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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

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*.

This first edition cancels and replaces the first edition (ISO/TS 21219-15:2016), which has been technically revised.

The main changes are as follows:

— Lane Level feature has been added for all TEC events;

— Road Closure feature has been added for roads with At-Grade Junctions;

— the document has been changed from a Technical Specification to an International Standard.

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 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 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 21219-2, ISO 21219-3 and ISO 21219-4 and the conversion to two current physical formats: binary and XML; 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 - this document), TPEG2-FPI (ISO 21219-16), TPEG2-SPI (ISO 21219-17), 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:

SP20012/3.4/001

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 document specifies the "traffic event compact" (TEC) TPEG application. The TEC application has been specifically designed to support information about traffic events (e.g. road works, traffic jams). A specific form of traffic event is local hazard warnings which, being safety-related messages, are sent with high priority to warn a driver of unexpected dangerous situations (e.g. black-ice, accident beyond curves, obstacles on road, etc.).

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

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 21219-10, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 10: Conditional access information (TPEG2-CAI)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21219-1, ISO 21219-9, ISO 21219-10 and the following 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
local hazard warning
specific form of traffic event (a safety-related message) which is sent with high priority to assist a driver in avoiding encountering dangerous situations

4 Abbreviated terms

For the purposes of this document, the abbreviated terms in ISO 21219-1, ISO 21219-9, ISO 21219-19 and the following apply.

AR	access road
BP	bypass
CR	closed road
ITS	intelligent transport systems
LA	limited access
LRC	location referencing container
mi	miles
MMC	message management container
NR	not recommended
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 could have an impact on client devices.

The version numbering principle is defined in ISO 21219-9.

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	4

5.3 Ordered components

TPEG2-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 (MMC). This shall be the only component if the message is a cancellation message. Otherwise, the MMC component shall be followed by one or more *ADC* component(s) which includes the application-specific information.

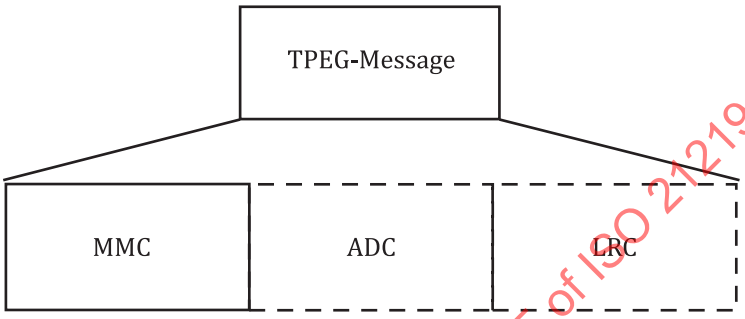

Figure 1 — Composition of TPEG messages

5.4 Extension

Although it is necessary 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 interleaving other component types.

EXAMPLE (allowed)

Figure 2 shows the original component model being extended to the new component model in Figure 3. The Advice component shown in Figure 2 is replaced by BetterAdvice with its own component ID. A WeatherSituation component is inserted after BetterAdvice component.

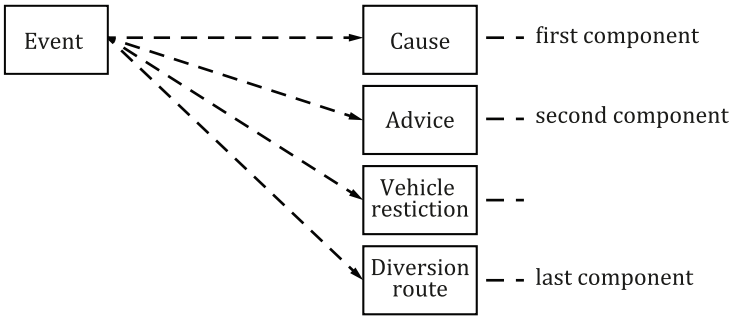

Figure 2 — Example for extension (original component model, before addition of additional components)

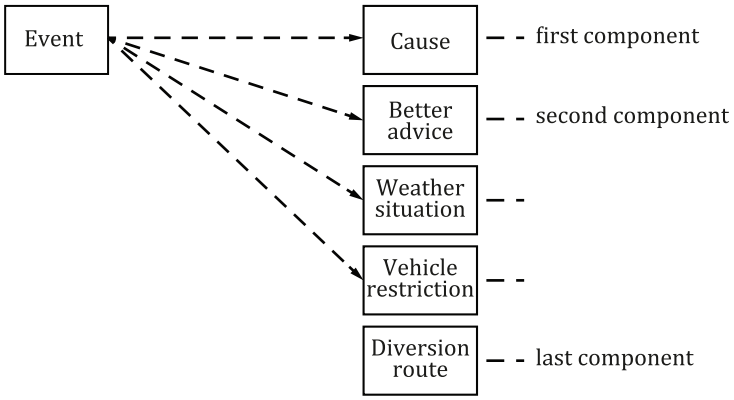

Figure 3 — Example for extension (Advice replaced by BetterAdvice and WeatherSituation added)

5.5 TPEG service component frame

TPEG2-TEC (this document) makes use of the "service component frame with dataCRC, groupPriority and messageCount" according to ISO 21219-5.

6 TEC structure

The structure of TEC messages is presented in Figure 4. This structure conforms to the UML modelling rules defined in ISO 21219-2. The binary format and XML format of the TPEG2-TEC application for use in transmission shall be in accordance with Annexes A and B, respectively.

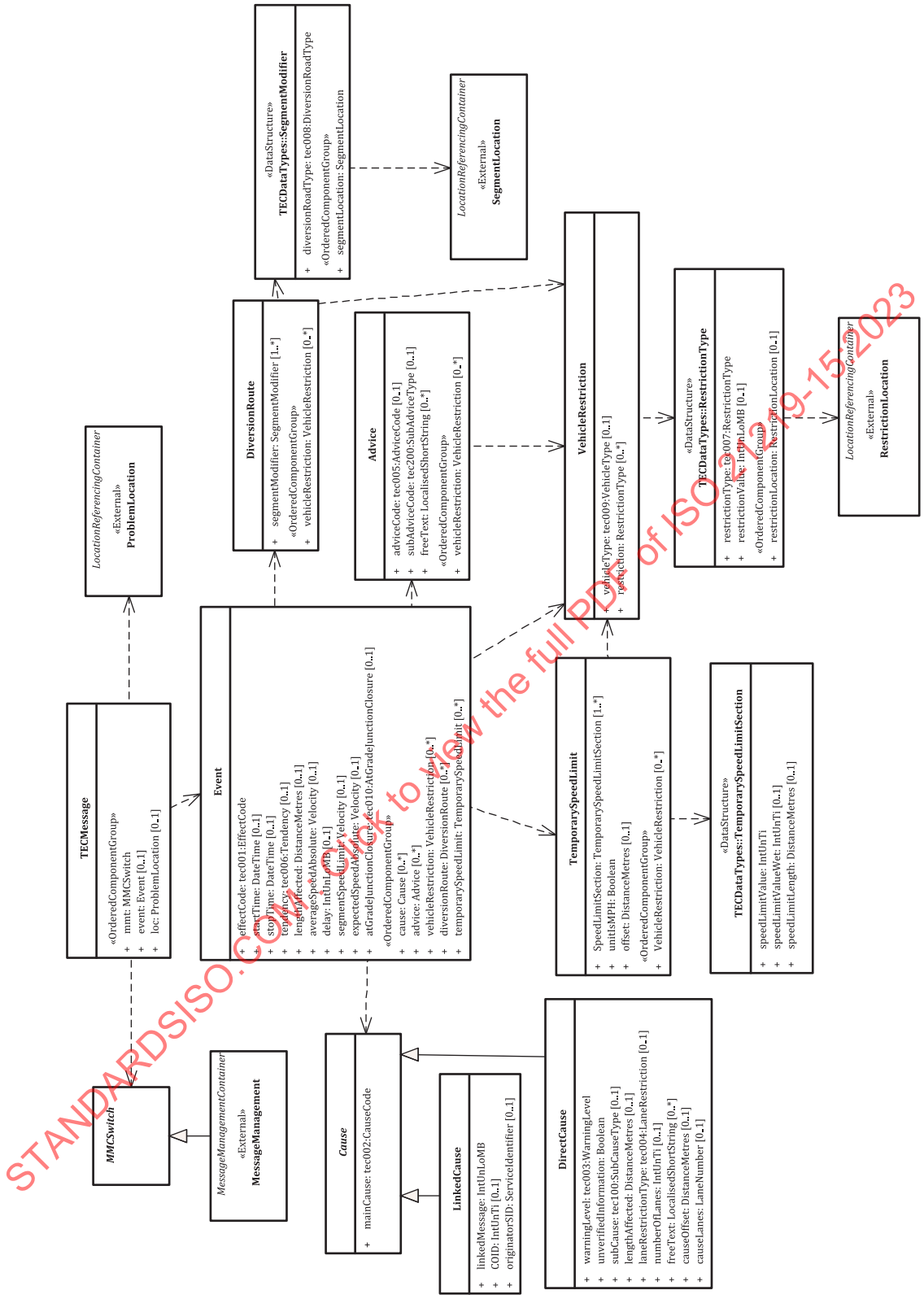

Figure 4 — TEC message structure

7 TEC message components

7.1 TECMessage

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

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

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

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

The message management container is mandatory, the event- and location reference container are optional.

Event and ProblemLocation are modelled optionally because cancel messages do not contain these elements: cancellation messages shall not include an event and location reference container whereas normal messages (cancelFlag = false) shall include exactly one event and one location reference container.

Table 2 defines the TECMessage component.

Table 2 — TECMessage

Name	Type	Multiplicity	Description
Ordered Components			
mmt	MMCSwitch	1	MMC
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	LRC (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 MessageManagementContainer.

7.3 MessageManagement

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

Message generation systems shall ensure that the information given in the MessageManagementContainer 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 transmission channels as typically encountered in broadcast systems suffering intermittent RF performance.

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

7.4 Event

The Event component with its subordinated component Cause supports the definition, in general, of the impact on the traffic flow and the related cause.

EXAMPLE Stationary Traffic (due to) Narrow Lanes.

Table 3 defines the Event component.

Table 3 — Event component

Name	Type	Multiplicity	Description
effectCode	tec001:EffectCode	1	Describes the impairment of the traffic flow.
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 can exist (e.g. multiple reducing speed limits on entering a roadworks zone). The 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 (s) when travelling at the defined speed limit. Shall be used as the 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 can potentially vary as function of the time of day and can be markedly different from the free-flow speed (especially in rush hour conditions).

Table 3 *(continued)*

Name	Type	Multiplicity	Description
atGradeJunctionClosure	tec010:AtGradeJunctionClosure	0..1	Defines the potential types of cases for dealing with cross traffic for at-grade junctions when there is a road closure, which is indicated by EffectCode=7.
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..*	Temporary speed limit displayed on road signs associated with the Event. This data is intended for display to drivers.

7.4.1 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).

7.4.2 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 referencing container (LRC).

LengthAffected shall not be greater than the length defined by the LRC.

7.4.3 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.

7.4.4 Speed Attributes

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

7.4.4.1 Average Speed Absolute

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

7.4.4.2 Delay

Delay associated with a specific location like a border crossing.

7.4.4.3 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.

7.4.4.4 Expected Speed Absolute

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

7.4.5 At Grade Junction Closure

For TEC coding examples for road closures with at grade junctions (see Clause C.6).

7.4.6 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)	mi/h (exact to 2 decimal places)	mi/h (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
5	18,0	20	11,22	10
6	21,6	20	13,47	15
7	25,2	25	15,71	15
8	28,8	30	17,96	20
9	32,4	30	20,20	20
10	36,0	35	22,44	20
11	39,6	40	24,69	25
12	43,2	45	26,93	25
13	46,8	45	29,18	30
14	50,4	50	31,42	30

The following Formula (1) and Formula (2) are used to calculate the values listed in Table 4. Additional higher values than those listed may be used.

