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Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) —

Part 17: Speed information (TPEG2-SPI)

Systèmes intelligents de transport — Informations sur le trafic et le tourisme via le groupe expert du protocole de transport, génération 2 (TPEG2) —

Partie 17: Information de vitesse (TPEG2-SPI)

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

A list of all parts in the ISO 21219 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 History

TPEG technology was originally proposed by the European Broadcasting Union (EBU) Broadcast Management Committee, who established the B/TPEG project group in the autumn of 1997 with a brief to develop, as soon as possible, a new protocol for broadcasting traffic and travel-related information in the multimedia environment. TPEG technology, its applications and service features were designed to enable travel-related messages to be coded, decoded, filtered and understood by humans (visually and/or audibly in the user's language) and by agent systems. Originally, a byte-oriented data stream format, which can be carried on almost any digital bearer with an appropriate adaptation layer, was developed. Hierarchically structured TPEG messages from service providers to end-users were designed to transfer information from the service provider database to an end-user's equipment.

One year later, in December 1998, the B/TPEG group produced its first EBU specifications. Two documents were released. Part 2 (TPEG-SSF, which became ISO/TS 18234-2) described the syntax, semantics and framing structure which was used for all TPEG applications. Meanwhile, Part 4 (TPEG-RTM, which became ISO/TS 18234-4) described the first application for road traffic messages.

Subsequently, in March 1999, CEN/TC 278, in conjunction with ISO/TC 204, established a group comprising members of the former EBU B/TPEG and this working group continued development work. Further parts were developed to make the initial set of four parts, enabling the implementation of a consistent service. Part 3 (TPEG-SNI, later ISO/TS 18234-3) described the service and network information application used by all service implementations to ensure appropriate referencing from one service source to another.

Part 1 (TPEG-INV, later ISO/TS 18234-1) completed the series by describing the other parts and their relationship; it also contained the application IDs used within the other parts. Additionally, Part 5, the public transport information application (TPEG-PTI, later ISO/TS 18234-5), was developed. The so-called TPEG-LOC location referencing method, which enabled both map-based TPEG-decoders and non-map-based ones to deliver either map-based location referencing or human-readable text information, was issued as ISO/TS 18234-6 to be used in association with the other applications of parts of the ISO 18234 series to provide location referencing.

The ISO 18234 series has become known as TPEG Generation 1.

0.2 TPEG Generation 2

When the Traveller Information Services Association (TISA), derived from former forums, was inaugurated in December 2007, TPEG development was taken over by TISA and continued in the TPEG applications working group.

It was about this time that the (then) new Unified Modelling Language (UML) was seen as having major advantages for the development of new TPEG applications in communities who would not necessarily have the binary physical format skills required to extend the original TPEG TS work. It was also realized that the XML format for TPEG described within the ISO 24530 series (now superseded) had a greater significance than previously foreseen, especially in the content-generation segment, and that keeping two physical formats in synchronism, in different standards series, would be rather difficult.

As a result, TISA set about the development of a new TPEG structure that would be UML-based. This has subsequently become known as TPEG Generation 2 (TPEG2).

TPEG2 is embodied in the ISO 21219 series and it comprises many parts that cover an introduction, rules, toolkit and application components. TPEG2 is built around UML modelling and has a core of rules that contain the modelling strategy covered in ISO 21219-2, ISO 21219-3 and ISO 21219-4 and the conversion to two current physical formats: binary (see Annex A) and XML (see Annex B); others can be added in the future. TISA uses an automated tool to convert from the agreed UML model XMI file directly into an MS Word document file, to minimize drafting errors; this file forms the annex for each physical format.

TPEG2 has a three-container conceptual structure: message management (ISO 21219-6), application (several parts) and location referencing (ISO/TS 21219-7). This structure has flexible capability and can accommodate many differing use cases that have been proposed within the TTI sector and wider for hierarchical message content.

TPEG2 also has many location referencing options as required by the service provider community, any of which may be delivered by vectoring data included in the location referencing container.

The following classification provides a helpful grouping of the different TPEG2 parts according to their intended purpose. Note that the list below is potentially incomplete, as there is the possibility that new TPEG2 parts will be introduced after the publication of this document.

