SafetyCube

Economic Efficiency Evaluation (E³) of Road Safety Measures – Results from the SafetyCube project

Wouter Van den Berghe, Heike Martensen, Stijn Daniels

Vias institute

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

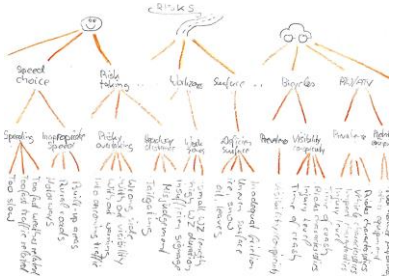
10/13/2017

The SafetyCube Decision Support System (DSS)

Road Safety Decision Support System

- **Risks**
- **Measures**

Taxonomy



Repository

Synopsis

Prioritisation

How to prioritise road safety policy measures?

Methods for prioritisation

Effectiveness	Cost-effectiveness	Cost-utility	Cost-benefit	Multicriteria
What will be the reduction in the number of accidents / injuries / fatalities?	How many deaths will be avoided per unit cost of the measure?	What will be the cost per QALY when imple-menting the measure?	Do the benefits exceed the costs of imple-menting the measure?	Which factors should be considered for deciding on a particular measure?

Focus on Cost Benefit Analysis (CBA)

- In a CBA, the benefits and drawbacks – both expressed in monetary terms – derived from the implementation of a road safety measure are compared.
- It is necessary to assign a monetary value to the impacts of measure. This can be controversial since a monetary value is given to human life.
- In a CBA analysis, it is possible to account for – positive and negative – side effects, eg environmental or mobility impacts
- Two indicators can be used for prioritisation
  - *Benefit-Cost ratio*
  - *Net present value*

Economic efficiency evaluation: what do you need?

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

E³ method

Input

- Measures and measure costs
- Effectiveness of the measures
- Crash costs

Calculations

- Benefits
- Costs and benefits per year

Output

- Costs + benefits (present values)
- Prevented crashes
- Socio-economic return
- Costs per prevented crash

Extra analyses

- Sensitivity analyses
- Penetration rate
- Side impacts
- Long term trends

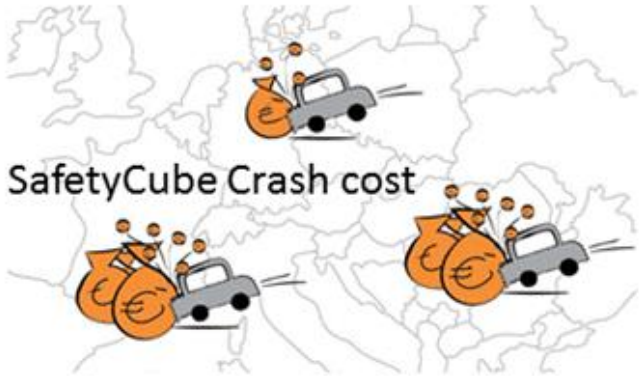
- Effectiveness (CMF)
- Target Group
- (Prevented crashes)
- (Penetration rate)
- (Side effects)

Measure costs

- Studies
- Rune's list
- Other sources

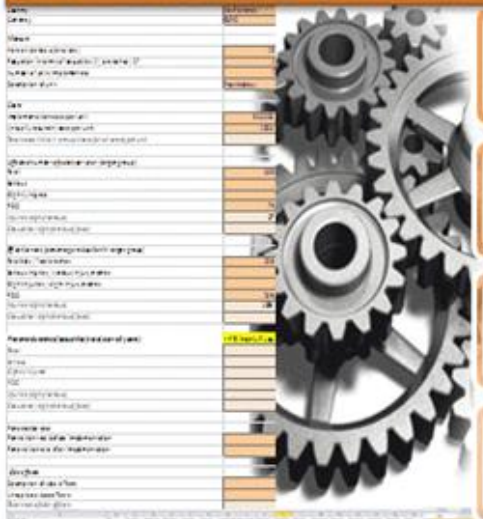
Inflation correction

PPP correction



E3 calculator

Input | Calculations | Output



- Cost – benefit ratio
- Including & excluding side-effects
- Costs per prevented crash
- Break even costs

