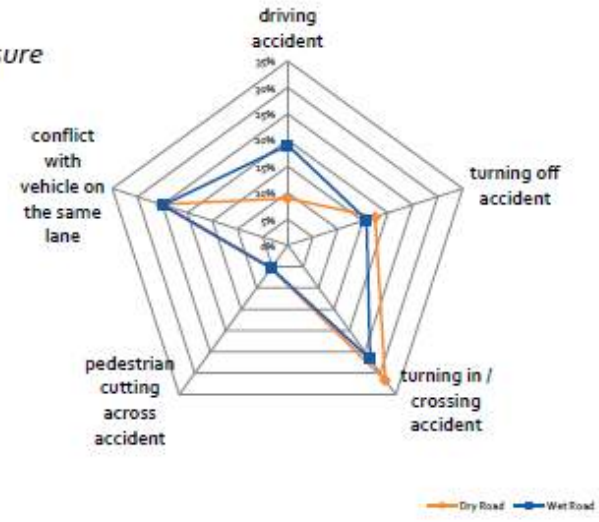
- Key conclusion

Red light running can lead to two basic types of traffic conflict at intersections: right-angle and left turn-opposed conflicts. Red light running is a traffic violation that is associated with very serious crash outcomes (fatality or serious injury). Red-light-running related crashes compose a substantial part of urban road safety. It has been estimated that the relative crash risk of red light violation for pedestrians is 8 times higher than that for legal crossing at signalised intersections.

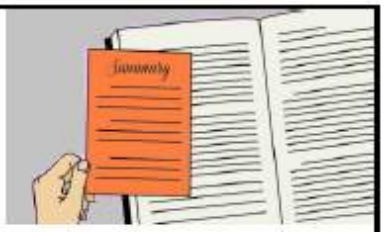
Synopsis



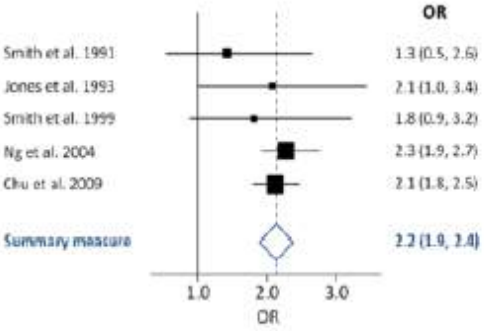
- Overview
  - *Description risk/measure*
  - *Main results*



Synopsis



- Scientific summary
  - *Analysis*
  - *Detailed results*



Synopsis

- Supporting background
  - *Tables*
  - *Details on literature search*

Progress to date

600 Studies

3500 Effects

60 Synopses

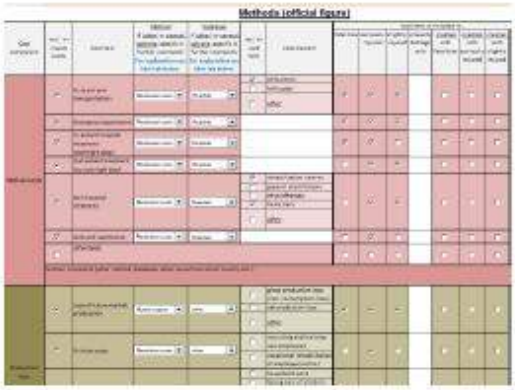
4. Prioritisation

Prioritisation

- Crash costs
- Measure costs
- Economic efficiency assessment

Prioritisation
Crash costs

- From all EU countries
- Methodology
- Cost components
- Injury costs

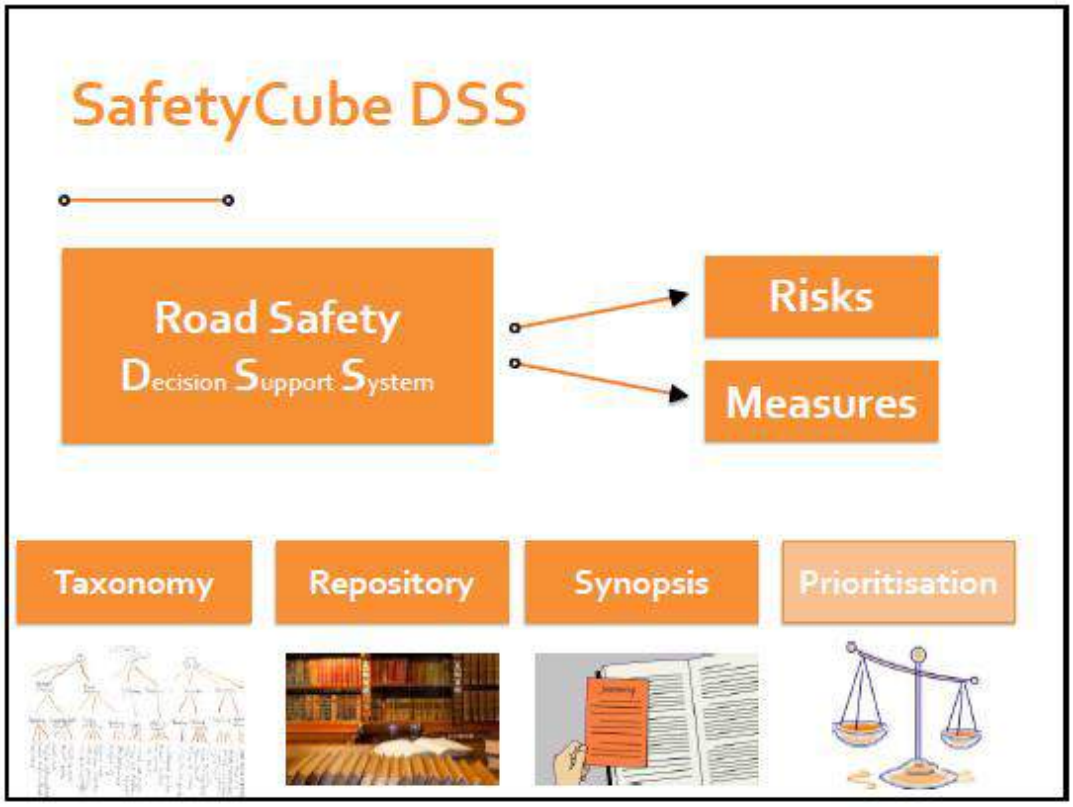


Prioritisation
Measure costs

- Preparatory costs
- Direct and indirect costs
- Maintenance costs

Prioritisation
Economic efficiency assessment

Info on measures	*Economic assessment*	Info per country
Effectiveness saved crashes - per severity category	*Cost Effectiveness Analysis* • *Costs per crash prevented (for each severity category separately)*	**Crash costs** - severity category
Time horizon	*Cost Benefit Analysis* • *Net present value (benefits – costs)* • *Cost benefit ratio (benefit / costs)*	Discount rate
Costs of measures		


SafetyCube DSS
Road Safety
Decision Support System
Risks
Measures
Taxonomy
Repository
Synopsis
Prioritisation


SafetyCube
Decision Support System:
The Scientific Basis
Heike Martensen and Wouter Van den Berghe
SafetyCube Workshop
Brussels, 27 September 2016
Co-funded by the Horizon 2020
Framework Programme of the European Union
9/27/2016