1) For steps of 5 km/h (0, 5, 10, 15, 20, etc.):

$$V_1 = 5 \times [(36 \times v + 25)/50] \quad (1)$$

2) For steps of 5 mi/h (0, 5, 10, 15, 20, etc.):

$$V_2 = 5 \times [(360 \times v + 401)/802] \quad (2)$$

where

v is the velocity signalled, in m/s;

V_1 is the rounded speed, in km/h;

V_2 is the rounded speed, in mi/h.

In these formulae, the division is an integer division, which means that the fractional part (remainder) is discarded.

7.5 ProblemLocation

The ProblemLocation component is a placeholder for the LRC container as specified in ISO/TS 21219-7. It assigns the TEC application specific local component ID for the LRC container. All component IDs within the LRC container are local to the LRC toolkit.

7.6 RestrictionLocation

The RestrictionLocation component is a placeholder for the LRC container as specified in ISO/TS 21219-7. It assigns the TEC application specific local component ID for the LRC container. All component IDs within the LRC container are local to the LRC toolkit.

7.7 SegmentLocation

The SegmentLocation component is a placeholder for the LRC container as specified in ISO/TS 21219-7. It assigns the TEC application specific local component ID for the LRC container. All component IDs within the LRC container are local to the LRC toolkit.

7.8 Cause

The cause component specifies the additional interface including a mandatory CauseCode for all instances.

Table 5 defines the Cause component.

Table 5 — Cause

Name	Type	Multiplicity	Description
mainCause	tec002:CauseCode	1	Main categorization of the cause according to table tec002

There are two ways to encode “events” where an effect and one or more causes belong together.

1) **Direct Cause**

   One method is to combine both the effect and the cause by encoding together in the same message. This is called a 'DirectCause' and can be used in situations where no detailed information is given about the location or the length of the linked cause, for example. Both the cause and effect occur within the same location as defined by the LRC.

2) **Linked Cause**

   The other method is called a 'LinkedCause' and shall be used in cases where detailed information is explicitly given.

   EXAMPLE The location and the length of the cause differ from that of the effect, and additional speed information is available. In this case the complete description of the traffic situation is spread over two or more messages.

7.9 DirectCause

The DirectCause (see Table 6) can be used to describe the reason for traffic congestion in general.

The main reason for the separation of causes and the effect is so that the real traffic situation can be described in the most meaningful way to the driver.

EXAMPLE Road closed (effectCode = 7), (due to) objects on the road (causeCode = 10).

Table 6 — DirectCause

Name	Type	Multiplicity	Description
mainCause	tec002:CauseCode	1	Main categorization of the cause according to table tec002.
warningLevel	tec003:WarningLevel	1	The level “informative” should be used for all traffic events which can influence the driver's route in any way requiring a normal level of attention from the driver. The “danger levels” 1 to 3 should only be used for dangerous situations. Levels 1 to 3 are used in ascending levels of danger (Level 1 - Danger; Level 3 – Highly Dangerous). Danger levels 1 to 3 in combination with "unverifiedInformation = True" should be used in case of an unverified danger. For example, a traffic management centre receives a call from a private “jam buster” reporting that there is a “vehicle travelling on the wrong side of the road”, but this has not been confirmed by the police.
unverifiedInformation	Boolean	1	If element is set to 1, the given information has not been verified.
subCause	tec100:SubCauseType	0..1	Carries the value in the subCause table defined by the mainCauseCode.
lengthAffected	DistanceMetres	0..1	Length of the cause in metres.
laneRestrictionType	tec004:LaneRestriction	0..1	Specifies whether lanes are closed or open.
numberOfLanes	IntUnTi	0..1	Specifies how many lanes are closed or open. If this element is not given, but laneRestrictionType indicates there are lane closures, it means an unspecified number of lanes are closed, i.e. “one or more lanes closed”. Or if laneRestrictionType indicates lanes open: “one or more lanes open”.
freeText	LocalisedShortString	0..*	Additional description.
causeOffset	DistanceMetres	0..1	Offset (metres) from the start of the cause to the end of the Problem Location. When used together with attribute lengthAffected, the cause can be positioned within the Event more accurately. Without causeOffset, but with lengthAffected defined, the cause position is not defined. If neither lengthAffected nor causeOffset are defined, the cause spans the entire Problem Location.
causeLanes	LaneNumber	0..1	The lane number(s) for which the cause applies.

NOTE The attribute causeLanes has been introduced with an updated version of TPEG-TEC. Encoding of one or more closed lanes within a cause has previously been possible by using LaneRestrictionType 3 (right lane(s) closed) and 4 (left lane(s) closed) in case of neighbouring lanes and right-most or left-most lane being affected. If the exact number of lanes is known, this number is provided in the attribute numberOfLanes. Coding examples can be found in Clause C.5.

7.10 Causes and subCauses

When using a DirectCause, then this DirectCause component can optionally include a single subCause attribute of type SubCauseType.

The subCause attribute is used to further elaborate on the type of incident causing the problem.

Applicable SubCauseType values are defined in tables particular to each (mainCause) CauseCode.

Simple client devices shall support all possible CauseCodes.

Client devices with more memory may additionally support subCauses. In this case, subCauses should replace the (main) cause completely. It is not necessary to combine causes and subCauses in such a manner as to produce a grammatically correct complete sentence.

7.11 LinkedCause

7.11.1 General

LinkedCause specifies a link to a message providing more details about the cause, e.g. for a divergent location. A link to another message is uniquely specified by the combination of originatorServiceID, contentID, applicationID and messageID. The linked message can be found in the service component where those attributes are equal to the values given in that component: linkedMessage, COID, originatorSID. The applicationID points to the TEC Application and is therefore not explicitly given in this component.

Table 7 defines the LinkedCause component.

Table 7 — LinkedCause

Name	Type	Multiplicity	Description
mainCause	tec002:CauseCode	1	Main categorization of the cause according to table tec002.
linkedMessage	IntUnLoMB	1	Contains a messageID as a pointer to a message. If contentID and originatorSID is not given, the linked message is contained in the actual component stream of the actual service.
COID	IntUnTi	0..1	If COID is not included, the linked message can be found in the component stream that has the same contentID as the linking message.
originatorSID	ServiceIdentifier	0..1	If originatorID is not included, the linked message can be found in the same service as the linking message.

7.11.2 Rules

Effect and cause(s) shall be split into two or more messages (linked cause) if:

— they are from different providers (e.g. effect is provided by the police, and cause by a private service provider);

— different update rates shall be used;

— the effect does not share the same position with the cause(s) (splitting the messages permits a different Problem Location definition for the cause(s) and the effect); and

— the same situation requires two traffic flow-effects (e.g. different speed limits for cars and lorries).

7.11.3 Further constraints

One real cause can be represented either as a linked cause or as a direct cause. A message shall not describe one situation using both a direct cause and a linked cause at the same time. However, it can use a direct cause and, in addition, a linked cause if two different causes apply to one situation (see Example 2 in Clause C.2).

7.11.4 Coding examples

For TEC coding examples for traffic situations with cause and effect, refer to Clause C.2.

7.12 Advice

The Advice component contains information on recommendations or prohibitions for the driver.

Table 8 defines the Advice component.

Table 8 — Advice

Name	Type	Multiplicity	Description
adviceCode	tec005:AdviceCode	0..1	Main categorization of advice
subAdviceCode	tec200:SubAdviceType	0..1	Detailed advice codes
freeText	LocalisedShortString	0..*	Additional advice or information example: "please be ready to show passports"
Ordered Components			
vehicleRestriction	VehicleRestriction	0..*	Used when advice applies to specific vehicle types

7.13 VehicleRestriction

VehicleRestriction is used when the Event (or Diversion or Advice) is restricted to a specific vehicle type, e.g. only for lorries. If vehicleType is not present, the subsequent RestictionType shall be applied to all types of vehicles.

Table 9 defines the VehicleRestriction component.

Table 9 — VehicleRestriction

Name	Type	Multiplicity	Description
vehicleType	tec009:VehicleType	0..1	Type of vehicle
restriction	RestrictionType	0..*	Even when a particular vehicle type has been defined by tec009:VehicleType, RestrictionType may be used to specify further attributes to more closely define the vehicles for which the message applies, e.g. vehicle weight, vehicle height, or other attribute, including vehicle destination. For example: "without winter tyres" means the message applies to vehicles without winter tyres. "width greater 300" means that the event or the closure affects only vehicles with a width greater than three metres. "with destination in a given area" means the message is targeted only at those vehicles whose destination is as specified in the area as attached to this restriction attribute.

7.14 DiversionRoute

DiversionRoute specifies one or more diversions.

Table 10 defines the DiversionRoute component.

Table 10 — DiversionRoute

Name	Type	Multiplicity	Description
segmentModifier	SegmentModifier	1..*	Data structure to define diversion
Ordered components			
vehicleRestriction	VehicleRestriction	0..*	Defines how diversion is restricted to specific vehicles

7.14.1 Description for creating and applying diversions

Recommendations to avoid the traffic problem area can be added to any event. At the most basic level, this can simply be advice such as “avoid the area“ or “follow signposted diversion”. However, by using the DiversionRoute component, specific diversion routes can be suggested.

TEC creates diversion routes from several road segments. For each segment, a ”segment type” is given describing the suitability of the segment as part of a diversionary route. These range from ”closed road” to ”bypass” (see Table 14). By evaluating the types assigned for each segment, the optimum diversion to route the vehicle from its current position to rejoin the route ”bypassing” the problem area can be calculated.

Differing diversion advice can be appropriate for different classes of vehicle. For example, a diversion route can be suitable for cars, but not for lorries. Different attributes, including vehicle type and further restriction types, as well as diversions specific to destination may be applied. Different diversion recommendations are also often suggested appropriate to the direction of travel.

As well as suggesting diversionary routes, it is also possible to give information to discourage the use of certain segments because of given circumstances. A navigation system knowing that a particular road segment is restricted due to, for example, roadworks, is able to plan a route to avoid the parts of the road network that are unsuitable for a diversion.

In many cases, a provider or road operator can define the diversion information for strategic routes in advance of an actual problems occurring. This is the case in many countries and often predefined signage is in place.

In general, TEC DiversionRoute provides a list of road segments which define the recommended route for the diversion. The diversion segments can also signal roads that are not recommended due to their low capacity.

The segmentType attribute is provided to define the significance of each segment.

Adjustment to the route of a vehicle should only be applied by vehicles directly affected by the traffic problem. If a planned route uses roads near the traffic problem, but not actually part of it, the segment modifiers should not be considered for the routing.

7.14.2 Strategy for coding a diversion

The diversions suggested should only be used by the vehicle receiver if both the following apply:

a) the vehicle, if not diverted, would travel on at least one part of the given problem location;

b) the filter criteria apply to the vehicle.

The definition of the TEC diversion allows the signalling of which road segments should be considered as preferred in the routing algorithm and which segments should be avoided, if possible.

The definition neither gives explicit routing cost, nor time delay for each segment as the routing function of receivers can be very diverse, but instead describes the relative priority of each segment for use.

The road segment types are detailed below:

— LA: The segment shall be used for local traffic only. If possible, plan a route avoiding this segment.

  — Routing costs for that segment should be raised by a factor much greater than one.

— NR: The segment should be avoided if an alternative is available. Service provider's intent is to limit traffic using this segment as it already has reduced capacity or will become congested easily.

  — Routing costs for that segment should be raised by a factor greater than one.

— BP: This indicates the best segment to use to bypass the obstruction. This shall be used for routing in preference to any other.

  — Routing costs for that segment should be reduced by a factor much smaller than one.

— AR: This segment provides the preferred way to get to and from the bypass segments. The use of the AR segment is related to the start position so is not as important as the BP segments in the new route calculation.

  — Routing costs for that segment should be reduced by a factor smaller than one.

— CR: The segment should be avoided for routing, unless there is no other possibility to reach the destination.

  — Routing costs for that segment should be increased by a factor much greater than one and higher than any other possible route reaching the destination.

For TEC coding examples for diversion routes, refer to Clause C.3.

7.15 TemporarySpeedLimit

One of the highly visible attributes of many roadworks is the imposed temporary speed limit. This component provides the ability to define temporary speed limit information suitable for display to the driver.

