Criticality Analysis – Application

9.4 | Identification and Analysis of Criticality Phenomena within the GIDAS database

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Criticality Phenomena (CP)

- concrete influencing factors in a scenario
- associated with increased criticality
- represent abstract classes of danger

ID	Criticality Phenomenon	Absolute Frequency	Relative Frequency	Projected Frequency
#17	Intersecting Planned Trajectories of TPs	7 156	55.1%	88 305
#31	Non-Ego-TP violating Right of Way	2 644	20.3%	32 628
#131	Occlusion	2 978	22.9%	36 746

GIDAS Database

- largest German in-depth traffic accident database
- representative for the German accident statistic
- important data source for VVM criticality analysis
  - we considered <u>12997</u> accident cases with passenger car involvement in urban areas
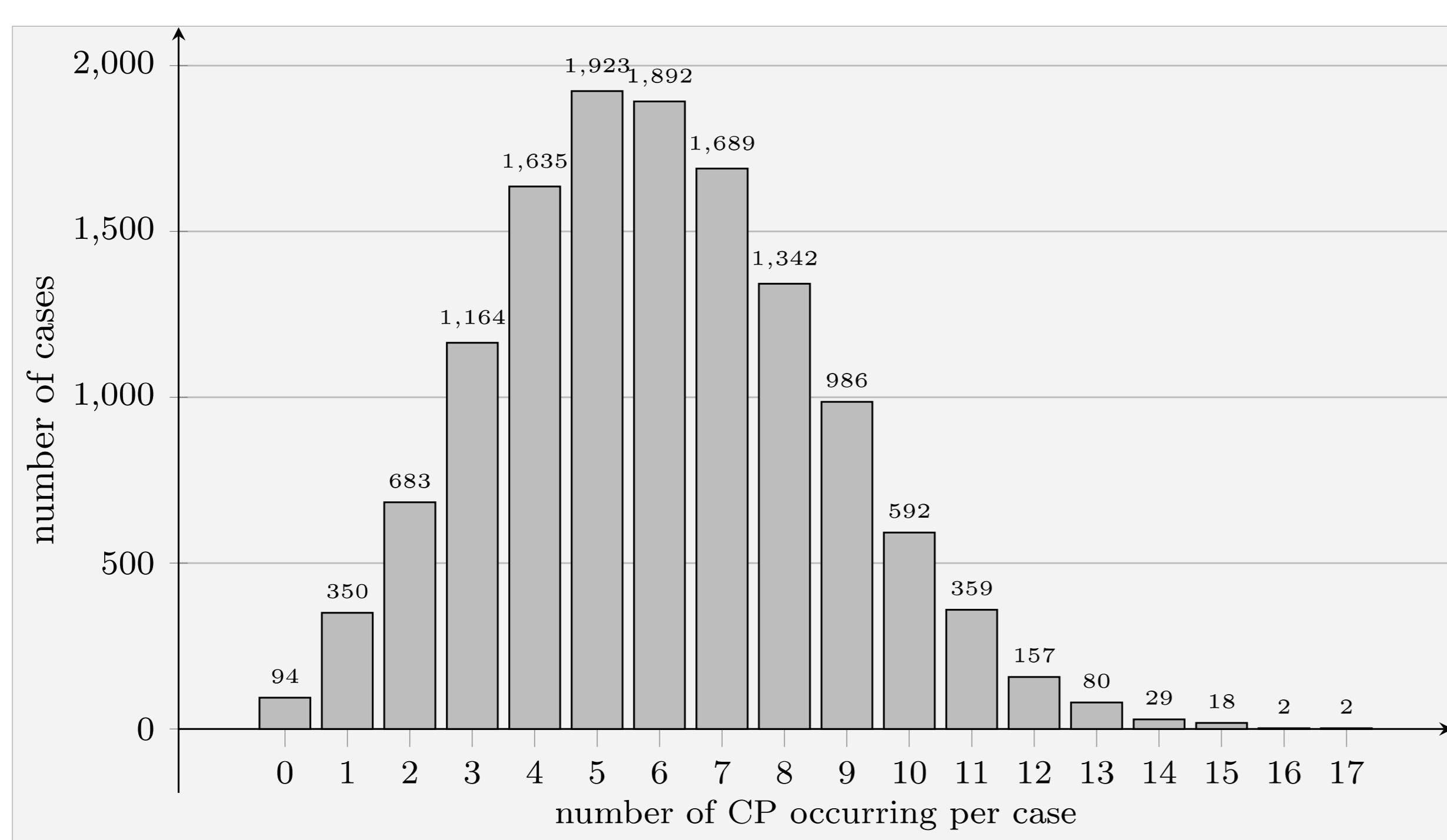 - analyzed regarding the presence of <u>166</u> CP

