SafetyCube

Decision Support System: The Scientific Basis

SafetyCube midterm-workshop Brussels, 27 September 2016

Co-funded by the Horizon 2020
Framework Programme of the European Union

9/27/2016

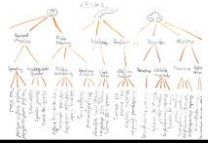
SafetyCube DSS

Road Safety
Decision **S**upport **S**ystem

Risks

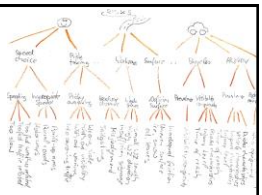
Measures

Taxonomy | **Repository** | **Synopsis** | **Prioritisation**

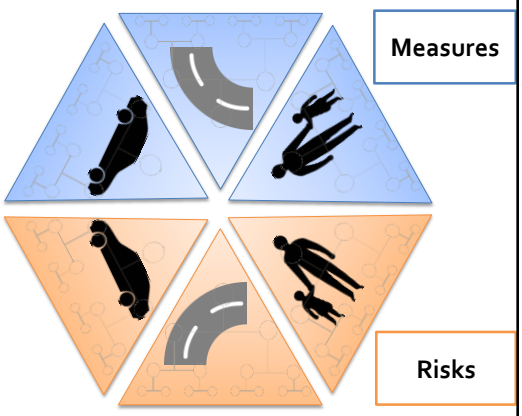


1. Taxonomy

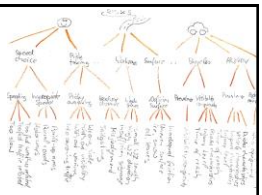
Taxonomy



- Hierarchical
- 3 main AREAS
  - *Behaviour*
  - *Infrastructure*
  - *Vehicle*
- Risks & Measures



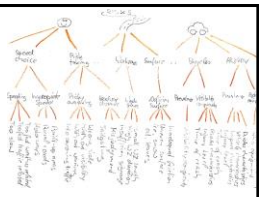
Taxonomy



Risks

- Speed choice
  - Speeding
    - Built up areas
    - Rural roads
    - Motorways
  - Inadequate Speed
    - Too fast weather related
    - Too fast traffic related
    - Too slow

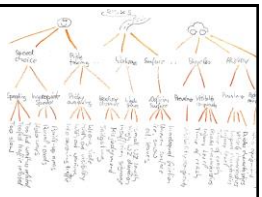
Taxonomy

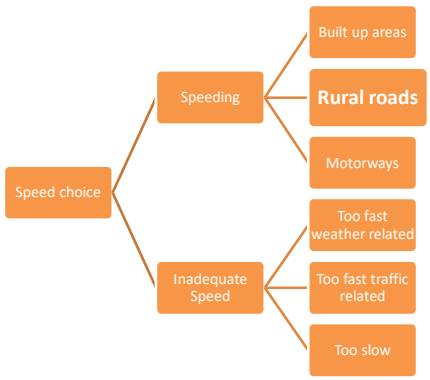


Measures

- Traffic control road segments
  - Traffic signs
    - Installation
    - Replacement
  - Delineation & road markings
    - Road markings
    - Chevron in curves
    - Rumble strips
  - Driver information & alert
    - Variable messages: incident warning
    - Variable messages: congestion warning
    - Dynamic speed warning
    - V2I

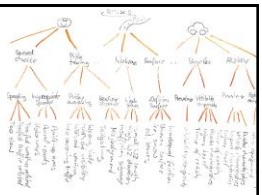
Taxonomy - linking





- Demerit point system
- Increase sanctions
- Speed awareness course
- Speed Campaign
- Zero tolerance/ reduction of tolerance
- Mobile speed enforcement
- Change Speed limits
- Speed Cameras
- Section control
- Variable traffic signs
- Dynamic speed warning - Smiley
- Speed humps
- Adaptiv cruise control
- ISA

Taxonomy - DSS



- Backbone of DSS
- Finding risks & measures
- Linking risks to measures
- Systems view
- Additional entry points:
  - *Linked to user-groups*
  - *Linked to accident scenarios*