Temporary speed limit information associated with the event is defined in either km/h or mi/h. Multiple sections with a different speed value can be provided with a length. The offset from the end of the location reference to the start of the first speed limit restriction allows the speed limit zone to be positioned independently of the cause.

A vehicle restriction can be added if needed.

Table 11 defines the TemporarySpeedLimit component.

Table 11 — TemporarySpeedLimit

Name	Type	Multiplicity	Description
SpeedLimitSection	TemporarySpeedLimitSection	1..*	Individual section for the speed limit.
unitIsMPH	Boolean	1	Units definition for this temporary speed limit. If speed limit should be displayed as mi/h, then this is set to true.
offset	DistanceMetres	0..1	Offset defines the distance from the start of the temporary speed limit to the end of the location reference. If not defined, then first SpeedLimitSection starts at the beginning of the location reference.

Table 11 *(continued)*

Name	Type	Multiplicity	Description
Ordered components			
VehicleRestriction	VehicleRestriction	0..*	One or more vehicle restrictions can be associated to each temporary speed limit. This allows different speed limits to be signalled to different vehicles. (lorries, towing vehicles) without the use of "VehicleRestriction" indicates that all vehicles are relevant.

For TEC coding examples for TemporarySpeedLimit, refer to Clause C.3.

8 TEC Datatypes

8.1 LaneNumber

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.

Table 12 defines the LaneNumber datatype.

Table 12 — LaneNumber

Name	Type	Multiplicity	Description
hardShoulder	Boolean	1	true, if the outer hard shoulder exists and is selected
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 an inner side hard shoulder exists and is selected

The lane numbering shall follow these rules:

a) outer hard shoulder is always number 0;

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

   2) 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);

b) first drivable lane for vehicles is number 1;

c) all lanes which are physically available count;

d) lanes which are temporarily closed also count;

e) numbering is consecutive.

If physical layout changes, then a split of the location is recommended.

8.2 RestrictionType

Table 13 defines the RestrictionType datatype.

Table 13 — RestrictionType

Name	Type	Multiplicity	Description
restrictionType	tec007:RestrictionType	1	Defines the sort of restriction.
restrictionValue	IntUnLoMB	0..1	Defines value associated to the restrictions where applicable.
Ordered components			
restrictionLocation	RestrictionLocation	0..1	Restriction filter for specific destination

8.3 SegmentModifier

Table 14 defines the SegmentModifier datatype.

Table 14 — SegmentModifier

Name	Type	Multiplicity	Description
diversionRoadType	tec008:DiversionRoadType	1	Type of road used as a diversion.
Ordered components			
segmentLocation	SegmentLocation	1	Position of segment.

8.4 TemporarySpeedLimitSection

Each section of the speed limit is defined by a speed value and length.

A value for use in wet conditions is also optionally available.

Table 15 defines the TemporarySpeedLimitSection datatype.

Table 15 — TemporarySpeedLimitSection

Name	Type	Multiplicity	Description
speedLimitValue	IntUnTi	1	Speed limit numerical value in km/h or mi/h.

Table 15 *(continued)*

Name	Type	Multiplicity	Description
speedLimitValueWet	IntUnTi	0..1	Speed limit numerical value to be used in wet conditions, in km/h or mi/h.
speedLimitLength	DistanceMetres	0..1	Length of the SpeedLimitSection. If this is not defined, then the section finishes at end of the problem location.

9 TEC Tables

9.1 tec001:EffectCode

EffectCode describes the effect on the traffic flow.

Table 16 enumerates the possible values for type tec001:EffectCode.

Table 16 — EffectCode

Code	Reference-English "Word"	Comment	Example
1	traffic flow unknown	Shall be used if traffic flow is unknown. NOTE This is often the case for local hazard warnings.	
2	free traffic flow	Traffic flow is not restricted.	
3	heavy traffic	Traffic flow is restricted due to a large number of vehicles.	
4	slow traffic	Traffic flow is slower than normal.	
5	queuing traffic	The traffic is in queues, but still slowly moving.	
6	stationary traffic	The traffic is stationary or barely moving.	
7	no traffic flow	Traffic is completely stopped or there is no flow due to the road being closed/blocked; the cause-component can give more information about the reason for "no traffic flow". For roads with at-grade junctions, how the closure/blockage affects cross-road traffic can be further specified with the attribute atGradeJunctionClosure.	— The road has been closed by police as a "regulatory measure"; or — The road is blocked by a temporary incident.

9.2 tec002:CauseCode

CauseCode defines various reasons why this message was sent.

Table 17 enumerates the possible values for type tec002:CauseCode.

Table 17 — CauseCode

Code	Reference-English "word"	Comment	Example
1	traffic congestion	The event is signalled due to the amount of traffic on the road causing, queues delays, or increase travel time.	

Table 17 *(continued)*

Code	Reference-English "word"	Comment	Example
2	accident	An accident is affecting normal traffic movement.	
3	roadworks	Roadworks are affecting normal traffic movement.	
4	narrow lanes	The width of a road lane is smaller than usual.	
5	impassability	The road is affected by an obstacle that can make it impassable. Actual impassable road should be signalled with trafficFlowEffect = no_traffic_flow.	
6	slippery road	Traction between tyres and the road is adversely affected.	
7	aquaplaning	Substantial areas of water are on the road surface, and a danger of aquaplaning exists.	
8	fire	Used when fire/smoke is adversely affecting driving conditions.	
9	hazardous driving conditions	Driving conditions are hazardous and driver should proceed with caution.	
10	objects on the road	Objects are on the road that can require the driver to deviate to avoid them; objects are not large enough to block the road.	
11	animals on roadway	Animals are on the road.	
12	people on roadway	People are on the road.	
13	broken down vehicles	A broken-down vehicle is on the road causing a potential obstruction.	
14	vehicle on wrong carriageway	A motorist is driving his/her vehicle on the wrong side of the carriageway (also known as ghost-driver).	
15	rescue and recovery work in progress	Emergency services are on site to deal with an earlier accident.	
16	regulatory measure	Traffic authorities have imposed some change to the regulations or road situation changing the usual traffic situation (usually this will affect traffic flow, resulting in an "effect" e.g. "slow traffic").	One or more lanes have been closed.
17	extreme weather conditions	Extreme weather conditions exist.	
18	visibility reduced	Visibility is reduced, requiring reduced speeds and additional care.	
19	precipitation	Precipitation is affecting driving conditions, usually requiring reduced speeds and consequently resulting in longer journey times.	
20	reckless persons	The reckless acts of a person which can require drivers to take action.	
21	overheight warning system triggered	An overheight vehicle has triggered a warning system, and can potentially cause delays.	

Table 17 *(continued)*

Code	Reference-English "word"	Comment	Example
22	traffic regulations changed	A higher than usual risk of accidents exists due to a change in traffic regulation (risk exists until drivers become familiar with the revised regulations).	
23	major event	A major event causes traffic disruption. Details can be given as "free-text".	
24	service not operating	A transport service is not operating, causing disruption to would-be users and others.	
25	service not useable	Although operating, a service, is not usable, or usable with restrictions.	
26	slow-moving vehicles	Slow-moving vehicles are causing congestion or are a hazard.	
27	dangerous end of queue	There is particular danger to vehicles suddenly encountering the end of a queue of traffic.	
28	risk of fire	A risk of fire exists (see code 8). Open fire, naked flames or glow could present a danger.	
29	time delay	A time delay exists.	
30	police checkpoint	A police checkpoint is causing delay or congestion.	
31	malfunctioning roadside equipment	Roadside equipment is not working, or working incorrectly.	
100	test message	This is a test message used for testing only. Any additional content of this message shall be marked as being a test only.	
255	undecodable cause		

9.3 tec003:WarningLevel

WarningLevel defines different levels of danger associated with the event.

Table 18 enumerates the possible values for type tec003:WarningLevel.

Table 18 — WarningLevel

Code	Reference-English "word"	Comment	Example
1	informative	This level is of an informative nature.	
2	danger level 1	This level is used for situations requiring additional attention by the driver.	"Attention, there is a dangerous obstruction, reduced visibility due to fog."
3	danger level 2	This level is used when local hazard situations present a danger to the driver.	"Attention, danger due to deer."
4	danger level 3	This level is used when local hazard situations present a highly dangerous situation to the driver.	"Attention, highest danger due to ghost driver."

9.4 tec004:LaneRestriction

LaneRestriction defines lanes being restricted with this message.

Table 19 enumerates the possible values for type tec004:LaneRestriction. Refer to C.5 for lane level coding examples.

Table 19 — LaneRestriction

Code	Reference-English "word"	Comment	Example
1	lane(s) closed or blocked	One or more lanes are defined as being closed or blocked. If exact lanes are known, use causeLanes to provide exact lanes that are closed/blocked.	Middle lanes closed.
2	lane(s) open	One or more lanes are defined as being open. If exact lanes are known, use causeLanes to provide exact lanes that are open.	
3	right lane(s) closed or blocked	Right-hand "lane" always refers to driving lane on driver's right, irrespective of the side of the road used for driving in a particular country. This excludes "special" lanes such as crawler lanes, or hard-shoulder. If the exact number of lanes is known, provide this number in the attribute numberOfLanes.	- The lanes have been closed by police as a "regulatory measure"; or - The lanes are blocked by a temporary incident.
4	left lane(s) closed or blocked	Left-hand "lane" always refers to driving lane on driver's left, irrespective of the side of the road used for driving in a particular country. It excludes "special" lanes such as crawler lanes, or hard-shoulder. If the exact number of lanes is known, provide this number in the attribute numberOfLanes.	In countries that drive on the left, "left-hand-lane" would be the "normal driving (slow) lane"; in countries that drive on the right, "left-hand-lane" would be the "overtaking lane".
5	hard shoulder open	The hard shoulder is open for driving. Use causeLanes to indicate the exact lane (outer shoulder or inner shoulder).	
255	undecodable lane restriction	Undefined entry.	

NOTE The attribute causeLanes has been introduced with an updated version of TPEG-TEC (this document). Encoding of one or more closed lanes within a cause has already been possible before using LaneRestrictionType 3 (right lane(s) closed) and 4 (left lane(s) closed) in case of neighbouring lanes and right-most or left-most lane being affected. If the exact number of lanes is known, provide this number in the attribute numberOfLanes. Refer to Clause C.5 for coding examples.

Refer to Clause C.5 for coding examples.

9.5 tec005:AdviceCode

AdviceCode (see Table 27) describes recommendations or instructions for the driver where they shall take a specific action.

Table 20 enumerates the possible values for type tec005:AdviceCode.

Table 20 — AdviceCode

Code	Reference-English "word"	Comment	Example
1	drive to next available parking place	Drivers should find a safe place to park.	In combination with time delay at frontier.
2	overtaking not allowed	Drivers should remain in line and not overtake.	In case a ghost driver approaches.
3	driving not allowed	Situations determine that driving is not allowed. Drivers should stop at the first place it is safe to do so.	
4	use hard shoulder as lane	The hard shoulder may be used as a driving lane.	
5	wait for police patrol	Vehicles are required to wait for a police patrol before continuing on their journey.	
6	wait for improved weather	Current weather conditions are unsafe for driving and drivers are required to wait until conditions improve before continuing their journey.	
7	make way for vehicles coming from behind to pass	Drivers are requested to move aside to allow vehicles approaching from behind to pass.	
8	follow diversion	Instruction to a driver to follow a specific diversion route.	
9	no diversion to recommend	Drivers are advised that a diversion is required, however there is no specific diversion offered.	
10	do not divert	Used to advise the driver that although there is a problem on the road, no suitable better alternative exists, and that the driver should keep on the current route.	
11	follow police instructions	Police are directing traffic; drivers should follow their instructions	
12	avoid the area	Used to advise that particular areas should be avoided.	
13	drive carefully	Drivers should take extra care, because there is increased road hazard.	
14	do not leave your vehicle	Drivers should remain with their vehicles.	
15	switch on radio	Used to advise drivers that further detailed information is available on the radio.	
16	use toll lanes	Used to advise that Toll Lanes may be used.	
17	wait for convoy	The driver should await a convoy service before proceeding.	
255	undecodable advice		

9.6 tec006:Tendency

Tendency is related to the traffic flow speed indicating if this has been increasing, decreasing or has remained constant. It is not a forecast of a future trend, nor does it relate to the length of the traffic queue.