Appendix F. The SafetyCube Decision Support System prototype – George Yannis

SafetyCube

Design of the European Road Safety Decision Support System

George Yannis and Eleonora Papadimitriou

SafetyCube Workshop

Brussels, 27 September 2016

Co-funded by the Horizon 2020 Framework Programme of the European Union

9/27/2016

SafetyCube DSS Objectives

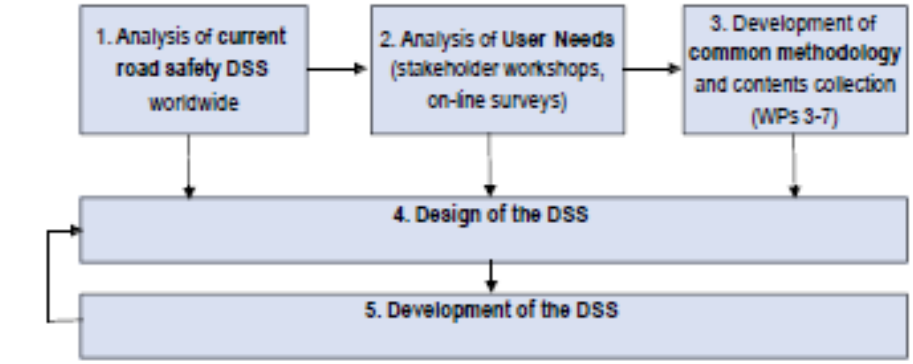
The SafetyCube DSS objective
is to provide the European and Global road safety community
a user friendly, web-based, interactive Decision Support Tool
to properly substantiate their road safety decisions
for the actions, measures, programmes, policies and strategies
to be implemented at local, regional, national, European and international level.

The main contents of the SafetyCube DSS concern:

- road accident risk factors and problems
- road safety measures
- best estimate of casualty reduction effectiveness
- cost-benefit evaluation
- all related analytic background

Special focus is given to linking road safety problems with related countermeasures.

SafetyCube DSS Development Methodology



Testing, Pilot Operation, User Training and future continuous Maintenance will follow.

Current Road Safety DSS Worldwide

- Crash Modification Factors Clearinghouse (www.cmfclearinghouse.org)
  by NHTSA (USA) - **5.151 CMF** on infrastructure only - on going
- Road Safety Engineering Kit (www.engtoolkit.com.au)
  by Austroads (Australia) - **67 treatments** on infrastructure only
- PRACT Repository (www.pract-repository.eu)
  by CEDR (Europe) - **889CMF and 273 APM** on infrastructure only – high quality
- iRAP toolkit (toolkit.irap.org/)
  by iRAP - **58 treatments** (43 on infrastructure)
- Safety Performance Factors Clearinghouse (spfclearinghouse.org)
  by Tatum Group LLC, Dr. Andrew Kwasniak (USA) - **few SPF** – subscribers only

SafetyCube DSS Users

- PublicAuthorities
  local, regional, national, European and international
- Industry
  Infrastructure, Vehicle, Insurance, Technology
- Research Institutes
- Non GovernmentalOrganisations
- Mass media

The SafetyCube DSS is intended to have a life well beyond the end of the SafetyCube research project. Furthermore, it will be developed in a form that can readily be incorporated within the existing European Road Safety Observatory of the European Commission DG-MOVE.

SafetyCube DSS User Needs

- SafetyCube stakeholders' consultation Workshops
  - Brussels 2015,
  - Ljubljana 2015,
  - Brussels (WP5-Infrastructure) 2016,
  - Hague (WP7-Serious Injuries) 2016
- SafetyCube on-line survey
- Consolidated Table of user needs

SafetyCube DSS Design Principles

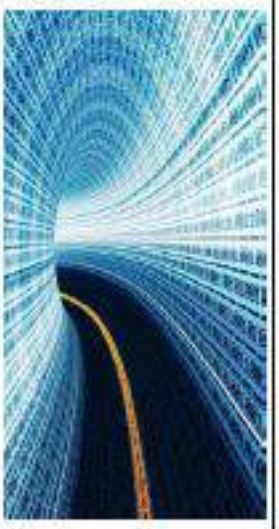
- A **Modern** web-based tool
- High **Ergonomy** interface
- **Simple** structure
- Powerfull **Search** Engines
- Fully **Documented** information
- Easily **Updated**

SafetyCube DSS Website Design Principles

- A strong **web address**
  e.g. www.safetycube-dss.eu
- **Consistent design** throughout all tools
  (unique visual identity, colors, design, messages, etc.)
- Modern and **ergonomic** design
  [multimedia (photos and videos) wherever possible]
- Allow for **updates**
  - *feedback from the users*
  - *feedback from visits traffic monitoring*
- Develop a robust **promotion policy**, during and after the project (newsletter, twitter, etc.)

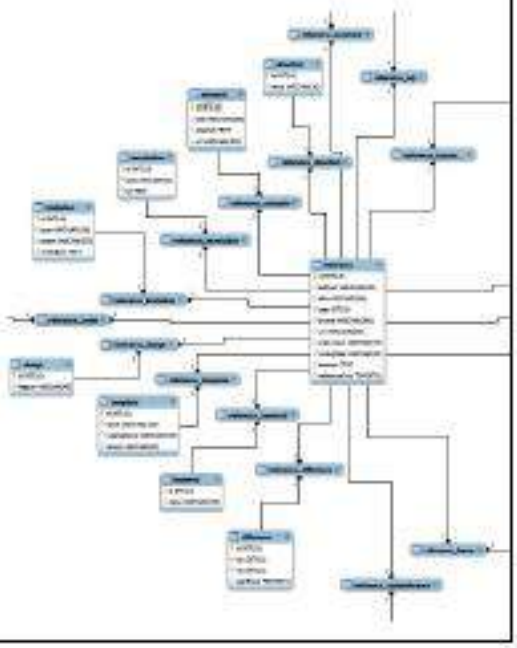
SafetyCube DSS Search Engine

- Fully **linked** search
  - *search a road safety problem alone or through the measures*
  - *search a measure alone or through the road safety problems*
  - *Search for risks and measures related to specific road user groups or crash types*
- Fully **detailed** search
  - *search by any parameter in each data table (road safety problems, measures)*
- Fully **flexible** search
  - *adjust and customize search according to results*
- Fully **documented** search
  - *access background information at any stage (links, etc.)*

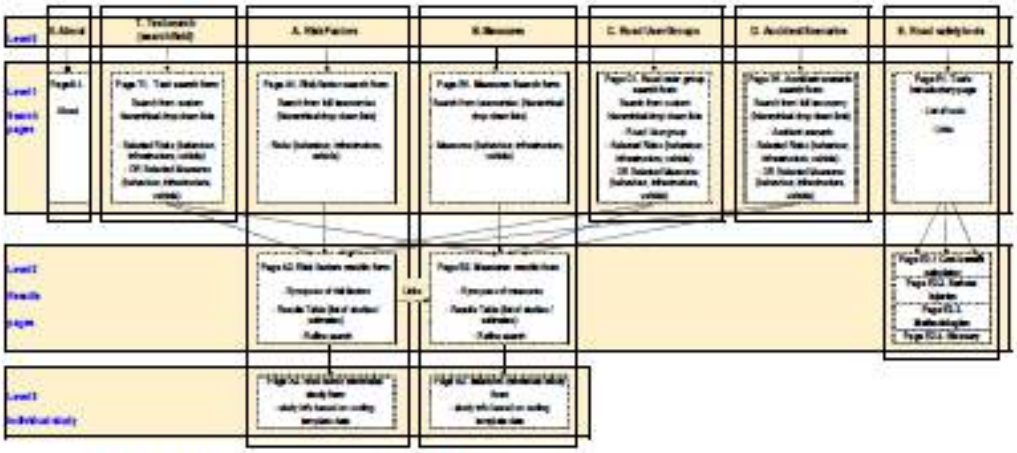


Relational Data Base

- The templates of **coded studies** will undergo a thorough checking and debugging process
- The templates are eventually stored in a **relational database**, which will serve as the back-end of the DSS
- Front-end DSS results will be retrieved through **queries** on the back-end database (DSS search engine).



