



# ISO PAS 11585

ISO TC 22/SC 33/WG 3 assistance and active safety Functions

## Road vehicles – Partial driving automation — Technical characteristics of conditional hands-free driving systems

Presentation for the TF ADAS - L2 Hands-Off Workshop #1  
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# LEVEL 2 HANDS-FREE DRIVING



## Titel:

## ISO PAS 11585 “Road vehicles – Partial driving automation – Technical characteristics of conditional hands-free driving systems”

## Scope:

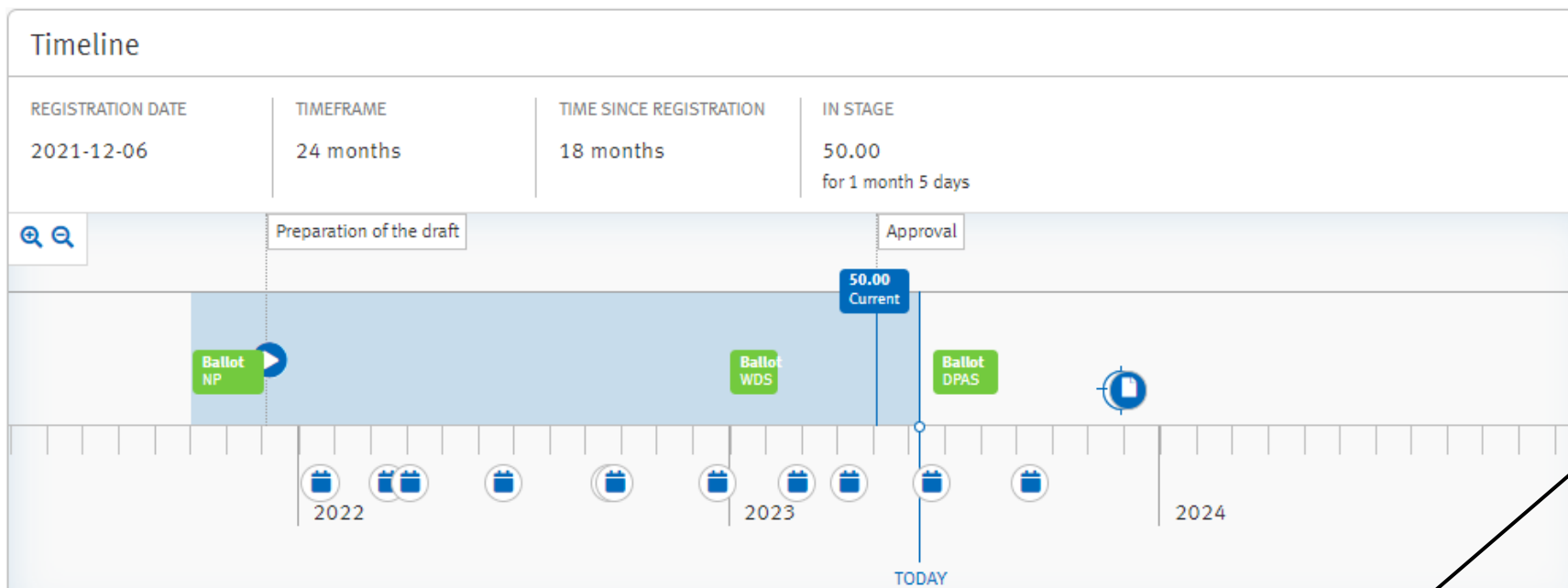
This document provides **technical characteristics** of partial driving automation system according to ISO/SAE PAS 22736 and associated control strategies enabling hands-free driving.

These technical characteristics, together with an appropriate operational design domain enable the proper usage of such partial driving automation systems which is supervised by drivers.

This document does **not address performance limits, verification and validation** of such systems.

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# INTRODUCTION TO ISO PAS 11585 - STATUS



## Participants



- several commenting phases performed within ISO TC22/SC33, ISO TC22/SC33/WG3 and TC204/WG14
- Deep-dives with China/CATARC and JP

- Final draft available end of June
- Voting Phase for publication from June 26<sup>th</sup> to August 21<sup>st</sup>