Text Search	Risk Factors	Road Safety Measures	Road User Groups	Accident Scenarios
Search for your topic within the entire SafetyCube database of studies on road safety Risk Factors and Measures.	Search for a Risk Factor related to Behaviour, Infrastructure or Vehicle within the SafetyCube taxonomy of Risk Factors. The search results will also indicate Road Safety Measures for these Risk Factors.	Search for a Measure related to Behaviour, Infrastructure or Vehicle within the SafetyCube taxonomy of Measures. The search results will also indicate Risk Factors related to the Measure.	Search for Risk Factors and Measures related to different Road User Groups.	Search for Risk Factors and Measures related to different Accident Scenarios.

2. Repository

Repository

- Literature search
- Evaluation of studies
- Coding template
- Data-base

Repository
Literature Search

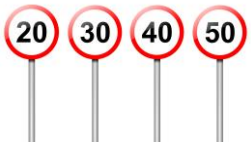
Literature search	Screening abstracts	Full text download	Evaluation full text
• Lit. data base • Key words • Other sources • # records identified	• Evaluate • # relevant records	• Download pdf • Enter in list of papers	• Exclude • Criteria • Include • Priority for coding • Included in meta

Repository
Evaluation of Studies

- Different study designs
- Different analyses types
- Essence
  - *Risk estimate*
  - *Safety effects*
- Biases

Repository
Evaluation of Studies

- Transferability
- Conditions
  - *Country*
  - *Road user type*
  - *Road type*
  - *Traffic conditions*
  - *Crash severity*



Repository
Coding template

Core info

Coder	*Name*	Focant Nathalie				
	Institution	BRSI				
	Date (dd/mm/yyyy)	20/05/2016				
Reference	*Authors*	Nathalie Focant, Martensen Heike				
	Title	Are there more accidents in the rain? Exploratory analysis of the influence of weather conditions on the number of road accidents in B				
	Year	2014				
	Source	BRSI report				
	URL					
Topic	*Risk factor or Countermeasure?*	Risk factor				
	IVR	VRS				
	Header 5 - Infrastructure element	Road environment				
	Header 6 - Risk factor	Adverse weather				
	Header 7 - Specific risk factor	rain	snow / ice / low temperature	wind		
	Abstract	Its purpose is to determine how "weather" conditions do or do not influence the daily occurrence of "injury"- and "fatal" "accidents" in B				
	Keywords	mean comparison				
Sampling frame	*Countries*	Belgium				
	Administrative Level	National				
	Road user profile - Modes	Pedestrian	Cyclist	Car	LGV	HGV
	Road user profile - Type	All				
	Road user profile - Subgroup					
	Road user profile - Age	All				
	Road user profile - Gender	All				
	Road network profile - Area	All				
	Road network profile - Segments	All				
	Accident severities	Injury	fatal			
	Injury severities	All				
	Comments					
Design	*Features*	Observational				
	Direction	*1. Exposure -> 1. Outcome*				
	EXPOSURE DEFINITION	Rain	Snow	High winds	Cold	
	OUTCOME DEFINITION	Injury accidents	Fatal accidents			
	Total number of effects	56				
	Comments	Mean comparison				
Limitations / Potential sources of bias		*Extent*	*Attribution*			
	Experiments: Pre-trial group differences	Maybe a problem	Dags with rain might differ from dags without on characteristics other than the weather.			

Repository
Coding template

Core info

Sampling frame	☐ *Countries*	Belgium			
	☐ *Administrative Level*	National			
	☑ *Road user profile - Modes*	Pedestrian	Cyclist	Car	LGV
	☐ *Road user profile - Type*	All			
	☐ *Road user profile - Subgroup*				
	☐ *Road user profile - Age*	All			
	☐ *Road user profile - Gender*	All			
	☐ *Road network profile - Area*	All			
	☐ *Road network profile - Segments*	All			
	☐ *Accident severities*	Injury	fatal		
	☐ *Injury severities*	All			
	Comments				
Design	*Features*	Observational			
	Direction	*≠ Exposure -> ≠ Outcome*			
	EXPOSURE DEFINITION	Rain	Snow	High winds	Cold
	OUTCOME DEFINITION	Injury accidents	Fatal accidents		
	Total number of effects	56			
	Comments	Mean comparison			
Limitations / Potential sources of bias		*Extent*	*Motivation*		
	Experiments: Pre-trial group differences	Maybe a problem	Days with rain might differ from days without on characteristics other than		

