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**Intelligent Transport Systems (ITS);  
Users and applications requirements;  
Part 2: Applications and facilities layer  
common data dictionary;  
Release 2**

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RTS/ITS-001982

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# Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

The present document is part 2 of a multi-part deliverable covering the Intelligent Transport Systems (ITS); Users and applications requirements, as identified below:

Part 1: "Facility layer structure, functional requirements and specifications; Release 2";

**Part 2: "Applications and facilities layer common data dictionary; Release 2".**

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# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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## Introduction

ITS applications are enabled by the data exchanges among ITS Stations (ITS-Ss) via wireless or wired communications. Even though each message has specific requirements on the data being included and transmitted to other ITS-Ss, ETSI TC ITS has identified a set of data types which are commonly used in multiple ITS applications and facilities layer messages. A common data dictionary is therefore defined for this common set.

For each data type, this common dictionary includes a textual description of the semantic of the data type in question. It also includes the ASN.1 definition of the data type. Therefore, this common data dictionary can be imported by any message when necessary during the encoding and decoding procedure.

---

# 1 Scope

The present document specifies the syntax and semantics of data objects in the field of Intelligent Transport Systems (ITS). It represents a dictionary of common data objects that can be used to define applications and facilities layer Protocol Data Unit and Service Data Unit in ETSI TC ITS Release 2 documents.

The present document does not specify the syntax and semantics of data elements in the specific context of any message. Such syntax and semantics are specified in the corresponding message standards.

---

## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] [Recommendation ITU-T X.680](#): "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".

### 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ISO 1176:1990: "Road vehicles -- Masses -- Vocabulary and codes".

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the terms given in Recommendation ITU-T X.680 [1] and the following apply:

**bounding box:** rectangular shape covering all parts of an empty load vehicle projected from top view

NOTE: The empty load vehicle is defined in ISO 1176 [i.1], clause 4.6.

**data element:** data type that contains one single data

**data frame:** data type that contains more than one data element in a predefined order

**ITS common data dictionary:** repository of data elements and data frames used in the ITS applications and ITS facilities layer

**ITS messages:** messages exchanged at ITS facilities layer among ITS stations or messages exchanged at ITS applications layer among ITS stations

## 3.2 Symbols

Void.

## 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ASN	Abstract Syntax Notation
ASN.1	Abstract Syntax Notation One
CDD	Common Data Dictionary
DE	Data Element
DF	Data Frame
ITS	Intelligent Transport Systems
ITS-S	ITS Station
ITU-T	International Telecommunication Union-Telecommunication
OID	Object Identifier
SHA	Secure Hash Algorithm
TC	Technical Committee
VRU	Vulnerable Road User
wgX	working group X (where X is a number)

---

# 4 ITS data dictionary structure

## 4.1 Introduction

The ITS Common Data Dictionary (CDD) is a repository of data objects called Data Elements (DEs) and Data Frames (DFs) that represent data as well as information necessary for the realization of ITS applications and ITS facilities. A DE/DF may be used to construct ITS facilities layer or ITS applications layer messages, if needs are identified by the message in question.

Each data object is defined by a set of attributes, enabling the identification of the data in question. These attributes are defined in clause 4.2 and clause 4.3.

According to the usage purpose, a DE or a DF can be classified into the following categories:

- **Message management:** the DE/DF is used to support the management of an ITS facilities layer or ITS application layer message and communication protocol, e.g. protocol version.
- **Application usage:** the DE/DF includes information and data that are useful for the realization of one or multiple ITS applications.

The CDD data objects including their syntax and semantics are specified in Annex A.

For readability, the same semantical specification is presented in a different format in Annex B.

Guidelines and recommendations on how to write ASN.1 Modules based on the use of the present document are provided in Annex C.

Additional requirements on DEs/DFs are specified in Annex D.

## 4.2 Attributes for DE/DF identification

### 4.2.1 Descriptive name

This attribute provides a descriptive name of the data object which is unique within the CDD. The descriptive name shall focus on the information that is contained in the data object, not on the possible usage of the information.

### 4.2.2 ASN.1 representation

This attribute provides the specification of the abstract syntax, i.e. the abstract structure of data objects, using ASN.1. The ASN.1 definition shall follow the specifications as defined in Recommendation ITU-T X.680 [1]. The ASN.1 type name shall be identical to the descriptive name.

