Developing the European Road Safety Decision Support System

within the *SafetyCube* project

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Framework for Assessing and Transferring Highway Safety Performance Measurement to Both Developing and Developed Countries
TRB Annual Meeting, January 8th, 2017

The SafetyCube project

SafetyCube project

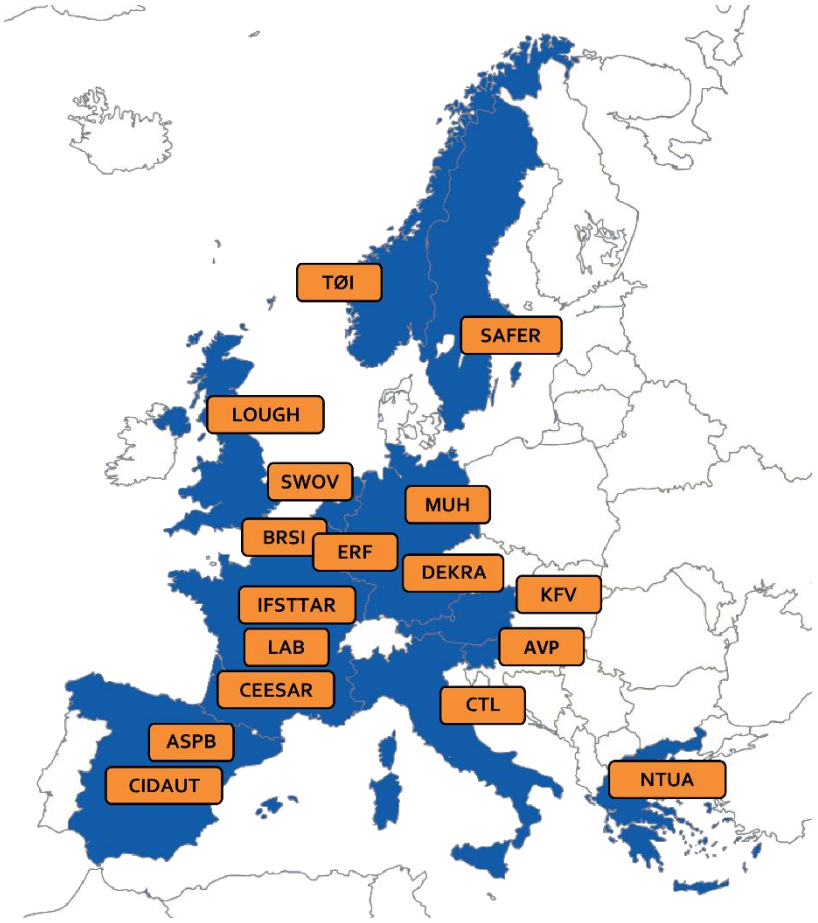
Funded by the European Commission under the Horizon 2020 research framework programme

Coordinator: Pete Thomas, Loughborough University

Start: May 2015

Finish: April 2018

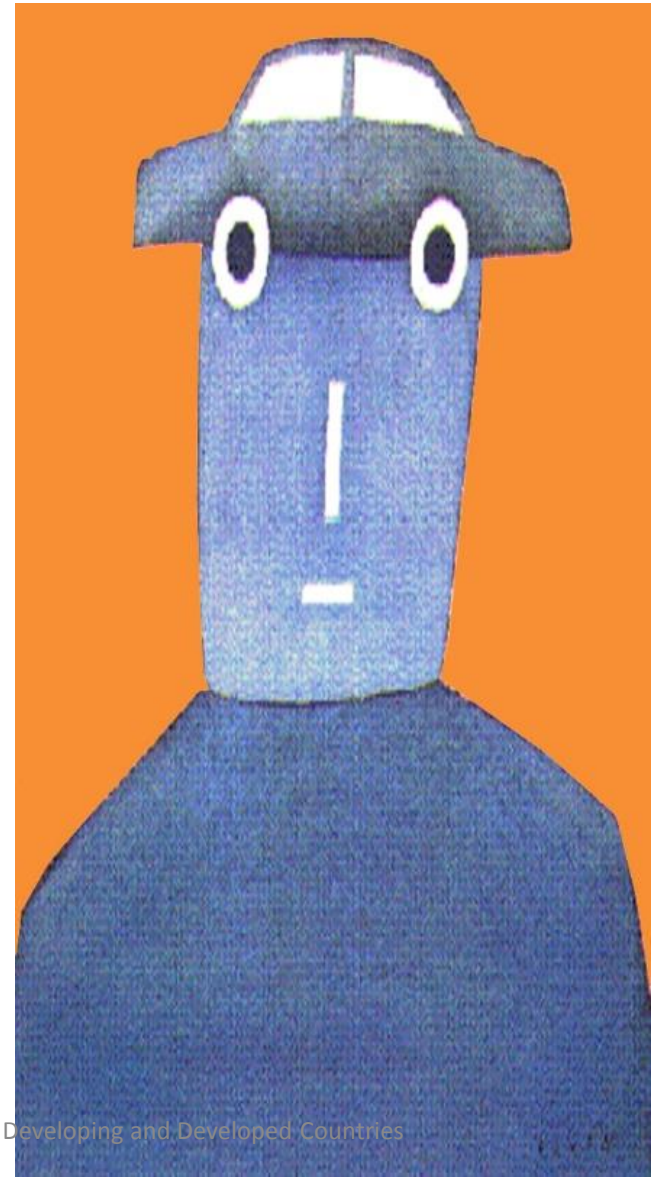
17 partners from 12 EU countries



SafetyCube concept and vision

- 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, to be integrated in a **European Road Safety Decision Support System (DSS)**



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?
- How can it be made accessible to stakeholders?

