

Data model for TMPs and navigation systems

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Data model for Traffic Management Plans (TMP) and navigation systems

Explanation of symbols see Appendix ,Key to the UML representation’.

Note: In this document, the term ‘strategy’ is often used as synonym for a traffic management plan.

Using this data model traffic control strategies can be described. They include a set of routes that can be weighted as geo-referenced objects depending on the vehicle classifications. So-called input and output triggers can be defined for Strategies on which relevant vehicles can be filtered for the strategy.

SituationRecord

The entry into the model is given via the **PayloadPublication** that may have several **SitautionRecords** for several **situations** (equivalent to a strategy)

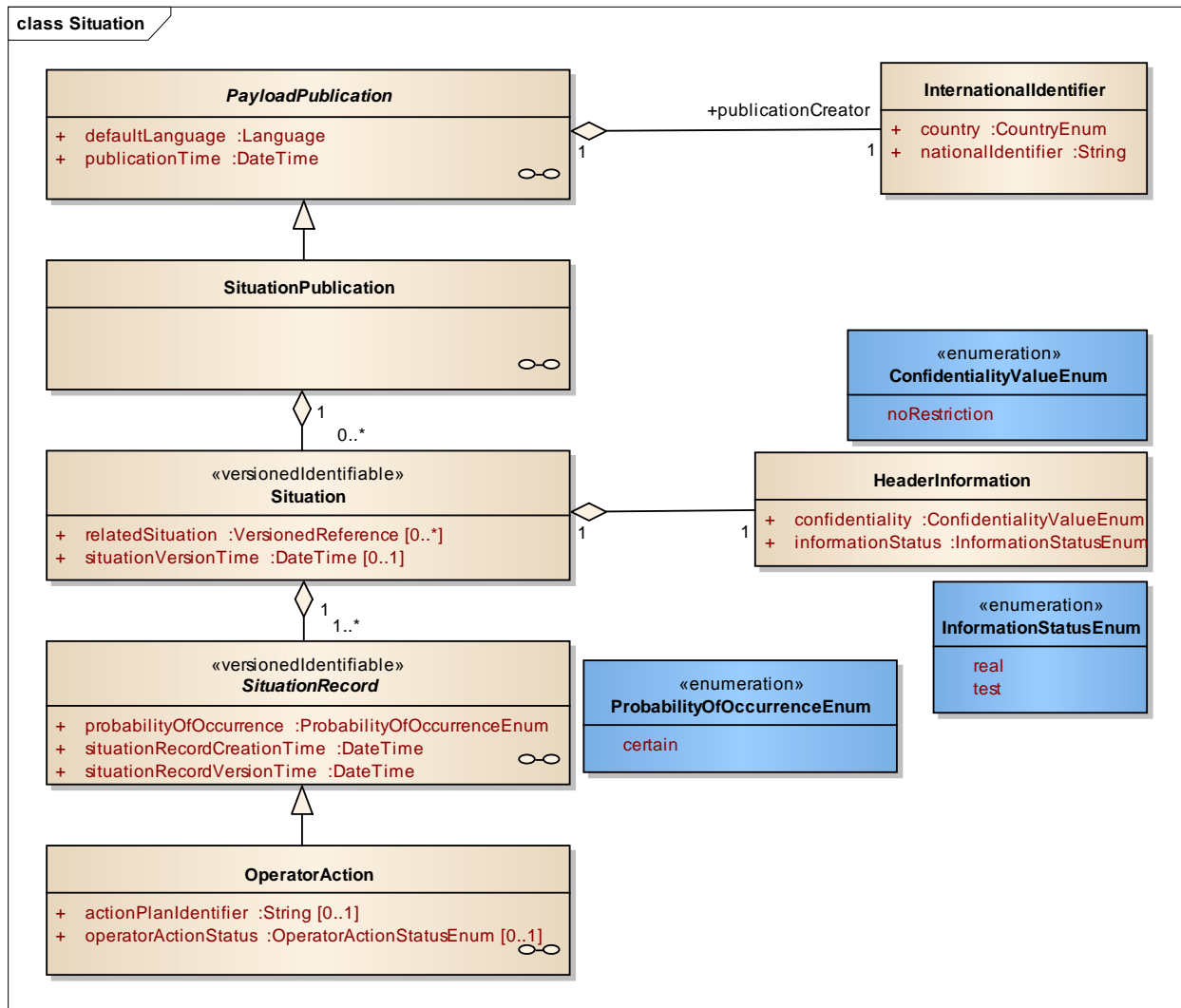






Figure 1: Basic model – SituationRecord

Note: All elements are optional, except where indicated by a red star. Elements indicated with a (*) are thus obligatory.

| General information on messages | Coding in DATEX II |
|--|--|
| Timestamp of the message / publication * | publicationTime |
| Identification data provider * | publicationCreator – (InternationalIdentifier) – country Example Germany: “de” publicationCreator – (InternationalIdentifier) – nationalIdentifier = <i>unique identifier within the specified country</i> |
| Language * | defaultLanguage |
|  Real or test data * | SituationPublication – Situation - HeaderInformation – informationStatus = „real“ or „test“ |
|  Confidentiality * | SituationPublication – Situation - HeaderInformation – confidentiality = “noRestriction” |
| Reference to another, related situation (using ID and version) | SituationPublication – relatedSituation |
| Timestamp of the currently published version of the situation | SituationPublication – situationVersionTime |
|  Probability of occurrence * | SituationPublication – SituationRecord – probabilityOfOccurrence = „certain“ |
| Timestamp of the first published version of the Situationrecord * | SituationPublication – SituationRecord - situationRecordCreationTime |
| Timestamp of the currently published version of the Situationrecord * | SituationPublication – SituationRecord - situationRecordVersionTime |

 **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, e.g. **de** for German and Germany.

The **SituationRecord** also contains the following characteristics (see Figure 2):

- Public and non-public comments
- The Georeferencing of the area of validity; see also chapter Georeferencing – this is not a Georeference of the route or of the trigger!
- A validity model (**Validity**) – see next chapter
- Specifying a reason (**Cause**) - see chapter Cause

Validity model

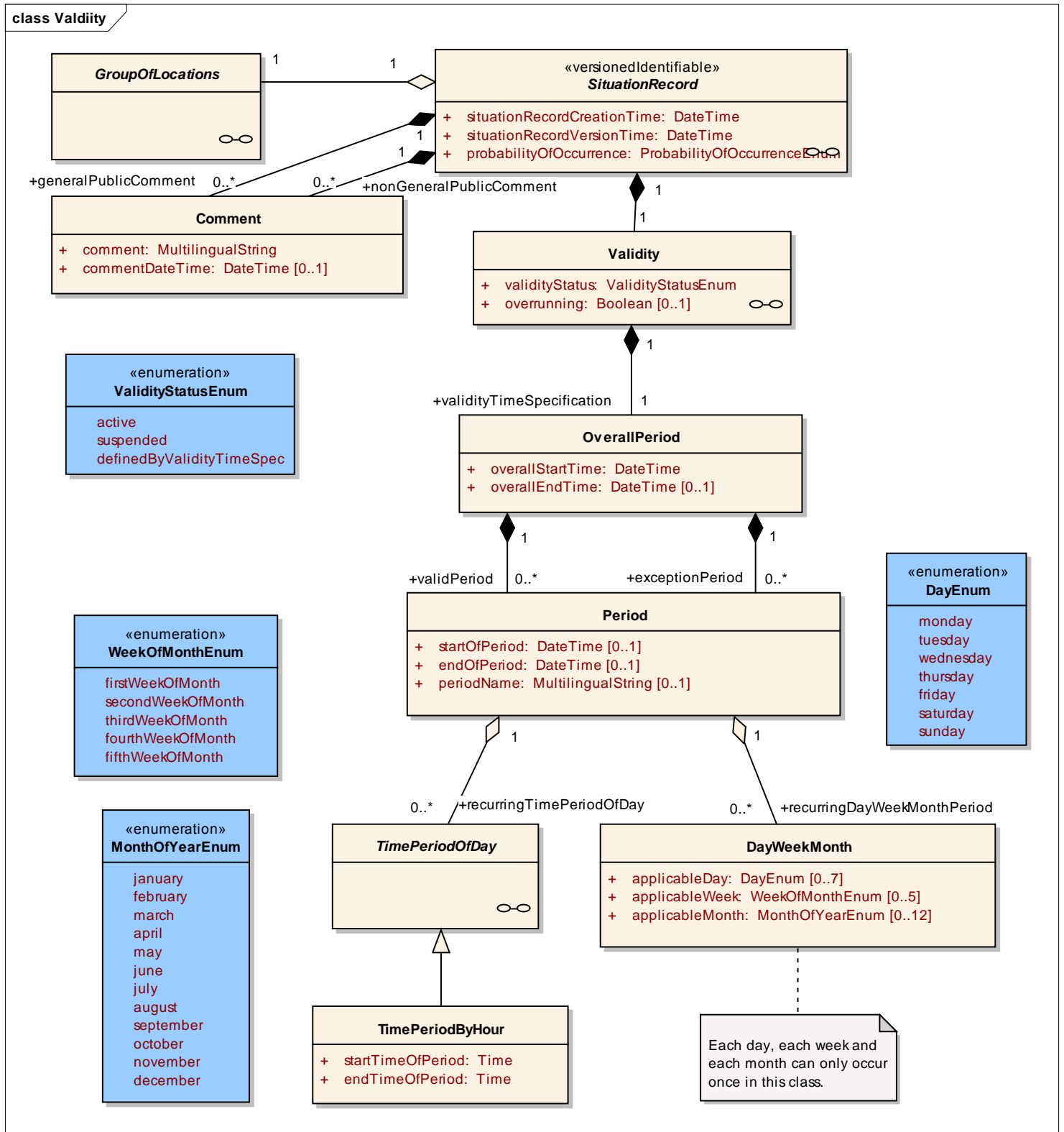


Figure 2: validity model

The validity of the strategy action (**SituationRecord**) can be shown 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 **SituationRecord** is (possibly temporarily) no longer valid.

Overrunning should be set to **true** if the measure is still running and takes longer than specified in an earlier version of the **SituationRecord**.

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**):

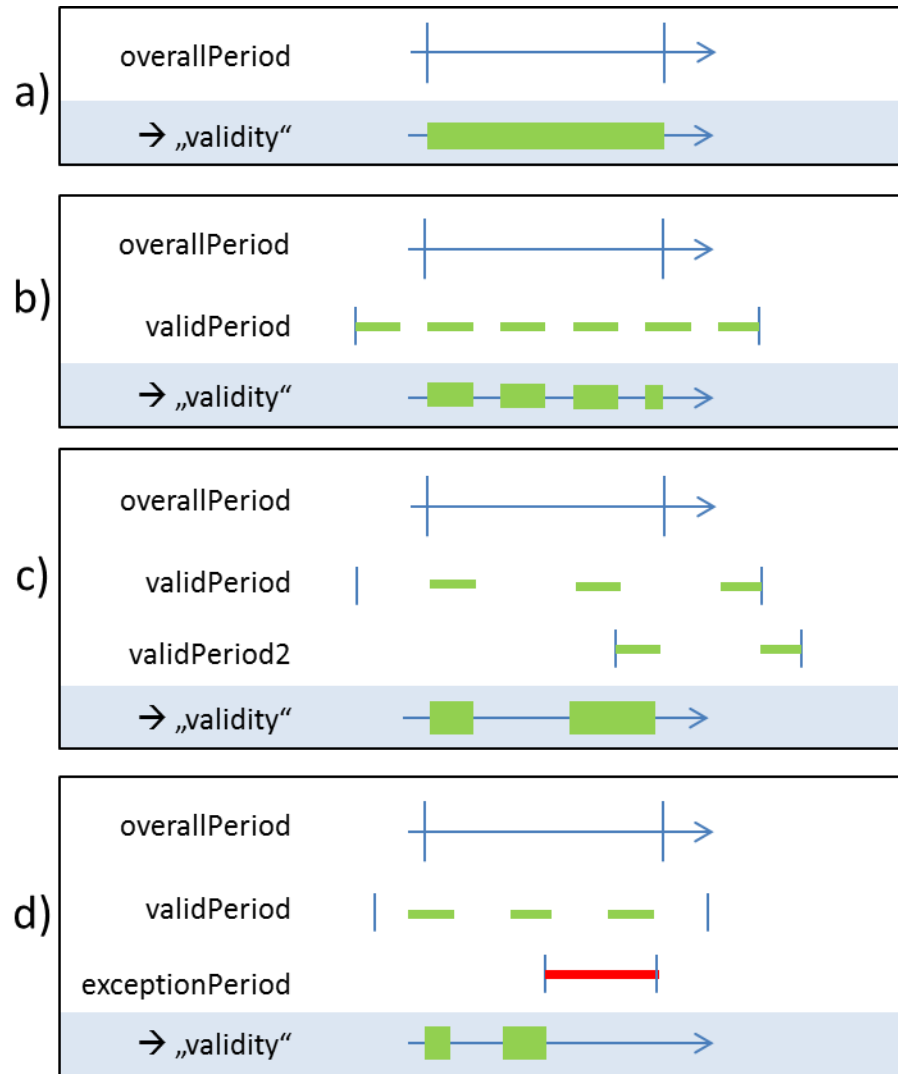


Figure 3: Validity when using multiple periods

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.

Termination of SituationRecords

Since the MDM works stateless (i.e. the MDM broker has no control which clients have received the data), each message must contain a complete set of valid **SituationRecords**. This means: records that are not contained are no longer valid.

Moreover, the attribute **suspend** can be used as described above. In addition, implementations should always check the end time (if specified), to be able to find "expired" **SituationRecords**.

Cause

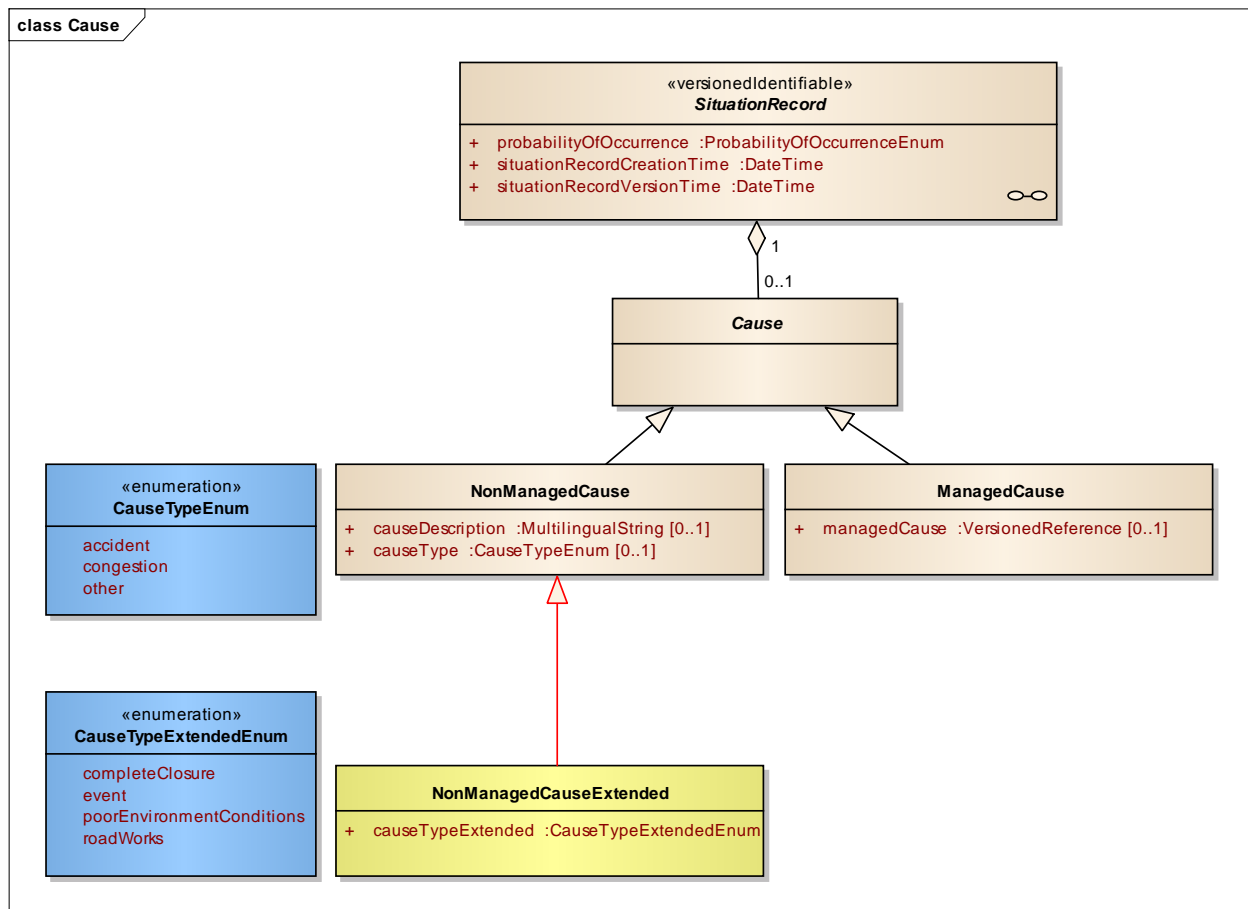


Figure 4: Cause

The reason for the action can optionally be specified as either a reference to another **SituationRecord** (**ManagedCause**) or as one of the following enumerations:



- accident
- congestion
- completeClosure
- event
- poorEnvironmentConditions
- roadWorks



On the technical level the last four of these values need to be realised via the extension **NonMangedCausesExtended**, for that the original attribute `causeType` must be set to `other`.

The cause can be stated multilingual via **NonMangedCausesExtended**.

Extension of the General Network-Management

For the insertion of **StrategicRouteManagement** a Level B extension of the component **GeneralNetworkManagement** (derived from **OperatorAction**) is used.

