# Relevant test scenarios on proving grounds for the urban use-case – OICA views

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Submitted by the experts of OICA

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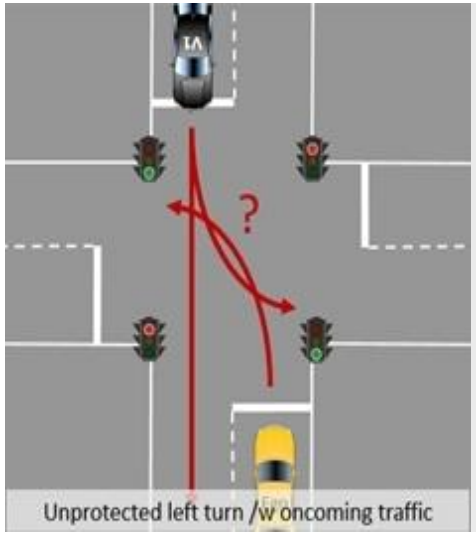
# Introduction/basis for discussion

- The next slides are based on the concept document “Structure of a future Regulation of autonomous vehicles” that OICA provided to the TF AutoVeh
  → Special requirements for the use-case urban traffic: See Annex 5, paragraph 2: “Physical tests required for type approval/certification”
- The intention of this presentation is to start the discussion and explain a proposal on four critical test scenarios for the urban use-case that are suitable for testing on proving grounds
- There may be additional scenarios to be added
- It should be noted that defined tests on proving grounds/test tracks are only one single element in the overall concept of the system certification/assessment. Additional scenarios are addressed by other means e.g. during the real-world-driving test and the audit/assessment.
- Proposed working structure: Agree on the general test scenarios in a first step. And then define the exact requirements (including parameters and numerical values) and develop the test procedure.

# Scenario Justification

- In a first step, the proposed test scenarios were identified and evaluated with an “engineering judgement approach” based on two criteria:
  - Criteria 1: Performance based technical difficulty/complexity for the system to detect/manage the particular situation
  - Criteria 2: Injury/crash severity
- Remark: It was qualitatively considered that the scenarios should have a significant relevance /occurrence probability in traffic
- Outlook: Additional statistics/external sources could be added in mid- and long-term to complete the justification on a scientific basis

# Proposal Test Track Scenarios „Urban“




**2.1 Unprotected „left turn“ (in case of right hand traffic)**

Situation: The vehicle approaches an intersection in autonomous mode with the intention to perform a left turn. Other Dynamic Objects are present.

Expected Behavior: The vehicle should automatically activate the left direction indicator when slowing down. Then, the vehicle yields considering the traffic rules from the corresponding country and turns left.

Initial Condition: The vehicle follows the ego-lane and is heading an intersection that is controlled by a traffic light without green arrows as status, by a yield sign or without any traffic elements at all.

Final Condition: The vehicle has applied the left turn indicators and turned left according to the traffic rules without endangering oncoming traffic. The vehicle drives on at the new lane.

**Justification:**

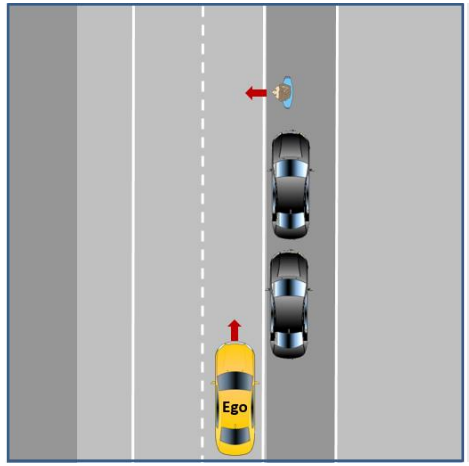
Criteria 1: Technical difficulty/complexity for the system to detect/manage the situation

- Path of other vehicles is difficult to predict/sense; high differential speeds

Criteria 2: Injury/crash severity

- High severity due to side impact and high speeds of involved vehicles

# Proposal Test Track Scenarios „Urban“




**2.2 Obstructed Pedestrian crossing (without traffic lights, without pedestrian walkway)**

Situation: The vehicle follows in autonomous mode the ego-lane and approaches a gap after parked vehicles, where a pedestrian has the intention to pass the street.

Expected Behavior: The vehicle shall stop in a safe manner in order to let the pedestrians pass. The vehicle may continue the drive, when all pedestrians have crossed the street.

Initial Condition: The vehicle follows the ego-lane and is heading towards a pedestrian behind parking vehicles.

Final Condition: The vehicle continues its drive without violating traffic rules as well as safety and comfort criteria.

