

# SafetyCube - the European Road Safety Decision Support System



The screenshot displays the SafetyCube DSS website. At the top, the logo 'SafetyCube DSS' is shown next to a stylized orange cube icon. To the right of the logo, the text 'European Road Safety Decision Support System' is displayed. Below this, a navigation bar contains five tabs: 'Search', 'Knowledge', 'Calculator', 'Methodology', and 'Support'. A paragraph of text describes the system as a European research project funded by the Horizons 2020 Programme, aimed at supporting evidence-based policy making. Below the text, five image-based tiles represent different system features: 'Keyword Search' (a person on a road), 'Risk Factors' (a speedometer), 'Measures' (a road sign), 'Road User Groups' (a person on a bicycle), and 'Accident Categories' (a road with red markings).

**SafetyCube DSS** European Road Safety Decision Support System

Search Knowledge Calculator Methodology Support

The SafetyCube DSS is the European Road Safety Decision Support System, which has been produced within the European research project SafetyCube, funded within the Horizons 2020 Programme of the European Commission, aiming to support evidence-based policy making. The SafetyCube Decision Support System provides detailed interactive information on a large list of road accident risk factors and related road safety countermeasures. A Quick Guide on using the SafetyCube DSS, with instructions on how to browse the system, make a search and further refine the results, is available for download [here](#).

**Keyword Search** **Risk Factors** **Measures** **Road User Groups** **Accident Categories**

Prof. Pete Thomas  
Loughborough University UK

Decision Support System Launch Event  
Brussels, October 5, 2017



# Purpose of the workshop



- To introduce the Decision Support System to road safety community
- To explain the scientific basis of the DSS
- To invite feedback from users
- To identify any training needs
- To open a discussion on the continuation of the DSS after SafetyCube ends

# SafetyCube project

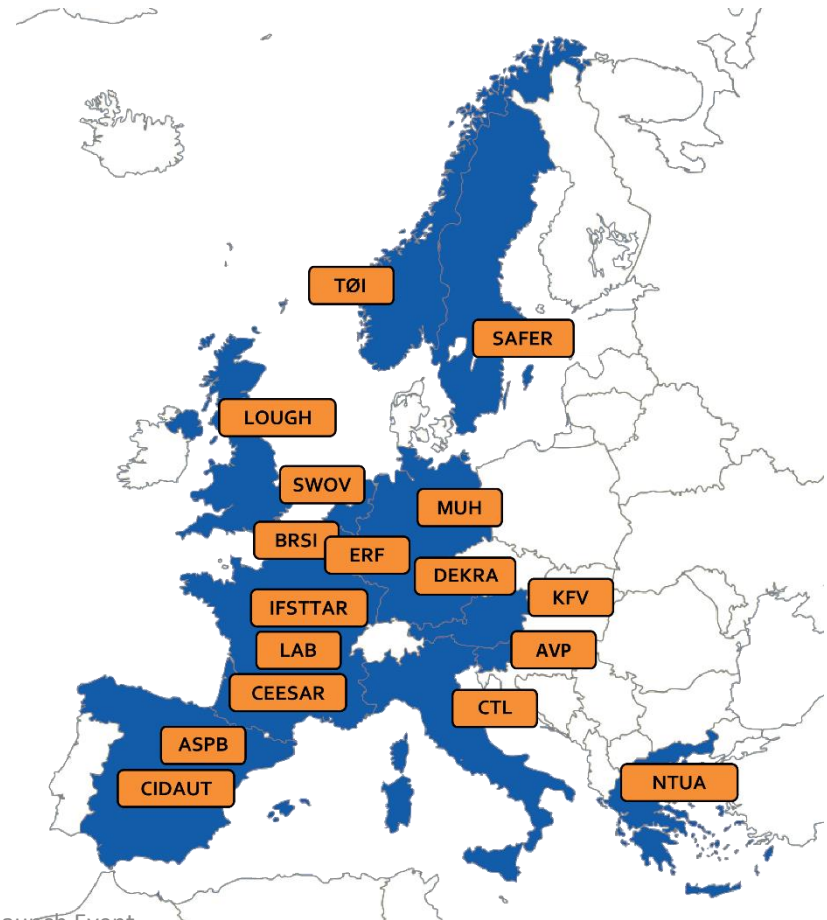
Funded by the European Commission  
under the Horizon 2020 research  
framework programme

