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Inteligentni transportni sistemi - Kooperativni sistem (ITS) - Podatkovni slovar informacijskih struktur v vozilih (IVi) (ISO/PRF TS 19321:2014)

Intelligent transport systems - Cooperative ITS - Dictionary of in-vehicle information (IVI) data structures (ISO/PRF TS 19321:2014)

Intelligente Transportsysteme - Kooperative ITS - Beschreibungsverzeichnis fahrzeuginterner Informationen von Datenstrukturen (IVI) (ISO/PRF TS 19321:2014)

Systèmes intelligents de transport - Coopérative STI - Dictionnaire de structures de données d'informations dans les véhicules (IVI) (ISO/PRF TS 19321:2014)

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TECHNICAL SPECIFICATION

ISO/TS 19321

First edition

Intelligent transport systems — Cooperative ITS — Dictionary of in-vehicle information (IVI) data structures

Systèmes intelligents de transport — Coopérative STI — Dictionnaire de structures de données d'informations dans les véhicules (IVI)

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Foreword

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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).

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ISO/TS 19321 was prepared by European Committee for Standardization (CEN) in collaboration with ISO/TC 204, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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Introduction

In Cooperative-ITS (C-ITS), presenting information related to the traffic situation or regulation of a road to the driver of a vehicle is an important component of road operations. The road operators are responsible for road setup, operation, signage, and maintenance for traffic management and road safety, and in some countries, also for the enforcement of road laws. For road operators, efficient transport of vehicles on roadways ensures a safe and predictable trip for all road users. Road operators, together with equipment manufacturers, be it that they are of vehicles or of roadside equipment, contribute to how road information is properly presented to drivers.

So far, one defined C-ITS method for notifying road users of road and/or traffic situations and events is by transmission of messages such as Cooperative Awareness Messages (CAM), Decentralized Environment Notification Messages (DENM), or Basic Safety Messages (BSM).

This Technical Specification supports mandatory and advisory road signage such as contextual speeds and road works warnings. In-vehicle information can be sent by an ITS-S and either corresponds to physical road signs such as static or variable road signs or not correspond to physical road signs (a virtual sign) or correspond to road works. IVI does not include identification of road events as already provided by DENM.

This Technical Specification provides a toolbox of information elements for IVI. It can be used to fulfil the requirements of the service provider considering the needs of receiving ITS-S. The container concept provides a way for an ITS-S to manage the relevant IVI information, determine where the IVI is relevant, and to provide details for the application of IVI. The description of data elements encompasses the data syntax and semantics, i.e. a definition of data format and content, together with a description of how to use those data elements.

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This Technical Specification is of an enabling nature. It does not specify which information is necessary for a certain service, but it supports those IVI information elements that can be necessary to be transmitted to a receiving ITS-S to carry out a certain service. Usage of the IVI information elements depends on the specific context and application of IVI for a specific service and usage is established as mandatory or optional only for messaging purposes, not for application purposes. The IVI Structure is intended to be profiled to fulfil the requirements of a specific service.

This Technical Specification refers to ISO/TS 14823 as one system of standardized codes for existing road signs codes. Note that ISO/TS 14823 does not contain codes for specific national or regional signs which are not commonly used. ISO/TS 14823 also does not represent a catalogue of road sign pictograms for all applicable nations.

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Intelligent transport systems — Cooperative ITS — Dictionary of in-vehicle information (IVI) data structures

1 Scope

This Technical Specification specifies the in-vehicle information (IVI) data structures that are required by different ITS services (for example, refer to ISO/TS 17425 and ISO/TS 17426) for exchanging information between ITS Stations. A general, extensible data structure is specified (see Clause 5). This is split into structures called containers to accommodate current-day information (see Clause 6). Transmitted information includes IVI such as contextual speed, road works warnings, vehicle restrictions, lane restrictions, road hazards warnings, location-based services, re-routing, etc. The information in the containers is organized in sub-structures called data frames and data elements which are described in terms of its content (see Clause 7) and its syntax (see Annex A).

