

Criticality Analysis – Application

9.5 | Criticality Analysis with openPASS

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Simulation of Scenarios within the Criticality Analysis

The criticality analysis as developed and conducted in VVMethods aims at structuring the complex and open context of the traffic world by eliciting a finite & manageable set of artifacts, namely

- Criticality phenomena – phenomena associated with increased criticality
- Causal relations – plausible explanations of the causality underlying these phenomena
- Abstract scenarios – featuring criticality phenomena and their causal relations



Simulation of traffic scenarios can play a vital role in identifying and analyzing these artifacts, e.g. the plausibilization of causal relations including the quantification of effect sizes.

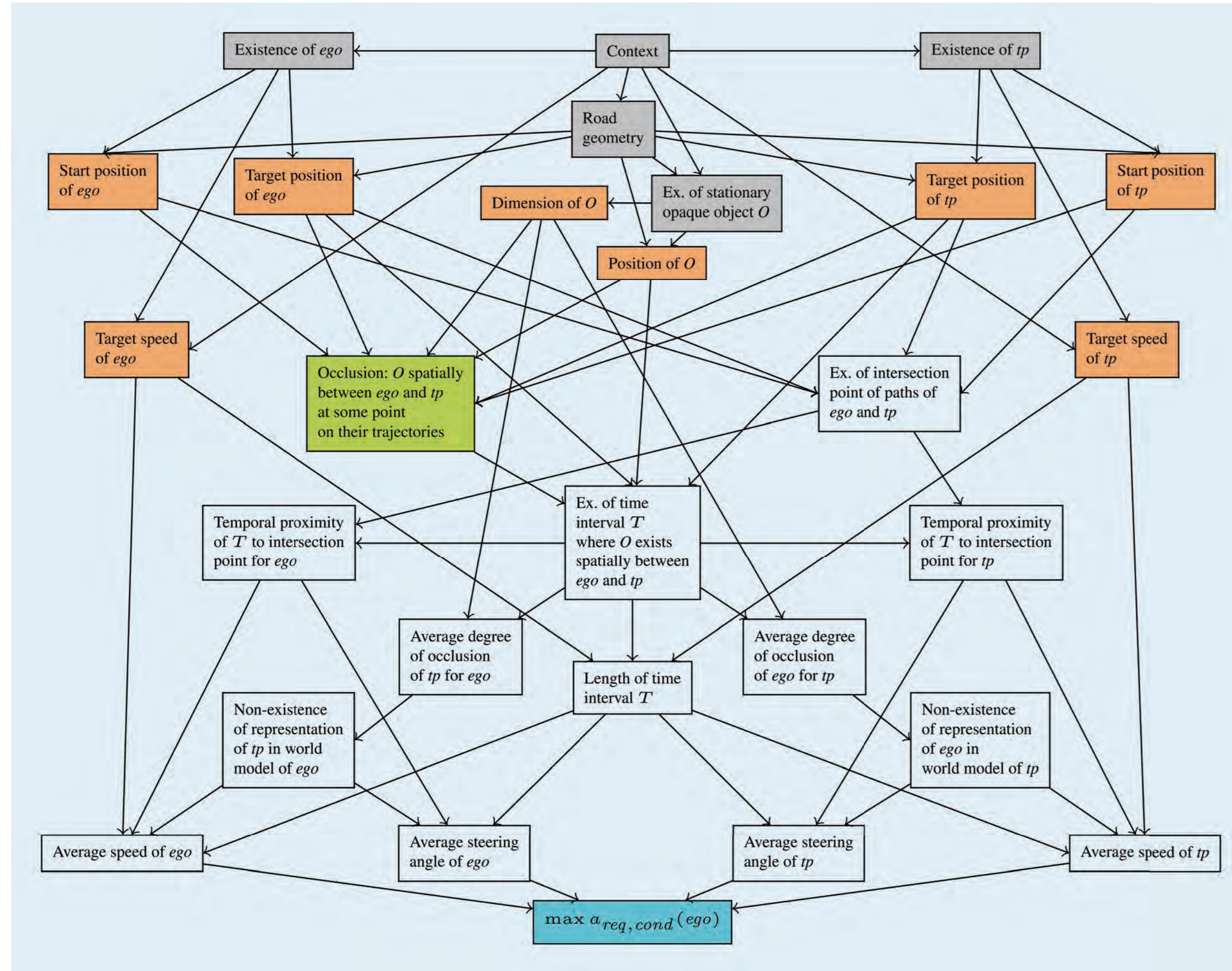


Figure 1: causal graph for evaluating the causal effect of „occlusion“ on the criticality metric $a_{req,cond}(ego)$. © Neurohr et al. [1]

