

Guidelines for cost-effective road safety measures for the next decade

The European Road Safety Decision Support System DSS

www.roadsafety-dss.eu



Eleonora Papadimitriou*, Delft University of Technology
Klaus Machata, KFV - Austrian Road Safety Board

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*Involved in the development of the European Road Safety DSS while at NTUA, Greece



-
- measures
- decision support system
- risk factors
- vehicle
- casualties
- elderly
- cost-effectiveness
- evaluation
- safe system approach
- cyclists
- motorcyclists
- young drivers
- targuing roads
- pedestrians
- user behaviour
- accident severity
- road infrastructure
- road safety
- monitoring
- distraction
- serious injuries
- self-explaining roads
- VRU detection
- cooperative systems
- active protection of VRU
- ITS applications
- priority setting
- risk factors

Decisions in road safety so far often ...



... taken intuitively.

The alternative would be:

- Tedious search in
 - *libraries*
 - *Online-databases (e.g. Scopus, Elsevier, Springer)*
 - Expensive acquisition of online papers
 - Laborious search for universal statements and quantified evidence
- **The SafetyCube Road Safety Decision Support System (DSS) has already done that for you!**



SafetyCube DSS: a long waited powerful tool

- SafetyCube DSS is the first integrated road safety support system **developed in Europe**
- **User friendly**, web-based & **free access**
- **Quantitative** evidence & analytical background
- SafetyCube DSS **offers for the first time** scientific evidence on:
 - ***risks** and not only **measures**, and not only on **infrastructure***
 - *a wealth of **estimates** of risks and measures effects*
 - ***links** between risks factors and measures*
 - ***Taxonomies** for the whole road safety domain*
 - 118 risk factors, 167 measures
- For **evidence-based decisions** at **local, regional, national and European level**

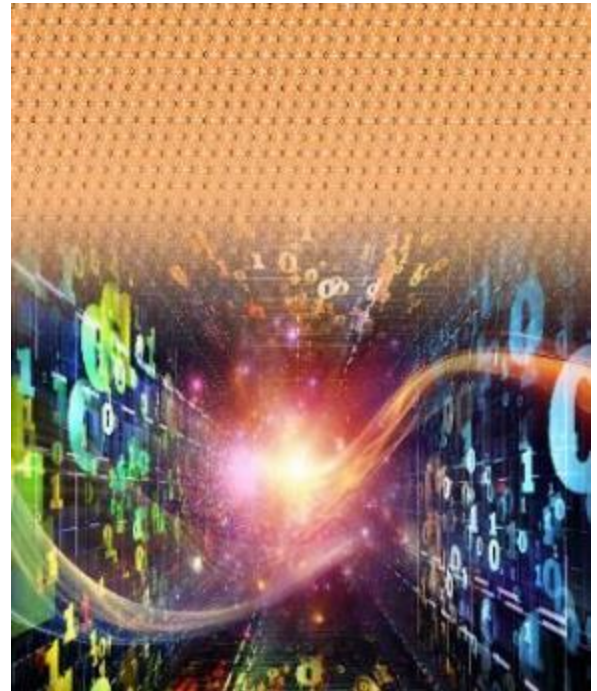


SafetyCube DSS Knowledge Wealth



The SafetyCube DSS includes

- more than **1,250 studies**,
- with more than **7,500 estimates** of risks/measures effects on:
 - behaviour,
 - infrastructure,
 - vehicle, and
 - post impact care
- **211 Synopses**
- **36 cost-benefit analyses** (adjustable)



The SafetyCube Project



- Funded by the European Commission
- Coordinator: Loughborough University, UK
- 2015 – 2018
- 17 partners from 12 EU-countries



Goal: “To develop a user friendly, web-based, interactive **Decision Support Tool** to properly **substantiate road safety decisions**”


The SafetyCube DSS



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. The SafetyCube DSS fact-sheet is available for download [here](#). 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](#). A full webinar on the SafetyCube DSS is available [here](#).

