TECHNISCHE UNIVERSITÄT DRESDEN

„Friedrich List“ Faculty of Transport and Traffic Sciences
Chair of Integrated Transport Planning and Traffic Engineering
Prof. Dr.-Ing. Regine Gerike

Statistics and Criteria for Traffic Safety

Co-funded by the
Erasmus+ Programme
of the European Union

Accident Data Collection
Legal Framework: European Union

- Directive (EU) 2019/1936 of the European Parliament and of the Council (October 2019)
- road infrastructure safety management

Article 7

Data management

1. Member States shall ensure that for each fatal accident occurring on a road referred to in Article 1(2) an accident report is drawn up by the competent entity. Member States shall endeavour to include in that report each of the elements listed in Annex IV.

Figure [1]

ANNEX IV

ACCIDENT INFORMATION CONTAINED IN ACCIDENT REPORTS

Accident reports include the following elements:

1. location of the accident (as precise as possible), including GNSS coordinates;
2. pictures and/or diagrams of the accident site;
3. date and hour of accident;
4. information on the road such as area type, road type, junction type incl. signalling, number of lanes, markings, road surface, lighting and weather conditions, speed limit, roadside obstacles;
5. accident severity;
6. characteristics of the persons involved such as age, sex, nationality, alcohol level, use of safety equipment or not;
7. data on the vehicles involved (type, age, country, safety equipment if any, date of last periodical technical check according to applicable legislation);
8. accident data such as accident type, collision type, vehicle and driver manoeuvre;
9. whenever possible, information on the time elapsed between the time of the accident and the recording of the accident, or the arrival of the emergency services.

Figure [2]

Accident Data Collection
Legal Framework: Germany

law on the statistics of road traffic accidents (de: Straßenverkehrsunfallstatistikgesetz, StVUnfStatG)

- obligation to provide data on the number of accidents with fatalities/injuries, serious property damage in terms of
  - location
  - time (period)
  - other characteristics (e.g. accident causes, number/age/gender of injured people, ...)
  - recording of other property damage accidents ("minor accidents") only in terms of numbers
- recording of other property damage accidents ("minor accidents") only in terms of numbers
- compilation of statistics by state statistical offices + reporting to Federal Statistical Office (Destatis)

Accident Data Sources/Reports
European Union

Road Safety Annual Report (International Transport Forum)

- database of IRTAD
  (International Traffic Safety Data and Analysis Group)
- currently 33 countries worldwide

Figure [3]

Global Status Report on Road Safety (WHO)

- database of WHO
- survey of the 175 member states
  (legal framework, national accident databases)

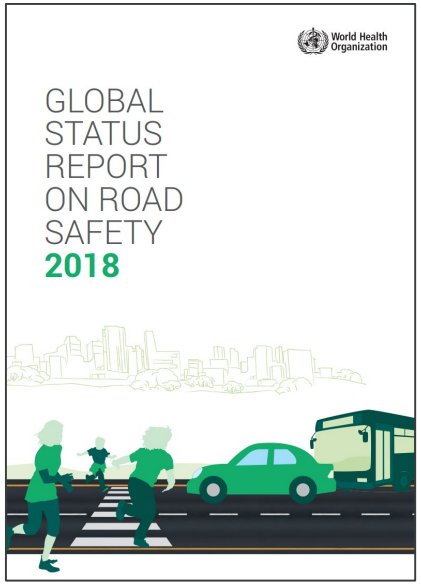


Figure [4]

Accident Data Sources/Reports
European Union

CARE: **Community Database on Accidents on the Roads in Europe**

- European Union road accidents database, since 1993
- accidents with personal injuries
- accident data of member states, challenge: incompatibilities
- access for expert users only

https://ec.europa.eu/transport/road_safety/statistics-and-analysis_en

Figure [5]

Accident Data Sources/Reports
Germany

Federal Statistical Office (Destatis)

- various publications (e.g. monthly report/ annual report on road accidents, annual report with time series)
- provision of micro data in the database **GENESIS**
- additional individual databases of several federal states