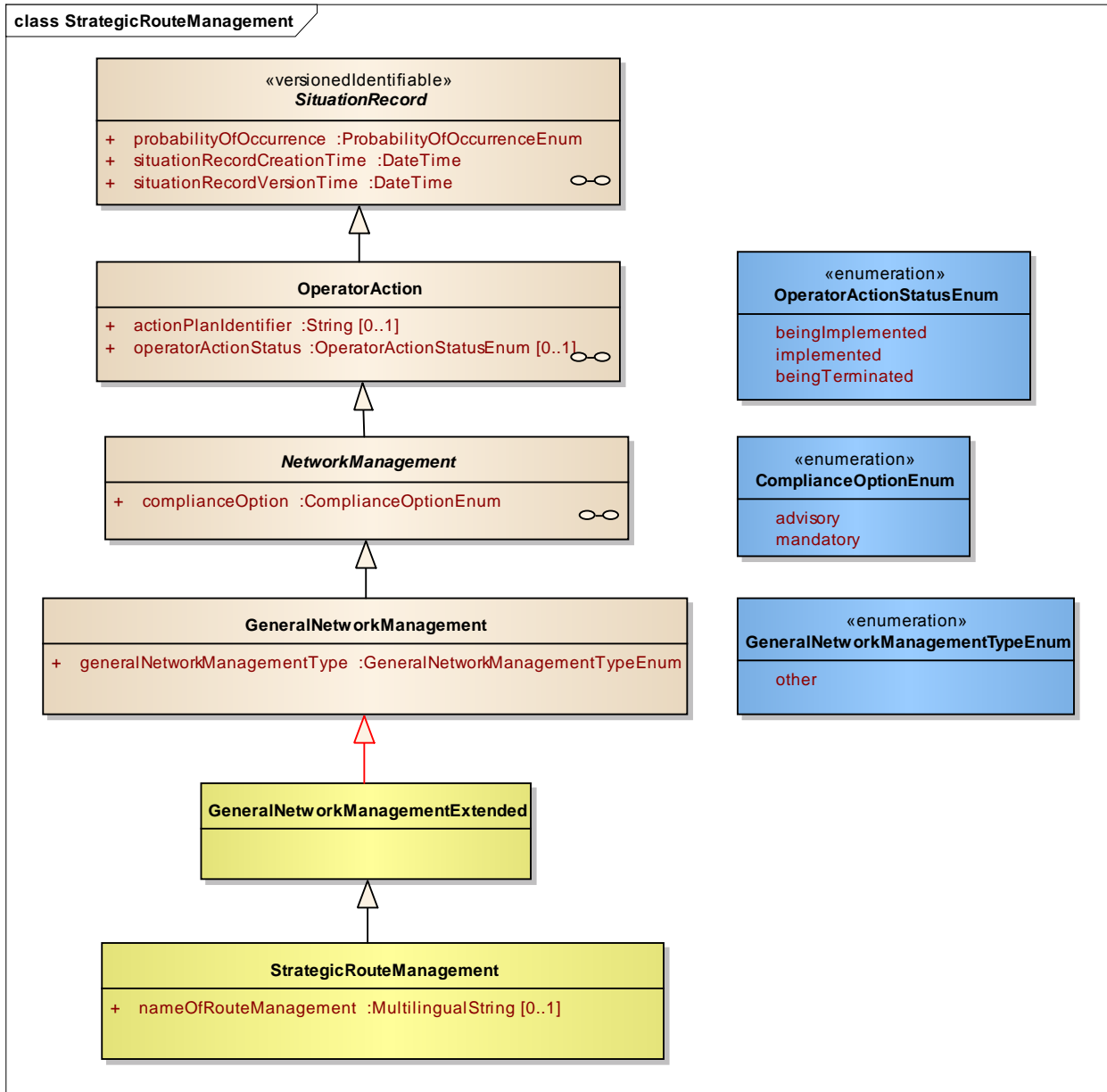




Figure 5: Extension GeneralNetworkManagement

| General strategy information | Coding in DATEX II |
|--|---------------------------------------|
| Reference to a Traffic Management Plan | OperatorAction - actionPlanIdentifier |

| General strategy information | Coding in DATEX II |
|---|--|
|  Status of the measure | OperatorAction – operatorActionStatus = {beingImplemented, implemented, beingTerminated} - see below |
| Measure recommended or mandatory (the latter e.g. at closures) * | OperatorAction – NetworkManagement - complianceOption = {advisory, mandatory} |
|  General Network Management Type * <i>Note: This component is part of the component hierarchy only due to technical constraints. The binding type attribute is to be set to other.</i> | OperatorAction – NetworkManagement – GeneralNetworkManagementType – generalNetworkManagementType = other |

The literals **beingImplemented** and **beingTerminated** indicate that a routing measure is set up or terminated right at this moment. The literals should only be used when useful, e.g. if there is a transition period for the switching of traffic signals, if the police builds up or breaks down barricades, etc. These values should then be promptly replaced again by an update, either by the typical literal **implemented** ("The action is fully implemented") or by omitting this optional attribute.

StrategicRouteManagement

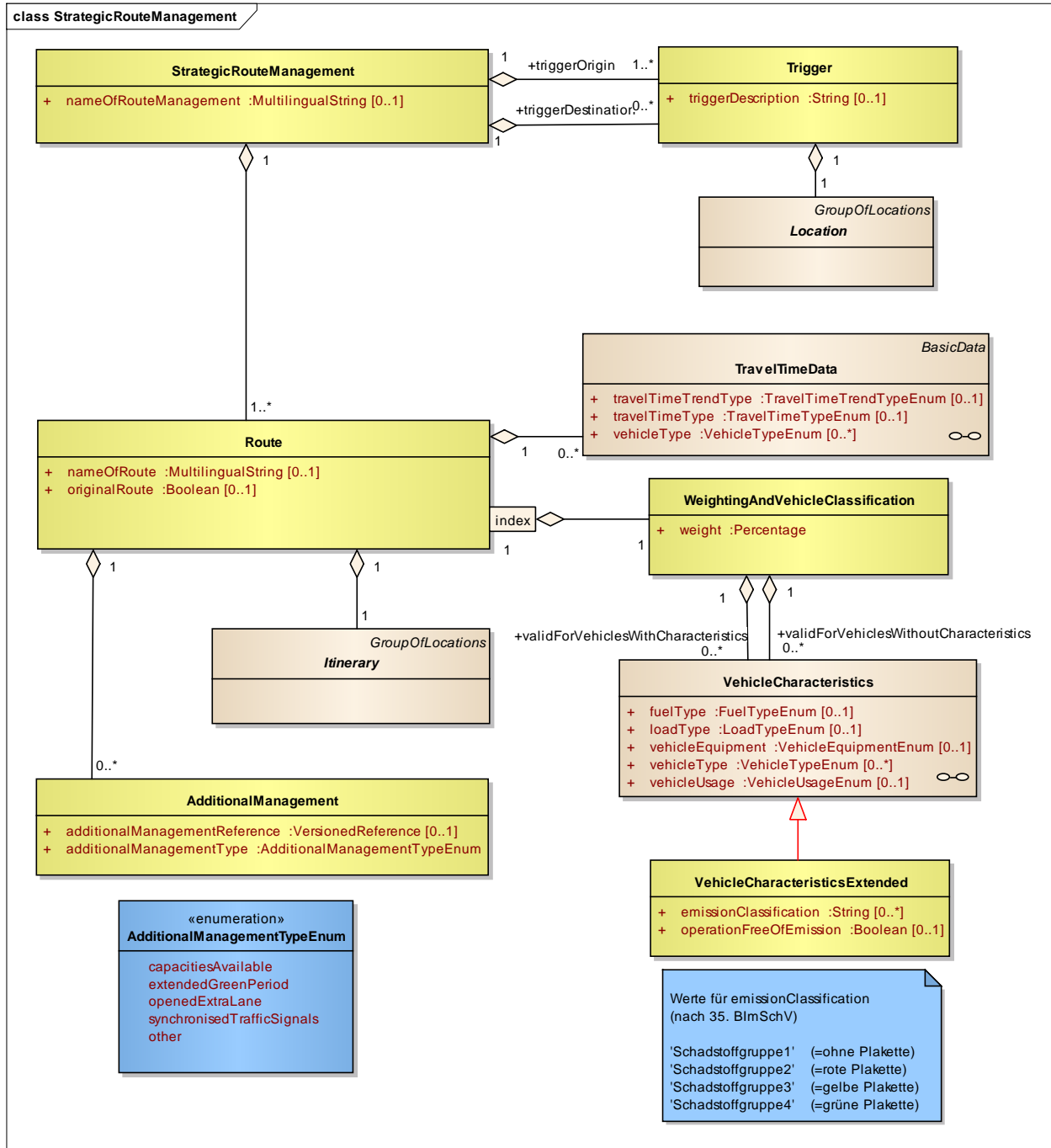


Figure 6: StrategicRouteManagement

| StrategicRouteManagement | Coding in DATEX II |
|---|------------------------------------|
| Name of measure (multilingual text) <i>Regarding ID see ActionPlanIdentifier in previous chapter.</i> | <code>nameOfRouteManagement</code> |

Trigger

With the help of the so-called **trigger** it is decided whether the measure will become active. These are random geographical objects (Points, Linears, Areas), an indication of at least one input trigger is mandatory.

The described measurement plan applies to all vehicles which will pass (e.g. according to navigation systems) both an input and an output trigger (if no output trigger is specified, it is sufficient to pass an input trigger).

| Trigger | Coding in DATEX II |
|---|---|
| Any number of input trigger* and output trigger, an input trigger is required. An optional trigger can be stated for differentiation purposes. | <code>triggerOrigin *</code> / <code>triggerDestination -</code> with <code>triggerDescription</code> and <code>Location *</code> |

Weighting



Any number of routes can be specified, which can be assigned weights differentiated according to vehicle classification:


- A weighting without explicit specification of a vehicle classification leads to a classification of "All vehicles" (also for the following regulations).
- The weight is a percentage (0% - 100%).
- A weighting of 0% corresponds to a closure (impassable in the direction of travel); multiple routes (unlimited) may also receive a weight of 0% per vehicle classification
- If weights are in place all routes must add up exactly to 100% for each vehicle classification.
- It is permissible for a vehicle classification to assign just one route the 100%.
- Weights are assigned sequentially to a route (technically: use of an index). An identical set of vehicle classifications (in the same order) must be assigned to all routes of a measure.
- The vehicle classification is processed in the order of the index, i.e. the first appropriate classification determines the weighting.
- The use of weights is optional; routes without specifying weights can also be used (which are then treated as an equal weight). If only a single route is given with no weight, it will receive 100% of the traffic.

Examples can be found below.

| Weighting | Coding in DATEX II |
|-------------------------------|--|
| Weighting of the route in % * | Route – WeightingAndVehicleClassification - weight |

Route incl. Georeferencing

For the geo-referencing of the routes the use of **PredefinedLocations** is recommended (use via **Route – Itinerary – ItineraryByReference** – see also Chapter Predefined Locations). The trigger can also be predefined in this way (use via **Trigger – Location – LocationByReference**).

| Route | Coding in DATEX II |
|--|-----------------------|
| For better differentiation routes can be given a name (multilingual text *) | Route - nameOfRoute |
| Indicator (Boolean), whether this route is the main route, i.e. is it the originally planned route | |
|  This attribute may be set to True <u>only for one route</u> for each SituationRecord! But this information is optional, i.e. it is not absolutely necessary to indicate the original route at all. | Route - originalRoute |
| Geo-reference via (predefined) Itinerary * | Route - Itinerary |

Additional measures

To a route several „additional measures“ can be specified in the form of an enumeration:

- capacitiesAvailable
- extendedGreenTime
- openedExtraLane
- synchronisedTrafficSignals

If a measure is specified in this way a SituationRecord can optionally be referenced, which describes the measure in detail. The relevant parts of the model are also described in this document.

| Additional measures | Coding in DATEX II |
|--|---|
| Type of additional measure | Route – AdditionalManagement – additionalManagementType – see above |
| Reference to a SituationRecord with more detailed information about the measure May only be used if the type of additional measure is specified | Route – AdditionalManagement – additionalManagementReference |

Travel times

A route can have travel time information (**TravelTimeData**).

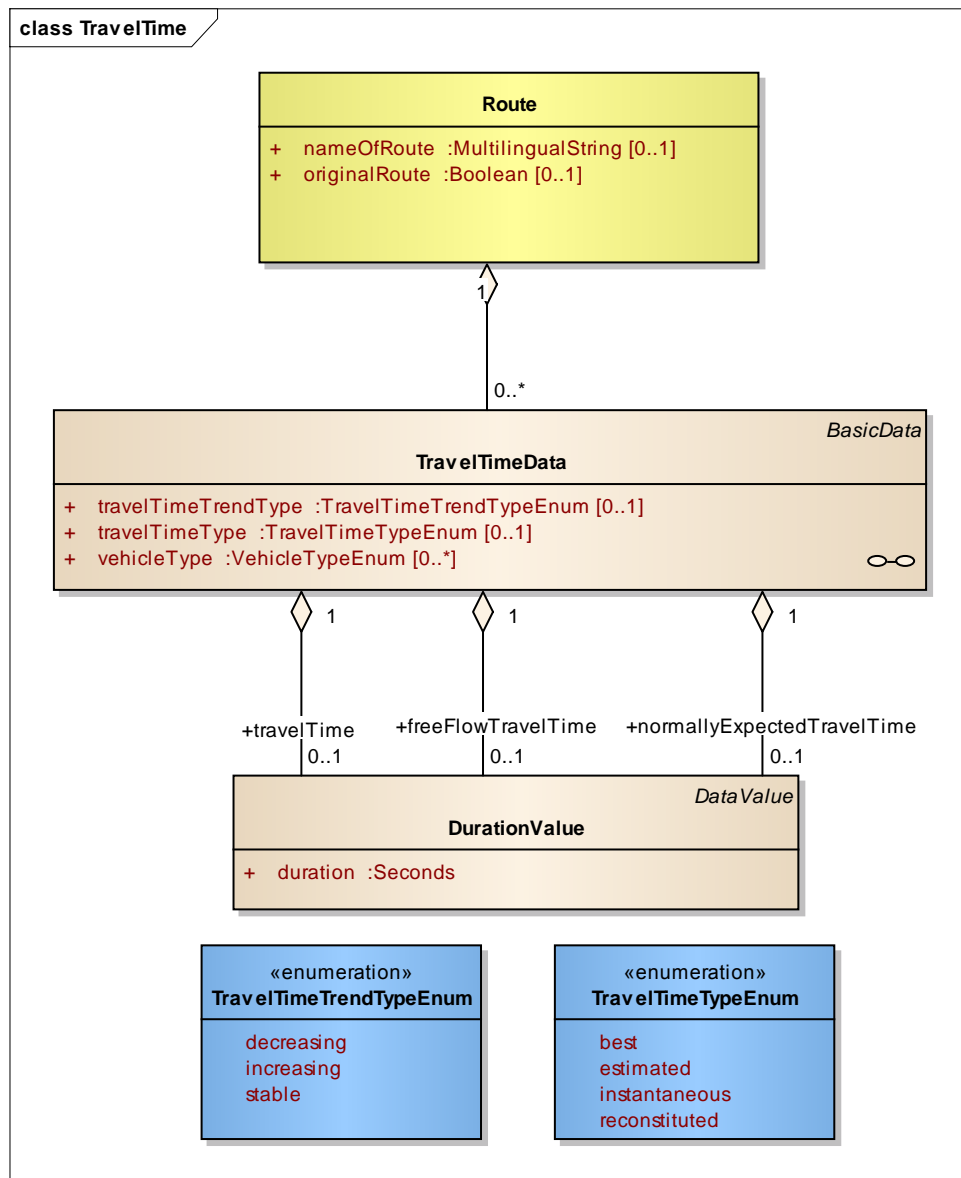


Figure 7: Travel times

Note: the DATEX-model of travel times is not specified here more in detail.

Vehicle classification

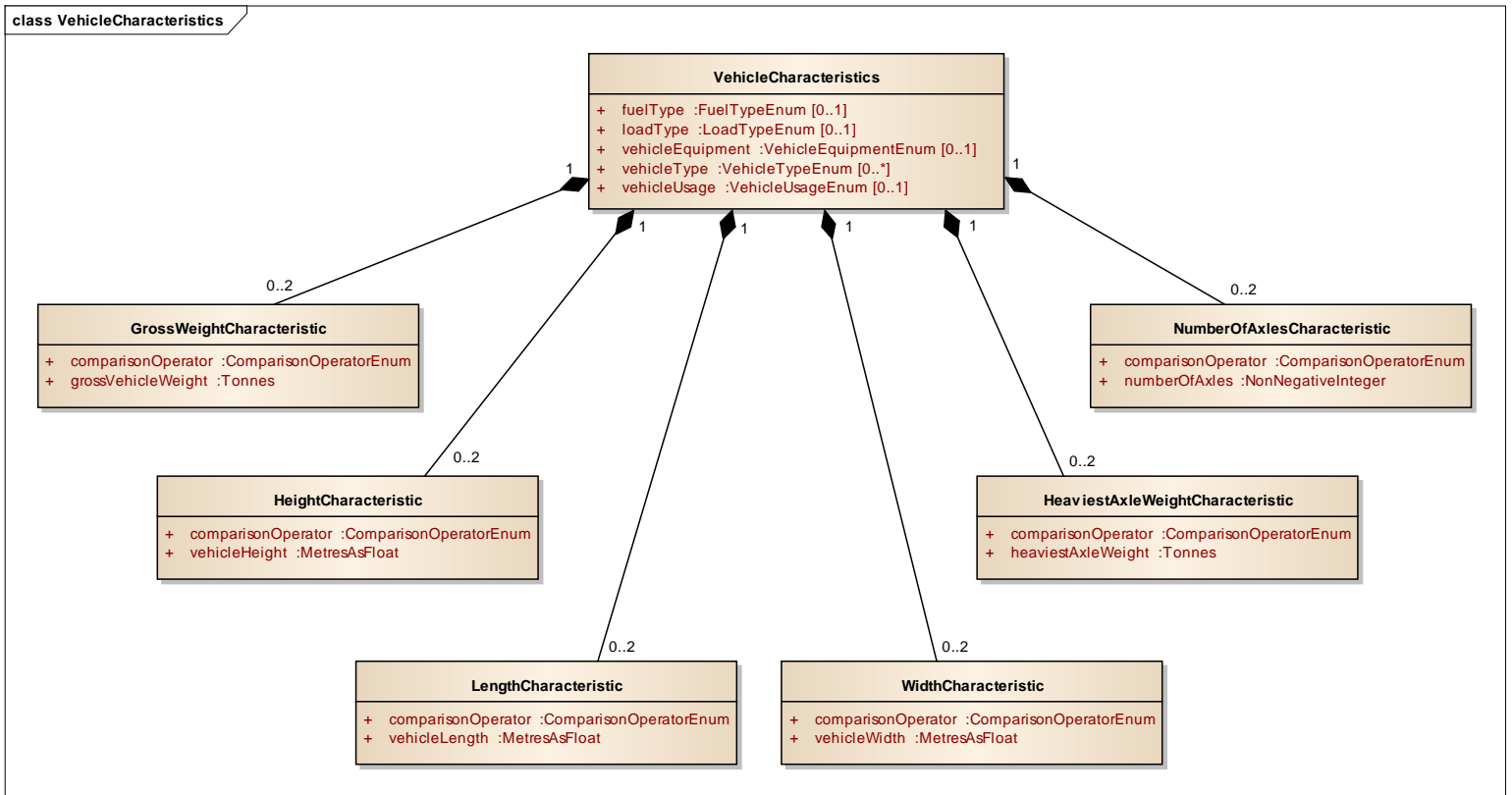


Figure 8: VehicleCharacteristics (listing see figure after the next)

For the application of vehicle classification, see above in the section 'Weighting'.

