



IFC Rail Phase 2 Final Report

WP4 – Conceptual Model Report

Report of the updated Conceptual Model of IFC Rail.

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Contents

1	Introduction.....	8
1.1	Context of the document	9
1.2	Objectives of the document.....	10
1.3	Model updates	10
2	Package structure and convention.....	11
2.1.1	Package structure	11
2.1.2	Naming convention.....	13
2.1.3	Colour-code	13
2.1.4	Objects.....	13
2.1.5	Attributes.....	13
2.1.6	Business properties.....	14
2.1.7	Enumerations.....	14
2.1.8	Relationships.....	14
2.1.9	Descriptions	14
2.1.10	Tag values	14
3	Track	15
3.1	Track Structural (physical)	15
3.1.1	Class diagram "Track" Structural (physical), overview: candidate	15
3.1.2	Track- and turnout panel	15
3.1.3	Rail	19
3.1.4	Rail fastening	29
3.1.5	Sleeper	31
3.1.6	Strengthening equipment.....	33
3.1.7	Ballast.....	38
3.1.8	Slab track	39
3.1.9	Track coverage.....	44
3.1.10	Abs_Track-covering	45
3.1.11	Track sidewalk	47
3.1.12	Track alignment stops	48
3.1.13	Survey	50

3.1.14	Other equipment.....	51
3.2	Track Spatial	55
3.2.1	Class diagram track spatial structure.....	55
3.2.2	Track system	55
3.2.3	Track part.....	56
3.2.4	Plain track super structure.....	57
3.2.5	Turnout superstructure	57
3.2.6	Dilatation superstructure	58
3.2.7	Track substructure	58
4	Energy.....	59
4.1	Energy Structural (physical).....	59
4.1.1	Auxiliary Services	59
4.1.2	Earthing Circuit	61
4.1.3	Earthing Line	66
4.1.4	Electric Power Converter	67
4.1.5	Electric Storage	68
4.1.6	Feeder Line	70
4.1.7	Instrument Transformer	71
4.1.8	Mooring	74
4.1.9	Overhead Contact Line System.....	77
4.1.10	OverHead Line Supporting	80
4.1.11	Power Transformer	88
4.1.12	Protecting Devices.....	91
4.1.13	Regulating Devices	98
4.1.14	Return Circuit	102
4.1.15	Sectioning	106
4.1.16	Shared.....	107
4.1.17	Substation Control Equipment and technical building.....	116
4.1.18	Switch	122
4.1.19	Underground Facilities	127
4.2	Energy Spatial	130

4.2.1	Class diagram energy spatial	130
4.2.2	Class diagram energy reserved volume.....	131
4.2.3	Railway energy facility	131
4.2.4	Energy Overhead Line.....	132
4.2.5	Energy Power supply facility.....	134
4.2.6	Energy Reserved Volume.....	138
5	Signalling.....	142
5.1	Signalling Structural (physical)	142
5.1.1	Class diagram Objects overview pt.1.....	142
5.1.2	Class diagram Objects overview pt.2.....	143
5.1.3	Abstract_equipment.....	144
5.1.4	Axle counting equipment.....	146
5.1.5	Balise.....	147
5.1.6	Cable and Wire	149
5.1.7	Control Equipment.....	152
5.1.8	Detector types	157
5.1.9	Housing	162
5.1.10	Trackside battery.....	187
5.1.11	Level Crossing equipment	187
5.1.12	Local operation device	192
5.1.13	Lock.....	194
5.1.14	Signal	195
5.1.15	Track Circuit.....	201
5.1.16	Train protection equipment	206
5.1.17	Turnout signalling equipment	208
5.1.18	Vehicle barring/breaking device.....	212
5.1.19	_Shared (not analysed).....	216
5.2	Signalling Spatial.....	218
5.2.1	Signalling Spatial Structure	218
5.2.2	Signalling Outdoor Equipment placeholder (trackside).....	219
5.2.3	Signalling Indoor Equipment Placeholder (non-trackside)	220

6	Telecom	220
6.1	Telecom Structural (physical).....	220
6.1.1	Class diagram Telecom Structural overview.....	220
6.1.2	Abs_telecom object	221
6.1.3	Telecom active equipment	221
6.1.4	Telecom equipment element	223
6.1.5	Telecom passive equipment	224
6.1.6	Cabling & Cables	224
6.1.7	Interface with Other Domain.....	243
6.1.8	Fixed telephony system	244
6.1.9	Fixed transmission network.....	250
6.1.10	Mobile network (GSMR - WiFi - LTE).....	252
6.1.11	Railway natural disaster and Foreign object intrusion monitoring system	265
6.1.12	Relationships	270
6.1.13	Support and laying infrastructure	271
6.1.14	Telecom interfaces	277
6.1.15	Ticketing system	280
6.1.16	Time and frequency synchronization system.....	282
6.1.17	Wired access network	283
6.2	Telecom Spatial	284
6.2.1	Class diagram Telecom_Spatial_Model.....	284
6.2.2	Bottom equipment access zone	285
6.2.3	Equipment access zone.....	286
6.2.4	Front equipment access zone	286
6.2.5	Indoor laying infrastructure (routing) zone	287
6.2.6	Indoor telecom equipment zone	287
6.2.7	Indoor telecom zone.....	288
6.2.8	Left equipment access zone	288
6.2.9	Outdoor laying infrastructure (routing) zone	288
6.2.10	Outdoor telecom equipment zone.....	289
6.2.11	Outdoor Telecom zone.....	289

6.2.12	Rear equipment access zone	290
6.2.13	Right equipment access zone	290
6.2.14	Telecom laying infrastructure zone	290
6.2.15	Top equipment access zone	291
7	Common - Shared	291
7.1	Positioning	292
7.1.1	Class diagram "Positioning"	292
7.1.2	Abs At	292
7.1.3	Abs From - To	293
7.1.4	Contact Line At	293
7.1.5	Contact Line From - To	293
7.1.6	Line At	294
7.1.7	Line From - To	294
7.1.8	Track At	294
7.1.9	Track From - To	295
7.2	LRS & Alignment	295
7.2.1	Class diagram "LRS & Alignment"	295
7.2.2	Global Reference System	296
7.2.3	Line Alignment	297
7.2.4	Line LRS	297
7.2.5	Track Alignment	297
7.2.6	Track LRS	298
7.2.7	Track LRS-Segment	298
7.2.8	Track LRS-Broken-Segment	299
7.2.9	Cabling Alignment	299
7.2.10	Catenary Alignment	299
7.2.11	Contact Line LRS	300
7.2.12	Drainage alignment	300
7.2.13	Span Alignment	300
7.3	Alignment Proposal	301
7.3.1	Principles	301



7.3.2	Overview	301
7.3.3	Parameterized description	302
7.3.4	Discretized representation	312
7.3.5	Topology reference.....	313

1 Introduction

This document is built to report the IFC Rail Conceptual Model in UML. It is part of the official deliverables of IFC Rail Phase 2 project, as shown in Figure 1 below. Please refer to the *IFC Rail Phase 2 Final Report: Executive Summary* for further details.

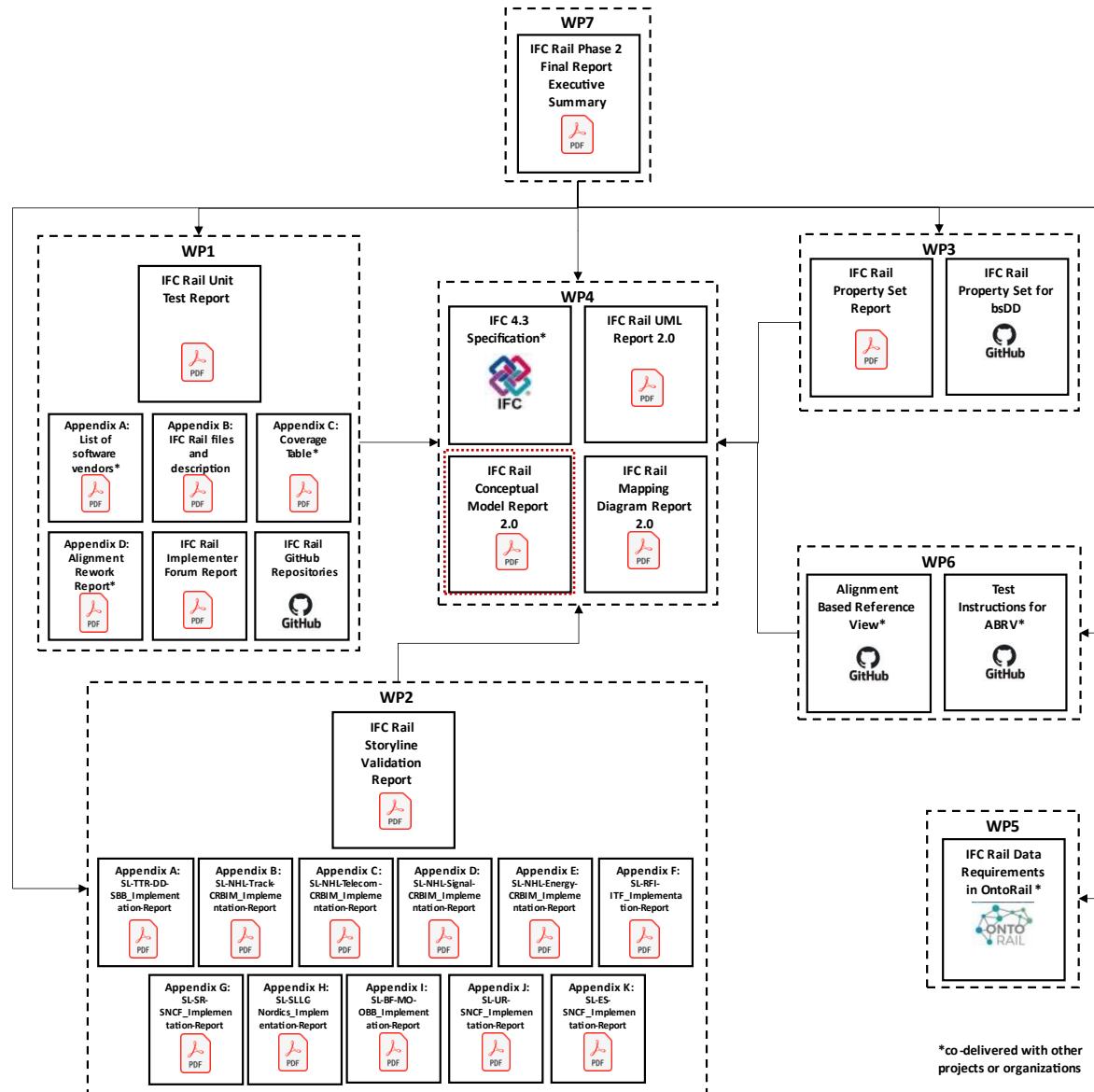


Figure 1 The position of this document in the structure of deliverables

This document is an updated version of IFC Rail Conceptual Model Report issued in IFC Rail project from 2018 to 2019. The reported conceptual model formalizes business requirements from railway domains independent with IFC. This document reports the general context of this work (Chapter 1),

package structure and convention (Chapter 2), domain packages including Track (Chapter 3), Energy (Chapter 4), Signalling (Chapter 5), Telecom (Chapter 6) and Common - Shared (Chapter 7).

1.1 Context of the document

In IFC Rail Project Phase 1, to capture the Rail Data Requirements, the project adopted a model-based approach. In particular, the object-modelling notation of UML (Unified Modelling Language) is used.

The present document describes the content of the (UML) Conceptual Model produced by the IFC Rail Project (Phase 1). It is one of many documents produced during the project, to understand its hierarchy inside the overall process documentation in IFC Rail Phase 1 see the following diagram (highlighted in red).

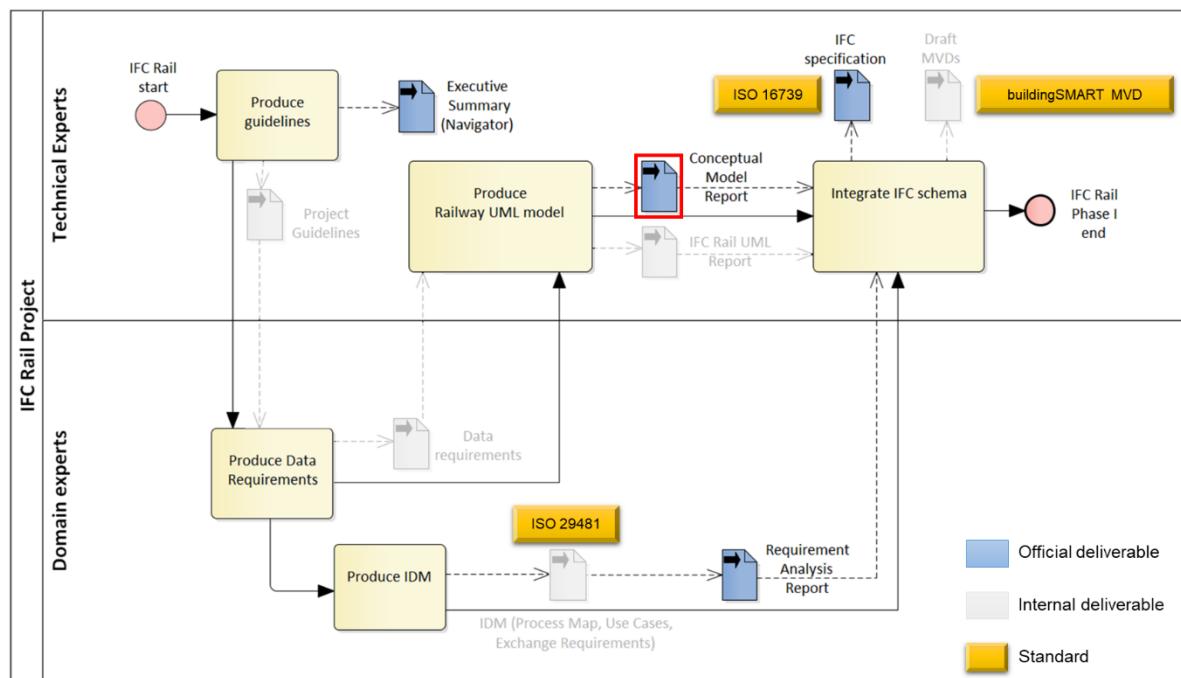


Figure 2 - Overall process and relative documentation of the IFC Rail Project (Phase I)

In IFC Rail Project Phase 2, a test-driven approach is taken to implement the IFC specification. During this process, issues and change requests are received to update IFC. Some of the change requests also have impact to the IFC Rail Conceptual Model. This document hence reports the updated version. The major updates are briefly reported in Chapter 1.3.



1.2 Objectives of the document

The Conceptual Model serves as:

- Formalization of the Concepts that define a business domain (i.e. Track, Signalling, etc.);
- Representation of the business requirements expressed by rail experts;
- Reference for the extension of the IFC schema;
- Reference for mapping between rail Concepts and IFC Concepts;
- Reference for BIMQ mapping;
- Additional documentation to the IFC specification.

Also, it is important to note that:

1. The Conceptual Model IS NOT the simple replica of the Data Requirements expressed by domain groups, but a conceptualization of them;
2. A conceptual model IS NOT a Product Breakdown Structure (PBS).

Since it is not possible to deliver the UML Model itself, the objective of the present document is to reflect part of the content of the Model, allowing the reader to evaluate the quality of the proposal.

1.3 Model updates

The updates on the conceptual model are listed as follows:

1. Package structure is updated to adapt to the harmonization requirements between IFC extension projects;
2. 2 classes are added in the Signalling domain: Lineside electronic unit, Radio block center;
3. 16 classes are added in the Telecom domain: Dispatching switch, Recording equipment, Operational telephony system, Fixed transmission network, Mobile switching center, MSC server, Packet control unit, Base station controller, Equipment identity register, Acknowledgement center, Home location register, Service GPRS support node, Gateway, Gateway GPRS support node, Mobile network, Monitoring system.

2 Package structure and convention

2.1.1 Package structure

The picture below represents the structure of the packages contained inside the IFC Rail package.

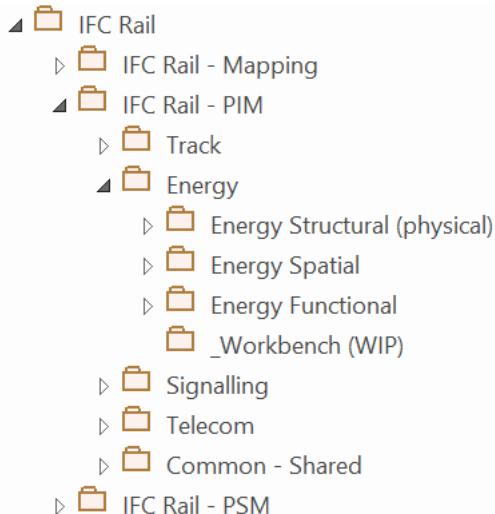


Figure 3 Structure of the IFC Rail package

On the first level there are 3 main packages:

- **IFC Rail - PIM:** which includes one sub-package for each railway domain (Track, Energy, Signalling, Telecom, and Common-Shared). This package is reported in this document.
- **IFC Rail - PSM:** which includes all diagrams that have IFC 4.3 concepts relevant for railway. This package is reported in *IFC Rail UML Report*.
- **IFC Rail - Mapping:** which includes all diagrams used to map classes in the conceptual model (IFC Rail – PIM) to IFC. This package is reported in *Mapping Diagrams Report*.

For the following reasons:

- To help reading the UML model;
- To help identify the concepts that need to be mapped toward IFC.

Inside each domain's package under 'IFC Rail – PIM', the following sub-package organization is enforced:

1. *domain name* Structural (physical);
2. *domain name* Spatial;
3. *domain name* Functional;
4. _Workbench (WIP).

The purpose and content of such packages is the following. Each railway object is a unique Concept inside the Conceptual Model, meaning it is described one time and for all inside the Model. However,

the same object can be seen under multiple *points of view*. To facilitate the readings and comprehension of the Conceptual Model, three major modelling *views* are adopted and encapsulated into the mentioned sub-packages.

The organization of the content of these sub-packages is subject to domains' need and peculiarities. The purpose and minimum requirement of the four packages are described in the following table.

Table 1 - Modelling views and their use

#	View	Used to express	Minimum content
1	Structural (Physical)	How objects are (de)composed, using (e.g.) Aggregation (i.e. part of, composed of) and Generalization of rail objects	<ul style="list-style-type: none"> all physical Concepts; structural diagrams to express physical breakdown of components, if needed
2	Spatial	How objects occupy the space. Namely, places / volumes / zones where rail objects are located	<ul style="list-style-type: none"> only spatial Concepts; spatial diagrams (which of course can contain link to physical objects from Structural package)
3	Functional	How objects are linked together and why. Namely, functional spaces/areas where objects are gathered under certain criteria, or functional groups where objects are collected under certain criteria	<ul style="list-style-type: none"> only functional Concepts; functional diagrams (which of course can contain link to physical objects from Structural package)
4	_Workbench (WIP)	All Work-In-Progress items and discussion of each domain	n.a.

NOTE: for all domains, the content of the packages (3), (4) is not described in the present document.

In addition to the packages of the four domains, a specific package is dedicated to the Common – Shared topics. This package contains:

- The identified shared and common concepts;
- *Alignment proposal: which includes the conceptual representation of the alignment geometry for Railway;
- *LRS & Alignment: which includes a diagram to clarify the distinction between Alignment as geometry curves and the Linear Reference Systems (LRS) that might use those curves;
- *Positioning: which includes the Data Types used to indicate explicitly the positioning of certain Railway objects.
- *Track Topology and LRS: which includes the topology concepts.
- *Spatial structure: which includes the shared spatial structure concepts used in railway.

* See the document *Requirement Analysis Report* issued in IFC Rail Phase 1 for details.

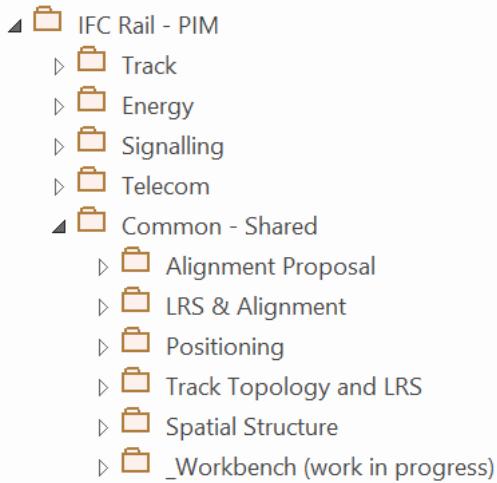


Figure 4 - Package structure of the IFC Rail – PIM package, detail of Common - Shared package

2.1.2 Naming convention

- All names, descriptions, notes of any element of the model are in English;
- Ifc prefix is forbidden in Conceptual Model;
- Regular case is used (no *camelCase*, *PascalCase*, *snake_case*, nor else).

2.1.3 Colour-code

- In the Conceptual Model, elements are differentiated as follows:
 - Spaces / Zones / Volumes (all non-product concepts) → WHITE background;
 - Functional Spaces → Brown background;
 - Functional Groups → Grey background;
 - Alignment → Blue;
 - Physical elements → Any background colour EXCEPT WHITE, BROWN, GREY.
- Furthermore, notes in diagrams are represented according to this convention:
 - Open notes or questions → Yellow
 - Solved notes or general info → Green

2.1.4 Objects

- Rail objects are modelled as UML Classes;
- Element's Name is the English name of the object (according to Data Requirements);
- Element's Alias is left to domain usage. Sometimes is used for the Chinese name of the object (according to Data Requirements);
- No Element Stereotype is allowed for the Conceptual Model;

2.1.5 Attributes

- Attributes which are related to geometrical representation are included in the Conceptual Model. These are expressed as attribute of the UML Class
- These attributes are intended to be defined in the IFC schema;

2.1.6 Business properties

- Business properties of the objects are not included in the Conceptual Model. They are reported in the Data Requirement Report document;
- These properties are

2.1.7 Enumerations

- Subtyping using enumerations is strictly prohibited inside the Conceptual Model;
- Enumerations are sometimes used to represent a list of predefined values of attributes;

2.1.8 Relationships

- UML Associations must be used to express business relationships between objects. No IFC implementation consideration is used for the Conceptual Model;
- The allowed UML associations for Conceptual Model are described in the table below.

Table 2 - Relationships used inside the Conceptual Model

RELATIONSHIP	DESCRIPTION
Aggregation [Sharing]	<ul style="list-style-type: none"> • It is used to depict elements which are made up of smaller components
Generalization [Typing]	<ul style="list-style-type: none"> • It is used to indicate inheritance. The source inherits the target's characteristics • It is drawn from the specific classifier (source) to a general classifier (target)
Association [general use]	<ul style="list-style-type: none"> • It is the general relationship type between elements • Use this when not sure of none of the above relationships • To provide further understanding, add a description to this association

- For all the above association there are two possible uses:
 - Plain (no text), means that the two concepts are somehow related;
 - Described (with text), to express constraints or any other relationship (e.g. supports; connects; etc.);
- Stereotyped relationships are forbidden in the Conceptual Model;
- Only for the Conceptual Model, multiple inheritance is accepted;
- Multiplicity (a.k.a. Cardinality) is considered as “optional”.

2.1.9 Descriptions

- English description of objects and attributes is included as Element's note.

2.1.10 Tag values

- Only one tag value is admitted and used inside the Conceptual Model: IFC_RAIL_ID. This is compiled with values from Domains' Data Requirements and it is used for BIMQ synchronization (tooling purpose only).

3 Track

3.1 Track Structural (physical)

3.1.1 Class diagram "Track" Structural (physical), overview: candidate

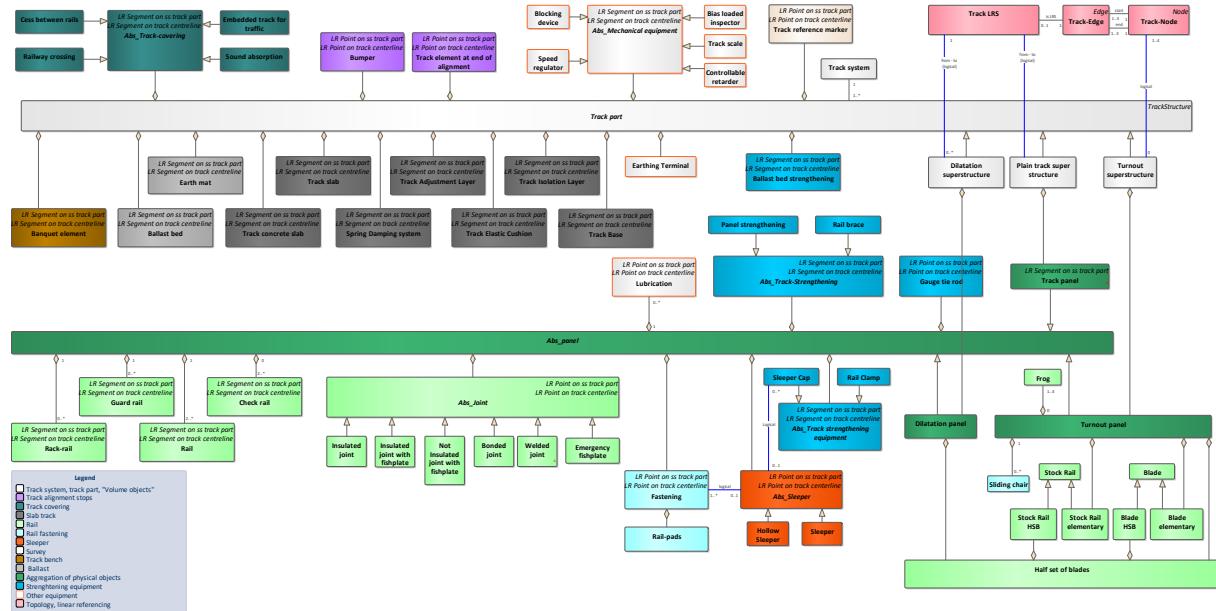


Table 1: Class diagram "Track" Structural (physical), overview: candidate

3.1.2 Track- and turnout panel

3.1.2.1 Class diagram "Track- and turnout panel"

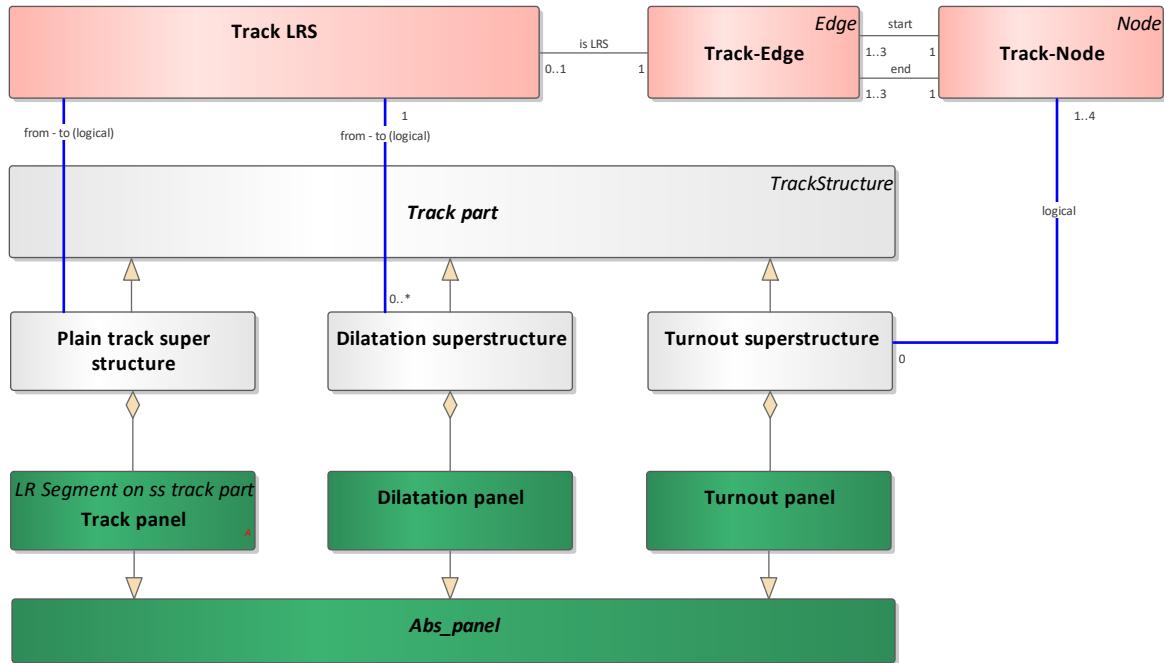


Table 2: Class diagram "Track- and turnout panel"

3.1.2.2 *Abs_panel*

Abstract class representing any panel for track physical objects.

Relationships

Source	Type	Target
Fastening	Aggregation	<i>Abs_panel</i>
Check rail	Aggregation	<i>Abs_panel</i>
Turnout panel	Generalization	<i>Abs_panel</i>
Transistion Layer	Aggregation	<i>Abs_panel</i>
Lubrication	Aggregation	<i>Abs_panel</i>
Guard rail	Aggregation	<i>Abs_panel</i>
Dilatation panel	Generalization	<i>Abs_panel</i>
<i>Abs_Track-Strengthening</i>	Aggregation	<i>Abs_panel</i>
<i>Abs_Track strengthening equipment</i>	Aggregation	<i>Abs_panel</i>
Rail	Aggregation	<i>Abs_panel</i>
Track panel	Generalization	<i>Abs_panel</i>

Source	Type	Target
Abs_Sleeper	Aggregation	Abs_panel
Barrier layer	Aggregation	Abs_panel
Gauge tie rod	Aggregation	Abs_panel
Abs_Joint	Aggregation	Abs_panel
Foundation Layer	Aggregation	Abs_panel
Rack-rail	Aggregation	Abs_panel

3.1.2.3 Track panel

Trackwork ensuring the support and guidance of a vehicle along a route. It consists of assembly of rail, sleepers and fastenings.

Relationships

Source	Type	Target
Track panel	Realization	IfcElementAssembly.TRACK PANEL
Track panel	Generalization	LR Segment on ss track part
Track panel	Realization	IfcElementAssemblyTypeEnum.TRACKPANEL
Track panel	Generalization	Abs_panel
Track panel	Aggregation	Plain track super structure
Track panel	Realization	IfcElementAssembly.TRACK PANEL

3.1.2.4 Turnout panel

(NF EN 13232-1-2004)

Trackwork ensuring the support and guidance of a vehicle along any given route among various diverging or intersecting tracks.

Relationships

Source	Type	Target
Turnout panel	Realization	IfcElementAssembly.TURNO UTPANEL
Turnout panel	Generalization	Abs_panel
Turnout panel	Realization	IfcElementAssembly.TURNO UTPANEL
Turnout panel	Aggregation	Turnout superstructure
Turnout panel	Realization	IfcElementAssemblyTypeEnum.TURNOUTPANEL
Frog	Aggregation	Turnout panel
Sliding chair	Aggregation	Turnout panel
Blade elementary	Aggregation	Turnout panel
Stock Rail elementary	Aggregation	Turnout panel
Half set of blades	Aggregation	Turnout panel

3.1.2.5 Dilatation panel

(NF EN 13232-1-2004)

Device which permits longitudinal relative rail movement of two adjacent rails, while maintaining correct guidance and support.

Relationships

Source	Type	Target
Dilatation panel	Realization	IfcElementAssemblyTypeEnum.DILATATIONPANEL
Dilatation panel	Generalization	Abs_panel
Dilatation panel	Aggregation	Dilatation superstructure
Dilatation panel	Realization	IfcElementAssembly.DILATATIONPANEL
Dilatation panel	Realization	IfcElementAssembly.DILATATIONPANEL

Source	Type	Target
Half set of blades	Aggregation	Dilatation panel

3.1.3 Rail

3.1.3.1 Class diagram "Rail positioning"

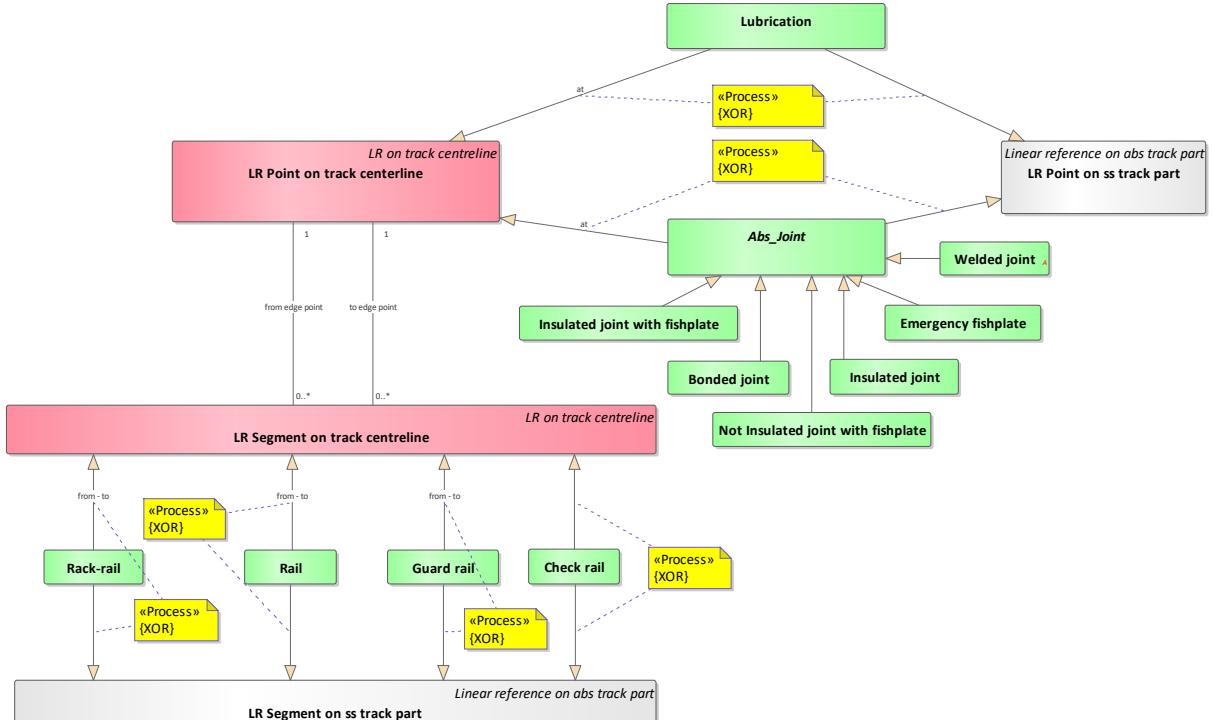


Table 3: Class diagram "Rail positioning"

1.1.1.1.1 Class diagram "Rail"

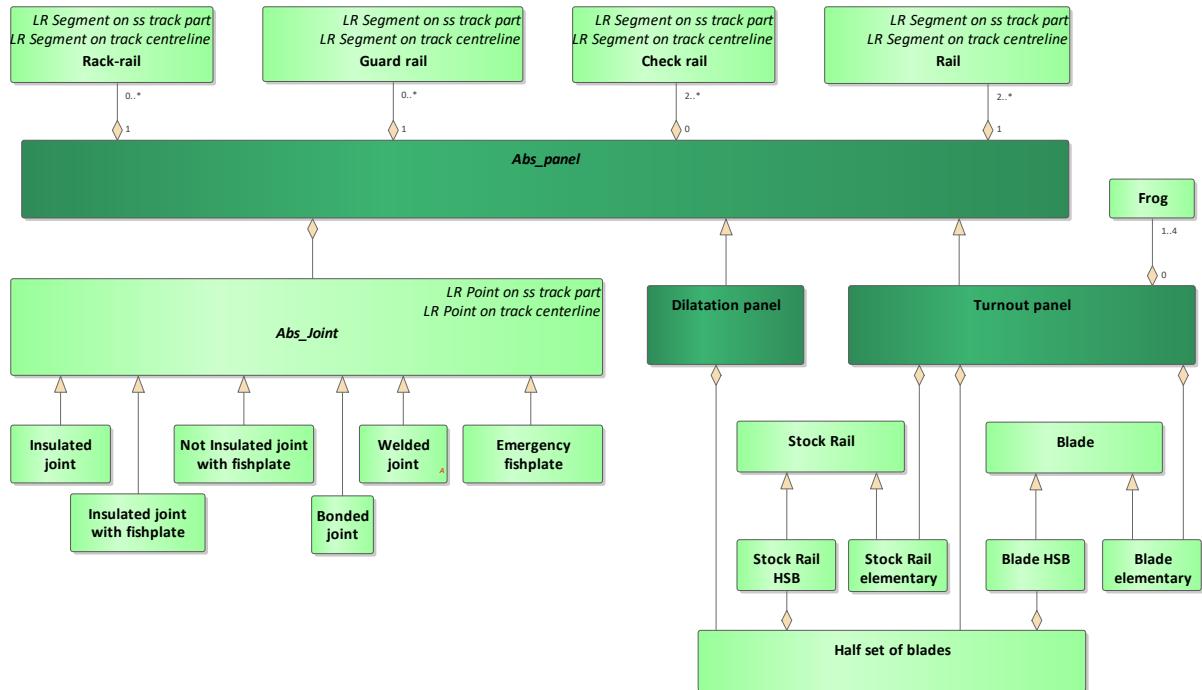


Table 4: Class diagram "Rail"

3.1.3.2 Rail

Special section bar (usually of steel) ensuring the guidance of the wheel of a rolling stock or other heavy machineries. In railway, two rails are combined to form the track.

Relationships

Source	Type	Target
Rail	Generalization	LR Segment on ss track part
Rail	Generalization	LR Segment on track centreline
Rail	Aggregation	Abs_panel
IfcRail.RAIL	Realization	Rail
IfcRailTypeEnum.RAIL	Realization	Rail
IfcRail.RAIL	Realization	Rail

3.1.3.3 Check rail

(EN 13481-1) :

Rail laid close to the gauge face of a running rail which takes part in lateral guidance of the wheel and prevents derailment in small radius curved track and switches and crossings.

Relationships

Source	Type	Target
Check rail	Aggregation	Abs_panel
Check rail	Generalization	LR Segment on track centreline
Check rail	Generalization	LR Segment on ss track part
IfcRail.CHECKRAIL	Realization	Check rail
IfcRail.CHECKRAIL	Realization	Check rail
IfcRailTypeEnum.CHECKRAIL	Realization	Check rail

3.1.3.4 Guard rail

Rail that limits risk of train derailment, normally not loaded.

Relationships

Source	Type	Target
Guard rail	Generalization	LR Segment on ss track part
Guard rail	Aggregation	Abs_panel
Guard rail	Generalization	LR Segment on track centreline
IfcRailTypeEnum.GUARDRAIL	Realization	Guard rail
IfcRail.GUARDRAIL	Realization	Guard rail
IfcRail.GUARDRAIL	Realization	Guard rail

3.1.3.5 Rack-rail

Building module for enhancing traction and break performance.

Relationships

Source	Type	Target
Rack-rail	Generalization	LR Segment on ss track part
Rack-rail	Generalization	LR Segment on track centreline
Rack-rail	Aggregation	Abs_panel
IfcRailTypeEnum.RACKRAIL_L	Realization	Rack-rail
IfcRail.RACKRAIL	Realization	Rack-rail
IfcRail.RACKRAIL	Realization	Rack-rail

3.1.3.6 Frog

(EN 13232-1-2004):

Arrangement ensuring the intersection of two opposite running edges of turnouts or diamond crossings and having one crossing vee and two wing rails.

Named frog in the US

Relationships

Source	Type	Target
Frog	Aggregation	Turnout panel
IfcTrackElement.FROG	Realization	Frog
IfcTrackElementTypeEnum.FROG	Realization	Frog
IfcTrackElement.FROG	Realization	Frog

3.1.3.7 Half set of blades

(EN 13232-1-2004)

Consists of one stock rail and its switch rail complete with small fittings. It is right or left hand as seen by an observer in the centre of the track facing the switch heel from the switch toe.

Relationships

Source	Type	Target
Half set of blades	Aggregation	Dilatation panel
Half set of blades	Aggregation	Turnout panel
Blade HSB	Aggregation	Half set of blades
Stock Rail HSB	Aggregation	Half set of blades
IfcTrackElement.HALF_SET_OF_BLADES	Realization	Half set of blades
IfcTrackElementTypeEnum.HALF_SET_OF_BLADES	Realization	Half set of blades
IfcTrackElement.HALF_SET_OF_BLADES	Realization	Half set of blades

3.1.3.8 Blade

(EN 13232-1-2004)

movable machined rail, often of special section, but fixed and/or joined at the heel end to a rail to provide continuity of wheel support. The two switch rails in a set are the two inside rails. A switch rail is described as right or left hand according to whether it is part of a right hand or left hand half-set of switches.

Relationships

Source	Type	Target
Blade elementary	Generalization	Blade
Blade HSB	Generalization	Blade

Source	Type	Target
IfcRailTypeEnum.BLADE	Realization	Blade
IfcRail.BLADE	Realization	Blade
IfcRail.BLADE	Realization	Blade

3.1.3.9 Blade elementary

Subtype of blade as a separated manufactured element (i.e. tramways)

Relationships

Source	Type	Target
Blade elementary	Generalization	Blade
Blade elementary	Aggregation	Turnout panel

3.1.3.10 Blade HSB

Subtype of blade only used in half set of blades

Relationships

Source	Type	Target
Blade HSB	Aggregation	Half set of blades
Blade HSB	Generalization	Blade

3.1.3.11 Stock Rail

(EN 13232-1-2004)

fixed machined rail, ensuring the continuity on the main or diverging track with the switch in the open position. The machined part of the stock rail supports its switch rail in the closed position, giving continuity of line through this switch rail. The two stock rails in a set of switches are the two outside rails. A stock rail is described as right or left hand according to whether it is part of a right hand or left hand half-set of switches.

Relationships

Source	Type	Target
IfcRail STOCKRAIL	Realization	Stock Rail
IfcRailTypeEnum STOCKRAIL	Realization	Stock Rail
IfcRail STOCKRAIL	Realization	Stock Rail
Stock Rail HSB	Generalization	Stock Rail
Stock Rail elementary	Generalization	Stock Rail

3.1.3.12 Stock Rail elementary

Subtype of stock rail as a separated manufactured element (i.e. tramways)

Relationships

Source	Type	Target
Stock Rail elementary	Aggregation	Turnout panel
Stock Rail elementary	Generalization	Stock Rail

3.1.3.13 Stock Rail HSB

Subtype of stock rail only used in half set of blades

Relationships

Source	Type	Target
Stock Rail HSB	Aggregation	Half set of blades
Stock Rail HSB	Generalization	Stock Rail

3.1.3.14Abs_Joint

Mechanical assembly with e.g. fishplates to join two rail ends with optional functions (insulation or expansion capacity).