The transfer syntax is defined in the ITS facilities layer or ITS applications layer message standard that defines the Protocol Data Unit to be transmitted.

## 4.3 Attributes for DE/DF definition

### 4.3.1 Definition

This attribute provides the specification of the semantics, i.e. the meaning of the data object.

### 4.3.2 Unit

The applied unit for the data, if necessary.

### 4.3.3 Category

This attribute indicates the category that the data object belongs to. Currently, the following categories are defined:

- **Basic Information:** the data object provides basic, elementary information.
- **Vehicle information:** the data object provides information specific about road and rail vehicles.
- **GeoReference information:** the data object provides geographical description of the data.
- **Kinematic information:** the data object provides information about the kinematic state of a traffic participant.
- **Road topology information:** the data object provides one or a set of road topology information.
- **Traffic information:** the data object provides one or a set of road traffic information.
- **Infrastructure information:** the data object provides one or a set of ITS infrastructure information.
- **Personal information:** the data object provides one or a set of ITS personal information.
- **Communication information:** the data object provides one or a set of information that are relevant to the ITS application layer or ITS facilities layer communication protocol.
- **Sensing information:** the data object provides information about physical objects and/or the sensors detecting those.
- **Cluster Information:** the data object provides information about clusters of objects such as Vulnerable Road Users.
- **VRU Information:** the data object provides information specific about Vulnerable Road Users.

A data object shall belong to at least one of the above categories. It is expected that more categories will be added in the future.



#### 4.3.4 Revision

Revision information of the data object, starting from V1.3.1 of the present document.

## Annex A (normative): ASN.1 Module

The syntax of the common data objects is defined using the Abstract Syntax Notation One (ASN.1) technique according to Recommendation ITU-T X.680 [1]. This annex provides the normative ASN.1 module containing the complete syntactical definitions of the data types defined in the present document.

The semantical specification of the data objects is contained in the same module, in the form of ASN.1 comments. For readability, the same semantical specification is presented in a different format in Annex B.

The ETSI-ITS-CDD ASN.1 module is identified by the Object Identifier {itu-t (0) identified-organization (4) etsi (0) itsDomain (5) wg1 (1) 102894 cdd (2) major-version-4 (4) minor-version-2 (2)}. The module can be downloaded as a file as indicated in Table A.1. The associated SHA-256 cryptographic hash digest of the referenced file offers a means to verify the integrity of that file.

**Table A.1: ITS-Container ASN.1 module information**

Module name	ETSI-ITS-CDD
OID	{itu-t (0) identified-organization (4) etsi (0) itsDomain (5) wg1 (1) 102894 cdd (2) major-version-4 (4) minor-version-2 (2)}
Link	<a href="https://forge.etsi.org/rep/ITS/asn1/cdd_ts102894_2/-/raw/v2.3.1/ETSI-ITS-CDD.asn">https://forge.etsi.org/rep/ITS/asn1/cdd_ts102894_2/-/raw/v2.3.1/ETSI-ITS-CDD.asn</a>
SHA-256 hash	b682244b7ad59d54adff2836b0b4c00244d6cd419933788e0d904aad5c0456c7

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## Annex B (informative): Specification of CDD in readable format

The specification of the CDD data objects is available at the following URL:

[https://forge.etsi.org/rep/ITS/asn1/cdd\\_ts102894\\_2/-/blob/v2.3.1/docs/ETSI-ITS-CDD.md](https://forge.etsi.org/rep/ITS/asn1/cdd_ts102894_2/-/blob/v2.3.1/docs/ETSI-ITS-CDD.md)

# Annex C (informative): Guidelines for writing ASN.1 Modules

## C.1 General guidelines

An ASN.1 schema file should contain exactly one ASN.1 module.

Each ASN.1 module should be assigned a meaningful name.

Each ASN.1 module should be assigned a unique OID below the following arc:

```
{itu-t (0) identified-organization (4) etsi (0) itsDomain (5) wgX (X)}
```

where wgX (X) indicates the Working Group in ETSI TC ITS that owns the standard in which the module is defined.

