Introduction of the Draft UN Regulation on Driver Control Assistance Systems (DCAS)

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WP.29 Outline

United Nations Organization

UNECE Inland Transport Committee

WP.29 — World Forum for Harmonization of Vehicle Regulations — 5 Informal working groups

WORKING PARTIES

GRPE	ON POLLUTION AND ENERGY	5 Informal working groups
GRSG	ON GENERAL SAFETY PROVISIONS	2 Informal working groups
GRVA	ON AUTOMATED/AUTONOMOUS AND CONNECTED VEHICLES	5 Informal working groups
GRE	ON LIGHTING AND LIGHT-SIGNALLING	2 Informal working groups
GRBP	ON NOISE AND TYRES	2 Informal working groups
GRSP	ON PASSIVE SAFETY	8 Informal working groups

WP.29 PARTICIPANTS

- ECE Member Countries
- Other countries – members to any Agreement administered by WP.29
- Any other countries with consultative status
- REIO which are set up by countries that are members of the ECE or members of the United Nations and are Contracting Parties to any of the Agreements
- UN agencies & organizations
- NGOs

WP.29 MANAGING COMMITTEES

- Administrative Committee for the Coordination and Organization of Work (AC.2)
- Administrative Committee for the 1958 Geneva Agreement (AC.1)
- Executive Committee for the 1998 Global Agreement (AC.3)
- Administrative Committee for the 1997 Vienna Agreement (AC.4)

International Agreements Administered by WP.29

Agreement concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations

172 UN Regulations

62 Contracting Parties

Contracting Parties voluntary apply UN Regulations and may mandate those at national level. Contracting Parties mutually recognize the results of the compliance assessment pursuant to the latest versions of UN Regulations

Agreement concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts Which Can Be Fitted and/or Be Used on Wheeled Vehicles

24 UN GTR

39 Contracting Parties

Contracting Parties implement UN GTR provisions to their national legislation

Agreement Concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections

4 UN Rules

17 Contracting Parties

The UN Rules contain requirements for vehicles in operation. The results of Periodical Technical Inspections are mutually recognized by the Contracting Parties

New Industry-Requested ADAS Use Cases: Continuous Assistance

Main requests by the industry:

- Allow operation in a larger set of operational environments
- Allow more dynamic control
- Allow system-initiated manoeuvring
- Allow so called “hands-off” systems

Key contributors to road traffic accidents:

- Speeding
- Too little distance
- Driver disengagement from the driving task
- Human limitations
- Wrong judgement

Continuous assistance systems:

- Primarily designed to reduce the workload while driving
- Beneficial for road safety

The use of continuous assistance could encourage the driver to:

- Keep an appropriate distance to other road users
- Drive at the permitted speed
- React to potential hazard preventatively
- Judge situations correctly

Use Case
Assisting changing lanes in a non-highway environment

Description
Assisting the driver in performing a lane change in urban or inter-urban scenarios (e.g. changing from one lane to another at a fork/intersection)

ODD
Domain:
- Urban
- Inter-urban

Speed:
< [70]km/h

Assumed driver supervision/involvement:
- Hands-on lateral control

Use Case
Assisting Driving through roundabouts

Description
Assisting the driver in driving through a roundabout

ODD
Domain:
- Urban
- Inter-urban

Speed:
< [70]km/h

Assumed driver supervision/involvement:
- Hands-on lateral control

Use Case
Assisting Turning at an intersection

Description
Assisting the driver in turning at an intersection

Specifics:
- With/without traffic lights

ODD
Domain:
- Urban
- Inter-urban

Speed:
< [70]km/h

Assumed driver supervision/involvement:
- Hands-on lateral control

Use Case
Driving around obstacles being in the driving lane

Description
Assisting the driver in following a driving path around obstacles, which are blocking the current driving lane.
(this is not an emergency situation)

Specifics:
- the adjacent lane may used by traffic moving in the same or in the oncoming direction

ODD
Domain:
- Urban
- Interurban

Speed:
Usually in urban scenarios <[50]km/h
In inter-urban environments < [100]km/h