Relationships

Source	Type	Target
Abs_Joint	Generalization	LR Point on ss track part
Abs_Joint	Aggregation	Abs_panel
Abs_Joint	Generalization	LR Point on track centerline
Emergency fishplate	Generalization	Abs_Joint
Welded joint	Generalization	Abs_Joint
Not Insulated joint with fishplate	Generalization	Abs_Joint
Insulated joint	Generalization	Abs_Joint
Bonded joint	Generalization	Abs_Joint
Insulated joint with fishplate	Generalization	Abs_Joint

3.1.3.15Insulated joint

(PR EN_16843)

Mechanical rail joint that connects two rails of the same profile, with the additional function to separate both rail ends electrically, without expansion capacity which can resist the forces in CWR.

Relationships

Source	Type	Target
Insulated joint	Generalization	Abs_Joint
IfcMechanicalFastener.RAILJOINT	Realization	Insulated joint
IfcMechanicalFastener.RAILJOINT	Realization	Insulated joint
IfcMechanicalFastenerTypeEnum.RAILJOINT	Realization	Insulated joint

3.1.3.16 Emergency fishplate

Temporary mechanical connection between 2 rails or reinforcement of one rail

Relationships

Source	Type	Target
Emergency fishplate	Generalization	Abs_Joint
IfcMechanicalFastener.RAILJOINT	Realization	Emergency fishplate
IfcMechanicalFastenerTypeEnum.RAILJOINT	Realization	Emergency fishplate
IfcMechanicalFastener.RAILJOINT	Realization	Emergency fishplate

3.1.3.17 Bonded joint

(PR EN_16843)

Mechanical rail joint that connects two rails of the same profile, electrically bounded, without expansion capacity which can resist the forces in CWR

Relationships

Source	Type	Target
Bonded joint	Generalization	Abs_Joint

Source	Type	Target
IfcMechanicalFastener.RAIL JOINT	Realization	Bonded joint
IfcMechanicalFastener.RAIL JOINT	Realization	Bonded joint
IfcMechanicalFastenerTypeEnum.RAILJOINT	Realization	Bonded joint

3.1.3.18 Welded joint

A weld seam between parts of metallic material or other suitable materials.

Relationships

Source	Type	Target
Welded joint	Generalization	Abs_Joint
IfcFastener.WELD	Realization	Welded joint
IfcFastener.WELD	Realization	Welded joint
IfcFastenerTypeEnum.WELD	Realization	Welded joint

3.1.3.19 Insulated joint with fishplate

(PR EN_16843)

mechanical rail joint with expansion capacity which can accommodate longitudinal displacement of the jointed rail length, with the additional function to separate both rail ends electrically,

Relationships

Source	Type	Target
Insulated joint with fishplate	Generalization	Abs_Joint
IfcMechanicalFastener.RAIL JOINT	Realization	Insulated joint with fishplate

Source	Type	Target
IfcMechanicalFastener.RAILJOINT	Realization	Insulated joint with fishplate
IfcMechanicalFastenerTypeEnum.RAILJOINT	Realization	Insulated joint with fishplate

3.1.3.20 Not Insulated joint with fishplate

(PR EN_16843)

Mechanical rail joint, electrically bounded,

with expansion capacity which can accommodate longitudinal displacement of the jointed rail length.

Relationships

Source	Type	Target
Not Insulated joint with fishplate	Generalization	Abs_Joint
IfcMechanicalFastenerTypeEnum.RAILJOINT	Realization	Not Insulated joint with fishplate
IfcMechanicalFastener.RAILJOINT	Realization	Not Insulated joint with fishplate
IfcMechanicalFastener.RAILJOINT	Realization	Not Insulated joint with fishplate

3.1.4 Rail fastening

3.1.4.1 Class diagram "Rail fastening"

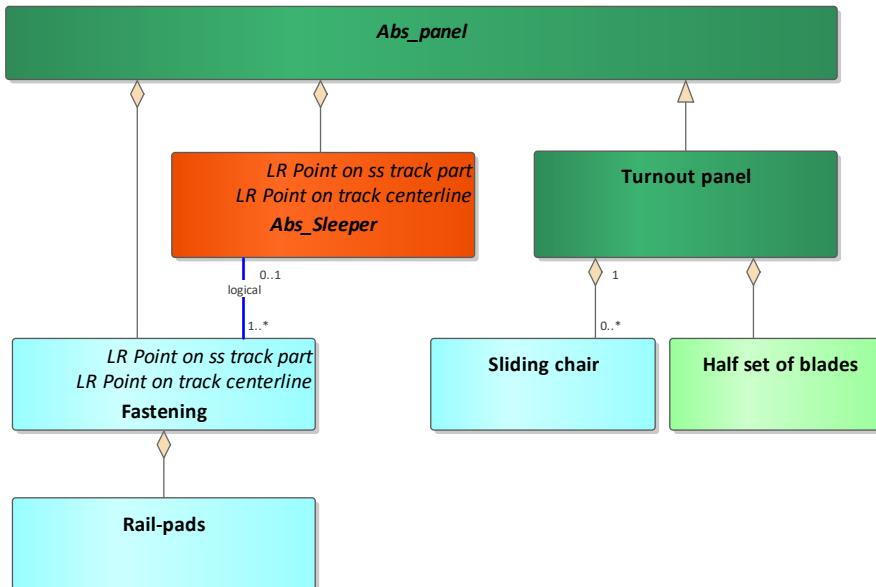


Table 5: Class diagram "Rail fastening"

3.1.4.2 Fastening

(EN 13481-1):

Assembly of components which secures a rail to the supporting structure and retains it in the required position whilst permitting any necessary vertical, lateral and longitudinal movement.

Relationships

Source	Type	Target
Fastening	Aggregation	Abs_panel
Fastening	Generalization	LR Point on track centerline
Fastening	Generalization	LR Point on ss track part
Fastening	Association	Abs_Sleeper
Fastening	Realization	IfcMechanicalFastener.RAILFASTENING
Fastening	Realization	IfcMechanicalFastener.RAILFASTENING
Fastening	Realization	IfcMechanicalFastenerTypeE.num.RAILFASTENING
Rail-pads	Aggregation	Fastening

3.1.4.3 Rail-pads

(EN 13481-1) :

Non-metallic pad placed between rail and baseplate or rail and sleeper, bearer or slab.

Relationships

Source	Type	Target
Rail-pads	Realization	IfcDiscreteAccessory.RAILPAD
Rail-pads	Realization	IfcDiscreteAccessory.RAILPAD
Rail-pads	Realization	IfcDiscreteAccessoryTypeEnum.RAILPAD
Rail-pads	Aggregation	Fastening

3.1.4.4 Sliding chair

Part which supports and retains the stock rail and a flat surface upon which the foot of the switch rail slides.

Relationships

Source	Type	Target
Sliding chair	Aggregation	Turnout panel
Sliding chair	Realization	IfcDiscreteAccessory.SLIDINGCHAIR
Sliding chair	Realization	IfcDiscreteAccessory.SLIDINGCHAIR
Sliding chair	Realization	IfcDiscreteAccessoryTypeEnum.SLIDINGCHAIR

3.1.5 Sleeper

3.1.5.1 Class diagram "Sleeper"

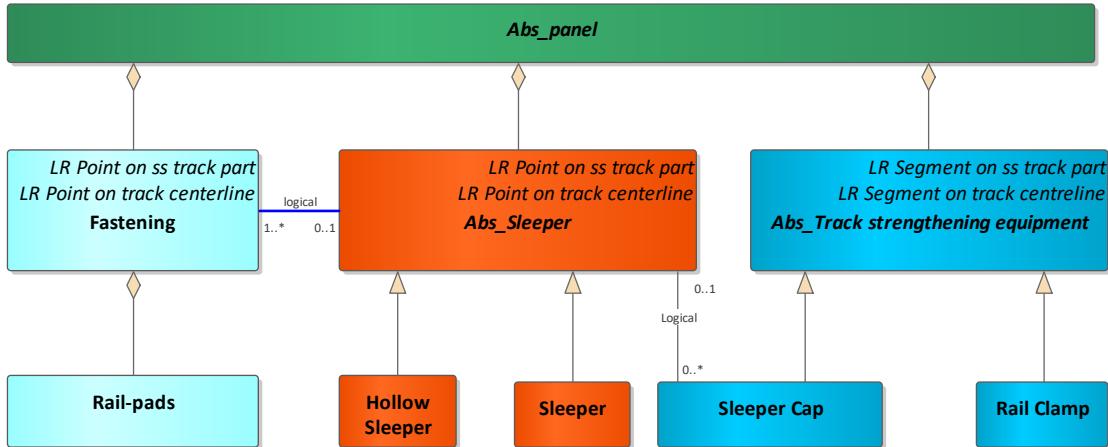


Table 6: Class diagram "Sleeper"

3.1.5.2 *Abs_Sleeper*

Abstract class for sleepers

Relationships

Source	Type	Target
Abs_Sleeper	Generalization	LR Point on track centerline
Abs_Sleeper	Aggregation	Abs_panel
Abs_Sleeper	Generalization	LR Point on ss track part
Sleeper	Generalization	Abs_Sleeper
Hollow Sleeper	Generalization	Abs_Sleeper
Fastening	Association	Abs_Sleeper
Sleeper Cap	Association	Abs_Sleeper

3.1.5.3 *Sleeper*

(EN 13481-1) :

Beam, which may be composite in construction, which supports running rails, guard rails and check rails at right angles to its axis.

Relationships

Source	Type	Target
Sleeper	Generalization	Abs_Sleeper
Sleeper	Realization	IfcTrackElementTypeEnum.SLEEPER
Sleeper	Realization	IfcTrackElement.SLEEPER
Sleeper	Realization	IfcTrackElement.SLEEPER

3.1.5.4 Hollow Sleeper

(EN16431) :

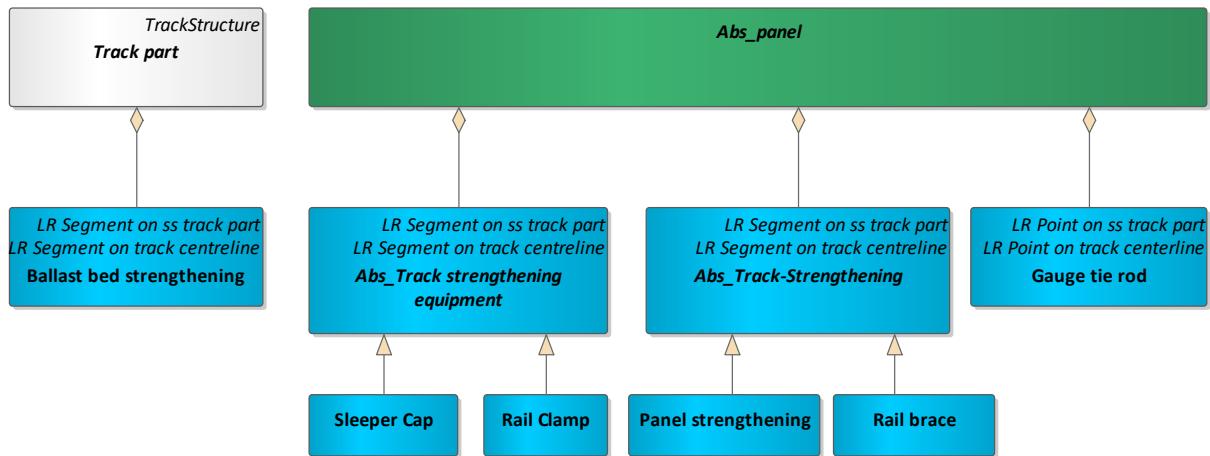
Sleepers and bearers with hollow structure, with support for Vignole rails on ballasted or ballastless track, including the fastenings systems and all components, with a minimum of 50 % of the cross sectional-area hollow throughout its length.

Relationships

Source	Type	Target
Hollow Sleeper	Generalization	Abs_Sleeper
Hollow Sleeper	Realization	IfcTrackElement.SLEEPER
Hollow Sleeper	Realization	IfcTrackElement.SLEEPER
Hollow Sleeper	Realization	IfcTrackElementTypeEnum.SLEEPER

3.1.6 Strengthening equipment

3.1.6.1 Class diagram "Strengthening equipment"



3.1.6.2 *Abs_Track-Strengthening*

Abstract class for track strengthening

Relationships

Source	Type	Target
Abs_Track-Strengthening	Generalization	LR Segment on track centreline
Abs_Track-Strengthening	Aggregation	Abs_panel
Abs_Track-Strengthening	Generalization	LR Segment on ss track part
Rail brace	Generalization	Abs_Track-Strengthening
Panel strengthening	Generalization	Abs_Track-Strengthening

3.1.6.3 *Panel strengthening*

Object minimizing pump effects of the substructure

Relationships

Source	Type	Target
Panel strengthening	Realization	IfcDiscreteAccessory.PANEL_STRENGTHENING

Source	Type	Target
Panel strengthening	Realization	IfcDiscreteAccessoryTypeEnum.PANEL_STRENGTHENING
Panel strengthening	Generalization	Abs_Track-Strengthening
Panel strengthening	Realization	IfcDiscreteAccessory.PANEL_STRENGTHENING

3.1.6.4 Rail brace

System that prevents rails from tipping and twisting.

Relationships

Source	Type	Target
Rail brace	Realization	IfcDiscreteAccessoryTypeEnum.RAILBRACE
Rail brace	Generalization	Abs_Track-Strengthening
Rail brace	Realization	IfcDiscreteAccessory.RAILBRACE
Rail brace	Realization	IfcDiscreteAccessory.RAILBRACE

3.1.6.5 Ballast bed strengthening

Structural element on the side of the ballast bed stabilizing the ballast.

Relationships

Source	Type	Target
Ballast bed strengthening	Generalization	LR Segment on ss track part
Ballast bed strengthening	Realization	IfcWallTypeEnum.RETAININGWALL
Ballast bed strengthening	Realization	IfcWall.RETAININGWALL
Ballast bed strengthening	Aggregation	Track part

Source	Type	Target
Ballast bed strengthening	Generalization	LR Segment on track centreline
Ballast bed strengthening	Realization	IfcWall.RETAININGWALL

3.1.6.6 Abs_Track strengthening equipment

Component for increasing the positional stability and functionality of a sleeper

Use often depends on topology and line routing

Main function: Increasing the lateral stability (Often used in low radius curves in the case of continuous welded rail.)

Dovetails with ballast

Improves the transmission of longitudinal forces from the running rail into the sleeper (e.g. anti creep device)

Assigned to a sleeper

Changed to abstract class, GoToMeeting / 22.7.2019

Relationships

Source	Type	Target
Abs_Track strengthening equipment	Generalization	LR Segment on ss track part
Abs_Track strengthening equipment	Generalization	LR Segment on track centreline
Abs_Track strengthening equipment	Aggregation	Abs_panel
Sleeper Cap	Generalization	Abs_Track strengthening equipment
Rail Clamp	Generalization	Abs_Track strengthening equipment

3.1.6.7 Sleeper Cap

Component fixed to sleeper increasing lateral stability.

Relationships

Source	Type	Target
Sleeper Cap	Realization	IfcMechanicalFastener.ANCHORBOLT
Sleeper Cap	Realization	IfcMechanicalFastener.ANCHORBOLT
Sleeper Cap	Association	Abs_Sleeper
Sleeper Cap	Realization	IfcMechanicalFastenerTypeEnum.ANCHORBOLT
Sleeper Cap	Generalization	Abs_Track strengthening equipment

3.1.6.8 Rail Clamp

Component fixed to rail preventing rail movement from sleeper.

Relationships

Source	Type	Target
Rail Clamp	Realization	IfcMechanicalFastener.RAILFASTENING
Rail Clamp	Realization	IfcMechanicalFastenerTypeEnum.RAILFASTENING
Rail Clamp	Realization	IfcMechanicalFastener.RAILFASTENING
Rail Clamp	Generalization	Abs_Track strengthening equipment

3.1.6.9 Gauge tie rod

A linear bar element used to secure or stabilise a structure by resisting lateral and longitudinal loading through tension and or compression. usually formed by a solid bar.

Relationships

Source	Type	Target
Gauge tie rod	Generalization	LR Point on ss track part
Gauge tie rod	Aggregation	Abs_panel
Gauge tie rod	Generalization	LR Point on track centerline
IfcMember.TIEBAR	Realization	Gauge tie rod
IfcMember.TIEBAR	Realization	Gauge tie rod
IfcMemberTypeEnum.TIEBAR	Realization	Gauge tie rod

3.1.7 Ballast

3.1.7.1 Class diagram "Ballast"

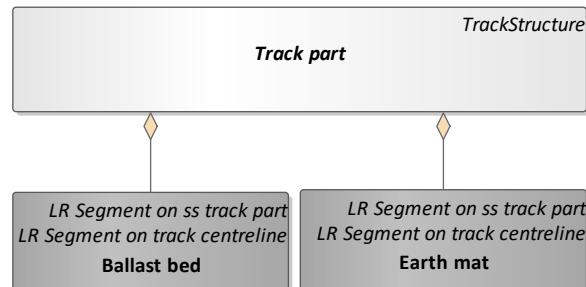


Table 8: Class diagram "Ballast"

3.1.7.2 Ballast bed

Layer composed of broken stones under the sleepers

Relationships

Source	Type	Target
Ballast bed	Generalization	LR Segment on track centreline

Source	Type	Target
Ballast bed	Aggregation	Track part
Ballast bed	Generalization	LR Segment on ss track part
IfcCourse.BALLASTBED	Realization	Ballast bed
IfcCourse.BALLASTBED	Realization	Ballast bed
IfcCourseTypeEnum.BALLASTBED	Realization	Ballast bed

3.1.7.3 Earth mat

Functional layer that separates the superstructure from the substructure.

Relationships

Source	Type	Target
Earth mat	Realization	IfcCovering.MEMBRANE
Earth mat	Generalization	LR Segment on ss track part
Earth mat	Realization	IfcCoveringTypeEnum.MEMBRANE
Earth mat	Generalization	LR Segment on track centreline
Earth mat	Aggregation	Track part
Earth mat	Realization	IfcCovering.MEMBRANE

3.1.8 Slab track

3.1.8.1 Class diagram "Slab track"

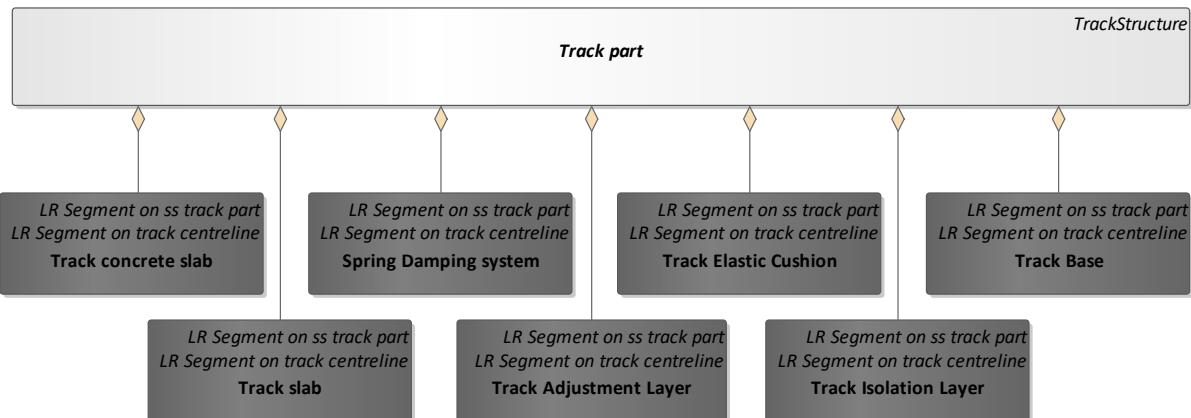


Table 9: Class diagram "Slab track"

3.1.8.2 Track concrete slab

Track concrete slab is an integral reinforced concrete layer cast in-situ, in which bi-block sleepers, concrete turnout sleepers or other sleepers are embedded.

Track concrete slab shall only appear in ballastless track structures.

Relationships

Source	Type	Target
Track concrete slab	Generalization	LR Segment on track centreline
Track concrete slab	Generalization	LR Segment on ss track part
Track concrete slab	Realization	IfcSlabTypeEnum.TRACKSLAB
Track concrete slab	Aggregation	Track part
IfcSlab.TRACKSLAB	Realization	Track concrete slab
IfcSlab.TRACKSLAB	Realization	Track concrete slab

3.1.8.3 Track slab

Track slab is prefabricated reinforced concrete slab or prestressed reinforced concrete slab, which is a main element of slab track.

It transfers the load from rails and fastenings to sub-structures uniformly and longitudinal and lateral load of track structures to displacement-stopping structures.

Track Slab shall only appear in ballastless track structures.

The line where install track slab provide the place for installing fastening system. No sleeper is needed.

Relationships

Source	Type	Target
Track slab	Generalization	LR Segment on track centreline
Track slab	Aggregation	Track part
Track slab	Generalization	LR Segment on ss track part
Track slab	Realization	IfcSlabTypeEnum.TRACKSLAB
IfcSlab.TRACKSLAB	Realization	Track slab
IfcSlab.TRACKSLAB	Realization	Track slab

3.1.8.4 Spring Damping system

Elastic elements are inserted between the superstructure (track and plate on slab track or ballast bed with ballast inserted in) and the tunnel structure (tunnel floor). Some of the elastic elements have a partial decoupling effect between the superstructure and underground due to vibrations. Both helical springs and elastomer blocks or elastomer strips can be used as suspension systems.

Relationships

Source	Type	Target
Spring Damping system	Realization	IfcImpactProtectionDeviceTypeEnum.DAMPINGSYSTEM
Spring Damping system	Generalization	LR Segment on ss track part
Spring Damping system	Aggregation	Track part
Spring Damping system	Generalization	LR Segment on track centreline

Source	Type	Target
IfcImpactProtectionDevice.DAMPINGSYSTEM	Realization	Spring Damping system

3.1.8.5 Track Adjustment Layer

Track adjustment layer is a concrete layer or mortar layer cast or paved in-situ, which is used for supporting track slabs or track concrete slabs.

Track adjustment layer shall only appear in ballastless track structures.

Relationships

Source	Type	Target
Track Adjustment Layer	Generalization	LR Segment on track centreline
Track Adjustment Layer	Aggregation	Track part
Track Adjustment Layer	Realization	IfcSlabTypeEnum.BASESLAB
Track Adjustment Layer	Generalization	LR Segment on ss track part
IfcSlab.BASESLAB	Realization	Track Adjustment Layer
IfcSlab.BASESLAB	Realization	Track Adjustment Layer

3.1.8.6 Track Elastic Cushion

Track elastic cushion is a kind of layer set on grooved sides of a concrete base, which is used for mitigating the impact of longitudinal and lateral load on track structures.

Track elastic cushion shall only appear in ballastless track structures.

Relationships

Source	Type	Target
Track Elastic Cushion	Generalization	LR Segment on track centreline

Source	Type	Target
Track Elastic Cushion	Realization	IfcDiscreteAccessoryTypeEnum.ELASTIC_CUSHION
Track Elastic Cushion	Aggregation	Track part
Track Elastic Cushion	Generalization	LR Segment on ss track part
IfcDiscreteAccessory.ELASTIC_CUSHION	Realization	Track Elastic Cushion
IfcDiscreteAccessory.ELASTIC_CUSHION	Realization	Track Elastic Cushion

3.1.8.7 Track Isolation Layer

Track isolation layer is a structure layer placed on top surface of track bases. It may implement functions of damage repair of track superstructure under special circumstances and coordinate temperature deformation.

Track isolation layer shall only appear in ballastless track structures.

Relationships

Source	Type	Target
Track Isolation Layer	Generalization	LR Segment on ss track part
Track Isolation Layer	Realization	IfcCoveringTypeEnum.MEMBRANE
Track Isolation Layer	Aggregation	Track part
Track Isolation Layer	Generalization	LR Segment on track centreline
Track Isolation Layer	Realization	IfcCoveringTypeEnum.INSULATION
IfcCovering.MEMBRANE	Realization	Track Isolation Layer
IfcCovering.INSULATION	Realization	Track Isolation Layer
IfcCovering.INSULATION	Realization	Track Isolation Layer
IfcCovering.MEMBRANE	Realization	Track Isolation Layer

3.1.8.8 Track Base

Concrete base is a kind of reinforced foundation cast in-situ, which is used for supporting track slabs or track concrete slabs.

Concrete base shall only appear in ballastless track structures.

Relationships

Source	Type	Target
Track Base	Generalization	LR Segment on track centreline
Track Base	Realization	IfcSlabTypeEnum.BASESLAB
Track Base	Generalization	LR Segment on ss track part
Track Base	Aggregation	Track part
IfcSlab.BASESLAB	Realization	Track Base
IfcSlab.BASESLAB	Realization	Track Base

3.1.9 Track coverage

3.1.9.1 Class diagram "Track coverage"

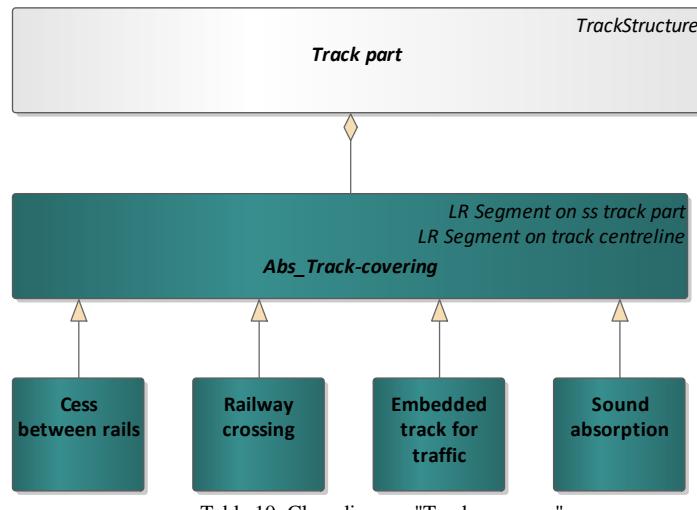


Table 10: Class diagram "Track coverage"

3.1.10 Abs_Track-covering

Abstract class for track covering

Relationships

Source	Type	Target
Abs_Track-covering	Aggregation	Track part
Abs_Track-covering	Generalization	LR Segment on track centreline
Abs_Track-covering	Generalization	LR Segment on ss track part
Embedded track for traffic	Generalization	Abs_Track-covering
Sound absorption	Generalization	Abs_Track-covering
Cess between rails	Generalization	Abs_Track-covering
Railway crossing	Generalization	Abs_Track-covering

3.1.10.1 Embedded track for traffic

Tracks recessed into road surface.

Superstructure type usually specific (slab track/grooved rail).

Covering can be driven on in all directions.

Usually used in public areas.

Combined drainage systems normally used.

Relationships

Source	Type	Target
Embedded track for traffic	Generalization	Abs_Track-covering
Embedded track for traffic	Realization	IfcSlab.TRACKSLAB
Embedded track for traffic	Realization	IfcSlab.TRACKSLAB

Source	Type	Target
Embedded track for traffic	Realization	IfcSlabTypeEnum.TRACKSLAB

3.1.10.2 Railway crossing

Railway crossing covering for roads (secured/unsecured).

Superstructure type also possible with ballast.

Covering can be driven on in the transverse direction.

Usually used in public areas.

Often entails changes to the stiffness of the superstructure/substructure.

Relationships

Source	Type	Target
Railway crossing	Generalization	Abs_Track-covering

3.1.10.3 Cess between rails

Covering between rails for internal maintenance purposes.

Can be walked on.

Situated in the track.

Not public.

Relationships

Source	Type	Target
Cess between rails	Realization	IfcSlab.TRACKSLAB

Source	Type	Target
Cess between rails	Generalization	Abs_Track-covering
Cess between rails	Realization	IfcSlabTypeEnum.TRACKSLAB
Cess between rails	Realization	IfcSlab.TRACKSLAB

3.1.10.4 Sound absorption

Components in the track for sound absorption.

May also absorb vibrations.

Not included noise barriers at track side.

Often used in combination with slab track.

Relationships

Source	Type	Target
Sound absorption	Realization	IfcDiscreteAccessoryTypeEnum.SOUNDABSORPTION
Sound absorption	Generalization	Abs_Track-covering
Sound absorption	Realization	IfcDiscreteAccessory.SOUNDABSORPTION
Sound absorption	Realization	IfcDiscreteAccessory.SOUNDABSORPTION

3.1.11 Track sidewalk

3.1.11.1 Class diagram "Track sidewalk"

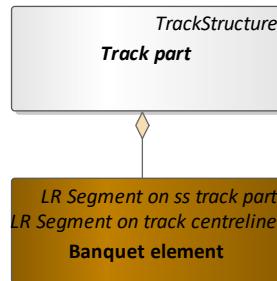


Table 11: Class diagram "Track sidewalk"

3.1.11.2 Banquet element

Usually at ballast level.

Outside of structure gauge.

Function: walkway, service path.

Access to track.

Relationships

Source	Type	Target
Banquet element	Generalization	LR Segment on track centreline
Banquet element	Generalization	LR Segment on ss track part
Banquet element	Aggregation	Track part
IfcCourse.PAVEMENT	Realization	Banquet element
IfcCourse.PAVEMENT	Realization	Banquet element

3.1.12 Track alignment stops

3.1.12.1 Class diagram "Track alignment stops"

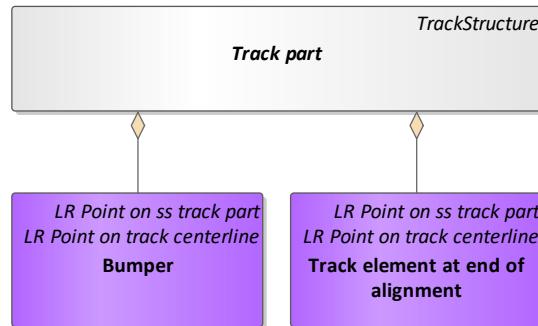


Table 12: Class diagram "Track alignment stops"

3.1.12.2 Bumper

Buffer, object at end of track.

Function: prevents driving over; can be fixed on rails or the track panel - Can also be a natural element (rock, sand).

Relationships

Source	Type	Target
Bumper	Aggregation	Track part
Bumper	Realization	IfcImpactProtectionDevice.BUMPER
Bumper	Generalization	LR Point on ss track part
Bumper	Generalization	LR Point on track centerline
Bumper	Realization	IfcImpactProtectionDeviceTypeEnum.BUMPER

3.1.12.3 Track element at end of alignment

Alignment stop

Special functional installations such as axle-gauge changeover point; transporter wagon loading point.

Relationships

Source	Type	Target
Track element at end of alignment	Generalization	LR Point on track centerline
Track element at end of alignment	Generalization	LR Point on ss track part
Track element at end of alignment	Realization	IfcTrackElementTypeEnum.TRACKENDOFALIGNMENT
Track element at end of alignment	Realization	IfcTrackElement.TRACKENDOFALIGNMENT
Track element at end of alignment	Realization	IfcTrackElement.TRACKENDOFALIGNMENT
Track element at end of alignment	Aggregation	Track part

3.1.13 Survey

3.1.13.1 Class diagram "Survey"

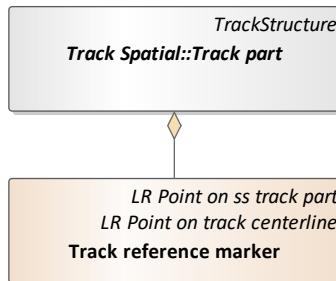


Table 13: Class diagram "Survey"

3.1.13.2 Track reference marker

Generally bolts which are firmly fixed to permanent components such as foundations, platform edges or civil engineering structures. Their position and elevation are known to the nearest mm (planar, x/y/z coordinates).

Serve as a reference for inspecting or ensuring (e.g. by mechanical tamper) the ideal location and elevation of the track panel and other installation elements.

Serve to hold technical measuring elements (e.g. prism mirrors)

Relationships

Source	Type	Target
Track reference marker	Aggregation	Track part
Track reference marker	Generalization	LR Point on track centerline
Track reference marker	Generalization	LR Point on ss track part
IfcSign.MARKER	Realization	Track reference marker
IfcReferent.REFERENCEMARKER	Realization	Track reference marker
IfcReferentTypeEnum.REFERENCEMARKER	Realization	Track reference marker
IfcSign.MARKER	Realization	Track reference marker
IfcSignTypeEnum.MARKER	Realization	Track reference marker
IfcReferent.REFERENCEMARKER	Realization	Track reference marker

3.1.14 Other equipment

3.1.14.1 Class diagram "Other equipment"

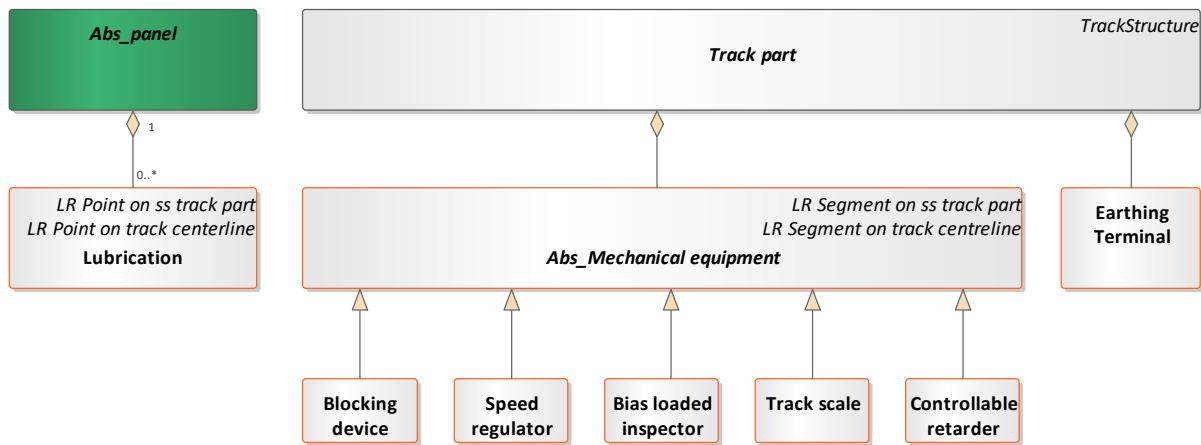


Table 14: Class diagram "Other equipment"

3.1.14.2 *Abs_Mechanical equipment*

Abstract class for mechanical equipment

Relationships

Source	Type	Target
Abs_Mechanical equipment	Realization	IfcDiscreteAccessory.RAIL_MECHANICAL_EQUIPMENT
Abs_Mechanical equipment	Realization	IfcElementAssembly.RAIL_MECHANICAL_EQUIPMENT_ASSEMBLY
Abs_Mechanical equipment	Generalization	LR Segment on track centreline
Abs_Mechanical equipment	Realization	IfcElementAssemblyTypeEnum.RAIL_MECHANICAL_EQUIPMENT_ASSEMBLY
Abs_Mechanical equipment	Realization	IfcDiscreteAccessory.RAIL_MECHANICAL_EQUIPMENT
Abs_Mechanical equipment	Realization	IfcElementAssembly.RAIL_MECHANICAL_EQUIPMENT_ASSEMBLY
Abs_Mechanical equipment	Generalization	LR Segment on ss track part
Abs_Mechanical equipment	Realization	IfcDiscreteAccessoryTypeEnum.RAIL_MECHANICAL_EQUIPMENT
Abs_Mechanical equipment	Aggregation	Track part
Blocking device	Generalization	Abs_Mechanical equipment
Speed regulator	Generalization	Abs_Mechanical equipment
Controllable retarder	Generalization	Abs_Mechanical equipment
Bias loaded inspector	Generalization	Abs_Mechanical equipment
Track scale	Generalization	Abs_Mechanical equipment

3.1.14.3 Bias loaded inspector

Equipment installed on track to inspect whether the load of vehicles is biased.

Relationships

Source	Type	Target
Bias loaded inspector	Generalization	Abs_Mechanical equipment

3.1.14.4 Blocking device

Equipment installed on classification yard (also named as shunting yard) to block rolling vehicles.

Relationships

Source	Type	Target
Blocking device	Generalization	Abs_Mechanical equipment

3.1.14.5 Controllable retarder

Equipment installed on classification yard (also named as shunting yard) to regulate the speed of rolling vehicles.

Relationships

Source	Type	Target
Controllable retarder	Generalization	Abs_Mechanical equipment

3.1.14.6 Speed regulator

Equipment installed on railway hump and classification yard (also named as shunting yard) to regulate the speed of rolling vehicles.

Relationships

Source	Type	Target
Speed regulator	Generalization	Abs_Mechanical equipment

3.1.14.7 Track scale

Equipment installed on track of freight yard to measure the weight of vehicles.

Relationships

Source	Type	Target
Track scale	Generalization	Abs_Mechanical equipment

3.1.14.8 Earthing Terminal

Object used for earthing.

Installed in track slab or concrete slab.

Welded to reinforcing bar in track slab or concrete slab.

Relationships

Source	Type	Target
Earthing Terminal	Aggregation	Track part

3.1.14.9 Lubrication

Prevent wearing of the rails throughout the flange of wheel.

Reduce noise emissions.

Often located at inner side of the outer rail in a curve or near turnouts (depends from function wearing or noise reduction)

Relationships

Source	Type	Target
Lubrication	Generalization	LR Point on track centerline

Source	Type	Target
Lubrication	Aggregation	Abs_panel
Lubrication	Realization	IfcDiscreteAccessory.RAIL_LUBRICATION
Lubrication	Generalization	LR Point on ss track part
Lubrication	Realization	IfcDiscreteAccessoryTypeEnum.RAIL_LUBRICATION
Lubrication	Realization	IfcDiscreteAccessory.RAIL_LUBRICATION

3.2 Track Spatial

3.2.1 Class diagram track spatial structure

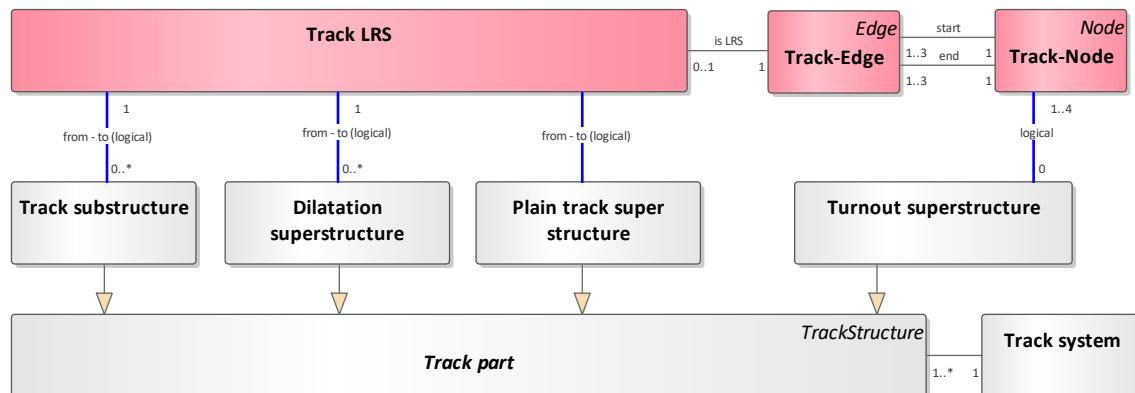


Table 15: Class diagram track spatial structure

3.2.2 Track system

Track System refers to a functional track with the explicit terminals. It refers a continuous sequence of track parts.

Relationships

Source	Type	Target
Track system	Realization	IfcSystem
Track system	Association	Track part

3.2.3 Track part

Track part is the basic volume object for all objects of track superstructure. It refers to a segment of track system engineering which is part of the track system and has a unique structural type and functional type.

Relationships

Source	Type	Target
Track part	Aggregation	TrackStructure
Track part	Generalization	TrackStructure
Turn table	Generalization	Track part
Bumper	Aggregation	Track part
Earthing Terminal	Aggregation	Track part
Abs_Track-covering	Aggregation	Track part
Ballast bed	Aggregation	Track part
Track reference marker	Aggregation	Track part
Track Adjustment Layer	Aggregation	Track part
IfcRailwayPartTypeEnum.T RACKSTRUCTUREPART	Realization	Track part
Dilatation superstructure	Generalization	Track part
Track slab	Aggregation	Track part
Track Isolation Layer	Aggregation	Track part
IfcRailwayPart.TRACKSTRU CTUREPART	Realization	Track part
Plain track super structure	Generalization	Track part
Ballast bed strengthening	Aggregation	Track part
Track Elastic Cushion	Aggregation	Track part
Track substructure	Generalization	Track part
Traverser	Generalization	Track part
Earth mat	Aggregation	Track part

Source	Type	Target
Spring Damping system	Aggregation	Track part
Track Base	Aggregation	Track part
Track system	Association	Track part
Linear reference on abs track part	Association	Track part
Track concrete slab	Aggregation	Track part
Track element at end of alignment	Aggregation	Track part
Turnout superstructure	Generalization	Track part
Abs_Mechanical equipment	Aggregation	Track part
Banquet element	Aggregation	Track part

3.2.4 Plain track super structure

Plain track super structure is one subtype of track part without turnout panel or dilatation panel.

Relationships

Source	Type	Target
Plain track super structure	Generalization	Track part
Track Asset version	Association	Plain track super structure
Track LRS	Association	Plain track super structure
IfcRailwayPart.PLAINTRAC_KSUPERSTRUCTURE	Realization	Plain track super structure
Track panel	Aggregation	Plain track super structure

3.2.5 Turnout superstructure

Turnout superstructure is one subtype of track part with turnout panel.

Relationships

Source	Type	Target
Turnout superstructure	Realization	IfcRailwayPartTypeEnum.TURNOUTSUPERSTRUCTURE
Turnout superstructure	Association	Track-Node
Turnout superstructure	Generalization	Track part
Dilatation/Turnout Asset version	Association	Turnout superstructure
IfcRailwayPart.TURNOUTSUPERSTRUCTURE	Realization	Turnout superstructure
Turnout panel	Aggregation	Turnout superstructure

3.2.6 Dilatation superstructure

Dilatation superstructure is one subtype of track part with Dilatation panel.

Relationships

Source	Type	Target
Dilatation superstructure	Realization	IfcRailwayPartTypeEnum.DILATATIONSUPERSTRUCTURE
Dilatation superstructure	Generalization	Track part
Dilatation superstructure	Association	Track LRS
Dilatation panel	Aggregation	Dilatation superstructure
Dilatation/Turnout Asset version	Association	Dilatation superstructure
IfcRailwayPart.DILATATIONSUPERSTRUCTURE	Realization	Dilatation superstructure

3.2.7 Track substructure

New in Version 1.5

Result of Rom workshop.

Contained physical objects come from common schema (foundation layer, barrier layer, ...)

