Submitted by the Chair of
the IWG on ACSF

Informal document **GRVA-05-25**
5th GRVA session, 10 – 14 February 2020
Provisional agenda item 4(a)

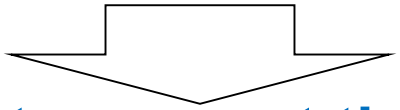
Status of the Informal Working Group on ACSF

Summary of ACSF IWG Meetings – 24th and 25th Session

Schedule of IWG on ACSF

- **24th meeting** was held from 18th to 20th November 2019 (Barcelona, Spain)

- **25th meeting** was held from 21st to 24th January 2020 (Tokyo, Japan)



IWG ACSF would like to present the draft regulation for ALKS and the last points for discussions

Overview of the Draft UN Regulation No. [X]

Uniform Provisions concerning the Approval of Vehicles with regard to Automated Lane Keeping System

1. Scope and Purpose
2. Definitions
3. Applicatin of Approval
4. Approval
5. System Safety and Fail-safe Response
6. Human Machine Interface / Operator Information
7. Object Event Detection and Response
8. Data Storage for Automated Systems – to be provided by EDR/DSSAD IWG
9. Cybersecurity and Software Update – to be reviewed by CS/OTA TF
10. Modification of Vehicle Type and Extention of Approval
11. Conformity of Production
12. Production Definitively Discontinued
13. Names and Addressed of Technical Services Responsible for Conducting Approval Tests and of Typpe Approval Authorities

Annexes

1. Communicatoin
2. Arrangements of Approval Marks
3. System Informatio Data
4. Special Requirements to be Applied to the Safety Aspects of Electronic Control System [and Audit] - to be provided by VMAD IWG
5. Test Specifications for ALKS

Scope & Definitions

- This Regulation applies to vehicles of Category M1.
- “Automated Lane Keeping System (ALKS)” for low speed application is a system which is activated by the driver and which keeps the vehicle within its lane at the speed of 60 km/h by influencing the lateral movement of the vehicle and controls the longitudinal movement of the vehicle for extended periods without further driver command.

System Safety and Fail-safe Response

■ General Requirements

- Perform all dynamic driving task, manage all situations including failures, and shall not endanger safety of vehicle occupants & other road users
- Not cause any ‘rationally foreseeable and preventable’ collisions
- Comply with traffic rules relating to the dynamic driving task in the country of operation
- Exercise control over systems to maximize driver controllability (e.g. demist, windscreen, wipers and lights)
- Continuously perform self-check
- Implement measures to avoid reasonably foreseeable misuse/tampering
- No activation of the system when the system can no longer meet the requirements of this Regulation
- Implement process to manage the safety and continued compliance of the ALKS system over lifetime

■ Dynamic Driving Task

- Keep the vehicle inside the lane in a stable lateral position
- Detect a vehicle driving beside and adjust speed/lateral position
- Maximum speed system is allowed to operate is 60 km/h
- Adjust the distance to the vehicle in front

The minimum following distance shall be calculated using the formula:

$d_{min} = v_{ALKS} * t_{front}$

Present speed of the ALKS vehicle		Minimum time gap	Minimum following distance
km/h	m/s	s	m
7,2	2,0	1,0	2,0
10	2,78	1,1	3,1
20	5,56	1,2	6,7
30	8,33	1,3	10,8
40	11,11	1,4	15,6
50	13,89	1,5	20,8
60	16,67	1,6	26,7

- Bring the vehicle to a complete stop behind a stationary vehicle/road user/blocked lane of travel
- Detect the risk of an imminent collision and perform EM
- Avoid a collision with a leading vehicle decelerating up to full braking
- Avoid a collision with a cut-in vehicle up the blow threshold:

$$TTCLaneIntrusion > vrel/(2 \cdot 6\text{m/s}^2) + [0.35s^*]$$

*Parameters defining a manoeuvre that shall be avoided have to be reviewed.

- Avoid a collision with pedestrian – UN R152 requirement to be satisfied

■ EM

- Carried out in case of an imminent collision risk
- Longitudinal deceleration > 5.0 m/s² be considered to be an EM
- Full braking performance a/o evasive manoeuvre in lane*
- EM shall not be terminated unless the imminent collision risk disappeared or the driver deactivated the system
- After EM is terminated the system shall continue to operate
- If the EM results in the vehicle being standstill the signal to activate the hazard warning lights shall be generated

* Possibility of lane change is expected once appropriate technical requirements for such a function is established.

■ TD

- System shall detect its limits and always issue a transition demand with sufficient lead time
    - planned event: sufficiently before the event
    - unplanned event/failure: immediately upon detection
- System shall continue to operate work properly during the whole transition phase
- TD terminated when the system is deactivated or MRM has started
- a minimum risk manoeuvre shall be started automatically, earliest 10 s after the start of the transition demand
- Vehicle shall not be brought to standstill during TD (except required by the traffic situation (then hazard warning light within 5s)
- In case of severe ALKS or severe vehicle failure MRM may be initiated immediately

■ MRM

- During MRM the vehicle shall be slowed down inside the lane* or remain on an appropriate trajectory
- Aim of achieving a deceleration demand not greater than 4.0 m/s²
- The hazard warning lights shall be activated with the start of MRM (until deactivated manually)
- MRM shall only be terminated once the system is deactivated or the system has brought the vehicle to a standstill.
- The system shall be deactivated at the end of MRM

* Possibility of lane change is expected once appropriate technical requirements for such a function is established.

