

# DATEX II profile for Travel Times and Traffic Condition

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## Preliminary note

Elements not shown at all in any of the diagrams (nor entailed by another element shown on diagrams), are excluded from the profile. E.g. if a subset of literals is shown for an enumeration, the literals not listed shall not be used in this profile; if a subset of attributes is shown on a class, the attributes not shown shall not be used etc. The corresponding schema file does follow these rules.

*For further explanation of notation see Appendix ,Key to the UML representation'.*

## DATEX II profile for Travel Times and Traffic Condition

Using this DATEX II profile, Travel Times and Traffic Status can be described.

### ElaboratedDataPublication

The entry into the model is given via the **ElaboratedDataPublication** (of Type **PayloadPublication**) that may have several **ElaboratedData** elements.

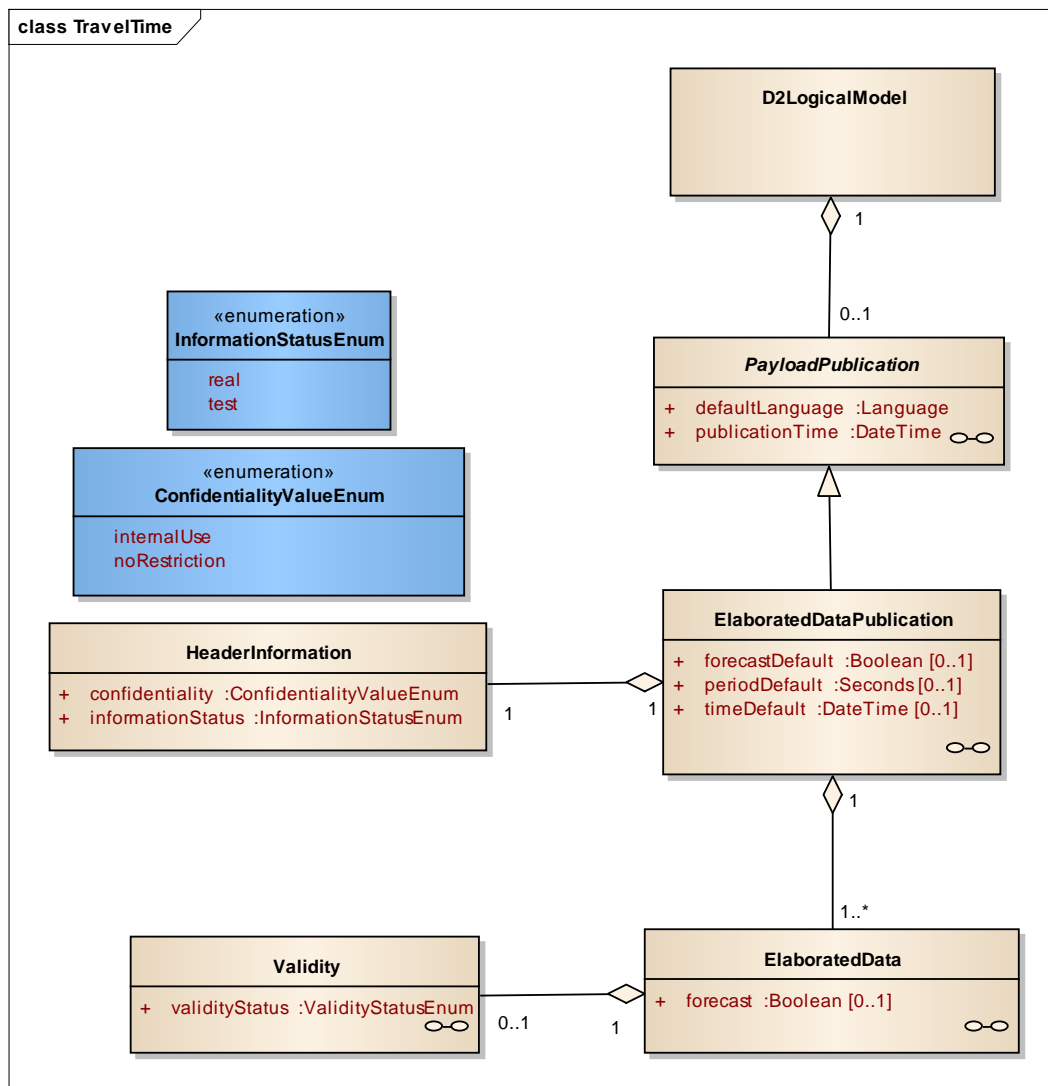


Figure 1: Basic structure of Elaborated Data Publication

Component	Definition
<b>D2LogicalModel</b>	The DATEX II logical model comprising exchange, content payload and management sub-models.
<b>PayloadPublication [0..1]</b>	A payload publication of traffic related information or associated management information created at a specific point in time that can be exchanged via a DATEX II interface.
<b>ElaboratedDataPublication</b>	A publication containing one or more elaborated data sets.
<b>ElaboratedData [1..*]</b>	An instance of data which is derived/computed from one or more measurements over a period of time. It may be a current value or a forecast value predicted from historical measurements.
<b>HeaderInformation</b>	Management information relating to the data contained within a publication.
<b>Validity [0..1]</b>	Specification of validity, either explicitly or by a validity time period specification which may be discontinuous.

Table 1: Components of basic structure

Component	Attribute name	Definition	Multi - plicity	Type
<b>Payload Publication</b>	defaultLanguage	The default language used throughout the payload publication.	1	Language
	publicationTime	Date/time at which the payload publication was created.	1	DateTime
<b>ElaboratedData Publication</b>	forecastDefault	The default value for the publication of whether the elaborated data is a forecast (true = forecast).	0..1	Boolean
	periodDefault	The default value for the publication of the time elapsed between the beginning and the end of the sampling or measurement period. This item may differ from the unit attribute; e.g. an hourly flow can be estimated from a 5-minute measurement period.	0..1	Seconds
	timeDefault	The default for the publication of the time at which the values have been computed/derived.	0..1	DateTime
<b>HeaderInforma tion</b>	confidentially	The extent to which the related information may be circulated, according to the recipient type. Recipients must comply with this confidentiality statement.	1	Enum

	informationStatus	The status of the related information (real, test, exercise ....).	1	Enum
<b>ElaboratedData</b>	forecast	Indication of whether this elaborated data is a forecast (true = forecast).	0..1	Boolean

Table 2: Attributes of basic structure



**Language and country:** In several parts of a message (including the data type 'Multilingual String') a declaration of language and/or country is expected. This should be expressed as a **two-letter code in lower case** according to ISO 639-1 resp. ISO 3166-1<sup>1</sup>, e.g. **de** for German and Germany.

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<sup>1</sup> In fact, ISO 3166-1 requires uppercase codes. There's a pending DATEX issue to change the enumeration values to uppercase.