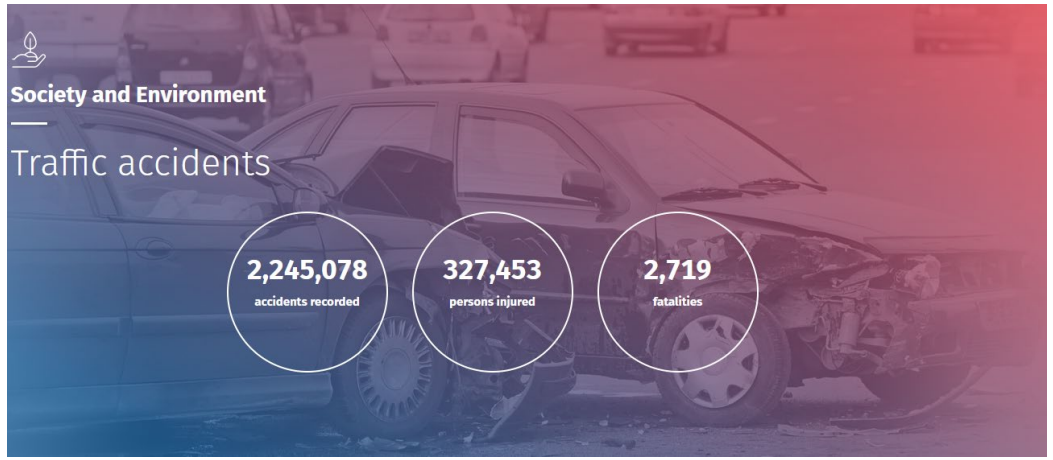


Figure [6]; 2020

Accident Data Sources/Reports
Germany

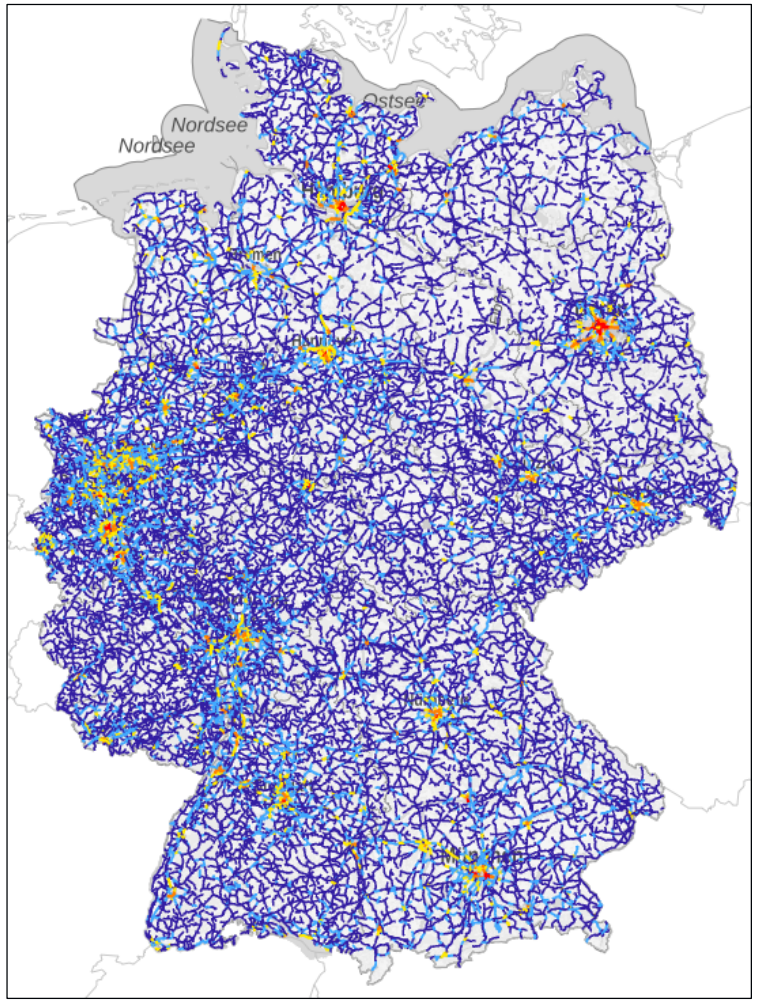


Figure [7]

Interactive Database „Unfallatlas“

- only accidents with personal injuries
- only classified network (roads for motorized traffic)
- available characteristics:
  location, time, accident category, accident type, accident kind, light conditions, road conditions
- not available characteristics:
  verbal accident descriptions, urban area/outside urban area, detailed information about involved road users, accident causes

number of accidents (road section)

