



Safety Measurement Principles for Validation of Automated Driving

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Introduction

The purpose of these few slides is to create some discussion around how measurement should be incorporated across the multi pillars

When a minimum standard is published there is a risk that someone develops only to the minimum, therefore we must be able to extend.

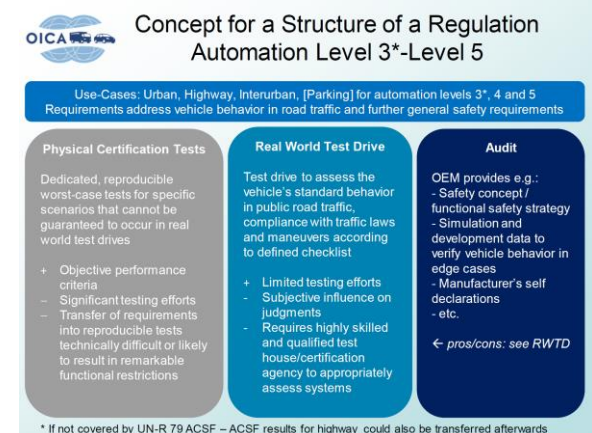
Testing requires two key parts

1. A real or virtual scenario to drive
2. A measurement of success – can be a binary pass/fail or score that helps drives up standards.

Three areas to measure

1. Perception – how well does the ADS understand its environment and the objects near by
2. Planning – how well does the ADS create a near future driving plan that is safe for everyone
3. Execution – how well does the ADS drive to its own plan

These measures are relevant to all stages of testing virtual, track and road (OICA's 3 Pillars)





Open

1. Implementation agnostic

- The measurement system should be outcome based and not impose a design on the developers of the ADS.
- E.g. target vehicle is going to turn left (possibly with a confidence level) not
 - Video camera shows left indicator, or
 - Car positioned to turn left, or
 - V2V data, or
 - Driver's body language

2. Open standard

- The measurement system must be an open standard that all OEMs and tier 1s can work with
- Must compare like with like
- OEMs will need long range visibility to adapt
- Industry needs standards to create tools and systems
- Work with other standard such as those from ISO, ASAM and SAE

Practical



- **Efficient**
 - The number of tests could grow, but it is important that system updates can be validated quickly - weeks or months but not years.
 - Creating trust between virtual and physical testing can accelerate the testing process.
- **Extendable**
 - The number of potentially unsafe driving scenarios is unlimited and so any measurement system must be able to be extended to account for new insights.
 - OEMs may also want to add their own supporting measurements.
- **Deployable**
 - Safety should be measurable both in development, validation and deployment.
 - The measurement system itself needs proving, which can best be done during ADS development.

Transparent



- **High fidelity**
 - Need to measure how safe a manoeuvre is not just a pass/fail
 - Simple pass/fail could miss a drop in safety
 - Needs to detect even very small chances of a serious accident
 - Recording accidents is not enough, as humans we learn from near misses where accidents are avoided by drivers taking evasive action or the luck of timing.
 - OEMs and regulators should have the opportunity to understand trends before they become a problem.
- **Objectivity**
 - The tests and measurement process must be the same for everyone
 - Feeling safe is highly subjective and in this context actual safety is more important than the feeling.



Multi Tier Measurement

