INTERNATIONAL STANDARD

First edition 2016-10-15

Intelligent transport systems — External hazard detection and notification systems — Basic requirements

Systèmes intelligents de transport — Détection du danger externe et systèmes de notification — Exigences de base

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<u>ISO 18682:2016</u> https://standards.iteh.ai/catalog/standards/sist/23afb54e-98a2-49d5-97db-8b0bc8940940/iso-18682-2016



Reference number ISO 18682:2016(E)

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Contents

Page

Fore	word		iv		
Intro	oductio	n	v		
1	Scope				
2	Norr	Normative references			
3	Terms and definitions				
4	External hazard detection and notification systems				
	4.1	4.1 General			
	4.2	Categories of hazard notification			
	4.3	Types of external hazard detection and notification system			
	4.4	Functional configuration			
		4.4.1 Basis of functional configuration			
		4.4.2 Detection functional block			
		4.4.3 Assessment functional block			
		4.4.4 Human machine interface (HMI) functional block			
		4.4.5 Communication functional block	5		
	4.5	Time factors of hazard notification			
		4.5.1 General	5		
		4.5.2 Detection functional block time factor	5		
		4.5.3 Assessment functional block time factor	5		
		4.5.4 HMPfunctional block time factor PREVER			
		4.5.5 Communication functional block time factor			
		4.5.6 Time factor after hazard notification a1)			
5	Requ	irements for external hazard detection and notification systems			
	5.1	Principle	7		
	5.2	Particulars//standards.teh.a/catalog/standards/sist/23atb54e-98a2-49d5-97db-	7		
		5.2.1 General 860bc8940940/iso-18682-2016			
		5.2.2 Detection information	7		
		5.2.3 Assessment information			
		5.2.4 Notification information			
		5.2.5 Timing of hazard notification	9		
		5.2.6 Distance of hazard notification			
6	Non-functional requirements				
-	6.1	General			
	6.2	Consistency			
	6.3	6.3 Priority			
	6.4	.4 Security			
	6.5	Quality			
	6.6	.6 Integration			
Anne	ex A (in	formative) Consideration of timing and distance of hazard notification (ca	se study) 16		
Bibli	iograpł	ıy			

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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

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Introduction

External hazard detection and notification systems recognize vehicle conditions and their ambient environment using on-board remote sensing or cooperatively through communication between infrastructure and vehicle (I-V), or among vehicles (V-V), and warn or inform the driver about external hazards.

This document addresses a number of functions, such as slow vehicle indication, collision hazard warning, lane change assistance, red light warning, and intersection crossing assistance. There are common requirements for several external hazard detection and notification systems. Many other standard development organizations may consider systems that assist driving safety. The scope of ISO/TC 204 is to promote a positive experience of vehicle/roadway warning and control systems for the driver.

This document is not intended to provide requirements for particular systems defined in each individual standard, but basic requirements based on basic principles for external hazard detection and notification systems. They are common requirements in similar systems, such as safety systems on nomadic devices and systems developed in ISO/TC 204, and should become root or primal requirements to define each system's requirements. This document will be referred to when designing various systems in the future. It is expected to ensure uniformity and efficiency and building systems that reduce the likelihood of confusion for the driver.

For a better understanding of basic requirements, examples of typical formulae are shown in this document as informative elements. In addition, calculated examples of some services are given as information in the annex. Fruitful information on particular consideration is listed in the Bibliography.

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Intelligent transport systems — External hazard detection and notification systems — Basic requirements

1 Scope

This document specifies basic requirements for systems to execute notifications such as warning and awareness messages to provide hazard information to a driver.

Requirements include principle of notifying, timing of notification, distance of notification, and information elements that should be included in messages.

NOTE 1 Methods of implementing functions such as hazardous conditions detection, communication, and presentation to drivers are not specified in this document.

NOTE 2 The formulae in <u>Clause 5</u> and calculated concrete time or distance duration in <u>Annex A</u> are not normative elements but informative elements.

