BS ISO 21219-15:2023

BSI Standards Publication

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

Part 15: Traffic event compact (TPEG2-TEC)

Documents
Document Sharing Hub

Full document details: BS ISO 21219-15:2023

National foreword

This British Standard is the UK implementation of ISO 21219-15:2023. It supersedes PD ISO/TS 21219-15:2016, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 12418 7

ICS 03.220.01; 35.240.60

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2023.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS ISO 21219-15:2023

INTERNATIONAL STANDARD

ISO 21219-15

First edition
2023-05

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)

Reference number
ISO 21219-15:2023(E)

Documents
Document Sharing Hub

© ISO 2023

Full document details: BS ISO 21219-15:2023

COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub

Full document details: BS ISO 21219-15:2023

Contents

Page

Foreword ... **v**
Introduction ... **vi**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Abbreviated terms ... **2**
5 Application specific constraints ... **2**
5.1 Application identification ... 2
5.2 Version number signalling ... 2
5.3 Ordered components ... 3
5.4 Extension ... 3
5.5 TPEG service component frame ... 4
6 TEC structure ... **4**
7 TEC message components ... **6**
7.1 TECMessage ... 6
7.2 MMCSwitch ... 6
7.3 MessageManagement ... 6
7.4 Event ... 7
7.4.1 Effect and Cause ... 8
7.4.2 LengthAffected ... 8
7.4.3 startTime and stopTime ... 8
7.4.4 Speed Attributes ... 8
7.4.5 At Grade Junction Closure ... 9
7.4.6 Rounding of speed information ... 9
7.5 ProblemLocation ... 10
7.6 RestrictionLocation ... 10
7.7 SegmentLocation ... 10
7.8 Cause ... 10
7.9 DirectCause ... 10
7.10 Causes and subCauses ... 12
7.11 LinkedCause ... 12
7.11.1 General ... 12
7.11.2 Rules ... 12
7.11.3 Further constraints ... 13
7.11.4 Coding examples ... 13
7.12 Advice ... 13
7.13 VehicleRestriction ... 13
7.14 DiversionRoute ... 14
7.14.1 Description for creating and applying diversions ... 14
7.14.2 Strategy for coding a diversion ... 14
7.15 TemporarySpeedLimit ... 15
8 TEC Datatypes ... **16**
8.1 LaneNumber ... 16
8.2 RestrictionType ... 17
8.3 SegmentModifier ... 17
8.4 TemporarySpeedLimitSection ... 17
9 TEC Tables ... **18**
9.1 tec001:EffectCode ... 18
9.2 tec002:CauseCode ... 18
9.3 tec003:WarningLevel ... 20
9.4 tec004:LaneRestriction ... 21

AVA Documents
Document Sharing Hub

© ISO 2023 – All rights reserved

Full document details: BS ISO 21219-15:2023

9.5 tec005:AdviceCode 21
9.6 tec006:Tendency 22
9.7 tec007:RestrictionType 23
9.8 tec008:DiversionRoadType 24
9.9 tec009:VehicleType 24
9.10 tec010:AtGradeJunctionClosure 25
9.11 tec100:SubCauseType 26
9.12 tec101:TrafficCongestion 27
9.13 tec102:Accident 27
9.14 tec103:Roadworks 27
9.15 tec104:NarrowLanes 28
9.16 tec105:Impassability 28
9.17 tec106:SlipperyRoad 29
9.18 tec108:Fire 29
9.19 tec109:HazardousDrivingConditions 30
9.20 tec110:ObjectsOnTheRoad 30
9.21 tec111:AnimalsOnRoadway 31
9.22 tec112:PeopleOnRoadway 31
9.23 tec113:BrokenDownVehicles 31
9.24 tec115:RescueAndRecoveryWorkInProgress 32
9.25 tec116:RegulatoryMeasure 32
9.26 tec117:ExtremeWeatherConditions 33
9.27 tec118:VisibilityReduced 33
9.28 tec119:Precipitation 34
9.29 tec120:RecklessPersons 34
9.30 tec123:MajorEvent 35
9.31 tec124:ServiceNotOperating 35
9.32 tec125:ServiceNotUseable 36
9.33 tec126:SlowMovingVehicles 36
9.34 tec127:DangerousEndOfQueue 36
9.35 tec128:RiskOfFire 37
9.36 tec129:TimeDelay 37
9.37 tec130:PoliceCheckpoint 38
9.38 tec131:MalfunctioningRoadsideEquipment 38
9.39 tec200:SubAdviceType 38
9.40 tec202:OvertakingNotAllowed 39
9.41 tec203:DrivingNotAllowed 39
9.42 tec207:GiveWayToVehiclesFromBehind 39
9.43 tec208:FollowDiversion 40
9.44 tec213:DriveCarefully 40
9.45 tec214:DoNotLeaveYourVehicle 40
9.46 tec216:UseTollLanes 41