## Validity model

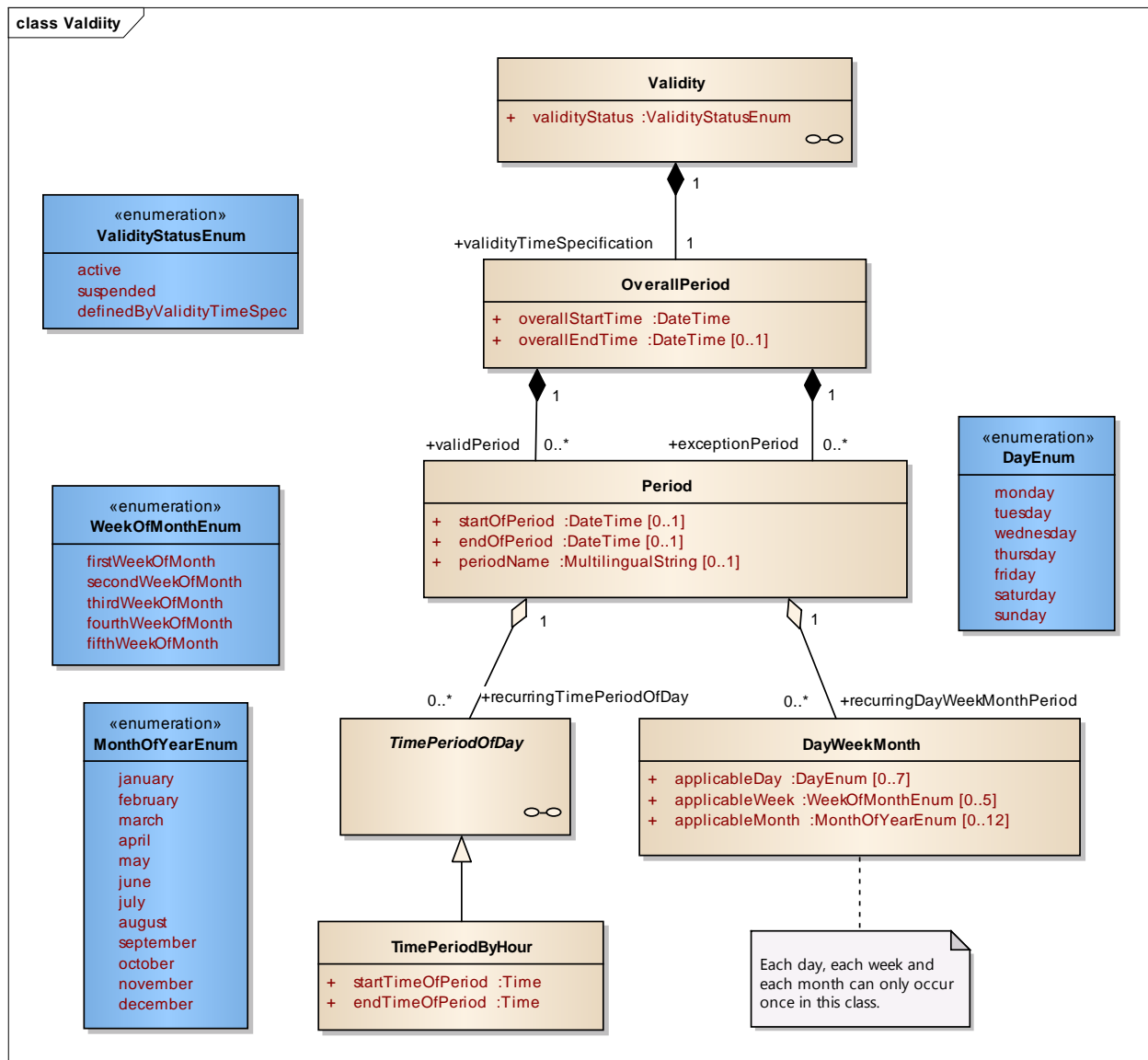


Figure 2: Validity model

The validity period for data can be set very easily by just specifying a start time (mandatory) and optionally an end time ("overallPeriod").

This attribute **validityStatus** is usually set to **definedByTimeSpec**, but can also be explicitly set to **active** or **suspend**. The last two values then override all other information concerning the validity control. **Suspend** therefore means that the current data is (possibly temporarily) no longer valid.

### Important note:

For Travel Times, the usage of the Validity model is restricted to the **OverallPeriod** component. Only for the Traffic Status, the more complex model described below can be used, if necessary.

If the validity turns out to be complex, **periods** can either be included or excluded. A period is composed of any combination of times, weekdays, weeks of a month or months, e.g.:

- Every Monday 9 am – 5 pm
- Every 3rd and 5th week of a month
- Sat. and Sun. 7 – 8 am and 5 – 6 pm

(note: Sat. and Sun. 7 – 8 am and 5 – 6 pm would have to be modelled in form of two periods)

In addition, a period can be assigned with its own start and end time validity within which it is active, e.g. every Monday 9 am – 5 pm in the summer holidays, whereof the summer holidays are given by absolute dates (**startOfPeriod**, **endOfPeriod**).

The following chart illustrates the interaction of the **overallPeriod** and any additional specified periods. The green bars describe "valid time periods", shown on the time axis. The vertical lines delimit the different periods (overallStartTime, overallSendTime or. startOfPeriod, endOfPeriod):

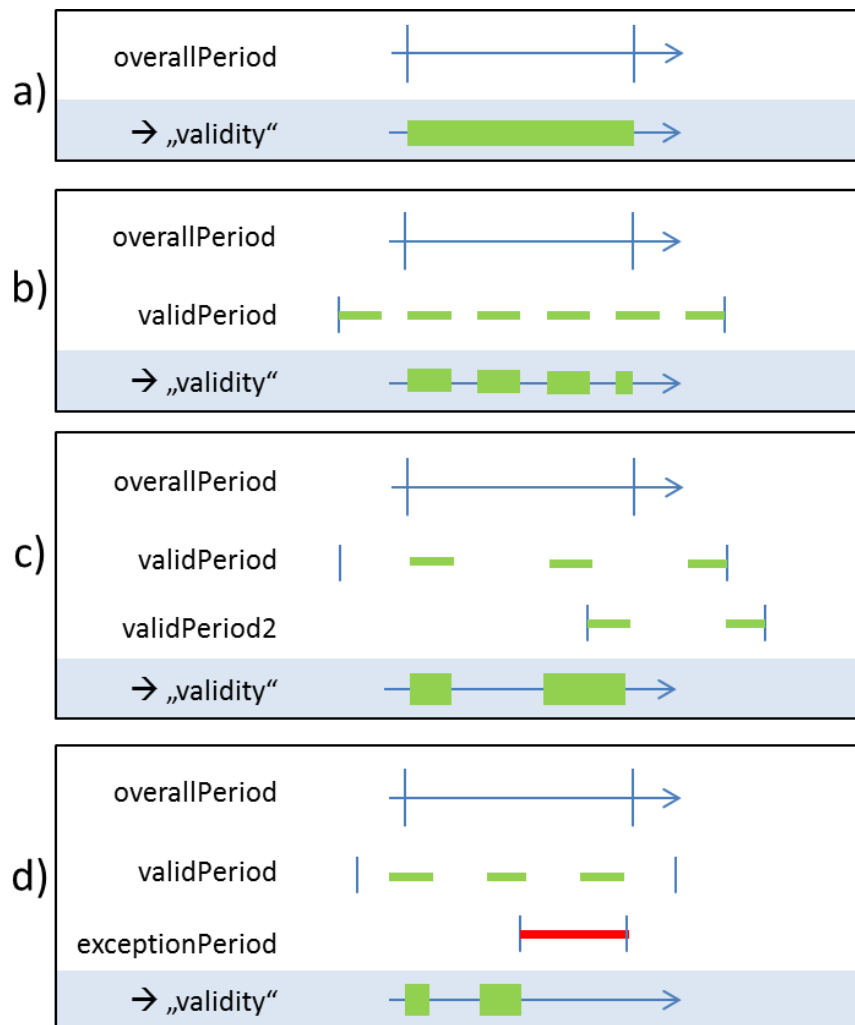


Figure 3: Validity when using multiple periods

In case a) the actual validity corresponds exactly to the **overallPeriod**.

In case b) it corresponds to the proportion of **validPeriod** that lies within the **overallPeriod**.

In case c) the set union of the two specified periods is cut with the **overallPeriod**.

And in case d) the period specified as **exceptionPeriod** is taken out of validity.

## ReferenceSettings

With the component **ReferenceSettings** a **predefinedLocation** can be set as well as a default for **trafficStatus**. Note that individual location referencing can be done via component **BasicData** (see below). The **trafficStatusDefault** can be overridden via component **TrafficStatus** (see below).

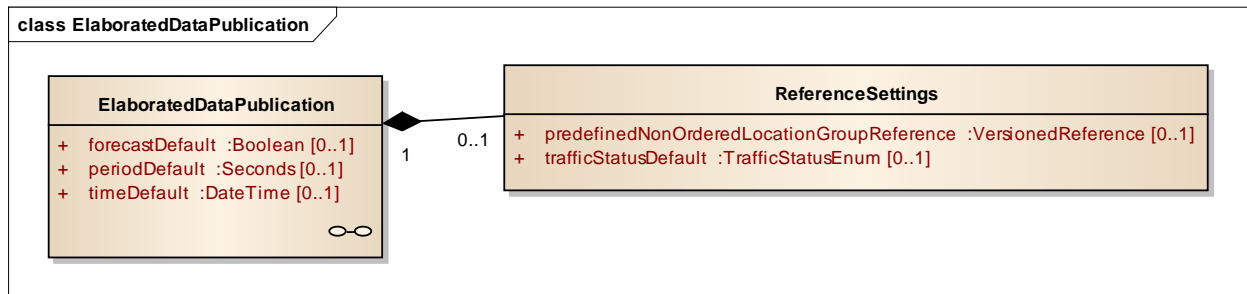


Figure 4: Component ReferenceSettings

Component	Definition
ReferenceSettings	Specification of the default value for traffic status on a group of predefined locations on the road network. Only when traffic status differs from this value at a location in the group need a value be sent.