2 Normative references

There are no normative references in this document I I Ch STANDARD PREVIEW

3 Terms and definitions(standards.iteh.ai)

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

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

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

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

3.1

hazard notification

information that is provided to a driver to notify of external hazards

3.2

warning

type of *hazard notification* (3.1) that requests action be taken immediately to avoid an external hazard

3.3

awareness message

type of *hazard notification* (3.1) that informs the driver about an external potential hazard within a short time in the future

3.4

hazardous condition

external conditions that have intrinsic risks of causing accidents or collisions

3.5

safe state

vehicle state that is achieved after avoiding a hazardous condition (3.4)

4 External hazard detection and notification systems

4.1 General

External hazard detection and notification systems distinguish hazardous conditions that occur currently, imminently, or potentially and notify the driver with a warning and/or awareness message to adjust steering and speed quickly enough to avoid such situations.

4.2 Categories of hazard notification

Hazard notifications given to a driver are classified into two categories according to response of the driver expected by the system as follows.

- a) Warnings. Systems detect immediate hazardous conditions, assess need to perform an avoidance manoeuvre by the driver in a short time, and notify the driver with a warning. The driver is expected to respond accordingly with a corrective manoeuvre in a short time;
- b) Awareness messages. Systems detect potentially hazardous conditions and assess that a probability of a hazard is high if the condition remains and the driver needs to perform avoidance action. The system then notifies the driver with an awareness message. The driver is expected to prepare to avoid a potential hazard within a short time in the future.

4.3 Types of external hazard detection and notification system

External hazard detection and notification systems collect information on a detected hazardous condition from various sources and assess its hazardous nature, then inform drivers via a hazard notification.

External hazard detection and notification systems are classified into two types according to how the information is acquired. https://standards.iteh.ai/catalog/standards/sist/23afb54e-98a2-49d5-97db-

- a) Autonomous external hazard detection and notification systems (autonomous type). Autonomous external hazard detection and notification systems assess the situation using information obtained solely on-board the subject vehicle and notify the driver of hazards;
- b) Cooperative external hazard detection and notification systems (cooperative type). Cooperative external hazard detection and notification systems assess the situation using information obtained from external systems such as infrastructure or other vehicles via wireless communication and notify the driver of hazards.

NOTE 1 Cooperative external hazard detection and notification systems may also use information from the subject vehicle, such as velocity of vehicle and location of vehicle.

Cooperative type includes two types of systems.

- Infrastructure-vehicle cooperative external hazard detection and notification systems (I-V cooperative type). Infrastructure-vehicle cooperative external hazard detection and notification systems assess a situation using information from the subject vehicle and infrastructure and notify the driver of hazards;
- 2) Vehicle-vehicle cooperative external hazard detection and notification systems (V-V cooperative type). Vehicle-vehicle cooperative external hazard detection and notification systems assess a situation using information from the subject vehicle and other vehicles and notify the driver of hazards.

NOTE 2 There may be systems that use information from both infrastructure and other vehicles.

Types of external hazard detection and notification system are shown in <u>Table 1</u>.

Table 1 — Types of external hazard detection and notification system that function as sourcesof information

	Direct sourc	e of information ^a Type	Own vehicle	Infrastructure ^b	External vehicle ^b
a) Autonomous type			Х		
b)	Cooperative type	1) I-V cooperative type	Х	Х	
		2) V-V cooperative type	Х		Х
^a Information on subject vehicle such as speed, acceleration/deceleration, and location may be used regardless of system type.					

^b There may be cooperative systems that use information from both infrastructure and other vehicles.

4.4 Functional configuration

4.4.1 Basis of functional configuration

Systems described in the present standard include necessary functional blocks, which encompasses the following:

- a) detection functional block;
- b) assessment functional block;
- c) human machine interface (HMI) functional block. **PREVIEW**

NOTE 1 Where each function is allocated depends on system design. For example, the HMI notifies a driver of the same notification that may be assessed by devices in infrastructures or assessed in own vehicle. There are systems in which assessments or decisions are performed by infrastructure systems and an example of a system is described in <u>A.2</u>. ISO 18682:2016

When hazardous conditions are detected by systems outside the vehicle and transmitted to the vehicle via wireless communication, communication functional blocks is added.

NOTE 2 Transmitting information between devices at the same location (e.g. between vehicle devices or between devices in the infrastructure) is not included in this functional block, but in other detection, assessment, or HMI functional block.

Abstract functional block configuration is shown in <u>Figure 1</u>.