Human Machine Interface/Operator Information

■ Driver Availability Recognition System

- Driver presence:
  - Check driver's presence in the seat (1 s)
  - Check use of the seat belt
  - When driver presence not confirmed, TD to be initiated

- Driver Availability:
  - At least two individual criteria need to be met (rational of the criteria to be explained to TS) in the 30 sec interval
  - When Driver Availability not confirmed, warning is provided until appropriate driver's action detected or transition demand is initiated (15 s after warning)

■ Activation, Deactivation and Driver Input

- Dedicated means shall be provided for activation and deactivation
- System shall be default off
- Activation Conditions:
  - Driver Present,
  - Driver Available,
  - no failure affecting the safe operation/functionality of the ALKS is present,
  - DSSAD is operational,
  - the environmental and infrastructural conditions allow the operation,
  - positive confirmation of system self-check, and
  - the vehicle is on roads where pedestrians and cyclists are prohibited and which, by design, are equipped with a physical separation that divides the traffic moving in opposite directions and prevent traffic from cutting across the path of the vehicle
- Deactivation Conditions:
  - Dedicated means,
  - Driver override by steering (thresholds),
  - Driver override by braking + hands on steering, acceleration + hands on steering, or
  - TD/MRM + hands on steering + attentive
- During EM deactivation may be delayed
- On deactivation of the system, there shall not be an automatic transition to any function which provides continuous longitudinal and/or lateral movement of the vehicle (e.g. ACSF-B1 System).

■ System Override

- Thresholds need to be defined to avoid unintentional override/input
- Driver Attentiveness shall be confirmed by following criteria:
    - Driver gaze direction (road ahead),
    - Driver gaze direction (the rear view mirrors), or
    - Driver head movement,
- Driver input to steering control (when the input exceeds a reasonable threshold): override the lateral control function of the system
- Driver input to the braking control (resulting in a higher deceleration than that induced by the system or maintaining the vehicle in standstill by any braking system): override the longitudinal control function of the system
- Driver input to the accelerator control (within fulfilling requirements): override the longitudinal control function of the system
- Any driver input to the accelerator or brake control shall immediately initiate a TD

■ Information to the driver

- The following information shall be provided to the driver:
  - System status: unavailability, display when activated, change to deactivation
    - Activation: dedicated optical signal (tell-tale and something more)
    - Deactivation: acoustic (unless deactivation after TD)
  - Any failure affecting the operation of the system: optical
  - TD: optical + acoustic or haptic, and
  - after 4 s, escalation (of package of warning), haptic warning mandatory
  - MRM: optical + acoustic or haptic
  - EM: optical

Object Event Detection and Response

- Forward detection range: min. 46 m
- Lateral detecting range: to be sufficient to cover the full width of the lane immediately to the left/right
- Declared detection range to be verified by TS
- Manufacturer shall provide evidence that effect of wear and aging does not reduce sensing system performance below minimum detection range

Annex 5 Test Specifications for ALKS

Para	Description	No Object	Passenger Car			Powered Two Wheeler			Pedestrian			Obstacle		
		RM	RM	EM	NAS	RM	EM	NAS	RM	EM	NAS	RM	EM	NAS
4.1 Lane Keeping														
	Lane Keeping and stability	X												
	Parallel vehicle drifting towards ego vehicle		X			X								
4.2 Avoid a collision with a road user or object blocking the lane														
	Stationary vehicle					X								
	Stationary adult pedestrian								X					
	Adult pedestrian crossing the lane								X	[X]				
	Object representing a blocked lane											X		
	Object partially blocking the lane											X		
	Multiple obstacles in the lane					X								
4.3	**Following a lead vehicle**													
	Following Distance Test		X	X		[X]	[X]							
	[Following Stability Test (lateral offset)]		X			[X]								
4.4	**Lane Change of another vehicle into the lane**													
	Cut in Tests with an accelerating cut in vehicle		X			[X]								
	Cut in Tests with a constant speed cut in vehicle		X	X		[X]	[X]							
	Cut in Tests with a decelerating cut in vehicle		X	X	X	[X]	[X]							
4.5	**Stationary obstacle after lane change of the lead vehicle**													
	Cut out Tests		X	X		X	X		X	X		X	X	
4.6.	**Field of view**													
	[Dynamic Field of View Tests (Forward)]					[X]			[X]					
	[Dynamic Field of View Test (Lateral)]					[X]								

RM	Regular Manoeuvre.
EM	Emergency Manoeuvre.
NAS	Non-Avoidable Situation.

Detail to be further reviewed

	Potential test area that can be selected by the technical service in addition to the mandatory testing. Note pass/fail criteria for NAS tests does not apply, mitigation strategy will be assessed by the technical service.
X	Mandatory test area to be tested by the technical service. Each 'X' indicates that a mandatory single test is to be carried out. Additional testing may be carried out in this area at the request of the technical service with varied parameters compared to the testing already performed.
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Summary

- IWG ACSF discussion is almost finished.
- IWG ACSF focused only on the low speed system in order to finalize the draft proposal for submission to 5th GRVA.
- Work Plan until 6th GRVA:
  The last discussion points are to be discussed/finalized among the expert members