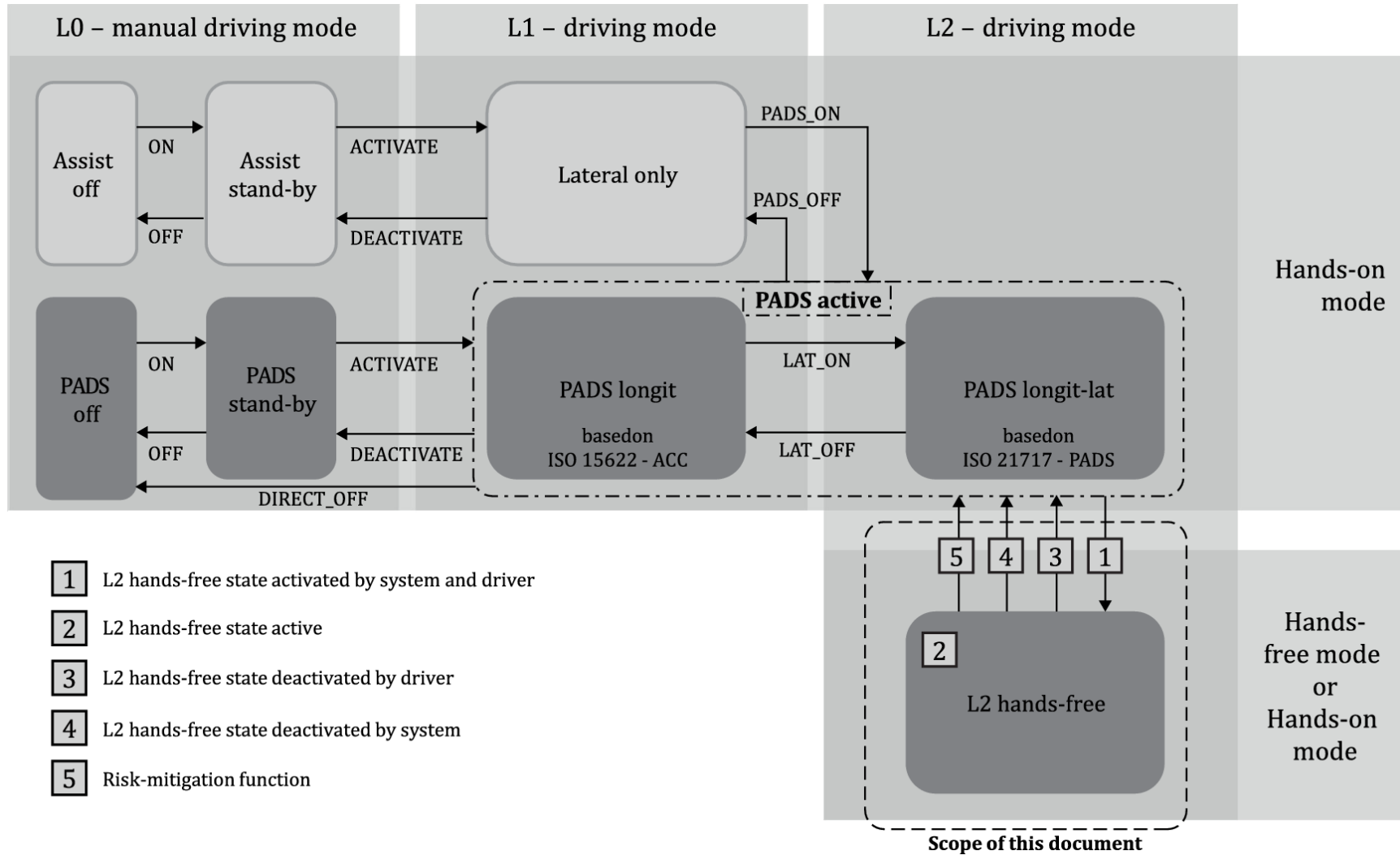
Publication date will be moved forward (personal estimation: Oct/Nov 2023)

Stage ⓘ

Stage	Version	Description	Edit draft	Target date	Limit date	Started	Status
50.00	1	Final text received or FDIS registered for formal approval				2023-05-09	Current
50.20	1	Proof sent to Secretariat or FDIS ballot initiated: 2 months		2023-06-26			Awaiting
50.60	1	Close of voting -- Proof returned by Secretariat		2023-08-21			Awaiting
60.60	1	International Standard published		2023-12-01	2023-12-06 ⓘ		Awaiting

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# COMBINATION OF ISO 15622 (ACC) & ISO 21717 FOR LKS (PADS) INCLUDING "L2-HANDS FREE DRIVING MODE/STATE"



**Modes and States** are defined to differ between a system and a driver view. For example, "hands-on-mode" also possible in "L2-hands-free-state" but "hands-free-mode" is only allowed in "L2-hands-free-state"