Relationships

Source	Type	Target
Track substructure	Association	Dilatation/Turnout Asset version
Track substructure	Association	Track LRS
Track substructure	Generalization	Track part
Track Asset version	Association	Track substructure

4 Energy

4.1 Energy Structural (physical)

4.1.1 Auxiliary Services

4.1.1.1 Class diagram "Auxiliary Services"

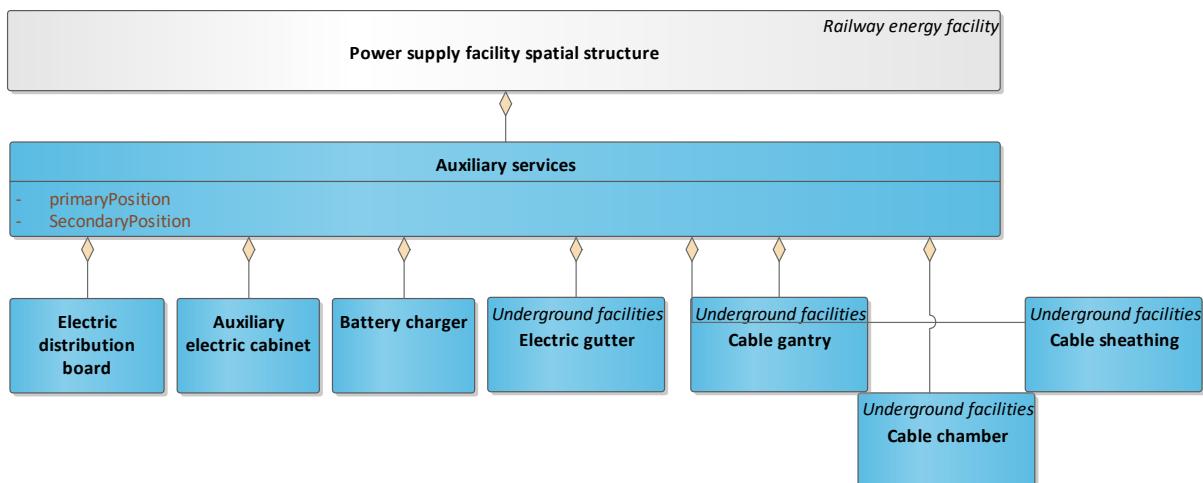


Table 16: Class diagram "Auxiliary Services"

4.1.1.2 Auxiliary electric cabinet

Cabinet for different low voltage services (signaling, telecom..)

Relationships

Source	Type	Target
Auxiliary electric cabinet	Aggregation	Auxiliary services
IfcFurniture.TECHNICALCABINET	Realization	Auxiliary electric cabinet
IfcFurniture.TECHNICALCABINET	Realization	Auxiliary electric cabinet
IfcFurnitureTypeEnum.TECHNICALCABINET	Realization	Auxiliary electric cabinet

4.1.1.3 Auxiliary services

Provide Energy port for different low voltage services (signaling, telecom..)

Relationships

Source	Type	Target
Auxiliary services	Aggregation	Power supply facility spatial structure
Electric distribution board	Aggregation	Auxiliary services
Cable gantry	Aggregation	Auxiliary services
Battery charger	Aggregation	Auxiliary services
Cable chamber	Aggregation	Auxiliary services
Auxiliary electric cabinet	Aggregation	Auxiliary services
Electric gutter	Aggregation	Auxiliary services
Cable sheathing	Aggregation	Auxiliary services

4.1.1.4 Battery charger

Equipment used to charge the battery, which is storing electric energy for substation.

Relationships

Source	Type	Target
Battery charger	Aggregation	Auxiliary services
IfcElectricFlowStorageDevice.RECHARGER	Realization	Battery charger
IfcElectricFlowStorageDeviceTypeEnum.RECHARGER	Realization	Battery charger
IfcElectricFlowStorageDevice.RECHARGER	Realization	Battery charger

4.1.1.5 Electric distribution board

Electric distribution board used to dispatch electric power.

Relationships

Source	Type	Target
Electric distribution board	Aggregation	Auxiliary services
IfcElectricDistributionBoardTypeEnum.DISTRIBUTIONBOARD	Realization	Electric distribution board
IfcDistributionBoardTypeEnum.DISTRIBUTIONBOARD	Realization	Electric distribution board
IfcElectricDistributionBoard.DISTRIBUTIONBOARD	Realization	Electric distribution board
IfcElectricDistributionBoard.DISTRIBUTIONBOARD	Realization	Electric distribution board

4.1.2 Earthing Circuit

4.1.2.1 Class diagram "Earthing Circuit"

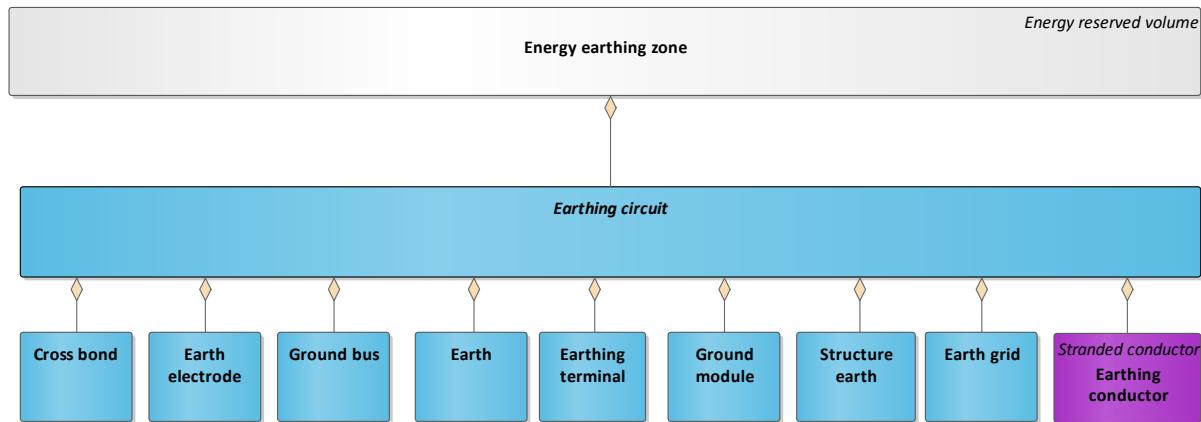


Table 17: Class diagram "Earthing Circuit"

4.1.2.2 Earthing circuit

All conductors which form the intended path for the earthing.

Relationships

Source	Type	Target
Earthing circuit	Aggregation	Energy earthing zone
IfcDistributionSystem.EARTHING	Realization	Earthing circuit
Rigid catenary grounding clamp	Aggregation	Earthing circuit
Earth	Aggregation	Earthing circuit
IfcDistributionSystem.EARTHING	Realization	Earthing circuit
IfcDistributionSystemEnum.EARTHING	Realization	Earthing circuit
Earthing fitting	Aggregation	Earthing circuit
Ground module	Aggregation	Earthing circuit
Earthing conductor	Aggregation	Earthing circuit
Cross bond	Aggregation	Earthing circuit
Earth grid	Aggregation	Earthing circuit
Structure earth	Aggregation	Earthing circuit
Ground bus	Aggregation	Earthing circuit
Earthing terminal	Aggregation	Earthing circuit

Source	Type	Target
Earth electrode	Aggregation	Earthing circuit

4.1.2.3 Cross bond

Electrical connection intended to connect in parallel the conductors of the return circuit.

Relationships

Source	Type	Target
Cross bond	Aggregation	Earthing circuit
IfcCableSegment.CONDUCTORSEGMENT	Realization	Cross bond
IfcCableSegment.CONDUCTORSEGMENT	Realization	Cross bond
IfcCableSegmentTypeEnum.CONDUCTORSEGMENT	Realization	Cross bond

4.1.2.4 Earth electrode

Conductive part, which may be embedded in a specific conductive medium, e.g. concrete or coke, in electric contact with the Earth.(Grounding rod)(IEC 60050-826-13-05)

Relationships

Source	Type	Target
Earth electrode	Aggregation	Earthing circuit
IfcCableFitting.EXIT	Realization	Earth electrode
IfcCableFitting.EXIT	Realization	Earth electrode
IfcCableFittingTypeEnum.EXIT	Realization	Earth electrode

4.1.2.5 Ground bus



Grounding grid consisting of horizontal grounding bodies.

Relationships

Source	Type	Target
Ground bus	Aggregation	Earthing circuit
IfcCableSegment.BUSBARS EGMENT	Realization	Ground bus
IfcCableSegment.BUSBARS EGMENT	Realization	Ground bus
IfcCableSegmentTypeEnum. BUSBARSEGMENT	Realization	Ground bus

4.1.2.6 Earth

Part of the Earth which is in electric contact with an earth electrode and the electric potential of which is not necessarily equal to zero.(IEC 60050-195-01-03)

Relationships

Source	Type	Target
Earth	Aggregation	Earthing circuit

4.1.2.7 Earthing terminal

Grounding terminal provided on equipment or on a device and intended for the electric connection with the earthing arrangement.

Relationships

Source	Type	Target
Earthing terminal	Aggregation	Earthing circuit
IfcCableFitting.EXIT	Realization	Earthing terminal
IfcCableFittingTypeEnum.E XIT	Realization	Earthing terminal

Source	Type	Target
IfcCableFitting.EXIT	Realization	Earthing terminal

4.1.2.8 Ground module

Grounding Composed of nonmetallic minerals with good conductivity and stability.

Relationships

Source	Type	Target
Ground module	Aggregation	Earthing circuit

4.1.2.9 Structure earth

Construction made of metallic parts or construction including interconnected metallic structural parts, which can be used as an earth electrode.

Relationships

Source	Type	Target
Structure earth	Aggregation	Earthing circuit
IfcElementAssembly.GRID	Realization	Structure earth
IfcElementAssembly.GRID	Realization	Structure earth
IfcElementAssemblyTypeEnum.GRID	Realization	Structure earth

4.1.2.10 Earth grid

Part of an earthing arrangement comprising only the earth electrodes and their interconnections.(IEC 60050-826-13-06)

Relationships

Source	Type	Target
Earth grid	Aggregation	Earthing circuit
IfcElementAssemblyTypeEnum.GRID	Realization	Earth grid
IfcElementAssembly.GRID	Realization	Earth grid
IfcElementAssembly.GRID	Realization	Earth grid

4.1.3 Earthing Line

4.1.3.1 Class diagram "Earthing Line"

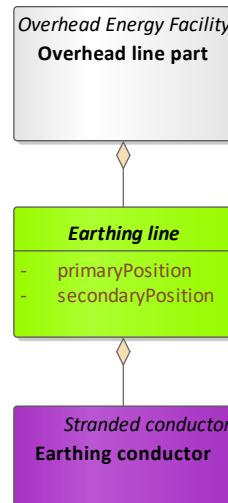


Table 18: Class diagram "Earthing Line"

4.1.3.2 Earthing line

Earthing a point or points in a system or in an installation or in equipment, for purposes other than electrical safety

Relationships

Source	Type	Target
Earthing line	Aggregation	Overhead line part
Earthing line	Association	Tensioning section

Source	Type	Target
IfcDistributionSystem.EARTHING	Realization	Earthing line
Earthing conductor	Aggregation	Earthing line
IfcDistributionSystemEnum.EARTHING	Realization	Earthing line
IfcDistributionSystem.EARTHING	Realization	Earthing line

4.1.4 Electric Power Converter

4.1.4.1 Class diagram "Electric Power Converter"

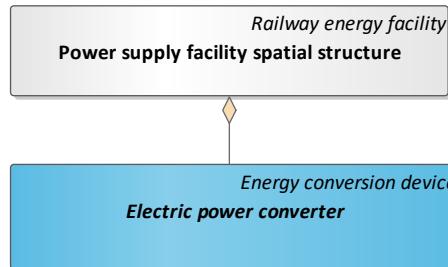


Table 19: Class diagram "Electric Power Converter"

4.1.4.2 Electric power converter

an electrical or electro-mechanical device for converting electric energy from one form to another such as converting between AC and DC; or changing the voltage or frequency; or some combination of these.

Relationships

Source	Type	Target
Electric power converter	Aggregation	Power supply facility spatial structure
Electric power converter	Generalization	Energy conversion device
Inverter	Generalization	Electric power converter
Chopper	Generalization	Electric power converter
Rectifier	Generalization	Electric power converter

4.1.5 Electric Storage

4.1.5.1 Class diagram "Electric Storage"

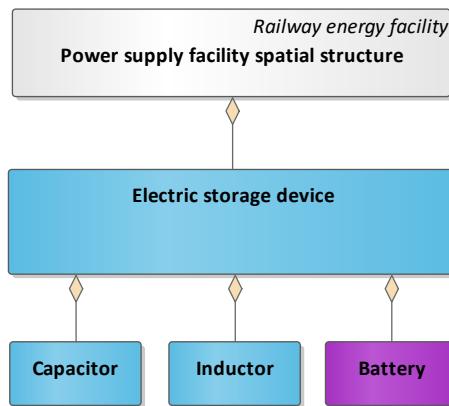


Table 20: Class diagram "Electric Storage"

4.1.5.2 Electric storage device

A Device that stores electric energy.

Relationships

Source	Type	Target
Electric storage device	Aggregation	Power supply facility spatial structure
Capacitor	Aggregation	Electric storage device
Battery	Aggregation	Electric storage device
Inductor	Aggregation	Electric storage device

4.1.5.3 Capacitor

Assembly of one or more capacitor elements assembled in the same housing with lead terminals.

Relationships

Source	Type	Target
Capacitor	Aggregation	Electric storage device

Source	Type	Target
IfcElectricFlowStorageDeviceTypeEnum.CAPACITOR	Realization	Capacitor
IfcElectricFlowStorageDeviceTypeEnum.CAPACITOR	Realization	Capacitor
IfcElectricFlowStorageDeviceTypeEnum.CAPACITOR	Realization	Capacitor

4.1.5.4 Inductor

Electrical appliances used in circuits or power systems due to their inductance.(IEC 60050-811-26-19)

Relationships

Source	Type	Target
Inductor	Aggregation	Electric storage device
IfcElectricFlowStorageDeviceTypeEnum.INDUCTOR	Realization	Inductor
IfcElectricFlowStorageDeviceTypeEnum.INDUCTOR	Realization	Inductor
IfcElectricFlowStorageDeviceTypeEnum.INDUCTOR	Realization	Inductor

4.1.5.5 Battery

One or more cells fitted with devices necessary for use, for example case, terminals, marking and protective devices. (IEC 60050-482-01-04)

Relationships

Source	Type	Target
Battery	Aggregation	Electric storage device
IfcElectricFlowStorageDeviceTypeEnum.BATTERY	Realization	Battery
IfcElectricFlowStorageDeviceTypeEnum.BATTERY	Realization	Battery

Source	Type	Target
IfcElectricFlowStorageDeviceTypeEnum.BATTERY	Realization	Battery

4.1.6 Feeder Line

4.1.6.1 Class diagram "Feeder Line"

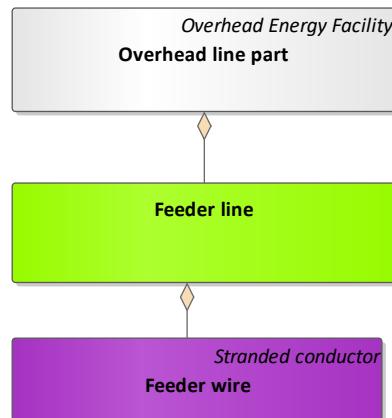


Table 21: Class diagram "Feeder Line"

4.1.6.2 Feeder line

In traction power system, overhead conductors besides overhead contact line include feeder line, reinforcing feeder, return line, positive feeder, protective wire, lightning protective wire, earth wire and so on.

Relationships

Source	Type	Target
Feeder line	Aggregation	Overhead line part
Feeder line	Association	Tensioning section
Negative feeder	Generalization	Feeder line
By-pass feeder	Generalization	Feeder line
IfcDistributionSystem.ELECTRICAL	Realization	Feeder line
Along-track feeder	Generalization	Feeder line

Source	Type	Target
IfcDistributionSystem.ELEC TRICAL	Realization	Feeder line
IfcDistributionSystemEnum. ELECTRICAL	Realization	Feeder line
Positive feeder	Generalization	Feeder line
Insulator	Aggregation	Feeder line
Reinforcing feeder	Generalization	Feeder line
Feeder wire	Aggregation	Feeder line

4.1.7 Instrument Transformer

4.1.7.1 Class diagram "Instrument Transformer"

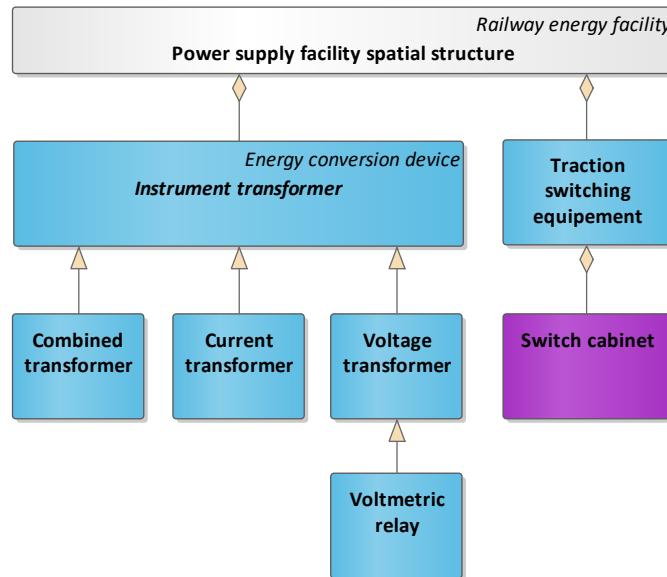


Table 22: Class diagram "Instrument Transformer"

4.1.7.2 Combined transformer

an instrument transformer consisting of a current and a voltage transformer in the same case (IEC 60050-321-01-03)

Relationships

Source	Type	Target
Combined transformer	Generalization	Instrument transformer
IfcFlowInstrument.COMBINED	Realization	Combined transformer
IfcFlowInstrument.COMBINED	Realization	Combined transformer
IfcFlowInstrumentTypeEnum.COMBINED	Realization	Combined transformer

4.1.7.3 Current transformer

An instrument transformer in which the secondary current, in normal conditions of use, is substantially proportional to the primary current and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections.(IEC 60050-321-02-01)

Relationships

Source	Type	Target
Current transformer	Generalization	Instrument transformer
IfcFlowInstrument.AMMETER	Realization	Current transformer
IfcFlowInstrumentTypeEnum.AMMETER	Realization	Current transformer
IfcFlowInstrument.AMMETER	Realization	Current transformer

4.1.7.4 Instrument transformer

A transformer intended to transmit an information signal to measuring instruments, meters and protective or control devices.(IEC 60050-321-01-01)

Relationships

Source	Type	Target
Instrument transformer	Generalization	Energy conversion device

Source	Type	Target
Instrument transformer	Aggregation	Power supply facility spatial structure
Voltage transformer	Generalization	Instrument transformer
Combined transformer	Generalization	Instrument transformer
Current transformer	Generalization	Instrument transformer

4.1.7.5 Voltage transformer

An instrument transformer in which the secondary voltage, in normal conditions of use, is substantially proportional to the primary voltage and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections.(IEC 60050-321-03-01)

Relationships

Source	Type	Target
Voltage transformer	Generalization	Instrument transformer
IfcFlowInstrument.VOLTME TER	Realization	Voltage transformer
IfcFlowInstrumentTypeEnum .VOLTMETER	Realization	Voltage transformer
Voltmetric relay	Generalization	Voltage transformer
IfcFlowInstrument.VOLTME TER	Realization	Voltage transformer

4.1.7.6 Voltmetric relay

A relay device used to observe the voltage level and disconnect the circuit from the supply if any variations occurs from the standard range.

Relationships

Source	Type	Target
Voltmetric relay	Generalization	Voltage transformer

4.1.8 Mooring

4.1.8.1 Class diagram "Mooring"

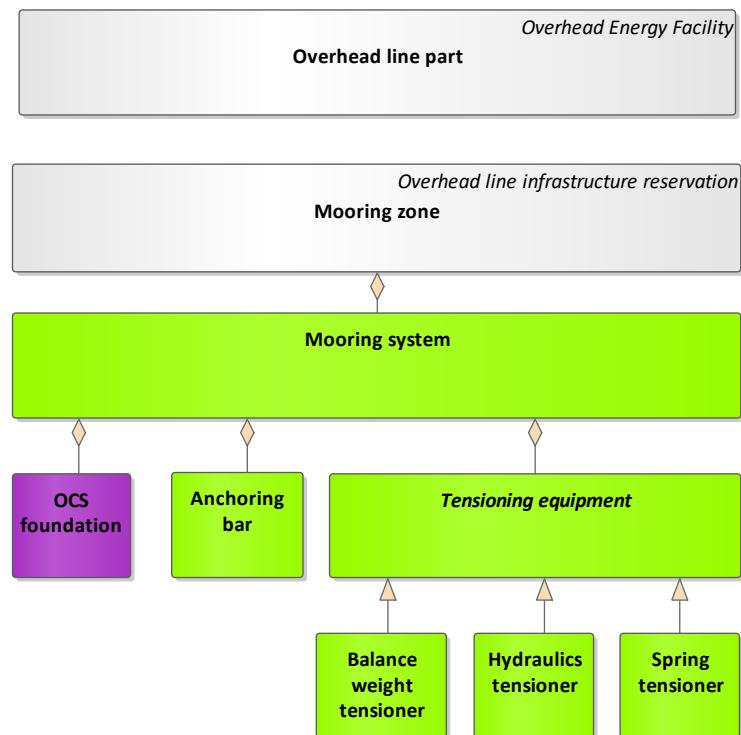


Table 23: Class diagram "Mooring"

4.1.8.2 Anchoring bar

Used to connect stay from pole to the foundation.

Relationships

Source	Type	Target
Anchoring bar	Aggregation	Mooring system
IfcMemberTypeEnum.BRAC E	Realization	Anchoring bar
IfcMember.BRACE	Realization	Anchoring bar
IfcMember.BRACE	Realization	Anchoring bar

4.1.8.3 Mooring system

Mooring System for overheadline is a common system provide functionnality of anchoring and stressing the ContactWire to have constant Tension in the cable.

Relationships

Source	Type	Target
Mooring system	Aggregation	Mooring zone
Mooring system	Aggregation	Overhead line infrastructure reservation
IfcBuiltSystemTypeEnum.M_OORINGSYSTEM	Realization	Mooring system
IfcBuiltSystem.MOORING	Realization	Mooring system
OCS foundation	Aggregation	Mooring system
Tensioning fitting	Aggregation	Mooring system
Tensioning equipment	Aggregation	Mooring system
IfcBuiltSystem.MOORING	Realization	Mooring system
Anchoring bar	Aggregation	Mooring system

4.1.8.4 Balance weight tensioner

Automatic tensioner attached to a mast to ensure constant tension in conductors by means of balance weights.(UIC R 791-2006)

Relationships

Source	Type	Target
Balance weight tensioner	Generalization	Tensioning equipment

4.1.8.5 Hydraulics tensioner



Automatic tensioner attached to a mast to ensure constant tension in conductors by means of Hydraulics.

Relationships

Source	Type	Target
Hydraulics tensioner	Generalization	Tensioning equipment

4.1.8.6 Spring tensioner

Automatic tensioner attached to a mast to ensure constant tension in conductors or in cross-span registration cables by means of springs.(UIC R 791-2006)

Relationships

Source	Type	Target
Spring tensioner	Generalization	Tensioning equipment
Pset_SpringTensioner	Realization	Spring tensioner
Pset_SpringTensioner	Realization	Spring tensioner
Pset_SpringTensioner	Realization	Spring tensioner

4.1.8.7 Tensioning equipment

Device to maintain the tension of conductors within the system design parameters.(EN 50119/IEC 60050-811-33-45)

Arrangement enabling the mechanical tension of conductors to be adjusted.(UIC R 791-2006)

Relationships

Source	Type	Target
Tensioning equipment	Aggregation	Mooring system

Source	Type	Target
IfcDiscreteAccessoryTypeEnum.TENSIONINGEQUIPMENT	Realization	Tensioning equipment
Hydraulics tensioner	Generalization	Tensioning equipment
Spring tensioner	Generalization	Tensioning equipment
IfcDiscreteAccessory.TENSIONINGEQUIPMENT	Realization	Tensioning equipment
IfcDiscreteAccessory.TENSIONINGEQUIPMENT	Realization	Tensioning equipment
Balance weight tensioner	Generalization	Tensioning equipment

4.1.9 Overhead Contact Line System

4.1.9.1 Class diagram "Overhead Contact Line System"

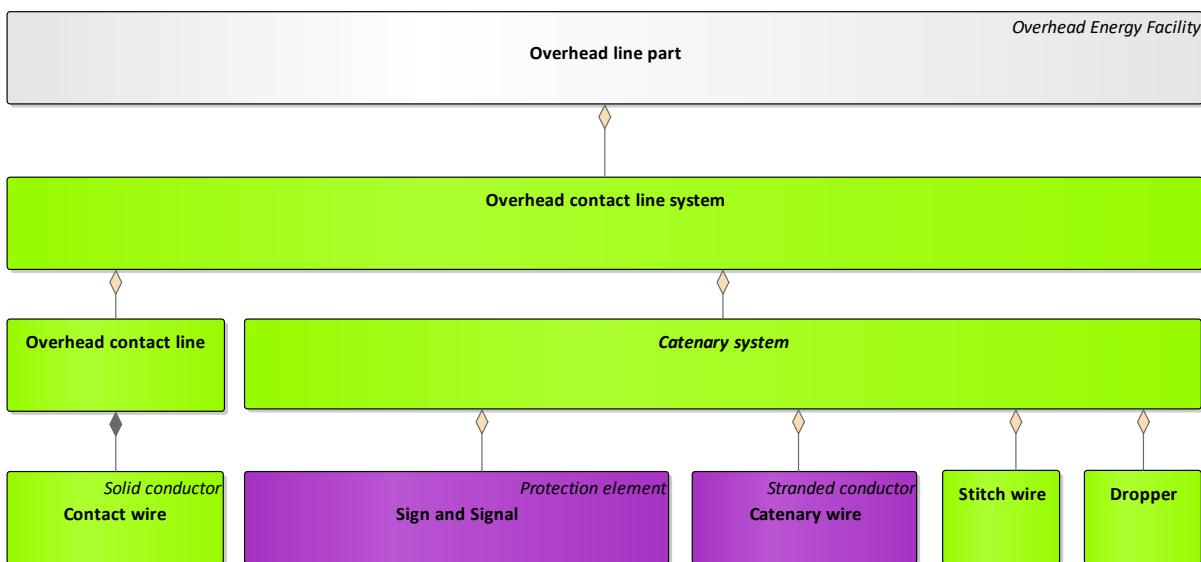


Table 24: Class diagram "Overhead Contact Line System"

4.1.9.2 Catenary system

The longitudinal system that supports the contact wire, including catenary wire dropper and stich wire.

Relationships

Source	Type	Target
Catenary system	Aggregation	Tensioning section
Catenary system	Aggregation	Overhead contact line system
IfcDistributionSystemEnum.CATENARY_SYSTEM	Realization	Catenary system
Catenary wire	Aggregation	Catenary system
IfcDistributionSystem.CATENARY_SYSTEM	Realization	Catenary system
Sign and Signal	Aggregation	Catenary system
IfcDistributionSystem.CATENARY_SYSTEM	Realization	Catenary system
Stitch wire	Aggregation	Catenary system
Dropper	Aggregation	Catenary system
Insulator	Aggregation	Catenary system

4.1.9.3 Contact wire

Electric conductor of an OCL with which the current collectors make contact. Carries the electricity which is supplied to the train by its pantograph. (IEC 60050-811-33-15/UIC R 791-2006)

Relationships

Source	Type	Target
Contact wire	Aggregation	Overhead contact line
Contact wire	Generalization	Solid conductor
IfcCableSegmentTypeEnum.CONTACTWIRESEGMENT	Realization	Contact wire
IfcCableSegment.CONTACTWIRESEGMENT	Realization	Contact wire
IfcCableSegment.CONTACTWIRESEGMENT	Realization	Contact wire

4.1.9.4 Dropper

Component used to suspend a registration, an auxiliary catenary or a contact wire from a head-span or a longitudinal catenary wire.(IEC 60050-811-33-22/UIC R 791-2006)

Relationships

Source	Type	Target
Dropper	Aggregation	Catenary system
IfcCableCarrierSegmentTypeEnum.DROPPER	Realization	Dropper
IfcCableCarrierSegment.DROPPER	Realization	Dropper
IfcCableCarrierSegment.DROPPER	Realization	Dropper

4.1.9.5 Overhead contact line system

Contact line above the upper limit of the train using an overhead contact line to supply current for use by traction units.

Relationships

Source	Type	Target
Overhead contact line system	Aggregation	Overhead line part
Rigid catenary	Generalization	Overhead contact line system
Connected Overlap	Aggregation	Overhead contact line system
IfcDistributionSystemEnum.OVERHEAD_CONTACTLINE_SYSTEM	Realization	Overhead contact line system
Overhead contact line	Aggregation	Overhead contact line system
IfcDistributionSystem.OVERHEAD_CONTACTLINE_SYSTEM	Realization	Overhead contact line system
Catenary system	Aggregation	Overhead contact line system
IfcDistributionSystem.OVERHEAD_CONTACTLINE_SYSTEM	Realization	Overhead contact line system

4.1.9.6 Overhead contact line

Contact line placed above the upper limit of the vehicle gauge and supplying vehicles with electrical energy through pantographs.(UIC R 791-2006)

Relationships

Source	Type	Target
Overhead contact line	Aggregation	Overhead contact line system
Insulator	Aggregation	Overhead contact line
Contact wire	Aggregation	Overhead contact line

4.1.9.7 Stitch wire

The auxiliary wire used in stitched suspension.(IEC 60050-811-33-18/UIC R 791-2006)

Relationships

Source	Type	Target
Stitch wire	Aggregation	Catenary system
IfcCableSegmentTypeEnum. STITCHWIRE	Realization	Stitch wire
IfcCableSegment. STITCHWI RE	Realization	Stitch wire
IfcCableSegment. STITCHWI RE	Realization	Stitch wire

4.1.10 OverHead Line Supporting

4.1.10.1 OCS supporting system

Include foundation, supporting elements and suspension.

Relationships

Source	Type	Target
OCS supporting system	Aggregation	Overhead line infrastructure reservation
Sign and Signal	Aggregation	OCS supporting system
IfcElementAssemblyTypeEnum.SUPPORTINGASSEMBLY	Realization	OCS supporting system
Anti-arcing device	Aggregation	OCS supporting system
IfcElementAssembly.SUPPORTINGASSEMBLY	Realization	OCS supporting system
OCS suspension	Aggregation	OCS supporting system
OCS fitting	Aggregation	OCS supporting system
IfcElementAssembly.SUPPORTINGASSEMBLY	Realization	OCS supporting system
OCS supporting elements	Aggregation	OCS supporting system
OCS foundation	Aggregation	OCS supporting system
Anticlimbing	Aggregation	OCS supporting system
Bird protection	Aggregation	OCS supporting system

4.1.10.2 Mid point anchor

1.A midpoint anchor structure is designed to resist the termination forces of the midpoint anchor in addition to other functions such as carrying cantilevers.(EN 50119)

2.The anchoring equipment near the middle of the mechanical section, which prevents the OCL from making longitudinal movements.(UIC R 791-2006)

Relationships

Source	Type	Target
Mid point anchor	Aggregation	Overhead line infrastructure reservation

4.1.10.3 OCS Support

4.1.10.3.1 Class diagram "OCS Support"

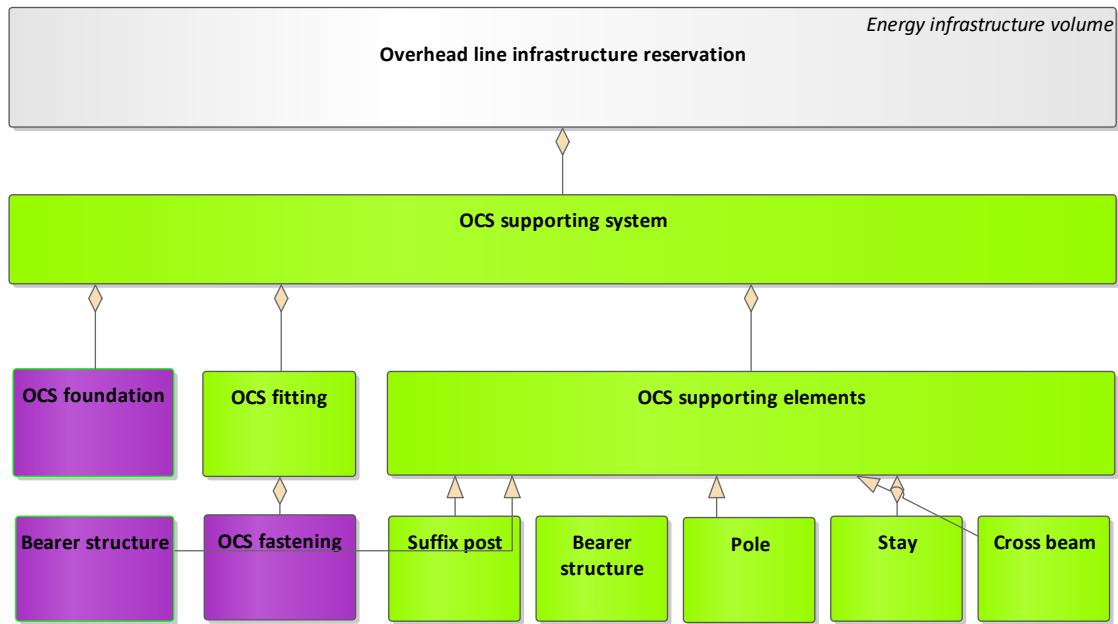


Table 25: Class diagram "OCS Support"

4.1.10.3.2 OCS supporting elements

Parts which support the conductors and the associated insulators of an OCL.(UIC R 791-2006/IEC 60050-811-33-19)

Relationships

Source	Type	Target
OCS supporting elements	Aggregation	OCS supporting system
Suffix post	Generalization	OCS supporting elements
Head-span	Generalization	OCS supporting elements
Pole	Generalization	OCS supporting elements
Stay	Aggregation	OCS supporting elements
Bearer structure	Generalization	OCS supporting elements
Cross beam	Generalization	OCS supporting elements

4.1.10.3.3 Cross beam

Rigid cross span structures consist of bending resistant beams which are fixed onto the structures either by hinges or by bending resistant joints.(EN 50119)

Support consisting of a transverse beam and masts situated on either side of tracks.(IEC 60050-811-33-38/UIC R 791-2006)

Relationships

Source	Type	Target
Cross beam	Generalization	OCS supporting elements
IfcElementAssembly.RIGID_FRAME	Realization	Cross beam
IfcElementAssembly.RIGID_FRAME	Realization	Cross beam
IfcElementAssemblyTypeEnum.RIGID_FRAME	Realization	Cross beam

4.1.10.3.4 Bearer structure

Insure the function of holding registration component in tunnel context.

Relationships

4.1.10.3.5 OCS fitting

Clamps and fittings provide the mechanical and structural connection of components and provide electrical connections in contact line systems and within cross-span structures. They have to withstand both operating currents and short-circuit current loads in the energised part of the overhead contact line system. In addition to the mechanical stresses, short-circuit current loads occur in the passive part of the overhead contact line system, at rigid and flexible terminations and also in cross-span equipment.

Relationships

Source	Type	Target
OCS fitting	Aggregation	OCS supporting system
Fitting accessory	Aggregation	OCS fitting
Turn bukle	Aggregation	OCS fitting
IfcMechanicalFastener.COUPLER	Realization	OCS fitting
Joint fitting	Generalization	OCS fitting
Earthing fitting	Generalization	OCS fitting
IfcMechanicalFastener.COUPLER	Realization	OCS fitting
Tensioning fitting	Generalization	OCS fitting
Insulator	Aggregation	OCS fitting
Steady fitting	Aggregation	OCS fitting
Tube	Aggregation	OCS fitting
OCS fastening	Aggregation	OCS fitting
Termination fitting	Generalization	OCS fitting
Suspension fitting	Generalization	OCS fitting
Clamp	Aggregation	OCS fitting
Registration fitting	Generalization	OCS fitting
Support fitting	Generalization	OCS fitting

1.1.1.1.1 Pole

1.Vertical support in solid wood, concrete or steel, or of steel lattice construction, with one end planted in the ground at the side of the track, either directly or through a separate base or foundation(IEC 60050-811-33-20)

2.A main vertical support construction with one end embedded in the ground adjacent to the track,tensioning and registion of the OCL.(UIC R 791-2006)

Relationships

Source	Type	Target
Pole	Generalization	OCS supporting elements
IfcMember.POST	Realization	Pole
IfcElementAssemblyTypeEnum.MAST	Realization	Pole
IfcMemberTypeEnum.POST	Realization	Pole
IfcElementAssembly.MAST	Realization	Pole
IfcMember.POST	Realization	Pole
IfcElementAssembly.MAST	Realization	Pole

4.1.10.3.6 Stay

Rod, wire or cable, with a tensioner, to anchor a mast or a cantilever(IEC 60050-811-33-47/UIC R 791-2006)(tie, guy)

Relationships

Source	Type	Target
Stay	Aggregation	OCS supporting elements
IfcMember.BRACE	Realization	Stay
IfcMember.BRACE	Realization	Stay
IfcMemberTypeEnum.BRACE	Realization	Stay

4.1.10.3.7 Suffix post

Insure the function of holding registration component in specific condition like tunel or under-bridge.

Relationships

Source	Type	Target
Suffix post	Generalization	OCS supporting elements

Source	Type	Target
IfcMember.POST	Realization	Suffix post
IfcMember.POST	Realization	Suffix post
IfcElementAssembly.MAST	Realization	Suffix post
IfcElementAssemblyTypeEnum.MAST	Realization	Suffix post
IfcElementAssembly.MAST	Realization	Suffix post
IfcMemberTypeEnum.POST	Realization	Suffix post

4.1.10.3.8 Turn bukle

Fitting element for adjusting the tension or length of tensioning systems

Relationships

Source	Type	Target
Turn bukle	Aggregation	OCS fitting

4.1.10.4 OCS Suspension

4.1.10.4.1 Class diagram "OCS Suspension"

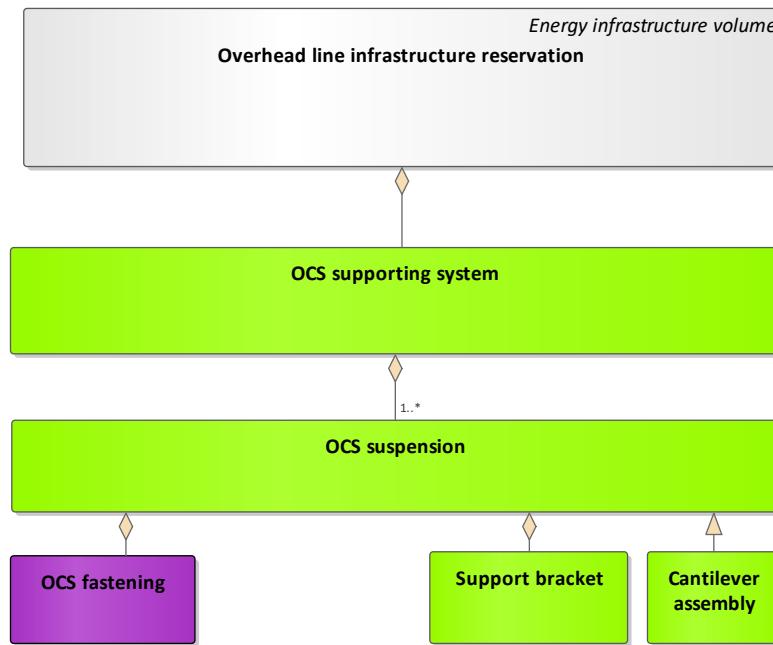


Table 26: Class diagram "OCS Suspension"

4.1.10.4.2 OCS fastening

Fastening device that mechanically joins or affixes two or more objects together for OCS equipment.

Relationships

Source	Type	Target
OCS fastening	Aggregation	OCS suspension
OCS fastening	Aggregation	OCS fitting
IfcMechanicalFastener	Realization	OCS fastening
IfcMechanicalFastener	Realization	OCS fastening

4.1.10.4.3 OCS suspension

The group which used to support directly contactline, feeder or earthwire, contains all the parts installed between supports and conductors(including insulators).

Relationships

Source	Type	Target
OCS suspension	Aggregation	OCS supporting system
Rigid catenary suspension	Generalization	OCS suspension
Support bracket	Aggregation	OCS suspension
Cantilever assembly	Generalization	OCS suspension
Insulator	Aggregation	OCS suspension
Contact line suspension	Generalization	OCS suspension
IfcElementAssembly.SUSPENSIONASSEMBLY	Realization	OCS suspension
Feeder suspension	Generalization	OCS suspension
OCS fastening	Aggregation	OCS suspension
IfcElementAssemblyTypeEnum.SUSPENSIONASSEMBLY	Realization	OCS suspension
IfcElementAssembly.SUSPENSIONASSEMBLY	Realization	OCS suspension

4.1.10.4.4 Support bracket

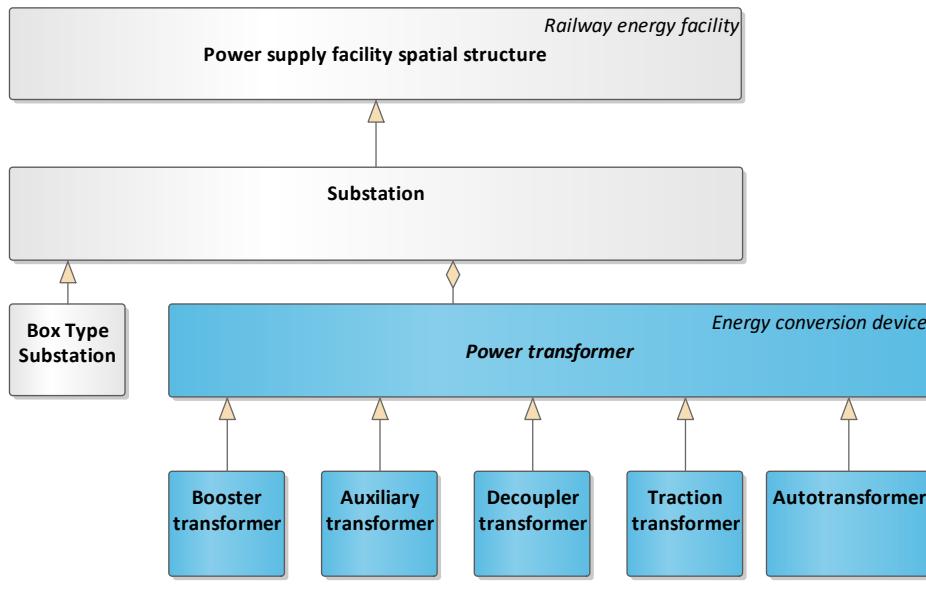
A device designed to carry, through insulators(or no), a set of conductors of overhead line.