Coordinator: Pete Thomas,  
Loughborough University

Start: May 2015

Finish: April 2018

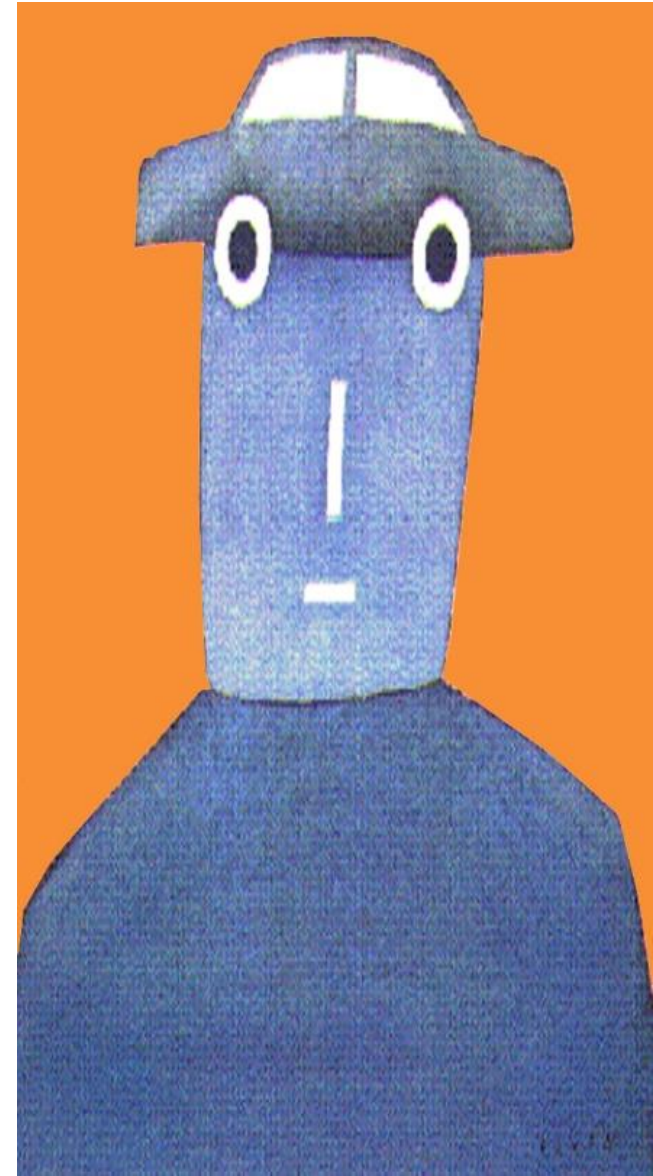
17 partners from 12 EU countries



# 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 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.



# 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.





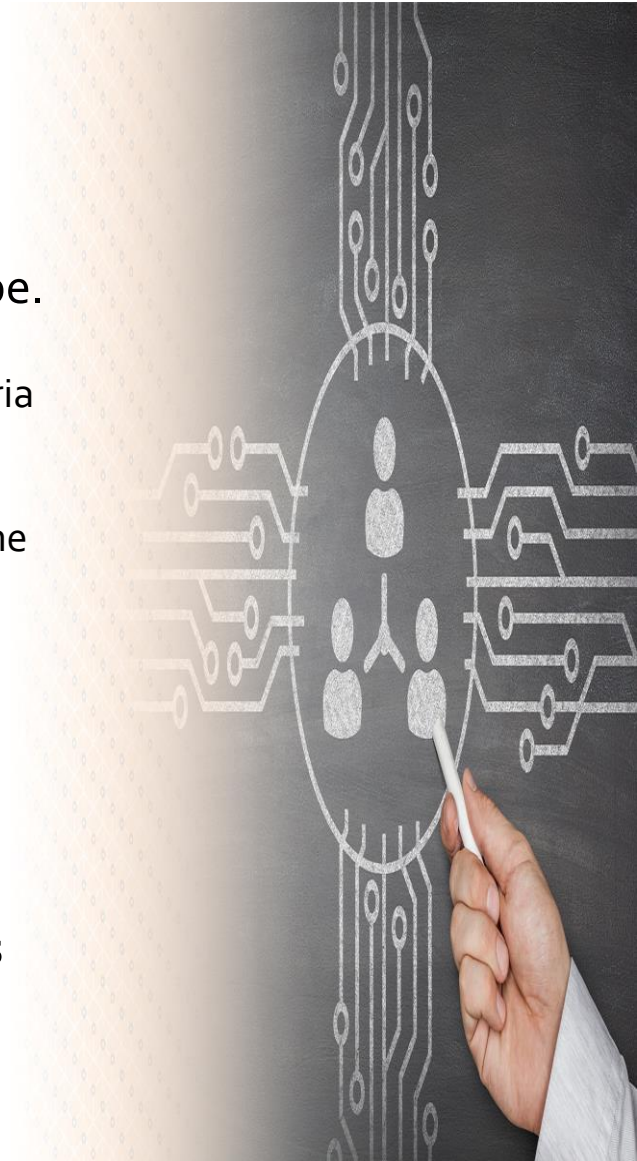
# Current Road Safety DSS Worldwide



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

# SafetyCube methodology

- — ○
  - **Consulting future users of the DSS**
    1. Hot topics
    2. User requirements
  - **Methodologies and guidelines** developed in SafetyCube.
    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. Studies analysed for 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**



# SafetyCube Taxonomies



## Three-level taxonomies Separately for risks and measures



- **4 Categories**  
road user, infrastructure, vehicle, post impact care
- **88 Topics**  
e.g. distraction, roadside, crashworthiness
- **175 Specific topics**  
e.g. mobile phone use, no clear-zone, low pedestrian rating (NCAP)

Behavior	Infrastructure	Vehicle	Post Impact Care
Law and enforcement	Traffic flow	Frontal impact	Ambulances/helicopters
Education and voluntary training or programmes	Traffic composition	Side impact	Extraction from vehicle
Driver training and licensing	Formal tools to address road network deficiencies	Rear impact	Pre-hospital medical care
Fitness to drive assessment and rehabilitation	Speed management & enforcement	Rollover	Triage and allocation to trauma facilities
Awareness raising and campaigns	Road type	Pedestrian	First aid training drivers
	Road surface treatments	Child	
	Visibility / Lighting treatments	PTW	
	Workzones	Cyclist	
	Horizontal & vertical alignment treatments	HGV	
		Longitudinal	

# 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 journals)
- Recent studies
- European studies

## **Coding of studies in a dedicated template**

- Study design and methodology
- Results and their confidence intervals
- Study limitations



# SafetyCube Synopses

## 139 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

#### Synopsis 11: Presence of workzones- Workzone length



SafetyCube | Synopsis on work zone length | WP5

measured as crash risk (probability of crash occurrence versus probability of non-crash occurrence<sup>1</sup>). It is noted that no studies concerning crash or injury severity were identified through the literature search.

1.2.4. How is the effect of work zone length studied?

In general, when the impact of work zone length is examined, crash data from police records are usually utilized. Regarding the methods of analysis, the effect of workzone length is usually examined by applying multivariable linear statistical models. When crash frequency is examined, the relationship between work zone length and number of crashes is investigated by applying negative binomial models. Probability of crash occurrence was investigated by applying rare-events logistic regression models.