The set of valid vehicle classification can be obtained additive (**validForvehiclesWithCharacteristics**) and by exclusion (**validForVehiclesWithoutCharacteristics**) (see Figure 6).

Please note: With the second method vehicles cannot be excluded from on a route - this needs to be controlled by the weighting. See also the examples below.

Note: The basic model for vehicle classification (Figure 8) is not detailed at this point any further. The corresponding enumerations can be found in the following figure

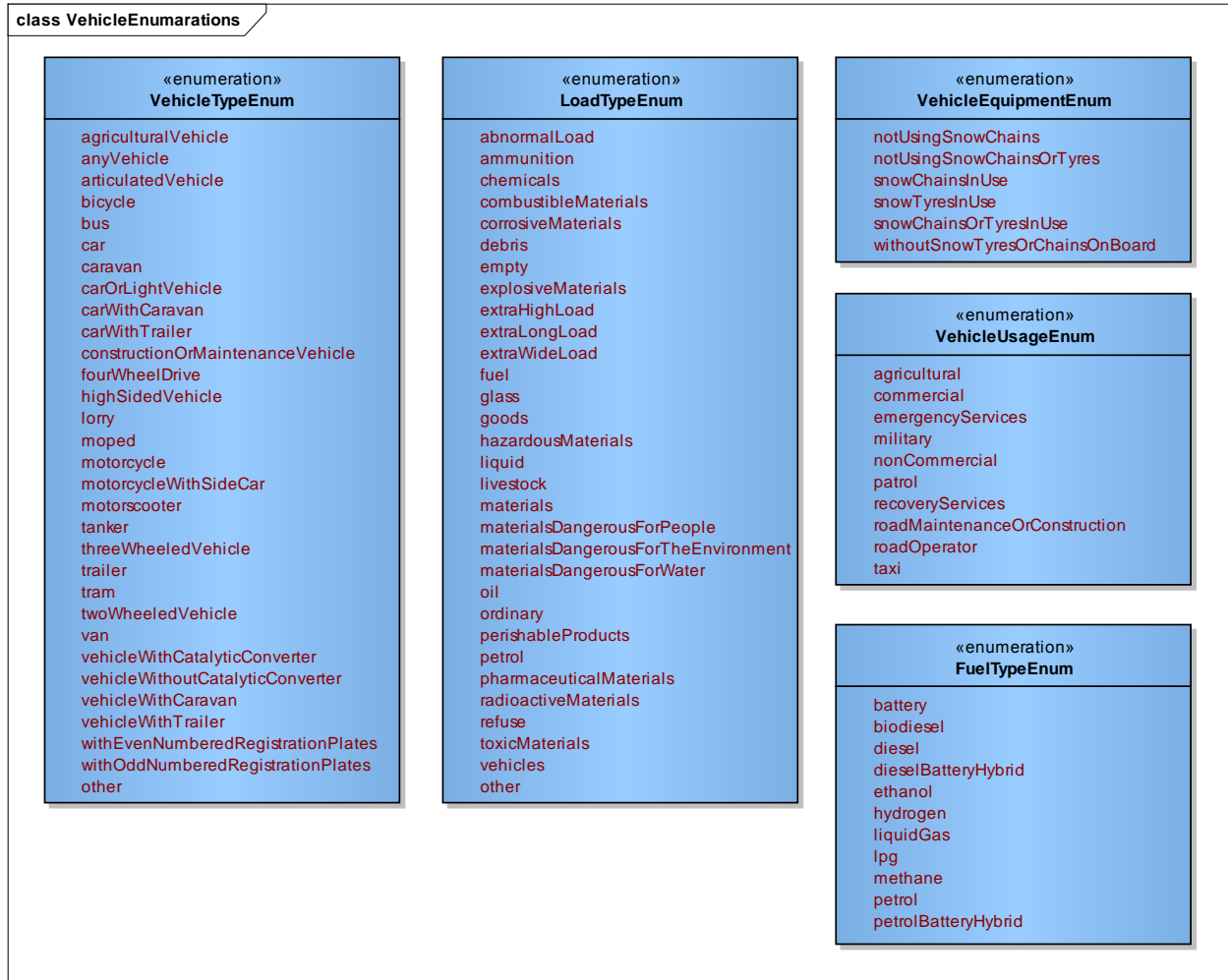


Figure 9: Enumerations to VehicleCharacteristics

Emissions

The previously presented model for DATEX Vehicle Classification (**VehicleCharacteristics**) was extended by information on vehicle emissions (**VehicleCharacteristicsExtended**):

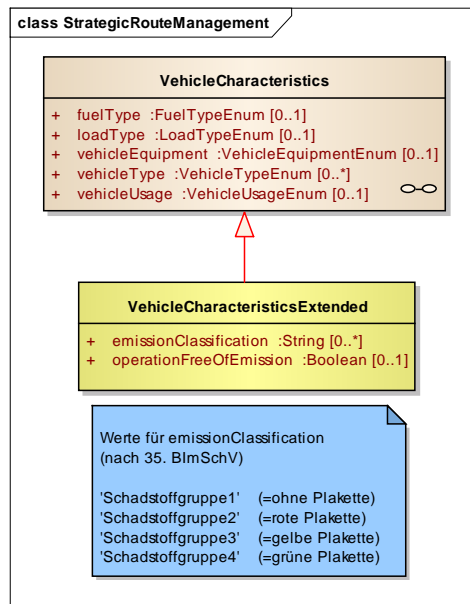


Figure 10: Emissions

| Emissions (to Figure 10) | Coding in DATEX II |
|--|--|
| Emission Classification | VehicleCharacteristicsExtended – emissionClassification Text. Should be further specified in a national or project specific context. |
| Emission-free operation (Boolean) This filtering includes also vehicles with combustion engine for example, if they can operate at least temporarily without emissions. | VehicleCharacteristicsExtended - operationFreeOfEmission |

Examples of weightings and vehicle classifications

| | Index | Weighting | Vehicle classification |
|----------------------------------|-------|-----------|---------------------------------------|
| Example 1 | | | |
| Route1 | 1 | 100% | - |
| | 2 | 20% | HGV |
| Route2 | 1 | 0% | - |
| | 2 | 40% | HGV |
| Route3 | 1 | 0% | - |
| | 2 | 40% | HGV |
| Example 2 - non-compliant | | | |
| Route1 | 1 | 0% | dangerous goods |
| | 2 | 20% | HGV |
| | 3 | 100% | - |
| Route2 | 1 | 0% | HGV |
| Example 3 | | | |
| Route1 | 1 | 0% | German emission category 1 |
| | 2 | 20% | Vehicles > 7.5 tonnes and no tractors |
| Route2 | 1 | 100% | German emission category 1 |
| | 2 | 80% | Vehicles > 7.5 tonnes and no tractors |

Example 1: This example is compliant to the rules, but not particularly useful. Since no vehicle classification is stated in index 1, all vehicles are guided on Route 1, because this rule has priority (with no particular vehicle classification). The remaining rules are then ignored.

Example 2: This example is non-compliant for three reasons:

- The index for the HGV classification is not identical for the two routes.
- The HGV classification does not add up to 100%.
- In Route 2 the classifications 1 and 3 are missing.

Example 3: Vehicles not fulfilling a better German environment category than 1 are not allowed to drive on Route 1, but only on route 2. Vehicles of more than 7.5 tonnes are to spread 20 to 80 on the two routes, if better than German environment category 1 and no tractors. Note that no statement is made for vehicles less than 7.5 tonnes as well as for tractors, if they have an environment category better than 1.

Data model for capacity-enhancing measures

The measures listed in this section have an additional character and do not immediately belong to a strategic measure. They may therefore be regarded as supplementary information. It is possible to refer

to this measures within a strategy; but it is equally possible to refer to a capacity-enhancing measure (by means of an enumeration), but to **not** further describe it explicitly.

The capacity-enhancing measures are part of the strategy schema, it is therefore possible to transmit one or more strategies together with capacity-enhancing measures in a situation (and of course in a message). It is also possible to transmit capacity-enhancing measures without strategies.

TrafficSignalManagement

The component **TrafficSignalManagement** - also located in the **GeneralNetwork- Management** extension class – provides to represent **green waves** and **extended green times**.

TrafficSignalManagement measures must be published as a separate **SituationRecord**. The affected route / road section is defined by the component **GroupOfLocation** (using Itinerary); for that the same ways of Geo-referencing are available as for the strategy compliant routes (including **PredefinedLocations**).

It is **also possible** to indicate the affected traffic lights individually as ordered list. The geo referencing is always pointing to the centre of the intersection.

Note: This point reference to a traffic light is modelled optionally in order to allow a potential subsequent expansion of geo-referencing (like the positioning via the stop line or the like), but is currently regarded as mandatory.

If no traffic lights are specified, the measures according to the **TrafficSignalManagement** apply to all traffic signals which are on the specified route given in the SituationRecord.

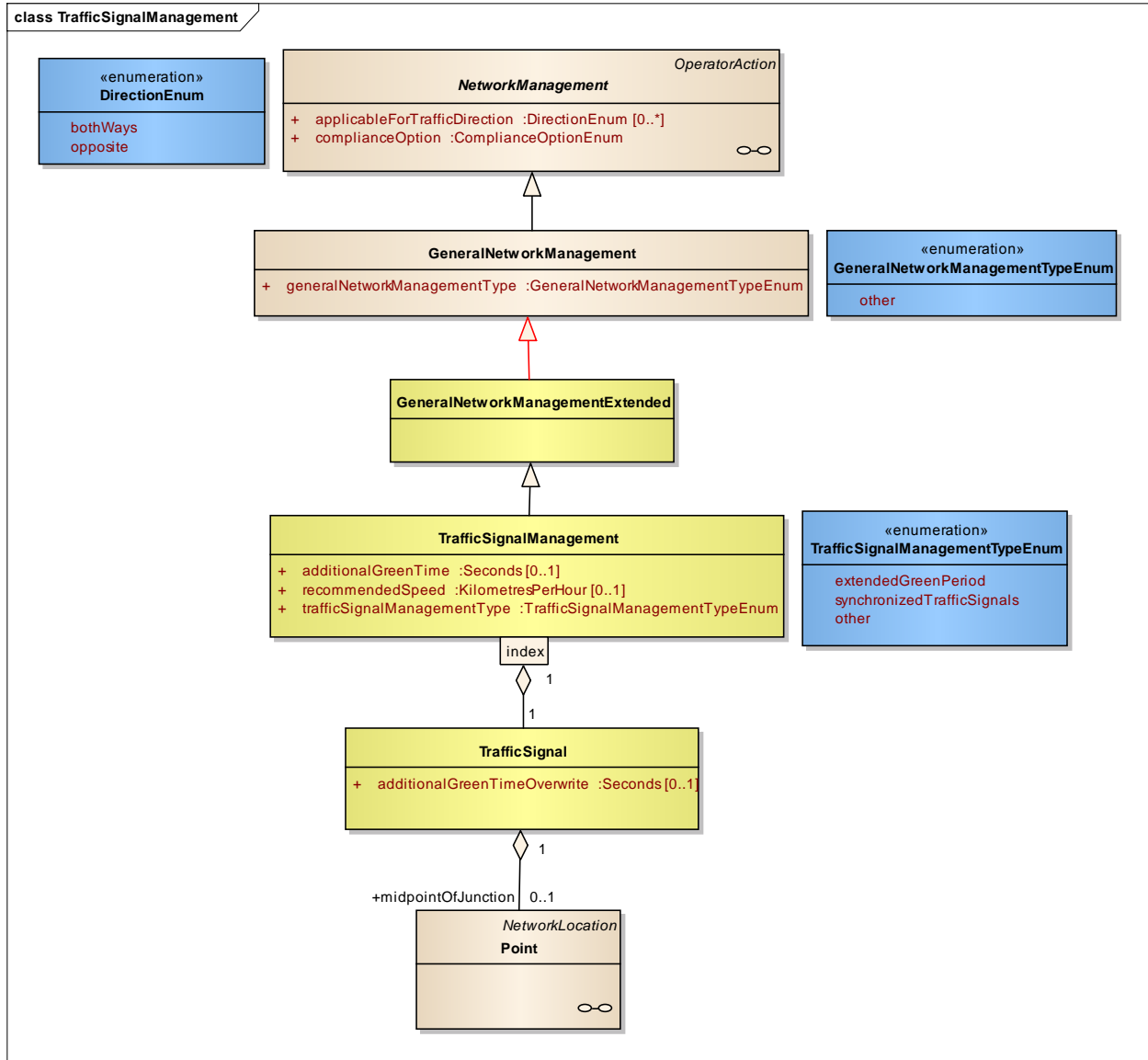



Figure 11: TrafficSignalManagement

| TrafficSignalManagement | Coding in DATEX II |
|--|---|
| Direction of the measure | |
|  Default (= no details) is in the direction of the ordered list of traffic lights; this direction can be reversed or extended to both directions | <code>applicableForTrafficDirection = {bothWays, opposite}</code> |
| Component path | <code>... - GeneralNetworkManagementExtended - TrafficSignalManagement</code> |
| Additional green time (as a default for all specified traffic lights) | <code>additionalGreenTime</code> |
| Recommended speed (e.g. for optimal use of the green wave) | <code>recommendedSpeed</code> |

| TrafficSignalManagement | Coding in DATEX II |
|--|---|
| Type of action * (Green wave or extended green times) | <code>trafficSignalManagementType = {extendedGreenTypePeriod, synchronisedTrafficSignals, other}</code> |
| Additional green time (as an override of default) | TrafficSignal – <code>additionalGreenTimeOverwrite</code> |
| Point Location of the traffic light (centre of the intersection) | |
| <i>It is not an indication of the route - this is separately stated directly in the SituationRecord! see note in the free text above</i> | TrafficSignal – <code>midPointOfJunction -</code> |

Opening additional lanes

The opening of additional lanes need to be published as a separate **SituationRecord**, the **SituationRecord – GroupOfLocations** serves also as direct entry to localisation. All geo-referencing methods are available, which are also available for routes (see Chapter Georeferencing).

In addition, the following description of items is available:

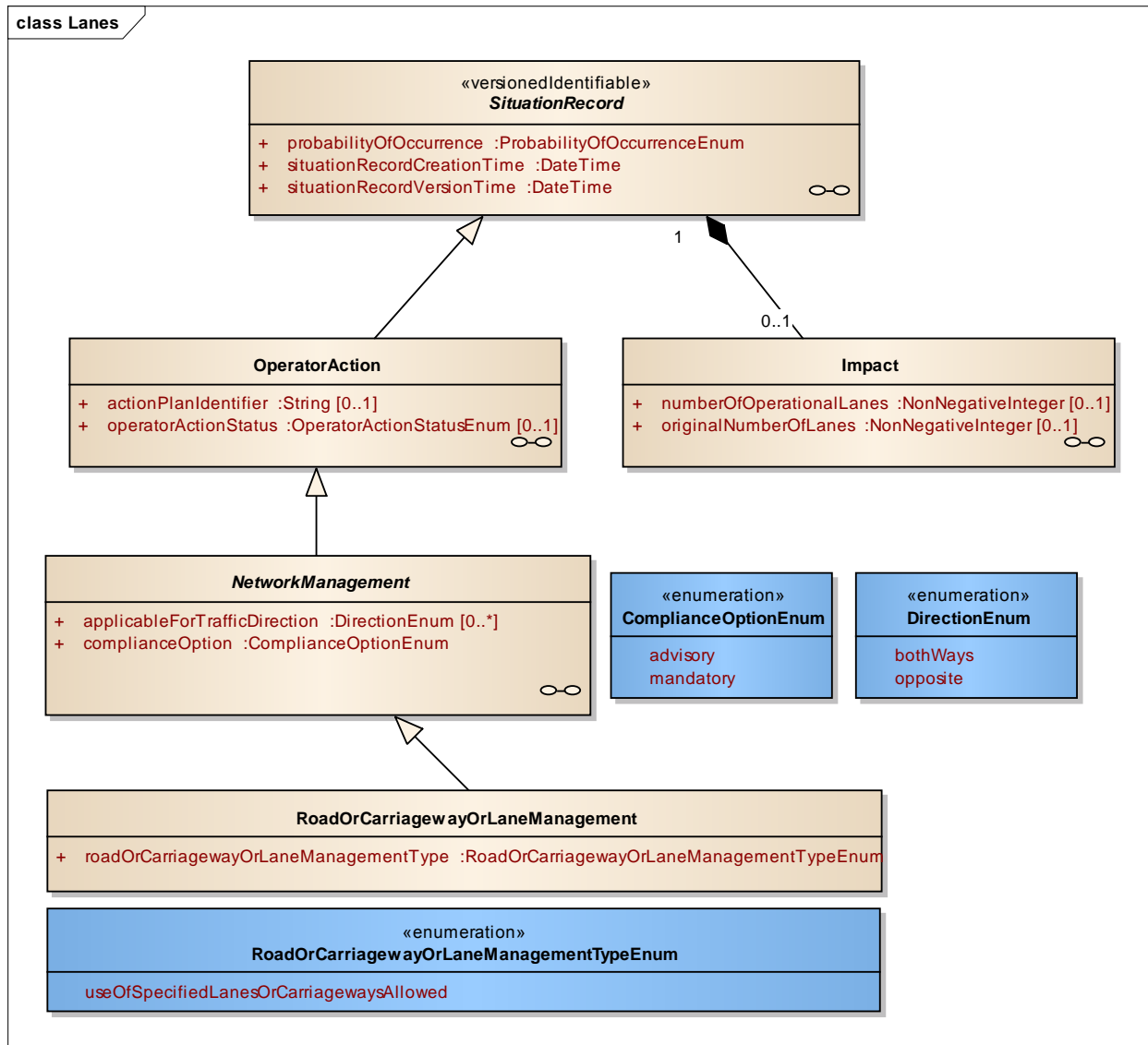


Figure 12: lane allocation

| Lane allocations | Coding in DATEX II |
|----------------------------|---|
| Opening additional lanes * | NetworkManagement – RoadOrCarriagewayOrLaneManagement - roadOrCarriagewayOrLaneManagementType = useOfSpecifiedLanesOrCarriagewaysAllowed |
| Number of original lanes | SituationRecord – Impact - numberOfOriginalLanes |



Number of operational lanes
 The number of operational lanes is expected to be higher than the original lanes.