The data structures are specified as communications agnostic. This Technical Specification does not provide the communication protocols. This Technical Specification then provides scenarios for usage of the data structure, e.g. in case of real time, short-range communications.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ISO 639-1:2002, *Codes for the representation of names of languages — Part 1: Alpha-2 code*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO/IEC 8824-1:2008, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

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ISO 14816:2005,*Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

ISO 14906:2011,*Electronic fee collection — Application interface definition for dedicated short-range communication*

ISO/TS 14823,*Traffic and travel information — Messages via media independent stationary dissemination systems — Graphic data dictionary for pre-trip and in-trip information dissemination systems*

3 Terms and definitions

3.1
application data unit
data unit exchanged between ITS-S applications

3.2
container
group of *data frames* (3.4) and data elements semantically belonging together in one place in the IVI structure

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3.3
data element
data type that contains one single data

[SOURCE: ETSI/TS 102 894-2 V1.1.1]

3.4
data frame
data type that contains more than one *data element* (3.3) in a predefined order

[SOURCE: ETSI/TS 102 894-2 V1.1.1]

3.5
detection zone
part of the road network that is passed by a vehicle in approach of the *relevance zone* (3.12)

3.6
driver awareness zone
parts of road network on which a message is presented to inform drivers about upcoming situations

Note 1 to entry: This definition will be aligned with ISO/TS 17425.

3.7
in-vehicle information
information contained in the In-vehicle Information (IVI) data structure that is required by different ITS services

3.8
in-vehicle signage
ITS service that provides static, as well as dynamic road sign and message sign information to drivers

Note 1 to entry: This definition will be aligned with ISO/TS 17425.

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3.9
International Terrestrial Reference Frame
realisation of the ITRS

[SOURCE: ISO 17572-1:2008]

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3.10
International Terrestrial Reference System
reference system for the earth derived from precise and accurate space geodesy measurements not restricted to GPS Doppler measurements which is periodically tracked and revised by the International Earth Rotation Service

[SOURCE: ISO 17572-1:2008]

3.11
Minimum Dissemination Area
parts of the road network where the IVS message can be received by the potentially targeted vehicles

Note 1 to entry: This definition will be aligned with ISO/TS 17425.

3.12
Relevance Zone
parts of the road network for which the information in an Application Container is valid

Note 1 to entry: Definition adapted from the definition in ISO/TS 17425

3.13
road hazard warning
ITS service that provides road hazard information to drivers

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3.14
Road Works Warning
alerts for routing road users around road construction and/or road repair

3.15
Variable Message Sign
electronic sign board presenting text, symbols, or a combination of them

4 Abbreviations

The following abbreviations are used in this document.

ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
ASN.1	Abstract Syntax Notation One
BLOB	Binary Large Object
DAZ	Driver Awareness Zone
DE	Data Element
DENM	Decentralized Environmental Notification Message
DF	Data Frame
ETRF	European Terrestrial Reference Frame
HOT	High-Occupancy Toll (lane)
HOV	High-Occupancy Vehicle
ID	Identification
ITRF	International Terrestrial Reference Frame
ITRS	International Terrestrial Reference System
ITS	Intelligent Transport Systems
ITS-S	ITS Station
IVI	In-vehicle Information
IVS	In-vehicle Signage
MDA	Minimum Dissemination Area
OEM	Original Equipment Manufacturer
POI	Point of Interest
RZ	Relevance Zone
RWW	Road Works Warning
VMS	Variable Message Sign

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5 In-vehicle Information (IVI) data structure

5.1 Structural model

5.1.1 General model

The IVI Structure represents the Application Data Unit to be transmitted and received by an ITS-Station (ITS-S). The IVI Structure shall comply with the syntax defined in Annex A as the data type `IviStructure`. This means that it shall be composed of Containers defined in this Technical Specification and follow the form depicted in Figure 1.

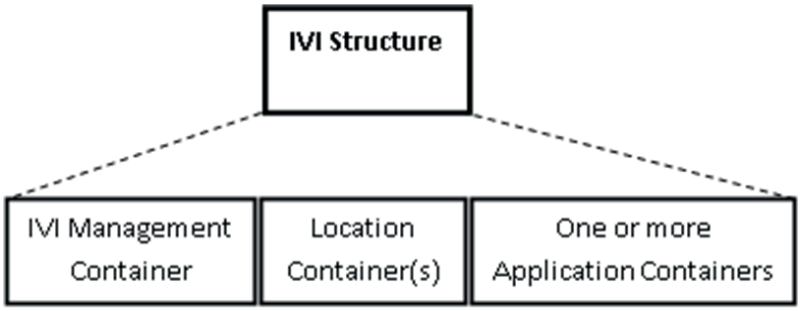

Figure 1 — IVI Structure

The IVI Structure is extensible and other containers can be added in the future.