Repository
Coding template

Results

☐ Differences between effects	Effect 3	Effect 4	Effect 5	Effect 6
OUTCOME DEFINITION	Injury accidents	Injury accidents	Injury accidents	Injury a
Road user profile - Modes	Cyclist	Motorcyclist	Car	LGV
Rain - Test group	Normal day	Normal day	Normal day	Norma
Rain - Reference group	Rainy day	Rainy day	Rainy day	Rainy d
Measure of effect/association	Percent change	Percent change	Percent change	Percen
Specifications				
Estimate	-0,3420	-0,5470	0,0550	0,1750
Standard error of estimate				
Statistic [name(parameters)=x]				
p-value				
Sample size (x or n1=x1; n2=x2)	555 normal days; 702 rainy da	555 normal days; 702 rainy da	555 normal days; 702 rainy da	555 nor
Confidence level	0,0500	0,0500	0,0500	0,0500
Lower limit				
Upper limit				
Adjustment variables/Covariates				
Conclusion	Significant positive effect on	Significant positive effect on	Significant negative effect of	Signific

Repository
Coding template

Core info

Coder	*Name*	Kevin Diependaele			
	Institution	BRSI			
	Date (dd/mm/yyyy)	08/12/2015			
Reference	*Authors*	M.R. Bambach, R.J. Mitchell, R.H. Grzebieta, J. Olivier			
	Title	The effectiveness of helmets in bicycle collisions with motor vehicles: A case-co			
	Year	2013			
	Source	Accident Analysis and Prevention, 53, pp. 78-88			
	URL	doi:10.1016/j.aap.2013.01.005			
Topic	*Risk factor or Countermeasure?*	Countermeasure			
☐	*WP*	WP6			
☐	*Service*	Passive Safety (VRU)			
☐	*System*				
☐					
☐					
☐					
	Abstract	There has been an ongoing debate in Australia and internationally regarding th			
	Keywords	bicycle helmets; head injury; case-control; bicycle collisions with motor vehicles			
Sampling frame	☐ *Countries*	Australia			
☐	*Administrative Level*	Regional			
☐	*Road user profile - Modes*	Cyclist			
☐	*Road user profile - Type*	Rider			
☐	*Road user profile - Subgroup*				
☐	*Road user profile - Age*				
☐	*Road user profile - Gender*	All			
☐	*Road network profile - Area*	Rural road	Urban road	Suburban road	
☐	*Road network profile - Segments*	All			
☐	*Accident severities*	Injury	Fatal		
☑	*Injury severities*	Hospital	AIS 3	AIS 4+	
	Comments	Region = New South Wales; Injury severities defined on the basis of Survival Ris			