Table 21 enumerates the possible values for type tec006:Tendency.

Table 21 — Tendency

Code	Reference-English "word"	Comment	Example
1	slightly increasing		
2	increasing		
3	strongly increasing		
4	slightly decreasing		
5	decreasing		
6	strongly decreasing		
7	constant		
255	undecodable tendency		

9.7 tec007:RestrictionType

RestrictionType defines different types of attributes for filtering the addressed vehicles for this message.

Table 22 enumerates the possible values for type tec007:RestrictionType.

Table 22 — RestrictionType

Code	Reference-English "word"	Comment	Example
1	width less than	Units: cm	
2	width greater than	Units: cm	
3	height less than	Units: cm	
4	height greater than	Units: cm	
5	weight less than	Units: kg	
6	weight greater than	Units: kg	
7	without winter tyres		
8	without snow chains		
9	with trailer		
10	with caravan		
11	persons in vehicle less than	Units: number	
12	persons in vehicle more than	Units: number	
13	even number plate		
14	odd number plate		
15	length less than	Units: cm	
16	length greater than	Units: cm	
17	axle load less than	Units: kg	
18	axle load greater than	Units: kg	
19	vehicle fulfils emission standard EURO3	"EURO3" is a specific vehicle emission class according to European Council Directives.	

Table 22 *(continued)*

Code	Reference-English "word"	Comment	Example
20	vehicle fulfils emission standard EURO3D4	"EURO3D4" is a specific vehicle emission class according to European Council Directives.	
21	vehicle fulfils emission standard EURO4	"EURO4" is a specific vehicle emission class according to European Council Directives.	
22	vehicle fulfils emission standard EURO5	"EURO5" is a specific vehicle emission class according to European Council Directives.	
23	with petrol engine		
24	with diesel engine		
25	with LPG engine		
26	through traffic		
27	residents traffic		
28	with destination in given area		
255	undecodable restriction		

9.8 tec008:DiversionRoadType

DiversionRoadType defines different levels of usability for parts of the diversion.

Table 23 enumerates the possible values for type tec008:DiversionRoadType.

Table 23 — DiversionRoadType

Code	Reference-English "word"	Comment	Example
1	bypass	A road or section of a road that passes around the restricted or congested area.	
2	access road	The part of the diversion that gives access to the bypass.	
3	limited access road	Part of the network which is not usable for through traffic.	
4	not recommended route	Part of the network which should be avoided.	
5	closed road	Part of the network which is closed.	
255	undecodable diversion road type		

9.9 tec009:VehicleType

VehicleType defines different types of cars for filtering the addressed vehicles for this message.

Table 24 enumerates the possible values for type tec009:VehicleType.

Table 24 — VehicleType

Code	Reference-English "word"	Comment	Example
1	car		
2	lorry		
3	bus		
4	taxi		
5	train		
6	motor cycle		
7	vehicle with trailer		
8	motor vehicle		
9	vehicle transporting hazardous goods		
10	vehicle transporting an abnormal size load		
11	heavy goods vehicle		
255	undecodable vehicle type		

9.10 tec010:AtGradeJunctionClosure

AtGradeJunctionClosure defines the potential types of cases for dealing with cross traffic for at-grade junctions when there is a road closure, which is indicated by EffectCode=7. Usage of AtGradeJunctionClosure is only relevant for a junction between two non-controlled access roads. The attribute does not apply to slip roads. If no value is specified, then the client shall assume value 0, "unknown".

Table 25 enumerates the possible values for type tec010:AtGradeJunctionClosure.

Table 25 — AtGradeJunctionClosure

Code	Reference-English "word"	Comment	Example
0	unknown	Recommend using "Intermediate junctions closed and edge junctions open" as the default behavior.	
1	all junctions closed	All at-grade junctions are closed for cross traffic. This includes junctions at the edge of the main roadway closure. If the edge of this road closure is near an at-grade junction, then these edge junctions are also closed.	A marathon or parade which does not allow traffic for any at-grade junctions closed.
2	intermediate junctions closed and edge junctions open	Intermediate at-grade junctions closed for cross traffic, and edge at-grade junctions are open for cross traffic. If the edge of this road closure is near an at-grade junction then these edge junctions are open.	A major roadwork that does not allow crossing traffic at the intermediate at-grade junctions; however, the junctions at the edge of the road closure will be open.
3	all junctions open	All at-grade junctions are open for cross traffic.	A roadwork that allows crossing for all at-grade junctions.
255	Undecodable at grade junction closure type		

9.11 tec100:SubCauseType

The SubCauseType defines the generic type applying different tables according to the different mainCauses.

Valid entries for attributes of this type are listed in the tables.

tec101:TrafficCongestion

tec102:Accident

tec103:Roadworks

tec104:NarrowLanes

tec105:Impassability

tec106:SlipperyRoad

tec108:Fire

tec109:HazardousDrivingConditions

tec110:ObjectsOnTheRoad

tec111:AnimalsOnRoadway

tec112:PeopleOnRoadway

tec113:BrokenDownVehicles

tec115:RescueAndRecoveryWorkInProgress

tec116:RegulatoryMeasure

tec117:ExtremeWeatherConditions

tec118:VisibilityReduced

tec119:Precipitation

tec120:RecklessPersons

tec123:MajorEvent

tec124:ServiceNotOperating

tec125:ServiceNotUseable

tec126:SlowMovingVehicles

tec127:DangerousEndOfQueue

tec128:RiskOfFire

tec129:TimeDelay

tec130:PoliceCheckpoint

tec131:MalfunctioningRoadsideEquipment.

NOTE In the case a client device is unable to decode a subCause code, the original mainCause is used.

9.12 tec101:TrafficCongestion

TrafficCongestion is used when the volume of traffic is excessive for the roadway.

Table 26 enumerates the possible values for type tec101:TrafficCongestion.

Table 26 — TrafficCongestion

Code	Reference-English "word"	Comment	Example
1	increased volume of traffic	Traffic problem is caused by the volume of traffic being excessive for the roadway.	
255	undecodable traffic congestion	Undecodable sub-cause code, use main cause code instead.	

9.13 tec102:Accident

This enumeration type is used in the case of an accident.

Table 27 enumerates the possible values for type tec102:Accident.

Table 27 — Accident

Code	Reference-English "word"	Comment	Example
1	multi-vehicle accident	Multiple vehicles are involved in an accident.	
2	major accident	Used when it will take an especially long time for rescue and recovery work to clear after an accident and for normal flow to be re-established.	
3	accident involving lorry	The accident involves a lorry.	
4	accident involving bus	The accident involves a bus.	
5	accident involving hazardous materials	The accident involves a vehicle carrying hazardous materials, posing additional dangers.	
6	accident in opposite lane	An accident occurred affecting traffic in the opposite direction, but drivers are slowing to look, causing a "secondary" effect on the traffic flow.	
7	unsecured accident	An accident has occurred; at time of broadcast, the accident is not being attended to by the emergency services.	
255	undecodable accident	Undecodable sub-cause code, use main cause code instead.	

9.14 tec103:Roadworks

This enumeration type is used in case of road works.

Table 28 enumerates the possible values for type tec103:Roadworks.

Table 28 — Roadworks

Code	Reference-English "word"	Comment	Example
1	major roadworks	Major roadworks are causing disruption.	
2	road marking work	Road marking work is causing disruption.	
3	slow moving road maintenance	Slow-moving road maintenance vehicles are causing disruption.	Trimming of the grass on the soft shoulder.
255	undecodable road-works	Undecodable sub-cause code, use main cause code instead.	

9.15 tec104:NarrowLanes

This enumeration type is used when the width of lanes is less than usual or other lane restrictions exist.

Table 29 enumerates the possible values for type tec104:NarrowLanes.

Table 29 — NarrowLane

Code	Reference-English 'Word'	Comment	Example
1	contraflow	One side of the roadway is closed, resulting in both directions sharing the remaining open side: consequently, the number of lanes in both directions is reduced.	
2	hard shoulder closed	The hard shoulder is closed.	
3	slip lane closed	An entry or exit slip lane is closed.	
4	crawler lane closed	The crawler lane is closed; slow traffic can be using a 'normal' driving lane.	
255	undecodable narrow lane type	Undecodable sub-cause code, use main cause code instead.	

9.16 tec105:Impassability

This enumeration type is used in cases where the road is generally impassable or partially blocked, or is hazardous due to driving conditions. If truly blocked, then TrafficFlowEffect is expected to be "no_traffic_flow" (use of the impassability cause does not in itself indicate a closure).

Table 30 enumerates the possible values for type tec105:Impassability.

Table 30 — Impassability

Code	Reference-English "word"	Comment	Example
1	flooding	The road is affected by flooding.	
2	danger of avalanches	The road has a danger of being affected by avalanches.	
3	blasting of avalanches	There is active blasting of avalanches on or near the road and so it can be impassable for short periods of time.	
4	landslips	The road is affected by landslips.	
5	chemical spillage	The road is affected by a chemical spill.	
6	winter closure	The road is impassable due to a winter closure.	

Table 30 *(continued)*

Code	Reference-English "word"	Comment	Example
255	undecodable impass-ability	Uundecodable sub-cause code, use main cause code instead.	

9.17 tec106:SlipperyRoad

This enumeration type is used when the road surface is slippery.

Table 31 enumerates the possible values for type tec106:SlipperyRoad.

Table 31 — SlipperyRoad

Code	Reference-English "word"	Comment	Example
1	heavy frost on road	Heavy frost is making road surface slippery.	
2	fuel on road	A fuel spill is making road surface slippery.	
3	mud on road	Mud is making the road surface slippery.	
4	snow on road	Snow is making the road surface slippery.	
5	ice on road	Ice is making the road surface slippery.	
6	black ice on road	Black ice is making the road surface slippery.	
7	oil on road	Oil on the road is making the road surface slippery.	
8	loose chippings	Loose chippings are making the road surface slippery.	
9	instant black ice	Black ice, which is forming instantly when freezing rain hits the road is making the road surface slippery.	
10	roads salted	Although the roads have been salted, the surface can still be slippery.	
255	undecodable slippery road	Undecodable sub-cause code, use main cause code instead.	

9.18 tec108:Fire

This enumeration type is used when fire is affecting the traffic flow.

Table 32 enumerates the possible values for type tec108:Fire.

Table 32 — Fire

Code	Reference-English "word"	Comment	Example
1	major fire	A major fire is causing a problem for traffic.	
2	forest fire	A forest fire is causing a problem for traffic.	
255	undecodable fire	Undecodable sub-cause code, use main cause code instead.	

9.19 tec109:HazardousDrivingConditions

This enumeration type is used when environmental conditions are causing problems and require additional caution by the driver.

Table 33 enumerates the possible values for type tec109:HazardousDrivingConditions.

Table 33 — HazardousDrivingConditions

Code	Reference-English "word"	Comment	Example
1	rock falls	Falling rocks are causing a danger to traffic.	
2	earthquake damage	There is a danger to traffic resulting from earthquake damage.	
3	sewer collapse	A sewer has collapsed.	
4	subsidence	Subsidence has affected the road condition.	
5	snow drifts	Snow drifts are causing a hazard to drivers.	
6	storm damage	Damage caused by a storm is causing hazardous conditions for drivers.	
7	burst pipe	Traffic is affected by a burst pipe.	
8	volcano eruption	A danger to traffic exists resulting from a volcano eruption.	
9	falling ice	There is danger to traffic due to falling ice.	
255	undecodable hazardous driving conditions	Undecodable sub-cause code, use main cause code instead.	

9.20 tec110:ObjectsOnTheRoad

This enumeration type is used when objects on the road are impeding traffic or can be a hazard to traffic.

Table 34 enumerates the possible values for type tec110:ObjectsOnTheRoad.

