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

Part 15: Traffic event compact (TPEG2-TEC)

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

Partie 15: Événement trafic compact (TPEG2-TEC)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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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*.

ISO/TS 21219 consists of the following parts, under the general title *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2)*:

— *Part 1: Introduction, numbering and versions (TPEG2-INV) [Technical Specification]*

— *Part 2: UML modelling rules [Technical Specification]*

— *Part 3: UML to binary conversion rules [Technical Specification]*

— *Part 4: UML to XML conversion rules [Technical Specification]*

— *Part 5: Service framework (TPEG2-SFW) [Technical Specification]*

— *Part 6: Message management container (TPEG2-MMC) [Technical Specification]*

— *Part 9: Service and network information (TPEG2-SNI) [Technical Specification]*

— *Part 10: Conditional access information (TPEG2-CAI) [Technical Specification]*

— *Part 14: Parking information application (TPEG2-PKI) [Technical Specification]*

— *Part 15: Traffic event compact [Technical Specification]*

— *Part 18: Traffic flow and prediction application (TPEG2-TFP) [Technical Specification]*

— *Part 19: Weather information (TPEG2-WEA) [Technical Specification]*

The following parts are under preparation:

— *Part 16: Fuel price information and availability application (TPEG2-FPI) [Technical Specification]*

— *Part 23: Road and multi-modal routes application (TPEG2-RMR) [Technical Specification]*

— *Part 24: Light encryption (TPEG2-LTE) [Technical Specification]*

— *Part 25: Electromobility charging infrastructure (TPEG2-EMI) [Technical Specification]*

The following parts are planned:

— *Part 7: Location referencing container [Technical Specification]*

— *Part 11: Universal location reference [Technical Specification]*

— *Part 21: Geographic location referencing [Technical Specification]*

— *Part 22: OpenLR location referencing [Technical Specification]*

Introduction

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.

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, 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 (many 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/TS 21219-2), TPEG2-UBCR (ISO/TS 21219-3), TPEG2-UXCR (ISO/TS 21219-4), TPEG2-SFW (ISO/TS 21219-5), TPEG2-MMC (ISO/TS 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-ULR (ISO/TS 21219-11), 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-TFP (ISO/TS 21219-18), TPEG2-WEA (ISO/TS 21219-19), TPEG2-RMR (ISO/TS 21219-23), TPEG2-EMI (ISO/TS 21219-25).

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 part of ISO/TS 21219 is based on the TISA specification technical/editorial version reference:

SP13001/3.2/002

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

Part 15: Traffic event compact (TPEG2-TEC)

1 Scope

This part of ISO/TS 21219 specifies the TPEG application: Traffic Event Compact (TEC). The TEC application has been specifically designed to support information about traffic events (e.g. road works, traffic jams). A specific form of traffic events are local hazard warnings which, being safety-related messages, are sent with high priority to warn a driver that may encounter dangerous situations (e.g. black-ice, accident beyond curves, obstacles on road, etc.) unexpectedly.

Generally, the Traffic Event Compact application is designed to allow receivers to

— ensure travel safety for the driver,

— enable the calculation of alternative routes,

— avoid delays (e.g. traffic jams),

— warn the driver of obstructions on route, and

— provide the driver with information on infrastructural problems (e.g. closed petrol stations, non-functioning emergency telephones).

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/TS 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/TS 21219-6, *Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2(TPEG2) — Part 6: Message management container (TPEG2-MMC)*

ISO/TS 21219-7[1)], *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 7: Location referencing container (TPEG2-LOC)*

3 Terms and definitions

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

3.1
local hazard warning
specific form of traffic events which, being safety-related messages, are sent with high priority to assist a driver from encountering dangerous situations

1) Planned.

3.2
location referencing container
concept applied to the grouping of all of the location referencing elements of a TPEG-Message

3.3
location referencing
method to provide information which allows a system to accurately identify a location

Note 1 to entry: The content of a location reference allows the location to be presented in a plain-language manner to the end-user (i.e. text, speech or icons) and also to be used for navigational purposes, for example, for map-based systems.

4 Abbreviated terms

ACID	Application and Content Identifier
ADC	Application Data Container
LRC	Location Reference Container
MMC	Message Management Container
RF	Radio Frequency
SFW	TPEG Service Framework: Modelling and Conversion Rules
TEC	Traffic Event Compact
TISA	Traveller Information Services Association
TPEG	Transport Protocol Expert Group
TTI	Traffic and Traveller Information
UML	Unified Modelling Language

5 Application specific constraints

5.1 Application identification

The word “application” is used in this part of ISO/TS 21219 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 the TPEG2-INV specification.

