TECHNICAL SPECIFICATION

**ISO/TS 23792-1**

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# Intelligent transport systems — Motorway chauffeur systems (MCS) —

## Part 1: Framework and general requirements

*Systèmes de transport intelligents — Systèmes de conduite automatisée sur voie à chaussée séparée (MCS) —*
*Partie 1: Cadre et exigences générales*



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# Foreword

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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).

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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

An automated driving system (ADS) needs to be designed with the capability to cope with various conditions, such as the driving environment, behaviour of other vehicles in the surroundings, traffic regulations, etc.

In addition, an ADS designed to operate on motorways can encounter various situations such as merging into the main lane of traffic, adjusting the speed according to congested or freely flowing traffic, overtaking other vehicles, or changing lanes when approaching an exit/lane closure.

For Level 3 automated driving, the ADS issues a request to the fallback-ready user (FRU) to take over driving tasks when it cannot respond to certain conditions/situations.

The ISO 23792 series identifies the performance requirements for an ADS based on its capability to respond to certain conditions and situations. The requirements are derived in order to reliably transfer the control between the human driver and ADS, and for safe operation by the ADS.

The ISO 23792 series focuses on the system functionalities, under the assumption that the FRU is available and responsive to system requests to take over driving tasks.

# Intelligent transport systems — Motorway chauffeur systems (MCS) —

# Part 1: Framework and general requirements

## 1 Scope

Motorway chauffeur systems (MCS) perform Level 3 automated driving[1] on limited access motorways with the presence of a fallback-ready user (FRU). MCS can be implemented in various forms capable of responding to different driving scenarios. This document describes a framework of MCS including system characteristics, system states/transition conditions and system functions.

MCS are equipped with a basic set of functionalities to perform in-lane operation and can also be equipped with additional functionalities such as lane changing.

This document specifies requirements of the basic set of functionalities and test procedures to verify these requirements. The requirements include vehicle operation to perform the entire dynamic driving task (DDT)[1] within the current lane of travel, to issue a request to intervene (RTI)[1] before disengaging, and to extend operation and temporarily continue to perform the DDT after issuing an RTI.



This document describes one specific form of system engagement. Other forms are possible. These other system engagement forms, especially those provided in combination with other driving automation system features, are not within the scope of this document.



Requirements and test procedures for the additional functionalities are provided in other parts of the ISO 23792 series.

Means related to setting a destination and selecting a route to reach the destination are not within the scope of this document. This document applies to MCS installed in light vehicles.[2]

## 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 15622:2018, *Intelligent transport systems — Adaptive cruise control systems — Performance requirements and test procedures*

ISO/SAE PAS 22736, *Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/SAE PAS 22736 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**
**subject vehicle**
vehicle equipped with a motorway chauffeur system (MCS) feature

**3.2**
**motorway**
road specially designed and built for motorized traffic that does not serve properties bordering on it, and which;

— is provided, except at special points or temporarily, with separate carriageways for the two directions of traffic, separated from each other either by a dividing strip not intended for traffic or, exceptionally, by other means;

— does not cross at level with any road, railway or tramway track, or footpath;

— is specifically sign-posted as a motorway;

— is prohibited for access from non-motorized road users, such as pedestrians and cyclists.

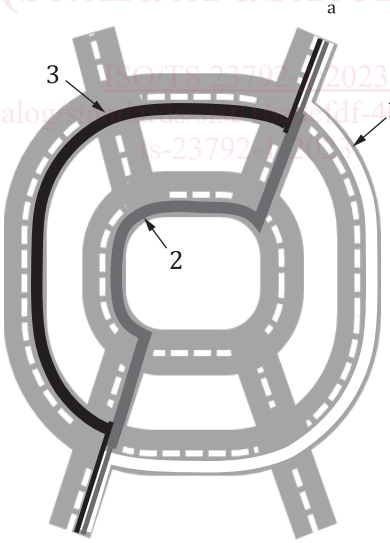
Note 1 to entry: Roads which satisfy the defined conditions above may be referred to using different terms in different countries.

