

PD CEN ISO/TS 18234-9:2013



BSI Standards Publication

# **Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format**

Part 9: Traffic event compact (TPEG1-TEC)

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

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**Intelligent transport systems - Traffic and travel information via  
transport protocol experts group, generation 1 (TPEG1) binary  
data format - Part 9: Traffic event compact (TPEG1-TEC)  
(ISO/TS 18234-9:2013)**

Systèmes intelligents de transport - Informations sur le trafic  
et le tourisme via les données de format binaire du groupe  
d'experts du protocole de transport, génération 1 (TPEG1) -  
Partie 9: Événement trafic compact (TPEG1-TEC) (ISO/TS  
18234-9:2013)

Intelligente Transportsysteme - Reise- und  
Verkehrsinformation über Datenströme der  
Transportprotokoll Expertengruppe (TPEG) - Teil 9:  
Kompakte Verkehrereignisse (TPEG-TEC) (ISO/TS  
18234-9:2013)

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## Foreword

This document (CEN ISO/TS 18234-9:2013) has been prepared by Technical Committee ISO/TC 204 "Intelligent transport systems" in collaboration with Technical Committee CEN/TC 278 "Intelligent transport systems" the secretariat of which is held by NEN.

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### Endorsement notice

The text of ISO/TS 18234-9:2013 has been approved by CEN as CEN ISO/TS 18234-9:2013 without any modification.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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.

ISO/TS 18234-9 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Road transport and traffic telematics*, in collaboration with ISO Technical Committee ISO/TC 204, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO/TS 18234 consists of the following parts, under the general title *Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format*:

- *Part 1: Introduction, numbering and versions (TPEG1-INV)*
- *Part 2: Syntax, semantics and framing structure (TPEG1-SSF)*
- *Part 3: Service and network information (TPEG1-SNI)*
- *Part 4: Road Traffic Message application (TPEG1-RTM)*
- *Part 5: Public Transport Information (PTI) application*
- *Part 6: Location referencing applications*

- *Part 7: Parking information (TPEG1-PK1)*
- *Part 8: Congestion and travel-time application (TPEG1-CTT)*
- *Part 9: Traffic event compact (TPEG1-TEC)*
- *Part 10: Conditional access information (TPEG1-CAI)*
- *Part 11: Location Referencing Container (TPEG1-LRC)*

## Introduction

### TPEG technology

TPEG technology uses a byte-oriented data stream format, which may be carried on almost any digital bearer with an appropriate adaptation layer. TPEG-messages are delivered from service providers to end-users and used to transfer information from the database of a service provider to an end-user's equipment.

The brief history of TPEG technology development dates back to the European Broadcasting Union (EBU) Broadcast Management Committee establishing the B/TPEG project group in autumn 1997 with the mandate 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 are 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.

One year later in December 1998, the B/TPEG group produced its first EBU specifications. Two Technical Specifications were released. ISO/TS 18234-2, described the Syntax, Semantics and Framing Structure, which is used for all TPEG applications. ISO/TS 18234-4 (TPEG-RTM) described the first application, for Road Traffic Messages.

Subsequently, CEN/TC 278/WG 4, in conjunction with ISO/TC 204, established a project group comprising the members of B/TPEG and they have continued the work concurrently since March 1999. Since then two further parts were developed to make the initial complete set of four parts, enabling the implementation of a consistent service. ISO/TS 18234-3 (TPEG-SNI) describes the Service and Network Information Application, which should be used by all service implementations to ensure appropriate referencing from one service source to another. ISO/TS 18234-1 (TPEG-INV), completes the series, by describing the other parts and their relationship; it also contains the application IDs used within the other parts. Additionally ISO/TS 18234-5 the Public Transport Information Application (TPEG-PTI) and ISO/TS 18234-6 (TPEG-LRC), were developed.

This Technical Specification adds another powerful application for the ISO 18234 series allowing detailed road event information to be encoded and transmitted to the user. It was developed specifically to satisfy messaging for Navigation System clients and designed to provide cause and effect in the Road Traffic events information domain. This Technical Specification includes new advanced message management and new datatypes as specified in the annexes.

TPEG applications are developed using UML modelling and a software tool is used to automatically select content which then populates this Technical Specification. Diagrammatic extracts from the model are used to show the capability of the binary coding in place of lengthy text descriptions; the diagrams do not necessarily include all relevant content possible.

This Technical Specification describes the binary data format of the on-air interface of the Traffic Event Compact application, (TPEG-TEC) with the technical version number TPEG-TEC\_3.0/001.

### TEC Model

The basic concept behind the TEC model is that a traffic situation is described by a primary information structure describing the most important information to present to a driver and secondary descriptions of the causes and/or more details. This model enables a traffic editor to describe complex events in a modular way allowing TEC-based system and mobile terminals to present the message as it was intended by the editor. This can be either graphical, textual, voice or a combination of those.

Next to the above mentioned requirement, it is very important to design an efficient coding scheme:

- there will be terminal devices with limited resources;

- to be able to extract those elements early that are relevant to the driver's route, it is key to use the available bandwidth efficiently.

# Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format —

## Part 9: Traffic event compact (TPEG1-TEC)

### 1 Scope

This Technical Specification defines the TPEG application Traffic Event Compact (TEC). It has been specifically designed to support information about traffic events, e.g. road works, traffic jams. A specific form of traffic event are local hazard warnings, which as safety-related messages, are sent with high priority to assist a driver in encountering dangerous situations (e.g. black-ice, accident behind curves, obstacles on road) unexpectedly.

Generally, TEC focuses on the following requirements:

- ensuring travel safety for the driver;
- enabling the calculation of alternative routes;
- avoiding delays (e.g. traffic jams);
- warning the driver of obstructions on route;
- informing the driver of infrastructural problems (e.g. closed petrol stations, non-functioning emergency phones).

### 2 Normative references

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

ISO/TS 18234-2, *Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 2: Syntax, semantics and framing structure (SSF)*

ISO/TS 18234-11, *Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 11: Location Referencing Container (TPEG1-LRC)*

### 3 Terms and definitions

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

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

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

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

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

**3.4**  
**startTime**  
beginning time of a traffic event

**3.5**  
**stopTime**  
end time of a traffic event

## 4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

|        |                                           |
|--------|-------------------------------------------|
| CEN    | Comité Européen de Normalisation          |
| EBU    | European Broadcasting Union               |
| LRC    | Location Referencing Container            |
| OSI    | Open Systems Interconnection              |
| RTM    | Road Traffic Message (see ISO/TS 18234-4) |
| TLV    | Tag length value; a coding method         |
| TPEG   | Transport Protocol Expert Group           |
| WGS 84 | World Geodetic System 1984                |

## 5 Application framing and signalling

### 5.1 Application identification

The word 'application' is used in the TPEG specifications to describe specific subsets of the TPEG structure. An application defines a limited vocabulary for a certain type of messages, for example parking information or road traffic information. Each TPEG application is assigned a unique number, called the Application IDentification (AID). An AID is defined whenever a new application is developed and these are all listed in CEN ISO/TS 18234-1.

The application identification number is used within the TPEG-SNI application (ISO/TS 18234-3:2006) to indicate how to process TPEG content and facilitates the routing of information to the appropriate application decoder.