- 1-5
- 6-13
- 14-27
- 28-56
- 57-127

Accident Data Sources/Reports
Germany

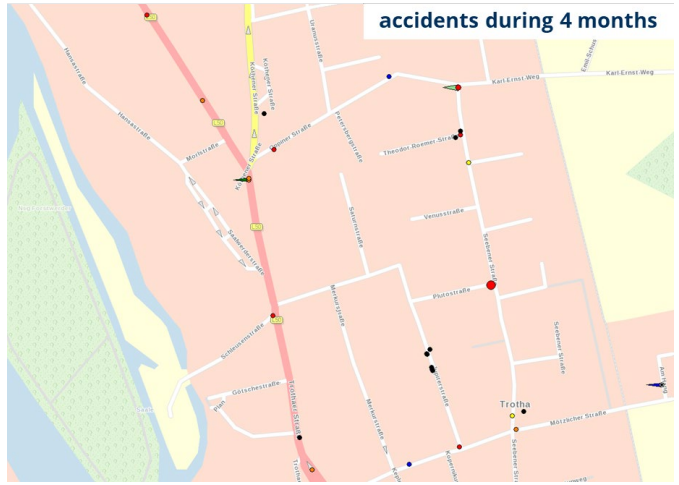


Figure [8]

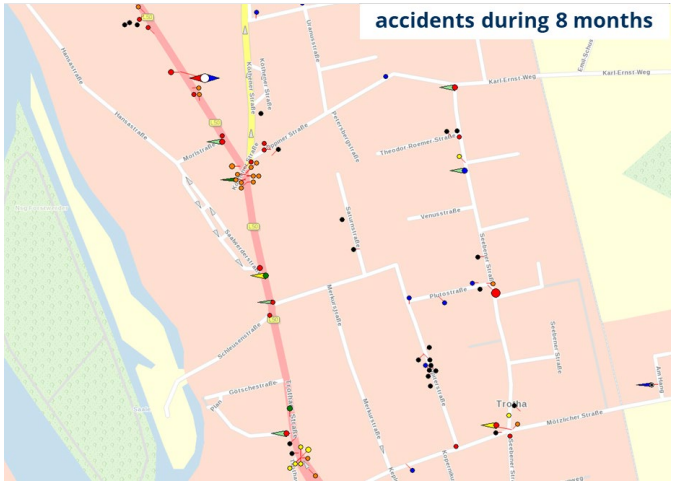


Figure [9]

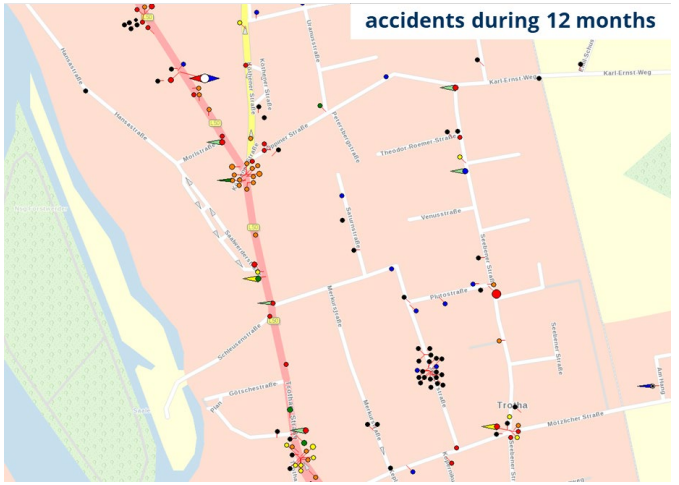


Figure [10]

EUSka – Electronic accident type map

- accidents recorded by the police
- accident data: date, road type, accident type, accident severity (category), coordinates of accident location, short description of the accident event

Accident Data Sources
Sweden, The Swedish Transport Administration

Figure [11]

STRADA: Swedish Traffic Accident Data Acquisition

- national information system for road accidents with personal injuries
- since 2013: accident data from the police
- since 2016: accident data from all emergency hospitals
- goals: reducing the number of unreported accidents, better base for work on Vision Zero

https://www.trafikverket.se/en/startpage/operations/Operations-road/vision-zero-academy/Vision-Zero-and-ways-to-work/data-collection/