Table 3: Component ReferenceSettings

Class name	Attribute name	Definition	Multi- plicity	Type
ReferenceSettings	predefinedNonOrderedLocationGroupReference	A reference to a versioned instance of a predefined non ordered location group as specified in a PredefinedLocationsPublication.	0..1	VersionedReference
	trafficStatusDefault	The default value of traffic status that can be assumed to apply to the locations defined by the associated predefined location set.	0..1	TrafficStatusEnum

Table 4: Attributes for ReferenceSettings



## ElaboratedData

**ElaboratedData** might have some information about its source:

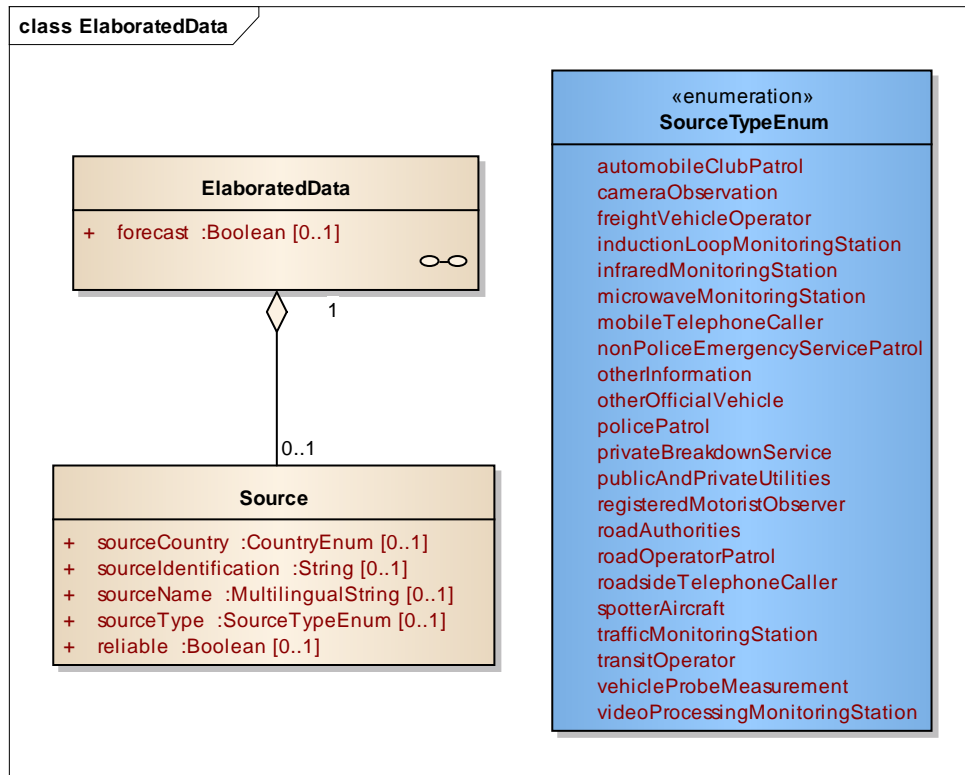


Figure 5: Elaborated data with component Source

Component	Definition
<b>Source [0..1]</b>	Details of the source from which the information was obtained.

Table 5: Component Source

Component	Attribute name	Definition	Multi- plicity	Type
<b>Source</b>	sourceCountry	ISO 3166-1 two character country code of the source of the information.	0..1	CountryEnum
	sourceIdentification	Identifier of the organisation or the traffic equipment which has produced the information relating to this version of the information.	0..1	String

	sourceName	The name of the organisation which has produced the information relating to this version of the information.	0..1	MultilingualString
	sourceType	Information about the technology used for measuring the data or the method used for obtaining qualitative descriptions relating to this version of the information.	0..1	SourceTypeEnum
	reliable	An indication as to whether the source deems the associated information to be reliable/correct. "True" indicates it is deemed reliable.	0..1	Boolean

Table 6: Attributes for Source

## Travel Times

Travel times are provided by the component **TravelTimeData**, which is of Type **BasicData**. Only one dataset is allowed for each package of **ElaboratedData**.

For describing Travel Times, the Validity model is restricted to the **OverallPeriod** class, i.e. the complex part of the Validity model is not allowed here.

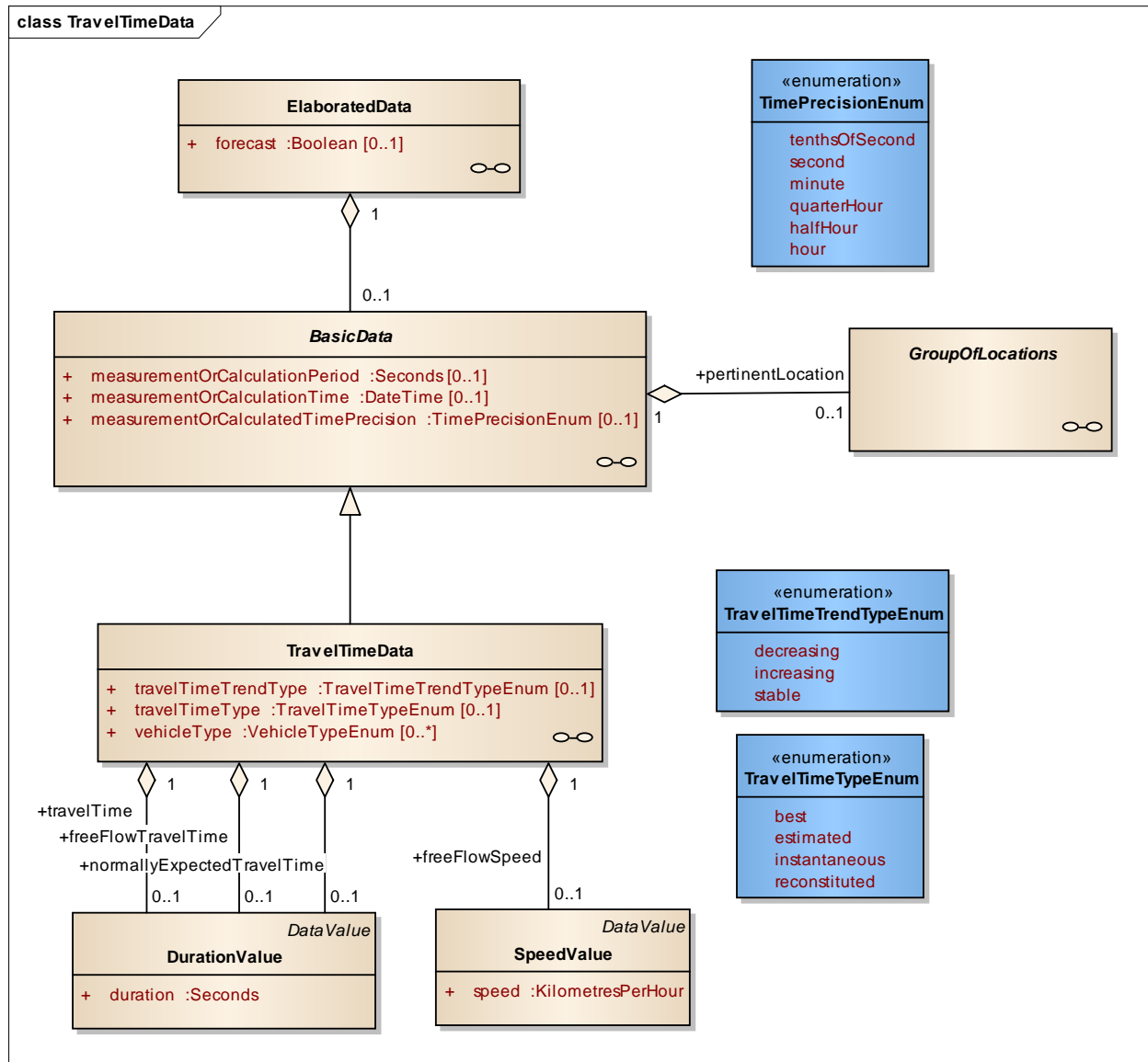


Figure 6: Components for TravelTimeData

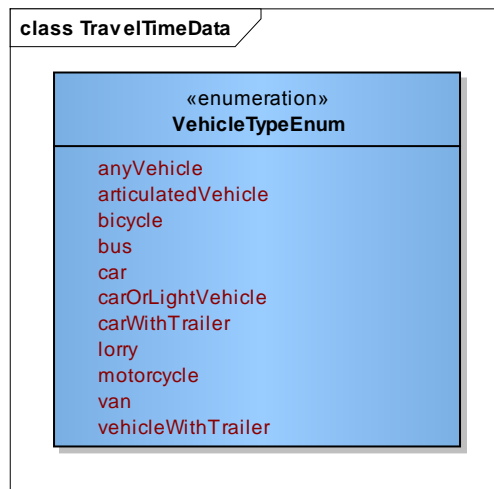
Component	Definition
BasicData [0..1]	Generic data that is either measured or calculated (elaborated) at the same time or over the same time period.
TravelTimeData	Derived/computed travel time information relating to a linear section of the road network.
DurationValue	A measured or calculated value of a period of time.
SpeedValue	A measured or calculated value of speed.