Table 34 — ObjectsOnTheRoad

Code	Reference-English "word"	Comment	Example
1	shed load	Part of a load being carried has fallen into the roadway.	
2	parts of vehicles	Part of a vehicle has become detached and fallen into the roadway.	
3	parts of tyres	A vehicle has shed parts of its tyres, which are on the roadway.	
4	large objects	Objects in the roadway are of a large size that a vehicle cannot drive over and will need to drive around them.	
5	fallen trees	Fallen trees or branches have fallen onto the roadway.	
6	hub caps	Hub caps are lying on the roadway.	
7	stationary vehicle	There is an abandoned or stationary vehicle on the roadway.	

Table 34 *(continued)*

Code	Reference-English "word"	Comment	Example
255	undecodable objects on the road	Undecodable sub-cause code, use main cause code instead.	

9.21 tec111:AnimalsOnRoadway

This enumeration type is used when there is a danger to the driver from animals on the roadway.

Table 35 enumerates the possible values for type tec111:AnimalsOnRoadway.

Table 35 — AnimalsOnRoadway

Code	Reference-English "word"	Comment	Example
1	wild animals	There is a danger from wild animals on the roadway ("wild" animals are not "controlled" by humans).	Deer
2	herd of animals	A herd of animals is on the roadway. It is to be expected that the herd is being "controlled" by a human, who will expect the driver to stop until the herd has been moved on.	Sheep
3	small animals	Small animals are on the roadway.	Frogs, foxes, badgers
4	large animals	Large animals are on the roadway which are a danger to drivers and may cause considerable damage. Drivers should slow down and proceed with caution.	Cows or horses
255	undecodable animals on roadway	Undecodable sub-cause code, use main cause code instead.	

9.22 tec112:PeopleOnRoadway

This enumeration type is used when people or people with unauthorized vehicles are on the roadway.

Table 36 enumerates the possible values for type tec112:PeopleOnRoadway.

Table 36 — PeopleOnRoadway

Code	Reference-English "word"	Comment	Example
1	children on roadway	Children are on the road.	
2	cyclists on roadway	A cyclist is on a road where cycling is prohibited.	
3	moped rider on roadway	A moped rider is driving on a road where mopeds are prohibited.	
255	undecodable people on roadway	Undecodable sub-cause code, use main cause code instead.	

9.23 tec113:BrokenDownVehicles

This enumeration type is used when a broken-down vehicle is on the roadway, causing a danger or obstruction hazard.

Table 37 enumerates the possible values for type tec113:BrokenDownVehicles.

Table 37 — BrokenDownVehicles

Code	Reference-English "word"	Comment	Example
1	broken-down vehicle on fire	A broken-down vehicle is also on fire.	
2	broken-down unlit vehicle	An unlit vehicle is causing a hazard	
255	undecodable broken-down vehicle	Undecodable sub-cause code, use main cause code instead.	

9.24 tec115:RescueAndRecoveryWorkInProgress

This enumeration type is used when accident rescue and recovery work is in progress. Drivers should take extra care and slow down.

Table 38 enumerates the possible values for type tec115:RescueAndRecoveryWorkInProgress.

Table 38 — RescueAndRecoveryWorkInProgress

Code	Reference-English "word"	Comment	Example
1	emergency vehicles	Emergency vehicles are at the scene of an accident.	
2	rescue helicopter landing	A rescue helicopter is landing at or near the scene of an accident.	
3	police activity ongoing	There is ongoing police activity.	
4	medical emergency ongoing	Emergency medical crews are at the scene.	
5	child abduction in progress	A child abduction has occurred (Amber Alert).	
255	undecodable rescue and recovery work in progress	Undecodable sub-cause code, use main cause code instead.	

9.25 tec116:RegulatoryMeasure

This enumeration type is used when additional restrictions or regulations are imposed. If a road is closed, then the traffic flow effect shall be set to "no_traffic_flow".

Table 39 enumerates the possible values for type tec116:RegulatoryMeasure.

Table 39 — RegulatoryMeasure

Code	Reference-English "word"	Comment	Example
1	security alert	A security alert has been declared, possibly resulting in restrictions on traffic movement and delays.	An area is closed due to hostage situation.
2	contagious disease	A contagious disease is affecting the location potentially resulting in movement restrictions being applied.	A disease of animals such as foot and mouth or blue tongue.
3	environmental	An environmental incident has occurred, potentially resulting in a movement restrictions being applied.	An area is closed due to pollution.

Table 39 *(continued)*

Code	Reference-English "word"	Comment	Example
4	smog alert	A smog alert has been declared due to pollution levels in the air.	
5	batch service in progress	Traffic may flow in only one direction at a time. commonly known as 'Single Alternate Line Traffic'.	Batch service in Tunnels, 5 minutes one way, then 5 minutes the other way.
6	road closed by the regulatory authorities	The regulatory authorities have closed the road for any reason.	
255	undecodable regulatory measure	Undecodable sub-cause code, use main cause code instead.	

9.26 tec117:ExtremeWeatherConditions

This enumeration type is used when extreme weather conditions are causing a hazard to drivers.

Table 40 enumerates the possible values for type tec117:ExtremeWeatherConditions.

Table 40 — ExtremeWeatherConditions

Code	Reference-English "word"	Comment	Example
1	strong winds	Strong winds, especially cross winds, are causing a driving hazard.	
2	damaging hail	Hail is falling that could potentially damage cars.	
3	hurricane	Winds in excess of 118 km/h.	
4	thunderstorm	Thunderstorm can affect driving conditions.	
5	tornado	Destructive wind likely to make driving dangerous.	
6	blizzard	Strong winds combined with snow reducing visibility to less than a few hundred metres.	
255	undecodable extreme weather condition	Undecodable sub-cause code, use main cause code instead.	

9.27 tec118:VisibilityReduced

This enumeration type is used to warn drivers of reduced visibility, which can require a speed reduction and other measures.

Table 41 enumerates the possible values for type tec118:VisibilityReduced.

Table 41 — VisibilityReduced

Code	Reference-English "word"	Comment	Example
1	visibility reduced due to fog	Fog is reducing visibility.	
2	visibility reduced due to smoke	Smoke is reducing visibility.	
3	visibility reduced due to heavy snowfall	Heavy snowfall is reducing visibility.	

Table 41 *(continued)*

Code	Reference-English "word"	Comment	Example
4	visibility reduced due to heavy rain	Heavy rain is reducing visibility.	
5	visibility reduced due to heavy hail	Heavy hail is reducing visibility.	
6	visibility reduced due to low sun glare	Glare from low sun is reducing visibility (usually applies to a specific direction of travel).	
7	visibility reduced due to sandstorms	A sandstorm is reducing visibility.	
8	visibility reduced due to swarms of insects	A swarm of insects is reducing visibility.	
255	undecodable visibility reduced	undecodable sub cause code, use main cause code instead.	

9.28 tec119:Precipitation

This enumeration type is used when precipitation is causing a hazard to drivers.

Table 42 enumerates the possible values for type tec119:Precipitation.

Table 42 — Precipitation

Code	Reference-English "word"	Comment	Example
1	heavy rain	Heavy rain is causing a hazard to drivers.	
2	heavy snowfall	Heavy snowfall is causing a hazard to drivers.	
3	soft hail	Soft hail (or snow pellets) is causing a hazard to drivers.	
255	undecodable precipitation	Undecodable sub-cause code, use main cause code instead.	

9.29 tec120:RecklessPersons

This enumeration type is used when persons acting irresponsibly are causing a danger to motorists.

Table 43 enumerates the possible values for type tec120:RecklessPersons.

Table 43 — RecklessPersons

Code	Reference-English "word"	Comment	Example
1	reckless driver	A motorist driving in a reckless manner. Drivers can need to take evasive action.	
2	gunfire on road	Someone is discharging a weapon on or near the roadway.	
3	persons throwing objects	Drivers are potentially in danger due to objects being thrown at or into the path of vehicles.	

Table 43 *(continued)*

Code	Reference-English "word"	Comment	Example
255	undecodable reckless persons	Undecodable sub-cause code, use main cause code instead.	

9.30 tec123:MajorEvent

This enumeration type is used when an organized event is affecting normal driving progress.

Table 44 enumerates the possible values for type tec123:MajorEvent.

Table 44 — MajorEvent

Code	Reference-English "word"	Comment	Example
1	sports event	A sports event is affecting traffic.	
2	demonstration	A demonstration is affecting traffic.	
3	demonstration with vehicles	A demonstration, with added presence of vehicles, is affecting traffic.	
4	concert	Traffic is affected by a concert, due to people arriving or leaving the venue.	
5	fair	A fair is affecting traffic.	
6	military training	Military training is affecting traffic.	
7	emergency training	Emergency services training is affecting traffic.	
8	festival	A festival is affecting traffic.	
9	procession	A procession is affecting traffic.	
255	undecodable major event	Undecodable sub-cause code, use main cause code instead.	

9.31 tec124:ServiceNotOperating

This enumeration type is used when a transport service is not operating.

Table 45 enumerates the possible values for type tec124:ServiceNotOperating.

Table 45 — ServiceNotOperating

Code	Reference-English "word"	Comment	Example
1	ferry service not operating	A ferry service is not operating.	
2	air service not operating	An air service is not operating.	
3	train service not operating	A train service is not operating.	
4	bus service not operating	A bus service is not operating.	
255	undecodable service not operating	Uundecodable sub-cause code, use main cause code instead.	

9.32 tec125:ServiceNotUseable

This enumeration type is used when a service is operational, but is temporarily not usable.

Table 46 enumerates the possible values for type tec125:ServiceNotUseable.

Table 46 — ServiceNotUseable

Code	Reference-English "word"	Comment	Example
1	fuel station closed	A fuel station is temporarily closed.	
2	service area closed	A service area is temporarily closed.	
3	service area busy	A service area is busy; there can be long waiting times.	
4	parking full	A parking area/car park is full.	
5	car park closed	A parking area or car park is closed.	
255	undecodable service not usable	undecodable sub cause code, use main cause code instead.	

9.33 tec126:SlowMovingVehicles

This enumeration type is used when slow-moving vehicles are impeding normal progress.

Table 47 enumerates the possible values for type tec126:SlowMovingVehicles.

Table 47 — SlowMovingVehicles

Code	Reference-English "word"	Comment	Example
1	slow-moving maintenance vehicle	Slow-moving maintenance vehicles are affecting traffic or can be causing a hazard.	
2	vehicles slowing to look at accident	Drivers are slowing to look at an accident or incident on the opposite carriageway or by the side of the road, thus causing a hazard.	
3	abnormal load	A vehicle carrying an abnormal load is affecting traffic or causing a hazard.	
4	abnormal wide load	A vehicle carrying a wide load is affecting traffic or causing a hazard, possibly restricting the ability to pass the vehicle.	
5	convoy	A convoy on the road is affecting traffic.	
6	snowplough	A snowplough is on the road.	
7	de-icing	A de-icing vehicle is on the road.	
8	salting vehicles	A vehicle is salting/gritting the road	
255	undecodable slow maintenance vehicle	Undecodable sub-cause code, use main cause code instead.	

9.34 tec127:DangerousEndOfQueue

This enumeration type is used when the end of queue of vehicles can cause an accident.

Table 48 enumerates the possible values for type tec127:DangerousEndOfQueue.

Table 48 — DangerousEndOfQueue

Code	Reference-English "word"	Comment	Example
1	sudden end of queue	Used when the end of a queue is in a dangerous situation or unexpected location causing an added hazard for approaching drivers.	
2	queue over hill	Used when a queue has formed over a hill and can be not visible to approaching drivers.	
3	queue around bend	Used when a queue has formed around a bend in the road and can be not visible to approaching drivers.	
4	queue in tunnel	Used when a queue has formed in a tunnel and can be not visible to approaching drivers.	
255	undecodable dangerous end of queue	Undecodable sub-cause code, use main cause code instead.	

9.35 tec128:RiskOfFire

This enumeration type is used to warn that a risk of fire exists.

Table 49 enumerates the possible values for type tec128:RiskOfFire.

Table 49 — RiskOfFire

Code	Reference-English "word"	Comment	Example
1	leakage of fuel	A risk of fire exists due to a fuel leak.	
2	leakage of gas	A risk of fire exists due to a gas leak.	
255	undecodable risk of fire	Undecodable sub-cause code, use main cause code instead.	