Accident Data Statistics
Basic Terms, Characteristics of Accidents, Example Germany

accident severity

- most serious accident consequence
- in Germany 6 different accident categories: accidents with fatalities, accidents with serious injuries, accidents with slight injuries, serious property damage accidents not under/under the influence of intoxicating substances, other property damage accidents

accident type

- traffic event causing the accident
- in Germany 7 different accident types: driving accident, turn accident, turn off/crossing accident, exceeding-accident, accident due to stationary traffic, accident in parallel traffic, other accident

kinds of accidents

- accident process after the formation phase; direction of movement of the involved/colliding road users immediately before the collision
- in Germany 10 different kinds of accidents (e.g. collision with oncoming vehicle)

Accident Data Statistics
Basic Terms, Characteristics of Accidents, Example Germany

accident causes

- general causes, e.g. weather conditions, obstacles
- personal misconduct (e.g. error of driver), technical defects

involved road users

- all vehicle drivers/cyclists/pedestrians who caused or suffered damage (not passengers!)
- first involved road user: person who was mainly at fault (according to the police)

casualties

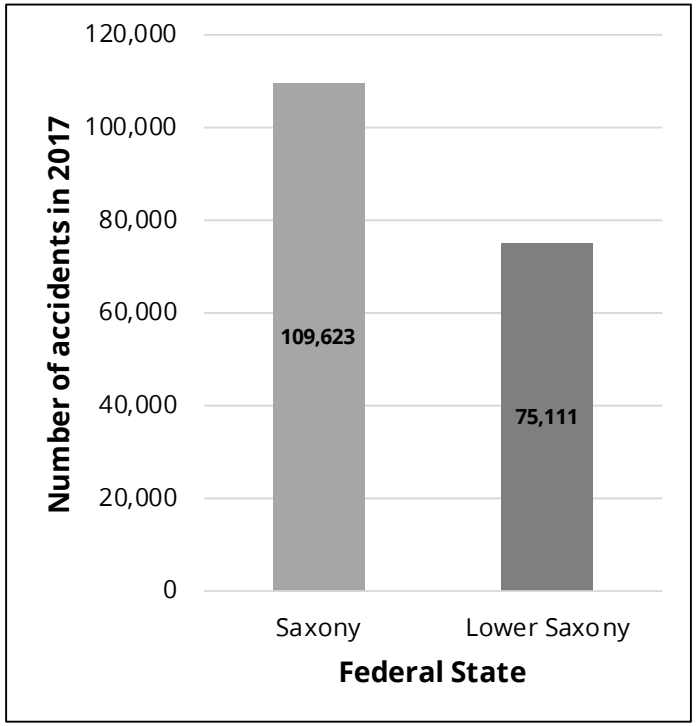
- killed persons (person who dies within 30 days)
- seriously injured persons (person who is hospitalized for at least 24 hours)
- slightly injured persons (all other injuries)

Accident Data Statistics
Absolute Parameters

number of accidents

- temporal characteristics
  - whole calendar years
  - periods of several years

- spatial characteristics
  - local site (urban, …)
  - intersection, stretch, bus stop/station, …
  - surroundings (buildings, trees, …)



Source of data: Federal Statistical Office (Destatis)

➢ differentiation according to various characteristics (e.g. local site, accident severity, accident type, type of participation) as a condition for effective identification of measures

