
**Intelligent transport systems —
Cooperative systems — Data
exchange specification for in-vehicle
presentation of external road and
traffic related data**

*Systèmes intelligents de transport — Systèmes coopératifs —
Spécifications d'échange des données pour la présentation dans le
véhicule de la route externe et des données relatives au trafic*

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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.

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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#).

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

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Introduction

Traditional fixed road signs are positioned on road verges to inform drivers about the applicable regulations, or to warn them about dangers or to provide them with other general information – this can be considered as roadside signage information. Beyond this fixed signage, the newer technologies have now allowed for some time for more accurate dynamic presentation of roadside signage information depending on the actual road and environmental conditions using variable or dynamic message signs. With the advent of Cooperative Intelligent Transport Systems (C-ITS) it is possible to provide more focused and timely guidance to vehicle controllers and drivers by supporting continuous presentation of the content of roadside signage information in the vehicle along the impacted road section rather only during the short moments it takes for a vehicle to pass traditional road signs. Direct in-vehicle presentation of roadside signage information, called In-Vehicle Signage, facilitates the potential provision of information to specific classes or characteristics of vehicles, and for potentially more granular definition of affected road sections than stationary-position traditional fixed plate signs and use of variable/dynamic road signs. It does not deal with contextual speeds which are covered by ISO/TS 17426.

Delivering the In-Vehicle Signage service to road users can improve road safety, support traffic management, and reduce greenhouse gas emissions. It does not preclude other usage of the delivered information but such services are not in the scope of this Technical Specification.

All ITS services follow the same abstract process structure consisting of a sequence of detection (of an event) including pre-processing of the detected content, execution of the service algorithm (processing of detected content), and presentation or utilization of the service result. [Figure 1](#) (extracted from ISO/TS 17427) summarizes and details this process structure.

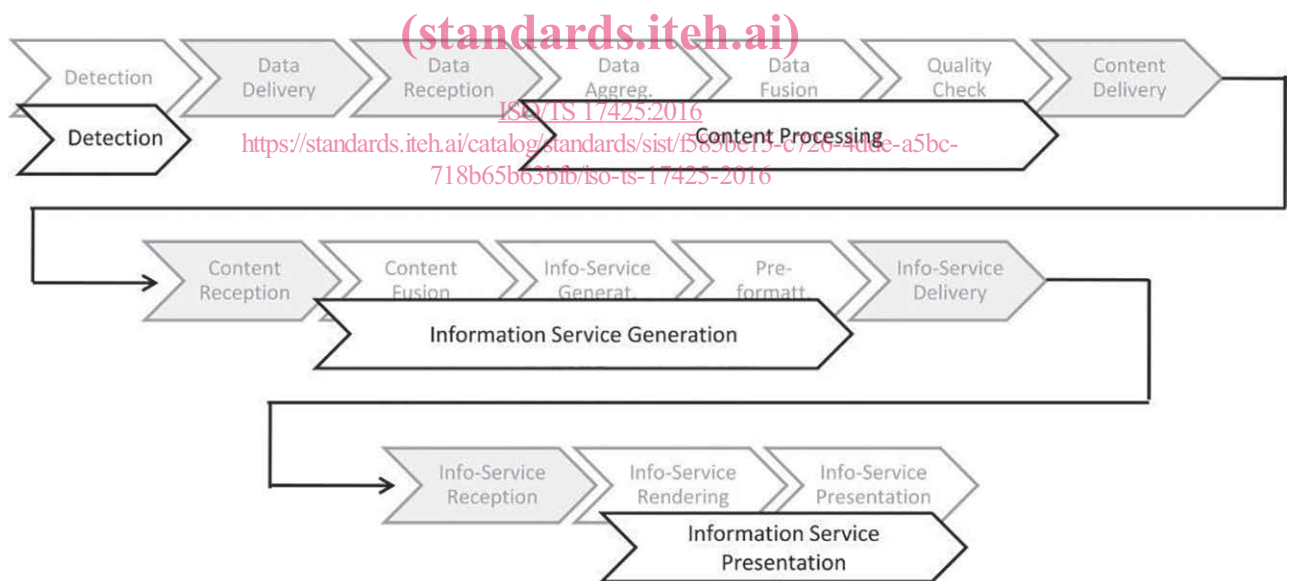


Figure 1 — General description of process for In-Vehicle Signage (from ISO/TS 17427:2014, Annex A)

Based on this abstract and general description of process steps in an ITS service, a large number of possible scenarios can be derived. This is true for In-Vehicle Signage. Every step in the process chain can be executed by different actors or stakeholders. Additionally, the execution of a process step for different spatial areas may be delivered by different actors. Each combination of different actors for different process steps can be used to identify distinct scenarios.