The application identification number is used in the TPEG2-SNI application 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 the TPEG2-INV specification.

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

Table 1 — Current version numbers for signalling of TEC

Major version number	3
Minor version number	2

5.3 Ordered components

TPEG-TEC requires a fixed order of TPEG components. The order for the TEC 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* and this, in turn, is followed by the *Location Referencing Container.*

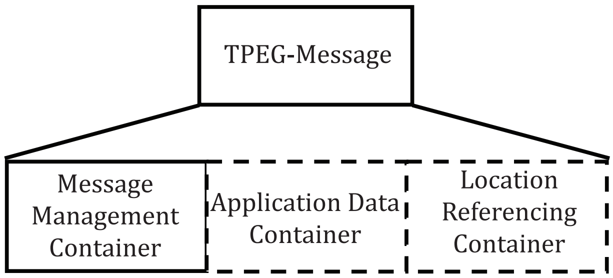

Figure 1 — Composition of TPEG messages

Within the *Event* component, one or more *Cause* components shall come first followed by one or more *Advice* components and so on. Components of the same type shall immediately follow each other.

5.4 Extension

Although there is a requirement to maintain a fixed component order, this does not prevent the extension of a TEC message generally. In case of future extensions, new components may be inserted or existing components may be replaced by new ones without losing backward compatibility. This requires that a TEC decoder shall be able to detect and skip unknown components.

Components of the same type shall be included sequentially without the interleaving of other forms of component.

Example (allowed)

The *Advice* component is replaced by *BetterAdvice* having its own component id. A *WeatherSituation* component is inserted after *Advice* component as shown in Figures 2 and 3.

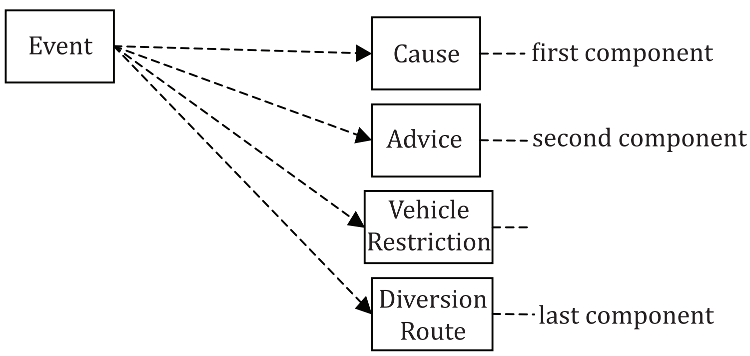

Figure 2 — Example for extension; original component model (before addition of additional components)

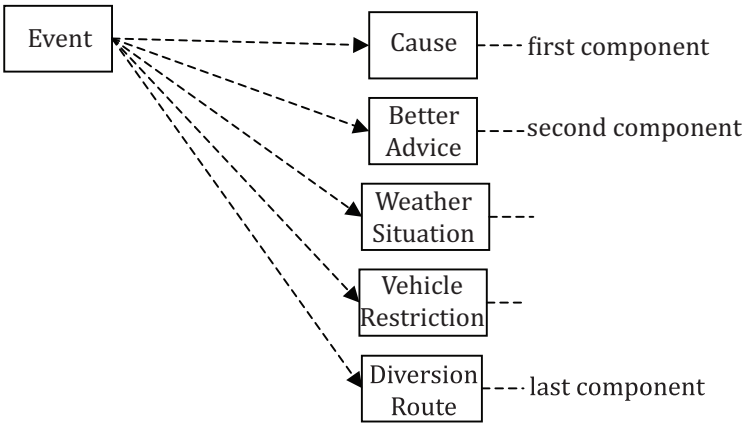

Figure 3 — Example for extension; *Advice* replaced by *BetterAdvice* and *WeatherSituation* added

5.5 TPEG Service Component Frame

TEC makes use of the "Service component frame with dataCRC, groupPriority and messageCount**".**

6 TEC Structure

The TEC structure is presented in Figure 4.