SafetyCube DSS Structure



Home Page Main Menu (About - Search - Tools)

Three Levels of Search (Search - Results pages - Individual study pages)

Two Interlinked Search Streams (Risk Factors – Road Safety Measures)

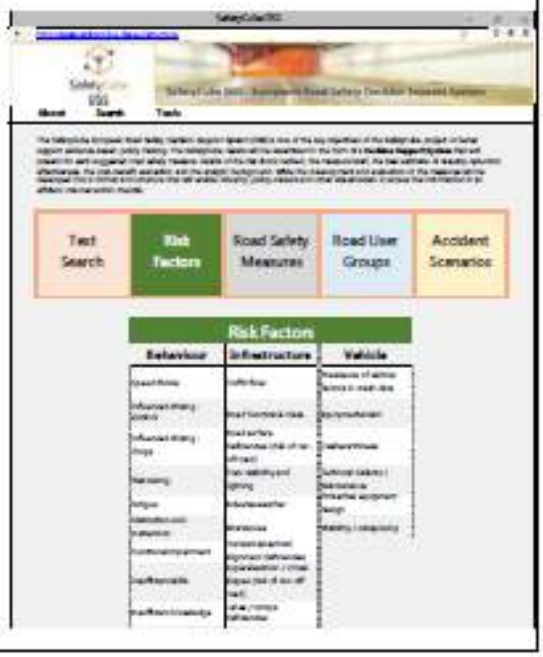
SafetyCube DSS Homepage (Entry Points)

- **ABOUT** SafetyCube
  Basic Information about SafetyCube and the DSS
- **SEARCH**
  - Text search (key-words)
  - Risk Factors
    (Risk factors search engine)
  - Road Safety Measures
    (Measures search engine)
  - Road User Groups
    (Risk factors and Measures search engines)
  - Accident Scenarios
    (Risk factors and Measures search engines)
- **TOOLS**
  Background information, resources and methodology, including extensive glossary

Risk Factors Search Parameters

Three categories of taxonomy fields

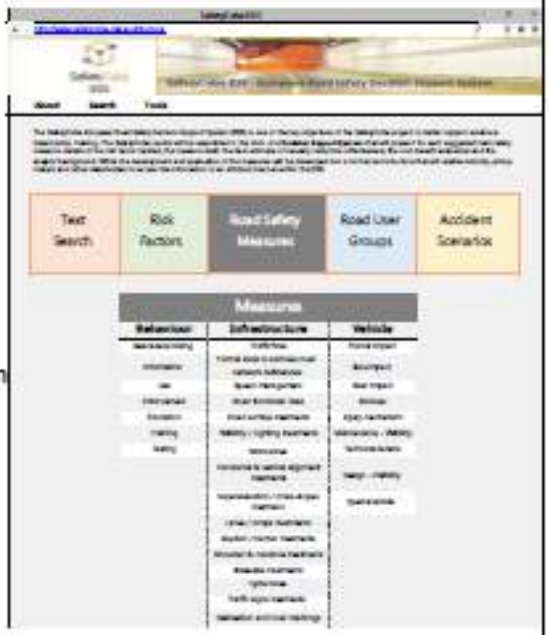
- Category
  road user, infrastructure, vehicle
- Topic
  e.g. roadside deficiencies, distraction inside vehicle, inappropriate speed
- Specific risk factor
  e.g.no clear-zone, mobile phone, too fast / too slow



Measures Search Parameters

Three categories of taxonomy fields

- Category
  road user, infrastructure, vehicle
- Topic
  e.g. formal tools to address road network deficiencies, speed regulation
- Specific measure
  e.g. road safety audits, lower speed limits



Risk Factors results parameters

Search results

- Short summaries of syntheses (meta-analyses) available
- Table listing the available synopses, meta-analyses and other studies
- Table columns concern main study characteristics (design, outcome variable, effect type and size, country, year etc.)

Refine search

- Specific risk factor
- Search filters:
  - Road user types: All, car occupants, drivers, passengers, PTW riders, pedestrians, cyclists, HGV.
  - Road types: All, motorways, rural roads, urban roads
  - Region / Country: EU, EU countries (all names), US and Canada, Australia, Asia.
  - "Colour code": Risky, probably risky, unclear, probably not risky

Links to related measures

- Go to measures search page, where the list of related measures is displayed as a pre-filled search

Individual study results

Title, author, source, abstract

- Link to URL for full-text download (depending on Institute permissions)

Study design info

- Country
- Research Method, Design, Sample N
- Control group, Risk Group
- Modifying Conditions

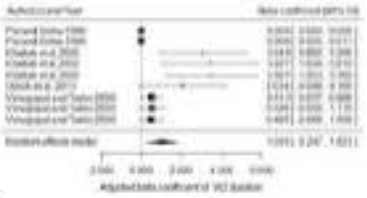
Study results:

- Table listing the effects reported in the study
- Table columns concern main study / effect characteristics (outcome variable, effect type, size and confidence intervals, statistical significance)

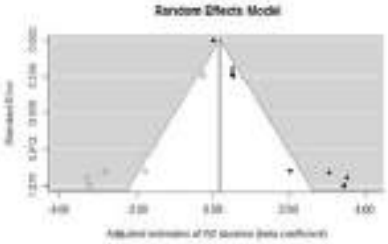
SafetyCube synopses

Syntheses on risk factors / measures

Summary (2 pages)
- Effect of risk factor / measure and ranking (colour code)
- Risk / safety effect mechanisms
- Risk / safety effects size, transferability of effects



Scientific overview (4-5 pages)
- Comprehensive comparative analysis of available studies desig ns and results
- Analysis results
  - *Meta-analysis*
  - *Vote-count analysis*
  - *Qualitative analysis*



Supporting document (3-10 pages)
- Literature search strategy and study selection criteria
- Detailed analyses

Road User Group Search Parameters

Road User Groups
- Pedestrian
- Bicycles
- Power Two Wheelers / ATV
- Passenger Cars
- Light Goods Vehicles
- Trucks / Bus

For each group, 3+3 categories of taxonomy fields
- Risks: road user, infrastructure, vehicle
- Measures: road user, infrastructure, vehicle

- Topic
- Specific risk factor / measure

Accident Scenario Search Parameters

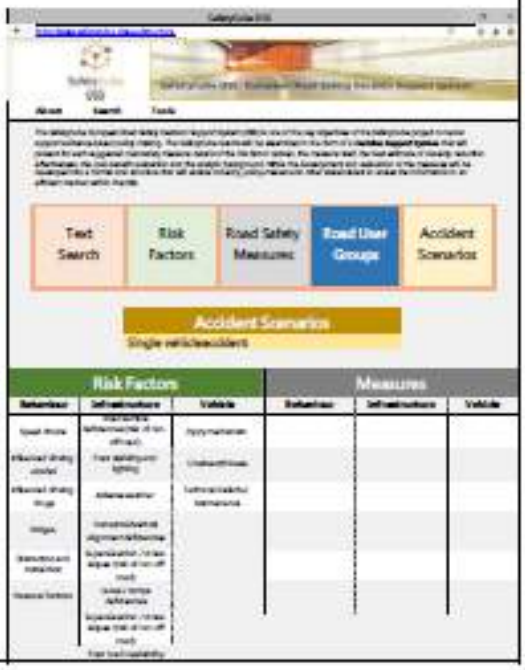
Accident scenarios

- Pedestrian accident
- Bicycle accident
- Single vehicle accident
- Head-on collisions
- Rear end collisions
- Junction accident – no turning
- Junction accident – turning
- Railway level crossing

