

# Candidate of LKAS requirements

- ① Japanese Guideline
- ② ISO
- ③ LDWS
- ④ ITS Guideline
- ⑤ Others (Japanese original idea)

Each cell painted in this color is the first proposal at the present considered by Japan.

Items	Option	Reference	Requirements	Reasons
1. Definition	1	①	LKAS is the device which are provided by motor vehicle manufacturers for the purpose of reducing the operating load of the driver when he attempts to keep his motor vehicle within the lane.	To align with the definition of Japanese Guideline.
	2	②	The main system function of a Lane Keeping Assistance System (LKAS) is to support the driver in keeping the vehicle within the current lane. LKAS acquires information on the position of the vehicle within the lane and, when required, sends commands to actuators to influence the lateral movement of the vehicle. LKAS provides status information to the driver.	To align with the definition of LKAS ISO.
	3	⑤	LKAS is the system which detects lane marking and supports the driver to keep the vehicle within the lane. However, such systems which purpose only warning or which keep the vehicle within the lane by only braking control to the driver are out of the scope.	In order to clarify that such systems which purpose only warning or which keep the vehicle within the lane by only braking control to the driver are out of the scope.
2. Scope	1	R79	M, N, O	To align with the scope of R79.
	2	③	Category 2 and 3 (M2, M3, N2, N3)	To align with the scope of LDWS.
	3	⑤	M, N	Mainly, LKAS is assumed to be installed in vehicles category M and N.
3. Operational requirements				
A. Requirements for activation				
Operating speed	1	①	LKAS may start to operate above 50km/h. (LKAS shall not start to operate below 50km/h.)	Because LKAS is the system assumed to be operated on an expressway.
	2	③	LKAS shall start to operate at least at vehicle speeds above 60km/h when all other operating conditions for are satisfied. (LKAS may start to operate less than 60km/h.)	To align with the requirement of LDWS.
	3	②	LKAS shall be operational between 72km/h and the maximum speed which is 108km/h or the maximum possible vehicle speed, whichever is less. (In this speed range, when all the operating conditions are satisfied, the system shall start to operate.)	To align with the requirement of LKAS ISO.
Acceleration etc. caused by the operation of the system	1	①	The lateral acceleration caused by the system operation while cornering shall not exceed $2 \text{ m/s}^2$ . In case of the system keeping the center of the lane, the lateral acceleration caused by the system operation while straight running shall be $0.5 \text{ m/s}^2$ or less. And also in case of the system operating near the lane marking, the lateral acceleration caused by the system operation while straight running shall be $1 \text{ m/s}^2$ or less.	The value of lateral acceleration ( $2 \text{ m/s}^2$ ) is the one which is occurred while running on the curved road of the Japanese expressway with the speed limit (80km/h).
	2	⑤	The lateral acceleration caused by the system operation shall not exceed $[xx] \text{ m/s}^2$ .	Because if there is no limitation of the value of lateral acceleration occurred by the system operation, the driver might misunderstand that the system could go through any curved road. And also in order to prevent a rollover occurred by rapid steering operation by the system.
	3		Lateral acceleration shall not exceed $3 \text{ m/s}^2$ , and lateral jerk shall not exceed $5 \text{ m/s}^3$ .	To align with the requirement of LKAS ISO.
	4	②	The lane keeping action shall not cause a longitudinal deceleration larger than $3 \text{ m/s}^2$ . If the lane keeping action causes a longitudinal deceleration larger than $1.0 \text{ m/s}^2$ , this shall not cause a speed reduction more than 18km/h.	To align with the requirement of LKAS ISO.
Road shape	1	③	At least, the system shall be operational on a curved road which has the radius more than 250m. (LKAS may operate on a curved road which has the radius less than [250]m.)	To align with the requirement of LDWS.
	2	⑤	At least, the system shall be operational on a straight road which has the radius more than [1000]m. (LKAS may operate on a curved road which has the radius less than [1000]m.)	In order to be accepted such kind of LKAS which is operational on a straight road.
	3	②	As the one of examples, The system shall be tested on a curved road which has the radius 800m.	To align with the requirement of LKAS ISO.
Lane marking	1	③	The system shall be operational on the lane marking which is required in the LDWS regulation.	To align with the requirement of LDWS.
	2	⑤	The system shall be operational on the lane marking which is required in each countries.	The detection systems of LKAS for lane marking must be more accurate than one of LDWS.
LKAS performance requirement	1	⑤	When the LKAS is tested, the value of departure of the outside of the tire closest to the lane markings shall not exceed more than [XX]cm.	In order to prevent lane departure accidents certainly. And also in order to prevent lane departure triggered by the system operation. This requirement is prescribed in the test procedure of LKAS..
	2		When the LKAS is tested, the outside of the tire closest to the lane markings shall not depart from the lane marking.s.	In order to prevent lane departure accidents certainly. And also in order to prevent lane departure triggered by the system operation This requirement is prescribed in the test procedure of LKAS.
	3	②	When the LKAS is tested, the outer edges of the tyres of the vehicle shall not exceed the lane boundary more than 0.4m for light vehicles, and 1.1m for heavy vehicles.	To align with the requirement of LKAS ISO
	4	GRRF74-40	When the LKAS is tested, it shall start to activate at least when the outside of the tire closest to the lane markings crosses a line 0.3m beyond. (The value of departure is not specified.)	To align with the requirement of LDWS. This requirement is prescribed in the test procedure of LKAS..

