

**LKA Requirements**

**Submitted by**

Anshuman Singh

Davide Occello

Raymond Wouters

Sharad Bhadgaonkar

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-Eindhoven

# LKA and LDWS requirements:

# **Important functional requirements:**

# **LKA:** LKA should detect unintentional lane change at least, when the outside of the tire closest to the outside of the lane markings crosses 0.3 m or beyond.

(source : Partially from EURO NCAP: section1 and UNECE)

1. **LKA:** LKA shall use the lateral support system to restore control of the vehicle while countering the unintentional lane change.

(source : EURO NCAP: section1)

1. **LKA:** LKA system shall be available only if vehicle possess Electronic Stability Control system in compliance with regulatory requirements.

(source : EURO NCAP: section1)

1. **LDWS:** LDWS shall automatically warn the driver (e.g. audible signal, vibrating steering wheel etc.) at least when, outside of the tire closest to the outside of the lane markings crosses 0.3 m or beyond.

(source : Partially EURO NCAP: section1 and definition of LDW and UNECE)

1. **LKA:** LKA shall determine the lateral deviation from path which is distance between current center of vehicle and center of intended path. The absolute deviation shall not exceed 0.15 m.

(source : 1st sentence from Euro NCAP: section 3.2)

1. **LDWS and LKA:** Both LKA and LDWS shall be operational at least when driving on straight road with radius more than 1000 m and 250 m on curved road, unless manually deactivated.

(source : Regulation: 130 UNECE)

1. **LDWS:** The LDWS should be active at least if vehicle speeds exceeds 50 km/h, unless manually deactivated.

(source : Regulation: 130 UNECE)

1. **LKA:** The LKA should be active at least when vehicle speed exceeds 50 km/h, unless manually deactivated.

To be confirmed after referring ISO.

1. **LDWS:** If a vehicle is equipped with a means to deactivate the LDWS function, the following condition shall apply as appropriate:

The LDWS function shall be automatically reinstated at the initiation of each new ignition on (run) cycle.

(source: EURO NCAP and Regulation: 130 UNECE)

1. **LKA and LDWS:** LKA and LDWS shall be operational at least under below conditions while performing unintended lane change
   1. Lane width between 3.5 to 3.7 m
   2. Dashed line on one side having width of 0.1 to 0.25
   3. Solid line on other side with 0.1 to 0.25
   4. Dry conditions
   5. No precipitation
   6. Horizontal visibility till 1km
   7. Ambient temperature between 5 to 40 deg.
   8. Natural ambient illumination excess of 2000 lux for day light with no strong shadow
   9. Uniform solid paved surface with consistent slope and no irregularity within a lateral distance of 3.0 m to either side. The minimum peak braking coefficient shall be 0.9.
   10. Test ready vehicle
   11. Wind speed less than 10 m/s
   12. Slope of the surface between 0 and 1 deg.
   13. Original fitment of tires according to make, model, size, speed and load rating specified by the manufacturer with correct pressure.
   14. Default wheel alignment measure set by the OEM

(source: EURO NCAP: section 5)

1. **LKA:** The steering to counter lateral deviation, shall be smooth controlled manner and with minimal overshoot not more than xx %.

(source : EURO NCAP: section 6.4)

1. **LKA and LDWS [Input Requirement]:** The system must have an accuracy of 0.1 km/h in longitudinal speed

(source : EURO NCAP: section4.3)

1. **LKA and LDWS [Input Requirement]:** The system must have an accuracy of 0.03m in longitudinal and lateral position.

(source : EURO NCAP: section4.3)

1. **LKA and LDWS [Input Requirement]:** The system must have an accuracy of 0.1 degrees in heading angle

(source : EURO NCAP: section4.3)

1. **LKA and LDWS [Input Requirement]:** The system must have an accuracy of 0.1 deg/sec in yaw rate

(source : EURO NCAP: section4.3)

1. **LKA and LDWS [Input Requirement]:** The system must have an accuracy of 0.1 m/sec2 in longitudinal acceleration

(source : EURO NCAP: section4.3)

1. **LKA and LDWS [Input Requirement]:** The system must have an accuracy of 1 deg/sec in steering wheel velocity

(source : EURO NCAP: section4.3)

1. **LKA:** LKA shall make sure the driver remains in control at all times (as long as LKA active).

