

Use case overview

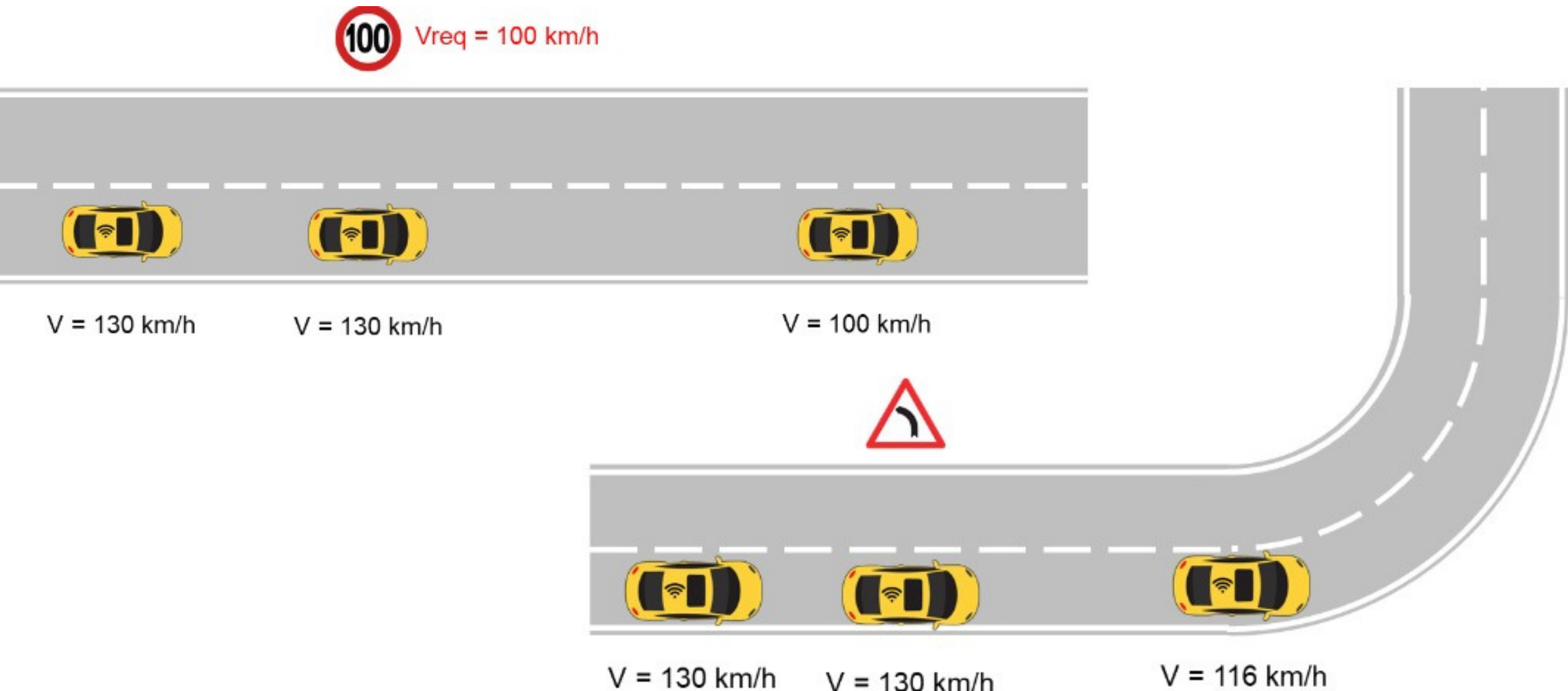


Figure 1. Overview of Use Case 3.1A and 3.1B

UC3.1 tests the SUNRISE SAF in map-based highway Automated Driving Systems for 2 scenarios: [A] adjusting speed to speed limit and [B] adapting to road curvature.

Objectives

Use the SAF to show how the safety and efficiency of map-based highway Automated Driving Systems can be demonstrated successfully.