SituationRecord – Impact - numberOfOperationalLanes

Indication of Free capacities

To show that additional capacity is available on a route, the following model is used:

Lane allocations need to be published as a separate **SituationRecord**, the **SituationRecord – GroupOfLocations** serves also as direct entry to localisation. All geo-referencing methods are available, which are also available for routes (see Chapter Georeferencing).

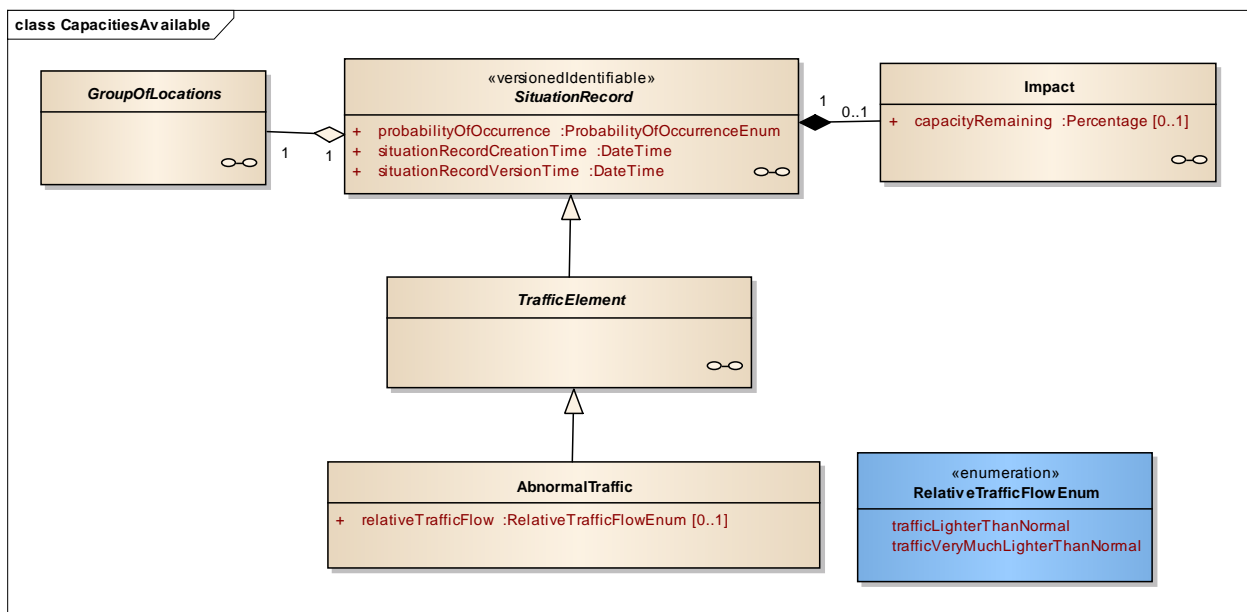


Figure 13: Free capacities

| Free capacities | Coding in DATEX II |
|---|---|
| capacities * | |
| <i>Note: This attribute is declared as mandatory, although it is optional according to the schema. See in Appendix Chapter ,Enumerations and multiplicities in DATEX‘</i> | SituationRecord – TrafficElement – AbnormalTraffic – relativeTrafficFlow = {trafficLighterThanNormal, trafficVeryMuchLighterThanNormal} |
| Percentage of remaining free capacity | SituationRecord – Impact – capacityRemaining |
| Localisation of the route (via Itinerary) * | SituationRecord - GroupOfLocations |



Georeferencing

The following table shows the geo-referencing methods used and visualises their application (trigger, route or as a component of **SituationRecord**):

| Traffic Management Plans and Navigation systems | Validity (via SituationRecord) | Trigger | Route | Green wave, Green time extension (via SituationRecord) | Green wave, Green time extension (traffic light) | lane allocation (via SituationRecord) | Free capacities (via SituationRecord) |
|--|--------------------------------|---------|--------|--|--|---------------------------------------|---------------------------------------|
| Point | | | | | | | |
| PointByCoordinates | | X | X | X | X | X | X |
| Alert C Point | | M2, M4 | M2, M4 | M2, M4 | M2, M4 | M2, M4 | M2, M4 |
| LocationForDisplay (Coordinates) | | X | X | X | X | X | X |
| TPEG-Loc | | X | X | X | X | X | X |
| ISO 19148 original container - NOT USED | | | | | | | |
| PointAlongLinear - ISO 19148 extension container | | P/I | P/I | P/I | P/I | P/I | P/I |
| OpenLR Point | | X | X | X | X | X | X |
| Linear | | | | | | | |
| ALERT-C Linear | | M2, M4 | M2, M4 | M2, M4 | | M2, M4 | M2, M4 |
| TPEG-Loc | | X | X | X | | X | X |
| ISO 19148 original container - NOT USED | | | | | | | |
| LinearWithinLinear - ISO 19148 extension container | | P/I | P/I | P/I | | P/I | P/I |
| OpenLR Linear | | X | X | X | | X | X |
| Area | | | | | | | |
| ALERT-C Area | X | X | | | | | |
| TPEG-Loc | X | X | | | | | |
| PolygonArea | X | X | | | | | |
| Others | | | | | | | |
| Supplementary PositionalDescription | | | | | | | |
| Predefined Locations | X | X | X | X | | X | X |
| ExternalReferencing | | | | | | | |

| Colour key |
|-------------------------|
| Via Itinerary |
| DATEX Level A model |
| DATEX Level B extension |

| Text key |
|--|
| M2: ALERT-C method 2 (without offset) |
| M4: ALERT-C method 4 (with offset) |
| P/I: Identification of an edge via points (coordinates) or edge-ID |
| X: methode for referencing available |

Figure 14: Table Geo-referencing

The table can be regarded as mandatory, i.e. not shown variations are also not allowed (even if it is not explicitly prohibited by the scheme). For example, a route must always be based on an Itinerary object and must not include an Area.

Of particular note are the following issues:

- Generally, there is a need for the possibility to use the ISO 19148 container several times for the same location, but with different semantic interpretation. But in DATEX II, version 2.0, this container is limited to just a single occurrence (see also issue #93 in the DATEX II issue tracker – www.datex2.eu).

For this reason, a Level-B-Extension adds unlimited multiplicity of this ISO 19148 container. The original container is reserved for national types of Georeferencing (not used here) whereas the linear elements by ID or by coordinates need to be expressed using the extension containers (see figure 15, **AdditionalPointAlongLinearElement** or **AdditionalLinearOnLinearElement**).



- Each **SituationRecord** must contain Georeferencing information. It is defined to specify an Area at this point (as ALERT-C code, TPEG-Loc or polygon), which classifies the validity of the strategy-compliant measure (equivalent to a preceding gross trigger, such as a coarse polygon, which includes the entire urban area). In the case of this polygon it should be described with as few points as possible for reasons of performance (limit: 1000 points).
- The routes are represented via an **Itinerary**, i.e. the individual route elements (points or linear objects) are part of an ordered list.

| Area (see also Figure 15) | Coding in DATEX II |
|---|--|
| Component path | ... - Location – Area – AreaExtended – PolygonArea |
| Name of the Area (e.g. Urban area of Düsseldorf) | sectionName – language sectionName - value |
| Coordinates of the points (max. 1000, see above) (in ETRS89-format; see also appendix) | PointCoordinates – longitude / latitude |

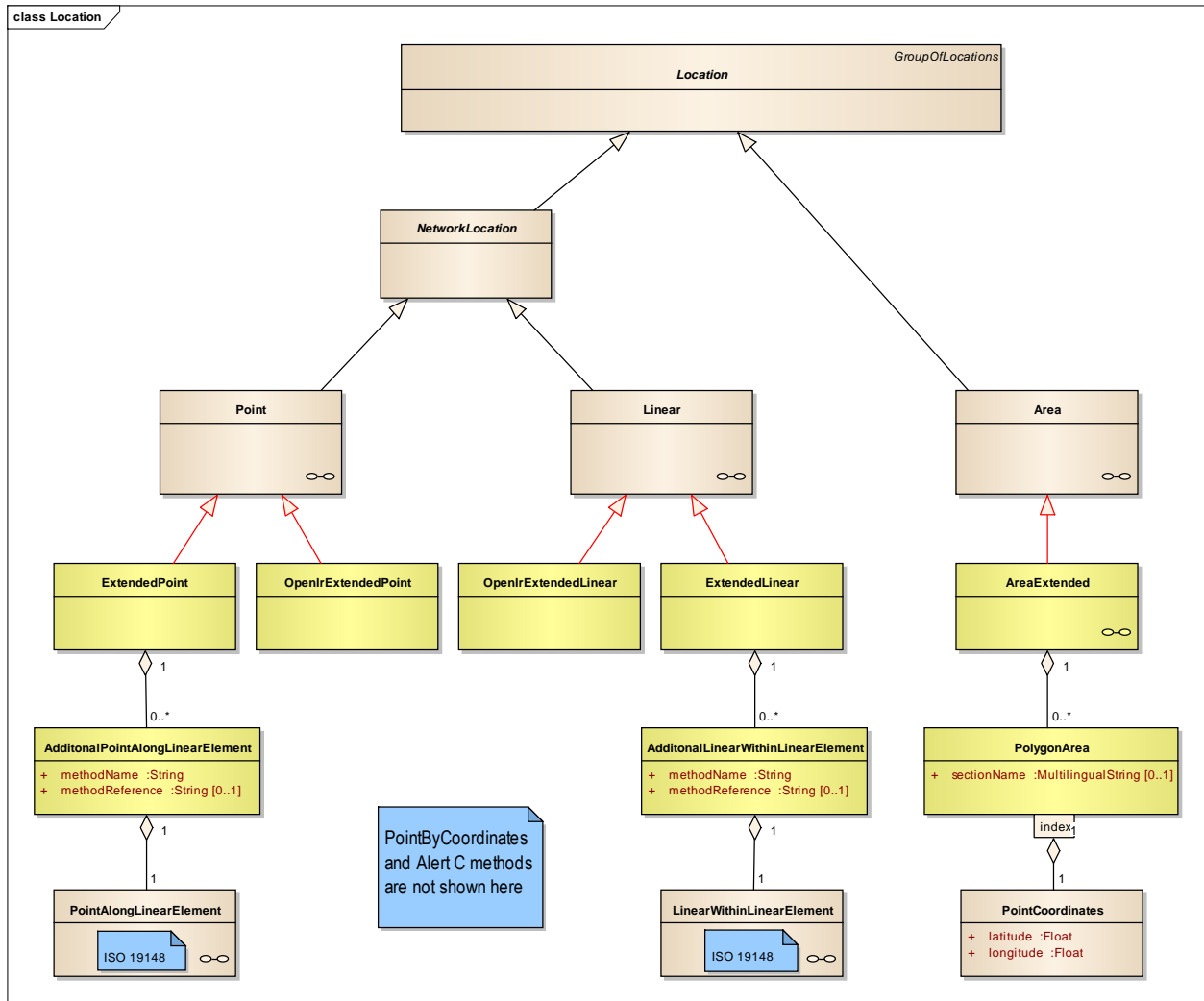


Figure 15: Geo-referencing Linear, Point and Area (presented here without PointByCoordinates, TPEG-Loc and Alert C)



In Figure 15 it can be seen that the components **PointAlongLinearElement** and **LinearWithinLinearElement** must be included via the extension classes (yellow) and not directly via **Point** and **Linear**.

| ISO 19148 extension classes (see also Figure 15) | Coding in DATEX II |
|--|--|
| Component path | ... - Point – ExtendedPoint – AdditionalPointAlongLinearElement or ... - Linear – ExtendedLinear - AdditionalLinearWithinLinearElement |
| Name of the ISO 19148 method used * | methodName = {ByCode, ByPoints} |
| Possible indication of a reference graph (at „ByCode“) | rmethodReference |

Details of the localisation according to ISO/DIS 19148

As described in the preceding chapter, the integration is done necessarily via an expansion container (ExtendedPoint and ExtendedLinear). The two figures below show the structures of this option for locating points and linear objects.