The object identifier of an ASN.1 Module should be based on the identifier of the standard and an identifier of the module within the context of the standard.

### EXAMPLE 1:

```
{itu-t (0) identified-organization (4) etsi (0) itsDomain (5) wg1 (1) 102894 cdd (2)}
```

An ASN.1 Module should be identified by an OID that have the two last arcs used to indicate the version number: the first of them should indicate the major version number and the second should indicate the minor version number.

### EXAMPLE 2:

```
{itu-t (0) identified-organization (4) etsi (0) itsDomain (5) wg1 (1) 102894 cdd (2) major-version-3 (3) minor-version-1 (1)}
```

Identifiers associated to nodes of the OID are not mandatory but if used should be unique below the arc.

### EXAMPLE 3:

```
major-version-3 (3)
```

or

```
102894
```

and not

```
major-version (3)
```

or

```
ts (102894)
```

**NOTE:** According to the OID notation, any identifier followed by a number inside an OID can be replaced by the same number without parentheses.

**EXAMPLE 4:** Therefore the above OID can also be noted as {0 4 0 5 1 102894 2 3 1}.

Each ASN.1 module should define exactly one each Protocol Data Unit, i.e. one upper level data type that is not referenced by any other data type in that module. One exception is the ASN.1 Module defined in Annex B of the present document that provides data types which are building blocks for Protocol Data Units.

For the definition of the type that represents the Protocol Data Unit, common data objects defined in the present document should be used as far as possible.

When an ASN.1 Entity (type, value assignment, object class, etc.) needs to reference another ASN.1 Entity defined in a different Module, the name of the referenced ASN.1 Entity should be listed in an IMPORTS clause referring to that different module and the name of the entity should be used (normally without a prefix) to refer to the imported ASN.1 Entity.

Each Module listed in an IMPORTS clause should be referred to by its object identifier and not only by its name.

After each IMPORTS clause that refers to an ASN.1 module identified by an object identifier that ends with a major version number and a minor version, the statement WITH SUCCESSORS should be added. When the WITH SUCCESSORS clause is present, all the corresponding arcs of the OID except the last arc should match exactly with the imported module: the last arc of the former OID only needs to be *greater or equal* to the last arc of the latter. This supports running the module with all future minor versions of the imported module without a need for update.

ASN.1 Entities with identical names should not be imported from two different Modules.

When a new version of the ASN.1 Module is produced, the module, together with the modules referred to in the IMPORTS clause should be run through two or more ASN.1 compilers and no ASN.1 syntactic errors should be found.

---

## C.2 Versioning of ASN.1 modules

Each time a new version of an ASN.1 module is produced, either the major and/or the minor version number of the Module OID should be incremented from the previous version, starting from the initial value 1: if the changes to the module negatively affect backwards compatibility, the major version should be incremented and the minor version set to the value 1. Otherwise only the minor version should be incremented.

**NOTE:** The version numbers of the ASN.1 module and/or the entire OID are not transferred in a Protocol Data Unit. The DF ItsPduHeader identifies the version of the ITS message. This version is increased only if the backward compatibility of encoded protocol data units is affected. The value of the version is specified in the standard that specifies the ITS message.

There are two aspects of backwards compatibility that should be considered when versioning ASN.1 modules:

**Backwards compatibility of encoded protocol data units:** If the changes made to a module directly or indirectly modify a type representing a protocol data unit in such a way that the new version of the modified type is not "extension-related" to the older version of the type according to Recommendation ITU-T X.680 [1], the backward compatibility of encoded protocol data units is affected. This means that the protocol data unit encoded according to the new version of the module cannot be decoded according to the previous version(s) of the same module.

**Backwards compatibility of ASN.1 Entities defined in the module:** If the changes made to a module potentially affect the IMPORT statement of other modules such that the compiler will produce errors when compiling those modules together with the new version of the revised module.

Backwards compatibility is negatively affected in case of changes such as:

- Renaming an ASN.1 type.
- Deleting an ASN.1 type from the Module.
- Changing the name of one of the components of a type.
- Modifying the order of the components of a type.
- Deleting components of a type.
- Adding components of a type when not complying with the ASN.1 extensibility rules.