Accident Data Statistics
Relative Parameters

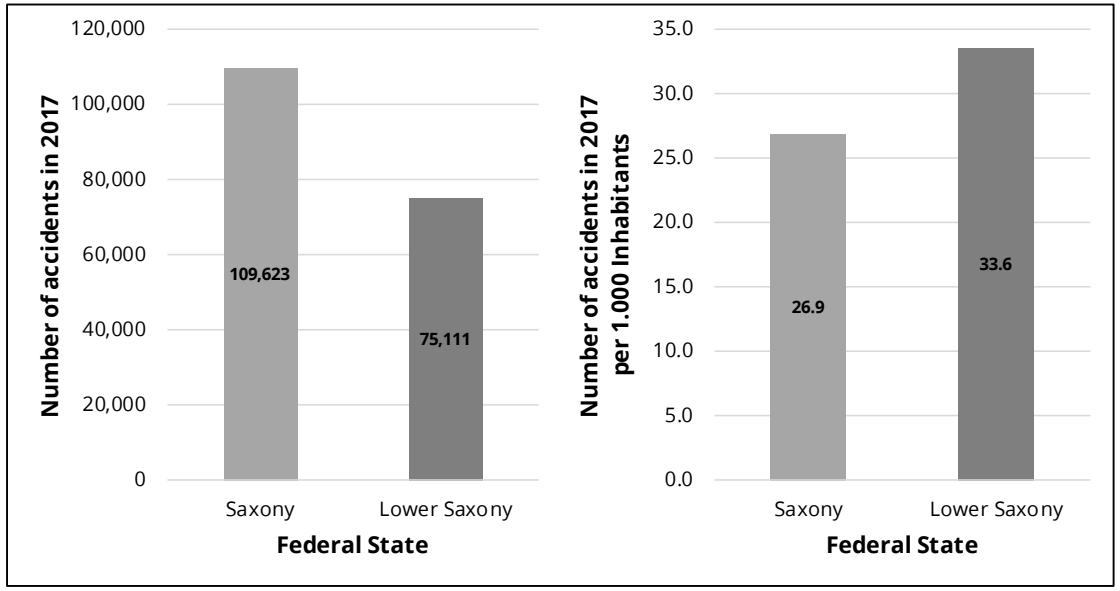
- set absolute values in relation to reference values
- allow comparison and better understanding of absolute values (e.g. comparison of countries)
- parameters:
  - **accident load** $AL = \frac{\text{Accidents}}{\text{Time} * \text{Number of Inhabitants}}$ [A/(1,000 I*year)]
  - **accident density** $AD = \frac{\text{Accidents}}{\text{Time} * \text{Length of traffic road (network)}}$ [A/(km*year)]
  - **accident rate** $AR = \frac{\text{Accidents}}{\text{Time} * \text{Length of traffic road (network)} * \text{ADT}}$ [A/(10^6 Vehicle*km)]

    (ADT: Average Daily Traffic)
- no consideration of accident severity

Accident Data Statistics
Relative Parameters

- set absolute values in relation to reference values
- allow comparison and better understanding of absolute values (e.g. comparison of countries)
- parameters:
  - **accident load**

$$AL = \frac{\text{Accidents}}{\text{Time} * \text{Number of Inhabitants}} \qquad [\text{A}/(1{,}000\ \text{I}*\text{year})]$$



Source of data: Federal Statistical Office (Destatis)

Accident Data Statistics
Monetary Valuation of Accidents

- accident costs are suitable for quantifying economic losses due to accidents

accident costs [€] = number of accidents * accident cost rates [€]

- description with accident cost rates:
  - summarise the number and severity of accidents in one parameter
  - allow comparison of road safety including accident severity
  - allow comparison of road safety with other traffic impacts or costs of measures
- accident cost rates are calculated on the basis of the nationwide accident shares of severity levels

