Roadside and Median Deficiencies

within the *SafetyCube* Road Safety Decision Support System

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AFB20(2) ROADSIDE DESIGN SAFETY
International Research Activities Subcommittee

SafetyCube project

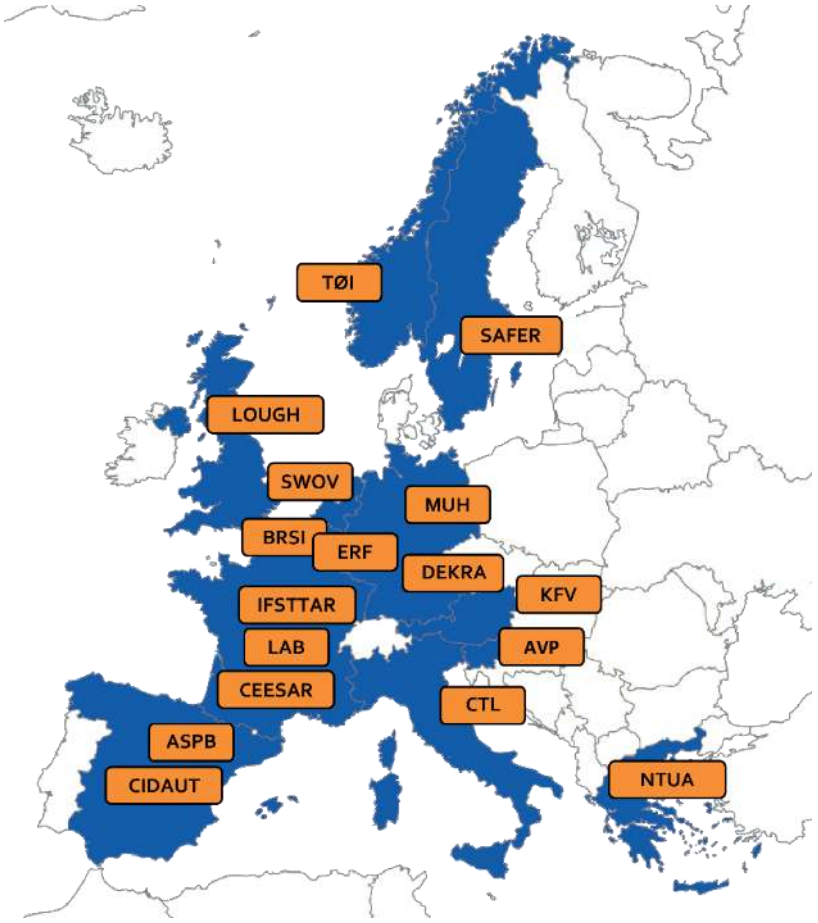
Funded by the European Commission under the Horizon 2020 research framework programme