Plausibilization of Causal Relations of Occlusion in Simulation

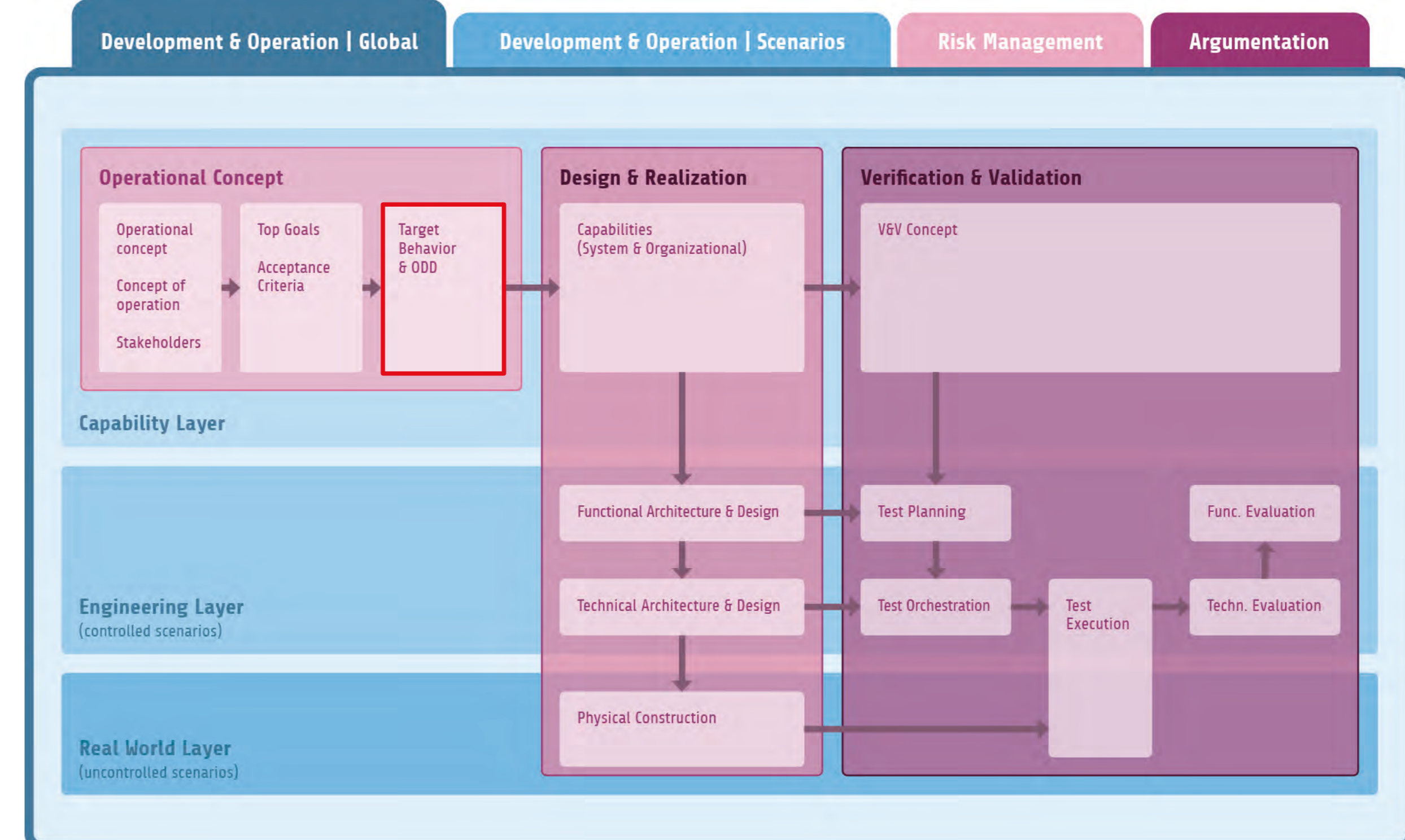
causal graphs are used to model the assumptions about the underlying causal relation of criticality phenomena.

→ simulation task: generate evidences for the causal relations of „occlusion“

→ approach: execute sufficiently many simulation runs using stochastic variation of adjustment variables and evaluate criticality metrics

The open source approach with openPASS

The openPASS (open Platform for Assessment of Safety Systems) platform is being developed under the umbrella of the Eclipse Foundation. It is an ecosystem of open source simulation components to conduct scenario based traffic simulation. Strong support for simulation standards and a modular setup allow to tailor the platform to a wide variety of simulation use cases.



Realized Requirements for Criticality Analysis

OpenPASS was further developed within VVMethods to cope with the simulation task.

- Implementation of a bicycle model
- Development of a simple automated driving function which can detect, predict the bicycle trajectory
- Interpretation of a pedestrian crossing from OpenDRIVE
- Integration of SET-Level models
- Realization of weather conditions
- Simulation of traffic lights

Since openPASS is an open source tool, all developments can continue to be used even after the VVMethods project ends.

Simulation



Figure 2: Simulation of FUC 2-3 with openPASS. The green car is equipped with a simple HAD function. The parking car is occluding the bicycle.

Summary

- Simulation is used as an evidence generating method for criticality phenomena
- Usage of virtual methods to plausible the causal relations of “occlusion”
- Open source approach via demonstration of openPASS
- Adaptations in the simulation environment are necessary to cope with the simulation task
- more information on [posters #8.1, #8.2]

References:

[1] Criticality Analysis for the Verification and Validation of Automated Vehicles, Neurohr et al.

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