Repository
Coding template

Flexible info

Sampling frame	☐ *Traffic volume (AADT)*				
☐	*Relative share of road users (Mode - %)*				
☐	No. lanes per direction				
☐	Speed limit (km/h)				
☐	Speed limit (miles/h)				
☐	Type of median separation				
☐	Ditch				
☐	Type of shoulder				
☐	*Road width (m)*				
☐	*Lane width (m)*				
☐	*Shoulder width (m)*				
☐	*Clear zone width (m)*				
☐	Clear zone provided				
☐	Roadside safety barrier				
☐	*Horizontal curvature (curve radius)*				
☐	*Gradient*				
☐	*Vertical curvature (curve radius)*				
☐	*Type of road surface*				
☐	*Road surface*				
☐	*Workzone*				
☐	*Tram*				
☐	*Bus*				
☐	*At-grade junction type*				
☐	*Interchange type*				
☐	*Traffic control*				
☐	*Delineation and road markings*				
☐	*Roadside parking*				
☐	*Accident types*				
☐	*Accident - Opponent (a)*				
☐	*Accident - Opponent b*				
☐	*Accident - Collisions*				
☐	*Accident - CDC: Directions of force*				
☐	*Accident - CDC: Area of deformation*				
☐	*Accident - CDC: Types of damage distribution*				
☐	*Injury nature*				
☐	*Injury - Body region*				
☐	*Injury scale*				
☐	*Data collection - Start-Stop (ddmmyyyy-...)*	01/01/2003-31/12/2012			
☐	*Annual driving distance (miles)*				
☐	*Annual driving distance (km)*				
☐	*Total driving distance since licensing (miles)*				
☐	*Total driving distance since licensing (km)*				
☐	*Years of licence possession*				
☐	*Time of the day (hh:mm)*				
☐	*Day of the week*				
☐	*Weather conditions*				
☐	*Light conditions*				
☐	*Blood Alcohol Concentration (BAC)*				
☐	*Type of drugs*				
☐	*Length of planned journey at time of police control (km)*				
☐	*Distraction*				

Repository
Coding template

Flexible info

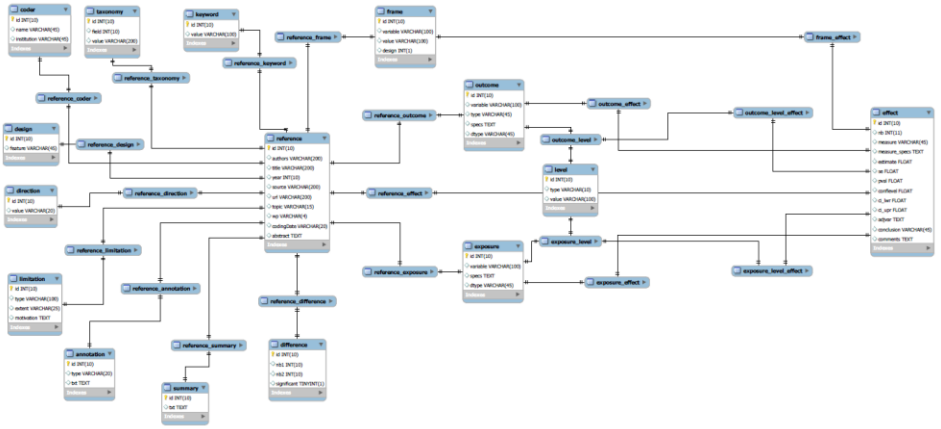
☐ *Interchange type*			
☐ *Traffic control*			
☐ *Delineation and road markings*			
☐ *Roadside parking*			
☐ *Accident types*			
☐ *Accident - Opponent (a)*	Motor vehicle (incl PTW)		
☐ *Accident - Opponent b*			
☐ *Accident - Collisions*			
☐ *Accident - CDC: Directions of force*			
☐ *Accident - CDC: Areas of deformation*			
☐ *Accident - CDC: Types of damage distribution*			
☑ *Injury nature*	Fracture	Internal	Open wound
☐ *Injury - Body region*	Head		
☐ *Injury scale*	AIS		
☐ *Data collection - Start-Stop (dd/mm/yyyy-...)*	2001-2009		

Repository
Coding template

Results

☐ Differences between effects	Effect 4	Effect 5	Effect 6	Effect 7
Injury severities	AIS 3	AIS 3; AIS 4+	Hospital	AIS 3
Injury nature	Fracture	Fracture	Internal	Internal
Injury - Cases	Hospital; Head	Hospital; Head	Hospital; Head	Hospital
Injury - Controls	Non-Head; Minor head	Non-Head; Minor head	Non-Head; Minor head	Non-Hea
Measure of effect/association	Odds ratio	Odds ratio	Odds ratio	Odds rat
Specifications	Odds for wearing a helmet	Odds for wearing a helmet	Odds for wearing a helmet	Odds for
Estimate	0,4370	0,2170	0,6260	0,3560
Standard error of estimate				
Statistic [name(parameters)=x]				
p-value	0,1710	<0.0001	0,0290	<0.0001
Sample size (x or n1=x1; n2=x2)	n (cyclist casualties)= 6745	n (cyclist casualties)= 6745	n (cyclist casualties)= 6745	n (cyclist
Confidence level	0,9500	0,9500	0,9500	0,9500
Lower limit	0,1300	0,1320	0,4080	0,2000
Upper limit	1,4660	0,3570	0,9610	0,6330
Adjustment variables/Covariates	Speed limit; Collision vehicle	Speed limit; Collision vehicle	Speed limit; Collision vehicle	Speed li
Conclusion	Non-significant effect on roa	Significant positive effect on	Significant positive effect on	Significa