For each scenario, 3+3 categories of taxonomy fields

- Related Risks: road user, infrastructure, vehicle
- Related Measures: road user, infrastructure, vehicle

- Topic
- Specific risk factor / measure



Text Search Parameters

Key-word search

- Auto-complete field among all key-words in the database

For each key-word, 3+3 categories of taxonomy fields

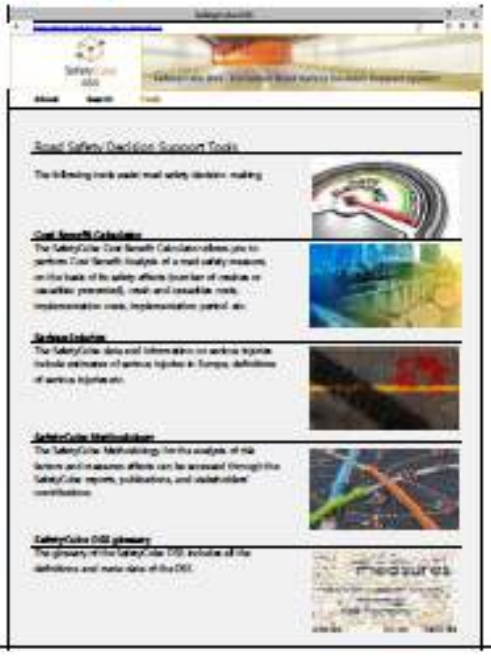
- Related Risks: road user, infrastructure, vehicle
- Related Measures: road user, infrastructure, vehicle

- Topic
- Specific risk factor / measure

SafetyCube Tools pages

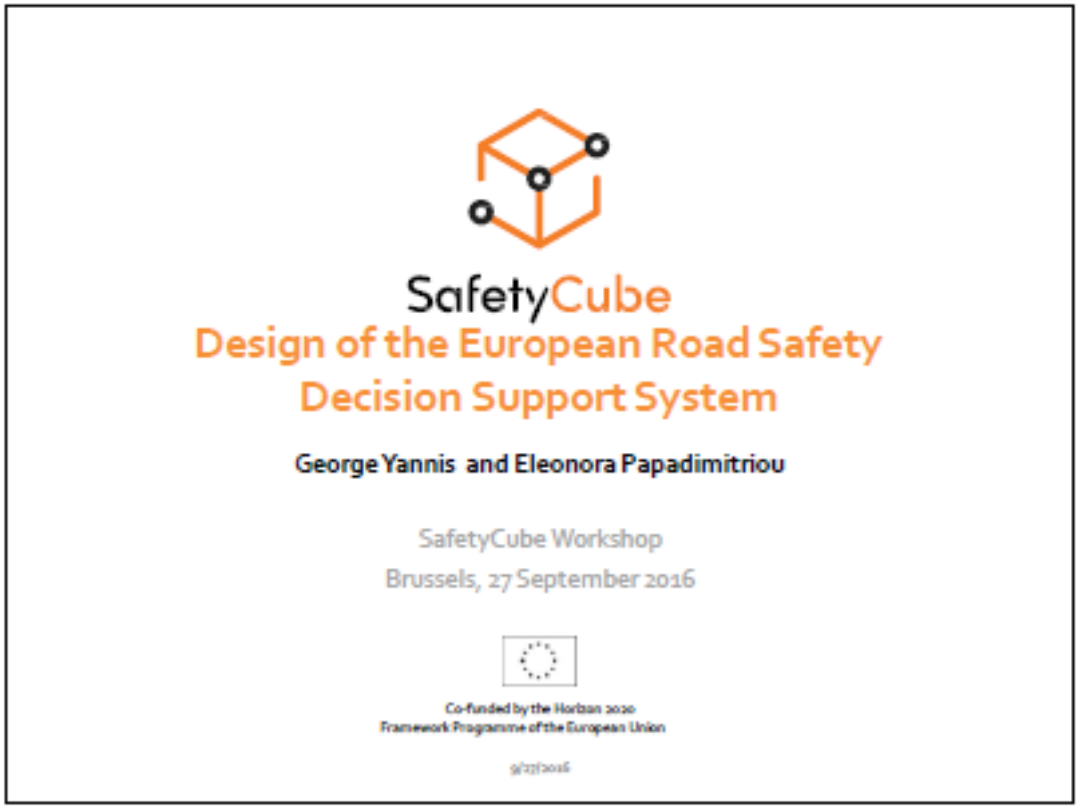
Links to SafetyCube tools

- Cost Benefit Calculator
- Serious Injuries
- SafetyCube Methodology
- SafetyCube Glossary
- …



SafetyCube DSS Development Next steps

- **Development of the static DSS (Wire Frames)**
  - *Completed*
  - *[further improved incorporating comments from this Workshop]*
- **SafetyCube DSS Development phase**
  - *between September and December 2016*
  - *including all risk factors (~3.500 effects from 600 studies) and several measures*
- **SafetyCube DSS Pilot Operation**
  - *starting early 2017*
- **SafetyCube DSS Opening**
  - *Starting mid 2017*
- **Continuous Update**
  - *Starting on April 2018 (end of SafetyCube project)*


SafetyCube
Design of the European Road Safety Decision Support System
George Yannis and Eleonora Papadimitriou
SafetyCube Workshop
Brussels, 27 September 2016
Co-funded by the Horizon 2020 Framework Programme of the European Union
9/27/2016

Appendix G. Cost-benefit Information in the DSS – Heike Martensen

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Decision Support System: Economic Efficiency Assessment

SafetyCube midterm-workshop Brussels, 27 September 2016

Co-funded by the Horizon 2020 Framework Programme of the European Union

9/27/2016

SafetyCube DSS

Road Safety Decision Support System

- Risks
- Measures

Taxonomy	Repository	Synopsis	Prioritisation




Prioritisation
Cost efficiency assessment

Info on measures	Economic assessment	Info per country
Effectiveness saved crashes - per severity category	Cost Effectiveness Analysis • Costs per crash prevented (for each severity category separately)	Crash costs - severity category
Time horizon	Cost Benefit Analysis • Net present value (benefits – costs) • Cost benefit ratio (benefit / costs)	Discount rate
Costs of measures		

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Appendix H. Accident Scenaria – Walter Niewöhner

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Accident Scenarios

Prepared by SafetyCube participants
Presenter: Walter Niewöhner

SafetyCube Workshop

Brussels, 27 September 2016

Co-funded by the Horizon 2020
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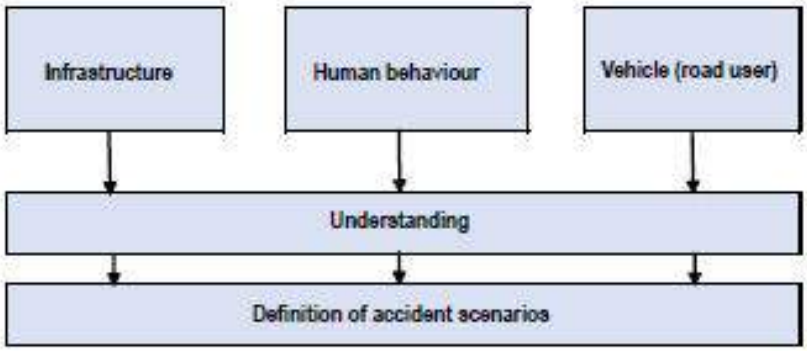
Accident Scenarios

- One Entry Point of DSS

The background of the end user is influencing the point of view

SafetyCube Accident Scenarios



Accident Scenarios

- Types of interest:
  background of end user
  risks
  measures
  passive safety
  active safety
  ...
- Example:
  single vehicle accident,
  leaving the road,
  object collision

Source: DEKRA Road Safety Report

Accident Scenarios
Main Groups

Scenarios prepared for accident level

- Run-off the road
- Object in carriage way
- Head-on collisions
- Rear end collisions
- Junction accident (no turning)
- Junction accident (turning)
- Railway level crossing
- Others

Accident Scenarios
Main Level – Run-Off The Road

- Main level
  + Sub level

  * involved road user(s) **(incl. 1 + 'x' involved parties)**

  x = 0, 1, 2, 3, ...