Relationships

Source	Type	Target
Support bracket	Aggregation	OCS suspension
IfcDiscreteAccessory.BRACKET	Realization	Support bracket
IfcDiscreteAccessoryTypeEnum.BRACKET	Realization	Support bracket
IfcDiscreteAccessory.BRACKET	Realization	Support bracket

4.1.11 Power Transformer

4.1.11.1 Class diagram "Power Transformer"



4.1.11.2 Autotransformer

A transformer in which at least two windings have a common part (IEC - 811-26-03; 421-01-11)

Relationships

Source	Type	Target
Autotransformer	Aggregation	Autotransformer post
Autotransformer	Generalization	Power transformer
PEnum_VoltageAndCurrentTransformerType	Realization	Autotransformer

4.1.11.3 Auxiliary transformer

In a substation, a transformer intended to provide supply to the auxiliary equipment (IEC 60050-605-02-46)

Relationships

Source	Type	Target
Auxiliary transformer	Generalization	Power transformer
PEnum_VolatgeAndCurrentTransformerType	Realization	Auxiliary transformer

4.1.11.4 Booster transformer

A transformer of which one winding is intended to be connected in series with a circuit in order to alter its voltage and the other winding is an energizing winding (IEC 60050-811-26-05, 60050-421-01-12)

Relationships

Source	Type	Target
Booster transformer	Generalization	Power transformer
PEnum_VolatgeAndCurrentTransformerType	Realization	Booster transformer

4.1.11.5 Decoupler transformer

Phase separation transformer.

Relationships

Source	Type	Target
Decoupler transformer	Generalization	Power transformer
PEnum_VolatgeAndCurrentTransformerType	Realization	Decoupler transformer

4.1.11.6 Power transformer

A static piece of apparatus with two or more windings which, by electromagnetic induction, transforms a system of alternating voltage and current into another system of voltage and current usually of different values and at the same frequency for the purpose of transmitting electrical power (IEC 60050-811-26-01)

Relationships

Source	Type	Target
Power transformer	Aggregation	Substation
Power transformer	Generalization	Energy conversion device
IfcTransformer.COMBINED	Realization	Power transformer
IfcTransformer.COMBINED	Realization	Power transformer
Booster transformer	Generalization	Power transformer
Traction transformer	Generalization	Power transformer
Auxiliary transformer	Generalization	Power transformer
Decoupler transformer	Generalization	Power transformer
Autotransformer	Generalization	Power transformer

4.1.11.7 Traction transformer

A stationary device with two or more windings, in order to transmit electrical energy, converts the AC voltage and current of one system to the AC voltage and current of another system at the same frequency by electromagnetic induction.(GB 1094, IEC 60076)

electric energy converter without moving parts that changes voltages and currents associated with electric energy without change of frequency.(IEC 60050)

Relationships

Source	Type	Target
Traction transformer	Generalization	Power transformer
PEnum_VoltageAndCurrent TransformerType	Realization	Traction transformer

4.1.12 Protecting Devices

4.1.12.1 Class diagram "Protecting Devices"

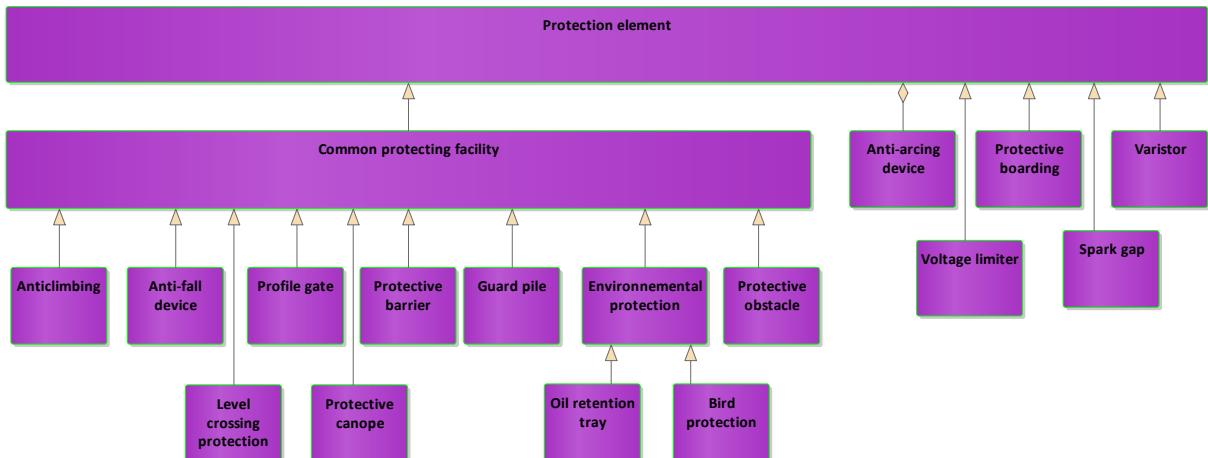


Table 28: Class diagram "Protecting Devices"

4.1.12.2 Anti-arcing device

Equipements against the electric arc

Relationships

Source	Type	Target
Anti-arcing device	Aggregation	OCS supporting system
Anti-arcing device	Aggregation	Protection element
IfcProtectiveDevice.ANTI_ARCING_DEVICE	Realization	Anti-arcing device
IfcProtectiveDeviceTypeEnum.ANTI_ARCING_DEVICE	Realization	Anti-arcing device
IfcProtectiveDevice.ANTI_ARCING_DEVICE	Realization	Anti-arcing device

4.1.12.3 Anticlimbing

protection against climbing

Relationships

Source	Type	Target
Anticlimbing	Aggregation	OCS supporting system
Anticlimbing	Generalization	Common protecting facility

Source	Type	Target
IfcMember.POST	Realization	Anticlimbing
Pset_PostProtectionAndSafety	Realization	Anticlimbing
IfcMember.POST	Realization	Anticlimbing

4.1.12.4 Anti-fall device

protection against operator falling

Relationships

Source	Type	Target
Anti-fall device	Generalization	Common protecting facility
IfcMember.POST	Realization	Anti-fall device
IfcMember.POST	Realization	Anti-fall device
Pset_PostProtectionAndSafety	Realization	Anti-fall device

4.1.12.5 Bird protection

Avoid a sitting down of the birds at electrically critical points of the catenary system. Thus the birds are protected against electrical shocks and disturbances by short circuit are avoided.

Relationships

Source	Type	Target
Bird protection	Generalization	Environmental protection
Bird protection	Aggregation	OCS supporting system
IfcDiscreteAccessory.BIRDPROTECTION	Realization	Bird protection
IfcDiscreteAccessoryTypeEnum.BIRDPROTECTION	Realization	Bird protection

Source	Type	Target
IfcDiscreteAccessory.BIRDPROTECTION	Realization	Bird protection

4.1.12.6 Common protecting facility

Basic protection against electric shock.

Relationships

Source	Type	Target
Common protecting facility	Generalization	Protection element
Protective obstacle	Generalization	Common protecting facility
Anti-fall device	Generalization	Common protecting facility
Protective barrier	Generalization	Common protecting facility
Protective canopy	Generalization	Common protecting facility
Environmental protection	Generalization	Common protecting facility
Profile gate	Generalization	Common protecting facility
Level crossing protection	Generalization	Common protecting facility
Guard pile	Generalization	Common protecting facility
Anticlimbing	Generalization	Common protecting facility

4.1.12.7 Environmental protection

Equipment and system dedicated to environment protection.

Relationships

Source	Type	Target
Environmental protection	Generalization	Common protecting facility
Oil retention tray	Generalization	Environmental protection
Bird protection	Generalization	Environmental protection

4.1.12.8 Guard pile

Pile or barrier provided for mechanical protection.

Relationships

Source	Type	Target
Guard pile	Generalization	Common protecting facility
IfcRailingTypeEnum.FENCE	Realization	Guard pile
IfcRailing.FENCE	Realization	Guard pile
IfcRailing.FENCE	Realization	Guard pile

4.1.12.9 Level crossing protection

Equipment dedicated to level crossing protection.

Relationships

Source	Type	Target
Level crossing protection	Generalization	Common protecting facility

4.1.12.10 Lightning arrester

Surge arrester: Device intended to protect the electrical apparatus from high transient overvoltage and to limit the duration and amplitude of the follow-on current.(UIC R 791-2006)

Relationships

Source	Type	Target
Lightning arrester	Generalization	Protection element
Lightning arrester	Association	Substation

4.1.12.11 Oil retention tray

Retention tray for environmental protection against oil.

Relationships

Source	Type	Target
Oil retention tray	Generalization	Environmental protection
Oil retention tray	Association	Substation
IfcTank.OILRETENTIONTRAY	Realization	Oil retention tray
IfcTank.OILRETENTIONTRAY	Realization	Oil retention tray
IfcTankTypeEnum.OILRETENTIONTRAY	Realization	Oil retention tray

4.1.12.12 Profile gate

Profile gate.

Relationships

Source	Type	Target
Profile gate	Generalization	Common protecting facility
IfcDoor.GATE	Realization	Profile gate
IfcDoor.GATE	Realization	Profile gate
IfcDoorTypeEnum.GATE	Realization	Profile gate

4.1.12.13 Protection element

Protection against electric shock for people and equipments.

Relationships

Source	Type	Target
Protection element	Aggregation	Traction power system
Insulator	Generalization	Protection element
High voltage fuse	Generalization	Protection element
Anti-arcing device	Aggregation	Protection element
Common protecting facility	Generalization	Protection element
Varistor	Generalization	Protection element
Lightning arrester	Generalization	Protection element
Lightning protection cable	Generalization	Protection element
Spark gap	Generalization	Protection element
Protective boarding	Generalization	Protection element
Sign and Signal	Generalization	Protection element
Voltage limiter	Generalization	Protection element
Rigid catenary protective sheath	Generalization	Protection element

4.1.12.14 Protective barrier

Part providing protection against direct contact from any usual direction of access.(IEC 60050-195-06-15)

Relationships

Source	Type	Target
Protective barrier	Generalization	Common protecting facility
Protective barrier	Association	Sector
IfcRailing.FENCE	Realization	Protective barrier
IfcRailing.FENCE	Realization	Protective barrier
IfcRailingTypeEnum.FENCE	Realization	Protective barrier

4.1.12.15 Protective boarding

Non-conducting barrier to protect persons from coming into direct contact with the live conductor rail.

Relationships

Source	Type	Target
Protective boarding	Generalization	Protection element
IfcRailing.FENCE	Realization	Protective boarding
IfcRailing.FENCE	Realization	Protective boarding
IfcRailingTypeEnum.FENCE	Realization	Protective boarding

4.1.12.16 Protective canopy

Conductive screen used to separate an electric circuit and/or conductors from hazardous-live-parts.

Relationships

Source	Type	Target
Protective canopy	Generalization	Common protecting facility
Protective canopy	Association	Sector
IfcRailingTypeEnum.GUAR DRAIL	Realization	Protective canopy
IfcRailing.GUARDRAIL	Realization	Protective canopy
IfcShadingDeviceTypeEnum .AWNING	Realization	Protective canopy
IfcRailing.GUARDRAIL	Realization	Protective canopy
IfcShadingDevice.AWNING	Realization	Protective canopy
IfcShadingDevice.AWNING	Realization	Protective canopy

4.1.12.17 Sign and Signal

4.1.13 Regulating Devices

4.1.13.1 Regulating Devices

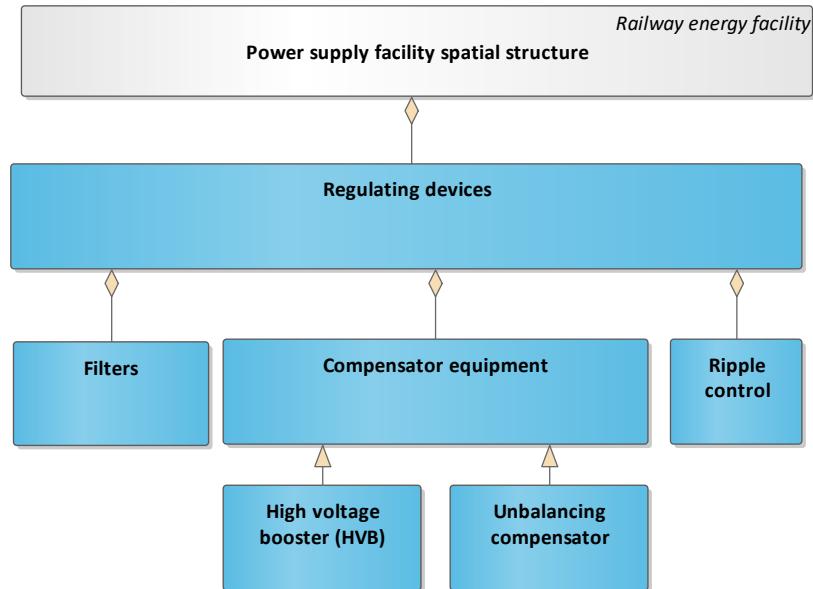


Table 29: Regulating Devices

4.1.13.2 Compensator equipment

A device that is used to 'fix' the parameter of electric energy, such as voltage loss, power factor and so on.

Relationships

Source	Type	Target
Compensator equipment	Aggregation	Regulating devices
IfcElectricFlowStorageDevice.e.COMPENSATOR	Realization	Compensator equipment
High voltage booster (HVB)	Generalization	Compensator equipment
IfcElectricFlowStorageDevice.e.COMPENSATOR	Realization	Compensator equipment
Unbalancing compensator	Generalization	Compensator equipment
Power factor correction(PFC)	Generalization	Compensator equipment
IfcElectricFlowStorageDeviceTypeEnum.COMPENSATOR	Realization	Compensator equipment

4.1.13.3 Filters

Linear two-port device designed to transmit spectral components of the input quantity according to a specified law, generally in order to pass the components in certain frequency bands and to attenuate those in other bands

(IEC - 151-13-55)

Relationships

Source	Type	Target
Filters	Aggregation	Regulating devices
IfcElectricFlowTreatmentDev ice.TypeEnum.ELECTRONICFILTER	Realization	Filters
Band stop filter	Generalization	Filters
Low pass filter	Generalization	Filters
High pass filter	Generalization	Filters
IfcElectricFlowTreatmentDev ice.ELECTRONICFILTER	Realization	Filters
Harmonic filter	Generalization	Filters
Band pass filter	Generalization	Filters
IfcElectricFlowTreatmentDev ice.ELECTRONICFILTER	Realization	Filters

4.1.13.4 High voltage booster (HVB)

Range extender for increasing the voltage supplied so that the supply distance could be extended.

Relationships

Source	Type	Target
High voltage booster (HVB)	Generalization	Compensator equipment

4.1.13.5 Regulating devices

A device that is used to regulate electric energy.

Relationships

Source	Type	Target
Regulating devices	Aggregation	Power supply facility spatial structure
Compensator equipment	Aggregation	Regulating devices
Ripple control	Aggregation	Regulating devices
Filters	Aggregation	Regulating devices

4.1.13.6 Ripple control

The remote control of a switch by electrical impulses.

Relationships

Source	Type	Target
Ripple control	Aggregation	Regulating devices
IfcActuatorTypeEnum.ELECTRICACTUATOR	Realization	Ripple control
IfcActuator.ELECTRICACTUATOR	Realization	Ripple control
IfcActuator.ELECTRICACTUATOR	Realization	Ripple control

4.1.13.7 Unbalancing compensator

A device that is used to correct voltage unbalance in the system.

Relationships

Source	Type	Target
Unbalancing compensator	Generalization	Compensator equipment

4.1.14 Return Circuit

1.1.1.1.2 Class diagram "Return Circuit"

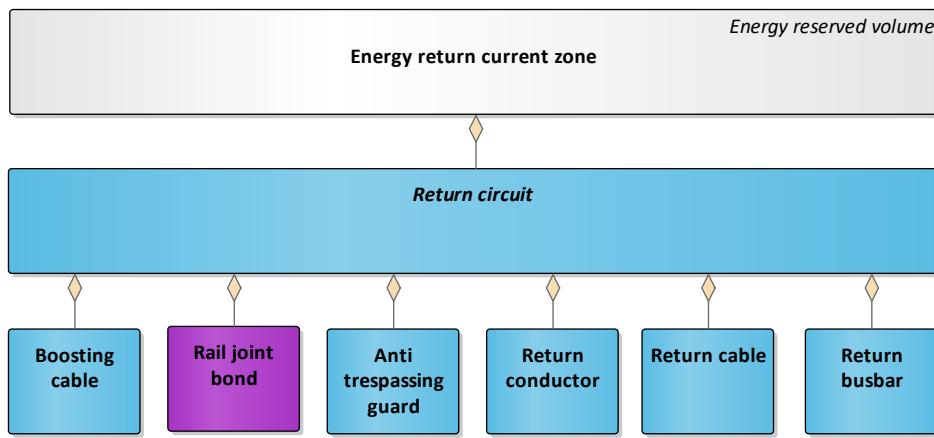


Table 30: Class diagram "Return Circuit"

4.1.14.1 Anti trespassing guard

Equipment provided to deter entry to a restricted area, structure or building by an unauthorized person.

Relationships

Source	Type	Target
Anti trespassing guard	Aggregation	Return circuit
IfcRailingTypeEnum.FENCE	Realization	Anti trespassing guard
IfcRailing.FENCE	Realization	Anti trespassing guard
IfcRailing.FENCE	Realization	Anti trespassing guard

4.1.14.2 Boosting cable

Cable used to connect between rail and return line.

Relationships

Source	Type	Target
Boosting cable	Aggregation	Return circuit
IfcCableSegment.CABLESEGMENT	Realization	Boosting cable
IfcCableSegment.CABLESEGMENT	Realization	Boosting cable
IfcCableSegmentTypeEnum.CABLESEGMENT	Realization	Boosting cable

4.1.14.3 Rail joint bond

Conductor ensuring the electrical continuity of rails at a joint.(UIC R 791-2006/IEC 60050-811-35-07)

Relationships

Source	Type	Target
Rail joint bond	Aggregation	Return circuit
IfcMechanicalFastener.RAILJOINT	Realization	Rail joint bond
IfcMechanicalFastener.RAILJOINT	Realization	Rail joint bond
IfcMechanicalFastenerTypeEnum.RAILJOINT	Realization	Rail joint bond

4.1.14.4 Return conductor

Conductor paralleling the track return and connected to the running rails at periodic intervals.(IEC 60050-811-35-13)

Relationships

Source	Type	Target
Return conductor	Aggregation	Return circuit

Source	Type	Target
IfcCableSegment.CONDUCTORSEGMENT	Realization	Return conductor
IfcCableSegment.CONDUCTORSEGMENT	Realization	Return conductor
IfcCableSegmentTypeEnum.CONDUCTORSEGMENT	Realization	Return conductor

4.1.14.5 Return busbar

Busbar in return current circuit

Relationships

Source	Type	Target
Return busbar	Aggregation	Return circuit
IfcCableSegment.BUSBARSEGMENT	Realization	Return busbar
IfcCableSegment.BUSBARSEGMENT	Realization	Return busbar
IfcCableSegmentTypeEnum.BUSBARSEGMENT	Realization	Return busbar

4.1.14.6 Return cable

Insulated return conductor forming part of the return circuit and connecting the rest of the return circuit of the sub-station.(UIC R 791-2006)

Relationships

Source	Type	Target
Return cable	Aggregation	Return circuit
IfcCableSegment.CABLESEGMENT	Realization	Return cable
IfcCableSegmentTypeEnum.CABLESEGMENT	Realization	Return cable

Source	Type	Target
IfcCableSegment.CABLESEGMENT	Realization	Return cable

4.1.14.7 Return circuit

The electric circuit comprising the running rails or a return current rail, their electrical connections and the return cables to the sub-station.(UIC R 791-2006)

All conductors which form the intended path for the traction return current and the current under fault conditions

Note 1 to entry: The conductors can be for example:

- running rails;
- return conductor rails;
- return conductors;
- return cables.(IEC 60050-811-35-01)

Relationships

Source	Type	Target
Return circuit	Association	Sector
Return circuit	Aggregation	Energy return current zone
Return conductor	Aggregation	Return circuit
Return cable	Aggregation	Return circuit
Return busbar	Aggregation	Return circuit
Rail joint bond	Aggregation	Return circuit
IfcDistributionSystem.RETURN_CIRCUIT	Realization	Return circuit
Boosting cable	Aggregation	Return circuit
IfcDistributionSystem.RETURN_CIRCUIT	Realization	Return circuit

Source	Type	Target
Anti trespassing guard	Aggregation	Return circuit
IfcDistributionSystemEnum. RETURN_CIRCUIT	Realization	Return circuit

4.1.15 Sectioning

4.1.15.1 Sectioning

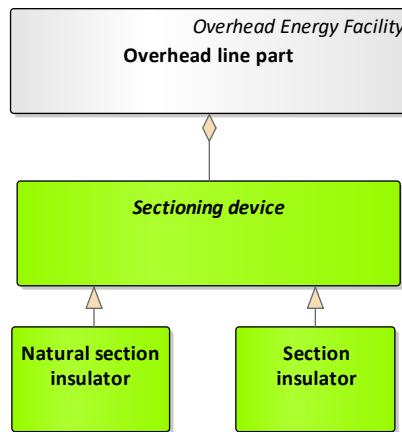


Table 31: Sectioning

4.1.15.2 Sectioning device

The division of the contact line into electrical sections, each of which may be isolated from the adjacent sections e.g. by means of a switch.(UIC R 791-2006)

Relationships

Source	Type	Target
Sectioning device	Aggregation	Overhead line part
IfcDiscreteAccessory.INSULATOR	Realization	Sectioning device
IfcDiscreteAccessoryTypeEnum.INSULATOR	Realization	Sectioning device
IfcDiscreteAccessory.INSULATOR	Realization	Sectioning device
Natural section insulator	Generalization	Sectioning device

Source	Type	Target
Section insulator	Generalization	Sectioning device

4.1.15.3 Natural section insulator

Neutral sections are required as phase separations with a neutral gap, when individual feeder sections are connected to different phases of the national electricity supply grid.

Relationships

Source	Type	Target
Natural section insulator	Generalization	Sectioning device

4.1.15.4 Section insulator

Sectioning point formed by insulators inserted in a continuous run of a contact line, with skids or similar devices to maintain continuous electrical contact with the current collector.(IEC 60050-811-36-15)

Relationships

Source	Type	Target
Section insulator	Generalization	Sectioning device
Pset_SectionInsulator	Realization	Section insulator

4.1.16 Shared

4.1.16.1 Class diagram "Shared"

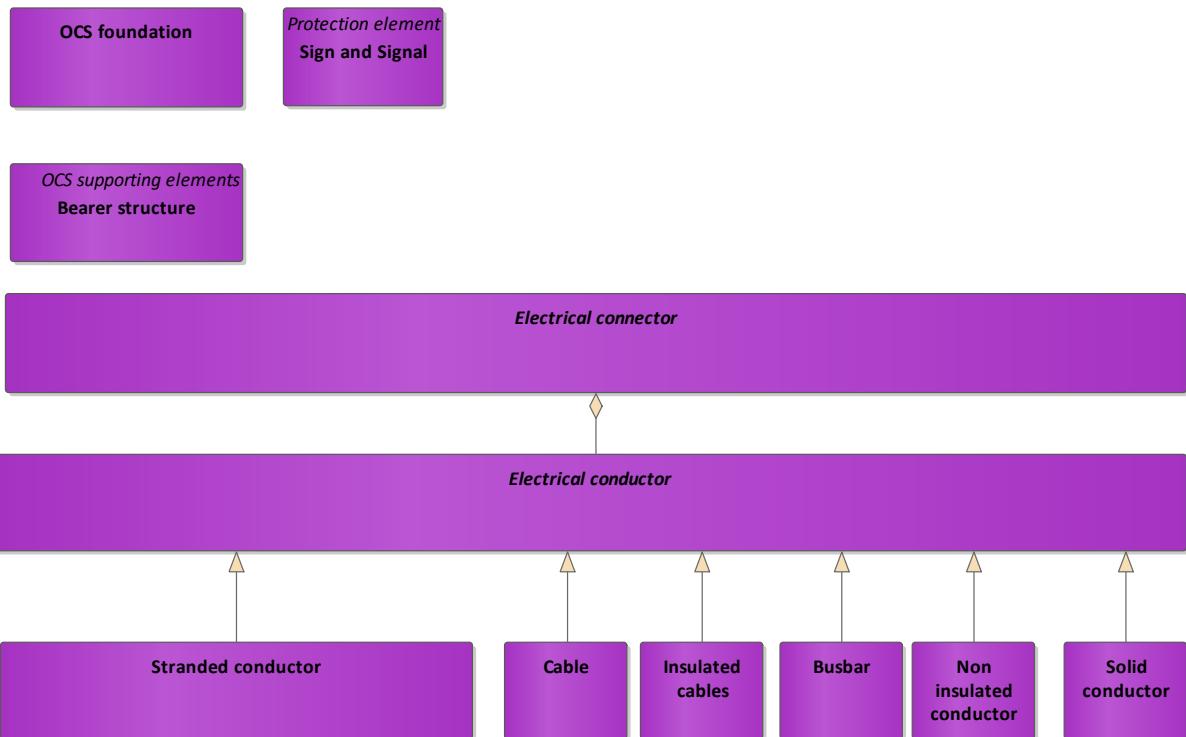


Table 32: Class diagram "Shared"

4.1.16.2 Bearer structure

Ensure the function of holding registration component in tunnel context.

Relationships

Source	Type	Target
Bearer structure	Generalization	OCS supporting elements
IfcMember.POST	Realization	Bearer structure
IfcMember.POST	Realization	Bearer structure

4.1.16.3 OCS foundation

Construction, usually of concrete or steel, completely or partly buried in the ground on which the support is mounted. The foundation must provide stability to all loads borne by the support.(UIC R 791-2006)

Relationships

Source	Type	Target
OCS foundation	Aggregation	OCS supporting system
OCS foundation	Aggregation	Mooring system
IfcFootingTypeEnum.PAD_FOOTING	Realization	OCS foundation
IfcFooting.PAD_FOOTING	Realization	OCS foundation
Pile foundation	Generalization	OCS foundation
IfcFooting.PAD_FOOTING	Realization	OCS foundation
Sealing	Generalization	OCS foundation
Block foundation	Generalization	OCS foundation
Corbel	Generalization	OCS foundation

4.1.16.4 Sign and Signal

Signs and signal for electrical protection and traction power equipment identification

Relationships

Source	Type	Target
Sign and Signal	Aggregation	OCS supporting system
Sign and Signal	Aggregation	Catenary system
Sign and Signal	Generalization	Protection element
IfcSignal.VISUAL	Realization	Sign and Signal
IfcSign.PICTORAL	Realization	Sign and Signal
IfcSignalTypeEnum.VISUAL	Realization	Sign and Signal
IfcSign.PICTORAL	Realization	Sign and Signal
IfcSignal.VISUAL	Realization	Sign and Signal
Lowerpantograph Signs	Generalization	Sign and Signal
IfcSignTypeEnum.PICTORAL	Realization	Sign and Signal
Structure Number Plate	Generalization	Sign and Signal

Source	Type	Target
Protective Plates	Generalization	Sign and Signal

4.1.16.5 Electrical Connector

4.1.16.5.1 Cable

Assembly consisting of:

- one or more cores,
- their individual covering(s) (if any),
- assembly protection (if any),
- protective covering(s) (if any).

(IEC 60050-461-06-01)

Relationships

Source	Type	Target
Cable	Generalization	Electrical conductor
IfcCableSegment.CABLESEGMENT	Realization	Cable
IfcCableSegment.CABLESEGMENT	Realization	Cable
IfcCableSegmentTypeEnum.CABLESEGMENT	Realization	Cable

4.1.16.5.2 Busbar

A low impedance conductor to which several electric circuits can be separately connected.(IEC 60050-605-02-01)

Relationships

Source	Type	Target
Busbar	Generalization	Electrical conductor
IfcCableSegmentTypeEnum.BUSBARSEGMENT	Realization	Busbar
IfcCableSegment.BUSBARS EGMENT	Realization	Busbar
IfcCableSegment.BUSBARS EGMENT	Realization	Busbar

4.1.16.5.3 Catenary wire

Longitudinal wire supporting the grooved contact wires either directly or indirectly.(IEC 60050-811-33-06/UIC R 791-2006)

Relationships

Source	Type	Target
Catenary wire	Aggregation	Catenary system
Catenary wire	Generalization	Stranded conductor
IfcCableCarrierSegment.CA TENARYWIRE	Realization	Catenary wire
Main catenary wire	Generalization	Catenary wire
IfcCableCarrierSegmentTyp eEnum.CATENARYWIRE	Realization	Catenary wire
Auxiliary catenary wire	Generalization	Catenary wire
IfcCableCarrierSegment.CA TENARYWIRE	Realization	Catenary wire

4.1.16.5.4 Earthing conductor

Conductor which provides a conductive path, or part of the conductive path, between a given point in a system or in an installation or in equipment and an earth electrode.

Relationships

Source	Type	Target
Earthing conductor	Generalization	Stranded conductor
Earthing conductor	Aggregation	Earthing line
Earthing conductor	Aggregation	Earthing circuit
IfcCableSegment.CONDUCTORSEGMENT	Realization	Earthing conductor
IfcCableSegmentTypeEnum.CONDUCTORSEGMENT	Realization	Earthing conductor
IfcCableSegment.CONDUCTORSEGMENT	Realization	Earthing conductor
IfcCableSegment.CABLESEGMENT	Realization	Earthing conductor
IfcCableSegmentTypeEnum.CABLESEGMENT	Realization	Earthing conductor
IfcCableSegment.CABLESEGMENT	Realization	Earthing conductor

4.1.16.5.5 Electrical conductor

A wire or combination of wires not insulated from one another, suitable for carrying an electric current.(IEC 60050-466-01-15)

Relationships

Source	Type	Target
Electrical conductor	Aggregation	Power supply facility spatial structure
Electrical conductor	Aggregation	Electrical connector
Solid conductor	Generalization	Electrical conductor
Stranded conductor	Generalization	Electrical conductor
Insulated cables	Generalization	Electrical conductor
Cable	Generalization	Electrical conductor
Busbar	Generalization	Electrical conductor
Non insulated conductor	Generalization	Electrical conductor

Source	Type	Target

4.1.16.5.6 Electrical connector

Permanent and switched electrical connections are used in the overhead contact line system to provide electrical current transfer.

Relationships

Source	Type	Target
Electrical connector	Association	Overhead Line
Electrical conductor	Aggregation	Electrical connector

4.1.16.5.7 Feeder wire

Electrical connection between the contact line and sub-station or the switch station.(IEC 60050-811-36-08/UIC R 791-2006)

Relationships

Source	Type	Target
Feeder wire	Generalization	Stranded conductor
Feeder wire	Aggregation	Feeder line
IfcCableSegment.CONDUCTORSEGMENT	Realization	Feeder wire
IfcCableSegmentTypeEnum.CONDUCTORSEGMENT	Realization	Feeder wire
IfcCableSegment.CONDUCTORSEGMENT	Realization	Feeder wire

4.1.16.5.8 Insulated cables

Common insulated cable

Relationships

Source	Type	Target
Insulated cables	Generalization	Electrical conductor
IfcCableSegmentTypeEnum. CABLESEGMENT	Realization	Insulated cables
IfcCableSegment.CABLESEGMENT	Realization	Insulated cables
IfcCableSegment.CABLESEGMENT	Realization	Insulated cables

4.1.16.5.9 Insulator

Device intended for electrical insulation and mechanical fixing of equipment or conductors which are subject to electric potential differences.(IEC 60050-471-01-10)

Relationships

Source	Type	Target
Insulator	Generalization	Protection element
Insulator	Aggregation	Feeder line
Insulator	Aggregation	OCS suspension
Insulator	Aggregation	Overhead contact line
Insulator	Aggregation	OCS fitting
Insulator	Aggregation	Power supply facility spatial structure
Insulator	Aggregation	Catenary system
Pin insulators	Generalization	Insulator
Suspension insulator	Generalization	Insulator
Long rod insulator	Generalization	Insulator
Post insulator	Generalization	Insulator
Strain insulator	Generalization	Insulator

4.1.16.5.10 Non insulated conductor

a wire or combination of wires not insulated from one another, suitable for carrying an electric current.(IEC 60050-466-01-15)

Relationships

Source	Type	Target
Non insulated conductor	Generalization	Electrical conductor
IfcCableSegment.CONDUCTORSEGMENT	Realization	Non insulated conductor
IfcCableSegment.CONDUCTORSEGMENT	Realization	Non insulated conductor
IfcCableSegmentTypeEnum.CONDUCTORSEGMENT	Realization	Non insulated conductor

4.1.16.5.11 Solid conductor

A conductor consisting of a single wire.(IEC 60050-466-10-01)

Relationships

Source	Type	Target
Solid conductor	Generalization	Electrical conductor
IfcCableSegmentTypeEnum.CONDUCTORSEGMENT	Realization	Solid conductor
IfcCableSegment.CONDUCTORSEGMENT	Realization	Solid conductor
Contact wire	Generalization	Solid conductor
IfcCableSegment.CONDUCTORSEGMENT	Realization	Solid conductor

4.1.16.5.12 Stranded conductor

A conductor consisting of a number of individual uninsulated wires laid up together in alternating left- and right-hand helical layers.(IEC 60050-466-10-03)

Relationships

Source	Type	Target
Stranded conductor	Generalization	Electrical conductor
Earthing conductor	Generalization	Stranded conductor
IfcCableSegment.CORESEGMENT	Realization	Stranded conductor
Feeder wire	Generalization	Stranded conductor
IfcCableSegment.CORESEGMENT	Realization	Stranded conductor
Catenary wire	Generalization	Stranded conductor
IfcCableSegmentTypeEnum.CORESEGMENT	Realization	Stranded conductor

4.1.17 Substation Control Equipment and technical building

4.1.17.1 SubstationControlEquipment

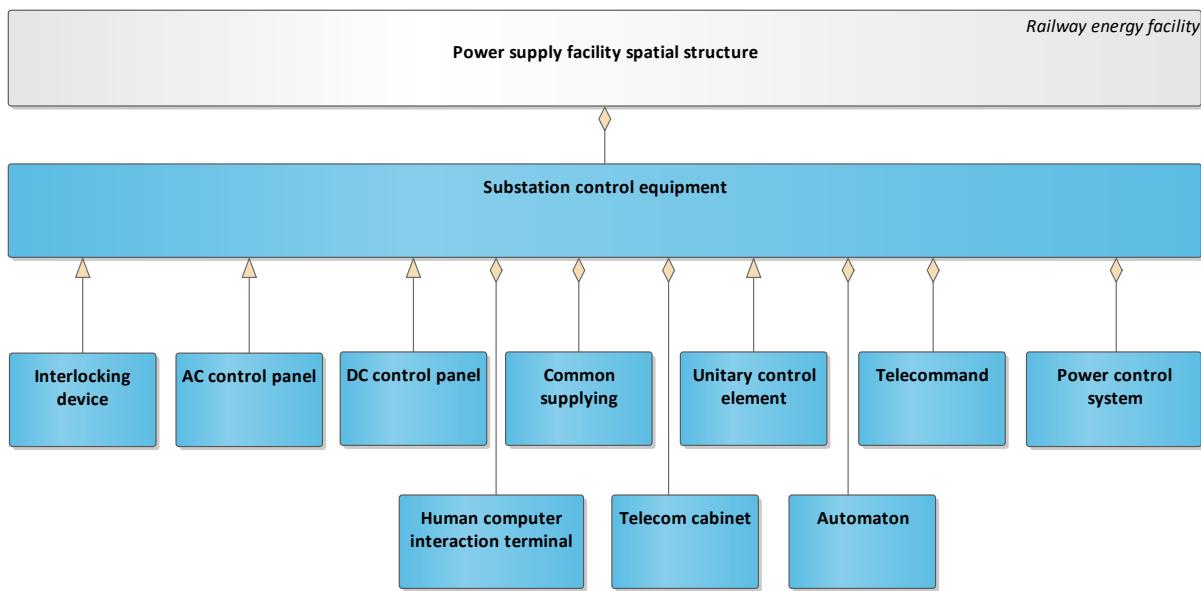


Table 33: SubstationControlEquipment

4.1.17.2 Automaton

Self-acting artificial system the behaviour of which is governed either in a stepwise manner by given decision rules or continuously in time by defined relationships, while the output variables of which are created from its input and state variables.(IEC 60050-351-42-32)

Relationships

Source	Type	Target
Automaton	Aggregation	Substation control equipment
IfcCommunicationsAppliance.AUTOMATON	Realization	Automaton
IfcCommunicationsAppliance.AUTOMATON	Realization	Automaton
IfcCommunicationsApplianceTypeEnum.AUTOMATON	Realization	Automaton

4.1.17.3 AC control panel

According to different electrical equipment and different power consumption, the AC power distribution panel generally controls the distribution cabinet by a branch switch consisting of a voltmeter, an ammeter, a switch (or an automatic switch), an insurance, a signal light, and a line.

Relationships

Source	Type	Target
AC control panel	Generalization	Substation control equipment
IfcUnitaryControlElement.CONTROLPANEL	Realization	AC control panel
IfcUnitaryControlElement.CONTROLPANEL	Realization	AC control panel

4.1.17.4 Common supplying

Power distribution facilities for low-voltage equipments or auxillary equipments.

Relationships

Source	Type	Target
Common supplying	Aggregation	Substation control equipment
IfcDistributionSystemEnum. ELECTRICAL	Realization	Common supplying
IfcDistributionSystem.ELEC TRICAL	Realization	Common supplying
IfcDistributionSystem.ELEC TRICAL	Realization	Common supplying

4.1.17.5 DC control panel

A cabinet that distributes and outputs DC power. The complex power distribution panel also configures the battery pack and monitoring unit.

Relationships

Source	Type	Target
DC control panel	Generalization	Substation control equipment
IfcUnitaryControlElement.C ONTROLPANEL	Realization	DC control panel
IfcUnitaryControlElement.C ONTROLPANEL	Realization	DC control panel

4.1.17.6 Human computer interaction terminal

Panel or interface for engineers to control the equipment.

Relationships

Source	Type	Target
Human computer interaction terminal	Aggregation	Substation control equipment

Source	Type	Target
IfcUnitaryControlElement.C ONTROLPANEL	Realization	Human computer interaction terminal
IfcUnitaryControlElementTyp eEnum.CONTROLPANEL	Realization	Human computer interaction terminal
IfcUnitaryControlElement.C ONTROLPANEL	Realization	Human computer interaction terminal

4.1.17.7 Interlocking device

A device which makes the operation of a switching device dependent upon the position or operation of one or more other pieces of equipment. (IEC 60050-441-16-49)

Equipement for interdependent liaison between the control levers or the electric control circuits of different apparatus such as points and signals, which makes it impossible to place them in positions which are unsafe.

Relationships

Source	Type	Target
Interlocking device	Generalization	Substation control equipment
IfcSwitchingDeviceTypeEnu m.SELECTORSWITCH	Realization	Interlocking device
IfcSwitchingDevice.SELECT ORSWITCH	Realization	Interlocking device
IfcSwitchingDevice.SELECT ORSWITCH	Realization	Interlocking device

4.1.17.8 Power control system

Control the entire network and manage protection control and auxiliaries services of traction power system.

Relationships

Source	Type	Target
Power control system	Aggregation	Substation control equipment

4.1.17.9 Substation control equipment

Equipment used to control operational equipment at a distance using the transmission of information by telecommunication techniques. (IEC 60050-371-01-01)

Relationships

Source	Type	Target
Substation control equipment	Aggregation	Power supply facility spatial structure
Telecommand	Aggregation	Substation control equipment
Unitary control element	Generalization	Substation control equipment
Human computer interaction terminal	Aggregation	Substation control equipment
Power control system	Aggregation	Substation control equipment
Common supplying	Aggregation	Substation control equipment
IfcUnitaryControlElement	Realization	Substation control equipment
IfcUnitaryControlElement	Realization	Substation control equipment
Interlocking device	Generalization	Substation control equipment
AC control panel	Generalization	Substation control equipment
IfcUnitaryControlElement	Realization	Substation control equipment
Telecom cabinet	Aggregation	Substation control equipment
DC control panel	Generalization	Substation control equipment
Automaton	Aggregation	Substation control equipment

4.1.17.10 Telecom cabinet

Cabinet containing the telecommunication equipment.

Relationships

Source	Type	Target
Telecom cabinet	Aggregation	Substation control equipment
IfcFurniture.TECHNICALCABINET	Realization	Telecom cabinet
IfcFurnitureTypeEnum.TECHNICALCABINET	Realization	Telecom cabinet
IfcFurniture.TECHNICALCABINET	Realization	Telecom cabinet

4.1.17.11 Telecommand

A system sending command to control and monitor the switches and circuit breakers or systems directly or not connected (e.g. via wires) within the traction power system remotly.

Relationships

Source	Type	Target
Telecommand	Aggregation	Substation control equipment
IfcCommunicationsAppliance.TELECOMMAND	Realization	Telecommand
IfcCommunicationsApplianceTypeEnum.TELECOMMAND	Realization	Telecommand
IfcCommunicationsAppliance.TELECOMMAND	Realization	Telecommand

4.1.17.12 Unitary control element

A unitary control element combines a number of control components into a single product, such as a thermostat or humidistat.

A unitary control element provides a housing for an aggregation of control or electrical distribution elements that, in combination, perform a singular (unitary) purpose. Each item in the aggregation may have its own geometric representation and location. (IFC4)

Relationships

Source	Type	Target
Unitary control element	Generalization	Substation control equipment
IfcUnitaryControlElement.COMBINED	Realization	Unitary control element
IfcUnitaryControlElementTypeEnum.COMBINED	Realization	Unitary control element
IfcUnitaryControlElement.COMBINED	Realization	Unitary control element

4.1.18 Switch

4.1.18.1 Switch

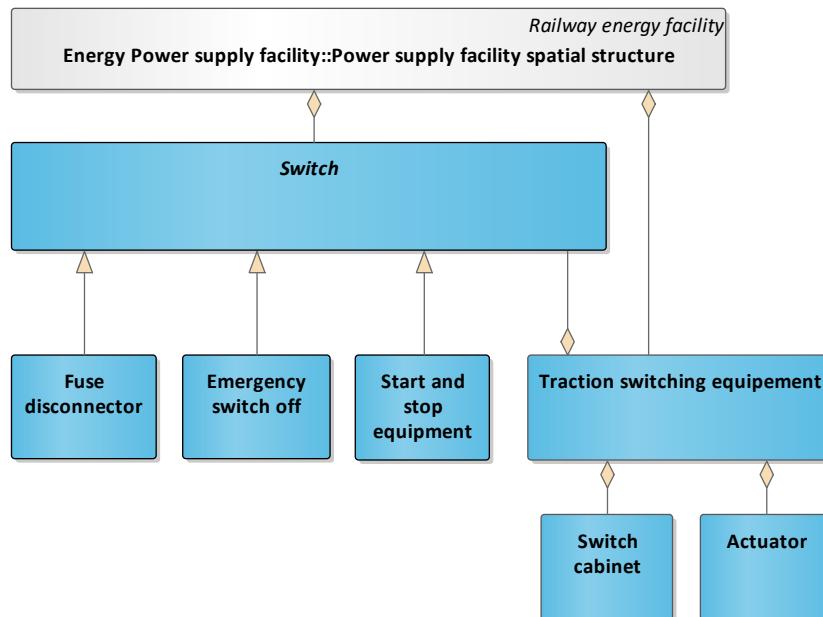


Table 34: Switch

4.1.18.2 Actuator

The part of the actuating system to which an external actuating force is applied.

(IEC-441-15-22)

Used for operating the switches.

