Submitted by the representative of Japan

Informal document **WP.29-166-21**
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Guidance to GRs concerning Automated Driving Technology

1. Purpose

At the 164th session of WP.29 GRRF sought guidance on how to proceed with the development of technical regulations aimed at permitting the advancement of automated driving. WP.29 tasked the ITS/AD Informal Group with developing guidance for the GRs.

The ITS/AD Informal Group has met twice to develop both new Terms of Reference for their activities (recognising the changed mandate to consider automated driving in addition to ITS) and to develop the GR guidance.

At the conclusion of the second meeting the ITS/AD Informal Group agreed to present the working paper to GRRF for consideration and comment in advance of further consideration by them at the 165th (March 2015) session of WP.29 where the document is expected to be finalised and adopted. The text below represents the status of the work of the ITS/AD Informal Group but with annotations inserted by the chair of GRRF and reflecting the comments from GRRF during its 79th session.

Recognising the urgency of this work, WP.29 has directed that provided the ITS/AD Informal Group can make progress, GRRF can continue its work on the basis of the understanding reached with the ITS/AD Informal Group.

It is generally accepted that the current description of levels, for example those of the SAE, are not sufficiently precise for use as definitions in regulatory text. It is therefore necessary to develop better understanding of the distinction between "assistance", "automated" and "autonomous". However, it is also recognised that, at this time, no work is planned to accommodate autonomous technology in the technical regulations.

It is also recognised that understanding of the technology, its impact in real traffic and its interaction with the infrastructure are developing rapidly. On this basis this document should be considered as being subject to change and should be revisited from time to time as understanding develops.

2. ITS/AD Draft paper

Issues related to Automated Driving Technology and Possible Guidance to GRRF

2.1. Background

a) Vehicle manufacturers are individually developing technologies related to the automated driving system such as automated lane keeping and lane change system, integrated and advanced lane change support system, dead-man system *(where the vehicle is brought automatically to a stop where there is no obvious driver engagement)*, etc. These technologies are moving closer to practical use.

b) These technologies are expected to contribute to road traffic safety if they are introduced properly. The deployment of such technologies in appropriate manner, therefore, should be promoted.

c) Currently, the Automatically Commanded Steering Function, defined in Regulation 79, is restricted to operate only under 10km/h.

d) It is reasonable to discuss whether R79 should be amended to permit the approval of technologies that provide dynamic control at higher speeds than currently permitted and, if so, what provisions may be required to ensure their safe application.

2.2. TOR of Informal Group on ITS / Automated Driving (IG-AD)

a) The TOR of IG-AD indicate that the IG-AD will discuss the practical application of Automated Driving Technologies (ADT) which are considered in line with the Vienna and Geneva Conventions. The outcome of the discussion will be submitted to WP29 (refer to TOR 5). Meanwhile, discussions on Autonomous Driving Technologies that envisage autonomy beyond that permitted by those conventions, will remain as an exchange of views (refer to TOR 6).

b) Therefore, in parallel with discussions in the IG-AD on the definition of Automated Driving Technology from the legal point of view, practical applications of the Automatically Commanded Steering Function on the basis of TOR 5 and consequent possible amendments of R79 could be discussed in GRRF.

Categories of Automated Driving in TOR	**Related laws and Regulations**	**Schedule**
Automated Driving technologies (Advanced Drivers Assistance System only)	Automatically Commanded Steering Function (R79)	From January, 2015 till November, 2015
Autonomous Driving technologies (including some Automated Driving technologies)	—	From January, 2015

2.3. Possible discussion items on Automated Driving Technologies

2.3.1. Concept of "designed to assist drivers"

a) While discussion in the relevant GRs on driver assistance technologies would be limited to technologies designed to assist drivers" on the basis of Vienna and Geneva Conventions, it would be necessary first for the IG-AD to agree the distinction between "automated assistance systems" and "autonomous systems" in order to help identify what technologies should be regarded as complying with the Conventions. However, since it would be clear that at least certain automated driving technology systems would be within the scope of both conventions, guidance by WP29 to start the discussion on such technologies, with the assumptions, could be made to the relevant GRs.

b) Automated driving technology which executes a portion of the dynamic driving task shall be designed so that:

i. They provide a means to keep the driver engaged to ensure that he/she constantly supervise the dynamic driving task executed by an automation system or a function of that system,

ii. they deactivate immediately with request for immediate control by the driver

iii. the driver's intention at any time shall be reliably reflected and functions of the system that cause a change in the dynamic behaviour of the vehicle (e.g. lane change) cannot be fulfilled without the driver providing a positive input to instigate that particular function. Exceptions to this requirement may include functions designed for operation to avoid loss of control or collision.