Assumed driver supervision/involvement:
- Hands-on lateral control

Use Case
Changing Lanes, initiated by the system

Description
Assists the driver in performing lane changes when deemed reasonable

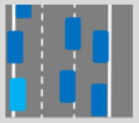
ODD
Domain:
- Highway
- Multilane roads without oncoming traffic

Speed:
No restriction

Assumed driver supervision/involvement:
- Hands-on lateral control

Use Case
Forming an emergency corridor

Description
Assisting the driver in the formation of a corridor for emergency vehicles at low speed



Specifics:
- With/without crossing of lane markings

ODD
Domain:
- Highway
- Multilane roads without risk of oncoming traffic

Speed:
< [30]km/h

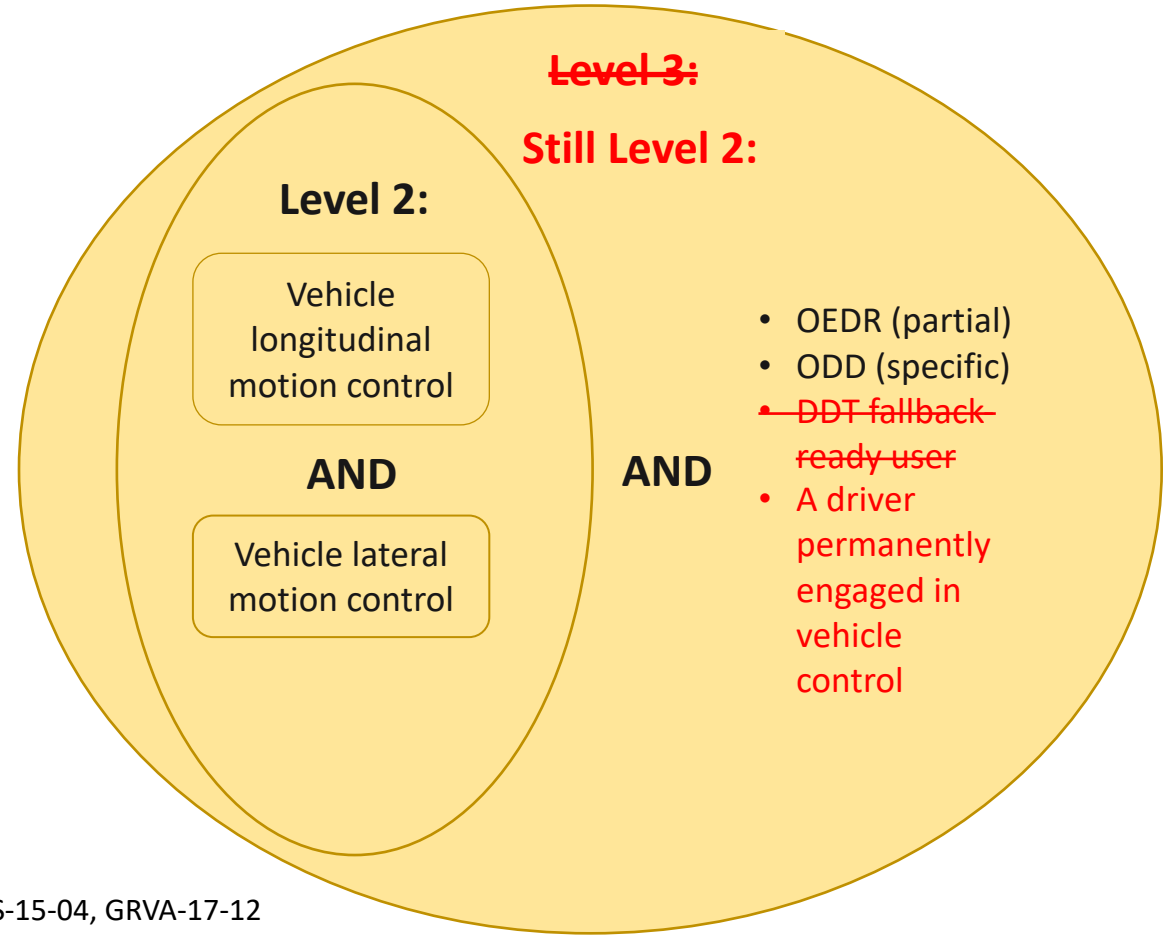
Assumed driver supervision/involvement:
- Hands-on lateral control

