INTERNATIONAL STANDARD

ISO 17575-3

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Electronic fee collection — Application interface definition for autonomous systems —

Part 3: Context data

Perception du télépéage — Définition de l'interface d'application pour les systèmes autonomes —

Partie 3: Données du contexte

Reference number
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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

This edition of ISO 17575-3 cancels and replaces ISO/TS 17575-3:2011, which has been technically revised. The following changes have been made:

— conversion from a Technical Specification to an International Standard;

— amendments to reflect changes to the underlying base standards, especially ISO 14906;

— major changes regarding

  — integration of functionalities for the support of complex toll domains that consist of more than one partition from ISO/TS 17575-2:2010,

  — changes in the security scheme details,

  — introduction of protocol version identification,

  — harmonization of the identification of toll contexts amongst the parts of ISO 17575,

  — improvement of the possibility to use rounding rules,

  — enabling the use of a second alternative currency in tariffs,

  — adaptation of the charge reporting configuration to changes in ISO 17575-1:2016,

  — enabling the use of toll context partitions which may be present in one single toll context,

  — support of optional geographic data files (GDF) based description of toll liable networks (embracing such data definitions from ISO 12855:2012,

  — revised terms and definitions (Clause 3), and

  — editorial and formal corrections as well as changes to improve readability.

ISO 17575 consists of the following parts, under the general title *Electronic fee collection — Application interface definition for autonomous systems*:

— *Part 1: Charging*

— *Part 2: Communication and connection to the lower layers*

— *Part 3: Context data*

In this edition of the ISO 17575-series the contents of ISO/TS 17575-4:2011 were incorporated into ISO 17575-3:2016. ISO/TS 17575-4:2011 will be withdrawn once ISO 17575-3 has been published.

Introduction

0.1 Autonomous systems

ISO 17575 is a series of standards defining the information exchange between the Front End and the Back End in electronic fee collection (EFC) based on autonomous on-board equipment (OBE). EFC systems automatically collect charging data for the use of road infrastructure including motorway tolls, zone-based fees in urban areas, tolls for special infrastructure such as bridges and tunnels, distance-based charging, and parking fees.

Further introductory explanations of autonomous systems in EFC and, in particular, the considerations with respect to business and technical architecture that form the base for interfaces within such system and their interoperable specification are provided in ISO 17575-1:2016.

0.2 Location of the specification interface

In order to abstract from, and become independent of, these architectural implementation choices, the primary scope of ISO 17575 is the data exchange between Front End and Back End (see the corresponding vertical line in Figure 1). For every toll scheme, the Back End will send context data, i.e. a description of the toll scheme in terms of charged objects, charging rules and, if required, the tariff scheme to the Front End, and will receive usage data from the Front End.

It has to be noted also that the distribution of tasks and responsibilities between service provider and toll charger will vary individually. Depending on the local legal situation, toll chargers will require "thinner" or "thicker" data, and might or might not leave certain data processing tasks to service providers. Hence, the data definitions in ISO 17575 may be useful on several interfaces.

ISO 17575 also provides for basic media-independent communication services that may be used for communication between Front End and Back End, which might be line-based or an air-link, and can also be used for the air-link between OBE and central communication server.

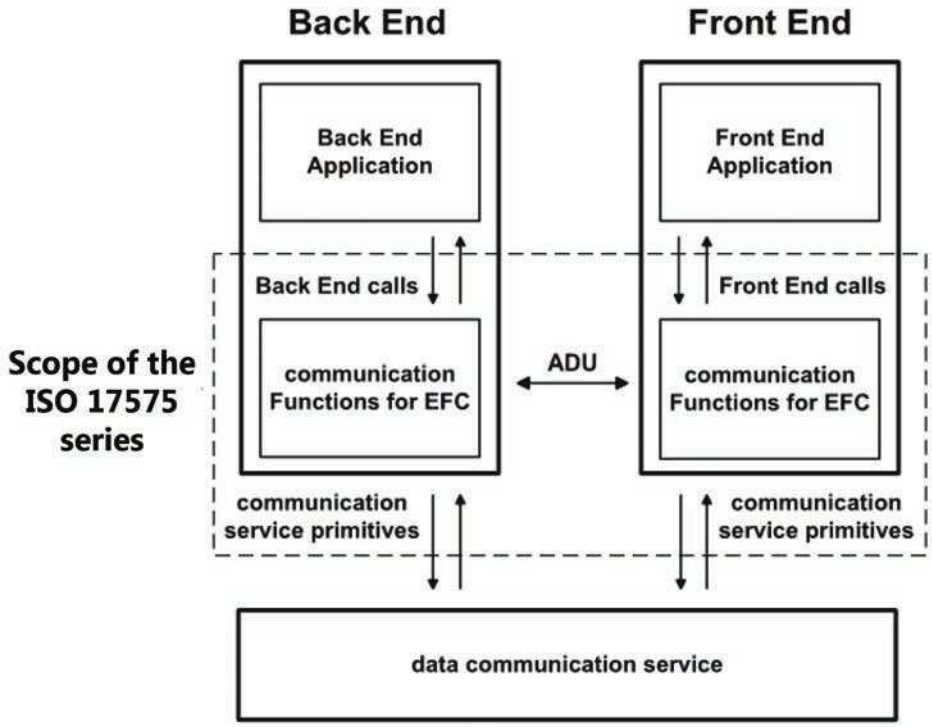


Figure 1 — Scope of ISO 17575

0.3 The parts of ISO 17575

Part 1: Charging, defines the attributes for the transfer of usage data from the Front End to the Back End. The contents of charge reports might vary between toll regimes, hence, attributes for all requirements are offered, ranging from attributes for raw localization data, for map-matched geographic objects and for completely priced toll transactions. A toll regime comprises a set of rules for charging, including the charged network, the charging principles, the liable vehicles and a definition of the required contents of the charge report.

Part 2: Communication and connection to lower layers, defines basic communication services for data transfer over the OBE air-link or between Front End and Back End. The data defined in ISO 17575-1 and ISO 17575-3 can, but need not be, exchanged using the communication stack as defined in ISO 17575-2.

Part 3: Context data, defines the data to be used for a description of individual charging systems in terms of charged geographical objects and charging and reporting rules. For every toll charger's system, attributes as defined in ISO 17575-3 are used to transfer data to the Front End in order to instruct it on which data to collect and report.

0.4 Application needs covered by ISO 17575

The ISO 17575-series of standards

- is compliant with the architecture defined in ISO 17573:2010,
- supports charges for use of road sections (including bridges, tunnels, passes, etc.), passage of cordons (entry/exit), and use of infrastructure within an area (distance, time),
- supports fee collection based on units of distance or duration, and based on occurrence of events,
- supports modulation of fees by vehicle category, road category, time of usage and contract type (e.g. exempt vehicles, special tariff vehicles, etc.),
- supports limiting of fees by a defined maximum per period of usage,
- supports fees with different legal status (e.g. public tax, private toll),
- supports differing requirements of different toll chargers, especially in terms of
  - geographic domain and context descriptions,
  - contents and frequency of charge reports,
  - feedback to the driver (e.g. green or red light), and
  - provision of additional detailed data on request, e.g. for settling of disputes,
- supports overlapping geographic toll domains,
- supports adaptations to changes in
  - tolled infrastructure,
  - tariffs, and
  - participating toll schemes, and
- supports the provision of trust guarantees by the service provider to the toll charger for the data originated from the Front End.

Electronic fee collection — Application interface definition for autonomous systems —

Part 3: Context data

1 Scope

This part of ISO 17575 defines the content, semantics and format of the data exchange between a Front End (OBE plus optional proxy) and the corresponding Back End in autonomous toll systems. It defines the data elements used to specify and describe the toll context details. Context data are transmitted from the Back End to the Front End to configure it for the charging processes of the associated toll context.

In ISO 17575, context data is the description of the properties of a single instance of an electronic fee collection (EFC) context. This single instance of an EFC context operates according to one of the basic tolling principles such as

— road section charging,

— area charging (according to travelled distance or duration of time), and

— cordon charging.

EFC context data comprise a set of rules for charging, including the description of the charged network, the charging principles, the liable vehicles and a definition of the required contents of the charge report. This set of rules is defined individually for each EFC context according to local needs.

The following data and associated procedures are defined in this part of ISO 17575:

— data providing toll context overview information;

— data providing tariff information (including definitions of required tariff determinants such as vehicle parameters, time classe, etc.);

— data providing context layout information;

— data providing reporting rules information.

This part of ISO 17575 also provides the required definitions and data specifications to be applied when one single toll context is spilt inot more than one toll context partitions. This is applicable to cases where one EFC scheme and the rules applied cannot be described with a single set of context data.

Annex A provides the data type specification using ASN.1 notation.

The protocol implementation conformity statements (PICS) proforma are provided in Annex B.

Annex C provides a graphical presentation of the structure of the toll context data.

Annexes D, E and F contain further information and descriptions, which may support the understanding and the implementation of the rules specified in this part of ISO 17575.

Annex G provides information how this part of ISO 17575 can be used in a European Electronic Toll Service (EETS) environment, with reference to EU Decision 2009/750.

2 Normative references

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

ISO 612, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions*

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 4217, *Codes for the representation of currencies and funds*

ISO/IEC 8824-1:2008, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation — Part 1*

ISO/IEC 8825-2:2008, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER) — Part 2*

ISO 12813:2015, *Electronic fee collection — Compliance check communication for autonomous systems*

ISO 14906:2011/Amd1:2015, *Electronic fee collection — Application interface definition for dedicated short-range communication*

ISO 17575-1:2016, *Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging*

EN 15509:2014, *Electronic fee collection — Interoperability application profile for DSRC*

NIMA TR8350.2, Third Edition — Amendment 1, January 2000, Department of Defense — *World Geodetic System 1984, Its Definition and Relationships With Local Geodetic Systems, issued by National Imagery and Mapping Agency (NIMA)*, US Department of Defense

3 Terms and definitions

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

3.1
area charging
charging based on road usage within a given area

[SOURCE: ISO 17575-1:2016, 3.1]

3.2
attribute
addressable package of data consisting of a single data element or structured sequences of data elements

[SOURCE: ISO 17575-1:2016, 3.2]

3.3
authenticator
data, possibly encrypted, that is used for authentication

[SOURCE: EN 15509:2014, 3.3]

3.4
Back End
part of a back office system interfacing to one or more *Front Ends* (3.11)

[SOURCE: ISO 17575-1:2016, 3.4]

3.5
charge object
geographic or road related object for the use of which a charge is applied

[SOURCE: ISO 17575-1:2016, 3.5]

3.6
charge report
information containing road usage and related information originated at the *Front End* (3.11)

[SOURCE: ISO 17575-1:2016, 3.6]

3.7
cordon
border line of an area

[SOURCE: ISO 17575-1:2016, 3.7]

3.8
cordon charging
charging for the crossing of a *cordon* (3.7)

[SOURCE: ISO 17575-1:2016, 3.8]

3.9
data element
coded information, which might itself consist of lower level information structures

[SOURCE: ISO 17575-1:2016, 3.9]

3.10
data set
logical set of *data elements* (3.9) with a semantic relation

Note 1 to entry: Data set is used only for better understanding and is fully independent from implementation solutions.

3.11
Front End
part of a tolling system consisting of an *OBE* (3.13) and possibly a *proxy* (3.14) where road tolling information and usage data are collected and processed for delivery to the *Back End* (3.4)

[SOURCE: ISO/TS 19299:2015, 3.17]

Note 1 to entry: The Front End comprises the *on-board equipment* (3.13) and an optional *proxy* (3.14).

3.12
layout
technical description of the location of tolled objects including their borders

3.13
on-board equipment
OBE
all required equipment on-board a vehicle for performing required EFC functions and communication services

3.14
proxy
optional part of a *Front End* (3.11) that communicates with external equipment and processes the data received into an agreed format to be delivered to the *Back End* (3.4)

[SOURCE: ISO 17575-1:2016, 3.13]

3.15
road section charging
tolling principle where the fee is due if predefined sections of roads are used

[SOURCE: ISO 17575-1:2016, 3.14]

3.16
toll
charge, tax or duty levied in connection with using a vehicle in a *toll domain* (3.20)

[SOURCE: ISO/TS 19299:2015, 3.42, modified — "any" has been deleted from before "charge".]

Note 1 to entry: The definition is the generalization of the classic definition of a toll as a charge, a tax, or a duty for permission to pass a barrier or to proceed along a road, over a bridge, etc. The definition also includes fees regarded as an (administrative) obligation, e.g. a tax or a duty.

3.17
tolled area
geographic area where a *toll* (3.16) is charged for road usage

3.18
toll context
logical view as defined by *attributes* (3.2) and functions of the basic elements of a toll scheme consisting of a single basic tolling principle, a spatial distribution of the *charge objects* (3.5) and a single behaviour of the related *Front End* (3.11)

[SOURCE: ISO 17575-1:2016, 3.17]

3.19
toll context data
information defined by the responsible toll charger as necessary to establish the *toll* (3.16) due for using a vehicle on a particular *toll context* (3.18) and to conclude the toll transaction

[SOURCE: ISO 12855:2015, 3.15]

3.20
toll domain
area or part of a road network where a certain *toll regime* (3.21) is applied

[SOURCE: ISO 17573:2010, 3.18, modified — "certain" has been added.]

3.21
toll regime
set of rules, including enforcement rules, governing the collection of *toll* (3.16) in a *toll domain* (3.20)

[SOURCE: ISO 17573:2010, 3.20]

3.22
toll scheme
organizational view of a *toll regime* (3.21), including the actors and their relationships

4 Abbreviated terms

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

ADU	Application data unit (ISO 14906)
ASN.1	Abstract Syntax Notation One (ISO/IEC 8824-1)
CCC	Compliance check communication (ISO 12813)

CN	Cellular network
DSRC	Dedicated short-range communication (ISO 14906)
DST	Daylight saving time
EFC	Electronic fee collection (ISO 14906)
GDF	Geographic Data Files (ISO 14825)
GNSS	Global Navigation Satellite Systems
HOT	High occupancy tolling
ID	Identifier
OBE	On-board equipment
PICS	Protocol implementation conformance statements
UTC	Coordinated Universal Time
VAT	Value added tax

5 General concept and overview

To enable a Front End to operate autonomously in a toll domain in the expected manner, a particular set of data elements containing application data has to be available to the Front End. These data elements shall contain a description of the rules that apply in a toll domain. This includes information regarding tariffs, vehicle classes, description of the charge objects, etc.

The data elements may be made available to the Front End using the communication services described in ISO 17575-2:2016.

For the purpose of data transfer an application data unit (ADU) is defined, which comprises a header (mainly containing identification and data management information) and a data body (containing the application data elements itself).

The ADU header allows for identification of the data originator and the data sender. Furthermore, it contains information about the toll context to which the application data belong. Finally, the ADU header carries a sequence number.

This part of ISO 17575 is based on the assumption that one toll scheme may consist of multiple parts. The data requirements provided in this part of ISO 17575 support this concept. In addition, Front Ends may be used in more than one toll scheme. In such cases, the Front End might have the capability to manage multiple sets of toll context data elements (one per toll scheme). See Figure 2.

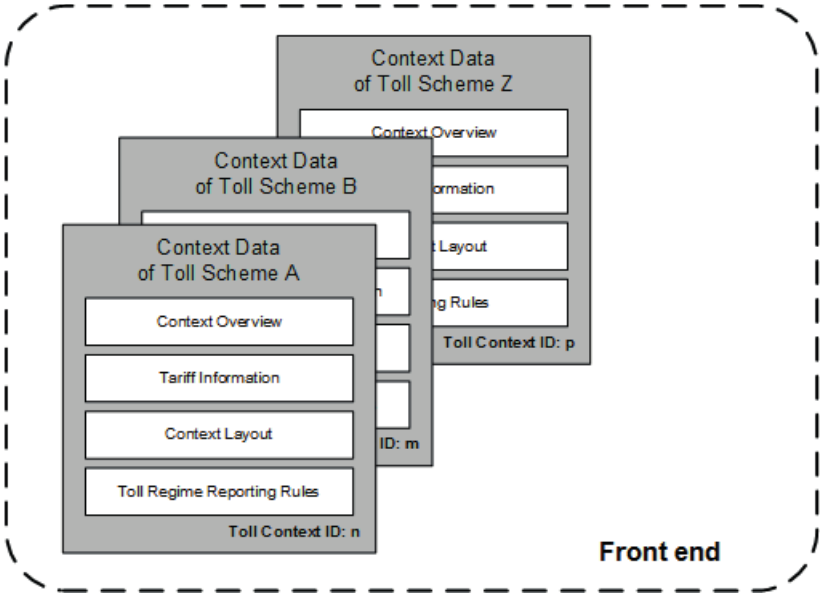


Figure 2 — Logical structure of toll context descriptions in a Front End

There may be a maximum number of toll contexts a Front End can manage. This number may depend on the memory size, the complexity of the toll context data and the envisaged use of the Front End. Front Ends may also be designed in a way to support the context description for one particular toll scheme only. Other Front End designs may support context descriptions for more than one toll scheme.

Context data are structured into logical data sets (see 8.3). Figure 3 gives an overview of these data sets and the type of information belonging to each data set.

Each data set comprises one or more EFC attributes. EFC attributes contain the application data. They are defined in Clause 8.

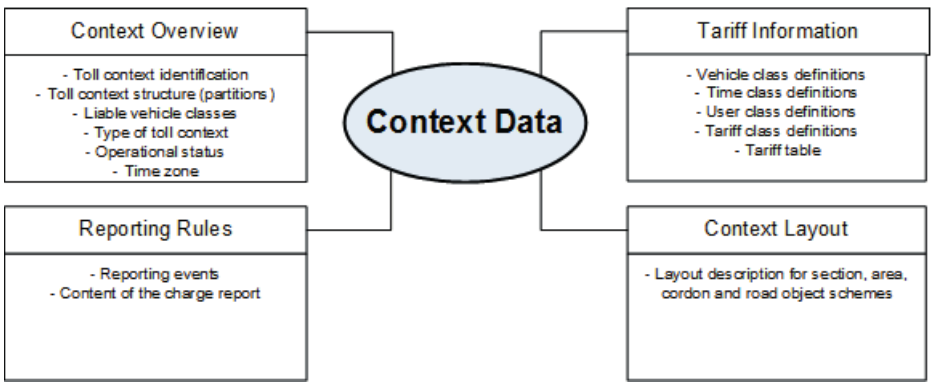


Figure 3 — Context data overview

A single toll scheme (and related toll context data) may be split into several parts. Each part of the toll scheme may be of different charging type (i.e. section charging, area charging and cordon charging), may have an individual layout and thus may require different toll context data. This part of ISO 17575 supports this concept by so-called toll context partitions. Details are specified in Clause 8.

The organization of the memory and the physical structure of the data within a Front End are outside the scope of this part of ISO 17575.

6 Procedural requirements and encoding rules

6.1 General

This clause provides normative requirements with regards to

— communication services to be applied for the exchange of context data,

— provisions offered in this part of ISO 17575 in order to enable version and validity control of context data, and

— encoding rules to be applied for context data.

6.2 Communication services

For the purpose of transmitting ADUs from the Back End to the Front End, the communication services defined in ISO 17575-2:2016 or any other appropriate communication services may be used.

NOTE 1 Details with respect to communication services are usually agreed between the operating entities of Back End and Front End.

NOTE 2 State-of-the-art communication frameworks (so-called middleware) designed for data exchange between IT systems and subsystems are appropriate candidate solutions.

6.3 Version and validity handling

6.3.1 Protocol versioning

The Back End shall provide, with each submission of toll context data to the Front End, the application interface definition (syntax and semantics) that is used by the Back End by means of the `protocolVersion`.

The `protocolVersion` information shall be part of the ADU header of the message. The specification of the `protocolVersion` information is provided in 7.4 and in A.2.

In cases where the receiving Front End does not support the application interface definition (as indicated by the `protocolVersion`) the Back End requests, the Front End shall provide a negative response to the Back End.

NOTE ISO/TS 17575-3:2011 id not support the version handling of application interface definitions by means of `protocolVersion`.

6.3.2 Context data versioning

Each EFC attribute includes an optional data element containing version and validity information applicable for the respective EFC attribute. The data type of this data element shall always be `VersionAndValidity`. This data type shall comprise two data elements:

— `version`;

— `validFrom`.

The data element `version` shall give the version number of the respective EFC attribute. The data type shall be `VersionId` defined in ISO 17575-1:2016. The version number shall be used in an increasing order.

NOTE 1 This concept enables the Front End to autonomously detect missing versions of context data and potentially initiate an action to update the respective information in the Front End.

The data element `validFrom` shall give the start date and time of the validity of the respective EFC attribute. The data type shall be `GeneralizedTime` as defined in ISO 14906:2011/Amd1:2015.

The information regarding version and validity of EFC attributes enables the Front End to autonomously notice the existence of new updated context data in the Back End.

NOTE 2 Once the start date and time of context data are reached, previous versions (having a version number lower than the current one) become obsolete. The Front End can decide – depending on local settings – to initiate an action to activate the valid context data and deactivate (and delete) the previous used version(s).

The given version and validity information shall be exclusively valid for the EFC attribute it belongs to.

NOTE 3 This concept allows the efficient use of different versions for different types of context data. For example, the tariff table version can be managed independently from the one valid for context layout and reporting rules. This approach reduces the amount of data to be updated.

NOTE 4 The update process itself is outside the scope of this part of ISO 17575.

The optional data element `tollContextVersion` shall be used for the version identification for the entire toll context description. This data element is a component of the data type `Iso17575-3AduBody`. The data type shall be `Int1`.

NOTE 5 If and how such context version identification is composed, using the version information of the underlying attributes and data elements (i.e. vehicle class definitions, layout description, charge reporting events, charge report configuration, tariff definitions), depends on the particular operational requirements and implementation solution.

NOTE 6 One potential use of such context version identification is in relation to compliance check communication (CCC) and the related data exchange. ISO 12813:2015 specifies a context version identifier (also of type Int1) that may be provided from the Front End to enforcement facilities. Based on such data, a simple check is possible to identify Front Ends in enforcement processes that use an outdated version of the toll context description.

6.4 Encoding rules

The data types and associated coding related to the data elements described in Clauses 7 and 8 are defined using the Abstract Syntax Notation One (ASN.1) technique according to ISO/IEC 8824-1 (see Annex A).

The encoding rules (e.g. Basic, Packed or XML Encoding Rules, BER, PER or XER) are not specified in this part of ISO 17575 because the physical implementation of the ISO 17575 interface can vary widely. Therefore, the choice of encoding rules shall be adapted to the specific needs (e.g. coding efficiency, compatibility with existing software environments, etc.).

6.5 Acknowledgement and behaviour on errors

The interface between Front End and Back End is located within the realm of the entity acting as toll service provider. Therefore, it can be expected that this interface is not necessarily an interoperable interface.

In order to keep the freedom and flexibility for existing and future implementation options and to not over-specify requirements that are in the sole realm of one designing entity, this part of ISO 17575 does not contain any requirements with regards to acknowledgements and behaviour on errors. It is expected that the entity designing this interface makes the appropriate provisions to ensure a reliable and stable operation of this interface and the transfer of toll context data under any possible conditions.

7 Application data units

7.1 General

This clause provides normative requirements with regards to information used to manage the exchange of toll context data. In order to provide the receiving end with the interface appropriate management information, such data are made available, in addition to the toll context data, in a dedicated protocol header (see 7.3). The header consists of various data elements, as specified in 7.4 below. The context

data are considered as the "payload" of the data exchange and are made available in the ADU body (see 7.3 and 7.5).

7.2 Message authentication (data type Iso17575-3-InformationContent)

To ensure an uninterrupted chain of trust, security mechanisms are implemented for proof of authenticity and integrity of the transmitted application data units.

To support an integer and secure transfer of toll context data from the Back End to the Front End, optional authentication mechanisms have been introduced and may be used by the involved entities.

Consequently, and depending on the use of the optional authentication, the information content is either an

— unauthenticated application data unit (`notAuthenticatedIso17575-3Adu` of type `Iso17575-3Adu`); or

— authenticated application data unit (`authenticatedIso17575-3Adu` of type `AuthenticatedIso17575-3Adu`).

The detailed specification of the data type `Iso17575-3Adu` is provided in 7.3.

The data type `AuthenticatedIso17575-3Adu` comprises the following data elements:

— `iso17575-3AduPer`;

— `messageAuthenticator`.

The data element `iso17575-3AduPer` is a container (of type `BIT STRING`) that shall hold a data element of type `Iso17575-3Adu`, which is encoded using ASN.1 Packed Encoding Rules aligned according to ISO/IEC 8825-2.

The data element `messageAuthenticator` (of type `MessageAuthenticator`) shall hold the authenticator, which shall be calculated over the single bit string content of `iso17575-3AduPer`.

NOTE The data type `MessageAuthenticator` is imported from and defined in ISO 17575-1:2016. Details with respect to functionalities, data elements and options provided in the entire message authentication data structure are described in ISO 17575-1:2016, ISO/TS 19299:2015 and in the underlying data security standards as referenced by ISO 17575-1:2016.

7.3 Application data unit structure (data type Iso17575-3Adu)

For the purpose of context data transfer and context data identification, the message content shall be structured into application data units (ADU), see Figure 4.

Each ADU shall consist of an

— ADU header (of data type `Iso17575-3AduHeader`), and

— ADU body (of data type `Iso17575-3AduBody`).

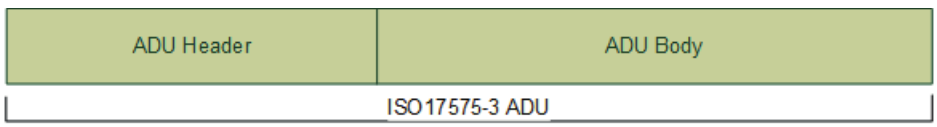


Figure 4 — Structure of an ISO 17575-3 ADU

7.4 Application data unit header (data type ISO 17575-3AduHeader)

The ADU header shall provide management information that applies in relation to the payload (i.e. context data) provided in the ADU body. The Front End may need this information for internal processes of context data management, storage and processing.

The information provided in the ADU header is valid for the entire set of context data provided in the ADU body.

The ADU header shall consist of the following data fields (Figure 5):

— applied protocol version;

— information sender identification;

— information originator identification;

— toll context identification;

— ADU sequence number;

— message date.

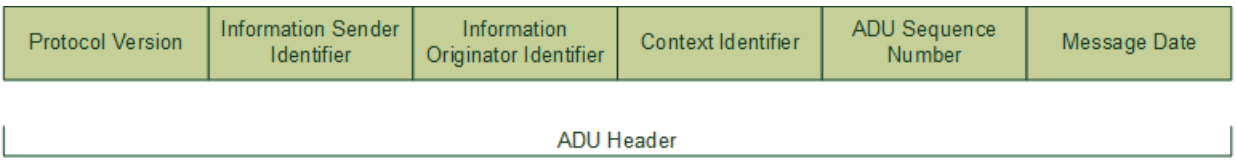


Figure 5 — Structure of the ADU header

The semantics for the data elements of the ADU header shall be according to Table 1. The data types are specified in Annex A.

