Discussion Document: Determination of Operational Speed

Longitudinal / Headway control

5.6.3.2.4 In addition to lateral control, an ALK system shall be able:

- to control automatically the longitudinal speed of the vehicle, and
- to react to the presence of another vehicle in the same traffic lane and maintain a safe separation distance even when that vehicle's speed reduces.

These functions shall be activated automatically whenever the ALK system is activated.

5.6.3.2.5 An activated ALK system shall adapt the vehicle speed to infrastructural and environmental conditions (e.g. narrow curve radii, heavy rain, etc.), [in particular to fulfil the requirement of paragraph 5.6.3.2.2.] This shall be demonstrated to the technical service and tested according to the relevant test in Annex 8.

5.6.3.2.6. The ALK system shall ensure that, when travelling on a road with more than one lane for traffic travelling in the same direction, the vehicle is prevented from passing another vehicle travelling in an adjacent lane where that traffic lane is designated for faster traffic (undertaking).

5.6.3.2.7 Once the ALK system is activated, it shall detect the presence of another vehicle travelling at a slower speed in the same traffic lane, and automatically adapt the ego vehicle speed to maintain a distance equal to or greater than the [safety] distance derived according to the procedure set out in paragraph 5.6.3.2.x.

5.6.3.2.8 **An** activated ALK system shall be able to bring the vehicle to a complete stop behind a stationary vehicle blocking its lane of travel. This shall be ensured up to the maximum operational speed of the system, as defined in Paragraph 5.6.3.2.x., and tested according to the relevant test in Annex 8.

5.6.3.2.9 An activated ALK shall detect if, due to a sudden unexpected event within its field of view, the vehicle is in imminent danger of a collision with another road user e.g. due to a decelerating lead vehicle, a cutting in vehicle or a suddenly appearing obstacle after a lane change of a leading vehicle.

Once such an event is detected, the system shall perform an emergency manoeuver. During an emergency manoeuver the system may employ the maximum available brake force.

This shall be tested according to the relevant tests in Annex 8.

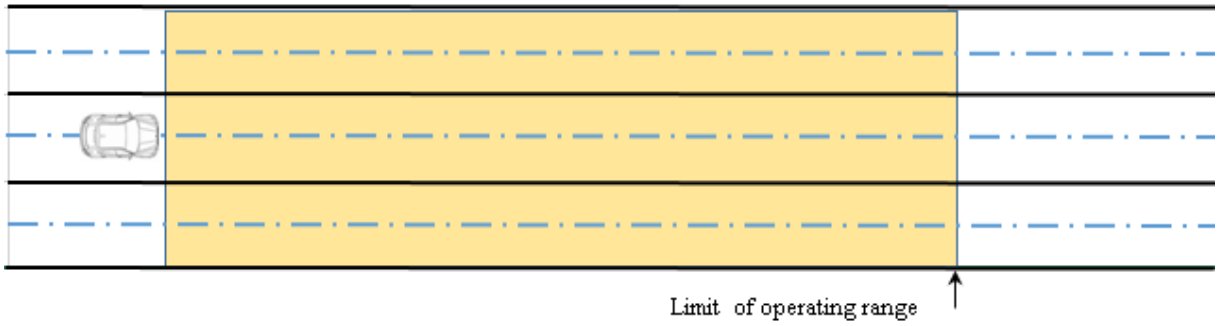
X. Operational Speed

The maximum operational speed at which the ALK system may be active shall be determined by the capability of the system's visualisation technology. This speed shall not exceed that at which the visualisation system can identify a foreseeable critical situation (e.g. slow, slowing or stationary traffic, lane obstruction etc.) within its field of view and, based upon that identification, cause the vehicle to be brought to a halt behind the hazard automatically with a deceleration rate not exceeding [3.7 ms^{-2}].

Y. Visualisation System

Y.1. Field of view

The field of view of the visualisation system shall be such that it can determine the driving environment and the traffic dynamics across its own traffic lane, the traffic lane immediately to its left and to its right, and at the limit of the operating range. The width of the traffic lane shall be considered to be 3.65m.



Y.2. Installation

The manufacturer shall provide information regarding the installation options that will be employed for the individual components that comprise the visualisation system. These options shall include, but are not limited to, the location of the component in/on the vehicle, the material(s) surrounding the component, the dimensioning and geometry of the material surrounding the component, and the surface finish of the materials surrounding the component, once installed in the vehicle. The information shall also include installation specifications that are critical to the system's performance, e.g. tolerances on installation angle.

Changes to the individual components of the visualisation system, or the installation options, shall be notified to the Type Approval Authority and be subject to further assessment.

Y.3. Detection Range

The detection range of the visualisation system is the distance at which the system can reliably recognise a target and generate an appropriate control signal. The manufacturer may declare the detection range of the visualisation system which shall be verified by the Technical Service

Proposals for tests have been added to Annex 8:

Y.4. Operating Range

The operating range shall be determined from the value for the detection range established by the procedure set out in paragraph Y.3 , qualified after taking account of the deterioration of components of the visualisation system due to time and usage throughout the normal life of the vehicle. Normal life is understood to be 10-years or 160,000 kilometres.

A time based deterioration factor of [20%] shall be applied to the detection range value.

Notwithstanding the above, the manufacturer may provide evidence to demonstrate a lower level of deterioration. This shall be subject to agreement with the Technical Service.

The detection range shall be further qualified to take account of performance limitations resulting from environmental conditions, e.g. rain.

An environmental factor of [20%] shall be applied to the detection range value.

Notwithstanding the above, the manufacturer may provide evidence to demonstrate a lower impact of environmental factors on the performance of the system, e.g. the system may transition back to the driver when rain is detected. This information shall be subject to verification by the Technical Service.

Where the manufacturer provides alternative deterioration factors for normal life and/or environmental conditions, the Technical Service shall append details of the assessment procedures to the test report. These details shall be sufficient for replication of the assessment during in-service compliance/market surveillance testing.

The operating range of the visualisation system shall be determined by the application of the deterioration factor and the environmental factor to the value for the detection range established by the procedure defined in paragraph Y.3. This value shall be rounded down to the nearest whole number.

5.6.3.2.9. Safety distance to the front

The safety distance shall be calculated using the following formula:

$S_{safety\text{-}Front} = v_{ALK} * 1.8$

Where:

v_{ACSF} = the actual speed of the ALK equipped vehicle in [m/s].

5.6.3.2.10. Maximum operational speed

The maximum speed $v_{max\text{-}ALK}$ up to which the ALK is permitted to operate shall be calculated with the distance $S_{front\text{-}ALK}$ using the formula below:

$$V_{max-ALK} = +\sqrt{2 * a_{AALKCSF} * (s_{front-ALK} - (v_{max-ALK} * t_{System}))}$$

$$=>$$

$$V_{max-\mathrm{ALK}} = -a_{AALK} * t_{System} + \sqrt{(a_{ALK} * t_{System})^2 + 2a_{ALK} * s_{front-\mathrm{ALK}}}$$

Where:

a_{ALK} = [3,7] m/s²;

$s_{front\text{-}ALK}$ = Value of the operating range in [m] as determined according to paragraph Y4.

$v_{max\text{-}ALK}$ = Resulting maximum operating speed for the ALK system B2.

t_{system} = System delay [of 0.5s] until deceleration level is reached

Notwithstanding the result of the formula above the maximal operational speed not exceed [130] km/h .