**3.3**
**route**
planned sequence of waypoints to reach a destination



Note 1 to entry: See Figure 1:



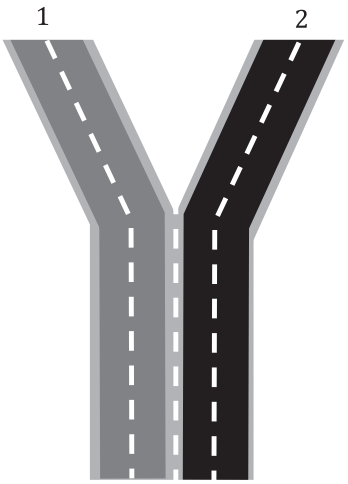



**Key**
1 route A
2 route B
3 route C
a To destination.

**Figure 1 — Route**

**3.4**
**path**
combination of one or more neighbouring lanes in the same direction of travel along a given route

Note 1 to entry: See Figure 2:




**Key**
1 path A
2 path B



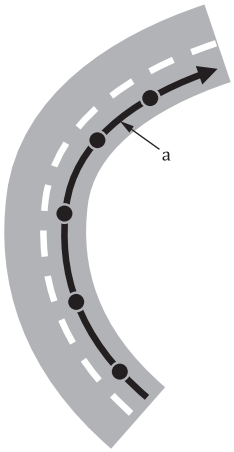
**Figure 2 — Path**



**3.5**
**trajectory**
sequence of locations that define the intended motion vector of the subject vehicle (SV) used as references for vehicle motion control

Note 1 to entry: The motion vector includes longitudinal position and/or speed, also lateral position and/or the vehicle's orientation information.

Note 2 to entry: see Figure 3:




**Key**
[a] Trajectory.

**Figure 3 — Trajectory**

**3.6**
**vehicle motion control**
activities necessary to adjust vehicle movement continuously in real time, which include “lateral vehicle motion control” and “longitudinal vehicle motion control”

Note 1 to entry: “Lateral vehicle motion control” and “longitudinal vehicle motion control” are defined in ISO/SAE PAS 22736.

# 4 Abbreviated terms

| | |
|---|---|
| ADS | Automated driving system [1] |
| DDT | dynamic driving task [1] |
| FRU | fallback-ready user [1] |
| FV | forward vehicle |
| HMI | human machine interface |
| MCS | motorway chauffeur system |
| MRC | minimal risk condition [1] |
| MRM | minimal risk manoeuvre |
| ODD | operational design domain [1] |
| OEDR | object and event detection and response [1] |
| TTC | time to collision |
| RTI | request to intervene [1] |
| SV | subject vehicle |
| VMC | vehicle motion control |



# 5 Characteristics of MCS

## 5.1 General

This document covers a variety of implementations of MCS based on its operational design domain (ODD) (see 5.2) and functionalities (see 5.3).

The ODD definition of an MCS is considered to be design-specific for its implementation. Therefore, the requirements in this document apply to the functionalities and performance of the MCS within its prescribed ODD.

## 5.2 Operational design domain

### 5.2.1 General

Each MCS shall have a pre-defined ODD, and the user shall be informed of the general ODD limitations (i.e. to make clear under which conditions a given MCS is capable of operating or not).

The description of an ODD shall, at minimum, include the following information unless the item does not represent a restriction for system operation.

— Roadway physical characteristics.

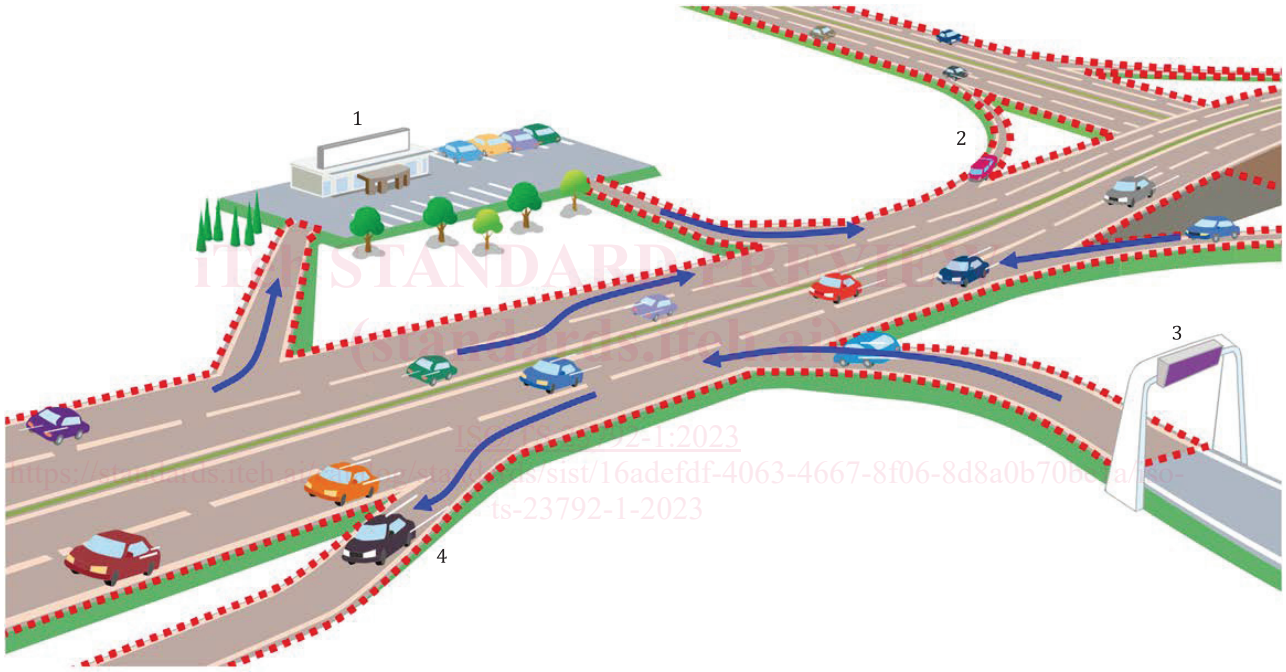
— Traffic in the surrounding environment.