Main Level	Sub level	Scenario no.	car/truck...	motorcycle	bicycle	pedestrian	train
Run-off-the-road							
	leaving nearside - with rollover	1.1	X				
	leaving nearside - with object collision (tree, pole, wall, ...)	1.2	X	X	X		
	leaving nearside - with collision with other road user	1.3	X	X	X	X	
	leaving nearside - without rollover / object collision	1.4	X	X	X		
	leaving farside - with rollover	1.5	X				
	leaving farside - with object collision (tree, pole, wall, ...)	1.6	X	X	X		
	leaving farside - with collision with other road user	1.7	X	X	X	X	
	leaving farside - without rollover / object collision	1.8	X	X	X		

Accident Scenarios Main Levels 1 - 4

Main Level	Sub level	Scenario no.	car/truck...	motorcycle	bicycle	pedestrian	train
Run-off-the-road							
	leaving nearside - with rollover	1.1	X				
	leaving nearside - with object collision (tree, pole, wall, ...)	1.2	X	X	X		
	leaving nearside - with collision with other road user	1.3	X	X	X	X	
	leaving nearside - without rollover / object collision	1.4	X	X	X		
	leaving farside - with rollover	1.5	X				
	leaving farside - with object collision (tree, pole, wall, ...)	1.6	X	X	X		
	leaving farside - with collision with other road user	1.7	X	X	X	X	
	leaving farside - without rollover / object collision	1.8	X	X	X		
Object in carriage way							
	parked vehicle	2.1	X	X	X		
	lost load	2.2	X	X	X		
	domestic animals	2.3	X	X	X		
	wild animals	2.4	X	X	X		
	other (e.g. fallen tree)	2.5	X	X	X		
Head-on collisions							
	front to front (overtaking)	3.1	X	X	X		X
	front to front (unintended lane change stable)	3.2	X	X	X		X
	front to front (unintended lane change instable)	3.3	X	X	X		X
	other	3.4	X	X	X		X
Rear-end collisions							
	standing vehicle	4.1	X	X	X		X
	breaking vehicle	4.2	X	X	X		X
	driving vehicle	4.3	X	X	X		X
	lane changing vehicle	4.4	X	X	X		X
	other	4.5	X	X	X		X

Accident Scenarios Main Levels 5 - 8

Main Level	Sub level	Scenario no.	car/truck...	motorcycle	bicycle	pedestrian	train
Junction accident - no turning							
	participant required to yield crossing from nearside road	5.1	X	X	X	X	X
	participant required to yield crossing from farside road	5.2	X	X	X	X	X
Junction accident - turning							
	farside turn - other participant in direction (following or overtaking)	6.1	X	X	X		X
	farside turn - other participant in opposite direction	6.2	X	X	X		X
	farside turn - other participant from other road	6.3	X	X	X		X
	farside turn - both participant farside turning	6.4	X	X	X		X
	farside turn - pedestrian/cyclist on sideway	6.5	X	X	X	X	X
	farside turn - other	6.6	X	X	X		X
	nearside turn - other road user in direction	6.7	X	X	X		X
	nearside turn - other road in opposite direction	6.8	X	X	X		X
	nearside turn - other road user from other road	6.9	X	X	X		X
	nearside turn - pedestrian/cyclist on sideway	6.10	X	X	X	X	X
	nearside turn - other	6.11	X	X	X		X
railway level crossing							
	with barriers	7.1	X	X	X	X	X
	without barriers	7.2	X	X	X	X	X
other accident							
	side collision with other participant crossing	8.1	X	X			X
	side-stroke collision with other participant in same direction	8.2	X	X			X
	falling two-wheeler without leaving the road	8.3		X	X		
	and without collision with another participant	8.4	X				X
	falling occupant (bus, tram) without collision	8.5	X	X	X	X	X
	pedestrian crossing at straight stretch	8.6	X	X	X	X	X
	pedestrian walking on the road	8.7	X	X	X	X	X
	u-turn	8.8	X	X	X		
	reversing	8.9	X	X	X		
	dooring	8.10	X	X	X		

Accident Scenarios Summary

- Is one possible 'Entry Point' for the DSS
- Interest of the end user
- Scenarios prepared for accident level
- 8 main levels + 46 sub levels
- Numerous combinations of involved road users

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Accident Scenarios Questions?

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Appendix I. SafetyCube DSS parameters and examples:

Road User Behaviour - Eva Aigner-Breuss
Infrastructure – Eleonora Papadimitriou

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Road User Behaviour

WP4

Road user behaviour – WP4

- Contributing partners

Objectives

Main objective of SafetyCube is to create a repository of estimates of risk factors and safety effects

→ Human Behaviour related risk factors and measures in WP4

- Identify and assess (accident) risk factors related to the road use
- Identify measures for addressing these risk factors
- Assess the effect of measures