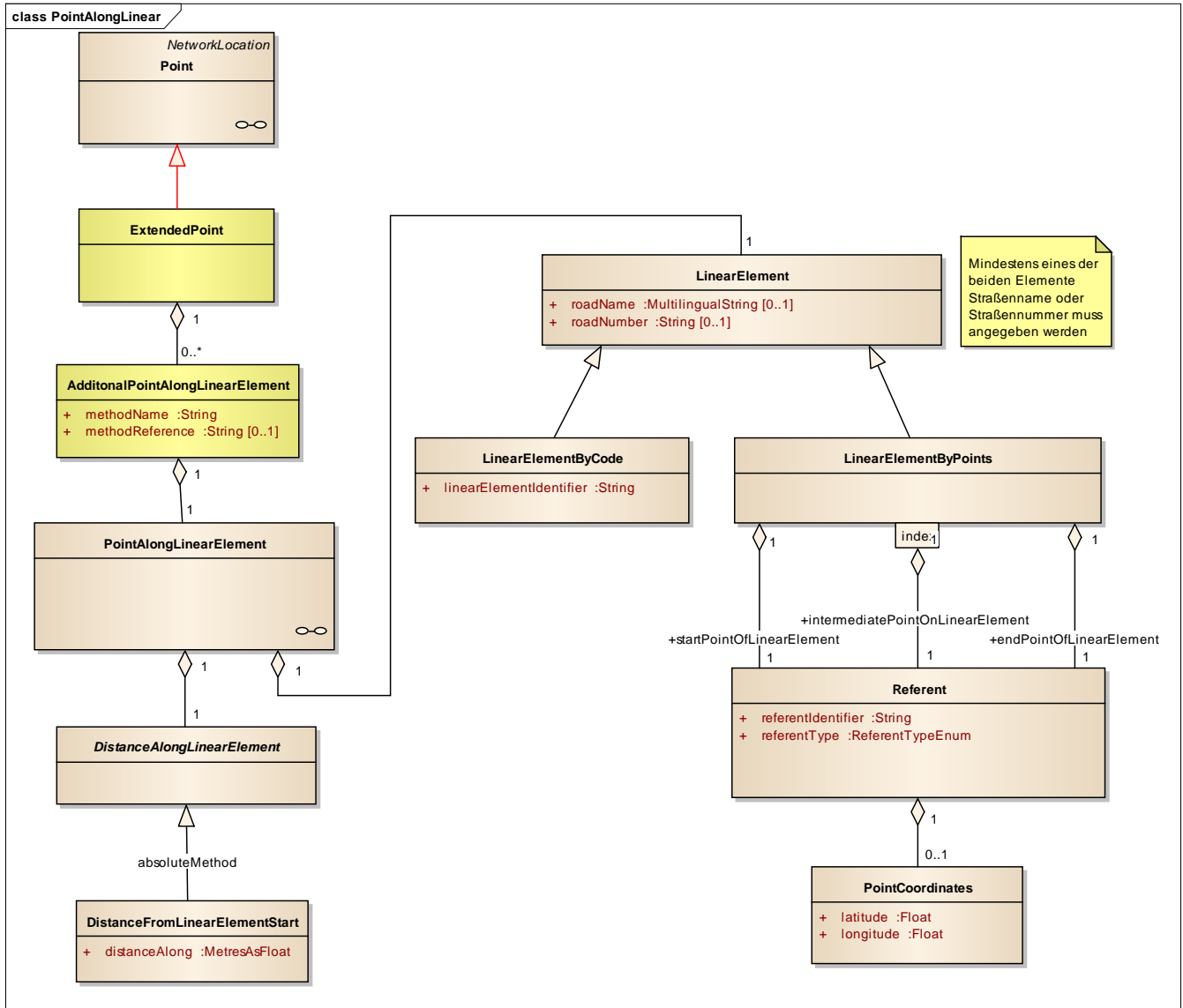


Figure 16: Details of the localisation of points according to ISO 19148

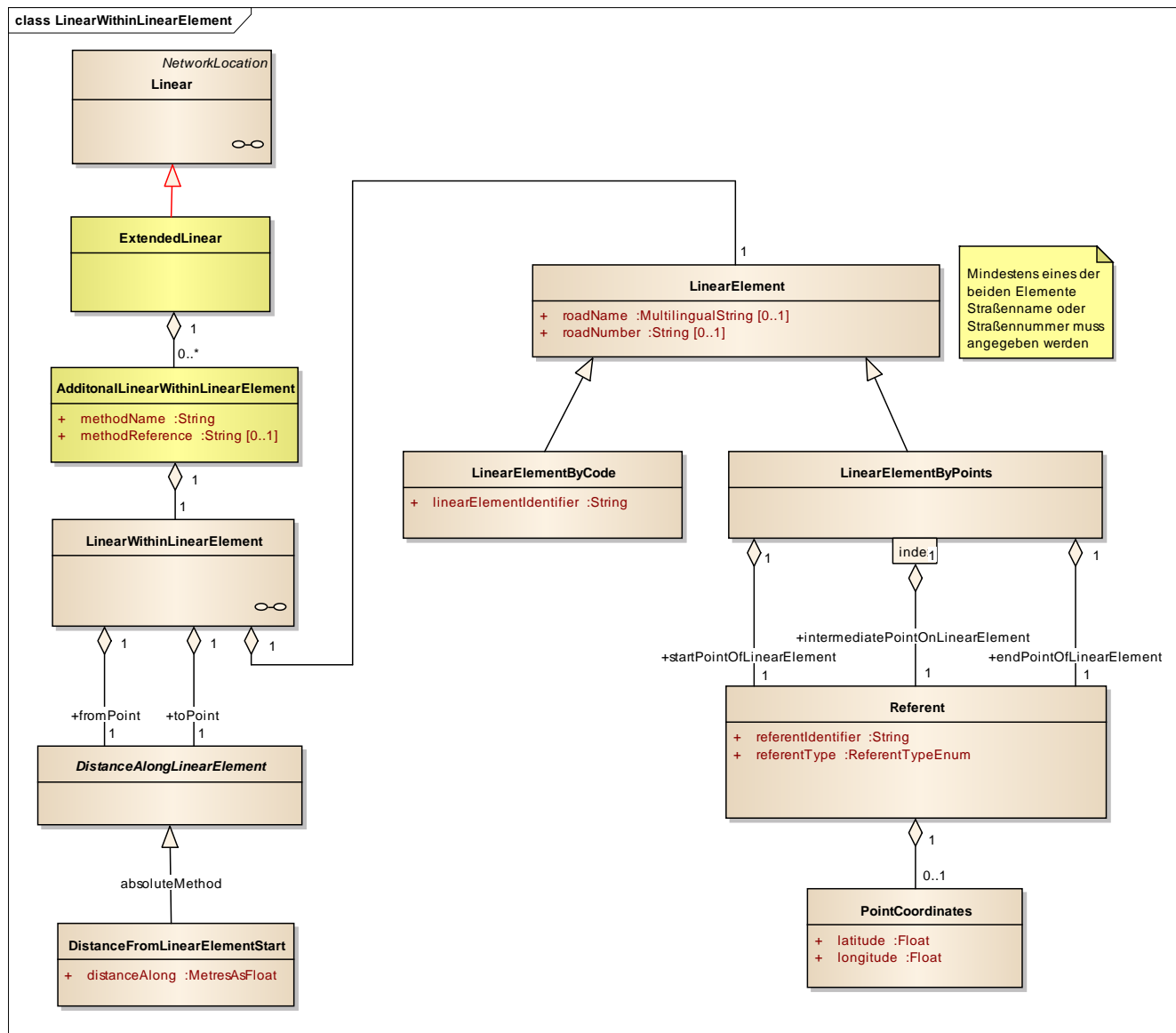


Figure 17: Details of the linear localisation according to ISO 19148

Localisation of points via coordinates

The point localisation via coordinates is done in ETRS89 format (see also the Appendix).

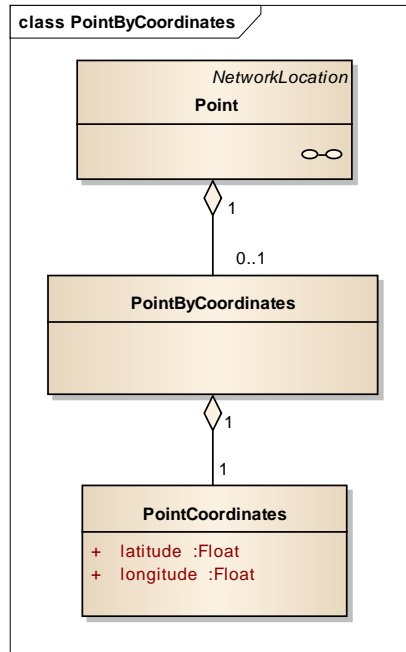


Figure 18: point localisation via coordinates

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 two figures below; all other information can be obtained from the above website¹.

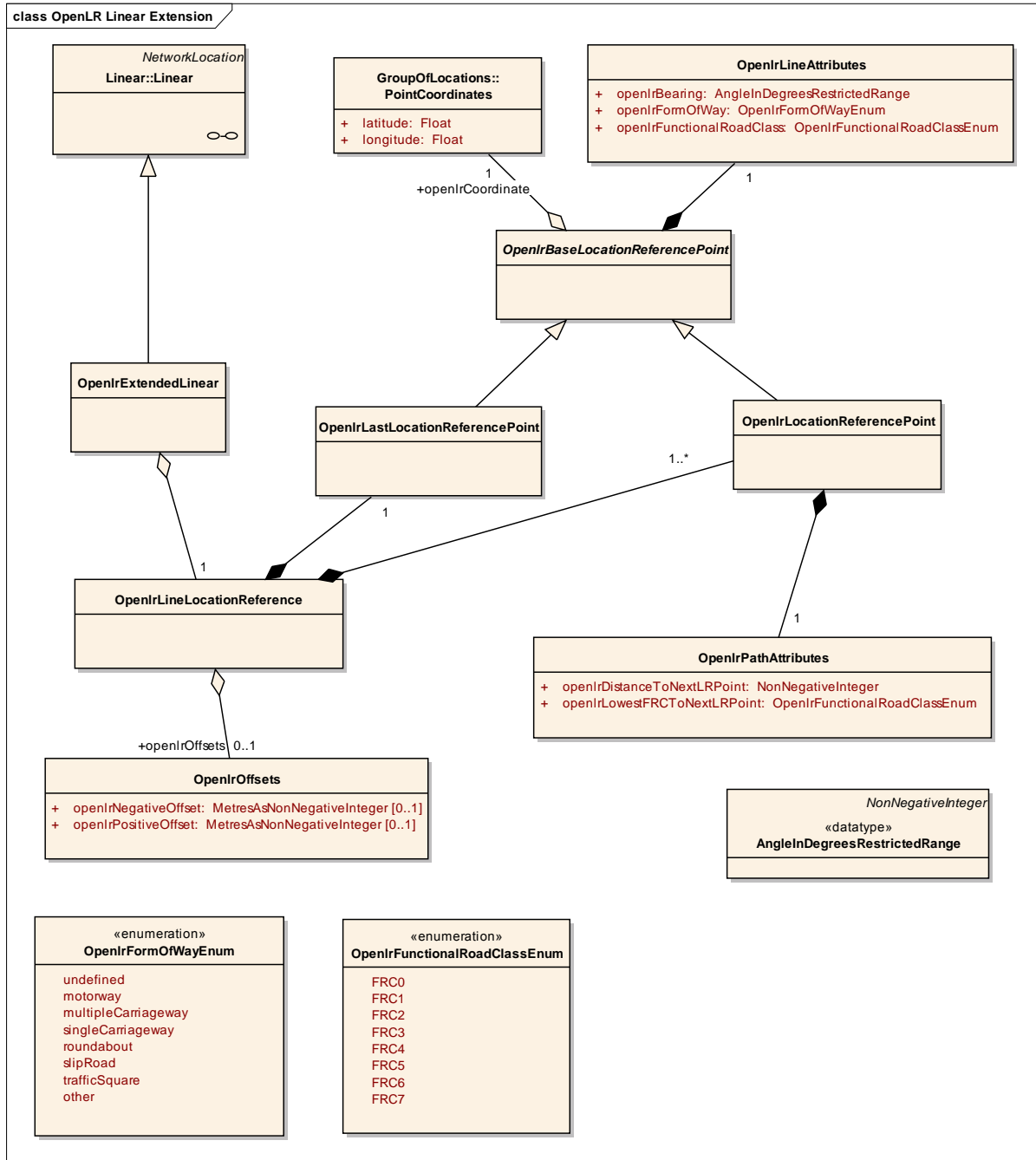


Figure 19: OpenLR Linear Extension

¹ Or the direct documentation via the following address:

http://www.datex2.eu/sites/www.datex2.eu/files/OpenLR_DATEX_II_extension_0.pdf

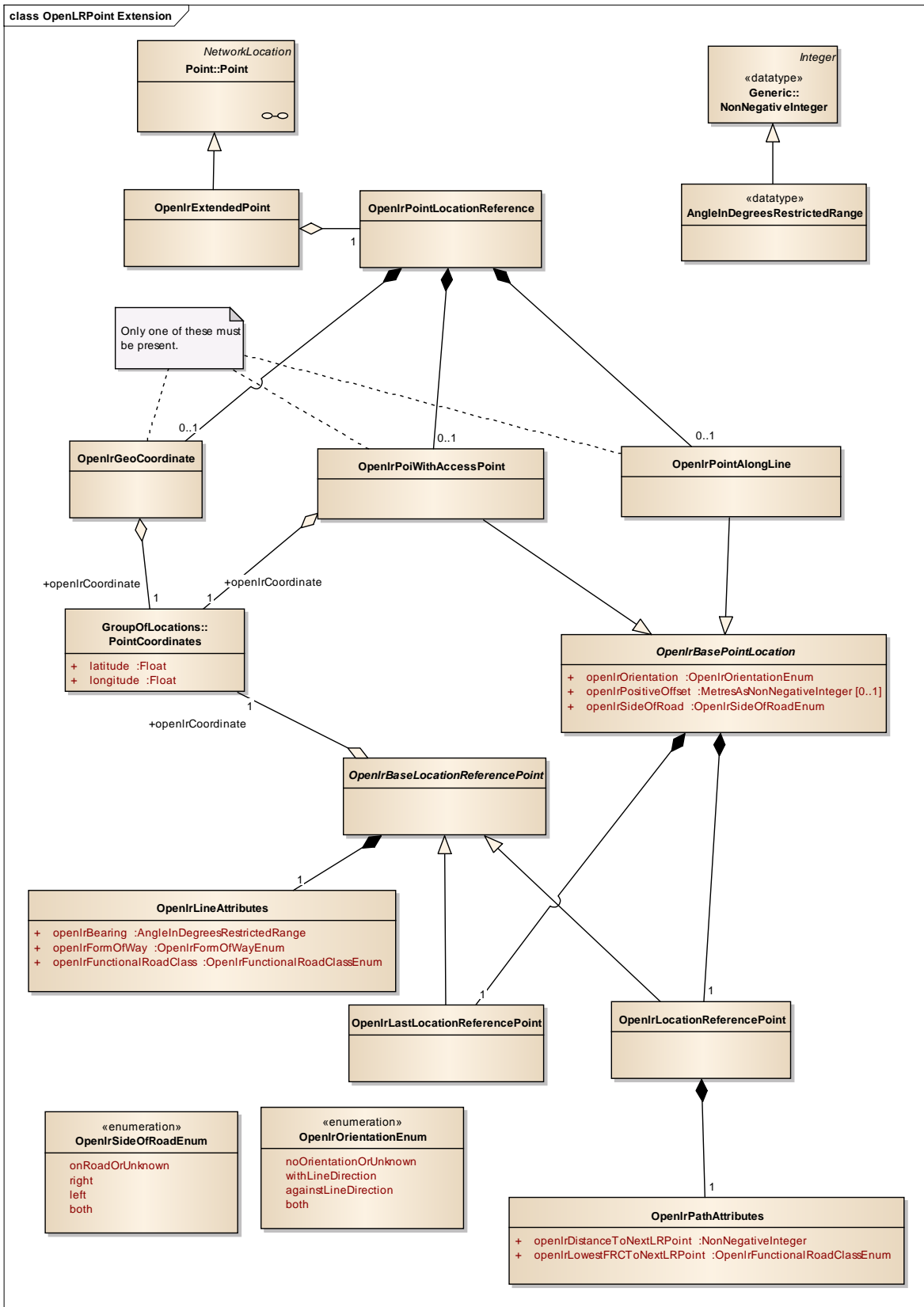


Figure 20: OpenLR Point Extension

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)
- M2 for points (one point)
- M4 for points (one point with offset)
- As well as ALERT-C für Areas.

More details can be found in the ISO 14819-3 standard².

| ALERT-C information (see also Figure 21) | Coding in DATEX II |
|--|---|
| ALERT-C coding. Given are only the most important attributes, not the whole model of the above methods. | <p>alertCLocationCountryCode *</p> <p>alertCLocationTableNumber *</p> <p>alertCLocationTableVersion *</p> <p>AlertCMethod[xx] - AlertCDirection – alertCDirectionCoded * = "positive", if the direction of travel is in the direction of the p-coding of the points, otherwise "negative"</p> |

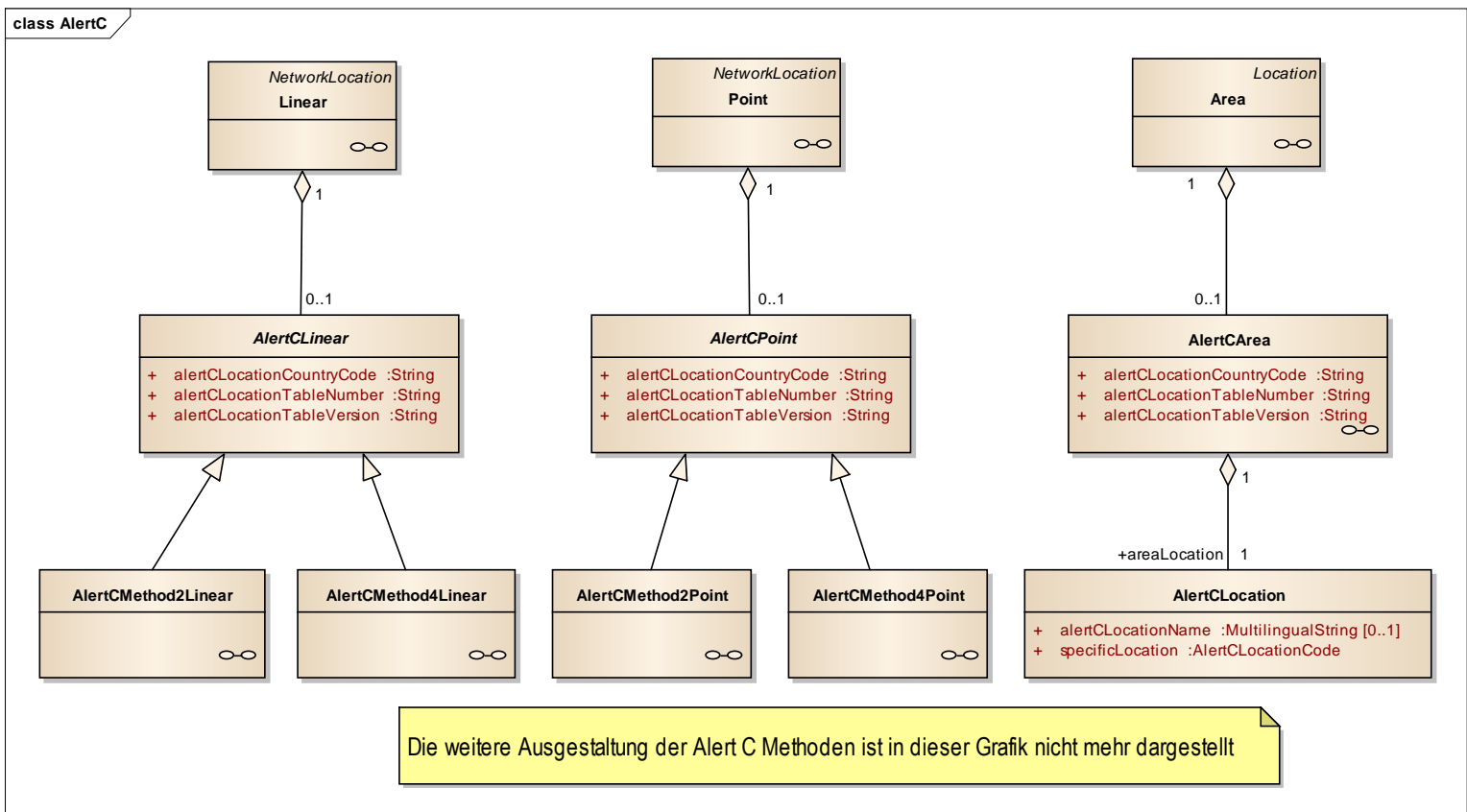


Figure 21: ALERT C for linear objects, points and Area

² 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, for points and areas (see Table Geo-referencing for exact mapping to applications). The three possibilities are illustrated in the following three figures, Figure 25 shows the **TpegDescriptors** used. Finally, in Figure 26 all used enumerations are listed.

