

Jörg Freudenstein



- Study of Computer Science, born 1977
- Since 2005 project engineer at AlbrechtConsult (Aachen, Germany)
- Emphasis on software engineering / software processes, communication networks und distributed systems, software architectures as well as data modelling, esp. in the field of ITS, C-ITS
- Specification of DATEX II-profiles for the German Mobility Data Market Place (MDM)
- Participation in technical DATEX development and maintenance (in Technical Management Group of EC Programme Support Action for DATEX II)
- Participation in the DATEX standardisation:
Editor of CEN/TS 16157 Part 6 (Parking Publications) and CEN/EN 16157 Part 7 (Common data elements)
- Member of CEN TC278 WG17 “Urban ITS”

DATEX II USER FORUM

24th May, 2018, Utrecht

INTRODUCTION

Sources

DATEX II Platform independent Model (PIM)

- ▣ Enterprise Architect format (.eap)
- ▣ HTML online browsing
- ▣ HTML offline ZIP

[http://d2docs.ndwcloud.nu/
downloads/modelv30.html](http://d2docs.ndwcloud.nu/downloads/modelv30.html)

Please note:

This is a temporary link, which already offers the Version 3.0 model. It will be shifted to a new DATEX II documentation URL soon.

Please further note:

Parking, VMS and RoadTrafficData are provided with their 2.3 data-model for convenience. Their structure will change due to the CEN standardisation schedule soon.

- ▣ Alternative online browser with very good search function (by TamTam research) - **ATTN: This is still version 2.3**

<http://datexbrowser.tamtamresearch.com>

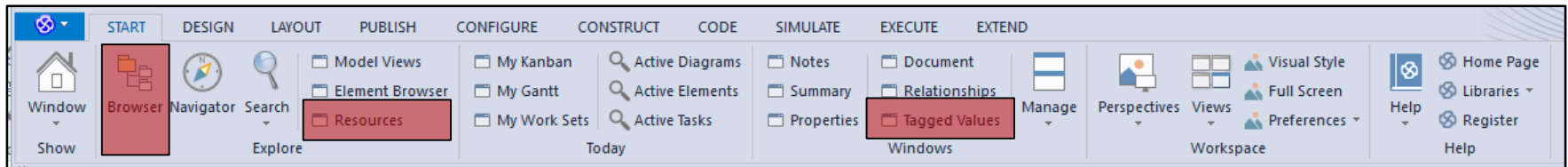
Enterprise Architect

- Inexpensive UML modelling tool used to view
- To obtain from Sparx Systems:
<http://www.sparxsystems.com/>
- There is also a free version (viewing only) available!

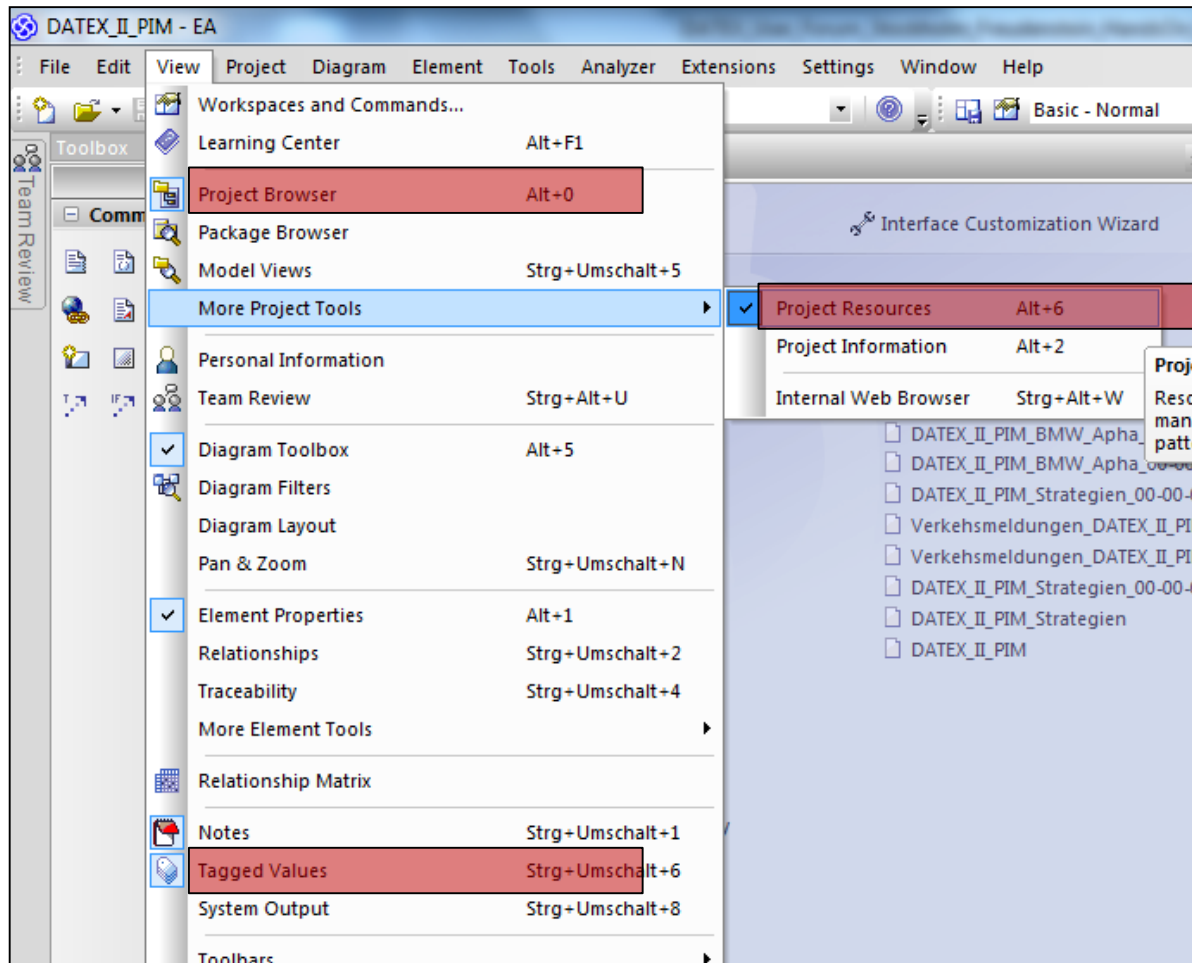


Settings in Enterprise Architect (version 13)

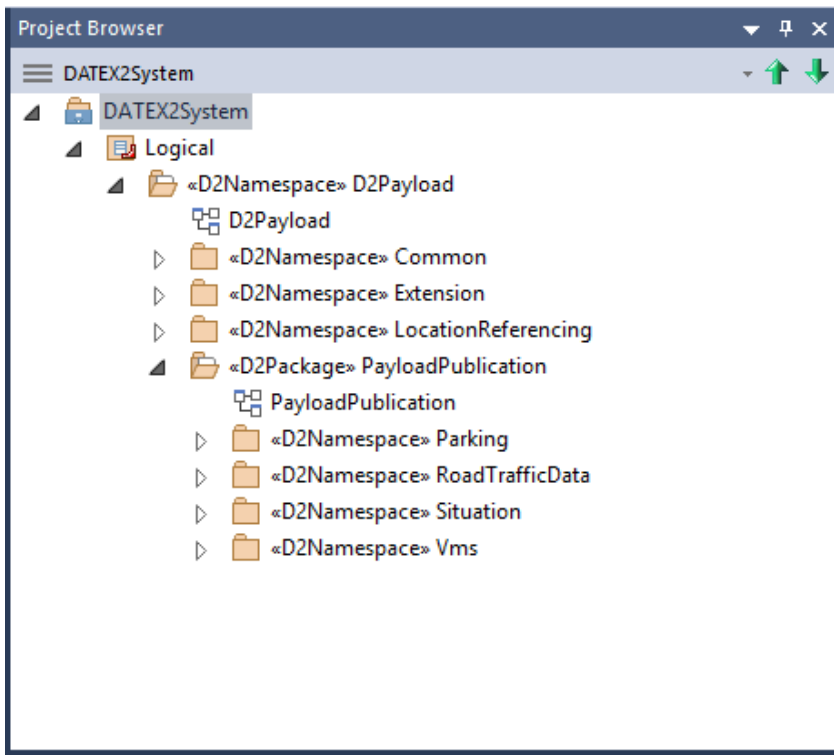
- The usage of at least these three panes is suggested:
 - ▣ Project-Browser
 - ▣ Resources
 - ▣ Tagged Values



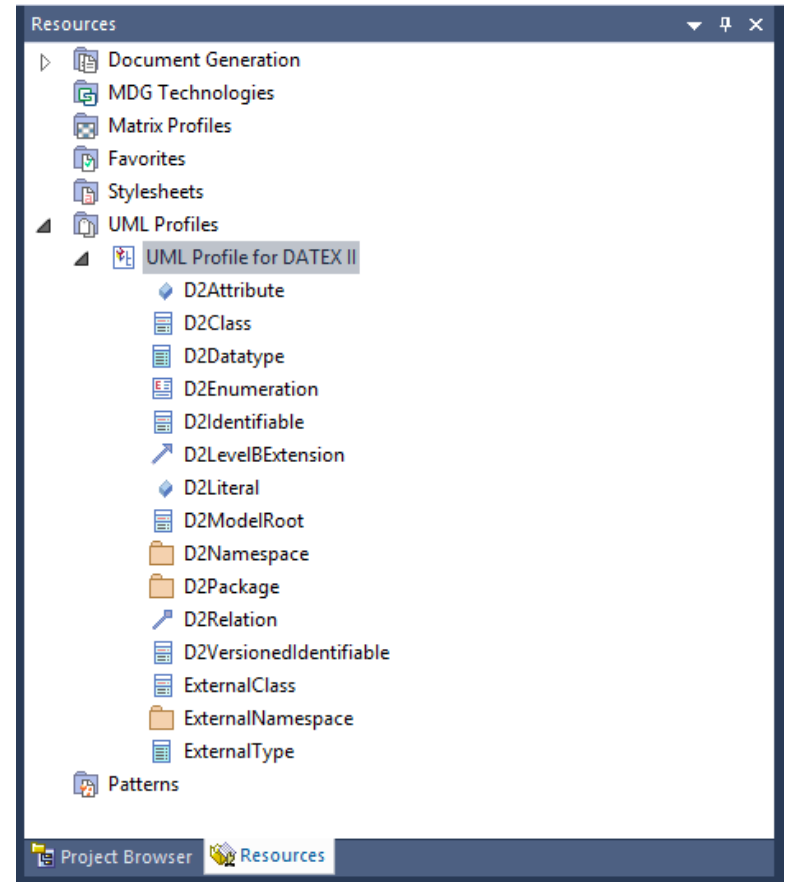
Settings in older versions of Enterprise Architect



Project Browser and Resources

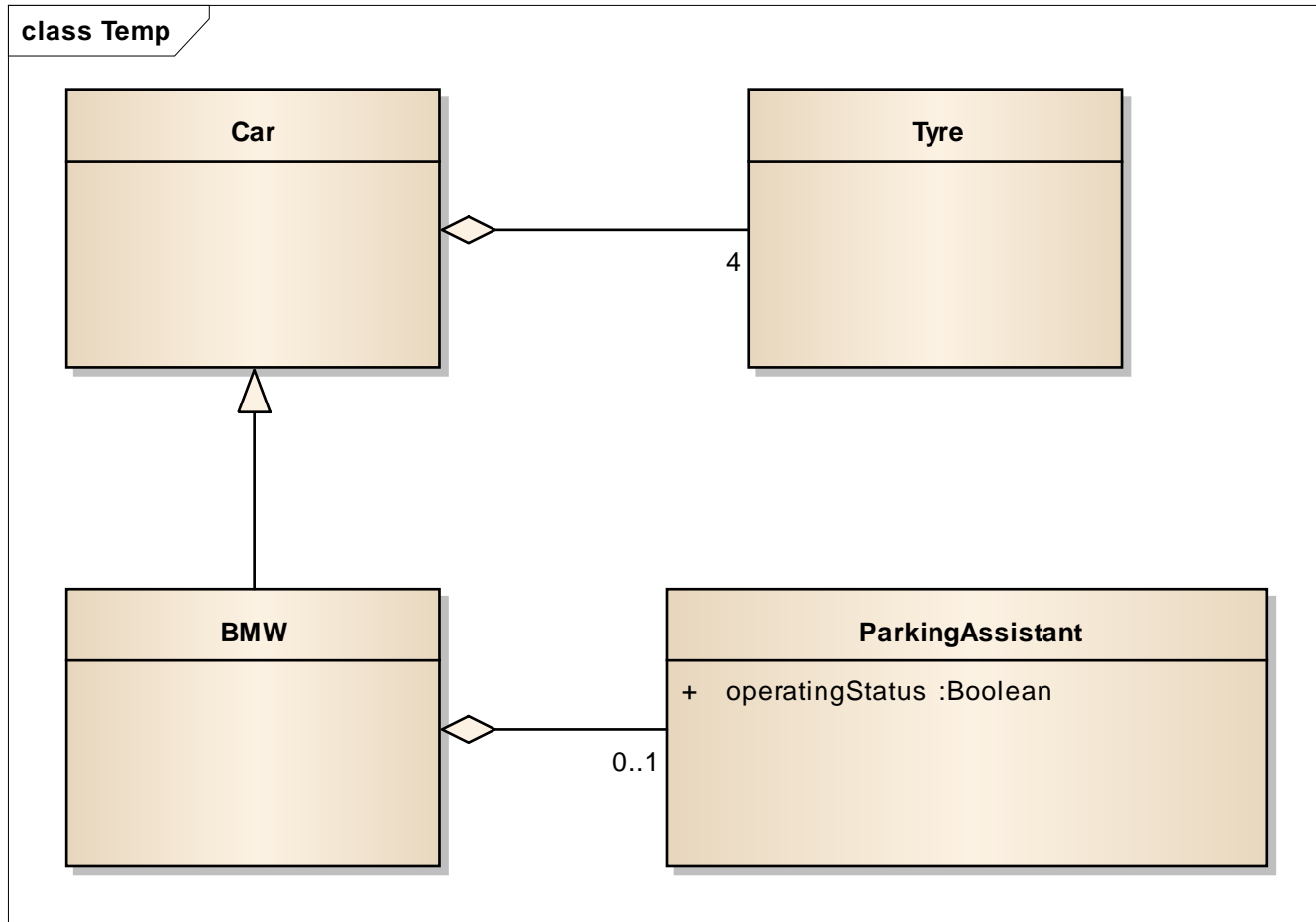


DATEX II
Version 3.0 data model



Special UML profile for DATEX for
the generation of preconfigured UML
elements

UML example



Data basis („the truth“)

- ▲ «D2Package» LocationReference
 - AreaLocation
 - LinearLocation
 - LocationReference
 - PointLocation
 - PointLocation
- ▷ «D2Package» AlertC
- ▷ «D2Package» Gml
- ▷ «D2Package» LinearReferencing
- ▷ «D2Package» OpenLR
- ▷ «D2Package» PointCoordinates
- ▷ «D2Package» SupplementaryPosit
- ▷ «D2Package» TpegLoc
- ▷ «D2Package» NamedArea
- ▷ «D2Class» AreaLocation
- ▷ «D2Class» LinearLocation
- ▷ «D2Class» PointLocation
- ▷ «D2Class» SingleRoadLinearLocati
- ▷ «D2Class» AreaDestination
- ▷ «D2Class» Destination
- ▷ «D2Class» ExternalReferencing
- ▷ «D2Class» Itinerary
- ▷ «D2Class» ItineraryByIndexedLocations

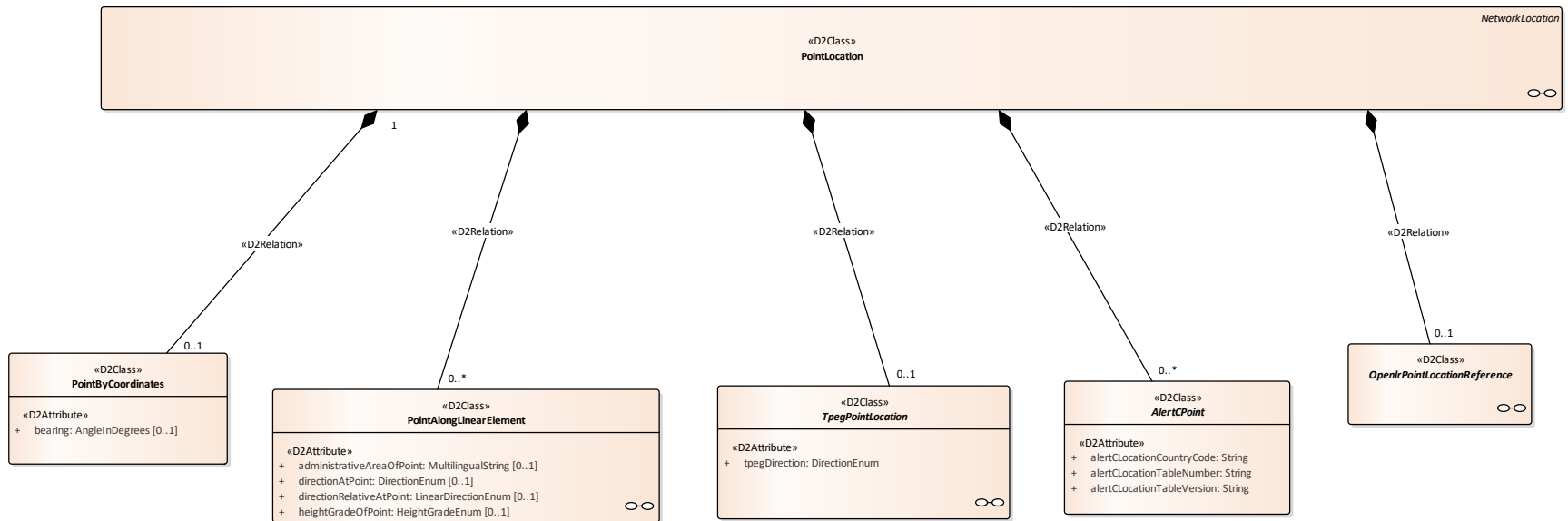
Elements in package

Connections / Relations

Class : PointLocation

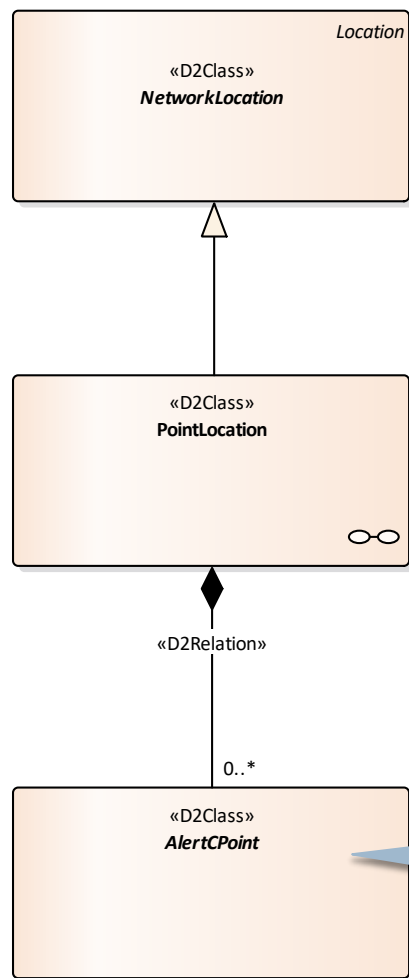
Element	Element St...	Type	Connection	Stereotype
AlertCPoint	D2Class	Class	Aggregation	D2Relation
NetworkLocation	D2Class	Class	Generalization	
OpenlrPointLocationReference	D2Class	Class	Aggregation	D2Relation
PointAlongLinearElement	D2Class	Class	Aggregation	D2Relation
PointByCoordinates	D2Class	Class	Aggregation	D2Relation
PointDestination	D2Class	Class	Aggregation	D2Relation
PointLocationForParking	D2Class	Class	Generalization	
TpegPointLocation	D2Class	Class	Aggregation	D2Relation

Different views on PointLocation



Class Point now called PointLocation

Different views on PointLocation



In this view, the possibility to express a point by coordinates is not shown, however, this is still a valid method.

A little awkward, because mandatory attributes are not shown. Anyway, it's not forbidden.

Tagged Values

Tagged values offer user-defined additional information and consist of a 'tag' and an associated 'value' element.

In terms of the DATEX methodology, the used tagged values are well defined in the Stereotype definitions.



Rootclass D2LogicalModel
now called PayloadPublication

UML Profile for DATEX II::D2ModelRoot (PayloadPublication)	
definition	A payload publication of traffic related inf...
extensionName	
extensionVersion	
modelBaseVersion	3
profileName	
profileVersion	
regulatoryContext	
rootElement	payload
version	3.0

Check on current
model version

Tagged Values (cont.)

Attribute (measurementOrCalculationPeriod)	
definition	The time elapsed between the beginning and the end of the sampling or measurement period.
order	0

Two important DATEX tagged values:

- **definition**
A definition for each component, attribute, literal and package.
It becomes part of the schema and can be visualized by software tools.
- **order**
An information for the relative position of this element within the schema.

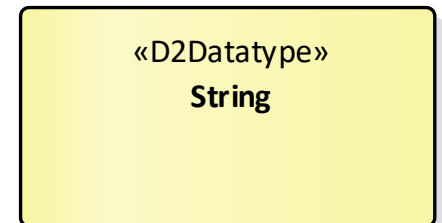
Data types

- All used (simple) data types are also realized in the form of DATEX components.

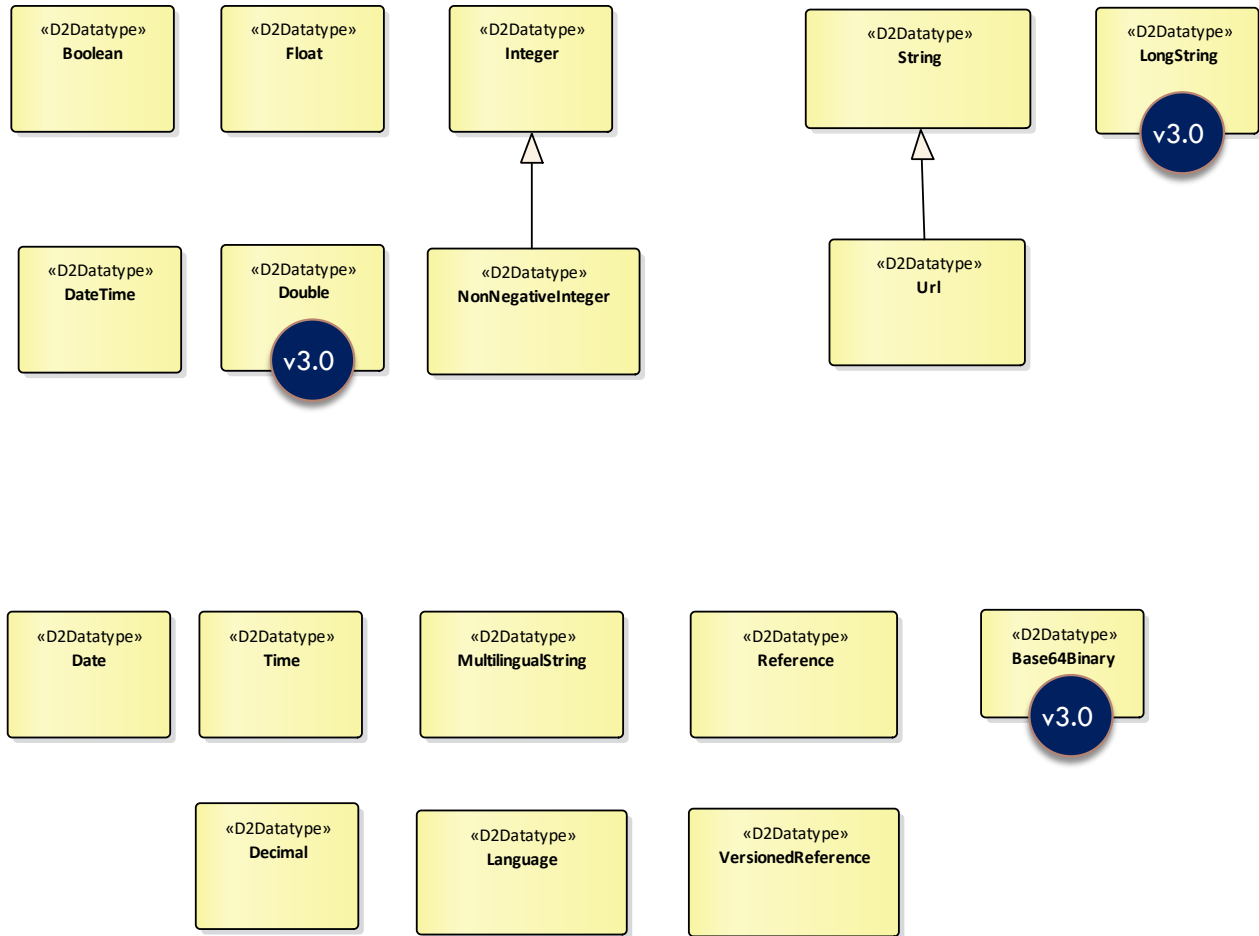
A distinction is made between generic and specific data types. The latter are derived from the generic types.

DATEX simple data types are mapped to the corresponding XSD simple types (using the tagged value 'schemaType').

