INTERNATIONAL STANDARD

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Data dictionary and message sets for preemption and prioritization signal systems for emergency and public transport vehicles (PRESTO)

Dictionnaire de données et ensembles de messages pour la préemption et la priorisation des systèmes de signaux pour les véhicules d'urgence et de transport public (PRESTO)

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Foreword

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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 22951 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

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Introduction

It is very important that police cars, fire engines, and other emergency vehicles arrive at the scene to which they are dispatched as soon as possible in order to improve crime prevention rate, lifesaving rate etc. Therefore, various countries are using, or developing, preemption signal-systems to support the smooth travelling of such vehicles. In addition, some countries use these priority signal-controls for buses and other public transport vehicles to provide punctual and more convenient service. This International Standard standardizes communication messages in these preemption signal-systems for emergency and public transport vehicles, aiming to promote system introduction through developing a common infrastructure.

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1 Scope

This International Standard relates to systems that use priority signal control functions to help emergency vehicles operate. This type of system, as shown in Figure 1, is composed of a traffic management centre, in-vehicle units, roadside communication units, and roadside units. Public transport vehicles such as buses are also targeted to receive priority signal control service.

The scope of standardization includes message sets and data dictionary related to the communications as follows:

— between a roadside communication unit and each in-vehicle unit,

— between a roadside communication unit and other roadside units,

— between in-vehicle units and roadside units.

This International Standard concerns only information related to priority signal control and does not deal with information provision such as that of the situations at scenes. Since it is necessary to handle public transport vehicles in accordance with the conditions of individual cities and regions, the section in the messages and the data dictionary that are concerned with priority signal control for the vehicles are treated as an option. Furthermore, the standardization does not depend on the type of communication medium used.
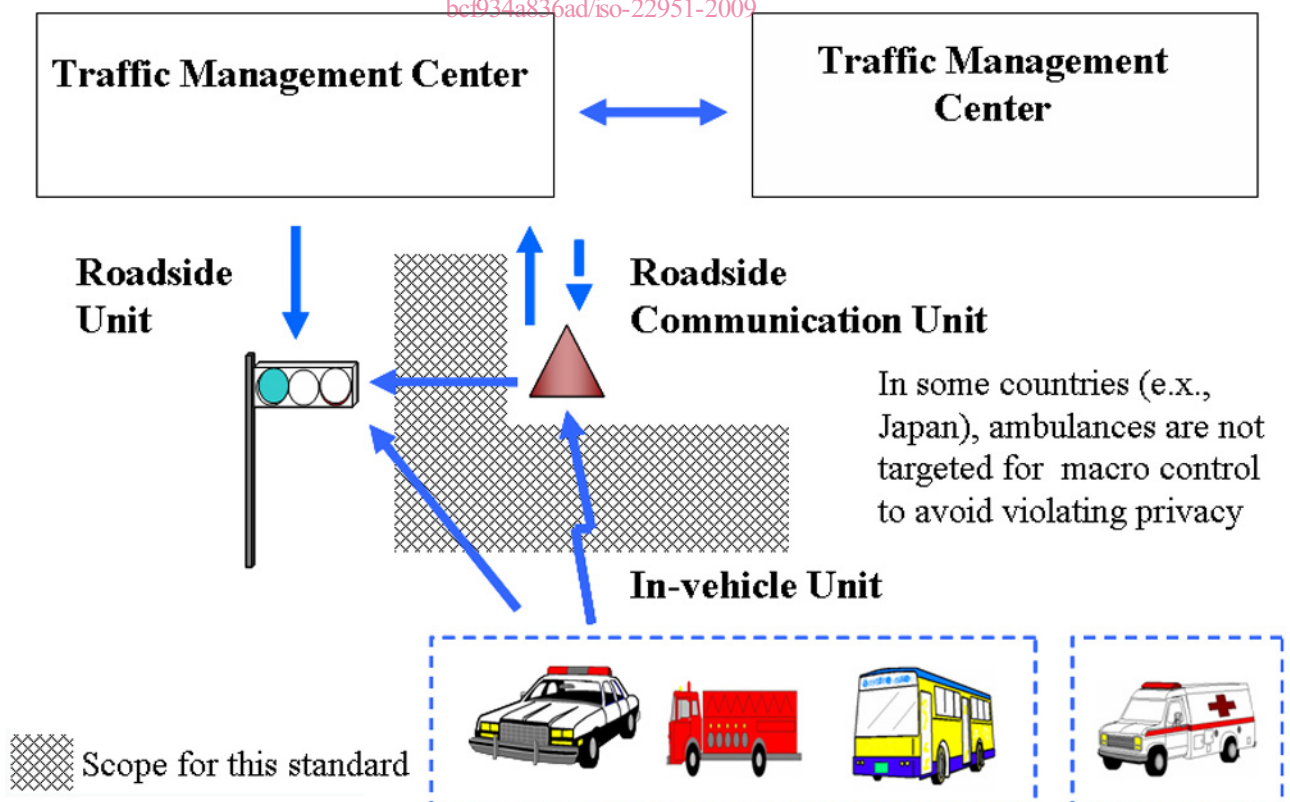