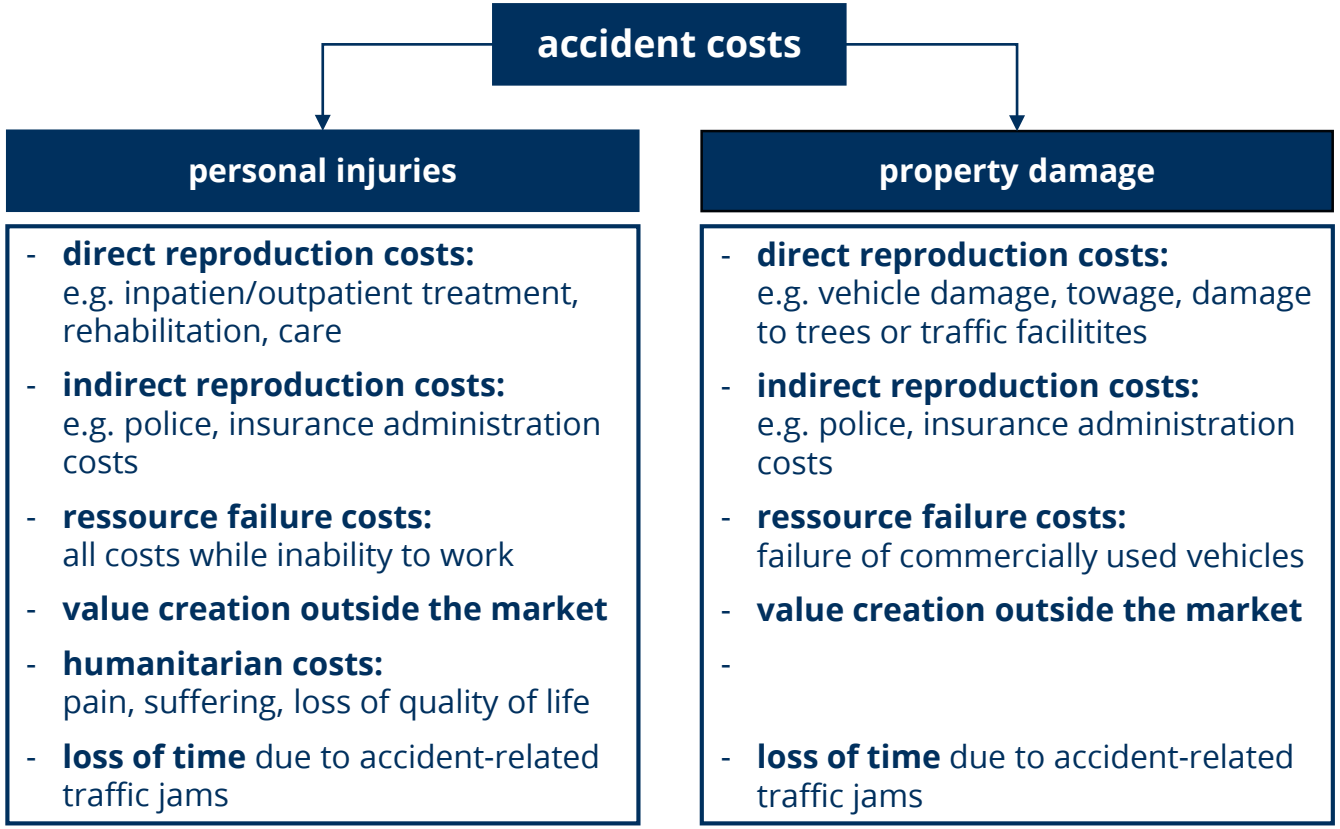
Accident Data Statistics
Monetary Valuation of Accidents

- parameters:
  - **accident cost load** $AL = \frac{\text{Accident Costs}}{\text{Time} * \text{Number of Inhabitants}}$ [€/(I*year)]
  - **accident cost density** $AD = \frac{\text{Accident Costs}}{\text{Time} * \text{Length of traffic road (network)}}$ [1,000 €/(km*year)]
  - **accident cost rate** $AR = \frac{\text{Accident Costs}}{\text{Time} * \text{Length of traffic road (network)} * ADT}$ [€/(1,000 Vehicle*km)]

(ADT: Average Daily Traffic)

Accident Data Statistics
Monetary Valuation of Accidents

– costs included in the calculation of accident costs/accident cost rates



[Baum et al, 2010]

Accident Data Statistics
Monetary Valuation of Accidents

– time series of accident cost rates in Germany

personal injury costs per injured person

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*	2017*	2018*	2019*	2020*
killed persons	1.018.064 €	1.013.326 €	1.025.067 €	1.035.165 €	996.412 €	1.022.401 €	1.177.980 €	1.161.892 €	1.182.126 €	1.191.397 €	1.191.937 €	1.156.273 €	1.178.333 €	1.168.255 €	1.203.203 €	1.219.396 €
seriously injured persons	105.476 €	106.758 €	107.837 €	110.506 €	110.571 €	114.020 €	112.834 €	116.151 €	121.776 €	120.921 €	123.510 €	116.166 €	117.466 €	117.190 €	122.042 €	119.788 €
slightly injured persons	4.305 €	4.327 €	4.354 €	4.403 €	4.416 €	4.458 €	4.482 €	4.829 €	4.982 €	5.014 €	5.139 €	5.069 €	5.162 €	5.225 €	5.371 €	5.391 €

