Submitted by the expert from the European Commission with Japanese comments

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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.
- ○ The color represents who modified it: Results of 1st ad hoc in Blue font, EC in Red font and Yellow background, and MLIT (Japan) in Green font

	Monitor by Driver The driver may not perform secondary tasks			Monitor by System The driver may perform secondary task		
	Monitor by Driver	Monitor by Driver (a)	Monitor by Driver (b)	Monitor by System (Return to Driver Control on System Request)	Monitor by System Full Time under defined use case	Monitor by System only
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 is able to cope with any situations in the concerned use case, which includes the period of transition to driver control, the system drives and monitors (specific to the use-case) the environment and is able to warn the driver sufficiently in advance if a takeover is necessary in the use case. The system detects system limits and issues a transition demand if these are reached.	4: The system is able to cope with any situations in the concerned use case (fallback included), Driver not necessarily needed during specific use-case, e. g. Vallet Parking/ Campus Shuttle. It may however request a takeover if the use case boundaries are reached (e.g. motorway exit).	5: The system is able to cope with any situations on all road types, speed ranges and environmental conditions. No driver necessary.
Outline of Classification	The vehicle cannot be driven without the driver's continuous operation.	The driver and the system share dynamic driving tasks (see SAE's definitions) under limited driving environments and conditions		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)*. *GRRF expert group should quantify	The system offers to operate the vehicle for the driver for a certain period (Long time)* which the driver requests. Meaning of "Long time" is assumed to be hands off duration. *GRRF expert group should quantify	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).	
Vehicle Tasks	1. Execute either longitudinal (acceleration/braking) or lateral (steering) dynamic driving tasks when activated. May include some monitoring of the driving environment. 2. System deactivated immediately at the request of the driver	1. Execute longitudinal (accelerating, braking) and lateral (steering) dynamic driving tasks when activated. May include some monitoring of the driving environment. 2. System deactivated immediately upon request by the human driver. 3. No transition demand as such, only warnings. 4-A driver availability recognition function (could be realized as hands-on detection or monitoring cameras to detect the driver's head position and eyelid movement etc.) could evaluate the driver's involvement in the monitoring task. If the vehicle has safety function(s) such as driver monitoring system (e.g. monitoring cameras to detect the driver's head position and eyelid movement), minimal risk maneuver and predictable and reproducible takeover scenarios, hands off may be allowed to some extent.		1. Execute longitudinal (accelerating/braking) and lateral (steering) portions of the dynamic driving task when activated. Shall monitor the driving environment for operational decisions when activated. 2. Permit activation only under conditions for which it was designed. System deactivated immediately at the request of the driver. However the system may momentarily delay deactivation when immediate human takeover could compromise safety 3. system automatically deactivated only after requesting the driver to take-over with a sufficient lead time; may – under certain, limited circumstances – transition (at least initiate) to minimal risk condition if the human driver does not take over. 4. Driver availability recognition shall be used to ensure the driver is in the position to take over when requested by the system. Potential technical solutions range from detecting the driver's manual operations to monitoring cameras to detect the driver's head position and eyelid movement. It would be	1. Execute longitudinal (accelerating/braking) and lateral (steering) portions of the dynamic driving task when activated. Shall monitor the driving environment for any decisions happening in the use case (Emergency vehicles?). 2 Permit activation only under conditions for which it was designed. System deactivated immediately at the request of the driver. However the system may momentarily delay deactivation when immediate human takeover could compromise safety 3. Shall deactivate automatically if design/boundary conditions are no longer met- must be able to transfer the vehicle to a minimal risk condition. May also ask for a transition demand before deactivating. 4. Driver availability recognition might be used to ensure the driver is in the position to take over when requested. This can however be lighter solutions than for level 3 because the system is able to transfer the vehicle to a	1. Monitor the driving environment 2. Execute longitudinal (accelerating/ braking) and lateral (steering) 3. Execute the OEDR subtasks of the dynamic driving task- human controls are not required in an extreme scenario 4. System will transfer the vehicle to a minimal risk condition