Table 7: Components for TravelTimeData

Component	Attribute name	Definition	Multiplicity	Type
BasicData	measurementOrCalculatedTimePrecision	The precision to which the time of measurement or calculation is given.	0..1	TimePrecisionEnum
	measurementOrCalculationPeriod	The time elapsed between the beginning and the end of the sampling or measurement period. This item may differ from the unit attribute; e.g. an hourly flow can be estimated from a 5-minute measurement period.	0..1	Seconds
	measurementOrCalculationTime	Point in time at which this specific value or set of values has been measured or calculated. It may also be a future time at which a data value is predicted.	0..1	DateTime
	pertinentLocation	The location (e.g. the stretch of road or area) to which the data value(s) is or are pertinent/relevant. This may be different from the location of the measurement equipment (i.e. the measurement site location).	0..1	GroupOfLocation <i>For Georeferencing see extra chapter below</i>
TravelTimeData	travelTimeTrendType	The current trend in the travel time between the defined locations in the specified direction.	0..1	TravelTimeTrendTypeEnum
	travelTimeType	Indication of the way in which the travel time is derived.	0..1	TravelTimeTypeEnum
	vehicleType	Vehicle type.	0..*	VehicleTypeEnum <i>Enumeration values see below.</i>
	freeFlowSpeed	The free flow speed expected under ideal conditions, corresponding to the freeFlowTravelTime.	0..1	SpeedValue

	freeFlowTravelTime	The travel time which would be expected under ideal free flow conditions.	0..1	DurationValue
	normallyExpectedTravelTime	The travel time which is expected for the given period (e.g. date/time, holiday status etc.) and any known quasi-static conditions (e.g. long term roadworks). This value is derived from historical analysis.	0..1	DurationValue
	travelTime	Derived/computed travel time information relating to a specific group of locations.  <b>Where ElaboratedData.forecast is missing or = false, this element travelTime is to be seen as mandatory!</b>	<b>0..1</b>  <b>1..1</b>	DurationValue
DurationValue	duration	A period of time expressed in seconds.	1..1	Seconds
SpeedValue	speed	A value of speed expressed in kilometres per hour.	1..1	KilometresPerHour

Table 8: Attributes for TravelTimeData

Figure 7: Enumeration values for vehicleType<sup>2</sup>

<sup>2</sup> Note that the classification of vehicles might be treated unequally in different countries. In Germany, for example, the “Lieferbedingungen für Streckenstationen” give three different scenarios of classification, which can all be mapped with the enumeration literals selected for this profile.

## Traffic Status

Traffic status information is provided by the component **TrafficStatus**, which is of Type **BasicData**. Only one dataset is allowed for each package of **ElaboratedData**.

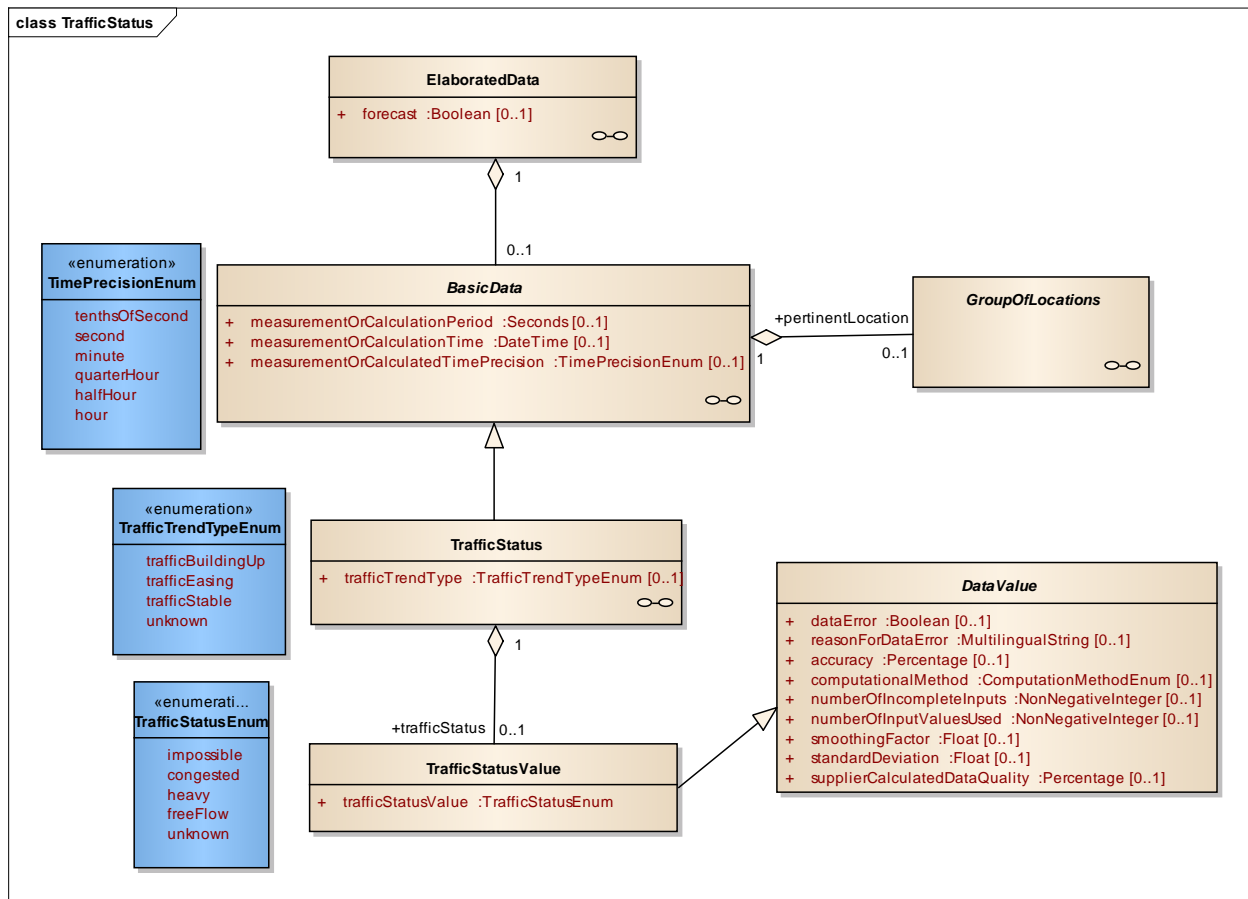


Figure 8: Components for Traffic Status

Component	Definition
TrafficStatus	The status of traffic conditions on a specific section or at a specific point on the road network.
TrafficStatusValue	A measured or calculated value of the status of traffic conditions on a section of road in a specified direction.

Table 9: Components for TrafficStatus

Component	Attribute name	Definition	Multi- plicity	Type
TrafficStatus	trafficTrendType	A characterization of the trend in the traffic conditions at the specified location and direction.	0..1	TrafficTrendTypeEnum <i>see below</i>

TrafficStatusValue	trafficStatusValue	A status value of traffic conditions on the identified section of road in the specified direction.	1..1	TrafficStatusEnum <i>see below</i>
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Table 10: Attributes for TrafficStatus

Enumerated value name	Definition
congested	Traffic in the specified direction is congested making driving very slow and difficult.
freeFlow	Traffic in the specified direction is free flowing.
heavy	Traffic in the specified direction is heavier than usual making driving conditions more difficult than normal.
impossible	Traffic in the specified direction is completely congested, effectively at a standstill, making driving impossible.
unknown	Traffic conditions are unknown.