Coordinator: Pete Thomas, Loughborough University

Start: May 2015

Finish: April 2018

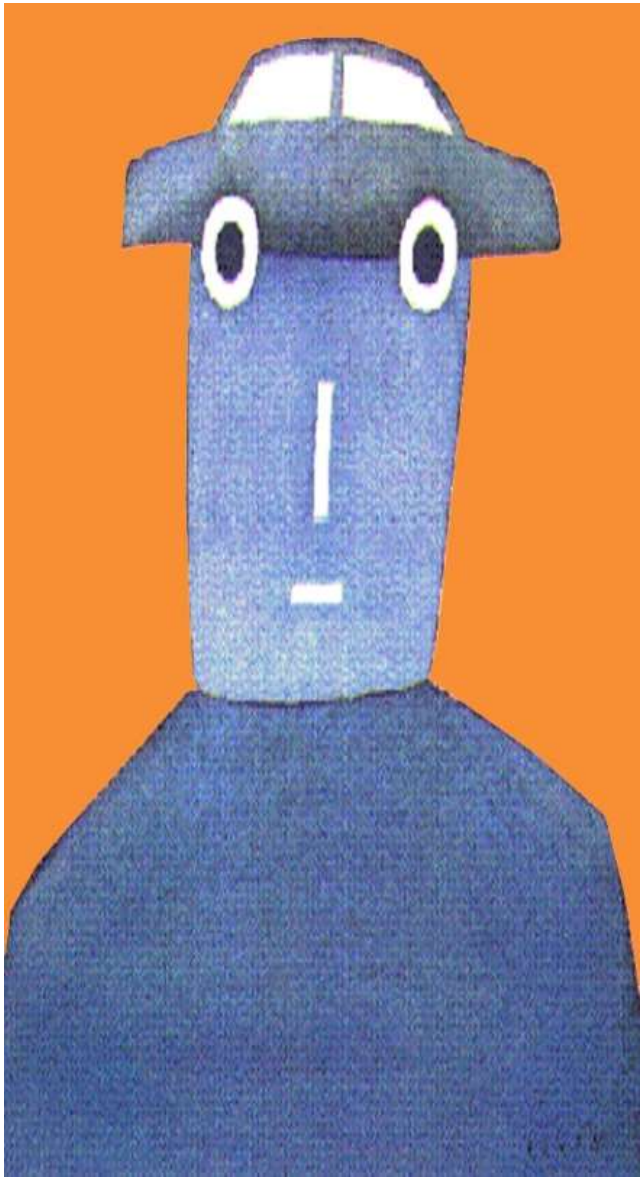
17 partners from 12 EU countries



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)



SafetyCube objectives

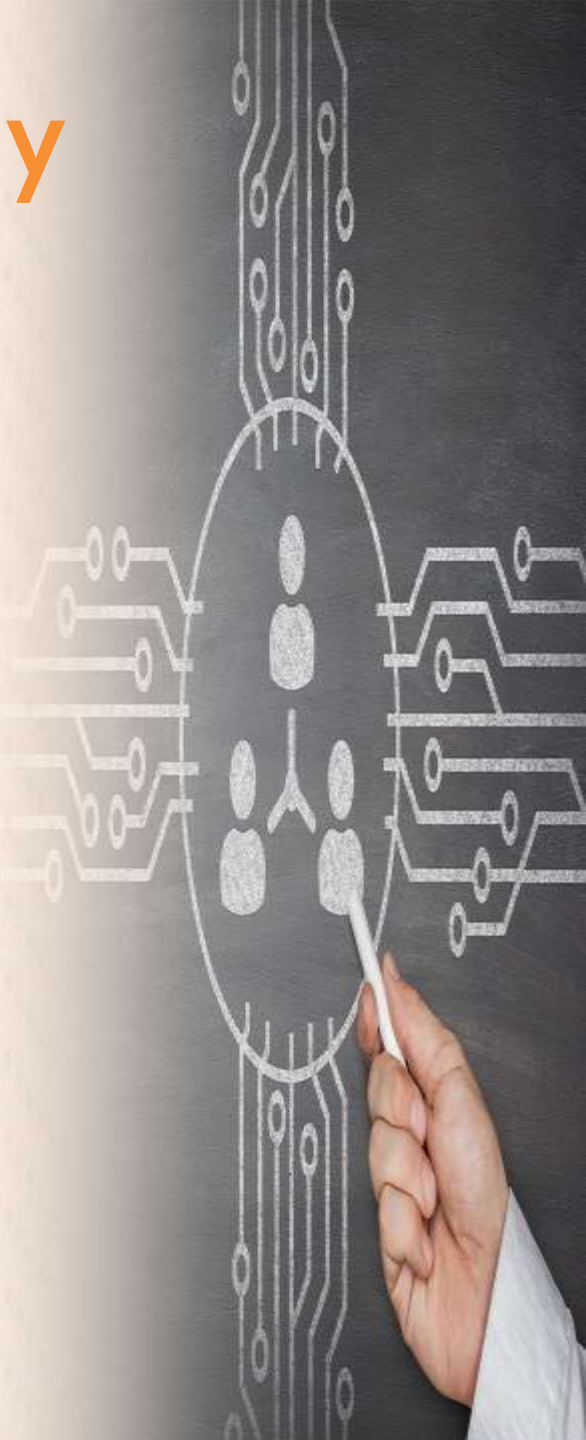
- The in-depth understanding of **accident causation and risk factors**.

