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Definitions of Traffic Safety

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How to Define and Measure Traffic Safety?
Subjective Perception

Figure [1]

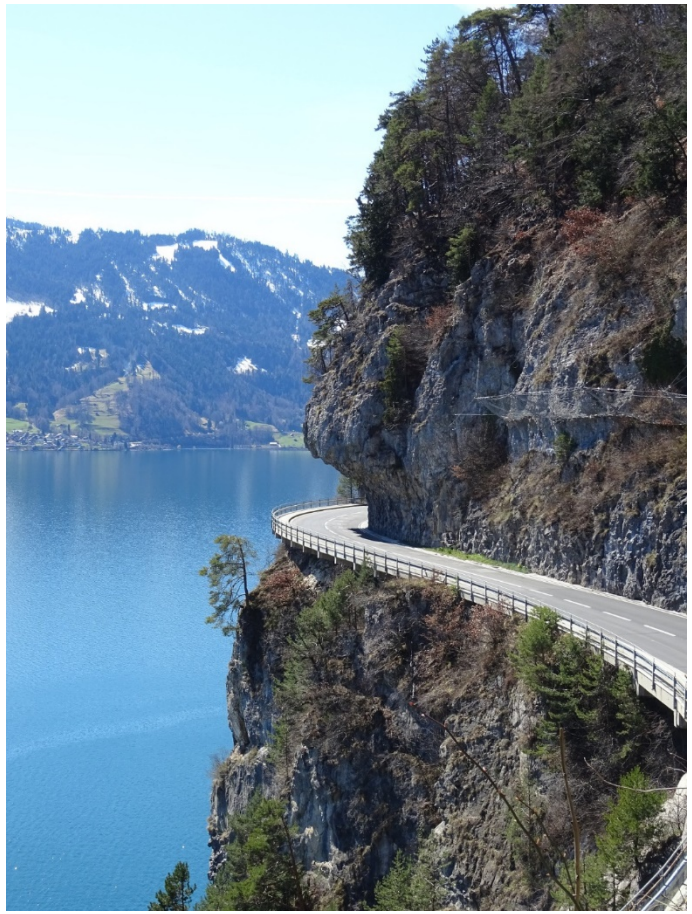


Figure [2]

How to Define and Measure Traffic Safety?
Subjective Perception

- self assessment ≠ behaviour, objective safety
- results of surveys dealing with perceived traffic safety show need for clarification
- responses are influenced by e.g. concern, expectation, information
- perceived safety as an important determinant for how people behave in traffic
- survey in Germany:
  How safe do people feel in traffic?

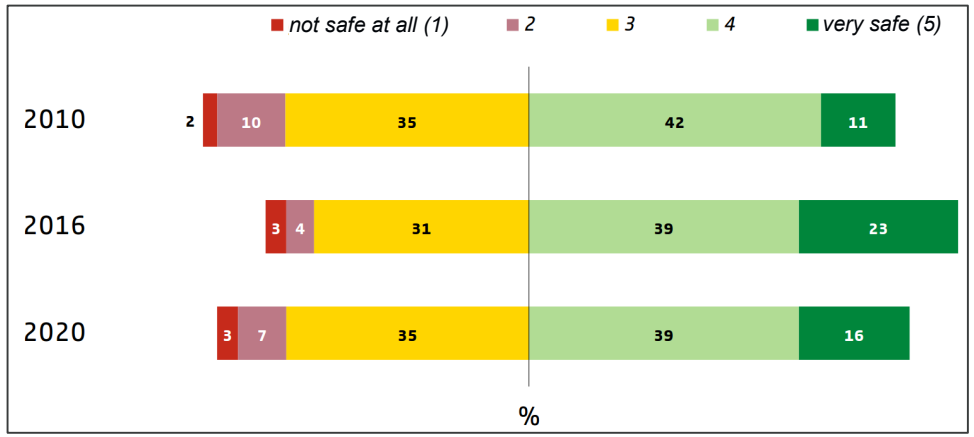


Figure [3]