For TPEG TEC, AID has the value five (5).

## 5.2 Version number signalling

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

The version numbering principle is defined in CEN ISO/TS 18234-1.

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

|                      |   |
|----------------------|---|
| major version number | 3 |
| minor version number | 0 |

Figure 1 — Current version numbers for signalling of TEC

## 5.3 Application framing

TEC makes use of the "Service component frame with severity and message count" according to Annex A, section A.3.2.6.2.4. For explanatory purpose this is repeated here.

|                                                            |  |                                                                               |
|------------------------------------------------------------|--|-------------------------------------------------------------------------------|
| <b>&lt; ServCompFramePrioritisedCountedProtected&gt;:=</b> |  | : CRC protected service component frame with group priority and message count |
| <b>&lt;ServCompFrameHeader&gt;</b> (header),               |  | : Component frame header as defined in A.3.2.6.                               |
| <b>&lt;typ007:Priority&gt;</b> (groupPriority),            |  | : group priority applicable to all messages in the ApplicationContent         |
| <b>&lt;IntUnTi&gt;</b> (messageCount),                     |  | : count of messages in this ApplicationContent                                |
| external <b>&lt;ApplicationContent&gt;</b> (content),      |  | : actual payload of the application                                           |
| <b>&lt;CRC&gt;</b> (dataCRC);                              |  | : CRC starting with first byte after the header                               |

Within the service component frame, the ApplicationContent is defined as follows:

|                                                 |  |                                            |
|-------------------------------------------------|--|--------------------------------------------|
| <b>&lt;ApplicationContent&gt;:=</b>             |  | : application content                      |
| messageCount * <b>&lt;TECMessage&gt;</b> (msg); |  | : Any number of any TEC message components |

## 5.4 Application specific constraints

TPEG-TEC requires the use of a fixed order of components, unlike other TPEG applications. The order is shown in Figure 2; the first component is *MessageManagement*. If the message is not a cancel message then the *MessageManagement* component shall be followed by the *Event* component and this is followed by the *LocationReferencing* component.

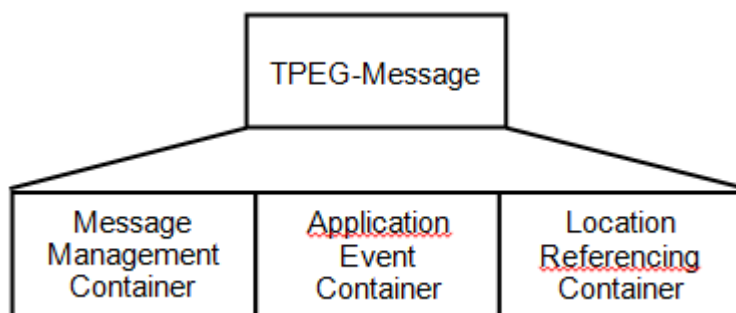


Figure 2 — Every TPEG message is constructed of three containers

Within the *Event* component one or more *Cause* components shall come first, followed by one or more *Advice* components, and so on. Components of the same type shall immediately follow each other, i.e. they shall not be spread over a TECMessage.

### Extendibility

The requirement of a fixed component order does not forbid the extension of TEC generally. In case of future extensions, new components may be inserted or existing components may be replaced by new ones without losing backward compatibility. That means, a TEC decoder must be able to detect and skip unknown components. But, it is not allowed that multiple components of the same type which belong to same upper component are spread over the message.

### Example

The *Advice* component is replaced by *BetterAdvice* having an own component id. A *WeatherSituation* component is inserted after *Advice* component.

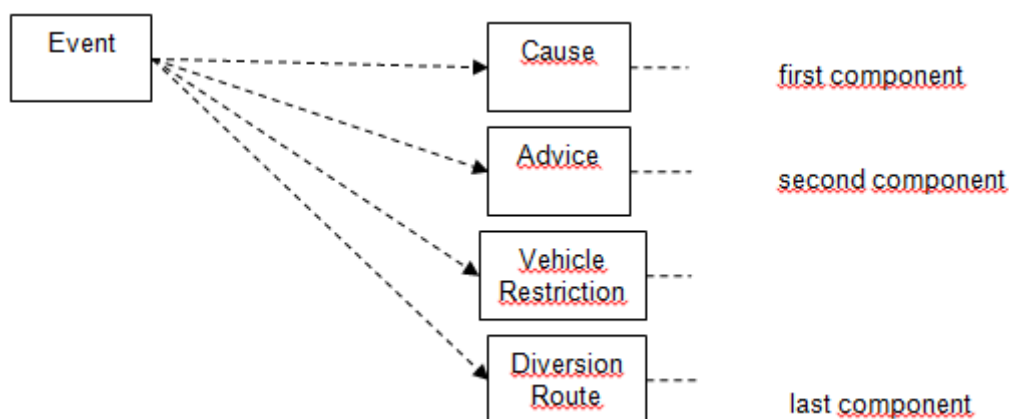


Figure 3 — Example for extension; original component model

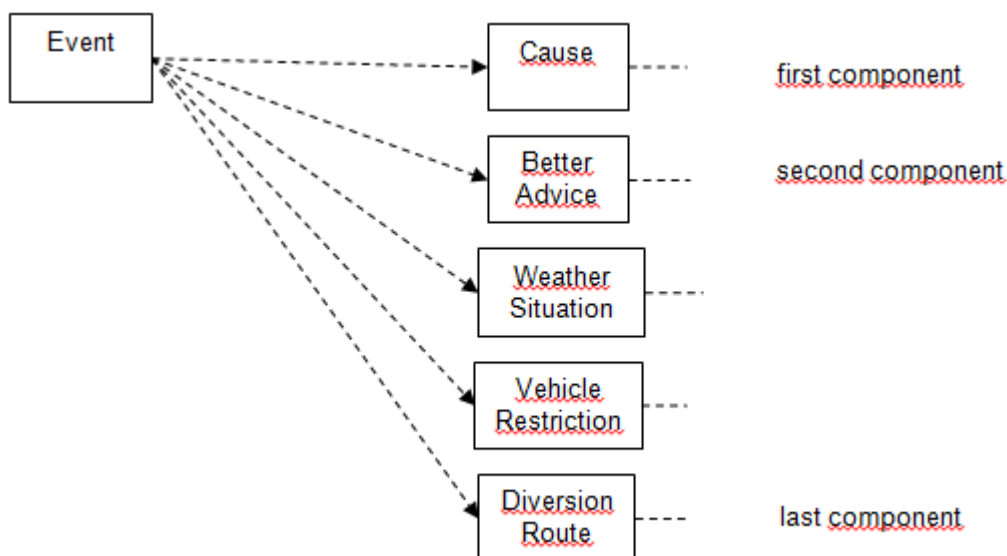


**Figure 4 — Example for extension; *Advice* replaced by *BetterAdvice* and *WeatherSituation* added**

In any case multiple components of the same type which belong to same upper component shall not be spread over the message.

Example (not allowed)

An *Event* component has two *Cause* components. The first one is followed by an *Advice* component and the last one related to the same *Event* component is a *Cause* component again. This is forbidden.