SAF blocks demonstrated

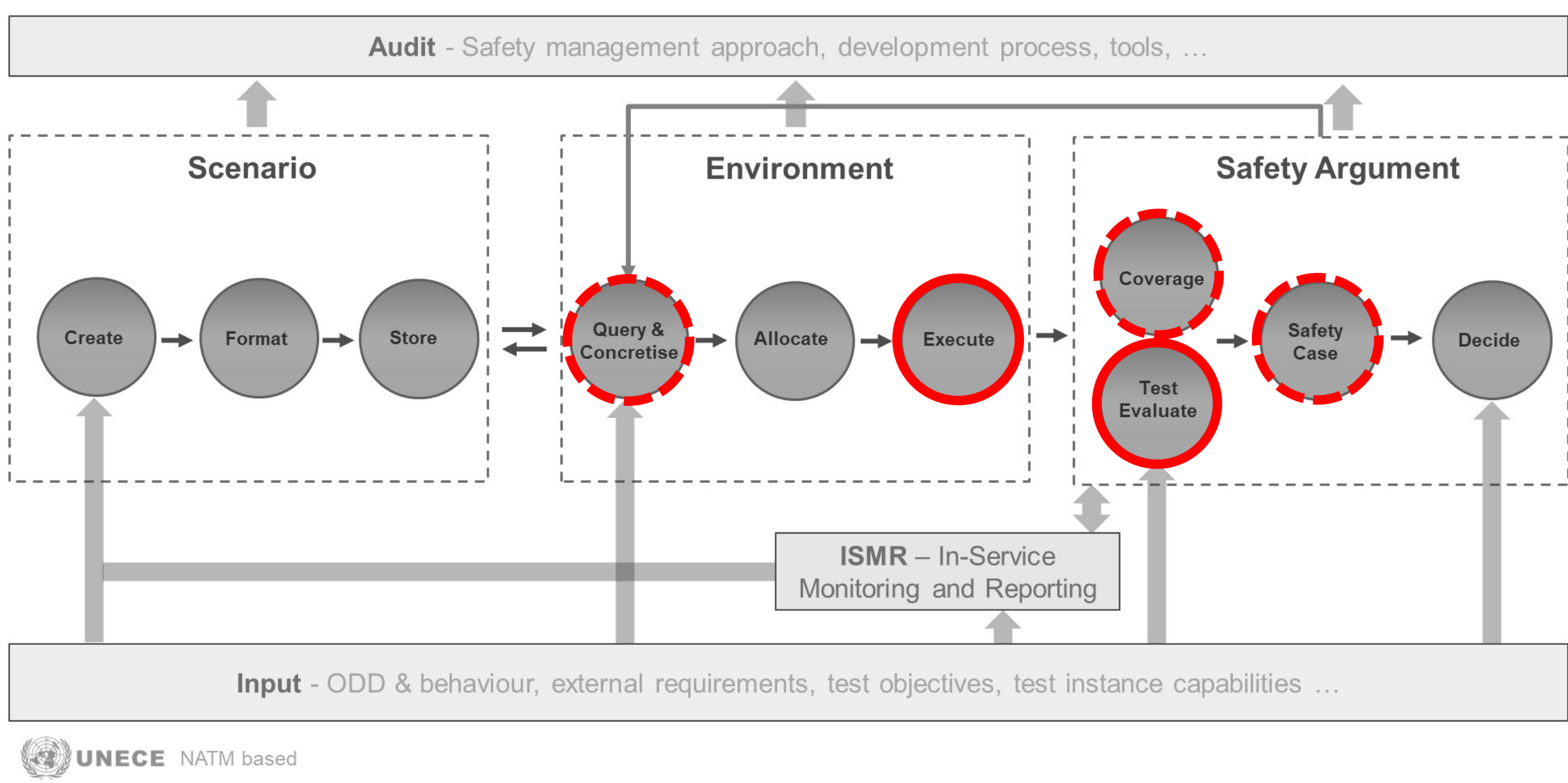


Figure 2. Overview of demonstrated SAF blocks

Test case setup

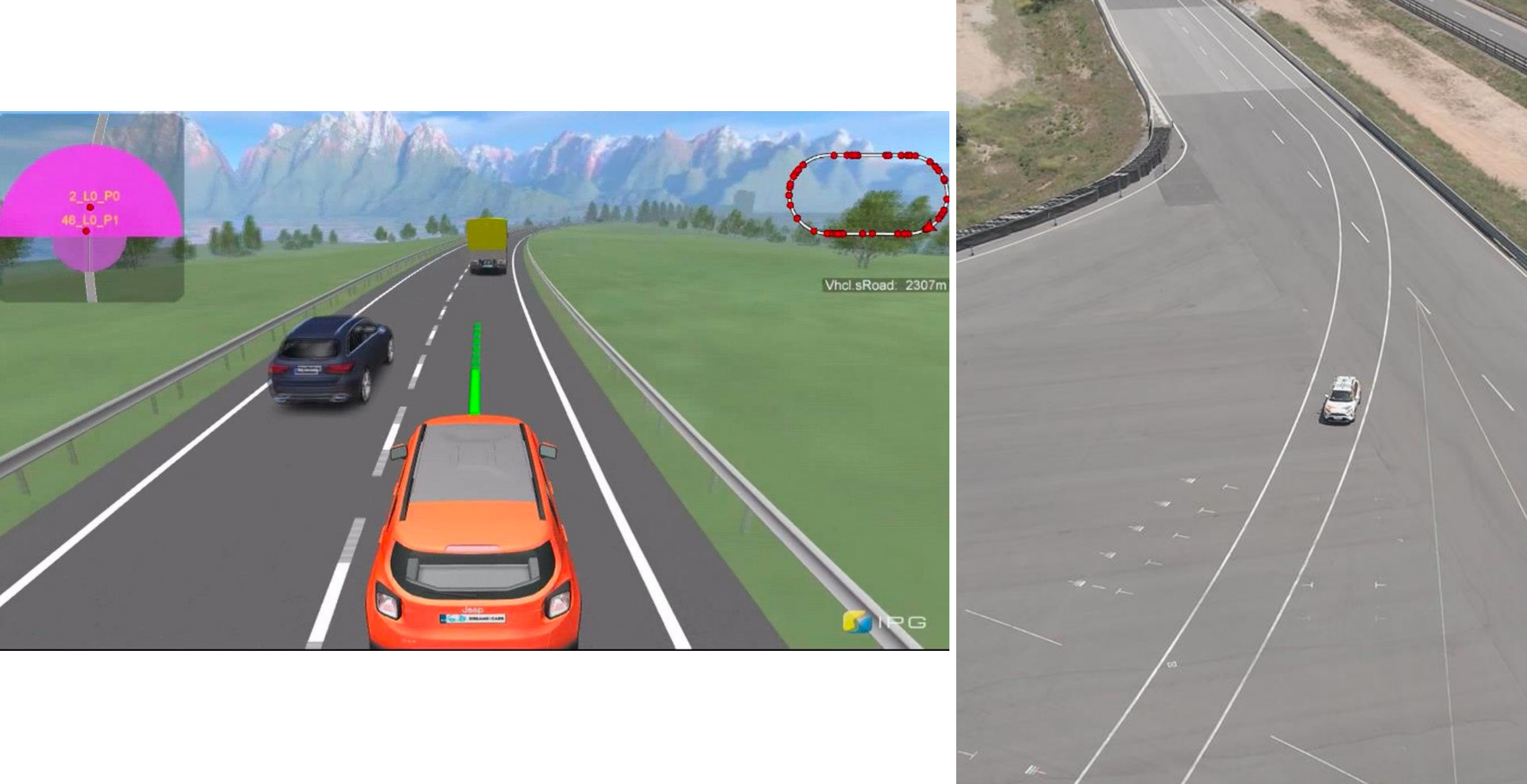


Figure 3. Test case setup (UC3.1B). On the left is the simulation environment, featuring a sensor view in the top left and a map view in the top right. On the right is the proving ground setup.

The test case is set up on a proving ground and as a virtual simulation in IPG CarMaker.

- For UC3.1A (adaptation to speed limits), 500 concrete scenarios were simulated with three parameters: initial speed, distance, and speed limit.
- For UC3.1B (speed adaptation in curves), 622 concrete scenarios were studied (3 on proving ground) with two consecutive curves ahead.