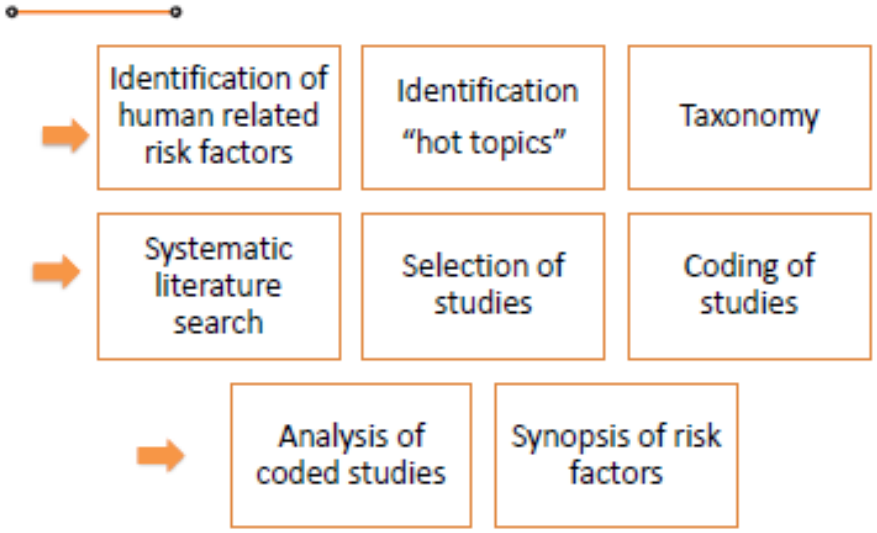
Including all kinds of …

… Road Users

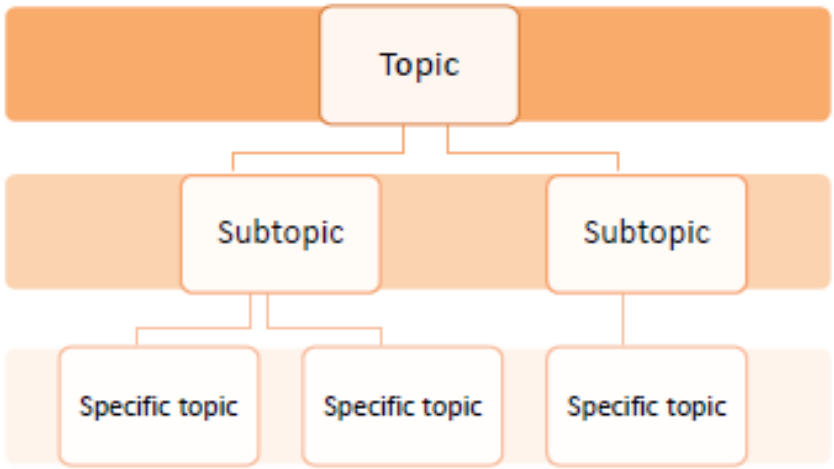
… Risk Factors

… Countermeasures

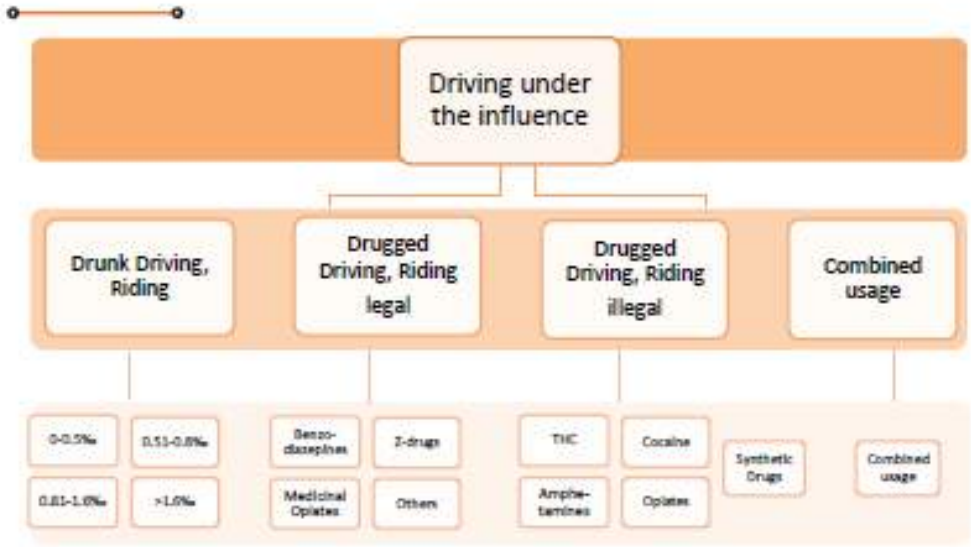
Steps in the process (risk factors)



Structur of the taxonomy (risk factors)



Example: driving under the influence



Topics (risk factors)

- Speeding
- Influenced driving
- Risk taking
- Fatigue
- Distraction and inattention
- Functional impairment
- Insufficient skills and knowledge
- Emotion & Stress
- Misjudgement & Observation Errors
- Traffic rule violations
- Personal Factors
- Diseases and Disorders
- Age

Road user groups, age groups, VRU

- Road user groups are included in the individual topics
- age groups and VRU are not treated as a separate risk factor but within the other risk factors
- There will be a focus on these groups in the step of identifying and selecting measures

Challenges

- rare or no studies that focused on the relationship between the risk factors and accidents for some risk factors (e.g. emotion)
- many available studies focused more on conditions of the behaviour rather than the risk factor itself
- Comparability of different outcome variables
- division between risk and measures e.g. safety devices
- interrelation of behaviour, infrastructure, vehicle

Results: Risk Factors

- More than 150 coded Studies
- Risk estimation for risk factors: Colour Code
- 24 Synopsis on various topics
- Deliverable

Risk assessment

Risky	Probably risky	Unclear
• Influenced Driving: Alcohol • Influenced Driving: Drugs (legal & illegal) • Speed Choice: Speeding • Traffic Rule Violations: Red light running • Distraction: Cell phone use (hand held) • Distraction: Cell phone use (hands free) • Fatigue: Sleep disorders - Sleep Apnea	• Risk taking: Overtaking • Risk taking: Close following (headway) • Insufficient Knowledge and Skills • Functional Impairment: Cognitive impairment • Functional Impairment: Vision loss • Diseases and Disorders: Diabetes • Personal Factors: Sensation seeking • Personal Factors ADHD • Emotions (Anger/Aggression) • Fatigue: Sleepiness/ sleep deprivation	• Functional Impairment: Hearing loss (few studies) • Observation Errors (few studies) • Distraction: Music – entertainment systems (many studies – mixed results) • Distraction: Operating Devices (many studies – mixed results)

Preview

- Measures

Your expertise is needed…

Most important human related Road Safety Measures

Measures / Risk				

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Safety CaUsation, Benefits and Efficiency

Infrastructure

Eleonora Papadimitriou, NTUA

Vision

- To create **an inventory of evaluated road safety risks measures related to the road infrastructure,** with results from accident risk factors analysis and measures cost-efficiency assessment, to be integrated in the European Road Safety Decision Support System (DSS)

Objectives

- The in-depth understanding of infrastructure related **accident causation factors** and the identification and evaluation of the most appropriate related **measures**.
- Exploit a large amount of existing accident data (macroscopic and in-depth) and knowledge (e.g. existing studies) in order:
  - *to identify and rank risk factors related to the road infrastructure,*
  - *to identify measures for addressing these risk factors,*
  - *to assess the effects of measures.*

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Research team

- NTUA, Greece
- Loughborough University, UK
- KfV, Austria
- CTL, Italy
- BRSI, Belgium
- TOI, Norway
- SWOV, Netherlands
- AVP, Slovenia
- ERF, Belgium

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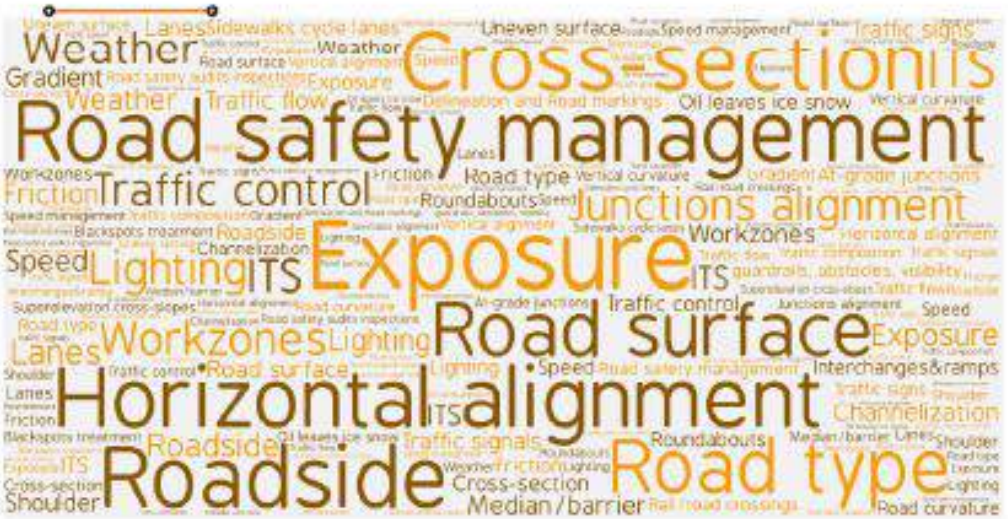
Nearly 60 risk factors and 100 measures in more than 15 infrastructure areas
- **motorways, rural and urban roads -**
- **road segments and junctions -**



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Infrastructure 'hot topics'