in %

n (2010) = 1.680 , n (2016) = 2.061, n (2020) = 2.080

Perceived requirements on road users

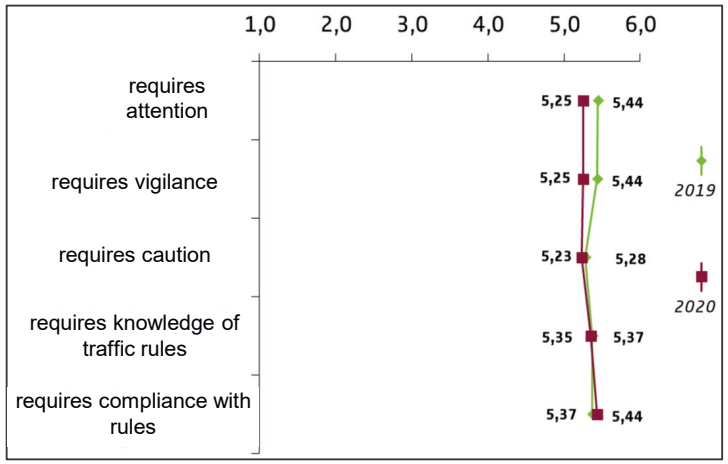


Figure [4]

n = 1.320, mean value (weighted)

1 = does apply at all

6 = fully applies

How to Define and Measure Traffic Safety?
Traffic Conflict Technique – Definitions

Traffic Conflict Technique

- *Observation of objectively defined parameters to capture traffic conflicts with the aim of estimating risks.* (ERKE & GSTALTER, 1985)

Traffic conflict

- *„A traffic conflict is an observable situation in which two or more road users approach each other in space and time to such an extent that there is a risk of collision if their movements remain unchanged."* (AMUNDSEN & HYDEN 1977)
- *Identification by critical action, e.g. changing in speed or direction in order to avoid a collision*

Interaction

- *Coordination of the behaviour of road users in order to avoid a collision when approaching each other in time and space*
- *Condition for the existence of a critical interaction: irregular behaviour by at least one involved road user* (MAIER ET AL. 2015)

How to Define and Measure Traffic Safety?

Traffic Conflict Technique – Pilot Test in Germany [Nistegge et al. 2020]

Right turn of cyclists while traffic light is red

- targets:
  - estimating impacts
  - defining conditions of use
- methodology:
  - literature research
  - choice of pilot intersections
  - before-after analysis, evaluation of the interactions between right turning cyclists and pedestrians/cyclists/vehicles

Figure [5]

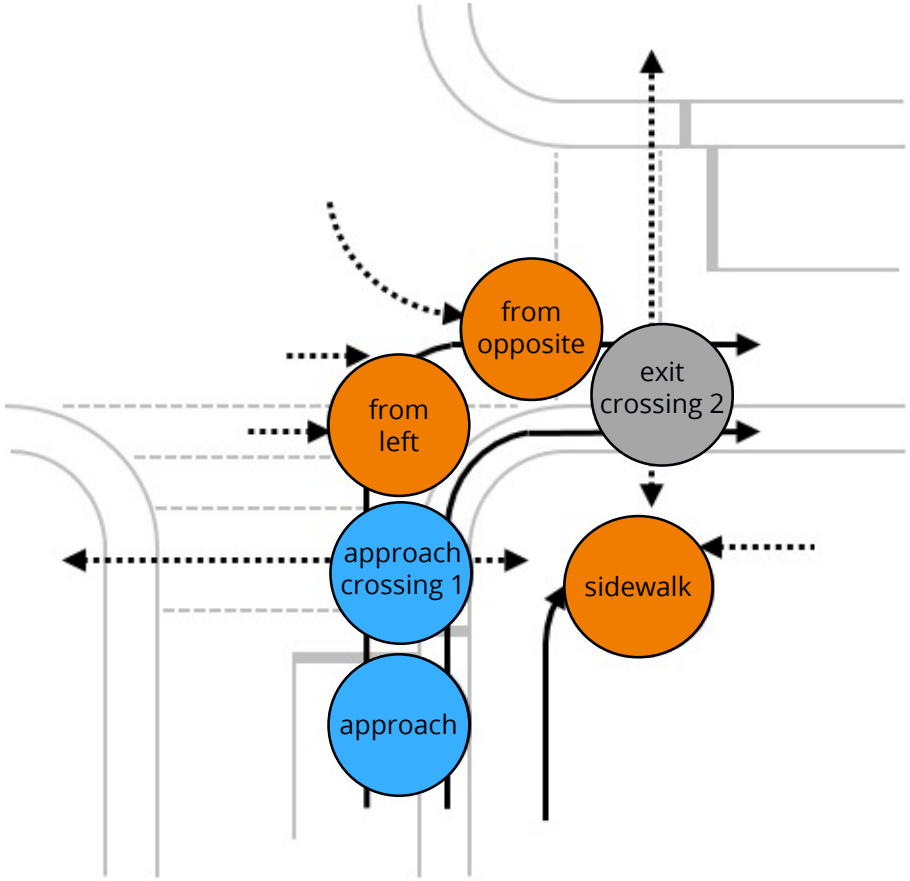


Figure [6]