Relationships

Source	Type	Target
Actuator	Aggregation	Traction switching equipement
IfcActuatorTypeEnum.ELEC TRICACTUATOR	Realization	Actuator
IfcActuator.ELECTRICACTUATOR	Realization	Actuator
Mechanical actuators	Generalization	Actuator
IfcActuator.ELECTRICACTUATOR	Realization	Actuator
Manual actuators	Generalization	Actuator
Electrical actuators	Generalization	Actuator

4.1.18.3 Emergency switch off

Opening operation of a switching device intended to remove electric power from an electrical installation to avert or alleviate a hazardous situation. (IEC 60050-826-17-03)

Relationships

Source	Type	Target
Emergency switch off	Generalization	Switch
IfcSwitchingDevice.EMERGENCYSTOP	Realization	Emergency switch off
IfcSwitchingDevice.EMERGENCYSTOP	Realization	Emergency switch off
IfcSwitchingDeviceTypeEnum.EMERGENCYSTOP	Realization	Emergency switch off

4.1.18.4 Fuse disconnector

a disconnector in which one or more poles have a fuse in series in a composite unit.(IEC 60050-441-14-15)

Relationships

Source	Type	Target
Fuse disconnector	Generalization	Switch
IfcProtectiveDeviceTypeEnum.FUSEDISCONNECTOR	Realization	Fuse disconnector
IfcProtectiveDevice.FUSEDISCONNECTOR	Realization	Fuse disconnector
IfcProtectiveDevice.FUSEDISCONNECTOR	Realization	Fuse disconnector

4.1.18.5 Start and stop equipment

Switch for alternatively closing and opening one or more electric circuits.(IEC 60050-151-12-23)

Relationships

Source	Type	Target
Start and stop equipment	Generalization	Switch
IfcSwitchingDevice.START_AND_STOP_EQUIPMENT	Realization	Start and stop equipment
IfcSwitchingDeviceTypeEnum.START_AND_STOP_EQUIPMENT	Realization	Start and stop equipment
IfcSwitchingDevice.START_AND_STOP_EQUIPMENT	Realization	Start and stop equipment

4.1.18.6 Switch

Switch for alternatively closing and opening one or more electric circuits (IEC

60050-151-12-23)

Relationships

Source	Type	Target
Switch	Aggregation	Power supply facility spatial structure
Switch	Association	Sub sector
Switch	Association	Elementary sector
Switch	Aggregation	Traction switching equipement
Earthing switch	Generalization	Switch
Disconnecter	Generalization	Switch
Emergency switch off	Generalization	Switch
Load switch	Generalization	Switch
Circuit breaker	Generalization	Switch
Sectioning breaking switch	Generalization	Switch
Blade switch	Generalization	Switch
Change over switch	Generalization	Switch
Sectioning disconnector switch	Generalization	Switch
Load break switch	Generalization	Switch
Switch disconnector	Generalization	Switch
Start and stop equipment	Generalization	Switch
Fuse disconnector	Generalization	Switch

4.1.18.7 Switch cabinet

In addition to the incoming and outgoing lines, the switchgear is completely enclosed by a grounded metal casing.

Switch cabinets/switchgear contain sensitive electrical, electronic and mechanical components to perform control, drive, power supply and safety functions. As a rule, these components are of high quality.

Switch cabinets consist of the cabinet housing and door and the interior components (e.g. mounting plates), which generally take the form of drawer units or are mounted on a panel.

Relationships

Source	Type	Target
Switch cabinet	Aggregation	Traction switching equipement
IfcFurnitureTypeEnum.TEC_HNICALCABINET	Realization	Switch cabinet
IfcFurniture.TECHNICALCABINET	Realization	Switch cabinet
IfcFurniture.TECHNICALCABINET	Realization	Switch cabinet

4.1.18.8 Traction switching equipment

Switching equipment used for traction power, which is usually composed by switch(s), cabinet (might be), instrument transformer (might be), and other auxillary equipments.

Relationships

Source	Type	Target
Traction switching equipment	Aggregation	Power supply facility spatial structure
Actuator	Aggregation	Traction switching equipment
IfcElementAssemblyTypeEnum.TRACTION_SWITCHING_ASSEMBLY	Realization	Traction switching equipment
IfcElementAssembly.TRACTION_SWITCHING_ASSEMBLY	Realization	Traction switching equipment

Source	Type	Target
Switch cabinet	Aggregation	Traction switching equipement
Switch	Aggregation	Traction switching equipement
IfcElementAssembly.TRACTION_SWITCHING_ASSEMBLY	Realization	Traction switching equipement

4.1.19 Underground Facilities

4.1.19.1 Underground Facilities

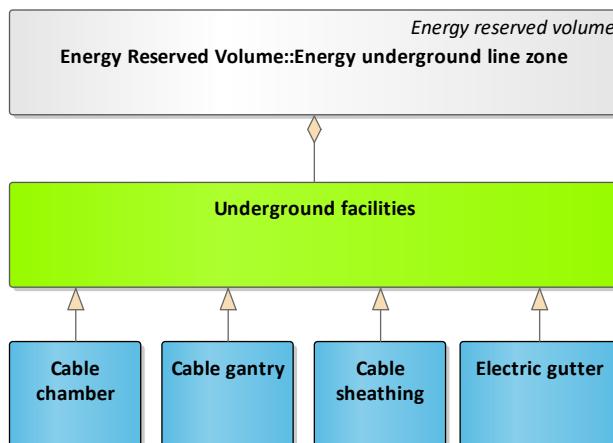


Table 35: Underground Facilities

4.1.19.2 Cable chamber

An opening to a confined space such as a shaft, utility vault, or large vessel, used as an access point for underground cable, allowing inspection, maintenance, and system upgrades. It's also called manhole.

Relationships

Source	Type	Target
Cable chamber	Generalization	Underground facilities
Cable chamber	Aggregation	Auxiliary services
IfcDistributionChamberElementTypeEnum.INSPECTION CHAMBER	Realization	Cable chamber

Source	Type	Target
IfcDistributionChamberElem ent.MANHOLE	Realization	Cable chamber
IfcDistributionChamberElem ent.INSPECTIONPIT	Realization	Cable chamber
IfcDistributionChamberElem ent.INSPECTIONCHAMBER	Realization	Cable chamber
IfcDistributionChamberElem ent.INSPECTIONPIT	Realization	Cable chamber
IfcDistributionChamberElem ent.MANHOLE	Realization	Cable chamber
IfcDistributionChamberElem ent.INSPECTIONCHAMBER	Realization	Cable chamber
IfcDistributionChamberElem entTypeEnum.MANHOLE	Realization	Cable chamber
IfcDistributionChamberElem entTypeEnum.INSPECTION PIT	Realization	Cable chamber

4.1.19.3 Cable gantry

Horizontal cable supports fixed at one end only, spaced at intervals, on which cables rest.(IEC 60050-826-15-10)

Relationships

Source	Type	Target
Cable gantry	Generalization	Underground facilities
Cable gantry	Aggregation	Auxiliary services
IfcCableCarrierSegment.CA BLEBRACKET	Realization	Cable gantry
IfcCableCarrierSegmentTyp eEnum.CABLEBRACKET	Realization	Cable gantry
IfcCableCarrierSegment.CA BLEBRACKET	Realization	Cable gantry

4.1.19.4 Cable sheathing

Flexible accessory or a part of a component placed around the cable to minimize flexing of the cable at the point of entry into the component.

Relationships

Source	Type	Target
Cable sheathing	Generalization	Underground facilities
Cable sheathing	Aggregation	Auxiliary services
IfcDiscreteAccessory.CABL EARRANGER	Realization	Cable sheathing
IfcDiscreteAccessory.CABL EARRANGER	Realization	Cable sheathing
IfcDiscreteAccessoryTypeEn um.CABLEARRANGER	Realization	Cable sheathing

4.1.19.5 Electric gutter

Electrical conduit used to protect and route electrical wiring in a building or structure.

Relationships

Source	Type	Target
Electric gutter	Generalization	Underground facilities
Electric gutter	Aggregation	Auxiliary services
IfcCableCarrierSegment.CA BLETRAYSEGMENT	Realization	Electric gutter
IfcCableCarrierSegmentTyp eEnum.CABLETRAYSEGMENT	Realization	Electric gutter
IfcCableCarrierSegment.CA BLETRAYSEGMENT	Realization	Electric gutter

4.1.19.6 Underground facilities

Cables and other facilities needed to connect OCS to substation and to low voltage services

Relationships

Source	Type	Target
Underground facilities	Aggregation	Energy underground line zone
Cable gantry	Generalization	Underground facilities
Cable chamber	Generalization	Underground facilities
Cable sheathing	Generalization	Underground facilities
Electric gutter	Generalization	Underground facilities
Signal connection plate	Generalization	Underground facilities

4.2 Energy Spatial

4.2.1 Class diagram energy spatial

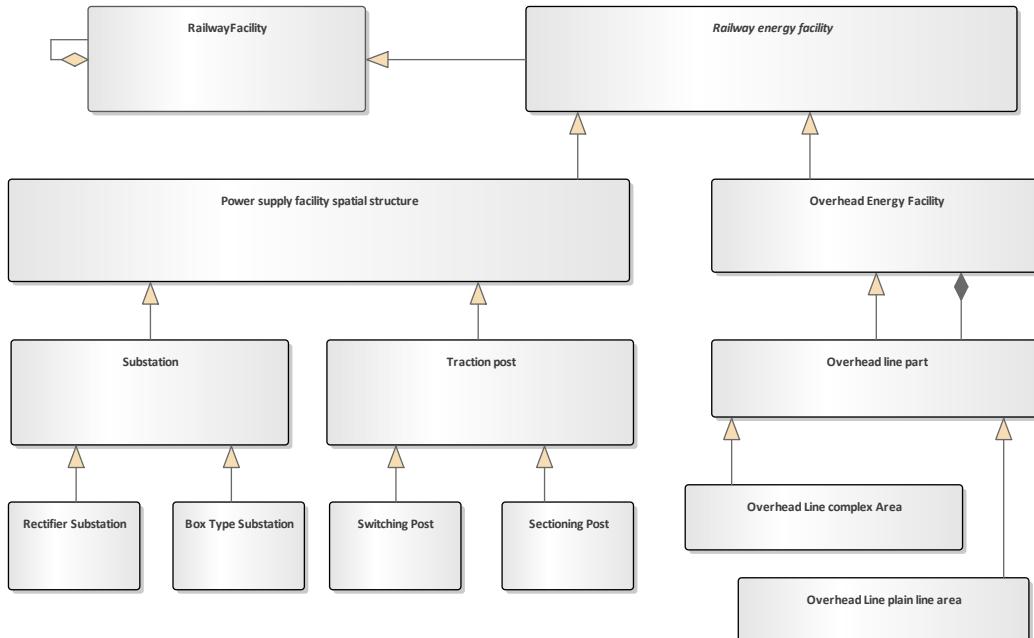


Table 36: Class diagram energy spatial

4.2.2 Class diagram energy reserved volume

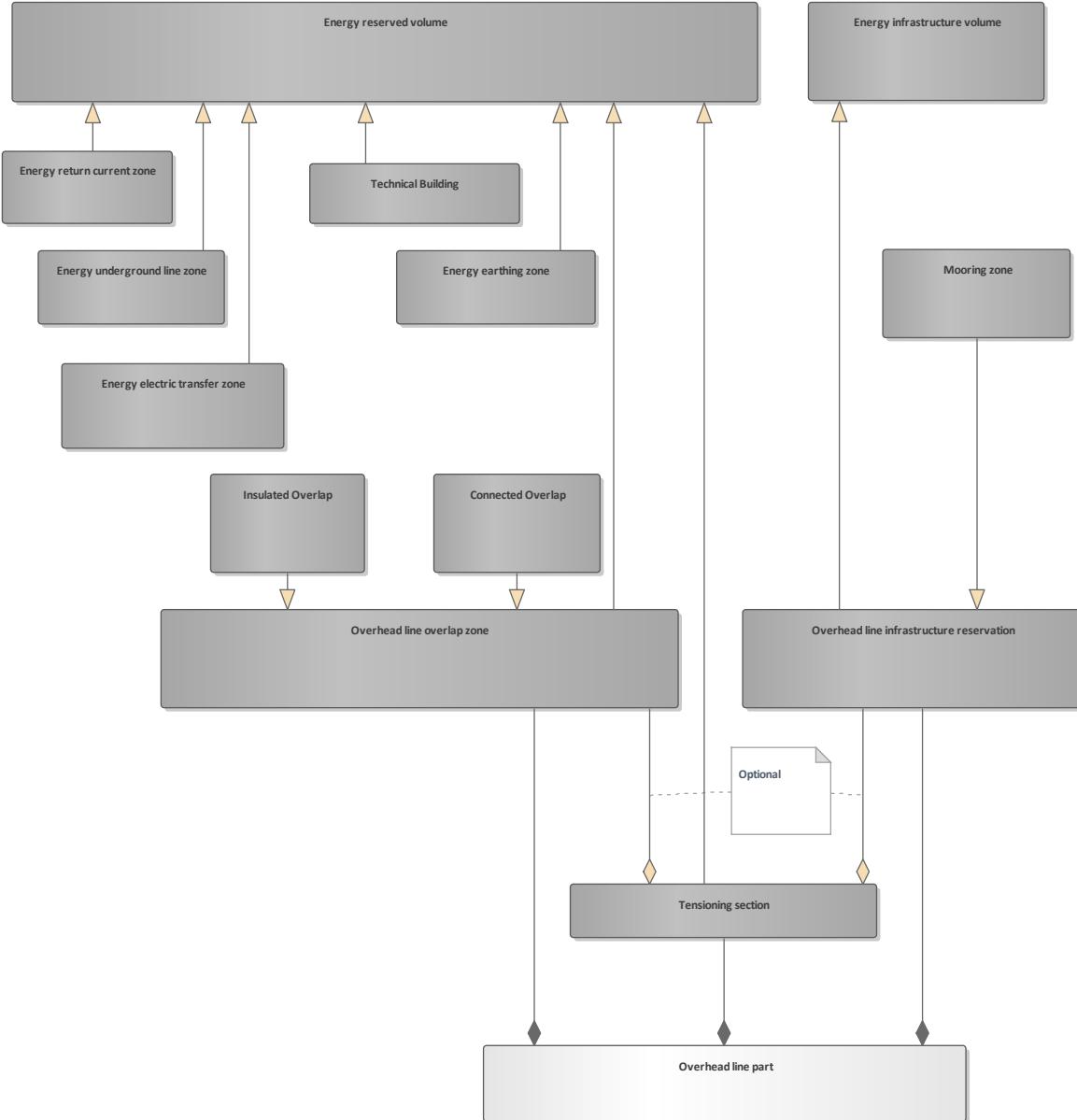


Table 37: Class diagram energy reserved volume

4.2.3 Railway energy facility

Energy System?

Relationships

Source	Type	Target
Railway energy facility	Generalization	RailwayFacility
Overhead Energy Facility	Generalization	Railway energy facility
Power supply facility spatial structure	Generalization	Railway energy facility

4.2.4 Energy Overhead Line

4.2.4.1 Overhead Energy Facility

Describe the spatial structure holding all energy domain facilities.

Relationships

Source	Type	Target
Overhead Energy Facility	Generalization	Railway energy facility
Overhead Energy Facility	Realization	RAILWAY OVERHEAD LINE
Overhead line part	Generalization	Overhead Energy Facility
Overhead line part	Aggregation	Overhead Energy Facility

4.2.4.2 Overhead Line complex Area

Spatial structure to organize overhead line features inside in a complex railway electrification project like Station , tunnel, turnout or connection area etc.

Relationships

Source	Type	Target
Overhead Line complex Area	Generalization	Overhead line part
Overhead Line complex Area	Realization	OVERHEAD LINE COMPLEX AREA

4.2.4.3 Overhead Line plain line area

Spatial structure to organize overhead line features inside a railway project in classical electrification project. It can be used to structure tensioning section facilities and overlaps.

Relationships

Source	Type	Target
Overhead Line plain line area	Realization	OVERHEAD LINE PLAIN LINE AREA
Overhead Line plain line area	Generalization	Overhead line part

4.2.4.4 Overhead line infrastructure reservation

Equipment to support ContactLine, Feeder or Earthwire

Relationships

Source	Type	Target
Overhead line infrastructure reservation	Aggregation	Tensioning section
Overhead line infrastructure reservation	Generalization	Energy infrastructure volume
Overhead line infrastructure reservation	Aggregation	Overhead line part
Overhead line infrastructure reservation	Realization	Pset_RailwayOverheadLinSupportingStructure
Mooring zone	Generalization	Overhead line infrastructure reservation
Mid point anchor	Aggregation	Overhead line infrastructure reservation
OCS supporting system	Aggregation	Overhead line infrastructure reservation
Mooring system	Aggregation	Overhead line infrastructure reservation

4.2.4.5 Overhead line part

An electric line whose conductors are supported above ground, generally by means of insulators and appropriate supports

Note – Certain overhead lines may also be constructed with insulated conductors.(IEC 60050-466-01-02)

Relationships

Source	Type	Target
Overhead line part	Generalization	Overhead Energy Facility
Overhead line part	Realization	RAILWAY OVERHEAD LINE PART
Overhead line part	Aggregation	Overhead Energy Facility
Feeder line	Aggregation	Overhead line part
Overhead line overlap zone	Aggregation	Overhead line part
Sectioning device	Aggregation	Overhead line part
Overhead Line plain line area	Generalization	Overhead line part
Overhead Line complex Area	Generalization	Overhead line part
Overhead line infrastructure reservation	Aggregation	Overhead line part
Earthing line	Aggregation	Overhead line part
Tensioning section	Aggregation	Overhead line part
Overhead contact line system	Aggregation	Overhead line part

4.2.5 Energy Power supply facility

4.2.5.1 Rectifier Substation

Rectifier substation

Relationships

Source	Type	Target
Rectifier Substation	Generalization	Substation

4.2.5.2 Sectioning Post

Power supply post for sectioning

Relationships

Source	Type	Target
Sectioning Post	Generalization	Traction post

4.2.5.3 Switching Post

Power supply post for switching

Relationships

Source	Type	Target
Switching Post	Generalization	Traction post

4.2.5.4 Box Type Substation

Pre build substation

Relationships

Source	Type	Target
Box Type Substation	Generalization	Substation
Box Type Substation	Association	Sub sector
Traction power system	Association	Box Type Substation

Source	Type	Target

4.2.5.5 Substation

Substation the main function of which is to supply an electric traction system.(IEC 60050-811-36-02)

Relationships

Source	Type	Target
Substation	Generalization	Power supply facility spatial structure
Power transformer	Aggregation	Substation
Rectifier Substation	Generalization	Substation
Box Type Substation	Generalization	Substation
Energy conversion device	Aggregation	Substation
Oil retention tray	Association	Substation
Lightning arrester	Association	Substation

4.2.5.6 Power supply facility spatial structure

To supply electric traction system from high voltage.

Relationships

Source	Type	Target
Power supply facility spatial structure	Association	Sector
Power supply facility spatial structure	Aggregation	Traction power system
Power supply facility spatial structure	Generalization	Railway energy facility
Traction post	Generalization	Power supply facility spatial structure
Bases	Aggregation	Power supply facility spatial structure

Source	Type	Target
Switch	Aggregation	Power supply facility spatial structure
Energy conversion device	Aggregation	Power supply facility spatial structure
Autotransformer post	Generalization	Power supply facility spatial structure
Substation control equipment	Aggregation	Power supply facility spatial structure
Electrical conductor	Aggregation	Power supply facility spatial structure
Auxiliary services	Aggregation	Power supply facility spatial structure
Electric storage device	Aggregation	Power supply facility spatial structure
Electric power converter	Aggregation	Power supply facility spatial structure
Traction switching equipement	Aggregation	Power supply facility spatial structure
Insulator	Aggregation	Power supply facility spatial structure
Substation	Generalization	Power supply facility spatial structure
Regulating devices	Aggregation	Power supply facility spatial structure
Instrument transformer	Aggregation	Power supply facility spatial structure

4.2.5.7 Traction post

Power Supply system

Relationships

Source	Type	Target
Traction post	Generalization	Power supply facility spatial structure
Sectioning Post	Generalization	Traction post

Source	Type	Target
Switching Post	Generalization	Traction post
Sub sector	Association	Traction post

4.2.6 Energy Reserved Volume

4.2.6.1 Energy earthing zone

Element that make the connections between ground and return circuit.

Relationships

Source	Type	Target
Energy earthing zone	Generalization	Energy reserved volume
Earthing circuit	Aggregation	Energy earthing zone

4.2.6.2 Energy electric transfer zone

Zone which contain the facilities on the over head line to transfer the current from the substation

Relationships

Source	Type	Target
Energy electric transfer zone	Generalization	Energy reserved volume

4.2.6.3 Energy return current zone

Zone that are containing - elements of electrical continuity for the rails,

- links to the impedance bond for return current,
- return conductor.

Relationships

Source	Type	Target
Energy return current zone	Generalization	Energy reserved volume
Return circuit	Aggregation	Energy return current zone

4.2.6.4 Energy underground line zone

Reserved area for underground facilities like gutter etc.

Relationships

Source	Type	Target
Energy underground line zone	Generalization	Energy reserved volume
Underground facilities	Aggregation	Energy underground line zone

4.2.6.5 Mooring zone

Holds the elements responsible for the mooring

Space where the catenary system will be moor to the ground.

The element present in this spatial structure are use for the same fonction : keep good mechanichal tension into all Overhead line Cable

Relationships

Source	Type	Target
Mooring zone	Generalization	Overhead line infrastructure reservation
Mooring zone	Realization	Pset_RailwayOverheadLineMooringZone
Mooring system	Aggregation	Mooring zone

4.2.6.6 Tensioning section

Length of the overhead contact line between two terminating points.(IEC 60050-811-33-61)

Relationships

Source	Type	Target
Tensioning section	Association	Sector
Tensioning section	Realization	Pset_RailwayTensioningSection
Tensioning section	Generalization	Energy reserved volume
Tensioning section	Aggregation	Overhead line part
Overhead line infrastructure reservation	Aggregation	Tensioning section
Neutral section	Generalization	Tensioning section
Feeder line	Association	Tensioning section
Catenary system	Aggregation	Tensioning section
Elementary sector	Association	Tensioning section
Earthing line	Association	Tensioning section
Overhead line overlap zone	Aggregation	Tensioning section

4.2.6.7 Connected Overlap

overlap spans where the two conductors are permanently connected together electrically by suitable jumpers

Relationships

Source	Type	Target
Connected Overlap	Realization	CONNECTED OVERLAP

Source	Type	Target
Connected Overlap	Generalization	Overhead line overlap zone
Connected Overlap	Aggregation	Overhead contact line system

4.2.6.8 Insulated Overlap

overlaps where the two Overhead line systems are kept apart

Relationships

Source	Type	Target
Insulated Overlap	Realization	INSULATED OVERLAP
Insulated Overlap	Generalization	Overhead line overlap zone

4.2.6.9 Overhead line overlap zone

Connect two tensioning lenght

An arrangement of adjacent mechanical sections of the OCL providing continuous contact of the pantograph with the contact wire(s) and continuous current collection. Each length of the contact wire overlaps with the next so that the pantograph slides smoothly from one to the other.(UIC R 791-2006)

Relationships

Source	Type	Target
Overhead line overlap zone	Aggregation	Overhead line part
Overhead line overlap zone	Generalization	Energy reserved volume
Overhead line overlap zone	Aggregation	Tensioning section
Overhead line overlap zone	Realization	Pset_RailwayOverheadLineOverlapZone
Connected Overlap	Generalization	Overhead line overlap zone
Switched Overlap	Generalization	Overhead line overlap zone
Insulated Overlap	Generalization	Overhead line overlap zone

4.2.6.10 Switched Overlap

Relationships

Source	Type	Target
Switched Overlap	Generalization	Overhead line overlap zone
Switched Overlap	Realization	SWITCHED OVERLAP
Sectioning disconnector switch	Aggregation	Switched Overlap
Sectioning breaking switch	Aggregation	Switched Overlap

4.2.6.11 Technical Building

Building on track side dedicated to railways operation.

Relationships

Source	Type	Target
Technical Building	Generalization	Energy reserved volume
Sector	Association	Technical Building
Building foundation	Aggregation	Technical Building

5 Signalling

5.1 Signalling Structural (physical)

5.1.1 Class diagram Objects overview pt.1

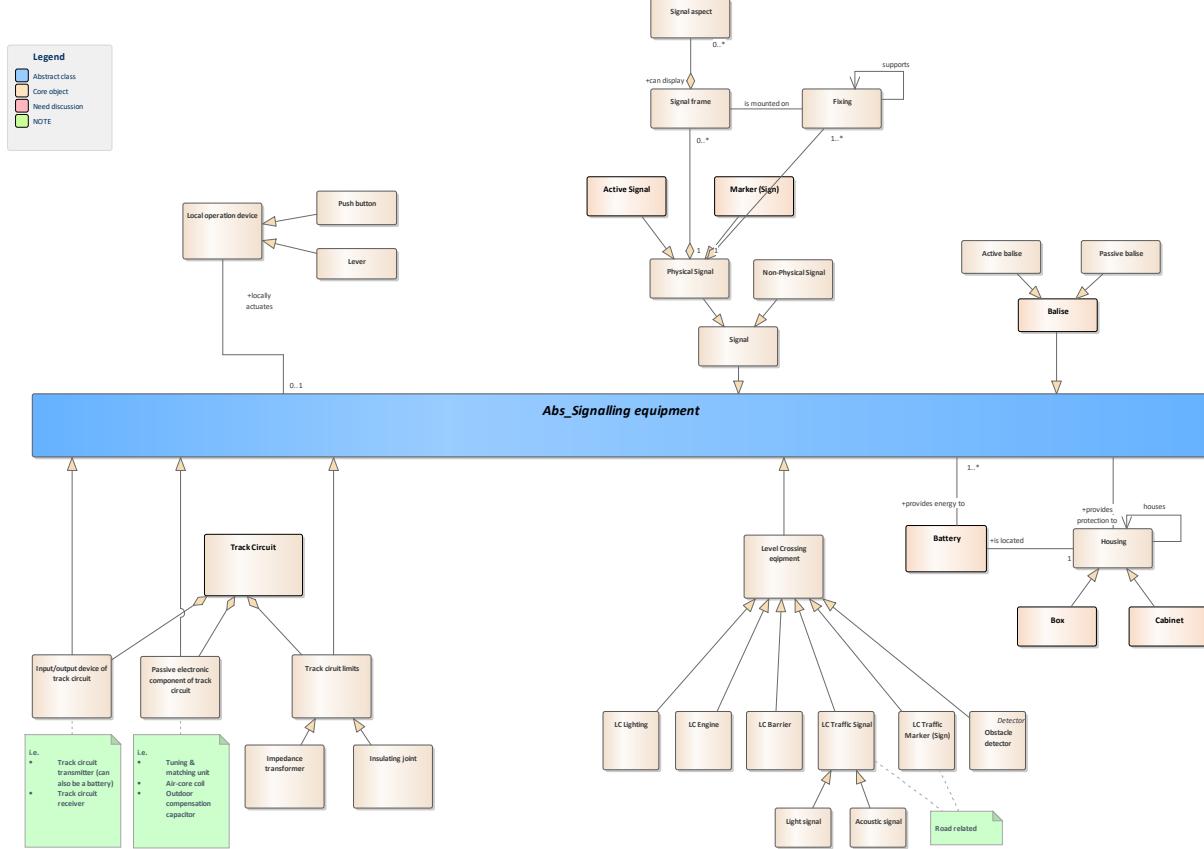


Table 38: Class diagram Objects overview pt.1

5.1.2 Class diagram Objects overview pt.2

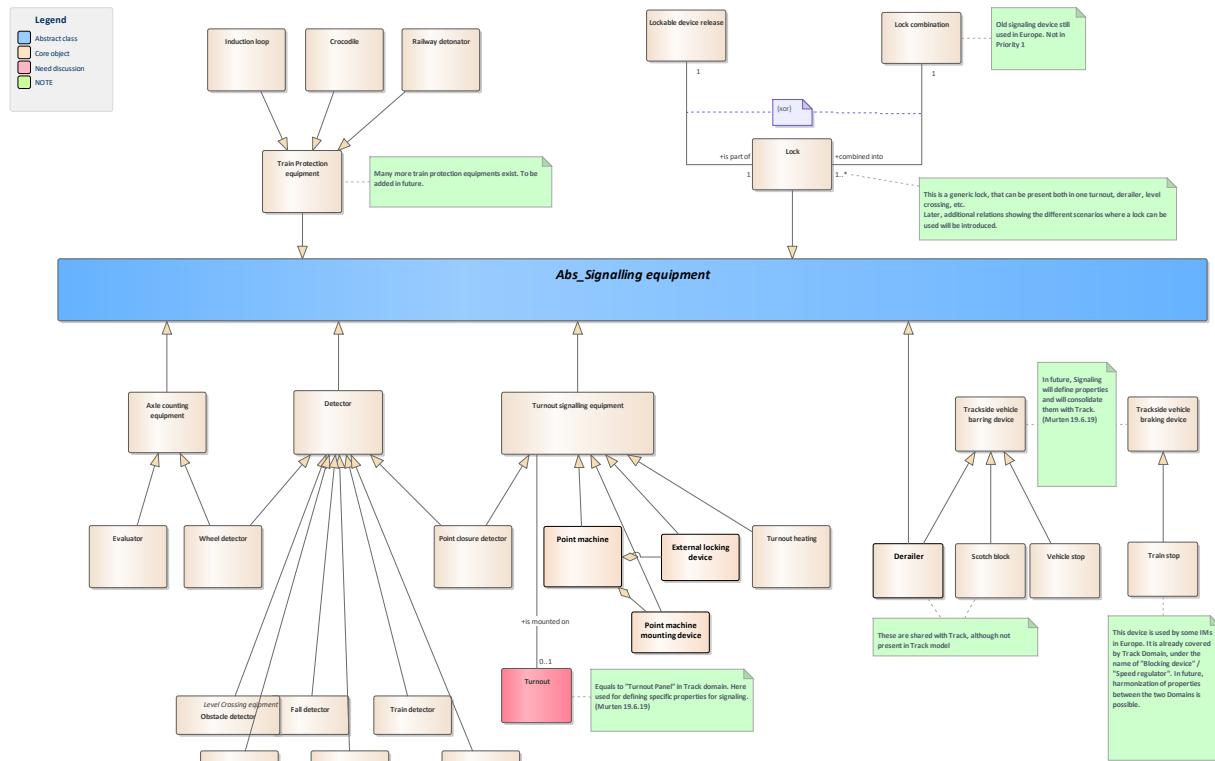


Table 39: Class diagram Objects overview pt.2

5.1.3 Abstract_equipment

5.1.3.1 Abs_Signalling equipment

Abstract, common ancestor of all Signalling elements.

Relationships

Source	Type	Target
Abs_Signalling equipment	Aggregation	Signalling equipment volume
Derailer	Generalization	Abs_Signalling equipment
Input/output device of track circuit	Generalization	Abs_Signalling equipment
Train Protection equipment	Generalization	Abs_Signalling equipment
Level Crossing equipment	Generalization	Abs_Signalling equipment
Balise	Generalization	Abs_Signalling equipment
Battery	Association	Abs_Signalling equipment

Source	Type	Target
Axle counting equipment	Generalization	Abs_Signalling equipment
Passive electronic component of track circuit	Generalization	Abs_Signalling equipment
Local operation device	Association	Abs_Signalling equipment
Detector	Generalization	Abs_Signalling equipment
Lock	Generalization	Abs_Signalling equipment
Turnout signalling equipment	Generalization	Abs_Signalling equipment
Abs_Signalling non-trackside equipment	Generalization	Abs_Signalling equipment
Housing	Association	Abs_Signalling equipment
Signal	Generalization	Abs_Signalling equipment
Track circuit limits	Generalization	Abs_Signalling equipment

5.1.3.2 *Abs_Signalling non-trackside equipment*

Abstract, common ancestor of all Signalling non-trackside elements.

Relationships

Source	Type	Target
Abs_Signalling non-trackside equipment	Generalization	Abs_Signalling equipment
Relay	Association	Abs_Signalling non-trackside equipment
Control Equipment	Generalization	Abs_Signalling non-trackside equipment
UPS	Association	Abs_Signalling non-trackside equipment
Transformer	Association	Abs_Signalling non-trackside equipment
Full-extrinsic execution unit	Generalization	Abs_Signalling non-trackside equipment

5.1.4 Axle counting equipment

5.1.4.1 Class diagram Axe counting equipment

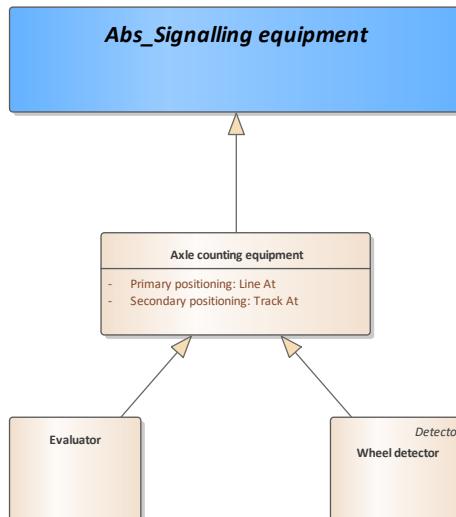


Table 40: Class diagram Axe counting equipment

5.1.4.2 Axe counting equipment

System using counting points with a wheel detector and a counter which detects the occupancy of a section of track by comparing the number of axles which enter the section with the number of axles which leave the section, parity of the numbers being necessary to give a clear indication.

[source: IEC 60050-821]

Relationships

Source	Type	Target
Axle counting equipment	Generalization	Abs_Signalling equipment
Wheel detector	Generalization	Axle counting equipment
Evaluator	Generalization	Axle counting equipment

5.1.4.3 Evaluator

Centrally located computer.

Relationships

Source	Type	Target
Evaluator	Generalization	Axle counting equipment
IfcCommunicationsAppliance.COMPUTER	Realization	Evaluator
IfcCommunicationsAppliance.COMPUTER	Realization	Evaluator
IfcCommunicationsApplianceTypeEnum.COMPUTER	Realization	Evaluator

5.1.5 Balise

5.1.5.1 Class diagram Balise

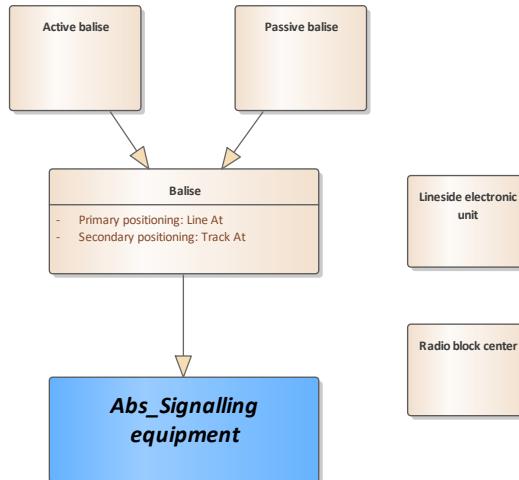


Table 41: Class diagram Balise

5.1.5.2 Active balise

The active balise is a point device used to transmit variable data packets to the train from the ground.

Relationships

Source	Type	Target
Active balise	Generalization	Balise

5.1.5.3 Lineside electronic unit

The LEU is the interface between the Eurobalise and interlocking. The LEU acquires the information from the interlocking, and in concordance with the lineside signalling (if available) sends the appropriate information (called a 'telegram') to the Eurobalises, which in turn send it to the train onboard system.

Relationships

Source	Type	Target
IfcCommunicationsAppliance.LINESIDEELECTRONICUNIT	Realization	Lineside electronic unit

5.1.5.4 Passive balise

The passive balise is a point device for transmitting fixed data packets from the trackside to the train.

Relationships

Source	Type	Target
Passive balise	Generalization	Balise

1.1.1.1.3 Radio block center

A lineside equipment of the European Train Control System (ETCS) level 2. It is a specialised computing device with specification Safety integrity level 4 (SIL) for generating Movement Authorities (MA) and transmitting it to trains. It gets information from Signalling control and from the trains in its section. It hosts the specific geographic data of the railway section and receives cryptographic keys from trains passing in. According to conditions, the RBC will attend the trains with MA until leaving the section.

Relationships

Source	Type	Target
IfcCommunicationsAppliance.RADIOBLOCKCENTER	Realization	Radio block center

5.1.5.5 Balise

Apparatus in the track by means of which data are transmitted to a train to update the train-borne automatic protection equipment regarding the track and signal conditions of the line ahead.

[source: IEC 60050-821]

Relationships

Source	Type	Target
Balise	Generalization	Abs_Signalling equipment
Passive balise	Generalization	Balise
IfcCommunicationsApplianceTypeEnum.TRANSPODER	Realization	Balise
Active balise	Generalization	Balise
IfcCommunicationsAppliance.TRANSPODER	Realization	Balise
IfcCommunicationsAppliance.TRANSPODER	Realization	Balise

5.1.6 Cable and Wire

5.1.6.1 Class diagram Cable and Wire

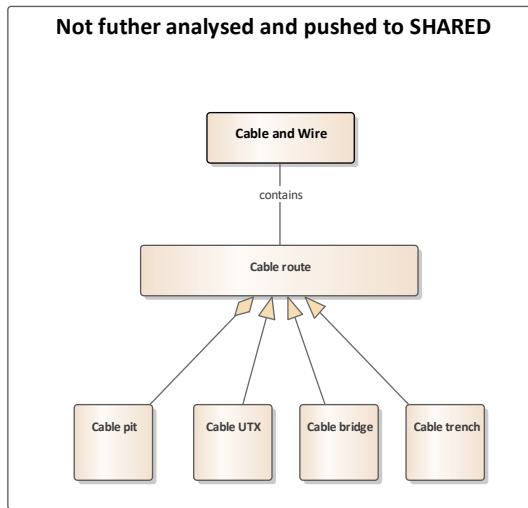


Table 42: Class diagram Cable and Wire

5.1.6.2 *Cable and Wire*

A cable segment is a flow segment used to carry electrical power, data, or telecommunications signals. A cable segment is used to typically join two sections of an electrical network or a network of components carrying the electrical service.

Relationships

Source	Type	Target
Cable and Wire	Association	Cable route

5.1.6.3 *Cable bridge*

Special type of a Cable route crossing a track or an obstacle in a certain height.

Relationships

Source	Type	Target
Cable bridge	Generalization	Cable route
IfcCableCarrierSegment.CONSOLIDATEDSEGMENT	Realization	Cable bridge

Source	Type	Target
IfcCableCarrierSegment.CONDUITSEGMENT	Realization	Cable bridge
IfcCableCarrierSegmentType.CONDUITSEGMENT	Realization	Cable bridge

5.1.6.4 Cable trench

Underground special channel/pipe for laying cables.

Relationships

Source	Type	Target
Cable trench	Generalization	Cable route
IfcDistributionChamberElement.TRENCH	Realization	Cable trench
IfcDistributionChamberElementTypeEnum.TRENCH	Realization	Cable trench
IfcDistributionChamberElement.TRENCH	Realization	Cable trench

5.1.6.5 Cable UTX

Special type of a Cable route crossing under the track.

Relationships

Source	Type	Target
Cable UTX	Generalization	Cable route

5.1.6.6 Cable pit

Manhole for inspection of cable routes under the earth.

Relationships

Source	Type	Target
Cable pit	Aggregation	Cable route
IfcDistributionChamberElem entTypeEnum.INSPECTION PIT	Realization	Cable pit
IfcDistributionChamberElem ent.INSPECTIONPIT	Realization	Cable pit
IfcDistributionChamberElem ent.MANHOLE	Realization	Cable pit
IfcDistributionChamberElem ent.MANHOLE	Realization	Cable pit
IfcDistributionChamberElem entTypeEnum.MANHOLE	Realization	Cable pit
IfcDistributionChamberElem ent.INSPECTIONPIT	Realization	Cable pit

5.1.6.7 Cable route

Housing for cables connecting Cable pits and Cable joints.

Relationships

Source	Type	Target
Cable trench	Generalization	Cable route
Cable UTX	Generalization	Cable route
Cable bridge	Generalization	Cable route
Cable and Wire	Association	Cable route
Cable pit	Aggregation	Cable route

5.1.7 Control Equipment

5.1.7.1 Class diagram Control Equipment

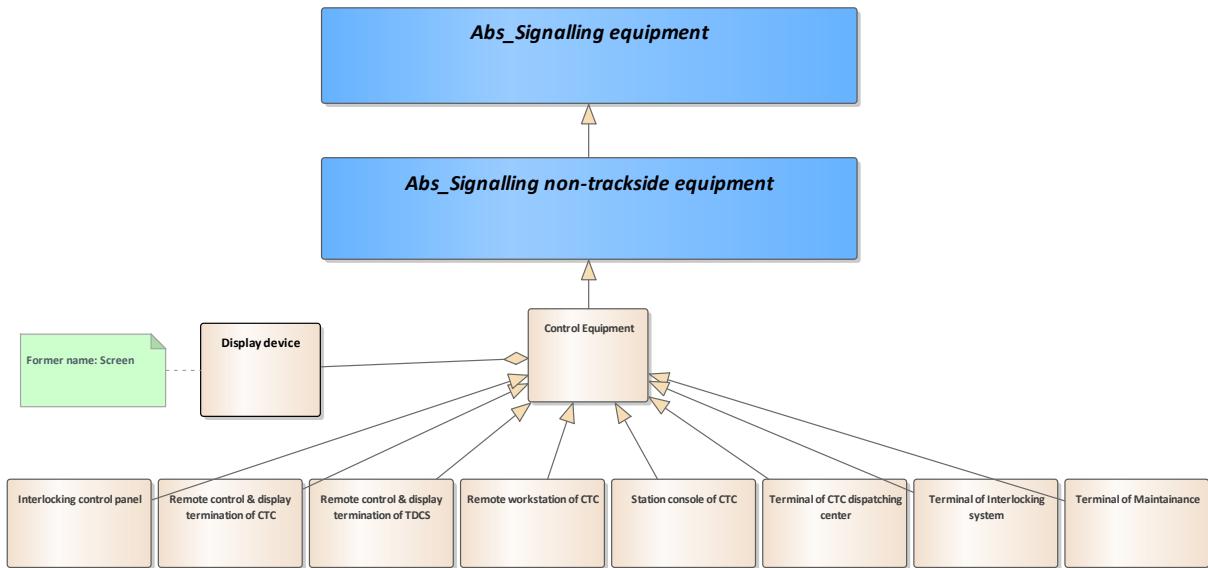


Table 43: Class diagram Control Equipment

5.1.7.2 Control Equipment

Control equipment is mainly the peripheral equipment in the computer network, used for inputting control commands and outputting the process results.

Relationships

Source	Type	Target
Control Equipment	Generalization	<i>Abs_Signalling non-trackside equipment</i>
Terminal of CTC dispatching center	Generalization	Control Equipment
Display device	Aggregation	Control Equipment
Terminal of Maintanance	Generalization	Control Equipment
Remote workstation of CTC	Generalization	Control Equipment
Terminal of Interlocking system	Generalization	Control Equipment
Station console of CTC	Generalization	Control Equipment
Remote control & display termination of TDCS	Generalization	Control Equipment
Remote control & display termination of CTC	Generalization	Control Equipment
Interlocking control panel	Generalization	Control Equipment

5.1.7.3 Display device

A display device is an output device for presentation of information in visual form.