Identifying Risks with Level 2 Systems

SAE J 3016 Level 2
Advanced Driver Assistance:
A driver is fully responsible for driving the vehicle while the system provides continuous assistance with both accelerating/braking and steering

SAE J 3016 Level 3
Conditional Automation:
A system handles all aspects of driving while the driver remains available to take over driving if the system can no longer operate

Targeted ADAS



Two main risks with a Level 2 System:

1. The system is so poor that the operator (driver) is constantly intervening to prevent catastrophic outcomes, and/or
2. The system is so good that the operator (driver) ceases to provide proper supervision (up to and including driver unresponsiveness).
   - In the first case, the system requires so much driver intervention that it impairs driver operation of the vehicle.
   - In the second case, the system is so reliable that the driver may not be available to intervene when needed.

The regulatory objectives:

- The system to provide stable control under the use conditions for which it is designed;
- The system to have safeguards to guarantee that the driver is always ready to intervene;
- The system to enable smooth transactions with the driver with safeguards to manage problematic transactions.

Re: ADAS-15-04, GRVA-17-12

DCAS Definition

"Driver Control Assistance System (DCAS)" means the hardware and software collectively capable of assisting a driver in controlling the longitudinal and lateral motion of the vehicle on a sustained basis.

Key Principles

1. ***"Driver" refers to a human being driving a vehicle***

1.1. A DCAS does not replace the driver (ADS); a DCAS assists the driver (ADAS).

1.2. A DCAS does not change the driver's responsibilities for control of the vehicle.

2. ***A DCAS is a driver-operated vehicle system***

2.1. A DCAS must prevent reasonably foreseeable risks of driver misuse or abuse.

2.2. A DCAS must have means to evaluate continuous driver involvement in and supervision of the vehicle operation.

2.3. A DCAS do not aim to permit driver activities other than driving in addition to those permitted for manual driving.

2.4. A DCAS must provide sufficient information to enable the driver to supervise its motion-control assistance.

3. ***A DCAS assists the driver via sustained lateral and longitudinal motion-control support***

3.1. The DCAS support must not adversely impact road safety.

3.2. The DCAS support must not adversely impact driver control over the vehicle behavior.

4. ***The availability of a DCAS to the driver is constrained by defined system boundaries***