— Toolkit parts: TPEG2-INV (ISO 21219-1), TPEG2-UML (ISO 21219-2), TPEG2-UBCR (ISO 21219-3), TPEG2-UXCR (ISO 21219-4), TPEG2-SFW (ISO 21219-5), TPEG2-MMC (ISO 21219-6), TPEG2-LRC (ISO/TS 21219-7).

— Special applications: TPEG2-SNI (ISO 21219-9), TPEG2-CAI (ISO 21219-10), TPEG2-LTE (ISO/TS 21219-24).

— Location referencing: TPEG2-OLR (ISO/TS 21219-22), TPEG2-GLR (ISO/TS 21219-21), TPEG2-TLR (ISO 17572-2), TPEG2-DLR (ISO 17572-3).

— Applications: TPEG2-PKI (ISO 21219-14), TPEG2-TEC (ISO 21219-15), TPEG2-FPI (ISO 21219-16), TPEG2-SPI (ISO 21219-17 - this document), TPEG2-TFP (ISO 21219-18), TPEG2-WEA (ISO 21219-19), TPEG2-RMR (ISO/TS 21219-23), TPEG2-EMI (ISO/TS 21219-25), TPEG2-VLI (ISO/TS 21219-26).

TPEG2 has been developed to be broadly (but not totally) backward compatible with TPEG1 to assist in transitions from earlier implementations, while not hindering the TPEG2 innovative approach and being able to support many new features, such as dealing with applications with both long-term, unchanging content and highly dynamic content, such as parking information.

This document is based on the TISA specification technical/editorial version reference:

SP19005/1.0/001.

Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) —

Part 17: Speed information (TPEG2-SPI)

1 Scope

This document defines the TPEG Speed information (SPI) application for reporting speed information for travellers. Speed limits are usually indicated to the driver through roadside signs. Drivers who are aware of the speed limit at all times are more likely to drive safely, which improves road safety. Most speed limit signs are static and remain unchanged for years and are thus available through navigation system map databases. However, there is an increasing number of variable message signs, temporary signing (e.g. for road works) and also changed speed limits which are not yet reflected in the map databases.

With the TPEG-SPI application, speed limit information is offered in an accurate way so that different lanes and different vehicle types can be differentiated. TPEG-SPI also allows the drivers to be aware of the current allowed (maximum) speed, by delivering timely information about the current position and values of speed limits to the navigation or driver assistance systems. These data are seen as informational and are intended to be encoded in a compact way to minimize bandwidth consumption.

TPEG2-SPI supports direct and indirect speed limits. Direct speed limits are used for signs showing a maximum speed at which a vehicle is allowed to travel. Such speed limit signs can be static or dynamic. Indirect speed limits refer to the speed of other road users. It is primarily the vehicle in front of the own vehicle that is used as a reference.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 21219-1, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 1: Introduction, numbering and versions (TPEG2-INV)*

ISO 21219-3, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 3: UML to binary conversion rules (TPEG2-UBCR)*

ISO 21219-4, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 4: UML to XML conversion rules*

ISO 21219-5, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 5: Service framework (TPEG2-SFW)*

ISO 21219-9, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 9: Service and network information (TPEG2-SNI)*

ISO 21219-15, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 15: Traffic event compact (TPEG2-TEC)*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
speed limit
maximum (or, in some cases, minimum) speed at which road vehicles may legally travel on particular stretches of road

4 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO 21219-1, ISO 21219-9, ISO 21219-15 and the following apply.

ADC	application data container
AID	application identification
CEN	Comité Européen de Normalisation
EBU	European Broadcasting Union
ISO	International Organization for Standardization
ITS	intelligent transport systems
LRC	location referencing container
MMC	message management container
OSI	open systems interconnection
SID	TPEG service ID
SFW	TPEG service framework
SNI	service and network information
TISA	traveller information services association
TPEG	transport protocol expert group
TMC	traffic message channel
TTI	traffic and traveller information
UML	unified modelling language
XML	extensible markup language

5 Application specific constraints

5.1 Application identification

The word “application” is used in the TPEG specifications to describe specific subsets of the TPEG structure. An application defines a limited vocabulary for a certain type of messages, for example, parking information or road traffic information. Each TPEG application is assigned a unique number, called the application identity (AID). An AID number is defined in ISO 21219-1 whenever a new application is developed.