property damage costs per accident

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*	2017*	2018*	2019*	2020*
accident with personal injuries								15.606 €	16.233 €	16.041 €	16.784 €	15.310 €	15.770 €	15.987 €	16.301 €	15.705 €
accident with killed persons	38.344 €	39.836 €	40.430 €	40.242 €	40.108 €	45.469 €	42.880 €	43.096 €	47.157 €	48.003 €	48.495 €	43.668 €	46.406 €	47.979 €	46.758 €	44.504 €
accident with seriously injured persons	18.386 €	18.890 €	18.892 €	19.436 €	19.215 €	20.637 €	20.400 €	20.782 €	21.646 €	21.883 €	22.756 €	21.012 €	21.776 €	22.112 €	22.900 €	21.642 €
accident with slightly injured persons	12.326 €	12.389 €	12.613 €	12.775 €	13.036 €	13.654 €	13.676 €	13.959 €	14.515 €	14.190 €	14.919 €	13.614 €	13.967 €	14.123 €	14.393 €	13.908 €
serious property damage accidents	17.884 €	18.281 €	18.500 €	19.035 €	19.365 €	19.843 €	20.442 €	20.808 €	21.484 €	21.484 €	22.369 €	20.262 €	20.710 €	21.521 €	22.009 €	22.422 €
other property damage accidents (including accident under the influence of intoxicating substances)	5.277 €	5.337 €	5.435 €	5.550 €	5.643 €	5.729 €	5.839 €	5.951 €	6.095 €	6.040 €	6.208 €	7.058 €	7.082 €	7.164 €	7.282 €	7.344 €

Figure [12]

References

Statistisches Bundesamt Destatis (en: German Federal Statistical Office) (2021): *Verkehr. Verkehrsunfälle*. Fachserie 8 Reihe 7. URL: https://www.statistischebibliothek.de/mir/receive/DEHeft_mods_00083585 (last access: 03-2022)

Baum, H.; Kranz, T.; Westerkamp, U. (2010): *Volkswirtschaftliche Kosten durch Straßenverkehrsunfälle in Deutschland.* Bericht zum Forschungsprojekt FP 82.321/2007. Berichte der Bundesanstalt für Straßenwesen. Mensch und Sicherheit. Heft M 208. Bergisch-Gladbach. https://bast.opus.hbz-nrw.de/opus45-bast/frontdoor/deliver/index/docId/209/file/M208.pdf (last access: 03-2022)

List of Figures

[1], [2]
European Parliament, European Council (2019): *DIRECTIVE (EU) 2019/1936 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2019 on road infrastructure safety management*. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008L0096-20191216&from=EN (last access: 03-2022)

[3] International Transport Forum (2020): *Road Safety Annual Report 2020*. URL: https://www.itf-oecd.org/sites/default/files/docs/irtad-road-safety-annual-report-2020_0.pdf (last access: 03-2022)

[4] World Health Organization (2018): *Global status report on road safety 2018*. Geneva. Licence: CC BY-NC-SA 3.0 IGO. URL: https://www.who.int/publications/i/item/9789241565684 (last access: 03-2022)

[5] European Commission (2021): *European Road Safety Observatory. Annual statistical report on road safety in the EU 2020*. URL: https://ec.europa.eu/transport/road_safety/system/files/2021-07/asr2020.pdf (last access: 03-2022)

[6] Statistisches Bundesamt Destatis (en: German Federal Statistical Office) (2021): *Society and Environment. Traffic accidents*. URL: https://www.destatis.de/EN/Themes/Society-Environment/Traffic-Accidents/_node.html (last access: 03-2022)

[7] Statistisches Bundesamt Destatis (en: German Federal Statistical Office); Statistical Offices of States: *Unfallatlas*. URL: https://unfallatlas.statistikportal.de/ (last access: 03-2022)

[8], [9], [10]
EUSka (PTV-Group): Electronic accident type map (german: Elektronische Unfalltypensteckkarte)

[11] Swedish Traffic Accident Data Acquisition: URL: https://www.trafikverket.se/en/startpage/ (last access: 03-2022)

[12] Bundesanstalt für Straßenwesen (2021): Volkswirtschaftliche Kosten von Straßenverkehrsunfällen in Deutschland. Bergisch Gladbach. URL: https://www.bast.de/DE/Statistik/Unfaelle/volkswirtschaftliche_kosten.pdf?__blob=publicationFile&v=9 (last access: 03-2022)

„Friedrich List“ Faculty of Transport and Traffic Sciences
Prof. Dr.-Ing. Regine Gerike
Regine.gerike@tu-dresden.de

Co-funded by the
Erasmus+ Programme
of the European Union

Grant Agreement No.:
2019-1-PL01-K1203-065244

Licence notice

„Statistics and Criteria for Traffic Safety“ (2022)

by „Friedrich List“ Faculty of Transport and Traffic Sciences, Chair of Integrated Transport Planning and Traffic Engineering,

Prof. Dr.-Ing. Regine Gerike, is licensed under a Creative Commons Attribution 4.0 International Licence.

The logos and figures are copyright protected and are not included in the free license.