Vehicle safety analysis

Risks, Safety measures and accident categories

Authors: T. Hermitte, F. Léopold, P. Lesire, H. Chajmowicz (LAB), J. Saadé, R. Krishnakumar, V. Phan (CEESAR), M. Jaensch, H..Johannsen (MUH), M. Anderson, R. Thompson (CHALMERS), O. Martin (CIDAUT), S. Reed, R. Talbot (LBORO), W. Niewoehner (DEKRA) A. Theofilatos (NTUA)

Read more: F. Léopold et al. 2018, Inventory of assessed vehicle risk factors and measures **Deliverable 6.4** of the H2020 project SafetyCube.

Objectives

The objective of work package 6 was to analyze data and implement methodologies developed by WP3, concerning vehicle-related accident risk factors and road safety measures. Vehicle-related accident risks and safety measures concerning all types of vehicles (passenger cars, heavy goods vehicles, powered two wheelers …) and road users including Vulnerable Road Users (VRU) such as cyclists and pedestrians were analyzed.

Therefore, various data sources (macroscopic and in-depth accident data) and knowledge databases (e.g. existing studies) were used in order to:

- Identify and rank risk factors related to the road use
- Identify measures addressing these risk factors
- Assess the effect of those measures

Methodology

In order to evaluate the scientific literature, a specific common methodology was developed in the context of the SafetyCube project:

- Identification of a comprehensive taxonomy of vehicle-related risks (ref. D6.1) and measures (ref. D6.2)
- Literature review for each risk and measure (selection, codification, synopsis)
- Cost Benefit Analysis for vehicle-related safety measures

The main results were integrated into the DSS and relevant risks and measures were linked.

Accident scenarios are the main tool used by the automotive industry, in order to define priorities for NCAP and Regulations – thus contributing to save lives on the road. The selection of scenarios closely depends on the objectives and allows to define accident target population, for safety assessment.


HGV


Bus


LGV


Car


PTW


Bicycle


Pedestrian

Risks

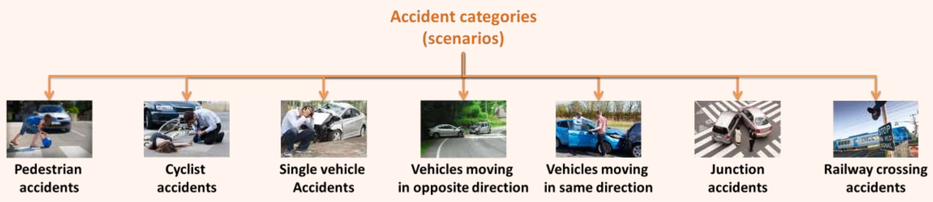
Risky (12)	Probably risky (10)	Unclear (4)
➢ **Pedestrian** • Prevalence of factors in crash data ➢ **Bicycle** • Prevalence of factors in crash data • Injury severity in accidents ➢ **PTW** • Prevalence of factors in crash data • injury severity in accidents ➢ **PC** • Injury mechanism / frontal impact • injury mechanism / Side impact • injury mechanism / Rollover • Abdominal injuries & submarining ➢ **LGV** • self & partner protection • Visibility ➢ **HGV** • Blind spot issue	➢ **Pedestrian** ▪ Vehicle design ▪ Low NCAP rating ➢ **Bicycle** ▪ Visibility - Conspicuity ➢ **PTW** ▪ Poor helmet performance ➢ **PC** ▪ Prevalence of vehicle factors in crash data ▪ Injury mechanism / Rear impact ▪ Low star rating ▪ Technical defects / Maintenance ➢ **LGV** • Prevalence of factors in crash data ➢ **HGV** • Prevalence of factors in crash data	➢ **Pedestrian** ▪ Visibility / Conspicuity ➢ **PTW** ▪ Other protective equipment ▪ Technical defect or maintenance problem ➢ **LGV** ▪ Crash data