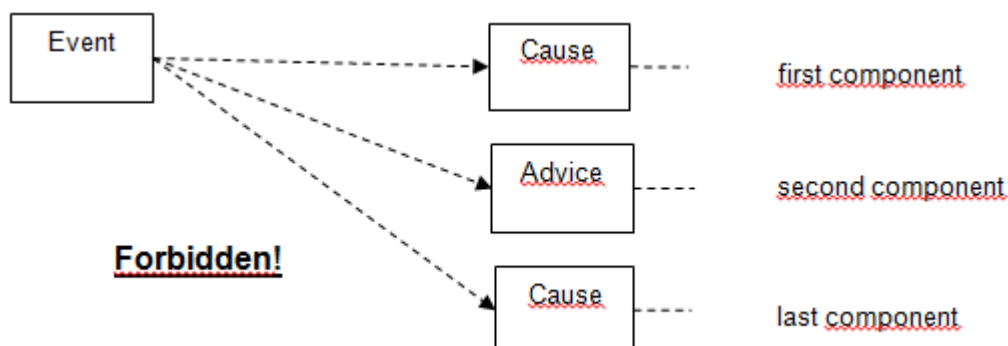


**Figure 5 — Forbidden ordering of same components**

Note: If general TPEG Toolkit definitions (e.g. ISO 18234 Part 2) deviate from the definition in this Part, the definition given herein takes precedence.

## 6 Message components

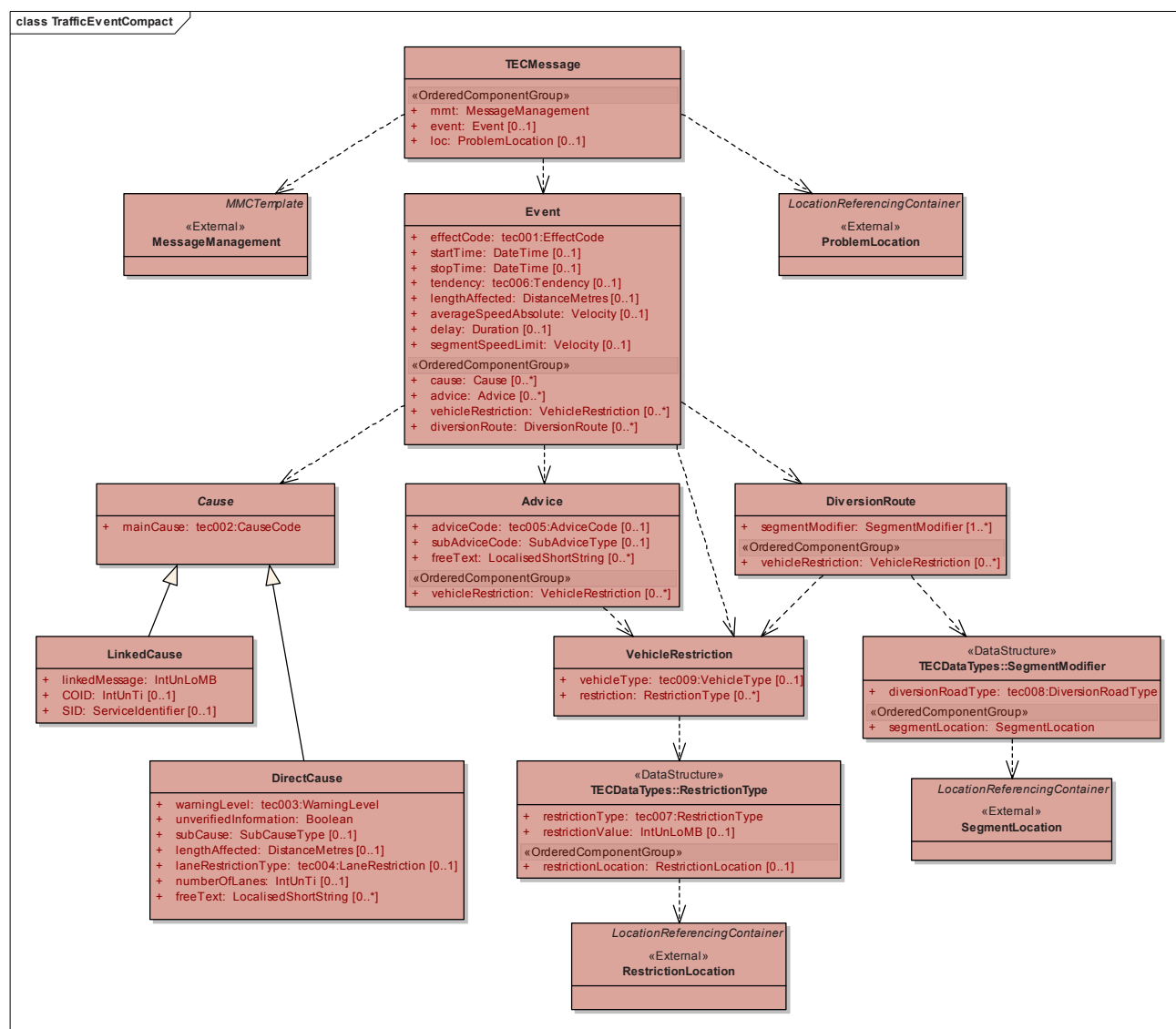


Figure 6 — UML Model of TPEG-TEC

## 6.1 List of 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 |

## 6.2 TECMessage

A TPEG-TEC Message may include:

- 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 container are optional.

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

|                                                       |                                                     |
|-------------------------------------------------------|-----------------------------------------------------|
| <b>&lt;TECMessage&lt;Component(0)&gt;&gt;:=</b>       | :Traffic Event Compact Message Component            |
| <b>&lt;IntUnTi&gt;(0),</b>                            | : id is unique within the scope of the application. |
| <b>&lt;IntUnLoMB&gt;(compLengthInByte),</b>           | : length of the component counted in bytes.         |
| <b>&lt;IntUnLoMB&gt;(attributeBlockLengthInByte);</b> | : length of the attribute block in bytes.           |
| <b>&lt;MessageManagement&gt;(mmt),</b>                | : {mandatory} Message management container          |
| <b>m * &lt;Event&gt;(event)[0..1],</b>                | : {optional} Event data                             |
| <b>m * &lt;LocationContainer&gt;(loc)[0..1];</b>      | : {optional} Location data                          |

### 6.2.1 MessageManagement

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

|                                                        |                           |
|--------------------------------------------------------|---------------------------|
| <b>&lt;MessageManagement(1)&gt;:=</b>                  | : Message management data |
| external <b>&lt;MessageManagementContainer(1)&gt;;</b> | : see MMC specification   |

Message Generation Systems shall ensure that the information given in the MMC allows unambiguous interpretation over the whole time a message is valid. It is particularly important to recognise 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. Multipart message management must not be used.