CCAM = Cooperative, Connected and Automated Mobility
ODD = Operational Design Domain
SAF = Safety Assurance Framework
UC = Use Case

Results

The findings for UC3.1A are as follows:

- It was found that the system realizes safe decelerations if the speed limits are spaced by at least 100 m and change in 20 km/h steps (Figure 4).

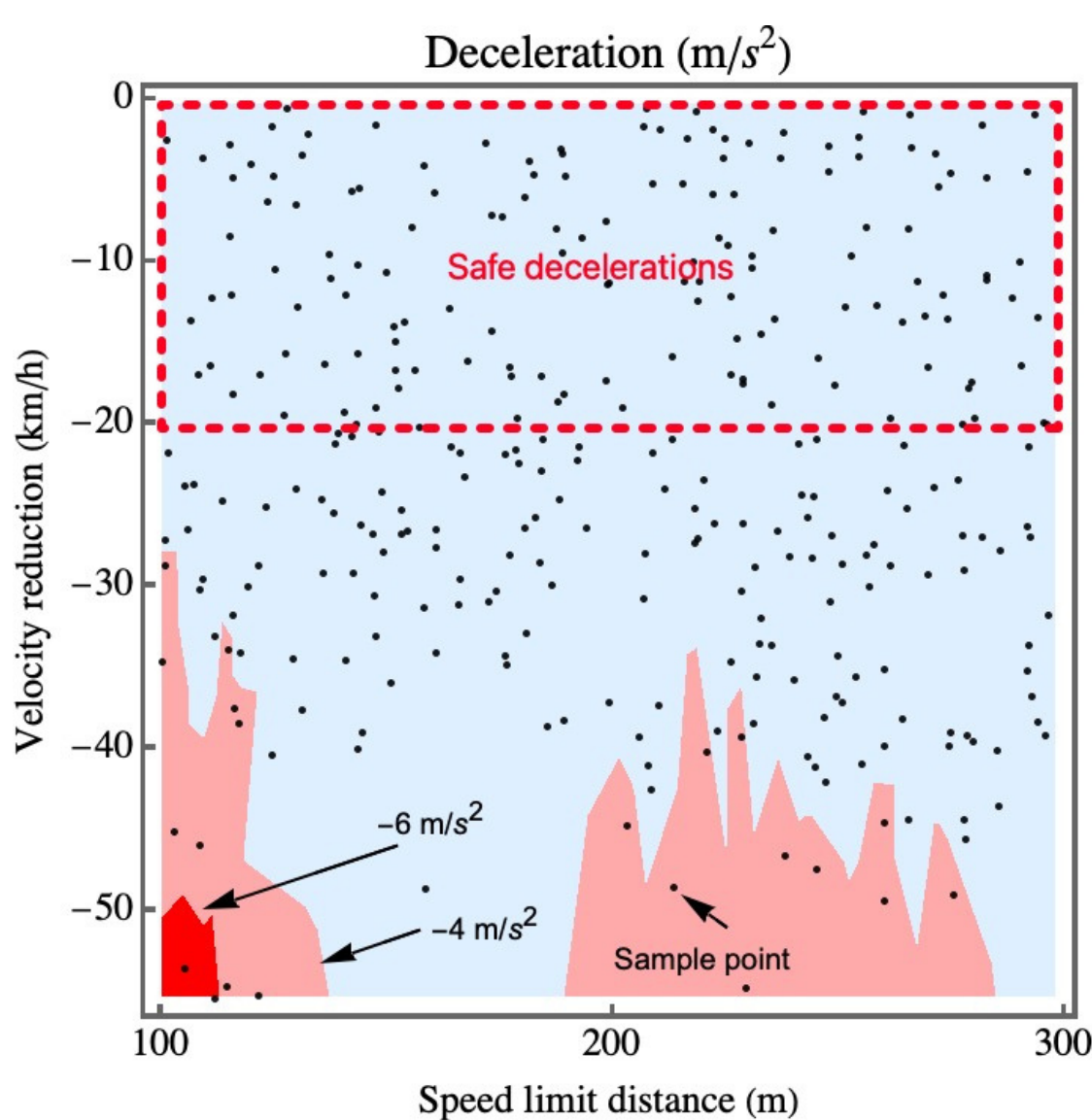


Figure 4. Vehicle decelerations UC3.1A

The findings for UC 3.1B are as follows:

- The vehicle maintained a minimum distance of about 0.4 meters from lane edges while wandering (Figure 5).
- Longitudinal and lateral accelerations are confirmed to be within a humanlike range using the GG diagram (Figure 6).
- Speed choices in curves were also within the humanlike range (Figure 6).