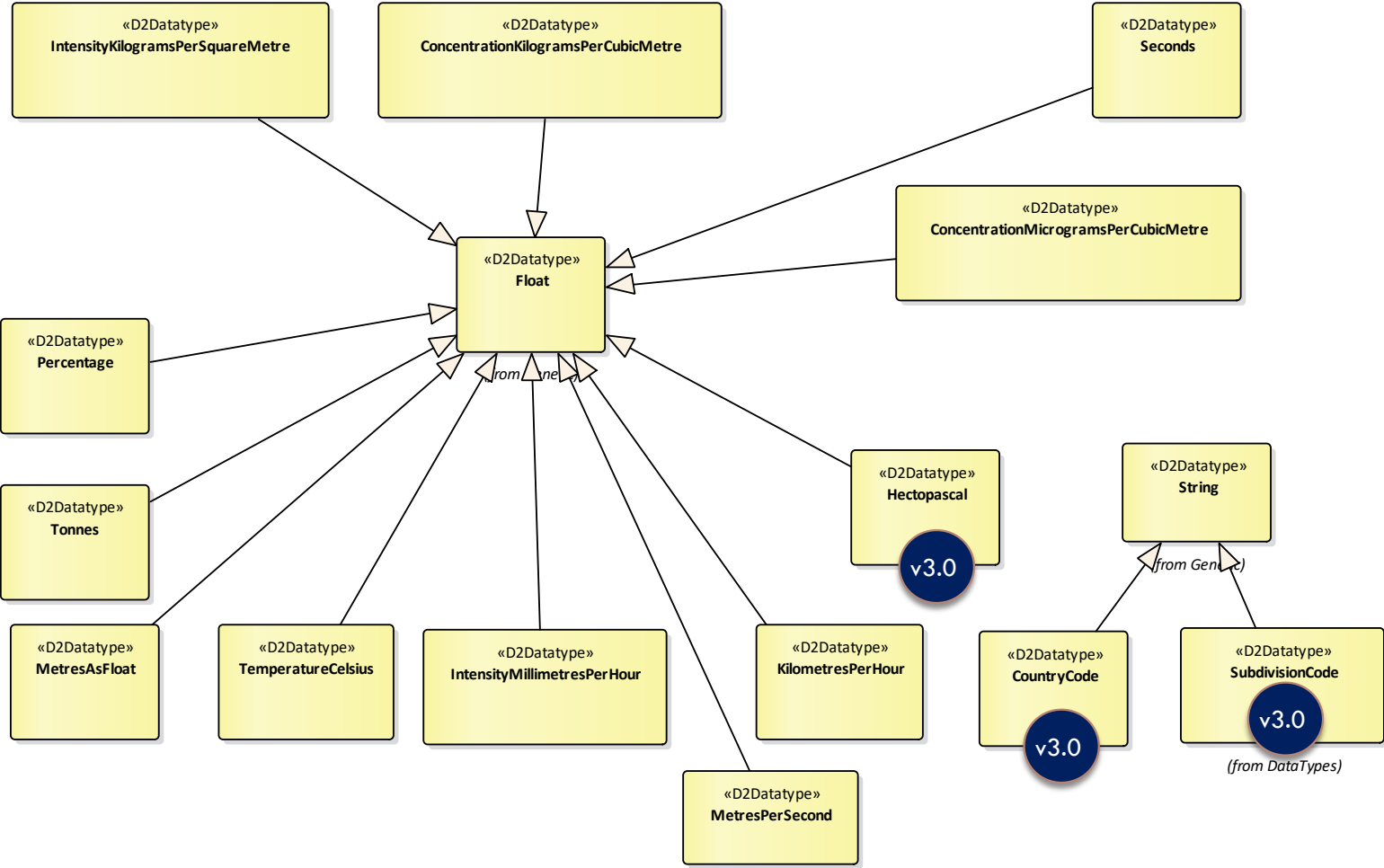
Property	Value
definition	A character string whose value space is the set of finite-length sequences of characters. E...
facets	<xs.maxLength value='1024'/>
regulatoryContext	
schemaType	string
schemaTypeInclude	



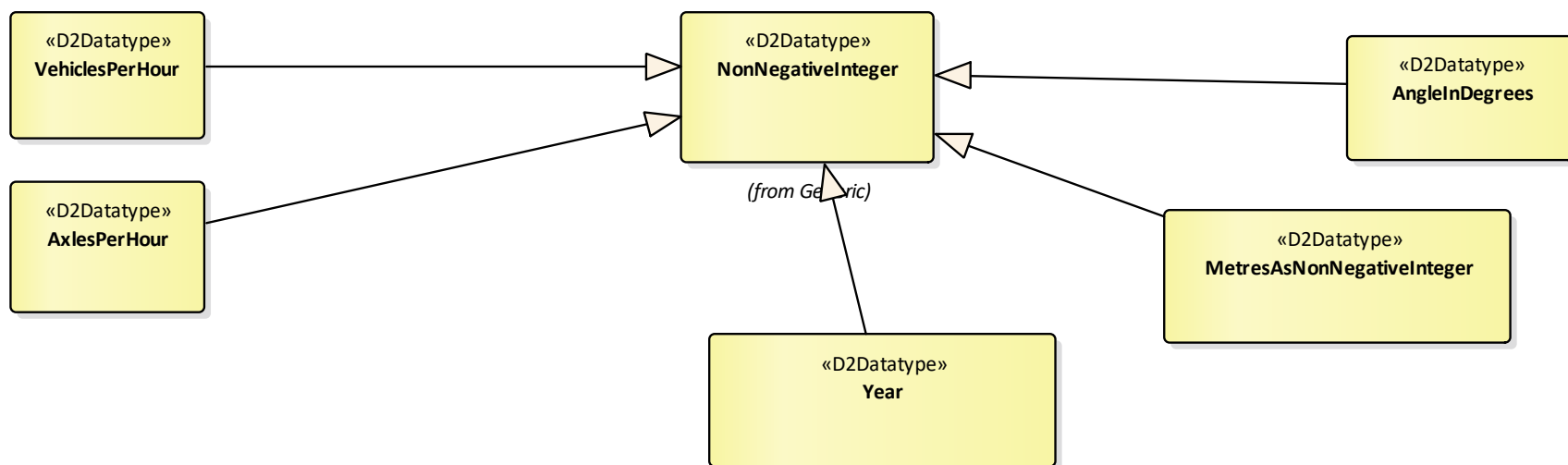
Data types (generic) in Common



Data types (specific I) in Common



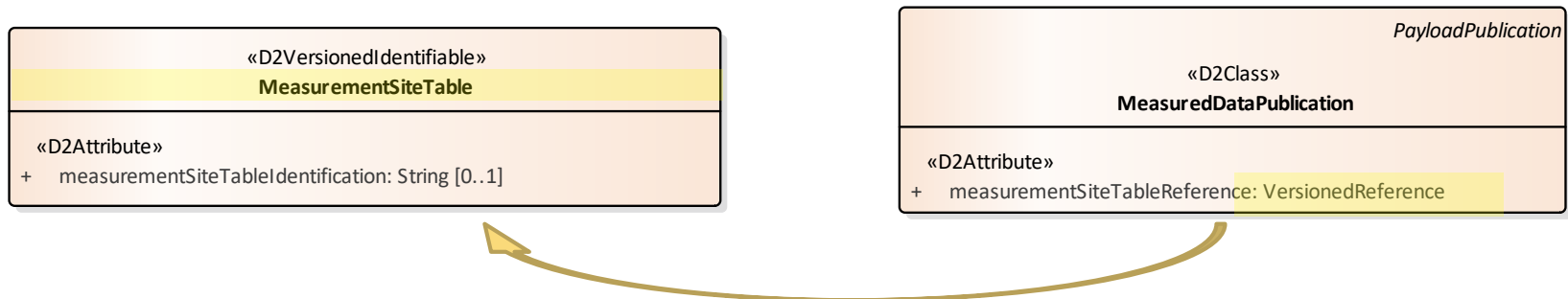
Data types (specific II) in Common



Note: These last three slides show the data types of Common. Other namespaces might have further specific datatypes, for example the LocationReferencing namespace.

References

- Using cross references as an alternative to direct aggregation or between different messages
- Example: Relationship between static data (e.g. infrastructure information) and dynamic data (e.g. high-frequency measurements)
- Identification by stereotype 'identifiable' (using an ID "unique in space and time")
- Reference with data type 'Reference'
- Different versions: Usage of 'D2VersionedIdentifiable' and 'VersionedReference'.



References in XML instance example

Definition of MeasurementSiteTable in static message:

```
<measurementSiteTable id="92126FC7-3D2E-4AAE-A1AC-FE33812D572F" version="1">
  <measurementSiteTableIdentification>Diebg12</measurementSiteTableIdentification>
  <measurementSiteRecord id="C69BE0FB-CA4C-43CE-A00F-9B3A77E5CB86" version="1">
    <measurementEquipmentTypeUsed>
```

Reference in dynamic message:

```
<payloadPublication xsi:type="MeasuredDataPublication" lang="de">
  <publicationTime>2012-08-14T09:00:01.0Z</publicationTime>
  <publicationCreator>
    <country>de</country>
    <nationalIdentifier>DE-MDM-xxxxxxx</nationalIdentifier>
  </publicationCreator>
  <measurementSiteTableReference targetClass="MeasurementSiteTable" id="92126FC7-3D2E-4AAE-A1AC-FE33812D572F" version="1"/>
  <headerInformation>
    <confidentiality>noRestriction</confidentiality>
    <informationStatus>test</informationStatus>
  </headerInformation>
```

a so called UUID was used (Universally Unique Identifier)

DATEX II USER FORUM

24th May, 2018, Utrecht

DATA MODEL LEVEL A

**NOTE: THIS PRESENTATION CANNOT COVER THE COMPLETE MODEL,
BUT ONLY SELECTED PARTS OF IT.**

DATEX data model ,interoperability levels'

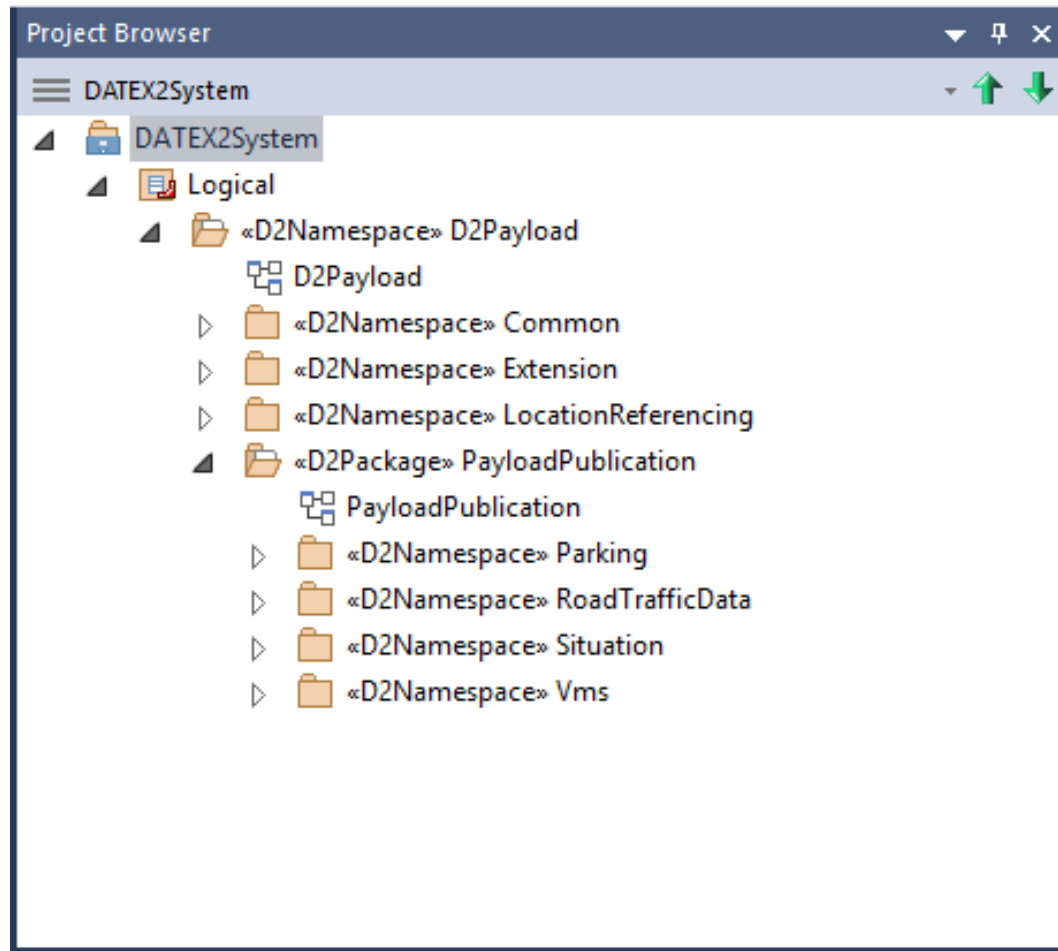
- **Level A**
 - ,Existing' data model
 - Data catalogue, ontology, data registry,
 - The Level A model is 'fix' and can only be adjusted within new DATEX versions, but not in general (but see also profile creation)
- **Level B**
 - Backward compatible extension/amendment to Level A
- **Level C**
 - Completely independent, no longer to Level A compatible scheme which corresponds to the DATEX methodology anyway.

v2.3

v3.0

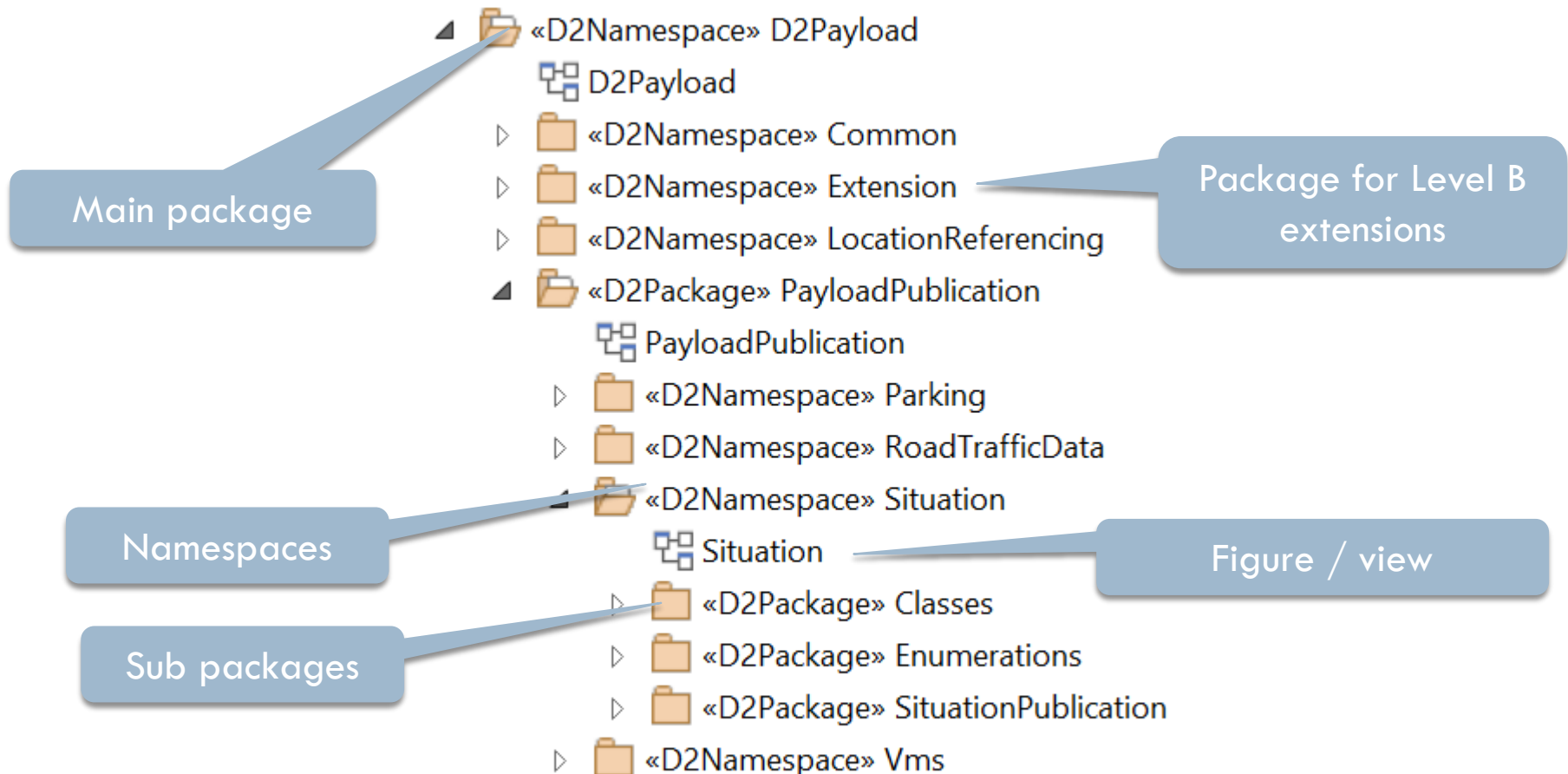
This slide shows previous level-categorisation. In Version 3.0, levels will be more detailed

DATEX Data model Level A



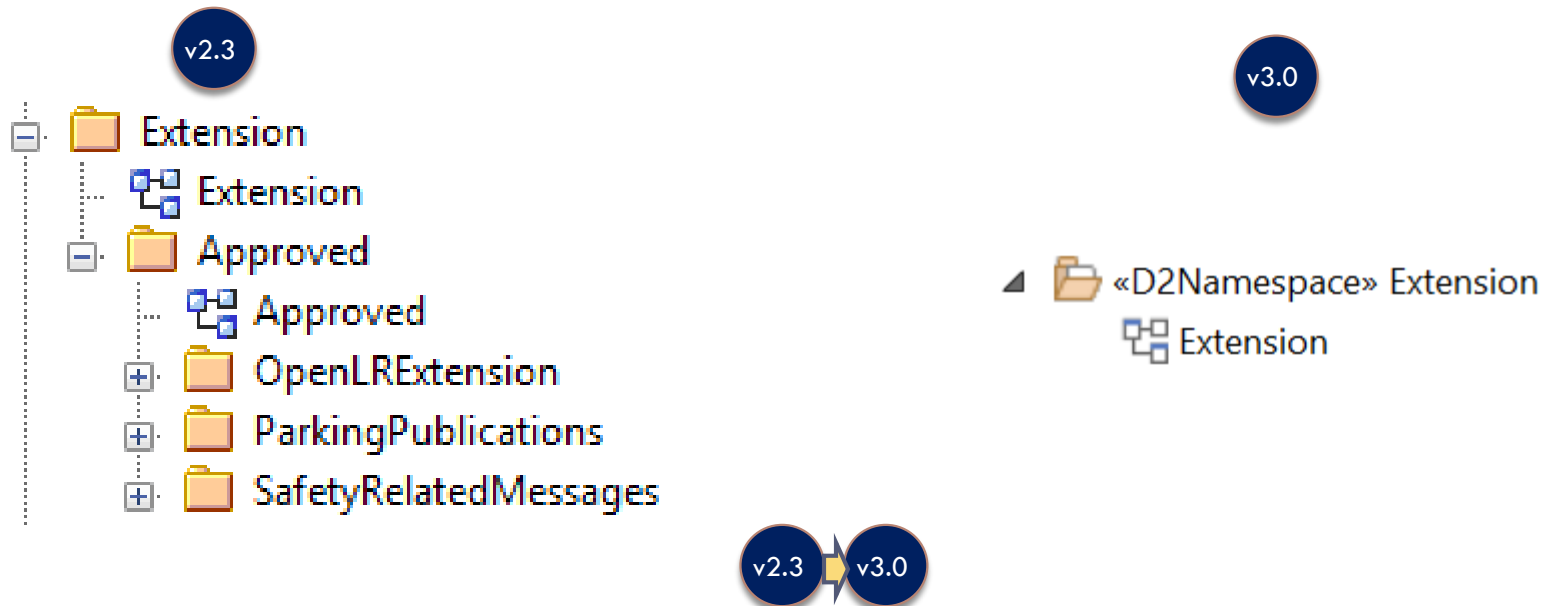
DATEX Data model Level A

Tree structure of Enterprise Architect Project Browser:



Packages: Extension

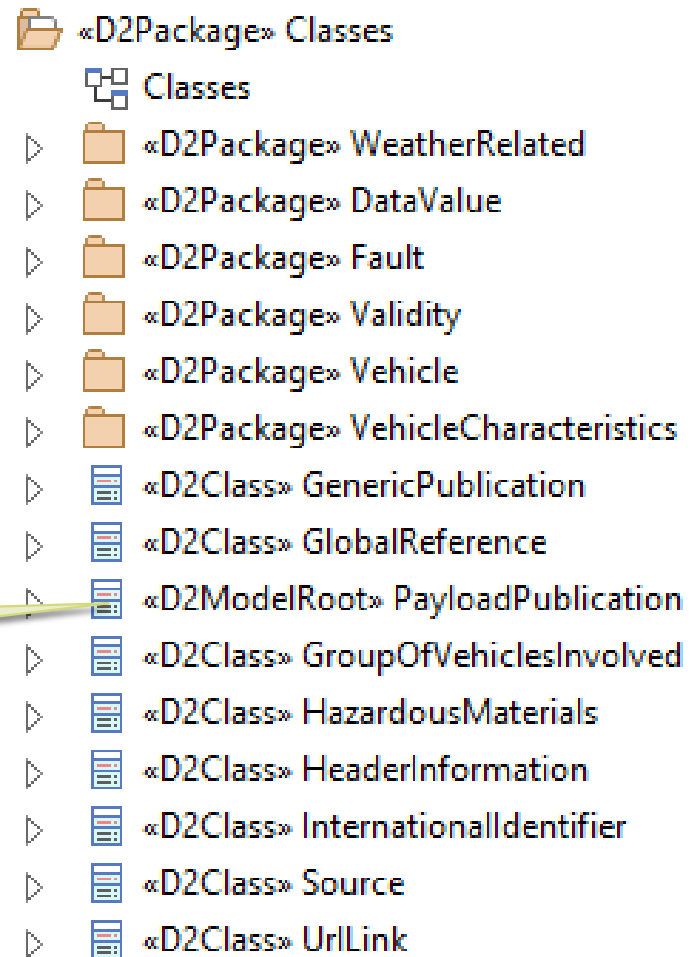
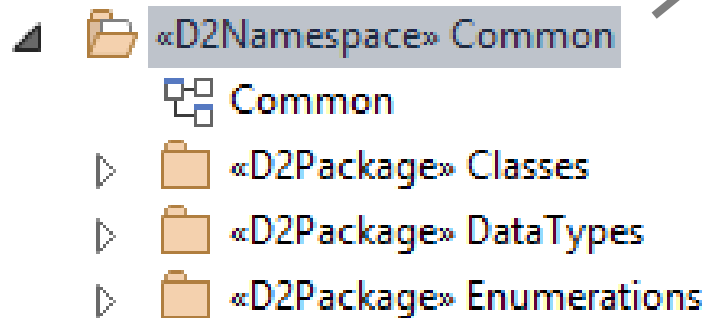
- reserved space for customized Level B extensions



The „Approved Extensions“ from version 2.3 have been incorporated into the model and are no longer in the Extension package. This is now empty by default.

Package / Namespace: Common

Common contains elements that are used in several (other) namespaces

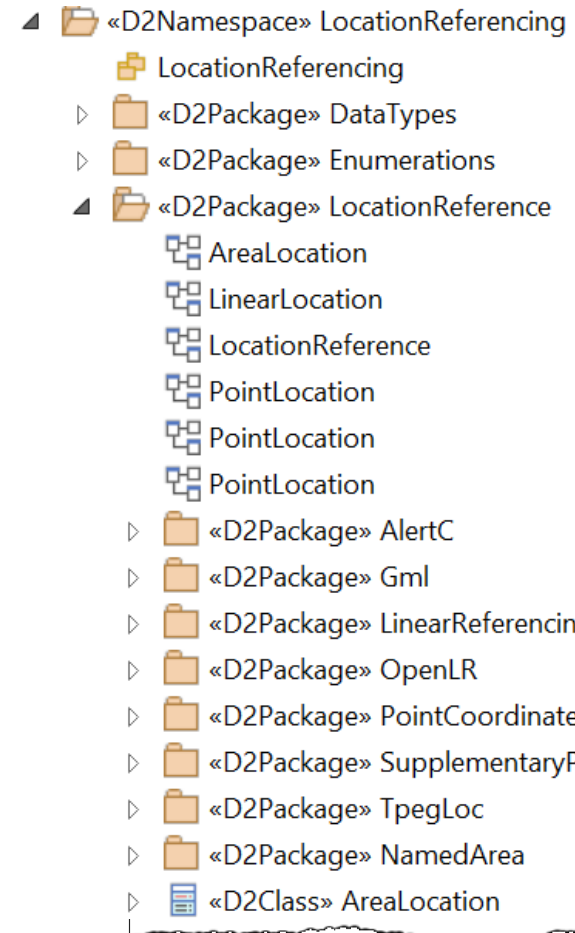


Model root class

Plus 36 Data Types
and 34 Enumerations

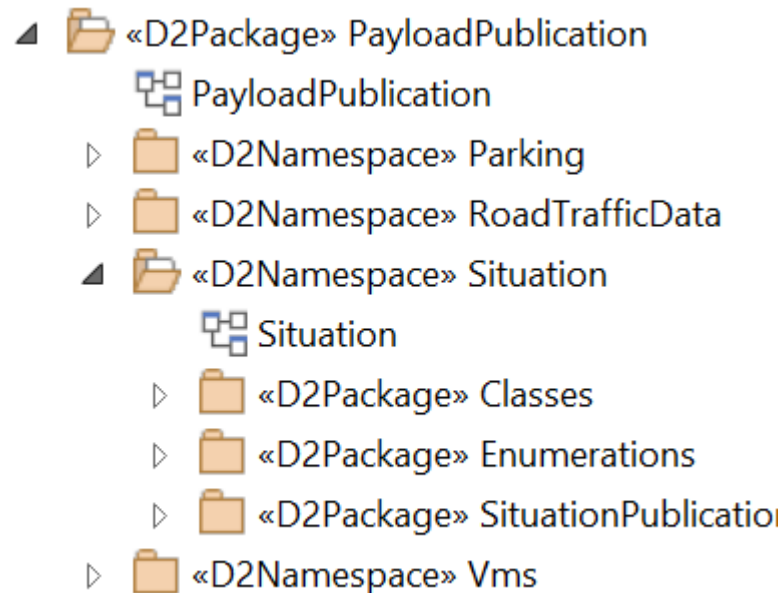
Package / Namespace: LocationReferencing

All elements used for Geo-
and Location Referencing.
This includes some data types
and enumerations, as well.



Packages: PayloadPublication

The main payload packages for different types of messages.



DATEX II objects

Basic objects (only dynamic)

Elaborated Data

Traffic Elements

Congestion, Accident...

Operator Actions

Network Mngmt, Roadworks...

Basic objects (static and dynamic part)

Measurements

Variable Message Signs

Parking

Additional objects

Location Referencing
Area, Point, Linear

ALERT-C, ISO 19148, Coordinates,
TPEG-LOC, OpenLR, GML-Linestring

Predefined Locations
Additional Positional Descriptions

Validity

Comments, URL, ...