The AID number is used within the TPEG2-SNI application (ISO 21219-9) to indicate how to process TPEG content. It facilitates the routing of information to the appropriate application decoder.

5.2 Version number signalling

Version numbering is used to track the separate versions of an application through its development and deployment. The differences between these versions can have an impact on client devices.

The version numbering principle is defined in ISO 21219-1.

Table 1 shows the current version numbers for signalling SPI within the SNI application.

Table 1 — Current version numbers for signalling of SPI

major version number	1
minor version number	1

5.3 Ordered components

TPEG2-SPI requires a fixed order of TPEG components. The order for the SPI message component is shown in Figure 1. The first component shall be the MMC. This shall be the only component if the message is a cancellation message. Otherwise, the MMC component shall be followed by the one or more ADC component(s) which includes the application-specific information.

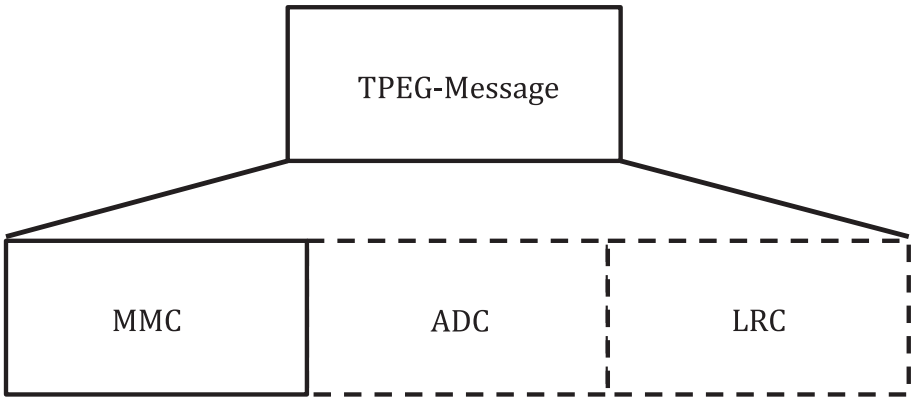

Figure 1 — Composition of TPEG messages

5.4 Extensibility

The requirement of a fixed component order does not affect the extension of TPEG2-SPI. Future application extensions may insert new components or may replace existing components by new ones without losing backward compatibility, i.e. a TPEG2-SPI decoder shall be able to detect and skip unknown components.

5.5 TPEG service component frame

TPEG2-SPI shall use the "service component frame with dataCRC and messageCount" conforming to ISO 21219-5.

6 SPI structure

The structure of SPI messages is shown in Figure 2. Annex A and Annex B specify respectively the binary format and XML format of the TPEG2-SPI application for use in transmission.

Annex C provides examples for speed limit signs and Annex D provides modelling examples for the SPI application.