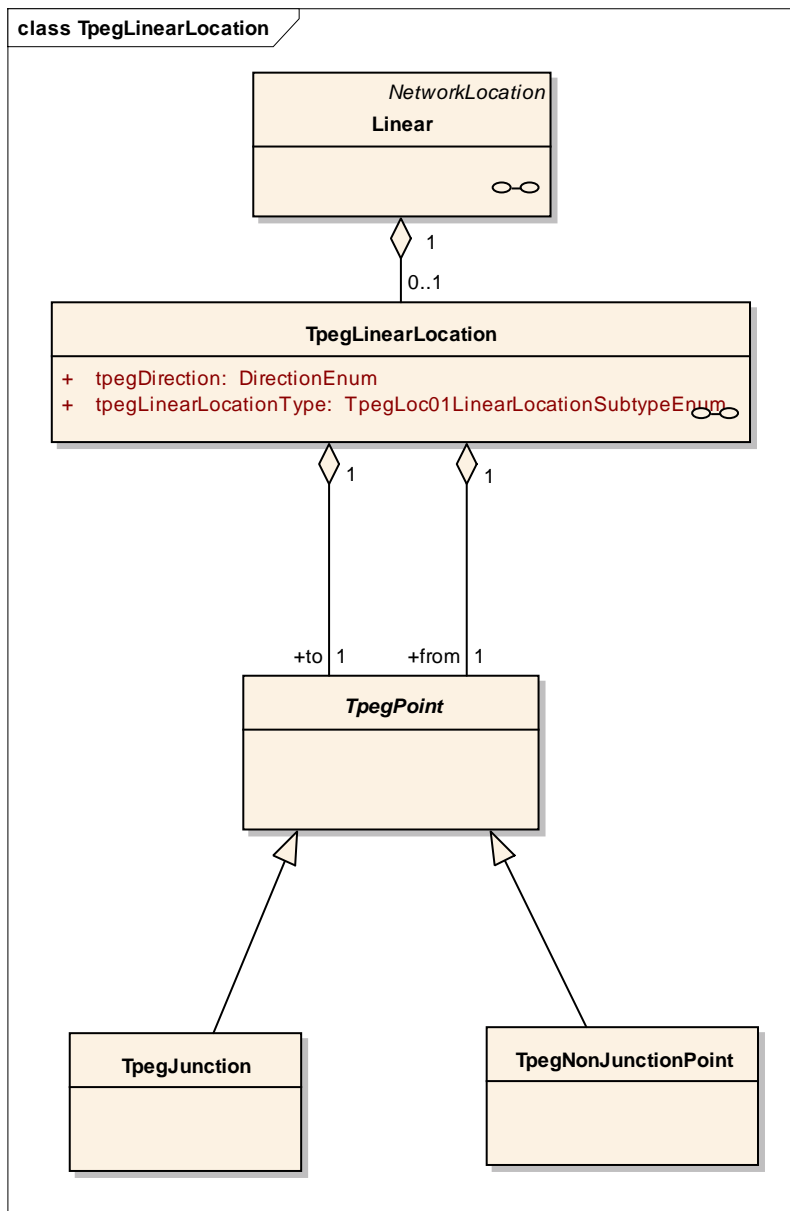


Figure 22: TPEG-Loc for linear objects

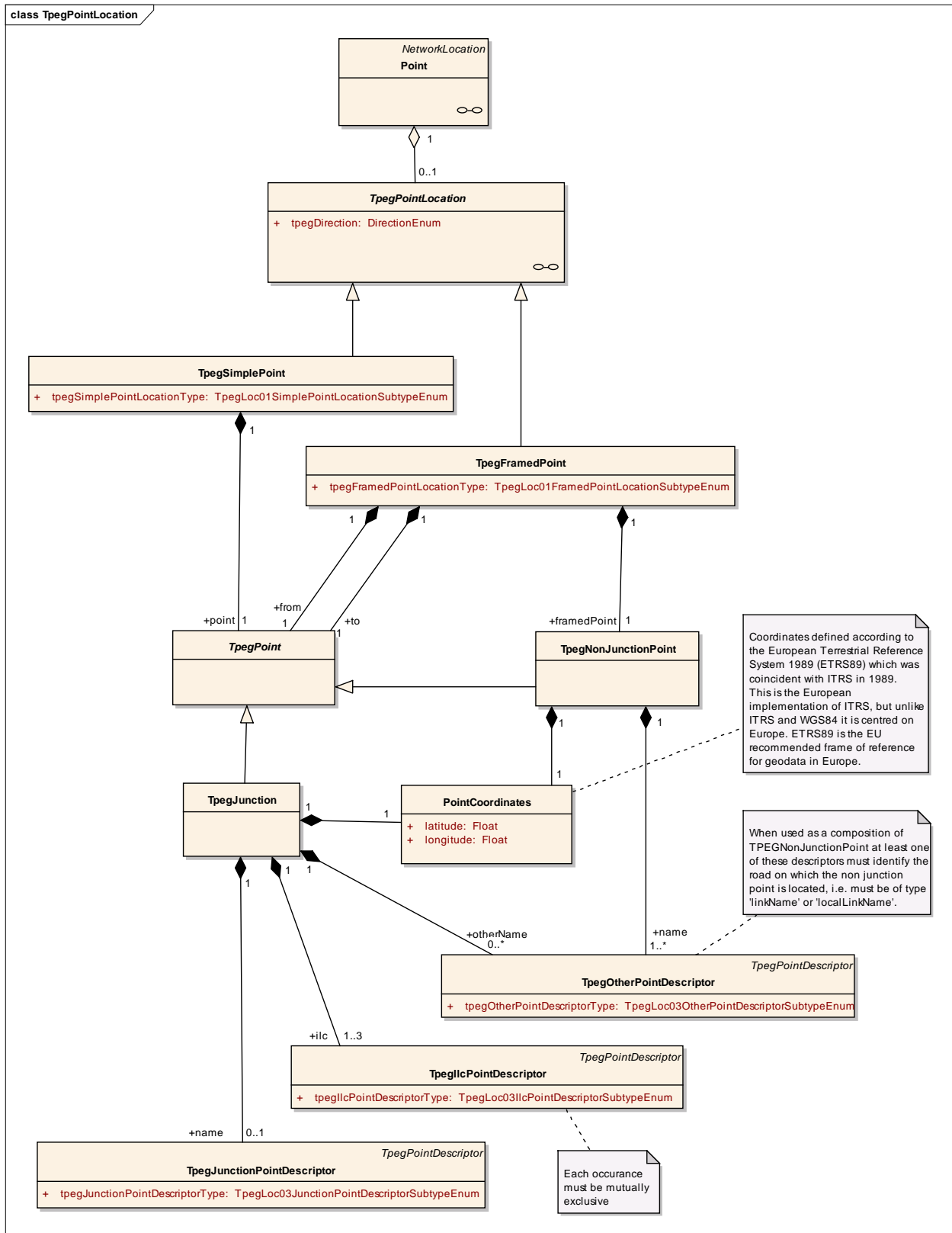


Figure 23: TPEG-Loc for point objects

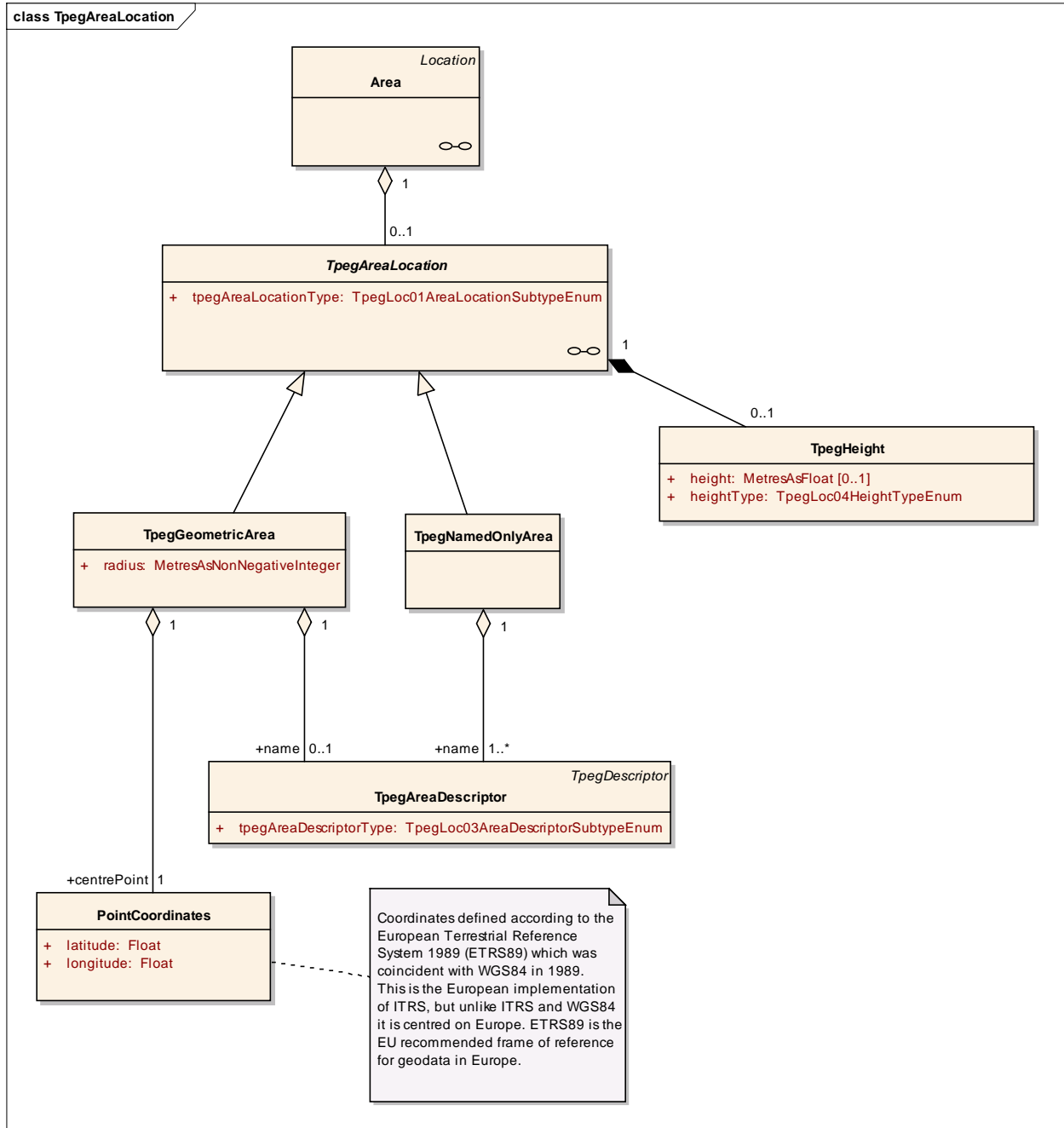


Figure 24: TPEG-Loc for Areas

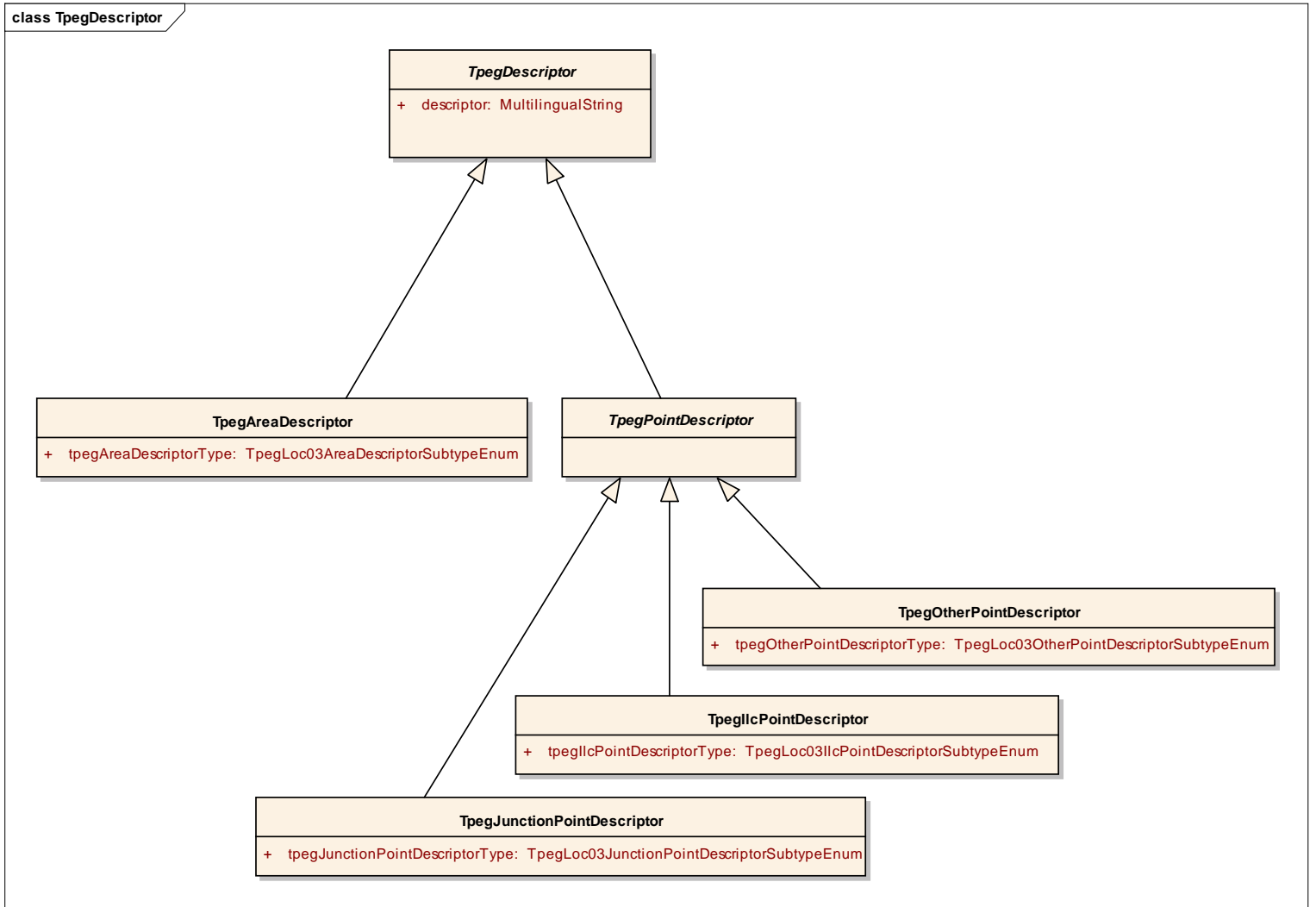


Figure 25: TPEG-Loc Descriptor



Figure 26: TPEG-Loc enumerations

Itinerary for routes

The routes need to be mapped on an *Itinerary*, i.e. the individual route elements (points or linear objects) are part of an ordered list

The "direct connection" (specialisation) between *GroupOfLocations* and *Location* in the graph below shows the integration of geo-referencing in the case of not using *Itinerary*, for example for the trigger.

| LocationForDisplay | Coding in DATEX II |
|---|---|
| <p>Additional coordinate information specifically for the projection of the object on maps or display system (in ETRS89 format, see also the Appendix).</p> <p>This optional information may therefore differ from the "real", high-resolution geo-reference to allow for a more attractive visualisation (e.g. more clustered) for the end-user.</p> | <p>... - <i>Location</i> – <i>PointCoordinates</i> - longitude / latitude</p> |

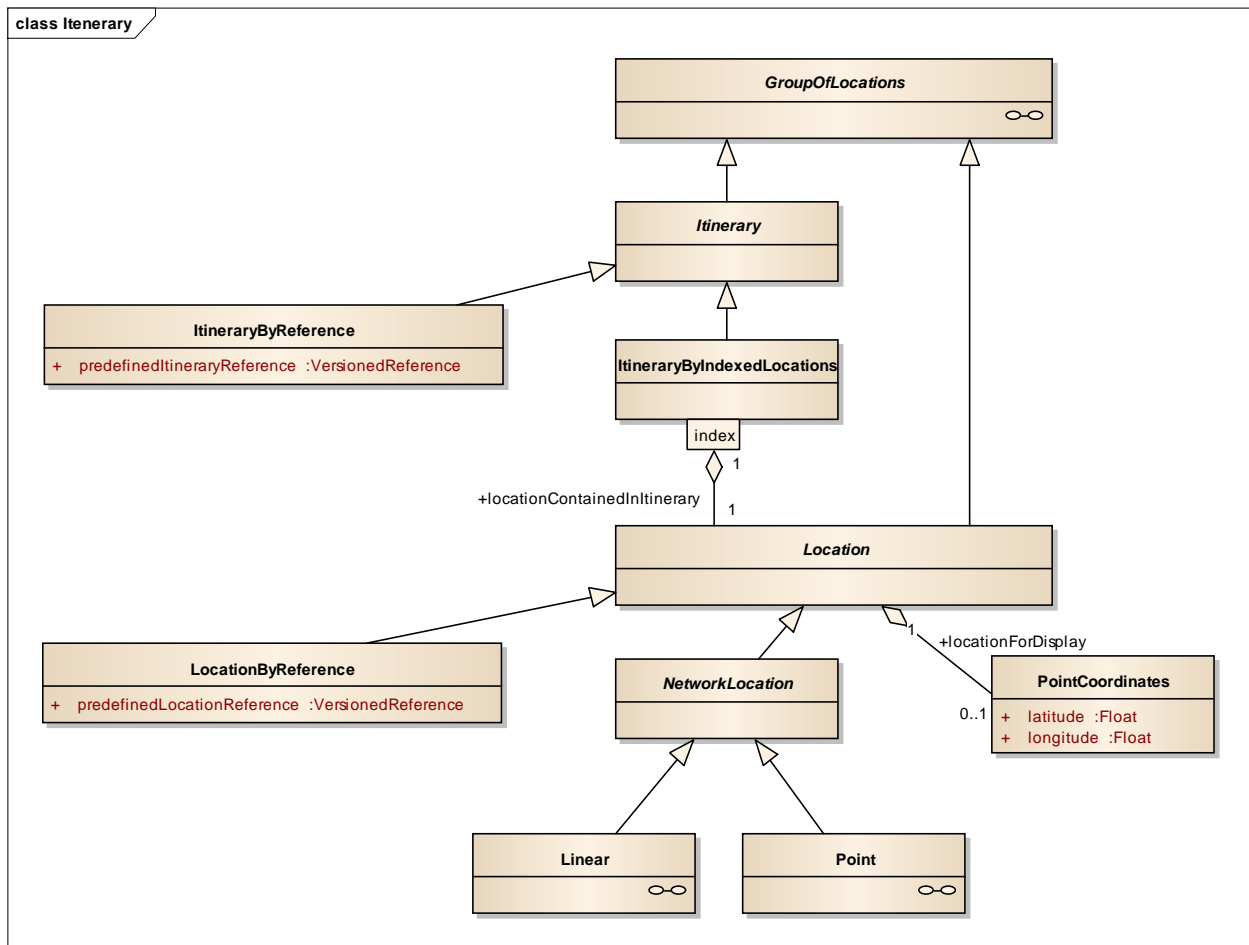


Figure 27: Use of the Itinerary-construct for routes

Alternately, as shown in Figure 27 on the left, **Itineraries** or **Locations** can be defined by references on **PredefinedLocations** („...ByReference“). Specifying **PredefinedLocations** is explained in the following chapter.