Table 11: Enumeration Values for TrafficStatusEnum

Enumerated value name	Definition
trafficBuildingUp	Traffic conditions are changing from free-flow to heavy or slow service levels. Queues may also be expected.
trafficEasing	Traffic conditions are changing from heavy or slow service levels to free-flow.
trafficStable	Traffic conditions are currently stable.
unknown	The trend of traffic conditions is currently unknown.

Table 12: Enumeration Values for TrafficTrendTypeEnum

## Georeferencing

Georeferencing can be accessed by the component **BasicData** – **pertinentLocation** (see above).

Another possibility is using **PredefinedLocations** (see below), which can be accessed by **ElaboratedDataPublication** – **ReferenceSettings**.

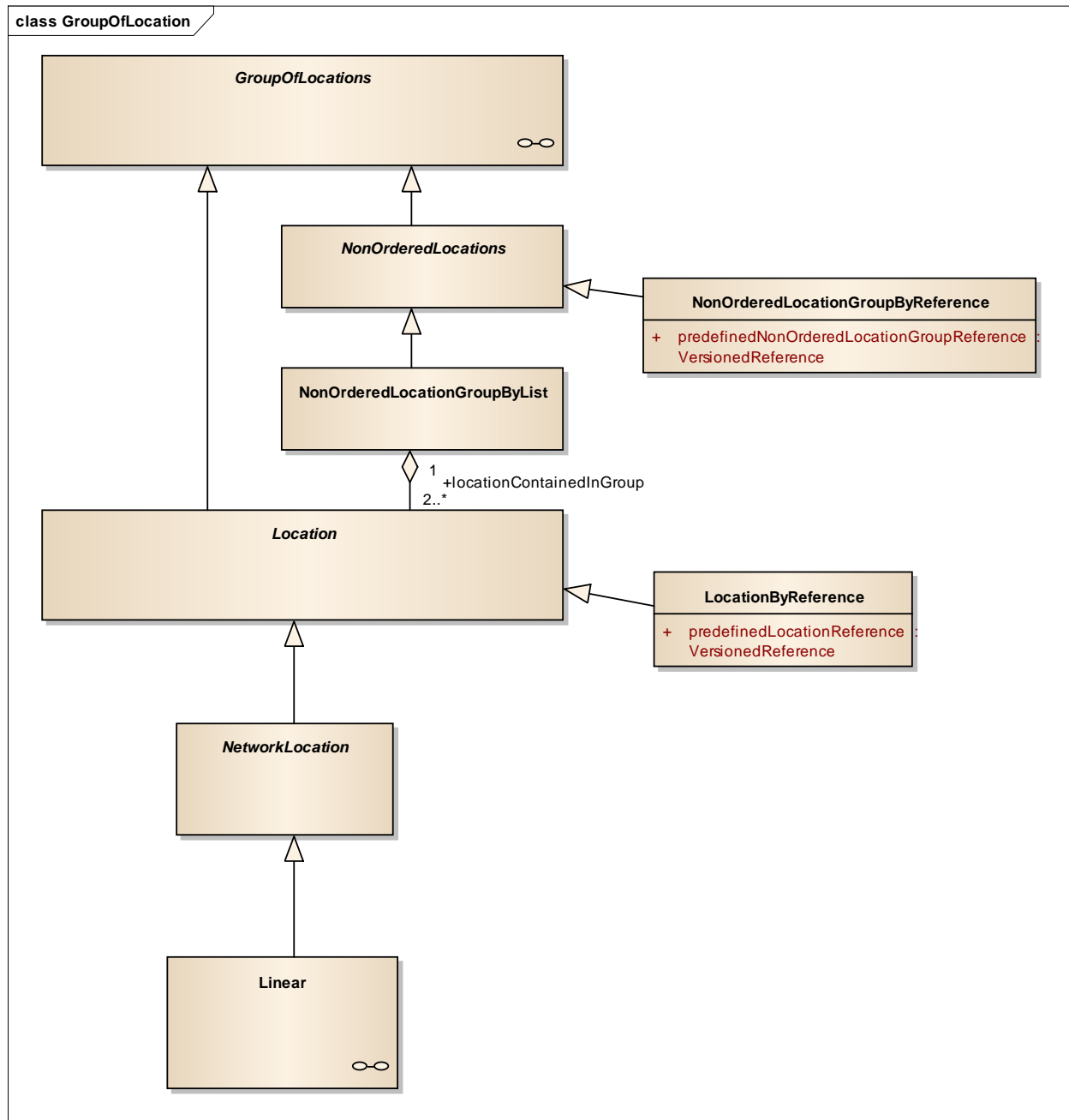


Figure 9: Basic structure for Georeferencing



A **GroupOfLocation** (which is a misleading description, by the way) can be a single linear network location or a group of non-ordered locations. For both cases these constructs can also point to a predefined location – see extra chapter on how to model a **PredefinedLocation**.

*Note: The Georeferencing methods are presented here, but not described in all details.*

The following table shows the available geo-referencing methods for the Travel Times profile:

	TravelTimes
<b>Point</b>	
PointByCoordinates	
Alert C Point	
LocationForDisplay (Coordinates)	
TPEG-Loc	
ISO 19148 - PointAlongLinearElement	
<b>OpenLR Point</b>	
<b>Linear</b>	
Alert C Linear	M2, M4
TPEG-Loc	X
ISO 19148 - LinearWithinLinear	
<b>LinearByCoordinates</b>	X
<b>OpenLR Linear</b>	X
<b>Area</b>	
Alert C Area	
TPEG-Loc	
<b>Other</b>	
Itinerary	
NonOrderedGroupOfLocations	X
Supplementary PositionalDescription	
Predefined Locations	X
ExternalReferencing	
X: method valid resp. available <b>red: Extension</b> M2, M4: Alert C method 2 resp. method 4	

Figure 10: Table Geo-referencing

This table can be regarded as mandatory, i.e. variations not marked are not allowed.

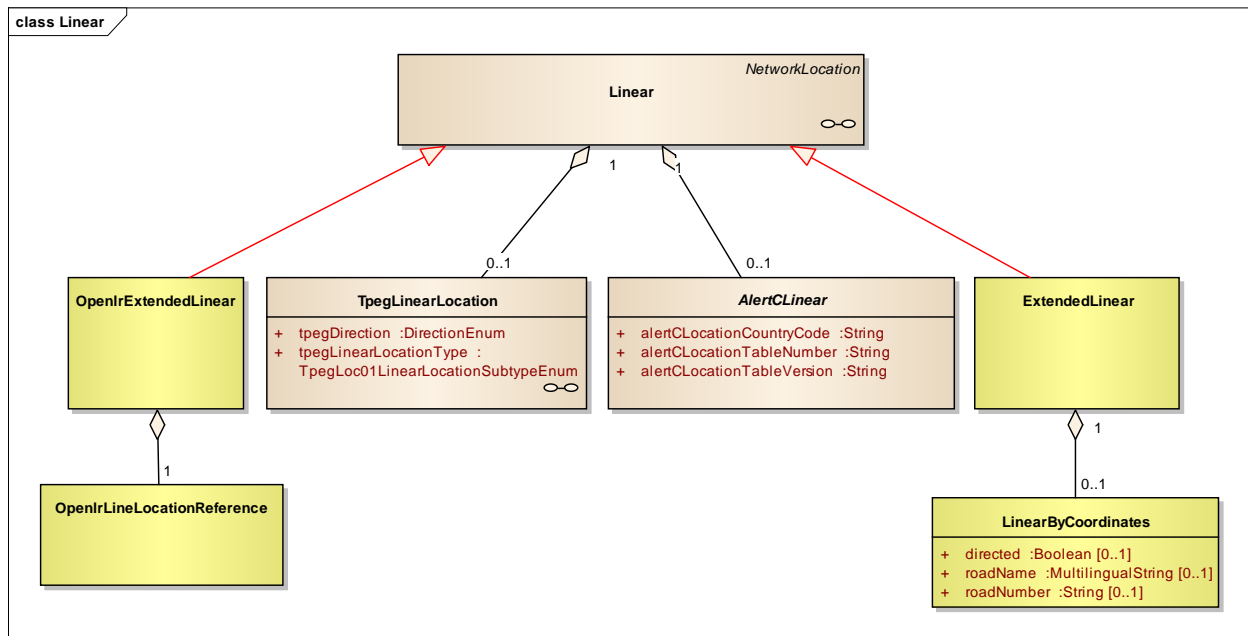


Figure 11: Possibilities for Linear elements

## LinearByCoordinates

For defining a linear element by coordinates, this useful Level B-extension can be used:

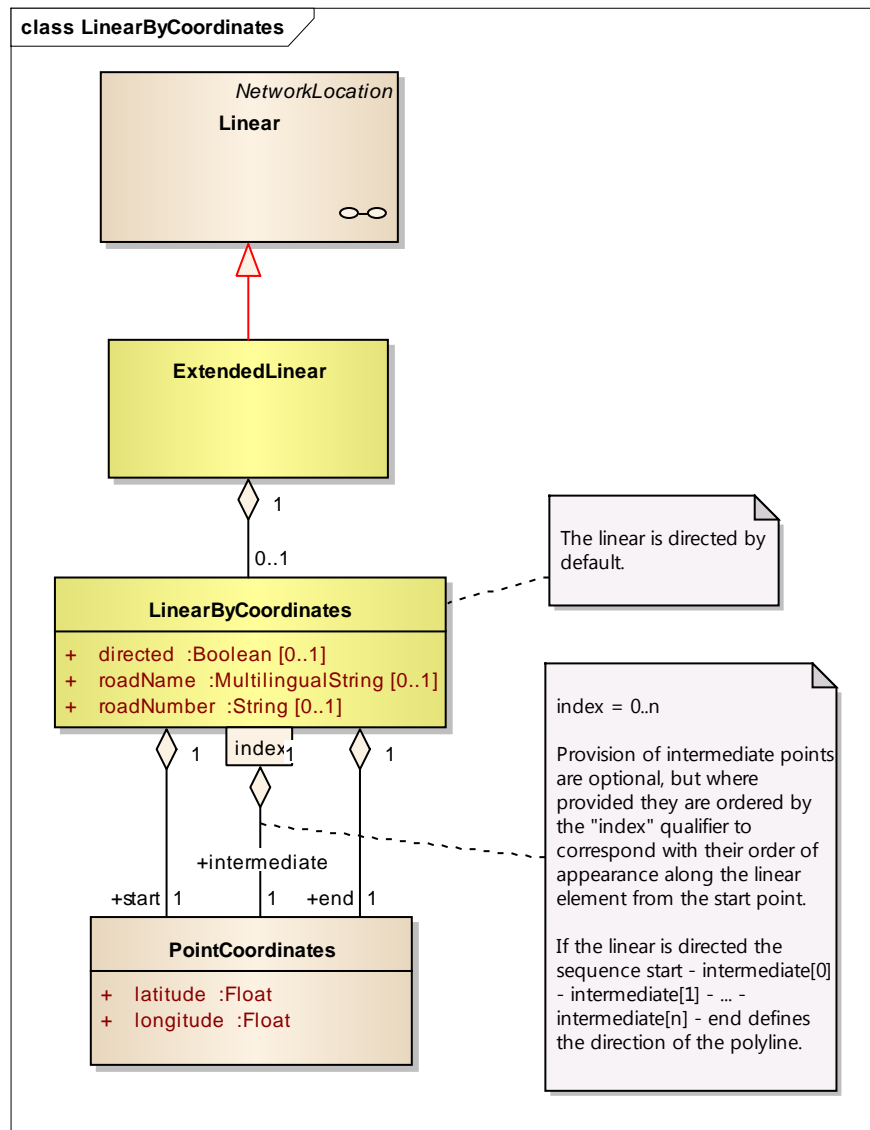


Figure 12: LinearByCoordinates, a DATEX Level B extension

## OpenLR

Another possibility of localisation DATEX II Expansion OpenLR, based on Open Source, is available (<http://www.openlr.org>), respectively for linear objects or points. Details are presented only in the form of the next figure below; all other information can be obtained from the above website<sup>3</sup>.

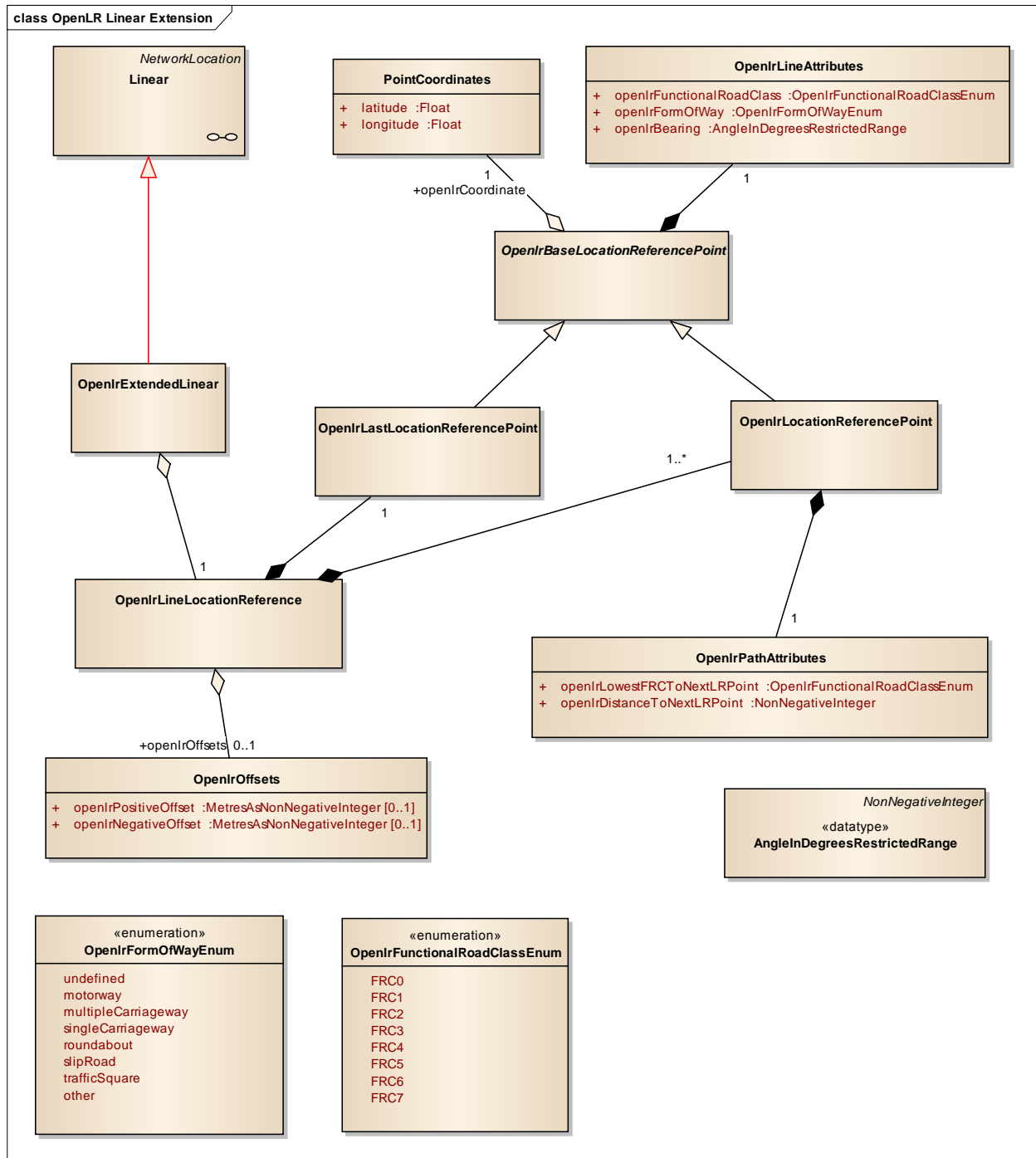


Figure 13: OpenLR Linear Extension

<sup>3</sup> Or the direct documentation via the following address:

<http://www.datex2.eu/sites/www.datex2.eu/files/OpenLR DATEX II extension 0.pdf>

## Localisation via ALERT C

The following ALERT-C methods are available:

- M2 for linear objects (definition of an edge via 2 points) and
- M4 for linear objects (definition of an edge via 2 points with offsets)

More details can be found in the ISO 14819-3 standard<sup>4</sup>.