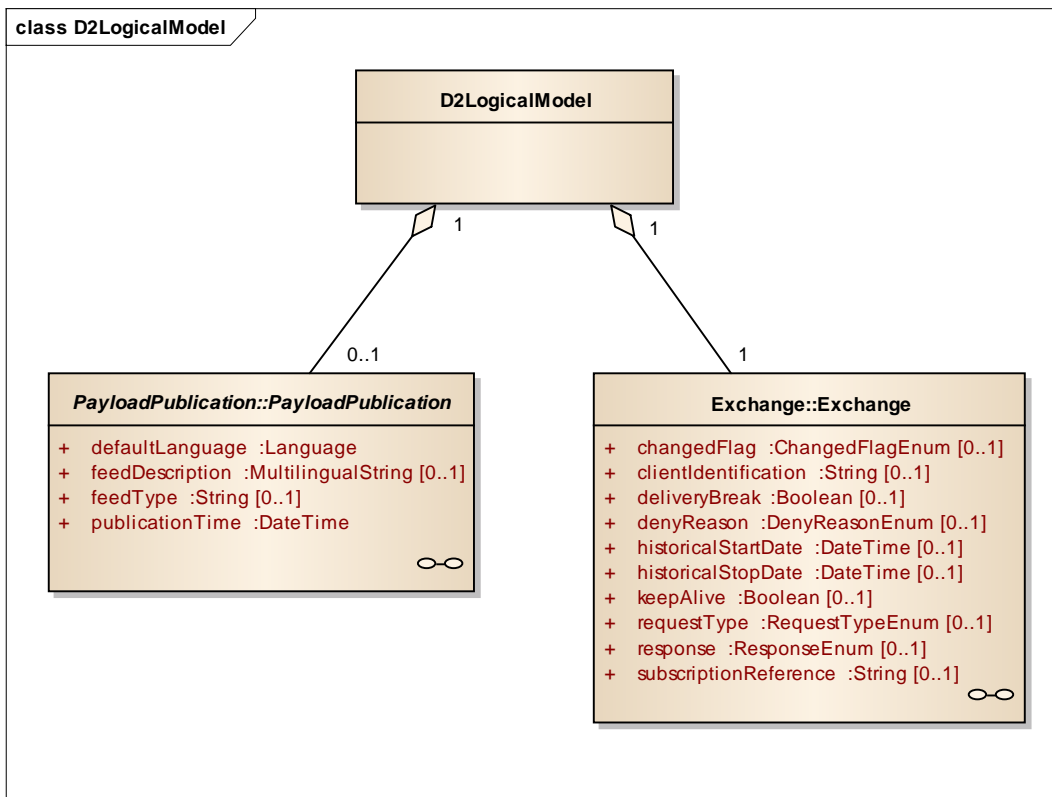
Impact, Source, Causes

Data Quality and Faults

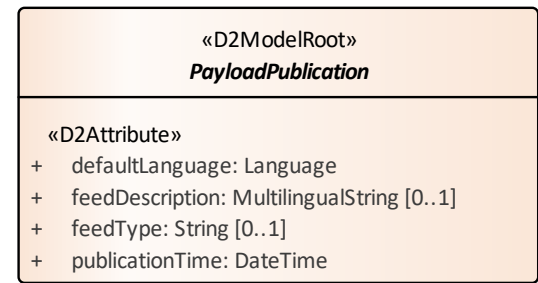
v3.0

Access to the model

v2.3



v3.0

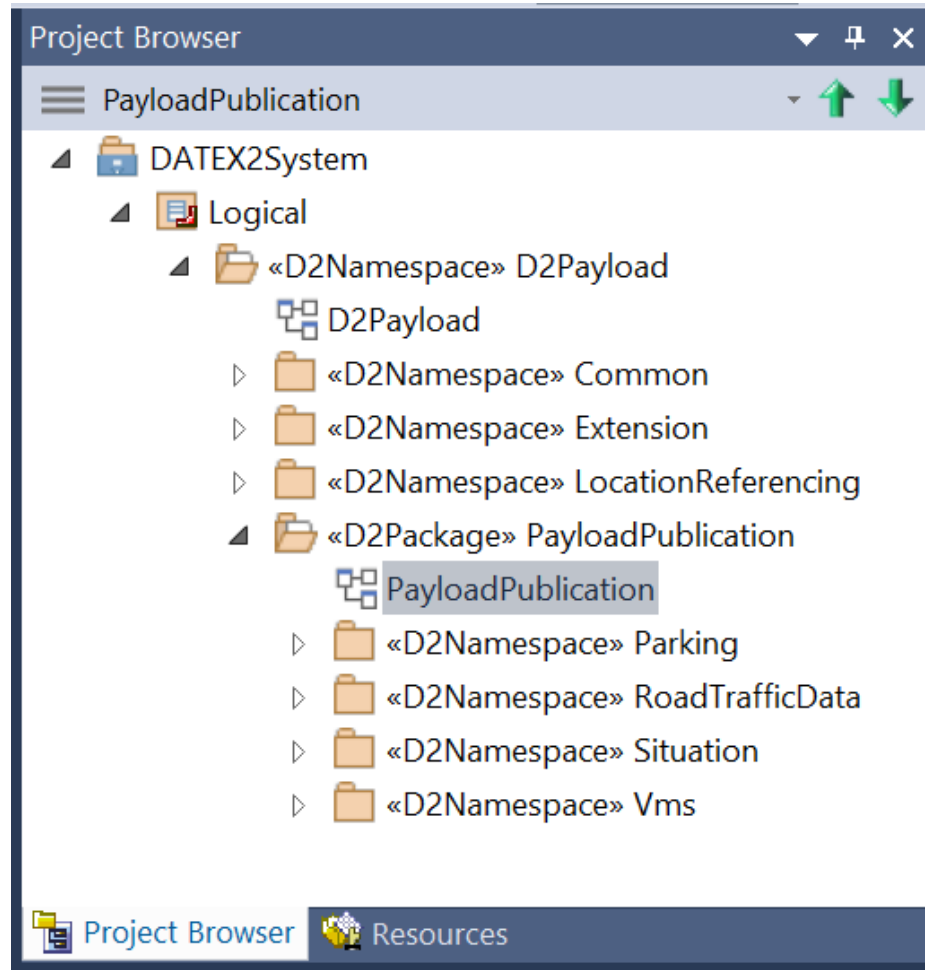


v2.3

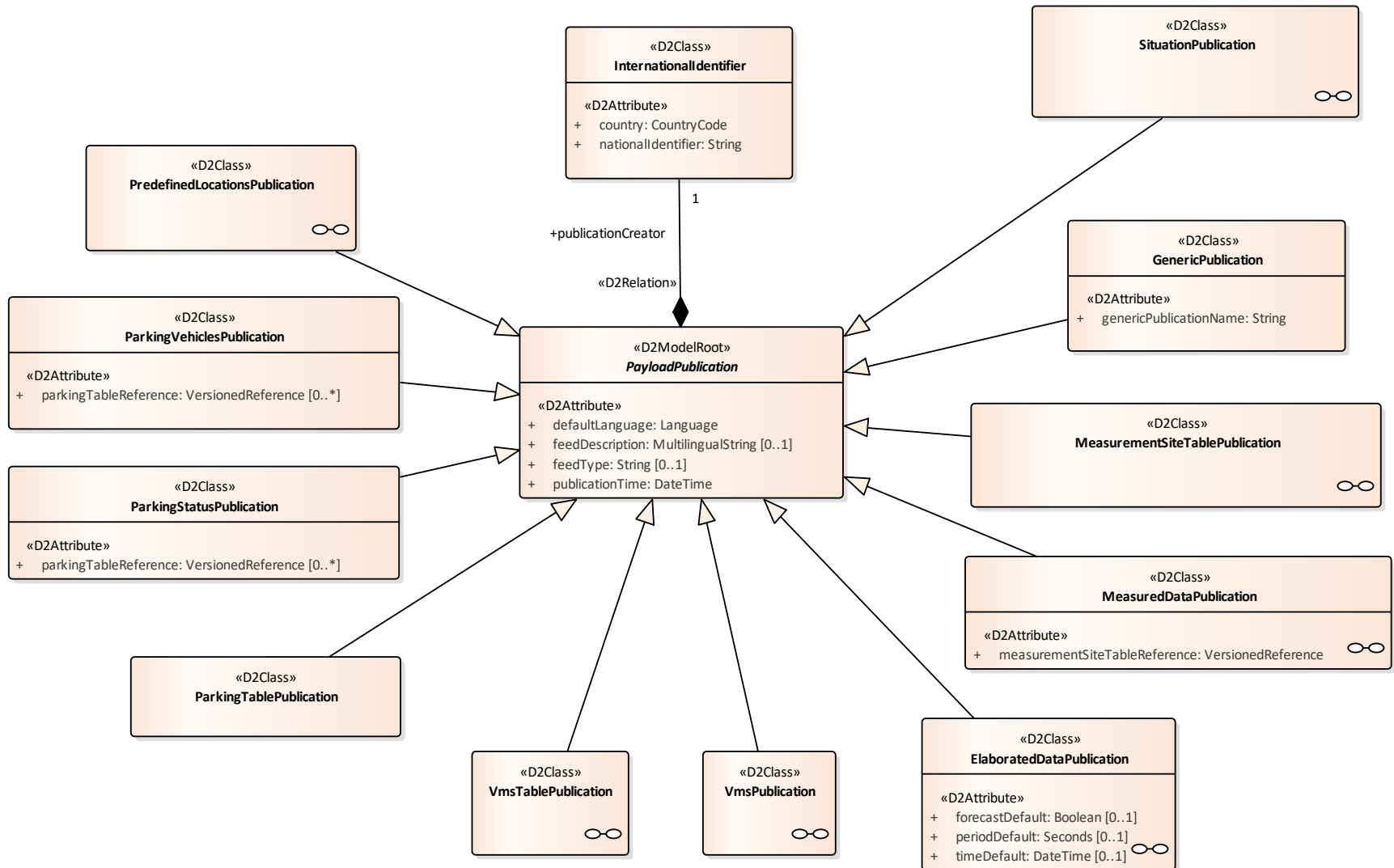
v3.0

The „D2LogicalModel“ level has been omitted: PayloadPublication is the root class now. “Exchange” has been omitted from the content model.

Where to find?

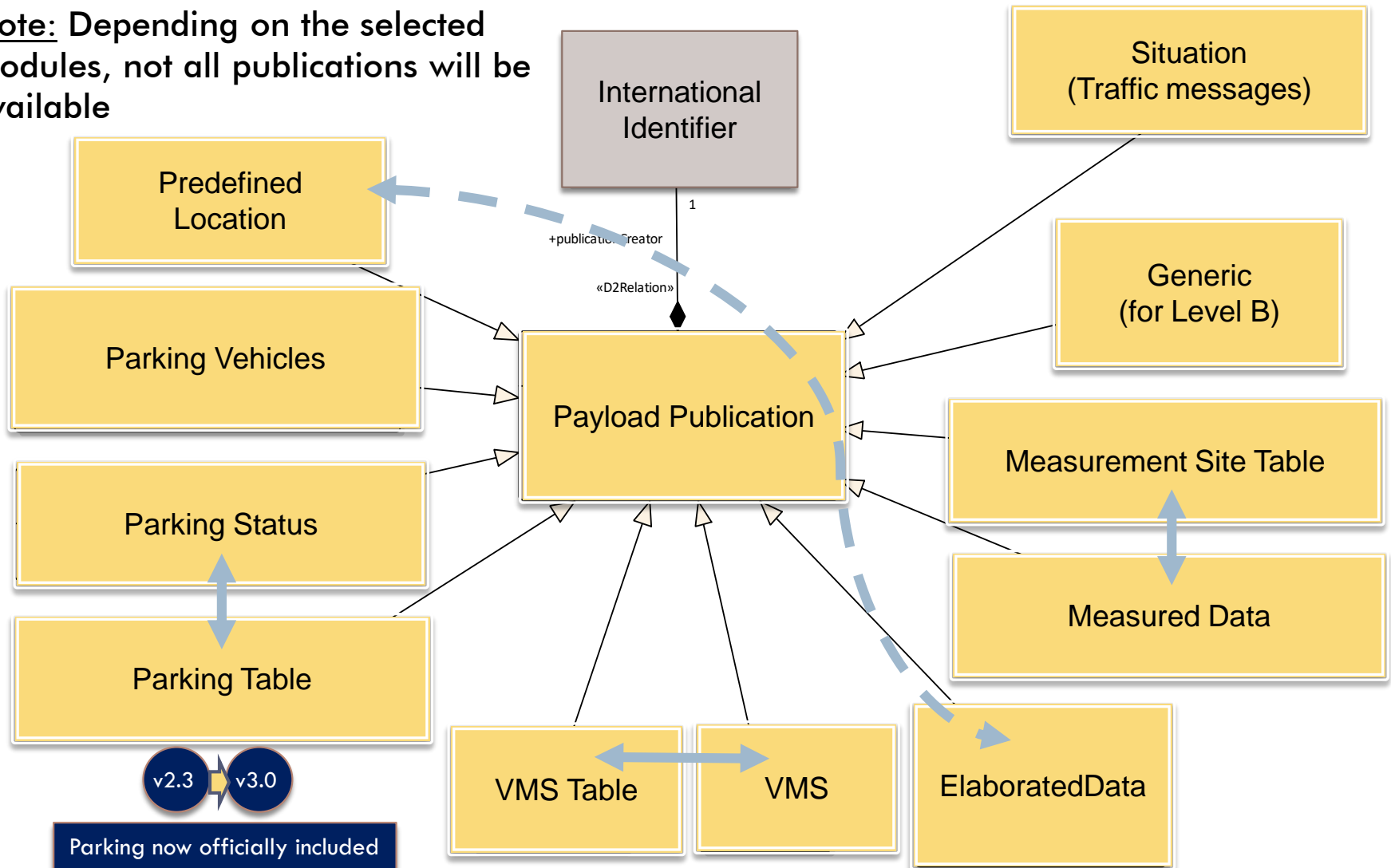


PayloadPublication



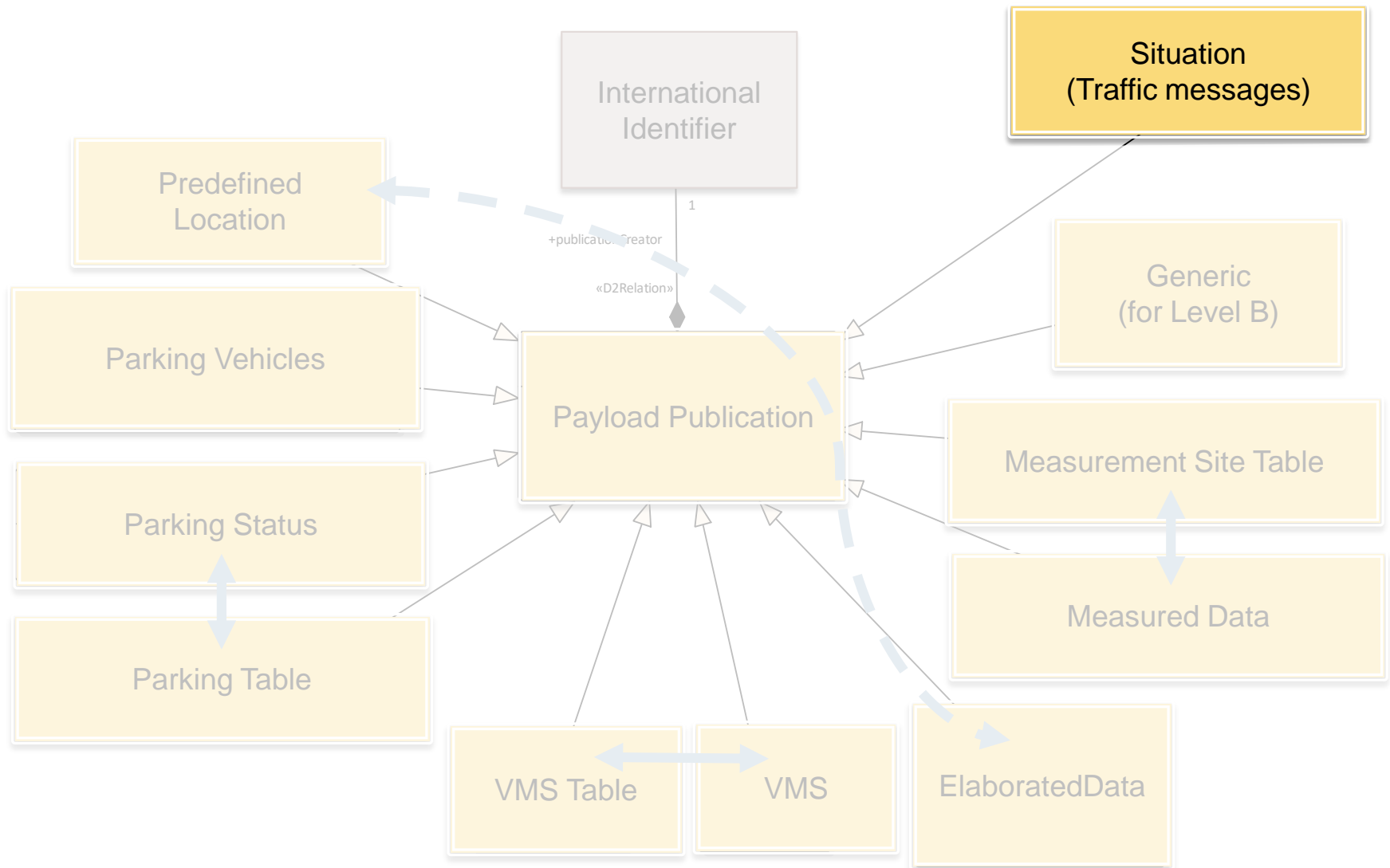
PayloadPublication

Note: Depending on the selected modules, not all publications will be available

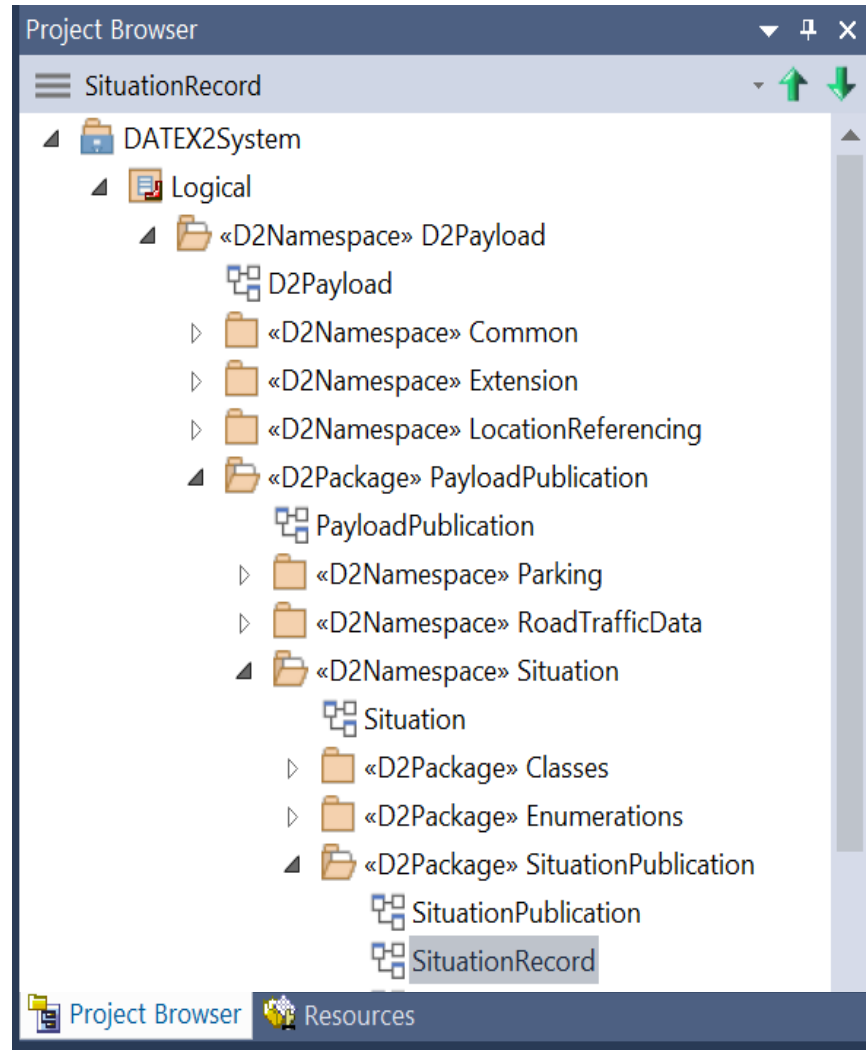


**DETAILED EXAMPLE:
SITUATION PUBLICATION
(TRAFFIC MESSAGES)**

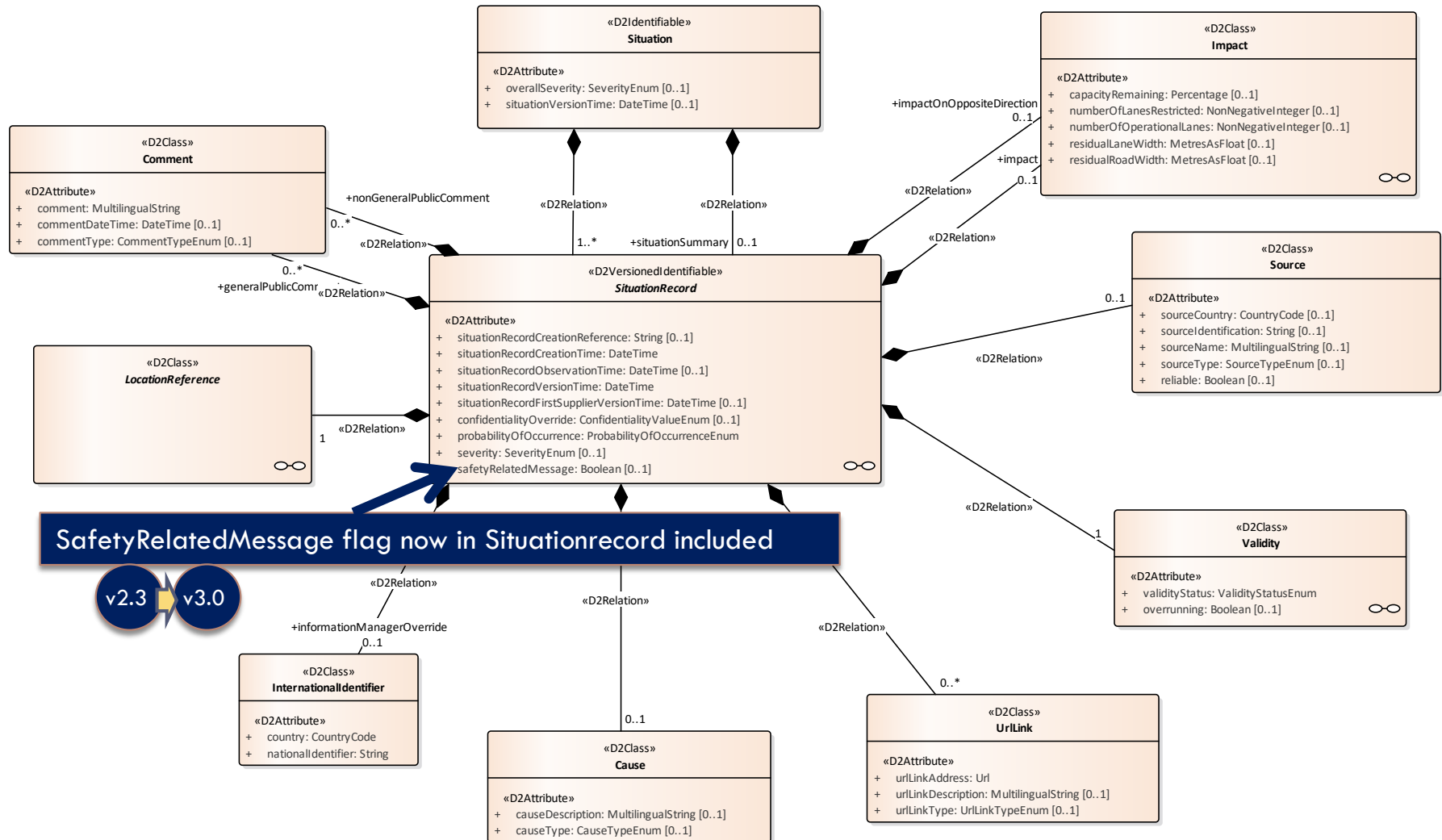
Situation (Traffic Messages)



Where to find?

