

SafetyCube SafetyCube - the European Road Safety Decision Support System

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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 (<u>www.cmfclearinghouse.org</u>) by NHTSA (USA) - 6.251 CMF on infrastructure only – ongoing
- Road Safety Engineering Kit (<u>www.engtoolkit.com.au</u>)
 by Austroads (Australia) 67 treatments on infrastructure only
- PRACT Repository (<u>www.pract-repository.eu</u>) by CEDR (Europe) 889
 CMF and 273 APM on infrastructure only high quality
- iRAP toolkit (<u>http://toolkit.irap.org/</u>) by iRAP 58 treatments (42 on infrastructure)
- Safety Performance Factors Clearinghouse (<u>http://spftool.com/</u>) 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
- Use of a template for coding studies, to be introduced in the DSS back-end database
- 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
- 88 Topics

e.g. distraction, roadside, crashworthiness

• **175 Specific topics** e.g. mobile phone use, no clear-zone, low pedestrian rating (NCAP)

Safety <mark>Cub</mark> DSS	European Ro	oad Safety	Decision S	upport Syst	em
	Search	Knowledge	Calculator	Methodology	Support
Home > Measures Search					
Keyword Search	Risk Factors	Measures	Road	User oups	Accident Categories
Behavior	Infrastructure	Vehicle		Post Impact Care	
Law and enforcement	Traffic flow	Frontal impact		Ambulances/helicop	ters
Education and voluntary training or	Traffic composition	Side impact		Extraction from vehi	cle
programmes	Formal tools to address road nettwork	Rear impact		Pre-hospital medical	care
Driver training and licensing	deficiencies	Rollover		Triage and allocation	n to trauma facilities
Fitness to drive assessment and rehabilitation	Speed management & enforcement	Pedestrian		First aid training driv	ers
Awareness raising and campaigns	Road type	Child			
Awareness raising and campaigns	Road surface treatments	PTW			
	Visibility / Lighting treatments	Cyclist			
	Workzones	HGV			
	Horizontal & vertical alignment treatments	Longitudinal			
	Superelevation / cross-slopes treatment	Lateral control			
	Lanes / ramps treatments	Lateral control			

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
 >210 Synopses, Serious Injuries, Accident Scenarios
- Calculator
 Economic Efficiency Evaluation
- Methodology
 System documentation
- Support
 Contact, help, feedback

SafetyCul DSS	ıropean Rc	ad Safety	Decision S	upport Syste	

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.



The Search Structure

- Search (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

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Countri

Search results

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

Refine search

- Specific Risk factor / Measure
- Other **search filters**:
 - <u>Road user groups</u>: All, car occupants, drivers, passengers, PTW riders, pedestrians, cyclists, HGVs.
 - <u>Road types:</u> All, motorways, rural roads, urban roads
 - <u>Country</u>: EU, EU countries, US and Canada, Australia, Asia.
- Links to related measures
- Select a specific risk factor / measure
- Get the list of related measures

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	Sei	arch Results						
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	319	Development of models for the n	crash severity or minumment of v	Dex	DENT ANALYSIS AND VENTION 40, 1724-1731	2008	OBSERVATIONAL	UNITED STATES

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

Presence of workzones - Workzone duration	
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SafetyCube Related Risks / Measures

- Linking based on a dedicated model categorizing risks
- Every Risk Factor (88) is **linked** to one or more Road Safety Measure(s) (175)
- Every Road Safety Measure (175) is linked to one or more Risk Factor(s) (88)
- Exploration of more than 270 relationships

SafetyCul DSS	Eu	ropean Rc	oad Safety	Decision S	upport Syste	em
		Search	Knowledge	Calculator	Methodology	Support
Home > Related Measures Related Studies for "poor visil	bility - darkness"					

The following measures are related to the risk factor you selected. Select a measure from the table below to see the available SafetyCube results.

Behavior	Infrastructure	Vehicle		Post Impact Care	
	installation of road lighting		hts (automated, adaptive,	Not Applicable	
visibility	improvement of existing lightlin		_)		
		Night Vision			
		Vehicle backup ca Camera systems (mera - Reversing Detection or REV)		
Countries	SafetyCube Synops	SeS Installation of lighting & Improve	ements to existing lighting:	• GREEN (EFFEC)	71VE) - 🔁
NETHERLANDS UNITED KINGDOM UNITED STATES		The vast majority of results show road lighting have favourable eff		0 0 1	ovements to existing
	ID Title	Source	Year	Design	Countries
	284 Relationship I	Between TRANSPORTATIO	N 2015	CROSS-	UNITED