SafetyCube will meet these challenges

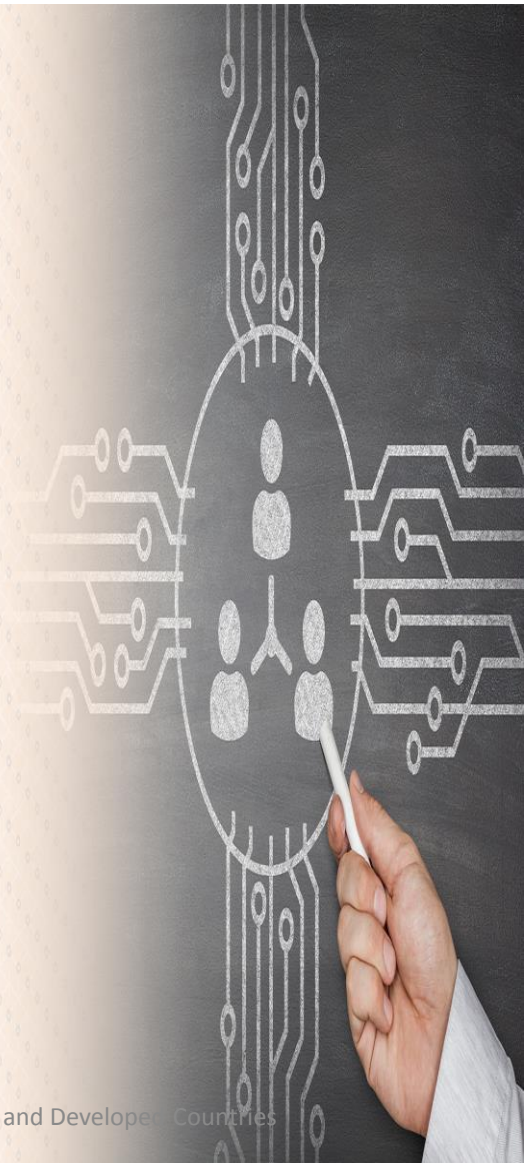
SafetyCube will:

- Provide new information about the **effects of risk factors and related measures** by bringing together published information
- Produce a comprehensive method to evaluate the **costs and benefits** of measures
- Produce new information about **seriously injured** casualties
- Produce a new **Decision Support System** that will enable easy access to information on risks and measures

SafetyCube methodology

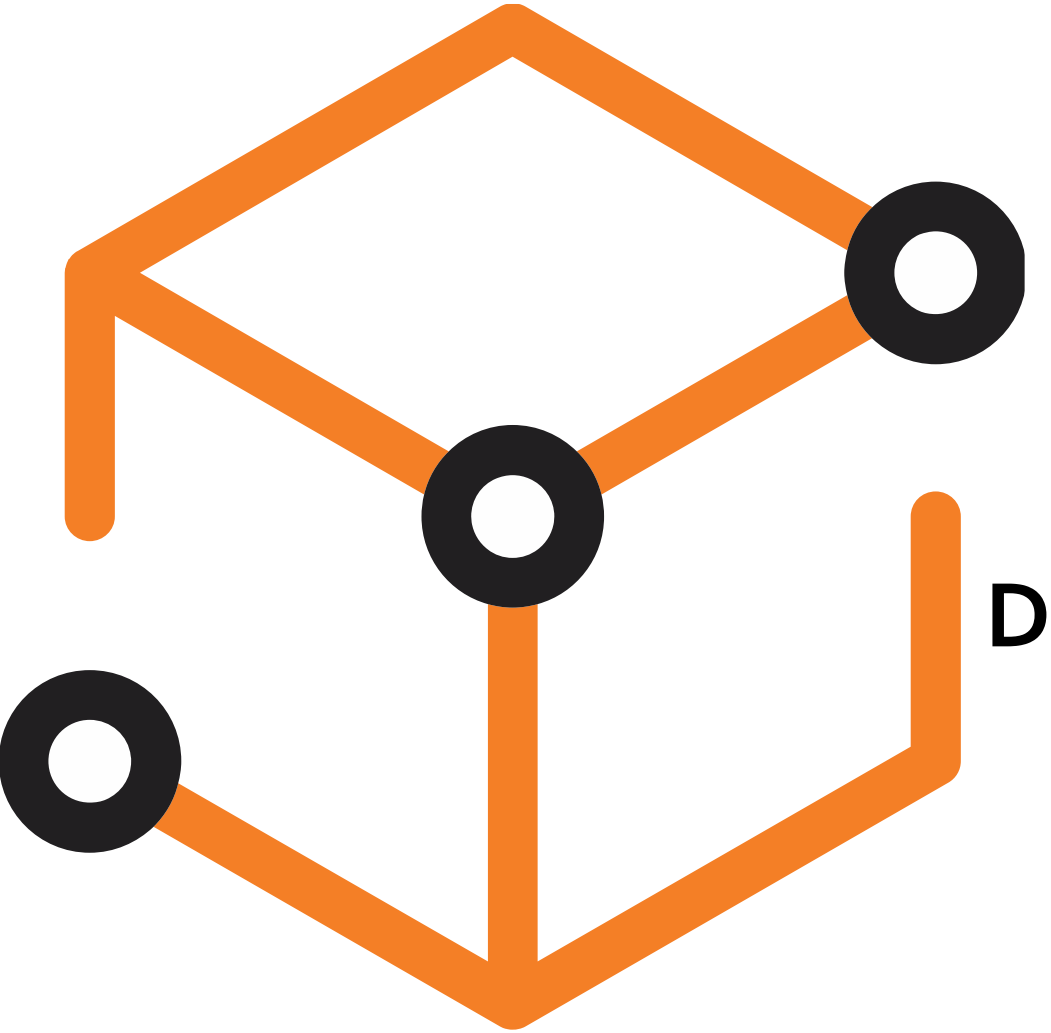
1. Creating **taxonomies** of risk factors and measures
2. Exhaustive literature review and rigorous study selection criteria
3. Use of a template for **coding studies**, to be introduced in the DSS back-end database
4. Carrying out meta-analyses to estimate the effects of risk factors / measures.
5.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

