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SafetyCube - the European Road Safety Decision Support System

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The SafetyCube project

SafetyCube

Funded by the European Commission under the **Horizon 2020** research framework programme

- Coordinator: Pete Thomas, Loughborough University
- Start: May 2015
- Finish: April 2018
- 17 partners from 12 EU countries

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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 effectiveness

– cost-benefit evaluation

– all related analytic background

Special focus on linking road safety problems with related measures.

Current Road Safety DSS Worldwide

- Crash Modification Factors Clearinghouse (www.cmfclearinghouse.org) by NHTSA (USA) - **6.251 CMF** on infrastructure only – ongoing
- 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) **- 889 CMF and 273 APM** on infrastructure only – high quality
- iRAP toolkit (toolkit.irap.org) by iRAP - **58 treatments** (42 on infrastructure)
- Safety Performance Factors Clearinghouse (spfclearinghouse.org) by Tatum Group LLC, Dr. Andrew Kwasniak (USA) - **few SPF** – subscribers only

SafetyCube DSS Users

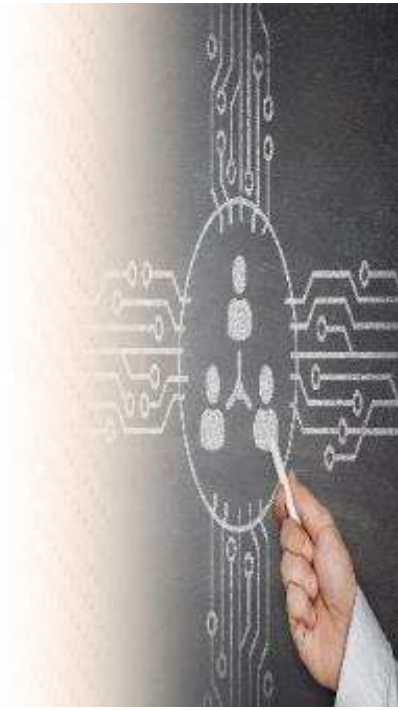
- **Public authorities -** local, regional, national, European and international
- **Industry -** Infrastructure, Vehicle, Insurance, Technology
- **Research Institutes, Experts**
- **Non Governmental Organisations**
- **Mass Media**
- **Everyone**

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

SafetyCube Methodology

1. Creating **taxonomies** of risk factors and measures
2. Exhaustive **literature review** and rigorous study selection criteria
3. Use of a template for **coding studies**, to be introduced in the DSS back-end database
4. Carrying out **meta-analyses** to estimate the effects of risk factors / measures.
5. Drafting **Synopses** summarising results of risk factors / measures.
6. Carrying out **cost-benefit analyses** for the most effective measures

- **Systems approach:** links between infrastructure, user and vehicle risks
- Rigorous assessment of the **quality of the data / study methods**



SafetyCube Taxonomies

Three-level taxonomies
Separately for risks and measures

- **4 Categories**
  road user, infrastructure, vehicle, post impact care
- **38 risks, 50 measures (88 in total)**
  e.g. distraction, roadside, crashworthiness
- **120 specific risks, 193 specific measures (313 in total)**
  e.g. mobile phone use, no clear-zone, low pedestrian rating (NCAP)

Selection and Coding of Studies

Study search in key databases

(Scopus, TRID, Elsevier, Taylor & Francis, Springer etc.)

Study selection and prioritization criteria

– Studies with quantitative results

– Meta-analyses, or other high quality studies (peer-reviewed)

– Recent studies

– European studies

Study selection and prioritization criteria

– Study design and methodology

– Results and their confidence intervals

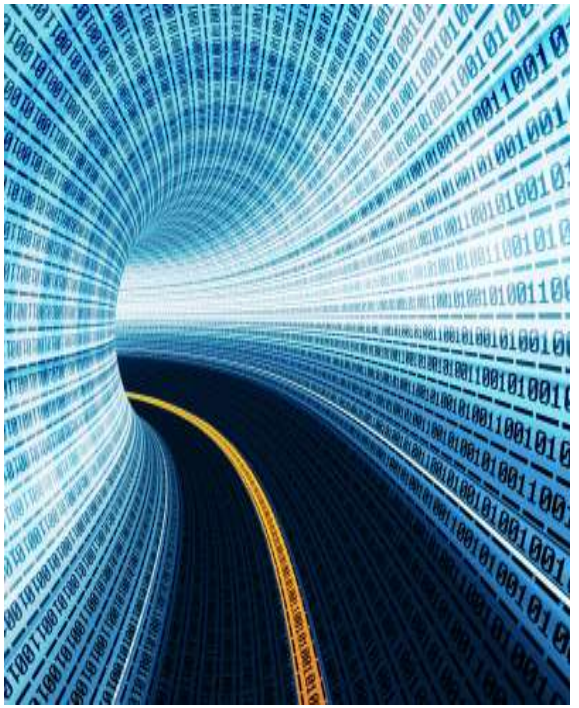
– Study limitations

SafetyCube DSS Design Principles

- A **Modern** web-based tool
- Highly **Ergonomic** interface
- **Simple** structure
- Powerful **Search** Engines
- Fully **Documented** information
- Easily **Updated**

