Transmitted by SG1a Leader

VMAD-10-03

Report of SG1a (Traffic Scenario) to 10th VMAD-IWG

United Nations Economic Commission for Europe (UNECE)
Working Party on Automated/Autonomous and Connected Vehicles (GRVA)
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WebEx

Background and Purpose of Scenarios (excerpt from NATM master document)

- A scenarios catalogue consisting of a series of relevant, critical, and complex scenarios that represent real-world traffic situations.
- The goal of these scenarios is to exercise and challenge an ADS' capabilities to safely operate.
- This catalogue will provide a minimum baseline (non-exhaustive inventory) of scenarios that should be considered (and built upon as required) to validate the safety of an ADS.
- The NATM then proposes the next three pillars [virtual, track, and real-world testing] as the principal testing methodologies to validate the safety of an ADS against these traffic scenarios

Abstract of SG1a Concept paper

WHY

- A scenario-based approach helps to systematically organize safety validation activities in an efficient, objective, repeatable, and scalable manner and is critical addition to the existing testing methodologies for ensuring holistic and dense coverage of traffic situations.

Abstract of SG1a Concept paper

WHAT

- Traffic scenario (or scenario for short) is a sequence or combination of situations used to assess the functional safety requirements for AVs.
- Scenarios involve a wide range of elements, such as some or all portions of the dynamic driving task (DDT), different roadway layouts; interactions with a variety of different types of road users and objects exhibiting static or dynamic behaviours; and, environmental conditions (among many others factors).

Abstract of SG1a Concept paper

Applying scenarios within the NATM

- The use of scenarios can be applied to different testing methodologies (NATM Pillars), such as simulation/virtual testing, track testing, and real-world testing to validate the safety of an ADS.
- Together these methodologies provide a multifaceted testing architecture, with each methodology possessing its own strengths and weaknesses.
- As a result, some scenarios may be more appropriately tested using certain test methodologies over others.
- Therefore, it is important that the NATM Master Document develop a methodology and scenario catalogue that is flexible enough to apply to simulation/virtual testing, track testing, and real-world testing. Going forward, VMAD will establish a catalogue of a minimum baseline/non-exhaustive inventory of scenarios that should be considered (and built upon as required) to validate, using the NATM pillars, each functional requirement for an ADS.
- This work will be accomplished in consultation with VMAD subgroups and FRAV.

Abstract of SG1a Concept paper

Developing scenarios

- Identifying scenarios through:
  - Analyzing various sources of data (e.g., collision data, human driver behaviour)
  - Synthetically generated scenarios from key parameter variations
  - Scenarios based on functional safety requirements and safety of intended functionality
  - In-use monitoring/operation
  - Structure: 3-[layer]-model (perception/traffic disturbance/vehicle disturbance)
- Classifying Scenarios

  -e.g. level of abstraction (functional/logical/concrete)
- Scenario Properties

  -e.g. 6-layer-model (from Pegasus project)

Comments on VMAD 8th (10th July)

- SG1a presented the current status at VMAD-IWG 8th.
- Some comments were raised as follows.
  - ✓ (1) Would it be necessary to consider further how to develop scenarios to be added to scenario database? Would criteria and ODD be necessary at this moment?
  - ✓ (2) Would it be necessary to study common scenario description language? Existing language used by Pegasus, MUSICC, etc. can be used.
  - ✓ (3) Would it be necessary to study common definitions? Existing definitions used by ISO, SAE, etc. can be used.
  - ✓ (4) Would it be necessary to elaborate further on how to apply scenarios within the NATM?
  - ✓ (5) Would it be necessary to clarify that the purpose of scenario is to assess that the ADS can cope with the situation happen under ODD?

- Above issues were discussed at SG1a meeting on 29th July

SG1a meeting on 29th July

Common view

- At this point in the process, SG1a should focus on developing a methodology for identifying scenarios in a structured approach, focusing initially on:
- ✓ functional scenarios, which has the most abstract description.
- ✓ A simple operational design domain (ODD) and industry needs (e.g. divided-highway application)
- Previous work (e.g. ISO, SAE) should be considered.

Noted comments

- Scenarios should be logically structured by 3 [layers].
- It is not necessary to have database which store raw data. Database will initially be focus on functional scenarios. As the project progresses, SG 1a can work with other sub-working groups to focus its attention on more detailed/ technical scenarios.
- Scenario can be added if necessary after having developed scenario.
- Consider each scenario layer separately and add available cases
- Perform a literature review to identify and leverage existing materials and clarify the researched area and gaps.

Next Action (How to develop NATM)

- Reflect the concept paper and discussed issues ~~to~~ within the NATM Master Document.
- Literature review should be conducted to:
  - Identify/leverage areas of prior research/work to prevent duplication and recognize the work of others.
  - Identify gaps in research/work, including conflicts in previous studies, and/or open questions/next steps raised from previous research
  - Examine concepts/topics such as identifying scenarios, scenario description language, definitions, levels of abstractions, scenario elements/properties, scenario coverage
- In close collaboration with FRAV, map out the relation between scenarios and safety requirements
- Create a methodology for developing scenarios, focusing highway driving and functional scenarios

Questions & Comments?

Thank you and stay safe!