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Transport information and control systems — Traffic Impediment Warning Systems (TIWS) — System requirements

Systèmes de commande et d'information des transports — Systèmes d'avertissement des obstacles au trafic (TIWS) — Exigences des systèmes

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Foreword

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

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

ISO/TS 15624 was prepared by Technical Committee ISO/TC 204, *Transport information and control systems*.

Annexes A to J of this Technical Specification are for information only.

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Introduction

Once an accident occurs on a highway, the accident and congestion and other hazardous conditions may result in blocking of the lanes. This often leads to a situation where the safety of the traffic flow behind the accident cannot be guaranteed. Conventionally, it could take more than ten minutes before the occurrence of an accident is known, since accidents are generally reported by emergency telephones installed along the road. In the case of minor accidents, drivers usually drive away without reporting the incident. Detection, therefore, is very difficult, and there are cases where damaged facilities often obstruct traffic flow.

The main system function of a Traffic Impediment Warning System (TIWS) is to secure a smooth and safe flow of traffic subsequent to an accident, and can be achieved by: quick detection of an accident, rapid processing of the initial activities surrounding the accident and removal of impediments, dissipating traffic congestion at an early stage, and providing information to following vehicles.

The goal of TIWS is a partial automation of the traffic impediment information collection and provision, and the reduction of the workload of the driver with the aim to support and relieve the driver and the traffic system operator in a convenient manner.

This Technical Specification may be used as a system level standard by other standards, which extends the TIWS to a more detailed standard e.g. for specific sensor concepts or higher level of functionality. So, issues like specific requirements for the sensor function and performance or communication links for cooperative solutions will not be considered in this document.

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Transport information and control systems — Traffic Impediment Warning Systems (TIWS) — System requirements

1 Scope

This Technical Specification specifies system requirements for Traffic Impediment Warning Systems (TIWS). The purposes of the warning system are that information collected by the infrastructure is automatically and quickly provided to vehicles and reported to the traffic system operator, so vehicles can avoid secondary accidents. A major function of the system is to save lives by speedier rescue activities and, a quicker clearing up of accident-caused congestion. This Technical Specification focuses on closed circuit television (CCTV) cameras as the sensors, to detect traffic impediments using image processing and variable message signs as the communication method to provide information to drivers.

2 Terms and definitions

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

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2.1
Traffic Impediment Warning Systems
TIWS
system that automatically detects traffic impediments by employing sensors, reports occurrences of accidents to a traffic system operator, and provides information on the presence of traffic impediments to following vehicles before the cause is visible to them

NOTE See annex A.

2.2
stopped vehicles
vehicle that has stopped in a traffic lane or on the shoulder of the roadway

2.3
slow moving vehicles
vehicle travelling at or below “A” km/h within a traffic flow

NOTE The value for “A” is to be determined according to the road configuration and speed limit.

2.4
judgement distance
distance travelled by a vehicle until the driver judges what action is to be taken after having received information about a traffic impediment

2.5
reaction distance
distance travelled by a vehicle from the time the driver judged what action to take until the time the brake is applied after having been notified of a traffic impediment

2.6
braking distance
distance the vehicle needs in order to stop after the brakes have been applied

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2.7
camera blind spot range
distance from the location where a camera is installed to the beginning of the area over which the camera is able to monitor traffic impediments

NOTE The camera is unable to monitor traffic impediments in this blind area.

2.8
out-of-sight range
distance from the point where a variable message sign becomes no longer readable to the place where the variable message sign is located

2.9
average spacing
average distance between the front of one vehicle and another in a continuous traffic flow

NOTE This parameter is inversely proportional to the density of traffic.

3 Specifications and requirements

3.1 General specifications

The system configuration should be in accordance with Figure 1.