Backwards compatibility is not affected by the following changes:

- Reformatting or reordering the ASN.1 entities of the Module.
- Adding or removing white space.
- Adding a new ASN.1 type to the Module.
- Making any change that complies with the ASN.1 extensibility rules, such as adding a field at the end of a sequence type that contains an extension marker (...).

---

## C.3 Template for semantic definitions

It is recommended to specify the semantics of data objects directly in the ASN.1 Module that defines the syntax (data types) of those data objects. Therefore, the following template should be used:

```
/**@brief (optional): indicates the header of the clause, otherwise the name of the data type will
be used as header.
 * Definition: specification of the semantics of the data object.
 *
 * If the data object represents a data frame, all elements within the data frame
 * should be described using @param or @field. One @param or @field per attribute:
 *
 * @param or @field: describes a component of the data type.
 *
 * @param or @field: describes a component of the data type.
 *
 * @unit: the unit of the data type.
 * @category: the category of the data type.
 * @revision: the revision of the data type.
 */
ASN.1Type ::= SomeDefinition -- definition of the syntax of the data object.
"empty line"
/** next data type
```

## Annex D (normative): Additional requirements on DE/DFs

### D.1 Usage of DF PathPredicted2 to generate a shape

DF PathPredicted2 can be used to generate a shape by using a list of predicted path points that together with one or two offset values span an area. For this purpose the component *symmetricAreaOffset* of *PathPointPredicted* shall be present in all points inside the component *pathPredicted*. In the absence of the component *asymmetricAreaOffset*, the component *symmetricAreaOffset* shall be applied to both sides of the path. However, if both offsets are available, the *symmetricAreaOffset* component shall be implemented on the left-hand side, while the *asymmetricAreaOffset* shall be implemented on the right-hand side. Moreover, each *PathPointPredicted* may include the component *pathDeltaTime*, which, if present, shall denote distinct segments of the area valid at various time intervals.

If there is more than one *pathPointPredicted* inside *PathPredicted2*, the relevant area enclosed by the set of consecutive *pathPointPredicted* as shown in Figure D.1 shall be encoded as follows:

- 1) Create for consecutive points  $P_{i-1}$ ,  $P_i$ ,  $P_{i+1}$  of type *pathPointPredicted* the angle bisector L of  $\phi$ , where  $\phi$  is the angle between  $\overline{P_{i-1}P_i}$  and  $\overline{P_iP_{i+1}}$ .
- 2) See detail in Figure D.2:  $A_i$  is located on the straight line L with distance *symmetricalAreaOffset*( $P_i$ ) to  $P_i$ , where  $A_i$  is on the left when following the Path from  $P_{i-1}$  over  $P_i$  to  $P_{i+1}$ .
- 3) If *asymmetricalAreaOffset*( $P_i$ ) is present,  $B_i$  is located on the straight line L with distance *asymmetricalAreaOffset*( $P_i$ ) to  $P_i$  opposite of  $A_i$ , if *asymmetricalAreaOffset* is absent,  $B_i$  is calculated correspondingly using the *symmetricalAreaOffset*.
- 4) Special case  $i=0$  and  $i=n$ , where  $P_0$  is the first point and  $P_n$  the last point of the path: In case of calculating the angle bisector L as in 1., L here is the perpendicular line to  $\overline{P_0P_1}$  and  $\overline{P_{n-1}P_n}$  respectively.
- 5) The encoded area consists of the enclosure of the Points  $A_i$ ,  $B_i$ ,  $P_0$  and  $P_n$ .