Table 1 — Data elements of the ADU Header

Data element	Data type (informative)	Definition of semantic	Remarks
protocolVersion	AidIdentifier	Identifier of the version of the ASN.1 data specification (version of ISO 17575) that is used in the application data units	e.g. "1" = ISO17575-3:2016 (see also 6.3.1)
informationSender	Provider	Unique identifier of the entity which has sent the entire message	Usually a service provider operating the Back End, but may also be e.g. a transport service provider, toll charger
informationOriginator	Provider	Unique identifier of the entity which has created the context data provided in the ADU body	e.g. transport service provider, toll charger or service provider
tollContext	Provider	Unique identifier of the entity which acts as toll charger of the toll scheme to which the toll context data belong	Consists of country code and unique number within the country
aduSequenceNumber	Int4	Sequence number of the respective ADU. Shall be used in increasing order. In case of overflow the sequence number shall restart at '0'.	
messageDate	GeneralizedTime	Date and time when the message is generated by the informationSender	Can be used for message security purposes, e.g. for the generation of the authenticator

7.5 Application data unit body (data type ISO 17575-3AduBody)

The ADU body shall contain one or more EFC attributes describing the toll context. One ADU body shall contain EFC attributes belonging to one single toll context only.

NOTE Very complex toll contexts (e.g. containing different types of toll schemes such as a cordon charging and a section charging) can be split into more than one toll context partitions. Interdependencies (priorities) between the individual toll context partitions are specified by means of priority rules.

The toll context for which the data in the ADU body provide detailed description is identified by information given in data element `tollContext` in the ADU header.

EXAMPLE 1 The ADU body contains the tariff table for the Barcelona congestion charging scheme.

EXAMPLE 2 The ADU body contains the geographic description of the road network of the truck tolling schemes applicable on highways in Hungary.

EXAMPLE 3 The ADU body contains the reporting rules applicable in the nationwide all-road charging scheme in Denmark.

EFC attributes that hold toll context data are defined in Clause 8.

The ADU body also contains the optional data element `tollContextVersion`. This data element can be used to specify the version of the entire toll context description (see also 6.3.2).

8 EFC Attributes

8.1 General

This clause provides normative requirements with regards to the EFC attributes holding the context data in terms of their use, structure and semantics.

8.2 Rules with respect to support of context data

Context data available in the Front End shall contain all information required to ensure a minimum level of functionality to either participate in the services of this toll scheme or to unambiguously identify the toll scheme as being not valid e.g. for the specific user, vehicle, moment in time.

Each EFC attribute being part of the context data shall be allocated to one single toll context.

8.3 Attributes and data sets

Each EFC context shall be described using one or more EFC attributes. The full set of EFC attributes belonging to one EFC context shall contain all necessary information to enable proper functioning of the Front End in the respective EFC scheme.

For readability, in this part of ISO 17575 the EFC attributes have been logically structured into data sets.

The following data sets are used:

— Context Overview;

— Tariff Information;

— Context Layout;

— Reporting Rules.

NOTE Logical data sets are fully independent from the physical data structure in a Front End. The physical structure is implementation dependent and outside the scope of this part of ISO 17575.

8.4 EFC attributes authentication

This part of ISO 17575 provides measures that allow for optional authentication of the individual EFC attributes. In contrast to the message authentication (see 7.2) this option can be used for true end-to-end security covering the full chain from the originator of context data to the Front End.

EXAMPLE Such end-to-end security allows a Front End module (which can e.g. reside in an OBE) to check the authenticity, completeness and integrity of a tariff table that is created by the toll charger.

EFC attributes being part of the ADU body can be present in an

— unauthenticated form (data element unsigned-data shall be used), or

— authenticated manner (data element signed-data shall be used).

In cases where the authenticated option is chosen, the data type shall be `Signed{Payload}`, which comprises the following data elements:

— payload;

— timeOfAuthentication;

— authenticator.

The data element `payload` is a container (of type `BIT STRING`) that shall hold a data element of type `Iso17575-3Adu`, which is encoded using ASN.1 Packed Encoding Rules aligned according to ISO/IEC 8825-2. The parameter `Payload` is replaced by the data type of the individual EFC attribute.

The data element `timeOfAuthentication` shall hold the information of the point in time the authenticator was calculated.

The data element `authenticator` (of type `MessageAuthenticator`) shall hold the authenticator, which shall be calculated over the single bit string content of `payload`.

The data type `MessageAuthenticator` is imported from and defined in ISO 17575-1:2016. Details with respect to functionalities and options provided in the entire message authentication data structure are described in ISO 17575-1:2016, ISO/TS 19299:2015 (and the underlying data security standards as referenced by ISO 17575-1:2016).

NOTE Not all of the possible options provided by the data structure described in ISO 17575-1:2016 are appropriate for EFC attribute authentication.

8.5 EFC attributes data catalogue

8.5.1 General

The following EFC attributes or a subset here of shall be available to the Front End (Table 2).

Table 2 — List of EFC attributes

EFC attribute	Remark	Data set	Relevant section
`TollContextOverview`		Context Overview	8.5.2.2
`TollContextPartitionOverview`	Defined as list (`SEQUENCE OF`), which contains one list entry per toll context partition		8.5.2.3
`TariffTable`	Defined as list (`SEQUENCE OF`), which contains one list entry per toll context partition	Tariff Information	8.5.3.2
`CurrencyConversionTable`			8.5.3.2.3
`TariffClassDefinition`			8.5.3.3
`LocalVehicleClassDefinition`			8.5.3.4
`TimeClassDefinition`			8.5.3.5
`UserClassDefinition`			8.5.3.6
`TollContextPartitionLayout`	Defined as list (`SEQUENCE OF`), which contains one list entry per toll context partition	Context Layout	8.5.4
`ChargeReportingEvents`	Defined as list (`SEQUENCE OF`), which contains one list entry per toll context partition	Reporting Rules	8.5.5.2
`ChargeReportConfiguration`	Defined as list (`SEQUENCE OF`), which contains one list entry per toll context partition		8.5.5.3
`TollContextVersion`		Version Information	6.3.2

In the following clauses, EFC attributes and data elements are specified in terms of

— names of the data elements forming the EFC attributes,

— content and semantic definition of the EFC attributes and data elements, and

— informative remarks, including references to other standards.

The specification of the corresponding data types in ASN.1 is provided in Annex A.

8.5.2 Requirements with regards to context overview

8.5.2.1 Concept of toll context partitions

One single toll context shall consist of one or more toll context partitions.

Each of the individual partitions shall get an identifier that is unique within the toll context.

Toll context partitions may overlap in terms of their geographical extensions. In cases where they overlap, priority rules ensure the proper functionality according to the applicable toll regulations. The toll charger is responsible for defining the correct priority rules in the toll context data.

8.5.2.2 Toll context overview

The attribute `TollContextOverview` shall contain information about toll context identification, number of present toll context partitions and additional supporting information for the toll context.

The main purpose of the EFC attribute `TollContextOverview` is to give the Front End a minimum amount of basic information regarding a toll scheme. Based on these overview data, the Front End may or may not require and request more information.

EXAMPLE Based on the information in data element `tollContextBoundingBoxes` a Front End dedicated to a passenger car can notice that it is moving in a toll domain. Using the information in the data element `operationalStatus` the Front End algorithms identify this toll scheme is currently inactive. In this case, the Front End does not require additional data (such as context layout or tariff table) of this respective toll scheme.

The structure and data elements of the EFC attribute `TollContextOverview` are given in Table 3 and defined in Annex A.

Table 3 — EFC attribute `TollContextOverview` (informative)

EFC attribute	Data element	Data type	Remark
TollContextOverview	tollContext	Provider	
	tollContextPartitions	SEQUENCE OF TollContext-PartitionID	
	tollSchemeName	UTF8String	optional
	tollContextBoundingBoxes	SEQUENCE OF SphericalBox	optional
	TollContextOverviewVersion	VersionAndValidity	

The data element `tollContext` shall identify the toll charger that operates the toll scheme for which the context description is valid. The data type shall be `Provider` as specified in ISO 14906:2011/Amd1:2015.

The data element `tollContextPartitions` shall contain the list of identifiers of the toll context partitions belonging to the single toll context. Each list entry is of data type `TollContextPartitionID`.

At least one toll context partition identifier shall be present in the list. The toll context partition identifiers shall be uniquely defined within the single toll context.

The data element `tollSchemeName` shall contain a designation for the toll scheme. The data element shall be optional. The data type shall be UTF8String.

EXAMPLE This data element is used to display a well-known “brand name” of the toll scheme in the OBE (e.g. “LKW Maut”, “Go Maut” or “TIS-PL”).

The data element `tollContextBoundingBoxes` shall contain a list of spherical rectangles that enclose the geographic area of the toll context. Each list entry shall be of data type `SphericalBox`. The data type `SphericalBox` shall contain the description of a spherical rectangle by defining the edges of the rectangle in latitude and longitude. The data element `SphericalBox` shall contain

the data elements `southernLatitude`, `northernLatitude`, `westernLongitude` and `easternLongitude`. The data elements in the data type `SphericalBox` shall be used as follows:

— data element `southernLatitude` shall contain the lower (southernmost) latitude value (data type `Latitude`);

— data element `northernLatitude` shall contain the larger (northernmost) latitude value (data type `Latitude`);

— data element `westernLongitude` shall contain the lower (westernmost) longitude value (data type `Longitude`);

— data element `easternLongitude` shall contain the larger (easternmost) longitude value (data type `Longitude`).

The data element `TollContextOverviewVersion` shall contain version and validity information for the EFC attribute `TollContextOverview`. The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.2.3 Toll context partition overview

The attribute `TollContextPartitionOverview` shall contain information about identification, type of the toll scheme (e.g. section based tolling, area charging, cordon charging), time zone information and information regarding the operational status of the respective toll context partition.

The main purpose of the EFC attribute `TollContextPartitionOverview` is to give the Front End a minimum amount of basic information regarding a toll context partition. Based on these overview data, the Front End may or may not require more information.

The structure and data elements of the EFC attribute `TollContextPartitionOverview` are given in Table 4 and defined in Annex A.

Table 4 — EFC attribute TollContextPartitionOverview **(informative)**

EFC attribute	Data element	Data type	Remark
TollContextPartitionOverview	tollContextPartitionID	TollContextPartitionID	
	tollContextPartitionName	UTF8String	optional
	tollContextPartitionType	TollSchemeType	
	operationalStatus	OperationalStatus	
	timeZone	INTEGER (-720..720)	
	dstOffset	INTEGER (-120..120)	optional
	tollContextPartitionBoundingPolygon	Polygon	optional
	sendChargeReportIfEntering	BOOLEAN	optional
	precedenceLevel	Int1	optional
	chargeReportFinalRecipient	Provider	optional
	TollContextPartitionOverviewVersion	VersionAndValidity	

The data element `tollContextPartitionID` shall contain the identifier of the respective toll context partition for which the overview information is provided. The toll context partition ID provided in this field shall correspond to one element in the list of toll context partition IDs in the attribute `tollContextOverview`.

The data element `tollContextPartitionName` shall contain a designation for the toll context partition. The data element shall be optional. The data type shall be UTF8String.

NOTE 1 This data element can be used to display a well-known “brand name” of the toll context at the OBE. (e.g. “LKW Maut”, “Go Maut” or “TIS-PL”).

The data element `tollContextPartitionType` shall contain information regarding the type of the toll context partition (road section charging, distance based area charging, time based area charging, cordon charging).

The data element `operationalStatus` shall contain information regarding the period of operation of the toll context partition. This information shall be given by defining date and time when the toll scheme starts or has started operation (in data element `startsOperationAt`) and optionally by defining date and time when the toll scheme will stop operation (in date element `stopsOperationAt`). Both data elements `startsOperationAt` and `stopsOperationAt` shall be of data type `GeneralizedTime`.

The data element `timeZone` shall give the time zone applicable for the toll context partition in relation to Coordinated Universal Time (UTC). The data type is `INTEGER(-720..720)`. The value shall be given in minutes in relation to UTC (–720 … +720 minutes). In cases where the toll domain of this toll context partition is located on more than one time zone, this toll context partition shall be split into two separate toll context partitions and have two toll context partition data sets.

All absolute time information used in EFC attributes and data elements defined in this part of ISO 17575 (especially in the time class definitions) shall be given in local real time. In cases where daylight saving time (DST) applies, the Front End shall be capable of re-calculating time information according to the applicable legal rules.

To provide supporting information with respect to DST, the optional data element `dstOffset` shall be used to specify the amount in minutes the DST offsets compared to the standard local time. The data type shall be `INTEGER(-120..120)`. Positive values shall be used in cases where the DST is "ahead" of standard local time. Negative values shall be used in cases where the DST is "behind" the standard local time.

EXAMPLE 1 In cases where the standard local time is 12:00h and dstOffset = 60, the resulting applicable local time during DST is 13:00h.

EXAMPLE 2 In cases where the standard local time is 12:00h and the dstOffset = −45, the resulting applicable local time during DST is 11:15h.

NOTE 2 The time and date from and to DST is effective is not specified in this part of ISO 17575. Particular rules which are compatible to the legal ground are available in several underlying IT systems and frameworks.

The data element `tollContextBoundingPolygon` shall contain a polygon representation that encloses the geographic area of the toll context partition.

The data type `Polygon` is defined as a list of the data type `Point`. The points shall be defined in an order that creates and closes the polygon in a clockwise direction. The segments of the polygon shall be created by connecting each of the points with its successor point. The polygon shall be closed by connecting the last point in the list with the first point. The points shall be defined in a way that the connections between the points do not intersect. The inner side of the polygon (tolled area) is defined as the geographical area that is located at the right-hand side when moving on a polygon segment from its start point to its end point.

The optional data element `sendChargeReportIfEntering` shall be applied in order to require the generation and transmission of a charge report in cases where the Front End is entering the geographical area of the respective toll context partition. The geographical area of the toll context partition is specified in the data element `tollContextBoundingPolygon`. The resulting charge report may also be empty.

NOTE 3 This feature allows the opening or closing of accounts based on the presence of a toll liable vehicle in a given toll context partition.

The optional data element `precedenceLevel` (of type `Int1`) may be used to specify priorities for overlapping toll context partitions. In cases where two or more toll context partitions have got the same preceded level, charge reports shall be generated and transmitted for each individual toll context partition. In cases where the precedence levels of overlapping toll context partitions have different

values, only charge reports for the toll context partition having the higher precedence level shall be generated and transmitted.

A precedence level value of 0 shall be used for the lowest priority and a value of 255 shall be used for the highest priority.

The optional data element `chargeReportFinalRecipient` may be used to provide supplementary information for the management of charge reports in cases where one toll charger operates the toll scheme of another toll charger. In such cases, a dedicated toll context partition shall be used. The data element shall hold the identification of the entity that is the final destination of the respective usage data generated by the Font End. This data element is of the data type `Provider`, which is imported from ISO 14906:2011/Amd1:2015.

NOTE 4 Small toll context partitions (e.g. a bridge) might be embedded within larger toll contexts (e.g. a national toll scheme). In these cases, the toll charger of the large toll context partition assumes the role of toll charger for all external purposes, but internally the final destination of the charge reports is the toll charger of the small toll context partition. This latter operator is identified with the data element chargeReportFinalRecipient.

The data element `TollContextPartitionOverviewVersion` shall contain version and validity information for the EFC attribute `TollContextPartitionOverview`. The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.3 Requirements with regards to tariff information

8.5.3.1 Concept and overview

The EFC attributes in the data set Tariff Information shall contain all necessary information regarding

— tariff table,

— tariff classes, and

— locally applicable definitions for vehicle classes, time classes and user classes.

All this information is toll scheme specific.

The data set shall comprise the following EFC attributes:

— `TariffTable`

— `CurrencyConversionTable`

— `TariffClassDefinition`

— `LocalVehicleClassDefinition`

— `TimeClassDefinition`

— `UserClassDefinition`

The descriptions and definitions for these EFC attributes are given in 8.5.3.2 to 8.5.3.6.

The fee calculation algorithm is specified in 8.5.3.7.

8.5.3.2 Tariff table

Each toll context description contains one or more tariff tables. One tariff table is valid for one or more toll context partitions. The tariff table comprises the following information:

— toll context partitions the tariff table is applicable for;

- for each tariff class
  - a unique tariff class identifier,
  - the definition of the charge unit,
  - the rounding rule that applies for the charged units used,
  - a basic fee per charge unit,
  - the rounding rule that applies for the fee calculated,
  - the VAT amount per charge unit (optional),
  - the rounding rule that applies for the VAT calculated (optional),
  - an interval scale parameter (optional),
  - an offset fee (optional),
  - a minimum fee (optional),
  - a threshold fee (optional),
  - a maximum fee (optional), and
  - an alternative currency for this tariff class (optional);
- standard currency used in this tariff table;
- type of the fee;
- version and validity information.

The tariff table provides all the tariff data to the Front End that are required to calculate the fee to be paid by a user under given and defined conditions (e.g. vehicle class, time class, etc.).

8.5.3.2.1 EFC attribute TariffTable

The tariff table shall be presented in the EFC attribute `TariffTable`.

The structure and data elements of the EFC attribute `TariffTable` are given in Table 5 and defined in Annex A.

Table 5 — EFC attribute `TariffTable` (informative)

EFC attribute	Data element	Data type	Remark
TariffTable	applicablePartitions	SEQUENCE OF TollContextPartitionId	
	tariffs	SEQUENCE OF Tariff	
	standardCurrency	PayUnit	
	typeOfFee	TypeOfFee	optional
	tariffTableVersion	VersionAndValidity	

The data element `applicablePartitions` shall contain a list of the identifiers of those toll context partitions the tariff table is applicable for. Each list entry shall be of type `TollContextPartitionId`.

The data element `tariffs` shall contain a list of tariff related data for each tariff class. Each of the list entries shall be of data type `Tariff`. This data type is described in 8.5.3.2.2.

The data element `standardCurrency` shall be used to determine the currency that shall be used. This currency shall be applicable for all data containing any sort of fee information in the tariffs (see

8.5.3.2.2) that are `basicFeePerChargeUnit`, `offsetFee`, `minFee`, `thresholdFee` and `maxFee`. The data type shall be `PayUnit` as specified in and imported from ISO 14906:2011/Amd1:2015.

In cases where more than one currency is allowed or required in one toll domain (e.g. for particular user groups or because of legal requirements), the alternative currencies are specified in the respective tariff (see 8.5.3.2.2).

The optional data element `typeOfFee` provides information about the nature of the fee (e.g. tax, duty, custom). The data element shall be of type `TypeOfFee`.

NOTE The presence and content of this data element can be irrelevant for the functioning of the Front End, but it can be of major relevance for the Back End and for the interfaces between the toll charger and the service provider.

The data element `tariffTableVersion` shall contain version and validity information for the EFC attribute `TariffTable`. The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.3.2.2 Data type Tariff

The data type `Tariff` shall provide the following information per tariff class:

— a tariff class identifier (to unambiguously identify a tariff class within the toll context description);

— the charge unit (e.g. 100 m);

— rounding rule for the calculation of the charge units used (e.g. always rounding up);

— basic fee per charge unit (e.g. 0,03 EUR);

— rounding rules for the calculated fee (e.g. always rounding down);

— optional VAT amount (e.g. 20,3 %);

— optional rounding rules for the calculated VAT (e.g. always using accounting rounding rules);

— optional interval scale parameter;

— optional offset fee;

— optional minimum fee;

— optional threshold fee;

— optional maximum fee;

— optional alternative currency valid for this particular tariff class.

The structure and data elements of the data type `Tariff` are given in Table 6 and defined in Annex A.

Table 6 — Data type `Tariff` (informative)

Data type	Data element	Data type	Remark
Tariff	tariffClass	TariffClassId	
	chargeUnit	ChargeUnit	
	roundingRuleForChargeUnitsUsed	RoundingRule	
	basicFeePerChargeUnit	Int4	
	roundingRuleForFee	RoundingRule	
	vat	Int4	optional
	roundingRuleForVAT	RoundingRule	optional
	intervalScaleParameters	Sequence of IntervalScaleParameter	optional
	offsetFee	Int4	optional
	minFee	Int4	optional
	thresholdFee	Int4	optional
	maxFee	MaxFee	optional
	alternativeCurrency	Currency	optional

The data element `tariffClass` shall identify the tariff class. The data type shall be `TariffClassId`. This data type is defined as `Int4`. The applicable tariff class is defined in attribute `TariffClassDefinition`, which is defined in 8.5.3.2.3.

Data element `chargeUnit` shall contain the charge unit valid for the toll scheme. It contains the smallest interval of time period, distance or number of events that are of relevance for the fee calculation. A charge unit shall have one of the following natures:

— a distance (e.g. 100 m or 1 km);

— a time period (e.g. 10 min, 1 h or 7 h);

— a number of events that have occurred (e.g. 1 passage).

The use of charge units depends on the type of charging scheme. The following combinations of charge unit type and toll scheme type shall be possible:

— distance (e.g. metre, km), which shall only be used in section or area charging schemes;

— time (e.g. seconds, minutes, hours), which shall only be used in area charging schemes;

— event (e.g. number of passages), which shall only be used in cordon or section charging schemes.

EXAMPLE 1 A section charging scheme uses as charge unit 1 km, as the fee depends on the length of the used sections. In this example the fee increases every 1 km.

EXAMPLE 2 An area charging scheme uses as charge unit 1 hour, as the fee depends on the duration of stay in the defined area. In this example the fee increases every hour.

EXAMPLE 3 A cordon charging scheme uses as a charge unit 1 event, as the fee depends on the number of passages of the cordon. In this example the fee increases with every single event.

NOTE 1 In time based charging schemes, the charge unit can also be used to define the smallest possible time periods to be used in the fee calculation.

EXAMPLE 4 A time based charging scheme with a charge unit value of 7 hours is defined. In cases where the basic fee is defined by 5 GBP, a stay in the charging area of less than 7 hours would, in any case, result in a fee of 5 GBP.

The data element `chargeUnit` shall be of data type `ChargeUnit`, which is a `CHOICE` type and has the type `distance`, `time` or `event`. The data type of the data element `distance` shall be `Distance`,

as defined in ISO 17575-1:2016. The data type of data element `time` shall be `Duration`, as defined in ISO 17575-1:2016. The data type of the data element `event` shall be `Int1`.

The data element `roundingRuleForChargeUnitsUsed` shall be used to specify if and how rounding of distance driven or time in the toll liable network shall applied when determining the charge units used. The data type shall be `RoundingRules`. This data type is specified as `Int1`. The following values are defined:

— `no` (0) – no rounding is applied;

— `up` (1) – always rounding up to the next full larger value of the charge unit specified in `chargeUnit`;

— `down` (2) – always rounding down to the next full lower value of the charge unit specified in `chargeUnit`;

— `accounting` (3) – always rounding according to methods used in accounting (e.g. as defined in DIN 1333[6]).

EXAMPLE 5 Charge units are specified with 200 m (section based charging). The vehicle has used the toll liable road network for 750 m. A rounding rule is set up to 1 = rounding up. The resulting number of charge units used is 4.

EXAMPLE 6 Charge units are specified with 4 h (area based charging). The vehicle has used the toll liable area for 5:56 h. A rounding rule is set up to 2 = rounding down. The resulting number of charge units used is 1.

The data element `basicFeePerChargeUnit` shall contain the basic fee per charge unit. The data type shall be `Int4`. The value shall be given in the currency and unit as defined in the data element `standardCurrency` in the data element `tariffTable`. The value in the data element `basicFeePerChargeUnit` shall be given excluding VAT.

EXAMPLE 7 A `basicFeePerChargeUnit` value of 175, `currency` value of "EUR" and a currency unit of "minor units of 1000:1" (see ISO 14906:2011/Amd1:2015) is specified. The resulting fee is 0,175 EUR = 17,5 cent.

The data element `roundingRuleForFee` shall be used to specify if and how rounding of resulting toll fee shall applied when calculating the fee per used charge object (see also 8.5.3.7). The data type shall be `RoundingRules`. This data type is specified as `Int1`. The following values are defined:

— `no` (0) – no rounding is applied;

— `up` (1) – always rounding up to the next larger value of the currencies minor unit;

— `down` (2) – always rounding down to the next lower value of the currencies minor unit;

— `accounting` (3) – always rounding according to methods used in accounting (e.g. as defined in DIN 1333[6]).

The optional data element `vat` shall contain the VAT per charge unit. The data type shall be `Int4`. The value shall be given in 0,01 %.

The optional data element `roundingRuleForVate` shall be used to specify if and how rounding of the resulting VAT for the toll fee shall applied when calculating the VAT per used charge object (see also 8.5.3.7). The data type shall be `RoundingRules`. This data type is specified as `Int1`. The following values are defined:

— `no` (0) – no rounding is applied;

— `up` (1) – always rounding up to the next larger value of the currencies minor unit;

— `down` (2) – always rounding down to the next lower value of the currencies minor unit;

— `accounting` (3) – always rounding according to methods used in accounting (e.g. as defined in DIN 1333[6]).

In cases where the optional data element `vat` is present but the optional data element `roundingRuleForVat` is not present, no rounding shall be applied for the VAT.

The optional data element `intervalScaleParameters` shall contain a list of additional parameters to adapt the basic fee depending on the parameters maximum laden weight of a vehicle and the length of the vehicle. These parameters shall contain offset values (data element `zeroOffset`), resolution data (data element `resolution`) and maximum values (data element `max`).

NOTE 2 Maximum laden weight of vehicles as interval scale parameters are currently in use in the Swiss LSVA toll scheme. The maximum length of a vehicle is also considered useful for payment for use of ferries.

The optional data element `offsetFee` shall be used to specify an offset value that should be added to the calculated fee (see also 8.5.3.7). The data type shall be `Int4`. The value shall be given in the currency and currency units that are specified by the data element `standardCurrency` in the data element `tariffTable`.

The optional data element `minFee` shall be used to specify a minimum fee. This minimum fee may be lower than the fee that would apply according to the real usage of the charged network. The data type shall be `Int4`. The value shall be given in the currency and currency units that are specified by the data element `standardCurrency` in the data element `tariffTable`.

EXAMPLE 8 A minimum fee of 1,00 EUR is defined in a section based charging scheme. However, there are very short sections for which, based on the applicable toll section length and the tariff, a fee of less than 1,00 EUR would apply (e.g. 1 km x 0,10 EUR/km = 0,10 EUR).

The optional data element `thresholdFee` shall be used to specify a threshold fee. In cases where the fee resulting from the real usage of the charged network is lower than the threshold value, no fee shall apply. The data type shall be `Int4`. The value shall be given in the currency and currency units that are specified by the data element `standardCurrency` in the data element `tariffTable`.

EXAMPLE 9 A vehicle uses a time based area charging scheme for 10 minutes. The fee valid for the applicable tariff class is specified by 0,02 EUR per minute. The threshold fee is specified by 0,30 EUR. As the calculated fee does not reach the threshold value, the resulting fee is 0,00 EUR.

The optional data element `maxFee` shall contain a maximum value for the fee valid for the particular tariff class. The data type shall be `MaxFee`.