Assuming that there are two main stakeholder groups in C-ITS, the Infrastructure stakeholder and the Vehicle stakeholder, multiple combinations, and therefore multiple scenarios, are possible as every step might be delivered by either stakeholder group (see [Figure 2](#)) or shared between both stakeholder groups (see [Figure 3](#)).

	CONTENT	SERVICE	PRESENTATION		CONTENT	SERVICE	PRESENTATION
1	Vehicle	Vehicle	Vehicle	5	Infrastructure	Vehicle	Vehicle
2	Vehicle	Vehicle	Infrastructure	6	Infrastructure	Vehicle	Infrastructure
3	Vehicle	Infrastructure	Vehicle	7	Infrastructure	Infrastructure	Vehicle
4	Vehicle	Infrastructure	Infrastructure	8	Infrastructure	Infrastructure	Infrastructure

Figure 2 — Possible scenarios — Simple combinations

	CONTENT	SERVICE	PRESENTATION		CONTENT	SERVICE	PRESENTATION
9	Vehicle	Vehicle	Vehicle + Infrastructure	19	Vehicle + Infrastructure	Vehicle	Vehicle
10	Vehicle	Infrastructure	Vehicle + Infrastructure	20	Vehicle + Infrastructure	Vehicle	Infrastructure
11	Vehicle	Vehicle + Infrastructure	Vehicle + Infrastructure	21	Vehicle + Infrastructure	Vehicle	Vehicle + Infrastructure
12	Vehicle	Vehicle + Infrastructure	Vehicle	22	Vehicle + Infrastructure	Infrastructure	Vehicle
13	Vehicle	Vehicle + Infrastructure	Infrastructure	23	Vehicle + Infrastructure	Infrastructure	Infrastructure
14	Infrastructure	Vehicle	Vehicle + Infrastructure	24	Vehicle + Infrastructure	Infrastructure	Vehicle + Infrastructure
15	Infrastructure	Infrastructure	Vehicle + Infrastructure	25	Vehicle + Infrastructure	Vehicle + Infrastructure	Vehicle
16	Infrastructure	Vehicle + Infrastructure	Vehicle + Infrastructure	26	Vehicle + Infrastructure	Vehicle + Infrastructure	Infrastructure
17	Infrastructure	Vehicle + Infrastructure	Vehicle	27	Vehicle + Infrastructure	Vehicle + Infrastructure	Vehicle + Infrastructure
18	Infrastructure	Vehicle + Infrastructure	Infrastructure				

Figure 3 — Possible scenarios — Complex combinations

Every scenario is one specific of combination of stakeholders executing process steps. This Technical Specification addresses the scenarios where detection, content pre-processing, and the information service generation (see Figure 1) are delivered under the responsibility of the infrastructure stakeholder group (scenario 7 as seen in Figure 2). In scenario 7, the information service presentation takes place in the vehicle. Scenario 7 is considered in detail in this Technical Specification.

The defined C-ITS applications rely on the functionality and procedures defined within the Communications Architecture and by the reference ITS station architecture (as defined in ISO 21217 and other International Standards or Technical Specifications from the C-ITS standard set).

Annex A and Annex B contain profiles that define an instantiation for the IVS service. Annex A and Annex B contain conditional mandatory requirements. There is no need to comply with these requirements to claim compliance with this Technical Specification.

Annex A contains a profile that is communication technology agnostic. Annex B contains a profile that is focused on ITS-G5. For details on the referenced standards, see the introduction of the corresponding Annex.

These profiles are expected to be implemented and validated in European initiatives. Based on the results of these initiatives, it is intended to specify one interoperable solution in a future version of this Technical Specification.

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Intelligent transport systems — Cooperative systems — Data exchange specification for in-vehicle presentation of external road and traffic related data

1 Scope

This Technical Specification specifies the In-Vehicle Signage service and application that delivers In-Vehicle Signage information to ITS stations (vehicle ITS stations or personal ITS stations devices) concerning road and traffic conditions, qualified by road authorities/operators, in a consistent way with road authority's/operator's requirements, in the manner that is coherent with the information that would be displayed on a road sign or variable message sign (VMS).

NOTE A Variable Message Sign is also named dynamic message sign. Both terms are considered as synonyms and can be used interchangeably. In the text below, only variable message sign and its abbreviated term VMS are used.