The IVI Structure is intended to be encapsulated in a message with the appropriate ITS Common Header, for example, the ItsPduHeader of ETSI/TS 102 894-2. The header structure and contents are out of the scope of this Technical Specification

The IVI Structure shall contain a Management Container. The information in the IVI Management Container is applicable to the entire IVI Structure. This Container is mandatory to be present and provides a receiving ITS-S with enough information to handle the IVI Structure and decide on its further processing.

The IVI Structure can contain one or more Location Container(s). The Location Container describes the essential information for applications in the receiving ITS-S. Applications can use the location information to understand how to apply information provided by IVI Application Containers. Location Containers can carry information relevant for different IVI Application Containers or carry the same content, but expressed in different forms (see 5.2). This enables a receiving ITS-S to choose the appropriate location referencing system that the ITS-S supports.

The IVI Structure can contain one or more IVI Application Container(s). The IVI Application Container provides IVI information for use by an application. Application information is self-contained and refers to the location information for its spatial validity. Application information of the same type shall not refer to overlapping Reference Zones. Each Application Container refers to zones defined in the Location Container identified by their IDs for the following usage: 1) Detection Zone, 2) Relevance Zone, and 3) Driver Awareness Zone. An Application Container may optionally provide information about the minimum awareness time, that is, the minimum time that the IVI should be available before the vehicle enters the Relevance Zone. This MinimumAwarenessTime information can be used by the receiving ITS-S to determine the appropriate Driver Awareness Zone.

5.1.2 Conceptual zones

When an ITS-S receives the IVI Structure, the ITS-S is able to interpret the application information in the context of the appropriate location information. Principally, there are four conceptual zones:

1) Minimum Dissemination Area (MDA);

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2) Detection Zone;

3) Driver Awareness Zone (DAZ);

4) Relevance Zone (RZ).

The MDA refers to the minimum area where the IVI Structure is disseminated by an ITS-S based on application requirements. The MDA is defined in the relevant application standards or specification(s) and is therefore out of scope of this Technical Specification.

In some situations, a vehicle ITS-S must be able to detect whether or not it is approaching a Relevance Zone at a certain minimum time before it enters the Relevance Zone. This is, for example, to guarantee that the Relevance Zone is detected immediately at its entry (e.g. in case of a very small Relevance Zone) or to guarantee that the Relevance Zone is correctly detected (in case it is near to other road segments, e.g. parallel or on different altitude level). Therefore, a Detection Zone occurs in approach to a Relevance Zone. If a receiving ITS-S moves through the Detection Zone, then the received IVI will be enabled for further usage in the receiving ITS-S.

The IVI can be used to inform drivers about upcoming situations in the DAZ. The DAZ can be determined by the receiving ITS-S because the DAZ can be based on the dynamic status of the receiving ITS-S and can depend on the presence of other higher priority information to be presented. Alternatively, the DAZ can be provided by the sending ITS-S for usage by the receiving ITS-S.

The final zone and the Relevance Zone covers the area where the IVI is applicable.

Examples of the Detection and Relevance Zones for the spatial validity of the IVI Structure are illustrated in Figure 2. The Driver Awareness Zone (outside the scope of this Technical Specification) can be physically overlapping with the Detection Zone (but is not necessarily equal in size).

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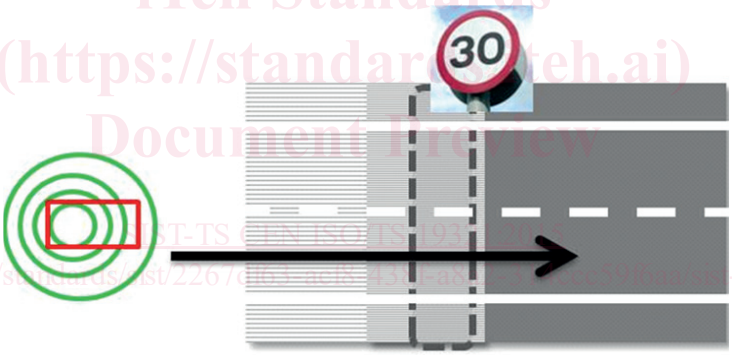

Key

- minimum dissemination area (not transmitted)
- detection zone
- driver awareness zone
- relevance zone

Figure 2 — Spatial validity for IVI: Detection and Relevance Zones

The Location Container always contains a definition of one or more zones which can represent a Detection Zone, a Relevance Zone, or both. In Figure 2, from left to right, the first zone represents a Detection Zone and the second zone represents a Relevance Zone.