How to Define and Measure Traffic Safety?
Traffic Conflict Technique – Pilot Test in Germany

Right turn of cyclists while traffic light is red

- targets:
  - estimating impacts
  - defining conditions of use
- methodology:
  - literature research
  - choice of pilot intersections
  - before-after analysis, evaluation of the interactions between right turning cyclists and pedestrians/cyclists/vehicles
  - defined framework for the evaluation
    - 4 levels of interaction
    - possible reactions: brake, accelerate, get out of way, stop

Figure [5]

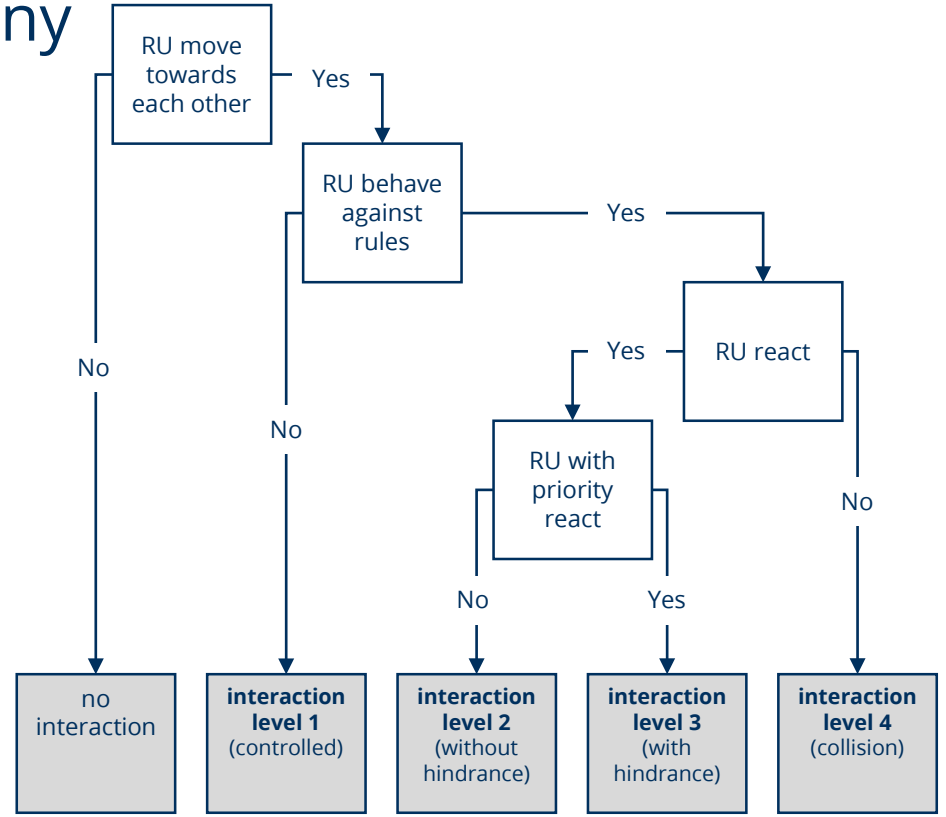
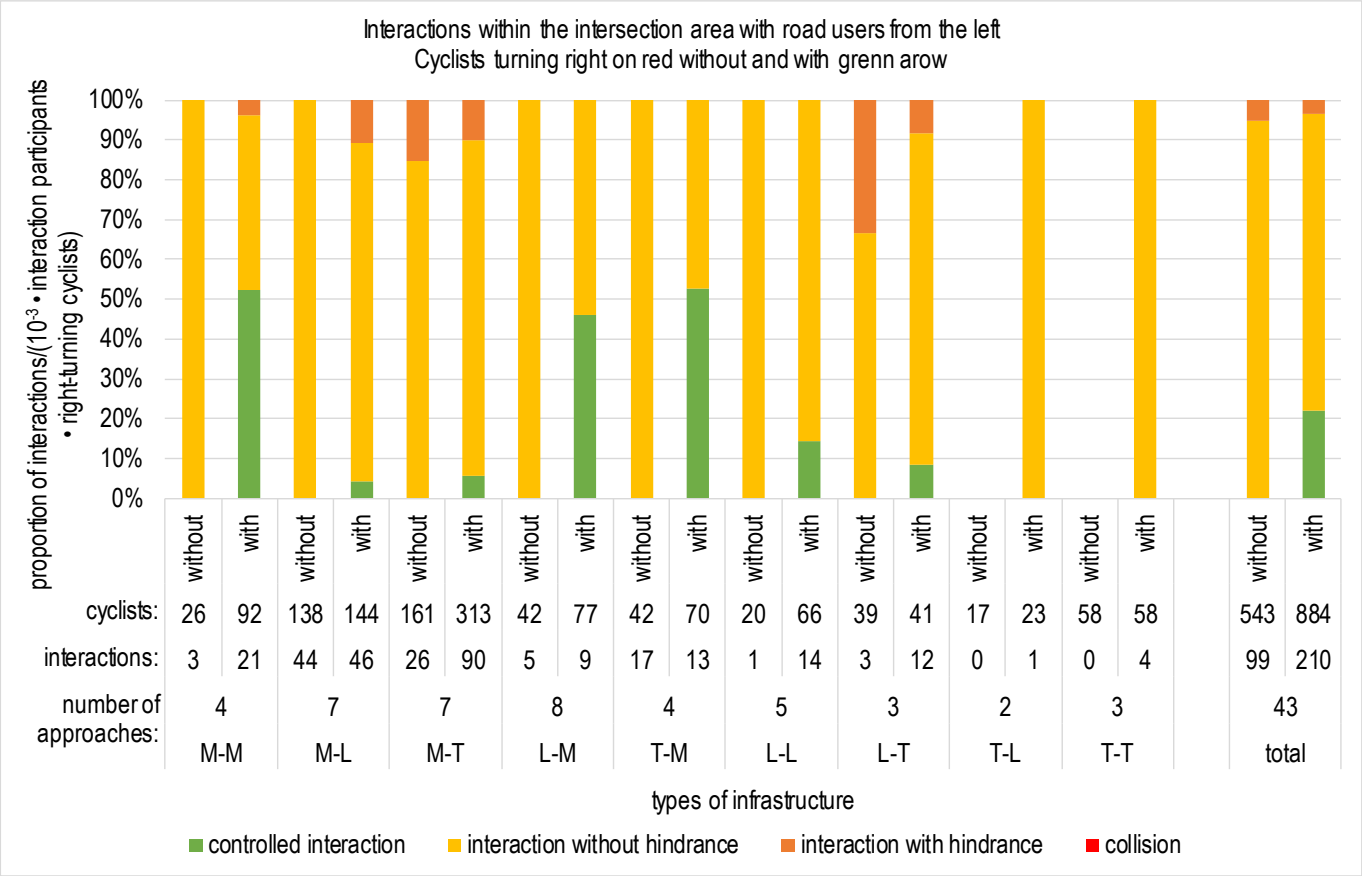