## 6.2.2 Instances of Location Containers

The ProblemLocation, RestrictionLocation and SegmentLocation component are instances of the Location Referencing Container (LRC) as specified in ISO/TS 18234-11. It assigns the traffic event compact (TEC) application specific local component ID for the LRC. The different places of the LRC components define different ids to enable *separated evolution over time* of these components in the specification. All component IDs within the LRC are local to the LRC toolkit.

|                                                                         |                                                                                                                              |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>&lt;ProblemLocation&lt;LocationReferencingContainer(2)&gt;&gt;:=</b> | : the information given by the TEC elements (e.g. effect, cause , advice) are related to this ProblemLocation; LRC container |
| External <b>&lt;LocationReferencingContainer(2)&gt;;</b>                | : see LRC specification                                                                                                      |

|                                                                                 |                                                                                              |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>&lt;RestrictionLocation \ \&lt;LocationReferencingContainer(9)&gt;&gt;:=</b> | : RestrictionLocation is used by Advice component or DiversionRoute component; LRC container |
| external <b>&lt;LocationReferencingContainer(9)&gt;;</b>                        | : see LRC specification                                                                      |

|                                                                              |                                                                     |
|------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>&lt;SegmentLocation \ \&lt;LocationReferencingContainer(10)&gt;&gt;:=</b> | : SegmentLocation is used by DiversionRoute component LRC container |
| external <b>&lt;LocationReferencingContainer(10)&gt;;</b>                    | : see LRC specification                                             |

## 6.2.3 Event

The Event component with its subordinated component Cause describes in general the impact on the traffic flow and the related cause.

For example: 'Stationary Traffic, (due to) Narrow Lanes

### Rules

— For a single event it should be possible to distinguish between the effect that describes an acute 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 determined by the attribute effectCode. Furthermore the sub-component Cause can be used to inform or warn the driver for a special situation (e.g. oil on the road). The following combinations are possible:

- 1) a message contains only the Event component with its attribute effectCode that describes the impairment of the traffic flow directly;
- 2) the previous described element Event is expanded by one or more sub-components Cause. If a specific traffic flow is not available or shall not be given, the effectCode must set to 'unknown'.

- A (real) cause can be represented in the message by either a 'DirectCause' or a 'LinkedCause', but not both.
- Causes and subCauses- CauseCodes can be further specified by subCauseCodes. Each cause having more than one assigned subCause has an own subCause list numbered tec1xx where 'xx' is the code from tec002. Simple terminals must support at least all causes, terminals with more memory might support subCauses. In the latter case sub-causes should replace the (Main)cause completely. With other words: it is not necessary to combine causes and subCause to a meaningful grammar.
- Advices and subAdvices - The principle for Causes and subCauses are also used for Advice, with the exception that the subAdvice tables are numbered tec2xx.
- The component VehicleRestriction can be used to set a filter for different vehicles.
- Table tec001 and tec002 including all subCauseTables (tec1xx) are mainly taken from TMC-Event list (refer to ISO/TS 14819-2:2003).

### **startTime and stopTime**

Describe the beginning and the end of a traffic event. The terminal should use these values to calculate the validity of the event. This validity can be guaranteed by the provider only if the transmission channel is reliable, i.e. the messages expiry time does not elapse. If the message expiry time elapses, the validity can not be guaranteed and it is recommended to ignore the message. Finally, the use of the message is up to the device.

### **LengthAffected and Length in ProblemLocation (LocationReferencingContainer)**

The Length in the location referencing container ProblemLocation, called ProblemLength, describes the overall length of the event.

If LengthAffected is not defined within the Event component or any Cause of the Event Container, the Length of ProblemLocation has to be taken.

If the LengthAffected is given by an Event or Cause component it has to be taken only for the specific component.

In any case, the LengthAffected must not be greater than the ProblemLength.

If, in case of TMC location coding, neither LengthAffected nor ProblemLength is given, the total length between Primary and Secondary Location has to be taken.

The reference point for the EffectCode and all Causes is defined by the ProblemLocation. If *DLR1LocationReference* or *TMCLocationReference* method is used, the reference point is defined as follows:

- the Start Location, in case of TMCLocationReference precise location referencing (refer to ISO/TS 14819-3:2004),
- the Secondary Location, in case of TMCLocationReference without precise location referencing (refer to ISO/TS 14819-3:2004), or
- the first location point, in case of DLR1LocationReference (refer to ISO 17572-3).

Some examples are shown in section "LinkedCause". Other location referencing methods may also be used even if they are not described here.

## Rounding of speed information

Speed information is always given in metres per seconds (m/s) since the general TPEG data type 'Velocity' is used. Depending on customer requirements the terminal has to convert and round these values.

### EXAMPLE

| m/s | km/h<br>(exact) | km/h<br>(rounded, steps<br>of 5) | mph<br>(exact) | mph<br>(rounded, steps<br>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              | 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              | 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 formulae are used to calculate the values listed above in the table:

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

—  $\text{ROUND}((v \cdot 3,6)/5) \cdot 5$

For steps of 5 mph (0, 5, 10, 15, 20, ...)

—  $\text{ROUND}((v \cdot 3,6)/1,604)/5 \cdot 5$

'ROUND' in this case is a typical mathematical function to round values without fractional digits.

The Event component is coded as follows:

|                                               |                                                                                                                                                                            |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&lt;Event&lt;Component(3)&gt;&gt;:=</b>    |                                                                                                                                                                            |
| <b>&lt;IntUnTi&gt;(3),</b>                    | : Identifier = 3                                                                                                                                                           |
| <b>&lt;IntUnLoMB&gt;(lengthComp),</b>         | : Length of component in bytes, excluding the id and length indicator                                                                                                      |
| <b>&lt;IntUnLoMB&gt;(lengthAttr),</b>         | : Length of attributes of this component in bytes                                                                                                                          |
| <b>&lt;tec001:EffectCode&gt;(effectCode),</b> | : Describes the impairment of the traffic flow                                                                                                                             |
| <b>&lt;BitArray&gt;(selector),</b>            | : 1 byte containing 7 switches.                                                                                                                                            |
| If (bit 0 of selector is set)                 |                                                                                                                                                                            |
| <b>&lt;DateTime&gt;(startTime),</b>           | : Date and time at which an event began or is scheduled to begin (used for presentation to the end-user). If startTime is missing first time of reception is used instead. |