The data type `MaxFee` allows the specification of different maximum fee values:

— per day;

— per week;

— per month;

— per year.

The value shall be given in data type `Int4` and in the currency and currency units that are specified by the data element `standardCurrency` in the data element `tariffTable`.

NOTE 3 These parameters may be used, for example, in cordon charging schemes to cap the maximum fee due per day in cases where there are multiple passages across the cordon border.

EXAMPLE 10 A `maxFee` value of “11650” and `currency` value of “EUR” specifies 116,50 EUR maximum fee.

The optional data element `alternativeCurrency` shall be used to specify an alternative currency in cases where the toll context uses more than one currency (e.g. for particular user groups or because of legal reasons). If this data element is present for this particular tariff class (identified by a tariff class ID), the alternative currency specified in the data element `alternativeCurrency` shall be valid instead of the standard currency that is specified in the attribute TariffTable. However, the data provided in the elements `basicFeePerChargeUnit`, `offsetFee`, `thresholdFee`, `minFee` and `maxFee` shall still be given in the currency and units specified in the tariff table. In these cases, a conversion rate shall be applied between the two currencies. The conversion rates for alternative currencies are provided in the attribute `CurrencyConversionTable` (see 8.5.3.2.3). The data type of the data element `alternativeCurrency` shall be `Currency`. The data type `Currency` provides the currency identification as specified in ISO 4217.

8.5.3.2.3 EFC attribute CurrencyConversionTable

The tariff conversion table shall be presented in the EFC attribute `CurrencyConversionTable`.

The structure and data elements of the EFC attribute `CurrencyConversionTable` are given in Table 7 and defined in Annex A.

Table 7 — EFC attribute `CurrencyConversionTable` (informative)

EFC attribute	Data element	Data type	Remark
CurrencyConversionTable	conversions	Sequence of	
	alternativeCurrency	Currency	
	conversionRate	Int4	
	CurrencyConversionTableVersion	VersionAndValidity	

For each toll domain a standard currency shall be defined in the Tariff Table (data element `standardCurrency` as specified in 8.5.3.2).

The attribute `CurrencyConversionTable` shall contain a list of conversion rates that are applicable in cases where the toll context applies more than one currency for the calculation of the fees due.

NOTE Additional currencies can apply for particular user groups or for legal reasons.

Alternative currencies shall be specified individually per tariff class (see 8.5.3.2.2) for the instances to which they apply. In cases where an alternative currency is specified in data element `Tariff`, the attribute `CurrencyConversionTable` shall be present.

The currency conversion table contains, for each alternative currency, the identification of the alternative currency and a conversion rate to the standard currency.

The element `alternativeCurrency` identifies the individual currency by its currency code. The data type shall be `Currency`, which provides the coding as specified in ISO 4217.

The data element `conversionRate` provides the conversion rate between the respective alternative currency and the standard currency. The data type shall be `Int4`. The value shall be given in 0,0001 major units of the alternative currency compared to one major unit of the standard currency.

The following formula shall apply:

Value_in_alternative_currency = Value_in_standard_currency x conversion_rate

EXAMPLE 1 The standard currency is specified as EUR. The alternative currency is specified as NOK. The exchange rate assumed 7,6771 NOK = 1 EUR. In this example, the value in the data element conversionRate shall be 76771.

EXAMPLE 2 The standard currency is specified as EUR. The alternative currency is specified as HUF. A basic fee per charge unit for the particular tariff class is specified as 0,11 EUR. The value in the element conversion rate is set to 2948500. The calculated basic fee per charge unit in the alternative currency is 32,4335 HUF (0,11 EUR x 2948500 × 0,0001).

The data element `CurrencyConversionTableVersion` shall contain version and validity information for the EFC attribute `CurrencyConversionTable`. The data type shall be `VersionAndValidity`. For details see 6.3.

Table 8 — EFC attribute `TariffClassDefinition` (informative)

EFC attribute	Data element	Data type	Remark
TariffClassDefinition	tariffClasses	SEQUENCE OF TariffClass	
	tariffClassDefinitionVersion	VersionAndValidity	

The data element `tariffClasses` shall contain a list of data types `TariffClass`. This data type is described in 8.5.3.3.3.

The data element `tariffClassDefinitionVersion` shall contain version and validity information for the EFC attribute `TariffClassDefinition`. The data type shall be `VersionAndValidity`. For details see 6.3.

This part of ISO 17575 supports different versioning concepts for tariffs, tariff classes, vehicle classes, time classes, user classes and location classes. Changes in tariffs and/or class definitions that apply in the operational lifetime of toll schemes can, for example, be applied the following manner (this is a non-exhaustive list):

— applying the same tariff / class ID after a change in tariffs or class definitions, but using the version and validity data elements in order to identify and specify respective changes in tariffs and classes;

— applying a new tariff / class ID that was not used before the change in tariffs or class definitions and specifying the tariff classes in a way that they comprise only those vehicle / location / time / user classes effective after the change in tariffs or class definitions.

Depending on the method applied in the respective toll context, the optional version and validity information in several class definitions can be present or absent.

8.5.3.3.3 Data type TariffClass

The data type `TariffClass` shall contain all valid combinations of the tariff determinants local vehicle class, time class, location class and user class for a tariff class. Tariff classes and the definition of the tariff determinants are applicable for the entire toll context including all toll context partitions.

The structure and data elements of the data type `TariffClass` are given in Table 9 and defined in Annex A.

Table 9 — Data type `TariffClass` (informative)

Data type	Data element	Data type	Remark
TariffClass	tariffClassId	TariffClassId	
	localVehicleClasses	SEQUENCE OF LocalVehicleClassId	
	timeClasses	SEQUENCE OF TimeClassId	optional
	locationClasses	SEQUENCE OF LocationClassId	optional
	userClasses	SEQUENCE OF UserClassId	optional

Each tariff class shall have a unique identifier (data element `tariffClassId` of data type `TariffClassId`).

The data element `localVehicleClasses` shall contain one or more locally defined vehicle classes. The data type shall be `LocalVehicleClassId`. Vehicle classes shall be defined in EFC attribute `LocalVehicleClassDefinition` (see 8.5.3.4).

The optional data element `timeClasses` shall contain one or more time classes. The data type shall be `TimeClassId`. Time classes shall be defined in EFC attribute `TimeClassDefinition` (see 8.5.3.5).

In cases where at least one time class is defined for the toll context, the optional data element `timeClasses` shall be present.

The optional data element `locationClasses` shall contain one or more location classes. The data type shall be `LocationClassId`. Location class information shall be part of the context layout description (see 8.5.4).

In cases where at least one location class is defined for the toll context, the optional data element `locationClasses` shall be present.

The optional data element `userClasses` shall contain one or more user classes. The data type shall be `UserClassId`. User classes shall be defined in EFC attribute `UserClassDefinition` (see 8.5.3.6).

In cases where at least one user class is defined for the toll context, the optional data element `userClasses` shall be present.

In cases where one of the optional elements `timeClasses`, `locationClasses`, `userClasses` is not present, the respective tariff class shall be valid for all possible values of this element.

EXAMPLE 1 Tariff Class 56 is defined as the combination of Local Vehicle Class 23 and User Class 2.

EXAMPLE 2 Tariff Class 106 is defined as the combination of Local Vehicle Classes 23, 78 and 98 Time Classes 32 and 206.

EXAMPLE 3 Tariff Class 87 is defined as the User Class 1.

EXAMPLE 4 Tariff Class 202 is defined as the combination of Local Vehicle Classes 156, 223 and 224 and Time Class 45 and Location Classes 2 and 5 and User Class 2.

8.5.3.4 EFC attribute LocalVehicleClassDefinition

8.5.3.4.1 Introduction

The attribute `LocalVehicleClassDefinition` shall contain all necessary data to define vehicle classes that locally apply in the respective toll scheme.

The structure and data elements of the EFC attribute are given in Table 10 and defined in Annex A.

Table 10 — EFC attribute `LocalVehicleClassDefinition` (informative)

EFC attribute	Data element	Data type	Remark
`LocalVehicleClass` Definition	localVehicleClasses	SEQUENCE OF LocalVehicleClass	
	localVehicleClassDefinitionVersion	VersionAndValidity	optional

The data element `localVehicleClasses` shall contain a list of data types `LocalVehicleClass`. This data type is described in 8.5.3.4.2.

The optional data element `localVehicleClassDefinitionVersion` shall contain version and validity information for the EFC attribute `LocalVehicleClassDefinition`. The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.3.4.2 Data type LocalVehicleClass

The data type `LocalVehicleClass` contains the definition for one vehicle class. The structure and data elements of the data type `LocalVehicleClass` are given in Table 11 and defined in Annex A.

Table 11 — Data type `LocalVehicleClass` (informative)

Data type	Data element	Data type	Remark
LocalVehicleClass	localVehicleClassId	LocalVehicleClassId	
	nominalElements	NominalVehicleParameters	
	ordinalElements	OrdinalVehicleParameters	optional
	priorityValue	Int1	optional

Each local vehicle class shall have a unique identifier (`localVehicleClassId`) of the data type `LocalVehicleClassId`.

EXAMPLE 1 Vehicle class 21 is defined as all trucks between 3,5 and 12 t and having 3 axles.

EXAMPLE 2 Vehicle class 107 is defined as passenger cars having 3 or 4 axles and euro classes better than 5.

EXAMPLE 3 To exempt vehicles with very low emissions from charges, e.g. in a city charging scheme, these vehicles may be grouped into one vehicle class (e.g. 67), which is defined by all vehicles with euro class 6.

In the context of tariffs, vehicle specific parameters may have a different nature. Vehicle specific parameters may be used as

— nominal scale parameter, or

— ordinal scale parameter.

The data elements `nominalElements` and `ordinalElements` (optional) shall contain the description of vehicle parameters for each local vehicle class.

Each locally defined vehicle class may depend on one or more vehicle specific parameters. Vehicle specific parameters are already defined as attributes in ISO 14906:2011/Amd1:2015 for the purposes of EFC.

NOTE 1 This part of ISO 17575 uses existing data elements (defined in ISO 14906:2011/Amd1:2015) wherever useful.

NOTE 2 Depending on the toll scheme, some of the vehicle parameters can be used in a different manner, e.g. as ordinal scale parameter in one toll scheme and as nominal scale parameter in a second toll scheme.

The data element `nominalElements` shall have the data type `NominalVehicleParameters`. This data type is defined in 8.5.3.4.3.

The data element `ordinalElements` shall have the data type `OrdinalVehicleParameters`. This data type is defined in 8.5.3.4.3.

Each vehicle class may contain priority information (`priorityValue`) of data type `Int1`. This data element shall be used to determine which vehicle class is valid in cases where more than one vehicle class is applicable (e.g. due to overlapping class definitions). A value of 0 shall be used for the lowest priority level and a value of 255 shall be used for the highest priority level.

EXAMPLE 4 Vehicle class 45 is defined as all trucks having an overall length of 6,50 m to 12,50 m. Priority level for this class is set to 8. Vehicle class 46 is defined as all trucks having an overall length of 8,00 m to 15,00 m. Priority level for this class is set to 5. In cases where a vehicle would fall into both classes, as it has a length of 10,65 m, it has to be grouped into vehicle class 45 as the priority level of class 45 is higher.

In cases where vehicle classes overlap (one single vehicle falling into more than one vehicle class), the data element `priorityValue` shall be present. In these cases, the priority values of (partly) overlapping vehicle classes shall have different values.

8.5.3.4.3 Data type NominalVehicleParameters

The data type `NominalElements` shall contain a list of all applicable values of one or more of the following predefined data types:

— `VehicleClass` (as defined in EN 15509:2014);

— `VehicleTrainAxles` (same use as defined in ISO 14906:2011/Amd1:2015 for `TractorAxles` and `TrailerAxles`);

— `EuroValue` (as defined in ISO 14906:2011/Amd1:2015);

— `CopValue` (as defined in ISO 14906:2011/Amd1:2015).

EXAMPLE Vehicle class 31 is defined as all vehicles showing a combination of a `VehicleClass` content "Trucks above 12t", a `VehicleAxles` content of "2 axles" or "3 axles" and a `EuroClass` content of "Euro3".

Data content, semantics and format of the data types VehicleClass, VehicleTrainAxles, EuroValue and CopValue shall be according to their definition in EN 15509:2014 and ISO 14906:2011/Amd1:2015, respectively.

8.5.3.4.4 Data type OrdinalVehicleParameters

The optional data type `OrdinalVehicleParameters` shall contain a list of the applicable value ranges of none, one or more of the following predefined optional data types, all defined in ISO 14906:2011/Amd1:2015 except where indicated:

— `VehicleLengthOverall`

— `VehicleHeightOverall`

— `VehicleWidthOverall`

— `VehicleFirstAxlesHeight`

— `VehicleTractorAxlesNumber`

— `VehicleTrailerAxlesNumber`

— `VehicleMaxLadenWeight`

— `VehicleTrainMaximumWeight`

— `VehicleWeightUnladen`

— `VehicleWeightLaden`

— `EuroValue`

— `CopValue`

— `VehicleClass` (defined in EN 15509:2014)

— `CO2EmissionValue`

— `DieselEmissionValue`

— `ExhaustEmissionValues`

Data content, semantics and format (including resolution if applicable) of the data types above shall be according to their definition in ISO 14906:2011/Amd1:2015 (or in EN 15509:2014 for `VehicleClass`).

The data element `lowerLimit` shall contain the lower limit of the respective parameter range. The value of the lower limit shall be included in the range.

The data element `upperLimit` shall contain the upper limit of the respective parameter range. The value of the upper limit shall not be included in the range.

EXAMPLE 1 A range defined with lowerRange = 3,5 t and upperRange = 12 t includes vehicles having 7,5 t in the respective vehicle class.

EXAMPLE 2 A range defined with lowerRange = 3,5 t and upperRange = 12 t includes vehicles having exactly 3,5 t in the respective vehicle class. It excludes vehicles having exactly 12 t from the respective vehicle class.

8.5.3.5 EFC attribute TimeClassDefinition

8.5.3.5.1 Introduction

The attribute `TimeClassDefinition` shall contain necessary definitions for all time classes which apply in the respective toll scheme.

The structure and data elements of the EFC attribute are given in Table 12 and defined in Annex A.

Table 12 — EFC attribute `TimeClassDefinition` (informative)

EFC attribute	Data element	Data type	Remark
TimeClassDefinition	timeClasses	SEQUENCE OF TimeClass	
	timeClassDefinitionVersion	VersionAndValidity	optional

The data element `timeClasses` shall contain a list of data types `TimeClass`. This data type is described in 8.5.3.5.2.

The optional data element `timeClassDefinitionVersion` shall contain version and validity information for the EFC attribute `TimeClassDefinition`. The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.3.5.2 Date type TimeClass

The data type `TimeClass` contains the definitions for one time class. The structure and data elements of the data type `TimeClass` are given in Table 13 and defined in Annex A.

Table 13 — Data type `TimeClass` (informative)

Data type	Data element	Data type	Remark
TimeClass	timeClassId	TimeClassId	
	nominalElements	NominalTimeParameters	optional
	ordinalElements	SEQUENCE OF OrdinalTime-Parameters	optional
	priorityValue	Int1	optional

Each time class shall have an identifier (`timeClassId`) of the data type `TimeClassId`.

The data elements `nominalElements` and `ordinalElements` shall contain the definitions for each time class.

All absolute time information in these data elements shall be given in local real time.

Time class definitions may be based on

— nominal scale parameter, and

— ordinal scale parameter

For each defined time class, at least one type of parameter – nominal scale or ordinal scale – shall be specified. In cases where both nominal and ordinal scale parameters are present in the definition of an individual time class, a Boolean OR combination shall apply.

If, at a certain point in time, the conditions given in nominal parameters, the definitions given in ordinal parameters or the definitions in both parameters are met, then the respective time class shall be active.

Nominal scale parameters shall be defined in data element `nominalElements`. The data type is `NominalTimeParameters`. Nominal scale parameters shall be defined in one or more of the following data elements:

— `weekdays`

— `dates`

— `externalSetClasses`

The data element `weekdays` shall be used to define one or more days of the week (e.g. Monday and Friday). Data type is `Weekday`, which is of data type `Int1`.

EXAMPLE 1 All odd weekdays of the year are coded using the nominal time parameters. This means that in data type `NominalTimeParameters` the element `weekdays` is present and contains the content (1), (3), (5), (7). The optional data elements `dates` and `classesSetExternally` are not present

The data element `dates` shall be used to identify one or more particular dates (e.g. 25.12.2017). Data type is `DateCompact`, as defined in ISO 14906:2011/Amd1:2015.

The optional data element `classesSetExternally` shall be used to set any predefined time class by external input sources independently from the effective time class.

NOTE 1 This function can be used to overrule the time class (and tariff), which would apply based on other time class determinants and the local time. This function can be used in cases where there is a fully dynamic congestion charging scheme. In such schemes, time classes (and tariffs) can be selected based on the real time traffic situation. The external source can, for example, be the Back End or a dedicated short-range communication (DSRC) device installed at the road side.

EXAMPLE 2 A toll charger wants to run a toll scheme in which a particular expensive tariff is valid during periods of congestion. However, the toll charger does not want to predefine the period of congestion as a fixed period, but to apply this tariff only when real congestion is present. In periods of normal traffic, the predefined tariff (based on the predefined time class) is valid. If suddenly the traffic amount exceeds a certain limit, then the toll charger increases the tariff to make use of the roads less attractive and keep the traffic demand at a lower level. In these cases, the special congestion tariff is applied by activating a new time class (`classesSetExternally`) that has higher priority compared to the predefined time class.

In cases where one instance of the data element `nominalTimeParameters` contains more than one entry (in one or more of the data elements `weekdays`, `dates` and `externalSetClasses`), this shall be understood as Boolean OR combination.

Ordinal scale parameters shall be defined in data element `ordinalElements`, which is defined as a `SEQUENCE OF` the date type `OrdinalTimeParameters`. Ordinal scale parameters shall be defined in one or more of the following data elements:

— `weekdays`

— `absoluteTimesOfDay`

— `relativeTimePeriods`

— `periodsInYear`

The data element `weekdays` shall be used to define one or more periods of days during a week. The first day of the period shall be given in data element `startDay`, the last day of the period shall be given in data element `endDay`. Both data elements are of data type `Weekday`, which is of data type `Int1`.

EXAMPLE 3 A specification of startDay = (1) and endDay = (5) will lead to a tariff class that is valid from Monday to Friday.

The data element `absoluteTimesOfDay` shall be used to define one or more absolute periods in time during a day (e.g. 08:00 h – 10:00 h and 16:30h – 18:15 h). Start times shall be given in data element `startTime` and end times shall be given in data element `endTime`. Both data elements are of data type `Time` defined in ISO 14906:2011/Amd1:2015.

The data element `relativeTimePeriods` shall be used to define one or more time periods (e.g. between 6 and 8 hours). The lower limit of the time period shall be defined in data element `minPeriod`. The upper limit of the time period shall be defined in data element `maxPeriod`. Both data elements are of data type `INT2`. The values shall be given in minutes.

The data element `periodsInYear` shall be used to define one or more periods of days within a year (e.g. 01.07.2013 – 31.08.2013 and 23.12.2013 – 31.12.2013). The first day of the respective periods shall be given in data element `startDay`. The last day of the respective periods shall be given in data element `endDay`. Both data elements are of data type `DateCompact` defined in ISO 14906:2011/Amd1:2015.

EXAMPLE 4 Time class 23 is defined as valid on Monday to Friday between 08:00 h – 10:00 h and 16:00 h – 18:00 h. Priority level of this time class is set to 18.

EXAMPLE 5 Time class 178 is defined valid at 25.12.2015 and 26.12.2015. Priority level of this time class is set to 245.

EXAMPLE 6 In cases where a toll context used time classes 23 and 178, as defined in Examples 1 and 2 above, and 25.12.2015 is a Tuesday, time class 178 is valid as it has the higher priority.

EXAMPLE 7 Time class 18 is defined valid on Monday and Friday between 16:00 h and 20:15 h.

EXAMPLE 8 Time class 221 is defined valid on Saturday between 06:00 and 21:00 and only in cases where the vehicle uses the toll service for less than 2 hours.

In cases where one instance of the data element `ordinalTimeParameters` contains more than one entry (in one or more of the data elements `weekdays`, `absoluteTimeOfDay`, `relativeTimePeriods` and `periodsInYear`), this shall be understood as Boolean AND combination.

NOTE 2 It is possible to apply this mechanism in order to support Examples 4, 7 and 8 above.

Each time class may contain an optional priority information (`priorityValue`) of data type `Int1`. This data element shall be used to determine which time class is valid in cases where more than one time class is active. A value of 0 shall be used for the lowest priority level and a value of 255 shall be used for the highest priority level.

In cases where time classes overlap (one specific point in time falling into more than one time class), the priority value shall be present. In these cases, the priority values of (partly) overlapping time classes shall have different values.

8.5.3.6 EFC attribute UserClassDefinition

8.5.3.6.1 Introduction

The attribute `UserClassDefinition` shall contain necessary definitions for all user classes that apply in the respective toll scheme.

User classes may be used to define different tariffs depending on particular characteristics of the user of toll schemes. This part of 17575 supports the differentiation of users according to the contract they have and according to the number of passengers in the vehicles (to support high applications for high occupancy tolling (HOT)).

The structure and data elements of the EFC attribute are given in Table 14 and defined in Annex A.

Table 14 — EFC attribute `UserClassDefinition` (informative)

EFC attribute	Data element	Data type	Remark
UserClassDefinition	userClasses	SEQUENCE OF UserClass	
	userClassDefinitionVersion	VersionAndValidity	optional

The data element `userClasses` shall contain a list of data types `UserClass`. This data type is described in 8.5.3.6.2.

The optional data element `userClassDefinitionVersion` shall contain version and validity information for the EFC attribute `UserClassDefinition`. The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.3.6.2 Data type UserClass

The data type `UserClass` contains the definitions for one user class. The structure and data elements of the data type `UserClass` are given in Table 15 and defined in Annex A.

Table 15 — Data type `UserClass` (informative)

Data type	Data element	Data type	Remark
UserClass	userClassId	UserClassId	
	contractTypes	SEQUENCE OF ContractTypes	optional
	actualNumberOfPassengers	SEQUENCE OF ActualNumber-OfPassengers	optional
	priorityValue	INT1	optional

Each user class shall have an identifier (`userClassId`) of the data type `UserClassId`.

The optional data elements `contractTypes` and `actualNumberOfPassengers` shall contain the definitions for each user class.

One, or more than one, particular contract that falls into the definition of the particular user class shall be defined in data element contract types. The data type shall be `ContractTypes`. The contracts shall be identified by the data elements `contractProvider` (data type `Provider` defined in ISO 14906:2011/Amd1:2015) and the data element `typeOfContract` (data type `OCTET STRING(SIZE(2))`). The use of these two data types shall be according to the definitions in ISO 14906:2011/Amd1:2015.

NOTE 1 Contract types are allocated by the service provider. It is up to the service provider to use particular contract types to support certain toll charger dependent user classes.

EXAMPLE The use of the data element `contractTypes` may allow fee exceptions for fire brigades and police cars.

One, or more than one, number for the actual number of passengers including the driver shall be given in the data element `actualNumberOfPassengers`. The data type shall be `ActualNumberOfPassengers`.

NOTE 2 The use of the data element `actualNumberOfPassengers` also allows for HOT type EFC applications. Hence, it can also be used for passenger vehicles. It is not intended to be used for vehicle types that are designed for the transportation of a larger number of passengers, e.g. buses.

Each user class may contain an optional priority information (`priorityValue`) of data type `Int1`. This data element shall be used to determine which user class is valid in cases where more than one user class is active at a time. A value of 0 shall be used for the lowest priority level and a value of 255 shall be used for the highest priority level.

In cases where user classes can overlap (more than one user class being active at a point in time), the priority value shall be present. In these cases, the priority values of (partly) overlapping user classes shall have different values.

8.5.3.7 The fee calculation algorithm

The fee due for payment for using a vehicle in a toll domain is determined by the content of the element `unitsUsed`, complemented by a set of four tariff determinants.

The tariff determinants are the

— vehicle class,

— time class,

— location class, and

— user class.

Each of the instances of a tariff determinant is identified by an integer number. At each individual moment, and for a specific charge object in a toll context, a user with the current condition of his or her vehicle can be allocated to a single combination of these four tariff determinants.

NOTE 1 For details on how to determine these determinants see 8.5.3.3.

The data element `TariffClass` associates a unique integer number identifier to a defined combination of the four tariff determinants. For each determinant, more than one instance may be associated. These multi-instances per determinant shall be combined by applying an OR concatenation.

Each `tariffClass` is associated in the data element `Tariff` with a number of attributes. The relevant elements calculating the fee are `chargeUnit`, `basicFeePerChargeUnit` and `intervallScaleFactor`.

The `basicFeePerChargeUnit` is the price to be paid within a specific `tariffClass` for one single unit of the type defined in the element `ChargeUnit`. Hence, the `basicFeePerChargeUnit` defines the price, e.g. for 1 km or 100 m or 4 h or one specific event such as crossing a border.

The `intervallScaleFactor` shall be used to scale the calculated fee linearly according to the specified parameter. `VehicleMaxLadenWeight` and `VehicleLengthOverall` may be applied and selected using the `IntervallScaleParameter` attribute. When applying interval scale parameters, the price indicated in the `basicFeePerChargeUnit` shall be the price for a single unit of the `IntervallScaleParameter`. For example, the price per 10 kg weight or the price per decimetre length, applying the units of these attributes as defined in ISO 14906:2011/Amd1:2015.

If the defined tariff does not use interval scaled parameters then the `intervallScaleFactor` shall be set to 1.

A Front End internal data element `unitsUsed` shall be used as an accumulator for the amount of toll relevant usage of the vehicle gathered by the Front End. For the purpose of calculating the fee, this accumulator shall aggregate the usage only as long as the combination of all four tariff determinants does not change and, therefore, the aggregated usage pertains to a single tariff class. The `unitsUsed` data element aggregates the number of "consumed" charge units. For `unitsUsed` the rounding rule, as defined in data element `roundingRuleForChargeUnitsUsed` in attribute `TariffTable`, shall be used, if applicable.

EXAMPLE 1 A toll scheme of the type area uses as a charge unit 1 h. The charge applies for each commenced hour. In cases where the vehicle stays 6 h and 23 min in this area, the units used is 7.

The value and unit of the charge unit are provided in the data element `ChargeUnit`. This is a defined distance driven by the vehicle, measured or read from the properties of the charge object; a defined

duration in which a vehicle stays within a toll relevant area; or a defined number of events where a vehicle crosses an area border in the relevant direction.

NOTE 2 In a specific toll context different tariff classes may be allocated to a different ChargeUnit choice. This may happen in a park house where in one tariff class, determined by a certain time class, the usage is defined and hence aggregated in hours, in another tariff class in days or in weeks. With this the more complex tariff schemes of parking areas can be modelled.

This completes the relevant elements required to calculate the fee according to a single tariff class. The total fee for a complete charge report interval shall be calculated aggregating all the fees calculated for a single tariff class belonging to the full charge report period.