Figure 1 —Scope of standardization work

2   Normative references

The following referenced documents are indispensable for the application 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 14817, *Transport information and control systems — Requirements for an ITS/TICS central Data Registry and ITS/TICS Data Dictionaries*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14817 and the following apply.

3.1
antenna
roadside equipment that communicates with the roadside units such as signal controllers and the in-vehicle units using radio signals

3.2
beacon
roadside equipment that communicates with the roadside units such as the signal controllers and the in-vehicle units

3.3
data dictionary
listing of data elements (and their characteristics) that meets the information and functional needs of a system

3.4
data element
atomic element of information

NOTE   A data element is a syntactically formal representation of some information of interest (such as a fact, proposition, observation, etc.) about some entity of interest (e.g. a person, place, process, property, object, concept, association, state, event).

3.5
in-vehicle unit
in-vehicle equipment that transmits/receives information to/from the roadside communication units and, in some cases, outputs information, for example, on its screen

3.6
message sets
set of basic messages that are normally used in business-oriented applications

3.7
roadside communication unit
roadside equipment that communicates with the in-vehicle units and the roadside units, e.g. beacons and antennas

3.8
roadside unit
roadside equipment that controls signals and provides information, e.g. the signal controllers and the information board controllers

3.9
signal controller
roadside equipment that controls the lighting timings of traffic lights

3.10
traffic management centre
central system that controls the functions of traffic data collection, signal control, and information service based on collected data, etc.

3.11
vehicle ID
identification number used for the identification of emergency and/or public transport vehicles

4 Symbols and abbreviated terms

PRESTO   data dictionary and message sets for preemption and prioritization signal systems for emergency and public transport vehicles

5 Data dictionary and message sets for PRESTO

Tables 1 and 2 give the list of data dictionary and message sets within the scope of the standardization, in-line with the data concept specified in ISO 14817. Further details are given in Annex C.

5.1 Data dictionary

Table 1 — Data dictionary within the scope of the standardization

Data concept type	ASN.1 object identifier	ASN.1 name	Descriptive name
Data element concept	{iso standard presto concepts dec 1 10}	PSC.authority-classification	PSC.authorityClassification
Data element	{iso standard presto concepts de 1 20}	PSC.vehicle-code	PSC.vehicleCode
	{iso standard presto concepts de 1 30}	PSC-transport-mode	PSC.transportMode
	{iso standard presto concepts de 1 40}	PSC-priority-signal-request-flag	PSC.prioritySignalRequestFlag
	{iso standard presto concepts de 1 50}	PSC-request-intersection id	PSCrequestIntersectionID
	{iso standard presto concepts de 1 60}	PSC-direction-at-intersection	PSC.directionAtIntersection
	{iso standard presto concepts de 1 70}	PSC-spot-id	PSC.spotID
	{iso standard presto concepts de 1 80}	PSC-spot-passing-time	PSC.spotPassingTime
	{iso standard presto concepts de 1 90}	PSC-vehicle-speed	PSC.vehicleSpeed
	{iso standard presto concepts de 1 100}	PSC-vehicle-acceleration	PSC.vehicleAcceleration
	{iso standard presto concepts de 1 110}	PSC-travel-distance	PSC.travelDistance
	{iso standard presto concepts de 1 120}	PSC-transmission-time	PSC.transmissionTime
Data frame	{iso standard presto concepts df 1 130}	PscVehicleID	PscVehicleID:frame
	{iso standard presto concepts df 1 140}	PscPrioritySignalRequest	PscPrioritySignalRequest:frame
	{iso standard presto concepts df 1 150}	PscVehicleCurrentLocation	PscVehicleCurrentLocation:frame
	{iso standard presto concepts df 1 160}	PsctravelInformation	PsctravelInformation:frame
	{iso standard presto concepts df 1 170}	PscSpotLocation	PscSpotLocation:frame
	{iso standard presto concepts df 1 180}	PscSpotPassingPoint	PscSpotPassingPoint:frame