Fig 1: Distribution of number of CP per accident case (©2023 Babisch et al. [1])

CP-Associated Human Risk

- computed from database analysis as product of exposure, controllbabiliy, and severity
- operational domain (OD) urban areas in Germany
- quantified human risk can be used for
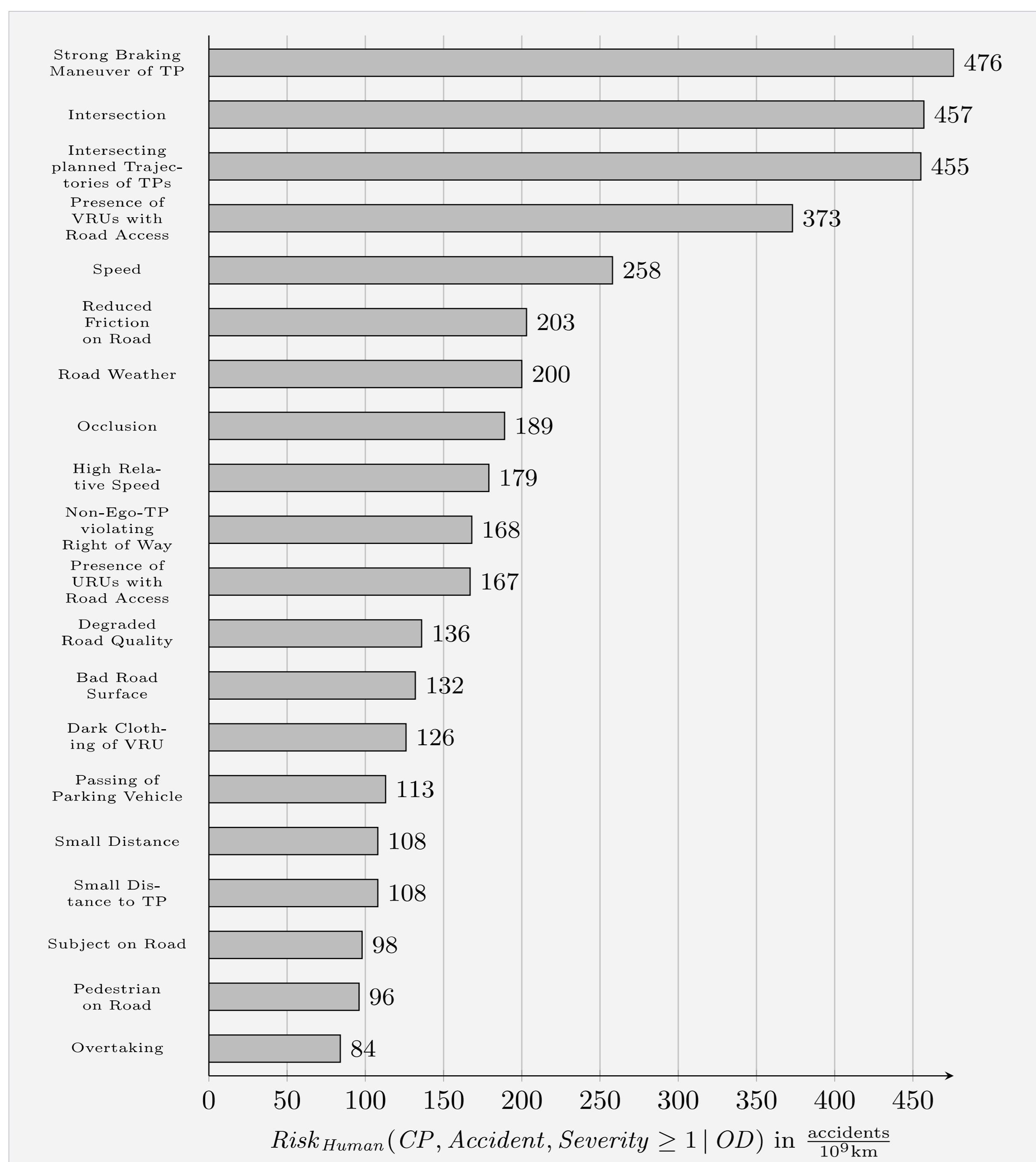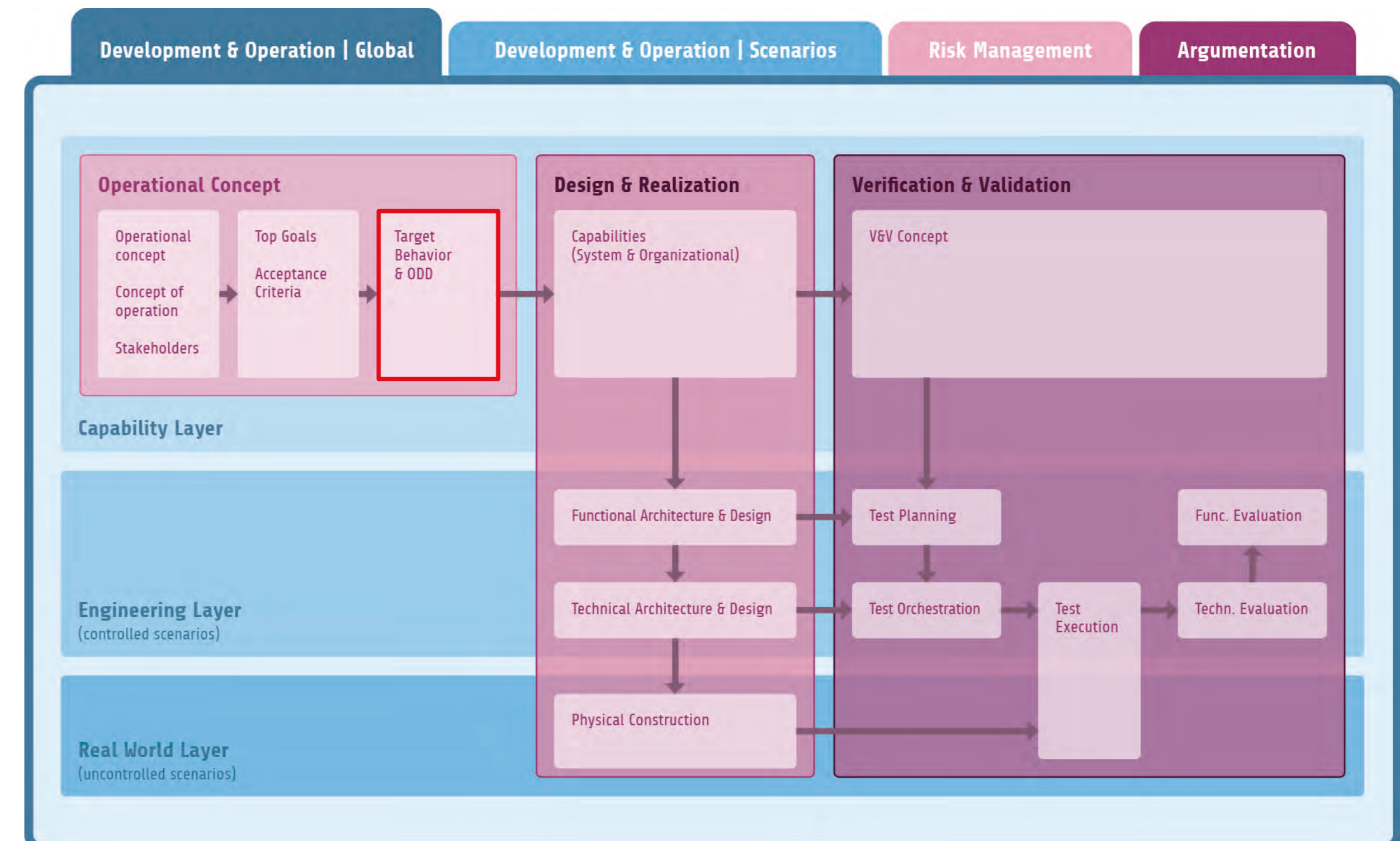 - reference values in positive risk balance
  - relevance estimation of CP

Fig 2: Top 20 CP sorted according to human risk (©2023 Babisch et al. [1])