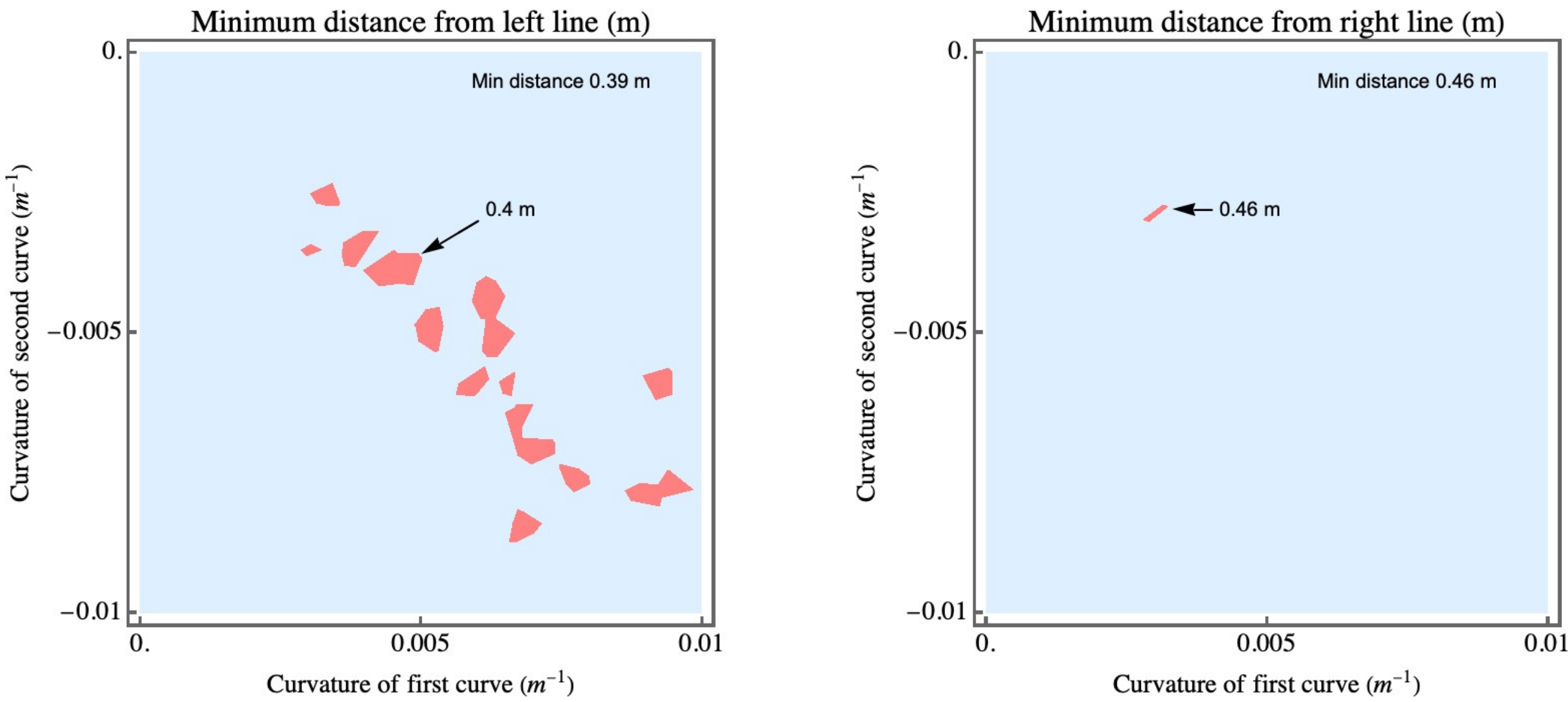


Figure 5. Vehicle distances to lane edges UC3.1B

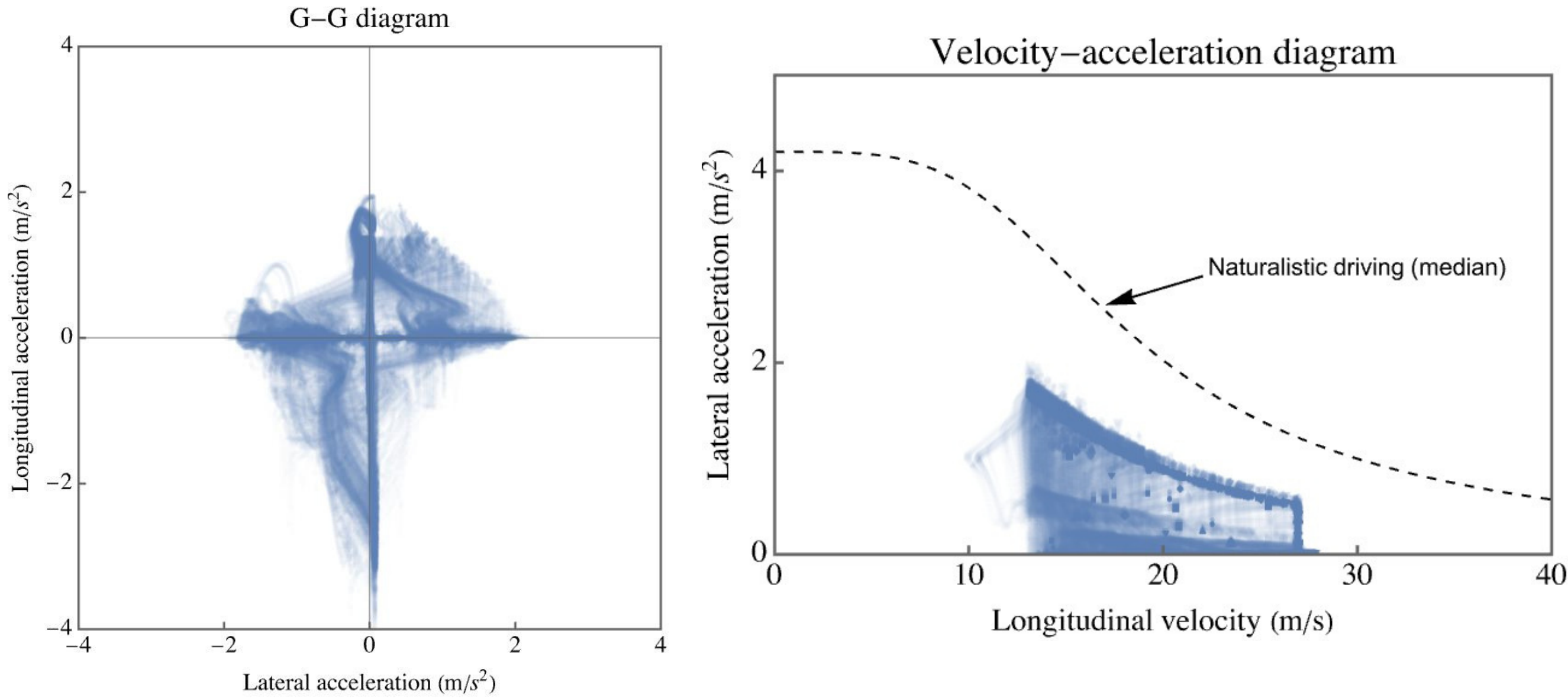


Figure 6. Vehicle G-G diagram (left) and Vel-Acc diagram (right) UC3.1B

Key take aways

- The sampling of (expert-defined) logical scenarios permitted extensive analysis of CCAM system safety across the ODD, finding it remains in the lane.
- The system is safe because it remains within the lane and is perceived as safe because it meets humanly expected velocities and accelerations.

References

- SUNRISE Deliverable D4.5
- SUNRISE Deliverable D4.6
- SUNRISE Deliverable D7.2

Partners



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