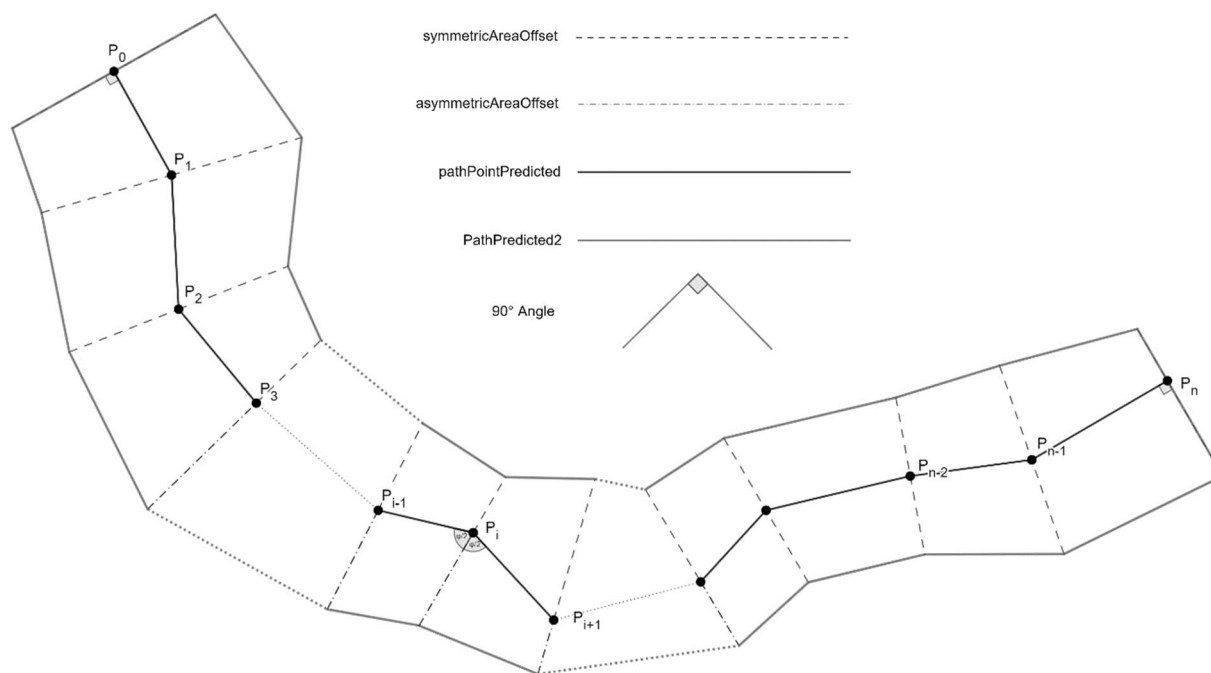
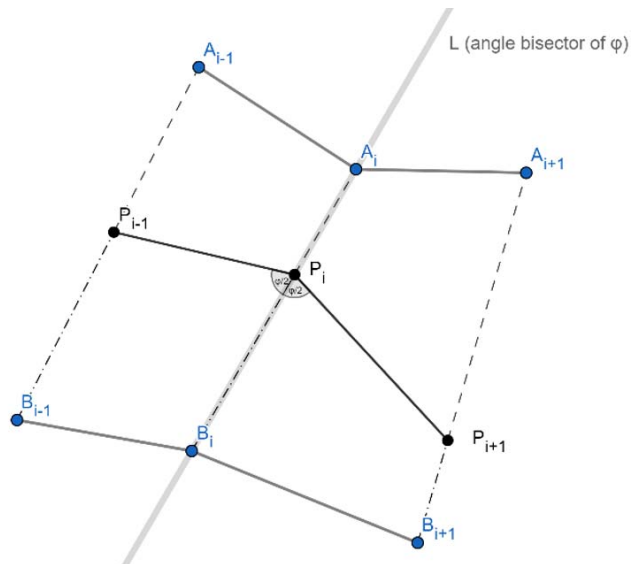
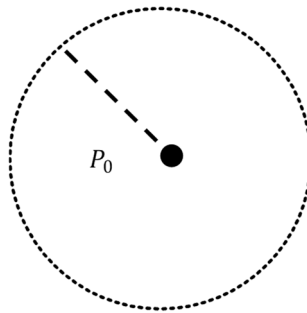


Figure D.1: Encoding scheme for one element of *pathPointPredicted2*



**Figure D.2: Encoding rules for a multiple path point area**

If the *PathPredicted2* consists of only one *pathPointPredicted*, the encoded area shall be a circle with the radius *symmetricAreaOffset*, see Figure D.3. In this case the optional asymmetrical offset shall not be used.



**Figure D.3: Encoding rules for a circular area, symmetrical border offset**



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## Annex E (informative): Bibliography

ISO 8855: "Road vehicles -- Vehicle dynamics and road-holding ability -- Vocabulary".