- **Systems approach**: links between infrastructure, user and vehicle risks
- **Hot topics** & additional risk factors and measures
- Assessment of the **quality of the data / study methods**



What have we already achieved?

- Mid-point of SafetyCube
- Consulted many different stakeholders
- Already reviewed and summarised hundreds of studies on crash risks
- Developed an outline of the SafetyCube DSS and its functionality
- Progressed well with work on serious injuries
- Preparing for the second half of the project
- Preparing for final project conference **22-23 March 2018 Vienna**



Development of the DSS

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 Too
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.

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) - **889 CMF 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

- **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.

SafetyCube DSS Design Principles

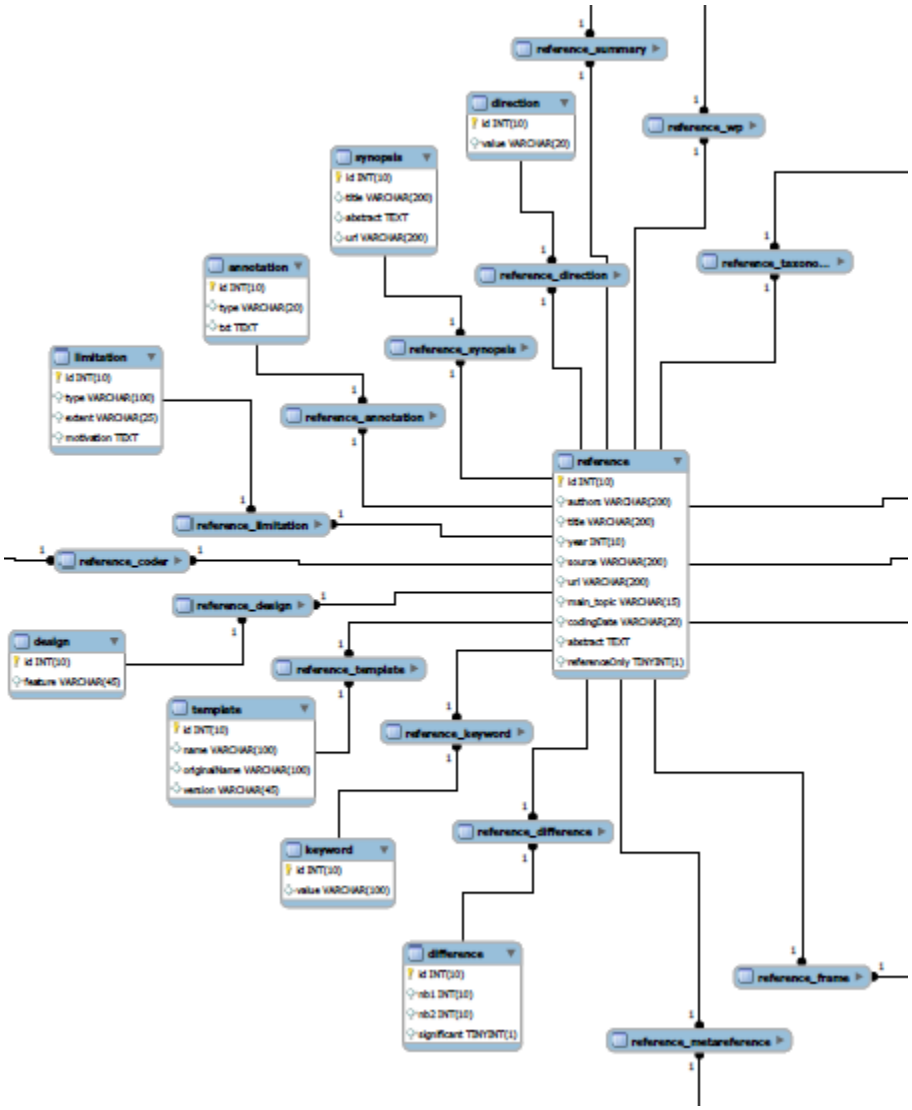
- A **Modern** web-based tool
- High **Ergonomy** interface
- **Simple** structure
- Powerfull **Search** Engines
- Fully **Documented** information
- Easily **Updated**