Annex A (normative) **TPEG TEC, TPEG-Binary Representation** **42**

Annex B (normative) **TPEG application, TPEG-ML Representation** **51**

Annex C (informative) **TPEG application,TEC message coding examples** **65**

Bibliography **80**

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

Documents
Document Sharing Hub

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 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

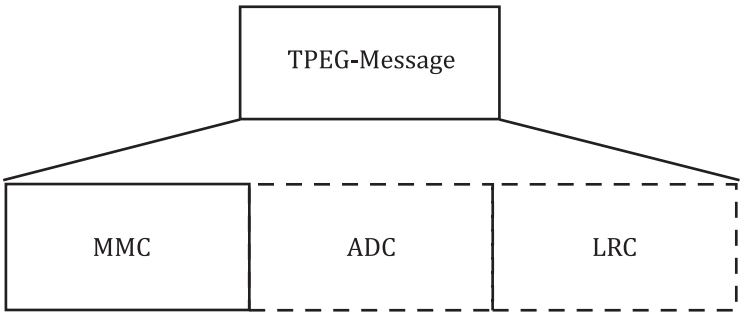

Figure 1 — Composition of TPEG messages

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.

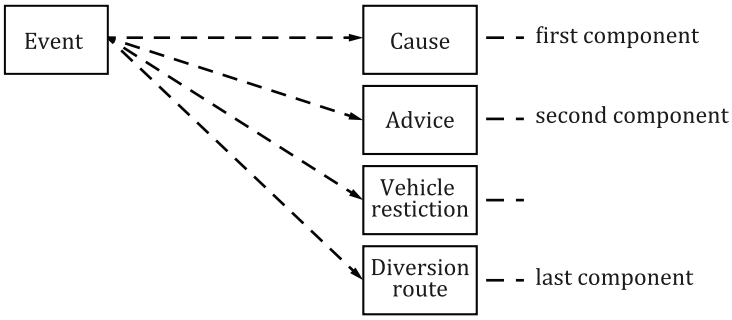

Figure 2 — Example for extension (original component model, before addition of additional components)

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

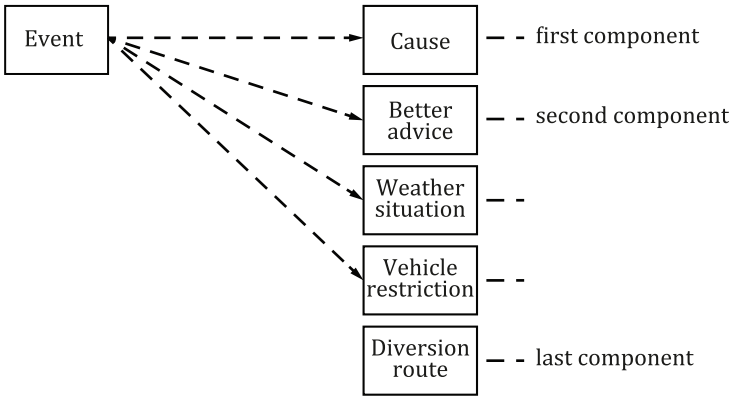

Figure 3 — Example for extension (Advice replaced by BetterAdvice and WeatherSituation added)

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.