9.36 tec129:TimeDelay

This enumeration type is used to advise of longer than usual delays.

Table 50 enumerates the possible values for type tec129:TimeDelay.

Table 50 — TimeDelay

Code	Reference-English "word"	Comment	Example
1	time delay at frontier	There is a delay at the frontier or border point.	
2	time delay at ferry port	There is a delay at the ferry port.	
3	time delay at vehicle-on-rail terminal	There is a delay at the car-train terminal.	
255	undecodable time delay	Undecodable sub-cause code, use main cause code instead.	

9.37 tec130:PoliceCheckpoint

This enumeration type is used to advise of time delays due to police checks.

Table 51 enumerates the possible values for type tec130:PoliceCheckpoint.

Table 51 — PoliceCheckpoint

Code	Reference-English "word"	Comment	Example
1	permanent police checkpoint	A delay is occurring at a regular police checkpoint.	
2	temporary police checkpoint	A delay is occurring at a temporary police checkpoint.	
255	undecodable police checkpoint	Undecodable sub-cause code, use main cause code instead.	

9.38 tec131:MalfunctioningRoadsideEquipment

This enumeration type is used when roadside equipment is malfunctioning.

Table 52 enumerates the possible values for type tec131:MalfunctioningRoadsideEquipment.

Table 52 — MalfunctioningRoadsideEquipment

Code	Reference-English "word"	Comment	Example
1	road-rail crossing failure	A level crossing (rail road crossing in USA) is malfunctioning.	
2	tunnel ventilation not working	Tunnel ventilation is malfunctioning.	
3	traffic control signals working incorrectly	Traffic control signals are malfunctioning.	
4	emergency telephones not working	Emergency telephones are malfunctioning.	
5	automatic payment lanes not working	Automatic payment lanes are not working.	
255	undecodable malfunctioning roadside equipment	Undecodable sub-cause code, use main cause code instead.	

9.39 tec200:SubAdviceType

The SubAdviceType defines the abstract type for choosing the appropriate SubAdvice table corresponding to the various mainAdviceCodes.

Valid entries for attributes of this type are listed in the following tables:

Table 53 — tec202:OvertakingNotAllowed

Table 54 — tec203:DrivingNotAllowed

Table 55 — tec207:GiveWayToVehiclesFromBehind

Table 56 — tec208:FollowDiversion

Table 57 — tec213:DriveCarefully

Table 58 — tec214:DoNotLeaveYourVehicle

Table 59 — tec216:UseTollLanes

NOTE If a client device is unable to decode a subadvice code, the original advice is used.

9.40 tec202:OvertakingNotAllowed

This enumeration type is used to advise that different forms of restriction on overtaking are in place.

Table 53 enumerates the possible values for type tec202:OvertakingNotAllowed.

Table 53 — OvertakingNotAllowed

Code	Reference-English "word"	Comment	Example
1	do not use overtaking lanes	Overtaking lanes are those closest to the central reservation (median) on highways. On single carriageway roads, the overtaking lane may be a central lane used by traffic in both directions.	A ghost driver approaches.
2	overtaking not allowed, drive on crawler lane	The overtaking lane(s) should not be used, but the crawler lane is available for use.	A ghost driver approaches.
3	overtaking not allowed, drive on left most lane	The overtaking lane(s) should not be used; drivers should use the left most lane only.	
4	overtaking not allowed, drive on right most lane	The overtaking lane(s) should not be used; drivers should use the right most lane only.	
255	undecodable overtaking not allowed	Undecodable sub-advice code, use main advice code instead.	

9.41 tec203:DrivingNotAllowed

This enumeration type is used to advise drivers that they should find a safe place to pull over and stop.

Table 54 enumerates the possible values for type tec203:DrivingNotAllowed.

Table 54 — DrivingNotAllowed

Code	Reference-English "word"	Comment	Example
1	driving not allowed, find a safe place to pull over and stop the vehicle	Driving is prohibited; drivers should pull over at next safe place.	An earthquake will happen.
255	undecodable driving not allowed	Undecodable sub-advice code, use main advice code instead.	

9.42 tec207:GiveWayToVehiclesFromBehind

This enumeration type is used to advise drivers to make way for vehicles approaching from behind and allow them to pass.

Table 55 enumerates the possible values for type tec207:GiveWayToVehiclesFromBehind.

Table 55 — GiveWayToVehiclesFromBehind

Code	Reference-English "word"	Comment	Example
1	make way for rescue vehicles to pass	Drivers are asked to pull aside and make way for rescue vehicles approaching from behind, which need to pass.	
2	make way for service vehicles to pass	Drivers are asked to pull aside and make way for service vehicles approaching from behind, which need to pass.	
255	undecodable make way for vehicles from behind	Undecodable sub-advice code, use main advice code instead.	

9.43 tec208:FollowDiversion

This enumeration type is used to advise drivers that they should follow a diversion.

Table 56 enumerates the possible values for type tec208:FollowDiversion.

Table 56 — FollowDiversion

Code	Reference-English "word"	Comment	Example
1	follow diversion signs	Drivers should follow a signed diversion.	
255	undecodable follow diversion	undecodable sub advice code, use main advice code instead.	

9.44 tec213:DriveCarefully

This enumeration type used to advise drivers that extra care should be taken.

Table 57 enumerates the possible values for type tec213:DriveCarefully.

Table 57 — DriveCarefully

Code	Reference-English "word"	Comment	Example
1	drive carefully, dangerous situation on entry slip road	A dangerous situation exists on an entry slip road.	
2	drive carefully, dangerous situation on exit slip road	A dangerous situation exists on an exit slip road.	
3	drive carefully, ice buildup on cable structure	Ice has built up on a cable structure at side of road, and there is a danger of cables breaking, or ice falling.	
255	undecodable drive carefully	Undecodable sub-advice code, use main advice code instead.	

9.45 tec214:DoNotLeaveYourVehicle

This enumeration type is used to advise drivers not to leave their vehicles.

Table 58 enumerates the possible values for type tec214:DoNotLeaveYourVehicle.

Table 58 — DoNotLeaveYourVehicle

Code	Reference-English "word"	Comment	Example
1	do not leave your vehicle		Due to security reasons.
2	do not leave your vehicle, close windows		Toxic gas coming from a fire could flow into the vehicle.
255	undecodable do not leave your vehicle	Undecodable sub-advice code, use main advice code instead.	

9.46 tec216:UseTollLanes

This enumeration type is used to advise about usage of toll lanes.

Table 59 enumerates the possible values for type tec216:UseTollLanes.

Table 59 — UseTollLanes

Code	Reference-English "word"	Comment	Example
1	use manual payment toll lanes	Manual payment toll lanes should be used.	
2	use automatic payment toll lanes	Automatic payment toll lanes should be used.	
255	undecodable use toll lanes	Undecodable sub-advice code, use main advice code instead.	

Annex A
(normative)

TPEG TEC, TPEG-Binary Representation

A.1 General

This annex provides the TPEG binary representation derived via application of the UML to binary conversion rules specified in ISO 21219-3 (TPEG2-UBCR).

A.2 Message components

A.2.1 List of generic component Ids

Table A.1 shows the list of generic component Ids.

Table A.1 — Generic component Ids

Name	Id
TECMessage	0
MessageManagement	1
ProblemLocation	2
Event	3
DirectCause	4
LinkedCause	5
Advice	6
VehicleRestriction	7
DiversionRoute	8
RestrictionLocation	9
SegmentLocation	10
TemporarySpeedLimit	11

A.2.2 TECMessage

<TECMessage(0)>:=	
<IntUnTi>(0),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
ordered {	
<MMCSwitch>(mmt),	MMC
n * <Event>(event)[0..1],	describes the impact on the traffic flow and the related cause.
n * <ProblemLocation>(loc) [0..1]	LRC (always included except for cancellation of a message).
};	

A.2.3 MMCSwitch

<MMCSwitch(x)>:=	
<IntUnTi>(x),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr);	number of bytes in attributes.

A.2.4 MessageManagement

<MessageManagement(1)<MMCSwitch()>>:=	
External<MessageManagementContainer(1)>;	see MMC specification.

A.2.5 Event

<Event(3)>:=	
<IntUnTi>(3),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
<tec001:EffectCode>(effectCode),	describes the impairment of the traffic flow.
BitArray(selector),	
if (bit 0 of selector is set)	
<DateTime>(startTime),	date and time at which an event began or is scheduled to begin (used for presentation to the end-user).
if (bit 1 of selector is set)	
<DateTime>(stopTime),	date and time at which an event, or status information, ended or is scheduled to end (used for presentation to the end-user).
if (bit 2 of selector is set)	
<tec006:Tendency>(tendency),	tendency is related to the traffic flow speed indicating if this has been increasing, decreasing, or has remained constant. It is not a forecast of a future trend, nor does it relate to the length of the traffic queue.
if (bit 3 of selector is set)	
<DistanceMetres>(lengthAffected),	length of the event in metres.
if (bit 4 of selector is set)	
<Velocity>(averageSpeedAbsolute),	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.
if (bit 5 of selector is set)	
<IntUnLoMB>(delay),	delay in minutes. Only applicable to point locations, i.e. at border crossings.
if (bit 6 of selector is set)	

<Velocity>(segmentSpeedLimit),	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 road-works zone). Shall be used as speed limit for re-routing, but not to display or warn the driver.
if (bit 7 of selector is set)	
<Velocity>(expectedSpeedAbsolute),	the expected (normal) speed in m/s for this time of the day, based on historical data, for example. This speed can vary depending of the time of day, and can be markedly different from the free-flow speed (especially in rush hour conditions).
if (bit 8 of selector is set)	
<tec010:AtGradeJunctionClosure>(atGradeJunctionClosure),	defines the potential types of cases for dealing with cross traffic for at-grade junctions when there is a road closure, which is indicated by EffectCode=7.
ordered {	
n * <Cause>(cause),	defines the reason for the traffic problem (direct or linked cause).
n * <Advice>(advice),	recommendations or prohibitions for the driver.
n * <VehicleRestriction>(vehicleRestriction),	vehicle types(restrictions) that are relevant for the message.
n * <DiversionRoute>(diversionRoute),	diversion information relating to the event.
n * <TemporarySpeedLimit>(temporarySpeedLimit)	this is the temporary speed limit displayed on road signs associated with the Event. This data is for display to drivers.
};	

A.2.6 ProblemLocation

<ProblemLocation(2)>:=	
External <LocationReferencingContainer(2)>;	see LRC specification.

A.2.7 RestrictionLocation

<RestrictionLocation(9)>:=	
External <LocationReferencingContainer(9)>;	see LRC specification.

A.2.8 SegmentLocation

<SegmentLocation(10)>:=	
External <LocationReferencingContainer(10)>;	see LRC specification.

A.2.9 Cause

<Cause(x)>:=	
<IntUnTi>(x),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
<tec002:CauseCode>(main-Cause);	main categorization of the cause according to table tec002.

A.2.10 DirectCause

<DirectCause(4)<Cause(4)>>:=	
<IntUnTi>(4),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
<tec002:CauseCode>(mainCause);	main categorization of the cause according to table tec002.
<tec003:WarningLevel>(warningLevel),	the level “informative” should be used for all traffic events which can potentially influence the driver's route in any way requiring a normal level of attention from the driver. the “danger levels” 1 to 3 should only be used for dangerous situations. Levels 1 to 3 are used in ascending levels of danger. (Level 1 - Danger; Level 3 - Highly Dangerous). danger levels 1 to 3 in combination with unverifiedInformation = True should be used in case of an unverified danger. EXAMPLE A traffic management centre receives a call from a private “jam buster” reporting that there is a “vehicle travelling on the wrong side of the road”, but this has not been confirmed by the police.
BitArray(selector),	
if (bit 0 of selector is set)	
<Boolean>(unverifiedInformation),	if element is set to 1, the given information has not been verified.
if (bit 1 of selector is set)	
<tec100:SubCauseType>(subCause),	carries the value in the sub-cause table defined by the mainCauseCode.
if (bit 2 of selector is set)	
<DistanceMetres>(lengthAffected),	length of the cause in metres.
if (bit 3 of selector is set)	
<tec004:LaneRestriction>(laneRestrictionType),	specifies whether lanes are closed or open.
if (bit 4 of selector is set)	

<IntUnTi>(numberOfLanes),	specifies how many lanes are closed or open. If this element is not given, but laneRestrictionType indicates there are lane closures it means an unspecified number of lanes are closed, i.e. “one or more lanes closed”.
if (bit 5 of selector is set)	
{	
<IntUnLoMB>(n),	
n * <LocalisedShortString>(freeText),	additional description
}	
if (bit 6 of selector is set)	
<DistanceMetres>(causeOffset);	offset (metres) from the start of the cause to the end of the problem location. When used together with lengthAffected, the cause can be positioned within the event more accurately. Without causeOffset, but with lengthAffected defined, the cause position is not defined. If neither lengthAffected nor causeOffset are defined, the cause spans the entire Problem Location.
if (bit 7 of selector is set)	
<LaneNumber>(causeLanes);	The lane number(s) for which the cause applies.