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 (accident categories)
- Fully **detailed** search
  - search by any parameter in each data table in the database
- Fully **flexible** search
  - adjust and customize search according to results
- Fully **documented** search
  - access background information at any stage (supporting documentation, links, etc.)



SafetyCube DSS Menu

- **Search**
  Risk Factors & Measures
- **Knowledge**
  211 Synopses, Serious Injuries, Accident Scenarios
- **Calculator**
  Economic Efficiency Evaluation
- **Methodology**
  System documentation
- **Support**
  Contact, help, feedback

The Search Structure

- **Search** pages
  (5 entry points)
- **Results** pages
  (Introduction, Colour codes, Synopses, Coded studies)
- Individual **Studies** pages
  (Disaggregate level, detailed effects listed, some studies not in synopses)

- **Links** between Risk Factors
  Information about which risks can be remedied by which types of measures

SafetyCube DSS Entry Points

- **Keyword** search
  (all database keywords)
- **Risk factor** search
  (taxonomy)
- **Measures** search
  (taxonomy)
- **Road User Groups**
  (database keywords related to each group)
- **Accident Categories**
  (inquiries about specific scenarios)

SafetyCube DSS Results Pages

Search results

- Synopses, and their short summaries & colour codes
- Table listing the available studies

Refine search

- Specific Risk factor / Measure
- Other **search filters**:
  - Road user groups: All, car occupants, drivers, passengers, PTW riders, pedestrians, cyclists, HGVs.
  - Road types: All, motorways, rural roads, urban roads
  - Country: EU, EU countries, US and Canada, Australia, Asia.

Links to related measures

- Select a specific risk factor / measure
- Get the list of related measures

SafetyCube Synopses

211 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)

– Comparative analysis of available studies
– Analysis results: Meta-analysis/Vote-count analysis/Qualitative analysis

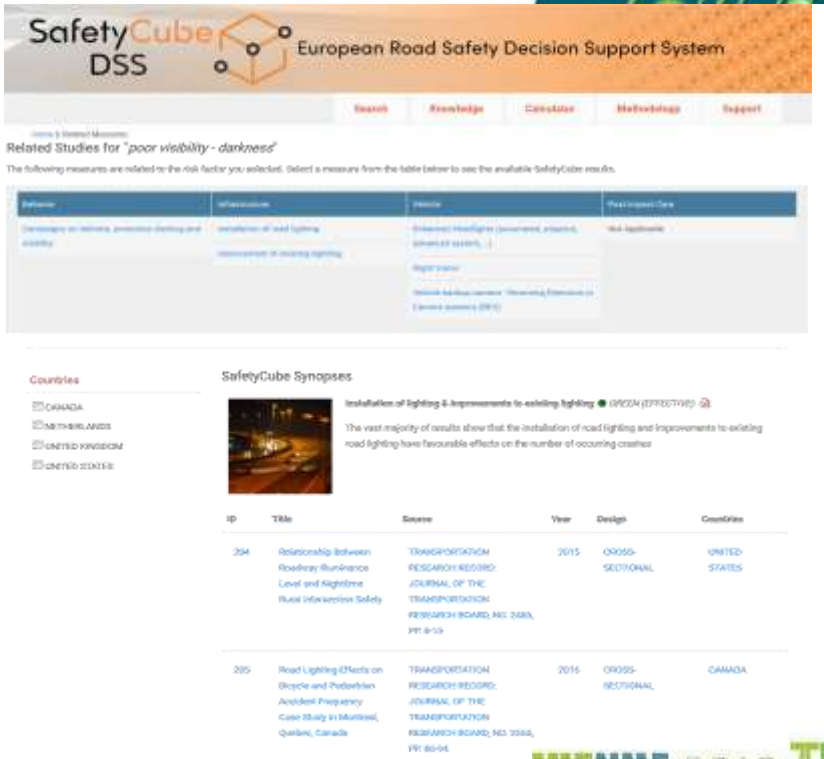
Supporting document (3-10 pages)

– Literature search strategy and study selection criteria
– Detailed analyses

SafetyCube Related Risks / Measures

- Linking based on a **dedicated model** categorizing risks
- Risk Factors (118) are **linked** to one or more Road Safety Measure(s) (167)*
- A total of **762 links** between risk factors and measures

**A few risk factors or measures (e.g. post-impact care) were not "linkable".*



SafetyCube DSS Individual Study Pages

Title, author, source, abstract

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

Study design info:

- Country
- Research Method, Design, Sample
- Exposure/Control group
- Risk/Outcome Group
- Modifying Conditions
- Potential limitations

Study results:

- Table **listing the detailed effects** reported in the study

SafetyCube DSS Calculator (1/2)

- Combines information about the **effectiveness of a measure** (i.e. the percentage of crashes or casualties prevented) with the **costs** of this measure.
- Integrates updated information of **crash costs in the European countries**
- Allows to express all costs and benefits of a measure in monetary values and conduct **cost benefit analysis**.

