

TR 68 : Part 2 : 2021
(ICS 43.020; 43.040)

TECHNICAL REFERENCE
Autonomous vehicles
– Part 2 : Safety

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Land Transport Authority
SBS Transit Limited
Siemens Mobility Pte Ltd
SMRT Corporation Ltd
ST Engineering Limited
TÜV SÜD Asia Pacific Pte Ltd

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Foreword

This Technical Reference (TR) was prepared by the Working Group on AV Safety set up by the Technical Committee on Automotive under the purview of MSC.

TR 68 series of standards is intended to support the development of Autonomous Vehicle (AV) technology and deployments. It consists of the following parts under the generic title “Autonomous vehicles”:

Part 1 – Basic behaviour

Sets out fundamental behaviours AVs should exhibit while driving on public roads in order to co-exist safely with entities on the roads such as other vehicles, cyclists, and pedestrians.

Part 2 – Safety

Sets out the safe design and continuing safety management process requirements, supported by competent personnel and organisational quality certifications that organisations can have in place so that the AVs driving on public roads are inherently safe and behave in the manner that they are designed to.

Part 3 – Cybersecurity principles and assessment framework

Sets out principles and assessment framework for organisations to support development and management of AVs. The assessment framework is intended to provide a cybersecurity safeguard for AVs to satisfy prior to on-road deployment.

Part 4 – Vehicular data types and formats

Sets out what data, resolution, capture frequency and the format in which they are transmitted so that there is seamless communication between the sending party and the receiving party.

This TR is a provisional standard made available for application over a period of three years. The aim is to use the experience gained to update the TR so that it can be adopted as a Singapore Standard. Users of the TR are invited to provide feedback on its technical content, clarity and ease of use. Feedback can be submitted using the form provided in the TR. At the end of the three years, the TR will be reviewed, taking into account any feedback or other considerations, to further its development into a Singapore Standard if found suitable.

The main changes made in this revision are as follows:

- a) Updated the definitions,
- b) Added topic “Design control requirements: Autonomous vehicles definition and Singapore scope of operations” as 6.2,
- c) Added topic “Minimum Equipment List” as 6.9,
- d) Added topic “Artificial Intelligence (AI) within safety systems” as Clause 8.

In preparing this TR, reference was made to ISO/PAS 21448:2019, “Road vehicles – Safety of the intended functionality”. Figure 5 of this TR was reproduced from ISO/PAS 21448 with the kind permission of the International Organization for Standardization (ISO). ISO standards can be purchased from Enterprise Singapore.

Attention is drawn to the possibility that some of the elements of this TR may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "Mature standards". Mature Standards will not be subject to further review, unless there are requests to review such standards.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*
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Technical Reference for autonomous vehicles – Part 2: Safety

0 Introduction

Safety is one of the key issues of future automobile development. With more functionalities being developed, there is a need to address the systems engineering aspect of these developments to facilitate the introduction of autonomous driving.

This TR describes a set of minimal safety provisions to be met by autonomous vehicle developers, original equipment manufacturers (OEMs) and/or operators at the organisational level that align with international practices, while taking into consideration local conditions. These are applicable to processes that impact the safety of the autonomous systems, including systems for managing one or more autonomous vehicle (AVs) operating on public roads and are intended to cover automated driving system (ADS) and vehicles that operate or aim to operate as defined in SAE J3016.

This TR is applicable to the following stakeholders:

- Public or private entities which design and/or manufacture and/or procure and/or install and/or test and/or commission AV technologies, systems and/or solutions;
- Public or private entities which use AVs and/or are in charge of the operation and/or maintenance of AVs and provides transportation services in public areas; and
- Independent bodies which check and/or assess AV technologies, systems and/or solutions and/or the operation and maintenance of AVs.

Automation driving levels, ADS, operational design domain (ODD) and dynamic driving task (DDT) are defined in SAE J3016.

1 Scope

The TR specifies the safety provisions for AVs deployed on public roads. It covers the use case of deployment in Singapore.

This TR can be subdivided into two major fields:

- a) Design and production quality; and
- b) Safe operation in the context of specific applications in Singapore.

This TR stipulates system-level safety in order to ensure that:

- a) functional and operational safety requirements of AVs are met;
- b) system safety is applicable to the operation design domain in which the AV operates;
- c) AV developer, system integrator and system operator are competent organisations with an appropriate quality management system in place supported by competent personnel; and
- d) appropriate safety goals are in place to guide safety assurance at the system level.

This TR does not differentiate between vehicles being built from scratch and conventional homologated vehicles, which have been equipped with additional ADS technology (see SAE J3016) to increase the supported level of driving automation within SAE J3016's levels.

Refer to Figure 1 for the scope chart.