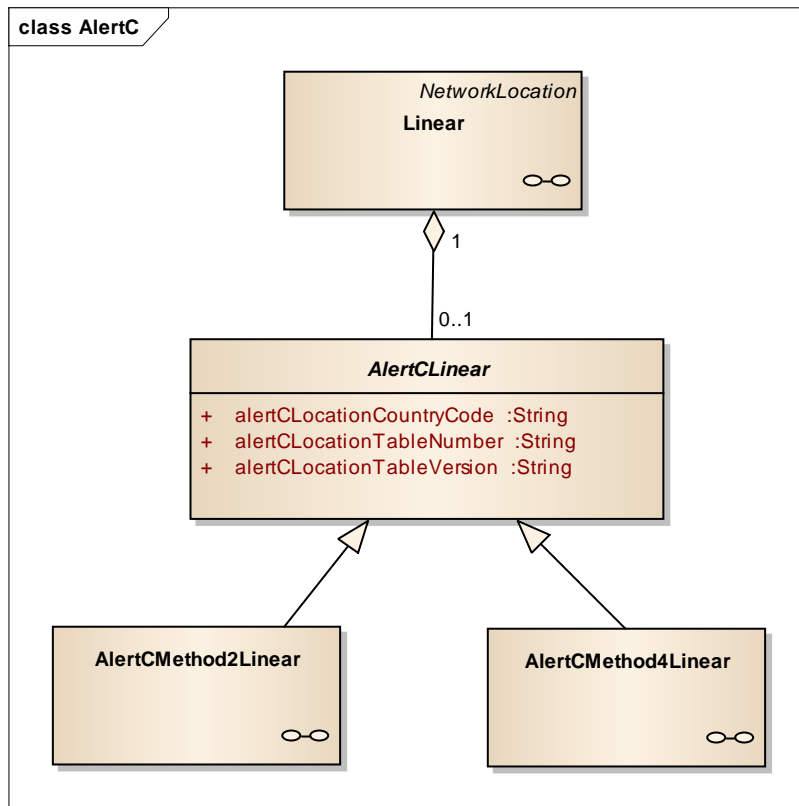


Figure 14: ALERT C for linear objects

<sup>4</sup> [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=59232](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=59232)

## Localisation via TPEG-Loc

The localisation via TPEG-Loc is available for linear elements. It's illustrated in the following figure.

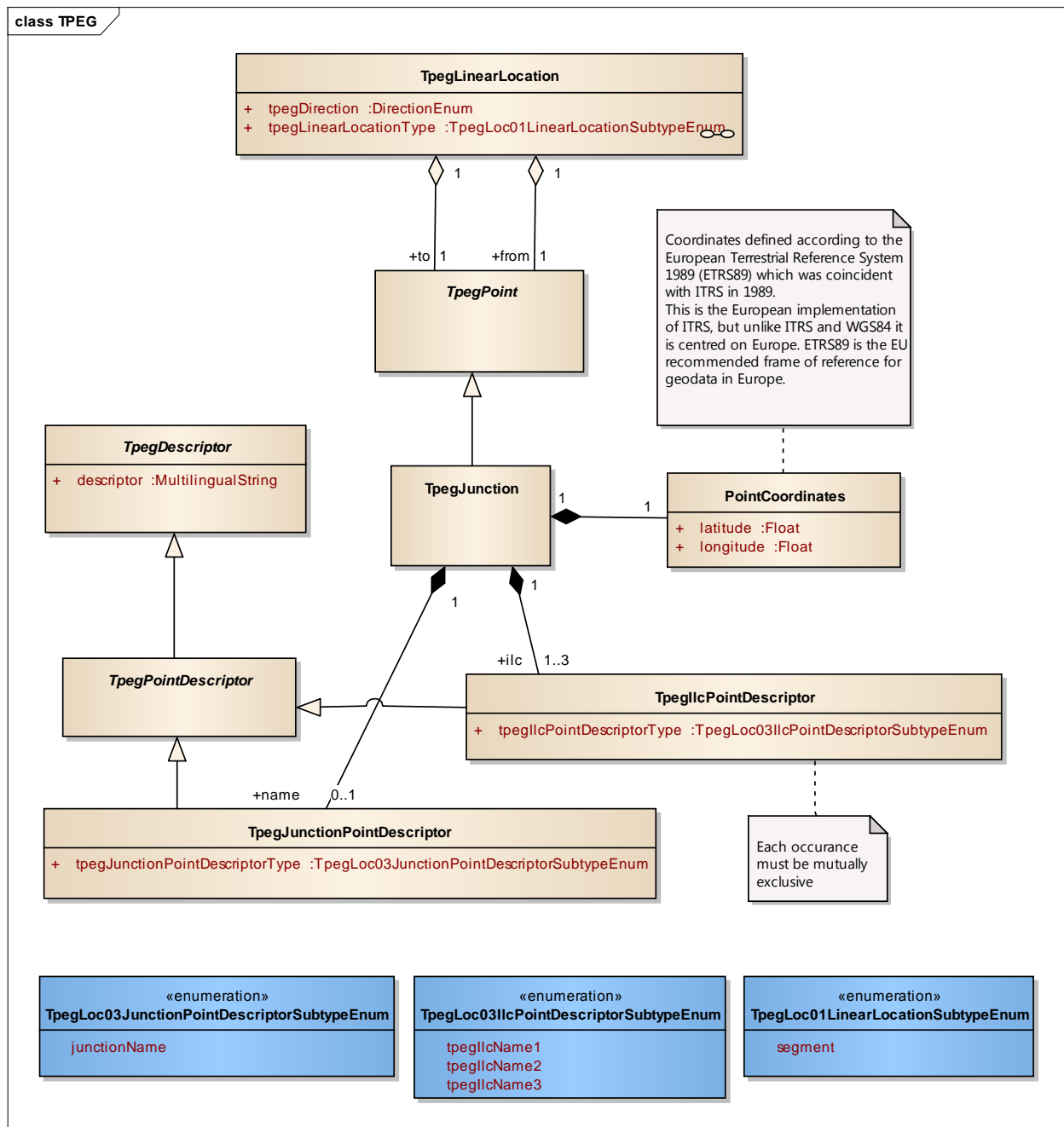


Figure 15: TPEG-Loc for linear objects

## Predefined Locations

With this independent publication **Locations** and non-ordered groups of locations may be defined once and later be referenced to save resources. The objects **PredefinedNonOrderedLocationGroup** and **PredefinedLocation** are identified as *VersionedIdentifiable* – see the explanation in the annex.