4.1. The manufacturer must describe the system boundaries.

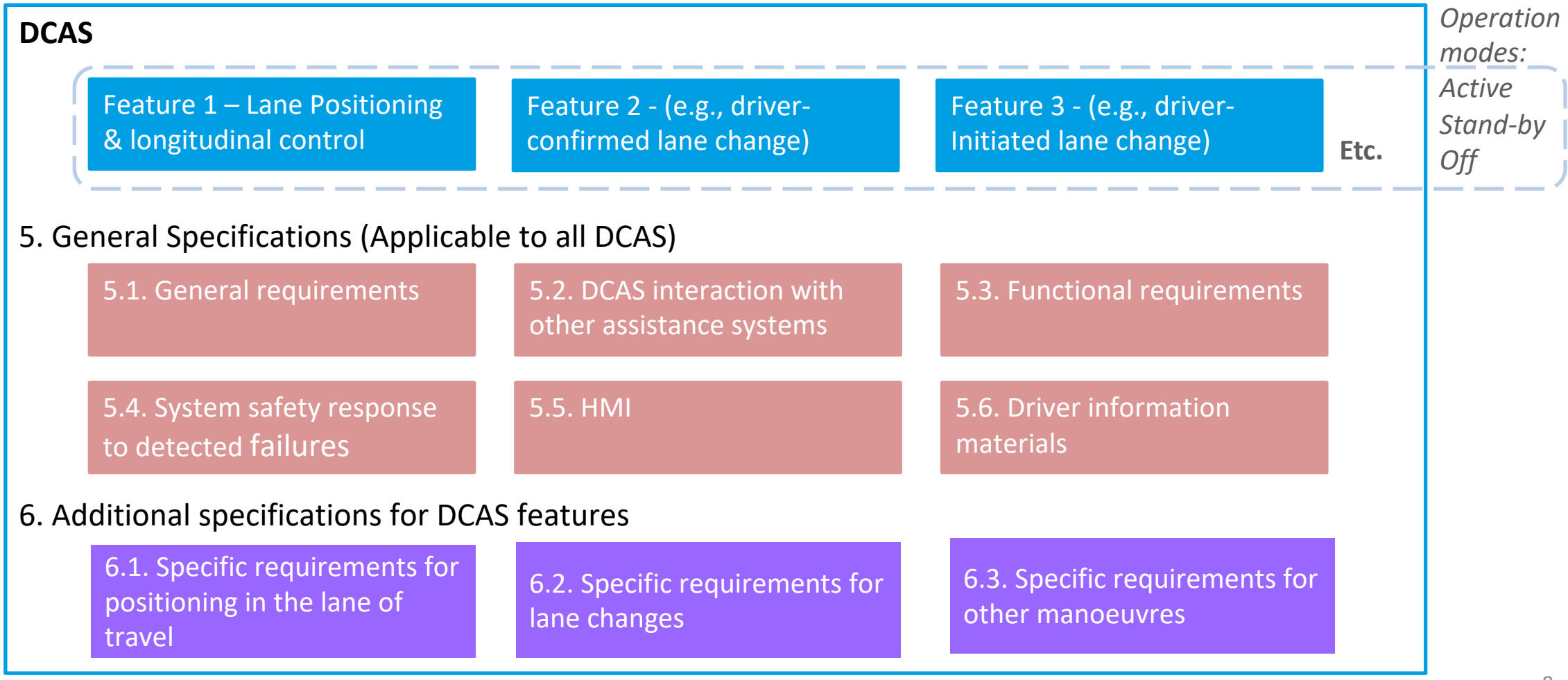
New language of Requirements

The availability of DCAS, and their capability to assist, are constrained by the defined system operational boundaries. This impact of system boundaries on the system's ability to fulfil certain requirements, and the nature of how certain requirements can be assessed, is reflected by the language of requirements:

- Some requirements are expected to always be met, including in all relevant tests. These provisions are phrased as "the system shall…".
- Some requirements are such that whilst the system is generally expected to fulfil them, either this might not be appropriate or achievable under the specific circumstances, or external disturbances may still lead to a varying output. These provisions are phrased as "the system shall aim to…".
- Some requirements are difficult to verify by assessing system performance directly and are more readily verified by assessing the design of the system, for example by analyzing its control strategies. These provisions are phrased as "the system shall be designed to…".

General Overview of the draft DCAS UN Regulation

DCAS is a system comprising of a number of features



New: Section 5 – 5.6. Driver Information Materials

- Manufacturer shall provide clear and easily accessible information to be legible for a non-technical audience (e.g. documentation, video, website materials) instructing the driver on DCAS operation
- Example information points:
  - Safety benefit of DCAS
  - How DCAS exerts dynamic control assisting the driver
  - System Boundaries
  - Driver Engagement Detection
  - HMI elements
  - Etc.

System Information Data (Section 9)

New obligation, in addition to CEL Audit, for manufacturer to declare in detail the system and features permitting detailed assessment/verification.

Declaration of System Capability (Annex 3, Appendix 4)