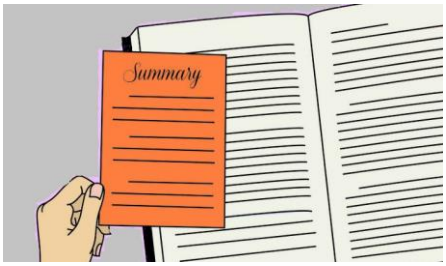
Repository Database



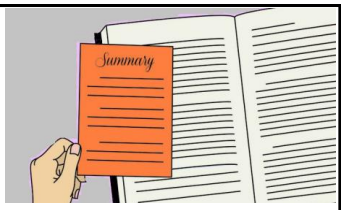
3. Synopsis

Synopsis

- Key conclusion
- Overview
- Scientific summary
- Supporting background



Synopsis



- Key conclusion

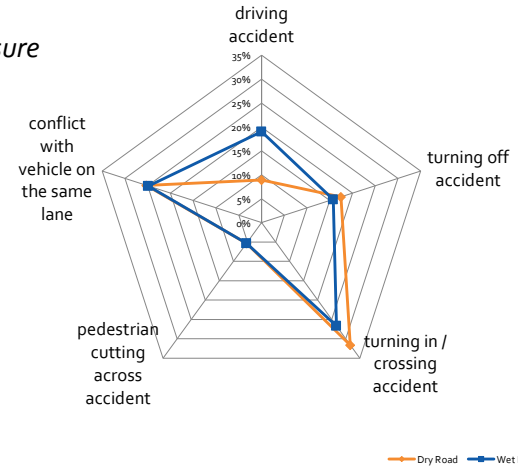
Synopsis

- Key conclusion

Red light running can lead to two basic types of traffic conflict at intersections: right-angle and left turn-opposed conflicts. Red light running is a traffic violation that is associated with very serious crash outcomes (fatality or serious injury). Red-light-running related crashes compose a substantial part of urban road safety. It has been estimated that the relative crash risk of red light violation for pedestrians is 8 times higher than that for legal crossing at signalised intersections.