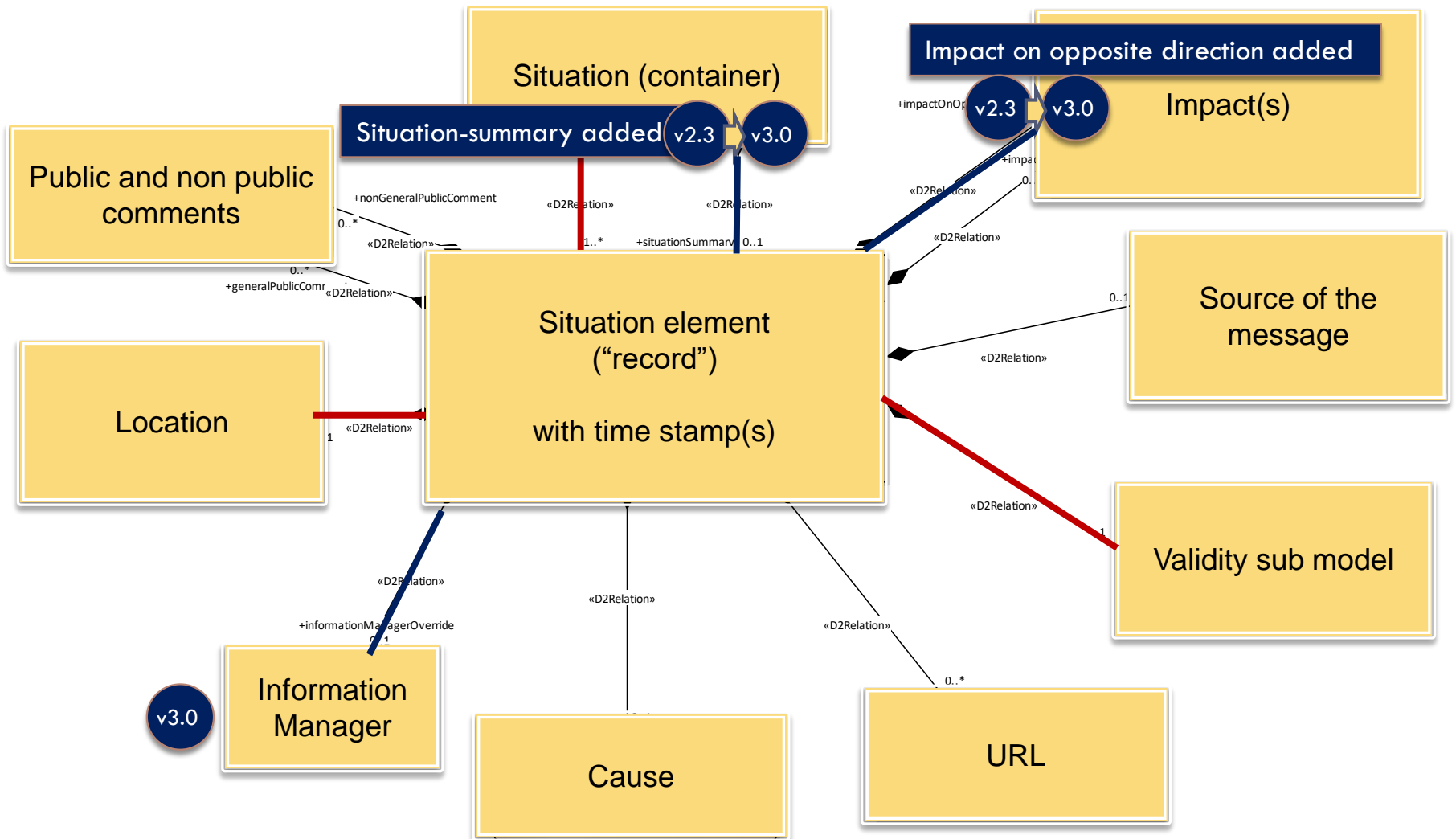


Message type „Situation“

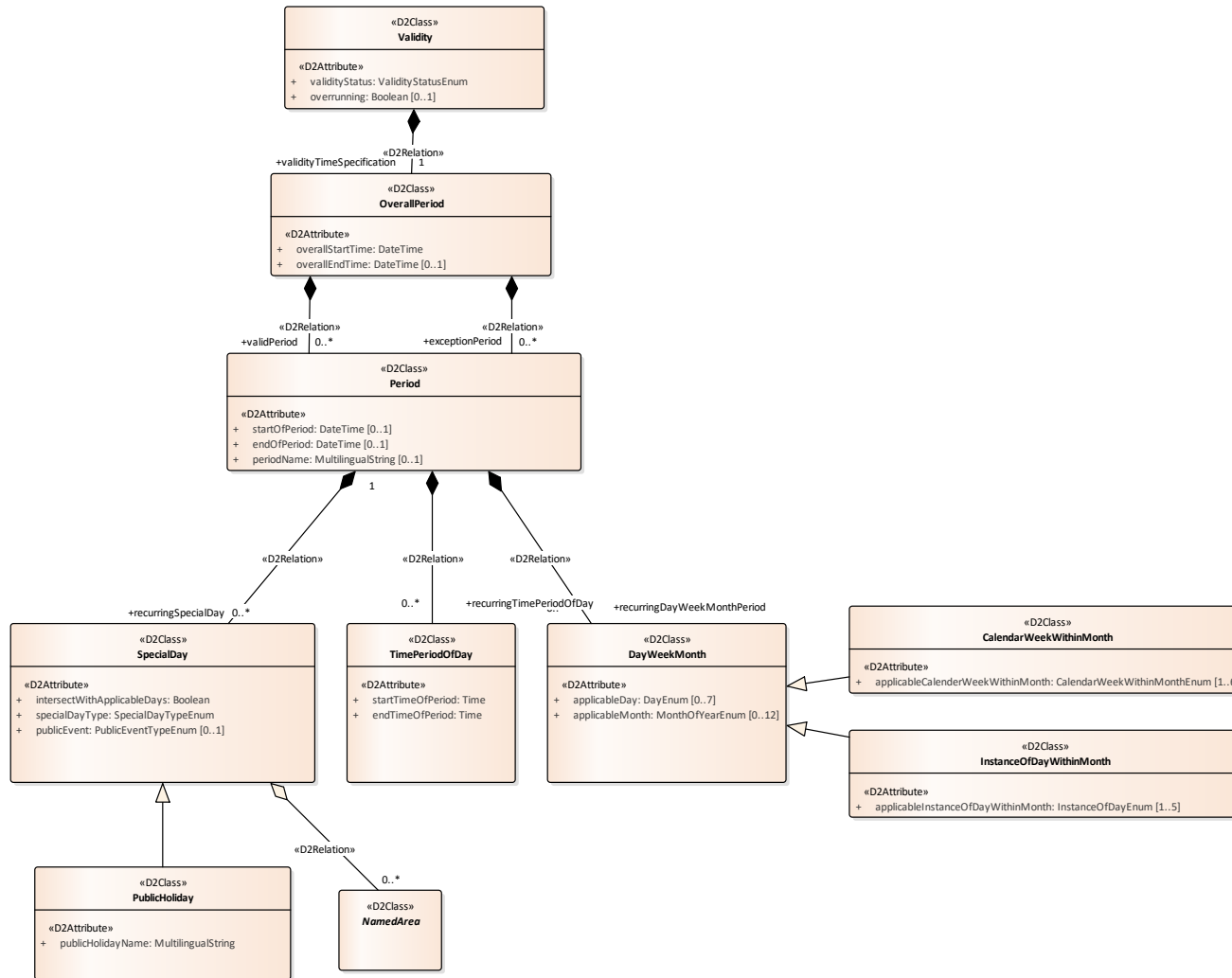


Message type „Situation“

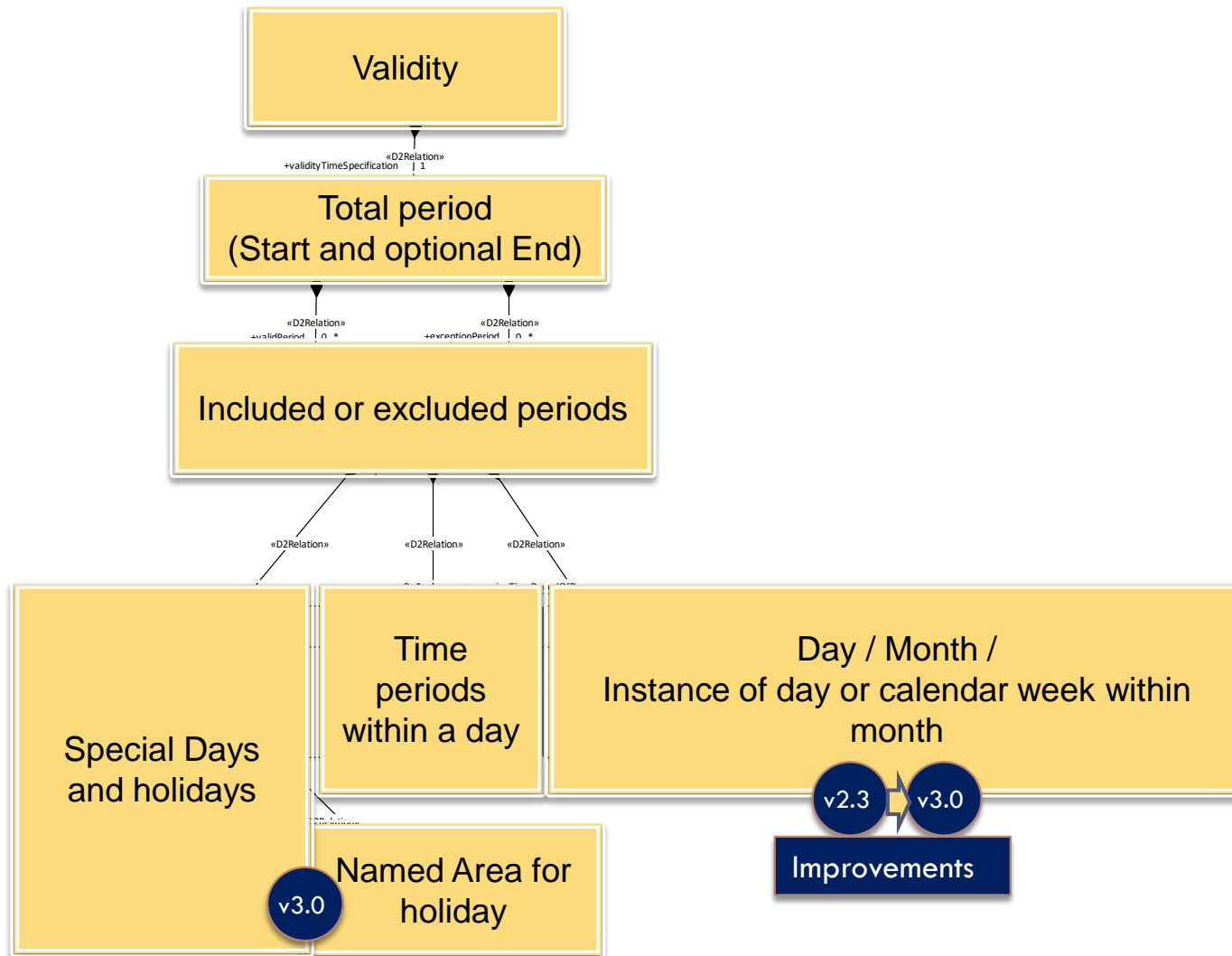
— mandatory link



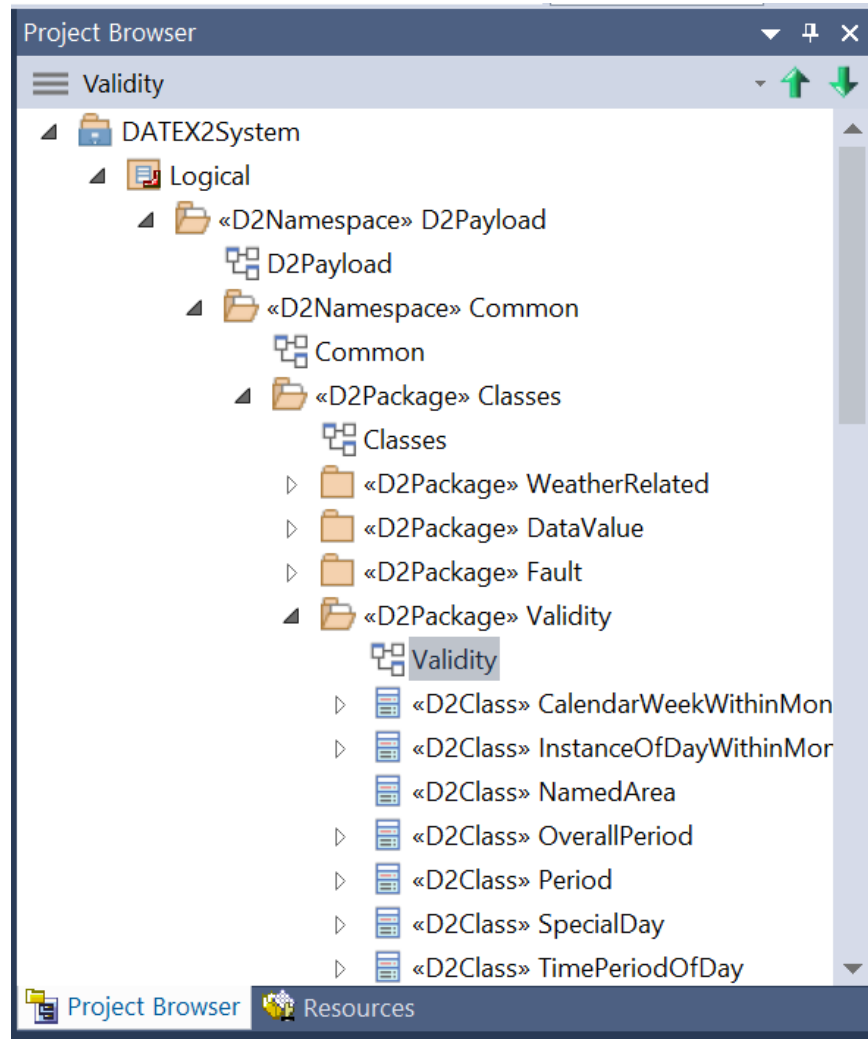
Validity model



Validity model



Where to find?



Validity model

The validity results from the intersection of

- Overall period
- Union of all other specified periods
- Complement of the union of all exclusion periods

All periods can be defined on date, times, days of the week etc..

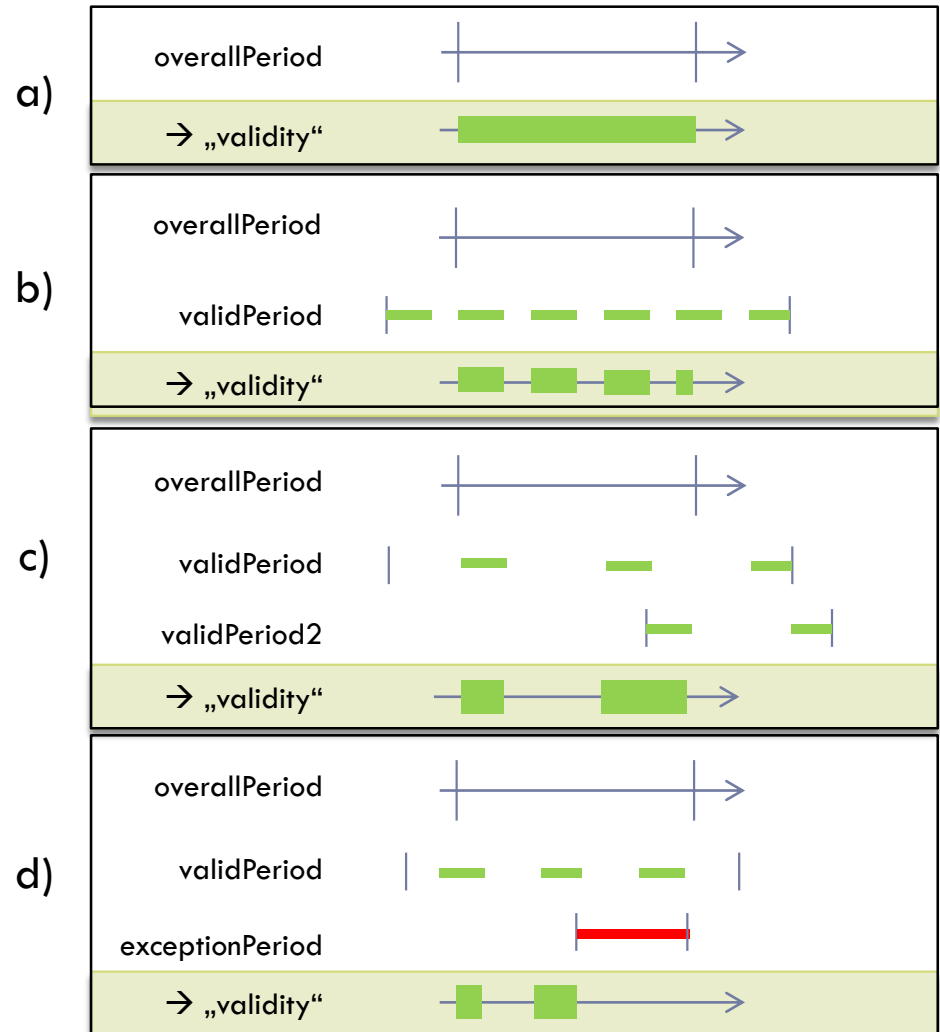
example:

Every 1st Monday of the month from 15-18 clock from April 1 to May 30 except May 1

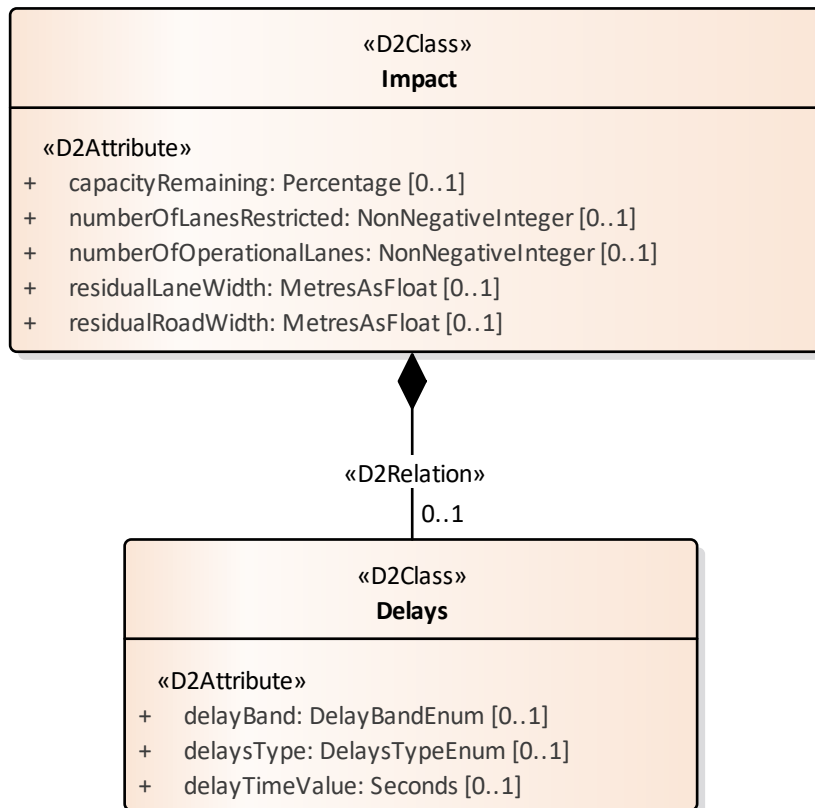
The specification of validity is particularly interesting for planned road works or closures.

The model can also be used for opening times (for example, gas stations or parking facilities).

For traffic information usually only the start time is indicated (even the end time is already optional).



Impact



- Remaining capacity
- Number of restricted lanes
- Residual lane and road width
- Delay information

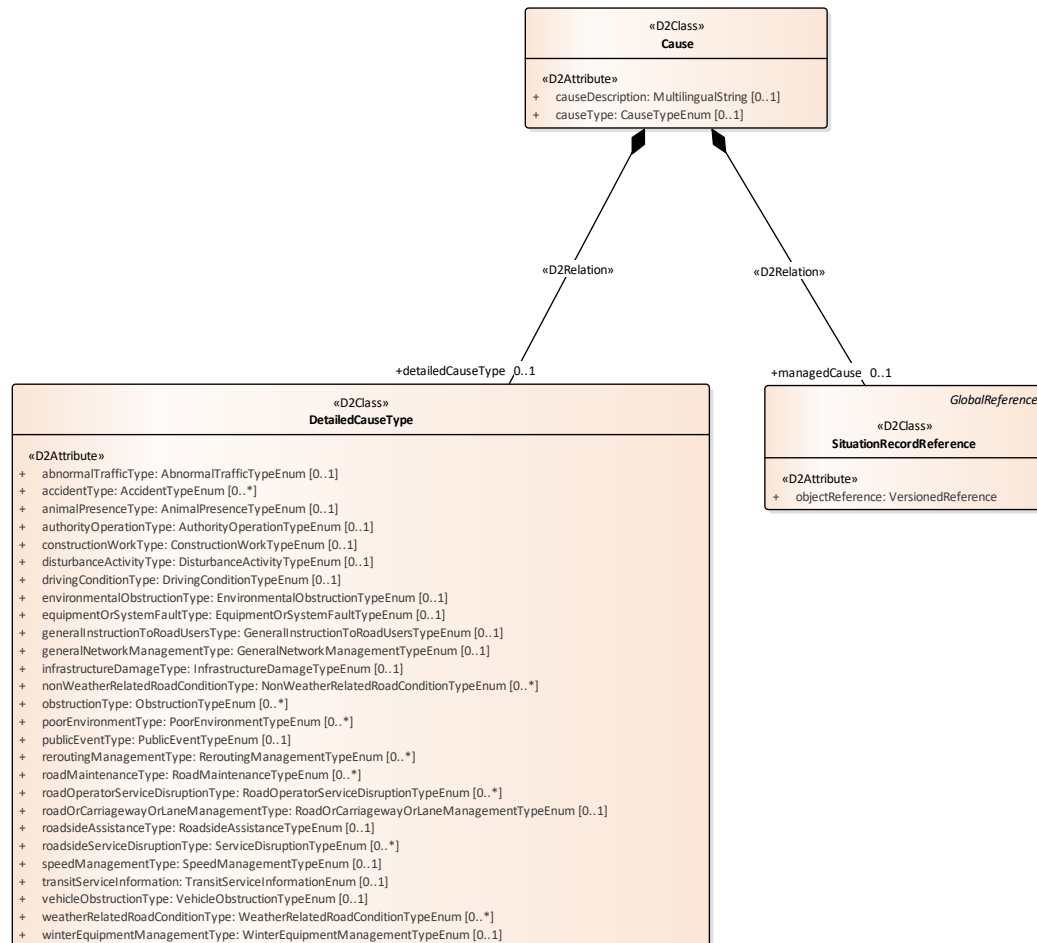


Original number of lanes moved into location info

Traffic constriction type moved into traffic information

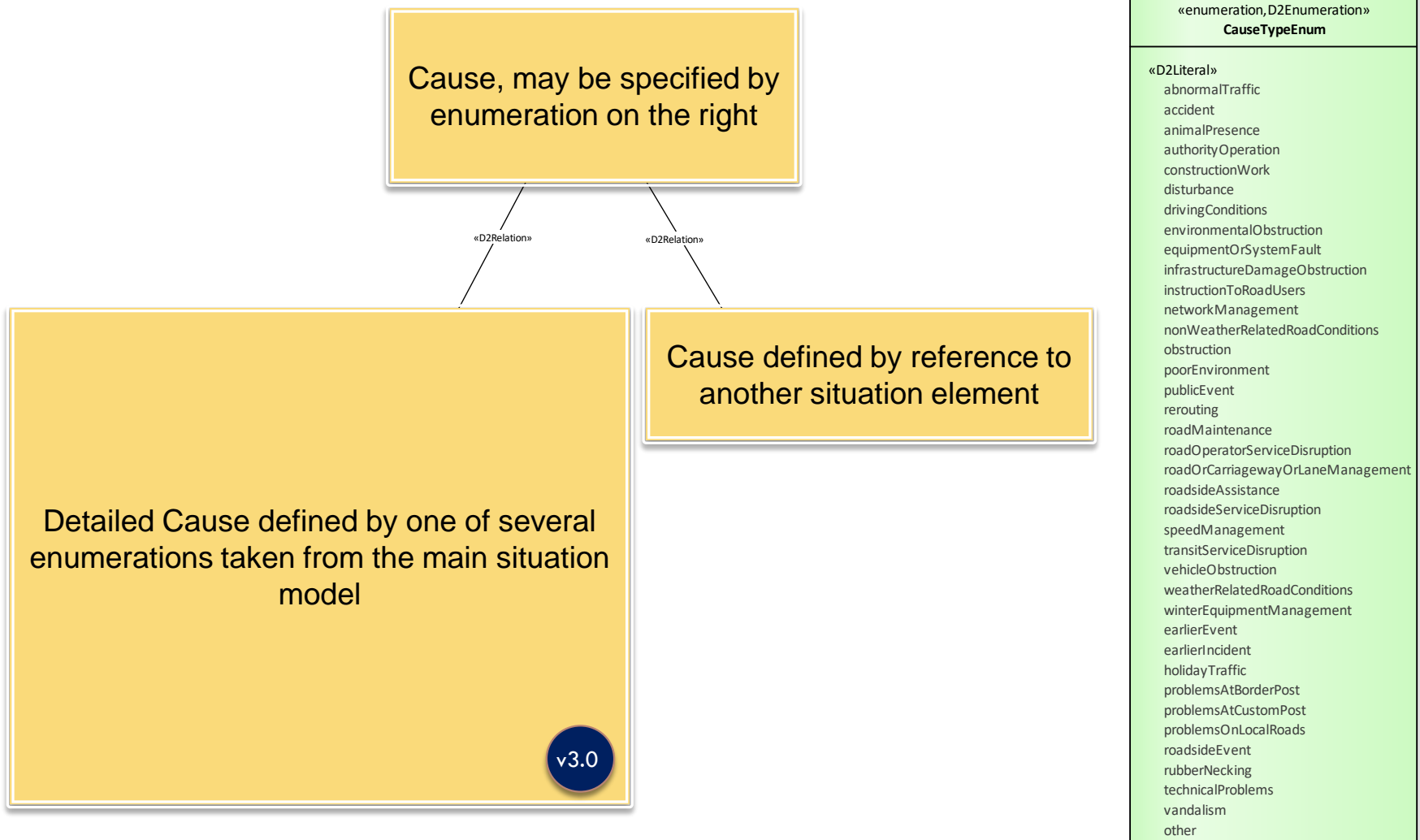
residualLaneWidth added

Cause

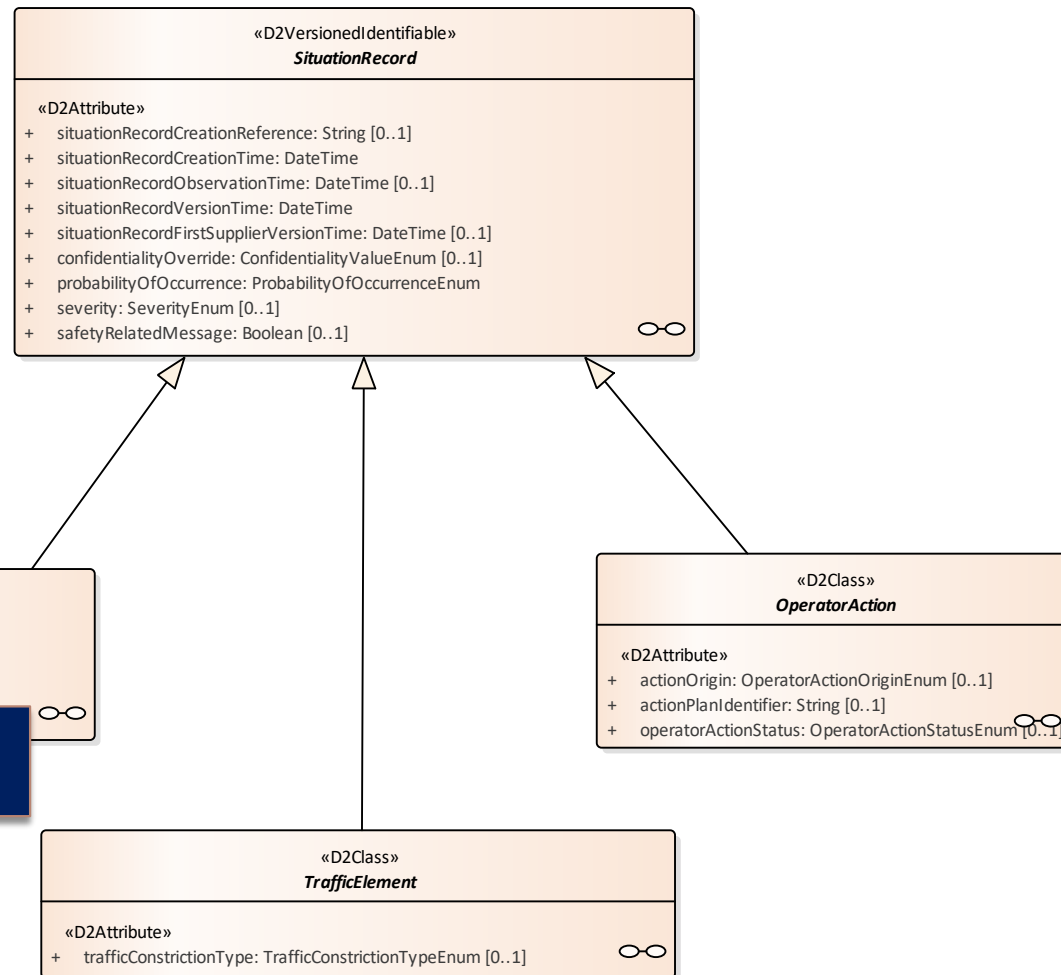


«enumeration, D2Enumeration» CauseTypeEnum
«D2Literal»
abnormalTraffic
accident
animalPresence
authorityOperation
constructionWork
disturbance
drivingConditions
environmentalObstruction
equipmentOrSystemFault
infrastructureDamageObstruction
instructionToRoadUsers
networkManagement
nonWeatherRelatedRoadConditions
obstruction
poorEnvironment
publicEvent
rerouting
roadMaintenance
roadOperatorServiceDisruption
roadOrCarriagewayOrLaneManagement
roadsideAssistance
roadsideServiceDisruption
speedManagement
transitServiceDisruption
vehicleObstruction
weatherRelatedRoadConditions
winterEquipmentManagement
earlierEvent
earlierIncident
holidayTraffic
problemsAtBorderPost
problemsAtCustomPost
problemsOnLocalRoads
roadsideEvent
rubberNecking
technicalProblems
vandalism
other

