

Hand-off Warning Time of LKA

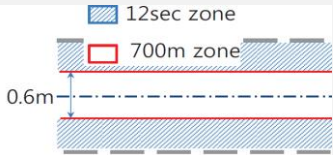
(Cat. B1)

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Hand-off warning time results by survey

(source : Korea Automobile Importer and Distributers Association, etc.)

Maker	Model	Hand-off warning time	Warning means	Whether to deactivate System or not	Note
HONDA	LEGEND, PILOT	15s	Acoustic & message	Deactivation (with acoustic & message)	
NISSAN	Serena	5s	Acoustic	?	SOURCE : News paper
BMW	730d 740d 730 Ld 740 Ld 740 Li 750Li xDrive	8s	Optical & acoustic	Deactivation*	*until reholding steering control or applying accelerator
AUDI	AUDI A6,7,8, Q7	10s	Optical & haptic (Head-up display)	Not*	*continuing warning
AUDI	Q7	10s	Haptic	Not*	*continuing warning
VW	PASSAT	8 to 10s	Optical & acoustic	Deactivation	
BENZ	S class	10s	Optical	Deactivation*	*with acoustic warning after a further 5s
FORD	FOCUS,MONDEO,TAU RUS,KUGA,EXPLORER, LINCOLN	4 to 6s	optical(4s)-acoustic(6s)	Not*	*acoustic chime will repeat every 8 sec after acoustic
HYUNDAI	EQ900	Lane's both sides : 12s Lane's Center(0.6m) : $t(s) = 700m/V(m/s)$	Acoustic & message	Deactivation (with acoustic & message)	

- According to the survey by KAIDA, etc. for cars with LKA currently selling in Korea, time range of hand-off warning is 4 s to 15s

○ Proposal about Hand-off Warning Time

(5.6.5.2.4 of ACSF-07-13 by OICA&CLEPA)

$$t(s) = 30(s) * 130/V$$

,where V is the speed of the vehicle in km/h at the time when the system has detected that the driver is no longer holding the steering control. Additionally t shall not be longer than 180s

- **What is justification to be proposed 30s in formula by OICA&CLEPA ?**
- ✓ **ROK think unconsciously about 1,083m is too long to ensure safety, thus it is necessary to reduce a fixed distance and an allowable hand-off time**
- ✓ **ROK's opinion is that there is no reason to allow too much time to hand off the steering control in safety perspective and a fixed time span(30s) is too excessive only to allow unintended hand-off use cases**

○ Proposal about Hand-off Warning Time

- Time range of hand-off warning on the second page may mean the current safety level to guarantee with current technology
- ✓ Therefore, it is necessary to reduce a fixed time span of 30s at 130km/h, that is, to replace 30s with 15s (max. hand-off warning time on the second page as a concession) in formula
- ✓ If we change a fixed time span in formula,
 - The limit time value of t , 180s, mentioned in 5.6.5.2.4 is meaningless because those speeds below 22km/h do not deteriorate road safety highly so it is not necessary to define this requirement and
 - the length of test road will be able to shorten.

< Appendix : The calculated hand-off warning time by formula >

Speed(V)	$t(s)=30*(130/V)^*$	$t(s)=15*(130/V)**$
10	390.0	195.0
20	195.0	97.5
30	130.0	65.0
40	97.5	48.8
50	78.0	39.0
60	65.0	32.5
70	55.7	27.9
80	48.8	24.4
90	43.3	21.7
100	39.0	19.5
110	35.5	17.7
120	32.5	16.3
130	30.0	15.0
140	27.9	13.9
150	26.0	13.0
160	24.4	12.2
170	22.9	11.5
180	21.7	10.8
190	20.5	10.3
200	19.5	9.8

A fixed time(* : 1083m ** : 542m)