5.2 Message sets

Table 2 — Messages sets within the scope of the standardization

Data concept type	ASN.1 object identifier	ASN.1 name	Descriptive name
Message	{iso standard presto concepts mes 1 190}	PscVehicleInformation	PscVehicleInformation:message
	{iso standard presto concepts mes 1 200}	PscVehicleData	PscVehicleData:message
	{iso standard pi 11}	PiSchedAdherenceOffSched	PiSchedAdherenceOffSched:message

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Annex A
(informative)

The concept of PRESTO

A.1 Purpose

PRESTO allows emergency vehicles such as police cars, fire engines and so forth to speedily and accurately respond to emergencies by carrying out traffic signal control with the highest priority and guiding optimal routes for these vehicles. In addition, this system draws the attention of general vehicles and pedestrians by indicating the approach of emergency vehicles on message boards. This system carries out priority signal control for public transport vehicles such as buses and trams. By providing travelling support to emergency vehicles and public transport vehicles in this way, the system intends to achieve the realization of the following effects.

a) Reduction in the response time of emergency vehicles:

— early resolution of accidents and improvement of arrest rates;

— support for speedy rescue activity and improvement of lifesaving rates.

b) Reduction of the number of traffic accidents associated with en-route emergency vehicles.

c) Improvement of convenience of public transport vehicles such as buses and trams by securing the regular time operation of them.

A.2 Basic function

This system has the functions of

— priority signal control,

— route guidance, and

— safety support.

The priority signal control function includes macro control function and micro control function.

The macro control function transmits signal parameters beforehand, for example, giving maximum green time in the direction of emergency vehicles and public transport vehicles to the group of traffic signals at intersections from the traffic management centre, so it is possible to reduce traffic jams and lines of vehicles waiting for a green signal, which are hindrance factors to a priority traffic route.

The micro control function extends the green time or reduces the red time by having the vehicle sensor detect approaching emergency vehicles and public transport vehicles in order to let those vehicles pass through the green light.

The route guidance function effectively supports an early arrival of emergency vehicles at the scene of an accident by guiding the emergency vehicles from their current position to the scene of the accident through the recommended route. The macro control function, as explained above, links to the route guidance function and minimizes disadvantages suffered by general vehicles and pedestrians.

The safety support function draws attention of the general vehicles and pedestrians to the approaching emergency vehicle via the message board.

Furthermore, the priority signal control function and safety support function carry out the above functions by managing the signal control computer[1] and information-board control computer[2] from the traffic management centre that takes the role of traffic control for general vehicles.

As stated above, the system covers public transport vehicles, including buses and trams (LRTs), in its priority signal control. This system will be put into service in road sections where it is expected to enhance the punctual operation of such vehicles and reduce adverse impact on general vehicles.

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1) One of the central functions that controls the signal controllers through the transmission of signal parameters, etc.

2) Roadside equipment that controls the information boards that display traffic information through their instructions.

Annex B
(informative)

PRESTO architecture

B.1 Overview of PRESTO user services

A requirement analysis based on the concepts given in Annex A was conducted and used to define PRESTO user services shown in Table B.1. PRESTO user services are systematized by referring to user subservices in the system architecture for ITS in Japan, which are described in Annex E.