SafetyCube DSS Search Engine

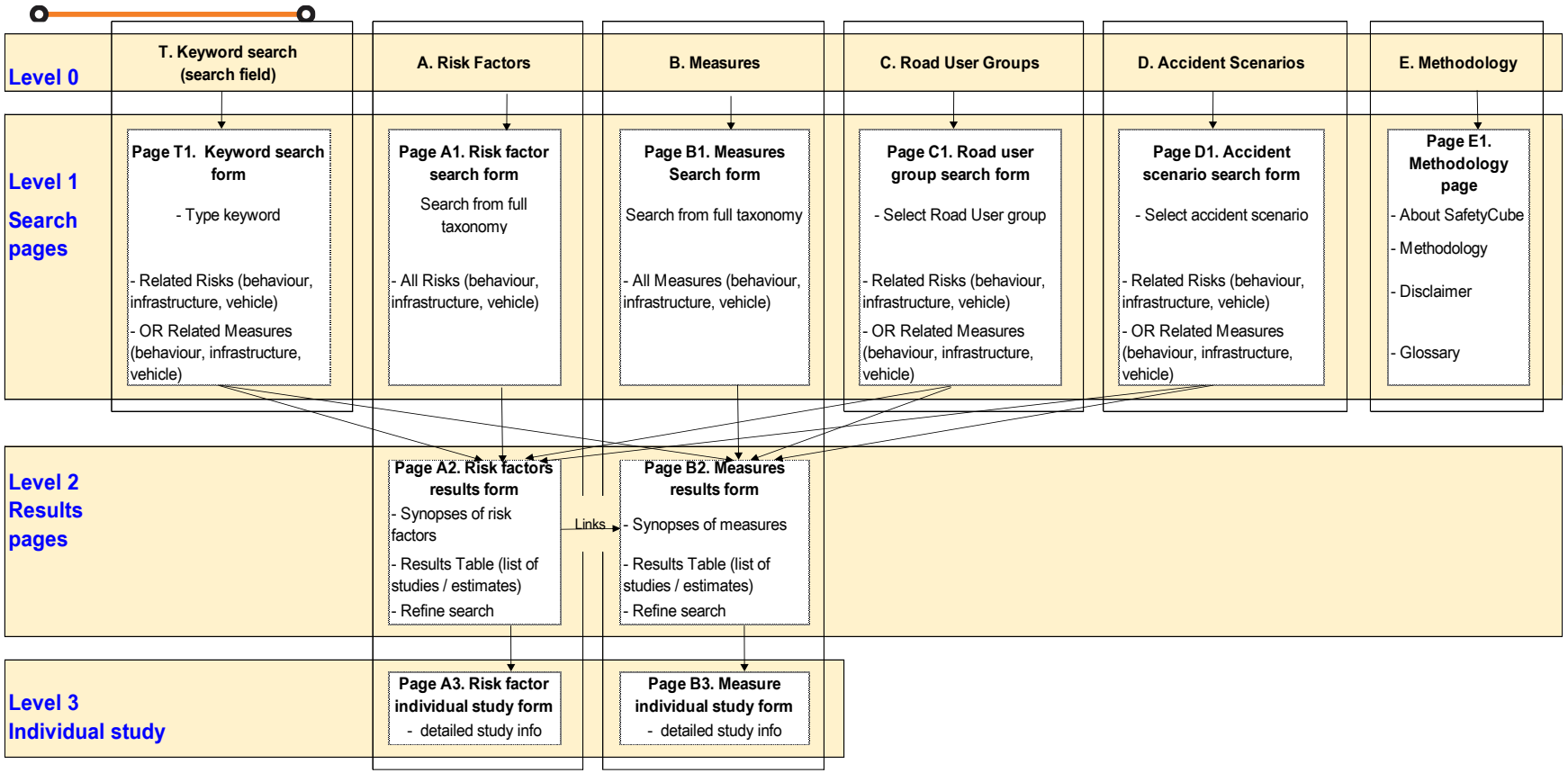
- Fully **linked** search
  - *search a road safety problem alone or through the measures*
  - *search a measure alone or through the road safety problems*
  - *search for risks and measures related to specific road user groups or crash types (accident scenaria)*
- Fully **detailed** search
  - *search 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** undergo a thorough checking and debugging process
- The templates are eventually stored in a **relational database**, which serves as the back-end of the DSS
- Front-end DSS results are retrieved through **queries** on the back-end database (DSS search engine).