Figure [7] RU = Road User

How to Define and Measure Traffic Safety?
Traffic Conflict Technique – Pilot Test in Germany

Right turn of cyclists while traffic light is red



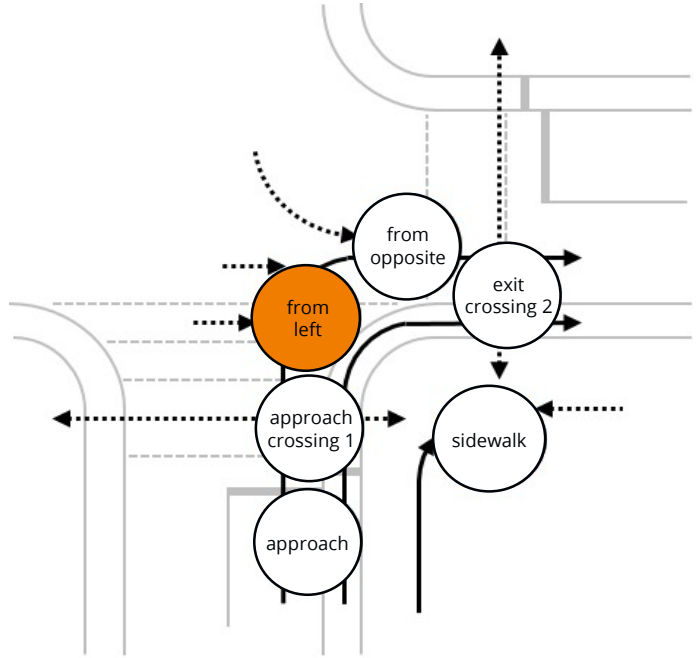


Figure [6]

M: Mixed traffic, no dedicated cycle facility, cyclists use the same space as motorised vehicles