For the single tariff fee calculation the following algorithm shall be applied:

$$Fee_{[period\ n]} = unitsUsed_{[period\ n]} \cdot basicFeePerChargeUnit_{[TariffClass\ n]} \cdot intervalScaleFactor$$

where

Fee	is the resulting fee (excluding VAT) for a single tariff class in the defined currency,
unitsUsed	contains the integer number of detected/measured/consumed charge units (the relevant charge unit is given in date element `chargeUnit` comprising its value and unit; e.g. 100 m or 2 hours or 1 mile),
basicFeePerChargeUnit	is the fee (excluding VAT) which applies for the use of the defined charge unit given in major units of the defined currency. It is given in data element `basicFeePerChargeUnit`. The applicable monetary unit is defined in data element `standardCurrency`,
intervalScaleFactor	is the value of the selected interval scale parameter using the information given in the data element `intervalScaleParameter`, and
TariffClass	is the identifier associated to the combination of the applicable TimeClass, LocalVehicleClass, UserClass and LocationClass which is defined in the data type `tariffClass`.

NOTE 3 The above formula does not include the optional data elements `offsetFee`, `minFee`, `thresholdFee` and `maxFee`.

EXAMPLE 2 In a distance based charging scheme, a vehicle for which tariff class 25 applies uses the toll road network for 3,4 km. The tariff for tariff class 25 is defined by 0,159 EUR/km. The fee shall be determined in 100 m resolution. Therefore, the charge unit is set to 100 m. The `basicFeePerChargeUnit` will be 0,0159 and `currency` will be EUR (0,159 EUR/km = 0,0159 EUR/100 m). The used units is 34 (= 3,4 km/100 m). Hence, the fee results in 34 x 0,0159 EUR = 0,5406 EUR.

EXAMPLE 3 In an area charging scheme, a vehicle for which tariff class 9 applies uses the tolled area for 8 hours. The tariff for the tariff class 9 is defined by 2,99 GBP/2 hours. The fee shall be determined in 2 hours resolution. Therefore, the charge unit is set to 2 hours. The `basicFeePerChargeUnit` will be 2,99 and `currency` will be GBP. The used units is 4 (= 8 hours/2 hours). Hence, the fee results in 4 x 2,99 GBP = 11,96 GBP.

The actual value used for the `intervalScaleFactor` shall be the value applicable during the calculation period for the value of the parameters `VehicleMaxLadenWeight` and `VehicleLengthOverall` plus the value indicated by the parameter `zeroOffset` (any of these optional parameters that are not available shall be counted as zero) and rounded to the resolution indicated by the parameter `resolution`.

The value used shall be capped to the value indicated by the parameter `max`. No capping shall be performed if this optional parameter is not available. No rounding shall be performed if this optional `zeroOffset` parameter is not available.

Additional flat rates such as monthly fees shall be applied after calculating the fee according to these rules. This part of ISO 17575 does not support these processes.

8.5.4 Requirements with regards to context layout

8.5.4.1 General rules

Toll context layout information shall be provided by the EFC attribute `TollContextLayout`.

One toll context shall have one or more toll context partition layout descriptions (= data type `TollContextPartitionLayout`), one per defined toll context partition.

The data type `TollContextPartitionLayout` shall contain all necessary descriptions of the tolled road infrastructure of a toll context partition.

It shall contain a list of single charge objects including their identifiers, their geographic description and additional information such as applicable location classes.

The main purpose of the EFC attribute `TollLayoutContext` is to provide the Front End with all information that enables the detection (and measurement) of toll liable usage of a tolled infrastructure.

Depending on the type of the toll scheme, the attribute `TollContextPartitionLayout` shall contain the layout descriptions of one of the following types:

— section charging scheme;

— area charging scheme;

— cordon charging scheme.

Charging of road objects (e.g. tunnel, ferries, passes) is considered a subtype of section charging schemes. For the description of road objects, the description of sections shall be used.

The structure and data elements of the EFC attribute are given in Table 16 and defined in Annex A.

Table 16 — Data type `TollContextPartitionLayout` (informative)

Data element	Data type	Remark
tollContextPartitionId	TollContextPartitionId	
layoutDescription	Layout	
geoRefPoint	Point	optional
tollContextPartitionLayoutVersion	VersionAndValidity	

The data element `tollContextPartitionId` shall contain the identifier of the respective toll context partition for which the further parameters in this data type is applicable for.

The data element `layoutDescription` shall give the description of the layout of the respective toll context partition. The data type shall be `Layout`.

The data type `Layout` contains one of the data elements `sectionLayout` (a list of data types `SectionLayout`), `areaLayout` (a list of data types `AreaLayout`) and `cordonLayout` (a list of data types `CordonLayout`).

These data elements shall be present according to the type of the toll context following the rules below:

— for section or road object charging schemes the data element `sectionLayout` shall be used. The data element is described and defined in 8.5.4.2.

— for area charging schemes the data element `areaLayout` shall be used. The data element is described and defined in 8.5.4.3.

— for cordon charging schemes the data element `cordonLayout` shall be used. The data element is described and defined in 8.5.4.4.

The optional data element `geoRefPoint` (data type `Point`) may be used as geographic reference point for the toll context partition. This reference point shall be specified by its longitude and latitude value. In cases where this data element is present all longitude and latitude values given in the layout description shall be relative to this point.

The data element `tollContextPartitionLayoutVersion` shall contain version and validity information for the layout description for the respective toll context partition (i.e. the data type `TollContextPartitionLayout`). The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.4.2 Requirements for section based layout

8.5.4.2.1 Introduction

This standard provides two alternative methods and data elements for the purpose of a description of section layouts:

— analytical method using a set of links defined by start-, end- and intermediate points, and where the points are defined by their coordinates or references to any kind of digital map (see data type `SectionLayout` and 8.5.4.2.2);

— method based on a possible concept or referencing to digital maps based on geographic data files (GDF) (see data type `SectionLayoutGDF` and 8.5.4.2.6).

NOTE The latter GDF-based method for description of the tolled road network is introduced in this part of ISO 17575. Therefore, it provides no backwards compatibility to ISO/TS 17575-3:2011.

The GDF-based method may not be the best and most suitable choice for Front End implementation. Alternative methods and formats may provide better performance and benefits from an operational perspective. In contrast, GDF-based methods may be a good choice for the interface between toll charger and service provider, as specified in ISO°12855:2015.

8.5.4.2.2 Data element sectionLayout/Data type SectionLayout

The data element `sectionLayout` in the data type `Layout` contains a list of data types `SectionLayout`. This list shall contain the geographic description and supporting data of all road sections forming the charged road network of the respective toll scheme. Each list entry represents one road section. The entire charged road network may consist of one or more than one section.

EXAMPLE 1 Austrian Go-Maut and German LKW-Maut systems are considered as section tolling schemes. Both tolling schemes consist of a certain number of road sections. In both EFC schemes the fee depends on predefined length information per section.

A tolled road section shall be described by the following data:

— section identifier/charge object identifier;

— section/charge object name (optional);

— geographic reference point (optional);

— list of points used in the data elements of the section description;

— description of the toll path;

— liability rules;

— list of possible paths towards the toll path (optional);

— list of possible paths onwards the toll path (optional);

— supporting information regarding other road network located close to the toll section (optional);

— charged distance of the section (may not in all cases equal the real distance);

— real distance of the section (optional);

— time classes applicable for this section (optional);

— location class for the section.

Each section shall be described by means of the data type `SectionLayout`.

The structure and data elements of the data type `SectionLayout` are given in Table 17 and defined in Annex A.

Table 17 — Data type `SectionLayout` (informative)

Data type	Data element	Data type	Remark
SectionLayout	chargeObjecDesignation	ChargeObjectDesignation	
	chargeObjectName	UTF8String	optional
	chargeObjectRefPoint	Point	optional
	networkPoints	SEQUENCE OF PointIdDefinition	optional
	tollPath	Link	
	liabilityRules	LiabilityRules	
	pathStructureTowards	SEQUENCE OF Link	optional
	pathStructureOnwards	SEQUENCE OF Link	optional
	supportingInformation	SEQUENCE OF SupportingPoint	optional
	chargeDistance	ChargeDistance	
	realDistance	Distance	optional
	applicableTimeClasses	SEQUENCE OF TimeClassId	optional
	locationClass	LocationClassId	
	storageRequired	BOOLEAN	optional
	InvoicingRelatedData	SupplementaryInvoicingData	optional

Each section shall be identified by a charge object identifier. The data element `chargeObjectDesignation` shall contain this identifier. The data type shall be `ChargeObjectDesignation`, which is defined as `Int4`. The charge object identifier shall be unique within the toll context partition. In cases where the section is part of a road network that is defined within an area charging scheme, the charge object identifier shall be unique within the area (within the given `areaId`).

The optional data element `chargeObjectName` shall be used to give the name or designation of the section. The data type shall be `UTF8String`.

EXAMPLE 2 “A8 Augsburg West – Augsburg Ost” or “M9 Exits 4a – 5”.

The optional data element `chargeObjectRefPoint` shall be used to set a reference point valid for this particular charge object. In cases where this data element is present, all longitude and latitude values given within this charge object description are considered being relative to this point.

To set a reference point valid for the entire context layout the data element `geoRefPoint` in the EFC attribute `TollContextLayout` shall be used.

The data type of the data element `chargeObjectRefPoint` shall be `Point`.

The data type `Point` provides three options for the provision of the location of a point. These options are:

— point identifier (data element `pointIdentifier` of data type `PointId`);

— absolute longitudinal, latitudinal and optional altitude coordinates (data element `abolutePointCoordinates` of data type `AbsolutePointCoordinates`);

— relative longitudinal, latitudinal and optional altitude coordinates (data element `relativePointCoordinates` of data type `RelativePointCoordinates`).

In cases where a point identifier is used, the coordinates of the respective location are either specified in the data element `networkPoints` (as decribed in the next paragraph) or are provided, e.g. in digital maps. Thus, the use of point identifiers avoids duplication of location specifications and enables referencing to one single definition of the absolute coordinates of a location in the entire toll context description.

The optional data element `networkPoints` shall contain a list of all geographic points used for the various location specifications as given in the description of the section. Each list element shall be of the data type `PointIdDefinition`. For each point, this list shall contain a unique identifier and the respective longitude and latitude values.

NOTE 1 In cases where the list of network points is present and these network points are given by their coordinates and identifiers, other data elements in this attribute can reference individual network points by their identifiers only.

To translate `longitude`, `latitude` and `altitude` coordinates to the corresponding real position on earth or vice-versa the geodetic datum shall be WGS84(G1150), according to NIMA TR8350.2 version 3, per default unless another earth-centred, earth-fixed, polar coordinate geodetic datum is agreed mutually by the toll charger and toll service provider.

Furthermore, by default it is allowed to use any earth-centred, earth-fixed, polar coordinate geodetic datum, as long as the maximum datum displacement relative to the geodetic datum prescribed is acceptable to the toll charger of the related toll domain.

The maximum tolerated datum displacement, also called datum shift, should not exceed 0.4 metres.

NOTE 2 The recommended maximum tolerated displacement allows, for example, for using one of the International Terrestrial Reference Frames (ITRF), the Russian PZ90.2 or one of the European Terrestrial Reference Frame (ETRF) as geodetic datums alternative to the WGS84.

The calculated datum displacement should be determined according to the definitions in ASME Y14.5:2009.

The data element `tollPath` shall contain the geographic description of the respective road section. The data type shall be `Link`. This data type is defined in 8.5.4.2.3.

The data element `liabilityRules` shall contain rules to specify under which circumstances a vehicle using the section is liable to pay for the use of the entire toll section. The data type shall be `LiabilityRules`. This data type is defined in 8.5.4.2.4.

The optional data element `pathStructureTowards` shall contain the layout description of the roads that are in front (relative to the driving direction) of the charged road section. It shall contain a list of data types `Link`. For the definition of the data type `Link` see 8.5.4.2.3.

NOTE 3 This information is useful to support certain charge object detection algorithms in some Front End implementations.

The optional data element `pathStructureOnwards` shall contain the layout description of the roads that are connected ahead (relative to the driving direction) of the charged road section. It shall contain a list of data types `Link`. For the definition of the data type `Link` see 8.5.4.2.3.

NOTE 4 This information is useful to support certain charge object detection algorithms in some Front End implementations. Depending on their particular implementations, Front Ends can use this additional information for performance improvements with respect to the detection of the toll liable use of a charge object. It gives more details about the road network that leads to the `Link` and the road network that connects to the `Link`. Thus, such additional data about the context of the `Link` can help to prevent the false detection of the charge object or the missing detection of a charge object.

The optional data element `supportingInformation` shall contain a list of intermediate points on the charged road section. For each point in the list, a distance to other (non-tolled) road infrastructure may be given. The data type of the list elements is `SupportingPoint`. This data type is described in 8.5.4.2.5.

The data element `chargeDistance` shall contain length information for the toll section. This length information shall be used as the basis for calculation of the fee to be paid for the use of this road section. However, this length information may or may not represent the real length of the section. The type of the data element `chargeDistance` shall be `ChargeDistance`.

The definition of the data type `ChargeDistance` allows either a predefined distance value for the section or a distance values depending on the entry section of the road network.

NOTE 5 Such predefined length values provide the possibility to set section length values based on “political” reasons or to implicitly apply a particular rounding strategy for section length values.

NOTE 6 Section length values that depend on the entry section are typically used in closed tolling schemes.

The optional data element `realDistance` shall give the real measured length of the toll section. This length information may be different from the one given in data element `chargeDistance`. The type of the data element `realDistance` shall be `Distance` as defined in ISO 17575-1:2016.

The optional data element `applicableTimeClasses` shall contain a list of all time classes (represented by data type `TimeClassId`) that may apply to this specific toll section.

NOTE 7 This data element enables single road sections to be charged at certain times only.

EXAMPLE 3 This supports highway sections in urban areas, which will be charged only at peak hours.

The data element `locationClass` shall contain the location class information for this toll section (data type `LocationClassId`). The value in this data element shall be used as one of the tariff class determinants (see 8.5.3.2.3).

The optional data element `storageRequired` shall provide information to the Front End if the passage (= toll liable use) of a section shall be internally stored as an event for further use and processing. The data type shall be BOOLEAN.

NOTE 8 Such storage is of added value, e.g. in cases where there is a more complex closed section based toll network that allows different paths to be taken between an entry and an exit. In such cases, the fee depends on the individual path (= sections used) the vehicle has chosen.

The optional data element `invoicingRelatedData` shall provide supplementary data that may be required and used by the toll service provider for road user invoicing purposes. Consequently, such data are not required for toll charging related processes in the Front End. However, such data are of relevance for the data exchange between the toll charger and toll service provider(s). While this interface is outside the scope of ISO 17575, it is in the scope of ISO 12855:2015. ISO 12855:2015 imports data types and entire data structures from this part of ISO 17575 and therefore the data specification for such invoicing related data in included here.

The data element `invoicingRelatedData` shall be of type `SupplementaryInvoicingData`, as specified in Annex A. This data type provides for

— detailed (textual) description on road sections,

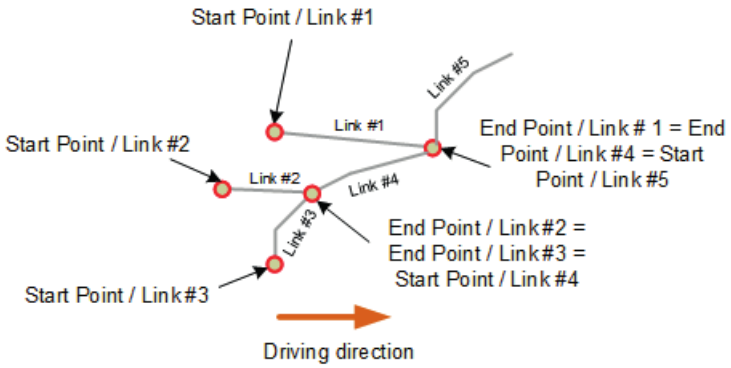


Figure 8 — Example of a complex road structure

8.5.4.2.4 Data type LiabilityRules

To define the liability rule that applies in the tolling context, the data type `LiabilityRules` shall be used. Liability rules give the conditions to decide if and when a vehicle driving on the section has to pay for the section or not. This part of ISO 17575 supports the following rules:

— passage of defined number (one or two) of location points (toll point(s)) on the entire section;

— passage of a particular road piece of the entire section;

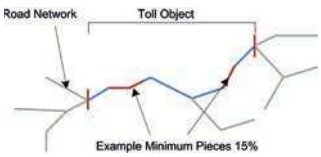
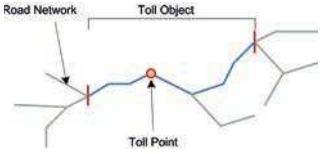
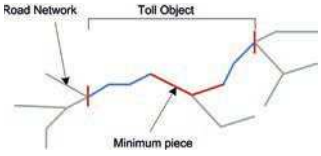
— passage of a certain percentage of the entire section.

NOTE Liability rules are typically defined in a legal framework belonging to each toll scheme. This part of ISO 17575 only gives the possibility to "convert" the legal rules into technical definitions.

The data type `LiabilityRules` shall contain one of the data elements `tollPoints`, `minTollPath` and `minTollPortion`.

Table 18 describes the use of the data type `LiabilityRules`.

Table 18 — Use of the data elements in data type `LiabilityRules`

Rule	Description	Example	ASN.1 element in liabilityRules
Toll point(s)	Passage of a number of location points (one to two) – makes the vehicle liable to pay for the use of the entire section		`tollPoints`
Absolute piece of section	Passage of a certain piece of the entire toll section – makes the vehicle liable to pay for the use of the entire section		`minTollPath`
Relative piece of section	Passage of a certain percentage of the entire toll section – makes the vehicle liable to pay for the use of the entire section		`minimumUsage`

The optional data element `tollPoints` shall be used to define toll point(s). It shall contain one or two points. Both points shall be of data type `Point` (for an explanation of the options in this data type see 8.5.4.2).

The optional data element `minTollPath` shall be used to define a particular piece of the section which shall be passed as a minimum. It shall contain the geographic description of this piece of road. The data type shall be `Link`.

The optional data element `minUsage` shall be used to define the portion of the entire section (percentage value) that has to be passed as a minimum. The data type shall be `INTEGER(0..1000)`. The resolution shall be 0,1 %.

8.5.4.2.5 Data type SupportingPoints

The data type `SupportingPoints` shall be used to give information regarding the distance to road infrastructure that is adjacent to the charge object. It shall contain a list of points that shall be located on the charged section. Each point shall be of data type `Point` (for an explanation of the options in this data type see 8.5.4.2).

For each point, the minimum distance to the adjacent road infrastructure shall be given in the optional data element `distanceToNextRoad`. This data element shall be of type `Distance`, as defined in ISO 17575-1:2016.

8.5.4.2.6 Data type SectionLayoutGDF

The data type `SectionLayoutGDF` provides the possibility to describe a section based layout by means of references to digital maps that use a GDF-type of format.

The ASN.1 data specification of the data structure is provided in Annex A.

For details, see also the note in 8.5.4.2.1 and Annex E.

8.5.4.3 Requirements for area based layouts

The data element `areaLayout` shall give the full description of the context layout of an area charging scheme. The data element `areaLayout` shall contain a list of the descriptions of one or more geographic areas forming one toll context and belonging to one toll scheme (applying one single tariff table, tariff class definitions, etc.). In cases where more than one area layout is present, the areas must not overlap. The elements of the list shall have the type `AreaLayout`.

EXAMPLE An area charging scheme is split into two non-overlapping areas. One area covers the southern part of a metropolitan area, the second area covers the northern part, whereas the city centre is not covered at all.

Each area shall be described using the data type `AreaLayout`.

The structure and data elements of the data type `AreaLayout` are given in Table 19 and defined in Annex A.

Table 19 — Data type `AreaLayout` (informative)

Data type	Data element	Data type	Remark
AreaLayout	areaId	AreaId	
	areaBorder	Polygon	
	locationClass	LocationClassId	optional
	applicableTimeClasses	SEQUENCE OF TimeClassID	optional
	roadNetwork	SEQUENCE OF RoadNetwork	optional

The data element `areaId` shall contain an identifier for the area. The identifier shall be unique in the toll context. The data type shall be `AreaId`.

The data element `areaBorder` shall contain the description of the border of the area. The data type shall be `Polygon`.

The data type `Polygon` is defined as a list of the data type `Point`. The points shall be defined in an order that creates and closes the polygon in a clockwise direction. The segments of the polygon shall be created by connecting each of the points with its successor point. The polygon shall be closed by connecting the last point in the list with the first point. The points shall be defined in a way that the connections between the points do not intersect. The inner side of the polygon (tolled area) is defined as the geographical area that is located at the right-hand side when moving on a polygon segment from its start point to its end point.

The optional element `altitude` in data type `Point` shall not be used in relation to the data element `areaBorder`.

The optional data element `locationClass` shall contain the location class for this area (data type `LocationClassId`). The value in this data element shall be used as one of the tariff class determinants (see 8.5.3.2.3).

The optional data element `applicableTimeClasses` shall contain a list of all time classes (represented by data type `TimeClassId`) that may apply to this area.

NOTE 1 This data element enables the area charging schemes to be active at certain time periods only (e.g. 08:00 – 12:00 h).

The optional data element `roadNetworks` shall contain a list of descriptions of road networks. Each of these networks may have a different location class. This data element may be used for area charging schemes that charge according to the measured distance on a specified road network. Moreover, the area may contain more than one network supporting different tariffs.

NOTE 2 This feature allows the use of different tariffs, e.g. depending on the classes of the road networks. In these cases, all road segments belonging to the same road class are defined in one single data element `roadNetworks` that has a defined `locationClass`.

Each list entry shall have the data type `RoadNetwork`. The data elements and respective data types of the data type `RoadNetwork` are described in 8.5.4.2.

The charge object identifiers allocated to each section of the road network shall be unique within the entire toll context.

8.5.4.4 Requirements for cordon based layouts

8.5.4.4.1 Data element cordonLayout

The data element `cordonLayout` shall give the full description of the context layout of a cordon charging scheme. The data element `cordonLayout` shall contain a list of the descriptions of one or more geographic cordons forming one `toll` context and belonging to one toll scheme (applying one single tariff table, tariff class definitions, etc.). In cases where more the one cordon layout is present, the cordons must not overlap. The elements of the list shall have the type `CordonLayout`.

Each cordon shall be described using the data type `CordonLayout`.

The structure and data elements of the data type `CordonLayout` are given in Table 20 and defined in Annex A.

Table 20 — Data type `CordonLayout` (informative)

Data type	Data element	Data type	Remark
CordonLayout	cordonId	CordonId	
	cordonBorderPolygon	SEQUENCE OF CordonBorderSegment	

The data element `cordonId` shall contain an identifier for the cordon. The identifier shall be unique in the toll context. The data type shall be `CordonId`.

Table 21 — Data type `CordonBorderSegment` (informative)

Data type	Data element	Data type	Remark
CordonBorderSegment	cordonSegmentId	CordonSegmentId	
	startPoint	Point	
	cordonEntryLocation	SEQUENCE	optional
	cordonExitLocation	SEQUENCE	optional

The data element `cordonSegmentId` shall contain an identifier for the cordon segment. The identifier shall be unique within the cordon layout. The data type shall be `CordonSegmentId`.

The data element `startPoint` shall be used for the description of the start point of the border segment. The data type shall be `Point`.

The optional data element `cordonEntryLocation` shall be present in cases where the respective cordon border segment is considered as an entry location of the tolled cordon.

The data element `entryLocationId` shall contain a charge object identifier. The data type shall be `ChargeObjectDesignation`. The charge object identifier shall be unique within the toll context.

The data element `entryLocationClass` shall contain the location class which is applicable to this particular entry point. The data type shall be `LocationClassId`.

The optional data element `applicableTimeClasses` shall contain a list defining all applicable values for the time classes. The data type of the list elements shall be `TimeClassId`. This data element shall be used to define those time classes which are valid at this specific entry point.

NOTE This option allows the definition of cordon charging schemes with different time classes at different entry points.

The optional data element `cordonExitLocation` shall be present in cases where the respective cordon border segment is considered as an exit location of the tolled cordon.

The data element `exitLocationId` shall contain a charge object identifier. The data type shall be `ChargeObjectDesignation`. The charge object identifier shall be unique within the toll context.

The data element `exitLocationClasses` shall contain a list of location classes. These location classes may also depend on the entry location (which shall be contained in an optional list of data elements `entryLocation` of the data type `LocationClassId`). The location classes shall be specified using the data type `LocationClassId`.

The optional data element `applicableTimeClasses` shall contain a list defining all applicable values for the time classes. The data type of the list elements shall be `TimeClassId`. This data element shall be used to define those time classes which are valid at this specific exit point.

8.5.5 Requirements with regards to reporting rules

8.5.5.1 Introduction

The data element in the data set Reporting Rules shall give information regarding

— rules which force the generation of a charge report, and

— the content of the charge report.

NOTE The definition of the charge report and its data elements are given in ISO 17575-1:2016 and is therefore outside the scope of this part of ISO 17575.

The following EFC attributes belong to the data set Reporting Rules:

— ChargeReportingEvents;

— ChargeReportConfiguration.

The following clauses give the description and definition of these EFC attributes.

8.5.5.2 Charge reporting event definitions

8.5.5.2.1 EFC attribute ChargeReportingEvents

The attribute `ChargeReportingEvents` shall contain a definition of all events that shall trigger the generation of a charge report in the Front End.

One toll context shall have one or more charge reporting event definitions (= EFC attributes `ChargeReportingEvents`). One charge reporting event definition is valid for one or more toll context partitions.

The following event types are supported by this part of ISO 17575:

— events depending on absolute points in time;

— events depending on relative time periods;

— events depending on the travelled distance;

— events depending on passing specified locations;

— events depending on account limits.

The structure and data elements of the EFC attribute `ChargeReportingEvents` are given in Table 22 below and defined in Annex A.

Table 22 — EFC attribute `ChargeReportingEvents` (informative)

EFC attribute	Data element	Data type	Remark
ChargeReportingEvents	applicablePartitions	SEQUENCE OF TollContextPartitionId	
	absoluteTimeEvents	SEQUENCE OF AbsoluteTimeEvent	optional
	relativeTimeEvents	RelativeTimeEvent	optional
	travelledDistanceEvents	Distance	optional
	locationEvents	SEQUENCE OF LocationEvent	optional
	feeLimitEvents	FeeLimit	optional
	chargeReportingEventsVersion	VersionAndValidity	

The data element `applicablePartitions` shall contain a list of the identifiers of those toll context partitions the respective charge reporting event definition is applicable for. Each list entry shall be of type `TollContextPartitionId`.

The optional data element `absoluteTimeEvents` shall contain a list of the descriptions of events that depend on specified absolute points in time. Each list element shall have the data type `AbsoluteTimeEvent`. This data type is described in 8.5.5.2.2.

The optional data element `relativeTimeEvents` shall contain the definition of a periodical generation of the charge report. The data element shall be of data type `RelativeTimeEvent`. This data type is described in 8.5.5.2.3.