L2-Hands-free can be **activated** if all conditions are met from

- manual driving directly (theoretically)
- L1 Hands-on Mode/State
- L2 Hands-on Mode/State

L2-Hand-free can become **unactive** by ending in any driving mode depending on the conditions due to

- Driver intervention
- System intervention

# OVERVIEW OF THE MOST IMPORTANT REQUIREMENTS – TERMS AND DEFINITIONS

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## Some examples from Terms and definitions:

- **direct control**  
control ... by the driver by holding or moving the steering wheel or using brake or driving pedal
- **EOR - eyes-on request**  
request ... to monitor the traffic situation
- **HOW - hands-on warning**  
warning ... to direct control the vehicle, at least by lateral steering control ... (e.g. "yellow warning")
- **HOA - hands-on alert**  
alert ... to direct control the vehicle immediately, at least by lateral steering control ... (e.g. "red alert")
- **overrule**  
... direct control of lateral and/or longitudinal motion ... which deactivates ...
- **override**  
... direct control of lateral and/or longitudinal motion ... within a defined threshold without deactivation ...

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## **General requirements for "L2-hands-free-system":**

- ... Driver Monitoring System (DMS) shall monitor the driver's presence and attentiveness.
- ... intended ODD ... shall be defined based on the performance of the vehicle dynamics control and the drivers' capabilities (street curvature, driving speed, possibility to control vehicle by the driver also in case of failures or unwanted performance will influence the definition of the indented ODD)
- DMS shall be active ...
- ODD-monitoring-system shall be active ...
- Driver-information-and-warning-system shall
  - inform the driver ...
  - shall request eyes (EOR), hands on Warning (HOW) or Hands on Alert (HOA).
- Risk-mitigation-function shall be operational ...

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## **The control loop** of the "L2-hands-free-state" shall

- control longitudinal and lateral motion.
- keep the vehicle sufficiently centered ... (Lane Change possible)
- adapt the longitudinal control, e.g. speed to curvature
- limit the longitudinal and lateral control considering the ODD.

## **Possibility for the driver to deactivate, overrule and override ...**

- Deactivate => "off"
- Overrule => "direct control", e.g. hands on, system is "on"
- Override => "direct control", e.g. ADAS-Button "off"

## **ODD monitoring**

- The ODD-monitoring ... shall ensure "L2-hands-free-state" is active within the ODD conditions: road type (motorway), road geometries (lane width, curve radius), road properties (e.g. , toll station), valid vehicle speed

## **Driver monitoring**

- Driver-monitoring shall evaluate the driver (presence on seat, visual attentiveness, hands-on/off, long/lat control inputs)

## **Driver Information and Warning**

- Inform driver if "L2-hands-free-state" is available
- "L2-hands-free-mode" shall be perceptible for the driver.
- Requests (EOR), Warnings (HOW), Alerts (HOA) and active risk-mitigation shall be perceptible for the driver.

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## Enter "L2 hands-free state"

Activation if the following conditions are fulfilled (independent of hands-on/off):

- The vehicle shall drive sufficiently in the middle of the lane.
- The DMS confirms that the driver is monitoring the traffic
- The ODD monitoring confirms a valid ODD

## Leaving "L2 hands-free state" due to drivers' intervention

- The driver shall be able to deactivate including overrule at least with one of the following trigger conditions (depending on implementation concept, not all are required):
  - operating the brake pedal;
  - operating the steering wheel; holding the steering wheel;
  - operating the element for deactivation (ADAS-button, voice or gesture, per menu)
- After leaving "L2 hands-free state" lateral control should still be active if no direct control is detected by DMS.
- The driver shall be informed by information and warning system

## Leaving "L2 hands-free state" due to system intervention

... if one or more of the trigger conditions disables the "L2 hands-free state":

- DMS or ODD-monitoring is unavailable
- driver attention cannot be ensured after EOR
- ODD monitoring indicates imminent violation of ODD criteria;
- safety or system integrity is considered insufficient



# OVERVIEW OF THE MOST IMPORTANT REQUIREMENTS – TECHNICAL LEVEL

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The DMS contains appropriate combination of methods for "driver presence on driver's seat"  
e.g. DMC (DM-Camera), seatbelt status, seat occupancy mat

The DMC shall include

- detection of the head posture
- thresholds for distraction (eyes gaze to side window, HMI)
- detection of driver's eyes closure
- above traffic-jam speed, DMS shall contain driver's eyes gaze, including the corresponding time. Additionally, DMS should include drowsiness recognition

The DMS contains detection of hands-on/free mode

- hands on steering wheel sensor, e.g. capacitive sensors
- DMC being able to detect hands-on state
- torque on the steering wheel

The DMS shall contain detection of longitudinal and lateral control inputs.