SafetyCube DSS Structure



Home Page Main Menu (Search - Tools)

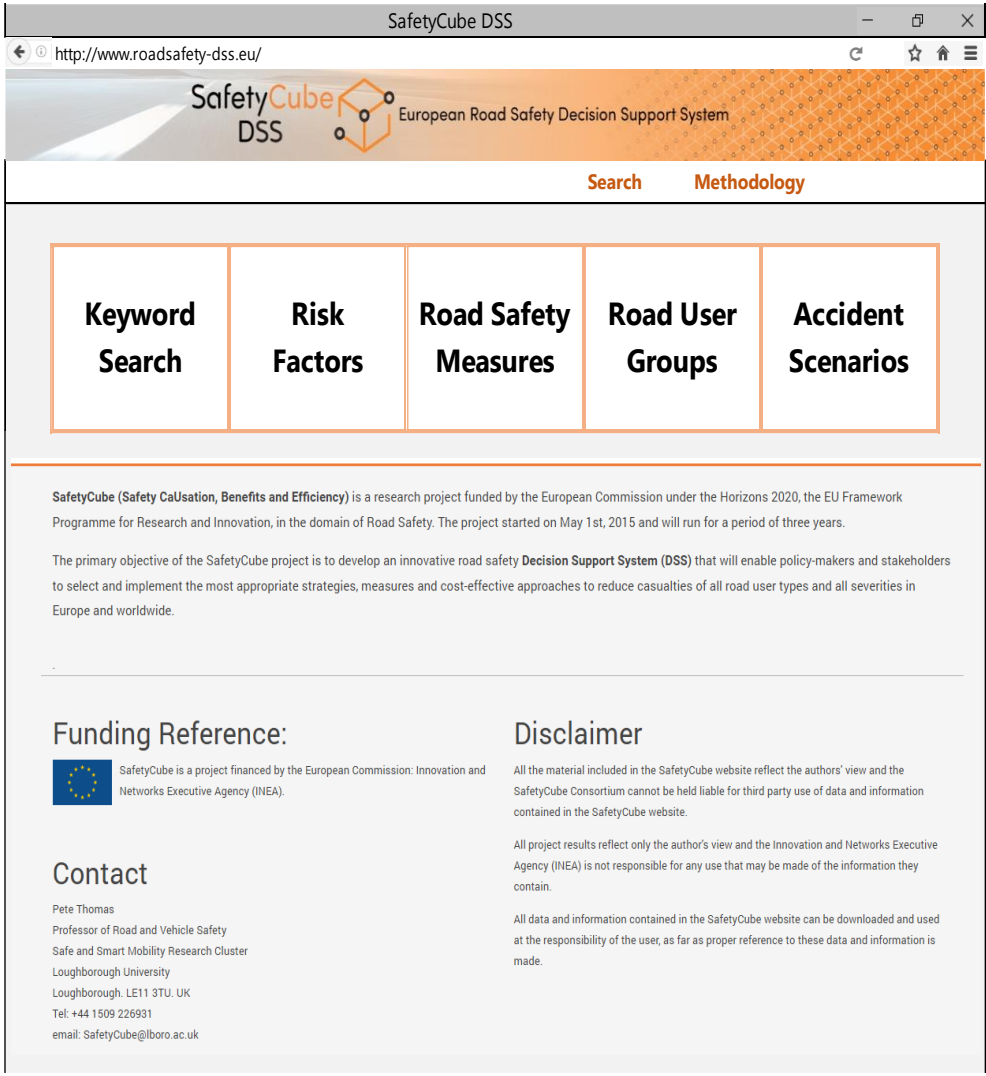
Three Levels of Search (Search - Results pages - Individual study pages)

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

DSS prototype demonstration

SafetyCube DSS Homepage (Entry Points)