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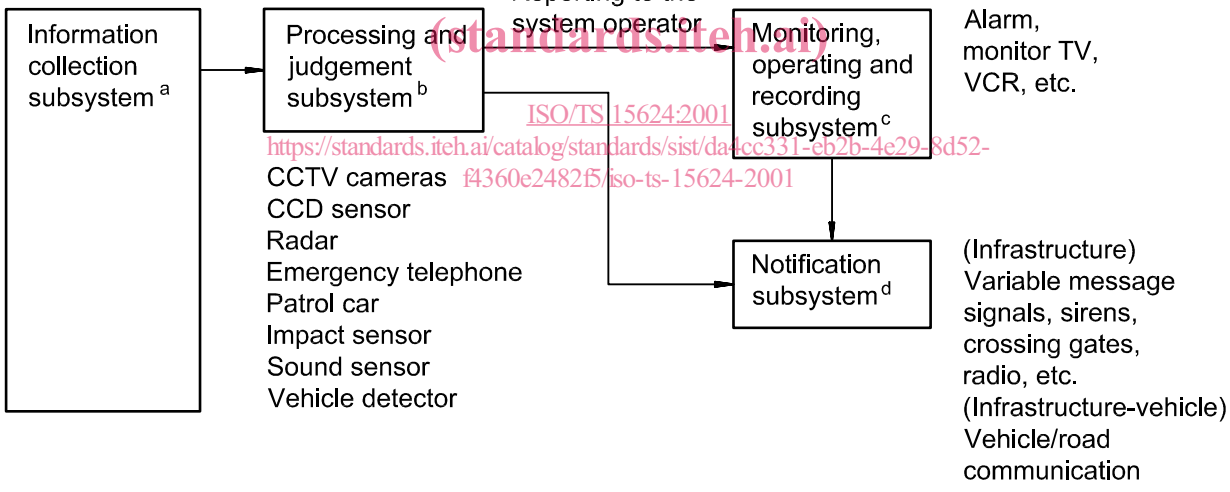

a The information collection subsystems consist of equipment to detect traffic impediments by various sensors installed on, or alongside, a road. This Techical Specification focuses on the detection of traffic impediments from image processing by using CCTV cameras serving as sensors to automatically detect traffic impediments.

b The processing and judgement subsystem processes the information detected from a camera, and/or a sequence of cameras, and determines the occurrence of traffic impediments.

c The monitoring, operating and recording subsystem notifies the traffic system operator using an alarm or another method when a traffic impediment is detected. The subsystem, using monitor TV, allows the operator to confirm both the situation and the location of the impediment. The operator can then change the information provided to drivers as necessary, record the situation with a VCR, or take action.

d The notification subsystem provides information about the traffic impediments to drivers using variable message signs and other means. Alternatively, it can forcibly close roads or prohibit traffic through certain roads.

Figure 1 — System configuration

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3.2 Classifications

Table 1 presents a conceptual basis of the system. The table indicates that secondary accidents can be avoided and drivers protected in the future because of the speedy detection and quick provision of information concerning traffic impediments. Current standardization subjects are those indicated by “X” in the table.

NOTE The detection of congestion is not within the range of the systems addressed in this Technical Specification. TIWS should detect stopped vehicles and/or slow moving vehicles at the tail of a congestion queue.

3.3 Objects constituting traffic impediments and detection coverage

3.3.1 Detection objects

3.3.1.1 **Level 1:** Stopped vehicles and slow moving vehicles, excluding motorcycles

3.3.1.2 **Level 2:** Level 1 + change in the movement of vehicles performed to avoid some obstacle or hazardous condition that is present

3.3.1.3 **Level 3:** Level 2 + motorcycles

3.3.1.4 **Level 4:** Level 3 + other obstacles

NOTE 1 Level 1 is currently being considered as a subject for standardization.

NOTE 2 Limits of the size of detectable obstacles related to Level 4 are not addressed in this Technical Specification.

NOTE 3 Vehicle includes three-wheeled vehicles.

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3.3.2 Detection coverage

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The detection coverage in transverse directions shall include all traffic lanes and shoulders. The detection coverage in longitudinal directions should be determined according to the sensor instrument performance, detection time, installation height and peripheral environment (see annex D).

Table 1 — System concept for TIWS

Detection systems			Detection objects				
			Level 1	Level 2	Level 3	Level 4	Information providing methods
Infrastructure system	Infrastructure-infrastructure	Class 1 [a]	X				Variable message sign
		Class 2 [b]	X				Variable
Cooperative system	Infrastructure-vehicle	Class 3 [c]					Beacon, leakage coaxial cable, variable message, sign, radio

NOTE Levels are defined in 3.3.

[a] Necessary traffic information that has been collected by the infrastructure and reported to the traffic system operator is provided to the travellers via variable message signs.

[b] Information collected by the infrastructure is automatically provided to equipment (i.e. variable message signs) which are installed in the infrastructure to improve the safe traffic flow of following vehicles. The information is also reported to the traffic system operator.

[c] Information collected by the infrastructure is automatically provided to devices installed in a vehicle (i.e. radio, navigation display) by various communication methods (i.e. beacon, leakage coaxial cable), to avoid secondary accidents. The information is also reported to the traffic system operator.