Cause

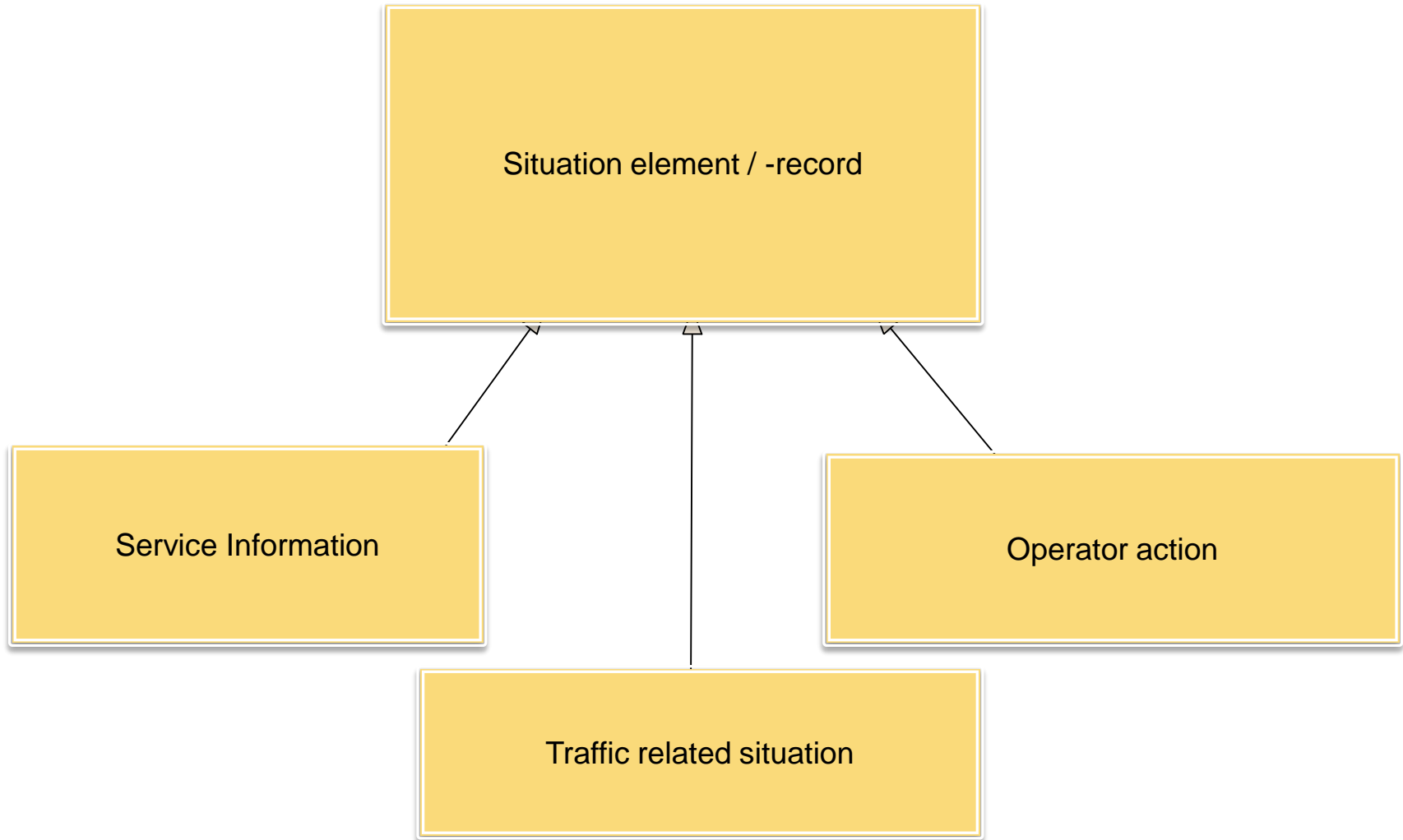


Three types of Situation elements

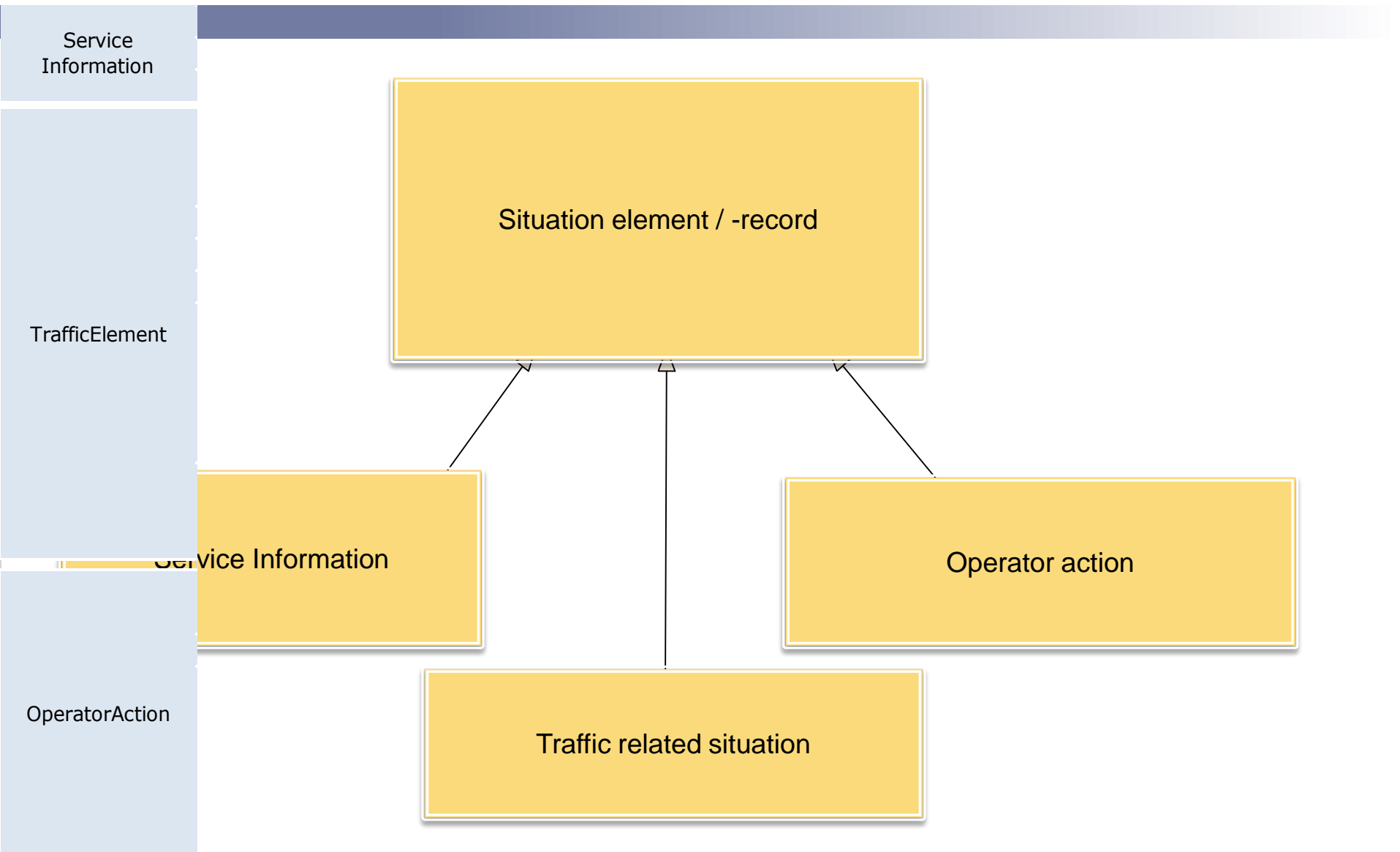


NonRoadEventInformation was renamed to ServiceInformation

Three types of Situation elements



Three types of Situation elements



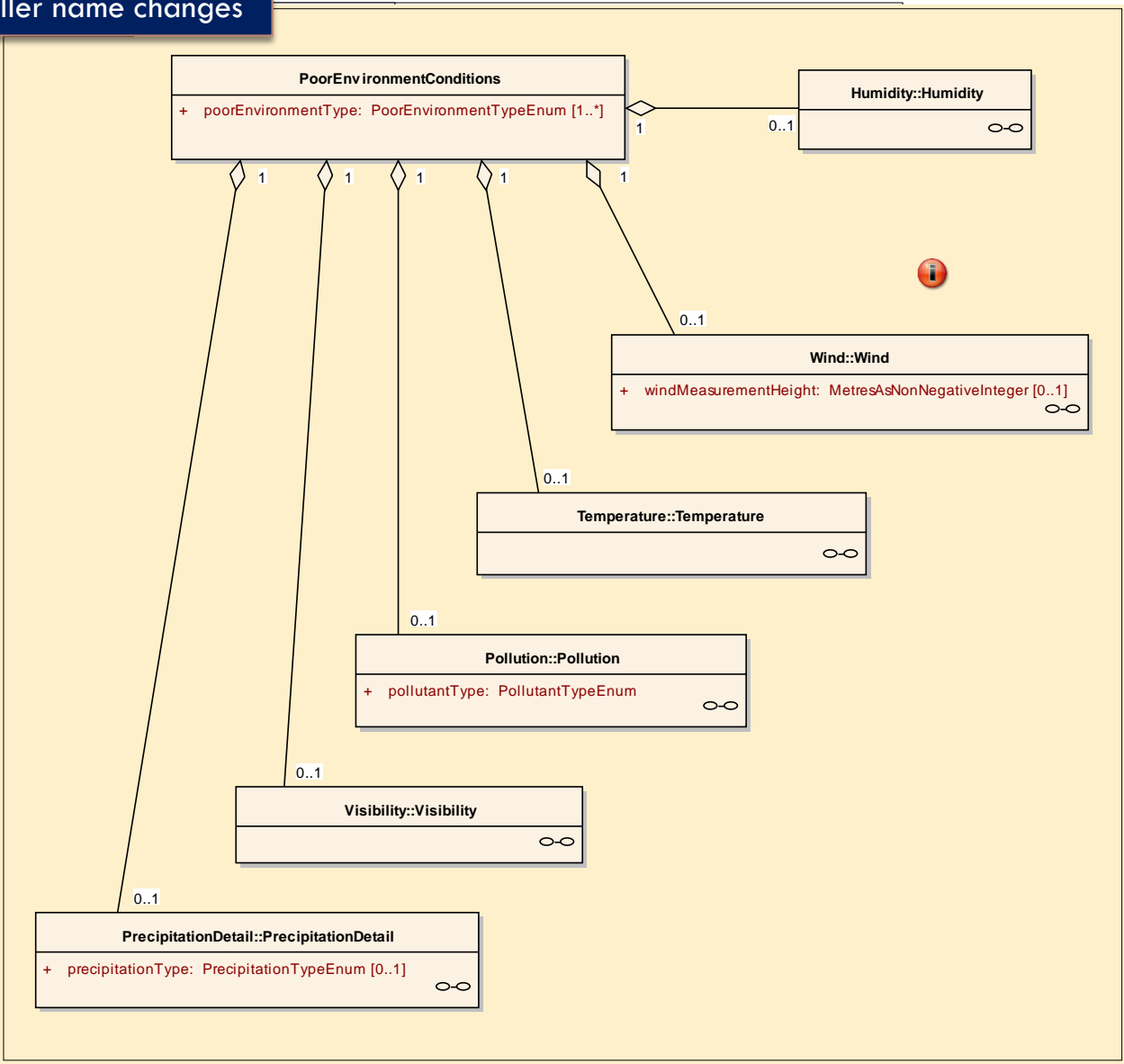
v2.3

v3.0

Situation elements

CarPark removed (replaced by Parking) & smaller name changes

- Service Information
- TrafficElement
- OperatorAction



ed here.

edRoadConditions (1+)
relatedRoadConditions

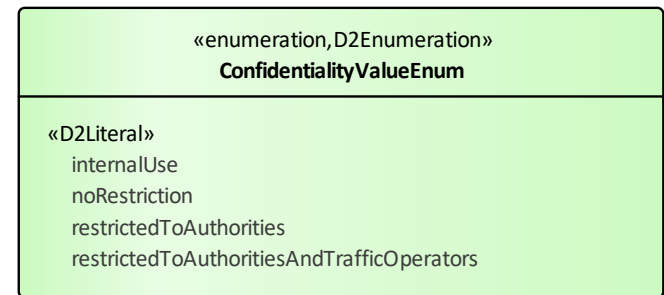
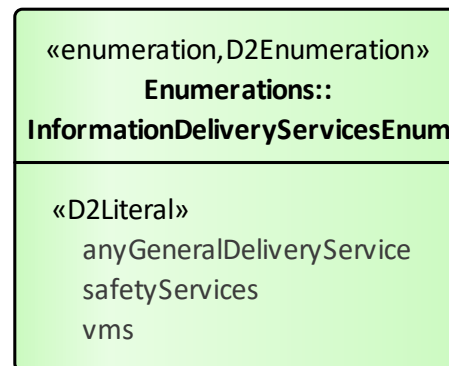
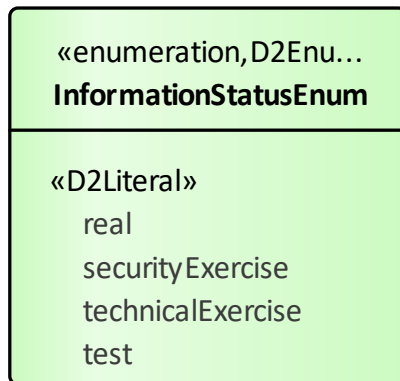
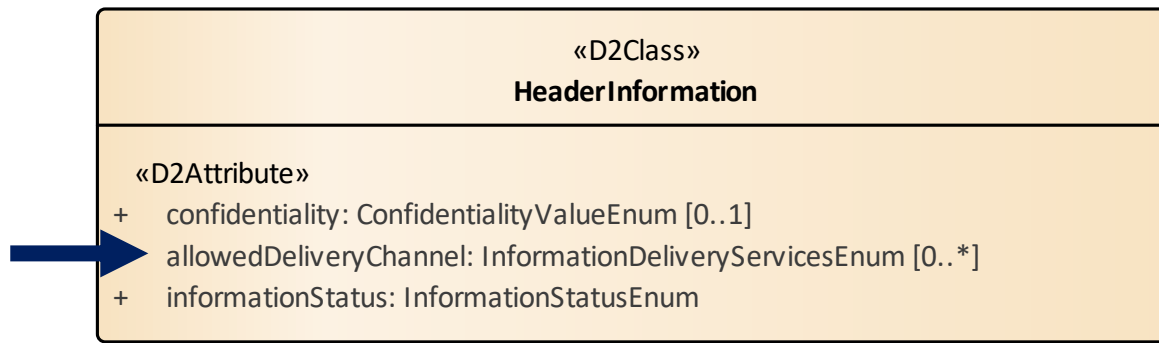