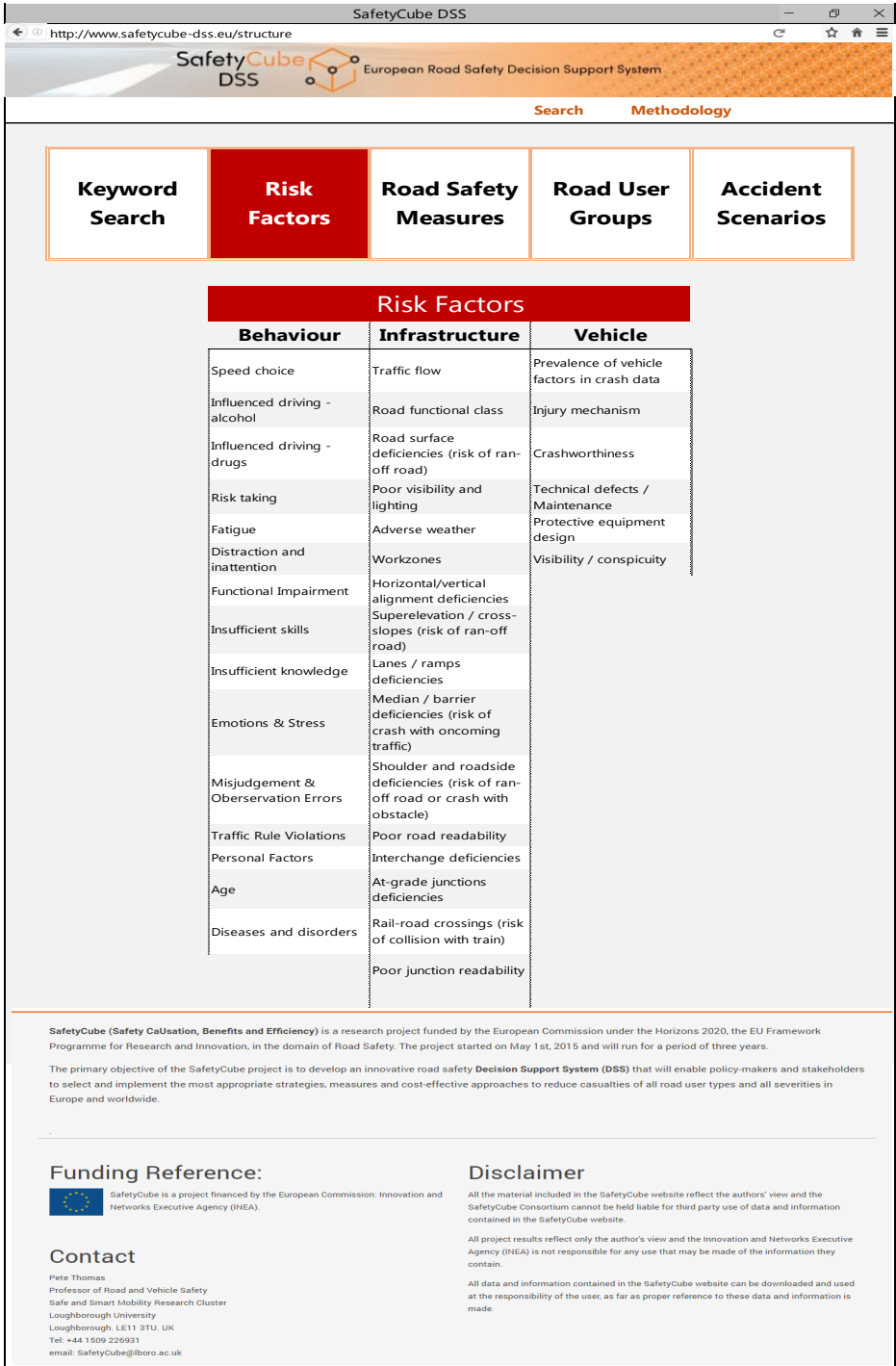
- **Methodology**
  Basic Information about SafetyCube and the DSS
- **Search**
  - **Text** search (key-words)
  - **Risk Factors**
    (Risk factors search engine)
  - **Road Safety Measures**
    (Measures search engine)
  - **Road User Groups**
    (Risk factors and Measures search engines)
  - **Accident Scenarios**
    (Risk factors and Measures search engines)



Risk Factors Search Parameters

Three categories of taxonomy fields

- Categories (3)
  road user, infrastructure, vehicle
- Topics (57)
  e.g. roadside deficiencies, distraction inside vehicle, inappropriate speed
- Specific risk factors (175)
  e.g.no clear-zone, mobile phone, too fast / too slow