When the input information that is supplied has an electrical signal the display is called an electronic display.

Common applications for electronic visual displays are television sets or computer monitors.

Relationships

Source	Type	Target
Display device	Aggregation	Control Equipment

5.1.7.4 Control Equipment types

5.1.7.4.1 Terminal of Interlocking system

联锁系统终端

It provides interlocking system control and display equipment for operators, generally including display, mouse, keyboard and so on.

Relationships

Source	Type	Target
Terminal of Interlocking system	Generalization	Control Equipment

5.1.7.4.2 Terminal of Maintenance

维护终端



It is the terminal equipment for system maintenance

Relationships

Source	Type	Target
Terminal of Maintenance	Generalization	Control Equipment

5.1.7.4.3 Remote control & display termination of CTC

CTC 远程控显终端

CTC remote control system provides operator with control and display equipment, generally including display, mouse, keyboard, etc.

Relationships

Source	Type	Target
Remote control & display termination of CTC	Generalization	Control Equipment

5.1.7.4.4 Remote workstation of CTC

CTC 远程工作站（RBC 中心、电务段、动车所）

It is the CTC remote terminal for scheduling management and monitoring of signnaling equipment

Relationships

Source	Type	Target
Remote workstation of CTC	Generalization	Control Equipment

5.1.7.4.5 Remote control & display termination of TDCS

TDCS 远程控显终端



TDCS remote control system provides operator with control and display equipment, generally including display, mouse, keyboard, etc.

Relationships

Source	Type	Target
Remote control & display termination of TDCS	Generalization	Control Equipment

5.1.7.4.6 Interlocking control panel

联锁控制台

It is used to place the interlocking system control equipment for the staff to operate the equipment.

Relationships

Source	Type	Target
Interlocking control panel	Generalization	Control Equipment

5.1.7.4.7 Terminal of CTC dispatching center

CTC 调度中心

CTC dispatching center centralized control railway signaling equipment and trains management of a certain range

《Operation Foundation of Railway Signaling》

[ISBN 978-7-113-08943-6]

Relationships

Source	Type	Target
Terminal of CTC dispatching center	Generalization	Control Equipment

5.1.7.4.8 Station console of CTC

CTC 车站控制台

It is used for placing CTC extension control equipment at the station, which is used for staff scheduling.

《Operation Foundation of Railway Signaling》

[ISBN 978-7-113-08943-6]

Relationships

Source	Type	Target
Station console of CTC	Generalization	Control Equipment

5.1.8 Detector types

5.1.8.1 Class diagram Detector types

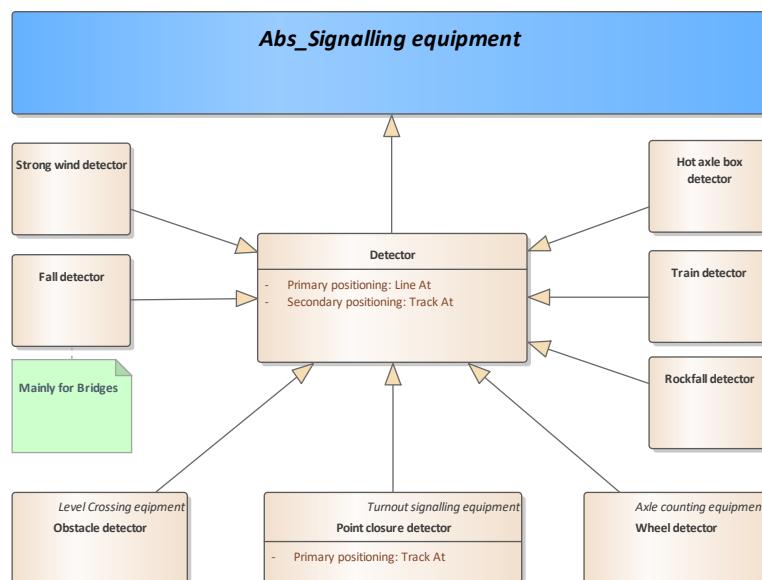


Table 44: Class diagram Detector types

5.1.8.2 Detector

Generic element for all kind of sensors which detect e. g. the passage of a wheel, falling rocks, strong wind etc.

Relationships

Source	Type	Target
Detector	Generalization	Abs_Signalling equipment
Train detector	Generalization	Detector
Fall detector	Generalization	Detector
Point closure detector	Generalization	Detector
Rockfall detector	Generalization	Detector
Wheel detector	Generalization	Detector
Strong wind detector	Generalization	Detector
Obstacle detector	Generalization	Detector
Hot axle box detector	Generalization	Detector

5.1.8.3 Fall detector

Device for detecting the descent on the track of obstacles such as vehicles

Relationships

Source	Type	Target
Fall detector	Generalization	Detector
IfcSensorTypeEnum.OBSTA CLESENSOR	Realization	Fall detector
IfcSensor.OBSTACLESENS OR	Realization	Fall detector
IfcSensor.OBSTACLESENS OR	Realization	Fall detector

5.1.8.4 Hot axle box detector

Device for detecting an overheated bearing by measuring the level of infrared radiation emitted by the axle box of a vehicle.

Relationships

Source	Type	Target
Hot axle box detector	Generalization	Detector
IfcSensorTypeEnum.HEATS ENSOR	Realization	Hot axle box detector
IfcSensor.HEATSENSOR	Realization	Hot axle box detector
IfcSensor.HEATSENSOR	Realization	Hot axle box detector

5.1.8.5 Obstacle detector

Device for detecting any obstacle

Relationships

Source	Type	Target
Obstacle detector	Generalization	Level Crossing equipment
Obstacle detector	Generalization	Detector
IfcSensor.OBSTACLESENS OR	Realization	Obstacle detector
IfcSensor.OBSTACLESENS OR	Realization	Obstacle detector
IfcSensorTypeEnum.OBSTA CLESENSOR	Realization	Obstacle detector

5.1.8.6 Point closure detector

Device checking the position of a blade.

[source: IEC 60050-821]

Relationships

Source	Type	Target
Point closure detector	Generalization	Detector
Point closure detector	Generalization	Turnout signalling equipment
IfcSensor.TURNOUTCLOSURESENSOR	Realization	Point closure detector
IfcSensor.TURNOUTCLOSURESENSOR	Realization	Point closure detector
IfcSensorTypeEnum.TURNOUTCLOSURESENSOR	Realization	Point closure detector

5.1.8.7 Rockfall detector

Device for detecting the descent on the track of obstacles such as stones.

Relationships

Source	Type	Target
Rockfall detector	Generalization	Detector
IfcSensorTypeEnum.OBSTACLESENSOR	Realization	Rockfall detector
IfcSensor.OBSTACLESENSORS	Realization	Rockfall detector
IfcSensor.OBSTACLESENSORS	Realization	Rockfall detector

5.1.8.8 Strong wind detector

Device for detecting the strong wind.

Relationships

Source	Type	Target
Strong wind detector	Generalization	Detector
IfcSensor.WINDSENSOR	Realization	Strong wind detector
IfcSensor.WINDSENSOR	Realization	Strong wind detector
IfcSensorTypeEnum.WINDENSOR	Realization	Strong wind detector

5.1.8.9 Train detector

Device attached to the rear end of the last vehicle of a train acting on a fixed equipment to give an indication that the train is complete.

Relationships

Source	Type	Target
Train detector	Generalization	Detector
IfcSensor.TRAINSENSOR	Realization	Train detector
IfcSensor.TRAINSENSOR	Realization	Train detector
IfcSensorTypeEnum.TRAIN SENSOR	Realization	Train detector

5.1.8.10 Wheel detector

Sensor which detects the passage of a wheel. A wheel detector can be used as part of an axle counter or as a treadle.

Relationships

Source	Type	Target
Wheel detector	Generalization	Axle counting equipment
Wheel detector	Generalization	Detector
IfcSensor.WHEELSENSOR	Realization	Wheel detector
IfcSensorTypeEnum.WHEELSENSOR	Realization	Wheel detector

Source	Type	Target
IfcSensor.WHEELSENSOR	Realization	Wheel detector

5.1.9 Housing

5.1.9.1 Class diagram Housing + Trackside Battery

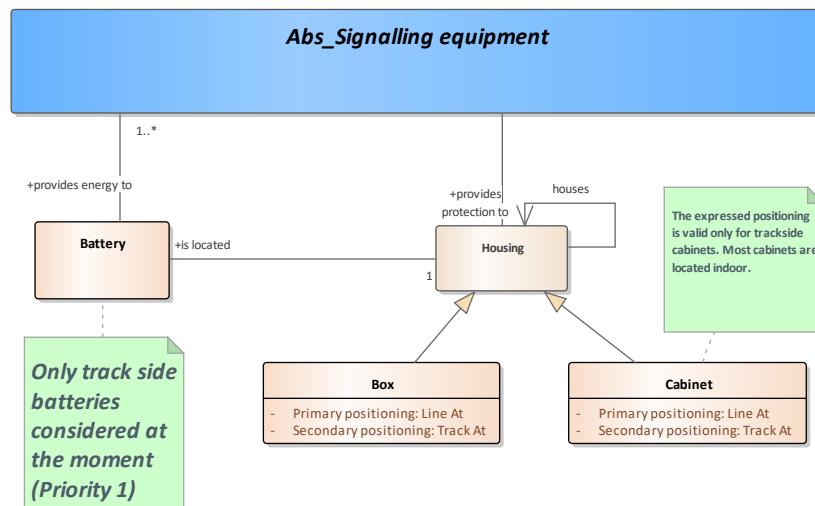


Table 45: Class diagram Housing + Trackside Battery

5.1.9.2 Box

1. Housing for placing equipment/objects and having protective functions.
2. It is used to place outdoor signal devices/objects, and realize wiring, electrical connection and protection of the device (with certain protection functions).

Relationships

Source	Type	Target
Box	Generalization	Housing
Protection box (Outoor)	Generalization	Box
Power distribution box	Generalization	Box
Outdoor terminal box	Generalization	Box
IfcJunctionBox.POWER	Realization	Box

Source	Type	Target
IfcJunctionBox.DATA	Realization	Box
IfcJunctionBox.DATA	Realization	Box
Outdoor direction box	Generalization	Box
IfcJunctionBoxTypeEnum.POWER	Realization	Box
Box for optical cable and cable connection	Generalization	Box
IfcJunctionBoxTypeEnum.DA	Realization	Box
Transformer box	Generalization	Box
IfcJunctionBox.POWER	Realization	Box

5.1.9.3 Cabinet

The equipment cabinet is usually made of cold-rolled steel or alloy for storing computer and related control equipment, and provides protection against electromagnetic interference.

Relationships

Source	Type	Target
Cabinet	Generalization	Housing
Cabinet for station ZPW-2000 track circuit interface and monitoring device	Generalization	Cabinet
Cabinet for ZPW-2000 track circuit interface and monitoring device of relay station	Generalization	Cabinet
Cabinet for application server of monitoring system	Generalization	Cabinet
Electric control cabinet (Outdoor)	Generalization	Cabinet
Cabinet of station frequency-shift	Generalization	Cabinet

Source	Type	Target
Cabinet of driver and acquisition interface equipment	Generalization	Cabinet
Cabinet of simulation training server	Generalization	Cabinet
Cabinet for train control center of relay station	Generalization	Cabinet
Cabinet of station monitoring equipment	Generalization	Cabinet
Cabinet of blocks frequency-shift equipment	Generalization	Cabinet
Cabinet of storage device	Generalization	Cabinet
Temporary speed restriction server (TSRS) communication device cabinet	Generalization	Cabinet
Cabinet for data server of monitoring system	Generalization	Cabinet
RBC interface cabinet	Generalization	Cabinet
Cabinet of interface server	Generalization	Cabinet
Network management server (EMS) cabinet	Generalization	Cabinet
Cabinet of interlocking system monitoring equipment	Generalization	Cabinet
Cabinet of interlocking system remote control and display	Generalization	Cabinet
IfcFurnitureTypeEnum.TEC_HNICALCABINET	Realization	Cabinet
Cabinet of digital IT equipment control system	Generalization	Cabinet
Cabinet of interlocking system electronic terminal	Generalization	Cabinet
Cabinet for interface server of monitoring system	Generalization	Cabinet
Cabinet of simulation network pannel equipment	Generalization	Cabinet
Cabinet of communication prepositive server	Generalization	Cabinet

Source	Type	Target
Cabinet for web server of monitoring system	Generalization	Cabinet
IfcFurniture.TECHNICALCA BINET	Realization	Cabinet
Cabinet of blocks unit combination	Generalization	Cabinet
Cabinet of 25Hz track rack	Generalization	Cabinet
Cabinet for clock server of monitoring system	Generalization	Cabinet
Cabinet of network safety server	Generalization	Cabinet
RBC Host cabinet	Generalization	Cabinet
Cabinet of interface network	Generalization	Cabinet
LEU (outdoor cabinet)	Generalization	Cabinet
Cabinet of clock server	Generalization	Cabinet
IfcFurniture.TECHNICALCA BINET	Realization	Cabinet
Cabinet of signalling total wiring	Generalization	Cabinet
Network management server (NMS) cabinet	Generalization	Cabinet
Cabinet of spare machine	Generalization	Cabinet
Cabinet of local interlocking system actuator	Generalization	Cabinet
Cabinet of external information providing server	Generalization	Cabinet
Cabinet of station unit block	Generalization	Cabinet
Cabinet of repeating & query terminal server	Generalization	Cabinet
Temporary speed restriction server (TSRS) cabinet	Generalization	Cabinet
LEU cabinet of train control center	Generalization	Cabinet
Cabinet of distributing terminal board	Generalization	Cabinet
Cabinet for communication preprocessor of monitoring system	Generalization	Cabinet

Source	Type	Target
Cabinet of system software management server	Generalization	Cabinet
Cabinet of power supply	Generalization	Cabinet
Cabinet of database server	Generalization	Cabinet
Cabinet for internet safety device of monitoring system	Generalization	Cabinet
Cabinet of application server	Generalization	Cabinet
station coding composite cabinet	Generalization	Cabinet
PIO cabinet of train control center	Generalization	Cabinet
Cabinet of interlocking system power supply	Generalization	Cabinet
Cabinet for computer power & environmental monitoring system	Generalization	Cabinet
Cabinet for network management server of monitoring system	Generalization	Cabinet
Cabinet of network equipment	Generalization	Cabinet
Cabinet for station train control center equipment INDOOR	Generalization	Cabinet
Cabinet for acquisition equipment of station monitoring equipment	Generalization	Cabinet
Distribution Cabinet of lightning-protection device	Generalization	Cabinet
Cabinet of power supply for local interlocking system	Generalization	Cabinet
Host cabinet of interlocking system	Generalization	Cabinet
Cabinet of communication quality supervision equipment	Generalization	Cabinet

5.1.9.4 Housing



Housing is a generic class to be used by various elements/installations which can be placed in a structure for protection (metal or concrete boxes etc). The Shelter/Housing describes the type of protection and its location.

Relationships

Source	Type	Target
Housing	Association	Housing
Housing	Association	Abs_Signalling equipment
Housing	Association	Housing
Battery	Association	Housing
Box	Generalization	Housing
Cabinet	Generalization	Housing

5.1.9.5 Box types

5.1.9.5.1 Box for optical cable and cable connection

The box is used for optical cable connection (it has protection and shielding electromagnetic interference function.)

Relationships

Source	Type	Target
Box for optical cable and cable connection	Generalization	Box

5.1.9.5.2 Outdoor direction box

Electrical connection equipment for multi-directional branching of cables (with one entrance, seven or four exits, for connecting trunk cables to branching cables).

Relationships

Source	Type	Target
Outdoor direction box	Generalization	Box

5.1.9.5.3 Outdoor terminal box

It is installed at the end of cable to connect signal equipment.

Relationships

Source	Type	Target
Outdoor terminal box	Generalization	Box

5.1.9.5.4 Power distribution box

It is the last-level equipment of the power distribution system, which is responsible for allocating a certain amount of power of the upper-level power to the nearest load.

Relationships

Source	Type	Target
Power distribution box	Generalization	Box

5.1.9.5.5 Protection box (Outoor)

Protect equipment to ensure the normal transmission of track circuit and coded signal and prevent mutual interference of signals.

Relationships

Source	Type	Target
Protection box (Outoor)	Generalization	Box

5.1.9.5.6 Transformer box

It is a box for placing transformer

Relationships

Source	Type	Target
Transformer box	Generalization	Box

5.1.9.6 Cabinet types

5.1.9.6.1 Cabinet for acquisition equipment of station monitoring equipment

It is a cabinet for storing acquisition equipment of station monitoring equipment.

Relationships

Source	Type	Target
Cabinet for acquisition equipment of station monitoring equipment	Generalization	Cabinet

5.1.9.6.2 Cabinet for application server of monitoring system

It is a cabinet for storing application server of monitoring system.

Relationships

Source	Type	Target
Cabinet for application server of monitoring system	Generalization	Cabinet

5.1.9.6.3 Cabinet for clock server of monitoring system



It is a cabinet for storing clock server of monitoring system.

Relationships

Source	Type	Target
Cabinet for clock server of monitoring system	Generalization	Cabinet

5.1.9.6.4 Cabinet for communication preprocessor of monitoring system

It is a cabinet for storing communication preprocessor of monitoring system.

Relationships

Source	Type	Target
Cabinet for communication preprocessor of monitoring system	Generalization	Cabinet

5.1.9.6.5 Cabinet for computer power & environmental monitoring system

The cabinet is used for placing computer power & environmental monitoring system

Relationships

Source	Type	Target
Cabinet for computer power & environmental monitoring system	Generalization	Cabinet

5.1.9.6.6 Cabinet for data server of monitoring system

It is a cabinet for storing data server of monitoring system.

Relationships

Source	Type	Target
Cabinet for data server of monitoring system	Generalization	Cabinet

5.1.9.6.7 Cabinet for interface server of monitoring system

It is a cabinet for storing interface server of monitoring system.

Relationships

Source	Type	Target
Cabinet for interface server of monitoring system	Generalization	Cabinet

5.1.9.6.8 Cabinet for internet safety device of monitoring system

It is a cabinet for storing internet safety device of monitoring system

Relationships

Source	Type	Target
Cabinet for internet safety device of monitoring system	Generalization	Cabinet

5.1.9.6.9 Cabinet for network management server of monitoring system

It is a cabinet for storing network management server of monitoring system.

Relationships

Source	Type	Target
Cabinet for network management server of monitoring system	Generalization	Cabinet



5.1.9.6.10 Cabinet for station train control center equipment INDOOR

It is a cabinet for storing station train control center equipment.

Relationships

Source	Type	Target
Cabinet for station train control center equipment INDOOR	Generalization	Cabinet

5.1.9.6.11 Cabinet for station ZPW-2000 track circuit interface and monitoring device

车站 ZPW-2000 轨道电路接口及监测机（柜）

It is a cabinet for storing station ZPW-2000 track circuit interface and monitoring device .

Relationships

Source	Type	Target
Cabinet for station ZPW-2000 track circuit interface and monitoring device	Generalization	Cabinet

5.1.9.6.12 Cabinet for train control center of relay station

It is a cabinet for storing train control center host of relay station.

Relationships

Source	Type	Target
Cabinet for train control center of relay station	Generalization	Cabinet

5.1.9.6.13 Cabinet for web server of monitoring system



It is a cabinet for storing web server of monitoring system.

Relationships

Source	Type	Target
Cabinet for web server of monitoring system	Generalization	Cabinet

[5.1.9.6.14 Cabinet for ZPW-2000 track circuit interface and monitoring device of relay station](#)

It is a cabinet for storing ZPW-2000 track circuit interface and monitoring device of relay station.

Relationships

Source	Type	Target
Cabinet for ZPW-2000 track circuit interface and monitoring device of relay station	Generalization	Cabinet

[5.1.9.6.15 Cabinet of blocks unit combination](#)

It is a cabinet for storing blocks unit combination and relays.

Relationships

Source	Type	Target
Cabinet of blocks unit combination	Generalization	Cabinet

[5.1.9.6.16 Cabinet of simulation network pannel equipment](#)

It is a cabinet for storing simulation network pannel equipment.

Relationships

Source	Type	Target
Cabinet of simulation network pannel equipment	Generalization	Cabinet

5.1.9.6.17 Cabinet of spare machine

The cabinet is used for placing spare / redundant machine

Relationships

Source	Type	Target
Cabinet of spare machine	Generalization	Cabinet

5.1.9.6.18 Cabinet of 25Hz track rack

It is a cabinet for storing frequency equipment

Relationships

Source	Type	Target
Cabinet of 25Hz track rack	Generalization	Cabinet

5.1.9.6.19 Cabinet of application server

The cabinet is used for placing application server

Relationships

Source	Type	Target
Cabinet of application server	Generalization	Cabinet

5.1.9.6.20 Cabinet of blocks frequency-shift equipment



It is a cabinet for storing blocks frequency shift transmitting and receiving equipment.

Relationships

Source	Type	Target
Cabinet of blocks frequency-shift equipment	Generalization	Cabinet

[5.1.9.6.21 Cabinet of clock server](#)

The cabinet is used for placing clock server

Relationships

Source	Type	Target
Cabinet of clock server	Generalization	Cabinet

[5.1.9.6.22 Cabinet of communication prepositive server](#)

The cabinet is used for placing prepositive server

Relationships

Source	Type	Target
Cabinet of communication prepositive server	Generalization	Cabinet

[5.1.9.6.23 Cabinet of communication quality supervision equipment](#)

The cabinet is used for placing communication quality supervision equipment

Relationships

Source	Type	Target
Cabinet of communication quality supervision equipment	Generalization	Cabinet

5.1.9.6.24 Cabinet of database server

The cabinet is used for placing database server

Relationships

Source	Type	Target
Cabinet of database server	Generalization	Cabinet

5.1.9.6.25 Cabinet of digital IT equipment control system

The cabinet is used for placing digital IT equipment control system

Relationships

Source	Type	Target
Cabinet of digital IT equipment control system	Generalization	Cabinet

5.1.9.6.26 Cabinet of distributing terminal board

The cabinet is used for placing distributing terminal board

Relationships

Source	Type	Target
Cabinet of distributing terminal board	Generalization	Cabinet



5.1.9.6.27 Cabinet of driver and acquisition interface equipment

It is the interface cabinet between interlocking system, train control system and the external control devices (the cabinet for storing driving and acquisition interface equipment)

Relationships

Source	Type	Target
Cabinet of driver and acquisition interface equipment	Generalization	Cabinet

5.1.9.6.28 Cabinet of external information providing server

The cabinet is used for placing external information providing server

Relationships

Source	Type	Target
Cabinet of external information providing server	Generalization	Cabinet

5.1.9.6.29 Cabinet of interface network

The cabinet is used for placing interface network device

Relationships

Source	Type	Target
Cabinet of interface network	Generalization	Cabinet

5.1.9.6.30 Cabinet of interface server

The cabinet is used for placing interface server

Relationships

Source	Type	Target
Cabinet of interface server	Generalization	Cabinet

5.1.9.6.31 Cabinet of interlocking system power supply

It is a cabinet for storing power supply equipment of interlocking system.

Relationships

Source	Type	Target
Cabinet of interlocking system power supply	Generalization	Cabinet

5.1.9.6.32 Cabinet of interlocking system electronic terminal

It is a cabinet for storing the electronic terminal of interlocking system.

Relationships

Source	Type	Target
Cabinet of interlocking system electronic terminal	Generalization	Cabinet

5.1.9.6.33 Cabinet of interlocking system monitoring equipment

It is a cabinet for storing interlocking system monitoring equipment.

Relationships

Source	Type	Target
Cabinet of interlocking system monitoring equipment	Generalization	Cabinet

5.1.9.6.34 Cabinet of interlocking system remote control and display

It is a cabinet for storing remote control and display equipment of interlocking system.

Relationships

Source	Type	Target
Cabinet of interlocking system remote control and display	Generalization	Cabinet

5.1.9.6.35 Cabinet of local interlocking system actuator

It is a cabinet for storing the electronic terminal of the local interlocking system.

Relationships

Source	Type	Target
Cabinet of local interlocking system actuator	Generalization	Cabinet

5.1.9.6.36 Cabinet of network equipment

The cabinet is used for placing network equipment

Relationships

Source	Type	Target
Cabinet of network equipment	Generalization	Cabinet

5.1.9.6.37 Cabinet of network safety server

The cabinet is used for placing network safety server

Relationships

Source	Type	Target
Cabinet of network safety server	Generalization	Cabinet

[5.1.9.6.38 Cabinet of power supply](#)

The cabinet is used for placing power supply equipment

Relationships

Source	Type	Target
Cabinet of power supply	Generalization	Cabinet

[5.1.9.6.39 Cabinet of power supply for local interlocking system](#)

It is a cabinet for storing power equipment of local interlocking system.

Relationships

Source	Type	Target
Cabinet of power supply for local interlocking system	Generalization	Cabinet

[5.1.9.6.40 Cabinet of repeating & query terminal server](#)

The cabinet is used for placing repeating & query terminal server

Relationships

Source	Type	Target
Cabinet of repeating & query terminal server	Generalization	Cabinet

5.1.9.6.41 Cabinet of signalling total wiring

The cabinet is used for placing signaling total wiring device

Relationships

Source	Type	Target
Cabinet of signalling total wiring	Generalization	Cabinet

5.1.9.6.42 Cabinet of simulation training server

The cabinet is used for placing simulation training server

Relationships

Source	Type	Target
Cabinet of simulation training server	Generalization	Cabinet

5.1.9.6.43 Cabinet of station frequency-shift

It is a cabinet for storing station frequency-shift equipment.

Relationships

Source	Type	Target
Cabinet of station frequency-shift	Generalization	Cabinet

5.1.9.6.44 Cabinet of station unit block

It is a cabinet for storing station unit block.

Relationships

Source	Type	Target
Cabinet of station unit block	Generalization	Cabinet

[5.1.9.6.45 Cabinet of storage device](#)

The cabinet is used for placing storage device

Relationships

Source	Type	Target
Cabinet of storage device	Generalization	Cabinet

[5.1.9.6.46 Cabinet of system software management server](#)

The cabinet is used for placing system software management server

Relationships

Source	Type	Target
Cabinet of system software management server	Generalization	Cabinet

[5.1.9.6.47 Cabinet of station monitoring equipment](#)

It is a cabinet for storing station monitoring equipment.

Relationships

Source	Type	Target
Cabinet of station monitoring equipment	Generalization	Cabinet

5.1.9.6.48 Distribution Cabinet of lightning-protection device

It is a cabinet for storing lightning-protection device.

Relationships

Source	Type	Target
Distribution Cabinet of lightning-protection device	Generalization	Cabinet

5.1.9.6.49 Electric control cabinet (Outdoor)

It is a cabinet for storing electric control equipment.

Relationships

Source	Type	Target
Electric control cabinet (Outdoor)	Generalization	Cabinet

5.1.9.6.50 Host cabinet of interlocking system

It is a cabinet for storing the interlocking system host.

Relationships

Source	Type	Target
Host cabinet of interlocking system	Generalization	Cabinet

5.1.9.6.51 LEU cabinet of train control center

It is a cabinet for storing LEU equipment of train control center.

Relationships

Source	Type	Target
LEU cabinet of train control center	Generalization	Cabinet

5.1.9.6.52 LEU (outdoor cabinet)

It is a cabinet for storing LEU.

Relationships

Source	Type	Target
LEU (outdoor cabinet)	Generalization	Cabinet

5.1.9.6.53 Network interface cabinet

Cabinet used to store network interface equipment

Relationships

5.1.9.6.54 Network management server (EMS) cabinet

The cabinet is used for placing EMS

Relationships

Source	Type	Target
Network management server (EMS) cabinet	Generalization	Cabinet

1.1.1.3.1 Network management server (NMS) cabinet



The cabinet is used for placing NMS

Relationships

Source	Type	Target
Network management server (NMS) cabinet	Generalization	Cabinet

[5.1.9.6.55 PIO cabinet of train control center](#)

It is a cabinet for storing PIO equipment of train control center.

Relationships

Source	Type	Target
PIO cabinet of train control center	Generalization	Cabinet

[5.1.9.6.56 RBC Host cabinet](#)

The cabinet is used for placing RBC host

Relationships

Source	Type	Target
RBC Host cabinet	Generalization	Cabinet

[5.1.9.6.57 RBC interface cabinet](#)

用于存放 RBC 接口设备的机柜

The cabinet is used for placing RBC interface device

Relationships

Source	Type	Target
RBC interface cabinet	Generalization	Cabinet

5.1.9.6.58 station coding composite cabinet

It is a cabinet for storing station coding composite equipment.

Relationships

Source	Type	Target
station coding composite cabinet	Generalization	Cabinet

5.1.9.6.59 Temporary speed restriction server (TSRS) cabinet

The cabinet is used for placing TSRS

Relationships

Source	Type	Target
Temporary speed restriction server (TSRS) cabinet	Generalization	Cabinet

5.1.9.6.60 Temporary speed restriction server (TSRS) communication device cabinet

The cabinet is used for placing TSRS communication device

Relationships

Source	Type	Target
Temporary speed restriction server (TSRS) communication device cabinet	Generalization	Cabinet

5.1.10 Trackside battery

5.1.10.1 Battery

A device that stores and releases electrical energy.

Relationships

Source	Type	Target
Battery	Association	Housing
Battery	Association	Abs_Signalling equipment
IfcElectricFlowStorageDevice.BATTERY	Realization	Battery
IfcElectricFlowStorageDevice.BATTERY	Realization	Battery
IfcElectricFlowStorageDeviceTypeEnum.BATTERY	Realization	Battery

5.1.11 Level Crossing equipment

5.1.11.1 Class diagram Level Crossing equipment

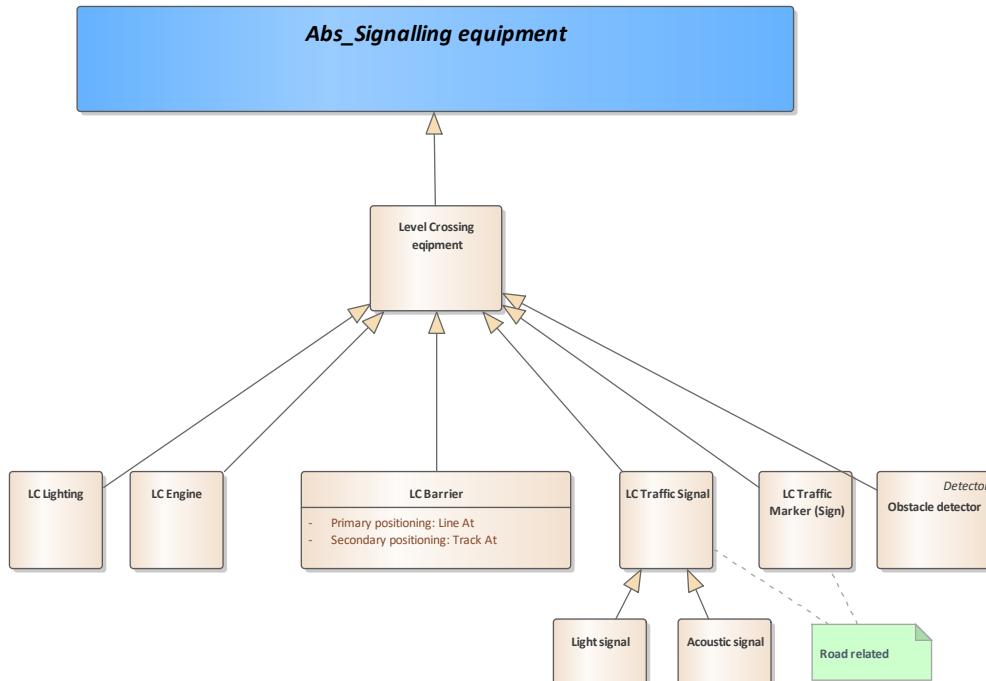


Table 46: Class diagram Level Crossing equipment

5.1.11.2 Acoustic signal

It is a danger signal that announces the arrival of the train near the level crossing.

Relationships

Source	Type	Target
Acoustic signal	Generalization	LC Traffic Signal
IfcSignalTypeEnum.AUDIO	Realization	Acoustic signal
IfcSignal.AUDIO	Realization	Acoustic signal
IfcSignal.AUDIO	Realization	Acoustic signal

5.1.11.3 LC Barrier

Installation which hinders road traffic passing the level crossing.

Relationships

Source	Type	Target
LC Barrier	Generalization	Level Crossing equipment
IfcDoorTypeEnum.BOOM_BARRIER	Realization	LC Barrier
IfcDoor.BOOM_BARRIER	Realization	LC Barrier
IfcDoor.BOOM_BARRIER	Realization	LC Barrier

5.1.11.4 LC Engine

An engine that raises or lowers the barrier at a crossing

Relationships

Source	Type	Target
LC Engine	Generalization	Level Crossing equipment
IfcActuator.HYDRAULICACTUATOR	Realization	LC Engine
IfcActuatorTypeEnum.HANDOPERATEDACTUATOR	Realization	LC Engine
IfcActuatorTypeEnum.HYDRAULICACTUATOR	Realization	LC Engine
IfcActuator.HANDOPERATEACTUATOR	Realization	LC Engine
IfcActuator.HANDOPERATEACTUATOR	Realization	LC Engine
IfcActuator.HYDRAULICACTUATOR	Realization	LC Engine

5.1.11.5 LC Lighting

Light signal for Level crossing

Relationships

Source	Type	Target
LC Lighting	Generalization	Level Crossing equipment

Source	Type	Target
IfcLightFixture.POINTSOURCE	Realization	LC Lighting
IfcLightFixture.POINTSOURCE	Realization	LC Lighting
IfcLightFixtureTypeEnum.SECURITYLIGHTING	Realization	LC Lighting
IfcLightFixtureTypeEnum.SECURITYLIGHTING	Realization	LC Lighting
IfcLightFixtureTypeEnum.POINTSOURCE	Realization	LC Lighting

5.1.11.6 LC Traffic Marker (Sign)

Sign related to the road at a level crossing.

Relationships

Source	Type	Target
LC Traffic Marker (Sign)	Generalization	Level Crossing equipment
IfcSign.PICTORAL	Realization	LC Traffic Marker (Sign)
IfcSign.PICTORAL	Realization	LC Traffic Marker (Sign)
IfcSignTypeEnum.PICTORAL	Realization	LC Traffic Marker (Sign)

5.1.11.7 LC Traffic Signal

Signal related to the road at a level crossing.

Relationships

Source	Type	Target
LC Traffic Signal	Generalization	Level Crossing equipment

Source	Type	Target
Light signal	Generalization	LC Traffic Signal
Acoustic signal	Generalization	LC Traffic Signal

5.1.11.8 Level Crossing equipment

A level crossing is an intersection where a railway line crosses a road or path at the same level. The purpose of LCSE is to prevent vehicles or pedestrians from crossing the railway after the train has been notified. It includes: LC Traffic signal, LC Traffic sign, LC Barrier, LC Engine, Obstacle detector, etc.

Relationships

Source	Type	Target
Level Crossing equipment	Generalization	Abs_Signalling equipment
LC Traffic Signal	Generalization	Level Crossing equipment
LC Barrier	Generalization	Level Crossing equipment
LC Traffic Marker (Sign)	Generalization	Level Crossing equipment
LC Engine	Generalization	Level Crossing equipment
LC Lighting	Generalization	Level Crossing equipment
Obstacle detector	Generalization	Level Crossing equipment

5.1.11.9 Light signal

A lighting device is installed near the level crossing. In the presence of the light signal, it is necessary to moderate the speed and stop.

Relationships

Source	Type	Target
Light signal	Generalization	LC Traffic Signal
IfcSignalTypeEnum.VISUAL	Realization	Light signal
IfcSignal.VISUAL	Realization	Light signal

Source	Type	Target
IfcSignal.VISUAL	Realization	Light signal

5.1.12 Local operation device

5.1.12.1 Class diagram Local operation device

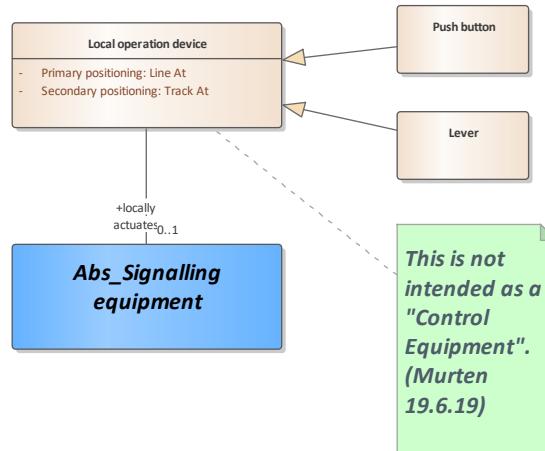


Table 47: Class diagram Local operation device

5.1.12.2 Lever

A bar of metal, wood or other rigid substance, used to trigger or control a mechanical device (like a point or a derailer).

Relationships

Source	Type	Target
Lever	Generalization	Local operation device
IfcActuator.HYDRAULICACTUATOR	Realization	Lever
IfcActuator.HYDRAULICACTUATOR	Realization	Lever
IfcActuatorTypeEnum.HYDRAULICACTUATOR	Realization	Lever
IfcActuator.HANDOPERATEACTUATOR	Realization	Lever

Source	Type	Target
IfcActuatorTypeEnum.HAND OPERATEDACTUATOR	Realization	Lever
IfcActuator.HANDOPERATE DACTUATOR	Realization	Lever

5.1.12.3 Push button

A simple switch mechanism for controlling some aspect of a device or a process

Relationships

Source	Type	Target
Push button	Generalization	Local operation device
IfcActuatorTypeEnum.ELEC TRICACTUATOR	Realization	Push button
IfcActuator.ELECTRICACTU ATOR	Realization	Push button
IfcActuator.ELECTRICACTU ATOR	Realization	Push button

5.1.12.4 Local operation device

Installation providing push buttons, indicators and switching devices, lever for local operation. In case there is no point machine. (is a track side equipment)

Relationships

Source	Type	Target
Local operation device	Association	Abs_Signalling equipment
Lever	Generalization	Local operation device
Push button	Generalization	Local operation device

5.1.13 Lock

5.1.13.1 Class diagram Lock

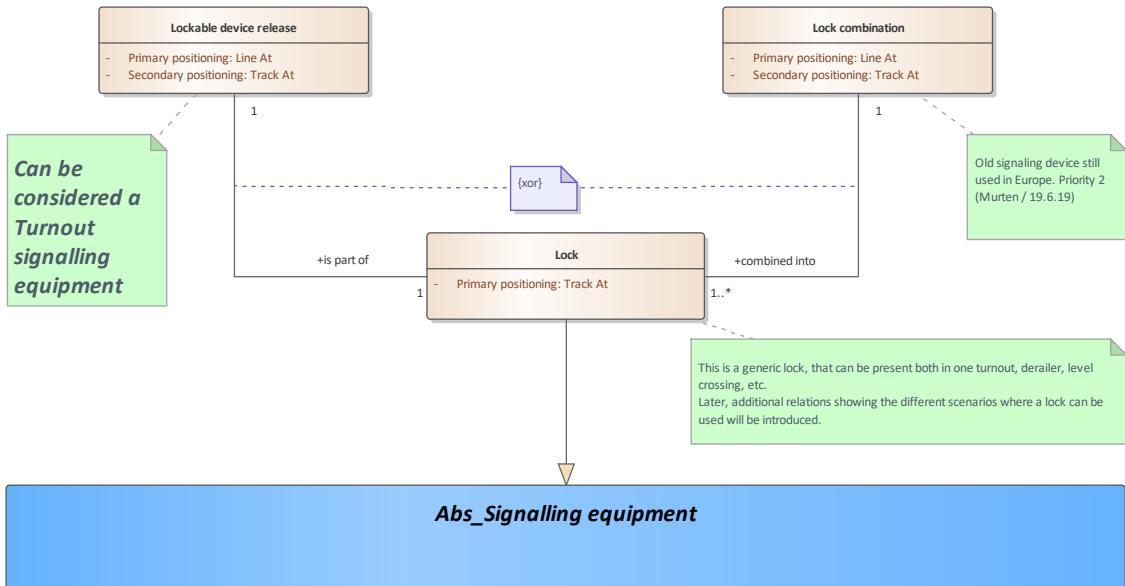


Table 48: Class diagram Lock

5.1.13.2 Lock

Mechanical device to fix an element (point, derailer, level crossing) in a certain position.

Relationships

Source	Type	Target
Lock	Generalization	Abs_Signalling equipment
Lock	Association	Lockable device release
Lock	Association	Lock combination
IfcDiscreteAccessory.LOCK	Realization	Lock
IfcDiscreteAccessory.LOCK	Realization	Lock
IfcDiscreteAccessoryTypeEnum.LOCK	Realization	Lock

5.1.13.3 Lock combination

Mechanical device for release of several dependent keys by a main key.

Relationships

Source	Type	Target
IfcDiscreteAccessoryTypeEnum.LOCK	Realization	Lock combination
IfcDiscreteAccessory.LOCK	Realization	Lock combination
Lock	Association	Lock combination
IfcDiscreteAccessory.LOCK	Realization	Lock combination

5.1.13.4 Lockable device release

Electro-mechanical device related to the interlocking to include locally operated elements. The lockable device release checks the presence of a key and releases the key by command.