FURTHER IMPORTANT CHANGES IN V3.0



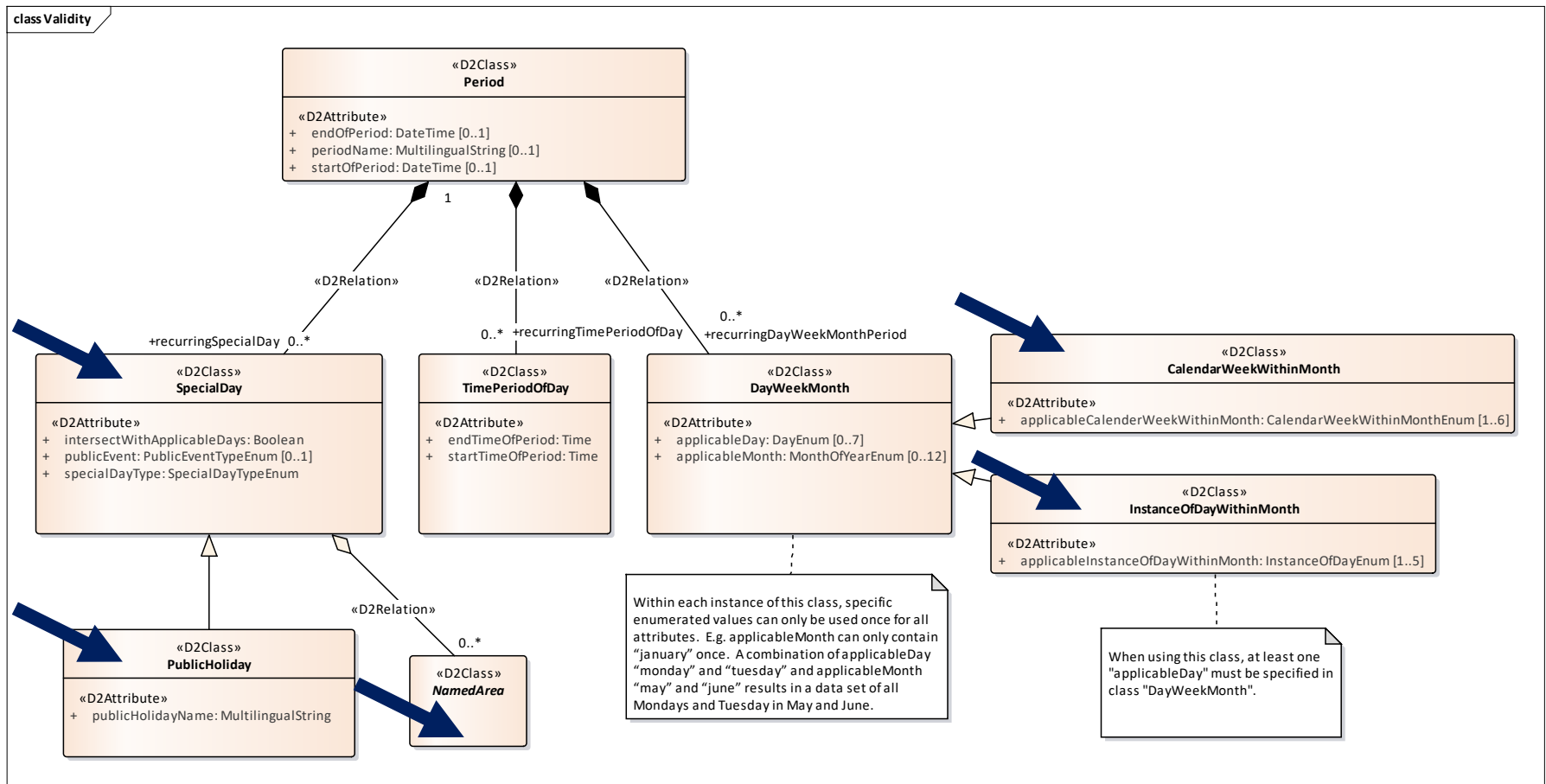
Header Information

v3.0

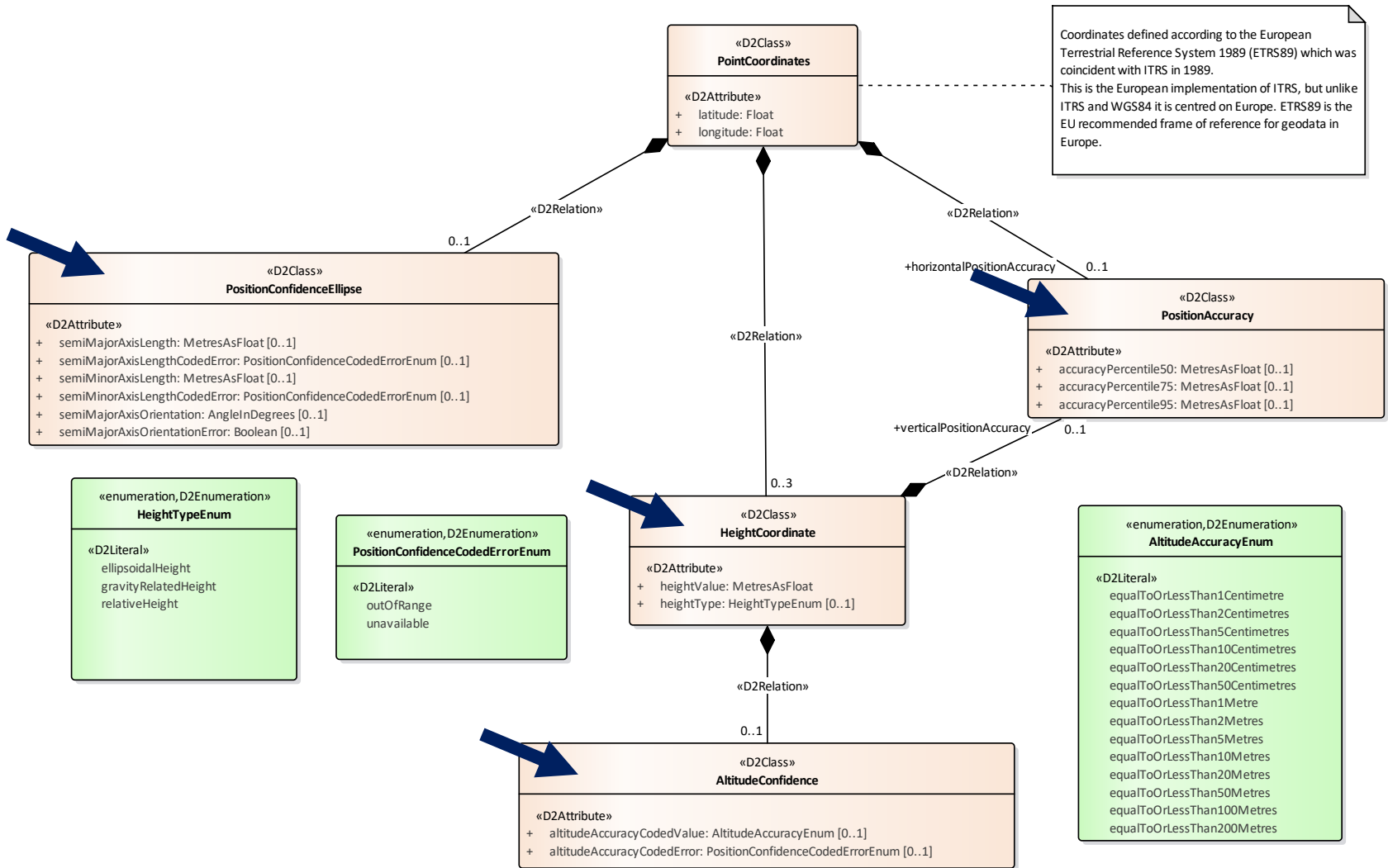


Validity model

v3.0

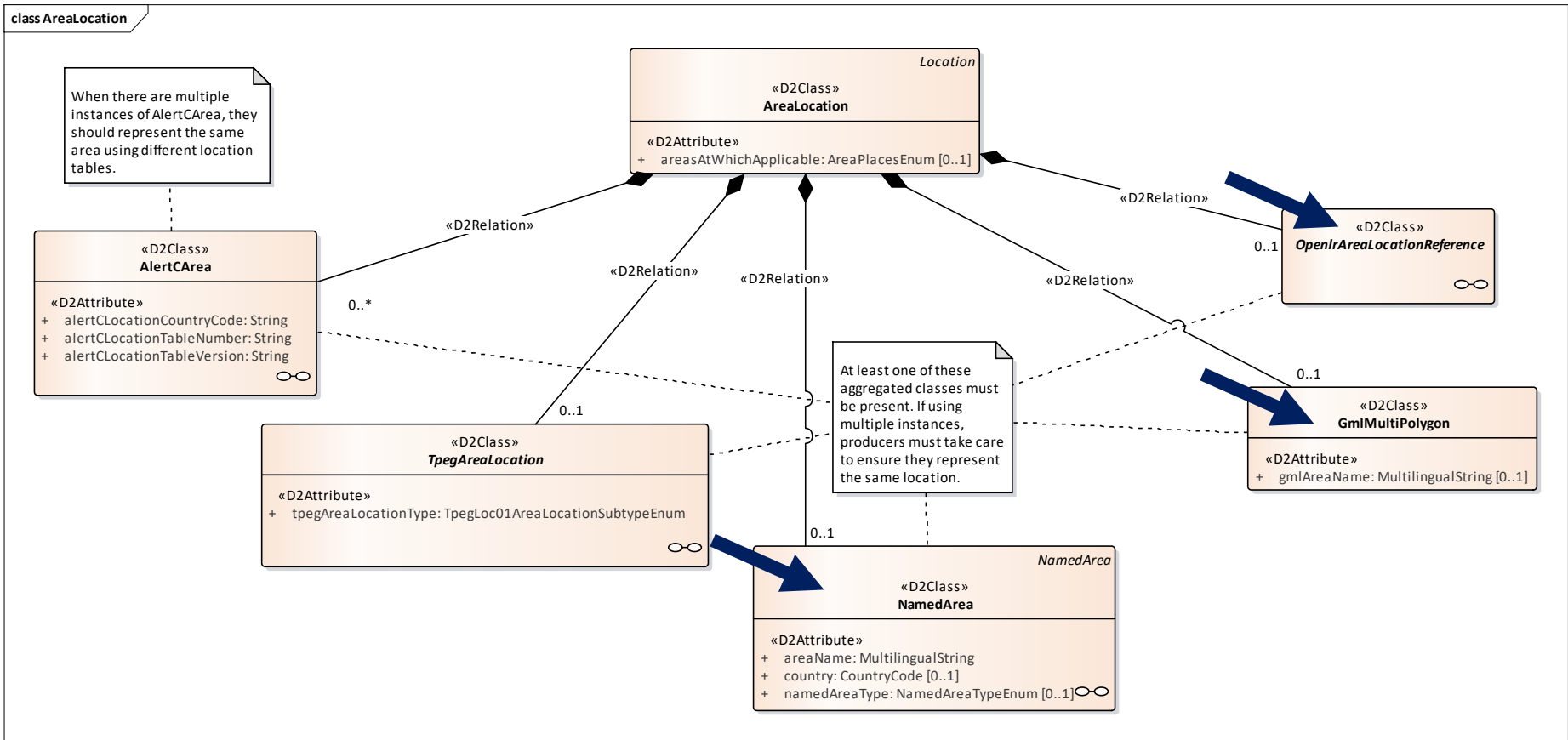


PointCoordinates

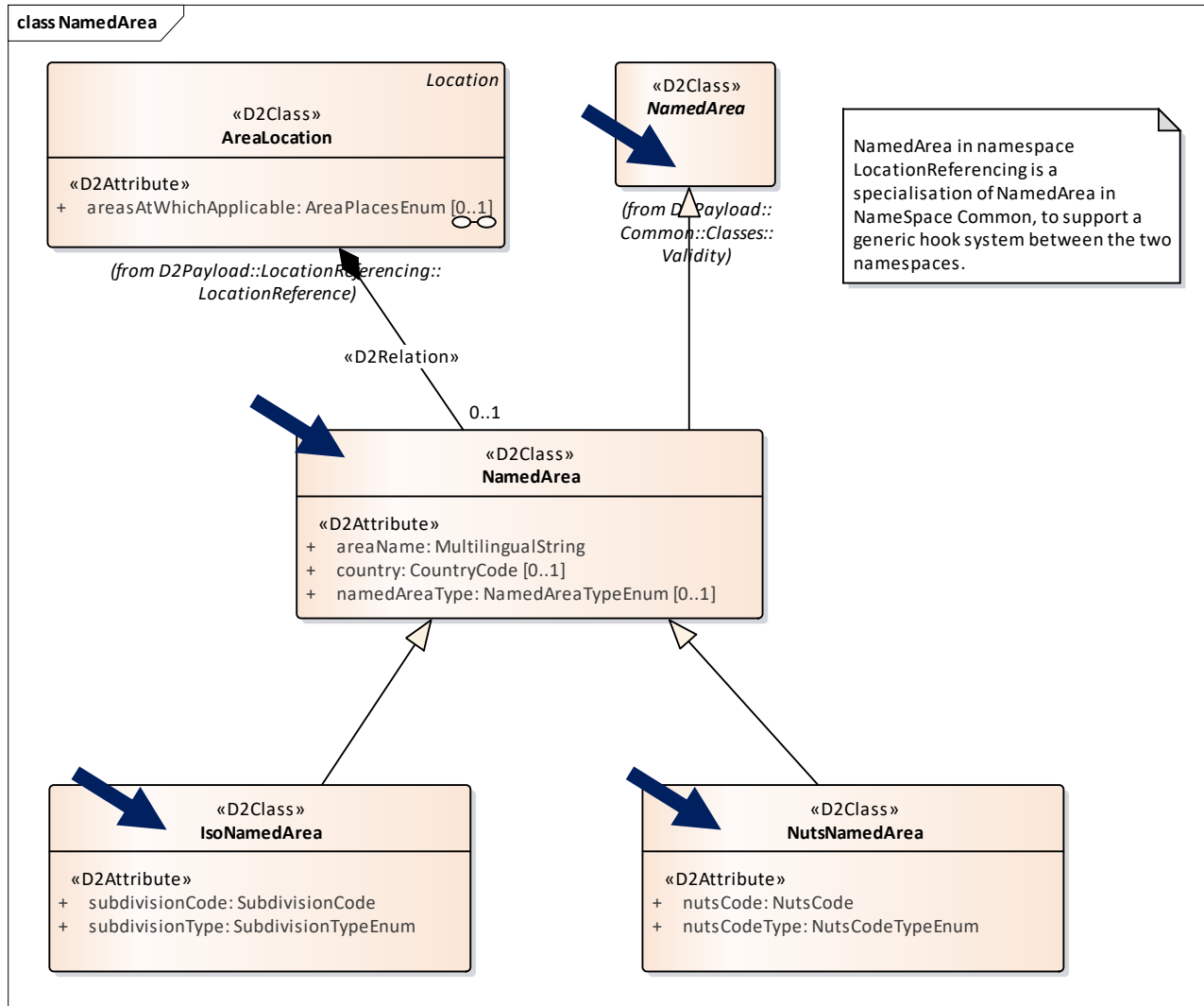


OpenLR, GML and NamedArea

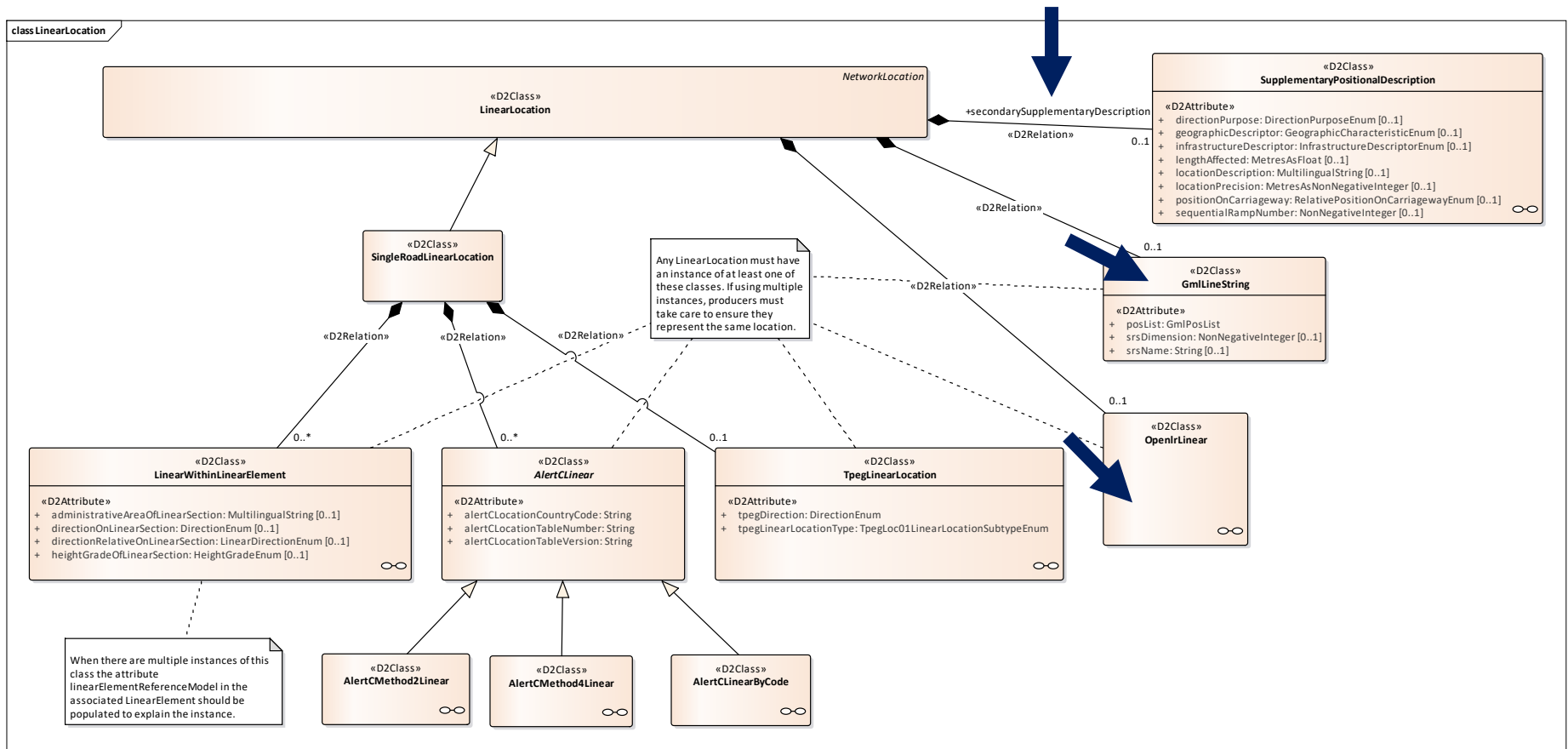
v3.0



Named Area

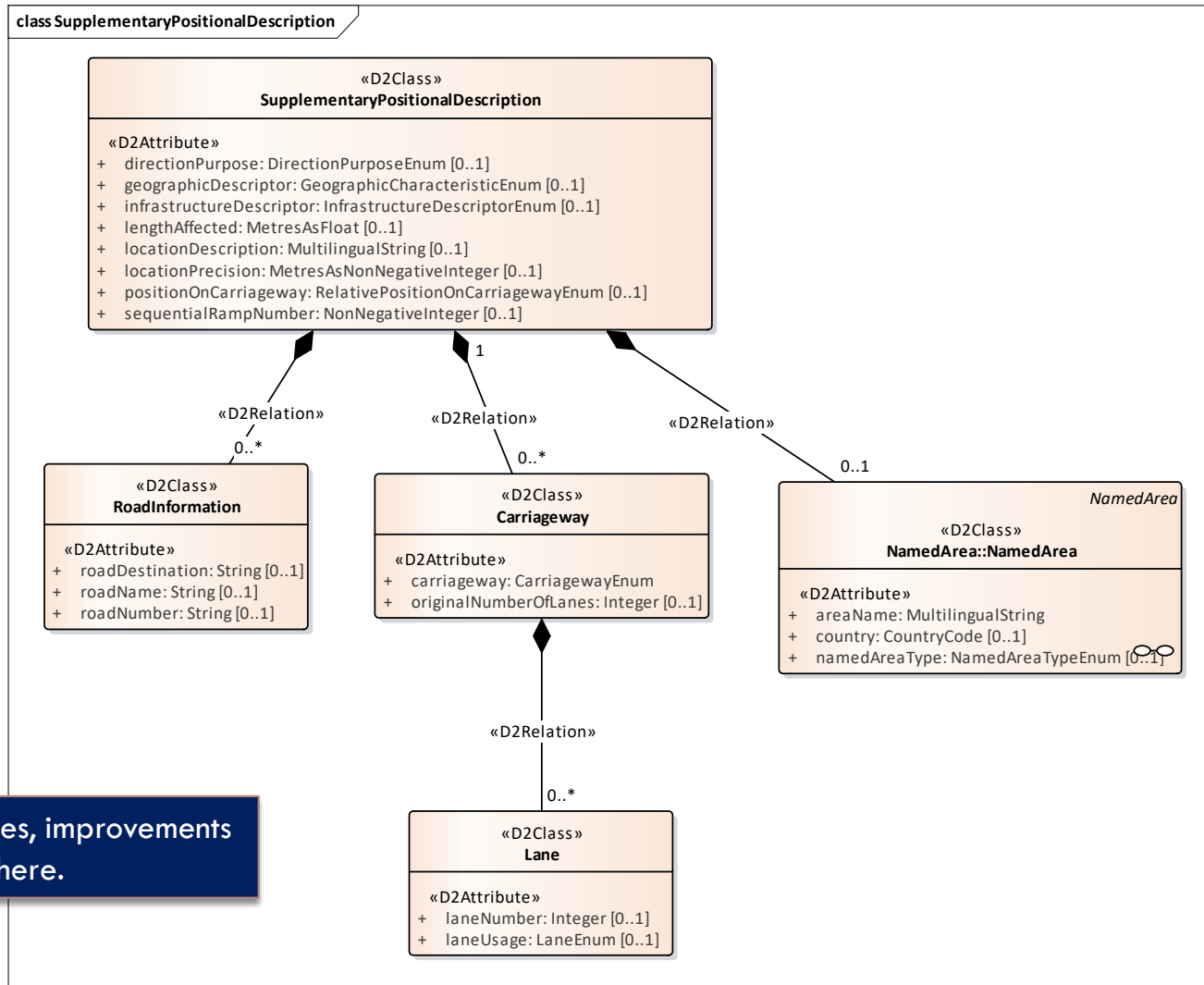


OpenLR and GML Line String, Changes in supplementary Descr.



Changes in supplementary Descr.

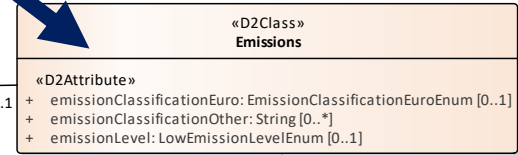
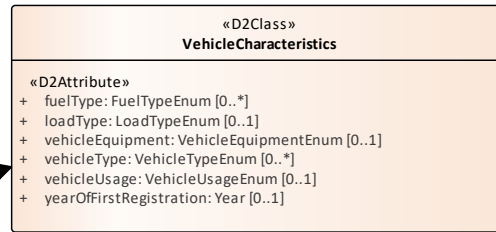
v3.0



Multiple changes, improvements and additions here.

Emissions, typeOfWeight, YearOfRegistration

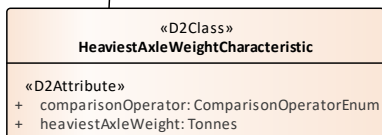
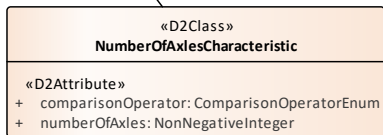
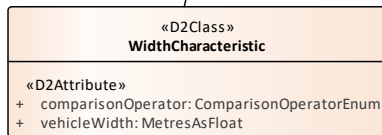
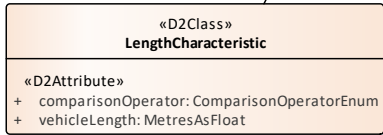
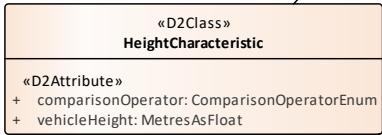
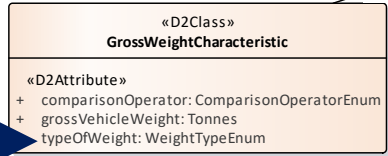
class VehicleCharacteristics



To specify emissionClassificationEuro properly, it is necessary to define

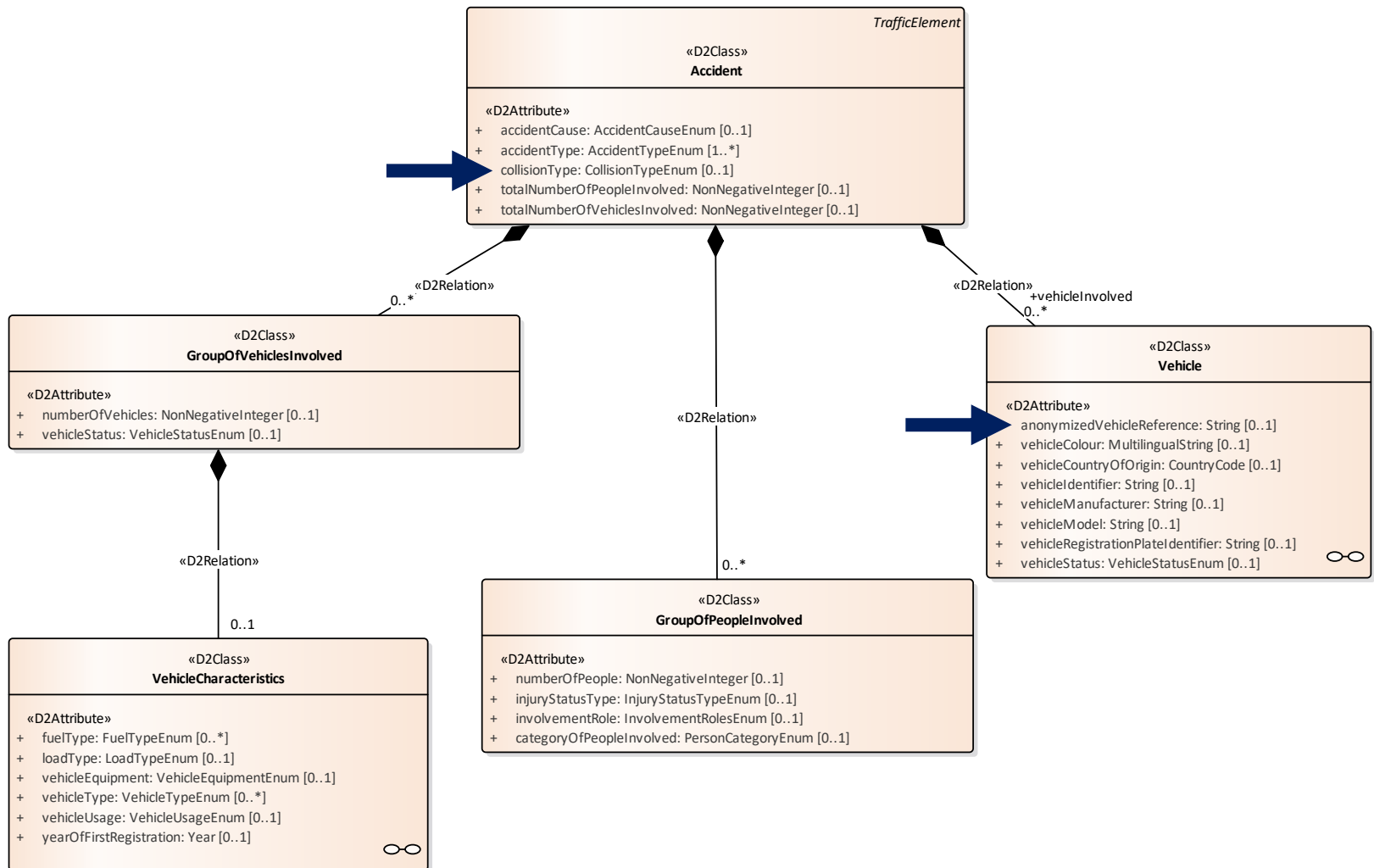
- the corresponding vehicle type (e.g. car for M1, miniBus for M2, lightCommercialVehicle for N1 or largeGoodVehicle for N2)
- and fuel type (e.g. diesel for CI engines or petrol for PI engines) in class vehicleCharacteristics.

Note that Euro V and Euro VI are used for emissions of lorries only.



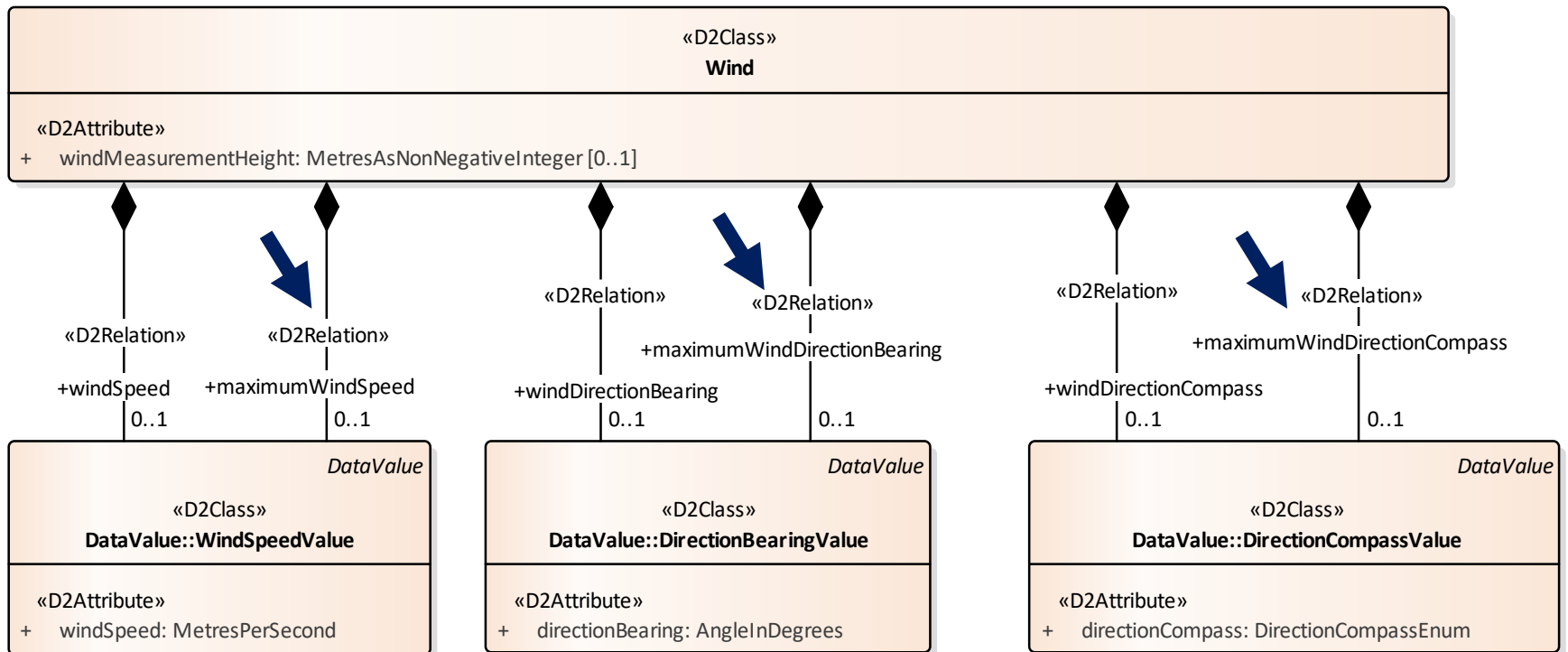
Accident: CollisionType, AnonymizedVehicleReference

v3.0



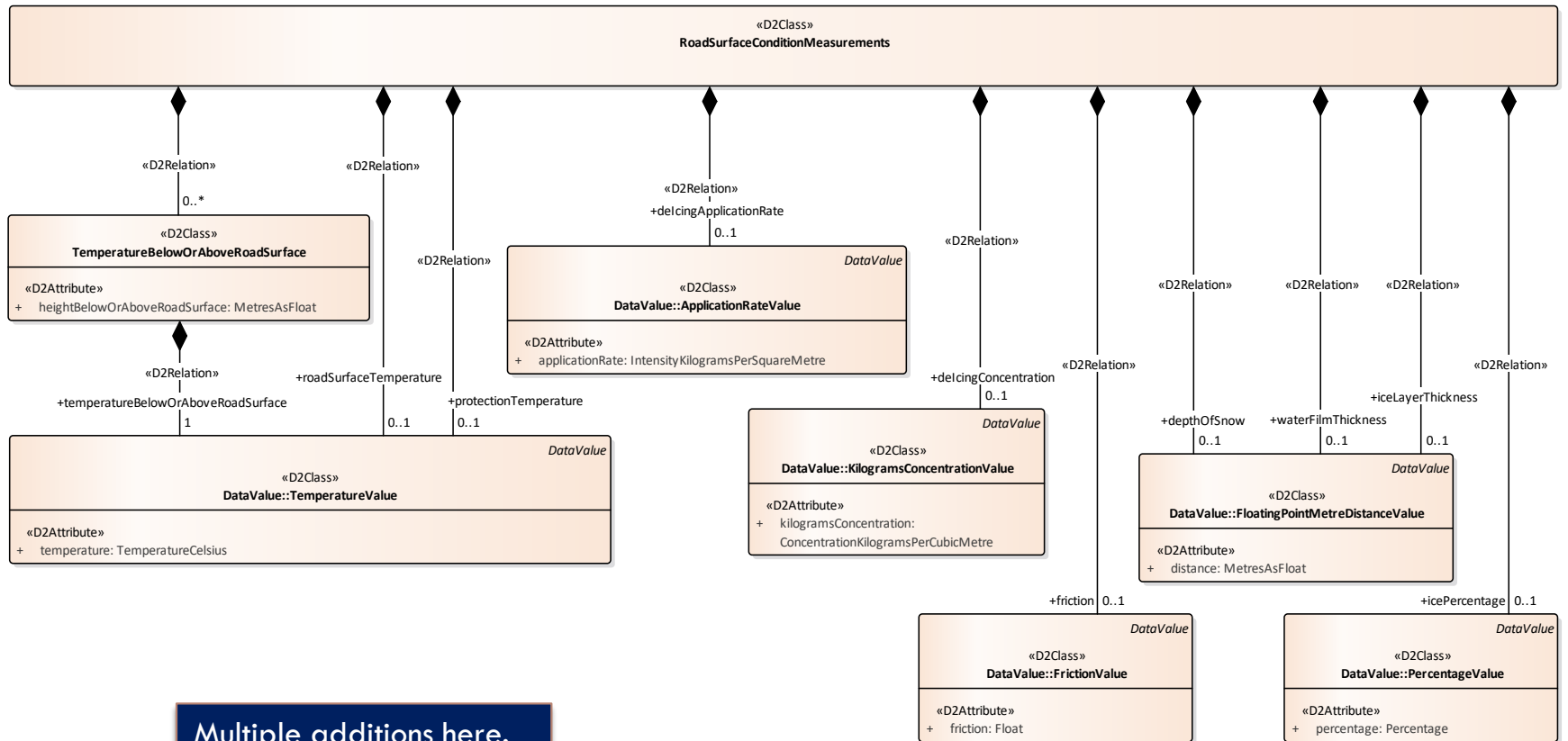
Wind

v3.0



RoadSurfaceConditions

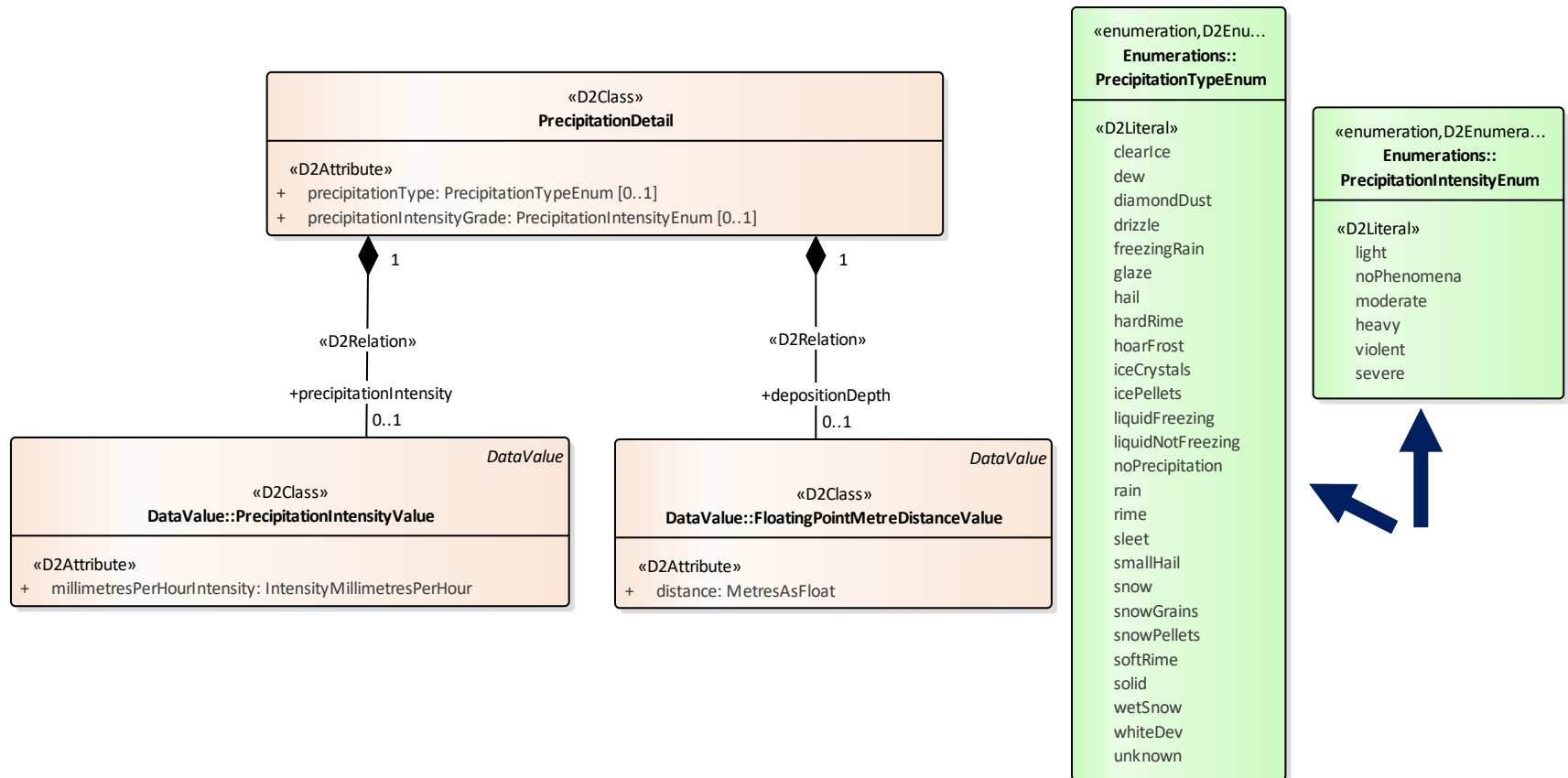
v3.0



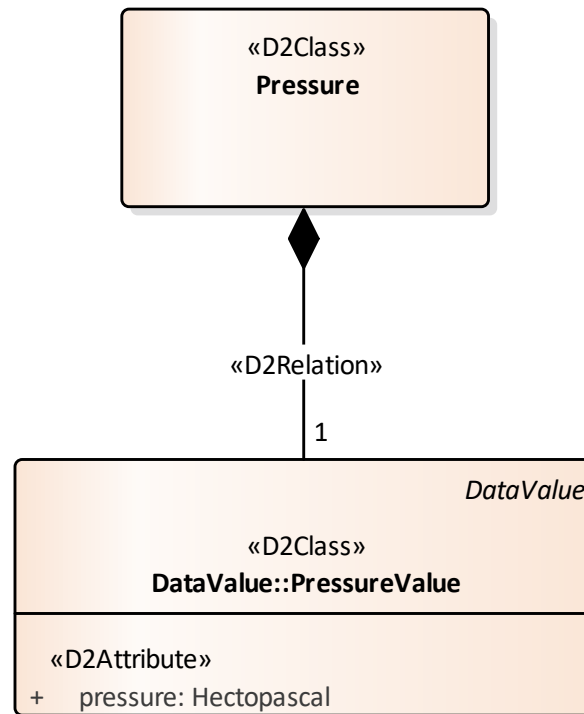
Multiple additions here.

Precipitation

v3.0

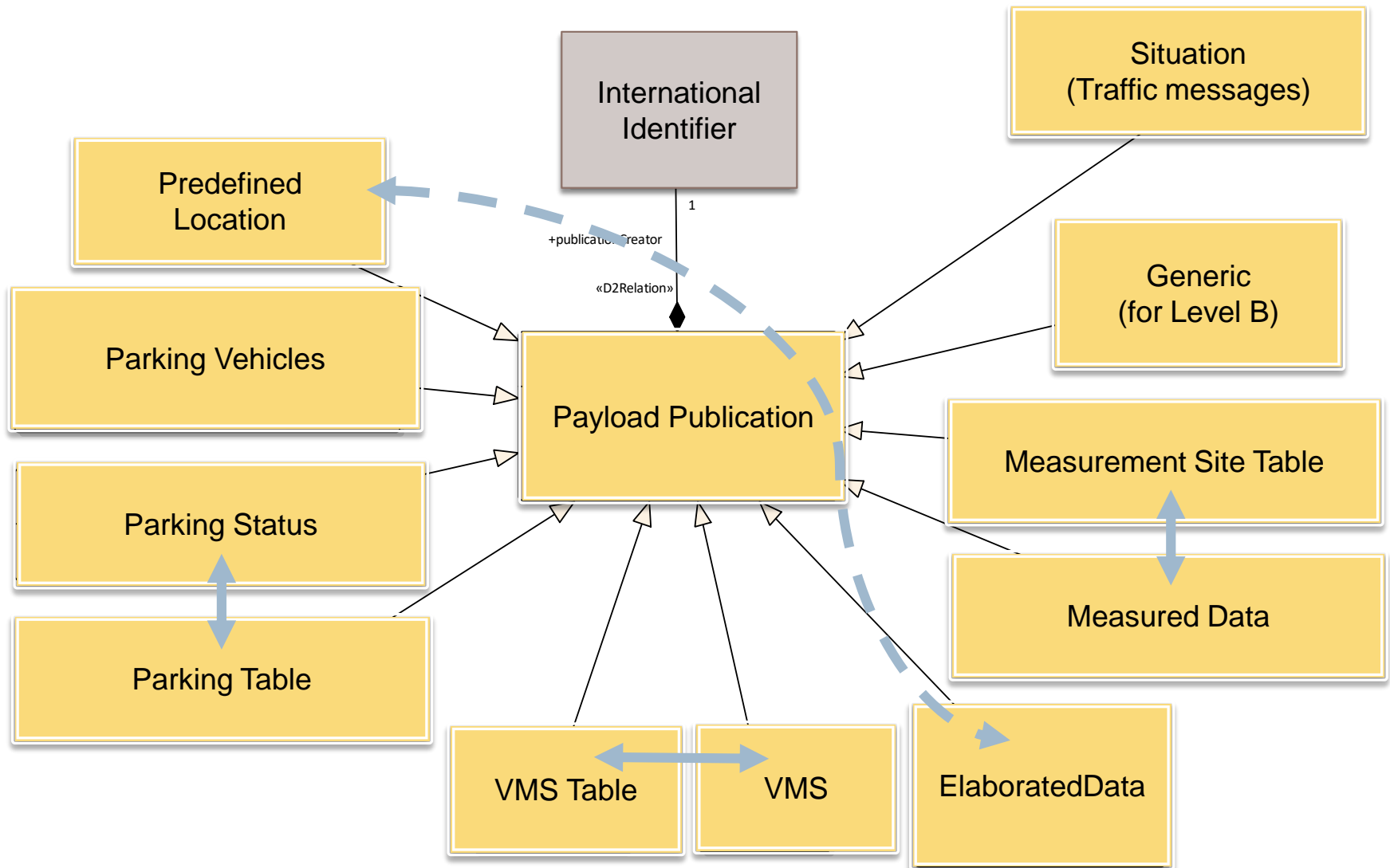


Pressure (new)

