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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

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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 may 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, 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, 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, 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 parts of the ISO/TS 18234 series to provide location referencing.

The ISO/TS 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 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/TS 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 is embodied in the ISO/TS 21219 series and it comprises many parts that cover 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/TS 21219-2, ISO/TS 21219-3 and ISO/TS 21219-4 and the conversion to two current physical formats: binary and XML; others could 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, that forms the annex for each physical format.

TPEG2 has a three container conceptual structure: message management (ISO/TS 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.

— Toolkit parts: TPEG2-INV (ISO/TS 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), TPEG2-LTE (ISO/TS 21219-24).

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

— Location referencing: TPEG2-GLR (ISO/TS 21219-21), TPEG2-OLR (ISO/TS 21219-22).

— Applications: TPEG2-PKI (ISO/TS 21219-14), TPEG2-TEC (ISO/TS 21219-15), TPEG2-FPI (ISO/TS 21219-16), TPEG2-SPI (ISO 21219-17 this document), TPEG2-TFP (ISO 21219-18), TPEG2-WEA (ISO/TS 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 having 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

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 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 reflected in the map databases yet. Speed limit information is offered in an accurate way so that different lanes and different vehicle types can be differentiated.

TPEG Speed Information 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. The data is seen as informational and will 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 a vehicle is allowed to travel. Such speed limit signs can be static or dynamic. Indirect speed limits are referring to the speed of other road users. Mostly the vehicle in front of the own vehicle is used as a reference.

2 Normative references

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

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

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

ISO/TS 21219-5, *Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) - Part 5:TPEG service framework (TPEG2-SFW)*

ISO/TS 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)*

*CEN ISO/TS 17426:*2016 *Intelligent transport systems - Cooperative systems - Contextual speeds*

ISO 3833:1977, *Road vehicles — Types — Terms and definitions*

3 Terms and Definitions

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

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

4 Abbreviated Terms

ACID	Application and Content Identifier
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 Modeling 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 IDentification (AID). An AID is defined whenever a new application is developed and these are all listed in ISO/TS 21219-1.

The application identification number is used within the TPEG2-SNI application (ISO/TS 21219-9) to indicate how to process TPEG content and 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 may have an impact on client devices.

The version numbering principle is defined in ISO/TS 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 *Message Management Container.* 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 *Application Data Container* component(s) which includes the application-specific information.

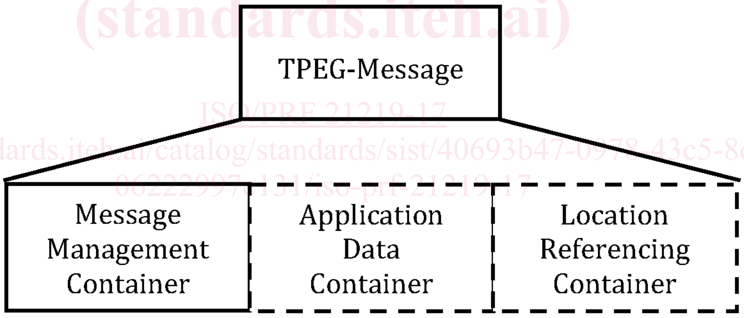

Figure 1 — Composition of TPEG messages

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 makes use of the "Service Component Frame with dataCRC and messageCount" according to ISO 21219-5.

Note This service is only advisory. In all circumstances, drivers are obliged to adhere to applicable legal regulations. e.g. in some countries, altered speed limits apply in different environmental conditions.

6 SPI Structure

The structure of SPI messages is shown in Figure 2.

