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A proposal for the Definitions of Automated Driving under WP.29 and the General Principles for developing a UN Regulation

- The following table reflects the general principles for automated driving systems as WP.29. These principles will be treated as guidelines for developing a new regulation related to automated driving systems at WP.29.
  - The control systems that intervening in case of emergency (AEB, ESC, Deadman, etc.) are not included in these definitions of automated driving.
  - The control functions that avoid dangers caused by unpredictable traffic conditions (goods/luggage dropping, frozen road, etc.) or other drivers' illegal driving behaviors are not considered in this table.
- The regulation on automated driving needs to have new specific performance requirements and verification tests under various conditions depending on each level.
- In discussing system requirements, it is desirable to organize them by level as well as by road way type (1: limited space; 2: motorway; 3: urban road).
- The following table shows the distinguish way of level of automated driving under WP.29 at this present considering the results of discussions so far and the assumed use cases. This table should be reconsidered appropriately in accordance with each concept of automated driving system to be placed on the market in the future.
- To identify the organizations that requested the modification in color: OICA in Red, EU in Blue, MLIT in Green

	Driver in the loop	**Driver in the loop (a)**	**Driver in the loop (b)**	**Driver out of the loop (return to request)**	**Driver out of the loop (Part Time)**	**Driver out of the loop (Full time)**
Outline of Classification	The vehicle cannot be driven without the driver's continuous operation. The driver may not perform secondary side-tasks	The driver and the system share dynamic driving tasks (see SAE's definitions) under limited driving environments and conditions The driver may not perform secondary side-tasks		The system occasionally performs all dynamic driving tasks.	The systems do not require the driver to provide fallback performance	The system always operates all dynamic driving tasks.
		The system offers to operate in response to the driver's request, or to operate the vehicle for the driver just for a limited period (short time).	The system offers to operate the vehicle for the driver for a certain period (Long time) which the driver requests.	Only secondary tasks with appropriate reaction time are allowed (e.g. texting, internet surfing, video-telephony)	All secondary tasks are allowed within the use case boundaries (e.g. motorway).	
Ref. SAE Level (J3016)	**1: (system takes care of longitudinal or lateral control, monitoring by the driver)**	**2: (the system takes care of both longitudinal and lateral control). Monitoring by driver (monitoring by system allowed?) necessary because the system is not able to detect all the situations in the use case. The driver shall be able to take over at any time**		**3: The system drives and monitors (fully?) the environment and is able to warn the driver sufficiently in advance if a takeover is necessary in the use case. Monitoring by driver is unnecessary.**	**4: the system is able to cope with any situations in the concerned use case. It may however request a takeover if the use case boundaries are reached (e.g. motorway exit)**	**5**
Consideration points on development of regulation	Same as current principle (manner)	Same as current principle (manner) Driver normally is forced to engage in dynamic driving tasks in order to address changes in the driving environment.	The regulation needs to consider an arrangement that ensures the driver's involvement in dynamic driving tasks even when the system is in control.	The regulation needs to ensure that the driver is in a condition that enables him or her to resume operation of dynamic driving tasks when the driver must resume the driving task (takeover demand by the system). ~~under other than the use cases.~~	The system is able to cope with all situations in the use case (fallback included), driver not necessarily needed.	Harmonization with the existing regulation on a driverless traffic system is necessary.
Examples of the necessary system performance requirements						
Override function by the driver	O (Necessary in general)	O (Necessary in general)	O (Necessary in general)	Δ (necessity depends on the system)	Δ (**Unnecessary during part time** ~~necessity depends on the system~~)	X （Unnecessary）
Aspects of arrangement that ensures the driver's involvement in dynamic driving tasks (driver monitoring, etc.)	Δ (detection of hands-off ~~as necessary~~i)	Δ (at least detection of hands-off as necessary).	O (detection of driver's readiness ~~distraction~~ for driving task: ~~at least hands-off detection~~, e.g. hands off detection, ~~detection of secondary tasks~~ driver availability recognition system, head and/or eye movement and/or input to any control element of the vehicle)	O (detection of seated/unseated, reminder to the driver to avoid that he falls asleep etc.).	O (System that depends on the driver's conditions that can resume to driving operation）	X （Unnecessary）
Aspects of arrangement that ensures the driver's resumption of dynamic driving tasks (transition periods to the driver, etc.)	X （Unnecessary）	X （Unnecessary）	O (Periods based on the condition which the driver does not involve in sub-tasks.)	O (sufficient periods that considers the driver's performance of sub-tasks).	O (periods that depends on the driver's conditions that can resume to driving operation)	X （Unnecessary）
System reliability (E-safety)	Reliability considering the driver override	Reliability considering the driver override	Reliability considering the transition periods to the driver	Reliability considering the transition periods to the driver performing sub-tasks	Reliability of the system's performance of safe driving	
Comprehensive recognition of surrounding environment (sensing, etc.)	Direction of travel only	The area to be monitored depends on the system function (Lateral and/or longitudinal directions)	The area to be monitored depends on the system function (Lateral and/or longitudinal directions)	Lateral and longitudinal directions	Lateral and longitudinal directions	
Recording of system status(inc. system behavior) (DSSA-Data Storage	X （Unnecessary）	X （Unnecessary）	O (the driver's operations and the system status**(inc. system behavior)**)	O (the driver's operations and the system status**(inc.**	O (the system status**(inc. system behavior)**)	