NOTE Where to allocate the function of the communication functional block depends on system design.

Figure 1 — Abstract functional block configuration

Examples of function allocation are shown in <u>Table 2</u>.

	Infrastructurea	Other vehicle ^a	Subject vehicle ^a	
Autonomous type	_	_	a) detection functional blockb) assessment functional blockc) HMI functional block	
I-V cooperative type	a) detection functional block d) communication functional block (I-V)	_	 d) communication functional block (I-V) b) assessment functional block c) HMI functional block 	
V-V cooperative type	_	a) detection functional block d) communication functional block (V-V) ^b	 d) communication functional block (V-V) b) assessment functional block c) HMI functional block 	
^a This function alloc	This function allocation is just an example. Each function may be allocated at other locations.			
Relaying communication via infrastructure (V-I to I-V) may be included.				

Table 2 — Example of function allocation

4.4.2 Detection functional block

The detection functional block detects hazardous conditions using sensors or accumulated data and provides them to the assessment block. Hazardous conditions are not distinguished using only a simple measurement value but together with time course, other measurement values, and also other information. The detection functional block may be located in the subject vehicle, infrastructure, or other vehicles.

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NOTE 1 Allocations of detection or related functions depend on system design. (standards.iteh.ai)

Detection block includes detection function.

NOTE 2 There may be multiple different detection functions in the vehicle and/or infrastructure.

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4.4.3 Assessment functional block

The assessment functional block handles information provided by the detection functional block and derives assessments needed to issue hazard notifications and provides information to the HMI functional block.

NOTE Allocation of functions for assessment or related functions depends on system design.

The assessment functional block includes sub-functions such as the following.

 Situation assessment function. Situation assessment function assesses hazardous situations using various detected information provided by the detection function.

EXAMPLE 1 To assess if a vehicle will experience a rear-end collision or not.

 Notification assessment function. Notification assessment function assesses implementation and content of hazard notifications based on hazard situation assessed function.

EXAMPLE 2 To assess which notification is suitable "apply brake" or "keep distance".

4.4.4 Human machine interface (HMI) functional block

The HMI functional block issues hazard notifications to a driver using information provided by the Assessment functional block.

NOTE There may be two types of device that have HMI: one is designed exclusively for specific hazard notification; the other is used in common for multiple types of hazard notification or other information provision.

The HMI functional block includes sub-functions such as the following.

- Provision processing function. Provision processing function prepares information provided to a driver. In case multiple information is notified to the driver, the priority of each piece of information is assessed and hazard notification is provided appropriately.
- Presentation function. Presentation function renders hazard notification to the driver.

4.4.5 Communication functional block

The communication functional block transmits information to vehicles from the infrastructure or other vehicles via wireless communication.

The communication functional block includes communication function.

4.5 Time factors of hazard notification

4.5.1 General

Time factors needed from the point when a hazardous condition occurs or is detected to the point when the vehicle has avoided a hazard are shown in <u>Table 3</u>.

	iTeh ttems	NDARD PREVI	Time factors
Functions of external	Detection block	Detection function	Detection time
hazard detection and notification systems	Assessment block	Situation assessment function Notification assessment	Situation assessment time Notification assessment time
http	s://standards.iteh.ai/cata	Buschlonds/sist/23afb54e-98a2-49	d5-97db-
	HMI block 8b0bc	Provision processing	Provision processing time
		function Presentation function	presentation time
	Communication block	Communication function	Communication time
Out of function of external hazard detection and notification systems	Time factor after ha	azard notification	Driver reaction time Vehicle state variation time, until vehicle has reached a safe state

Table	3	— Time	factor
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Each function may include a certain processing time. The time required to distribute information between devices should be included in the processing time of each function. Alternatively, the length of time may be zero depending on the layout of functions.

4.5.2 Detection functional block time factor

The detection functional block time factor is the time required to detect hazardous conditions. Detecting hazardous conditions may require measurement value of time course, other measurement values, and/or other information. These are included in the detection functional block time factor.

The detection functional block time factor includes detection time.

EXAMPLE If the area or length of the hazardous condition is expanding or moving, the hazardous conditions should be detected after a regular interval.

4.5.3 Assessment functional block time factor

The assessment functional block time factor is the time required to assess the situation and issue a hazard notification.