INTERNATIONAL STANDARD

ISO 34502

First edition
2022-11

Road vehicles — Test scenarios for automated driving systems — Scenario based safety evaluation framework

Véhicules routiers — Scénarios d'essai pour les systèmes de conduite automatisée — Cadre d'évaluation de la sécurité basé sur des scénarios

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Reference number
ISO 34502:2022(E)

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Published in Switzerland

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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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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 33, *Vehicle dynamics and chassis components.*

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

In order to safely introduce automated driving systems (ADS) into the market, socially acceptable and technically sound scenario-based safety evaluation methodologies need to be developed. A number of national and international governmental institutions are gradually releasing technical safety guidelines[7][8][9] to support the development of these methodologies, as well as associated regulations and standards.

In order to evaluate whether ADSs are free from unreasonable risks, it is beneficial to develop safety evaluation methodologies. Considering emphasis on limited access highways, scenario-based safety evaluation methodologies are suitable for assessing safety in a repeatable, objective and evidence-based manner and that is compatible with existing standards.

Functional safety is defined as the absence of unreasonable risks that arise from malfunctions of an electric/electronic (E/E) system. The ISO 26262 series specifies a hazard analysis and risk assessment to determine vehicle level hazards. This evaluates the potential risks due to malfunctioning behaviour of the system and enables the definition of top-level safety requirements, i.e. the safety goals, necessary to mitigate the risks.

For some E/E systems, which rely on sensing the external or internal environment to build situational awareness, there can be potentially hazardous behaviour caused by or within the intended functionality. Examples of the causes of such potentially hazardous behaviour include the inability of the function to correctly comprehend the situation and operate safely or insufficient robustness of the function, system, or algorithm. The absence of unreasonable risk resulting from hazardous behaviours related to functional insufficiencies is defined as the safety of the intended functionality (SOTIF).

Functional safety (the ISO 26262 series) and SOTIF (ISO 21448) are distinct, necessary, and complementary aspects of safety. This document is conformant with SOTIF and adds specificity to its content, by incorporating a scenario-based safety evaluation process that identifies risk factors and related critical scenarios that affect the intended functionality, and apply them to evaluate whether the ADS is free from unreasonable risks.

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Road vehicles — Test scenarios for automated driving systems — Scenario based safety evaluation framework

1 Scope

This document provides guidance for a scenario-based safety evaluation framework for automated driving systems (ADSs). The framework elaborates a scenario-based safety evaluation process that is applied during product development. The guidance for the framework is intended to be applied to ADS defined in ISO/SAE PAS 22736 and to vehicle categories 1 and 2 according to Reference [10]. This scenario-based safety evaluation framework for ADS is applicable for limited access highways.

This document does not address safety-related issues involving misuse, human machine interface and cybersecurity.

This document does not address non-safety related issues involving comfort, energy efficiency or traffic flow efficiency.

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 34501, *Road vehicles — Test scenarios for automated driving systems — Vocabulary*

ISO 21448, *Road vehicles — Safety of the intended functionality*

ISO 26262-3, *Road vehicles — Functional safety — Part 3: Concept phase*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 34501 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
critical scenario
scenario including one or more *risk factors* (3.3)

3.2
hazardous scenario
scenario in which harm occurs unless prevented by an entity other than the ADS

3.3
risk factor
factor or condition of a scenario that, if present, increases either the probability of the occurrence of harm, or the severity of harm, or both

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