|                                                 |                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| If (bit 1 of selector is set)                   |                                                                                                                                                                                                                                                                                                                     |
| <b>&lt;DateTime&gt;</b> (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 stopTime is missing stopTime is set to startTime plus default duration, which is defined per main cause. In case of multiple causes the highest default duration shall be taken. |
| If (bit 2 of selector is set)                   |                                                                                                                                                                                                                                                                                                                     |
| <b>&lt;tec006:Tendency&gt;</b> (tendency),      | : Tendency is related to traffic flow. It is not a forecast. compared with TMC it is not related to the jam length.                                                                                                                                                                                                 |
| If (bit 3 of selector is set)                   |                                                                                                                                                                                                                                                                                                                     |
| <b>&lt;DistanceMetres&gt;</b> (lengthAffected), | : Length of the event in metres.                                                                                                                                                                                                                                                                                    |
| If (bit 4 of selector is set)                   |                                                                                                                                                                                                                                                                                                                     |
| <b>&lt;Velocity&gt;</b> (averageSpeedAbsolute), | : Average speed in m/s at the given location. It is recommended to use this value for calculation of the route and the referring arrival time.                                                                                                                                                                      |
| If (bit 5 of selector is set)                   |                                                                                                                                                                                                                                                                                                                     |
| <b>&lt;IntUnLoMB&gt;</b> (delay),               | : Delay in minutes. Only applicable to point locations, i.e. at border.                                                                                                                                                                                                                                             |
| If (bit 6 of selector is set):                  |                                                                                                                                                                                                                                                                                                                     |
| <b>&lt;Velocity&gt;</b> (segmentSpeedLimit),    | : Maximum speed in m/s. Shall be used as administrativ speed limit for re-routing, but not to display or warn the driver because quality cannot be guaranteed.                                                                                                                                                      |
| m * <b>&lt;Cause&gt;</b> [0..*],                | : A Cause might be only represented by instances of Cause, either as LinkedCause or as DirectCause. Within a single message, the same cause code shall not be used for linked and direct causes.<br>Multiplicity of Cause is then 0...infinity                                                                      |
| m * <b>&lt;Advice&gt;</b> [0..*],               | : m represents the number of occurrences, between 0 and infinity.                                                                                                                                                                                                                                                   |
| m * <b>&lt;VehicleRestriction&gt;</b> [0..*],   | : m represents the number of occurrences, between 0 and infinity.                                                                                                                                                                                                                                                   |
| m * <b>&lt;DiversionRoute&gt;</b> [0..*];       | : m represents the number of occurrences, between 0 and infinity.                                                                                                                                                                                                                                                   |

### 6.2.3.1 Cause

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

|                                               |                                                                       |
|-----------------------------------------------|-----------------------------------------------------------------------|
| <b>&lt;Cause(x)&lt;Component(x)&gt;&gt;:=</b> | : Template for causes                                                 |
| <b>&lt;IntUnTi&gt;(id),</b>                   |                                                                       |
| <b>&lt;IntUnLoMB&gt;(lengthComp),</b>         | : Length of component in bytes, excluding the id and length indicator |
| <b>&lt;IntUnLoMB&gt;(lengthAttr),</b>         | : Length of attributes of this component in bytes                     |
| <b>&lt;tec002:CauseCode&gt;(mainCause);</b>   | : Main categorization of the cause according to table tec002          |

### 6.2.3.2 DirectCause

The component DirectCause can be used to describe the reason for traffic congestion in general. The main reason for the separation of causes and the effect is that the real traffic situation can be described in meaningful way to the driver.

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

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&lt;DirectCause&lt;Cause(4)&gt;&gt;:=</b>      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>&lt;IntUnTi&gt;(4),</b>                        | : Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>&lt;IntUnLoMB&gt;(lengthComp),</b>             | : Length of component in bytes, excluding the id and length indicator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>&lt;IntUnLoMB&gt;(lengthAttr),</b>             | : Length of attributes of this component in bytes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>&lt;tec002:CauseCode&gt;(mainCause),</b>       | : Main categorization of the cause according to table tec002                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>&lt;tec003:WarningLevel&gt;(warningLevel),</b> | : The level informative should be used for all traffic events, which may influence the drivers' route in any way and might require normal attention from the driver. The danger levels 1 to 3 should only be used for really dangerous situations, e.g. ghost-driver. The 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" that there is a "ghost-driver", but the event is still not confirmed by the police. |
| <b>&lt;BitArray&gt;(selector),</b>                | : 1 byte containing 6 switches.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| If (bit 0 of selector is set)                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>&lt;Boolean&gt;(unverifiedInformation),</b>    | : If element is set to 1 the given information has not been verified.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| If (bit 1 of selector is set)                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>&lt;SubCauseType&gt;(subCause),</b>            | : Carries the value in the sub cause table defined by the mainCauseCode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| If (bit 2 of selector is set)                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>&lt;DistanceMetres&gt;(lengthAffected),</b>    | : Length of the event in metres.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| If (bit 3 of selector is set)                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|                                                                                                              |                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>&lt;tec004:LaneRestriction&gt;</b> (laneRestrictionType), : Specifies whether lanes are closed or opened. |                                                                                                                      |
| If (bit 4 of selector is set)                                                                                |                                                                                                                      |
| <b>&lt;IntUnTi&gt;</b> (numberOfLanes),                                                                      | : Specifies how many lanes are closed or opened. If this element is not given, the plural form shall always be used. |
| If (bit 5 of selector is set){                                                                               |                                                                                                                      |
| <b>&lt;IntUnLoMB&gt;</b> (n),                                                                                | : Number of entries in array attribute, between 0 and infinity.                                                      |
| n * <b>&lt;LocalisedShortString&gt;</b> (freeText)                                                           |                                                                                                                      |
| };                                                                                                           |                                                                                                                      |

### 6.2.3.3 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 ServiceID, 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, SID. The ApplicationID points always to the TEC Application and is therefore not explicit given in this component.

There are two variants to encode so called 'linked events' where an effect and one or more cause(s) belong together.

- One method is to combine both the effect and the cause by encoding in only one message. This is called a 'DirectCause' and is to be used in situations where no detailed information is given, e.g. about the location or the length of the linked cause.
- The other method is called 'LinkedCause' and it must be used in cases where detailed information are explicitly given. For example: The location of the cause differ from that of the effect and additional speed information is available. Then, complete description of the traffic situation is spread over two or more messages.

#### Alternative

- The cause and effect occur on the same location (more precisely the most downstream location, refer to example 1 below). In this case the cause will be a DirectCause and described in the same message.
- The causes and effect do not share the same location. For this situation two messages will be created: one message describing the effect, and one describing the cause, with unknown traffic flow effect. The effect message will use the "cause" message's ID to signal its "LinkedCause".

#### Rules

Effect and cause(s) must 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 most downstream location (in TMC it is the primary location) of effect and cause is different;
- the same situation requires two traffic flow effects, e.g. different speed limits for cars and lorries.

Further constraints:

- One real cause may either be represented as a linked or as a direct cause. It is not allowed to describe one situation using a direct and a linked cause at the same time.
- If a 'linked cause' is used, it is not allowed to reset causes which have been set in the preceding messages belonging to the same traffic situation.