	Roadway Illuminance Level and Nighttime Rural Intersection Safety	RESEARCH RECORD: JOURNAL OF THE TRANSPORTATION RESEARCH BOARD, NO. 2485, PP. 8-15		SECTIONAL	STATES
285	Road Lighting Effects on	TRANSPORTATION	2016	CROSS-	CANADA
	Bicycle and Pedestrian	RESEARCH RECORD:		SECTIONAL	
	Accident Frequency	JOURNAL OF THE			
	Case Study in Montreal,	TRANSPORTATION			
	Quebec, Canada	RESEARCH BOARD, NO. 2555,			
		PP. 86-94			

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

SafetyCul DSS	European Ro	oad Safety	Decision S	upport Syste	**************************************	
	Search	Knowledge	Calculator	Methodology	Support	

Modeling work zone crash frequency by quantifying measurement errors in work zone length

Yang H., Ozbay K., Ozturk O., Yildirimoglu M.

Abstract

Work somes are temporary traffic control zones that can potentially cause safety problems. Maintaining safety, while implementing necessary changes on roadways, is an important challenge traffic engineers and researchers have to confront. In this study, the risk factors in work zone safety evaluation were identified through the estimation of a crash frequency (CF) model. Measurement errors in explanatory variables of a CF model can lead to unreliable estimates of certain parameters. Among these, work zone length naises a major concern in this analysis because it may change as the construction schedule progresses generally without being properly documented. This page proposes an improved modeling and estimation approach that involves the use of a massurement error (ML) model integrated with the traditional magnetic biomal (MI) model. The proper opposed was compared with the traditional NB approach. Both models were estimated using a large dataset that consists of 50 work zones in New Jersey. Results showed that the proposed approach outperformed the relational approach in terms of goodness-of-fit statistics. Moreover it is shown that the use of the traditional NB approach in this context can lead to the overestimation of the effect of work: zone length on the crash occurrence.

doi:10.1016/j.aap.2013.02.031

Summary

The study investigates workzone crashes in New Jersey state. 7 years of data are exploited. Full Bayesian Negative binomial models are applied. AADT, length of workzone and number of operating lanes in the workzone were found to increase frequency of injury and non-injury (property damage only) accidents.

Year: 2013

Basic Study Information

Topic: RISK FACTOR Source: ACCIDENT ANALYSIS AND PREVENTION 55 (2013) 192-201

Design: OBSERVATIONAL CROSS-SECTIONAL

Countries: UNITED STATES

Keywords: FULL BAYESIAN MEASUREMENT ERROR NEGATIVE BINOMIAL MODEL CRASH FREQUENCY SAFETY ANALYSIS WORK ZONE

Effects

Effect No	Outcome	Exposure	Group Type	Group	Effect Estimator	Effect Estimator Specifications	Sample	Estimate	Estimate Lower Limit	Estimate Upper Limit	Conclusion Comments
1	NUMBER OF PROPERTY DAMAGE ONLY ACCIDENTS	LN(LENGTH)	unit	MILES	SLOPE	FULL BAYESIAN NEGATIVE BINOMIAL MODEL		0.847	0.729	0.965	SIGNIFICANT NEGATIVE EFFECT ON ROAD SAFETY THE MODEL WITH THE BEST FIT IS PRESENTED (LOWER DIC VALUE). LOWER AND UPPER LIMIT REFER TO THE 95% (2.5%-97.5%).
2	NUMBER OF PROPERTY	LN(AADT)	unit	ADJUSTED VOLUME/LANE (BY	SLOPE			0.538	0.415	0.634	SIGNIFICANT NEGATIVE EFFECT ON ROAD SAFETY

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)

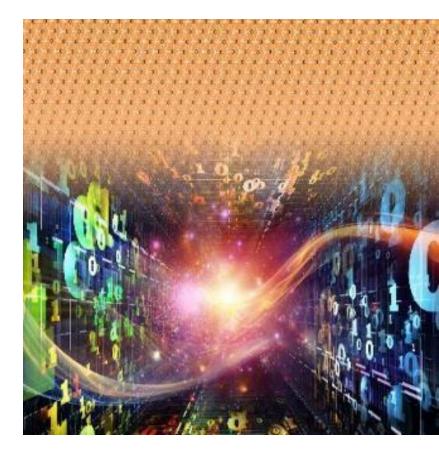
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		Search	Knowledge	Calculator	Methodolo	gy Suppo
Home > Calculator						
	Calculator Plot version, under development The calculator for Economic Efficien measure (i.e. the percentage of crasi crash-costs in the European countrie analysis. Select one of the SafetyCul All figures and estimates refer to eu	thes or casualties prever es, allowing to express a be cost benefit analyses	nted) with the costs of t all costs and benefits of	his measure. The calcu a measure in monetary	ilator also integrat y values and condu	es updated informat ucting cost benefit
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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
- more than 210 Synopses
- more than 35 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:
 - 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





SafetyCube SafetyCube - the European Road Safety Decision Support System

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