Relationships

Source	Type	Target
Lock	Association	Lockable device release

5.1.14 Signal

5.1.14.1 Class diagram Signal

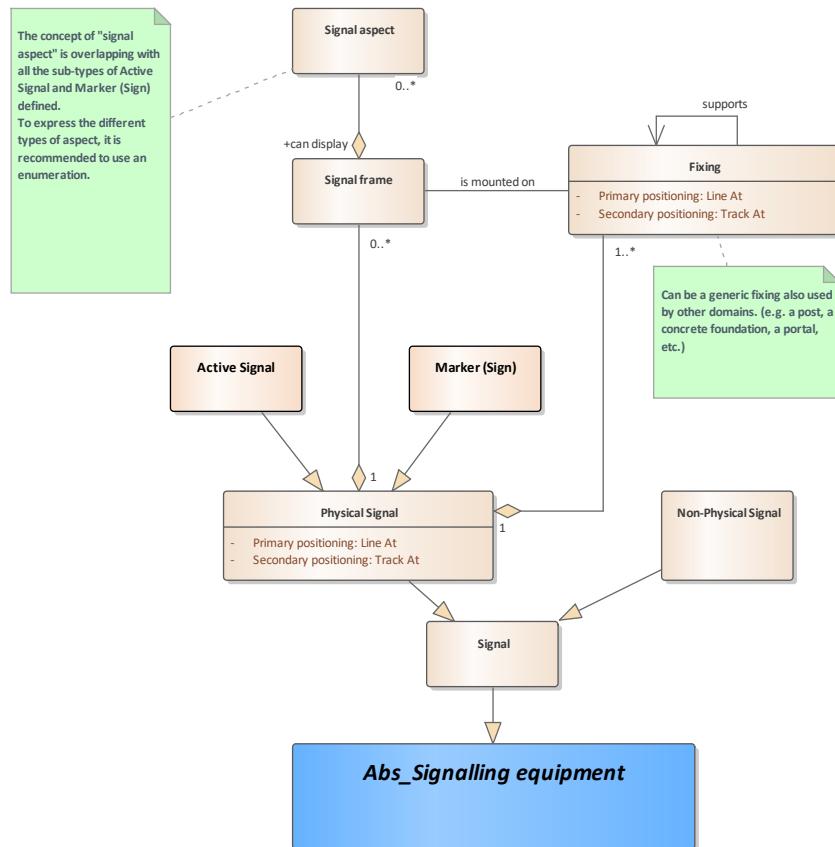


Table 49: Class diagram Signal

5.1.14.2 Class diagram Signal_IFC_RAIL_ID

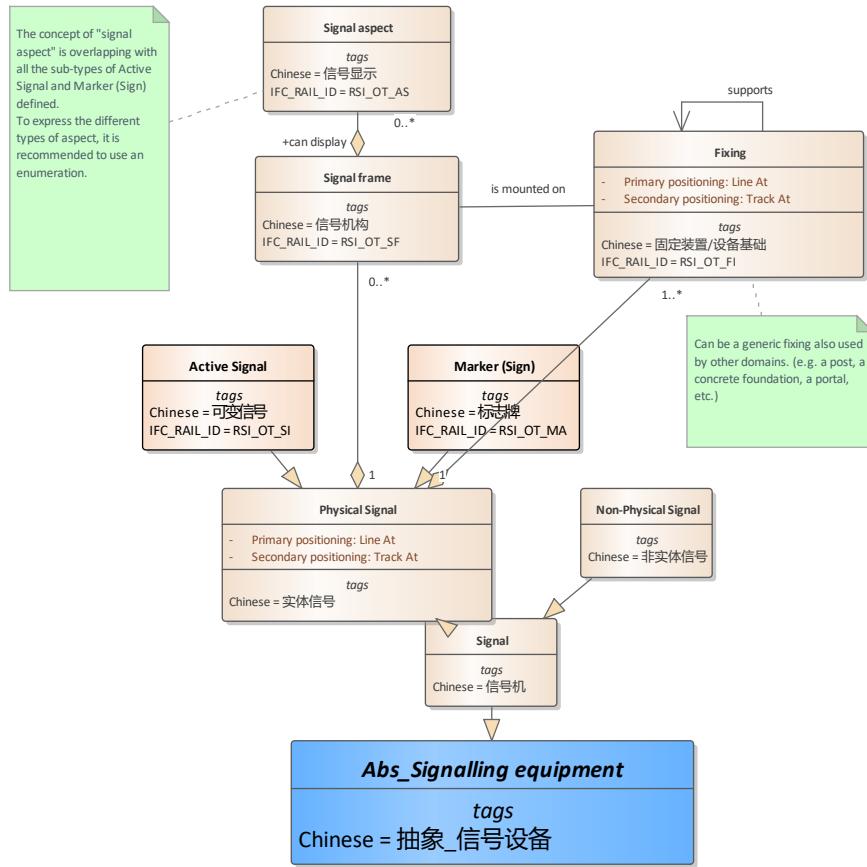


Table 50: Class diagram Signal_IFC_RAIL_ID

5.1.14.3 Active Signal

Relationships

Source	Type	Target
Active Signal	Generalization	Physical Signal
IfcElementAssembly.SIGNA LASSEMBLY	Realization	Active Signal
IfcElementAssemblyTypeEn um.SIGNALASSEMBLY	Realization	Active Signal
IfcElementAssembly.SIGNA LASSEMBLY	Realization	Active Signal

5.1.14.4 Fixing

1. Physical structure that supports equipment (e. g. signal frames as components of a signal).
2. A fixing is a generic term for a structure that supports equipment. Fixings can be decomposed like so:
 - Fixing of type post is mounted on fixing of type foundation.
 - Fixing of type cantilever is mounted on fixing of type rail.

Relationships

Source	Type	Target
Fixing	Aggregation	Physical Signal
Fixing	Association	Signal frame
Fixing	Association	Fixing
IfcMemberTypeEnum.POST	Realization	Fixing
IfcElementAssembly.RIGID_FRAME	Realization	Fixing
IfcMember.POST	Realization	Fixing
IfcMember.POST	Realization	Fixing
IfcElementAssemblyTypeEnum.RIGID_FRAME	Realization	Fixing
Fixing	Association	Fixing
IfcElementAssembly.RIGID_FRAME	Realization	Fixing

5.1.14.5 Marker (Sign)

1. A fixed signal on the side of a rail track that provides information for driver and staff.
2. A signal showing a permanent message that is a function of a normalised physical appearance, i.e. shape or colour. A sign is not controlled by the signalling system.

Relationships

Source	Type	Target
Marker (Sign)	Generalization	Physical Signal
IfcElementAssembly.SIGNA_LASSEMBLY	Realization	Marker (Sign)
IfcElementAssemblyTypeEnum.SIGNALASSEMBLY	Realization	Marker (Sign)
IfcElementAssembly.SIGNA_LASSEMBLY	Realization	Marker (Sign)

5.1.14.6 Non-Physical Signal

Virtual or fictitious signals. The neutral term "non physical" avoids confusion among IMs.

As opposed to the physical signal, the non-physical signal *need not to send information* to the train. E.g. a fictitious signal on the signalman's display needed to define the route exit towards open line where there's no real signal.

A virtual ERTMS L2 signal is also a non-physical signal but can have a physical presence, i.e. a stop marker board along the track.

Relationships

Source	Type	Target
Non-Physical Signal	Generalization	Signal
IfcAnnotationTypeEnum.NO_N_PHYSICAL_SIGNAL	Realization	Non-Physical Signal
IfcAnnotation.NON_PHYSICAL_SIGNAL	Realization	Non-Physical Signal
IfcAnnotation.NON_PHYSICAL_SIGNAL	Realization	Non-Physical Signal

5.1.14.7 Physical Signal

A signal with a physical trackside appearance.

Relationships

Source	Type	Target
Physical Signal	Generalization	Signal
Active Signal	Generalization	Physical Signal
Fixing	Aggregation	Physical Signal
Marker (Sign)	Generalization	Physical Signal
Signal frame	Aggregation	Physical Signal

5.1.14.8 Signal

Apparatus by means of which a conventional indication is given.

[source: IEC 60050-821]

Relationships

Source	Type	Target
Signal	Generalization	Abs_Signalling equipment
Physical Signal	Generalization	Signal
Non-Physical Signal	Generalization	Signal

5.1.14.9 Signal aspect

1. Single information shown to the train driver.
2. A signal can carry several signal frames, active or passive, each of which conveys an aspect.
The combination of aspects constitutes a signal message. The aspect can represent speed information.

Relationships

Source	Type	Target
Signal aspect	Aggregation	Signal frame

5.1.14.10 *Signal frame*

1. Trackside component, most often part of a signal, that sends a message to the driver.
2. Some IMs consider that a name plate is not an aspect. Thus, not all signal frames have an aspect (i.e. a signal frame of type name plate has 0 aspect)

Relationships

Source	Type	Target
Signal frame	Aggregation	Physical Signal
Signal aspect	Aggregation	Signal frame
IfcSign	Realization	Signal frame
IfcSign	Realization	Signal frame
IfcSignal	Realization	Signal frame
IfcSignal	Realization	Signal frame
IfcSignal	Realization	Signal frame
Fixing	Association	Signal frame
IfcSign	Realization	Signal frame

5.1.15 Track Circuit

5.1.15.1 *Class diagram Track Circuit*

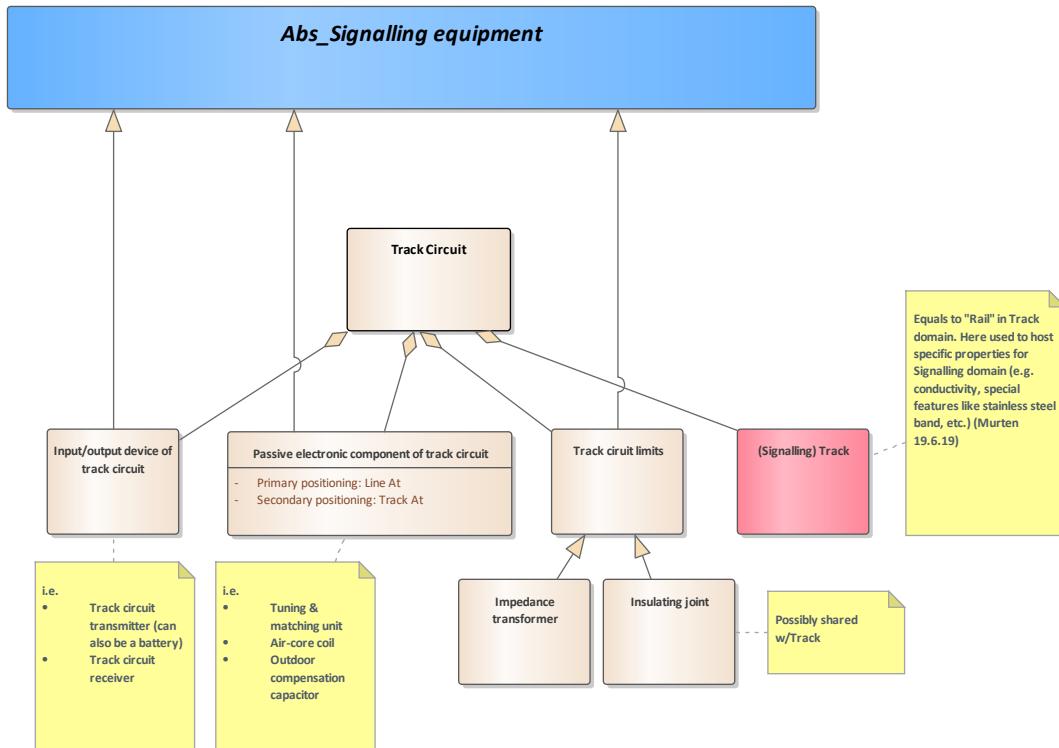


Table 51: Class diagram Track Circuit

5.1.15.2 Impedance transformer

In the AC electrified section track circuit, the impedance transformer makes the traction current cross the rail insulation, and connects the track circuit transmitting and receiving equipment to the rail by transformer coupling.

Relationships

Source	Type	Target
Impedance transformer	Generalization	Track circuit limits
IfcTransformerTypeEnum.COMBINED	Realization	Impedance transformer
IfcTransformer.COMBINED	Realization	Impedance transformer
IfcTransformer.COMBINED	Realization	Impedance transformer

5.1.15.3 Input/output device of track circuit

Device of Track circuit receiver or Track circuit transmitter

Relationships

Source	Type	Target
Input/output device of track circuit	Generalization	Abs_Signalling equipment
Input/output device of track circuit	Aggregation	Track Circuit
IfcElectricFlowStorageDevice.BATTERY	Realization	Input/output device of track circuit
IfcSwitchingDeviceTypeEnum.RELAY	Realization	Input/output device of track circuit
IfcElectricFlowStorageDeviceTypeEnum.BATTERY	Realization	Input/output device of track circuit
IfcSwitchingDevice.RELAY	Realization	Input/output device of track circuit
IfcElectricFlowStorageDevice.BATTERY	Realization	Input/output device of track circuit
IfcSwitchingDevice.RELAY	Realization	Input/output device of track circuit

5.1.15.4 Insulating joint

It is set at the boundary of a track circuit to achieve electrical insulation with an adjacent rail. It can be "mechanical" insulation or "electrical" insulation.

Relationships

Source	Type	Target
Insulating joint	Generalization	Track circuit limits
IfcMechanicalFastener.RAILJOINT	Realization	Insulating joint
IfcMechanicalFastener.RAILJOINT	Realization	Insulating joint
IfcMechanicalFastenerTypeEnum.RAILJOINT	Realization	Insulating joint

5.1.15.5 Passive electronic component of track circuit

Generic passive two-terminal electronic component. e.g. Tuning & matching unit, Outdoor Compensation capacitor, Impedance transformer.

Relationships

Source	Type	Target
Passive electronic component of track circuit	Generalization	Abs_Signalling equipment
Passive electronic component of track circuit	Aggregation	Track Circuit
IfcElectricFlowStorageDevice.CAPACITOR	Realization	Passive electronic component of track circuit
IfcCommunicationsAppliance.ANTENNA	Realization	Passive electronic component of track circuit
IfcElectricFlowStorageDevice.CAPACITOR	Realization	Passive electronic component of track circuit
IfcCommunicationsAppliance.ANTENNA	Realization	Passive electronic component of track circuit
IfcElectricFlowStorageDeviceTypeEnum.INDUCTOR	Realization	Passive electronic component of track circuit
IfcElectricFlowStorageDevice.INDUCTOR	Realization	Passive electronic component of track circuit
IfcCommunicationsApplianceTypeEnum.ANTENNA	Realization	Passive electronic component of track circuit
IfcElectricFlowStorageDevice.INDUCTOR	Realization	Passive electronic component of track circuit
IfcElectricFlowStorageDeviceTypeEnum.CAPACITOR	Realization	Passive electronic component of track circuit

5.1.15.6 Track Circuit

Electric circuit of which the rails of a track section form a part, with usually a source of current connected at one end and a detection device at the other end for detecting whether this track section is clear or occupied by a vehicle. In a continuous signalling system, the track circuit can be used to transmit information between the ground and the train.

[source: IEC 60050-821]

Relationships

Source	Type	Target
IfcBuiltSystem.TRACKCIRC UIT	Realization	Track Circuit
Input/output device of track circuit	Aggregation	Track Circuit
(Signalling) Track	Aggregation	Track Circuit
IfcBuiltSystemTypeEnum.TRACKCIRCUIT	Realization	Track Circuit
Passive electronic component of track circuit	Aggregation	Track Circuit
IfcBuiltSystem.TRACKCIRC UIT	Realization	Track Circuit
Track circuit limits	Aggregation	Track Circuit

5.1.15.7 Track circuit limits

The boundary of track circuit.

Relationships

Source	Type	Target
Track circuit limits	Aggregation	Track Circuit
Track circuit limits	Generalization	Abs_Signalling equipment
Insulating joint	Generalization	Track circuit limits
Impedance transformer	Generalization	Track circuit limits

5.1.15.8 (Signalling) Track

Relationships

Source	Type	Target
(Signalling) Track	Aggregation	Track Circuit

5.1.16 Train protection equipment

5.1.16.1 Class diagram Train protection equipment

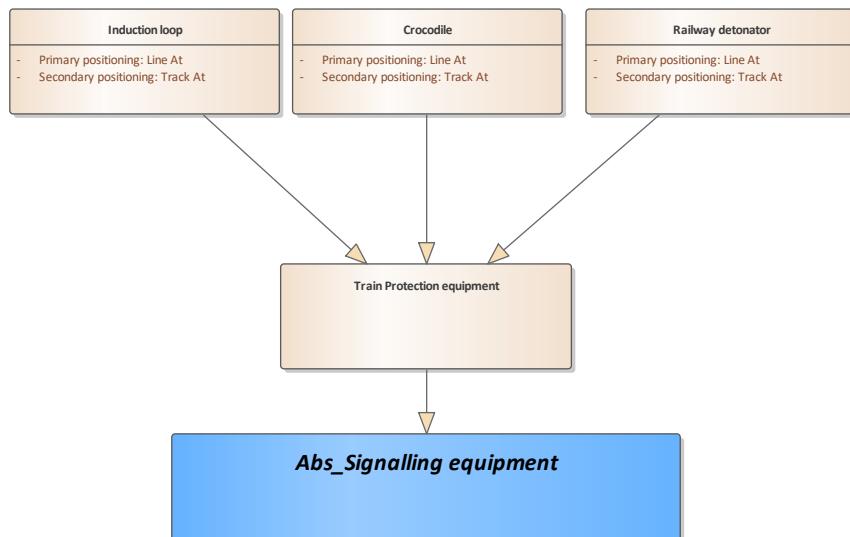


Table 52: Class diagram Train protection equipment

5.1.16.2 Crocodile

Component of a train protection system. It is an electrical contact placed between the rails which, in case of a danger situation, may cause a warning horn to beep in the driver's cab.

Relationships

Source	Type	Target
Crocodile	Generalization	Train Protection equipment
IfcAlarm.RAILWAYCROCO DILE	Realization	Crocodile
IfcAlarm.RAILWAYCROCO DILE	Realization	Crocodile

Source	Type	Target
IfcAlarmTypeEnum.RAILWAYCROCOCILE	Realization	Crocodile

5.1.16.3 Induction loop

Equipment for detection of the presence of a vehicle where a cable in the form of a loop between the rails, energized by alternating current derived from a local generator, detects the metallic mass of a vehicle, by its influence on the field of the loop, in order to provide an electric signal.

[source: IEC 60050-821]

Relationships

Source	Type	Target
Induction loop	Generalization	Train Protection equipment
IfcCableSegment.CABLESEGMENT	Realization	Induction loop
IfcCableSegment.CABLESEGMENT	Realization	Induction loop
IfcCableSegmentTypeEnum.CABLESEGMENT	Realization	Induction loop

5.1.16.4 Railway detonator

Explosive capsule placed on the rail to give an audible danger signal to driver.

Relationships

Source	Type	Target
Railway detonator	Generalization	Train Protection equipment
IfcAlarm.RAILWAYDETONATOR	Realization	Railway detonator
IfcAlarm.RAILWAYDETONATOR	Realization	Railway detonator

Source	Type	Target
IfcAlarmTypeEnum.RAILWAYDETONATOR	Realization	Railway detonator

5.1.16.5 Train Protection equipment

Railway technical installation to ensure safe operation in the event of human failure (magnet, crocodile etc.).

Relationships

Source	Type	Target
Train Protection equipment	Generalization	Abs_Signalling equipment
Induction loop	Generalization	Train Protection equipment
Railway detonator	Generalization	Train Protection equipment
Crocodile	Generalization	Train Protection equipment

5.1.17 Turnout signalling equipment

5.1.17.1 Class diagram Turnout signalling equipment

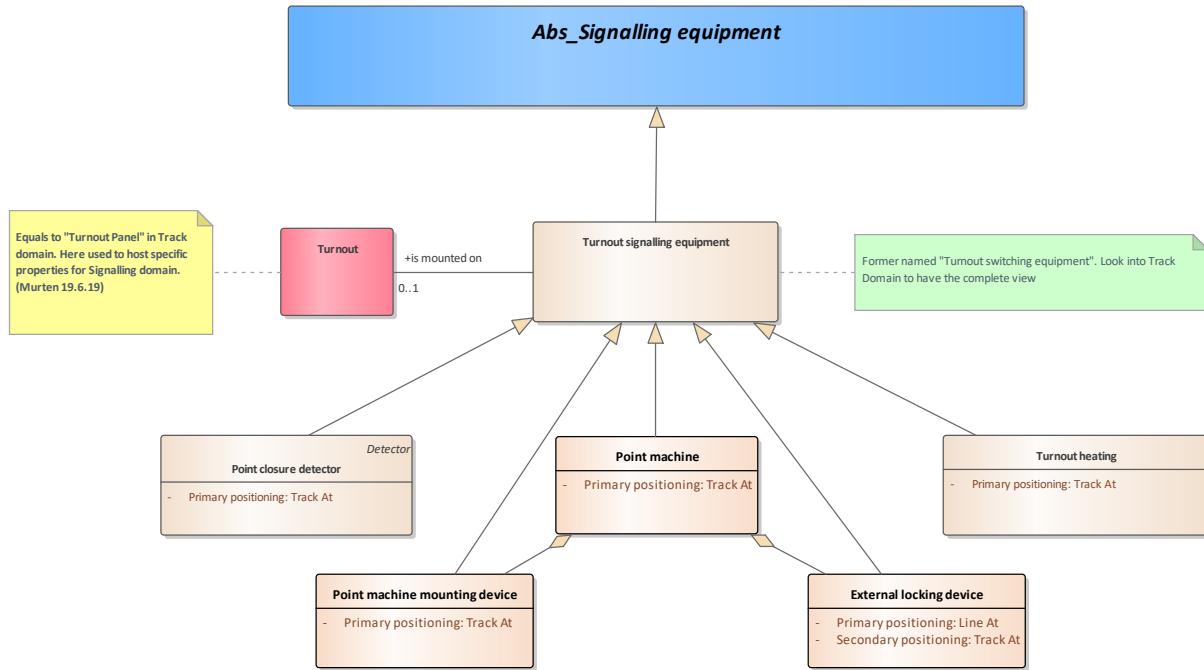


Table 53: Class diagram Turnout signalling equipment

5.1.17.2 External locking device

1. An external locking device is a mechanical device that locks the switch machine in a certain position from the outside .
2. The hook type external locking device locks the basic rail and the turnout sharp, the movable rail and the wing rail safely, and ensures the safety, stability and reliability of the switch under the lock state (in the process of high-speed and heavy-duty train running).

Relationships

Source	Type	Target
External locking device	Generalization	Turnout signalling equipment
External locking device	Aggregation	Point machine
IfcDiscreteAccessoryTypeEnum.POINT_MACHINE_LOCKING_DEVICE	Realization	External locking device
IfcDiscreteAccessory.POINT_MACHINE_LOCKING_DEVICE	Realization	External locking device

Source	Type	Target
IfcDiscreteAccessory.POINT _MACHINE_LOCKING_DEVICE	Realization	External locking device

5.1.17.3 Point machine

The point machine is a device that can switch and lock the turnout and indicate its position.

Relationships

Source	Type	Target
Point machine	Generalization	Turnout signalling equipment
IfcActuator.HYDRAULICACTUATOR	Realization	Point machine
External locking device	Aggregation	Point machine
IfcActuatorTypeEnum.HYDRAULICACTUATOR	Realization	Point machine
Point machine mounting device	Aggregation	Point machine
IfcActuator.HYDRAULICACTUATOR	Realization	Point machine

5.1.17.4 Point machine mounting device

A device used to install a point machine and to connect the point machine to a turnout components (to fix the point machine and connect it to the turnout).

Relationships

Source	Type	Target
Point machine mounting device	Aggregation	Point machine
Point machine mounting device	Generalization	Turnout signalling equipment

Source	Type	Target
IfcDiscreteAccessory.POINTMACHINEMOUNTINGDEVICE	Realization	Point machine mounting device
IfcDiscreteAccessoryTypeEnum.POINTMACHINEMOUNTINGDEVICE	Realization	Point machine mounting device
IfcDiscreteAccessory.POINTMACHINEMOUNTINGDEVICE	Realization	Point machine mounting device

5.1.17.5 Turnout heating

A series of devices used to remove snow from railways. E.g. electric heating device, sensor of rail temperature, electric control cabinet, isolating transformer, etc.

Relationships

Source	Type	Target
Turnout heating	Realization	IfcHeatExchangerTypeEnum.TURNOUTHEATING
Turnout heating	Realization	IfcHeatExchanger.TURNOUTHEATING
Turnout heating	Realization	IfcHeatExchanger.TURNOUTHEATING
Turnout heating	Generalization	Turnout signalling equipment

5.1.17.6 Turnout signalling equipment

Devices, such as point switches, locks, etc., which are used to control the turnout to the normal position or reverse position, realize the turnout lock and give corresponding position information.

Relationships

Source	Type	Target
Turnout signalling equipment	Generalization	Abs_Signalling equipment

Source	Type	Target
External locking device	Generalization	Turnout signalling equipment
Point closure detector	Generalization	Turnout signalling equipment
Turnout	Association	Turnout signalling equipment
Point machine	Generalization	Turnout signalling equipment
Point machine mounting device	Generalization	Turnout signalling equipment
Turnout heating	Generalization	Turnout signalling equipment

5.1.17.7 Turnout

Relationships

Source	Type	Target
Turnout	Association	Turnout signalling equipment

5.1.18 Vehicle barring/breaking device

5.1.18.1 Class diagram Vehicle barring/breaking device

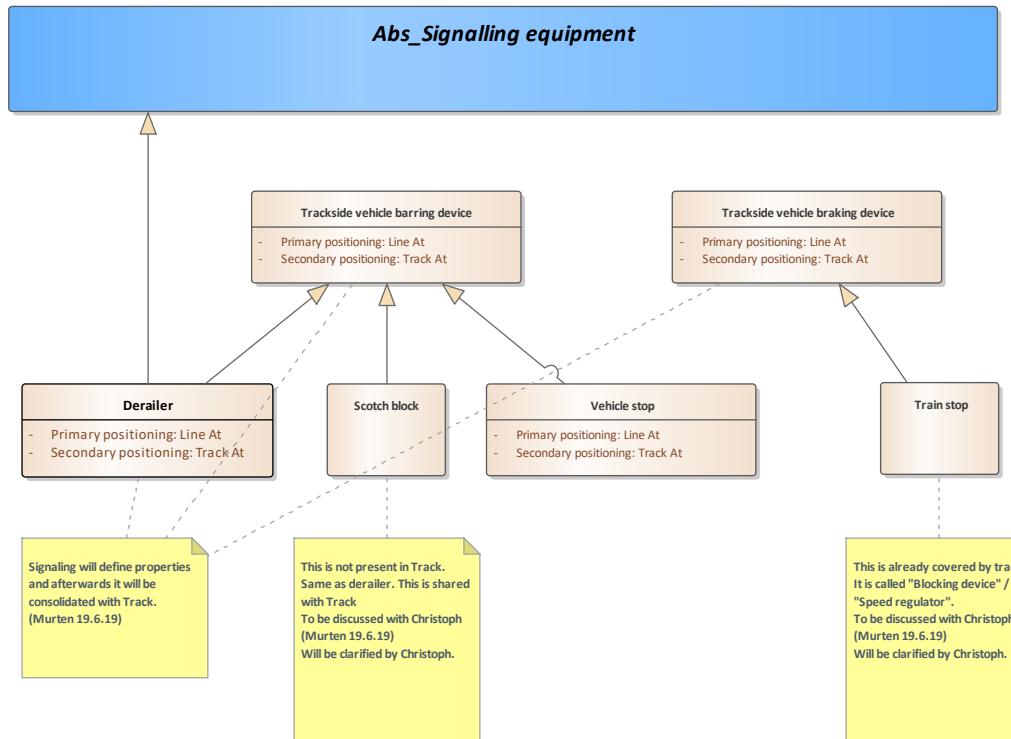


Table 54: Class diagram Vehicle barring/breaking device

5.1.18.2 Derailer

Fixed device which, when placed on the rail, derails the wheels of a vehicle, and serves to protect a converging line.

[source: IEC 60050-821]

Relationships

Source	Type	Target
Derailer	Generalization	Abs_Signalling equipment
Derailer	Generalization	Trackside vehicle barring device
IfcTrackElement.DERAILER	Realization	Derailer
IfcTrackElementTypeEnum.DERAILER	Realization	Derailer
IfcTrackElement.DERAILER	Realization	Derailer

5.1.18.3 Scotch block

Wedge which is put under or in front of a wheel so that the vehicle can't move. Fixed installation at the end of sidings.

Relationships

Source	Type	Target
Scotch block	Generalization	Trackside vehicle barring device

5.1.18.4 Trackside vehicle barring device

Device for stopping any vehicle movement permanently.

Relationships

Source	Type	Target
Vehicle stop	Generalization	Trackside vehicle barring device
Scotch block	Generalization	Trackside vehicle barring device
Derailer	Generalization	Trackside vehicle barring device

5.1.18.5 Trackside vehicle braking device

It is a set of pneumatic, mechanic or electric components causing a braking in the case the train is passing at danger.

Relationships

Source	Type	Target
Train stop	Generalization	Trackside vehicle braking device

5.1.18.6 Train stop

A train stop is a set of pneumatic, mechanic or electric components causing a breaking in the case the train is passing at danger. So this element belongs to the Intermittent Train Protection package of EULYNX model.

Relationships

Source	Type	Target
Train stop	Generalization	Trackside vehicle braking device
IfcTrackElementTypeEnum. SPEEDREGULATOR	Realization	Train stop
IfcTrackElementTypeEnum. BLOCKINGDEVICE	Realization	Train stop
IfcTrackElement.BLOCKING DEVICE	Realization	Train stop
IfcTrackElement.SPEEDREGULATOR	Realization	Train stop
IfcTrackElement.SPEEDREGULATOR	Realization	Train stop
IfcTrackElement.BLOCKING DEVICE	Realization	Train stop

5.1.18.7 Vehicle stop

A Vehicle stop is a (normally fixed) installation at the end of the track which stops any vehicle movement (e.g. buffer stop, sand hump etc.).

Relationships

Source	Type	Target
Vehicle stop	Generalization	Trackside vehicle barring device

Source	Type	Target
IfcTrackElement.VEHICLES TOP	Realization	Vehicle stop
IfcTrackElement.VEHICLES TOP	Realization	Vehicle stop
IfcTrackElementTypeEnum. VEHICLESTOP	Realization	Vehicle stop

5.1.19 _Shared (not analysed)

5.1.19.1 Shared (not analysed)

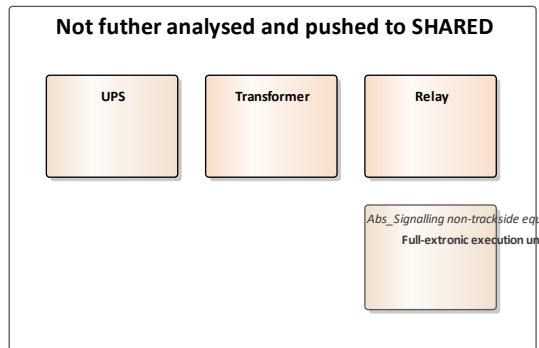


Table 55: _Shared (not analysed)

5.1.19.2 Full-extrinsic execution unit

FEU is a computer interlocking execution representation circuit using full electronic circuits, replacing safe relay as the control unit circuit, combining with computer interlocking, completed at the end of the computer interlocking system of control and acquisition function, can realize monitoring and control of all kinds of point machine, signal, track circuit, block, level crossing, etc. FEU can consist of Signal module, turnout module, track module.

Relationships

Source	Type	Target
Full-extrinsic execution unit	Generalization	Abs_Signalling non-trackside equipment

5.1.19.3 Relay

1. It is an electromagnetic device that is remotely or automatically controlled to switch on the state of the circuit and converting other devices (such as converters, current circuit breakers) in the same circuit or different circuits.

2. Relays are usually used in automated control circuits. They are actually "automatic switches" that use small currents to control the operation of large currents. It can control multiple loops and multiple control objects, and can also control remote objects. It plays the role of automatic regulation, security protection, conversion circuit and so on in the circuit.

Relationships

Source	Type	Target
Relay	Association	Abs_Signalling non-trackside equipment

5.1.19.4 Transformer

A transformer is an inductance device that transfers electric energy from one circuit to another. It is used for voltage transformation, current change, impedance transformation, isolation, voltage regulation and so on.

Relationships

Source	Type	Target
Transformer	Association	Abs_Signalling non-trackside equipment

5.1.19.5 UPS

Uninterruptible power supply refers to the power supply equipment which will not be interrupted due to short power outages, and can always supply high-quality power, and effectively protect precision instruments. It provides continuous, stable and uninterrupted power supply for load equipment.

Relationships

Source	Type	Target
UPS	Association	Abs_Signalling non-trackside equipment

5.2 Signalling Spatial

5.2.1 Signalling Spatial Structure

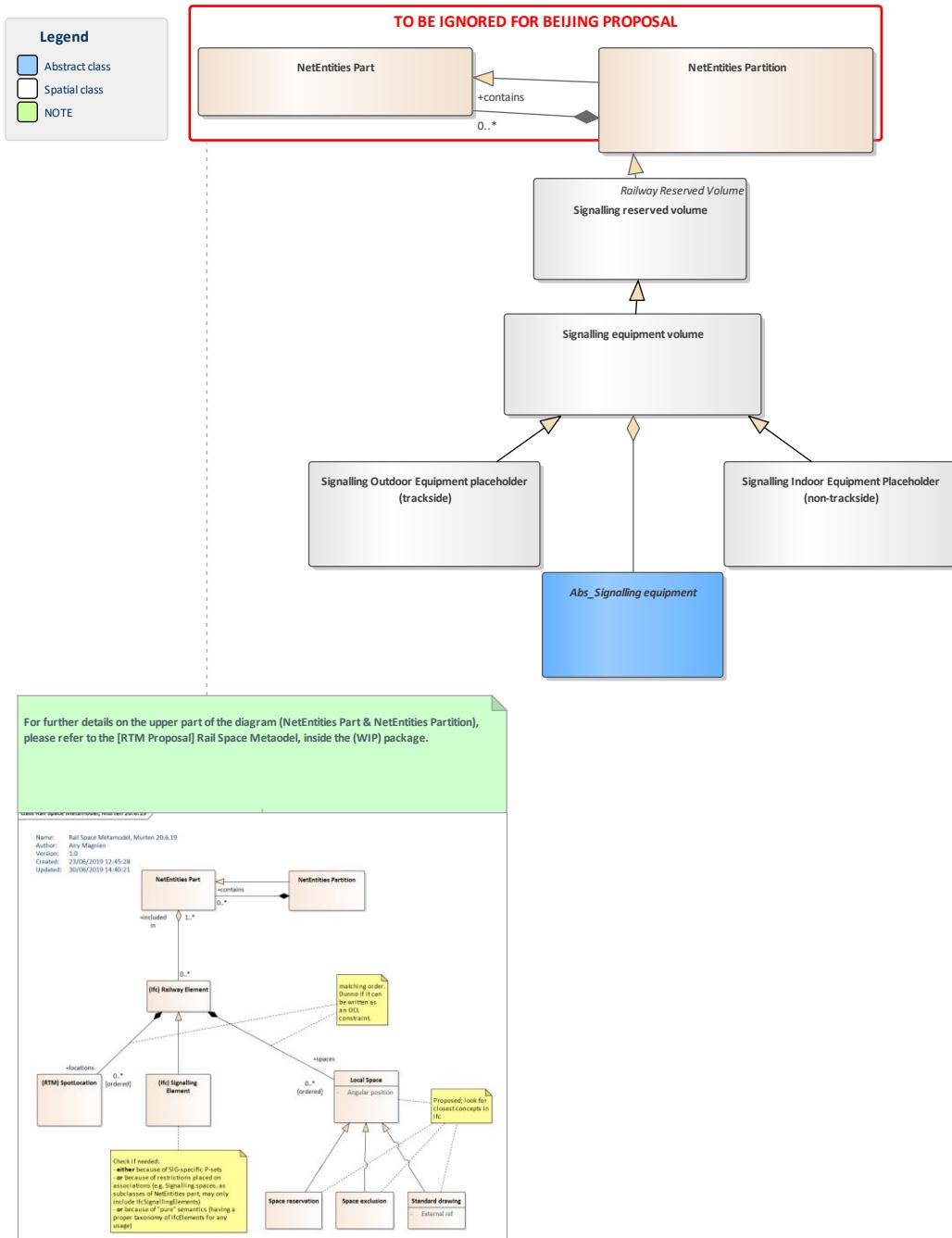


Table 56: Signalling Spatial Structure

5.2.2 Signalling Outdoor Equipment placeholder (trackside)

This is the trackside zone (non-strictly reserved space) where any signalling equipment can be installed.

It has shape, and this shape is flexible (may change)

Relationships

Source	Type	Target
Signalling Outdoor Equipment placeholder (trackside)	Realization	Pset_RailwaySignallingOutdo orReservation
Signalling Outdoor Equipment placeholder (trackside)	Generalization	Signalling equipment volume

5.2.3 Signalling Indoor Equipment Placeholder (non-trackside)

This is the non-trackside zone (non-strictly reserved space) where any signalling equipment can be installed (e.g Rooms, Control Center).

It has shape, and this shape is flexible (may change)

Relationships

Source	Type	Target
Signalling Indoor Equipment Placeholder (non-trackside)	Generalization	Signalling equipment volume
Signalling Indoor Equipment Placeholder (non-trackside)	Realization	Pset_RailwaySignallingIndoor Reservation

6 Telecom

6.1 Telecom Structural (physical)

6.1.1 Class diagram Telecom Structural overview

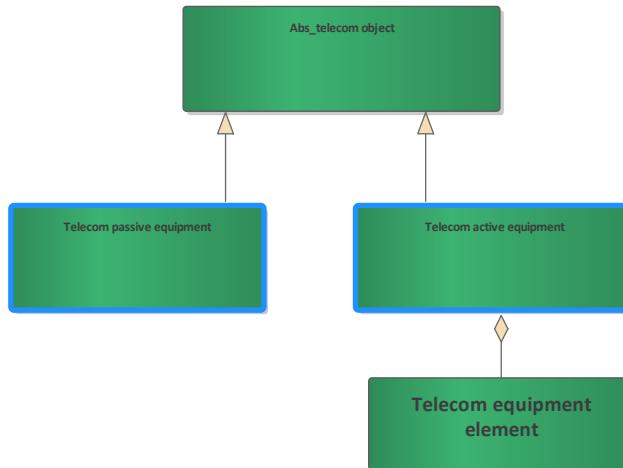


Table 57: Class diagram Telecom Structural overview

6.1.2 Abs_telecom object

A general telecom object with some general property groups, which can be inherited by its subclasses.

Relationships

Source	Type	Target
Abs_telecom object	Aggregation	Telecom reserved volume
Telecom passive equipment	Generalization	Abs_telecom object
Telecom casing elements	Association	Abs_telecom object
Telecom active equipment	Generalization	Abs_telecom object

6.1.3 Telecom active equipment

This class regroups all the telecommunication equipment that must be powered in order to be able to function.

Relationships

Source	Type	Target
Telecom active equipment	Association	Telecom support infrastructure
Telecom active equipment	Generalization	Abs_telecom object
Remote radio unit	Generalization	Telecom active equipment

Source	Type	Target
Telephone	Generalization	Telecom active equipment
Equipment identity register	Generalization	Telecom active equipment
Baseband unit	Generalization	Telecom active equipment
Railway self service identity verification gate	Generalization	Telecom active equipment
Mobility management entity	Generalization	Telecom active equipment
Base transceiver station	Generalization	Telecom active equipment
Access point	Generalization	Telecom active equipment
Ticket vending machine	Generalization	Telecom active equipment
Packet control unit	Generalization	Telecom active equipment
Synchronization support unit	Generalization	Telecom active equipment
Integrated telephony exchange	Generalization	Telecom active equipment
Sensor	Generalization	Telecom active equipment
Modem	Generalization	Telecom active equipment
Service GPRS support node	Generalization	Telecom active equipment
Gateway	Generalization	Telecom active equipment
Master unit	Generalization	Telecom active equipment
Home location register	Generalization	Telecom active equipment
Tandem MSC signaling transfer point	Generalization	Telecom active equipment
Transcoding rate adaptation unit	Generalization	Telecom active equipment
Trackside telephony exchange	Generalization	Telecom active equipment
Tunnel emergency telephone exchange	Generalization	Telecom active equipment
Private branch exchange	Generalization	Telecom active equipment
Redundant array of independent disk	Generalization	Telecom active equipment
Service control point	Generalization	Telecom active equipment
IP network equipment	Generalization	Telecom active equipment
Remote unit	Generalization	Telecom active equipment

Source	Type	Target
Data transmission unit	Generalization	Telecom active equipment
Recording equipment	Generalization	Telecom active equipment
Base station controller	Generalization	Telecom active equipment
Dispatching switch	Generalization	Telecom active equipment
Transport equipment	Generalization	Telecom active equipment
Desktop console	Generalization	Telecom active equipment
Intelligent peripheral	Generalization	Telecom active equipment
Telecom equipment element	Aggregation	Telecom active equipment
Transceiver module	Generalization	Telecom active equipment
Server	Generalization	Telecom active equipment
Acknowledgement center	Generalization	Telecom active equipment
Mobile switching center	Generalization	Telecom active equipment
Optical line terminal	Generalization	Telecom active equipment
Primary reference clock	Generalization	Telecom active equipment
Optical network unit	Generalization	Telecom active equipment
Automatic gate	Generalization	Telecom active equipment
E-utran node B	Generalization	Telecom active equipment
On-site control unit	Generalization	Telecom active equipment
Indoor telecom equipment zone	Association	Telecom active equipment

6.1.4 Telecom equipment element

Telecom Equipment Element refers to the elementary component of the Telecom active Equipments which can not decomposed (breaks down) into other telecom equipments. It represents only the equipment sub-units (e.g. Connection interface; chassis; Cooling fan; etc.)