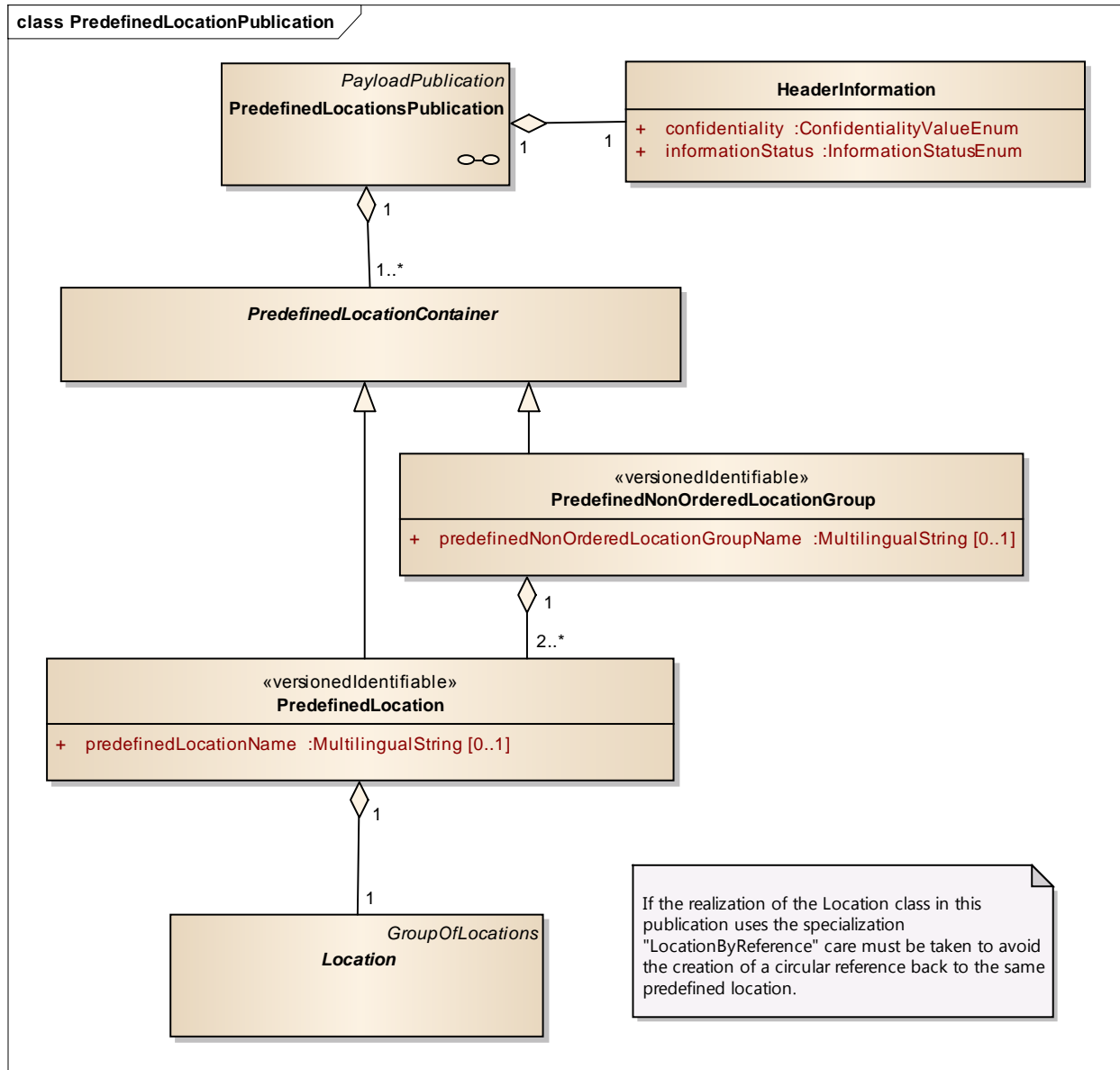


Figure 16: Predefined Locations

Care must be taken to avoid circular references.



**Note:** When using **PredefinedNonOrderedLocationGroup** the model requires the "redefinition" of all included **Locations** as *versionedIdentifiable* **PredefinedLocations** (in a route made of points for example every single point would be an identifiable with ID and version). This may not be desired (for example due to resource constraints). Contrary to the rules of DATEX it is permitted in this profile to leave the version attribute and id blank (empty string). Thus, these **PredefinedLocations** obviously cannot be referenced individually any more. See also the corresponding XML example in the Appendix.

(This is of course not valid for the carrier object **PredefinedNonOrderedLocationGroup** itself and it does not apply if a **PredefinedLocation** is defined directly, i.e. without using **PredefinedNonOrderedLocationGroup**).



## Annex

### Basics

#### DATEX II

DATEX II provides a comprehensive data model for traffic and travel information. In the case topics are not covered by the basic model ("Level A"), it is possible to create a DATEX II extension ("Level B") with custom content.

To keep the specification clear, not the entire DATEX II data model is required, only a dedicated part of it. This part can be found in the attached schema file and in the present description as well.

For more information on DATEX visit the website [www.datex2.eu](http://www.datex2.eu).

#### Enterprise Architect

The corresponding UML model for this DATEX II profile is available for Enterprise Architect. This is an affordable UML modelling tool and can be purchased on this website <http://www.sparxsystems.com/>. A free viewer for Enterprise Architect can be obtained from this address:

<http://www.sparxsystems.com.au/bin/EALite.exe>.

The UML model (Enterprise Architect file, \*.eap) is based on the current version of DATEX II v2.1. In contrast to schema file, the UML model covers the whole set of DATEX version 2.1 and is not reduced to the profile itself.

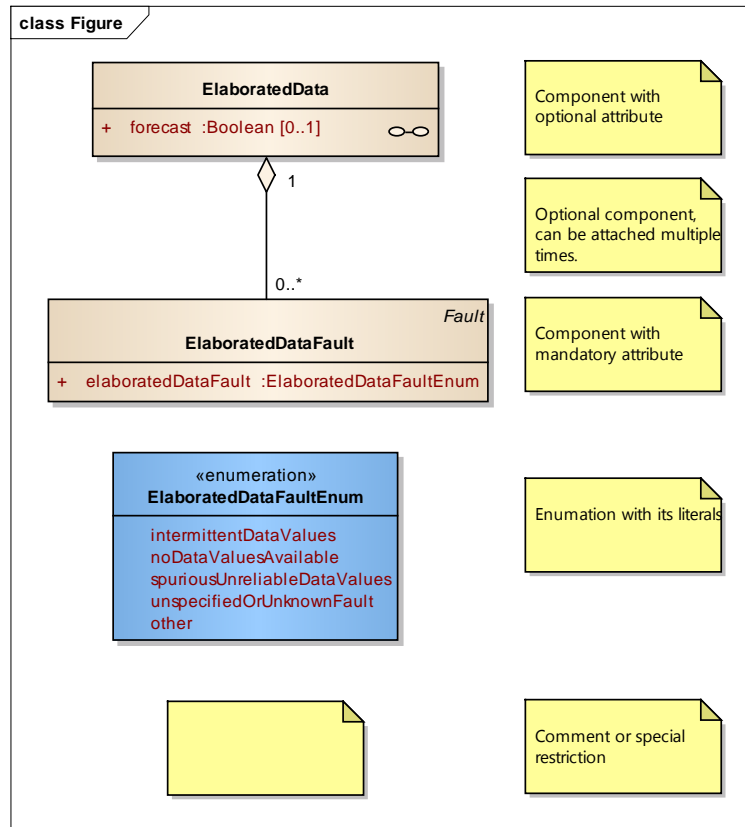
#### Version of the schema-file

The associated schema file (`DATEXprofileTravelTimes.xsd`) is versioned in the same manner as this documentation. Information about its version can be found within the files in the following line:

```
<xs:attribute name="extensionVersion" use="optional" default="xx-yy-zz" />
```

## Key to the UML representation

The following colours and semantics are used inside this document:



A yellow exclamation mark indicates special restrictions or agreements that do not reveal themselves from the data model or the DATEX conventions.

## ETRS89

DATEX II requires using geodetic coordinates according to the **European Terrestrial Reference System 1989** (ETRS89) for all coordinates. This was decided to be the unified official position reference system for all Germany in 1991 by the *Arbeitsgemeinschaft der Vermessungsverwaltungen der Länder der Bundesrepublik Deutschland*. In fact, however, many systems still work with other systems of reference and / or using Cartesian coordinates.

It has to be checked for the filling of the data model whether the coordinates are according to ETRS89 or if appropriate conversions are provided (this especially applies to coordinates in Cartesian projection).

**In many places coordinates according to WGS84 are in place; these can also be used (without conversion)** because they correspond (with a slight inaccuracy) to the ETRS89-values (the deviation is about 1.20m +2 cm / year).

## Versioning and IDs of elements in DATEX II (VersionedIdentifiables)

Elements resp. components, which are declared as **Identifiable** or **VersionedIdentifiable** have additional attribute(s) **id** or **id** and **version**. They can be referenced by these attributes. DATEX claims uniqueness

(„in time and space“) of the **id** resp. of **id** and **version** and points out GUIDs<sup>5</sup> as an example.

For the data consumer, layout and mode of creation of the ID is not relevant – he only uses it to map and filter objects belonging together.

Reusing the same **id** and same **version** is only allowed, when all content of this element is exactly identical, for instance in case of sending ‘a copy’ of a **SituationRecord**. In all other cases, you have to increment the **version** or to use a different **id** (in case of a different meaning).

(Versioned) Identifiable elements are referenced by attributes with data type **Reference** resp.

**VersionedReference**.

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<sup>5</sup> Refer to [http://de.wikipedia.org/wiki/Globally\\_Unique\\_Identifier](http://de.wikipedia.org/wiki/Globally_Unique_Identifier)