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Road vehicles — Human performance and state in the context of automated driving —

Part 1: Common underlying concepts

Véhicules routiers — Etat et performance humaine dans le contexte de la conduite automatisée —

Partie 1: Concepts fondamentaux

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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).

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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 22, *Road vehicles*, Subcommittee SC 39, *Ergonomics*.

This second edition cancels and replaces the first edition (ISO/TR 21959-1:2018), which has been technically revised. The main changes compared to the previous edition are as follows:

— editorial modifications to the format of the figures;

— corrections of the references to clause numbers (Clause 7 is now Clause 8);

— corrections to redundant descriptions.

A list of all parts in the ISO 21959 series can be found on the ISO website.

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.

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Introduction

Although automation technology is advancing at a very fast pace, the majority of automated driving levels (as defined by SAE) still require a human to fulfil specific remaining (driving related) tasks while being in automated driving mode. The basic requirements with respect to the driver strongly depend on the level of automation and are subject to human factors research all over the world. The SAE standards SAE J3016[70] [71] and SAE J3114[72] have already introduced working definitions of key concepts in this field. This document puts an emphasis on common underlying concepts of driver performance and state in the context of automated driving.

Driver performance includes driver's activities in transitions both from manual driving to automated driving and from automated to manual driving, as well as interaction behaviour while using the system. Driver state here means driver's internal conditions that may affect performance including knowledge of and attitudes toward driving automation systems.

Concepts on driver performances in transition from manual to automated driving and from automated to manual driving are described in Clause 5. Concepts on driver state related to the transition are described in Clause 6 and a specific concept "readiness/availability" that refers to driver state that predicts the intervention performance is described in Clause 7. Concepts for driver's experiences and attitudes that may affect driver performance and state in the context of automated driving are described in Clause 8.

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Road vehicles — Human performance and state in the context of automated driving —

Part 1: Common underlying concepts

1 Scope

This document introduces basic common underlying concepts related to driver performance and state in the context of automated driving. The concepts in this document are applicable to all levels of automated driving functions that require a human/driver to be engaged or fallback-ready (SAE level 1, 2 and 3). It can also be used with levels that enable a driver to resume manual control of the vehicle (a compatible feature for SAE levels 1 to 5).

Common underlying concepts can be applicable for human factors assessment/evaluations using driving simulators, tests on restricted roadways (e.g. test tracks) or tests on public roads. The information applies to all vehicle categories.

This document contains a mixture of information where technical consensus supports such guidance, as well as discussion of those areas where further research is required to support technical consensus. These common underlying concepts can be also useful for product descriptions and owner manuals. The contents in this document are informative, rather than normative, in nature.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Purpose

The purpose of this document is to provide common underlying concepts for human performance and state for the researchers and developers of driving automation systems (more specifically SAE levels 1–5) in order to facilitate the sharing of information and knowledge as these systems are developed and deployed.

This document does not provide design principles on how a human-machine interface (HMI) for automated driving should be designed or developed. However, common concepts and measures could be used during the development phase when different HMI designs are evaluated in terms of usability, user experience and safety.

It is not intended that anything in this document restricts or provides direction regarding the technology used to create these systems, or the underlying design of these system.

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