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Intelligent transport systems — Automated braking during low-speed manoeuvring (ABLS) — Requirements and test procedures

Systèmes de transport intelligents — Freinage automatique lors de manœuvres à basse vitesse (ABLS) — Exigences et procédures d'essai

PROOF/ÉPREUVE

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Foreword

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This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Existing International Standards for automated emergency braking, such as ISO 22839 or ISO 19237, are focused on collision mitigation or avoidance at moderate vehicle speeds in the forward direction, typically using front sensors such as radar. The implementation and utilization of additional perception sensors (i.e. around the entire vehicle) creates the possibility of advanced collision mitigation and avoidance systems covering the whole area surrounding the vehicle.

Low-speed collisions during parking and especially during reversing manoeuvres represent a high share of road traffic accidents, including both accidents with material damage leading to high monetary expenses,[3] and accidents leading to injuries or even fatalities of human road users. This document addresses such collisions.

Intelligent transport systems — Automated braking during low-speed manoeuvring (ABLS) — Requirements and test procedures

1 Scope

This document provides minimum requirements and test procedures for automated braking at velocities below 2,8 m/s (10 km/h) with the specific aim of avoiding or mitigating collisions with pedestrians, other road users (e.g. vehicles) and stationary objects, including infrastructure elements (e.g. walls, pillars). These collisions mainly occur during reversing manoeuvres, but this document also addresses collisions in other directions during low-speed manoeuvring.

Automated braking during low-speed manoeuvring (ABLS) requires information about the position and motion of the object, the motion of the subject vehicle, and the driver actions. It then determines if the evaluated situation represents a collision risk. If an imminent collision risk exists, ABLS will automatically activate a brake action to avoid or at least mitigate the collision.

The document does not define test objects, but refers to the ISO 19206 series for test objects to be used.

The human driver is assumed to perform or at least supervise all driving manoeuvres because the ABLS application is restricted to support only systems of SAE Level 0 – 2. Evasive steering manoeuvres are not within the scope of this document.

This document applies to light vehicles[4] only. Vehicles equipped with trailers are not within the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17386, *Intelligent transport systems — Manoeuvring aids for low-speed operation (MALSO) — Performance requirements and test procedures*

ISO 19206-2:2018, *Road vehicles — Test devices for target vehicles, vulnerable road users and other objects, for assessment of active safety functions — Part 2: Requirements for pedestrian targets*

ISO 20900:2023, *Intelligent transport systems — Partially-automated parking systems (PAPS) — Performance requirements and test procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17386, ISO 19206-2, ISO 20900 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
ABLS function
function capable of reducing the velocity of the vehicle to avoid or mitigate a collision during low-speed manoeuvring

3.2
ABLS types
types A to C which are related to the automation level of the driving function supported by ABLS

3.3
low-speed manoeuvring
LSM
driving manoeuvre of a vehicle at a velocity ≤ 2,8 m/s (10 km/h) mainly intended to park the subject vehicle

Note 1 to entry: Within the context of this document, continuous forward driving (e.g. in congested situations such as a traffic jam) where the velocity can potentially drop temporarily below 2,8 m/s (10 km/h) is not considered as low-speed manoeuvring.

3.4
vulnerable road user
VRU
human such as a pedestrian or cyclist, independent of age and size

3.5
subject vehicle
SV
vehicle under test in which ABLS is implemented

3.6
parked vehicle
PV
static vehicle that represents the boundary of an adjacent parking space or the obstacle within the driving path

3.7
manual driving
manoeuvre where the driver is in control of longitudinal and lateral movement of the vehicle and which corresponds to SAE Level 0 (no automation)

3.8
assisted parking system
APS
system which supports the driver during parking by controlling the lateral movement/steering of the vehicle and which corresponds to SAE Level 1 (Driver Assistance)

Note 1 to entry: See ISO 16787 for further information on APS.

3.9
partially automated parking system
PAPS
system which supports the driver during parking by controlling both the longitudinal and lateral movement of the vehicle and which corresponds to SAE Level 2 (Partial Automation)

Note 1 to entry: See ISO 20900:2023 for further information on PAPS.

3.10
parking
parking in
manoeuvring into a parking space

3.11
leaving
parking out
manoeuvring out of a parking space

3.12
object
item representing any kind of thing or creature

3.13
obstacle
object in or close to the driving path of the subject vehicle (SV) which is deemed to be collision-relevant

Note 1 to entry: All vulnerable road users are considered as collision-relevant obstacles if they are in or close to the SV driving path.

Note 2 to entry: It is assumed that an obstacle can either be damaged by the SV or has a certain size which can cause damages to the SV within the situation of a collision.

3.14
toddler target
TT
test device representing a two-year-old toddler according to ISO/TS 19206-9:—[1)], used for testing ABLS

4 Basic system functionality

The ABLS function shall avoid or mitigate a collision during low-speed manoeuvring (LSM). The risk of a collision is determined based on the detection of objects. If necessary, the ABLS function automatically initiates braking to avoid or to mitigate a collision. If the driver does not intervene to override the function, ABLS continues the braking until the vehicle comes to a full stop.

This document concerns the achievement of collision avoidance via deceleration of the subject vehicle (SV) regardless of the specific braking method. Evasive steering intervention to avoid a collision is not considered within this document.

4.1 Operating conditions

The ABLS function shall be active during LSM [manoeuvring at or under 2,8 m/s (10 km/h)] regardless of the applied steering angle. If the vehicle velocity exceeds the upper limit, $v_{standby}$, specified by the manufacturer, the ABLS function shall no longer be active. The ABLS function may only be activated if an LSM event is detected. It is the responsibility of the manufacturer to identify criteria for an LSM event.