The optional data element `travelledDistanceEvents` shall contain a distance value. When the vehicle has travelled the specified distance it shall trigger the generation of a charge report. The data type shall be `Distance`, as defined in ISO 17575-1:2016.

The optional data element `locationEvents` shall contain a list of the descriptions of events that depend on specified locations. When the vehicle passes the specified location it shall trigger the generation of a charge report. Each element of the list shall have the data type `LocationEvent`. This data type is described in 8.5.5.2.4.

The optional data element `feeEvent` shall contain the definition for triggering a charge report depending on the amount of fee collected since the last charge report has been initiated. The data type shall be `FeeLimit`, which is of data type `PaymentFee` as defined in ISO 14906:2011/Amd1:2015. In cases where the account balance reaches the value specified in the data element, the generation of a charge report shall be triggered.

The data element `chargeReportEventsVersion` shall contain version and validity information for the data contained in the EFC attribute `chargeReportEvents`. The data type shall be `VersionAndValidity`. The data element shall be optional. For details see 6.3.

8.5.5.2.2 Data type AbsoluteTimeEvent

The data type `AbsoluteTimeEvent` shall define a point in time. This point in time shall be of data type `Time`.

Once the point in time is reached, the Front End shall trigger the generation of a charge report.

In addition, the data type `AbsoluteTimeEvent` shall contain the optional data element `randomDelay`. The value specified in this data element shall delay the generation of the charge report by the given period. The data time shall be `Int4`. The value shall be given in seconds.

8.5.5.2.3 Data type RelativeTimeEvent

The data type `RelativeTimeEvent` shall contain a time interval. The data type shall be `Int3`. The value shall be given in seconds. The start of the interval shall be triggered by the generation of the last charge report.

Once the time interval has elapsed the Front End shall trigger the generation of a charge report.

In addition, the data type `RelativeTimeEvent` shall contain the optional data element `randomDelay`. The value specified in this data element shall delay the generation of the charge report by the given period. The data time shall be `Int3`. The value shall be given in seconds.

8.5.5.2.4 Data type LocationEvent

The data type `LocationEvent` shall contain a list of locations. Once the vehicle has reached the specified location, the Front End shall trigger the generation of a charge report. The list shall contain the optional location types

— chargeObject,

— line, and

— area.

The optional data element `chargeObject` shall contain the charge object identifier. The data type shall be `ChargeObjectDesignation`.

Once the Front End detects that is has reached the respective charge object, it shall trigger the generation of a charge report.

The optional data element `line` shall contain a line description. The data type shall be `Line`. The data elements `crossingDirection1` and `crossingDirection2` define the travel directions that cause the generation of the charge report. Both data elements are of type BOOLEAN.

The data element `crossingDirection1` is valid when the vehicle crosses the line from the left side to the right side. The viewing direction (to define left and right) shall be from the first point of the line definition to the last point of the line definition.

The data element `crossingDirection2` is valid when the vehicle crosses the line from the right side to the left side. The viewing direction (to define left and right) shall be from the first point of the line definition to the last point of the line definition.

If the value is set to `FALSE` no charge report shall be created. In cases where the value is set to `TRUE` a charge report shall be generated.

The data element `area` shall contain an area description. The data type of the data element shall be `Polygon`. The definition of the data element `Polygon` and the inner side of the polygon are outlined in 8.5.4.3. The data elements `atExit` and `atEntry` (both shall be of data type BOOLEAN) shall give information to distinguish between triggering a charge report at exit or entry of the specified area.

8.5.5.3 Charge reporting configuration definition

8.5.5.3.1 EFC attribute ChargeReportConfiguration

Charge reports are generated by the Front End. Content, semantics and coding of the charge reports are defined in ISO 17575-1:2016 and are therefore outside the scope of this part of ISO 17575.

One toll context shall have one or more charge report configurations (= EFC attributes `ChargeReportConfiguration`). One charge report configuration shall be valid for one or more toll context partitions.

As defined in ISO 17575-1:2016, the EFC attribute `ChargeReport` includes optional data elements. It is assumed that the presence of these optional data elements depends on the

— type and nature of the toll scheme,

— toll charger requirements, and

— service provider requirements.

NOTE More details and considerations regarding the charge report are provided in ISO 17575-1:2016.

The attribute `ChargeReportConfiguration` shall be used to set the contents of the charge reports that shall be generated by the Front End. ISO 17575-1:2016 defines the data elements of the charge report with respect to their coding and semantics. This part of ISO 17575 defines how the Back End shall request the presence of the optional date elements in the charge report.

To request the presence of an optional data element in the charge report, the corresponding data element in the attribute `ChargeReportConfiguration` shall be set to "`TRUE`".

To request the absence of an optional data element in the charge report, the corresponding data element in the attribute `ChargeReportConfiguration` shall be set to "`FALSE`".

The structure and data elements of the EFC attribute `ChargeReportConfiguration` are given in Table 23 and defined in Annex A.

Table 23 — EFC attribute `ChargeReportConfiguration` (informative)

Data element	Data type	Remark
applicablePartitions	SEQUENCE OF TollContextPartionId	

Table 23 *(continued)*

Data element	Data type	Remark
chargeReportContent	ChargeReportContent	
usageStatementContent	UsageStatementContent	
cccAttributesContent	CCCAttributesContent	optional
aggregatedSingleTariffClassSessionContent	AggregatedSingleTariff ClassSessionContent	optional
detectedChargeObjectContent	DetectedChargeObject Content	optional
listOfRawUsageDataContent	ListOfRawUsageData Content	optional
listOfDsrcUsageContent	ListOfDsrcUsageContet	optional
aggregatedFeeContent	aggregatedFeeContent	optional
measuredRawUsageDataContent	MeasuredRawUsageDataContent	optional
nmeaDataContent	NmeaDataContent	optional
chargeReportConfigurationVersion	VersionAndValidity	

The data element `applicablePartitions` shall contain a list of the identifiers of those toll context partitions the respective charge report configuration is applicable for. Each list entry shall be of type `TollContextPartitionId`.

The data element `chargeReportConfigurationVersion` shall contain version and validity information for the data contained in EFC attribute `ChargeReportConfiguration`. The data type shall be `VersionAndValidity`. For details see 6.3.

8.5.5.3.2 Data type ChargeReportContent

As defined in ISO 17575-1:2016, the data type `ChargeReport` includes optional data elements.

The attribute `ChargeReportContent` shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the attribute `ChargeReport`.

To request the presence of an optional data element in attribute `ChargeReport`, the corresponding data element in the attribute `ChargeReportContent` shall be set to "`TRUE`".

To request the absence of an optional data element in attribute `ChargeReport`, the corresponding data element in the attribute `ChargeReportContent` shall be set to "`FALSE`".

Table 24 contains a list of all data elements of the EFC attribute `ChargeReportContent`.

Table 24 — Data elements in EFC attribute `ChargeReportContent` (informative)

Data element	Data type (informative)	Description
useOfCrAuthenticator	BOOLEAN	Requests use of the authenticated charge report
obeId	BOOLEAN	Requests presence or absence of data element `obeId` in the charge report
vehicleLPNr	BOOLEAN	Requests presence or absence of data element `vehicleLPNr` in the charge report
paymentMeans	BOOLEAN	Requests the presence or absence of data element `paymentMeans` in the charge report
tollContext	BOOLEAN	Requests the presence or absence of data element `tollContext` in the charge report
chargeReportFinalRecipient	BOOLEAN	Requests the presence or absence of data element `chargeReportFinalRecipient` in the charge report

Table 24 *(continued)*

Data element	Data type (informative)	Description
timeOfReport	BOOLEAN	Requests the presence or absence of data element `timeOfReport` in the charge report
reportPeriod	BOOLEAN	Requests the presence or absence of data element `reportPeriod` in the charge report
versionInfo	BOOLEAN	Requests the presence or absence of data element `versionInfo` in the charge report
sumVatForThisSession	BOOLEAN	Requests the presence or absence of data element `sumVatForThisSession` in the charge report
accountStatus	BOOLEAN	Requests the presence or absence of data element `accountStatus` in the charge report
chargeReportCounter	BOOLEAN	Requests the presence or absence of data element `chargeReportCounter` in the charge report
mileage	BOOLEAN	Requests the presence or absence of data element `mileage` in the charge report
listOfCCCAttributes	BOOLEAN	Requests the presence or absence of data element `listOfCCCAttributes` in the charge report

8.5.5.3.3 Data type UsageStatementContent

As defined in ISO 17575-1:2016, the data type `UsageStatement` includes optional data elements.

The data type `UsageStatementContent` shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element `UsageStatement` in the attribute `ChargeReport`.

To request the presence of an optional data element in data type `UsageStatement`, the corresponding data element in data type `UsageStatementContent` shall be set to "`TRUE`".

To request the absence of an optional data element in data type `UsageStatement`, the corresponding data element in data type `UsageStatementContent` shall be set to "`FALSE`".

Table 25 contains a list of all data elements of the data type `UsageStatementContent`.

Table 25 — Data elements in data type `UsageStatementContent` (informative)

Data element	Data type (informative)	Description
useOfUsageStatementAuthenticator	BOOLEAN	Requests the use of an authenticated usage statement
usageStatementId	BOOLEAN	Requests the presence or absence of data element usageStatementId `in usageStatement`
tollContext	BOOLEAN	Requests the presence or absence of data element `tollContext` in `usageStatement`
chargeReportFinalRecipient	BOOLEAN	Requests the presence or absence of data element `chargeReportFinalRecipient` in `usageStatement`
aggregatedFee	BOOLEAN	Requests the presence or absence of data element `aggregatedFee` in `usageStatement`
sumVat	BOOLEAN	Requests the presence or absence of data element `sumVat` in `usageStatement`

Table 25 *(continued)*

Data element	Data type (informative)	Description
aggregatedSingleTariffClassSession	BOOLEAN	Requests the presence or absence of data element `aggregatedSingleTariffClassSession` in `usageStatement`
listOfChargeObjects	BOOLEAN	Requests the presence or absence of data element `listOfChargeObjects` in `usageStatement`
listOfDSRCUsageData	BOOLEAN	Requests the presence or absence of data element `listOfDSRCUsageData` in `usageStatement`
listOfRawUsageData	BOOLEAN	Requests the presence or absence of data element `listOfRawUsageData` in `usageStatement`
noUsage	BOOLEAN	Requests the presence or absence of data element `noUsage` in `usageStatement`
additionalUsageInformation	BOOLEAN	Requests the presence or absence of data element `additionalUsageInformation` in `usageStatement`

8.5.5.3.4 Data type CCCAttributesContent

As defined in ISO 17575-1:2016, the data type `CCCAttributes` includes optional data elements.

The data type `CCCAttributesContent` shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element `CCCAttributes` in the attribute `ChargeReport`.

To request the presence of an optional data element in data type `CCCAttributes`, the corresponding data element in data type `CCCAttributesContent` shall be set to "`TRUE`".

To request the absence of an optional data element in data type `CCCAttributes`, the corresponding data element in data type `CCCAttributesContent` shall be set to "`FALSE`".

Table 26 contains a list of all data elements of the data type `CCCAttributesContent`.

Table 26 — Data elements in data type `CCCAttributesContent` (informative)

Data element	Data type (informative)	Description
timeOfCCCRecord	BOOLEAN	Requests the presence or absence of data element `timeOfCCCRecord` in data element `CCCAttributes` in the charge report
axlesHistory	BOOLEAN	Requests the presence or absence of data element `axlesHistory` in data element `CCCAttributes` in the charge report
commStatus	BOOLEAN	Requests the presence or absence of data element `commStatus` data element `CCCAttributes` in the charge report
gnssStatus	BOOLEAN	Requests the presence or absence of data element `gnssStatus` in data element `CCCAttributes` in the charge report
distRecStatus	BOOLEAN	Requests the presence or absence of data element `distRecStatus` in data element `CCCAttributes` in the charge report
activeContexts	BOOLEAN	Requests the presence or absence of data element `activeContexts` in data element `CCCAttributes` in the charge report
obeHistory	BOOLEAN	Requests the presence or absence of data element `obeHistory` in data element `CCCAttributes` in the charge report

8.5.5.3.5 Data type AggregatedSingleTariffClassSessionContent

As defined in ISO 17575-1:2016, the data type `AggregatedSingleTariffClassSession` includes optional data elements.

The data type `AggregatedSingleTariffClassSessionContent` shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element `AggregatedSingleTariffClassSession`.

To request the presence of an optional data element in data type `AggregatedSingleTariffClassSession`, the corresponding data element in data type `AggregatedSingleTariffClassSessionContent` shall be set to "`TRUE`".

To request the absence of an optional data element in data type `AggregatedSingleTariffClassSession`, the corresponding data element in data type `AggregatedSingleTariffClassSessionContent` shall be set to "`FALSE`".

Table 27 contains a list of all data elements of the data type `AggregatedSingleTariffClassSessionContent`.

Table 27 — Data elements in data type `AggregatedSingleTariffClassSessionContent` (informative)

Data element	Data type (informative)	Description
timePeriodCovered	BOOLEAN	Requests the presence or absence of data element `timePeriodCovered` in data element `AggregatedSingle-TariffClassSession`
currenttariffClass	BOOLEAN	Requests the presence or absence of data element `currentTariffClass` data element `AggregatedSingle-TariffClassSession`
tariffClassDescription-Content	TariffClassDe-scriptionContent	Shall only be present in cases where currentTariffClass = TRUE, for details see 8.5.5.3.12
vehicleDescription	BOOLEAN	Requests the presence or absence of data element `vehicleDescription` in data element `AggregatedSingle-TariffClassSession`
vehicleDescriptionCon-tent	VehicleDescrip-tionContent	Shall only be present in cases where vehicleDescription = TRUE, for details see 8.5.5.3.14
totalDistanceCovered	BOOLEAN	Requests the presence or absence of data element `totalDistanceCovered` in data element `AggregatedSin-gleTariffClassSession`
numberOfDetectedE-vents	BOOLEAN	Requests the presence or absence of data element `numberOfDetectedEvents` in data element `AggregatedS-ingleTariffClassSession`
obeStatus	BOOLEAN	Requests the presence or absence of data element `obeStatus` in data element `AggregatedSingleTariffClassSession`
feeExclVat	BOOLEAN	Requests the presence or absence of data element `feeExclVat` in data element `AggregatedSingleTariffClassSession`
sumVat	BOOLEAN	Requests the presence or absence of data element `sumVat` in data element `AggregatedSingleTariffClassSession`

8.5.5.3.6 Data type DetectedChargeObjectContent

As defined in ISO 17575-1:2016, the data type `DetectedChargeObject` includes optional data elements.

The data type DetectedChargeObjectContent shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element DetectedChargeObject.

To request the presence of an optional data element in data type DetectedChargeObject, the corresponding data element in data type DetectedChargeObjectContent shall be set to "TRUE".

To request the absence of an optional data element in data type DetectedChargeObject, the corresponding data element in data type DetectedChargeObjectContent shall be set to "FALSE".

Table 28 contains a list of all data elements of the data type DetectedChargeObjectContent.

Table 28 — Data elements in data type DetectedChargeObjectContent (informative)

Data element	Data type (informative)	Description
chargeObjectIdContent	ChargeObjectIdContent	For details see 8.5.5.3.13
subObjectNumber	BOOLEAN	Requests the presence or absence of data element subObjectNumber in data element DetectedChargeObject
timeWhenUsed	BOOLEAN	Requests the presence or absence of data element timeWhenUsed in data element DetectedChargeObject
mileageWhenUsed	BOOLEAN	Requests the presence or absence of data element mileageWhenUsed data element DetectedChargeObject
currentTariffClass	BOOLEAN	Requests the presence or absence of data element currentTariffClass in data element DetectedChargeObject
tariffClassDescription-Content	TariffClassDescription-Content	Shall only be present in cases where currentTariffClass = TRUE, for details see the table in 8.5.5.3.12
vehicleDescription	BOOLEAN	Requests the presence or absence of data element vehicleDescription in data element DetectedChargeObject
vehicleDescriptionContent	VehicleDescriptionContent	Shall only be present in cases where vehicleDescription = TRUE, for details see 8.5.5.3.14
obeStatus	BOOLEAN	Requests the presence or absence of data element obeStatus in data element DetectedChargeObject
feeExclVat	BOOLEAN	Requests the presence or absence of data element feeExclVat in data element DetectedChargeObject
sumVat	BOOLEAN	Requests the presence or absence of data element sumVat in data element DetectedChargeObject
chargeObjDetectionMode	BOOLEAN	Requests the presence or absence of data element chargeObjDetectionMode in data element DetectedChargeObject

8.5.5.3.7 Data type ListOfRawUsageDataContent

As defined in ISO 17575-1:2016, the data type ListOfRawUsageData includes optional data elements.

The data type ListOfRawUsageDataContent shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element ListOfRawUsageData.

To request the presence of an optional data element in data type ListOfRawUsageData, the corresponding data element in data type ListOfRawUsageDataContent shall be set to "TRUE".

To request the absence of an optional data element in data type ListOfRawUsageData, the corresponding data element in data type ListOfRawUsageDataContent shall be set to "FALSE".

Table 29 contains a list of all data elements of the data type ListOfRawUsageDataContent.

Table 29 — Data elements in data type ListOfRawUsageDataContent (informative)

Data element	Data type (informative)	Description
currentTariffClass	BOOLEAN	Requests the presence or absence of data element currentTariffClass in data element ListOfRawUsage-Data
tariffClassDescription-Content	TariffClassDescrip-tionContent	Shall only be present in cases where currentTariffClass = TRUE, for details see the table in 8.5.5.3.12
vehicleDescription	BOOLEAN	Requests the presence or absence of data element vehicleDescription in data element ListOfRawUsage-Content
vehicleDescriptionCon-tent	VehicleDescrip-tionContent	Shall only be present in cases where vehicleDescription = TRUE, for details see 8.5.5.3.14

8.5.5.3.8 Data type ListOfDsrcUsageDataContent

As defined in ISO 17575-1:2016, the data type ListOfDsrcUsageData includes optional data elements.

The data type ListOfDsrcUsageDataContent shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element ListOfDsrcUsageData.

To request the presence of an optional data element in data type ListOfDsrcUsageData, the corresponding data element in data type ListOfDsrcUsageDataContent shall be set to "TRUE".

To request the absence of an optional data element in data type ListOfDsrcUsageData, the corresponding data element in data type ListOfDsrcUsageDataContent shall be set to "FALSE".

Table 30 contains a list of all data elements of the data type ListOfDsrcUsageDataContent.

Table 30 — Data elements in data type ListOfDsrcUsageDataContent (informative)

Data element	Data type (informative)	Description
data14906	BOOLEAN	Requests the presence or absence of data element data14906 in data element ListOfDsrcUsageData
data12813	BOOLEAN	Requests the presence or absence of data element data12813 in data element ListOfDsrcUsageData
data13141	BOOLEAN	Requests the presence or absence of data element data13141 data element ListOfDsrcUsageData

8.5.5.3.9 Data type AggregatedFeeContent

As defined in ISO 17575-1:2016, the data type AggregatedFee includes an optional data element.

The data type AggregatedFeeContent shall contain the data element vat of the data type BOOLEAN. This data element is associated to the optional data element vat in the data element AggregatedFee.

To request the presence of the optional data element in data type AggregatedFee, the corresponding data element in data type AggregatedFeeContent shall be set to "TRUE".

To request the absence of the optional data element in data type AggregatedFee, the corresponding data element in data type AggregatedFeeContent shall be set to "FALSE".

Table 31 contains a list of all data elements of the data type AggregatedFeeContent.

Table 31 — Data elements in data type AggregatedFeeContent (informative)

Data element	Data type (informative)	Description
sumVat	BOOLEAN	Requests the presence or absence of data element sumVat in data element AggregatedFee

8.5.5.3.10 Data type MeasuredRawDataContent

As defined in ISO 17575-1:2016, the data type MeasuredRawData includes optional data elements.

The data type MeasuredRawDataContent shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element MeasuredRawData.

To request the presence of an optional data element in data type MeasuredRawData, the corresponding data element in data type MeasuredRawDataContent shall be set to "TRUE".

To request the absence of an optional data element in data type MeasuredRawData, the corresponding data element in data type MeasuredRawDataContent shall be set to "FALSE".

Table 32 contains a list of all data elements of the data type MeasuredRawDataContent.

Table 32 — Data elements in data type MeasuredRawDataContent (informative)

Data element	Data type (informative)	Description
measuredPosition	BOOLEAN	Requests the presence or absence of data element measuredPosition in data element MeasuredRawData
timeWhenMeasured	BOOLEAN	Requests the presence or absence of data element timeWhenMeasured in data element MeasuredRawData
nMEAData	BOOLEAN	Requests the presence or absence of data element nMEAData in data element MeasuredRawData
additionalGNSSData	BOOLEAN	Requests the presence or absence of data element additionalGNSSData in data element MeasuredRawData

8.5.5.3.11 Data type NmeaDataContent

As defined in ISO 17575-1:2016, the data type NmeaData includes optional data elements.

The attribute NmeaDataContent shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the attribute NmeaData.

To request the presence of an optional data element in attribute NmeaData, the corresponding data element in the attribute NmeaDataContent shall be set to "TRUE".

To request the absence of an optional data element in attribute NmeaData, the corresponding data element in the attribute NmeaDataContent shall be set to "FALSE".

Table 33 contains a list of all data elements of the EFC attribute **NmeaDataContent**.

Table 33 — Data elements in EFC attribute `NmeaDataContent` (informative)

Data element	Data type (informative)	Description
time	BOOLEAN	Requests the presence or absence of data element `time` in data element `NmeaData`
status	BOOLEAN	Requests the presence or absence of data element `status` in data element `NmeaData`
latitude	BOOLEAN	Requests the presence or absence of data element `latitude` in data element `NmeaData`
latNS	BOOLEAN	Requests the presence or absence of data element `latNS` in data element `NmeaData`
longitude	BOOLEAN	Requests the presence or absence of data element `longitude` in data element `NmeaData`
longEW	BOOLEAN	Requests the presence or absence of data element `longEW` in data element `NmeaData`
speed	BOOLEAN	Requests the presence or absence of data element `speed` in data element NmeaData
heading	BOOLEAN	Requests the presence or absence of data element `heading` in data element `NmeaData`
date	BOOLEAN	Requests the presence or absence of data element `date` in data element `NmeaData`
signalIntegrity	BOOLEAN	Requests the presence or absence of data element `signalIntegrity` in data element `NmeaData`
altitude	BOOLEAN	Requests the presence or absence of data element `altitude` in data element `NmeaData`
usedSatellites	BOOLEAN	Requests the presence or absence of data element `usedSatellites` in data element `NmeaData`
hdop	BOOLEAN	Requests the presence or absence of data element `hdop` in data element `NmeaData`

8.5.5.3.12 Data type TariffClassDescriptionContent

As defined in ISO 17575-1:2016, the data type `TariffClassDescription` includes optional data elements.

The data type `TariffClassDescriptionContent` shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element `TariffClassDescription`.

To request the presence of an optional data element in data type `TariffClassDescription`, the corresponding data element in data type `TariffClassDescriptionContent` shall be set to "`TRUE`".

To request the absence of an optional data element in data type `TariffClassDescription`, the corresponding data element in data type `TariffClassDescriptionContent` shall be set to "`FALSE`".

Table 34 contains a list of all data elements of the data type `TariffClassDescriptionContent`.

Table 34 — Data elements in data type `TariffClassDescriptionContent` (informative)

Data element	Data type (informative)	Description
locationClassId	BOOLEAN	Requests the presence or absence of data element `locationClassId` in data element `TariffClassDescription`

Table 34 *(continued)*

Data element	Data type (informative)	Description
localVehicleClasses	BOOLEAN	Requests the presence or absence of data element `localVehicleClasses` in data element `TariffClassDescription`
timeClasses	BOOLEAN	Requests the presence or absence of data element `timeClasses` in data element `TariffClassDescription`
locationClasses	BOOLEAN	Requests the presence or absence of data element `locationClasses` in data element `TariffClassDescription`
userClasses	BOOLEAN	Requests the presence or absence of data element `userClasses` in data element `TariffClassDescription`

8.5.5.3.13 Data type ChargeObjectIdContent

As defined in ISO 17575-1:2016, the data type `ChargeObjectId` includes an optional data element.

The data type `ChargeObjectIdContent` shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element `ChargeObjectId`.

To request the presence of the optional data element in data type `ChargeObjectId`, the corresponding data element in data type `ChargeObjectIdContent` shall be set to "`TRUE`".

To request the absence of the optional data element in data type `ChargeObjectId`, the corresponding data element in data type `ChargeObjectIdContent` shall be set to "`FALSE`".

Table 35 contains a list of all data elements of the data type `ChargeObjectIdContent`.

Table 35 — Data elements in data type `ChargeObjectIdContent` (informative)

Data element	Data type (informative)	Description
chargeReportFinalRecipient	BOOLEAN	Requests the presence or absence of data element `chargeReportFinalRecipient` in data element `ChargeObjectId`

8.5.5.3.14 Data type VehicleDescriptionContent

As defined in ISO 17575-1:2016, the data type `VehicleDescription` includes an optional data element.

The data type `VehicleDescriptionContent` shall contain a list of data elements of the data type BOOLEAN. Each data element in this list is associated to one optional data element in the data element `VehicleDescription`.

To request the presence of the optional data element in data type `VehicleDescription`, the corresponding data element in data type `VehicleDescriptionContent` shall be set to "`TRUE`".

To request the absence of the optional data element in data type `VehicleDescription`, the corresponding data element in data type `VehicleDescriptionContent` shall be set to "`FALSE`".

Table 36 contains a list of all data elements of the data type `VehicleDescriptionContent`.

Table 36 — Data elements in data type `VehicleDescriptionContent` (informative)

Data element	Data type (informative)	Description
vehicleLPNr	BOOLEAN	Requests the presence or absence of data element `vehicleLPNr` in data element `VehicleDescription`

Table 36 *(continued)*

Data element	Data type (informative)	Description
axles	BOOLEAN	Requests the presence or absence of data element `axles` in data element `VehicleDescription`
class	BOOLEAN	Requests the presence or absence of data element `class` in data element `VehicleDescription`
dimensions	BOOLEAN	Requests the presence or absence of data element `dimensions` in data element `VehicleDescription`
specificCharacteristics	BOOLEAN	Requests the presence or absence of data element `specificCharacteristics` in data element `VehicleDescription`
ladenWeight	BOOLEAN	Requests the presence or absence of data element `ladenWeight` in data element `VehicleDescription`
weightLimits	BOOLEAN	Requests the presence or absence of data element `weightLimits` in data element `VehicleDescription`
trailerCharacteristics	BOOLEAN	Requests the presence or absence of data element `trailerCharacteristics` in data element `VehicleDescription`

Annex A
(normative)

Data type specifications

A.1 General

The EFC data types and associated coding related to the EFC attributes, data elements and types described in Clauses 6, 7 and 8 are defined using the Abstract Syntax Notation One (ASN.1) technique specified in ISO/IEC 8824-1.