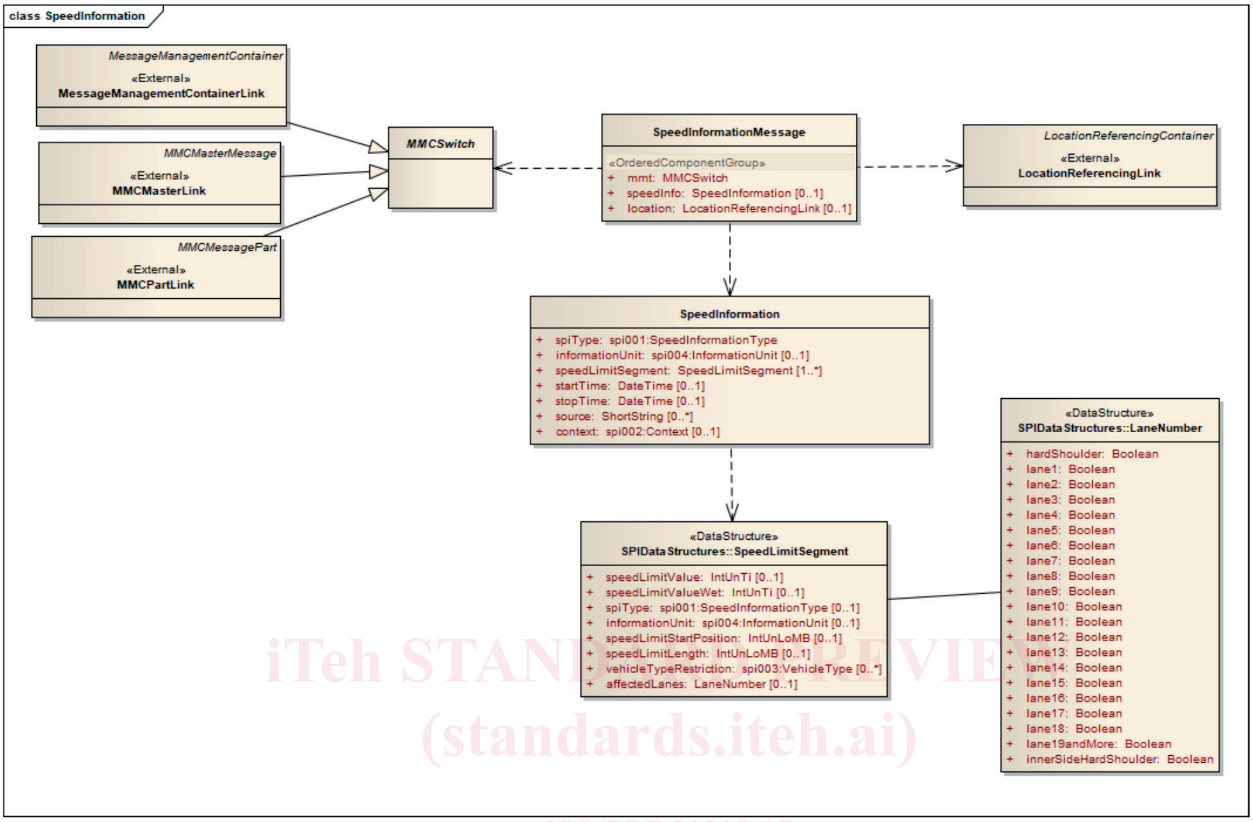

Figure 2 — SPI message structure

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 may have start and stop time. A 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 CEN ISO/TS 17426:2016)
context	spi002:Context	0..1	The context may provide additional information to the driver to understand the reasoning of 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 to 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 how such a case might be encoded is provided in modelling examples.

8 SPI Datatypes

8.1 LaneNumber

Lane numbering is a way to address each lane of a road stretch individually and 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:

Rule 1. 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.

Rule 2. The lowest possible number is 0 and only consecutive integer numbers are used.

Rule 3. Hard shoulder is always number 0

a. Leftmost lane in case of left hand driving (if exists)

b. Rightmost lane in case of right hand driving (if exists)

c. Additional hard shoulders are numbered consecutively (also applicable for hard shoulders next to the divider)

Rule 4. First drivable lane for vehicles is number 1
Applicable in case of no hard shoulder or just one hard shoulder

Rule 5. All lanes which are physically available, count

Rule 6. Lanes, which are temporarily closed or opened, keep their original number

Rule 7. If physical layout changes then the location must be split.

Rule 8. Lane numbers are per driving direction.

Rule 9. 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.