**Justification:**

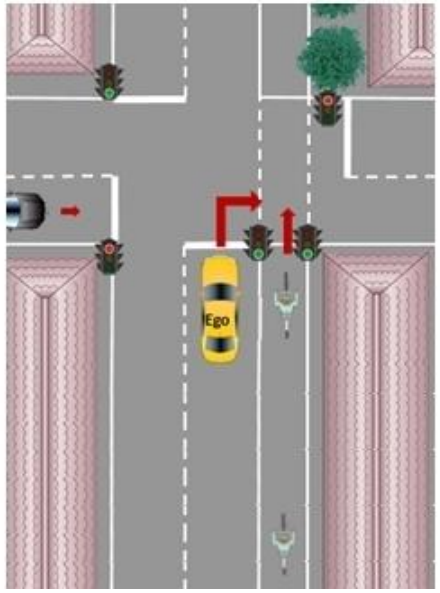
Criteria 1: Technical difficulty/complexity for the system to detect/manage the situation

- Dynamic obstacle test including obstruction of the pedestrian (child) dummy by other vehicles/objects on the side of the road is is difficult to predict/sense; high differential speeds

Criteria 2: Injury/crash severity

- High severity for an unprotected pedestrian if the vehicle does not safely stop

# Proposal Test Track Scenarios „Urban“




**2.3 Cyclist test in combination with right turn**

Situation: The vehicle is driving with [50 km/h] in autonomous mode on a priority road and approaches an intersection (vehicle has right of way or traffic light “green”) to perform a right turn. A cyclist is driving with [15 km/h] in the same direction using a separate bicycle lane adjacent to the priority road and wants to keep straight on across the intersection. A second bicycle is following with a [20m] gap to the first, also driving with [15km/h].

Expected Behavior: The vehicle should automatically activate the right direction indicator when slowing down, first stop and let the first bicycle pass and then use the gap between the first and the second cyclist in order to turn right.

Initial Condition: The vehicle follows the ego-lane.

Final Condition: The vehicle has applied the right turn indicators and used the gap between the two cyclists for turning right. The vehicle drives on at the new lane.

**Justification:**

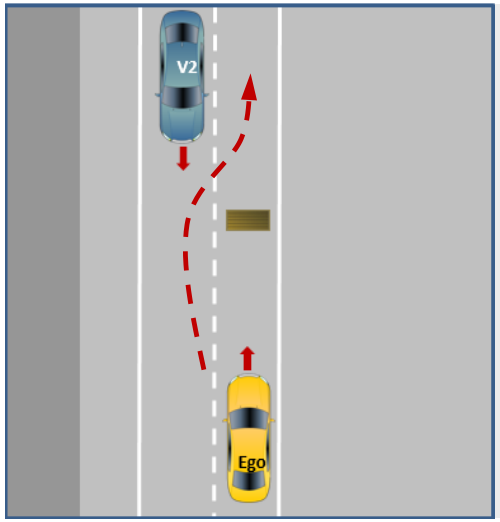
Criteria 1: Technical difficulty/complexity for the system to detect/manage the situation

- Path of the cyclist that has a certain (parallel) distance to the road is difficult to predict/detect, relatively high differential speeds

Criteria 2: Injury/crash severity

- High severity for a protected/unprotected cyclist if the vehicle does not safely stop before making the right turn

# Proposal Test Track Scenarios „Urban“




**2.4 Obstacle test**

Situation: The vehicle follows in autonomous mode the ego-lane and reacts on static objects located ahead of the vehicle on the driving lane while there is oncoming traffic on the neighbor lane (so that there is not at all times a possibility for evading the static object). The static object may have different sizes, but is not moved by itself.

Expected Behavior: The vehicle has to decide if the static object is traversable or not. If it is not traversable, the vehicle has to decide when it has to stop and when to evade/drive around the static object.

Initial Condition: The vehicle follows the ego-lane. The vehicle is heading a static object in lane.

Final Condition: The vehicle has just followed the ego-lane if the static object is traversable. If it is not traversable, the vehicle has safely (without endangering oncoming traffic) driven around the obstacle to follow the ego-lane.

**Justification:**

Criteria 1: Technical difficulty/complexity for the system to detect/manage the situation

- Detect the stationary obstacle and then drive around/evade including consideration of oncoming traffic is difficult! Note: The dynamic object that suddenly crosses the road would be covered by 2.2. and requires different technical capabilities.

Criteria 2: Injury/crash severity

- High severity for drivers/passengers due to oncoming traffic

# Next steps

- What is the expectation of the Contracting Parties regarding the development of test track scenarios for the urban use-case?
- OICA proposes to start working on specifying those four scenarios in a first step – this will likely require enormous efforts and discussions to develop suitable, realistic and reproducible test protocols.
- If the group could agree on those four scenarios, OICA volunteers to start working on a draft specification of reproducible tests for the agreed scenarios 2.1 – 2.4 (i.e. define numerical values/parameters like e.g. speed and distances, road infrastructure, definition of objects, pass/fail criteria, test equipment etc.).
- Such a draft specification could then be discussed and further developed/improved with the Contracting Parties.
- Would it be an acceptable approach to fix in a first step the requirements (incl. boundary conditions/parameters/expected system behavior) and later (if the timeframe allows), focus on the development of test procedures (how to test the requirements, specify test equipment, etc.)?