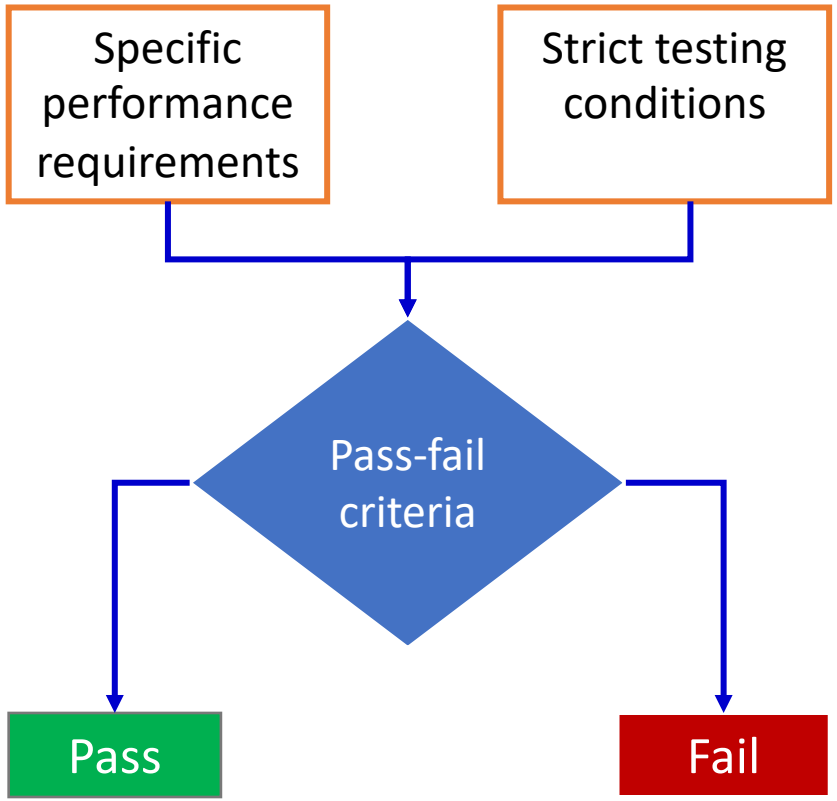
Annex 3, Appendix 4: Aimed to outline system/feature performance to support testing:

- Operating Ranges of each feature
- Operating Domain of each feature
- System capability to respond to other road users
- System capability to follow the course of the lane
- System's ability to ensure safe operation when assisting lane changes
- System's ability to operate in accordance to traffic rules for a certain manoeuvre