The encoding rules (e.g. Basic, Packed or XML Encoding Rules, BER, PER or XER) are not specified in this part of ISO 17575, except for the data elements `iso17575-3AduPer` and `payload` (see 7.2 and 8.4, respectively), because the physical implementation of the ISO 17575 interface can vary widely.

A.2 Data specifications

The actual ASN.1 module is contained in the attached file: "ISO17575(2016) EfcAutonomousContextDataV2.asn".

Annex B
(normative)

Protocol implementation conformance statement (PICS) proforma

B.1 General

In order to evaluate the conformance of a particular implementation, it is necessary to have a statement of capabilities and options that have been implemented. This is called an implementation conformance statement (ICS) or, more specifically when it covers transactions, a protocol implementation conformance statement (PICS).

This annex presents the PICS proforma that shall be used for the Front End implementation of the context description defined in Clauses 6, 7 and 8 and in Annex A. It provides PICS templates that shall be filled in by equipment suppliers.

B.2 Guidance and structure

The purpose of this PICS proforma is to provide a mechanism whereby a supplier of an implementation of the requirements defined in this part of ISO 17575 can provide information about the implementation in a standardized manner.

The PICS proforma is subdivided into the following categories of information:

— identification of the implementation;

— identification of the protocol;

— global statement of conformance;

— PICS proforma tables.

B.3 Instructions for completing the PICS proforma

B.3.1 Definition of support

A capability is said to be supported if the implementation under test (IUT) can

— generate the corresponding operation parameters (either automatically or because the end user requires that capability explicitly), and

— interpret, handle and, when required, make available to the end user the corresponding error or result.

A protocol element is said to be supported for a sending implementation if the IUT is able to generate it under certain circumstances (either automatically or because the end user requires relevant services explicitly).

A protocol element is said to be supported for a receiving implementation if it is correctly interpreted and handled and also, when appropriate, made available to the end user.

B.3.2 Status column

The status column indicates the level of support required for conformance to this part of ISO 17575. The values are as follows:

m mandatory support is required;

o optional support is permitted for conformance to the standard. If implemented, it must conform to the specifications and restrictions contained in the standard. These restrictions may affect the optionality of other items;

c the item is conditional (support of the capability is subject to a predicate);

c: m the item is mandatory if the predicate is true, optional otherwise;

– the item is not applicable;

I the item is outside the scope of this PICS.

In the PICS proforma tables, every leading item marked “m” shall be supported by the IUT. Sub-items marked “m” shall be supported if the corresponding leading item is supported by the IUT.

B.3.3 Support column

The support column shall be completed by the supplier or implementer to indicate the level of implementation of each item. The proforma has been designed such that the values required are as follows:

Y yes, the item has been implemented;

N no, the item has not been implemented;

– the item is not applicable.

All entries within the PICS proforma shall be made in ink. Alterations to such entries shall be made by crossing out, not erasing or making the original entry illegible, and by writing the new entry alongside. All such alterations to records shall be initialized by the person who made them.

B.3.4 Item reference numbers

Each line within the PICS proforma that requires implementation details to be entered is numbered at the left-hand edge of the line. This numbering is included as a means of uniquely identifying all possible implementation details within the PICS proforma. This referencing is used both inside the PICS proforma, and for references from other test specification documents.

The means of referencing individual responses is done by the following sequence:

— a reference to the smallest enclosing the relevant item;

— a solidus character (“/”);

— the reference number of the row in which the response appears;

— if, and only if, more than one response occurs in the row identified by the reference number, then each possible entry is implicitly labelled “a”, “b”, “c”, etc., from left to right, with this letter appended to the sequence.

B.4 PICS proforma for the Front End

B.4.1 Identification of the implementation

The following proforma (Tables B.1 to B.5) shall be used to identify the implementation for the Front End side.

Table B.1 — Identification of PICS

Item no.	Question	Response
1	Date of statement (DD/MM/YY)	
2	PICS serial number	
3	System conformance statement cross reference	

Table B.2 — Identification of the implementation and/or system

Item no.	Question	Response
1	Service provider or EFC context name	
2	Service provider and EFC context identifier	
3	Version number	
4	Other information	

Table B.3 — Identification of the Front End supplier

Item no.	Question	Response
1	Organization name	
2	Contact name(s)	
3	Address	
4	Phone number(s)	
5	e-mail address	
6	Other information	

Table B.4 — Identification of the Front End

Item no.	Question	Response
1	Brand name	
2	Type, version	
3	Manufacturer ID (if applicable)	
4	Equipment class	
5	Serial number(s)	
6	Other informatio006E	

Table B.5 — Identification of ISO 17575

Item no.	Question	Response
1	Title, reference no, publication date	
2	ISO 17575 version (edition) no.	
3	Implemented addenda	
4	Implementer's guide version no.	
5	Implementation defect reports (ref. no.)	
6	Other information	

B.4.2 Global statement of conformance

Are all mandatory capabilities implemented? (Yes/No) ……

NOTE Answering "No" to this question indicates non-conformance to the specification. Non-supported mandatory capabilities are to be identified in the PICS, with an explanation of why the implementation is non-conforming, on pages attached to the PICS proforma.

B.4.3 PICS proforma tables

This part of the PICS proforma (Tables B.6 to B.82) identifies the supported application context, the communication services and attributes (ADUs).

Table B.6 — Message authentication and ADU Header

Item no.	Element	Status	Support
1	Iso17575-3Adu	m	
2	AuthenticatedISO-3ADU	o	
3	messageAuthenticator	o	
4	protocollVersion	m	
5	informationSender	m	
6	informationOriginator	m	
7	tollContext	m	
8	aduSequenceNumber	m	
9	messageDate	m	

Table B.7 — Communication services support

Item no.	Element	Status	Support
1	Iso17575-2 Communication services supported	o	

Table B.8 — EFC Attributes

Item no.	Element	Status	Support
1	TollContextOverview	m	
2	TollContextPartitionOverview	m	
3	TariffTable	o	
4	CurrencyConversionTable	o	
5	TariffClassDefinition	o	
6	LocalVehicleClassDefinition	o	
7	TimeClassDefinition	o	
8	UserClassDefinition	o	
9	TollContextLayout	o	
10	ChargeReportingEvents	o	
11	ChargeReportConfiguration	o	
12	tollContextVersion	o	

Table B.9 — Support of EFC Attribute authentication

Item no.	Element	Status	Support
1	TollContextOverview	o	
2	TollContextPartitionOverview	o	
3	TariffTable	o	
4	CurrencyConversionTable	o	
5	TariffClassDefinition	o	
6	LocalVehicleClassDefinition	o	
7	TimeClassDefinition	o	
8	UserClassDefinition	o	
9	TollContextLayout	o	
10	ChargeReportingEvents	o	
11	ChargeReportConfiguration	o	

Table B.10 — Toll context overview

Item no.	Element	Status	Support
1	tollContext	m	
2	tollContextPartitions	m	
3	tollSchemeName	o	
4	tollContextBoundingBoxes	o	
5	tollContextOverviewVersion	m	

Table B.11 — Toll context partition overview

Item no	Element	Status	Support
1	tollContextPartitionId	m	
2	tollContextPartitionName	o	
3	tollContextPartitionType	m	
4	operationalStatus	m	
5	timeZone	m	
6	dstOffset	o	
7	tollContextPartitionBoundingPolygon	o	
8	sendChargeReportIfEntering	o	
9	precedenceLevel	o	
10	chargeReportFinalRecipient	o	
11	tollContextPartitionOverviewVersion	m	

Table B.12 — Toll scheme types

Item no.	TollSchemeType	Status	Support
1	roadSectionPricing	o	
2	areaPricingDistance	o	
3	areaPricingTime	o	
4	cordonPricing	o	

Table B.13 — Operational status

Item no.	TollRegimeType	Status	Support
1	startsOperationAt	m	
2	stopsOperationAt	o	

Table B.14 — Tariff table

Item no.	Element	Status	Support
1	applicablePartitions	m	
2	tariffs	m	
3	standardCurrency	m	
4	typeOfFee	o	

Table B.15 — Supported type of fee

Item no.	Element	Status	Support
1	reserved	-	
2	fee	o	
3	tax	o	
4	custom	o	
5	any other	o	

Table B.16 — Tariffs

Item no.	Element	Status	Support
1	tariffClass	m	
2	chargeUnit	m	
3	roundingRuleForChargeUnitsUsed	m	
4	basicFeePerChargeUnit	m	
5	roundingRuleForFee	m	
6	vat	o	
7	roundingRuleForVat	o	
8	intervalScaleParameters	o	
9	offsetFee	o	
10	minFee	o	
11	thresholdFee	o	
12	maxFee	o	
13	alternativeCurrency	o	

Table B.17 — Supported charge units

Item no.	Element	Status	Support
1	distance	o	
2	time	o	
3	event	o	

Table B.18 — Supported rounding rules for charge units used

Item no.	Element	Status	Support
1	no rounding	o	
2	up	o	
3	down	o	
4	accounting	o	
5	any other	o	

Table B.19 — Supported rounding rules for fee

Item no.	Element	Status	Support
1	no rounding	o	
2	up	o	
3	down	o	
4	accounting	o	
5	any other	o	

Table B.20 — Supported rounding rules for vat

Item no.	Element	Status	Support
1	no rounding	o	
2	up	o	
3	down	o	
4	accounting	o	
5	any other	o	

Table B.21 — Supported interval scale parameters

Item no.	Element	Status	Support
1	vehicleMaxLadenWeightIntervals	o	
2	vehicleLengthOverallIntervals	o	

Table B.22 — Supported max fee types

Item no.	Element	Status	Support
1	perDay	o	
2	perWeek	o	
3	perMonth	o	
4	perYear	o	

Table B.23 — Currency conversion table

Item no.	Element	Status	Support
1	conversions	m	
2	alternativeCurrency	m	
3	conversionRate	m	
4	currencyConversionTableVersion	m	

Table B.24 — Tariff class definitions

Item no.	Element	Status	Support
1	tariffClasses	m	
2	tariffClassDefinitionVersion	m	

Table B.25 — Tariff classes

Item no.	Element	Status	Support
1	tariffClassId	m	
2	localVehicleClasses	m	
3	timeClasses	o	
4	locationClasses	o	
5	userClasses	o	

Table B.26 — Local vehicle class definitions

Item no.	Element	Status	Support
1	localVehicleClasses	m	
2	localVehicleClassDefinitionVersion	o	

Table B.27 — Local vehicle classes

Item no.	Element	Status	Support
1	localVehicleClassId	m	
2	nominalElements	m	
3	ordinalElements	o	
4	priorityValue	o	

Table B.28 — Nominal vehicle parameters

Item no.	Element	Status	Support
1	vehicleClasses	m	
2	vehicleTrainAxlesNumbers	o	
3	euroValues	o	
4	copValue	o	

Table B.29 — Ordinal vehicle parameters

Item no.	Element	Status	Support
1	vehicleLengthOverall	o	
2	vehicleHeightOverall	o	
3	vehicleWidthOverall	o	
4	vehicleFirstAxlesHeight	o	
6	vehicleTractorAxlesNumber	o	
7	vehicleTrailerAxlesNumber	o	
8	vehicleMaxLadenWeight	o	
9	vehicleTrainMaximumWeight	o	
10	vehicleWeightUnladen	o	
11	vehicleWeightLaden	o	
12	euroValue	o	
13	copValue	o	
14	vehicleClass	o	
15	co2EmissionValue	o	
16	dieselEmissionValue	o	
17	exhaustEmissionValue	o	

Table B.30 — Diesel Emission Value Range

Item no.	Element	Status	Support
1	unitType	m	
2	valueRange	o	
3	absorptionCoeffRange	m	

Table B.31 — Exhaust Emission Value Range

Item no.	Element	Status	Support
1	unitType	m	
2	emissionCORange	o	
3	emissionHCRange	o	
4	emissionNOXRange	o	
5	emissionHCNOXRange	o	

Table B.32 — Time class definitions

Item no.	Element	Status	Support
1	timeClasses	m	
2	timeClassDefinitionVersion	o	

Table B.33 — Time classes

Item no.	Element	Status	Support
1	timeClassId	m	
2	nominalElements	o	
3	ordinalElements	o	
4	priorityValue	o	

Table B.34 — Nominal time parameters

Item no.	Element	Status	Support
1	weekdays	o	
2	dates	o	
3	classesSetExternally	o	

Table B.35 — Supported classes set externally

Item no.	Element	Status	Support
1	reserved	-	
2	congestionChargeLevel1	o	
3	congestionChargeLevel2	o	
4	any other	o	

Table B.36 — Ordinal time parameters

Item no.	Element	Status	Support
1	weekdays	o	
2	absoluteTimeOfDay	o	
3	relativeTimePeriods	o	
4	periodsInYear	o	

Table B.37 — Supported relative time period parameters

Item no.	Element	Status	Support
1	minPeriod	o	
2	maxPeriod	o	

Table B.38 — User class definitions

Item no.	Element	Status	Support
1	userClasses	m	
2	userClassDefinitionVersion	o	

Table B.39 — User classes

Item no.	Element	Status	Support
1	userClassId	m	
2	contractTypes	o	
3	actualNumberOfPassengers	o	
4	priorityValue	o	

Table B.40 — Toll context partition layout

Item no.	Element	Status	Support
1	tollContextPartitionId	m	
2	layoutDescription	m	
3	geoRefPoint	o	
4	tollContextPartitionVersion	o	

Table B.41 — Supported layout types

Item no.	Element	Status	Support
1	sectionLayoutDescription	o	
2	sectionLayoutDescriptionGdf	o	
3	areaPricingLayout	o	
4	cordonPricingLayout	o	

Table B.42 — Section layout description

Item no.	Element	Status	Support
1	chargeObjectId	m	
2	chargeObjectName	o	
3	chargeObjectRefPoint	o	
4	networkPoints	o	
5	tollPath	m	
6	liabilityRules	m	
7	pathStructureTowards	o	
8	pathStructureOnwards	o	
9	supportingInformation	o	
10	chargeDistance	m	
11	realDistance	o	
12	applicableTimeClasses	o	
13	locationClass	m	
14	storageRequired	o	
15	invoicingRelatedData	o	

Table B.43 — Supported point parameter types in section layout

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.44 — Link

Item no.	Element	Status	Support
1	linkId	m	
2	startPoint	m	
3	endPoint	m	
4	intermediatePoints	o	

Table B.45 — Supported point parameter types in link definitions

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.46 — Supported liability rules

Item no.	Element	Status	Support
1	tollPoints	o	
2	minTollPath	o	
3	minimumUsage	o	

Table B.47 — Supporting point parameters in section layout

Item no.	Element	Status	Support
1	supportingPoint	m	
2	distanceToNextRoad	o	

Table B.48 — Supported point parameter types in supporting point definitions

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.49 — Charge distance

Item no.	Element	Status	Support
1	predefinedDistance	o	
2	entryDependingDistance	o	

Table B.50 — Supplementary invoicing data

Item no.	Element	Status	Support
1	countryCode	o	
2	description	o	
3	networkName	o	
4	roadNumber	o	
5	sectionNumber	o	
6	directionCode	o	
7	directionDescription	o	
8	laneNumber	o	
9	typeOfSection	o	

Table B.51 — Supported types of sections in supplementary invoicing data

Item no.	Element	Status	Support
1	reserved	-	
2	manual	o	
3	closedEntry	o	
4	closedExit	o	
5	checkpoint	o	
6	openRoadTolling	o	
7	distanceBasedFreeFlowPhysical	o	
8	distanceBasedFreeFlowVirtual	o	
9	aggregatedTrx	o	
10	any other	o	

Table B.52 — Section layout GDF

Item no.	Element	Status	Support
1	efcLayer	m	

Table B.53 — EFC layer

Item no.	Element	Status	Support
1	efcLayerId	m	
2	tollContextName	o	
3	chargeObjects	m	
4	referencedGdfSource	m	
5	efcLayerVersion	m	

Table B.54 — GDF charge object

Item no.	Element	Status	Support
1	chargeObjectDesignation	m	
2	roadOperatorId	o	
3	applicableLocationClass	o	
4	applicableTimeClasses	o	
5	tollRelevantLength	m	
6	equivalentMeasuredLength	o	
7	tollRoad	m	
8	liabilityRules	m	

Table B.55 — Supported liability rules in GDF charge object designation

Item no.	Element	Status	Support
1	tollPoint	o	
2	minTollPath	o	
3	minimumUsage	o	

Table B.56 — Area layout description

Item no.	Element	Status	Support
1	areaId	m	
2	areaBorder	m	
3	locationClass	o	
4	applicableTimeClasses	o	
5	roadNetwork	o	

Table B.57 — Road network description

Item no.	Element	Status	Support
1	networkId	m	
2	locationClass	m	
3	roadNetworkObjects	m	

Table B.58 — Road network objects description in area layout

Item no.	Element	Status	Support
1	chargeObjectId	m	
2	chargeObjectName	o	
3	chargeObjectRefPoint	o	
4	networkPoints	o	
5	tollPath	m	
4	supportingInformation	o	
5	applicableTimeClasses	o	

Table B.59 — Supporting point parameters in area layout

Item no.	Element	Status	Support
1	supportingPoint	m	
2	distanceToNextRoad	o	

Table B.60 — Cordon layout description

Item no.	Element	Status	Support
1	cordonId	m	
2	cordonBorderPolygon	m	

Table B.61 — Cordon border segment description

Item no.	Element	Status	Support
1	cordonSegmentId	m	
2	startPoint	m	
3	cordonEntryLocation	o	
4	cordonExitLocation	o	

Table B.62 — Supported point parameter types in start point of cordon segment definitions

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.63 — Cordon entry location description

Item no.	Element	Status	Support
1	entryLocationId	m	
2	entryLocationClass	m	
3	applicableTimeClasses	o	

Table B.64 — Cordon exit location descriptiomn

Item no.	Element	Status	Support
1	exitLocationId	m	
2	exitLocationClass	m	
3	applicableTimeClasses	o	

Table B.65 — Cordon exit location class description

Item no.	Element	Status	Support
1	locationClass	m	
2	entryLocation	o	

Table B.66 — Charge reporting events

Item no.	Element	Status	Support
1	applicablePartitions	m	
2	absoluteTimeEvents	o	
3	relativeTimeEvents	o	
4	travelledDistanceEvents	o	
5	locationEvents	o	
6	feeLimitEvents	o	
7	chargeReportingEventsVersion	m	

Table B.67 — Absolute time event

Item no.	Element	Status	Support
1	timesDuringDay	m	
2	randomDelay	o	

Table B.68 — Relative time event

Item no.	Element	Status	Support
1	timeDuration	m	
2	randomDelay	o	

Table B.69 — Location event

Item no.	Element	Status	Support
1	chargeObject	o	
2	line	o	
3	area	o	

Table B.70 — Supported parameters of line in location events

Item no.	Element	Status	Support
1	lineDescription	m	
2	crossingDirection1	o	
3	crissingDirection2	o	

Table B.71 — Supported parameters of area in location events

Item no.	Element	Status	Support
1	areaDescription	m	
2	atEntry	o	
3	atExit	o	

Table B.72 — Charge report configuration

Item no.	Element	Status	Support
1	applicablePartitions	m	
2	chargeReportContent	m	
3	usageStatementContent	m	
4	cccAttributesContent	o	
5	aggregatedSingleTariffClassSessionContent	o	
6	detectedChargeObjectContent	o	
7	listOfRawUsageDataContent	o	
8	listOfDsrcUsageDataContent	o	
9	aggregatedFeeContent	o	
10	measuredRawDataContent	o	
11	nmeaDataContent	o	
12	chargeReportConfigurationVersion	o	

Table B.73 — Supported parameters in charge report content

Item no.	Element	Status	Support
1	useOfCrAuthentication	o	
2	obeId	o	
3	vehicleLPNr	o	
4	paymentMeans	o	
5	tollContext	o	
6	chargeReportFinalRecipient	o	
7	timeOfReport	o	
8	reportPeriod	o	
9	versionInfo	o	
10	sumVatForThisSession	o	
11	accountStatus	o	
12	chargeReportCounter	o	
13	mileage	o	
14	listOfCCCAttributes	o	

Table B.74 — Supported parameters in usage statement content

Item no.	Element	Status	Support
1	useOfUsageStatementAuthentication	o	
2	usageStatementId	o	
3	tollContext	o	
4	chargeReportFinalRecipient	o	
5	aggregatedFee	o	
6	sumVat	o	
7	agregatedSingleTariffClassSession	o	
8	listOfChargeObjects	o	
9	listOfDSRCUsageData	o	
10	listOfRawUsageData	o	
11	noUsage	o	
12	additionalUsageInformation	o	

Table B.75 — Supported parameters in CCC attributes content

Item no.	Element	Status	Support
1	timeOfCCCRecord	o	
2	axlesHistory	o	
3	commStatus	o	
4	gnssStatus	o	
5	distRecStatus	o	
6	activeContexts	o	
7	obeHistory	o	

Table B.76 — Supported parameters in aggregated single tariff class session content

Item no.	Element	Status	Support
1	timePeriodCovered	o	
2	currentTariffClass	o	
3	tariffClassDescriptionContent	o	
4	vehicleDescription	o	
5	vehicleDescriptionContent	o	
6	totalDistanceCovered	o	
7	numberOfDetecetedEvents	o	
8	obeStatus	o	
9	feeExclVat	o	
10	sumVat	o	

Table B.77 — Supported parameters in detected charge object content

Item no.	Element	Status	Support
1	chargeObjectIdContent	o	
2	subObjectNumber	o	
3	timeWhenUsed	o	
4	mileageWhenUsed	o	
5	currentTariffClass	o	
6	tariffClassDescriptionContent	o	
7	vehicleDescription	o	
8	vehicleDescriptionContent	o	
9	obeStatus	o	
10	feeExclVat	o	
11	sumVat	o	
12	chargeObjectDetectionMode	o	

Table B.78 — Supported parameters in list of raw usage data content

Item no.	Element	Status	Support
1	currentTariffClass	o	
2	tariffClassDescriptionContent	o	
3	vehicleDescription	o	
4	vehicleDescriptionContent	o	

Table B.79 — Supported parameters in list of DSRC usage data content

Item no.	Element	Status	Support
1	data14906	o	
2	data12813	o	
3	data13141	o	

Table B.80 — Supported parameters in list of aggregated fee content

Item no.	Element	Status	Support
1	sumVat	o	

Table B.81 — Supported parameters in measured raw data content

Item no.	Element	Status	Support
1	measuredPosition	o	
2	timeWhenMeasured	o	
3	nMEAData	o	
4	additionalGNSSData	o	

Table B.82 — Supported parameters in NMEA data content

Item no.	Element	Status	Support
1	time	o	
2	status	o	
3	latitude	o	
4	latNS	o	
5	longitude	o	
6	longEW	o	
7	speed	o	
8	heading	o	
9	date	o	
10	signalIntegrity	o	
11	altitude	o	
12	usedSatellites	o	
13	hdop	o	

B.5 PICS proforma for the Back End

B.5.1 Identification of the implementation

The following proforma (Tables B.83 to B.87) shall to be used to identify the implementation for the Back End side.

Table B.83 — Identification of PICS

Item no.	Question	Response
1	Date of statement (DD/MM/YY)	
2	PICS serial number	
3	System conformance statement cross reference	

Table B.84 — Identification of the implementation and/or system

Item no.	Question	Response
1	Service provider or EFC context name	
2	Service provider and EFC context identifier	
3	Version number	
4	Other information	

Table B.85 — Identification of the Back End supplier

Item no.	Question	Response
1	Organization name	
2	Contact name(s)	
3	Address	
4	Phone number(s)	
5	e-mail address	
6	Other information	

Table B.86 — Identification of the Back End

Item no.	Question	Response
1	Brand name	
2	Type, version	
3	Manufacturer ID	
4	Equipment class	
5	Serial number(s)	
6	Other information	

Table B.87 — Identification of ISO 17575

Item no.	Question	Response
1	Title, Reference No, publication date of the International Standard	
2	ISO 17575 version (edition) no.	
3	Implemented addenda	
4	Implementer's guide version no.	
5	Implementation defect reports	
6	Other information	

B.5.2 Global statement of conformance

Are all mandatory capabilities implemented? (Yes/No) ……

NOTE Answering "No" to this question indicates non-conformance to the specification. Non-supported mandatory capabilities are to be identified in the PICS, with an explanation of why the implementation is non-conforming, on pages attached to the PICS proforma.

B.5.3 PICS proforma tables

This part of the PICS proforma (Tables B.88 to B.164) identifies the supported application context, the communication services and attributes (ADUs).