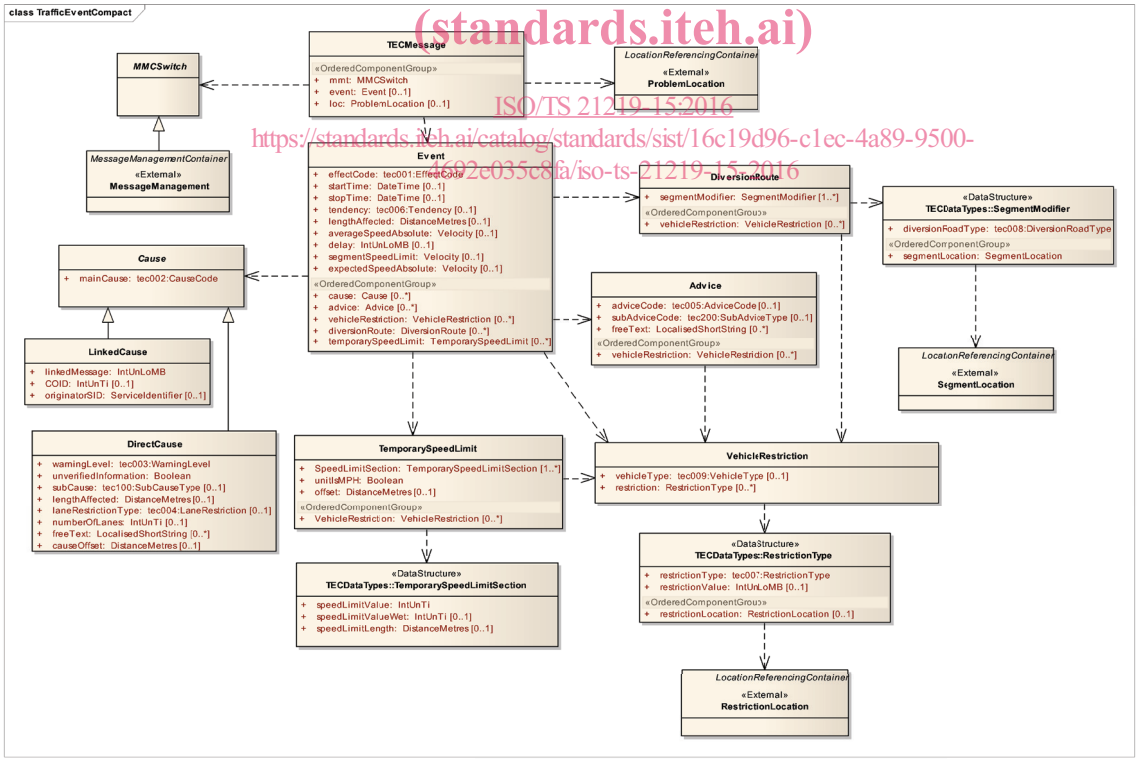

Figure 4 — TEC message structure

7 TEC Message components

7.1 TECMessage

A TECMessage (see Table 2) is either a normal message or a cancellation message. A normal message (i.e. other than cancellation messages) shall include the following:

— one message management container with management information related to the overall message (ID and version, expiry time);

— one event container with one traffic flow effect and, optionally, one or more causes with additional information;

— one location referencing container with the location reference for the overall traffic message.

Cancellation messages (cancelFlag = true) shall not include an event nor a location referencing container, only the message management container.

Table 2 — TECMessage

Name	Type	Multiplicity	Description
Ordered Components			
Mmt	MMCSwitch	1	Message Management Container
Event	Event	0..1	Describes the impact on the traffic flow and the related cause (always included except for cancellation of a message)
Loc	ProblemLocation	0..1	Location Referencing Container (always included except for cancellation of a message)

7.2 MMCSwitch

The MMCSwitch is an abstract container included for formal reasons, to allow future extension of the MMC.

7.3 MessageManagement

The MessageManagement component is a placeholder for the MessageManagementContainer as specified in ISO/TS 21219-6. It assigns the traffic event compact (TEC) application specific local component ID for the MMC container. All component IDs within the MMC container are local to the MMC toolkit. The MMC contains all and only information related to message management.

Message generation systems shall ensure that the information given in the MMC promotes unambiguous interpretation over the whole time a message is valid. It is particularly important to recognize that client devices are likely to suffer from non-continuous reception as typically encountered in broadcast systems suffering intermittent Radio Frequency (RF) performance.

TEC shall only use the monolithic message management as specified in ISO/TS 21219-6. Multipart messages management shall not be used.

7.4 Event

The Event component (see Table 3) supports definition, in general, of the impact on the traffic flow and the related cause.