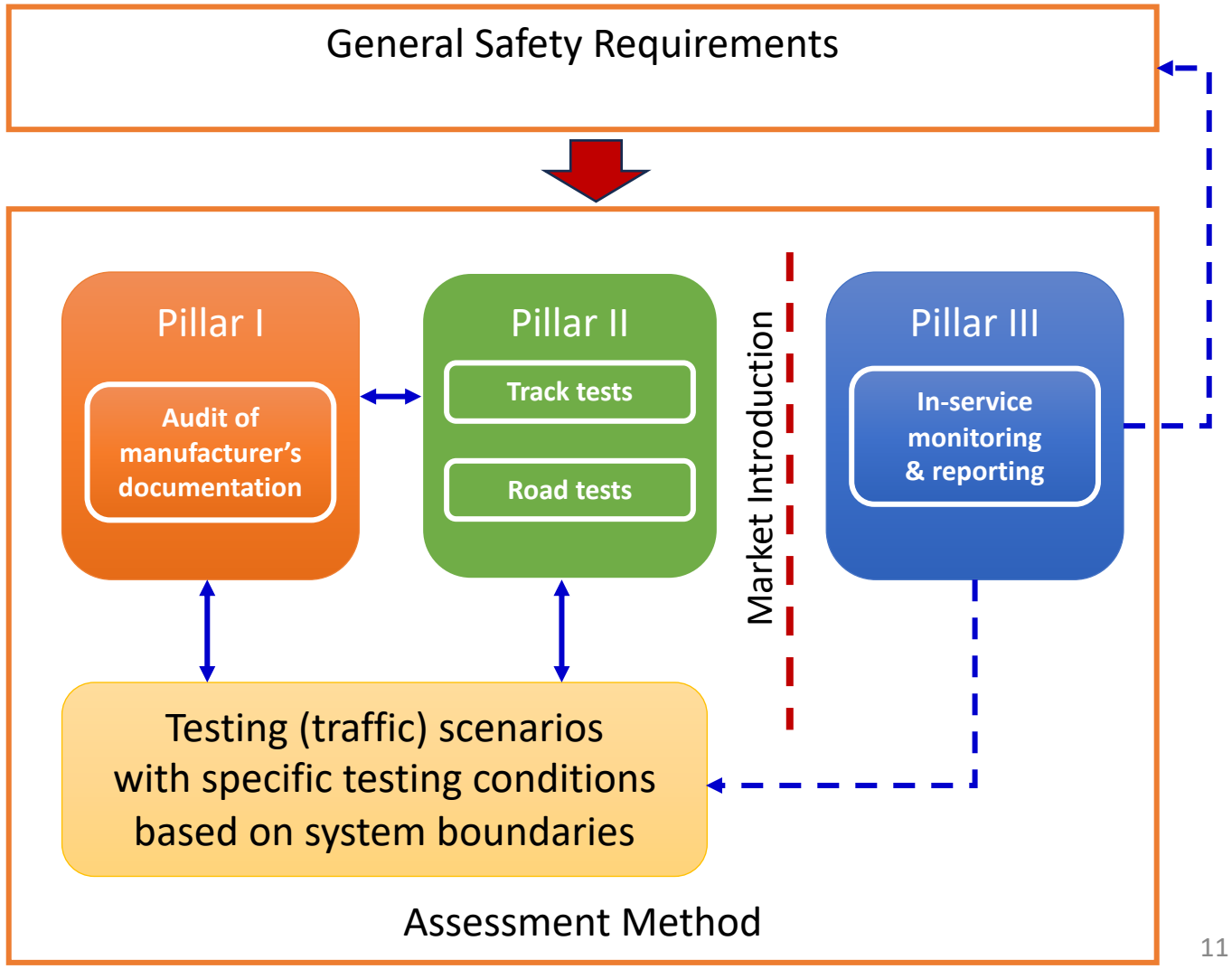
An new approach to DCAS Validation

- Due to DCAS operation in multiple domains, to ensure safe operation in all domains, for DCAS validation, “multi-pillar” techniques have been implemented, as they have been elaborated by the IWG on Validation Method for Automated Driving (VMAD) as the New Assessment Test Method (NATM):
  - The multiple assessment techniques compensate uncertainties related to operational cases that are not assessed directly and thus cover DCAS multiple operational cases that should be assessed;
  - Extensive assessment through multiple pillars allows a deep assessment of the manufacturer’s design (e.g., functional safety, controllability, driver engagement strategies) and allows for system flexibility to dynamically handle environments.
  - This in turn avoids requiring the definition of specific limit values. Appropriate behavior and control is verified in test scenarios;
  - In addition, the manufacturer will be required to monitor and report on system performance following entry into service;
  - The enhanced assessment techniques are not new; they are already known and implemented in other areas: this would ensure easier implementation of those in the DCAS UN Regulation. We implement synergy of these techniques.