Safety measures

Reduce Safety Risk (35)	Possible reduction	Unclear (12)
➢ **Frontal impact** • Directive 96/79/CEE and ECE R94 • EuroNcap (full width & ODB) • Frontal airbag • Seatbelt (effectiveness), SBR and Load limiter ➢ **Side impact** • Directive 96/27/CEE & ECE R95 • Regulation UN R135 • EuroNcap (MBD & pole) • Side airbags ➢ **Rear impact** • Anti whiplash (seat, active headrest …) ➢ **Pedestrian** • Pedestrian protection (active) • Pedestrian protection (veh. shape) • Pedestrian regulation ➢ **Child** • Child Restraint Systems • CRS (booster seats) ➢ **PTW** • Protective clothing • Helmet ➢ **Cyclist** • Protective clothing • Helmet ➢ **HGV** • Underrun protection (front / side / rear) ➢ **ADAS - longitudinal control** • Emergency Braking Assistance Systems • AEB (city , interurban) • AEB (pedestrian, cyclist) • PTW Braking system • Intelligent Speed Adaptation / Limiter / Regulator ➢ **ADAS - lateral control** • Electronic Stability Control (ESC) ➢ **ADAS – Driver assistance** • Alcohol interlock (ALC) ➢ **Visibility enhanced** • Daytime running lights • LDW & LKA & Lane Centering • Blind Spot Detection ➢ **Technical defects** • Vehicle inspection • AEB for trucks ➢ **Connected vehicle** • V2V communication ➢ **Post-Crash** • eCall • Rescue Data Sheet & Rescue Code • ECE R100 (batterie electric vehicle safety)		➢ **Frontal impact** ▪ PTW airbag ▪ Anti-submarining (seat bossage, knee airbag, seatbelt pretensionner …) ➢ **Rollover** ▪ Rollover protection systems (incl. ECE R66) ➢ **ADAS – longitudinal control** ▪ Emergency Stop Signal (ESS) ▪ Collision Warning ▪ Adaptive Cruise Control (ACC, ACCC Stop & start) ➢ **ADAS - lateral control** • LDW & LKA & Lane Centering ➢ **Visibility enhanced** • Enhanced headlights (automated, adaptive, advanced system …) • Night vision • Vehicle backup camera – Reversing detection (REV) ➢ **Technical defects** • TPMS ➢ **Post-Crash** • Event Data Recorder

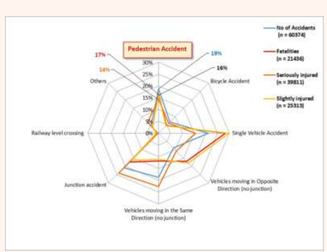
Accident categories / Scenarios

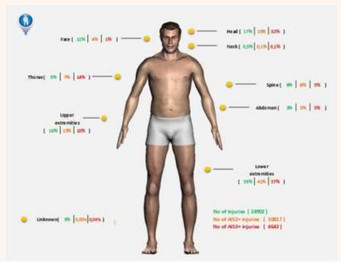
The accident categories available in SafetyCube are an example of accident configurations that are currently used to identify road safety issues (see below). For each scenario, a detailed synopsis was built, using in-depth French data.



Example : Pedestrian-related scenarios

France 2011	Scenario no.	No of Accidents	Fatalities	Seriously Injured	Slightly Injured	KSI	KSI pour 100 accidents
pedestrian crossing road out of crossing path	1.1	1309	97	401	574	498	38
pedestrian crossing road on crossing path at straight stretch	1.2	546	36	174	252	210	39
pedestrian crossing road in front of junction	1.3	3222	107	860	1820	967	30
pedestrian crossing road behind junction	1.4	3136	62	910	1626	972	31
pedestrian moving along the road	1.5	462	72	238	129	310	67
vehicle reversing	1.6	592	28	202	160	230	39
pedestrian sitting or lying on the ground	1.7	18	18	0	1	18	100
pedestrian – changing mode (e.g. driver getting off the car)	1.8	82	15	5	48	20	24
other pedestrian configuration	1.9	1969	68	750	1038	818	42
	Total	*11336*	*503*	*3541*	*5647*	*4044*	*409*





This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633485.