Items	Option	Reference	Requirements	Reasons
<b>B. Requirements for deactivation</b>				
Functional limitation of the system	1	①	An announcement shall be made through acoustic and optical means in the following cases. (a) The operation of the device is cancelled without the driver's intention while the device is operating. (b) There is the possibility that the device can no longer render the assist to the running of the vehicle within the lane while the device is operating.	Because an announcement might not be recognized by the driver immediately by only an optical means, plural means including an acoustic means are provided to the driver.
	2	④	An announcement shall be made through at least two means out of optical, acoustic and haptic in the above (a) and (b).	It is referred to LDWS regulation paragraph 5.4.1.. And also following "Guidelines on establishing requirements for high-priority warning signals" paragraph 3.8., and "Design Principles for Control Systems of ADAS" paragraph 4.3.
Requirement for the end of the system operation		①, ②	When the system operation is ended, it shall not be ended suddenly but shall be faded out smoothly.	To align with the requirement of Japanese Guideline and LKAS ISO.
<b>C. Requirements relevant to driver</b>				
Holding a steering wheel by the driver	1	①	The operation <b>shall be cancelled</b> when there is no steering operation of the driver for more than 5s.	In order to make the driver understand that LKAS is not the autonomous steering system.
	2	④	An announcement shall be made through at least two means out of optical, acoustic and haptic if there is no steering operation of the driver for a certain time, after that the system operation <b>shall be continued</b> .	Because to keep the safety by continuing the system operation if the driver's situation recognition is become uncertain. (Concern : Does that requirement increase driver distraction? )
	3		An announcement shall be made through at least two means out of optical, acoustic and haptic if there is no steering operation of the driver for a certain time, after that the system operation <b>may be cancelled</b> . (equal to "may be continued")	In order to make the driver understand that LKAS is not the autonomous steering system. Because the driver might be confused if the system operation is cancelled without any announcement, .
	4		An announcement shall be made through an optical means if there is no steering operation of the driver for a certain time, after that the system operation <b>shall be continued</b> .	In order to make the driver understand that LKAS is not the autonomous steering system. (Concern : Does that requirement increase driver distraction? )
	5		An announcement shall be made through an optical means if there is no steering operation of the driver for a certain time, after that the system operation <b>shall be cancelled/may be cancelled</b> . (equal to "may be continued")	In order to make the driver understand that LKAS is not the automated driving system.
	6		⑤	If there is no steering operation of the driver for a certain time, the system operation <b>shall be continued/may be continued</b> .
Override	1	①, ②, ④	Override steering operation by the driver <b>shall</b> be given priority to the system.	It is basic requirement for driving assistance. Due to following Vienna convention. Due to following "Design Principles for Control Systems of ADAS".
	2	④	Override steering operation by the driver <b>may</b> be given priority to the system.	(Concerns : Inconsistency with Vienna convention, inconsistency with AEBS)
	3		The system operation <b>shall</b> be given priority to steering operation by the driver.	(Concerns : Inconsistency with Vienna convention, inconsistency with AEBS)
Condition of non-operational being allowed	1	③	The system operation may be suppressed when there is a driver's action which indicates an intention of a lane change.	To align with the requirement of LDWS.
	2	②	Specific driver's actions, e.g. the turn signal, can be considered as a suppression request.	To align with the requirement of LKAS ISO.
	3	⑤	No requirement	It is considered to be included in the requirement of override.
<b>D. Information for driver</b>				
ON/OFF switch	1	①, ④	The device may be equipped with a switch whereby at driver's intention the driver can select the status of operational/non-operational of the device.	In order to be decided the system status of operational/non-operational by driver's will. Due to following "Design Principles for Control Systems of ADAS".
	2	③	The device may be equipped with a means to deactivate the LKAS function, and the LKAS function shall be automatically reinstated at the status of operational of each new ignition "on" (run) cycle.	To align with the requirement of LDWS.
	3	⑤	The device shall not be equipped with a means to deactivate the LKAS function, that means the LKAS function shall always be at the status of operational.	In order to make the safety system operate certainly.
Malfunction warning /Status display	1	①, ③, ④	The status of the switch operational/non-operational, the status of the system operating/not operating, and the situation of system malfunctions shall be indicated to the driver through an optical means.	In order to indicate the status of the system to the driver correctly.
	2	⑤	In the case of above ①, the teltail with the specific symbol for LKAS shall be used.	In order to indicate the status of the system to the driver more understandably.
	3		In the case of above ①, the teltail with the specific color for LKAS shall be used.	In order to indicate the status of the system to the driver more understandably.
	4	②	The teltale with the symbol referred to ISO2575 shall be used.	To align with the requirement of LKAS ISO.
Information to be known to users		①	Necessary information shall be known appropriately to the users through the instruction manuals, caution labels and so forth.	In order to make the driver understand usage correctly. It is one of the measure for prevention of over reliance.
<b>E. The other requirements</b>				
Failsafe	1	①	The device shall be capable of monitoring the operating conditions of the device concerned so that any malfunction may be detected. And in cases where the device should encounter any malfunction, the device shall have a function which makes it possible for the operation of the device concerned to be stopped safely.	In order to indicate malfunctions to the driver, and to stop the device safely same as the other electronic devices.
	2		The principal functions of the device shall be preferably of a dual system.	This item is not required in AEBS and LDWS.
Conformity with the safety aspects of complex electronic control systems		R79 etc.	Concerning the conformity with the safety aspects of complex electronic control systems, the LKAS shall satisfy the requirement in Annex CEL (e.g. Annex 6 in R79).	In order to satisfy the requirement of the conformity with the safety aspects of complex electronic control systems.
EMC		③	The LKAS shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by compliance with Regulation No. 10, 03/04 Series of Amendments	In order to satisfy the safety requirement of EMC.