- Exploit a large amount of existing accident data (macroscopic and in-depth) and knowledge (existing studies) in order:
  - *to identify risk factors,*
  - *to analyse the effects of risk factors on road safety outcomes.*
  - *To summarise the effects of risk factors and rank them on the basis of their effects.*

SafetyCube methodology

- **Methodologies and guidelines** developed in SafetyCube.
  1. Creating **taxonomies** of risk factors
  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: Infrastructure topics

Nearly 60 risk factors and 90 measures in more than 15 infrastructure areas

- motorways, rural and urban roads - road segments and junctions -

Roadside issues within the SafetyCube '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

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 tunnel poor sight distance - vertical curves

Risks taxonomy

Superelevation / cross-slopes (risk of ran-off road)	superelevetion 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

Overview of results

- **Ranking of infrastructure risk factors**

Red (Risky)	Yellow (Probably risky)	Grey (Unclear)
▪ Traffic Volume ▪ Risks associated with Traffic Composition ▪ Road Surface - Inadequate Friction ▪ Workzone length ▪ Low Curve Radius ▪ Number of Lanes ▪ **Absence of paved shoulders** ▪ **Narrow Shoulders**	▪ Occurrence of Secondary crashes ▪ Absence of Transition curves ▪ Risk of Different Road Types ▪ Adverse weather - Rain ▪ Poor Visibility - Darkness ▪ Cross-section deficiencies - Superelevation ▪ High grade ▪ Presence of Tunnels ▪ Narrow lanes ▪ **Undivided road** ▪ **Narrow median** ▪ **Risks associated with Safety Barriers and Obstacles** ▪ **Sight Obstructions (Landscape, Obstacles and Vegetation)** ▪ Interchange deficiencies - Ramp Length ▪ At-grade junctions - Number of conflict points ▪ Risk of different junction types ▪ At-grade junctions - Skewness / Junction angle ▪ At-grade junctions - Poor sight distance ▪ At-grade junctions - Gradient ▪ Uncontrolled rail-road crossing ▪ Absence of road markings and crosswalks ▪ Uncontrolled junction	▪ Congestion as a risk factor ▪ Risks associated with the distribution of traffic flow over arms at junctions ▪ Adverse weather - Frost and snow ▪ Workzone duration ▪ Frequent curves ▪ Densely spaced junctions ▪ Interchanges - Acceleration / deceleration lane length

Results for medians and roadsides

- **Detailed ranking of risk factors**

Infrastructure Element	Specific Risk Factor	Colour code	Crash risk	Crash frequency	Crash severity	Hot topic (Yes/No)
Cross-Section - Road Segments	Shoulder and roadside deficiencies -**Absence of paved shoulders**	**Red**	-	↑	-	**Y**
	Shoulder and roadside deficiencies -**Narrow shoulders**	**Red**	-	↑	-	**Y**
	Undivided Road	**Yellow**	-	-	↑	N
	Cross-section deficiencies - **Narrow Median**	**Yellow**	-	↑	↑	N
	Shoulder and roadside deficiencies - Risks associated with **safety barriers and obstacles**	**Yellow**	-	↑	↑	**Y**
	Shoulder and roadside deficiencies- **sight obstructions** (Landscape, Obstacles and Vegetation)	**Yellow**	-	-	-	**Y**

Overall progress to date

- A remarkable contribution to the DSS
  - *600 studies on risk factors (290 on infrastructure)*
  - *3500 effects of risk factors*
- Comprehensive summaries of existing knowledge
  - *More than 70 synopses of risk factors (38 on infrastructure)*
  - *10 original meta-analyses: workzones, distraction etc.*
- Ranking of risk factors
  - ***Risky, probably risky, unclear***
  - *Effect on crash risk, crash frequency, severity*
- SafetyCube DSS under development
  - *Pilot operation expected early 2017*
  - *Opening expected mid 2017*

Contact

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