Traditional Type Approval

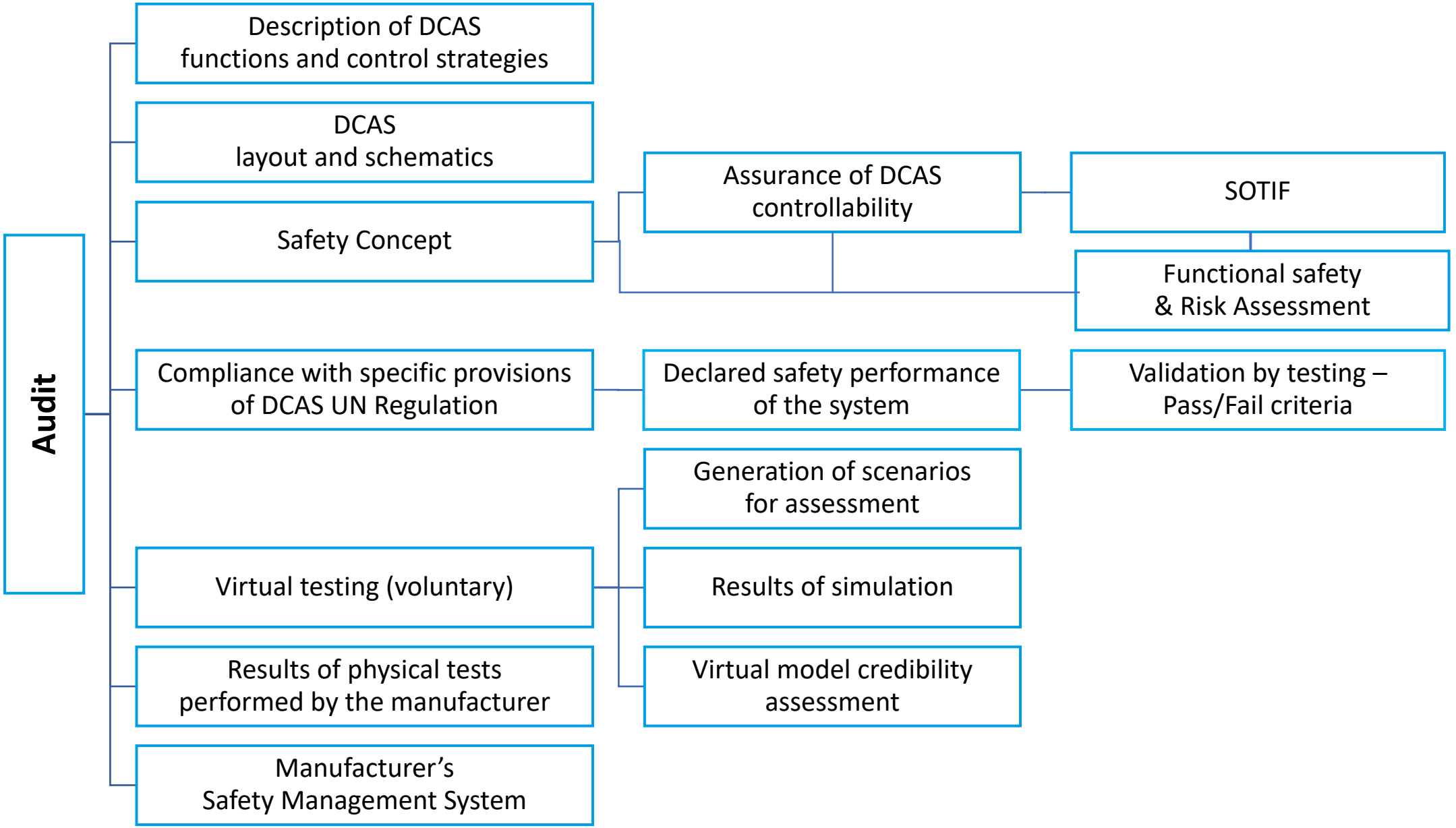


NATM – Multi-Pillar Assessment

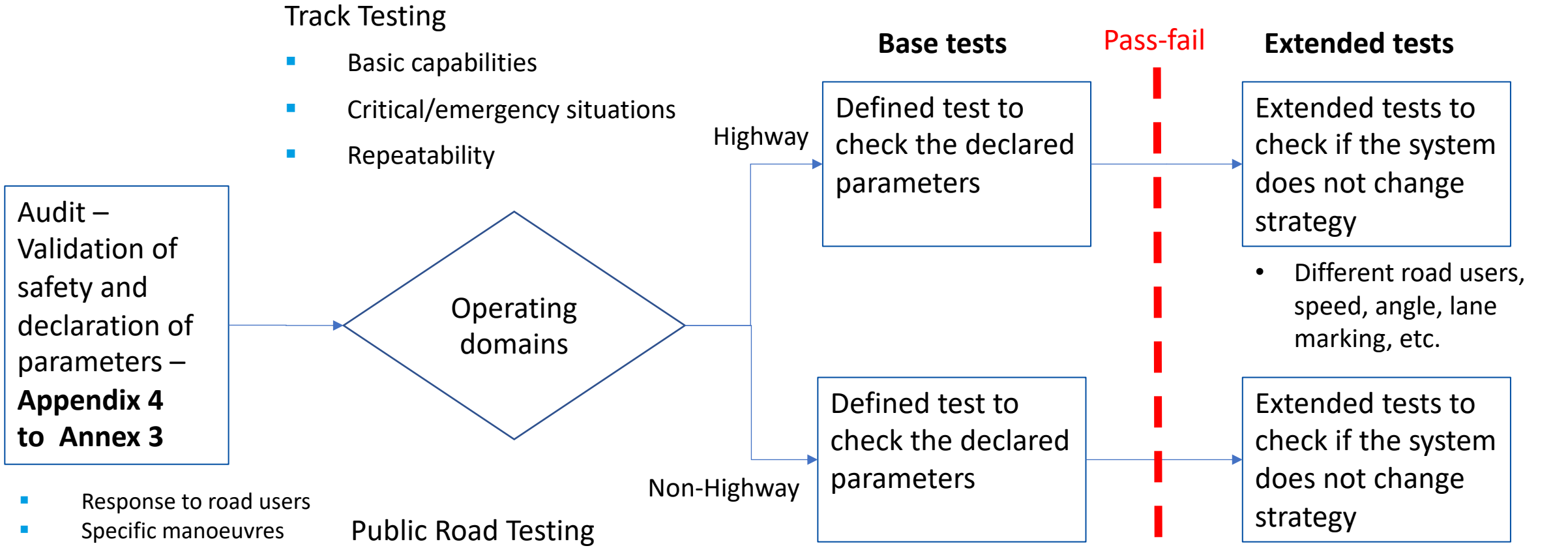


Re: ADAS-21-06

Assessment Pillar: Audit (Annex 3)



Track test framework



"Base Test" means a test scenario where the manufacturer shall declare a threshold for the missing boundary conditions (e.g. vehicle under test speed) up to which the system is able to safely control the vehicle.

"Extended Testing" means a set of test scenarios with a combination of test design variations to verify that the system does not unreasonably change the control strategy compared to the declared value and strategy in the base test, within the declared system boundaries.

Re: ADAS-21-05

Assessment Pillar: In-Service Monitoring & Reporting (Section 7)

Monitoring

- Learning from in-service data is a central component to the safety potential of DCAS
- **Objectives**: Safety confirmation, scenarios generation, safety recommendations
- Manufacturer shall maintain processes to monitor safety-critical occurrences resulting from DCAS operation
- Manufacturer shall notify the Approval Authority without undue delay of any severe accidents where DCAS was active, or active 5 seconds before the accident
- Any safety-critical occurence within system boundaries which may impact the broader safe use of DCAS, shall be investigated and notified to the Approval Authority (including applicable remediations)
- Approval Authority may request investigation results from the manufacturer if that Approval Autority becomes informed of a safety critical occurrence through sources other than a vehicle manufacturer

Periodic Reporting to the Approval Authority