(source : EURO NCAP: section1)

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**Less important requirements for the moment:**

1. **LKA and LDWS [Country specific]:** The system must be able to identify lane markings and lane width according to the country of operation.
2. **LKA:** LKA may function while only one distinct marking on either side (no/ non distinct marking on other).

(source : EURO NCAP: section1)

1. **LKA and LDWS**: Care shall be taken that the Driver shall not get distracted by LKA warning.

(source : EURO NCAP: section1)

1. **LDWS**: The effectiveness of the LDWS shall not be adversely affected by magnetic or electrical fields.

(source : Regulation: 130 UNECE)

**HMI related requirements:**

1. **LDWS [HMI]**: The warning above shall be noticeable by the driver and be provided by:
   1. At least two warning means out of optical, acoustic and haptic, or
   2. One warning means out of haptic and acoustic, with spatial indication

about the direction of unintended drift of the vehicle

(source : Regulation: 130 UNECE)

1. **LDWS [HMI]:**  The warning mentioned above may be suppressed when there is a driver action which indicates an intention to depart from the lane

(source : Regulation: 130 UNECE)

1. **LDWS [HMI]**: LDWS shall also provide the driver a warning as a yellow optical warning signal to detect failure.

Failure must be detected when:

the power source to any LDWS component or any electrical connection between LDWS components disconnected.

(source: Regulation: 130 UNECE)

1. **LDWS [HMI]**: The failure warning signal shall be activated and remain activated while the vehicle is being driven and be reactivated after a subsequent ignition off – ignition on cycle as long as the failure exists.

(source : Regulation: 130 UNECE)

1. **LDWS [HMI]**: Where an optical signal is used for the lane departure warning, it may use the failure warning signal.

(source: Regulation: 130 UNECE)

1. **LDWS [HMI]**: The LDWS optical warning signals shall be activated either when the ignition (start) switch is turned to the on (run) position or when the ignition (start) switch is in a position between the on (run) and start that is designated by the manufacturer as a check position (initial system (power-on). This requirement does not apply to warning signals shown in a common spaces.

(source: Regulation: 130 UNECE)

1. **LDWS [HMI]**: The optical warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat.

(source: Regulation: 130 UNECE)

1. **LDWS [HMI]**: When the driver is provided with an optical warning signal to indicate that the LDWS is temporarily not available, for example due to inclement weather conditions, the signal shall be constant. It may use failure warning signal for the same.

(source: Regulation: 130 UNECE)

1. **LDWS [HMI]**: At a periodic technical inspection it shall be possible to confirm the correct operational status of the LDWS by a visible observation of the failure warning signal status, following a power ON (off system OK, on system fault present.

(source : Regulation: 130 UNECE)

1. **LDWS [HMI]**: If a vehicle is equipped with a means to deactivate the LDWS function, when LDWS deactivated, a constant optical warning signal shall inform the driver that the LDWS function has been deactivated. The same yellow warning failure signal can be used.

(source : Regulation: 130 UNECE).

Additional requirements which I feel we should have:

1. **LKA:** LKA must be deactivated when
   1. Manually deactivated by the user
   2. Current center of the vehicle doesn’t deviate more than 15 cm w.r.t. center of intended path.
   3. LKA is active currently and driver does the counter steering (opposite to assist torque)
   4. LKA is active and driver doesn’t intervene to the steering wheel within 5 seconds.
2. **LKA**: The lane keeping action shall not exceed the lateral acceleration more than 3 m/s2, and lateral jerk shall not exceed 5 m/s3.

(source : ISO 11270**)**