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## Driver information and warning system

- A driver information and warning system keeps driver in the DDT.
- Without any drivers reaction the vehicle will come to standstill (<10km/h).
- The system informs the driver about the L2 hands-free status
- EOR, depending on the visual attentiveness status of the driver.
- HOW, if any limit of a condition is expected to be reached or the driver does not comply after an EOR.
- HOA, if the driver does not comply after an HOW, or an EOR if no HOW is implemented or the limits of the conditions for "L2-hands-free-state-active" are reached.

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## ODD-monitoring system

- provides information if the vehicle is in the intended ODD;
- contains a geo-positioning subsystem
- contains a lane-level detection while the L2 hands-free state
  - is active or
  - provides information to deactivate the L2 hands-free state in a timely manner to avoid situations where a lane-level detection is necessary ... , e.g lane splits or lane ends.

# OVERVIEW OF THE MOST IMPORTANT REQUIREMENTS – TECHNICAL LEVEL

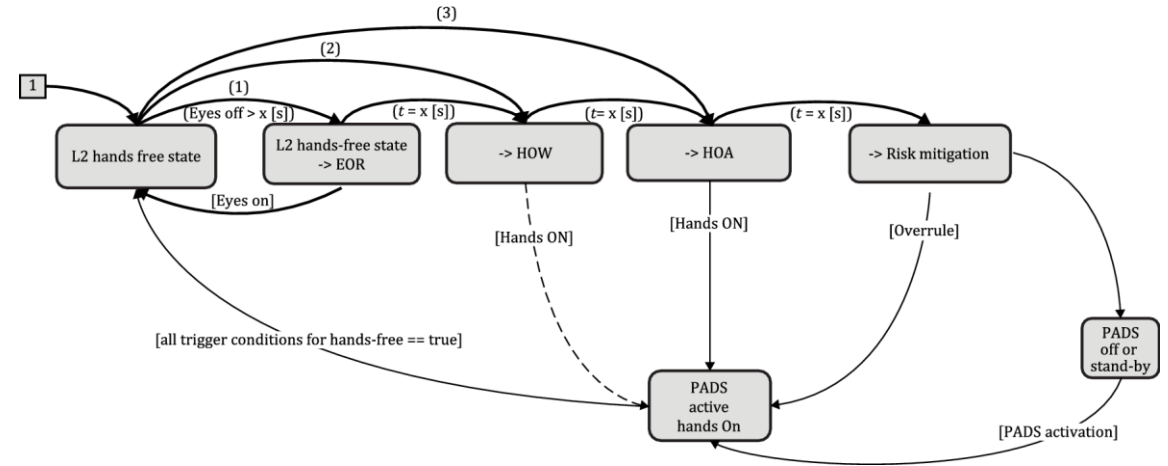
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The risk-mitigation (RM) system ensures unacceptable behavior of the driver, e.g. fails to directly control when requested by the system.

- If the driver has no direct control after a defined time since an HOA was started, the risk mitigation system will become active
- RM performs longitudinal and lateral control of the vehicle.
- RM ensures that the vehicle stays inside a defined driving corridor (driving corridor is typically the ego lane)
- RM reduces the velocity of the vehicle in a manner that decreases the risk of a severe collision by applying a controllable deceleration.
- RM will end in a standstill or lower than 10 km/h
- RM can be overruled by the driver

# EXAMPLES (INFORMATIVE) FOR DRIVER WARNING AND INFORMATION SYSTEM

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- Examples of use cases [(1)..(4)] for driver warning and information system:
- (1) driver misbehavior, e.g. driver is inattentive and ignores the EOR, HOW and HOA.
  - (2) system limits will be reached shortly or with low long/lateral effect, e.g. drivers intervention needed soon due to slow lane drift of the vehicle.
  - (3) system limits will be reached fast or with strong long/lateral effect, e.g. drivers intervention needed immediately due to leaving lane.
  - (4) system limits will be reached in an expected time or distance, e.g. ODD ends foreseeable. (not shown in this diagram but could be explained similar to use case b) with different timing.)

## Note

- for each transition from one to the next state an appropriate timing for [x] seconds must be chosen;
- HOW-state, can be skipped if x=[0] seconds is used, e.g. if HOA is required immediately;