Analysis of Associations among CP

- pairwise computation of Phi-coefficient
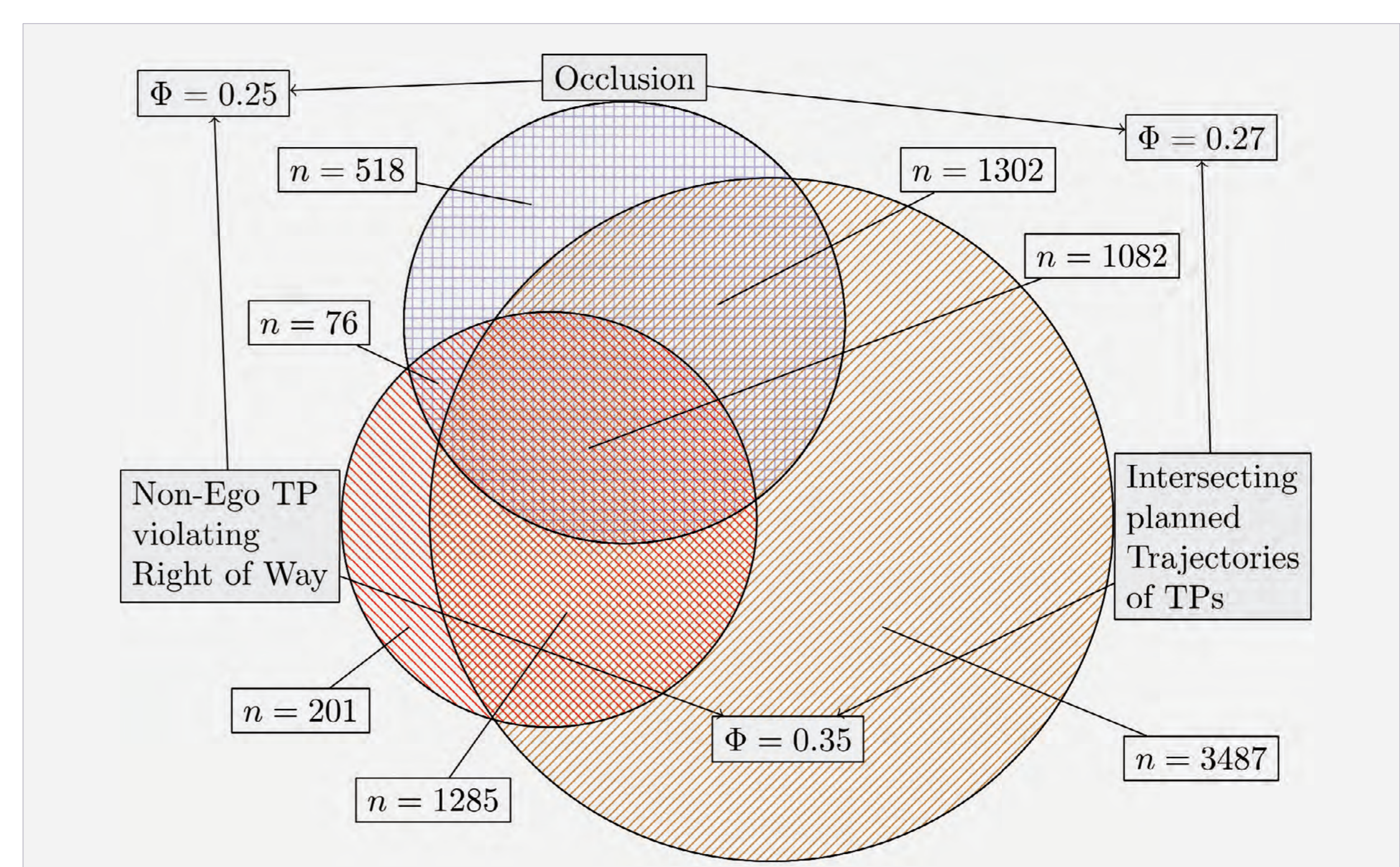- provides insights into CP concurrence or exclusion

Fig 3: Prop. Venn diagram and pairwise Phi-coefficients (©2023 Babisch et al. [1])