A.2.11 LinkedCause

<LinkedCause(5)<Cause(5)>>:=	
<IntUnTi>(5),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
<tec002:CauseCode>(mainCause);	main categorization of the cause according to table tec002.
<IntUnLoMB>(linkedMessage),	contains a messageID as pointer to a message. If contentID and originatorSID is not given, the linked messages is contained in the actual component stream of the actual service.
BitArray(selector),	
if (bit 0 of selector is set)	
<IntUnTi>(COID),	if COID is not signalled, the linked message shall be found in the component stream that has the same contentID as the linking message.
if (bit 1 of selector is set)	
<ServiceIdentifier>(originatorSID);	if originatorSID is not signalled, the linked message shall be found in the same service as the linking message.

A.2.12 Advice

<Advice(6)>:=	
<IntUnTi>(6),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
BitArray(selector),	

if (bit 0 of selector is set)	
<tec005:AdviceCode>(adviceCode),	main categorization of advice.
if (bit 1 of selector is set)	
<tec200:SubAdviceType>(subAdvice-Code),	detailed advice code.
if (bit 2 of selector is set)	
{	
<IntUnLoMB>(n),	
n * <LocalisedShortString>(freeText),	additional advice.
}	
ordered {	
n * <VehicleRestriction>(vehicleRestric-tion)	used when advice applies to specific vehicle types.
};	

A.2.13 VehicleRestriction

<VehicleRestriction(7)>:=	
<IntUnTi>(7),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
BitArray(selector),	
if (bit 0 of selector is set)	
<tec009:VehicleType>(vehicle-Type),	type of vehicle.
if (bit 1 of selector is set)	
{	
<IntUnLoMB>(n),	
n * <RestrictionType>(restric-tion)	even when a particular vehicle type has been defined by tec009:VehicleType, RestrictionType may be used to specify further attributes to more closely define the vehicles for which the message applies, e.g. vehicle weight, vehicle height or other attribute, including vehicle destination. For example: “no winter tyres” means the message applies to vehicles without winter tyres. “width greater 300” means that the event or the closure affects only vehicles with a width greater than 3 m. “with destination in a given area” means the message is targeted only at those vehicles whose destination is as specified in the area as attached to this restriction attribute.
};	

A.2.14 DiversionRoute

<DiversionRoute(8)>:=	
<IntUnTi>(8),	id of this component.

<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
<IntUnLoMB>(n),	
n * <SegmentModifier>(segmentModifier),	data structure to define diversion.
ordered {	
n * <VehicleRestriction>(vehicleRestriction)	defines how diversion information is restricted to specific vehicles.
};	

A.2.15 TemporarySpeedLimit

<TemporarySpeedLimit(11)>:=	
<IntUnTi>(11),	id of this component.
<IntUnLoMB>(lengthComp),	number of bytes in component, excluding the id and lengthComp indicator.
<IntUnLoMB>(lengthAttr),	number of bytes in attributes.
<IntUnLoMB>(n),	
n * <TemporarySpeedLimitSection>(SpeedLimitSection),	individual section for the speed limit information.
BitArray(selector),	
if (bit 0 of selector is set)	
<Boolean>(unitIsMPH),	units definition for this temporary speed limit.
if (bit 1 of selector is set)	
<DistanceMetres>(offset),	offset defines the distance from the start of the temporary speed limit to the end of the location reference. If not defined, then first SpeedLimitSection starts at the beginning of the location reference.
ordered {	
n * <VehicleRestriction>(VehicleRestriction)	One or more vehicle restrictions can be associated to each temporary speed limit. This allows different speed limits to be signalled to different vehicles (e.g. lorries, towing vehicles). Absence of the “VehicleRestriction” attribute indicates all vehicles are affected.
};	

A.3 TEC Datatypes

A.3.1 LaneNumber

<LaneNumber>:=	
BitArray(selector),	
if (bit 0 of selector is set)	
<Boolean>(hardShoulder),	true, if the hard shoulder exists and is selected.
if (bit 1 of selector is set)	
<Boolean>(lane1),	true, if the lane is selected.

if (bit 2 of selector is set)	
<Boolean>(lane2),	true, if the lane is selected.
if (bit 3 of selector is set)	
<Boolean>(lane3),	true, if the lane is selected.
if (bit 4 of selector is set)	
<Boolean>(lane4),	true, if the lane is selected.
if (bit 5 of selector is set)	
<Boolean>(lane5),	true, if the lane is selected.
if (bit 6 of selector is set)	
<Boolean>(lane6),	true, if the lane is selected.
if (bit 7 of selector is set)	
<Boolean>(lane7),	true, if the lane is selected.
if (bit 8 of selector is set)	
<Boolean>(lane8),	true, if the lane is selected.
if (bit 9 of selector is set)	
<Boolean>(lane9),	true, if the lane is selected.
if (bit 10 of selector is set)	
<Boolean>(lane10),	true, if the lane is selected.
if (bit 11 of selector is set)	
<Boolean>(lane11),	true, if the lane is selected.
if (bit 12 of selector is set)	
<Boolean>(lane12),	true, if the lane is selected.
if (bit 13 of selector is set)	
<Boolean>(lane13),	true, if the lane is selected.
if (bit 14 of selector is set)	
<Boolean>(lane14),	true, if the lane is selected.
if (bit 15 of selector is set)	
<Boolean>(lane15),	true, if the lane is selected.
if (bit 16 of selector is set)	
<Boolean>(lane16),	true, if the lane is selected.
if (bit 17 of selector is set)	
<Boolean>(lane17),	true, if the lane is selected.
if (bit 18 of selector is set)	
<Boolean>(lane18),	true, if the lane is selected.
if (bit 19 of selector is set)	
<Boolean>(lane19andMore),	true, if the lane and potential further lanes are selected.
if (bit 20 of selector is set)	
<Boolean>(innerSideHardShoulder);	true, if an inner side hard shoulder exists and is selected.

A.3.2 RestrictionType

<RestrictionType>:=	
<tec007:RestrictionType>(restrictionType),	defines the form of restriction.
BitArray(selector),	
if (bit 0 of selector is set)	

<IntUnLoMB>(restrictionValue),	defines the value associated to the restrictions where applicable.
if (bit 1 of selector is set)	
<RestrictionLocation>(restrictionLocation);	restriction filter for specific destination.

A.3.3 SegmentModifier

<SegmentModifier>:=	
<tec008:DiversionRoadType>(diversionRoadType),	nature of diversion route element.
<SegmentLocation>(segmentLocation);	position of segment.

A.3.4 TemporarySpeedLimitSection

<TemporarySpeedLimitSection>:=	
<IntUnTi>(speedLimitValue),	speed limit numerical value in km/h or mi/h.
BitArray(selector),	
if (bit 0 of selector is set)	
<IntUnTi>(speedLimitValueWet),	speed limit numerical value to be used in wet conditions; in km/h or mi/h.
if (bit 1 of selector is set)	
<DistanceMetres>(speedLimitLength);	length of the SpeedLimitSection. If this is not defined, then the section finishes at end of the problem location.

Annex B
(normative)

TPEG application, TPEG-ML Representation

B.1 General

This annex provides the tpegML representation derived via application of the UML to XML conversion rules specified in ISO 21219-4.

B.2 Message Components

B.2.1 TECMessage

```
<xs:element name="TECMessage" type="TECMessage"/>
<xs:complexType name="TECMessage">
 <xs:complexContent>
 <xs:extension base="tsf:ApplicationRootMessageML">
 <xs:sequence>
 <xs:element name="mmt" type="MMCSwitch"/>
 <xs:element name="event" type="Event" minOccurs="0"/>
 <xs:element name="loc" type="lrc:LocationReferencingContainer" minOccurs="0"/>
 </xs:sequence>
 </xs:extension>
 </xs:complexContent>
</xs:complexType>
```

B.2.2 MMCSwitch

```
<xs:complexType name="MMCSwitch">
 <xs:sequence>
 <xs:choice minOccurs="1" maxOccurs="1">
 <xs:element name="optionMessageManagement" type="mmc:MessageManagementContainer"
minOccurs="1" maxOccurs="1"/>
 </xs:choice>
 </xs:sequence>
</xs:complexType>
```

B.2.3 Event

```
<xs:complexType name="Event">
 <xs:sequence>
 <xs:element name="effectCode" type="tec001_EffectCode"/>
 <xs:element name="startTime" type="tdt:DateTime" minOccurs="0"/>
 <xs:element name="stopTime" type="tdt:DateTime" minOccurs="0"/>
 <xs:element name="tendency" type="tec006_Tendency" minOccurs="0"/>
 <xs:element name="lengthAffected" type="tdt:DistanceMetres" minOccurs="0"/>
 <xs:element name="averageSpeedAbsolute" type="tdt:Velocity" minOccurs="0"/>
 <xs:element name="delay" type="tdt:IntUnLoMB" minOccurs="0"/>
 <xs:element name="segmentSpeedLimit" type="tdt:Velocity" minOccurs="0"/>
 <xs:element name="expectedSpeedAbsolute" type="tdt:Velocity" minOccurs="0"/>
 <xs:element name="atGradeJunctionClosure" type="tec010_AtGradeJunctionClosure"
minOccurs="0"/>
 <xs:element name="cause" type="Cause" minOccurs="0" maxOccurs="unbounded"/>
 <xs:element name="advice" type="Advice" minOccurs="0" maxOccurs="unbounded"/>
 <xs:element name="vehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
 <xs:element name="diversionRoute" type="DiversionRoute" minOccurs="0"
maxOccurs="unbounded"/>
 <xs:element name="temporarySpeedLimit" type="TemporarySpeedLimit" minOccurs="0"
```

```
maxOccurs="unbounded"/>
 </xs:sequence>
</xs:complexType>
```

B.2.4 Cause

```
<xs:complexType name="Cause">
 <xs:sequence>
 <xs:choice minOccurs="1" maxOccurs="1">
 <xs:element name="optionDirectCause" type="DirectCause" minOccurs="1" maxOccurs="1"/>
 <xs:element name="optionLinkedCause" type="LinkedCause" minOccurs="1" maxOccurs="1"/>
 </xs:choice>
 </xs:sequence>
</xs:complexType>
```

B.2.5 DirectCause

```
<xs:complexType name="DirectCause">
 <xs:sequence>
 <xs:element name="mainCause" type="tec002_CauseCode"/>
 <xs:element name="warningLevel" type="tec003_WarningLevel"/>
 <xs:element name="unverifiedInformation" type="tdt:Boolean"/>
 <xs:element name="subCause" type="tec100_SubCauseType" minOccurs="0"/>
 <xs:element name="lengthAffected" type="tdt:DistanceMetres" minOccurs="0"/>
 <xs:element name="laneRestrictionType" type="tec004_LaneRestriction" minOccurs="0"/>
 <xs:element name="numberOfLanes" type="tdt:IntUnTi" minOccurs="0"/>
 <xs:element name="freeText" type="tdt:LocalisedShortString" minOccurs="0"
maxOccurs="unbounded"/>
 <xs:element name="causeOffset" type="tdt:DistanceMetres" minOccurs="0"/>
 <xs:element name="causeLanes" type="LaneNumber" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
```