Taxonomy – link to DSS

	A	B	C	D
1	**COST-BENEFIT ANALYSIS**			
2				
3	***Costs (present values)***			
4	One-time investment costs	311 070	EUR	
5	Recurrent costs	179 122	EUR	
6	Total costs excluding side-effects	490 192	EUR	
7				
8	Side-effects	-	EUR	
9	Total costs including side-effects	490 192	EUR	
10				
11				
12	***Benefits***			
13	Prevented Casualties	521739	EUR	
14				
15	***Socio-economic return excluding side-effects***			
16	Net present value	31 548	EUR	
17	Cost-benefit ratio	1.1		
18				
19	***Socio-economic return including side-effects***			
20	Net present value	31 548	EUR	
21	Cost-benefit ratio	1.1		
22				
23	***Break-even cost for measure (per unit)***	521 739	EUR	
24				
25				
26	**COST-EFFECTIVENESS ANALYSIS**			
27				
28	***Prevented casualties***			
29	Fatal	0.1		

Current status

- Documentation of the methodology, allowing a standardised methodology for CBA analyses for road safety measures
- Background data available
  - *Standardised data on crash costs (per country, and for EU)*
  - *Conversion tools for costs (PPP and indexation)*
  - *Effectiveness measures available through SafetyCube DSS*
- Concept version of E³ tool developed (in Excel), including user manual and reporting template available
- Cost-Benefits analyses are currently being undertaken using and documented for some 30 measures related to education, campaigns, enforcement, infrastructure and vehicle technology

Example 1: Section control systems

- Effect estimates from the meta-analysis by Høye (2014), supplemented by cost estimates in Owen et al. (2016) and target crash estimates in Montella et al. (2012).
- The resulting best estimate of the benefit-to-cost ratio is 19.5 which means that the benefits clearly outweigh the costs.
- The sensitivity analyses show that this measure remains cost-effective in all scenarios, even in the worst case scenario.

Input values
Fatal injury crash reduction: 56%
Serious injury crash reduction: 56%
Slight injury crash reduction: 30%
PDO only crash reduction: 30%
Implementation cost: 68323 €/km
Annual cost: 6832 €/km
Affected nr. of crashes per year:
Fatal crashes: 0.08
Serious injury crashes: 0.60
Slight injury crashes: 0.45
PDO crashes: 2.41

Sensitivity analysis section control

Scenario	Input values	B/C ratio
Low measure effect	Fatal injury crashes reduction: 42% Serious injury crashes reduction: 42% Slight injury crashes reduction:24 % PDO only crashes reduction: 24%	14.7
High measure effect	Fatal injury crashes reduction: 66% Serious injury crashes reduction: 66% Slight injury crashes reduction: 36% PDO only crashes reduction: 36%	23.0
Low measure cost (-50%)	Impl. cost: 34162 €/km Annual cost: 3416 €/km	39.1
High measure cost (+100%)	Impl. cost: 136646 €/km Annual cost: 13665 €/km	9.8

Example 2: Alcohol interlock programme

- An existing cost-benefit analysis on the effect of an alcohol interlock program in the Netherlands (SWOV, 2009) was revisited.
- The resulting best estimate from the E^3 calculator of the benefit-cost ratio (BCR) is 10.9 which means that the benefits substantially exceed the costs.
- The sensitivity analysis shows that while the BCR is sensitive to changes in the underlying assumptions, the ratio remains higher than 1, which means that the measure remains economically efficient.

Next steps

- E³ tool to be integrated in the final version of the SafetyCube DSS.

- Planned possibilities for the users
  - *Study the documented CBA analyses*
  - *Use such analyses as a basis for own analyses (overruling certain input values and run the calculations again)*
  - *Do a CBA analysis starting from a zero – i.e. providing all input values yourself (including values on side effects if relevant)*

- For more information
  - *Heike Martensen, heike.martensen@vias.be*
  - *Stijn Daniels, stijn.daniels@vias.be*
  - *Annelies Schoeters, annelies.schoeters@vias.be*
  - *Wouter Van den Berghe, wouter.vandenberghe@vias.be*