Predefined Locations

With this independent publication both **Itineraries** and **Locations** may be predefined one-time and can be referenced later to save resources. The objects **PredefinedItinerary** and **PredefinedLocation** are identified as *VersionedIdentifiable* – see the explanation in the annex.

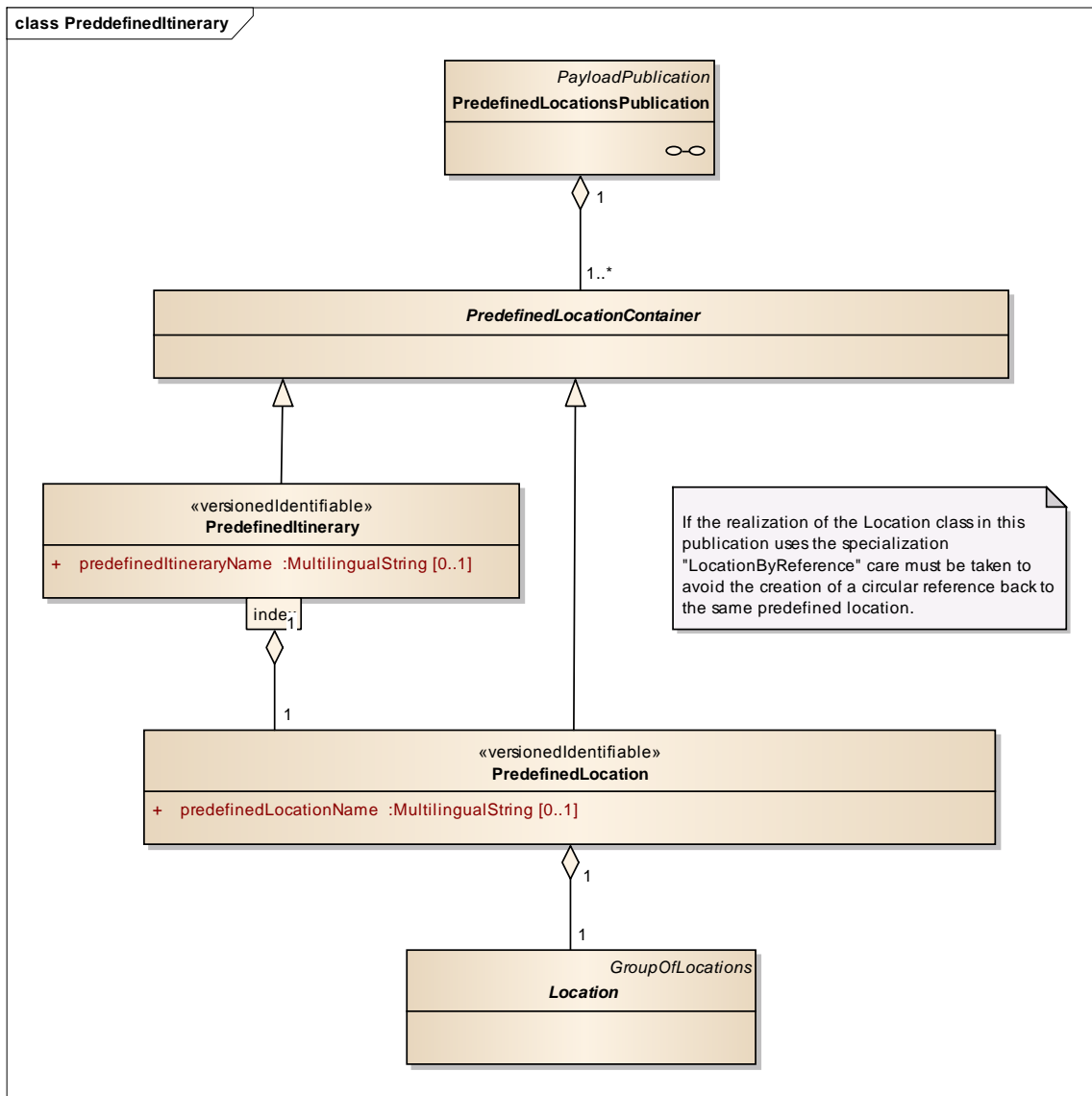


Figure 28: Predefined Locations

Care must be taken to avoid circular references.



Note: When using **PredefinedItinerary** the model requires the "redefinition" of all included **Locations** as *versionedIdentifiable PredefinedLocations* (at route made of points for example every single point that is contained would be made identifiable via UUID and version). This may not be desired (for example due to resource constraints). In this case it is permitted to leave the version attribute and id blank (empty

string). Thus, these **PredifinedLocations** obviously cannot be referenced any more. See also the corresponding XML example in the Appendix.

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

Annex

Basics

DATEX II

DATEX II provides a comprehensive data model for traffic and travel information, which includes also a large part of the data which is implemented here. Only little parts of specific data that are not listed in DATEX must be implemented with the help of a so-called DATEX II expansion ("Level B Extension").

To keep the specification lean 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.

Enterprise Architect

The complete DATEX II data model is available in the so-called Enterprise Architect format (*. eap).

Enterprise Architect is an affordable UML modelling tool and can be purchased on this website <http://www.sparxsystems.com/>.

Those who just want to have a look at the attached model can do so by using the free Viewer for Enterprise Architect, which can be obtained from this address:

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

The *. eap-model attached to this e-mail is based on the current version of DATEX II v2.0, but also contains the already mentioned extensions (the UML model has therefore not been reduced to the actually used data in contrast to the generated schema file).

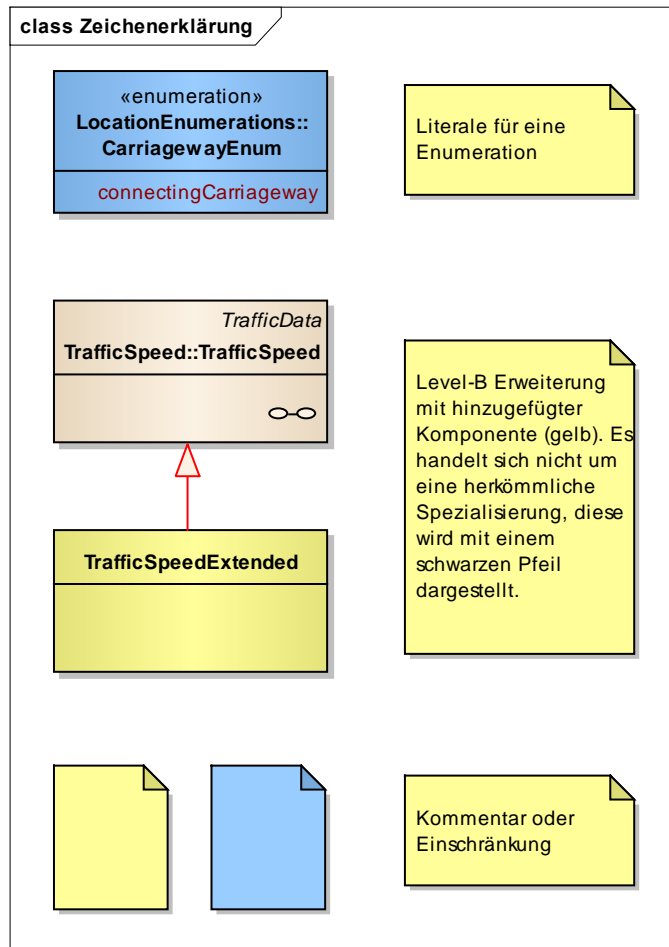
Version of the schema-file

The associated schema file ([StrategicRouting.xsd](#)) is versioned in the same manner as this documentation. The 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

In addition to the conventional UML symbolism the following (colour) semantics is used:



A red * indicates mandatory elements in the descriptions.



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



The blue exclamation mark identifies lists that have been restricted in the documentation in contrast to the schema. See also section ‚Enumerations and multiplicities in DATEX‘ below.

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).

Enumerations and multiplicities in DATEX

In DATEX II, version 2.0, it's not yet possible to select specific enumeration literals. Therefore, the schema always covers the whole set of literals, whether all of them are used or not.

A reduction of these sets is made within this documentation. You'll find a couple of enumerations, where the number of literals (shown in the figures) is much smaller than the number of literals available in the schema. In those cases, you find this blue exclamation mark on the left side. 

The documentation is significant in this case.

In DATEX II, version 2.0, it's not yet possible to modify multiplicities of attributes against the DATEX-standard profile. This could be useful to for instance for declaring optional attributes as mandatory in this special profile. Compatibility to DATEX would not be affected.

Showing these differences is only possible within this documentation. In just a few cases, attributes are declared as mandatory, whereas they have a multiplicity of 0..x.

Those cases – among others - are marked with a yellow exclamation mark. 

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 GUIDs³ 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).

(Versioned)Identifiable elements are referenced by attributes with datatype **Reference** resp. **VersionedReference**.

³ Refer to http://de.wikipedia.org/wiki/Globally_Unique_Identifier

XML-examples (instances)

„ Capacity overload ‘Rheinkniebrücke’“

The following situation is described:

- First record from 17/4., 8:55, valid until 12 PM
- Regional validity: „urban area Düsseldorf“ (Polygon by coordinates)
(here only 6 points are used)
- Visualisation point: Düsseldorf city centre (by point coordinates)
- Szenario: Rheinkniebrücke A52 in Düsseldorf congested because of an ‘event’
- Trigger origin: Junction A52 „Büderich“
- Trigger destination: City of Düsseldorf (ALERT-C Area Code)
- 2 routes:
 1. A52 Rheinkniebrücke (original route)
 - Georeference by predefined reference
(see further XML-example)
 - Weight 10% for vehicles without German emission sticker
 2. Theodor-Heuss-Brücke
 - Georeference by predefined reference
(not included in examples)
 - Weight 90% for vehicles without German emission sticker
 - Reference to action ‚opening additional lanes‘
(see further XML-example)

```
<?xml version="1.0" encoding="UTF-8"?>
<D2LogicalModel:d2LogicalModel modelBaseVersion="2" xsi:schemaLocation="http://datex2.eu/schema/2/2_0 StrategicRouting.xsd"
xmlns:D2LogicalModel="http://datex2.eu/schema/2/2_0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <D2LogicalModel:exchange>
    <D2LogicalModel:supplierIdentification>
      <D2LogicalModel:country>de</D2LogicalModel:country>
      <D2LogicalModel:nationalIdentifier>DE-MDM-X12345</D2LogicalModel:nationalIdentifier>
    </D2LogicalModel:supplierIdentification>
  </D2LogicalModel:exchange>
  <D2LogicalModel:payloadPublication xsi:type="D2LogicalModel:SituationPublication" lang="de">
    <D2LogicalModel:publicationTime>2012-04-17T08:55:02.0Z</D2LogicalModel:publicationTime>
    <D2LogicalModel:publicationCreator>
      <D2LogicalModel:country>de</D2LogicalModel:country>
      <D2LogicalModel:nationalIdentifier>DE-MDM-X12345</D2LogicalModel:nationalIdentifier>
    </D2LogicalModel:publicationCreator>
    <D2LogicalModel:situation id="CA1A84A1-3B00-49B2-BA6B-716537FA409C" version="1">
      <D2LogicalModel:situationVersionTime>2012-04-17T08:55:42.0Z</D2LogicalModel:situationVersionTime>
      <D2LogicalModel:headerInformation>
        <D2LogicalModel:confidentiality>noRestriction</D2LogicalModel:confidentiality>
        <D2LogicalModel:informationStatus>test</D2LogicalModel:informationStatus>
      </D2LogicalModel:headerInformation>
      <D2LogicalModel:situationRecord xsi:type="D2LogicalModel:GeneralNetworkManagement" id="305E2346-EE12-495A-A28E-03FA31642F5C" version="1">
        <D2LogicalModel:situationRecordCreationTime>2012-04-17T08:55:42.0Z</D2LogicalModel:situationRecordCreationTime>
        <D2LogicalModel:situationRecordVersionTime>2012-04-17T08:55:42.0Z</D2LogicalModel:situationRecordVersionTime>
        <D2LogicalModel:probabilityOfOccurrence>certain</D2LogicalModel:probabilityOfOccurrence>
        <D2LogicalModel:validity>
          <D2LogicalModel:validityStatus>definedByTimeSpec </D2LogicalModel:validityStatus>
        </D2LogicalModel:validity>
      </D2LogicalModel:situationRecord>
    </D2LogicalModel:situation>
  </D2LogicalModel:payloadPublication>
</D2LogicalModel:d2LogicalModel>
```

```

<D2LogicalModel:validityTimeSpecification>
  <D2LogicalModel:overallStartTime>2012-04-17T08:55:42.0Z</D2LogicalModel:overallStartTime>
  <D2LogicalModel:overallEndTime>2012-04-17T12:00:00.0Z</D2LogicalModel:overallEndTime>
</D2LogicalModel:validityTimeSpecification>
</D2LogicalModel:validity>
<D2LogicalModel:cause xsi:type="D2LogicalModel:NonManagedCause">
  <D2LogicalModel:causeType>other</D2LogicalModel:causeType>
  <D2LogicalModel:nonManagedCauseExtension>
    <D2LogicalModel:nonManagedCauseExtended>
      <D2LogicalModel:causeTypeExtended>event</D2LogicalModel:causeTypeExtended>
    </D2LogicalModel:nonManagedCauseExtended>
  </D2LogicalModel:nonManagedCauseExtension>
</D2LogicalModel:cause>
<D2LogicalModel:generalPublicComment>
  <D2LogicalModel:comment>
    <D2LogicalModel:values>
      <D2LogicalModel:value lang="de">Überlastung Rheinkniebrücke A52</D2LogicalModel:value>
    </D2LogicalModel:values>
  </D2LogicalModel:comment>
</D2LogicalModel:generalPublicComment>
<D2LogicalModel:groupOfLocations xsi:type="D2LogicalModel:Area">
  <D2LogicalModel:locationForDisplay>
    <D2LogicalModel:latitude>51.224948</D2LogicalModel:latitude>
    <D2LogicalModel:longitude>6.784344</D2LogicalModel:longitude>
  </D2LogicalModel:locationForDisplay>
  <D2LogicalModel:areaExtension>
    <D2LogicalModel:areaExtended>
      <D2LogicalModel:polygonArea>
        <D2LogicalModel:sectionName>
          <D2LogicalModel:values>
            <D2LogicalModel:value lang="de">Grossraum Düsseldorf</D2LogicalModel:value>
          </D2LogicalModel:values>
        </D2LogicalModel:sectionName>
        <D2LogicalModel:pointCoordinates index="1">
          <D2LogicalModel:pointCoordinates>
            <D2LogicalModel:latitude>51.230538</D2LogicalModel:latitude>
            <D2LogicalModel:longitude>6.697426</D2LogicalModel:longitude>
          </D2LogicalModel:pointCoordinates>
        </D2LogicalModel:pointCoordinates>
        <D2LogicalModel:pointCoordinates index="2">
          <D2LogicalModel:pointCoordinates>
            <D2LogicalModel:latitude>51.269004</D2LogicalModel:latitude>
            <D2LogicalModel:longitude>6.728382</D2LogicalModel:longitude>
          </D2LogicalModel:pointCoordinates>
        </D2LogicalModel:pointCoordinates>
        <D2LogicalModel:pointCoordinates index="3">
          <D2LogicalModel:pointCoordinates>
            <D2LogicalModel:latitude>51.269004</D2LogicalModel:latitude>
            <D2LogicalModel:longitude>6.819706</D2LogicalModel:longitude>
          </D2LogicalModel:pointCoordinates>
        </D2LogicalModel:pointCoordinates>
        <D2LogicalModel:pointCoordinates index="4">
          <D2LogicalModel:pointCoordinates>
            <D2LogicalModel:latitude>51.222583</D2LogicalModel:latitude>
            <D2LogicalModel:longitude>6.833096</D2LogicalModel:longitude>
          </D2LogicalModel:pointCoordinates>
        </D2LogicalModel:pointCoordinates>
      </D2LogicalModel:polygonArea>
    </D2LogicalModel:areaExtended>
  </D2LogicalModel:areaExtension>
</D2LogicalModel:groupOfLocations>

