Transmitted by the Experts of OICA and CLEPA

Informal Document ACSF-06-23

6th ACSF meeting

Tokyo, 19-21 April 2016

Industry proposal

Low Speed Systems < 60 kph Category B2

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5.6.1.1.4.1 The specified maximum lateral acceleration aysmax shall not have a value of more than 3 m/s2.
Additionally, in case $v_{S,max}$ is greater than 60 km/h, $a_{yS,max}$ shall not be less than 1 m/s².

Justification:

The range of recommended design speeds in km/h on international roads is as follows:

Motorways	x	80	100	120	140
Express roads	60	80	100	120	x
Ordinary roads	60	80	100	x	x

Design speed (km/h)		**60**	**80**	**100**	**120**	**140**
Minimum radii in plane (corresponding to maximum superelevation 7%)		120	240	**450**	650	1 000
Maximum gradient (percentage not to be exceeded)*		8	7	6	5	4
Maximum longitudinal gradient in new tunnels**		**5**	**5**	**5**	**5**	**5**
Minimum radii at the highest point of the vertical alignment (in m)	One-way	1 500	3 000	6 000	10 000	18 000
	Two-way	1 600	4 500	10 000	-	-
Minimum radii at the lowest point of the vertical alignment		1 500	2 000	3 000	4 200	6 000

Source: ECE-TRANS-SC1-384e - EUROPEAN AGREMENT ON MAIN INTERNATIONAL TRAFFIC ARTERIES (AGR)

Vsmax:

30 km/h: **radius 240m = lateral acceleration is 0,289 m/s²**

30 km/h: radius 650m = lateral acceleration is 0,107m/s²

60 km/h: radius 240m = lateral acceleration is 1,158m/s²

60 km/h: radius 650m = lateral acceleration is 0,428m/s²

➢ Simplified calculation excluding e.g. Gradient

Conclusions:

- **A low speed in a typical curve that can be found of a motorway will generate very low decelerations.**
- **Such low values of lateral acceleration (e.g. 0.2 m/s²) are very difficult to measure.**
- **From a practical standpoint, and given the lower criticality of the function at low speed (e.g. for a traffic jam assist), industry sees no necessity to define a minimum value for the lateral acceleration for maximum speed lower than 60km/h.**

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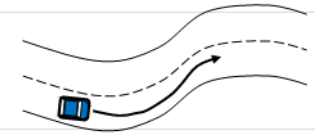
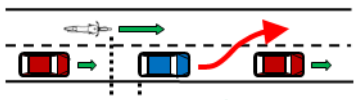
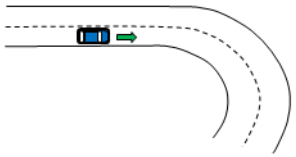
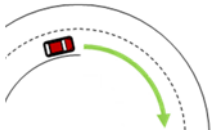
Neccesity of Tests for low speed systems Vsmax < 60 km/h

	aim	track (for the fuctional phase of the test)	speed v (for the functional phase of the test)	lateral acceleration ay (for the functional phase of the test)	
Tests for category E					
 FU1 Lane keeping	check lane keeping functionality within system boundaries	curved to deliver range for v and ay	varying between vsmin and vsmax - 10km/h	varying between 0.5 m/s^2 and 90% of aysmax	necessary, but with lower /other value of lateral acceleration
 FU2 Abort of lane change	check if willingness for lane change is aborted if motorcycle approaches from behind	straight, 2 lanes	the lower of 80 km/ h or vsmax - 20 km/h L3: 50 km/h above this value	–	Not necessary, no lane change on B2 e.g. traffic jam assist
 FU3 Lane change	check double lane change functionality	straight, 2 lanes	the lower of 80 km/ h or vsmax - 20 km/h	–	
 TR1 Lateral acceleration exceeded	check transition demand and MRM in case of a curve being too tight	straight + curved to deliver appropriate ay	the lower of 80 km/ h or vsmax - 10 km/h	at least the lower of aysmax + 0.5 m/s^2 or 3.5 m/s^2	Not necessary, the system boundary of max. lateral acceleration of this systems is 1 m/s^2 on Highways
 TR2 Missing marking	check transition demand and MRM in case of a missing lane marking	curved to deliver ay and with one lane marking missing in a section of min. 150 m	vsmax - 10 km/h	a value between 0.5 m/s^2 and 90% of aysmax	necessary, but with lower /other value of lateral acceleration

Lateral accelerations from slide 2:
Vsmax:
30 km/h: radius 240m = lateral acceleration is 0,289 m/s^2
30 km/h: radius 650m = lateral acceleration is 0,107m/s^2
60 km/h: radius 240m = lateral acceleration is 1,158m/s^2
60 km/h: radius 650m = lateral acceleration is 0,428m/s^2

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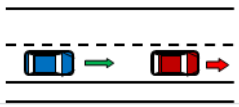
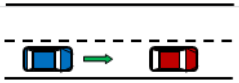
Neccesity of Tests for low speed systems Vsmax < 60 kph

	TR3 Driver not available	check transition demand and MRM if driver does not show appropriate actions	curved to deliver ay	vsmax - 10 km/h	a value between 0.5 m/s² and 90% of aysmax	necessary, but with lower /other value of lateral acceleration
	TR4 Failure	check transition demand, failure warning and MRM in case of a single sensor failure	curved to deliver ay in a section of min. 200 m	vsmax - 10 km/h	a value between 0.5 m/s² and 90% of aysmax	
	TR5 Taking over steering task by driver	check abortion of MRM after a single sensor failure in case of driver override	curved to deliver ay in a section of min. 200 m	vsmax - 10 km/h	a value between 0.5 m/s² and 90% of aysmax	
	EM1 Moving target (decel. 6 m/s²)	check protective braking in case of danger of collision due to braking vehicle ahead	straight, adjacent lanes blocked	the lower of 80 km/h or vsmax - 10 km/h	–	Not necessary for systems Vsmax < [50 kph], reflecting the Issue „measurability acceleration of 6 m/s²“
	EM2 Stationary target	check protective braking in case of danger of collision with stationary object ahead	straight, adjacent lanes blocked	vsmax - 10 km/h	–	necessary

Lateral accelerations from slide 2:
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60 km/h: radius 240m = lateral acceleration is 1,158m/s²
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5.6.1.4.2.3

In case of a sudden unexpected event without imminent danger of a collision a transition demand shall be given immediately and the system shall follow the initial path ~~and shall not cross any lane marking~~ for at least [4 s] after the transition demand, in the following cases

- if the speed of the vehicle with activated ACSF exceeds vsmax ~~+ 5 km/h, or a transition demand shall be given immediately and the.~~
- if the vehicle with activated ACSF [with Vsmax higher than 60 km/h] ~~and~~ reaches a lateral acceleration of more than aysmax , or ~~3 m/s² a transition demand shall be given.~~
- if a system boundary is reached due to a missing lane marking, or
- if a single sensor failure occurs.

Justification:

For a lateral acceleration of 3 m/s², the radius must be lower than 92m. The maximum lateral acceleration is lower than 1,2 m/s² for low speed systems (Vsmax is 60 km/h or lower).

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