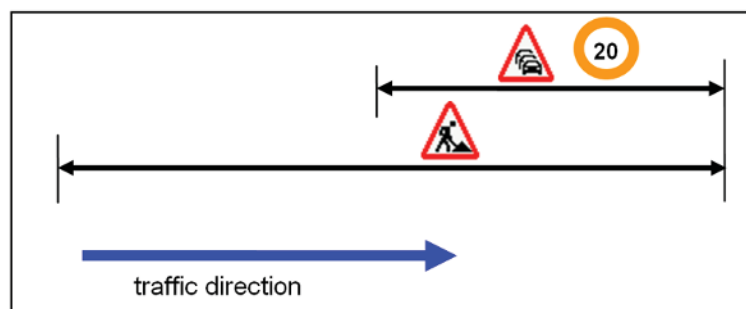


Figure 7 — Example 1 for a traffic situation, which can be coded by use of a DirectCause

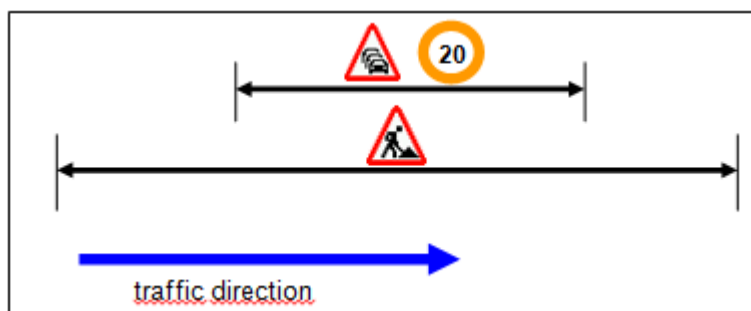


Figure 8 — Example 2 for a traffic situation, where a LinkedCause is necessary

Coding schemes for the given examples (simplified)

#### EXAMPLE 1

|                    |                     |                      |
|--------------------|---------------------|----------------------|
| trafficflow_effect | effect_code         | "stationary traffic" |
|                    | length_affected (m) | 5000                 |
|                    | Road_performance    | average_speed_abs=20 |
| direct_cause       | cause_code          | "roadworks"          |
|                    | length_affected (m) | 10000                |
|                    | severity            | Informative          |

## EXAMPLE 2

First message:

|                    |                     |                               |
|--------------------|---------------------|-------------------------------|
| trafficflow_effect | effect_code         | "stationary traffic"          |
|                    | length_affected (m) | 5000                          |
|                    | Road_performance    | average_speed_abs=20          |
| direct_cause       | cause_code          | "accident"                    |
|                    | severity            | Informative                   |
| linked_cause       | cause_code          | "roadworks"                   |
|                    | linked_message      | ID of 2 <sup>nd</sup> message |

NOTE Direct cause 'accident' is added above; in order to point out that a message may consist of direct\_cause(s) and linked\_cause(s).

Second message:

|                    |                     |                        |
|--------------------|---------------------|------------------------|
| trafficflow_effect | effect_code         | "traffic flow unknown" |
|                    | length_affected (m) | 10000                  |
|                    | Road_performance    | segment_speed=60       |
| direct_cause       | cause_code          | "roadworks"            |
|                    | length_affected (m) | 10000                  |
|                    | severity            | Informative            |

NOTE Additional information 'segment\_speed' is not shown in the figure above.

|                                              |                                                                                                                                                               |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&lt;LinkedCause&lt;Cause(5)&gt;&gt;:=</b> |                                                                                                                                                               |
| <b>&lt;IntUnTi&gt;(5),</b>                   | : Identifier                                                                                                                                                  |
| <b>&lt;IntUnLoMB&gt;(lengthComp),</b>        | : Length of component in bytes, excluding the id and length indicator                                                                                         |
| <b>&lt;IntUnLoMB&gt;(lengthAttr),</b>        | : Length of attributes of this component in bytes                                                                                                             |
| <b>&lt;tec002:CauseCode&gt;(mainCause),</b>  | : Main categorization of the cause according to table tec002                                                                                                  |
| <b>&lt;IntUnLoMB&gt;(linkedMessage),</b>     | : Contains a messageID as pointer to a message. If COID and SID is not given, the linked message is contained in the component stream of the current service. |
| <b>&lt;BitArray&gt;(selector),</b>           | : 1 byte containing 2 switches.                                                                                                                               |

|                                         |                                                                                                                              |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| If (bit 0 of selector is set)           |                                                                                                                              |
| <b>&lt;IntUnTi&gt;</b> (COLD),          | : In case of absence, the linked message can be found in the component stream that has the same COLD as the linking message. |
| If (bit 1 of selector is set)           |                                                                                                                              |
| <b>&lt;ServiceIdentifier&gt;</b> (SID); | : In case of absence, the linked message can be found in the same service as the linking message is in.                      |

#### 6.2.3.4 Advice

The advice contains recommendations or prohibitions for the driver either spoken or in computed form e.g. diversion routes.

|                                                    |                                                                       |
|----------------------------------------------------|-----------------------------------------------------------------------|
| <b>&lt;Advice&lt;Component(6)&gt;&gt;:=</b>        |                                                                       |
| <b>&lt;IntUnTi&gt;</b> (6),                        | : Identifier                                                          |
| <b>&lt;IntUnLoMB&gt;</b> (lengthComp),             | : Length of component in bytes, excluding the id and length indicator |
| <b>&lt;IntUnLoMB&gt;</b> (lengthAttr),             | : Length of attributes of this component in bytes                     |
| <b>&lt;BitArray&gt;</b> (selector),                | : 1 byte containing 2 switches.                                       |
| If (bit 0 of selector is set)                      |                                                                       |
| <b>&lt;tec005:AdviceCode&gt;</b> (adviceCode),     |                                                                       |
| If (bit 1 of selector is set)                      |                                                                       |
| <b>&lt;SubAdviceType&gt;</b> (subAdviceCode),      |                                                                       |
| If (bit 2 of selector is set) {                    |                                                                       |
| <b>&lt;IntUnLoMB&gt;</b> (n),                      | : Number of entries in array attribute, between 0 and infinity.       |
| n * <b>&lt;LocalisedShortString&gt;</b> (freeText) |                                                                       |
| }                                                  |                                                                       |
| m * <b>&lt;VehicleRestriction&gt;</b> [0..*];      | : m represents the number of occurrences, between zero and infinity.  |

##### 6.2.3.4.1 VehicleRestriction

The given element containing the restriction is restricted to a special vehicle type, e.g. only for trucks. In case that vehicleType is not present the subsequent RestrictionType shall be applied to all types of vehicles.

|                                                         |                                                                       |
|---------------------------------------------------------|-----------------------------------------------------------------------|
| <b>&lt;VehicleRestriction&lt;Component(7)&gt;&gt;:=</b> |                                                                       |
| <b>&lt;IntUnTi&gt;</b> (7),                             | : Identifier                                                          |
| <b>&lt;IntUnLoMB&gt;</b> (lengthComp),                  | : Length of component in bytes, excluding the id and length indicator |

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&lt;IntUnLoMB&gt;</b> (lengthAttr),           | : Length of attributes of this component in bytes                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>&lt;BitArray&gt;</b> (selector),              | : 1 byte containing 2 switches.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| If (bit 0 of selector is set)                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>&lt;tec009:VehicleType&gt;</b> (vehicleType), |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| If (bit 1 of selector is set) {                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>&lt;IntUnLoMB&gt;</b> (n),                    | : Number of entries in array attribute, between 0 and infinity.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| N * <b>&lt;RestrictionType&gt;</b> (restriction) | : The VehicleRestriction (even if meaning “all cars”) can be specified further by additional attributes, e.g.: weight in kilograms or height or the given destination with the help of Restriction.<br><br>For example:<br>“NoWintertyre” means vehicles without winter tyre<br>“width greater 300” means that the event or the closure affects only vehicles with a width greater than 3 metres.<br>“with destination in a given area” means destination filter is selected and the area is attached to this restriction. |
| };                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

### 6.2.3.5 DiversionRoute

Diversion route specifies one or more diversions valid in case that the location of the message is touched by the undisturbed route.