Table B.88 — Message authentication and ADU Header

Item no.	Element	Status	Support
1	Iso17575-3Adu	m	
2	AuthenticatedISO-3ADU	o	
3	messageAuthenticator	o	
4	protocollVersion	m	
5	informationSender	m	
6	informationOriginator	m	
7	tollContext	m	
8	aduSequenceNumber	m	
9	messageDate	m	

Table B.89 — Communication services support

Item no.	Element	Status	Support
1	Iso17575-2 Communication services supported	o	

Table B.90 — EFC Attributes

Item no.	Element	Status	Support
1	TollContextOverview	m	
2	TollContextPartitionOverview	m	
3	TariffTable	o	
4	CurrencyConversionTable	o	
5	TariffClassDefinition	o	
6	LocalVehicleClassDefinition	o	
7	TimeClassDefinition	o	
8	UserClassDefinition	o	
9	TollContextLayout	o	
10	ChargeReportingEvents	o	
11	ChargeReportConfiguration	o	
12	tollContextVersion	o	

Table B.91 — Support of EFC Attribute authentication

Item no.	Element	Status	Support
1	TollContextOverview	o	
2	TollContextPartitionOverview	o	
3	TariffTable	o	
4	CurrencyConversionTable	o	
5	TariffClassDefinition	o	
6	LocalVehicleClassDefinition	o	
7	TimeClassDefinition	o	
8	UserClassDefinition	o	
9	TollContextLayout	o	
10	ChargeReportingEvents	o	
11	ChargeReportConfiguration	o	

Table B.92 — Toll context overview

Item no.	Element	Status	Support
1	tollContext	m	
2	tollContextPartitions	m	
3	tollSchemeName	o	
4	tollContextBoundingBoxes	o	
5	tollContextOverviewVersion	m	

Table B.93 — Toll context partition overview

Item no.	Element	Status	Support
1	tollContextPartitionId	m	
2	tollContextPartitionName	o	
3	tollContextPartitionType	m	
4	operationalStatus	m	
5	timeZone	m	
6	dstOffset	o	
7	tollContextPartitionBoundingPolygon	o	
8	sendChargeReportIfEntering	o	
9	precedenceLevel	o	
10	chargeReportFinalRecipient	o	
11	tollContextPartitionOverviewVersion	m	

Table B.94 — Toll scheme types

Item no.	TollSchemeType	Status	Support
1	roadSectionPricing	o	
2	areaPricingDistance	o	
3	areaPricingTime	o	
4	cordonPricing	o	

Table B.95 — Operational status

Item no.	TollRegimeType	Status	Support
1	startsOperationAt	m	
2	stopsOperationAt	o	

Table B.96 — Tariff table

Item no.	Element	Status	Support
1	applicablePartitions	m	
2	tariffs	m	
3	standardCurrency	m	
4	typeOfFee	o	

Table B.97 — Supported type of fee

Item no.	Element	Status	Support
1	reserved	-	
2	fee	o	
3	tax	o	
4	custom	o	
5	any other	o	

Table B.98 — Tariffs

Item no.	Element	Status	Support
1	tariffClass	m	
2	chargeUnit	m	
3	roundingRuleForChargeUnitsUsed	m	
4	basicFeePerChargeUnit	m	
5	roundingRuleForFee	m	
6	vat	o	
7	roundingRuleForVat	o	
8	intervalScaleParameters	o	
9	offsetFee	o	
10	minFee	o	
11	thresholdFee	o	
12	maxFee	o	
13	alternativeCurrency	o	

Table B.99 — Supported charge units

Item no.	Element	Status	Support
1	distance	o	
2	time	o	
3	event	o	

Table B.100 — Supported rounding rules for charge units used

Item no.	Element	Status	Support
1	no rounding	o	
2	up	o	
3	down	o	
4	accounting	o	
5	any other	o	

Table B.101 — Supported rounding rules for fee

Item no.	Element	Status	Support
1	no rounding	o	
2	up	o	
3	down	o	
4	accounting	o	
5	any other	o	

Table B.102 — Supported rounding rules for vat

Item no.	Element	Status	Support
1	no rounding	o	
2	up	o	
3	down	o	
4	accounting	o	
5	any other	o	

Table B.103 — Supported interval scale parameters

Item no.	Element	Status	Support
1	vehicleMaxLadenWeightIntervals	o	
2	vehicleLengthOverallIntervals	o	

Table B.104 — Supported max fee types

Item no.	Element	Status	Support
1	perDay	o	
2	perWeek	o	
3	perMonth	o	
4	perYear	o	

Table B.105 — Currency conversion table

Item no.	Element	Status	Support
1	conversions	m	
2	alternativeCurrency	m	
3	conversionRate	m	
4	currencyConversionTableVersion	m	

Table B.106 — Tariff class definitions

Item no.	Element	Status	Support
1	tariffClasses	m	
2	tariffClassDefinitionVersion	m	

Table B.107 — Tariff classes

Item no.	Element	Status	Support
1	tariffClassId	m	
2	localVehicleClasses	m	
3	timeClasses	o	
4	locationClasses	o	
5	userClasses	o	

Table B.108 — Local vehicle class definitions

Item no.	Element	Status	Support
1	localVehicleClasses	m	
2	localVehicleClassDefinitionVersion	o	

Table B.109 — Local vehicle classes

Item no.	Element	Status	Support
1	localVehicleClassId	m	
2	nominalElements	m	
3	ordinalElements	o	
4	priorityValue	o	

Table B.110 — Nominal vehicle parameters

Item no.	Element	Status	Support
1	vehicleClasses	m	
2	vehicleTrainAxlesNumbers	o	
3	euroValues	o	
4	copValue	o	

Table B.111 — Ordinal vehicle parameters

Item no.	Element	Status	Support
1	vehicleLengthOverall	o	
2	vehicleHeightOverall	o	
3	vehicleWidthOverall	o	
4	vehicleFirstAxlesHeight	o	
6	vehicleTractorAxlesNumber	o	
7	vehicleTrailerAxlesNumber	o	
8	vehicleMaxLadenWeight	o	
9	vehicleTrainMaximumWeight	o	
10	vehicleWeightUnladen	o	
11	vehicleWeightLaden	o	
12	euroValue	o	
13	copValue	o	
14	vehicleClass	o	
15	co2EmissionValue	o	
16	dieselEmissionValue	o	
17	exhaustEmissionValue	o	

Table B.112 — Diesel Emission Value Range

Item no.	Element	Status	Support
1	unitType	m	
2	valueRange	o	
3	absorptionCoeffRange	m	

Table B.113 — Exhaust Emission Value Range

Item no.	Element	Status	Support
1	unitType	m	
2	emissionCORange	o	
3	emissionHCRange	o	
4	emissionNOXRange	o	
5	emissionHCNOXRange	o	

Table B.114 — Time class definitions

Item no.	Element	Status	Support
1	timeClasses	m	
2	timeClassDefinitionVersion	o	

Table B.115 — Time classes

Item no.	Element	Status	Support
1	timeClassId	m	
2	nominalElements	o	
3	ordinalElements	o	
4	priorityValue	o	

Table B.116 — Nominal time parameters

Item no.	Element	Status	Support
1	weekdays	o	
2	dates	o	
3	classesSetExternally	o	

Table B.117 — Supported classes set externally

Item no.	Element	Status	Support
1	reserved	-	
2	congestionChargeLevel1	o	
3	congestionChargeLevel2	o	
4	any other	o	

Table B.118 — Ordinal time parameters

Item no.	Element	Status	Support
1	weekdays	o	
2	absoluteTimeOfDay	o	
3	relativeTimePeriods	o	
4	periodsInYear	o	

Table B.119 — Supported relative time period parameters

Item no.	Element	Status	Support
1	minPeriod	o	
2	maxPeriod	o	

Table B.120 — User class definitions

Item no.	Element	Status	Support
1	userClasses	m	
2	userClassDefinitionVersion	o	

Table B.121 — User classes

Item no.	Element	Status	Support
1	userClassId	m	
2	contractTypes	o	
3	actualNumberOfPassengers	o	
4	priorityValue	o	

Table B.122 — Toll context partition layout

Item no.	Element	Status	Support
1	tollContextPartitionId	m	
2	layoutDescription	m	
3	geoRefPoint	o	
4	tollContextPartitionVersion	o	

Table B.123 — Supported layout types

Item no.	Element	Status	Support
1	sectionLayoutDescription	o	
2	sectionLayoutDescriptionGdf	o	
3	areaPricingLayout	o	
4	cordonPricingLayout	o	

Table B.124 — Section layout description

Item no.	Element	Status	Support
1	chargeObjectId	m	
2	chargeObjectName	o	
3	chargeObjectRefPoint	o	
4	networkPoints	o	
5	tollPath	m	
6	liabilityRules	m	
7	pathStructureTowards	o	
8	pathStructureOnwards	o	
9	supportingInformation	o	
10	chargeDistance	m	
11	realDistance	o	
12	applicableTimeClasses	o	
13	locationClass	m	
14	storageRequired	o	
15	invoicingRelatedData	o	

Table B.125 — Supported point parameter types in section layout

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.126 — Link

Item no.	Element	Status	Support
1	linkId	m	
2	startPoint	m	
3	endPoint	m	
4	intermediatePoints	o	

Table B.127 — Supported point parameter types in link definitions

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.128 — Supported liability rules

Item no.	Element	Status	Support
1	tollPoints	o	
2	minTollPath	o	
3	minTollPortion	o	

Table B.129 — Supporting point parameters in section layout

Item no.	Element	Status	Support
1	supportingPoint	m	
2	distanceToNextRoad	o	

Table B.130 — Supported point parameter types in supporting point definitions

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.131 — Charge distance

Item no.	Element	Status	Support
1	predefinedDistance	o	
2	entryDependingDistance	o	

Table B.132 — Supplementary invoicing data

Item no.	Element	Status	Support
1	countryCode	o	
2	description	o	
3	networkName	o	
4	roadNumber	o	
5	sectionNumber	o	
6	directionCode	o	
7	directionDescription	o	
8	laneNumber	o	
9	typeOfSection	o	

Table B.133 — Supported types of sections in supplementary invoicing data

Item no.	Element	Status	Support
1	reserved	-	
2	manual	o	
3	closedEntry	o	
4	closedExit	o	
5	checkpoint	o	
6	openRoadTolling	o	
7	distanceBasedFreeFlowPhysical	o	
8	distanceBasedFreeFlowVirtual	o	
9	aggregatedTrx	o	
10	any other	o	

Table B.134 — Section layout GDF

Item no.	Element	Status	Support
1	efcLayer	m	

Table B.135 — EFC layer

Item no.	Element	Status	Support
1	efcLayerId	m	
2	tollContextName	o	
3	chargeObjects	m	
4	referencedGdfSource	m	
5	efcLayerVersion	m	

Table B.136 — GDF charge object

Item no.	Element	Status	Support
1	chargeObjectDesignation	m	
2	roadOperatorId	o	
3	applicableLocationClass	o	
4	applicableTimeClasses	o	
5	tollRelevantLength	m	
6	equivalentMeasuredLength	o	
7	tollRoad	m	
8	liabilityRules	m	

Table B.137 — Supported liability rules in GDF charge object designation

Item no.	Element	Status	Support
1	tollPoint	o	
2	minTollPath	o	
3	minimumUsage	o	

Table B.138 — Area layout description

Item no.	Element	Status	Support
1	areaId	m	
2	areaBorder	m	
3	locationClass	o	
4	applicableTimeClasses	o	
5	roadNetwork	o	

Table B.139 — Road network description

Item no.	Element	Status	Support
1	networkId	m	
2	locationClass	m	
3	roadNetworkObjects	m	

Table B.140 — Road network objects description in area layout

Item no.	Element	Status	Support
1	chargeObjectId	m	
2	chargeObjectName	o	
3	chargeObjectRefPoint	o	
4	networkPoints	o	
5	tollPath	m	
6	supportingInformation	o	
7	applicableTimeClasses	o	

Table B.141 — Supporting point parameters in area layout

Item no.	Element	Status	Support
1	supportingPoint	m	
2	distanceToNextRoad	o	

Table B.142 — Cordon layout description

Item no.	Element	Status	Support
1	cordonId	m	
2	cordonBorderPolygon	m	

Table B.143 — Cordon border segment description

Item no.	Element	Status	Support
1	cordonSegmentId	m	
2	startPoint	m	
3	cordonEntryLocation	o	
4	cordonExitLocation	o	

Table B.144 — Supported point parameter types in start point of cordon segment definitions

Item no.	Element	Status	Support
1	pointIdentifier	o	
2	absolutePointCoordinates	o	
3	relativePointCoordinates	o	

Table B.145 — Cordon entry location description

Item no.	Element	Status	Support
1	entryLocationId	m	
2	entryLocationClass	m	
3	applicableTimeClasses	o	

Table B.146 — Cordon exit location description

Item no.	Element	Status	Support
1	exitLocationId	m	
2	exitLocationClass	m	
3	applicableTimeClasses	o	

Table B.147 — Cordon exit location class description

Item no.	Element	Status	Support
1	locationClass	m	
2	entryLocation	o	

Table B.148 — Charge reporting events

Item no.	Element	Status	Support
1	applicablePartitions	m	
2	absoluteTimeEvents	o	
3	relativeTimeEvents	o	
4	travelledDistanceEvents	o	
5	locationEvents	o	
6	feeLimitEvents	o	
7	chargeReportingEventsVersion	m	

Table B.149 — Absolute time event

Item no.	Element	Status	Support
1	timesDuringDay	m	
2	randomDelay	o	

Table B.150 — Relative time event

Item no.	Element	Status	Support
1	timeDuration	m	
2	randomDelay	o	

Table B.151 — Location event

Item no.	Element	Status	Support
1	chargeObject	o	
2	line	o	
3	area	o	

Table B.152 — Supported parameters of line in location events

Item no.	Element	Status	Support
1	lineDescription	m	
2	crossingDirection1	o	
3	crissingDirection2	o	

Table B.153 — Supported parameters of area in location events

Item no.	Element	Status	Support
1	areaDescription	m	
2	atEntry	o	
3	atExit	o	

Table B.154 — Charge report configuration

Item no.	Element	Status	Support
1	applicablePartitions	m	
2	chargeReportContent	m	
3	usageStatementContent	m	
4	cccAttributesContent	o	
5	aggregatedSingleTariffClassSessionContent	o	
6	detectedChargeObjectContent	o	
7	listOfRawUsageDataContent	o	
8	listOfDsrcUsageDataContent	o	
9	aggregatedFeeContent	o	
10	measuredRawDataContent	o	
11	nmeaDataContent	o	
12	chargeReportConfigurationVersion	o	

Table B.155 — Supported parameters in charge report content

Item no.	Element	Status	Support
1	useOfCrAuthentication	o	
2	obeId	o	
3	vehicleLPNr	o	
4	paymentMeans	o	
5	tollContext	o	
6	chargeReportFinalRecipient	o	
7	timeOfReport	o	
8	reportPeriod	o	
9	versionInfo	o	
10	sumVatForThisSession	o	
11	accountStatus	o	
12	chargeReportCounter	o	
13	mileage	o	
14	listOfCCCAttributes	o	

Table B.156 — Supported parameters in usage statement content

Item no.	Element	Status	Support
1	useOfUsageStatementAuthentication	o	
2	usageStatementId	o	
3	tollContext	o	
4	chargeReportFinalRecipient	o	
5	aggregatedFee	o	
6	sumVat	o	
7	agregatedSingleTariffClassSession	o	
8	listOfChargeObjects	o	
9	listOfDSRCUsageData	o	
10	listOfRawUsageData	o	
11	noUsage	o	
12	additionalUsageInformation	o	

Table B.157 — Supported parameters in CCC attributes content

Item no.	Element	Status	Support
1	timeOfCCCRecord	o	
2	axlesHistory	o	
3	commStatus	o	
4	gnssStatus	o	
5	distRecStatus	o	
6	activeContexts	o	
7	obeHistory	o	

Table B.158 — Supported parameters in aggregated single tariff class session content

Item no.	Element	Status	Support
1	timePeriodCovered	o	
2	currentTariffClass	o	
3	tariffClassDescriptionContent	o	
4	vehicleDescription	o	
5	vehicleDescriptionContent	o	
6	totalDistanceCovered	o	
7	numberOfDetecetedEvents	o	
8	obeStatus	o	
9	feeExclVat	o	
10	sumVat	o	

Table B.159 — Supported parameters in detected charge object content

Item no.	Element	Status	Support
1	chargeObjectIdContent	o	
2	subObjectNumber	o	
3	timeWhenUsed	o	
4	mileageWhenUsed	o	
5	currentTariffClass	o	
6	tariffClassDescriptionContent	o	
7	vehicleDescription	o	
8	vehicleDescriptionContent	o	
9	obeStatus	o	
10	feeExclVat	o	
11	sumVat	o	
12	chargeObjectDetectionMode	o	

Table B.160 — Supported parameters in list of raw usage data content

Item no.	Element	Status	Support
1	currentTariffClass	o	
2	tariffClassDescriptionContent	o	
3	vehicleDescription	o	
4	vehicleDescriptionContent	o	

Table B.161 — Supported parameters in list of DSRC usage data content

Item no.	Element	Status	Support
1	data14906	o	
2	data12813	o	
3	data13141	o	

Table B.162 — Supported parameters in list of aggregated fee content

Item no.	Element	Status	Support
1	sumVat	o	

Table B.163 — Supported parameters in measured raw data content

Item no.	Element	Status	Support
1	measuredPosition	o	
2	timeWhenMeasured	o	
3	nMEAData	o	
4	additionalGNSSData	o	

Table B.164 — Supported parameters in NMEA data content

Item no.	Element	Status	Support
1	time	o	
2	status	o	
3	latitude	o	
4	latNS	o	
5	longitude	o	
6	longEW	o	
7	speed	o	
8	heading	o	
9	date	o	
10	signalIntegrity	o	
11	altitude	o	
12	usedSatellites	o	
13	hdop	o	

Annex C
(informative)

Hierarchical data structure illustration

Figures C.1 to C.4 show the hierarchical data structure at different levels.

NOTE For better readability the data structure in Figures C.1 to C.4 has been split into several parts. Not all lower levels in the data structure are shown.

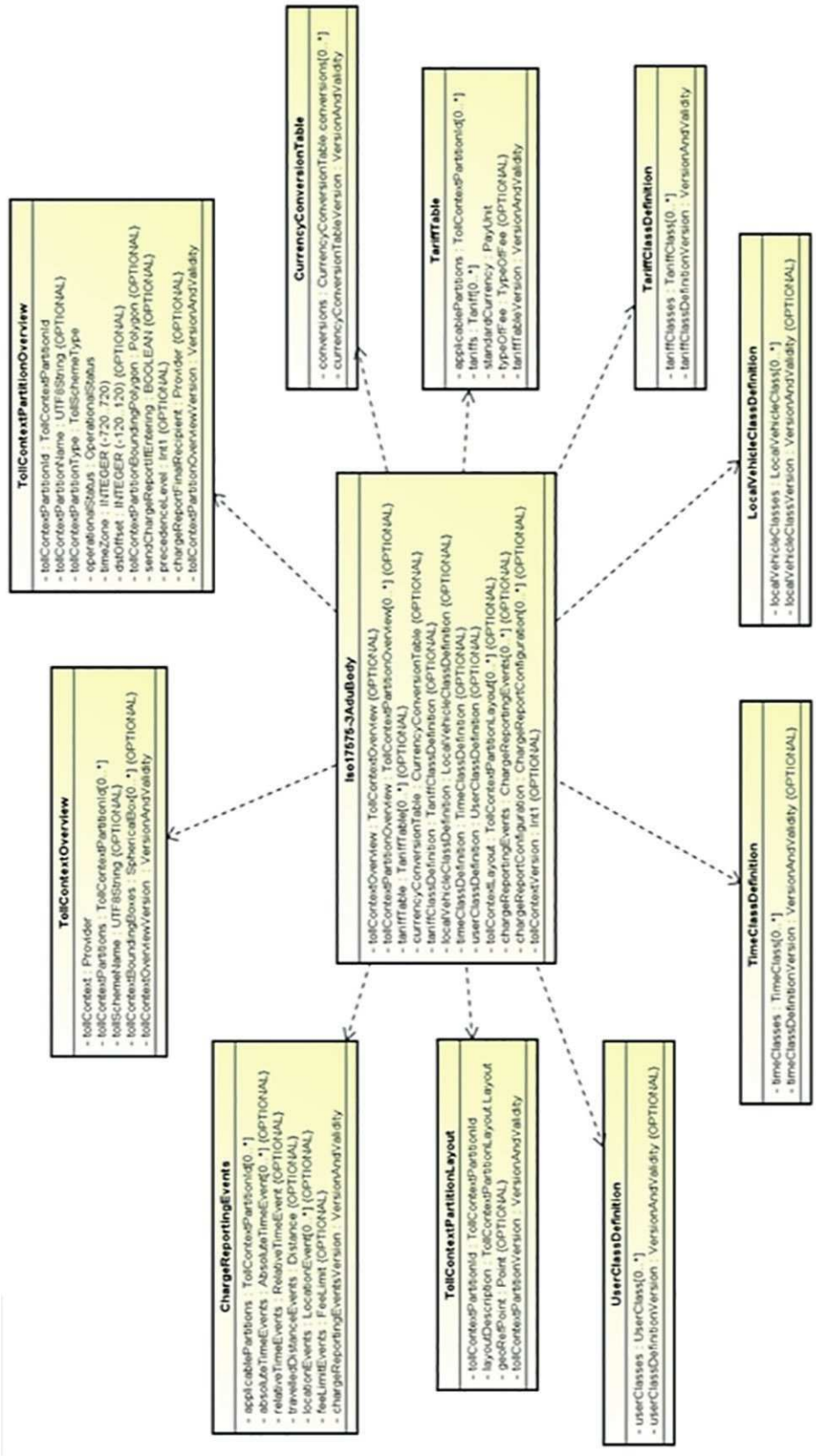


Figure C.1 — Hierarchical data structure (highest level)

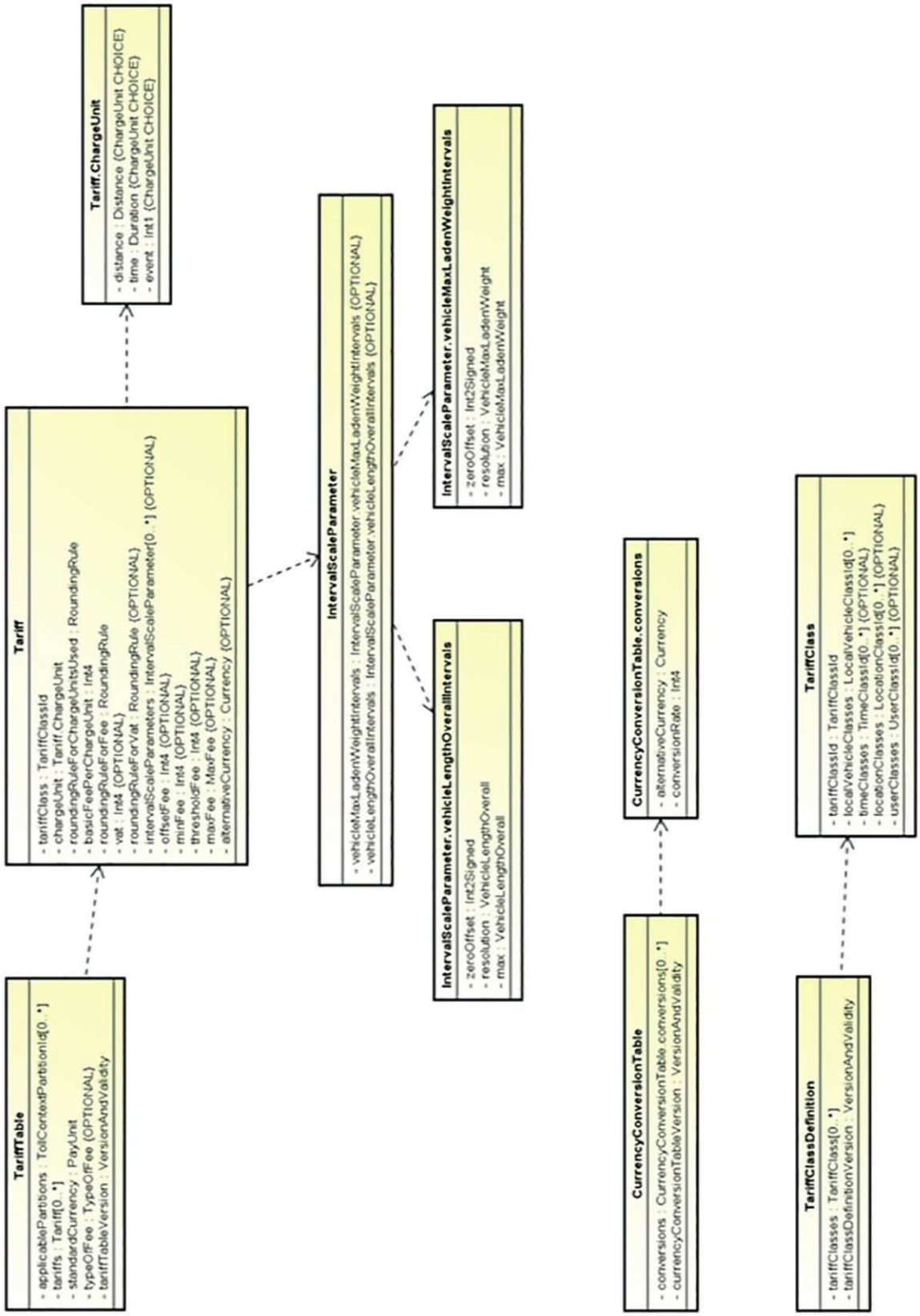


Figure C.2 — Hierarchical data structure (lower lewel part 1)

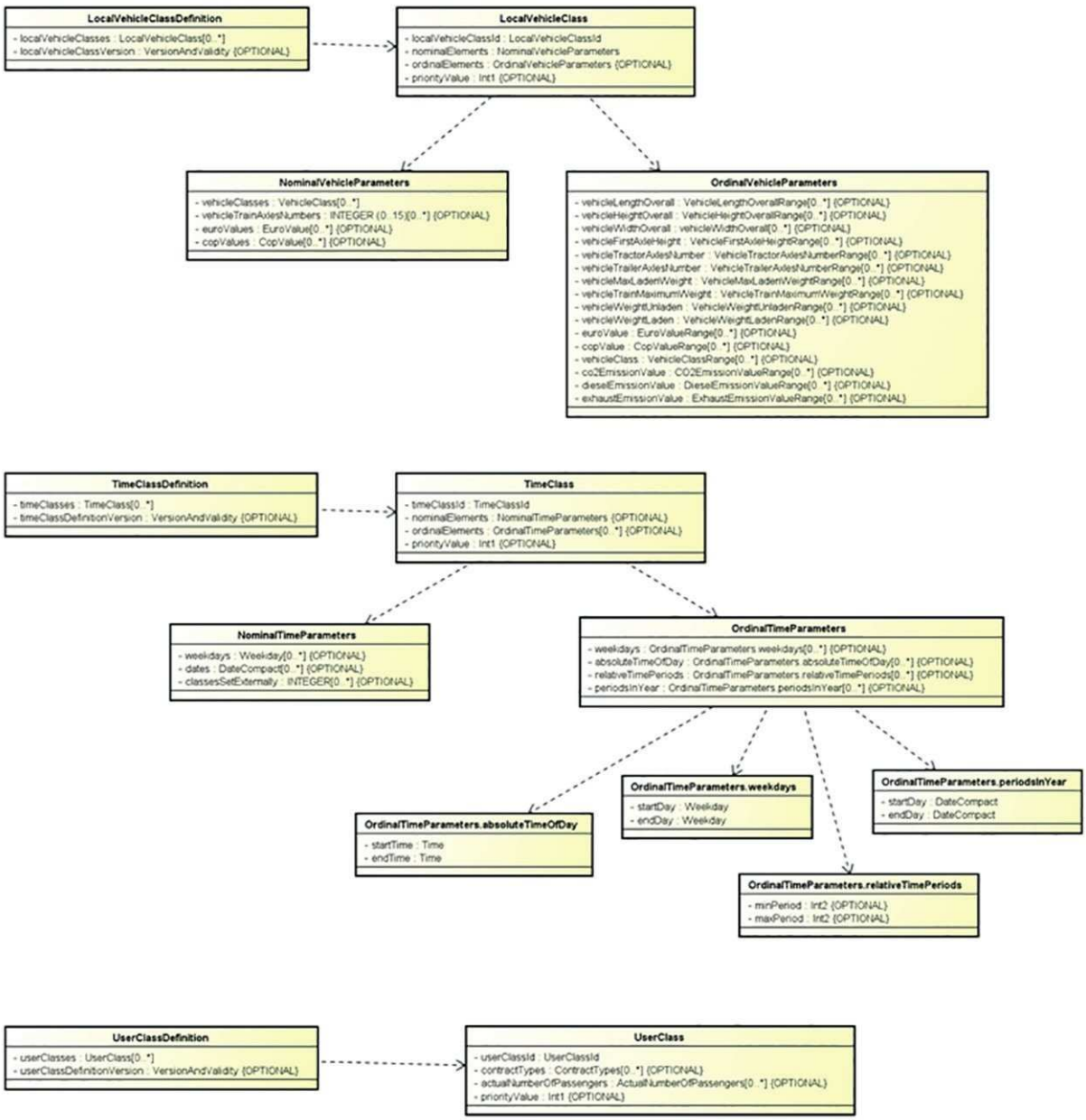


Figure C.3 — Hierarchical data structure (lower lewel part 2)

