
**Intelligent transport systems —
Collision evasive lateral manoeuvre
systems (CELM) — Requirements and
test procedures**

*Systèmes de transport intelligents — Systèmes de manœuvre latérale
d'évitement de collision (CELM) — Exigences et procédures d'essai*



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

| | |
|--|-----------|
| Foreword | v |
| Introduction | vi |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions | 1 |
| 4 Symbols and abbreviated terms | 2 |
| 4.1 Symbols | 2 |
| 4.2 Abbreviated terms | 3 |
| 5 System overview | 3 |
| 5.1 General | 3 |
| 5.2 Classification | 4 |
| 6 General functional requirements | 4 |
| 6.1 Functional elements | 4 |
| 6.2 State transition | 4 |
| 6.2.1 Definition of states | 5 |
| 6.2.2 Transition conditions | 5 |
| 6.3 Response to failure during CELM active state | 6 |
| 6.4 Status indication | 6 |
| 6.4.1 Active state | 6 |
| 6.4.2 Optional warning | 7 |
| 6.4.3 Failure | 7 |
| 6.4.4 CELM switch on/off status | 7 |
| 6.5 Status symbols | 7 |
| 6.6 Minimization of vehicle lateral movement by CELM | 7 |
| 6.7 Driver override | 7 |
| 6.8 User-adjustable intervention thresholds | 7 |
| 6.9 Information to the user in the manual | 7 |
| 7 Operating conditions and requirements for Type 1 systems | 7 |
| 7.1 General | 7 |
| 7.2 Object condition | 8 |
| 7.2.1 Object type | 8 |
| 7.2.2 Amount of lateral offset | 8 |
| 7.3 Activation speed of subject vehicle | 9 |
| 7.4 Road condition | 10 |
| 7.5 Operational limit | 10 |
| 7.5.1 Operation on roads with lane markings | 10 |
| 7.5.2 Operation on roads without lane markings | 11 |
| 8 Operating conditions and requirements for Type 2 systems | 12 |
| 8.1 General | 12 |
| 8.2 Object condition | 13 |
| 8.3 Activation speed of subject vehicle | 13 |
| 8.4 Additional considerations for support beyond collision avoidance | 13 |
| 9 Performance evaluation test methods | 13 |
| 9.1 General | 13 |
| 9.2 Test conditions | 13 |
| 9.2.1 Environmental conditions | 13 |
| 9.2.2 Test course conditions | 13 |
| 9.2.3 Test vehicle conditions | 14 |
| 9.2.4 Test system installation and configuration | 14 |
| 9.2.5 Data recording | 14 |
| 9.2.6 Test target | 14 |

| | | |
|---|--|-----------|
| 9.3 | Type 1 test procedures..... | 15 |
| 9.3.1 | Test case selection..... | 15 |
| 9.3.2 | Test parameters..... | 15 |
| 9.3.3 | Test target selection and positioning..... | 17 |
| 9.3.4 | Test procedures..... | 20 |
| 9.3.5 | Pass criteria..... | 21 |
| 9.4 | Type 2 test procedures..... | 21 |
| 9.4.1 | Test equipment..... | 21 |
| 9.4.2 | Trajectory and torque data..... | 22 |
| 9.4.3 | Test procedure..... | 25 |
| 9.4.4 | Pass criteria..... | 26 |
| Annex A (informative) Examples of use cases for Type 1 systems..... | | 27 |
| Annex B (informative) Additional information for Type 2 testing..... | | 30 |
| Bibliography..... | | 31 |

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

Reducing traffic fatalities, injuries and property damage caused by driver carelessness or unexpected events is a global challenge.

To address this situation, automatic emergency braking (AEB) systems were introduced to mitigate crash consequences through automatic deceleration by braking of the vehicle.

NOTE ISO 22839 and ISO 19237 are examples of related International Standards defining the minimum performance requirements of such systems. The ISO 22733 series defines test procedures to evaluate the performance level of such systems.

These AEB systems work effectively when there is a high probability of a collision, but their operation can be limited, or they can potentially not work at all, when there is a low probability of a collision (e.g. when the degree of overlap to the object is small). However, even in such scenarios, there are cases where a collision can be avoided by system support, i.e. by a small amount of lateral movement.

This document defines functional requirements, minimum performance requirements and test procedures to verify these requirements for collision avoidance systems using lateral movement of the vehicle. The aim of this system is to avoid collisions occurring in the subject vehicle's travelling direction.

Intelligent transport systems — Collision evasive lateral manoeuvre systems (CELM) — Requirements and test procedures

1 Scope

This document specifies basic control strategies, minimum functional requirements, basic driver interface elements, and test procedures for verifying the system requirements for collision evasive lateral manoeuvre systems (CELM).

A CELM is a safety system aimed at supporting the driver's vehicle operation by avoiding collisions with objects in the forward path of the vehicle. When a collision is predicted, the CELM controls lateral movement of the vehicle by generating yaw moment.

The lateral control manoeuvres can be performed automatically by CELM or can be initiated by the driver and supported by CELM.

Specific methods for object detection and other environmental perception technologies are not described in this document.

This document applies to light vehicles^[1] and heavy trucks.^[1] 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.

FMVSS 105, *Hydraulic and Electric Brake Systems*

ISO 19206-2, *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 19206-3, *Road vehicles — Test devices for target vehicles, vulnerable road users and other objects, for assessment of active safety functions — Part 3: Requirements for passenger vehicle 3D targets*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

subject vehicle

SV

vehicle equipped with a collision evasive lateral manoeuvre system (CELM)