This Technical Specification defines the following:

- the In-Vehicle Signage service and the In-Vehicle Signage application that instantiates this ITS service;
- the requirements to be fulfilled by the In-Vehicle Signage service;
- the requirements for using functions provided by the ITS station facilities layer supporting the use of the In-Vehicle Signage service;
- the ITS-S application processes in the different ITS station, that instantiate the In-Vehicle Signage ITS service.

This Technical Specification also specifies: the sets of communication requirements and objectives (profiles) using the methods defined in ISO/TS 17423 to select the level of performance (best effort or real-time, etc.), confidence and security (authentication, encryption, etc.) for each communication flow between ITS stations in the scope of the In-Vehicle Signage service.

This Technical Specification defines the selection of relevant functions and procedures provided by the ITS station facilities layer (ISO/TS 17429) and defines the message structure, content, syntax, atomic elements to be used by the In-Vehicle Signage application.

NOTE This application is colloquially called "In-Vehicle Signage".

The In-Vehicle Signage service includes the on-board information management. This management ensures contextual coherence of the end-user ITS service (e.g. vehicle characteristics, message priority, etc. avoiding amongst others things the presentation of conflicting information to end-users).

The production of information supporting the In-Vehicle Signage application, its qualification, and its relevance are out of the scope of this Technical Specification.

This Technical Specification does not specify the design of in-vehicle Human Machine Interfaces (HMI), but it does specify requirements that such interfaces shall be capable of supporting in order to permit the correct dissemination and use of information provided by the In-Vehicle Signage service.

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.

ISO 639-1, *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 21217, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

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*

ISO/TS 16951, *Road vehicles — Ergonomic aspects of transport information and control systems (TICS) — Procedures for determining priority of on-board messages presented to drivers*

ISO/TS 17423, *Intelligent transport systems — Cooperative systems — ITS application requirements and objectives for selection of communication profiles*

ISO/TS 17429, *Intelligent transport systems — Cooperative systems — Profiles for processing and transfer of information between ITS stations for applications related to transport infrastructure management, control and guidance*

3 Terms and definitions

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For the purposes of this document, the terms and definitions given in ISO 21217, ISO/TS 17423, ISO/TS 17429, and the following apply.

3.1 additional service

IVS service able to deal with the lower levels of message priority

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3.2 communication authority

entity in charge of regulating telecommunications and/or broadcast services

3.3 core service

IVS service able to deal with the two highest levels of message priority

3.4 driver awareness zone DAZ

parts of road network on which a message is present to inform drivers about upcoming situations

3.5 HMI control unit

in-vehicle device that manages prioritisation and presentation of messages designed for consumption by vehicle occupants

3.6 in-vehicle signage in-vehicle signage service IVS

ITS service that provides receiving ITS stations in order to inform drivers about static as well as dynamic road signs and variable message signs

3.7**IVS application**

ITS-S application process that instantiates the IVS service

3.8**IVS application service provider****application service provider****service provider**

entity that executes the corresponding ITS service

Note 1 to entry: According to ISO/TS 17427, its role can be defined as collecting the content that is required to run the IVS service, running the IVS service and providing a suitable service response.

3.9**IVS content service provider****content service provider****content provider**

source of the *in-vehicle signage* (3.6) information

Note 1 to entry: According to ISO/TS 17427, its role can be defined as providing the information content for the IVS service.

3.10**IVS message**

message generated for the *in-vehicle signage* (3.6) ITS service as specified in this Technical Specification

3.11**IVS receiving ITS station**

ITS station that receives and processes the *IVS messages* (3.10)

Note 1 to entry: It can be either a vehicle ITS-S or a personal ITS-S.

3.12**IVS sending ITS station**

ITS station that generates and transmits the *IVS messages* (3.10)

Note 1 to entry: It can be either a central ITS-S or a roadside ITS-S.

3.13**minimum dissemination area****MDA**

parts of the road network where the *IVS message* (3.10) can be received by the potentially targeted vehicles

3.14**qualified information**

information issued by authorised sources (road authorities, traffic managers) for their operated network

3.15**relevance zone****RZ**

parts of the road network for which the *IVS message* (3.10) is valid

3.16**traffic manager**

entity in charge of operating a road network and managing traffic

Note 1 to entry: For this Technical Specification, this entity is also considered as an enacting road authority; although in some circumstances, these different activities can be operated by separate entities.