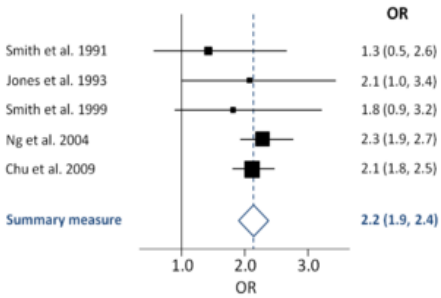
Synopsis

- Overview
  - *Description risk/measure*
  - *Main results*



Synopsis

- Scientific summary
  - *Analysis*
  - *Detailed results*



Synopsis

- Supporting background
  - *Tables*
  - *Details on literature search*

Author(s)	Country	Period covered	Dependant / outcome type	Effect on road safety	Exposure taken into account?	Main outcome - Description
Bergel, 2014	France	1975-1999	Injury accidents – All	↗	N	- Rainfall height was linked, positively, to the total number of injury accidents and fatalities
			Injury accidents – Secondary roads	↗	N	
			Injury accidents – Urban roads	↗	N	
			Injury accidents – Motorways	↗	Y	
			Injury accidents – Toll Motorways	↗	Y	
			Injury accidents – Main roads	↗	Y	
			Fatalities – All	↗	N	
			Fatalities – Secondary roads	↗	N	
			Fatalities – Urban roads	↗	N	
			Fatalities – Motorways	↗	Y	
			Fatalities – Toll Motorways	↗	Y	
			Fatalities – Main roads	↗	Y	
Bergel, Rattiere, Aron, Douvet, Violette, 2020	France	1995-2015	Injury accident risk – All	↗	Y	- The added risk appears high (+4 in average in 2014). - In 2015, the added risk is the highest on main roads (+6%), second on secondary roads (+4%) and on motorways (+3%), third on minor roads (+1.8%). - The added risk is higher outside built-in areas (+6) than the average value for the whole of France, and thus than inside built-in area (+)
			Injury accident risk – Motorways	↗	Y	
			Injury accident risk – Main roads	↗	Y	
			Injury accident risk – Secondary roads	↗	Y	
			Injury accident risk – Minor roads	↗	Y	
			Injury accident risk – Inside built-in area	↗	N	
			Injury accident risk – Outside built-in area	↗	N	
			Fatalities	-	N	
Bijleveld, Churchill, 2009	Netherlands	1987-2006	Fatalities plus hospitalized casualties - All	↘	N	- The effect is different for different levels of crash severity and this effect is different for vulnerable transport modes and less vulnerable transport modes. - The number of fatalities appears to be less sensitive to the duration of precipitation than the number of in-patients, which in turn is less sensitive to the duration of precipitation than the number of slightly injured. - Coefficients among vulnerable modes of transport are relatively low, and some are even negative
			Fatalities plus hospitalized casualties - Pedestrians	↗	N	
			Fatalities plus hospitalized casualties - Cyclists	↗	N	
			Fatalities plus hospitalized casualties – Light mopeds	↗	N	
			Fatalities plus hospitalized casualties - Mopeds	↗	N	
			Fatalities plus hospitalized casualties - Motorcyclists	↗	N	
			Fatalities plus hospitalized casualties - Cars	↘	N	
			Fatalities plus hospitalized casualties - LGV	↘	N	
			Fatalities plus hospitalized casualties - HGV	↘	N	
Brijs, Karlis, Wets, 2008	Netherlands	2001	Cars injury accidents	↗	Y	- Intensity of rain and precipitation duration are highly significant: the intensity/duration of the rain increases, then this leads to a higher number of crashes
Edwards, 1998	United Kingdom	1980-1990	Severity	↘	N	- Accident severity decreases significantly in rain compared with fine weather

Progress to date

600 Studies

3500 Effects

60 Synopses

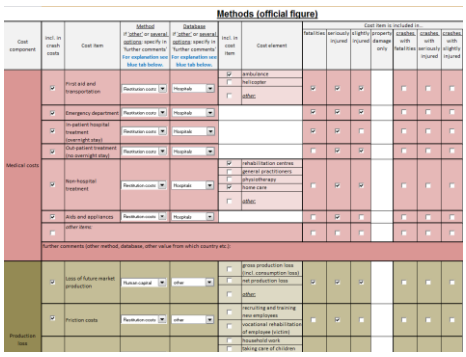
4. Prioritisation

Prioritisation

- Crash costs
- Measure costs
- Economic efficiency assessment

Prioritisation
Crash costs

- From all EU countries
- Methodology
- Cost components
- Injury costs



Prioritisation
Measure costs

- Preparatory costs
- Direct and indirect costs
- Maintenance costs

Prioritisation
Economic efficiency assessment

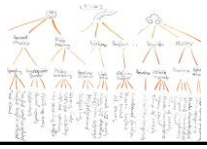
Info on measures	*Economic assessment*	Info per country
Effectiveness saved crashes - per severity category	***Cost Effectiveness Analysis*** • *Costs per crash prevented (for each severity category separately)*	**Crash costs** - severity category
Time horizon	***Cost Benefit Analysis*** • *Net present value (benefits – costs)* • *Cost benefit ratio (benefit / costs)*	Discount rate
Costs of measures		

SafetyCube DSS

Road Safety
Decision **S**upport **S**ystem

→ **Risks**
→ **Measures**

Taxonomy | **Repository** | **Synopsis** | **Prioritisation**

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Heike Martensen and Wouter Van den Berghe

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Brussels, 27 September 2016

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