Introductory Video: 



Introductory Video: 




Introductory Video: 




Introductory Video: 



Introductory Video: 



Introductory Video: 

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

Installation of section control & speed cameras

Please refer to this document as follows: De Ceunynck, T. (2027), Installation of section control & speed cameras, European Road Safety Decision Support System, developed by the H2020 project SafetyCube. Retrieved from www.roadafety-dss.eu on DD MM YYYY



Please note: The studies included in this synopsis were selected from those identified by a systematic literature search of specific databases (see supporting document). The main criterion for inclusion of studies in this synopsis and the DSS was that each study provided a quantitative effect estimate, preferably on the number or severity of crashes or otherwise on road user behaviour that is known to be related to the occurrence or severity of a crash. Therefore, key studies providing qualitative information might not be included in this synopsis.

Installation of section control & speed cameras

1.4.2 What is the rationale behind fixed speed cameras and section control?

Fixed speed cameras and section control (also referred to as average speed enforcement or point-to-point speed cameras) aim to reduce the number of crashes by enforcing the sign-posted speed limits. Excessive speed is a major road safety issue on all road types. Exceeding the speed limit, even by small amounts, has been found to be associated with substantial increases in crash risk (e.g., al., 2004). Therefore, even small reductions in vehicle speed can produce substantial reductions in the number and severity of crashes (Nilsson, 2004).

In addition, speed variation between vehicles has also been demonstrated to increase the risk of crash involvement (Sooile et al., 2013). Fixed speed cameras and section control could affect road safety not only through their impact on mean speed and/or exceedance of the speed limit, but also through an effect on the speed variation.

1.4.3 Description of the main research methods

The safety effects of section control and fixed speed cameras have been studied quite extensively. A recent meta-analysis (Kays, 2014) has been identified, as well as a number of more recent studies in peer-reviewed scientific journals. All studies apply a before-after study design or a quasi-experimental design. Only studies that

Ranking of risk factors and measures



Risk factor		Measure	
Red	Results consistently show an increased risk when exposed to the risk factor concerned.	Green	Results consistently show that the countermeasure reduces road safety risk.
Yellow	There is some indication that exposure to the risk factor increases risk, but results are not consistent.	Light green	There is some indication that the countermeasure reduces road safety risk, but results are not consistent.
Grey	No conclusion possible because of few studies with inconsistent results, or few studies with weak indicators, or an equal amount of studies with no (or opposite) effect.	Grey	No conclusion possible because of few studies with inconsistent results, or few studies with weak indicators, or an equal amount of studies with no (or opposite) effect.
Green	Results consistently show that exposure to the presumed risk factor does not increase risk.	Red	Results consistently show that this measure does NOT reduce road safety risk and may even increase it.

E3-calculator

Economic efficiency evaluation



- Cost Benefit Analysis
- 36 SafetyCube examples
- User can
 - *adapt SafetyCube examples for own purposes, or*
 - *Users can do own analysis from scratch*



Some challenges for the next decade



- **Safe roads and roadsides**
 - *Speed management (engineering, enforcement)*
 - *Roadside treatments (shoulders, barriers and crash cushions, clear-zones)*
 - *Road signs and delineation (road markings, rumble strips, chevron signs)*
- **Towards more connected (and automated) vehicles**
 - *Longitudinal & lateral control*
 - *V2X*
- **Ageing of the population**
- **Serious injuries**
- *Examples of SafetyCube DSS contribution follow*



Speed management



- Infrastructure treatments



Measure	Colour code	Number of studies	Meta-analysis	CBA
Reduction of speed limit	●	4	yes	
Dynamic / weather-variant speed limits	●	6		1.25
Speed cameras	●	5	yes	
Section control	●	4	yes	19.5
Speed humps	●	6	yes	18.2
Woonerfs	●	5		
Narrowings	●	5		
30-zones	●	5		1.9
Traffic calming scheme	●	4	yes	0.4
School zones	●	8		

Roadsides



Measure	Colour code	Number of studies	Meta-analysis	CBA
Shoulder implementation	●	4		
Increase shoulder width	●	6		
Change shoulder type	●	3		
Safety barriers installation	●	7	yes	19.5
Change type of safety barriers	●	4	yes	
Clear zone width	●	3	yes	
Road markings	●	6		
Edgeline rumble strips	●	7		
Chevron signs	●	7		2.7

Roadsides – key messages from the synopses

- Edgeline rumble strips show consistently **positive effects on crashes**, but also on SPIs (vehicle lateral position, edgeline encroachment, passing manoeuvres)
- Insufficient information for certain **road user groups** (e.g. PTWs, HGVs), insufficient **geographical coverage** (European studies?)
- The effect of safety barriers and crash cushions largely **varies by type of treatment** – e.g. changing from concrete to steel barriers may even increase fatalities, risks for PTW injury are involved.
- Crash reduction is proportional to **clear zone width**, which is in turn dependent on alignment and vehicle speeds.
- Hazards within the clear zone which cannot be removed, relocated, or made to breakaway on impact, will warrant a guardrail / barrier.