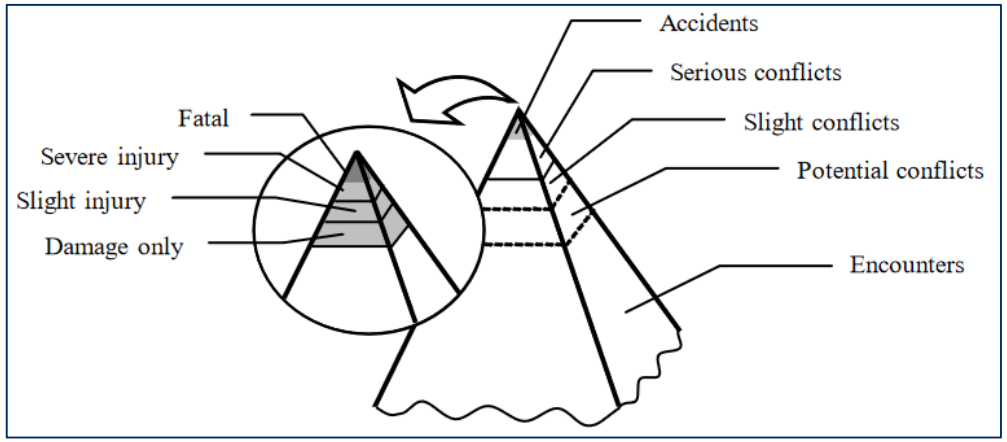
L: Cycle lanes, dedicated space for cyclists, separated from motorised traffic by marking

T: Cycle track, separated cycle facility off-carriageway, adjacent to the carriageway, physically separated from motorised traffic

Figure [8]

How to Define and Measure Traffic Safety?
Surrogate Safety Measures (SSM)

- theoretical background: safety pyramid, relation between severity and frequency of events
- objective measurement to determine the criticality of a situation
- based on objective criteria and defined thresholds
- research needs: how to define thresholds and validation



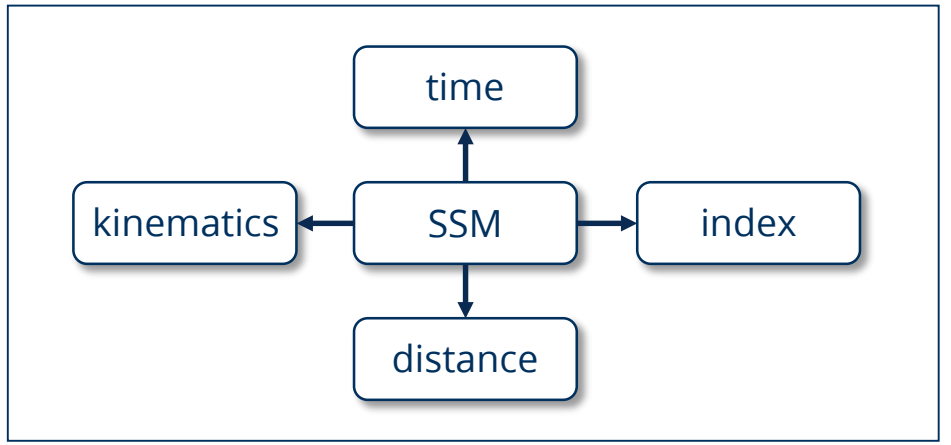
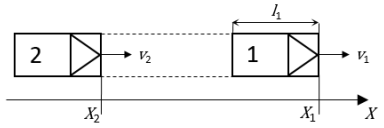


Figure [9]

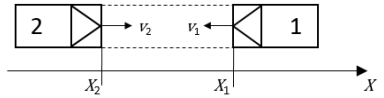
How to Define and Measure Traffic Safety?
Surrogate Safety Measures (SSM)

- Time to Collision (TTC) as an example of a time-based indicator
- time remaining until collision if the involved road users change neither direction nor speed
- serious conflict when TTC < 1 sec as the usual threshold, collision when TTC = 0 sec

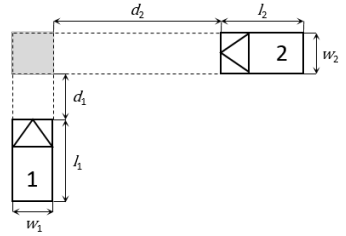
Collision of two vehicles moving in the same direction:



Collision of two vehicles approaching from opposite directions:



Collision of two vehicles crossing each other:



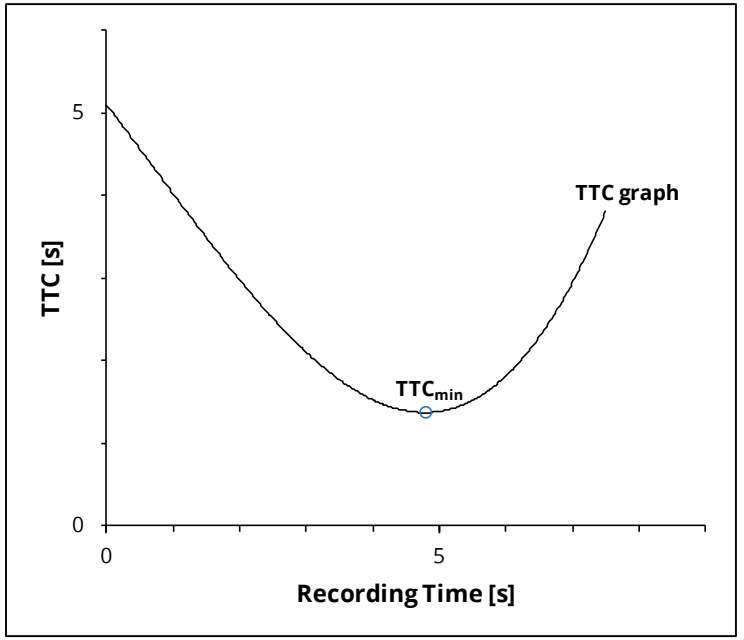


Figure [10], d = distance, l = length , v = speed, w = width

How to Define and Measure Traffic Safety?
Traffic Conflict Technique - Sweden

- application of different indicators (SSM): Time-to-Accident and Conflicting Speed
- video observations (at least one week, possibly longer)
- classification of events into serious and non-serious events

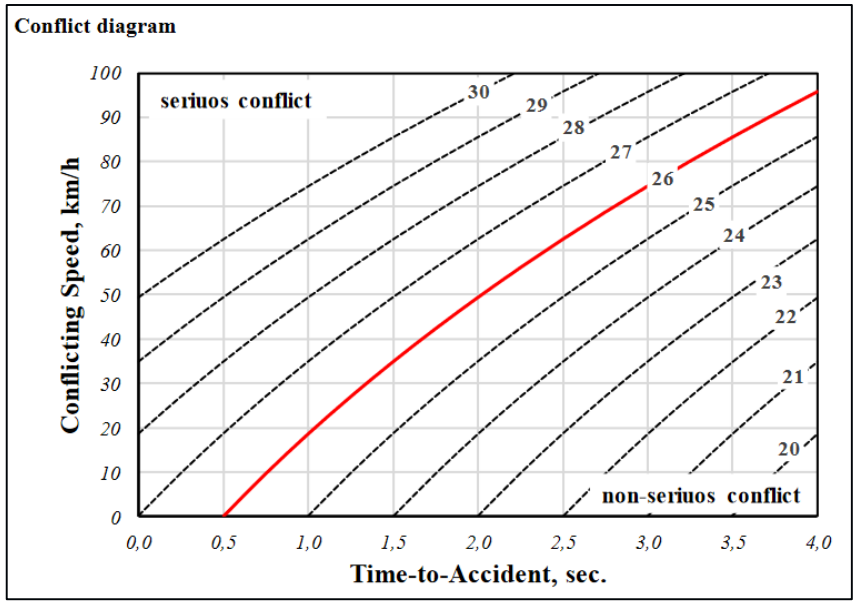
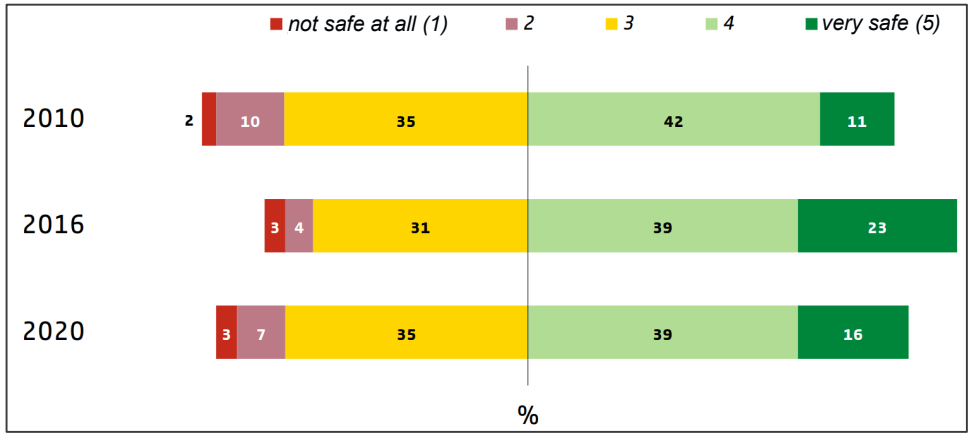


Figure [11]

- other european traffic conflict techniques: Dutch, Finnish, Belgian, ...