#### 6.2.3.5.1 Description of Creating and Applying Diversions

A recommendation in conjunction to a traffic problem in its easiest form consists of just an advice like “avoid area” or “follow signposted diversion”. In addition to that with the DiversionRoute-Component a message can express explicit diversions to the given traffic problem. The possibilities of expression of diversion information in TEC are far more than earlier TMC messages did allow.

TEC defines diversions as being several segments having different values of time delays against normal road going from “closed road” to “bypass”. This causes parts of the diversion influencing more the routing than other in either reduction or increasing the costs of a segment.

In addition to that it might also be useful to distinguish between different categories of the traffic being targeted by a diversion. This allows e.g. to define different detours for lorries as for cars. The different attributes for differentiation are vehicle type and further restriction types to those vehicles, same as the destination chosen by individual vehicles. The destination is already today in use. Diversions are suggested differently for both road sides for example. This causes expressing to different diversions one e.g. for “northern” and one for “southern” (more precise definition follows).

Another use case for diversions is not only to suggest the route to be taken but also to discourage segments because of given circumstances. For example: A road element is blocked due to road works. The road elements before and behind the blockage may only be used by local traffic, which lets a navigation system plan a route by avoiding the parts of the road network also.

The typical way for such diversions would be that a traffic center or service provider defines all necessary diversion information as one strategy being used for this specific traffic problem. Because it is relying on the existing road network, a strategy might be used more than once for this particular place.

In general, the diversion is a multi layer route cost influence for the given parts of the road network (segments). A segment defines one of the following attributes for this purpose:

- traffic problem segments;
- accesses to a possible bypass segments;
- bypass segments;
- not recommended segments.

All segments are in relation to each other; i.e. a vehicle not influenced by the traffic problem shall not be influenced by the bypass delivered, because than too many vehicles would route through the diversion unnecessarily.

#### 6.2.3.5.2 Procedure for Coding a Diversion Strategy

A diversion shall in all cases be provided together with a problem location. If a diversion was provided without a problem location, other vehicles within that area might needlessly be routed to the diversion. This phenomenon is called the “suck effect” and is undesirable because the diversion may become overloaded.

To prevent suck effects the diversions in a vehicle should only be taken into account if all of the following triggers do apply for the actual situation:

- 1) the actual route calculated does include at least one part of the given problem location;
- 2) the filter criteria matches to the conditions of the vehicle.

Another suck effect is caused by a fact that a diversion normally consists of a bypass being in a given distance to the problem location. To guide the traffic from the original route to the bypass mostly some additional streets are concatenated to that part of the bypass being in real parallel to the problem location. These parts of the diversion are called access roads. Access roads should only be taken into account from vehicles following the diversion from the original route. Vehicles being somewhere else, approaching the problem locations road should not take the access roads into account with the same weight but the bypass.

A service provider's possibility shall be given to be able to code all of the following statements:

- dead end at road works, free for local access only;
- street not recommended because of limited capacity prefer different possibilities if available;
- for a given problem location take this bypass as replacement;
- for a given problem location take this access roads to reach and leave the bypass;
- this road should not be taken into account for routing, unless the destination is not reachable with other ways.

With coding these values no routing cost value and no time delay is given but the relative relation to each other. Because the road network and the routing function are expected to be different in all vehicles, no default value would produce a consistent behavior in a vehicles receiver system. Instead of that, the expected behavior visible to the user is described in addition to the relative route calculation value.

- for 1.) LA = Limited Access: 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

- for 2.) NR = Not Recommended: The segment should be avoided if a second alternative is close to it. Service provider's intent is to reduce traffic volume due to reduced capacity of that segment.  
-> Routing costs for that segment should be raised by a factor greater than one
- for 3.) BP = Bypass: The segment is the part of the road network being in parallel to the problem location. In case that original route uses the problem location, this segment shall be taken into account as subsidiary in such way that also better, local alternatives are not chosen.  
-> Routing costs for that segment should be reduced by a factor much smaller than one.
- for 4.) AR = Access Road: This segment is part of the access to or away from the bypass. It is conditional to the vehicles position if it would be useful to take this segment into account.  
-> Routing costs for that segment should be reduced by a factor smaller than one.
- for 5.) CR = Closed Road: The segment should not be taken into account 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.

#### EXAMPLE 1

Figure 9 shows a combination of diversion segments explained above, causing that a vehicle at position S would chose the closed line route instead of the upper dashed line route as detour.

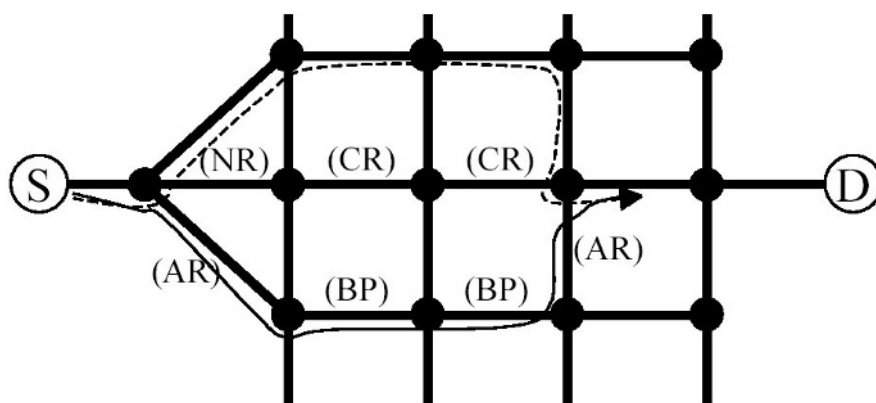


Figure 9 — Example for a simple diversion strategy

As shown in the UML Model (Figure 5) an event can carry a list of DiversionRoute elements which need not to be connected parts of the road network. Each of them can be further discriminated with filtering information in VehicleRestriction and consist of a list of at least one SegmentModifier. The given DiversionRoute-element should only be taken into account for routing if either no filter is given or at least one VehicleRestriction-element completely describes true statements for the vehicles condition.

#### EXAMPLE 2

A VehicleRestriction element consisting of a destination filter describing the urban area of a given town should only be taken into account for vehicles having a destination in the urban area of that town. Through traffic should not use this DiversionRoute; the service provider has prepared another diversion route for vehicles having a destination outside the urban area.