3.17
validity end time
STO

time from which the *IVS message* (3.10) shall no longer be presented

3.18
validity start time
STA

time from which the *IVS message* (3.10) shall be presented

4 Symbols and abbreviated terms

ADU	Application data unit
BSMD	Bounded secured managed domain
C-ITS	Cooperative intelligent transport systems
C-ITS-S	Central ITS station
DAZ	Driver awareness zone
DMB	Digital multimedia broadcast
DMS	Dynamic message sign
HMI	Human machine interface
ICT	Information and communication technologies
ITS	Intelligent transport systems
ITS-S	ITS station
ITS-SU	ITS station unit
ITS-SCU	ITS station communication unit
IVS	In-Vehicle Signage
LDM	Local dynamic map
MDA	Minimum dissemination area
P-ITS-S	Personal ITS station
R-ITS-S	Roadside ITS station
RZ	Relevance zone
STA	Validity start time
STO	Validity end time
TCC	Traffic control centre
TMC	Traffic management centre

NOTE 1 TCC and TMC are considered as synonyms and can be used one interchangeably. In the text below, TCC will be used.

V-ITS-S	Vehicle ITS station
VMS	Variable message sign

NOTE 2 VMS and DMS are considered as synonyms and can be used interchangeably. In the text below, VMS will be used.

5 Service definition and main concepts

5.1 General

The IVS service aims to provide information to road users from an authorized IVS content provider presented in the vehicle in a manner that is consistent with that of VMS or road signs. This information

is provided to drivers aiming to improve road safety, reduce environmental impact, and enhance traffic flow.

NOTE 1 The information conveyed within an IVS message is the information that is available on fixed road signs on roadside or on a VMS.

NOTE 2 In most circumstances, the IVS information is expected to be qualified by road authorities/operators, in a consistent way with road authority's/operator's requirements, in the manner that is coherent with the information that would be displayed on a road sign or a variable message sign (VMS).

Traffic information is presented automatically or at the request of the user.

Where possible, it is presented in the vehicle in a language chosen by the end-user.

NOTE 3 Such an ITS service is relevant when driving a terrestrial road vehicle but not for pedestrians. When in this Technical Specification it is said of vehicle it does not imply the ITS service is only based on Vehicle ITS-station. It may also be operated with a personal ITS-station present in a vehicle. In both cases, the information is presented to the driver through an adapted HMI.

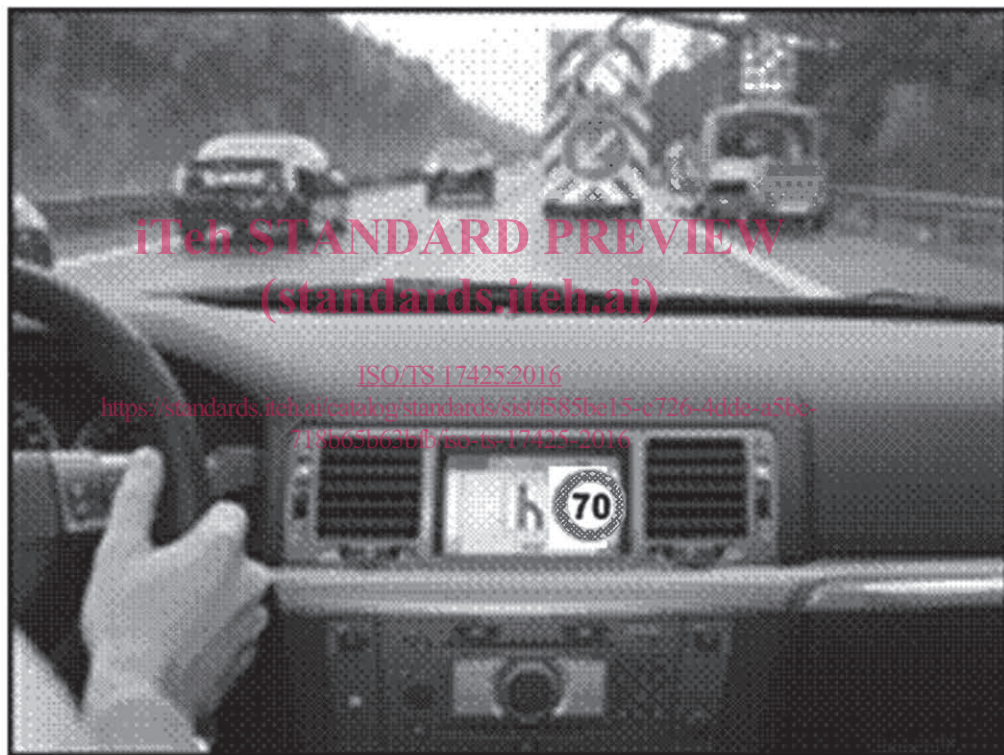


Figure 4 — Example of dynamic message display

Every IVS message presented from the In-Vehicle Signage service can depict either a road sign or a variable message sign. Annex C provides some background information on road signage and Annex D on VMS technologies.