How to Define and Measure Traffic Safety?
Accidents

- accidents show actual risks
- reliable statistics
- limits: only accidents with driving traffic, unrecorded cases, ex-post analyses
- perceived traffic safety vs. accident data



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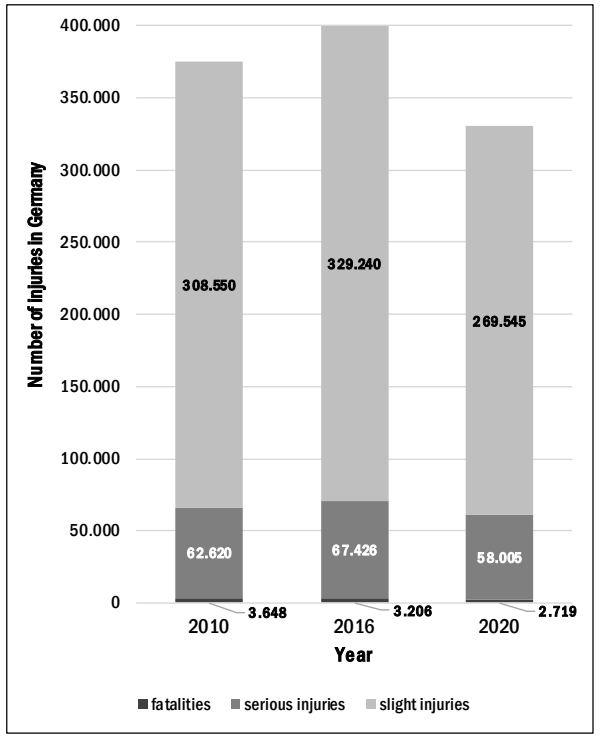

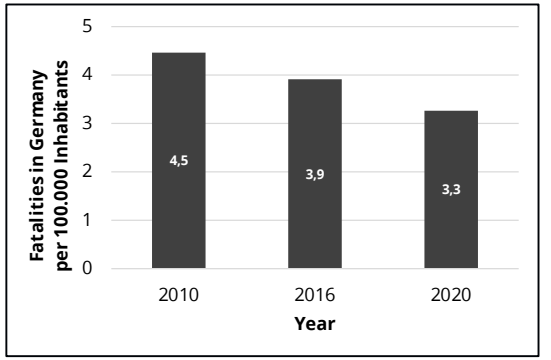

Source of data: Federal Statistical Office (Destatis)

How to Define and Measure Traffic Safety?
Accidents – Underreporting – German Case Study [von Below 2020]

- recording by the police not complete (official accident data statistics)
- example study on underreporting of cycling accidents
  - analysis of data of cyclists injured in road accidents
  - from 23 hospitals

    - For all reported incidents:
    - 58% are not reported to police
    - 12% are reported to police
    - 30% of respondents did not answer this question
    - no insights on the number of unrecorded cases without hospitalisation when cyclists get slightly injured or not injured at all

Share of incidences reported to police by type of treatment

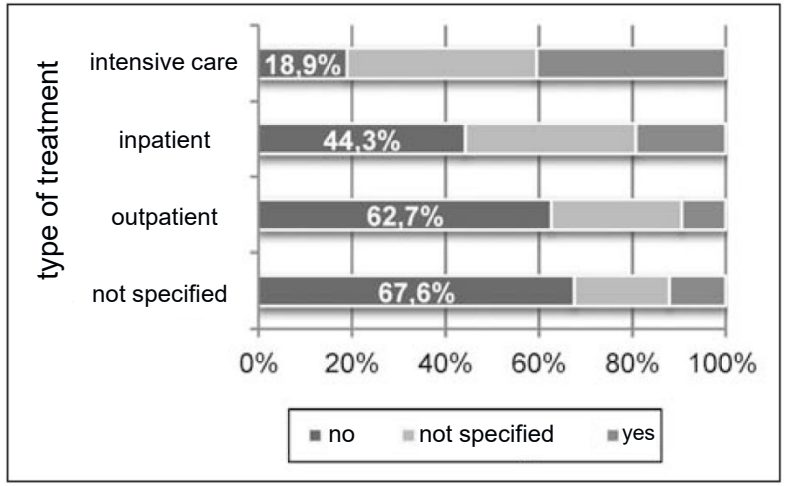

Figure [12]

How to Define and Measure Traffic Safety?
Accidents – Underreporting – German Case Study [von Below 2020]