Table B.1 — PRESTO user services

Specific user subservices	Description
Provide signal priority to bus and tram	To assist the improvement of the functional efficiency of public transportation and the management of its safe and smooth operation, implements a signal control system. The system detects information sent from public transport vehicles that includes notification of their approach to signalized intersections, lane change sections, their proceeding into main roads from bus bays, etc. and control signals to prioritize their passage.
Guide emergency vehicles along the optimum routes	When an accident, etc. occurs, collects in real-time information regarding the current road traffic conditions including traffic backup, the effects of road work, etc. and guides emergency vehicles to their destinations to enable them to mount their rescue operations quickly and appropriately.
Control traffic signals for priority guidance of emergency vehicles	To provide support for the quick movement of emergency vehicles and improve their safety when they are mobilized in connection with an accident, etc. that have occurred, controls traffic signals appropriately so as to enable them, when they approach intersections, to pass through with priority and safely.
Inform vehicles of approaching emergency vehicles	When an accident, etc. occurs, provides the drivers of vehicles ahead with information about the approach of emergency vehicles so as to provide support for the quick passage of emergency vehicles and assure their safe passage.
Manage emergency and public transport vehicle operations	To provide support for quick and appropriate rescue operations when an accident, etc. occurs, collects in real-time information, etc. regarding the locations of emergency and public transport vehicles and proceeds to appropriate vehicle allocation taking into account the status of the site of the accident, etc., and the present locations of emergency and public transport vehicles.

B.2 Definition of functions and messages

The necessary functions and messages for each PRESTO user service have been analysed and extracted.

B.2.1 Function name

Function name is the name of the function.

B.2.2 Common function

Common function is a common number given to a group of elements that is categorized by function in several user services.

B.2.3 Message name

Message name is the name of the messages received and transmitted by the functional elements.

B.2.4 Common message

Common message is a common number given to each message in several functional elements.

B.2.5 Definition of words in messages

a) Information – information received and transmitted between this system and "object" (vehicles and information sources)

b) Data – data received and transmitted in this system.

c) Status – information received and transmitted between this system and the "object" (vehicles and information sources). The format is not specified.

d) Control – the practical order of control action based on control parameters.

B.3 Descriptions of functions

Table B.2 — PRESTO functions

No.	Function	Description	Corresponding physical device
F01	Roadway&Traffic_Status_Collection	It gathers the PrtRoadwayStatus and the PrtTrafficStatus.	Traffic management centre / emergency vehicle management centre / public vehicle management centre
F02	Scene_Information_Collection&Call	It gathers the PrtSceneStatus and notifies it in response to the requests from emergency vehicles.	Emergency vehicle management centre
F03	Traffic_Prediction	It predicts the future traffic conditions from the PrtRoadway&TrafficStatusData and creates the PrtPredictedTrafficData.	Traffic management centre / emergency vehicle management centre / public vehicle management centre
F04	Destination_Identification	It identifies the destination from PrtIncidentInformation.	Emergency vehicle management centre
F05	Vehicle_Identification	It authenticates whether or not the emergency vehicles are subject to priority signal service from their PscVehicleData. This PscVehicleData includes the priority signal request, the vehicle ID, the current location, the passage (or the receiver ID), the vehicle travel information (speed, acceleration, mileage, GPS information, etc.), the destination, and the route information. It also tries to find the most probable current location based on the information included in the PscVehicleData, and then creates the PrtVehicleLocationData. This function may convert the passage, the receiver ID, or the vehicle travel information into the location information depending on the system. If the vehicles are identified as subject to priority signal service with this function, it will send the PrtVehicleLocationData to the Priority_Verification, the Route_Calculation, the Micro_Priority_Control_Adjudication, the Macro_Priority_Control_Adjudication, and the Vehicle_Approaching_Position_Adjudication.	Emergency vehicle management centre / public vehicle management centre / roadside communication unit (beacon, antenna) / roadside unit (signal controller)
F06	Route_Calculation	Under the traffic conditions indicated by the PrtRoadway&TrafficStatusData and the PrtPredictedTrafficData, it will calculate the PrtRouteData of the emergency vehicle's current location to the destination, and send the result to the Each Route_Verification.	Emergency vehicle management centre
F07	EachRoute_Verification	Under the situation where a number of emergency-vehicle-routes coexist, it will adjust the route for each emergency vehicle by following the Priority Level, then create the PrtRecommendedRouteData.	Traffic management centre
F08	Route_Information_Provision	It provides emergency vehicles with PrtRecommendedRouteData.	Traffic management centre
F09	Roadway&Traffic_Information_Call	It gives the PrtRoadway&TrafficStatusInformation in response to the requests from emergency vehicles.	Emergency vehicle management centre / roadside unit (beacon)