1. **Self-explaining and forgiving roads**: Removing obstacles, Introduce shoulder, Alignment (horizontal / vertical), Sight distance, Traffic signs, Raised crossings / intersections
2. **Urban road safety measures**: Pedestrians / cyclists, Upgrade of Crossings, New crossings, Junctions / roundabouts treatments for VRU, Visibility
3. **Road safety management**: Quality of measures implementation, Appropriate speed limits, Enforcement, Availability of cost-effectiveness data, Workzones
4. **ITS applications**: ISA, Dynamic speed warning, ADAS and active safety with V2I, VMS

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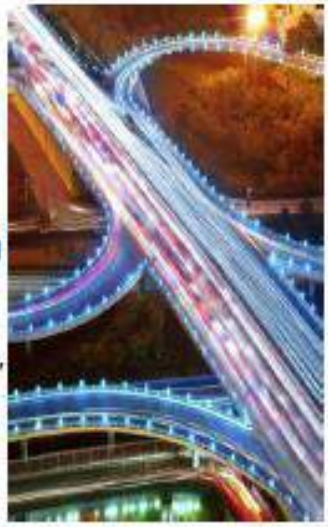
Methodological approach

- Taxonomy of infrastructure risk factors
- Exhaustive literature review and rigorous study selection criteria
- Template for coding studies
- Studies analysed for carrying out meta-analyses to estimate the effects of risk factors.
- Synopses summarising results / meta-analysing risk factors
- Systems approach: links between infrastructure, user and vehicle risks
- Assessment of the quality of the data / study methods



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Risks taxonomy

Traffic flow	Traffic volume congestion secondary accidents traffic composition (share of pedestrians, cyclists, PTW, HGV) distribution of flow over arms at junctions
Road type	Road type
Road surface deficiencies (risk of ran-off road)	inadequate friction uneven surface ice, snow oil, leaves, etc.
Poor visibility and lighting	poor visibility - darkness poor visibility - fog
Adverse weather	rain snow / ice / low temperatures wind
Workzones	small workzone length high workzone duration insufficient signage
Horizontal/vertical alignment deficiencies	low curve radius absence of transition curves frequent curves densely spaced junctions poor sight distance - horizontal curves high grade vertical curve radius

Risks taxonomy

Superelevation / cross-slopes (risk of ran-off road)	superelevation at curve
	cross-slope
Lanes / ramps deficiencies	number of lanes
	narrow lane
Median / barrier deficiencies (risk of crash with oncoming traffic)	undivided road
	narrow median
Shoulder and roadside deficiencies (risk of ran-off road or crash with obstacle)	absence of shoulder
	narrow shoulder
	absence of guardrails or crash cushions
	absence of clear zone
	roadside obstacles (per type of obstacle e.g. trees)
	sight obstructions
Poor road readability	absence of traffic signs
	misleading or unreadable traffic signs
	absence of road markings
	absence of rumble strips
Interchange deficiencies	inadequate ramp capacity
	insufficient ramp length
	insufficient acceleration / deceleration lane length
	absence of channelisation
	absence of access control
	poor sight distance
At-grade junctions deficiencies	high number of conflict points
	type of junction
	skewness / junction angle
	poor sight distance
	gradient
Rail-road crossings (risk of collision with train)	uncontrolled rail-road crossing
Poor junction readability	uncontrolled junction
	misleading or unreadable traffic sign
	absence of road markings

Main challenges

- Difficulty in separating risks from measures effects (e.g. median, guardrails)
- Combined effects of infrastructure design elements
- Complexity of 'hot topics' (e.g. road readability)
- Methodological issues:
  - *Outdated studies (e.g. alignment, cross-section)*
  - *Limited studies (e.g. interchanges, road surface)*
  - *Various forms of Accident Prediction Models*
- Transferability
  - *Lack of European studies*

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Analyses on risks

- **Wealth of studies** related to road infrastructure, but less focus on risk aspects
- Risk analysis completed
- Already analysed approx. **270 studies on risks**
- Selection criteria:
  - *Meta-analyses*
  - *Recent studies*
  - *High quality studies with quantitative results*
- Drafted **36 topic synopses (5 original meta-analyses)**.
- Risk estimation for risk factors: Colour Code

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Synthesis of results

- Ranking of risk factors

Red (Risky)	Yellow (Probably risky)	Grey (Unclear)	Green (no risk)
! Traffic Volume ! Traffic Composition ! Road Surface Deficiencies ! Small workzone length ! Low Curve Radius ! Absence of Shoulder ! Narrow Shoulders	Secondary incidents / accidents Absence of Transition curves Road type High grade Tunnel Narrow lane Undivided road Narrow median Absence of guard rails / clear zone & roadside obstacle Sight obstructions High number of conflict points Type of junction Skewness / Junction angle Poor sight distance Gradient Uncontrolled rail-road crossing Absence of road markings / marked crosswalks Uncontrolled junction	? Congestion ? Distribution of flow over arms at junctions ? Frost and snow ? High workzone duration ? Frequent curves ? Densely spaced junctions ? Insufficient acceleration / deceleration lane length	✓ Superelevation at curves

Stakeholders' involvement

- The activities are supported by the **consultation** of road safety infrastructure stakeholders:
- **At the beginning of the project**, assist in the identification of user needs and "hot topics" and provide related data and knowledge
- **At Mid-Term**, provide additional data and feedback on the analyses results and DSS development

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Workshop objectives

- To present the project activities to date and plans for the coming research steps, and to receive feedback concerning:
- **the DSS prototype**: is it user-friendly? is the structure clear? is the presentation of results appropriate? how could the system be accessed?, etc.
- **the infrastructure / behaviour topics in the DSS:** is the information presented useful? is the presentation helpful? how could it be improved?, etc.

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Safety CaUsation, Benefits and Efficiency

Infrastructure

Eleonora Papadimitriou, NTUA

Guided tour to the DSS

Appendix J. Discussion/Responses SafetyCube DSS Methodology

Question/feedback/suggestion	Answer given (if applicable)	Suggested implementation for DSS
The DSS contains a lot of studies often meta-analysis that have to have similar methods, do you take this into account? Did you code studies which contain quoted results from other studies?	In the analysis of the studies we focus on empirical data. We chose only studies with data analysis, we do not code reviews of studies. Sometimes we find quoted results but we try to look beyond this. We do consider the data analysis in a paper to see if it does support the conclusion. We focus on the data analysed to avoid bias. In the DSS there is also the link to the original material so you will be able to link to the actual study and read it in context with the expert's opinion.	
In the results list of studies would be good to see the year when the studies have been published and the years which the data of the studies refers to.	The date/year can be easily made more visible, we could also add it in the results table, this information is already in the reference fields of the study. We could also put it on the left so you can filter by recent studies.	Add year at the filtering parameters.
What is your current thought on how to do CBA?	We are collecting information and examples from several countries but we will not say how much the cost of crashes is in Europe. There are too many differences among European countries. We will present our results for each country but it will be impossible to generalise at a European level.	Set up a tool to put in your country's costs.
The cost is different between countries – how do you deal with this?	How much people are willing to spend – willingness to pay for accident prevention varies between countries. The basic rule is you have to match the crash cost and measure cost being considered from the same country.	
Do you prefer that SafetyCube DSS refers to "risk factors and measures" or "problems and solutions"?	The vote is for "Risk factors and measures".	Use "Risk factors and measures".
Why did you not use existing scenarios?	SafetyCube new scenaria integrate infrastructure, behaviour and vehicle whereas the existing ones are mainly referring to infrastructure. Data coming from different "in-depth crash" databases should be able to be transferred into SafetyCube scenaria. We also wanted definitions to be broad so that end users can easily find what they want.	
How you define risk factors and how do you classify them by colours?	We use risk more broadly as a term (see P. Thomas' presentation). 'Risky' means that there is enough research demonstrating that there is a risk. 'Probably risky' indicates that there is tendency it looks like it is going that way that it is going to be risky – you need to read more about it. 'Unclear' is used when you are not likely to find the answer at the moment – there are too few studies or they are not good quality, or they are completely 50/50 on the findings.	