The static information on static road signs and VMS is managed through catalogues. There are two levels of pictogram catalogues:

- a) the international level through the Convention on road signs and signals (also known as the Vienna convention - UNECE) used in around 100 countries;
- b) the national level (generally defined through regulations) (like e.g. in France: Regulation of 1967).

NOTE 4 For countries having signed and ratified the Vienna convention, the national level is mainly based on this convention and only presents minor differences with the convention content. There may also be some slight differences regarding the used pictograms among countries for the same meaning.

NOTE 5 They allow independence between the content and its restitution. It needs to be updated when necessary.

Within IVS, messages are being defined including a priority scheme for HMI usage within the IVS service. Messages are being delivered to the HMI module, how the information is presented to the driver is the responsibility of the equipment supplier. Information covered by the primary services should be handled in the HMI with higher priority resulting in presentation to the driver in the driver awareness zone at least once.

Overall priority cannot be determined by a single ITS service. This is dependent on the context and all active ITS services inside the vehicle.

NOTE 6 The importance of high quality and safe HMI is recognized. However, as stated in [Clause 1](#), HMI is out of the scope of IVS. IVS will be one of the ITS services/ITS applications available in-vehicle. How these ITS applications will work together in a harmonized manner is not specified in this Technical Specification.

5.2 Service definition

5.2.1 Definition

The In-Vehicle Signage ITS service supports the provision of information from an ITS-station to another ITS-station concerning either static or dynamic information about traffic conditions and traffic regulations. In countries where it is allowed, it can also include not directly traffic-relevant messages that can be displayed on variable message signs. The information is provided by traffic managers or authorized content providers to drivers seeking improved road safety, reduced environmental impact, and enhanced traffic flow.

NOTE The information is provided via a central or roadside ITS-station to another ITS-station located in a vehicle. Other schemes are possible such as messages hopping between ITS-stations in vehicles. This information is available on fixed road signs or variable message signs (VMS) on the roadside or mounted above specific lanes.

5.2.2 Message categories

The “In-Vehicle Signage” ITS service implements the following two message categories that are considered as part of service levels:

- a) higher priority messages associated with core services (see [5.2.3](#));
- b) lower priority messages associated with additional services (see [5.2.4](#)).

5.2.3 Core services

The core services implement the following two message types:

- a) Immediate danger warning message type: a warning alert concerning a danger involving drivers' or other users' safety.

NOTE 1 According to the UNO convention on traffic signs and signals (known as the Vienna convention), such warning messages are provided using either triangle-shaped or diamond-shaped signs depending on convention choices in specific countries.

NOTE 2 Typically on motorways or dual carriageway roads presentation of immediate danger warning messages is given at this distance between 2 km and 5 km from the danger, this varies according to national or regional rules. On other roads and in urban areas, this distance is typically shorter.

- b) Regulatory message type: prohibition, restriction, obligation or special regulation (that may depend on the vehicle type), compulsory routes, and rerouting.

NOTE 3 Regulatory messages are subject to relevant local/national legislation enacted by and recognized in law. Such regulatory messages may be relevant to specific classes of vehicle, driver qualifications, vehicle loads, environmental conditions, etc.

NOTE 4 According to the UNO convention on traffic signs and signals (known as the Vienna convention), such prescriptions are generally provided using round-shaped signs.

5.2.4 Additional services

Secondary services are related to messages of more general interest. Secondary services implement one or several of the following message types:

- a) Traffic-related information message type: events (that do not create not immediate dangers), driving conditions, forecasts (for traffic congestion, weather, events), travel time, advisory alternate route, etc.
- b) Pollution message type: there are commonly two forms of such messages: information messages and warning messages. Both forms of message exclude driving prohibitions or obligations which are part of core service.
- c) Not traffic-related information message type including but not limited to examples such as abduction alerts also sometimes called “amber alert”.

5.3 Fundamental parameters

5.3.1 Spatial relevance

Two fundamental parameters characterize an IVS message spatially that are:

- Relevance zone (RZ) which is defined by the parts of road network for which the IVS message is valid.
- Driver awareness zone (DAZ) which is defined by the parts of road network before entering the relevance zone, allowing presentation of the corresponding message to the driver in advance of entering the Relevance zone.

The two parameters are illustrated in [Figure 5](#) below.