```

```

</D2LogicalModel:pointCoordinates>
<D2LogicalModel:pointCoordinates index="5">
  <D2LogicalModel:pointCoordinates>
    <D2LogicalModel:latitude>51.198924</D2LogicalModel:latitude>
    <D2LogicalModel:longitude>6.782627</D2LogicalModel:longitude>
  </D2LogicalModel:pointCoordinates>
</D2LogicalModel:pointCoordinates>
<D2LogicalModel:pointCoordinates index="6">
  <D2LogicalModel:pointCoordinates>
    <D2LogicalModel:latitude>51.212906</D2LogicalModel:latitude>
    <D2LogicalModel:longitude>6.720142</D2LogicalModel:longitude>
  </D2LogicalModel:pointCoordinates>
</D2LogicalModel:pointCoordinates>
</D2LogicalModel:polygonArea>
</D2LogicalModel:areaExtended>
</D2LogicalModel:areaExtension>
</D2LogicalModel:groupOfLocations>
<D2LogicalModel:operatorActionStatus>implemented</D2LogicalModel:operatorActionStatus>
<D2LogicalModel:complianceOption>advisory</D2LogicalModel:complianceOption>
<D2LogicalModel:generalNetworkManagementType>other</D2LogicalModel:generalNetworkManagementType>
<D2LogicalModel:generalNetworkManagementExtension>
  <D2LogicalModel:generalNetworkManagementExtended xsi:type="D2LogicalModel:StrategicRouteManagement">
    <D2LogicalModel:triggerOrigin>
      <D2LogicalModel:triggerDescription>A52 Abfahrt Buderich</D2LogicalModel:triggerDescription>
      <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
        <D2LogicalModel>alertCPoint xsi:type="D2LogicalModel:AlertCMethod2Point">
          <D2LogicalModel>alertCLocationCountryCode>D</D2LogicalModel>alertCLocationCountryCode>
          <D2LogicalModel>alertCLocationTableNumber>1</D2LogicalModel>alertCLocationTableNumber>
          <D2LogicalModel>alertCLocationTableVersion>11.0</D2LogicalModel>alertCLocationTableVersion>
          <D2LogicalModel>alertCDirection>
            <D2LogicalModel>alertCDirectionCoded>positive</D2LogicalModel>alertCDirectionCoded>
          </D2LogicalModel>alertCDirection>
          <D2LogicalModel>alertCMethod2PrimaryPointLocation>
            <D2LogicalModel>alertCLocation>
              <D2LogicalModel:specificLocation>11669</D2LogicalModel:specificLocation>
            </D2LogicalModel>alertCLocation>
          </D2LogicalModel>alertCMethod2PrimaryPointLocation>
        </D2LogicalModel>alertCPoint>
      </D2LogicalModel:location>
    </D2LogicalModel:triggerOrigin>
    <D2LogicalModel:triggerDestination>
      <D2LogicalModel:triggerDescription>Düsseldorf Zentrum</D2LogicalModel:triggerDescription>
      <D2LogicalModel:location xsi:type="D2LogicalModel:Area">
        <D2LogicalModel>alertCArea>
          <D2LogicalModel>alertCLocationCountryCode>D</D2LogicalModel>alertCLocationCountryCode>
          <D2LogicalModel>alertCLocationTableNumber>1</D2LogicalModel>alertCLocationTableNumber>
          <D2LogicalModel>alertCLocationTableVersion>11.0</D2LogicalModel>alertCLocationTableVersion>
          <D2LogicalModel:areaLocation>
            <D2LogicalModel:specificLocation>279</D2LogicalModel:specificLocation>
          </D2LogicalModel:areaLocation>
        </D2LogicalModel>alertCArea>
      </D2LogicalModel:location>
    </D2LogicalModel:triggerDestination>
  </D2LogicalModel:route>
  <D2LogicalModel:nameOfRoute>
    <D2LogicalModel:values>

```

```

        <D2LogicalModel:value lang="de">Rheinkniebrücke</D2LogicalModel:value>
      </D2LogicalModel:values>
    </D2LogicalModel:nameOfRoute>
    <D2LogicalModel:originalRoute>true</D2LogicalModel:originalRoute>
    <D2LogicalModel:weightingAndVehicleClassification index="1">
      <D2LogicalModel:weightingAndVehicleClassification>
        <D2LogicalModel:weight>10</D2LogicalModel:weight>
        <D2LogicalModel:validForVehiclesWithCharacteristics>
          <D2LogicalModel:vehicleCharacteristicsExtension>
            <D2LogicalModel:vehicleCharacteristicsExtended>
              <D2LogicalModel:emissionClassification>Schadstoffgruppe 1</D2LogicalModel:emissionClassification>
            </D2LogicalModel:vehicleCharacteristicsExtended>
          </D2LogicalModel:vehicleCharacteristicsExtension>
        </D2LogicalModel:validForVehiclesWithCharacteristics>
      </D2LogicalModel:weightingAndVehicleClassification>
    </D2LogicalModel:weightingAndVehicleClassification>
    <D2LogicalModel:itinerary xsi:type="D2LogicalModel:ItineraryByReference">
      <D2LogicalModel:predefinedItineraryReference id="290F90B5-4FB6-4923-8768-0B6EB5466FA8"
version="1" targetClass="PredefinedItinerary"></D2LogicalModel:predefinedItineraryReference>
    </D2LogicalModel:itinerary>
  </D2LogicalModel:route>
<D2LogicalModel:route>
  <D2LogicalModel:nameOfRoute>
    <D2LogicalModel:values>
      <D2LogicalModel:value lang="de">Nord über Theodor-Heuss Brücke</D2LogicalModel:value>
    </D2LogicalModel:values>
  </D2LogicalModel:nameOfRoute>
  <D2LogicalModel:additionalManagement>
    <D2LogicalModel:additionalManagementReference id="1973FA15-6CC2-428E-83D9-E5515C2DBFD9"
version="2" targetClass="SituationRecord"></D2LogicalModel:additionalManagementReference>
  </D2LogicalModel:additionalManagementType>openedExtraLane</D2LogicalModel:additionalManagementType>
</D2LogicalModel:additionalManagement>
  <D2LogicalModel:weightingAndVehicleClassification index="1">
    <D2LogicalModel:weightingAndVehicleClassification>
      <D2LogicalModel:weight>90</D2LogicalModel:weight>
      <D2LogicalModel:validForVehiclesWithCharacteristics>
        <D2LogicalModel:vehicleCharacteristicsExtension>
          <D2LogicalModel:vehicleCharacteristicsExtended>
            <D2LogicalModel:emissionClassification>Schadstoffgruppe 1</D2LogicalModel:emissionClassification>
          </D2LogicalModel:vehicleCharacteristicsExtended>
        </D2LogicalModel:vehicleCharacteristicsExtension>
      </D2LogicalModel:validForVehiclesWithCharacteristics>
    </D2LogicalModel:weightingAndVehicleClassification>
  </D2LogicalModel:weightingAndVehicleClassification>
  <D2LogicalModel:itinerary xsi:type="D2LogicalModel:ItineraryByReference">
    <D2LogicalModel:predefinedItineraryReference id="1F58A191-44AA-4C96-A254-6F9C43E536F3"
version="1" targetClass="PredefinedItinerary"></D2LogicalModel:predefinedItineraryReference>
  </D2LogicalModel:itinerary>
</D2LogicalModel:route>
  </D2LogicalModel:generalNetworkManagementExtended>
</D2LogicalModel:generalNetworkManagementExtension>
</D2LogicalModel:situationRecord>
</D2LogicalModel:situation>

```


</D2LogicalModel:payloadPublication>
</D2LogicalModel:d2LogicalModel>

Predefined Location – Itinerary

Definition of a route out of (*just!*) 8 coordinates (A52 junction Buderich – Rheinkniebrücke).

This route is referenced in the upper example.

```
<?xml version="1.0" encoding="UTF-8"?>
<D2LogicalModel:d2LogicalModel modelBaseVersion="2" xsi:schemaLocation="http://datex2.eu/schema/2/2_0 StrategicRouting.xsd"
xmlns:D2LogicalModel="http://datex2.eu/schema/2/2_0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <D2LogicalModel:exchange>
    <D2LogicalModel:supplierIdentification>
      <D2LogicalModel:country>de</D2LogicalModel:country>
      <D2LogicalModel:nationalIdentifier>DE-MDM-X12345</D2LogicalModel:nationalIdentifier>
    </D2LogicalModel:supplierIdentification>
  </D2LogicalModel:exchange>
  <D2LogicalModel:payloadPublication xsi:type="D2LogicalModel:PredefinedLocationsPublication" lang="de">
    <D2LogicalModel:publicationTime>2012-04-16T08:00:02.0Z</D2LogicalModel:publicationTime>
    <D2LogicalModel:publicationCreator>
      <D2LogicalModel:country>de</D2LogicalModel:country>
      <D2LogicalModel:nationalIdentifier>DE-MDM-X12345</D2LogicalModel:nationalIdentifier>
    </D2LogicalModel:publicationCreator>
    <D2LogicalModel:headerInformation>
      <D2LogicalModel:confidentiality>noRestriction</D2LogicalModel:confidentiality>
      <D2LogicalModel:informationStatus>test</D2LogicalModel:informationStatus>
    </D2LogicalModel:headerInformation>
    <D2LogicalModel:predefinedLocationContainer id="290F90B5-4FB6-4923-8768-0B6EB5466FA8" version="1"
xsi:type="D2LogicalModel:PredefinedItinerary">
      <D2LogicalModel:predefinedItineraryName>
        <D2LogicalModel:values>
          <D2LogicalModel:value lang="de">A52 Rheinkniebrücke</D2LogicalModel:value>
        </D2LogicalModel:values>
      </D2LogicalModel:predefinedItineraryName>
      <D2LogicalModel:predefinedLocation index="1">
        <D2LogicalModel:predefinedLocation id="" version="">
          <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
            <D2LogicalModel:pointByCoordinates>
              <D2LogicalModel:pointCoordinates>
                <D2LogicalModel:latitude>51.234891</D2LogicalModel:latitude>
                <D2LogicalModel:longitude>6.703284</D2LogicalModel:longitude>
              </D2LogicalModel:pointCoordinates>
            </D2LogicalModel:pointByCoordinates>
          </D2LogicalModel:location>
        </D2LogicalModel:predefinedLocation>
      </D2LogicalModel:predefinedLocation>
      <D2LogicalModel:predefinedLocation index="2">
        <D2LogicalModel:predefinedLocation id="" version="">
          <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
            <D2LogicalModel:pointByCoordinates>
              <D2LogicalModel:pointCoordinates>
                <D2LogicalModel:latitude>51.233198</D2LogicalModel:latitude>
                <D2LogicalModel:longitude>6.715086</D2LogicalModel:longitude>
              </D2LogicalModel:pointCoordinates>
            </D2LogicalModel:pointByCoordinates>
          </D2LogicalModel:location>
        </D2LogicalModel:predefinedLocation>
      </D2LogicalModel:predefinedLocation>
    </D2LogicalModel:predefinedLocationContainer>
  </D2LogicalModel:payloadPublication>
</D2LogicalModel:d2LogicalModel>
```

```

</D2LogicalModel:predefinedLocation>
<D2LogicalModel:predefinedLocation index="3">
  <D2LogicalModel:predefinedLocation id="" version="">
    <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
      <D2LogicalModel:pointByCoordinates>
        <D2LogicalModel:pointCoordinates>
          <D2LogicalModel:latitude>51.234139</D2LogicalModel:latitude>
          <D2LogicalModel:longitude>6.730921</D2LogicalModel:longitude>
        </D2LogicalModel:pointCoordinates>
      </D2LogicalModel:pointByCoordinates>
    </D2LogicalModel:location>
  </D2LogicalModel:predefinedLocation>
</D2LogicalModel:predefinedLocation>
<D2LogicalModel:predefinedLocation index="4">
  <D2LogicalModel:predefinedLocation id="" version="">
    <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
      <D2LogicalModel:pointByCoordinates>
        <D2LogicalModel:pointCoordinates>
          <D2LogicalModel:latitude>51.227877</D2LogicalModel:latitude>
          <D2LogicalModel:longitude>6.745212</D2LogicalModel:longitude>
        </D2LogicalModel:pointCoordinates>
      </D2LogicalModel:pointByCoordinates>
    </D2LogicalModel:location>
  </D2LogicalModel:predefinedLocation>
</D2LogicalModel:predefinedLocation>
<D2LogicalModel:predefinedLocation index="5">
  <D2LogicalModel:predefinedLocation id="" version="">
    <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
      <D2LogicalModel:pointByCoordinates>
        <D2LogicalModel:pointCoordinates>
          <D2LogicalModel:latitude>51.224168</D2LogicalModel:latitude>
          <D2LogicalModel:longitude>6.759846</D2LogicalModel:longitude>
        </D2LogicalModel:pointCoordinates>
      </D2LogicalModel:pointByCoordinates>
    </D2LogicalModel:location>
  </D2LogicalModel:predefinedLocation>
</D2LogicalModel:predefinedLocation>
<D2LogicalModel:predefinedLocation index="6">
  <D2LogicalModel:predefinedLocation id="" version="">
    <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
      <D2LogicalModel:pointByCoordinates>
        <D2LogicalModel:pointCoordinates>
          <D2LogicalModel:latitude>51.219169</D2LogicalModel:latitude>
          <D2LogicalModel:longitude>6.765769</D2LogicalModel:longitude>
        </D2LogicalModel:pointCoordinates>
      </D2LogicalModel:pointByCoordinates>
    </D2LogicalModel:location>
  </D2LogicalModel:predefinedLocation>
</D2LogicalModel:predefinedLocation>
<D2LogicalModel:predefinedLocation index="7">
  <D2LogicalModel:predefinedLocation id="" version="">
    <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
      <D2LogicalModel:pointByCoordinates>
        <D2LogicalModel:pointCoordinates>
          <D2LogicalModel:latitude>51.215675</D2LogicalModel:latitude>
          <D2LogicalModel:longitude>6.774223</D2LogicalModel:longitude>

```

```
</D2LogicalModel:pointCoordinates>
</D2LogicalModel:pointByCoordinates>
</D2LogicalModel:location>
</D2LogicalModel:predefinedLocation>
</D2LogicalModel:predefinedLocation>
<D2LogicalModel:predefinedLocation index="8">
  <D2LogicalModel:predefinedLocation id="" version="">
    <D2LogicalModel:location xsi:type="D2LogicalModel:Point">
      <D2LogicalModel:pointByCoordinates>
        <D2LogicalModel:pointCoordinates>
          <D2LogicalModel:latitude>51.215594</D2LogicalModel:latitude>
          <D2LogicalModel:longitude>6.776669</D2LogicalModel:longitude>
        </D2LogicalModel:pointCoordinates>
      </D2LogicalModel:pointByCoordinates>
    </D2LogicalModel:location>
  </D2LogicalModel:predefinedLocation>
</D2LogicalModel:predefinedLocation>
</D2LogicalModel:predefinedLocationContainer>
</D2LogicalModel:payloadPublication>
</D2LogicalModel:d2LogicalModel>
```

Opening additional lanes

The following situation is described:

- Second update from 17/4., 9:30 AM
(2nd SituationRecord and 2nd update of situation)
- First version was from 9:15 AM *(not included in the examples)*
- Reference to “Capacity overload ‘Rheinkniebücke’” (component Situation)
- Valid from 17/4 9:30 AM to 12 PM
- Georeference predefined (identical to route 2 from upper example)
(not included in the examples)
- Originally 2 lanes, now 3 lanes are open.

```
<?xml version="1.0" encoding="UTF-8"?>
<D2LogicalModel:d2LogicalModel modelBaseVersion="2" xsi:schemaLocation="http://datex2.eu/schema/2/2_0 StrategicRouting.xsd"
xmlns:D2LogicalModel="http://datex2.eu/schema/2/2_0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <D2LogicalModel:exchange>
    <D2LogicalModel:supplierIdentification>
      <D2LogicalModel:country>de</D2LogicalModel:country>
      <D2LogicalModel:nationalIdentifier>DE-MDM-X12345</D2LogicalModel:nationalIdentifier>
    </D2LogicalModel:supplierIdentification>
  </D2LogicalModel:exchange>
  <D2LogicalModel:payloadPublication xsi:type="D2LogicalModel:SituationPublication" lang="de">
    <D2LogicalModel:publicationTime>2012-04-17T09:30:47.0Z</D2LogicalModel:publicationTime>
    <D2LogicalModel:publicationCreator>
      <D2LogicalModel:country>de</D2LogicalModel:country>
      <D2LogicalModel:nationalIdentifier>DE-MDM-X12345 </D2LogicalModel:nationalIdentifier>
    </D2LogicalModel:publicationCreator>
    <D2LogicalModel:situation id="DFDEB514-F9F9-4AF2-84B6-FA6C4EC6079F" version="2">
      <D2LogicalModel:relatedSituation id="CA1A84A1-3B00-49B2-BA6B-716537FA409C" targetClass="Situation" version="1"/>
      <D2LogicalModel:situationVersionTime>2012-04-17T09:30:47.0Z</D2LogicalModel:situationVersionTime>
      <D2LogicalModel:headerInformation>
        <D2LogicalModel:confidentiality>noRestriction</D2LogicalModel:confidentiality>
        <D2LogicalModel:informationStatus>test</D2LogicalModel:informationStatus>
      </D2LogicalModel:headerInformation>
      <D2LogicalModel:situationRecord xsi:type="D2LogicalModel:RoadOrCarriagewayOrLaneManagement" id="1973FA15-6CC2-428E-83D9-E5515C2DBFD9" version="2">
        <D2LogicalModel:situationRecordCreationTime>2012-04-17T09:15:02.0Z</D2LogicalModel:situationRecordCreationTime>
        <D2LogicalModel:situationRecordVersionTime>2012-04-17T09:30:47.0Z</D2LogicalModel:situationRecordVersionTime>
        <D2LogicalModel:probabilityOfOccurrence>certain</D2LogicalModel:probabilityOfOccurrence>
        <D2LogicalModel:validity>
          <D2LogicalModel:validityStatus>definedByTimeSpec</D2LogicalModel:validityStatus>
          <D2LogicalModel:overrunning>true</D2LogicalModel:overrunning>
          <D2LogicalModel:validityTimeSpecification>
            <D2LogicalModel:overallStartTime>2012-04-17T09:15:02.0Z</D2LogicalModel:overallStartTime>
            <D2LogicalModel:overallEndTime>2012-04-17T12:00:00.0Z</D2LogicalModel:overallEndTime>
          </D2LogicalModel:validityTimeSpecification>
        </D2LogicalModel:validity>
        <D2LogicalModel:impact>
          <D2LogicalModel:numberOfOperationalLanes>3</D2LogicalModel:numberOfOperationalLanes>
          <D2LogicalModel:originalNumberOfLanes>2</D2LogicalModel:originalNumberOfLanes>
        </D2LogicalModel:impact>
        <D2LogicalModel:groupOfLocations xsi:type="D2LogicalModel:ItineraryByReference">
          <D2LogicalModel:predefinedItineraryReference id="1F58A191-44AA-4C96-A254-6F9C43E536F3" version="1">
```

```
targetClass="PredefinedItinerary"/>
  </D2LogicalModel:groupOfLocations>
  <D2LogicalModel:operatorActionStatus>implemented</D2LogicalModel:operatorActionStatus>
  <D2LogicalModel:complianceOption>mandatory</D2LogicalModel:complianceOption>

  <D2LogicalModel:roadOrCarriagewayOrLaneManagementType>useOfSpecifiedLanesOrCarriagewaysAllowed</D2LogicalModel:roadOrCa
rriagewayOrLaneManagementType>
  </D2LogicalModel:situationRecord>
  </D2LogicalModel:situation>
  </D2LogicalModel:payloadPublication>
</D2LogicalModel:d2LogicalModel>
```