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

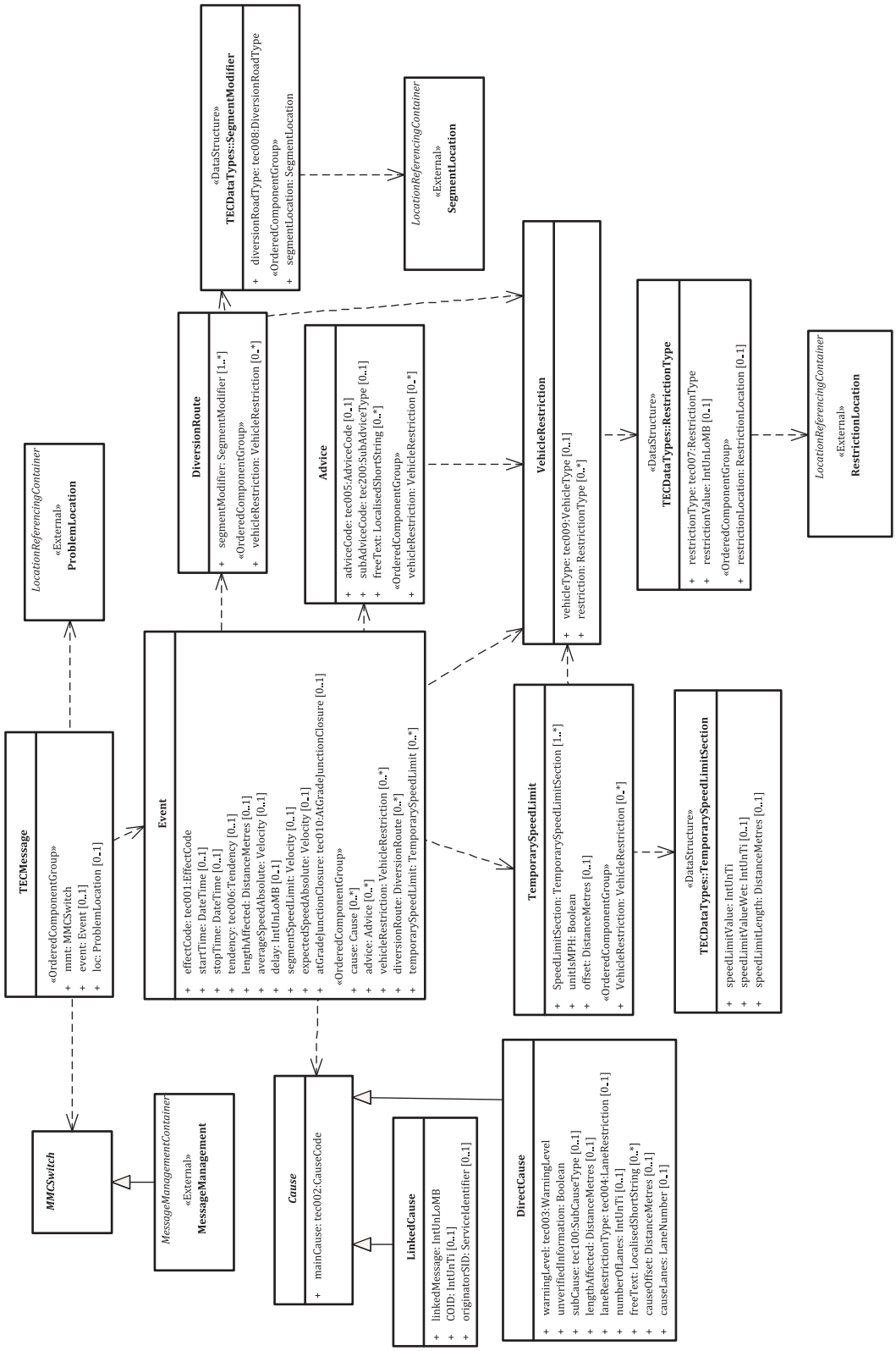

Figure 4 — TEC message structure

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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).

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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).

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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).

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved

AVA Documents Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved

AVA Documents Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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

© ISO 2023 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.	

© ISO 2023 – All rights reserved
Documents Document Sharing Hub
Full document details: BS ISO 21219-15:2023

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.	

© ISO 2023 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21219-15:2023