#### 1.3 OVERVIEW OF RESULTS

The initial examination of relevant studies suggests that the effect of work zone length on road safety is generally consistent, showing that when work zones have increased length the number of crashes is increased. The same direction of the effect is observed when crash risk is examined (probability of crash occurrence vs non-crash occurrence<sup>1</sup>), where there is also a negative effect of work zone length on safety.

#### 1 Summary

Theofilatos A., Papadimitriou E., Ziakopoulos A., Yannis G., Diamandouras K., Dursu C.  
September 2016

#### COLOUR CODE: RED

The presence of long workzones is intuitively considered as a risk factor, since more crashes are likely to occur in extensive work zone areas (increased crash risk). This result was reported by all coded studies, which have shown a consistent negative effect on the number of crashes (increased crash risk) and was also confirmed by the meta-analysis carried out. One study also indicates that increased lengths of work zones increase the probability of crash occurrence.

#### KEYWORDS

Work zones; length; crashes

#### 1.1 ABSTRACT

It can be assumed that long work zones may increase risk of crashes, because work zones are unfamiliar road environments for most road users, due to special arrangements (lane closures, traffic disruptions, changes in road delineation and signage, presence of barriers, obstacles, workers etc.). In general, work zone length was found to significantly increase the number of crashes. The vast majority of international literature investigates crash frequency, indicating that longer work zone lengths in road networks are associated with an increased number of crashes at a 95% confidence level. This result is confirmed by the meta-analysis that was carried out, which revealed a significant overall estimate of work zone length. Moreover, only one study that investigates crash risk (probability of crash occurrence vs non-crash occurrence) was found, suggesting that work zone length significantly increases crash risk.

#### 1.2 BACKGROUND

##### 1.2.1 Definitions of workzone length

This risk factor has a straightforward definition in international literature. It is defined as "work zone length" and examined as numerical variable measured in miles or kilometers. However, a number of studies measure it as the natural logarithm of length, for modelling purposes.

##### 1.2.2 How does work zone length affect road safety?

It is expected that long work zones may increase risk of crashes, because work zones are unfamiliar road environments for most road users, due to special arrangements (lane closures, traffic disruptions, changes in road delineation and signage, presence of barriers, obstacles, workers etc.). Therefore, driver exposure to such risky elements increases. Consequently, it is likely that they pose a greater threat to the safety of road users than regular road segments. Therefore, presence of such arrangements for long road segments can deteriorate road safety levels.

##### 1.2.3 Which safety outcomes are affected by work zone length?

In international literature, the effect of work zone length on road safety has been measured mainly on the basis of crash frequency (number of crashes occurred). Less frequently, it was found to be

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on the frequency of crashes is constrained to be the same for all observations (all work zone segments). Consequently, the resulting parameter estimates may be biased.

Overall, this risk factor could be considered to be adequately studied. However, there are no studies focusing on the effect of work zone length on crash or injury severity. Moreover, they all concern states of the US and there is no specific focus on different road users. In conclusion, data concerning more countries and different road users are needed.