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				beneficial if the vehicle displays were also used for the secondary tasks to improve the human takeover process. 5. Emergency breaking measures must be accomplished by the system and not expected from the driver (due to secondary tasks)	minimal risk condition in the use case. 5. Emergency breaking measures must be accomplished by the system and not expected from the driver (due to secondary tasks)	
Driver Tasks	1. Determine when activation or deactivation of assistance system is appropriate 2. Monitor the driving environment. Execute either longitudinal (acceleration/braking) or lateral (steering) dynamic driving task 3. Supervise the dynamic driving task executed by driver assistance system and take over immediately when required by the environment and the system (warnings)	1. Determine when activation or deactivation of the system is appropriate. 2. Execute the OEDR by monitoring the driving environment and responding if necessary (e.g. emergency vehicles coming). 3. Constantly supervise the dynamic driving task executed by the system. Although the driver is physically disengaged, mentally the driver must be engaged and must immediately intervene when required by the environment or by the system (no transition demand by the system, just warning in case of misuse or failure). 4. The driver may not perform secondary tasks which will hamper him in taking over immediately when required.		1. Determine when activation or deactivation of the automated driving system is appropriate. 2. Does not need to execute the longitudinal, lateral driving tasks and monitoring of the environment for operational decisions in the use case. 3. Shall remain sufficiently vigilant as to acknowledge the transition demand and , acknowledge vehicle warnings, mechanical failure or emergency vehicles(increase lead time compared to level 2). 4. The driver can turn his attention away from the complete dynamic driving task in certain domains but can only perform secondary tasks with appropriate reaction times.	1. Determine when activation/deactivation of the automated driving system is appropriate. 2. Does not need to execute the longitudinal, lateral driving tasks and monitoring of the environment in the use case. 3. May be asked to take over upon request within lead time. However the system does not require the driver to provide fallback performance under the use case. 4. The driver could perform a wide variety of secondary tasks in the use case.	1. Activate and deactivate the automated driving system. 2. Does not need to execute the longitudinal, lateral driving tasks and monitoring of the environment during the whole trip. 3. May be asked to take over upon request within lead time. However the system does not require the driver to provide fallback performance under the whole trip. 4. The driver could perform a wide variety of secondary tasks during the whole trip. 5. Determine waypoints and destinations
Consideration points on development of vehicle 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. A driver availability recognition function (could be realized as hands-on detection) could evaluate the driver's involvement in the monitoring task. Basically there is no transition demand from the system rather a warning in case of misuse or failure. However there is transition demand if hands off is allowed. With respect to systems of level 2b consideration should be given to the minimum level of the data capture concerning system status. Furthermore, for system of level 2b consideration should be also given for requirement for minimal risk maneuver.		The regulation needs to require that the driver is in a condition (driver availability) that enables him or her to resume operation of dynamic driving tasks when the driver must resume the driving task (transition demand by the system) under other than the use cases. The system shall be able to detect its own functional limitations. With respect to systems of level 3 consideration should be given to the minimum level of the data capture concerning system status. Furthermore, for system of level 3 consideration should be also given for requirement for minimal risk maneuver and emergency braking. Driver (availability recognition) activation monitoring ~~might~~should be used to ~~only~~allow secondary tasks with appropriate reaction time are allowed. Potential technical solutions range from detecting the driver's manual operations to monitoring cameras to detect the driver's head position and eyelid movement. To enable predictable and reproducible takeover scenarios it would be beneficial if vehicle displays that are controlled by the automation system would be used for secondary tasks (e.g. texting, internet surfing, video-telephony). If a takeover request occurs the secondary task content on the display is faded out and the takeover request is displayed instead	The system is able to cope with all situations in the use case (fallback included), driver availability may be required, not necessarily needed. (OICA homework)	The system is able to cope with all situations in the use case (fallback included), driver availability is not necessary any more.
Consideration points on ~~Harmonization with~~ traffic law (e. g. WP.1)				Allowed secondary tasks		Note: Harmonization with the existing regulation on a driverless traffic system is necessary.
Examples of the necessary system performance requirements						

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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)	X （Unnecessary）
Aspects of arrangement that ensures the driver's involvement in dynamic driving tasks (driver monitoring, etc.)	Δ (detection of hands-off)	Δ (at least detection of hands-off as necessary).	O (detection of driver's readiness for driving task: e.g. hands off detection, 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 System for ACSF, EDR, etc.)	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. system behavior)**)	O (the system status**(inc. 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)	ACSF is considered to be level 2 at the present time, but depending on each country's national traffic law, even the Cat. B2 and Cat. E may be regarded as level 3 according to kinds of driver monitoring systems.		
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	