Risk Factors results parameters

Search results

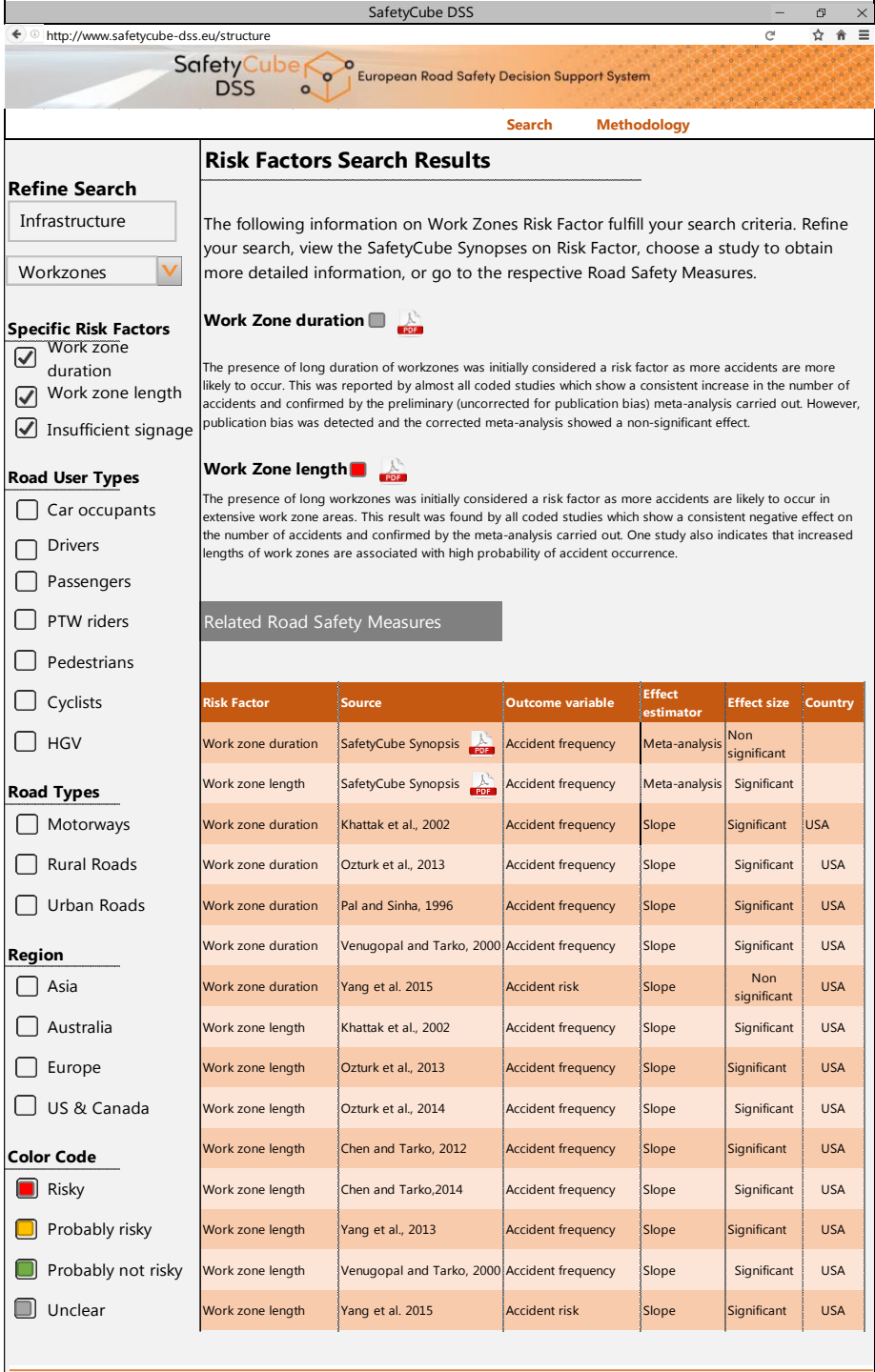
- Short summaries of syntheses (meta-analyses) available
- Table listing the available synopses, meta-analyses and other studies
- Table columns concern main study characteristics (design, outcome variable, effect type and size, country, year etc.)

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



SafetyCube synopses

Syntheses on risk factors / measures

Summary (2 pages)

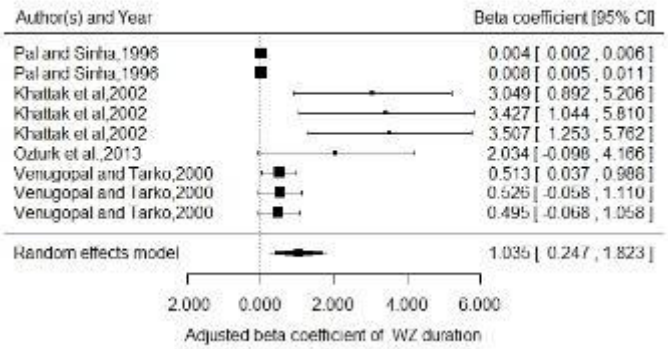
- Effect of risk factor / measure and ranking (colour code)
- Risk / safety effect mechanisms
- Risk / safety effects size, transferability of effects

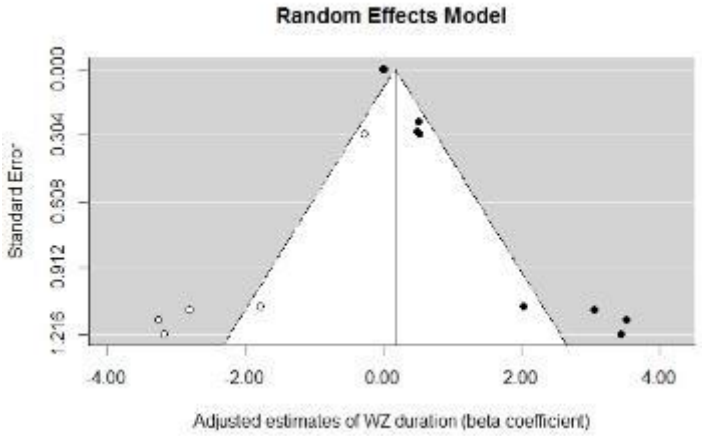
Scientific overview (4-5 pages)

- Comprehensive comparative analysis of available studies designs 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