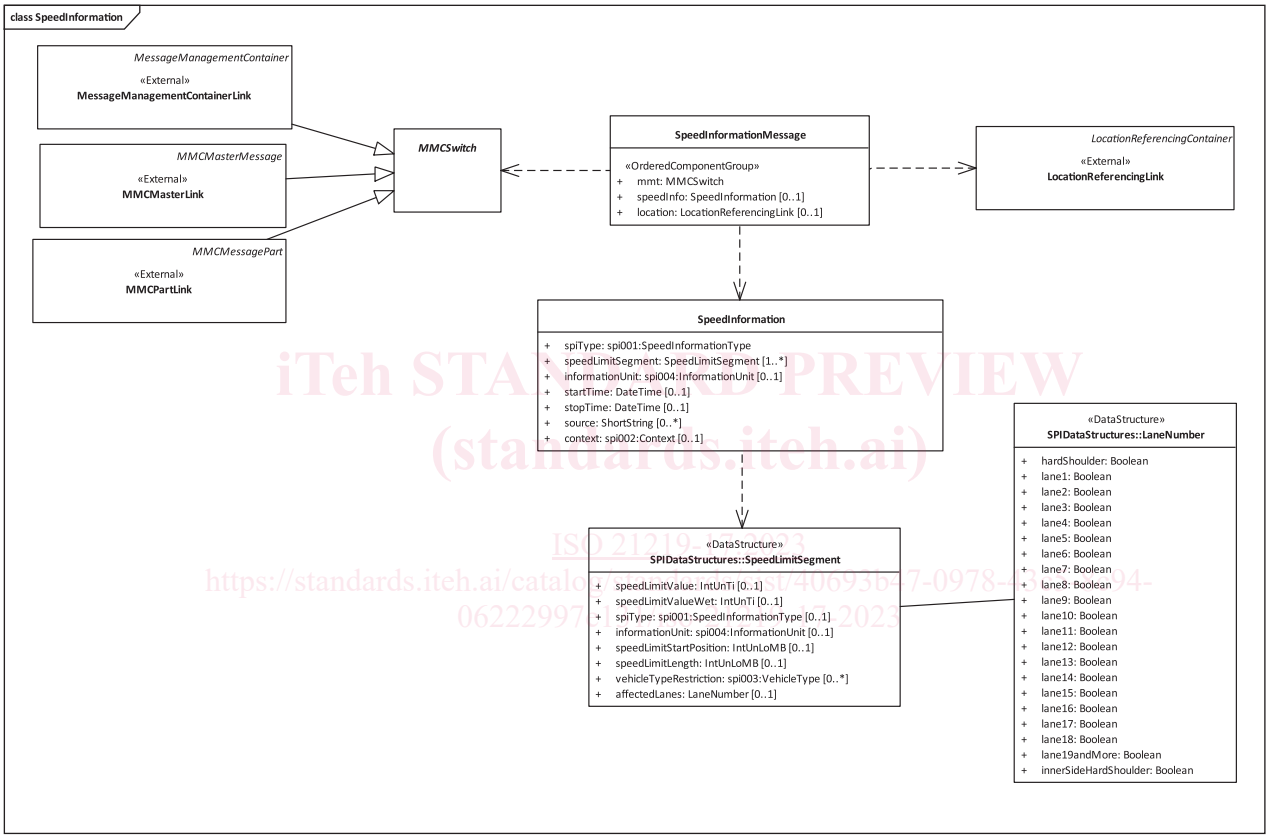

Figure 2 — SPI message structure

7 SPI message components

7.1 SpeedInformationMessage

A SpeedInformationMessage includes the message management container with management information related to the overall message. To transfer the actual payload, a simple speed information data container is provided. This container includes all speed information related to a location which is provided in a dedicated location referencing container.

Table 2 defines the SpeedInformationMessage component.

Table 2 — SpeedInformationMessage

Name	Type	Multiplicity	Description
Ordered components			
mmt	MMCSwitch	1	Message management container.
speedInfo	SpeedInformation	0..1	Describes the speed information.
location	LocationReferencingLink	0..1	Location referencing container (always included except for cancellation of a message and partial updates).

7.2 SpeedInformation

The speed information component provides information on the speed information type and additional attributes. It contains more detailed information about the limit itself and the affected parts of the location.

Speed limits can have start and stop time. Context and information about the source of the information may be provided on the background of the speed limit information.

Table 3 defines the SpeedInformation component.

Table 3 — SpeedInformation

Name	Type	Multiplicity	Description
spiType	spi001:SpeedInformationType	1	The speed information type shall provide information on the general sort of a speed limit message.
speedLimitSegment	SpeedLimitSegment	1..*	SpeedLimitSegments should be ordered with an increasing speedLimitStartOffset and in case of the same start offset the order should consider increased lane numbers.
informationUnit	spi004:InformationUnit	0..1	The information unit provides the unit in which the speed limit information provided in this message is dimensioned. The information unit may be omitted for the end of a speed limit.
startTime	DateTime	0..1	n.a.
stopTime	DateTime	0..1	n.a.
source	ShortString	0..*	Information about the source of this speed limit. The source may be a “C-ITS authority data set” (see ISO/TS 17426).[3]
context	spi002:Context	0..1	The context can provide additional information to the driver for understanding the reason for this restriction.

7.3 MMCSwitch

The MMCSwitch component is a placeholder for the MessageManagementContainerLink, MMCMasterLink and MMCPartLink.

7.4 MessageManagementContainerLink

The MMCLink component is used only if all information of a SpeedInformationMessage is transmitted within one complete message.