ABLS shall always be automatically activated without driver initiation.

The ABLS function may be deactivated by the driver. It is the responsibility of the manufacturer to determine a procedure for deactivation of the function. However, the procedure shall be designed to prevent an unintentional deactivation of ABLS function.

It shall be possible for the driver to override the ABLS function at any time. The specific detection and realization of an intended driver overriding intervention is not defined within this document and is left to the manufacturer's discretion.

The state transition of the ABLS function is shown in Figure 1.

The vehicle operator's handbook (owner's manual) should include an advisory note that clearly indicates the system availability conditions.

1) Under preparation. Stage at the time of publication: ISO/AWI TS 19206-9:2023.

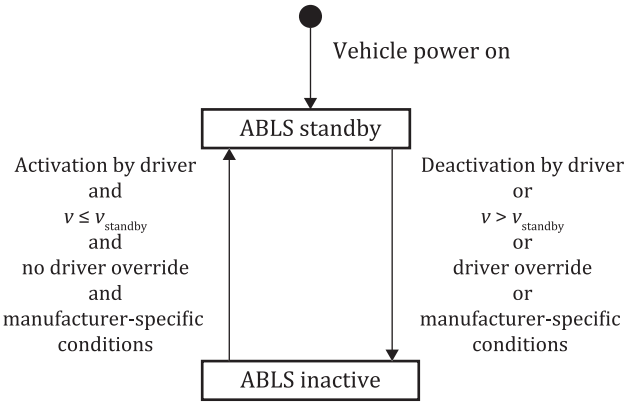

Figure 1 — State transition diagram of the ABLS function

4.2 Classification of ABLS

4.2.1 ABLS types

4.2.1.1 General

ABLS is classified into three types based on how the vehicle is being controlled prior to the activation of the ABLS function.

4.2.1.2 Type A — manual driving mode

ABLS type A is active during the manual driving of the vehicle. The longitudinal and lateral movement of the vehicle is under the control of the driver. This type of manoeuvring control corresponds to SAE Level 0.

4.2.1.3 Type B — assisted parking mode

ABLS type B is active when an SAE Level 1 parking automation system is engaged. The longitudinal movement is controlled by the driver. The lateral motion control is provided by the SAE Level 1 parking automation system and may be implemented in accordance with ISO 16787, for example.

4.2.1.4 Type C — partially-automated parking mode

ABLS type C is active when an SAE Level 2 parking automation system is engaged. Both longitudinal and lateral movement are provided by the SAE Level 2 parking automation system. This type of manoeuvring control corresponds to SAE Level 2 parking automation and may be implemented in accordance with ISO 20900.

4.2.2 Performance classification

4.2.2.1 General

The following ABLS performance classifications reflect the diversity of performance levels. Each ABLS type is split into the classes "base" and "enhanced", which represent a base performance that a driver can expect from all ABLS functions and an enhanced performance.

4.2.2.2 Class "base"

The performance class "base" represents the minimum requirements for ensuring a basic ABLS performance level for all three types (A, B, and C). The class "base" mainly aims to prevent collisions with stationary objects.

The type "class A base" only covers reverse driving and is separated into “object” and “pedestrian” variants reflecting the diversity of state-of-the-art systems in the market. The scope of the “object” variant is to avoid or mitigate collisions with static obstacles such as poles and vehicles. The scope of the “pedestrian” variant is to avoid or mitigate collisions with stationary pedestrians. A combination of these two variants is possible.

4.2.2.3 Class "enhanced"

The performance class "enhanced" provides additional characteristics which lead to an improved collision avoidance performance in other LSM conditions. In addition to the base performance, the class "enhanced" includes an improved collision avoidance performance for moving objects in all movement directions of the LSM system in use, for example (see Table 1).

4.2.3 ABLS classification overview

Based on the types and performance classes of ABLS, different combinations of system characteristics are possible reflecting the range of system use cases. An overview of these use cases is shown in Table 1. More detailed performance requirements are described in Clause 6. The test requirements in 6.6 for the minimal performance of all types and classes are derived from the use cases in Table 1 and the performance requirements in Clause 5.

Different kinds of ABLS systems may be implemented within one vehicle. For example, an ABLS type A1 pedestrian for manual driving and an ABLS type C2 for partially-automated parking may be available within one vehicle.

NOTE The class "enhanced" always includes all performance requirements of the class base.

The vehicle user’s manual (owner’s manual) should include an advisory note that clearly indicates what kind of ABLS system is implemented, including the driver’s responsibility and limitations of the system.

Table 1 — ABLS classification overview

Type	Class	Variant	Objects addressed	Object movement	Moving direction
A1	base	object	objects	stationary	reverse
A1	base	pedestrian	pedestrian	stationary	reverse
A2	enhanced	n.a.	objects+pedestrian	stationary+moving	reverse+forward
B1	base	n.a.	objects+pedestrian	stationary	design specific[a]
B2	enhanced	n.a.	objects+pedestrian	stationary+moving	design specific[a]
C1	base	n.a.	objects+pedestrian	stationary	design specific[a]
C2	enhanced	n.a.	objects+pedestrian	stationary+moving	design specific[a]

[a] Direction of movement depends on the design of the LSM function supported by ABLS.

n.a. = non-applicable

4.3 Principle of operation

4.3.1 General

The OEDR (object and event detection and response) of ABLS contains the following elements for performing the vehicle manoeuvre:

— object detection;