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 DSS

http://www.safetycube-dss.eu/structure

SafetyCube DSS — European Road Safety Decision Support System

Search Methodology

Effects of work zone presence on injury and non-injury crashes

Khattak et al., 2002, Accident Analysis and Prevention, 34 pp 19-29

Abstract

Work zones in the United States have approximately 700 traffic-related fatalities, 24 000 injury crashes, and 52 000 non-injury crashes every year. Due to future highway reconstruction needs, work zones are likely to increase in number, duration, and length. This study focuses on analyzing the effect of work zone duration mainly due to its policy-sensitivity. To do so, we created a unique dataset of California freeway work zones that included crash data (crash frequency and injury severity), road inventory data (average daily traffic (ADT) and urban/rural character), and work zone related data (duration, length, and location). Then, we investigated crash rates and crash frequencies in the pre-work zone and during-work zone periods. For the freeway work zones investigated in this study, the total crash rate in the during-work zone period was 21.5% higher (0.79 crashes per million vehicle kilometer (MVKM)) than the pre-work zone period (0.65 crashes per MVKM). Compared with the pre-work zone period, the increase in non-injury and injury crash rates in the during-work zone period was 23.8% and 17.3%, respectively. Next, crash frequencies were investigated using negative binomial models, which showed that frequencies increased with increasing work zone duration, length, and average daily traffic. The important finding is that after controlling for various factors, longer work zone duration significantly increases both injury and non-injury crash frequencies.

url: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.525.2933&rep=rep1&type=pd

Study design

Country: USA
Research methods: Negative Binomial Models
Design: Observational study, Cross-sectional
Sample: 2038 total accidents in 36 work zone sites in Indiana state, US, for the years 1992 a
Risk group: Work zone
Control group:
Modifying conditions: AADT

The following effects on Work Zones are reported in this study:

Risk factor	Unit	Outcome variable	Effect type	Effect size	Main outcome
Ln of workzone duration	Days	Injury and non-injury crashes	Slope	1.1149	Significant negative effect on road safety
Ln of workzone duration	Days	Non-injury crashes	Slope	1.2317	Significant negative effect on road safety
Ln of workzone duration	Days	Injury crashes	Slope	1.2549	Significant negative effect on road safety
Ln of workzone length	Km	Injury and non-injury crashes	Slope	0.6718	Significant negative effect on road safety
Ln of workzone length	Km	Non-injury crashes	Slope	0.6112	Significant negative effect on road safety
Ln of workzone length	Km	Injury crashes	Slope	0.7842	Significant negative effect on road safety

Next steps

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 **Enhancement and Update**
  - *Starting on April 2018 (end of SafetyCube project)*

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 DSS
Delivering a long waited powerful tool

- The SafetyCube DSS is a Road Safety Decision Support Tool :
  - long waited,
  - powerful,
  - full of scientific evidence,
  - user friendly, web-based and interactive

- 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

Contact

www.SafetyCube-project.eu

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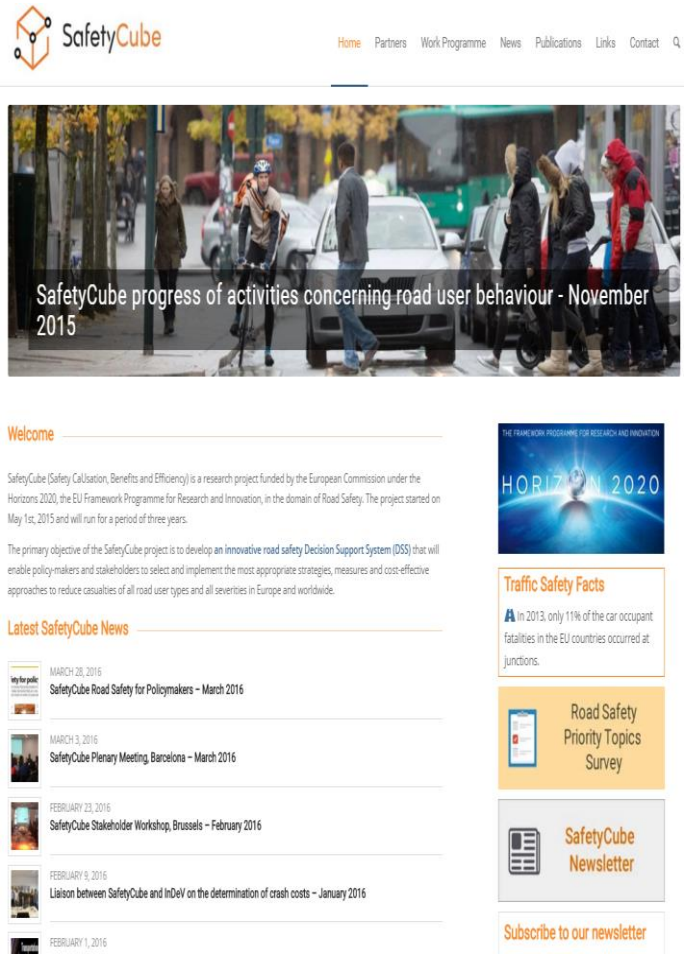

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