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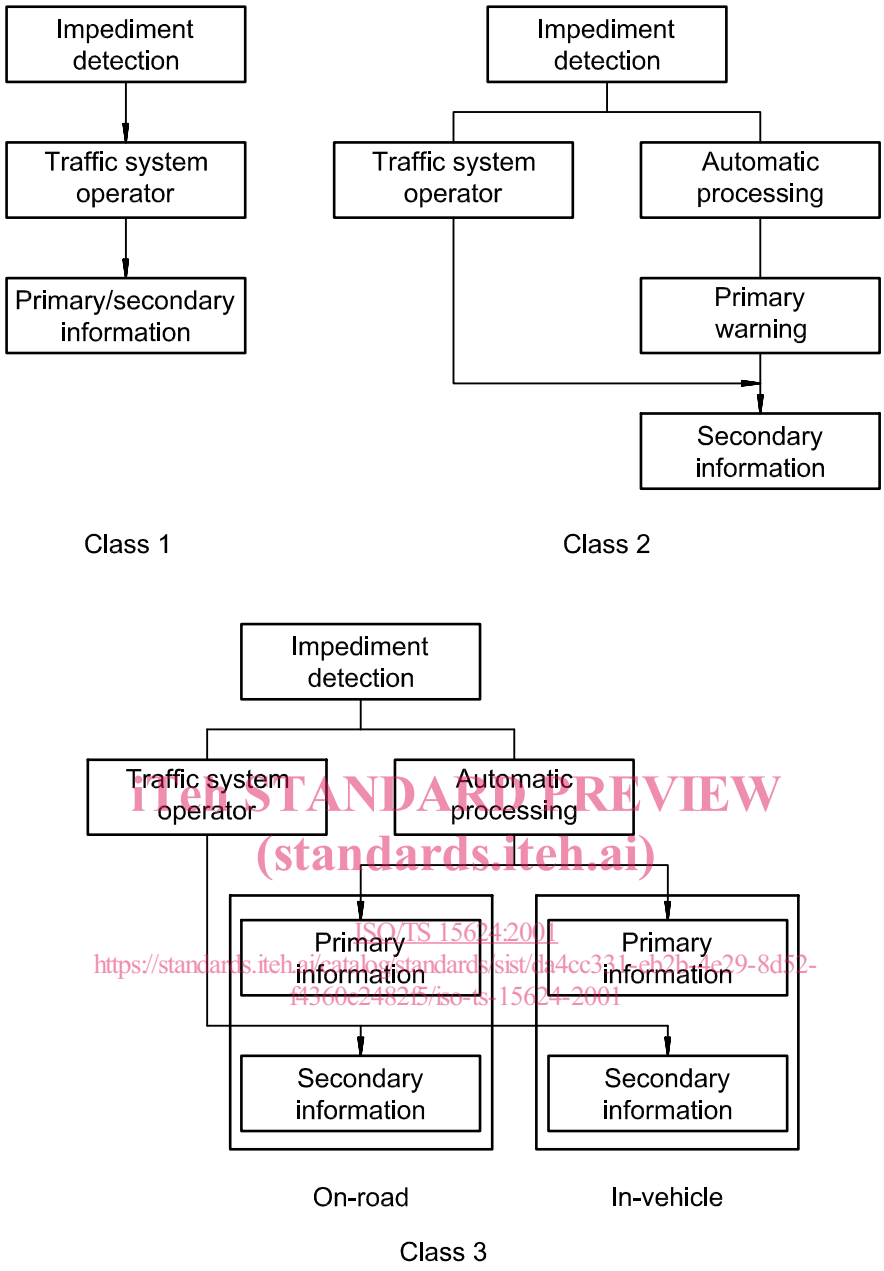

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Figure 2 — Information providing flow with each class

3.4 Types of sensors

Various types of sensors are considered for use as shown in Figure 1. However, this Technical Specification focuses on CCTV cameras that are used for image processing.

3.5 Provision of information

3.5.1 Required functions for providing information

3.5.1.1 Provision of information to drivers

The system has many ways, as shown in Figure 2, to provide drivers with information, however, this Technical Specification focuses on variable message signs as the methods of provision.

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3.5.1.2 Reporting to the traffic system operator

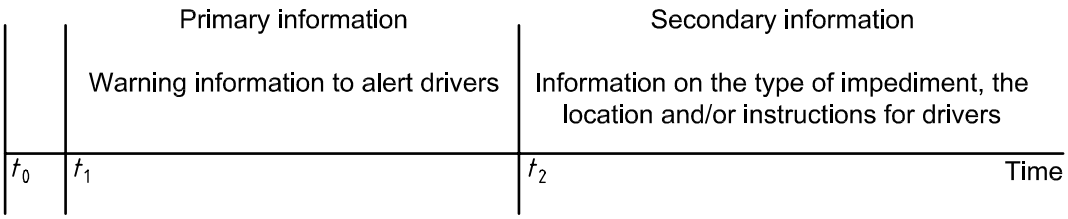
The occurrence of a traffic impediment shall be reported to the traffic system operator, who should be able to monitor the CCTV screen to confirm the impediment.