Analysis of Edge Cases

- accident cases with few or many CP provide interesting examples to study
- example below sketches a fatal case with 16 CP
  - Intersection, Pedestrian Crossing, Tram Rails
  - Degraded Road Quality, Degraded Lane Markings
  - Limited Global Light Source (Night), Rain
  - Dark Clothing of VRU, Reduced Friction on Road
  - Intersecting Trajectories of TPs
  - Presence of VRU/URU with Road Access
  - Pedestrian Crossing Road Directly
  - Non-Ego TP Running a Red Traffic Light
  - Non-Ego TP Violating Right of Way
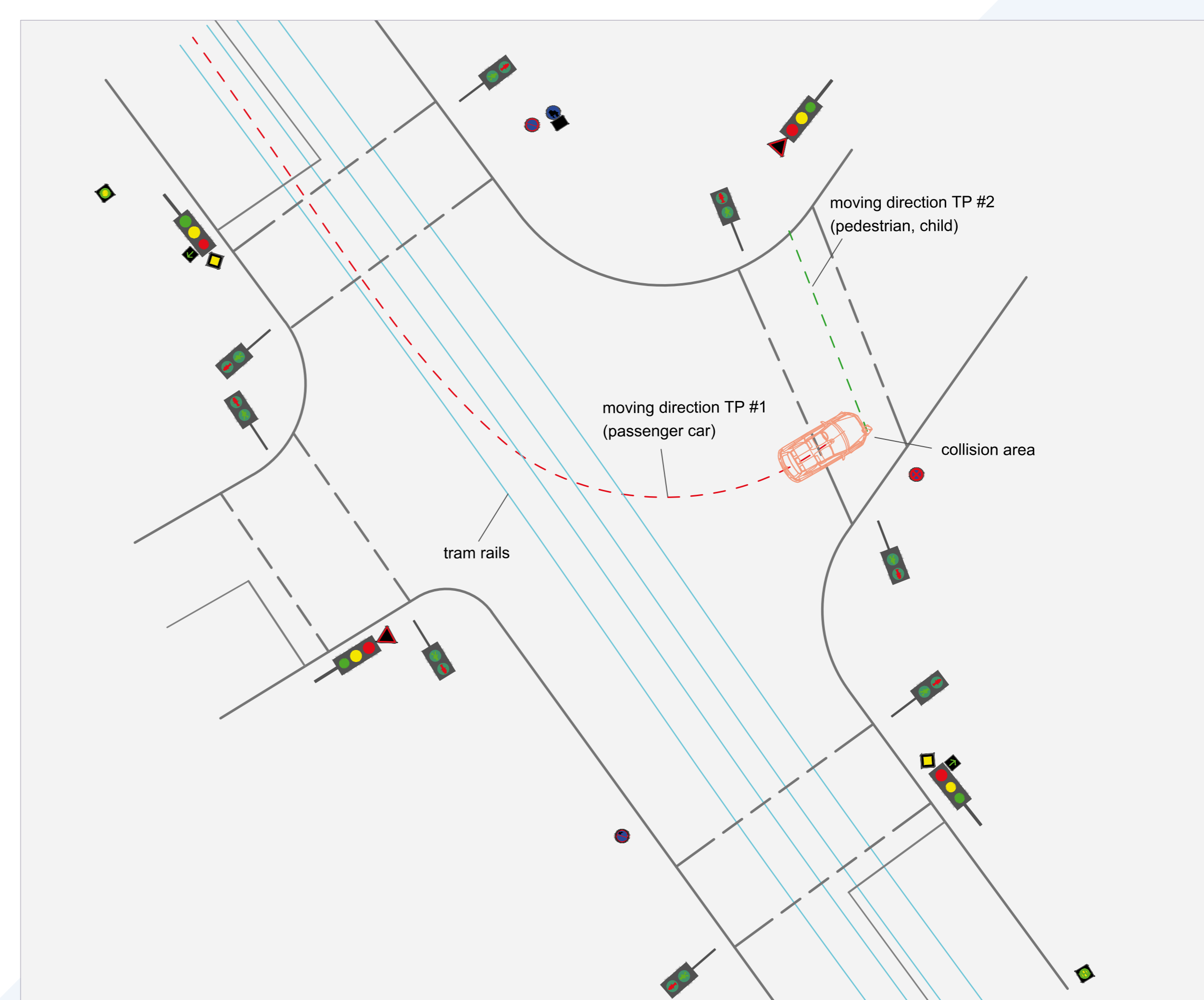 - Strong Braking Maneuver of TP

Figure 4: Sketch of fatal accident with 16 CP (©2023 Babisch et al. [1])

References:

[1] Babisch et al., Leveraging the GIDAS Database for the Criticality Analysis of Automated Driving Systems, Journal of Advanced Transportation, 2023

Application Example

Partners

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VDA LEITINITIATIVE

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