c) The narrative definitions below have been taken from the SAE and can be used as a starting point to understand the level of assistance/automation:

i. Level 1 DRIVER ASSISTANCE
The driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task

ii. Level 2 PARTIAL AUTOMATION
The driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task

d) The IG-AD should consider developing clarifications of these levels (and further levels if necessary) to provide comprehension of the above Levels 1 and 2 of "assistance" versus "automation" versus "autonomy"

in the context of international regulation.

e) Partial automation systems shall be so designed as to provide a continuous integrity check, recording any faults, failures, implausible messages etc., and shall record such events in a non-volatile memory. These data shall be accessible for the purposes of roadworthiness and maintenance inspection through a standardised scan tool.

f) The partial automation system shall provide the driver with timely, appropriate and understandable information concerning its status (engaged / dis-engaged) condition (plausibility checks, fault monitoring etc.).

g) The system shall be designed such that in the event of a defect that renders the system unable to fulfil the full range of control that the driver may expect, it shall not engage on driver request and, if already engaged, will warn the driver that he/she must resume control.

h) The system shall be designed to ensure the attentiveness of the driver during periods of use of the automated function.

i) The driver's intention at any moment in time shall be reliably reflected and systems shall be designed such that they deactivate immediately in response to a driver's request for immediate control,

j) Systems that are designed to provide automation of the lateral control of the vehicle shall ensure that the function (e.g. lane change) is preceded immediately by a positive input from the driver. This requirement shall not apply where the lateral manoeuvre is required as part of an emergency avoidance procedure.

2.3.2. Others

Discussion concerning electronic security, cybersecurity, roadworthiness inspection provisions (OBD), EDR, etc. could also be made in the IG-AD but should not preclude consideration by the appropriate GRs.

3. Guidance to GRRF (provisional draft)

a) Scope of considerations

Technological requirements for Automatically Commanded Steering Function related to technologies" designed to assist drivers" should be considered based on the points of sections 1, 2 and 3 above.

b) Targeted systems

Targeted systems would be:

i. **Driver assistance** systems functioning in normal condition where a driver can always override its control. (Example: following steering operations)

lane keeping assistance "designed to assist drivers"

ii. **Automated (Partial Automation) assistance systems** functioning under the specific command of the driver

Lane keeping and lane changing operation "designed to assist drivers" in a restricted area which has multilane road sections with constructional separation of the two directions of traffic and no mixed traffic with pedestrians, cyclists and oncoming vehicles

- Define requirements to permit development of new automatically commanded steering functions (ACSF) for lane changing and lane keeping operations.
- Lane keeping operations not limited to existing LKAS corrective steering.
- The driver can be hands-on or hands-off, but monitoring the dynamic driving task and the driving environment at all times, ready to take control when required: this should be ensured via a combination of in-use requirements and design requirements which should monitor the driver activity (to some extent) and define a minimum level of performance and functionality.
- Lane changing operations are targeting specific use cases such as overtaking or avoiding obstacles. Depending on the situation, the lane change can be initiated by the system (in emergency situations, e.g. an evasive manoeuvre) or by the driver. In all cases the driver shall be able to override/abort the lane

change. The technology shall provide a function to ensure/verify that the driver is monitoring the automated driving function and is available to abort or override its function.

iii. **Autonomous (full automation) systems** functioning without the need for a specific command from the driver (beyond a general command permitting autonomous control)

– This level of technology is not within the current scope of activity.

c) Possible points to note

i. Definition of driver input required to provide stimulus for the control mode of an automated system

ii. When the control mode makes a transition from a system to a driver, how to ensure the transition safe.

iii. How to prevent adverse effects on other vehicles and other traffic.

iv. The following should also be considered depending on the system; a limited use in specific road environment where safety can be ensured.(e.g. the expressway/highway where the ongoing vehicle lanes are separated by a median from the oncoming vehicle lanes)

v. Adequate safety measure provision should be considered so as not to inhibit current development of such systems. These shall include, but not be limited to, HMI, system integrity monitoring, status recording.

4. Others

This Guidance is limited to the main recommendations considered to be of critical importance. However, systems that arrive on the market in the future may require guidance for aspects that are not covered. Changes over time may also make some of the principles obsolete or unnecessary. The present Guidance shall therefore be revised as appropriate, and this task should be assigned to the IG-AD (in some cases in consultation with the respective GR group that may govern a specific system in question), since the present Guidance deal with ADT in general and not with specific systems.