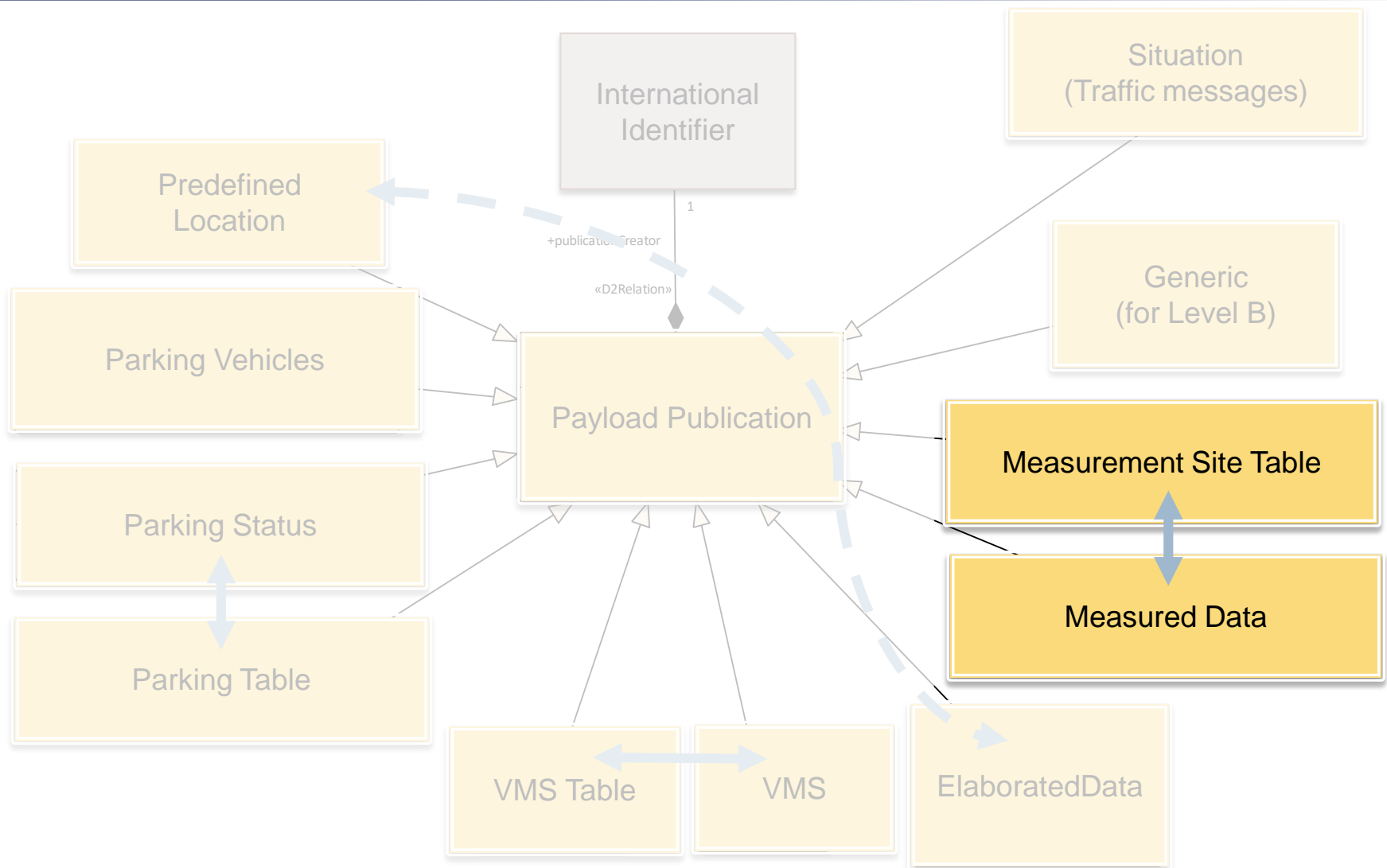


**DETAILED EXAMPLE:
MEASUREMENT SITES AND MEASURED DATA**

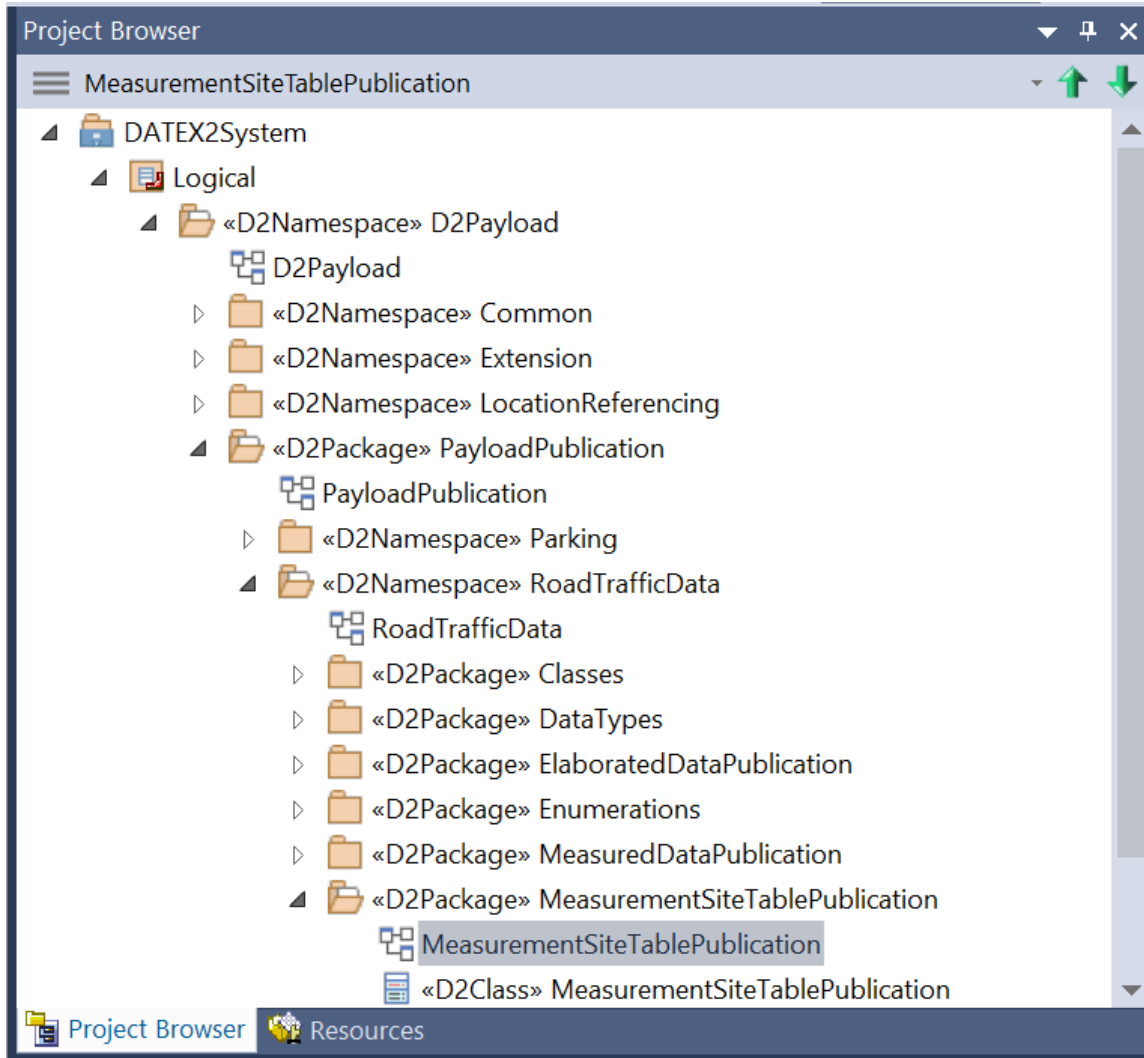
Payload Publication



Payload Publication



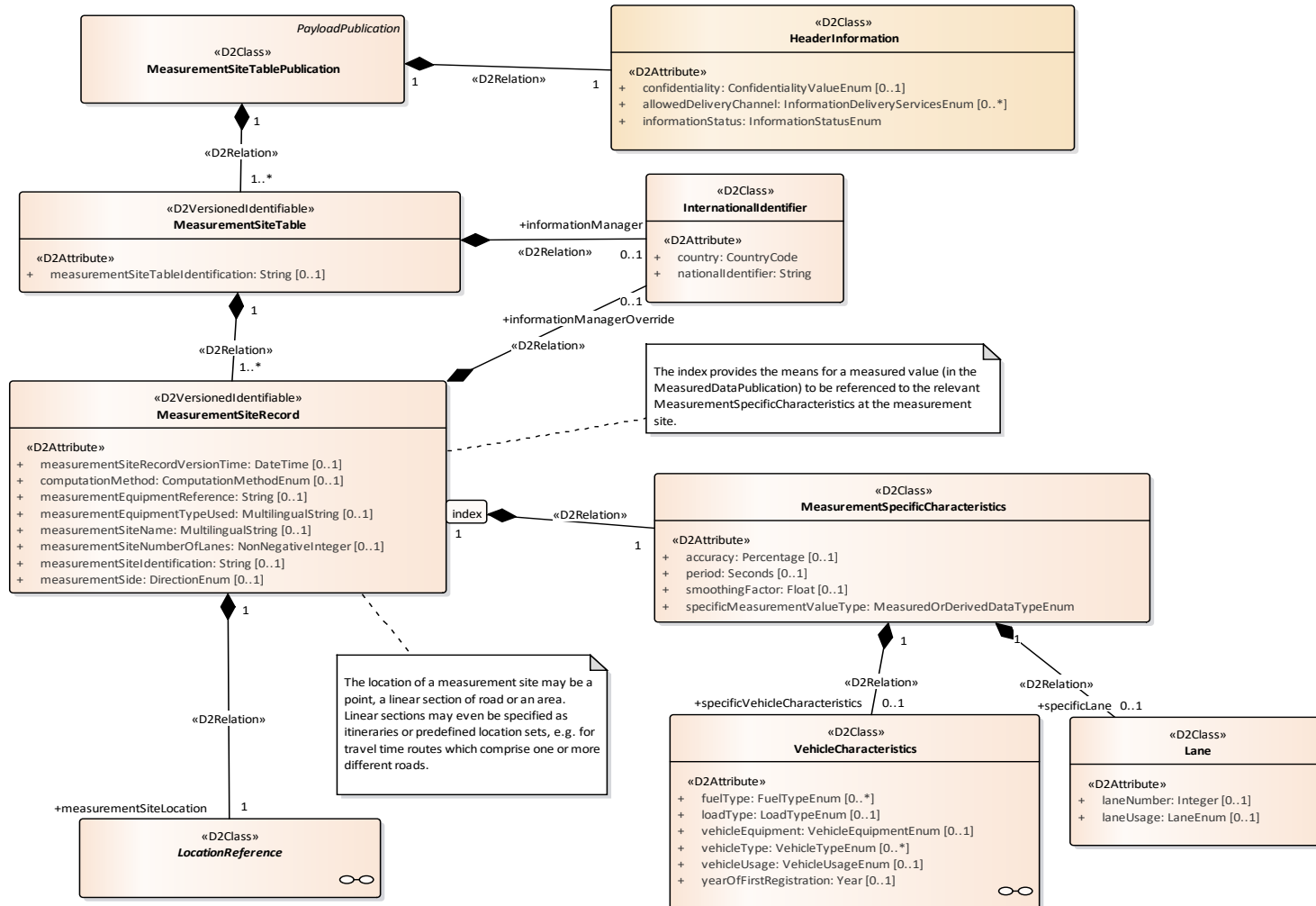
Where to find?



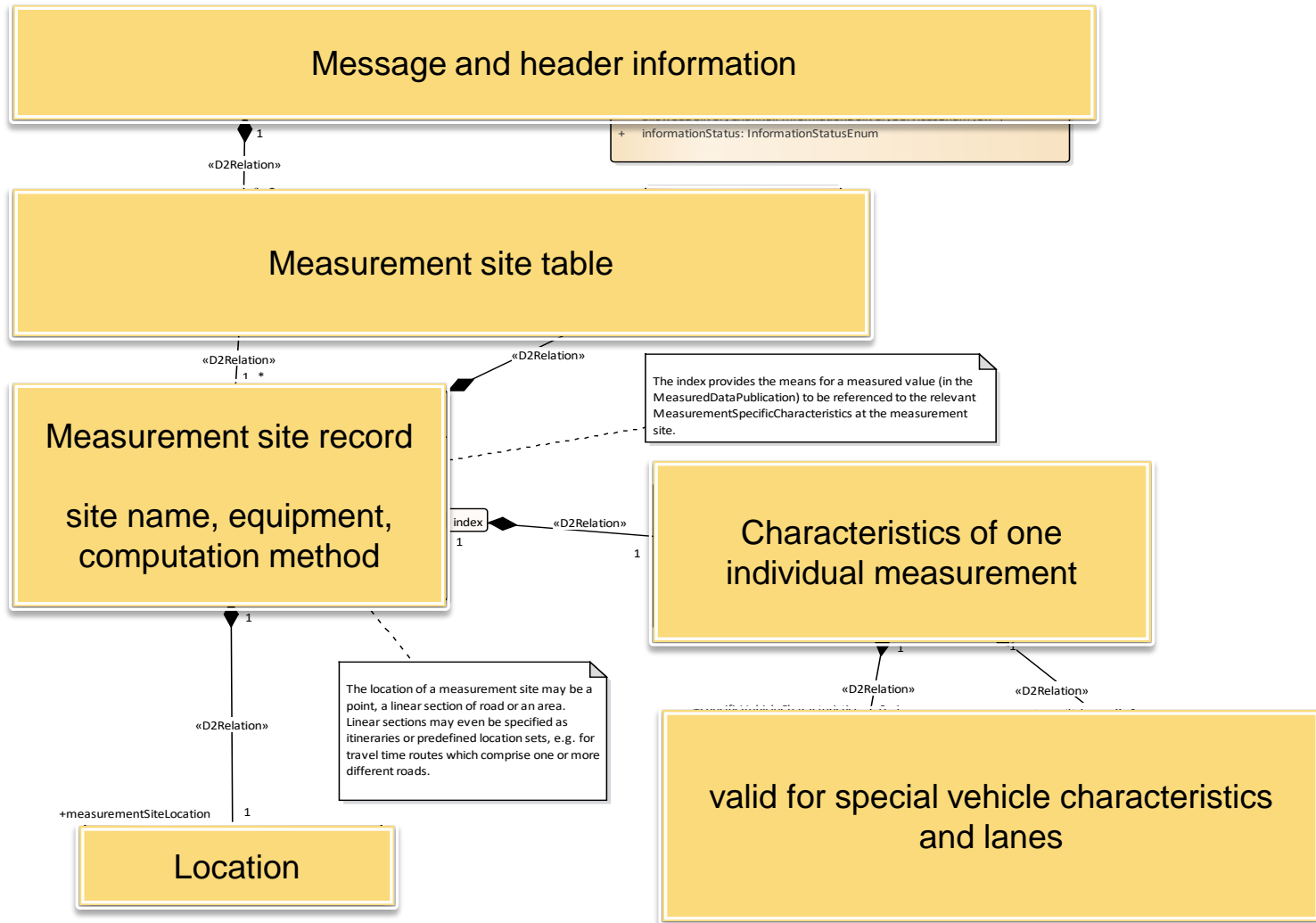
Please note:

Parking, VMS and RoadTrafficData – thus also the MeasurementSiteTables and MeasuredData - are provided with their 2.3 data-model for convenience. Their structure will change due to the CEN standardisation schedule soon.

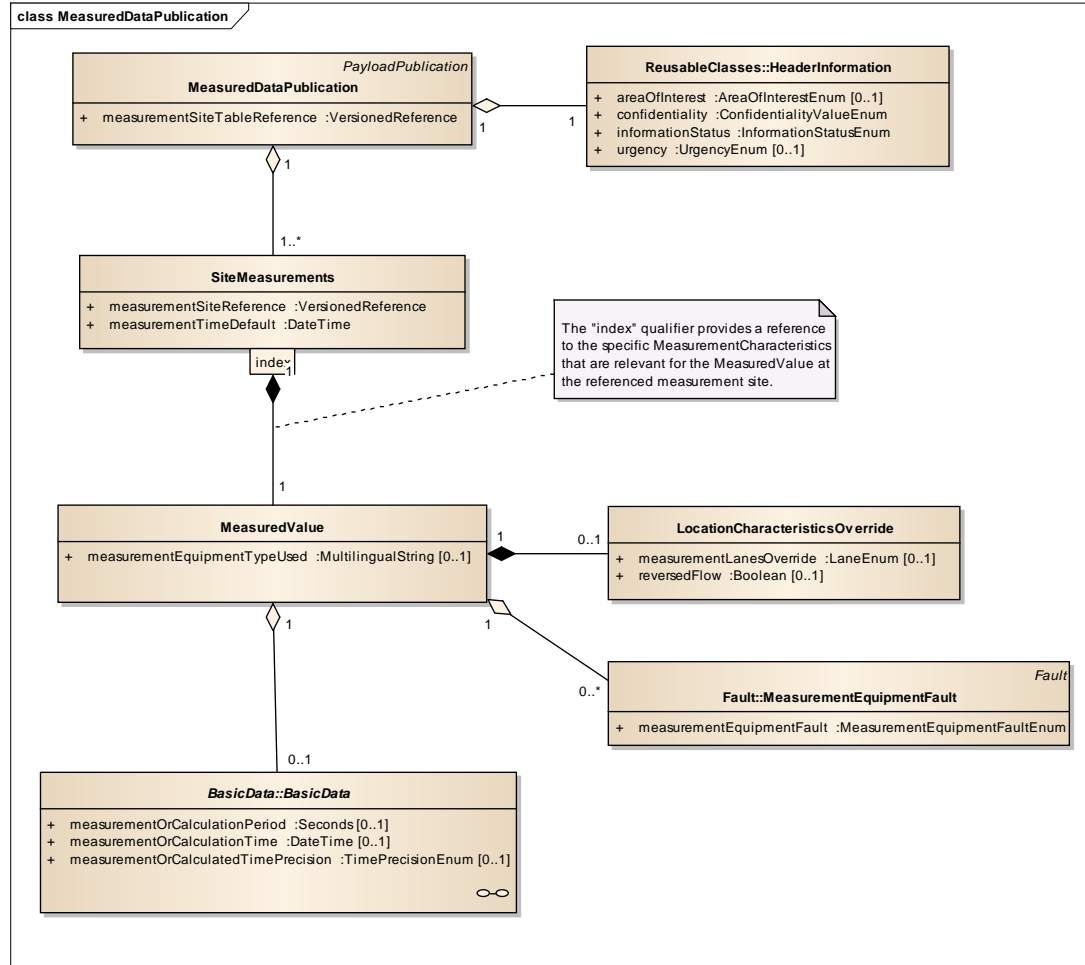
Measurement Site Table (static)



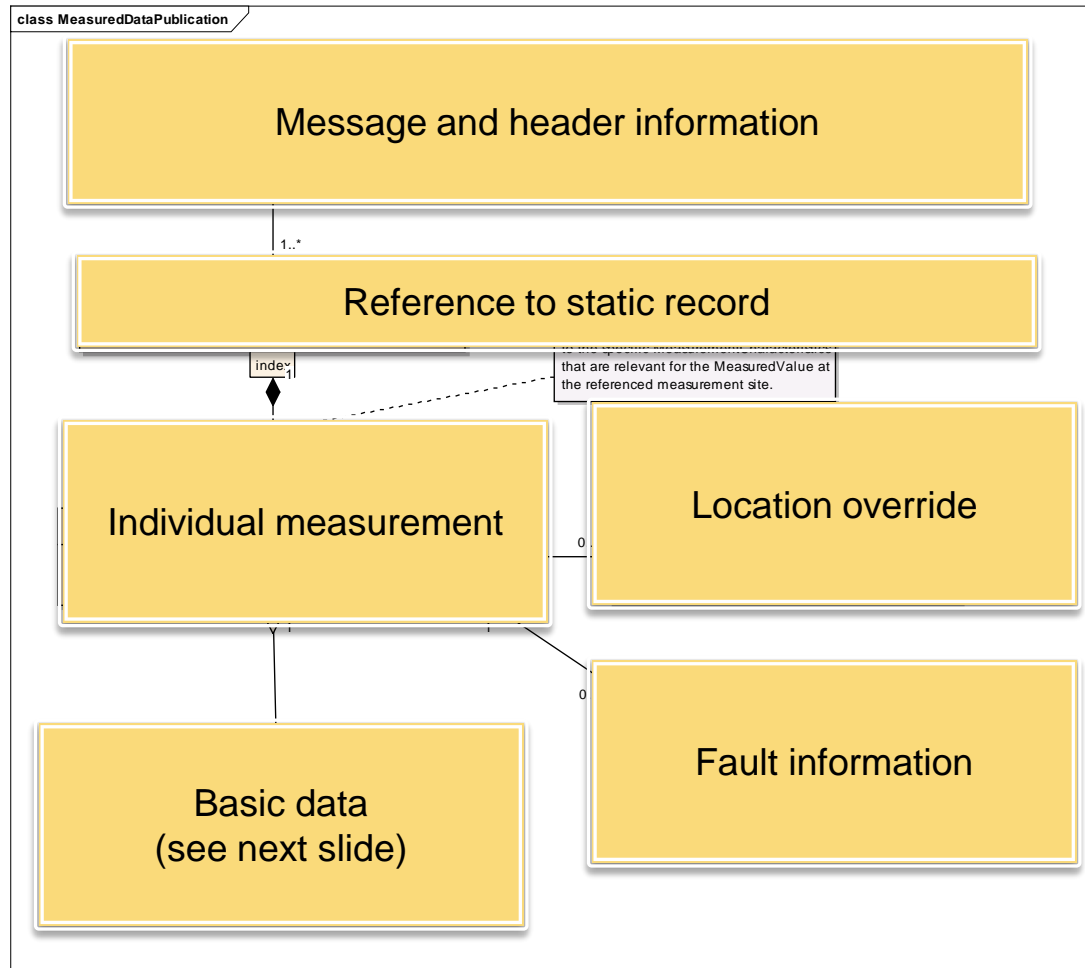
Measurement Site Table (static)



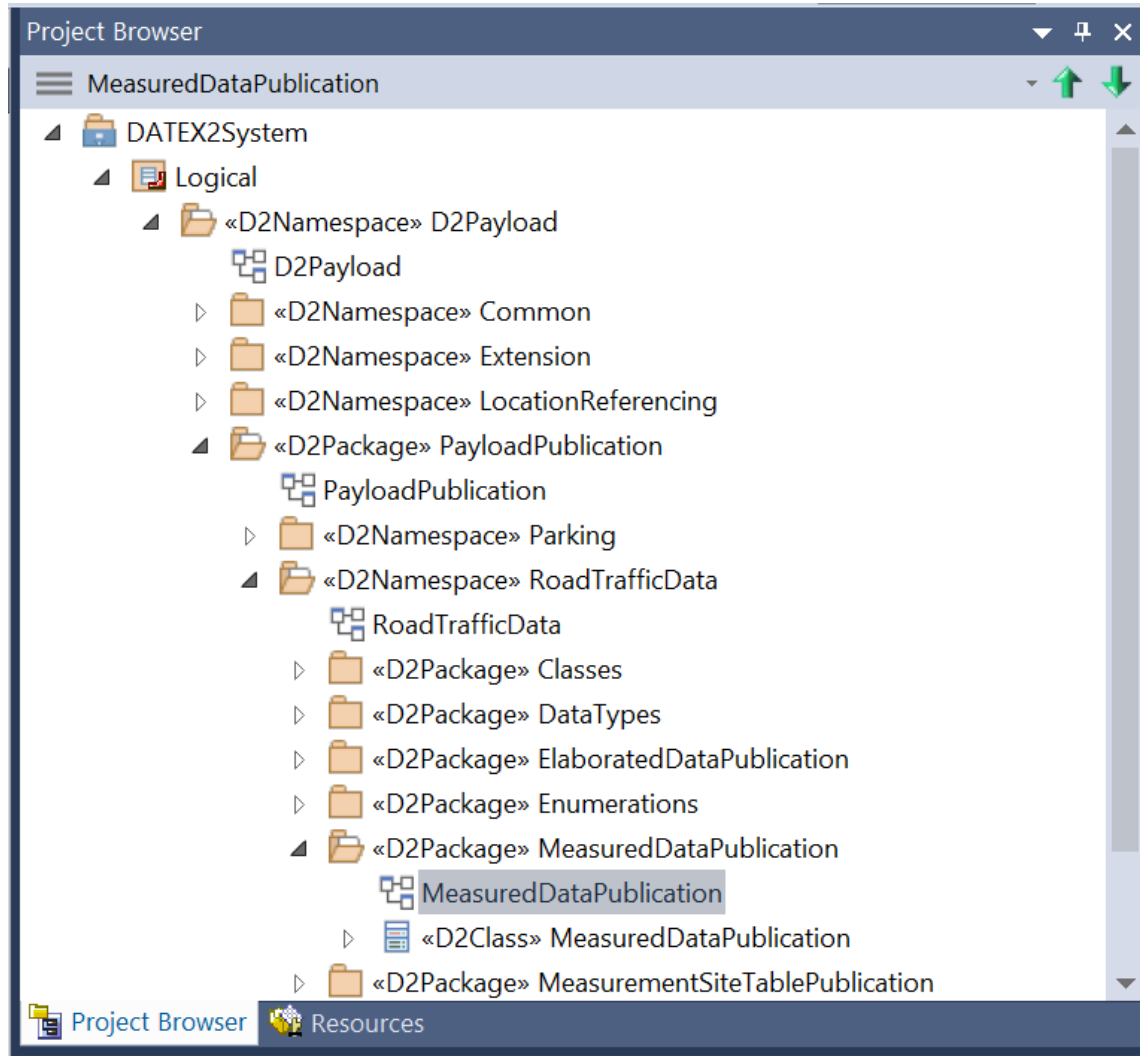
Measured Data (dynamic)



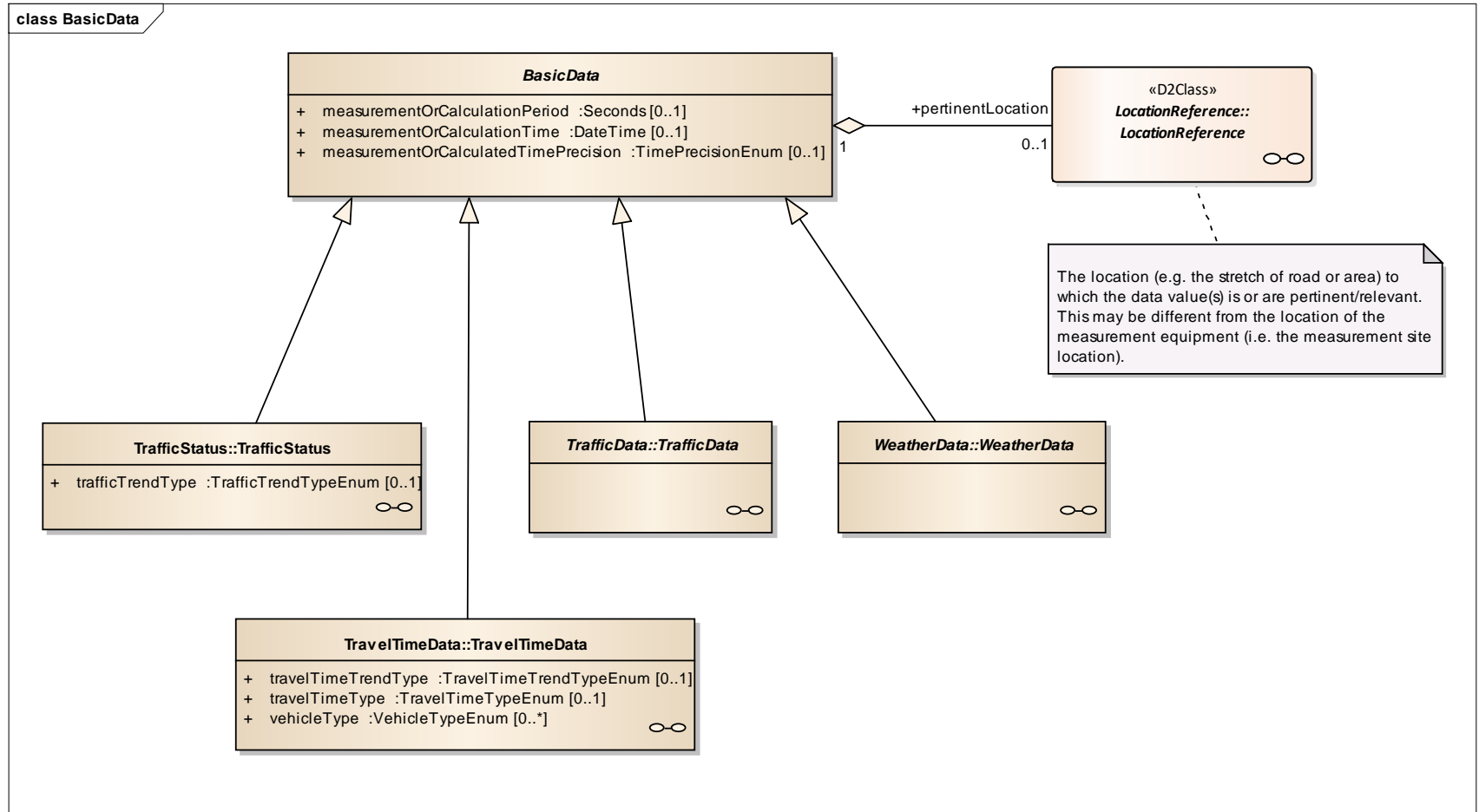
Measured Data (dynamic)