In Figure 3, from left to right, the first zone represents a Detection Zone. The second zone then represents Relevance Zone 1, but this same zone also serves as a Detection Zone for Relevance Zone 2.

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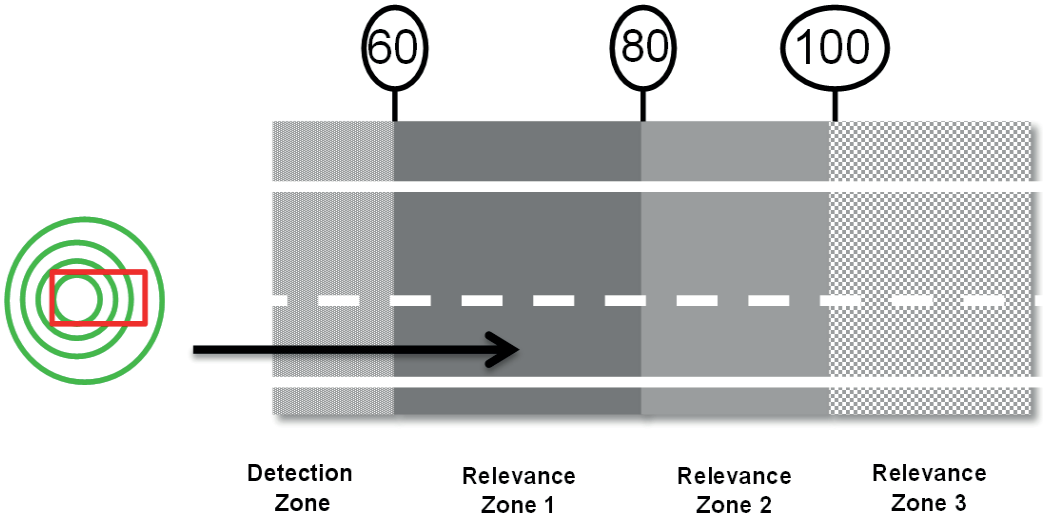

Figure 3 — Concatenated Relevance Zones

5.2 Location referencing

5.2.1 General

There are essentially two different ways of referencing road locations. It is called map-based location referencing in this Technical Specification when referencing attributes of the road network itself. It is called geographic location referencing in this Technical Specification when referencing a regular or irregular division of space which exists independent of the representation of the road network.

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5.2.2 Geographic positioning

Geographic location systems or coordinate systems are location maps composed of imaginary, intersecting lines forming a grid. Coordinate values of the grid, expressed as numeric or alphanumeric characters, are used to describe a position.

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To translate position data expressed in longitude, latitude, and height to the corresponding real position on earth or vice-versa, the earth-centred, earth-fixed, polar-coordinate geodetic datum WGS84(G1150) according to NIMA TR8350.2 Version 3 shall be used. Alternatively, any earth-centred, earth-fixed polar coordinate geodetic datum can be used as long as the maximum datum displacement relative to the geodetic datum agreed on, or relative to WGS84(G1150) in case of no agreement, is acceptable to the application.

NOTE A suggested tolerance of 0.3 meters in datum displacement (also called datum shift) is intended, for example, to allow for using the International Terrestrial Reference Frame (ITRF) or the European Terrestrial Reference Frame (ETRF) geodetic datum as alternative to the WGS84. Datum displacements are suggested to be calculated according to the definitions in ASME Y14.5 – 2009.

An ITS-S sending an IVI Structure provides one or more Reference Point(s). The Reference Point can be the reference for the description of a static zone or a dynamic (moving) zone. The zone can be described by a polygonal line which delineates a segment or an area, or can be described by a distance value indicating the extension of the relevance zone from the Reference Position and the heading relative to the Reference Position.

The detection zone can optionally be provided as a polygonal line in approach to the Reference Position. If the Reference Position is the position of a moving object, the polygonal line is represented by the last positions of the path of the moving object (e.g. the trace of a roadworks vehicle).

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