Main Functions

- Perform cost-benefit analysis with **own input data**.
- Select one of the **SafetyCube examples** of cost benefit analyses
  - Measures with high effectiveness
  - For which reliable cost information could be found

SafetyCube DSS Calculator (2/2)

Economic Efficiency Evaluation Tool (E3)

- Fully integrated in the DSS
- Enables users to create their custom CBA
  "My Measure" function with free input on:
  - Country, years of analyses
  - Basis: Crashes or Casualties
  - Costs (implementation and annual)
  - Measure effectiveness (per severity category)
  - Penetration rate and side effects
- Contains SafetyCube example CBAs on:
  - Behaviour (12 examples)
  - Infrastructure (19 examples)
  - Vehicle systems (4 examples)
  - Post-impact care (1 example)

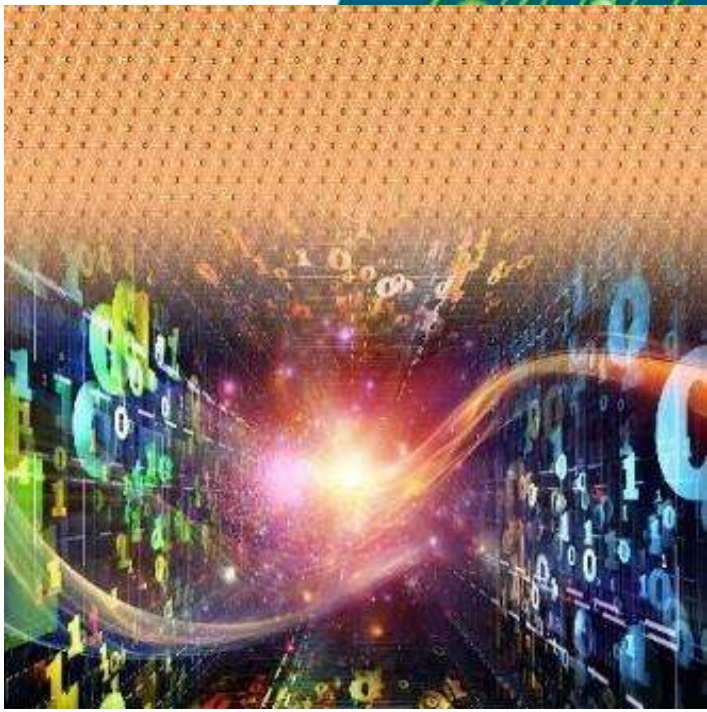
SafetyCube DSS Knowledge Wealth

SafetyCube DSS contains:

- more than 1,250 **studies**,
- with more than 7,500 **estimates** of risks/measure effects on:
  - behaviour,
  - infrastructure,
  - vehicle, and
  - post impact care

- **211 Synopses**

- **36 cost-benefit analyses** (adjustable)



Example questions addressed

- how important is my road safety problem?
- who else is having similar problems?
- what solutions are usually proposed for my problem?
- how efficient are the solutions proposed?
- which is the most efficient solution?
- and if I have a combination of problems…

…then use SafetyCube DSS to have the answers

SafetyCube Next Steps

- SafetyCube DSS **Opening** (October 2017)
- The **future operation** of the SafetyCube DSS concerns:
  1. the uninterrupted operation of the current SafetyCube DSS
  2. updates of the risk factors, measures and cost-benefit analyses (recent studies but also older ones)
  3. addition of studies in more languages
  4. translation of the contents in other languages
  5. possibility to receive, check and incorporate studies submitted by external experts and organizations and the respective quality control
  6. incorporation of additional data and knowledge sections

Delivering a long waited powerful tool

- SafetyCube DSS is the first integrated road safety support system **developed in Europe**
- SafetyCube DSS **offers for the first time** scientific evidence on:
  - risks and not only measures
  - risks and measures not only on infrastructure
  - a very large number of estimates of risks and measures effects
  - links between risks factors and measures
- SafetyCube DSS aims to be **a reference system** for road safety in Europe, constantly improved and enhanced

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