B.2.6 LinkedCause

```
<xs:complexType name="LinkedCause">
 <xs:sequence>
 <xs:element name="mainCause" type="tec002_CauseCode"/>
 <xs:element name="linkedMessage" type="tdt:IntUnLoMB"/>
 <xs:element name="COID" type="tdt:IntUnTi" minOccurs="0"/>
 <xs:element name="originatorSID" type="tdt:ServiceIdentifier" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
```

B.2.7 Advice

```
<xs:complexType name="Advice">
 <xs:sequence>
 <xs:element name="adviceCode" type="tec005_AdviceCode" minOccurs="0"/>
 <xs:element name="subAdviceCode" type="tec200_SubAdviceType" minOccurs="0"/>
 <xs:element name="freeText" type="tdt:LocalisedShortString" minOccurs="0"
maxOccurs="unbounded"/>
 <xs:element name="vehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
 </xs:sequence>
</xs:complexType>
```

B.2.8 VehicleRestriction

```
<xs:complexType name="VehicleRestriction">
 <xs:sequence>
 <xs:element name="vehicleType" type="tec009_VehicleType" minOccurs="0"/>
 <xs:element name="restriction" type="RestrictionType" minOccurs="0"
maxOccurs="unbounded"/>
 </xs:sequence>
</xs:complexType>
```

B.2.9 DiversionRoute

```
<xs:complexType name="DiversionRoute">
 <xs:sequence>
 <xs:element name="segmentModifier" type="SegmentModifier" maxOccurs="unbounded"/>
 <xs:element name="vehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
 </xs:sequence>
</xs:complexType>
```

B.2.10 TemporarySpeedLimit

```
<xs:complexType name="TemporarySpeedLimit">
 <xs:sequence>
 <xs:element name="SpeedLimitSection" type="TemporarySpeedLimitSection"
maxOccurs="unbounded"/>
 <xs:element name="unitIsMPH" type="tdt:Boolean"/>
 <xs:element name="offset" type="tdt:DistanceMetres" minOccurs="0"/>
 <xs:element name="VehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
 </xs:sequence>
</xs:complexType>
```

B.3 Datatypes

B.3.1 LaneNumber

```
<xs:complexType name="LaneNumber">
 <xs:sequence>
 <xs:element name="hardShoulder" type="tdt:Boolean"/>
 <xs:element name="lane1" type="tdt:Boolean"/>
 <xs:element name="lane2" type="tdt:Boolean"/>
 <xs:element name="lane3" type="tdt:Boolean"/>
 <xs:element name="lane4" type="tdt:Boolean"/>
 <xs:element name="lane5" type="tdt:Boolean"/>
 <xs:element name="lane6" type="tdt:Boolean"/>
 <xs:element name="lane7" type="tdt:Boolean"/>
 <xs:element name="lane8" type="tdt:Boolean"/>
 <xs:element name="lane9" type="tdt:Boolean"/>
 <xs:element name="lane10" type="tdt:Boolean"/>
 <xs:element name="lane11" type="tdt:Boolean"/>
 <xs:element name="lane12" type="tdt:Boolean"/>
 <xs:element name="lane13" type="tdt:Boolean"/>
 <xs:element name="lane14" type="tdt:Boolean"/>
 <xs:element name="lane15" type="tdt:Boolean"/>
 <xs:element name="lane16" type="tdt:Boolean"/>
 <xs:element name="lane17" type="tdt:Boolean"/>
 <xs:element name="lane18" type="tdt:Boolean"/>
 <xs:element name="lane19andMore" type="tdt:Boolean"/>
 <xs:element name="innerSideHardShoulder" type="tdt:Boolean"/>
 </xs:sequence>
</xs:complexType>
```

B.3.2 RestrictionType

```
<xs:complexType name="RestrictionType">
 <xs:sequence>
 <xs:element name="restrictionType" type="tec007_RestrictionType"/>
 <xs:element name="restrictionValue" type="tdt:IntUnLoMB" minOccurs="0"/>
 <xs:element name="restrictionLocation" type="lrc:LocationReferencingContainer"
minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
```

B.3.3 SegmentModifier

```
<xs:complexType name="SegmentModifier">
 <xs:sequence>
 <xs:element name="diversionRoadType" type="tec008_DiversionRoadType"/>
 <xs:element name="segmentLocation" type="lrc:LocationReferencingContainer"/>
 </xs:sequence>
</xs:complexType>
```

B.3.4 TemporarySpeedLimitSection

```
<xs:complexType name="TemporarySpeedLimitSection">
 <xs:sequence>
 <xs:element name="speedLimitValue" type="tdt:IntUnTi"/>
 <xs:element name="speedLimitValueWet" type="tdt:IntUnTi" minOccurs="0"/>
 <xs:element name="speedLimitLength" type="tdt:DistanceMetres" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
```

B.3.5 Full TEC Schema Definition

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- This XML schema is generated with tpegUMLconverter V3.1 at 2018-09-28 17:12, on basis
of release 3.3 -->
<xs:schema xmlns="https://www.tisa.org/TPEG/TEC_3_4"
   targetNamespace="https://www.tisa.org/TPEG/TEC_3_4"
   xmlns:xs="https://www.w3.org/2001/XMLSchema"
   xmlns:tsf="https://www.tisa.org/TPEG/SFW_1_1"
   xmlns:tdt="https://www.tisa.org/TPEG/TPEGDataTypes_2_1"
   xmlns:mmc="https://www.tisa.org/TPEG/MMC_1_1"
   xmlns:lrc="https://www.tisa.org/TPEG/LRC_3_0"
   elementFormDefault="qualified"
   attributeFormDefault="qualified">
   <xs:import namespace="https://www.tisa.org/TPEG/SFW_1_1" schemaLocation="SFW_1_1.xsd"/>
   <xs:import namespace="https://www.tisa.org/TPEG/TPEGDataTypes_2_1"
schemaLocation="TDT_2_1.xsd"/>
   <xs:import namespace="https://www.tisa.org/TPEG/MMC_1_1" schemaLocation="MMC_1_1.xsd"/>
   <xs:import namespace="https://www.tisa.org/TPEG/LRC_3_0" schemaLocation="LRC_3_0.xsd"/>
   <xs:element name="TECMessage" type="TECMessage"/>
   <xs:complexType name="TECMessage">
      <xs:complexContent>
         <xs:extension base="tsf:ApplicationRootMessageML">
            <xs:sequence>
               <xs:element name="mmt" type="MMCSwitch"/>
               <xs:element name="event" type="Event" minOccurs="0"/>
               <xs:element name="loc" type="lrc:LocationReferencingContainer"
minOccurs="0"/>
            </xs:sequence>
         </xs:extension>
      </xs:complexContent>
   </xs:complexType>
   <xs:complexType name="MMCSwitch">
      <xs:sequence>
         <xs:choice minOccurs="1" maxOccurs="1">
            <xs:element name="optionMessageManagement"
type="mmc:MessageManagementContainer" minOccurs="1" maxOccurs="1"/>
         </xs:choice>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="Event">
      <xs:sequence>
         <xs:element name="effectCode" type="tec001_EffectCode"/>
         <xs:element name="startTime" type="tdt:DateTime" minOccurs="0"/>
         <xs:element name="stopTime" type="tdt:DateTime" minOccurs="0"/>
         <xs:element name="tendency" type="tec006_Tendency" minOccurs="0"/>
         <xs:element name="lengthAffected" type="tdt:DistanceMetres" minOccurs="0"/>
         <xs:element name="averageSpeedAbsolute" type="tdt:Velocity" minOccurs="0"/>
         <xs:element name="delay" type="tdt:IntUnLoMB" minOccurs="0"/>
         <xs:element name="segmentSpeedLimit" type="tdt:Velocity" minOccurs="0"/>
```

```
         <xs:element name="expectedSpeedAbsolute" type="tdt:Velocity" minOccurs="0"/>
         <xs:element name="cause" type="Cause" minOccurs="0" maxOccurs="unbounded"/>
         <xs:element name="advice" type="Advice" minOccurs="0" maxOccurs="unbounded"/>
         <xs:element name="vehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
         <xs:element name="diversionRoute" type="DiversionRoute" minOccurs="0"
maxOccurs="unbounded"/>
         <xs:element name="temporarySpeedLimit" type="TemporarySpeedLimit" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="Cause">
      <xs:sequence>
         <xs:choice minOccurs="1" maxOccurs="1">
            <xs:element name="optionDirectCause" type="DirectCause" minOccurs="1"
maxOccurs="1"/>
            <xs:element name="optionLinkedCause" type="LinkedCause" minOccurs="1"
maxOccurs="1"/>
         </xs:choice>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="DirectCause">
      <xs:sequence>
         <xs:element name="mainCause" type="tec002_CauseCode"/>
         <xs:element name="warningLevel" type="tec003_WarningLevel"/>
         <xs:element name="unverifiedInformation" type="tdt:Boolean"/>
         <xs:element name="subCause" type="tec100_SubCauseType" minOccurs="0"/>
         <xs:element name="lengthAffected" type="tdt:DistanceMetres" minOccurs="0"/>
         <xs:element name="laneRestrictionType" type="tec004_LaneRestriction"
minOccurs="0"/>
         <xs:element name="numberOfLanes" type="tdt:IntUnTi" minOccurs="0"/>
         <xs:element name="freeText" type="tdt:LocalisedShortString" minOccurs="0"
maxOccurs="unbounded"/>
         <xs:element name="causeOffset" type="tdt:DistanceMetres" minOccurs="0"/>
         <xs:element name="causeLanes" type="LaneNumber" minOccurs="0"/>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="LinkedCause">
      <xs:sequence>
         <xs:element name="mainCause" type="tec002_CauseCode"/>
         <xs:element name="linkedMessage" type="tdt:IntUnLoMB"/>
         <xs:element name="COID" type="tdt:IntUnTi" minOccurs="0"/>
         <xs:element name="originatorSID" type="tdt:ServiceIdentifier" minOccurs="0"/>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="Advice">
      <xs:sequence>
         <xs:element name="adviceCode" type="tec005_AdviceCode" minOccurs="0"/>
         <xs:element name="subAdviceCode" type="tec200_SubAdviceType" minOccurs="0"/>
         <xs:element name="freeText" type="tdt:LocalisedShortString" minOccurs="0"
maxOccurs="unbounded"/>
         <xs:element name="vehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="VehicleRestriction">
      <xs:sequence>
         <xs:element name="vehicleType" type="tec009_VehicleType" minOccurs="0"/>
         <xs:element name="restriction" type="RestrictionType" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="DiversionRoute">
      <xs:sequence>
         <xs:element name="segmentModifier" type="SegmentModifier" maxOccurs="unbounded"/>
         <xs:element name="vehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="TemporarySpeedLimit">
      <xs:sequence>
```

```
         <xs:element name="SpeedLimitSection" type="TemporarySpeedLimitSection"
maxOccurs="unbounded"/>
         <xs:element name="unitIsMPH" type="tdt:Boolean"/>
         <xs:element name="offset" type="tdt:DistanceMetres" minOccurs="0"/>
         <xs:element name="VehicleRestriction" type="VehicleRestriction" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="LaneNumber">
      <xs:sequence>
         <xs:element name="hardShoulder" type="tdt:Boolean"/>
         <xs:element name="lane1" type="tdt:Boolean"/>
         <xs:element name="lane2" type="tdt:Boolean"/>
         <xs:element name="lane3" type="tdt:Boolean"/>
         <xs:element name="lane4" type="tdt:Boolean"/>
         <xs:element name="lane5" type="tdt:Boolean"/>
         <xs:element name="lane6" type="tdt:Boolean"/>
         <xs:element name="lane7" type="tdt:Boolean"/>
         <xs:element name="lane8" type="tdt:Boolean"/>
         <xs:element name="lane9" type="tdt:Boolean"/>
         <xs:element name="lane10" type="tdt:Boolean"/>
         <xs:element name="lane11" type="tdt:Boolean"/>
         <xs:element name="lane12" type="tdt:Boolean"/>
         <xs:element name="lane13" type="tdt:Boolean"/>
         <xs:element name="lane14" type="tdt:Boolean"/>
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