3.5.2 Event detection

The system detects stopped, or slow moving vehicles.

3.5.3 Levels of information

The system provides two levels of information, primary, and secondary information. The timing and levels of information are shown in Figure 3 (see annexes E and F).



t_0 time when the event occurred

t_1 time when the stopped vehicles or slow moving vehicles were detected

t_2 time when the traffic system operator confirmed the type of event, condition, location of the occurrence and any response action

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Figure 3 — Levels of information

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3.5.4 Types of information

Types of information can be classified as follows.

1) **Instructions for action:** Stop, limit speed, change lane.

2) **Attention:** Warning of a collision or a hazardous condition ahead.

3) **Explanation of present situation:** Type of impediment, route, location, traffic lane affected, any response, or traffic control actions.

4) **Forecast of situation:** Forecast of travel time, time estimated to clear the impediment.

The types of information provided for each level are shown in Table 2.

3.5.5 Out-of-order indication

In case of system failure, words or a readily recognizable symbol shall be used to indicate that the system is not able to provide traffic information.

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Table 2 — Levels and types of information

Information types	Message types	Message examples	Levels of information	
			Primary	Secondary
Instruction	Speed instruction	Stop, slow down, …		X
	Route changing instruction	Use alternative route		X
	Lane changing instruction	Use right lane, left lane closed, …		X
Attention	Caution for a rear-end collision	Stopped traffic ahead, slow moving traffic ahead,	X	X
	Caution to the hazardous condition ahead	Spilled load ahead, accident ahead		X
Explanation of present situation	Route of occurrence	Southbound Route 12 closed, …		X
	Location of occurrence	Accident 250 m ahead …		X
	Traffic lane of occurrence	One lane blocked, …		X
	Location of end of congestion queue	End of congestion queue, ahead		X
	Traffic control	Left lane closed, …		X
Forecast of situation	Forecast of travel time	About 20 min to XX, 30 min delay, …		X
	Estimated time of response action	Closed for 1 h,		X

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3.6 Range of information provision to drivers

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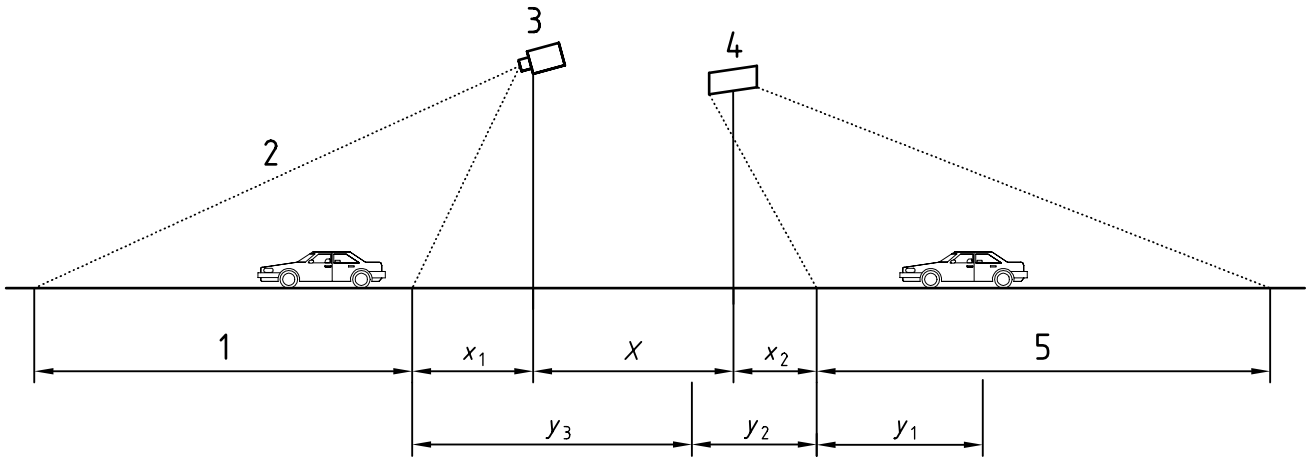
3.6.1 Locations for providing information

The locations where variable message signs are installed relative to the camera position, are as shown in Figure 4.



Key

1 Monitoring area
2 Occurrence of traffic impediment
3 CCTV camera
4 Variable message sign
5 Message sign recognition distance

X variable message sign installation interval
x_1 camera blind spot distance
x_2 out-of-sight distance
y_1 judgement distance
y_2 reaction distance
y_3 braking distance

Figure 4 — Locations where variable message signs are installed relative to camera position

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