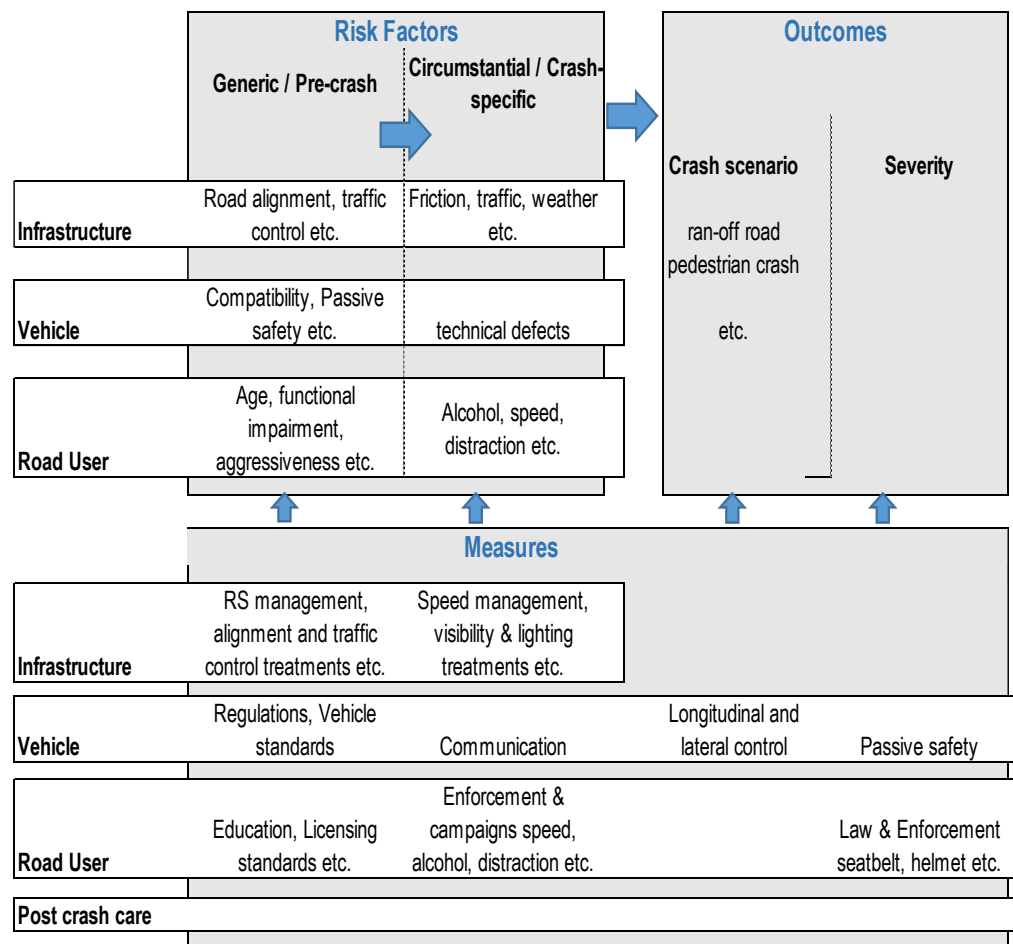


# SafetyCube Links between Risks & Measures

Based on a dedicated methodology

- **Sequence of crash events**
- Pre-crash events → crash → consequences/outcomes
- Risk factors can be:
  - *Generic (e.g. alignment deficiency)*
  - *Circumstantial (e.g. alcohol)*
- Measures may address:
  - *Generic risks: (e.g. road safety audit)*
  - *Circumstantial risks (e.g. enforcement)*

**Validated through studies and synopses results (ongoing)**



# 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

## • 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



# Contact



**[www.SafetyCube-project.eu](http://www.SafetyCube-project.eu)**

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## Welcome

SafetyCube (Safety Calibration, Benefits and Efficiency) is a research project funded by the European Commission under the Horizons 2020, the EU Framework Programme for Research and Innovation, in the domain of Road Safety. The project started on May 1st, 2015 and will run for a period of three years.

The primary objective of the SafetyCube project is to develop 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 in Europe and worldwide.

## Latest SafetyCube News

-  MARCH 28, 2016  
**SafetyCube Road Safety for Policymakers – March 2016**
-  MARCH 3, 2016  
**SafetyCube Plenary Meeting, Barcelona – March 2016**
-  FEBRUARY 23, 2016  
**SafetyCube Stakeholder Workshop, Brussels – February 2016**
-  FEBRUARY 9, 2016  
**Liaison between SafetyCube and InDeV on the determination of crash costs – January 2016**
-  FEBRUARY 1, 2016



## Traffic Safety Facts

**A** In 2013, only 11% of the car occupant fatalities in the EU countries occurred at junctions.

Road Safety  
Priority Topics  
Survey

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