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

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 18682 was prepared by Technical Committee ISO/TC 204, Intelligent transport systems, Working group WG14, Vehicle/roadway warning and control systems.

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 international standard 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 working groups of ISO and other standard development organizations may consider systems that assist driving safety. The scope of ISO/TC204/WG14 is to promote a positive experience of vehicle/roadway warning and control systems for the driver.

This international standard 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/TC204/WG14, and should become root or primal requirements to define each system's requirements. This international standard 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 formulas are shown in this standard 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 Bibliography.

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

1 Scope

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

NOTE Formulas in Section 5 and calculated concrete time or distance duration in Annex A are not normative elements.

2 Normative references

The following referenced documents are indispensable when applying this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

(TBD) ISO ab-c:199x, General title of series of parts - Part c: Title of part

(TBD) ISO xyz (all parts), General title of the series of parts

3 Terms and definitions

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

3.1

hazard notification

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

3.2

warning

one type of hazard notification that requests action be taken immediately to avoid an external hazard

3.3

awareness message

one type of hazard notification 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

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 manoeuver 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:

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 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 system:

1) 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 There may be systems that use information from both infrastructure and other vehicles.

Types of external hazard detection and notification system are shown in Table 1.

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

Туре	Direct source of information ^A	Own vehicle	Infrastructure ^B	External vehicle ^B
a) Autonomous ty	уре	Х		
b) Cooperative	1) I-V Cooperative type	Х	Х	
type	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:

- a) Detection functional block;
- b) Assessment functional block;
- c) Human machine interface (HMI) functional block

NOTE 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 Annex A2.

When hazardous conditions are detected by systems outside the vehicle and transmitted to the vehicle via wireless communication, the following function is added:

d) Communication functional blocks.

NOTE 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 Figure 1.



Figure 1 — Abstract functional block configuration

NOTE Where to allocate the function of the Communication functional block depends on system design. Examples of function allocation are shown in Table 2.

	Infrastructure ^A	Other vehicle ^A	Subject vehicle ^A					
Autonomous type	-	-	a)detection functional block					
			b)assessment functional block					
			c)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					
		PRE al al	CHMI functional block					
 A This function allocation is just an example. Each function may be allocated at other locations. B Relay communication via infrastructure (V-I to I-V) may be included. 								
4.2 Detection functional block								

Table 2 —	Example of	function	allocation
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4.4.2 Detection functional block

STATIONS CONTRACTOR STATISTICS AND S 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.

NOTE Allocations of detection or related functions depend on system design.

Detection block includes the following:

Detection function.

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

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 depend 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 To assess if a vehicle will experience a rear-end collision or not