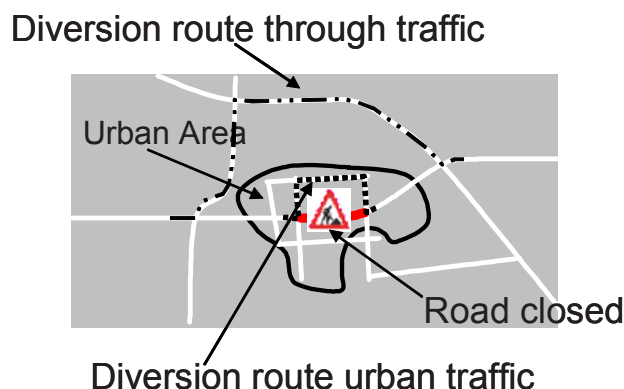


Figure 10 — Example for a simple diversion strategy

The DiversionRoute component is coded as follows:

```
<DiversionRoute<Component(8)>>:=
<IntUnTi>(8),                               : Identifier
<IntUnLoMB>(lengthComp),                     : Length of component in bytes, excluding the id and
                                              length indicator
<IntUnLoMB>(lengthAttr),                     : Length of attributes of this component in bytes
<IntUnLoMB>(n),                             : Number of entries in array attribute, between 1 and
                                              infinity.
N * <SegmentModifier>(segmentModifier)[1..*],
m * <VehicleRestriction>[0..*];              : m represents the number of occurrences, between 0
                                              and infinity.
```

## 7 Datatypes

### 7.1 RestrictionType

```
<RestrictionType>:=
<tec007:RestrictionType>(restrictionType),
<BitArray>(selector),                       : 1 byte containing 2 switches.
If (bit 0 of selector is set)
    <IntUnLoMB>(restrictionValue),
If (bit 1 of selector is set)
    <RestrictionLocation>(restrictionLocation); : see Section 6.2.2
```

## 7.2 SegmentModifier

|                                                                                                                                      |                     |
|--------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>&lt;SegmentModifier&gt;:=</b><br><b>&lt;tec008:DiversionRoadType&gt;</b> (diversionRoadType),<br><b>&lt;SegmentLocation&gt;</b> ; | : see Section 6.2.2 |
|--------------------------------------------------------------------------------------------------------------------------------------|---------------------|

## 7.3 TEC Tables

### 7.3.1 tec001:EffectCode

Describes the effect to the traffic flow.

| Code | CEN English 'Word'   | Comment                                                                                    | Example                                                                                                                                                                    |
|------|----------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 001  | traffic flow unknown | Must be used if traffic flow is unknown. This is often the case for local hazard warnings. |                                                                                                                                                                            |
| 002  | free traffic flow    | The traffic is not disturbed.                                                              |                                                                                                                                                                            |
| 003  | heavy traffic        | Heavy traffic causes problems in the traffic flow.                                         |                                                                                                                                                                            |
| 004  | slow traffic         | The traffic is moving slower than normal.                                                  |                                                                                                                                                                            |
| 005  | queuing traffic      | The traffic is in queues but still slowly floating.                                        |                                                                                                                                                                            |
| 006  | stationary traffic   | The traffic is jammed.                                                                     |                                                                                                                                                                            |
| 007  | no traffic flow      | The cause-component may give more information about the reason for "no traffic flow".      | <ul style="list-style-type: none"> <li>- The road has been closed by police as a "regulatory measure" or</li> <li>- The road is blocked by a temporary incident</li> </ul> |

### 7.3.2 tec002:CauseCode

Defines various reasons why this message was sent out.

NOTE "Undecodable cause" is to be used by client device unable to read the code provided by a service provider – no code value is transmitted.

| Code | CEN English        | Comment                                                                                | Example |
|------|--------------------|----------------------------------------------------------------------------------------|---------|
| 001  | traffic congestion | In case that the capacity limitation of the street is causing the message.             |         |
| 002  | accident           | In case of an accident                                                                 |         |
| 003  | roadworks          | In case that road works are the reason.                                                |         |
| 004  | narrow lanes       | In case of lanes being smaller as typical for the given country.                       |         |
| 005  | impassibility      | In case that in general the given part of a road is impassable. Traffic_flow_effect is |         |

| Code | CEN English                          | Comment                                                                                                                                             | Example |
|------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|      |                                      | expected to be no_traffic_flow                                                                                                                      |         |
| 006  | slippery road                        | In case that a slippery road is the reason.                                                                                                         |         |
| 007  | aquaplaning                          | In case that big areas of water are on the road surface. Deep water being hazardous conditions shall be signalled with hazardous driving condition. |         |
| 008  | fire                                 | In case that a traffic affecting fire is the reason.                                                                                                |         |
| 009  | hazardous driving conditions         | In case that natural conditions require high caution by the driver. The reason is mostly expected to appear suddenly.                               |         |
| 010  | objects on the road                  | In case that objects impede the drive. The objects would cause an accident or damage of the car.                                                    |         |
| 011  | animals on roadway                   | In case that animals are on the carriage way.                                                                                                       |         |
| 012  | people on roadway                    | In case that people are on the carriage way.                                                                                                        |         |
| 013  | broken down vehicles                 | In case that broken down car lies on the carriage way.                                                                                              |         |
| 014  | vehicle on wrong carriageway         | In case that cars are driving against the one way direction of the carriage way, also known as ghost-driver. (i.e. not parked).                     |         |
| 015  | rescue and recovery work in progress | In case that rescue and recovery work is in progress.                                                                                               |         |
| 016  | regulatory measure                   | In case that regulatory measure is the reason. (It is expected to be combined with traffic flow effect e.g. 'no_traffic_flow'.                      |         |
| 017  | extreme weather conditions           | In case that extreme weather conditions are the reason.                                                                                             |         |
| 018  | visibility reduced                   | In case the reduced visibility needs a speed adaptation.                                                                                            |         |
| 019  | precipitation                        | In case that increased precipitation is the reason. This cause is mostly combined with time delays.                                                 |         |
| 020  | reckless persons                     | In case that reckless persons are the reason.                                                                                                       |         |
| 021  | over-height warning system triggered | In case that an over-height warning system trigger is the reason for e.g. the closure.                                                              |         |
| 022  | traffic regulations changed          | In case that changed traffic regulations and therefore high risk of accident are the reason.                                                        |         |

| Code | CEN English                       | Comment                                                                                                                    | Example |
|------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------|
| 023  | major event                       | In case that a major event is the reason. More close description can be set in free text.                                  |         |
| 024  | service not operating             | In case that a transport service is not operating.                                                                         |         |
| 025  | service not useable               | In case that a service is not usable although it is operating. (e.g. overcrowded or paused)                                |         |
| 026  | slow moving vehicles              | In case that slow moving vehicles are the reason.                                                                          |         |
| 027  | dangerous end of queue            | In case that a dangerous end of queue could cause an accident.                                                             |         |
| 028  | risk of fire                      | In case that a risk of fire exists. Open fire or glow should be extinguished.                                              |         |
| 029  | time delay                        | In case that a time delay exists.                                                                                          |         |
| 030  | police checkpoint                 | In case that there is a spot for checking purposes                                                                         |         |
| 031  | malfunctioning roadside equipment | In case that a malfunctioning roadside equipment is the reason.                                                            |         |
| 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. |         |

### 7.3.3 tec003:WarningLevel

Defines different levels of danger.

| Code | CEN English 'Word' | Comment                                                              | Example                                                |
|------|--------------------|----------------------------------------------------------------------|--------------------------------------------------------|
| 001  | informative        | This level is of standard informative nature.                        |                                                        |
| 002  | danger level 1     | This level is used for acquiring attention by the driver.            | Attention, there is a dangerous obstruction due to fog |
| 003  | danger level 2     | This level is used for local hazard warnings being dangerous.        | Attention, danger due to deer                          |
| 004  | danger level 3     | This level is used for local hazard warnings being highly dangerous. | Attention, highest danger due to ghost driver          |