Share of incidences reported to police by constellation

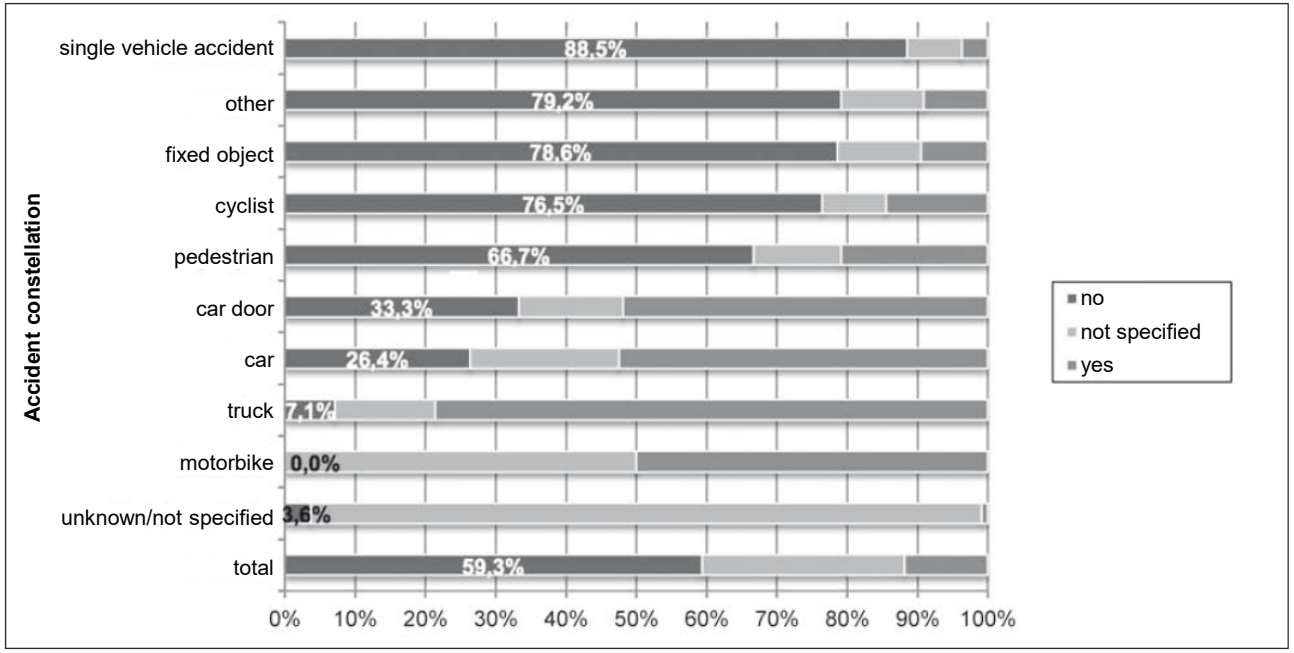

Figure [13]

How to Define and Measure Traffic Safety?
Further Data Sources

- hospitals
- doctors
- workshops (mechanics)
- insurances

Figure [14]

Figure [15]

Figure [16]

How to Define and Measure Traffic Safety? - Summary

	Accident Data	Conflicts, Near-Misses	Subjective Traffic Safety
strengths	• accidents show actual risks • reliable statistics	• larger number of conflicts compared to accidents (more reliable estimation of statistical parameters possible) • complete, reliable observation possible, e.g. via video recordings • complete process of conflict observable • targeted recording according to specific conditions, constellations between road users possible • application possible when accident data is insufficient	• perceived safety as important determinant of traffic behaviour
weaknesses	• only accidents with vehicle traffic • underreporting • ex-post analyses	• identification of conflicts is subjective, influence of staff • no reliable correlation between conflicts and accidents • statements on traffic safety only based on the assessment of conflicts/interactions are not possible	• self assessment ≠ behaviour, objective safety • results of surveys on perceived traffic safety show need for communication, education • responses are influenced by e.g. concern, expectation, information

- analysis of accident data as the the basis for traffic safety management
- analysis of conflicts/near-misses and surveys on subjective traffic safety as useful supplement

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List of Figures

[1] Image by Tuấn Ngọc Huỳnh from Pixabay (last access: 03-2022)

[2] Image by imagii from Pixabay (last access: 03-2022)

[3], [4]
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[14] RWB symbol: hospital on Wikimedia Commons (last access: 03-2022)

[15] Car Repair free icon (Freepik) on flaticon (last access: 03-2022)

[16] Versicherung Icon (Freepik) on flaticon (last access: 03-2022)

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