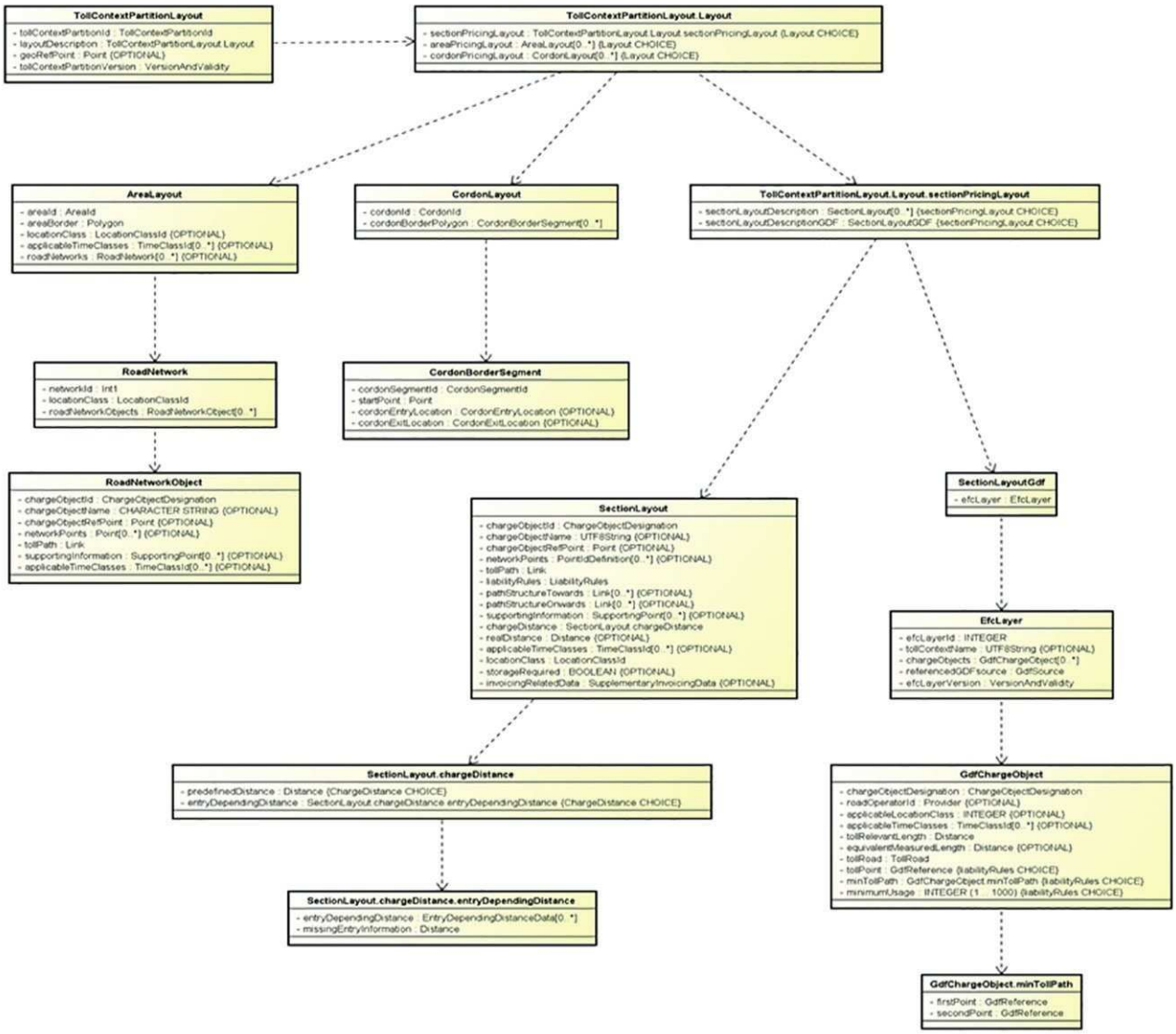


Figure C.4 — Hierarchical data structure (lower lewel part 3)

Annex D
(informative)

How to use context data to define the properties of an EFC regime

D.1 General

The following guidelines illustrate how EFC context data may be used to define the properties of a specific EFC regime. This annex aims to aid understanding of the basic principles of this part of ISO 17575.

In order to reduce complexity, not all the options available in this part of ISO 17575 are mentioned here, only those which are important for the reader to gain a general understanding. The normative parts of ISO 17575 shall be used for real-life situations.

The task of defining the regime properties is allocated to the Back End operator. Here, the context data are provided to support all the Front Ends for which the service provider is responsible.

In cases where responsibilities are split between the toll charger and the service provider, the service provider may take the scheme definition from similar definitions distributed by appropriate toll chargers.

D.2 The evaluation process to determine the basic fee

The process illustrated in Figure D.1 determines the basic fee that shall be applied per charge unit used. This basic fee shall be used to multiply the assembled charge relevant parameter. This is a price per event (in cordon pricing schemes) or per time (in time related area pricing schemes) or per distance driven (for distance based tariffs such as sectioned road tolling or distance based area pricing).

The process starts by determining the actual applicable vehicle class. The vehicle specific nominal and ordinal classification parameters shall be compared with the values provided in the toll context data in the list of the elements `LocalVehicleClass`. A vehicle class is recognised as being valid if all nominal scaling parameters provided in the data element `localVehicleClass` are equal with the actual specific vehicle parameters and all ordinal parameter limits provided in the `localVehicleClass` corresponds with the actual specific vehicle parameters.

The specific vehicle parameters are provided by the Front End configuration parameters or the variable parameters set by the road user. If more than one definition of local vehicle classes is fulfilled then the data element `priorityLevel` can be used, which selects the vehicle class with the highest priority.

The next parameter to be fixed when addressing the basic fee table is the user class, if applicable. Normally this should be a static identifier valid for a certain contract the road user has established with the service provider. However, this may change if vehicles are used for different purposes, which might have an influence on the tariff to be applied. In these cases, the Front End shall provide means for selecting one of the possible contract classes.

The charge object specific location class is an identifier provided in the context data in the data element `TollContextLayout`. The location class is set in a way that the corresponding charge object is allocated to the price class of this certain location. This may be used for distinguishing between high price and low price locations, such as urban and rural locations, in which the tariffs of a comparable road usage vary.

D.3 The definition of time classes

Time classes are specified in the toll context data by providing particular parameters in the `timeClasses` data element. A definition of a single time class consists of a `timeClassId`, which may be used to address this specific time class. It contains the `priorityLevel`, which allows this time class to be placed within the ranking relative to others, and consists of the nominal and ordinal scaled parameters to be compared with the time at which a charge object is used. The time used is defined as local time according to the `timeZone` defined in the data type `TollContextPartitionOverview`. An optional local daylight saving time period can be applied.

Nominal scaling parameters such as the weekdays, months and discrete dates of the year can be defined. External set time classes are processed as nominal parameters.

Ordinal parameters are, for example, a time duration within a day, a time period relative to the time the vehicle has entered a charge object, a contiguous group of weekdays and a contiguous group of days in a year.

D.4 The time class evaluation algorithm

To determine if a specified time class is valid for a particular time of used of a charge object, this time is applied for evaluating some specific parameters.

The first parameter is the time of the day modulo 24 hours. Then the weekday needs to be calculated. Then the date of the year. The last parameter is the time duration from entering the charge object until the time analysed.

These parameters are used for comparing, for each defined time class, the provided nominal values and the ordinal limits of the field of validity with the analysed values of the relevant reference time. If all the nominal parameters are equivalent to the actual ones and all ordinal parameters cover the respective actual values then this time class is or was valid at the reference time.

With this, more than one on the define time classes can be valid.

A graphical presentation of this process is illustrated in Figure D.2.

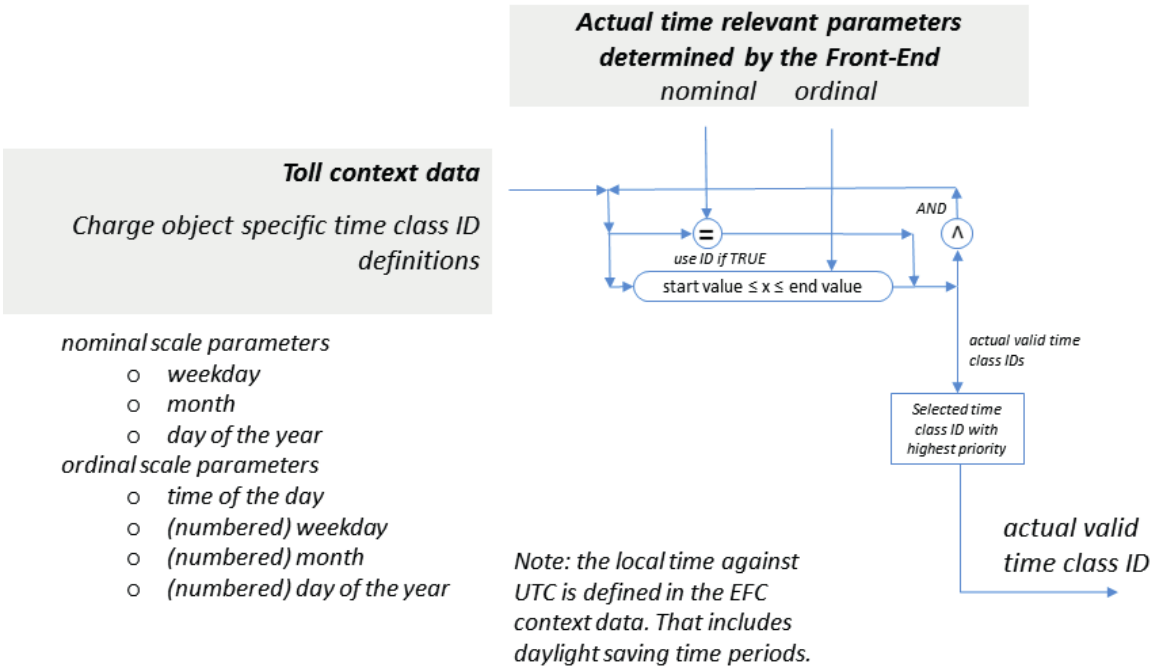


Figure D.2 — Mapping of toll context data and Front End specific timing parameters determining the actual valid time class

D.5 Example of a charge object recognition algorithm for sectioned roads

It is outside the scope of ISO 17575 to provide the charge object recognition algorithm for sectioned roads, as for other types of charge objects. However, understanding the `sectionLayout` data element of the EFC context data requires having at least an example of an evaluation algorithm in mind.

The example presented in Figure D.3 is split into two basic evaluation steps. The first step evaluates if the orthogonal distance from any of the known trajectories towards the charge point may allow assuming the vehicle has used this trajectory and a second step evaluates the heading deviation in the same way.

Both of these steps are again split into two phases. The first phase evaluates if all the single measurement samples measured in the full path towards the charge point are within a maximum tolerance of measurement. A second phase estimates if the mean square deviation between the measured values to the known value is below a tolerance level.

This provides four Boolean expressions. In cases where all these four Boolean results are TRUE then the output of this evaluation algorithm is TRUE, meaning that the vehicle might have used this charge object. This decision has an error probability depending on the measurement accuracy and noise, on the accuracy and noise of the provided parameters in the `Layout` and on the tolerances used.

NOTE It is of utmost importance that the provider of the context data and the manufacture of the Front End agree on the values of the tolerances.

Annex E
(informative)

Guidelines on the use of standardised digital maps in GDF format in the description of section based toll context layouts

E.1 General

ISO 14825 defines, among other things, how to code digital road maps. ISO 14825 is used to exchange information between data provider and data user, and several companies provide digital maps according to ISO 14825. However, the used identifier and names of the internal data elements are defined using proprietary identifiers.

It is anticipated that existing digital road maps will provide a valuable base for defining a toll road network within a general road network. This also covers the need of smart clients, especially if their functionality is combined with a vehicle navigation application using a full navigation road data set inside the vehicle. Although this is out of the scope of this part of ISO 17575, it may also be used by road operators or toll chargers to inform partner entities on how local rules should be applied. In these cases, the quality of the underlying digital road map should fulfil the requirements of the tolling application. This mainly focuses on actuality and completeness.

However, ISO 14825 does not cover toll relevant attributes even if the simple qualifier – that a certain road is a toll road – is supported. Therefore, this part of ISO 17575 defines an add-on to be used in conjunction with a clearly identified standard digital map coded in GDF. This add-on is defined in an ASN.1 coded data structure defining the toll relevant attributes in the GDF view of an additional EFC layer. Within this EFC layer, references to the digital map are used, feeding a tolled object evaluation algorithm with sufficient topologic data.

This annex provides guidelines on how to use references to GDF road data files defining context data for tolling.

In all cases, the specific underlying digital road network data base should be of a quality sufficient for toll applications.

E.2 A short introduction to GDF coded road maps

As defined in ISO 14825, digital road maps are defined mainly in three levels. The highest level 2 (for roads) defines the road network from the view of a driver finding the way to a destination. Roads are defined as simply links between intersections. Curves in the road are neglected and even complex structures, such as highway crossings, are defined as simply intersections. This view is sufficient and optimal for navigation.

In the level 1 of the GDF road map layer, the roads are split into road elements connecting junctions at both sides of the road element. A road element is defined as the smallest element of a road having a single set of properties. Road elements are defined as straight lines even if the actual road has some curves. There are no geographic coordinates defined at this level. References from level 1 junctions to level 0 may provide geographic locations. All the road elements provide the conceivable trajectories a vehicle can use when moving. This includes small areas such as parking areas or industry yards.

Level 0 defines the topology. This is done by defining all the relevant nodes with accurate geographic coordinates and the links between them, without defining their properties. Links between these nodes may be shaped to better fit the reality.

All these nodes may be referenced by defined junctions at level 1. All road elements interconnecting junctions at level 1 may be referenced from level 2. As such, the GDF standard provides a very practical view on road networks that may be re-used for defining sectioned toll roads.

E.3 The EFC layer as add-on to standard GDF coded road map data

In general, the EFC layer defines all the EFC specific attributes required in a Front End, recognizing a sectioned toll road tolled object and selecting the tolled object specific parameters required for calculating the fee. The toll road network is defined as a sequence of tolled objects. This network uses common node identifiers at both sides of a toll road segment, allowing for the reconstruction of the consecutive logical order of tolled objects.

NOTE This can be used in the Front End to recognize "missing" tolled objects if the timing supports the assumption that the tolled object in between the two selected should have been used. According to the level 2 definition of GDF, the EFC node is a logical location without a relation to any topology or geographic coordinates. However, the toll road is defined as a link between two EFC nodes described as a sequence of road elements according to the level 1 definition of GDF. These road elements have junctions (nodes) at both sides of each of the road elements and as such there is a relation of a junction by a reference to a node in level 0 of the digital map. These level 0 nodes provide the geographic coordinates and the link to the "real world".

Two consecutive toll road sections may be connected to the same EFC node using different level 1 junctions and with different geographic coordinates as defined in level 0. In this case, an EFC node may cover more than one geographic location even if this is not defined explicitly in the EFC layer.

A Front End evaluation algorithm may recognize this and extract a link between these junctions using level 1 (purely GDF) definitions. In this case, both the ends of toll road sections are connected in any trajectory the digital map provides.

This mechanism may also be used for deciding on the use of a tolled object if other roads are close by. Here, the logical connection supports the assumption that a tolled object may only have been used if the full vehicle trajectory follows a logical connection towards the tolled object.

The relationship between the EFC layer and the road network layers as defined in ISO 14825 is illustrated in Figure E.1. As shown, two consecutive EFC links are not necessarily connected together. In complex intersections providing more than one trajectory reaching the entrance or leaving the exit, the "area" of multiple trajectories should be associated with the complex structure of an EFC node. Any movement within this area between the end of the last and the beginning of the next toll link does not cause any charging on its own.

Within this part of ISO 17575, the definition of the GDF standard should not be repeated. In addition, the exchange of GDF data sets between Front End and Back End is seen as outside the scope. However, the definitions of ISO 17575-2:2016 can be applied for GDF type data transactions.

Annex F
(informative)

Examples using EFC context data for scheme definitions

F.1 General

The example given in this annex illustrates how toll context data, as defined in this part of ISO 17575, may be used when defining existing toll schemes. It is based on schemes in operation and may be adapted whenever required. The example does not provide a full set of context data required for a toll domain. Scheme identifiers and other obvious and self-explaining elements have been left out for better readability. In addition, some of the listed data elements at higher levels have not been explained in detail if they are obvious or if they define geographical details.

The example shall be used to help understand the overall concepts and to gather ideas for coding a scheme. It shall not be copied and used for operational use.

F.2 Example for a section tolling scheme

F.2.1 Introduction

This example explains how this part of ISO 17575 can be used to define the context description in a simple section tolling scheme for trucks.

It does not contain a complete set of attributes and data elements required to implement a full section pricing context. It gives a choice to explain how data elements can be used.

F.2.2 Description of the rules of the EFC scheme

F.2.2.1 Liable vehicle classes

All trucks weighing 3.5 tonnes and above are toll liable. The toll fee depends on the number of axles and the engine pollution class (see Table F.1).

Table F.1 — Vehicle class definitions

No. of axles	Emission class	Resulting vehicle class
2 and 3	Euro 1 and Euro 2	A
	Euro 3	B
	Euro 4	C
	Euro 5 and better	D
4 and more	Euro 1 and Euro 2	E
	Euro 3	F
	Euro 4	G
	Euro 5 and better	H

F.2.2.2 Time dependency

Charging is applied at any time. No time dependent fees are defined.

F.2.2.3 Charged road network

A road section pricing principle is chosen.

F.2.2.4 Tariff definitions

The tariffs (fee per km) shall be applied according to the Table F.2. In addition, a minimum fee of 1,50 EUR shall apply.

Table F.2 — Tariff table

Vehicle Class	**Tariff** [EUR/km]
A	0,32
B	0,25
C	0,18
D	0,11
E	0,35
F	0,28
G	0,21
H	0,15

F.2.3 Coding of data elements

Tables F.3 to F.8 show the coding of data elements.

Table F.3 — Attribute TollContextOverview

Data element	**Content**	**Remark**
tollContext	Truck toll SA registered in example country	Coding includes country identifier and an identifier for the toll charger within this country
tollContextPartitions	1	One partition defined with identifier “1”
tollSchemeName	“Example Truck Toll”	Optional and present
tollContextBoundingBoxes	List of boxes covering the charged road network	Optional and present
tollContextOverviewVersion	Version 1.23, valid from 01.03.2011	

Table F.4 — Attribute TollContextPartitionOverview

Data element	Content	Remark
tollContextPartitionId	1	corresponds to the identifier defined in TollContextOverview
tollContextPartitionName		optional and not present
tollContextPartitionType	roadSectionPricing (=0)	
operationalStatus		
startsOperationAt	01.01.2010	
stopsOperationAt	- *n.a.* -	optional and not present
timeZone	MET (=+60 minutes)	to be coded as difference in minutes compared to UTC
dSTOffset	+60 minutes	optional and present
tollContextPartitionBoundingBoxes		optional and not present
sendChargeReportIfEntering		optional and not present
precedenceLevel		optional and not present
chargeReportFinalRecipient		optional and not present
tollContextPartitionOverviewVersion	Version 1.67, valid from 01.09.2011	

Table F.5 — Attribute TariffTable

Data element	Content	Remark
applicablePartitions	1	corresponds to the identifier defined in TollContextOverview
tariffs	See Table F.6	
standardCurrency	EUR in minor units of 1000:1 ('0,1 cents')	
typeOfFee	2	tax
tariffTableVersion	Version 1.19 valid from 01.09.2011	

Table F.6 — Data element Tariff

Data element	Content	Remark
Tariff T1		For tariff T1
tariffClassId	1	
chargeUnit	100 m	
roundingRuleForChargeU-nitsUsed	always rounding up	
basicFeePerChargeUnit	32	= 0,032 EUR (32 x 0,001 EUR) per charge units (= per 100m)
roundingRuleForFee	always rounding up	
vat	- n.a. -	optional and not present
roundingRuleForVat	- n.a.	optional and not present
intervalScaleParameter	- n.a. -	optional and not present
offsetFee	- n.a. -	optional and not present
minFee	150.000	= 1,50 EUR (150.000 x 0,001 EUR)
thresholdFee	- n.a. -	optional and not present
maxFee	- n.a. -	optional and not present
alternativeCurrency	- n.a	optional and not present
Tariff T2		For tariff T2
tariffClassId	2	
chargeUnit	100 m	
currency	EUR	
basicFeePerChargeUnit	25	= 0,025 EUR (25 x 0,001 EUR) per charge unit (= per 100m)
...	...	see above at tariff T1
Tariff T3		For tariff T3
...	...	see above at tariff T1
basicFeePerChargeUnit	18	= 0,018 EUR (18 x 0,001 EUR) per charge unit (= per 100m)
...	...	

Table F.7 — Attribute LocalVehicleClassDefinition

Data element	Content	Remark
localVehicleClasses	See Table F.8	
tariffVehicleClassDefinitionVersion	Version 1.03 valid from 01.03.2011	

Table F.8 — Data element localVehicleClasses

Data element	Content	Remark
LocalVehicleClass A		For vehicle class A
localVehicleClassId	1	
nominalElements		
vehicleClasses	Trucks above 3.5t	Coding according to EN 15509
vehicleAxlesNumber	2, 3	Coding according to ISO 14906
euroValues	Euro 0, 1, 2	Coding according to ISO 14906
classesSetExternally	- n.a. -	optional and not present
ordinalElements	- n.a. -	optional and not present
priorityValue	250	
LocalVehicleClass B		For vehicle class B
localVehicleClassId	2	
nominalElements		
vehicleClasses	Trucks above 3.5t	Coding according to EN 15509
vehicleAxlesNumber	2, 3	Coding according to ISO 14906
euroValues	Euro 3	Coding according to ISO 14906
…	…	See above at vehicle class A
LocalVehicleClass C		For vehicle class C
localVehicleClassId	3	
nominalElements		
vehicleClasses	Trucks above 3.5t	Coding according to EN 15509
vehicleAxlesNumber	2, 3	Coding according to ISO 14906
euroValues	Euro 4	Coding according to ISO 14906
…	…	Analoguous to vehicle class A above

Annex G
(informative)

Use of this part of ISO 17575 for the EETS

G.1 General

In 2004, EU Directive 2004/52/EC of the European parliament and of the council "on the interoperability of electronic road toll systems in the community" was adopted. This EU Directive calls for the establishment of a European Electronic Toll Service (EETS).

In 2009, EC Decision 2009/750/EC "on the definition of the European Electronic Toll Service and its technical elements" was adopted. It set out the necessary technical specifications and requirements for that purpose, and contractual rules relating to EETS provision. The decision lays down rights and obligations on EETS providers, toll chargers and EETS users.

Other requirements and other EU Directives may also be applicable to the product(s) falling within the scope of this part of ISO 17575.

G.2 Overall relationship between European standardization and the EETS

EU Directive 2004/52/EC also triggered the establishment of a standardisation mandate (M/338, "Standardisation mandate to CEN, CENELEC and ETSI in support of Interoperability of electronic road toll systems in the Community") that called for development of technical standards in support of the EETS. Activities under M/338 are supervised by the "ITS co-ordination group" (ITS-CG, previously ICTSB/ITSSG).

M/338 does not explicitly call for the provision of harmonized standards (according to Directive 98/34/EC on the new approach to technical harmonization and standards), which means that this possibility is not available for the European standards that are developed in support of the EETS. Instead, this brief annex provides an outline of how this part of ISO 17575 could be used in the context of the EETS.

EC decisions can point out the use of specific standards, even if they are not formally harmonized. This is also done in EC Decision 2009/750/EC for a few standards (i.e. those that were available at the time of its approval). In case there will be more EC decisions in support of the EC directive, further European standards could be referenced there as well.

The European Commission has also published, in 2011, a "Guide for the Application of Directive on the Interoperability of Electronic Road Toll Systems" (ISBN 978-92-79-18637-0). This guide is intended to be a reference manual for all parties directly or indirectly concerned by Directive 2004/52/EC and Decision 2009/750/EC. It aims at providing help for the implementation of the EETS, including a list of standards that might be of use. The guide is only informative (e.g. the document cannot notify certain standards as "mandatory" for use in the EETS) and is intended to be updated on regular basis.

G.3 European standardization work supporting the EETS

Many of the standards developed by CEN/TC 278 have been drafted with the EETS requirements in mind (including the use of the results from European projects such as CARDME, PISTA, CESARE and RCI). CEN representatives have also taken part as observers in working groups, etc., initiated by the EC for the EETS. Hence, some work has been done in close co-operation between CEN working groups and the EC.

It should be noted that no CEN/ISO standards are "turnkey" solutions for the EETS. They are to be used as "building blocks" for the EETS, supporting the EETS legal framework and agreements between

the parties concerned by the EETS. A precise EETS specification is not within the scope of CEN/ISO standards, but remains that task of the owners of the EETS scheme.

It should also be noted that CEN/ISO has a wider scope than the EETS, which is a complementary service to the national services of the Member States and optional for the users, whereas CEN/ISO standards should be applicable to all EFC services worldwide.

G.4 Correspondence between this part of ISO 17575 and the EETS

This part of ISO 17575 defines requirements for the interface between a Back End and the Front End of a toll service provider for the provision of toll context information. Since both sides of the interface are within the domain of the toll service provider, it is not a specification supporting interoperability directly. The main intention is to facilitate an open market for Front End technology.

In addition, many of the application data elements specified in this part of ISO 17575 are referenced in the standard ISO 12855, which provides an interoperability specification for the interface connecting the Back Ends of the toll charger and the toll service provider. This standard is of crucial importance for achieving interoperability in regional and European contexts.

For the European context, this part of ISO 17575 is a toolbox intended to offer a set of optional data elements to support all autonomous toll schemes being currently in operation or reasonably probable in the near future of electronic tolling.

This part of ISO 17575 indirectly defines requirements that correspond to the requirements listed in EC-decision 2009/750/EC (see Table G.1).

Table G.1 — ISO 17575-3 and EC Decision 2009/750/EC

Clause(s)/sub-clause(s) of ISO 17575-3	**Essential requirements of EC Decision 2009/750/EC**	**Qualifying remarks/Notes**
8.5.3.4 and Annex A	Article 4.3	ISO 17575-3 provides a means for toll service providers to store vehicle class information in the Front End (OBE)
Clause 8 and Annex A	Article 6	ISO 17575-3 provides the interoperable specifications for major parts of the toll context data to be provided by the toll charger to the toll service provider.
Clause 8 and Annex A	Annex II. Clause 4 (f)	ISO 17575-3 provides the interoperable specifications for major parts of the toll context date to be provided by the toll charger to the toll service provider.
8.5.3.4 and Annex A	Annex IV	ISO 17575-3 provides a means for toll service providers to store vehicle class information in the Front End (OBE)
8.5.3 and Annex A	Annex IV	ISO 17575-3 provides toll chargers and toll service providers a means to operate, support and manage tariff schemes of different types and nature

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