List of occurrences for in-service reporting

Occurrence	Periodic Reporting (once a year)
1.a. Safety-critical occurrences known to the manufacturer	X
1.b. Aggregated distance driven with Paragraph 6 features switched on or active	X
2.a. Detection of prolonged driver disengagement, resulting in a warning escalation sequence	X
2.b. Activation of an emergency system, such as a Risk Mitigation Function, due to the continuous driver disengagement	X
3.a Detected system-level failures resulting in the unavailability of DCAS	X
3.b Detected DCAS-deactivations without prior warning to the driver	X
3.c Detected driver response to system deactivation	X

Re: ADAS-21-06

Next steps

Further development of the DCAS UN Regulation (so-called “Phase 2”) to address:

- System-initiated manoeuvres (lane changes and other)
- Driver disengagement monitoring by means of assessment of visual disengagement only (realization of the “Hands-off” technology)

Background:

- A study of hands-off technologies performed by Aachen University (FKA) and Munich Technical University (TUM)
- Provisions for automated lane changes established in UN-R157 that could serve as blueprint for system initiated lane changes
- Existing multi-pillar assessment in DCAS
- Experience with the indicated features in non-UNECE markets

Acknowledgements

The draft DCAS UN Regulation is a result of the work of the team of experts from Contracting Parties, industry and NGO's. Many experts had contributed to the drafting.

Thank you for your attention!

Link to the ADAS TF documents: https://wiki.unece.org/display/trans/ADAS

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