7.5 MMCMasterLink

The MMCMasterLink component is used in combination with MMCPartLink components to link static and dynamic parts of a message that are transmitted independently.

7.6 MMCPartLink

MMCPartLink components are used in combination with an MMCMasterLink component to link static and dynamic parts of a message that are transmitted independently.

7.7 LocationReferencingLink

The LocationReferenceLink component is a placeholder for the LocationReferencingContainer (LRC). It assigns the SPI application a specific local component ID for the LRC container. All component IDs within the LRC container are local to the LRC toolkit.

The component contains all information describing the location where the speed limit values are valid. It specifies a starting point and a route to which the SpeedInformation refers by giving offsets to indicate the exact position of a speed limit gantry along such a route.

It is allowed to use a flag indicating that both sides of the route are affected (both directions) in case the LRM supports it and the speed information provided in the ADC is identical for both directions. An example of how such a case can be encoded is provided in the modelling examples in Annex D.

8 SPI datatypes

8.1 LaneNumber

Lane numbering is a way to address each lane of a road stretch individually. It assigns each lane a unique number until the physical road layout changes. A physical road layout changes in cases where new lanes start or existing lanes end.

The lane numbering schema should follow these rules.

a) Lanes are numbered from the curb to the middle of the road. Right-hand traffic lanes are therefore numbered from the right to the left relating to the driving direction. Left-hand traffic lanes are numbered from left to right relating to the driving direction.

b) The lowest possible number is 0 and only consecutive integer numbers are used.

c) The hard shoulder is always number 0:

   1) this is the leftmost lane in case of left-hand driving (if exists);

   2) this is the rightmost lane in case of right-hand driving (if exists);

   3) additional hard shoulders are numbered consecutively (also applicable for hard shoulders next to the divider).

d) The first drivable lane for vehicles is number 1. This is applicable in case of no hard shoulder or just one hard shoulder.

e) All lanes which are physically available, count.

f) Lanes which are temporarily closed or opened keep their original number.

g) If the physical layout changes then the location shall be split.

h) Lane numbers are per driving direction.

i) In case of overlapping lanes (3 lanes with the middle lane drivable from both directions, or a single physical lane drivable from both directions) the lane which is drivable from both directions counts from both directions.

Table 4 defines the LaneNumber datatype.

Table 4 — LaneNumber

Name	Type	Multiplicity	Description
hardShoulder	Boolean	1	true, if the hard shoulder exists and is selected[a].
lane1	Boolean	1	true, if the lane is selected.
lane2	Boolean	1	true, if the lane is selected.
lane3	Boolean	1	true, if the lane is selected.
lane4	Boolean	1	true, if the lane is selected.
lane5	Boolean	1	true, if the lane is selected.
lane6	Boolean	1	true, if the lane is selected.
lane7	Boolean	1	true, if the lane is selected.
lane8	Boolean	1	true, if the lane is selected.
lane9	Boolean	1	true, if the lane is selected.
lane10	Boolean	1	true, if the lane is selected.
lane11	Boolean	1	true, if the lane is selected.
lane12	Boolean	1	true, if the lane is selected.
lane13	Boolean	1	true, if the lane is selected.
lane14	Boolean	1	true, if the lane is selected.
lane15	Boolean	1	true, if the lane is selected.
lane16	Boolean	1	true, if the lane is selected.
lane17	Boolean	1	true, if the lane is selected.
lane18	Boolean	1	true, if the lane is selected.
lane19andMore	Boolean	1	true, if the lane and potential further lanes are selected.
innerSideHardShoulder	Boolean	1	true, if a Central Reserve[b] exists and is selected[c].

[a] hardShoulder is usually only driveable in special cases.

[b] Terms equivalent for Central Reserve UK are Median Strip and Median Divider in the US.

[c] innerHardShoulder is usually only driveable in special cases.

8.2 SpeedLimitSegment

A SpeedLimitSegment contains the speed limit information for a segment starting at the position defined by an offset from a starting point defined by the LRC.

If segments are not consecutive, then such gaps shall be seen as information "unknown". A service provider can potentially not have a full coverage of speed information but can still send multiple segments in one message. Gaps can also occur at the start or at the end of a location.

Table 5 defines the SpeedLimitSegment datatype.