What is text search based on?	The free text search is based on all the keywords highlighted in the coded studies. There will be an auto complete then you have to choose from this. The synonyms are also considered with the search term.	
The colour code could be further differentiated for those risk factors that are influenced by other variables (i.e. a risk can be more or less risky if there is more or less traffic).	Within each study's result there is a table where you can find the effects of other variables on the risk factor.	
Why did you not include major national studies?	Because we chose a common language and mainly because the highest quality studies are in English.	Someday include studies in other languages.
Do you integrate in the DSS other European projects reports?	For historic projects the reports and papers will have been included as searchable. But for current projects this is harder as they do not have outputs yet.	

Appendix K. Discussion/Responses SafetyCube DSS Design and User Interface

Question/feedback/suggestion	Answer given (if applicable)	Suggested implementation for DSS
It would be useful to include in the results of measures the type of institution who should implement the measure e.g. industry, national or local authority.	It would be possible to include "type of user profile" as a label/filter– e.g. I am a local authority or industry.	Add user profile (Authority, industry, citizens, NGO, etc.), at the filtering parameters.
What results would I get if I search only for "truck"?	If truck is a keyword you will find risks and measures results. If it is not you may want to search in the Glossary for the correct synonym to use within the DSS.	Publish the Glossary in the search webpage of the DSS.
If I put in the search engine "blind side truck" but I don't know that the actual term is nearside?	You need to use the Glossary for "blind side" and then filter for road user group "truck".	Investigate if there is a way for the DSS to do this automatically.
If I enter the DSS through the Accident scenaria, will I get the information regarding the causes of a type of accident?	The scenaria will link to the risks as well as measures – so you will be directed to the risks that could lead to this type of accident.	
How do I search for accident scenaria that involve motorcycles?	You could go into Powered Two Wheelers as a road user group and here you would see a list of all the risks and measures that concern motorcycles. For further information we want to link our information to the existing information like ERSO where scientific texts and statistical information using CARE data are available. The DSS is not a stats information tool to give you figures but we want it to be a system which integrates with other databases.	Consider if there is any way to make it easier to get information related to different users groups

When moving between the risks and measures results page.Since the DSS links to an intermediate page when a risk is connected to several measures, in order to standardise the system, could we have the intermediate page also when a risk in connected to only one measure?		When moving from a risk factor to the related measures, always include an intermediate page which lists the different types of measures, even if there is only one measure.
Would it be possible to extract in pdf both the list of results and the webpage which includes the details about studies (level 3)?		Make the table of results printable as well as the study's details webpage.
When you look for specific results in a text search e.g. roundabout – do you get a synopsis for this?	The DSS will give the following results: (i) all the synopsis linked to the studies that have "roundabout" as keyword so the synopsis might be partially related to "roundabout"; (ii) all the studies coded that mention roundabout.	Identify some popular topics and see if maybe we could create a synopsis for them.
Would it be possible to add some filters? i.e I would like to look for workzone but only at night	Time of day is not a filter but it could be a filter. But this is quite specific. The DSS is not an accident prediction model, it is doing something different.	Maybe add time of the day as a filter. The search may be done for 2 keywords with OR and AND.
Where do I find the list of keywords to search in the free text search bar?	In each study the researchers have highlighted the keywords. We do not have a complete list yet.	Publish the list of keywords or use the list as an entry point to the DSS.
How does different wording influence research results, e.g. "pedestrian crash" vs. "pedestrian accident" or "bike" vs "bicycle" vs "pedelec" etc.?	The Glossary will provide synonym and a list of the correct words to use (i.e. bike/cyclist).	
It is desirable to have a powerful free text search engine.	Text search is a dangerous tool that can lead far away from the SafetyCube approach Risk/Measures.	
It would be useful to see the title of the studies at the first glimpse to facilitate decision on which one to open		Implement a new column in the results table with the study's title.
The list of results may be sorted by the prioritisation in terms of effects and it would be nice to see in a further column effect types, effect size, etc.		The list of results may be sorted by the prioritisation in terms of effects. Add a column with information on effects.
Would it be possible to see a preview of the study/synopsis (pdf) if you move cursor over the pdf icon?		Show a preview of the study/synopsis (pdf) if you put the cursor over the pdf icon.

Appendix L. Workshop Discussions: SafetyCube Applications

Question/feedback/suggestion	Answer given (if applicable)	Suggested implementation for DSS
How can a government be supported by the DSS if, for instance, they want to introduce a target for serious injuries?	SafetyCube addresses specific measures not general programmes and policies. ERSO database may be useful for this purpose.	
What is the added value of the DSS – particularly because road safety handbook already exists?	SC has a broader scope than the hand book. There is overlap, the studies in the handbook will be coded in DSS. The hand book doesn't give advice in the way the DSS does: set priority and choose measures.	
What is the plan to keep the website live after the end of the project? Would you put this in the EC website (ERSO)?	We are EC funded but we want to promote our work and have it available to all. The website will be available for at least 5 years if not forever. Maintaining a website is not an issue, updating it needs more work and more funding. The easiest thing is that the EC link to an external SafetyCube website. However, it is not just information it is a structured system so this is not easily transferable from one web site to another. We would have to discuss with EC how this might work – and within SC group.	
It is not clear who will be the end users, they could be from western countries which have already "safe" roads, but if someone from a developing country had a look they might end up with solutions for countries who are already at a higher base line than them.	The SafetyCube approach is to try to code all studies available without leaving topics behind. For certain topics there are not sufficient studies and these are from different countries so it may be difficult to transfer findings. We are limited by the availability of studies . We mainly focus on European studies if they are available because the ensure quality in research and studies. For expert user we assume they know that results might not be transferable completely to their situation. In the synopsis we comment on transferability to help non-expert users understand the limitations.	
Can you put a question list on the SC website – what issues we would like Stakeholders' opinion on?	We will.	Publish on SafetyCube website the questions we want the stakeholders to answer.
The DSS is too research centered. It does not look very useful for policy makers. You could integrate the synopsis with graphs and tables.	SafetyCube partners do not have enough time to produce info graphics, it is too time consuming since we starts from a knowledge text.	

The DSS is a tool for mid lower level people who advise policy makers, but not for policy makers themselves. A synopsis is not a tool for a minister. There is a lack of superficial analysis, the approach is too scientific.		
The Cost Benefit Analysis may be the most interesting tool for policy makers.		
The Cost Benefit Analysis is a very important outcome for us because the EC is asking more and more to provide costs on proposals.		
I don't see top policy makers going into this tool as users, but I do see those who inform the "political masters" using this. Let's keep the DSS at the level appropriate for people who do have some understanding of this so they can be informed when they advise prime ministers.	We want to make this an appropriate tool so need to make sure it is the right tool for the job and the users.	Do not go further with stakeholders' requests.

Appendix M. Discussion/Responses: General Comments

Question/feedback/suggestion	Answer given (if applicable)	Suggested implementation for DSS
It is preferable to use the word "collision or crashes", like already widespread in the US, to avoid the underlying suggestion that 'accidents' couldn't have been prevented.	In the writing of the Glossary it will be taken into account.	Concerning the keyword search take care of synonyms and American / British English language issues.
From your presentations, it is not clear which are the final tools/results of the DSS.	Studies and Synopsis.	Insert in SafetyCube presentations slides concerning DSS practical outputs.
There is a risk that the DSS will end up as a nice literature search tool but not providing practical benefit.		