Connected vehicles, V2X



Measure	Colour code	Number of studies	Meta-analysis	CBA
Emergency Braking Assistance	●	6		3
Autonomous Emergency Braking (urban & interurban)	●	5		0.73
Autonomous Emergency Braking (pedestrians & cyclists)	●	7		3.27
PTW enhanced braking systems (ABS, TCS)	●	8	yes	7.8
Collision warning	●	5		
Intelligent Speed Adaptation	●	6		
Adaptive Cruise Control	●	1		
Electronic Stability control	●	12	yes	5.8
Lane departure warning	●	1		
V2V	●	3		
V2I	●	4		

Connected vehicles, V2X – Key messages



- Several **ADAS-family systems** have known and well-established positive effects
- Information on **emerging systems** is limited (unavailable, or inaccessible) – and often inconclusive
- Many simulator studies, or ‘grey literature’ without statistical analysis...
- **Evaluation of V2X** is a key challenge for optimising the path to higher levels of vehicle automation

Ageing and driving



- Age-based screening does not seem effective and may even be counter-productive (increase the average risk *per driver*).
- **Effects largely vary with the type of screening** (from simple vision test to on-road tests) – but stricter screening rules do not seem to relate to reduced fatality rates.
- Main interpretation: **risk may not be age-based**, but primarily affected by motor / cognitive state and impairments
- Several batteries of neuropsychological tests show a very good predictive ability to on-road tests results.

Measure	Colour code	Number of studies	Meta-analysis	CBA
Age-based screening for elderly drivers	●	10	-	0.5*
Fitness-to-drive assessment tools for medical referrals	●	17	-	-

* Only for mandatory vision testing

Serious injuries



[Home](#) > [Knowledge](#)



Knowledge

The knowledge synthesized during the SafetyCube project is listed here, regarding the effects of risks and measures, the causes and impacts of serious injuries, and the most common accident scenarios. Select the related box to view and download the SafetyCube knowledge documents.

[ROAD SAFETY SYNOPSES](#)

SERIOUS INJURIES

[ACCIDENT SCENARIOS](#)

Estimating the number of serious road injuries

Serious road traffic injuries have recently been adopted as an additional road safety indicator. The EU High Level Group on Road Safety defined serious traffic injuries as road casualties with an injury level of MAIS⁺. Within SafetyCube, practical guidelines have been developed to help countries in determining the number of MAIS⁺ road casualties. A summary of these guidelines can be found [here](#).

Impacts and costs of serious road injuries

A literature review and analysis of additional case studies showed that road traffic injuries can have major consequences for casualties (and their families). Moreover, they also pose a burden to society. Within SafetyCube, the burden of non-fatal serious injury has been calculated for road traffic casualties in a number of countries. Finally, by means of a survey, information on the costs of serious injuries were collected. A summary of the main findings concerning health impacts and costs can be found [here](#).

Risk factors related to serious road injuries

Groups of road traffic casualties with relatively many MAIS⁺ casualties per fatality and/or a relatively high burden of injury for MAIS⁺ casualties were identified. The four most relevant groups were analysed: cyclists, 0-17 year olds, spinal cord injuries and knee/lower leg fractures. Contributing factors and injury mechanisms for these groups of MAIS⁺ casualties are discussed [here](#).

SafetyCube DSS future



- Uninterrupted operation of the current SafetyCube DSS
- Priorities for further development
 - *Updates of the risk factors, measures and cost-benefit analyses (recent studies but also older ones)*
 - *Add studies in more languages*
 - *Translate the contents in other languages*
 - *Possibility to receive, check and incorporate studies submitted by external experts and organizations*
 - *Incorporation of additional data and knowledge sections*



Contact



www.roadsafety-dss.eu



www.SafetyCube-project.eu

Eleonora Papadimitriou, e.papadimitriou@tudelft.nl

Klaus Machata, klaus.machata@kfv.at