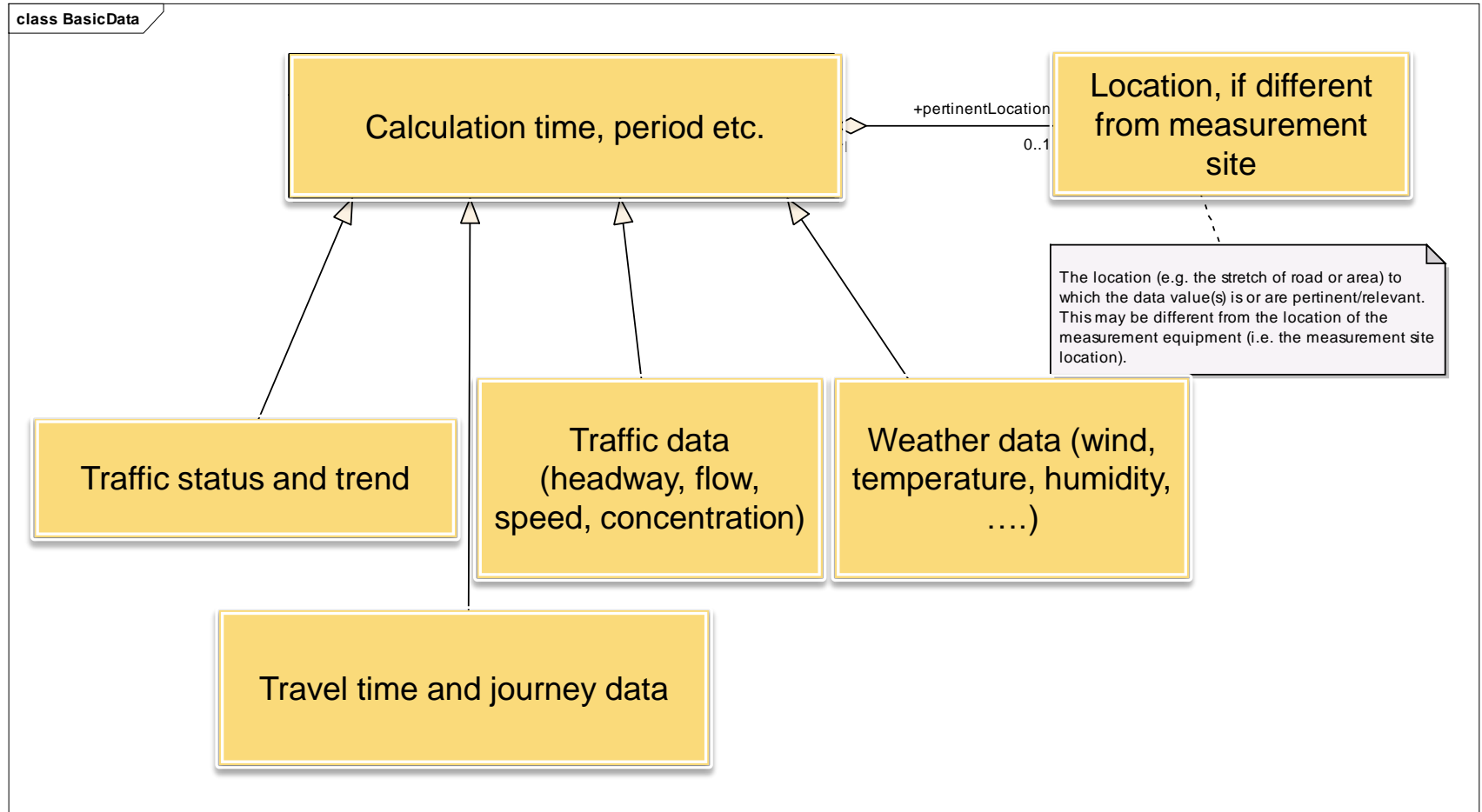
Where to find?



Basic Data (dynamic)



Basic Data (dynamic)

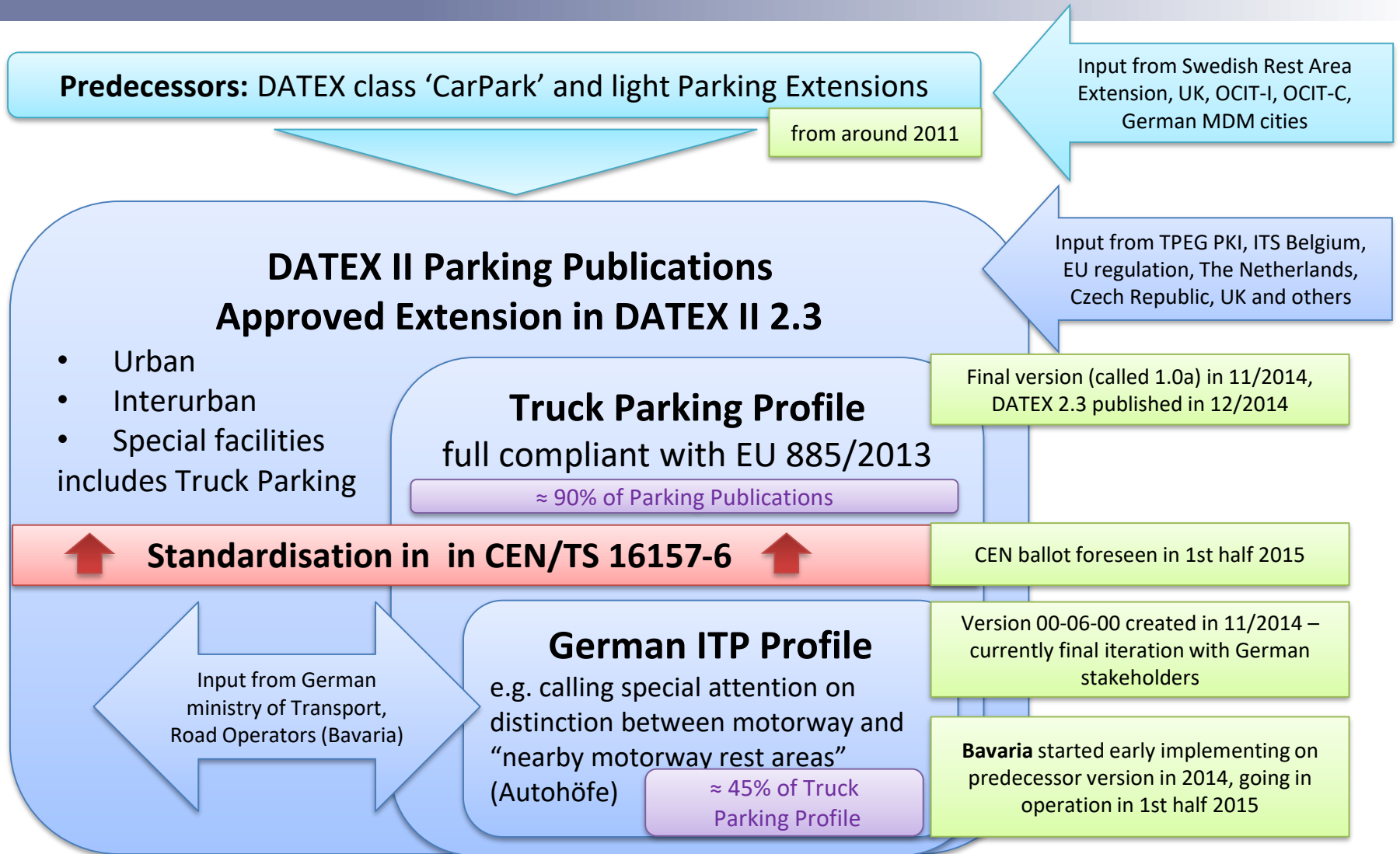


DETAILED EXAMPLE: PARKING PUBLICATIONS



Please note:
Parking, VMS and RoadTrafficData are provided with their 2.3 data-model for convenience. Their structure will change due to the CEN standardisation schedule soon.

History of Parking Publications



Standardisation time schedule

	2010				2011				2012				2013				2014				2015				2016				2017				2018				2019				2020							
	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4								
CEN TS 16157 Planning																																																
Part 1: Context and Framework	EN																				EN																											
Part 2: Location referencing	EN																				EN																											
Part 3: Situation	EN																				EN																											
Part 4: Variable Message Sign																																					EN											
Part 5: Measured & Elaborated data																																									EN							
Part 6: Parking Information																																									EN							
Part 7: Common data elements	EN																																															
CEN ISO/TS19468 PIM Exchange																																																

- = Stage 00: Preliminary stage (12m)
- Stage 10: Proposal/Approval stage (1m, left out in diagram)
- = Stage 20: drafting stage (6m)
- = Stage 30: Committee stage, comment resolution and dispatch ENQ-draft to CMC (3+3m)
- = Stage 40: Administrative, enquiry stage, comment resolution and dispatch FV-draft to CMC (3+3+6m)
- = Stage 50: Administrative, approval stage, Formal Vote (3+2m)
- = Stage 60: publication stage (3m)

Structure of Parking Publications

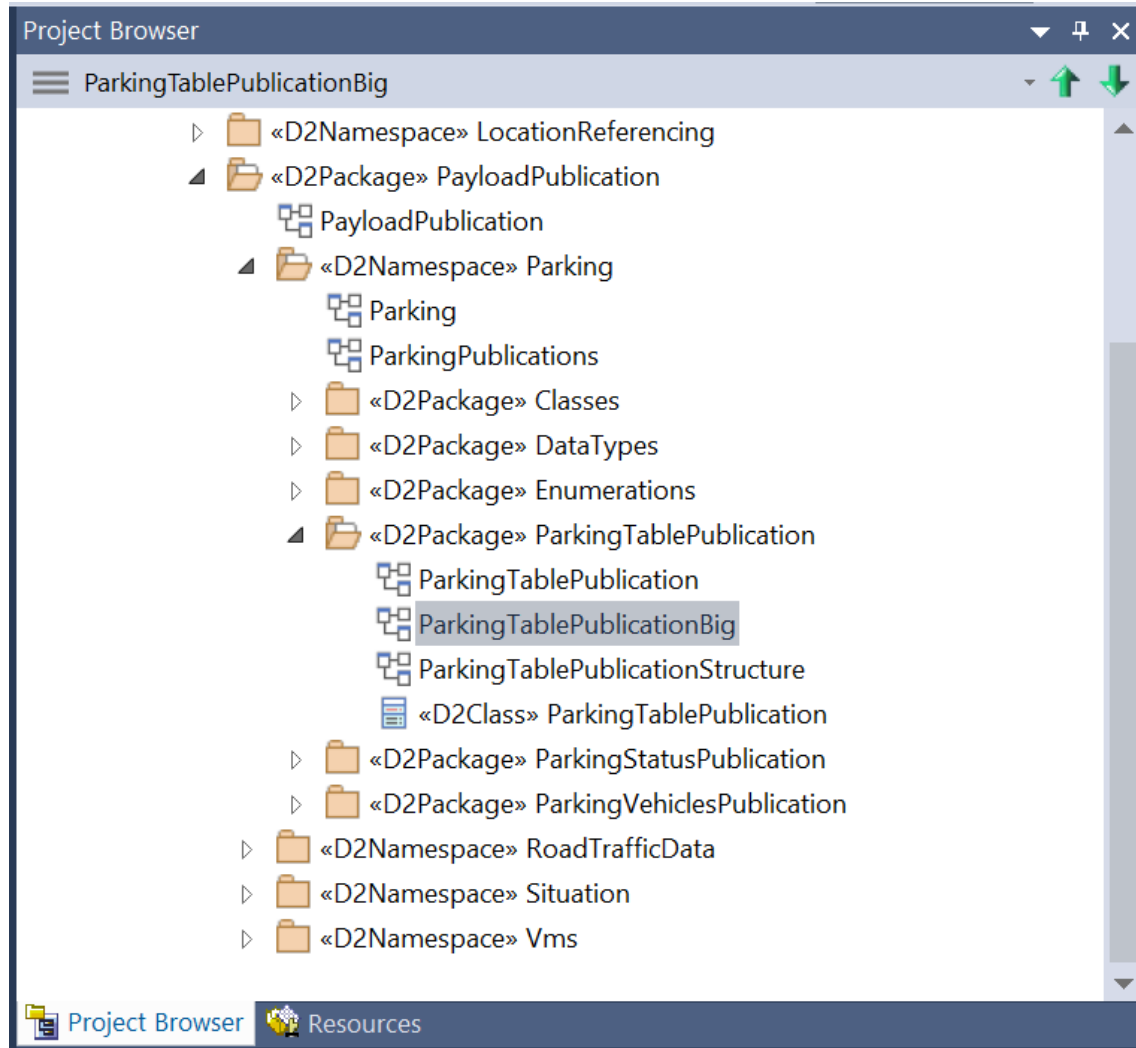
1. **Static Part**
(ParkingTablePublication)
 - Low frequency transmission
 - Basic information about rest areas and urban parking including
 - Specific parameters
 - Georeferencing
 - Additional services
2. **Dynamic part**
(ParkingStatusPublication)
 - High frequency transmission
 - Occupancy information
 - Status of facilities
 - Temporary changes of static data
3. **ParkingVehiclePublication**

More than 200 Attributes and 400 Enumeration-Literals have been added to DATEX for Parking Publications

includes basics like
Parking Sites and Groups of Parking
Sites, Parking Spaces and Groups of
Parking Spaces

as well as Opening Times, Tariffs,
Accesses, Infrastructure and Service
elements ...

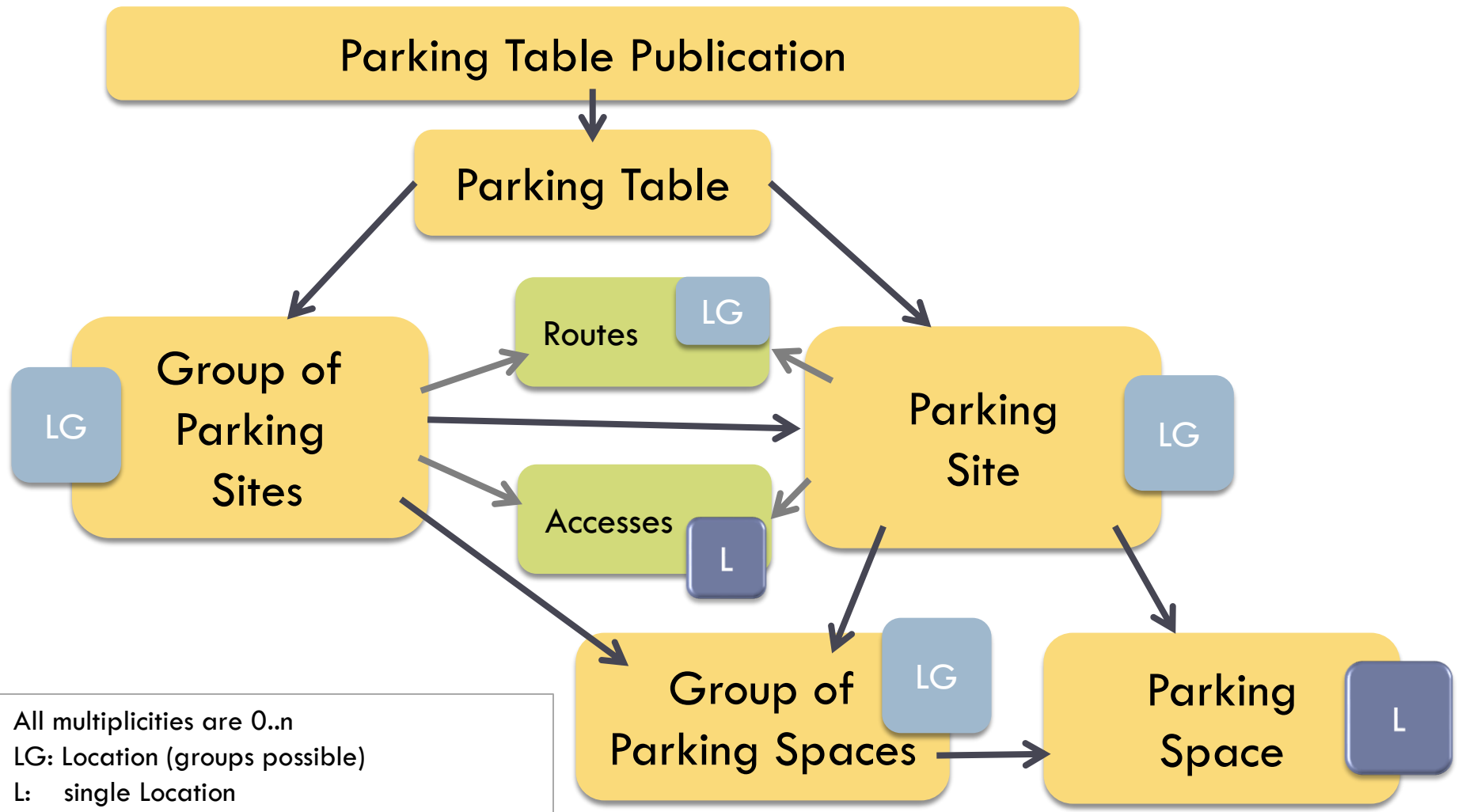
Where to find?



CEN/TS 16157 Part 6

- Very extensive parking model
- Static part is splitted into three main types of parking sites:
 - Urban parking sites
 - Interurban parking sites
 - Special Location parking sites
- Comprehensive requirements from different fields are considered:
 - Truck Parkings (including security issues)
 - Rest areas
 - Parking areas
 - Groups of parking sitesand many more
- For particular applications 'Profiles' can tailored

Structure static part



Parking Publications

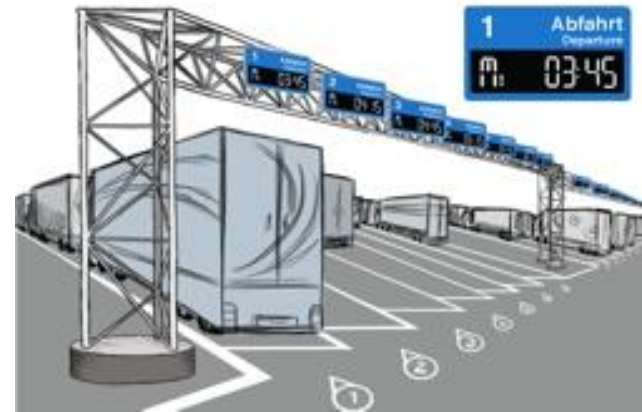
- Very extensive parking model ('data catalogue')
- Static and dynamic part:
 - Low frequency infrastructure information vs. high frequency occupancy information
- Comprehensive requirements from different fields are considered:
 - Urban parking (parking areas, parking facilities)
 - Rest areas
 - Truck Parking (including security issues)



- Model is in line with the Delegated Regulation (EU) 885/2013
- For particular applications / use-cases 'Profiles' can be tailored

Special elements for Truck Parking

- ❑ Standards and Security (dogs, fences, flood light, guards,)
- ❑ Permits and Prohibitions (smoking only outside buildings, picnic, ...)
- ❑ Hazardous Materials (from DATEX Level A standard)
- ❑ Mixed usage of groups of parking spaces (for example by time slots)
- ❑ Additional Service Facilities (Motel, Restaurant, ...)
- ❑ Additional Equipment (Toilets, Dumping station, ...)
- ❑ Special Elements:
 - Drive through parking space, compact parking, queue parking
- ❑ Junction name and number

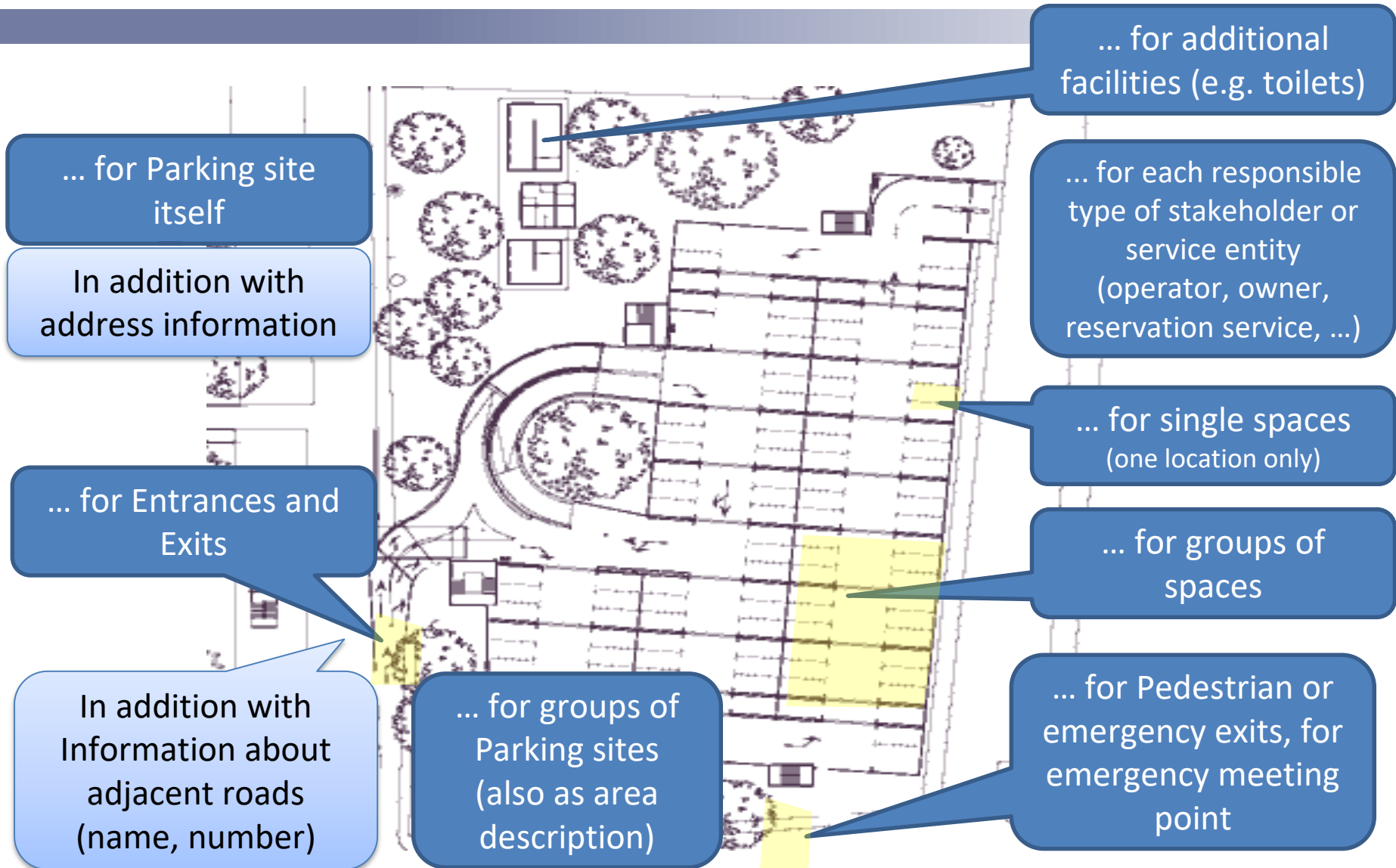


Compact parking (© BAST)

Elements for urban parking

- Parking Area
- Opening times
- Short term and long term spaces
- Facility layout (sort of building)
- Entrances for Pedestrians, Rental Car Return
- More / other facility types (airport parking, urban parking, ...)
- Additional parking users

Location Information (Georeference) is available ...



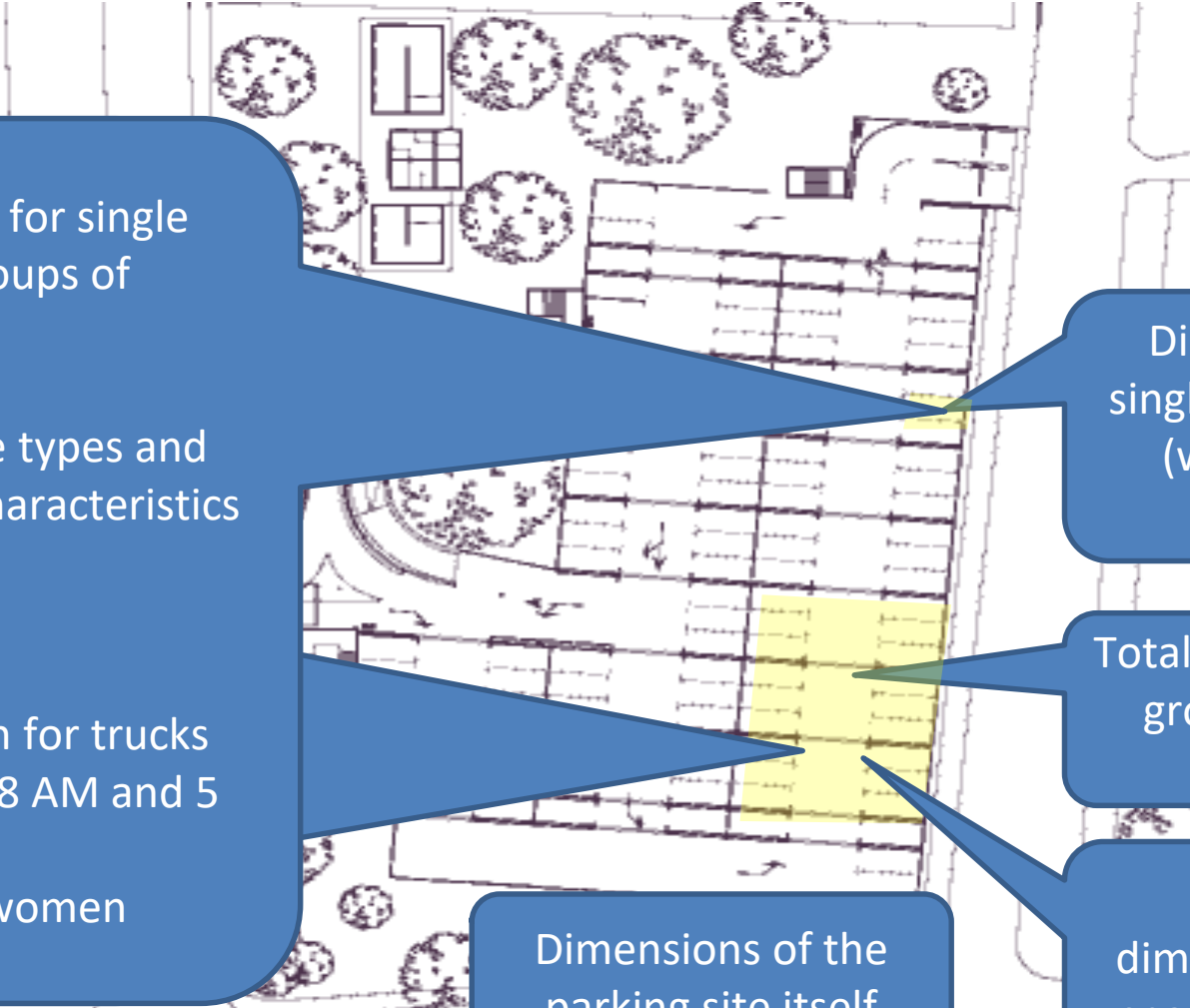
Dimensions and assignments

Assignments for single spaces or groups of spaces:

- by users
- by vehicle types and vehicle characteristics
- by time

Examples:

- Forbidden for trucks between 8 AM and 5 PM
- Only for women



Dimensions of a single parking space (width, length, height)

Total Dimensions of a group of parking spaces

Dimensions of the parking site itself

Minimum dimensions of each space of this group

Thank you



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