— Abnormalities in roadway operational condition.

— Ambient environmental conditions.

The following subclauses provide examples of possible ways to describe the above-mentioned ODD attributes. However, such attributes are not limited to those listed below, and more details should also be added as needed. ISO 34503 provides a sample list of ODD attributes.

Figure 4 illustrates an image of the geographical ODD boundaries for an MCS capable of operating from the entrance through the exit of a motorway.




**Key**

| | |
|---|---|
| 1 | service area |
| 2 | junction |
| 3 | tollgate |
| 4 | exit |
| | example of geographical ODD of MCS |
| | MCS may also be designed to operate within more restricted boundaries that do not include entrance and exit ramps or merging and lane changing locations |

**Figure 4 — Example of geographic boundary (geofence) of an ODD**

### 5.2.2 Roadway physical characteristics

Roadway characteristics should be considered as possible ODD attributes. MCS may be designed to operate on roads with or without certain characteristics such as those mentioned below.

— Road configuration (e.g. number of lanes in each direction, existence of medians, road shoulders).

— Road structure characteristics (e.g. curvatures, slopes, undulations).

— Quality and visibility of lane markings.

— Surface characteristics of road structures (e.g. irregularity, running resistance friction coefficient, potholes).

NOTE To explain the above general roadway characteristics as part of the ODD to the user, sections of the motorway can be mentioned. For example, if the absence of a median strip to divide the carriage way is an out of ODD condition, the starting point and the end point of the section with no median strips can be considered as the geographical boundaries of the ODD.

### 5.2.3 Traffic in the surrounding environment

Existence of traffic in the surrounding environment and its motions (e.g. travelling speed, travelling direction) may be considered as a possible ODD attribute. Vehicles in the forward direction, as well as in the adjacent lanes and behind the subject vehicle (SV) may be considered as ODD attributes for an MCS to operate.

Existence of emergency vehicles (e.g. ambulance) may also be considered as a possible ODD attribute. If an MCS is not capable of responding appropriately to emergency vehicles, existence of approaching emergency vehicles should be considered as an out of ODD condition.

### 5.2.4 Abnormalities in roadway operational condition

Restrictions in roadway operational conditions, such those in the following list, should be considered as possible ODD attributes.



— Lane blockage.

— Traffic incident (e.g. crash, failed vehicle).

— Existence of road work (e.g. construction, maintenance).



### 5.2.5 Ambient environmental conditions

Characteristics related to ambient environmental conditions (including weather conditions), such as those in the following list, should be considered as possible ODD attributes.

— Sunlight (e.g. illuminance, direction).

— Temperature.

— Rain, snow, hail (e.g. precipitation impact on visibility).

— Wind (e.g. speed, direction).

— Fog (e.g. visual distance).

## 5.3 System functionalities

### 5.3.1 General

The following subclauses define the functionalities of an MCS. Each MCS shall be equipped with the basic set of functionalities (5.3.2) and may also be equipped with additional functionalities (6.3.13). Each functionality may have further detailed classifications associated with individual requirements.