NOTE For example, Stationary Traffic (due to) Narrow Lanes.

Table 3 — Event component

Name	Type	Multiplicity	Description
effectCode	tec001:EffectCode	1	Describes the impairment of the trafficflow.
startTime	DateTime	0..1	Date and time at which an event began or is scheduled to begin (intended to be used for presentation to the end-user).
stopTime	DateTime	0..1	Date and time at which an event, or status information, ended or is scheduled to end (intended to be used for presentation to the end-user).
tendency	tec006:Tendency	0..1	Tendency is related to the averageSpeedAbsolute indicating if this has been increasing, decreasing or has remained constant. Timescale of this trend should be typically in the range of 30 min or less, but is defined by the service provider. It is not a forecast of a future trend, nor does it relate to the length of the traffic queue.
lengthAffected	DistanceMetres	0..1	Length of the event in metres.
averageSpeedAbsolute	Velocity	0..1	The actual average speed in m/s at the given location. It is recommended to use this value for calculation of the route and estimated arrival time.
delay	IntUnLoMB	0..1	Delay in minutes added to journey due to event at the location. Only applicable to point locations, i.e. at border crossings.
segmentSpeedLimit	Velocity	0..1	Averaged speed limit (in m/s) within the problem location. Within the problem location, multiple speed limits may exist (e.g. multiple reducing speed limits on entering a roadworks zone). Average speed limit is calculated as: the total length (in m) of the problem location divided by the sum of the individual travel times travel times (seconds) when travelling at the defined speed limit. Shall be used as speed limit for re-routing, but not to display or warn the driver.
expectedSpeedAbsolute	Velocity	0..1	The expected (normal) speed in m/s for this time of the day based on, e.g. historical data. This speed may vary as function of the time of day and can be markedly different from the free-flow speed (especially in rush hour conditions).
Ordered Components			
cause	Cause	0..*	Defines the reason for the traffic problem (direct or linked cause).
advice	Advice	0..*	Recommendations or prohibitions for the driver.
vehicleRestriction	VehicleRestriction	0..*	Vehicle types (restrictions) that are relevant for the message.
diversionRoute	DiversionRoute	0..*	Diversion information relating to the event.
temporarySpeedLimit	TemporarySpeedLimit	0..*	This is the temporary speed limit displayed on road signs associated with the Event. This data is intended for display to drivers.

Effect and Cause

For a single event, it should be possible to distinguish between the effect that describes an impairment of the traffic flow (e.g. stationary traffic) and the cause (e.g. roadworks). The latter can be seen as the reason for the traffic flow effect described by the attribute effectCode. A "Cause" can be used to provide further information to inform or warn the driver of a special situation (e.g. oil on the road).

LengthAffected

If LengthAffected is included within the Event component, it describes the length of the overall problem; otherwise, the length is defined by the location given in the Location Reference Container.

LengthAffected shall not be greater than the length defined by the Location Reference Container.

startTime and stopTime

These describe the beginning and end time of a traffic event. The startTime is the time at which an event started or is scheduled to start. The stopTime is the time at which the event is scheduled to end. These times may be presented directly to the user by the receiver for information.

Speed Attributes

Speed related attributes are all defined in metres per second (m/s). Client devices may need to convert to other units.

Average Speed Absolute

The averageSpeedAbsolute is used to signal the real speed of traffic through the problem location.

Delay

Delay associated with a specific location like a border crossing.

Segment Speed limit

The segmentSpeedLimit is used to signal the averaged potential speed (due to applied legal limits along the Problem Location) for re-routing and ETA calculations, but not to display or warn the driver. This attribute is not guaranteed to match signed speed limits on a road.

Expected Speed Absolute

The expectedSpeedAbsolute is used to signal the expected (normal) speed of traffic through the problem location.

Rounding of speed information

Speed information is always given in metres per seconds (m/s) as the TPEG data type "Velocity" is used. For calculations of journey and arrival times, receivers should use this information directly. However, for presentation to the driver, the receiver should convert and round these values as suggested in Table 4.

Table 4 — Rounding of speed information

m/s	km/h (exact)	km/h (rounded, steps of 5)	mph (exact to 2 decimal places)	mph (rounded, steps of 5)
0	0,0	0	0,0	0
1	3,6	5	2,24	0
2	7,2	5	4,49	5
3	10,8	10	6,73	5
4	14,4	15	8,98	10