コメント [AL21]: This has to be covered by the system from level 3 (driver is not able to react quickly enough in this use case). Otherwise it a level 2 with the full responsibility to the driver to be able to take over at any time

コメント [AL22]: (a) and (b) could be merged.

コメント [AL23]: These two cases seem to be very similar. Where should we put system that partially monitor the environment?

コメント [AL24]: Should this situation be allowed? Is the driver in the loop when the vehicle drives by itself for a long time?

コメント [AL25]: Need to be split

コメント [AL26]: Or the system has to cope with unexpected situation when the driver is out of the driving tasks

System for ACSF, EDR, etc.)				**system behavior))**	
Security (E-security)	O (Necessary if the information communication in connected vehicles, etc. affects the vehicle control)				
Summary of the current conditions and the issues to be discussed (specific use cases)					
Roads where entry is regulated except for motor vehicles (inc. a part of urban roads)	○ Already put into practice ○ To be develop standardized (guideline etc) as necessary ・LKA (draft standards) ・ACC (no specific performance requirements) ・ACSF Cat.B1 (Steering Function hands-on) ・IPA (Intelligent Parking Assist)	・Automated parking by the driver's remote control (monitoring) (RCP [Remote Control Parking], to be discussed by ACSF-IWG?)		Partially outside of the scope of discussion at WP.1 (currently possible to be discussed at WP.29)	Partially outside of the scope of discussion at WP.1 (currently possible to be discussed at WP.29)
Roads exclusively for motor vehicles (inc. a part of urban roads)		(Under discussion) ・Categories A-E under ACSF (amendment of R79)		To be discussed with the amendment of Conventions by WP.1 taken into account ・Highway chauffeur	To be discussed with the amendment of Conventions by WP.1 taken into account
		・ACC+ACSF (Cat.B1, Cat.C (Basic Lane Change Assist), Cat.D [Smart LCA])	・ACSF Cat. E ・ACSF Cat.B2 (Continuous Lane Guidance hands-off)		
Urban roads		・To be discussed as the second phase of ACSF		To be discussed with the amendment of Conventions by WP.1 taken into account	To be discussed with the amendment of Conventions by WP.1 taken into account

コメント [AL27]: The subtasks allowed for the driver are very relevant for WP1. This can cover cat E ACSF systems

コメント [AL28]: B1 including ACC. Otherwise Level 1.

コメント [AL29]: B2 and E could be seen as level ¾ depending on the detection capabilities. What is a system that partially monitors the environment, but let the driver do subtasks (level 2 or level 3)?