ISO 3833: "Road vehicles -- Types -- Terms and definitions".

ISO 3779 (2011-07): "Road vehicles -- Vehicle identification number (VIN) Content and structure".

VDV recommendation 420 (1992): "Technical Requirements for Automatic Vehicle Location / Control Systems - Radio Data Transmission (BON Version) with Supplement 1 and Supplement 2".

UNECE/TRANS/WP.29/78/Rev.4: "Consolidated Resolution on the Construction of Vehicles (R.E.3)".

[European Agreement \(applicable as from 1 January 2011\) concerning the International Carriage of Dangerous Goods by Road.](#)

[United Nations Recommendations on the Transport of Dangerous Goods - Model Regulations](#), Twelfth revised edition.

ETSI TS 103 900: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Specification of Cooperative Awareness Basic Service; Release 2".

ETSI TS 103 831: "Intelligent Transport Systems (ITS); C-ITS ECOSystem; Facilities Layer functionality; Decentralized Environmental Notification Service; Release 2".

ETSI TS 101 539-1: "Intelligent Transport Systems (ITS); V2X Applications; Part 1: Road Hazard Signalling (RHS) application requirements specification".

ETSI TS 101 556-1: "Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communication; Electric Vehicle Charging Spot Notification Specification".

ETSI TS 101 556-2: "Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communication; Part 2: Communication system specification to support application requirements for Tyre Information System (TIS) and Tyre Pressure Gauge (TPG) interoperability".

ETSI TS 101 556-3: "Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communications; Part 3: Communications system for the planning and reservation of EV energy supply using wireless networks".

ETSI TS 103 724: "Intelligent Transport Systems (ITS); Facilities layer function; Interference Management Zone Message (IMZM); Release 2".

ETSI TS 102 792: "Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range".

ETSI EN 302 890-1: "Intelligent Transport Systems (ITS); Facilities layer function; Part 1: Services Announcement (SA) specification".

ETSI TS 103 300-2: "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 2: Functional Architecture and Requirements definition; Release 2".

ETSI TS 103 300-3: "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 3: Specification of VRU awareness basic service; Release 2".

ETSI TS 103 301: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services; Release 2".

ETSI TS 103 175: "Intelligent Transport Systems (ITS); Cross Layer DCC Management Entity for operation in the ITS G5A and ITS G5B medium".

ETSI EN 302 571: "Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonised Standard for access to radio spectrum".

## Annex F (informative): Change history

Date	Version	Information about changes
2018-08	V1.3.1	Last Release 1 Version
2022-10	V2.1.1	First version of Release 2: <ul style="list-style-type: none"> <li>• Revision of Release 1 DE/DF specifications</li> <li>• Integration of Release 1 Change Requests</li> <li>• Integration of cause code and sub cause codes for highway level crossing</li> <li>• Generalization of some Release 1 DE/DFs (original ones kept for backwards compatibility)</li> <li>• Additions to Messageld</li> <li>• Additions to StationType (generalized also as TrafficParticipantType)</li> <li>• Integration (with changes) of DEs and DFs of ETSI TS 103 300-3</li> <li>• Integration (with changes) of DEs and DFs of ETSI TS 103 724 - V2.1.1</li> <li>• Integration (with changes) of DEs and DFs of ETSI TR 103 562</li> <li>• Integration of DEs and DFs for ETSI TR 103 324</li> <li>• Integration of DEs and DFs for ETSI TS 103 693</li> <li>• Integration of DEs for ETSI TS 103 301</li> <li>• Transfer of Annex A and B to ETSI FORGE</li> <li>• Addition of Annex C and D</li> </ul>
2023-10	V2.2.1	Second version of Release 2: change of major version due to changes documented in the ASN.1 module. Annex A is now moved to become informative Annex B. New Annex D is added.
2024-06	V2.3.1	Third version of Release 2: changes as documented in the ASN.1 module.

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## History

<b>Document history</b>		
V1.1.1	August 2013	Publication
V1.2.1	September 2014	Publication
V1.3.1	August 2018	Publication
V2.1.1	November 2022	Publication
V2.2.1	October 2023	Publication
V2.3.1	August 2024	Publication