Relationships

Source	Type	Target
Telecom equipment element	Aggregation	Telecom active equipment

Source	Type	Target
Connection interface	Generalization	Telecom equipment element

6.1.5 Telecom passive equipment

Telecom equipment that does not need power supply

Relationships

Source	Type	Target
Telecom passive equipment	Generalization	Abs_telecom object
Utility marking post	Generalization	Telecom passive equipment
Optical adapter	Generalization	Telecom passive equipment
Telecom outlet	Generalization	Telecom passive equipment
Distribution frame	Generalization	Telecom passive equipment
Optical splitter	Generalization	Telecom passive equipment
Cabling accessory	Generalization	Telecom passive equipment
Telecom casing elements	Generalization	Telecom passive equipment
Cable	Generalization	Telecom passive equipment
Antenna	Generalization	Telecom passive equipment

6.1.6 Cabling & Cables

6.1.6.1 Class diagram Cables

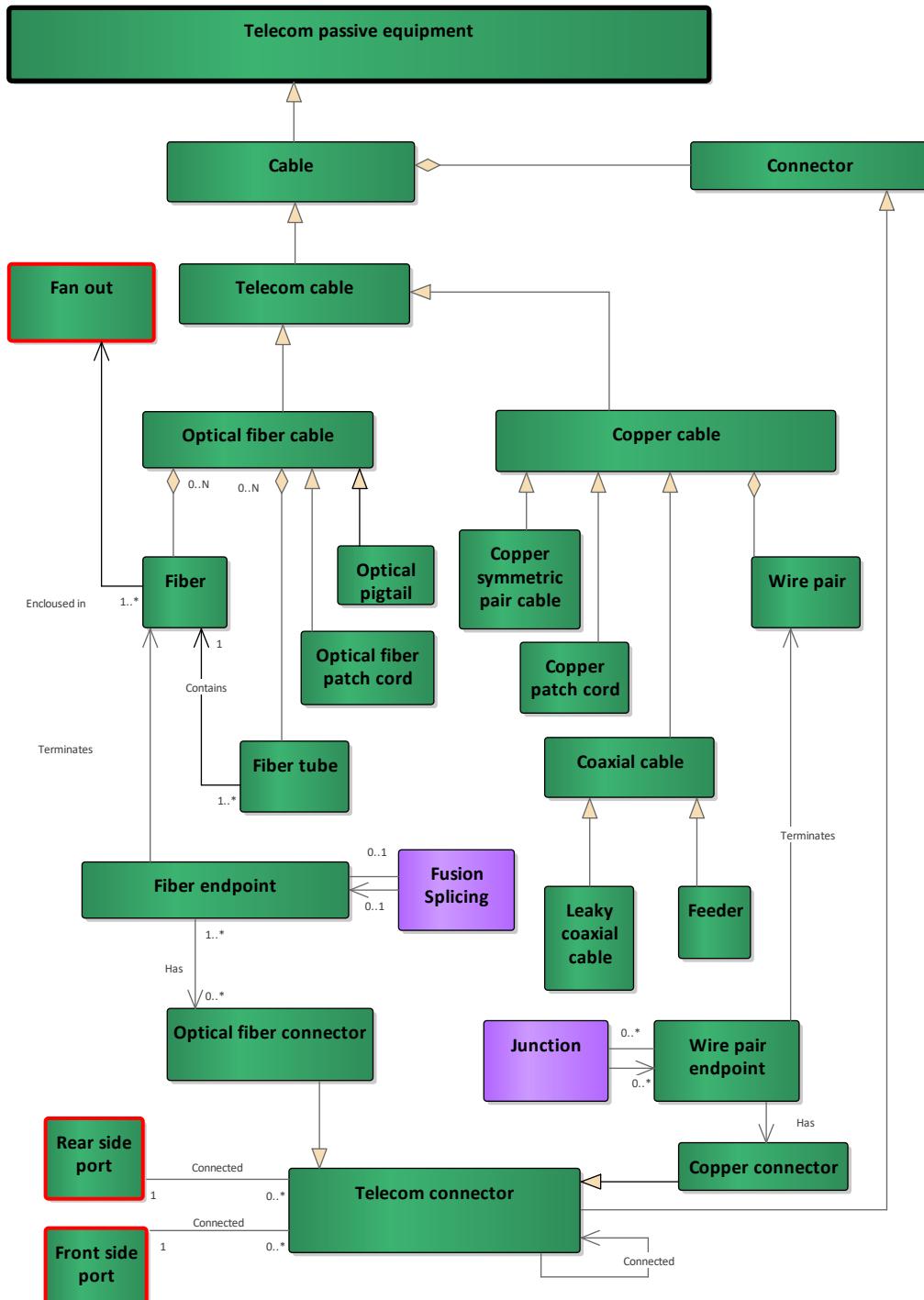


Table 58: Class diagram Cables

6.1.6.2 Class diagram Cabling

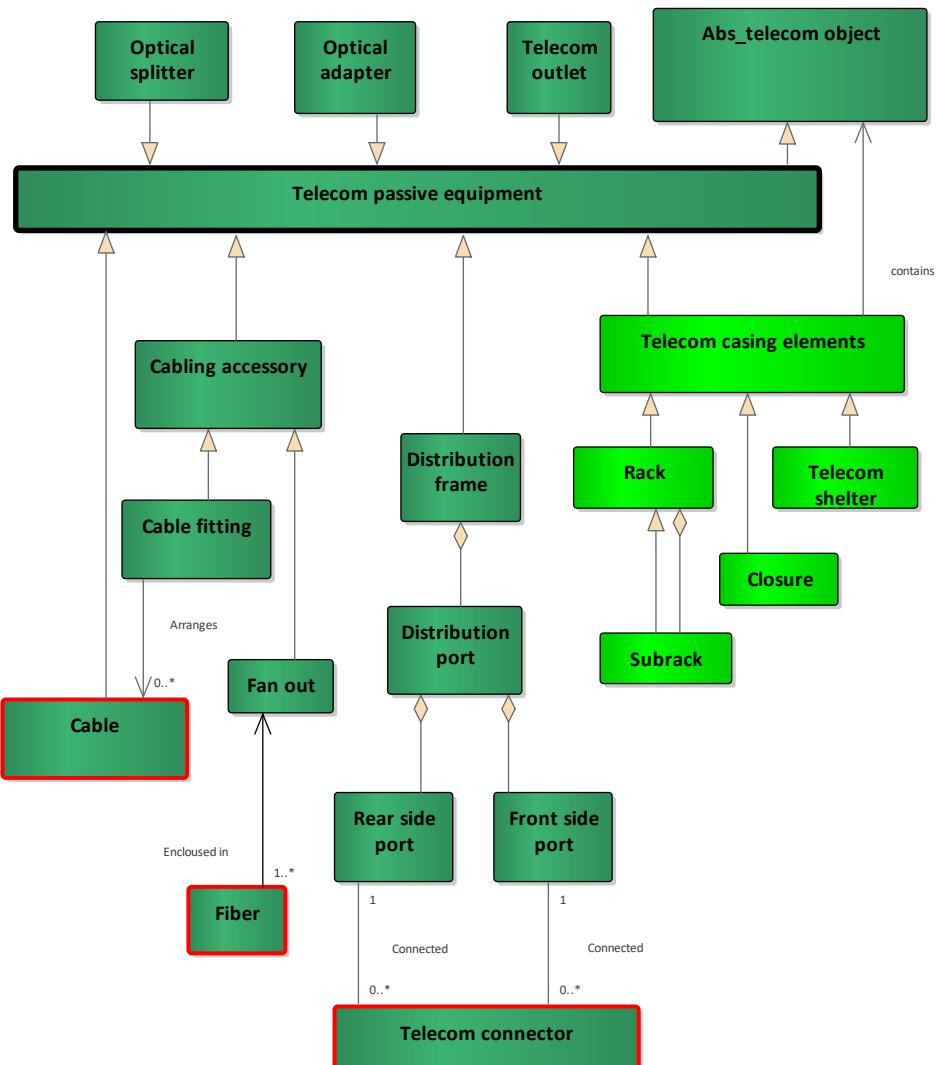


Table 59: Class diagram Cabling

6.1.6.3 Cabling accessory

This class collects all the required accessories in cabling work.

Relationships

Source	Type	Target
Cabling accessory	Generalization	Telecom passive equipment
Cable fitting	Generalization	Cabling accessory
Fan out	Generalization	Cabling accessory

6.1.6.4 Distribution port

Port of distribution frame.

Relationships

Source	Type	Target
Distribution port	Aggregation	Distribution frame
Rear side port	Aggregation	Distribution port
IfcDistributionBoard.DISTRIBUTIONBOARD	Realization	Distribution port
IfcDistributionBoard.DISTRIBUTIONBOARD	Realization	Distribution port
Front side port	Aggregation	Distribution port
IfcDistributionBoardTypeEnum.DISTRIBUTIONBOARD	Realization	Distribution port

6.1.6.5 Fiber endpoint

The termination point of an optical fiber. Each optical fiber has two termination points.

Relationships

Source	Type	Target
Fiber endpoint	Association	Optical fiber connector
Fiber endpoint	Association	Fusion Splicing
Fiber endpoint	Association	Fiber
Fusion Splicing	Association	Fiber endpoint

6.1.6.6 Front side port

The front side port of the distribution frame.

Relationships

Source	Type	Target
Front side port	Association	Telecom connector
Front side port	Aggregation	Distribution port
IfcDistributionPort.CABLE	Realization	Front side port
IfcDistributionPort.CABLE	Realization	Front side port
IfcDistributionPortTypeEnum.CABLE	Realization	Front side port

6.1.6.7 Optical fiber connector

Mechanical connector used to terminate a fiber end point so as to allow mechanical connection to another connectorized fiber end point or to a connectorized telecom equipment port.

Relationships

Source	Type	Target
Optical fiber connector	Generalization	Telecom connector
Fiber endpoint	Association	Optical fiber connector
Pset_OpticalFiberFittingGeneral	Realization	Optical fiber connector

6.1.6.8 Rear side port

The rear side port of the distribution frame.

Relationships

Source	Type	Target
Rear side port	Aggregation	Distribution port
Rear side port	Association	Telecom connector
IfcDistributionPortTypeEnum.CABLE	Realization	Rear side port

Source	Type	Target
IfcDistributionPort.CABLE	Realization	Rear side port
IfcDistributionPort.CABLE	Realization	Rear side port

6.1.6.9 *Telecom casing elements*

A passive element which houses and protects Telecom equipments

Relationships

Source	Type	Target
Telecom casing elements	Generalization	IfcElementAssembly.SHELTER
Telecom casing elements	Generalization	IfcElementAssembly.SHELTER
Telecom casing elements	Association	Abs_telecom object
Telecom casing elements	Generalization	Telecom passive equipment
Telecom casing elements	Generalization	IfcElementAssemblyTypeEnum.SHELTER
Telecom shelter	Generalization	Telecom casing elements
Rack	Generalization	Telecom casing elements
Closure	Generalization	Telecom casing elements

6.1.6.10 *Telecom Shelter*

Building used to contain telecom equipment along trackside/outdoor.

Relationships

6.1.6.11 *Wire pair endpoint*

The termination point of a wire pair. Each wire pair has two termination points.

Relationships

Source	Type	Target
Wire pair endpoint	Association	Wire pair
Wire pair endpoint	Association	Copper connector
Wire pair endpoint	Association	Junction
Junction	Association	Wire pair endpoint

6.1.6.12 Connector

Mechanical connector used to couple two cable endpoints, or to connect a cable endpoint to an equipment port. It is the supertype of telecom connector.

Relationships

Source	Type	Target
Connector	Aggregation	Cable
Power Cable Connector	Generalization	Connector
Telecom connector	Generalization	Connector

6.1.6.13 Cable

This class collects all the objects which describe type of cables, containing either fiber or copper wire used in telecom or power supply systems.

Always contained in a linearly placed object, thus it is generally positioned with respect to local reference.

Relationships

Source	Type	Target
Cable	Realization	IfcCableSegment
Cable	Realization	IfcCableSegment

Source	Type	Target
Cable	Association	Telecom laying infrastructure
Cable	Realization	IfcCableSegment
Cable	Realization	IfcCableSegment
Cable	Generalization	Telecom passive equipment
Cable	Association	Telecom support infrastructure
Cable fitting	Association	Cable
Telecom cable	Generalization	Cable
Power Supply Cable	Generalization	Cable
Connector	Aggregation	Cable

6.1.6.14 *Cable fitting*

Installed in a rack, used for arranging the wires.

Relationships

Source	Type	Target
Cable fitting	Association	Cable
Cable fitting	Generalization	Cabling accessory
IfcDiscreteAccessory.CABL_EARRANGER	Realization	Cable fitting
IfcDiscreteAccessory.CABL_EARRANGER	Realization	Cable fitting
IfcDiscreteAccessoryTypeEnum.CABLEARRANGER	Realization	Cable fitting

6.1.6.15 *Closure*

Box to contain a cable junction, a component for the uninterrupted connection of two pipes or cables.

Relationships

Source	Type	Target
Closure	Generalization	Telecom casing elements
IfcJunctionBox.DATA	Realization	Closure
IfcJunctionBoxTypeEnum.D ATA	Realization	Closure
IfcJunctionBox.DATA	Realization	Closure

6.1.6.16 Coaxial cable

Coaxial cable, a subtype of copper cable, is a copper cable with a variable number of copper coaxial pair conductors used to transmit data by means of electrical signals, especially at radio frequency.

Relationships

Source	Type	Target
Coaxial cable	Generalization	Copper cable
Pset_CoaxialCable	Realization	Coaxial cable
Leaky coaxial cable	Generalization	Coaxial cable
Feeder	Generalization	Coaxial cable
Pset_CoaxialCable	Realization	Coaxial cable

6.1.6.17 Copper cable

Copper cable is a subtype of telecom cable, with a variable number of copper coaxial conductors or pair conductors used to transmit data by means of electrical signals.

Relationships

Source	Type	Target
Copper cable	Generalization	Telecom cable
Wire pair	Aggregation	Copper cable

Source	Type	Target
Copper patch cord	Generalization	Copper cable
Coaxial cable	Generalization	Copper cable
Copper symmetric pair cable	Generalization	Copper cable
IfcCableSegmentTypeEnum. CABLESEGMENT	Realization	Copper cable
IfcCableSegment.CABLESEGMENT	Realization	Copper cable
IfcCableSegment.CABLESEGMENT	Realization	Copper cable

6.1.6.18 Copper connector

Mechanical connector used to terminate a wire pair end point so as to allow mechanical connection to another connectorized wire pair end point or to a connectorized telecom equipment port. It can realize electric coupling between two wire pair endpoints.

Relationships

Source	Type	Target
Copper connector	Generalization	Telecom connector
Pset_CopperCableFittingGeneral	Realization	Copper connector
Wire pair endpoint	Association	Copper connector

6.1.6.19 Copper symmetric pair cable

Telecom copper symmetric pair cable, a subtype of copper cable, is a copper cable with a variable number of copper twisted symmetric pair conductors used to transmit data by means of electrical signals.

Relationships

Source	Type	Target
Copper symmetric pair cable	Generalization	Copper cable
Pset_SymmetricPairCable	Realization	Copper symmetric pair cable
Pset_SymmetricPairCable	Realization	Copper symmetric pair cable

6.1.6.20 Copper patch cord

Copper patch cord, a subtype of copper cable, is a copper cable capped at either end with copper connectors that allow it to be rapidly and conveniently connected to other cable or to distribution panels.

Relationships

Source	Type	Target
Copper patch cord	Generalization	Copper cable
Pset_PatchCordCable	Realization	Copper patch cord
Pset_PatchCordCable	Realization	Copper patch cord

6.1.6.21 Distribution frame

Distribution frame is used to interconnect and manage wiring between active equipment and subscriber.

Relationships

Source	Type	Target
Distribution frame	Generalization	Telecom passive equipment
IfcDistributionBoardTypeEnum.DISTRIBUTIONFRAME	Realization	Distribution frame
IfcDistributionBoard.DISTRIBUTIONFRAME	Realization	Distribution frame
IfcDistributionBoard.DISTRIBUTIONFRAME	Realization	Distribution frame
Distribution port	Aggregation	Distribution frame

Source	Type	Target

6.1.6.22 Fan out

Provide a safe transition from multi-fiber cable units to individual fibers.

Relationships

Source	Type	Target
Fan out	Generalization	Cabling accessory
Fan out	Association	Fiber
IfcCableFitting.FANOUT	Realization	Fan out
IfcCableFittingTypeEnum.FANOUT	Realization	Fan out
IfcCableFitting.FANOUT	Realization	Fan out

6.1.6.23 Feeder

Feeder is the radio-frequency transmission line interconnecting an antenna and a transmitter or receiver, it is a subtype of coaxial cable.

Relationships

Source	Type	Target
Feeder	Generalization	Coaxial cable

6.1.6.24 Fiber

Optical fiber is used in telecommunication systems to transmit data by means of optical signals.

Relationships

Source	Type	Target
Fiber	Aggregation	Optical fiber cable
Fiber tube	Association	Fiber
IfcCableSegment.FIBERSEGMENT	Realization	Fiber
Fiber endpoint	Association	Fiber
IfcCableSegmentTypeEnum.FIBERSEGMENT	Realization	Fiber
IfcCableSegment.FIBERSEGMENT	Realization	Fiber
Fan out	Association	Fiber

6.1.6.25 Optical fiber cable

Cable containing a variable number of optical fibers.

Relationships

Source	Type	Target
Optical fiber cable	Generalization	Telecom cable
Optical pigtail	Generalization	Optical fiber cable
IfcCableSegmentTypeEnum.OPTICALCABLESEGMENT	Realization	Optical fiber cable
IfcCableSegment.OPTICALCABLESEGMENT	Realization	Optical fiber cable
Fiber	Aggregation	Optical fiber cable
Optical fiber patch cord	Generalization	Optical fiber cable
IfcCableSegment.OPTICALCABLESEGMENT	Realization	Optical fiber cable
Fiber tube	Aggregation	Optical fiber cable

6.1.6.26 Fiber tube

A very small radius, semi-rigid hollow plastic tube that houses and protects a certain number of optical fibers. An optical fiber cable may contain many loose fiber tubes.

Relationships

Source	Type	Target
Fiber tube	Association	Fiber
Fiber tube	Aggregation	Optical fiber cable
IfcCableSegment.FIBERTU BE	Realization	Fiber tube
IfcCableSegment.FIBERTU BE	Realization	Fiber tube
IfcCableSegmentTypeEnum. FIBERTUBE	Realization	Fiber tube

6.1.6.27 Leaky coaxial cable

Leaky coaxial cable is a coaxial cable whose outer conductor is not completely closed, it is a subtype of coaxial cable.

Part of the electromagnetic energy transmitted along the cable can be radiated or coupled to a wireless transmission system consisting of the outer conductor and the surrounding environment through a slot or gap on the outer conductor or in the opposite direction as mentioned above.

Relationships

Source	Type	Target
Leaky coaxial cable	Generalization	Coaxial cable

6.1.6.28 Optical pigtail

Optical pigtail, a subtype of optical fiber cable, is a specific hardware connection used for cable termination. On a fiber pigtail, one end of the wire is simply exposed fiber and the other end has a pre-

installed connector on it. Fiber pigtailed are commonly spliced onto individual strands of a multi-fiber trunk cable.

Relationships

Source	Type	Target
Optical pigtail	Generalization	Optical fiber cable
IfcCableSegmentTypeEnum.OPTICALCABLESEGMENT	Realization	Optical pigtail
IfcCableSegment.OPTICALCABLESEGMENT	Realization	Optical pigtail
Pset_CableSegmentTypeOpticalCableSegment	Realization	Optical pigtail
Pset_CableSegmentTypeOpticalCableSegment	Realization	Optical pigtail
IfcCableSegment.OPTICALCABLESEGMENT	Realization	Optical pigtail
Pset_CableSegmentTypeOpticalCableSegment	Realization	Optical pigtail

6.1.6.29 Optical splitter

A passive device used to split the optical signal.

Relationships

Source	Type	Target
Optical splitter	Generalization	Telecom passive equipment
IfcJunctionBoxTypeEnum.DATA	Realization	Optical splitter
IfcJunctionBox.DATA	Realization	Optical splitter
IfcJunctionBox.DATA	Realization	Optical splitter

6.1.6.30 Optical adapter

Optical adapter is used to convert one type of optical port to another type of optical port.

Relationships

Source	Type	Target
Optical adapter	Generalization	Telecom passive equipment
IfcCableFittingTypeEnum.T RANSITION	Realization	Optical adapter
IfcCableFitting.TRANSITION	Realization	Optical adapter
IfcCableFitting.TRANSITION	Realization	Optical adapter

6.1.6.31 Optical fiber patch cord

Optical fiber patch cord, a subtype of optical fiber cable, is an optical fiber cable capped at either end with connectors that allow it to be rapidly and conveniently connected to other cable or to distribution panels.

Relationships

Source	Type	Target
Optical fiber patch cord	Generalization	Optical fiber cable
IfcCableSegment.OPTICAL CABLESEGMENT	Realization	Optical fiber patch cord
Pset_CableSegmentTypeOpt icalCableSegment	Realization	Optical fiber patch cord
Pset_PatchCordCable	Realization	Optical fiber patch cord
IfcCableSegment.OPTICAL CABLESEGMENT	Realization	Optical fiber patch cord
Pset_PatchCordCable	Realization	Optical fiber patch cord
IfcCableSegmentTypeEnum. OPTICALCABLESEGMENT	Realization	Optical fiber patch cord

6.1.6.32 Rack

Metal frame container for equipment.

Relationships

Source	Type	Target
Rack	Generalization	Telecom casing elements
Rack	Aggregation	Telecom equipment volume
Subrack	Aggregation	Rack
IfcFurnitureTypeEnum.TEC_HNICALCABINET	Realization	Rack
IfcFurniture.TECHNICALCABINET	Realization	Rack
Subrack	Generalization	Rack
IfcFurniture.TECHNICALCABINET	Realization	Rack
Equipment access zone	Association	Rack

6.1.6.33 Subrack

Part of a rack.

Relationships

Source	Type	Target
Subrack	Aggregation	Rack
Subrack	Generalization	Rack
IfcSystemFurnitureElementTypeEnum.SUBRACK	Realization	Subrack
IfcSystemFurnitureElement.SUBRACK	Realization	Subrack
IfcSystemFurnitureElement.SUBRACK	Realization	Subrack

6.1.6.34 Telecom cable

Cable containing either fiber or copper wire used to transmit telecom signals, this class is a supertype of optical fiber cable and copper cable.

Relationships

Source	Type	Target
Telecom cable	Generalization	Cable
Pset_TelecomCableGeneral	Realization	Telecom cable
Copper cable	Generalization	Telecom cable
Optical fiber cable	Generalization	Telecom cable
Pset_TelecomCableGeneral	Realization	Telecom cable

6.1.6.35 Telecom connector

Mechanical connector used to couple two telecom cable endpoints or to connect a telecom cable endpoint to a telecom equipment port. This class is a supertype of optical fiber connector and copper cable connector.

Relationships

Source	Type	Target
Telecom connector	Association	Telecom connector
Telecom connector	Generalization	Connector
Telecom connector	Association	Telecom connector
IfcCableFitting	Realization	Telecom connector
Copper connector	Generalization	Telecom connector
Front side port	Association	Telecom connector
Rear side port	Association	Telecom connector
Wired communication port	Association	Telecom connector
IfcCableFitting	Realization	Telecom connector
Optical fiber connector	Generalization	Telecom connector

6.1.6.36 Telecom outlet

Telecom plug allowing telephone or network access.

Relationships

Source	Type	Target
Telecom outlet	Generalization	Telecom passive equipment

6.1.6.37 Telecom shelter

Building used to contain telecom equipment along trackside / outdoor.

Relationships

Source	Type	Target
Telecom shelter	Generalization	Telecom casing elements
IfcElementAssemblyTypeEnum.SHELTER	Realization	Telecom shelter
IfcElementAssembly.SHELTER	Realization	Telecom shelter
IfcElementAssembly.SHELTER	Realization	Telecom shelter

6.1.6.38 Wire pair

A pair of conductors contained in a copper cable, the pair is always used together to form a circuit to transmit data by means of electric signals.

Relationships

Source	Type	Target
Wire pair	Aggregation	Copper cable
IfcCableSegment.WIREPAIRSEGMENT	Realization	Wire pair

Source	Type	Target
Wire pair endpoint	Association	Wire pair
IfcCableSegment.WIREPAI RSEGMENT	Realization	Wire pair
IfcCableSegmentTypeEnum. WIREPAIRSEGMENT	Realization	Wire pair

6.1.7 Interface with Other Domain

6.1.7.1 Overhead line

Relationships

Source	Type	Target
Overhead line	Association	Telecom reserved volume

6.1.7.2 Power Cable Connector

Relationships

Source	Type	Target
Power Cable Connector	Generalization	Connector
Power Cable Connector	Aggregation	Power Supply Cable
Power supply port	Association	Power Cable Connector

6.1.7.3 Power Supply Cable

Relationships

Source	Type	Target
Power Supply Cable	Generalization	Cable
Power Cable Connector	Aggregation	Power Supply Cable

6.1.7.4 Track

Relationships

Source	Type	Target
Track	Association	Telecom reserved volume

6.1.8 Fixed telephony system

6.1.8.1 Class diagram Fixed telephony system

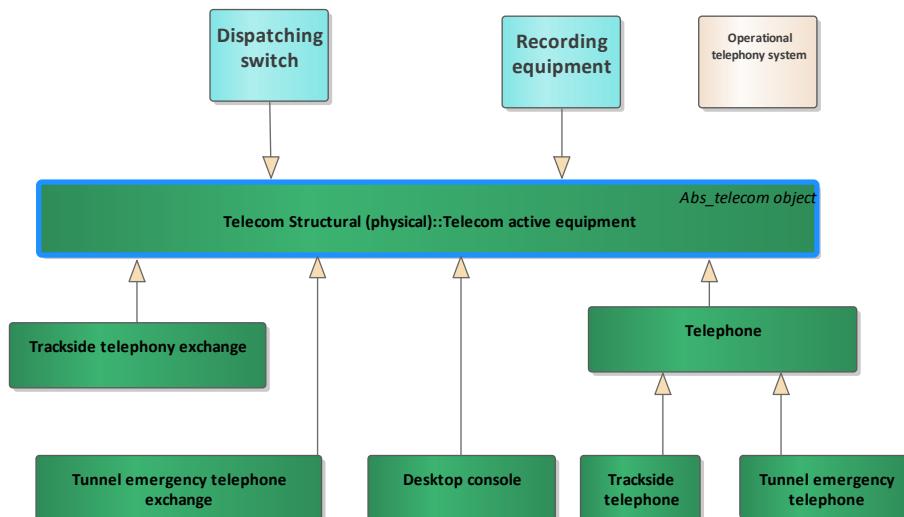


Table 60: Class diagram Fixed telephony system

6.1.8.2 Office telephone



Provides phone communications between one or several interlocutors inside the office

Relationships

Source	Type	Target
Office telephone	Generalization	Telephone

6.1.8.3 Operational telephony system

A system that allows communications between operators (e.g. switchtender, traffic regulator, operational agents, etc.) in operational centers and on the infrastructure site (e.g. railway, tunnel or road).

Relationships

Source	Type	Target
IfcDistributionSystem.OPERATIONALTELEPHONYSYSTEM	Realization	Operational telephony system

6.1.8.4 Railway operational telephone

Provides telephony communications between the operators of the railway network

Relationships

Source	Type	Target
Railway operational telephone	Generalization	Telephone

6.1.8.5 Trackside telephone

These telephone sets are installed along the railway right-of-way in order to be used by the general public or railway agents. They allow hands-free communication that can be established by pressing a button

Relationships

Source	Type	Target
Trackside telephone	Realization	PEnum_CommunicationTerminalType
Trackside telephone	Generalization	Telephone
PEnum_RailwayCommunicationTerminalType	Realization	Trackside telephone
PEnum_RailwayCommunicationTerminalType	Realization	Trackside telephone

6.1.8.6 Desktop console

A desktop terminal equipment used by railway dispatching system, mainly realizing dispatching voice communication.

Relationships

Source	Type	Target
Desktop console	Realization	IfcCommunicationsAppliance. COMPUTER
Desktop console	Realization	IfcCommunicationsApplianceTypeEnum.COMPUTER
Desktop console	Generalization	Telecom active equipment
Desktop console	Realization	IfcCommunicationsAppliance. COMPUTER

6.1.8.7 Dispatching switch

An intermediate device implementing voice and data communication between telephone consoles and telephone exchanges.

It can support IPv4 and IPv6 protocols.

Relationships

Source	Type	Target
Dispatching switch	Generalization	Telecom active equipment

6.1.8.8 Integrated telephony exchange

A device used for telephone exchange, can be used for legacy telephone or IP telephone.

Relationships

Source	Type	Target
Integrated telephony exchange	Generalization	Telecom active equipment

6.1.8.9 Telephone

A terminal device that realizes bidirectional voice communication by means of electrical signals.

Relationships

Source	Type	Target
Telephone	Generalization	Telecom active equipment
Railway operational telephone	Generalization	Telephone
Tunnel emergency telephone	Generalization	Telephone
Office telephone	Generalization	Telephone
IfcAudioVisualAppliance.CO MMUNICATIONTERMINAL	Realization	Telephone
IfcAudioVisualAppliance.CO MMUNICATIONTERMINAL	Realization	Telephone
Trackside telephone	Generalization	Telephone

6.1.8.10 Private branch exchange

PBX is private branch exchange.

Relationships

Source	Type	Target
Private branch exchange	Generalization	Telecom active equipment

6.1.8.11 Recording equipment

Records telephone calls between the railway telephony operators. It also provides the function of archiving and immediate replay.

It can support the IP, SIP and RTP protocols.

Relationships

Source	Type	Target
Recording equipment	Generalization	Telecom active equipment

6.1.8.12 Trackside telephony exchange

A device that ensures the routing of trackside telephone calls and communications.

Relationships

Source	Type	Target
Trackside telephony exchange	Realization	IfcCommunicationsAppliance. TELEPHONYEXCHANGE
Trackside telephony exchange	Generalization	Telecom active equipment

Source	Type	Target
Trackside telephony exchange	Realization	IfcCommunicationsAppliance TypeEnum.TELEPHONYEXCHANGE
Trackside telephony exchange	Realization	IfcCommunicationsAppliance. TELEPHONYEXCHANGE

6.1.8.13 Tunnel emergency telephone

A phone specifically provided for making calls to emergency services in tunnels.

Relationships

Source	Type	Target
Tunnel emergency telephone	Generalization	Telephone
Tunnel emergency telephone	Realization	PEnum_CommunicationTerminalType
PEnum_RailwayCommunicationTerminalType	Realization	Tunnel emergency telephone
PEnum_RailwayCommunicationTerminalType	Realization	Tunnel emergency telephone

6.1.8.14 Tunnel emergency telephone exchange

Electronic components that allows tunnel emergency telephones to establish calls with the operation center.

Relationships

Source	Type	Target
Tunnel emergency telephone exchange	Generalization	Telecom active equipment
Tunnel emergency telephone exchange	Realization	IfcCommunicationsAppliance. TELEPHONYEXCHANGE
Tunnel emergency telephone exchange	Realization	IfcCommunicationsAppliance TypeEnum.TELEPHONYEXCHANGE

Source	Type	Target
Tunnel emergency telephone exchange	Realization	IfcCommunicationsAppliance. TELEPHONYEXCHANGE

6.1.9 Fixed transmission network

6.1.9.1 Class diagram Fixed transmission network

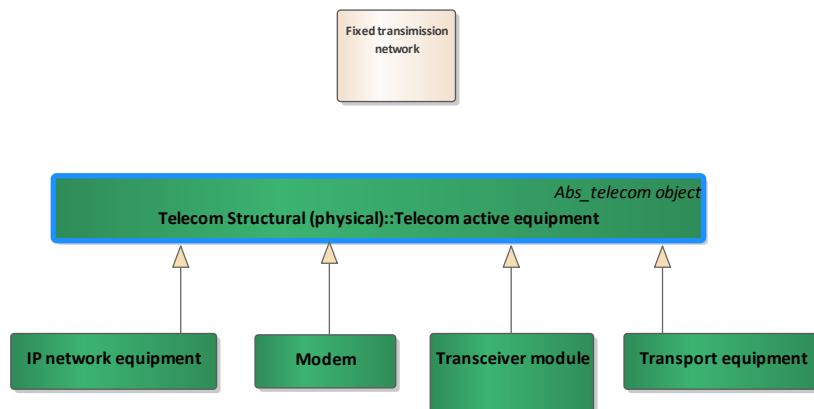


Table 61: Class diagram Fixed transmission network

6.1.9.2 Fixed transmission network

Represents all wired networks that provide a data transmission channel using optical fiber cables, copper cables or both. It aggregates many technologies that are based on the multiplexing method.

Relationships

Source	Type	Target
IfcDistributionSystem.FIXED TRANSMISSIONNETWORK	Realization	Fixed transmission network

6.1.9.3 IP network equipment

Generic IP network equipment can represent all kind of IP network equipment, which provide IP data transmission channel for telecom subsystems or other subsystems e.g., routers, network switches or firewalls.

Relationships

Source	Type	Target
IP network equipment	Generalization	Telecom active equipment

6.1.9.4 Modem

Modem is a device that converts data into a format suitable for a transmission medium which can be copper cables or optical fibers.

Relationships

Source	Type	Target
Modem	Generalization	Telecom active equipment
IfcCommunicationsAppliance.MODEM	Realization	Modem
IfcCommunicationsAppliance.MODEM	Realization	Modem
IfcCommunicationsApplianceTypeEnum.MODEM	Realization	Modem

6.1.9.5 Transceiver module

A device that can convert electric signal to optical signal at the sender, and convert optical signal to electric signal at the receiver.

Relationships

Source	Type	Target
Transceiver module	Generalization	Telecom active equipment

Source	Type	Target
IfcCommunicationsApplianceTypeEnum.TRANSITIONCOMPONENT	Realization	Transceiver module
IfcCommunicationsAppliance.TRANSITIONCOMPONENT	Realization	Transceiver module
IfcCommunicationsAppliance.TRANSITIONCOMPONENT	Realization	Transceiver module

6.1.9.6 Transport equipment

Generic transport equipment can represent all kind of transport equipment, which provides transmission channel for telecom subsystems or other subsystems.

Relationships

Source	Type	Target
Transport equipment	Realization	IfcCommunicationsAppliance.TRANSPORTEQUIPMENT
Transport equipment	Generalization	Telecom active equipment
Transport equipment	Realization	IfcCommunicationsApplianceTypeEnum.TRANSPOREQUIPMENT
Transport equipment	Realization	IfcCommunicationsAppliance.TRANSPORTEQUIPMENT

6.1.10 Mobile network (GSMR - WiFi - LTE)

6.1.10.1 Class diagram Mobile network (GSMR - WiFi - LTE)

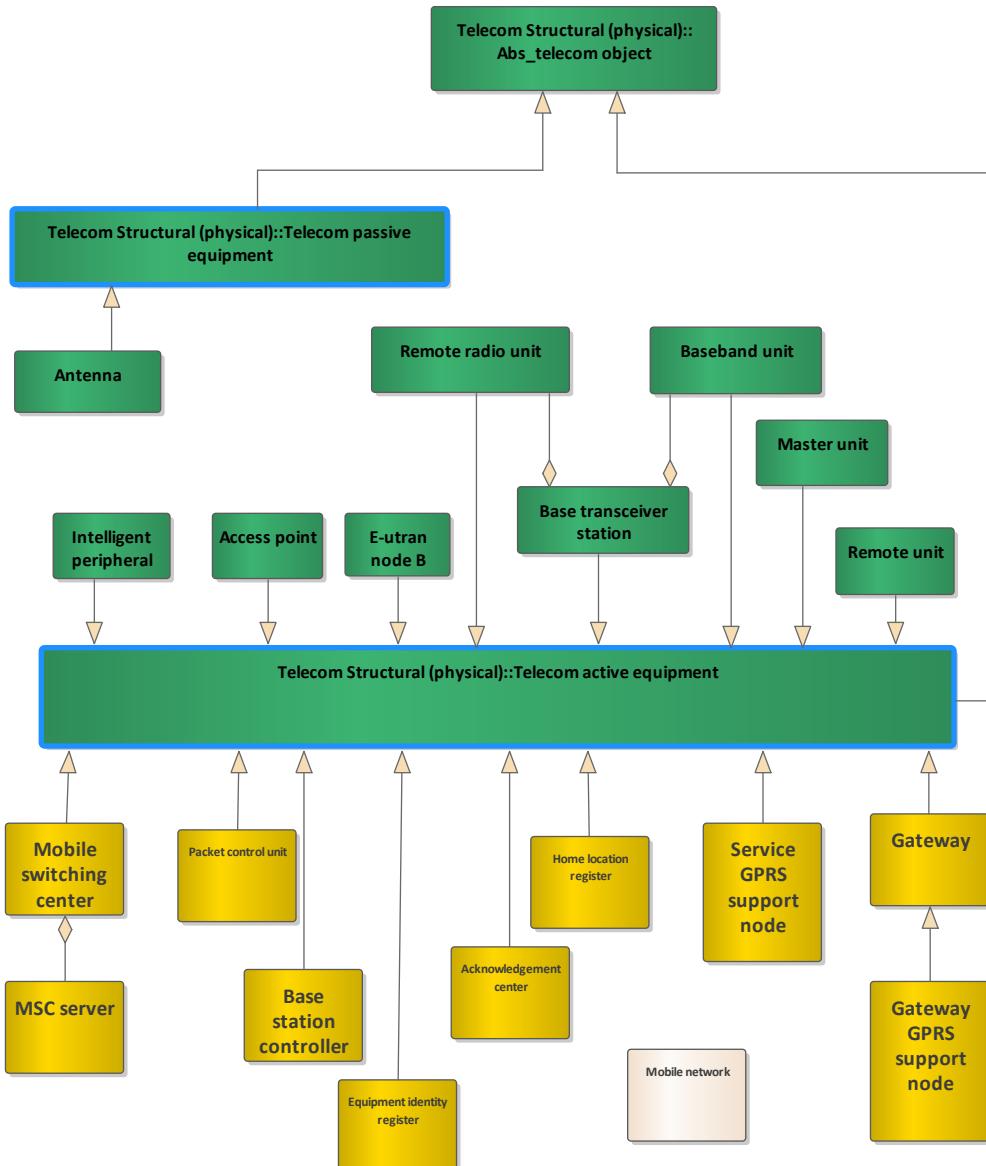


Table 62: Class diagram Mobile network (GSMR - WiFi - LTE)

6.1.10.2 Acknowledgement center

AC is used to record and store railway emergency call information.

Relationships

Source	Type	Target
Acknowledgement center	Generalization	Telecom active equipment

Source	Type	Target
IfcMobileTelecommunicationsAppliance.SUBSCRIBERSERVER	Realization	Acknowledgement center

6.1.10.3 Antenna

Antenna is a device that effectively radiates or receives electromagnetic waves, coupling a transmission line to space or other media.

Relationships

Source	Type	Target
Antenna	Generalization	Telecom passive equipment
IfcCommunicationsAppliance.ANTENNA	Realization	Antenna
IfcCommunicationsApplianceTypeEnum.ANTENNA	Realization	Antenna
IfcCommunicationsAppliance.ANTENNA	Realization	Antenna

6.1.10.4 Equipment identity register

The Equipment Identity Register (EIR) in the GSM system is the logical entity which is responsible for storing in the network the International Mobile Equipment Identities (IMEIs), used in the GSM system.

Relationships

Source	Type	Target
Equipment identity register	Generalization	Telecom active equipment
IfcMobileTelecommunicationsAppliance.SUBSCRIBERSERVER	Realization	Equipment identity register

6.1.10.5 Home location register

HLR is a data base in charge of the management of mobile subscribers. Authentication Center (AuC) is always associated with an HLR, and stores an identity key for each mobile subscriber registered with the associated HLR.

Relationships

Source	Type	Target
Home location register	Generalization	Telecom active equipment
IfcMobileTelecommunicationsAppliance.SUBSCRIBERSERVER	Realization	Home location register

6.1.10.6 Mobile network

Mobile network insures wireless communication by providing a secure platform for voice and data communication between infrastructure operators, including drivers, dispatchers, shunting team members and station controllers.

Relationships

Source	Type	Target
IfcDistributionSystem.MOBILENETWORK	Realization	Mobile network

6.1.10.7 Packet control unit

PCU performs some of the processing tasks of the BSC, but for packet data. It is responsible for data packet, wireless channel management, error sending detection and automatic retransmission.

Relationships

Source	Type	Target
Packet control unit	Generalization	Telecom active equipment
IfcMobileTelecommunicationsAppliance.PACKETCONTROLUNIT	Realization	Packet control unit

6.1.10.8 Access point

In a network, a point at which wireless devices may connect to the network. Access point allows a Wi-Fi device to connect to a wired network.

Relationships

Source	Type	Target
Access point	Generalization	Telecom active equipment
IfcMobileTelecommunicationsAppliance.ACCESSPOINT	Realization	Access point
IfcMobileTelecommunicationsAppliance.ACCESSPOINT	Realization	Access point
IfcMobileTelecommunicationsApplianceTypeEnum.ACCESSPOINT	Realization	Access point

6.1.10.9 Baseband unit

A component of a distributed base station for implementing baseband processing functions.

Relationships

Source	Type	Target
Baseband unit	Generalization	Telecom active equipment
Baseband unit	Aggregation	Base transceiver station
IfcMobileTelecommunicationsApplianceTypeEnum.BASEBANDUNIT	Realization	Baseband unit

Source	Type	Target
IfcMobileTelecommunicationsAppliance.BASEBANDUNIT	Realization	Baseband unit
IfcMobileTelecommunicationsAppliance.BASEBANDUNIT	Realization	Baseband unit

6.1.10.10 Base station controller

Base Station Controller (BSC) is a network component in the PLMN with the functions for control of one or more BTS.

As the control part of BSS, BSC is responsible for the management of various interfaces, the management of wireless resources and wireless parameters, the signalling processing of call establishment and the channel allocation in the cell.

Relationships

Source	Type	Target
Base station controller	Generalization	Telecom active equipment
IfcUnitaryControlElement.BASESTATIONCONTROLLER	Realization	Base station controller

6.1.10.11 Base transceiver station

A Base Transceiver Station (BTS) is a network component which serves one cell.

It completes the conversion between BSC and wireless channel, and realize the wireless transmission and related control functions between BSC and MS through the air interface.

BTS has the functions of rate matching, channel coding/decoding, modulation/demodulation and other air interface physical layer.

Relationships

Source	Type	Target
Base transceiver station	Generalization	Telecom active equipment
Baseband unit	Aggregation	Base transceiver station
IfcMobileTelecommunicationsAppliance.BASETRANSCEIVERSTATION	Realization	Base transceiver station
Remote radio unit	Aggregation	Base transceiver station
IfcMobileTelecommunicationsAppliance.BASETRANSCEIVERSTATION	Realization	Base transceiver station
IfcMobileTelecommunicationsApplianceTypeEnum.BASETRANSCEIVERSTATION	Realization	Base transceiver station

6.1.10.12 E-utran node B

An eNB is a logical network component which serves one or more E-UTRAN cells.

It is the hardware connected to the EPC (Evolved Packet Core), more specifically to the MME (Mobility Management Entity), which communicates directly with UEs (User Equipment) in wireless way.

On the basis of the original functions of Node B, eNB added the physical layer, MAC layer, RRC, scheduling, access control, load bearing control, mobility management and wireless resource management of adjacent cells of RNC, providing functions equivalent to the original RLC/MAC/PHY and RRC layer.

Relationships

Source	Type	Target
E-utran node B	Generalization	Telecom active equipment
IfcMobileTelecommunicationsAppliance.E_UTRAN_NODE_B	Realization	E-utran node B
IfcMobileTelecommunicationsAppliance.E_UTRAN_NODE_B	Realization	E-utran node B
IfcMobileTelecommunicationsApplianceTypeEnum.E_UTRAN_NODE_B	Realization	E-utran node B

Source	Type	Target

6.1.10.13 *Gateway*

Gateway is a networking hardware that provides interoperability between networks, i.e. it allows data to flow from one discrete network to another.

It can represent all types of equipment which permits interworking between distinct networks.

Relationships

Source	Type	Target
Gateway	Generalization	Telecom active equipment
Gateway GPRS support node	Generalization	Gateway
CS media gateway	Generalization	Gateway

6.1.10.14 *Gateway GPRS support node*

The gateway GPRS support node is a component of the GPRS core network that extends the GSM to allow packet switching functionalities. This component is responsible for the internetworking between the GPRS network and external packet switched networks (e.g. the internet).

The GGSN converts the GPRS packets coming from the SGSN into the appropriate packet data protocol (PDP) format (e.g., IP or X.25) and sends them out on the corresponding Packet Data Network (PDN). In the other direction, PDP addresses of incoming data packets are converted to the GSM address of the destination user.

The GGSN is responsible for IP address assignment and is the default router for the connected user equipment (UE). The GGSN also performs authentication and billing functions. The location register function in the GGSN stores subscription information and routeing information (needed to tunnel packet data traffic destined for a GPRS MS to the SGSN where the MS is registered) for each subscriber for which the GGSN has at least one PDP context active.

Relationships

Source	Type	Target
Gateway GPRS support node	Generalization	Gateway
IfcMobileTelecommunicationsAppliance.GATEWAY_GPRS_SUPPORT_NODE	Realization	Gateway GPRS support node

6.1.10.15 Intelligent peripheral

Under the control of SCP, IP offers a variety of specialized resources according to the corresponding service logical program. And these resources contain the receiver of DTMF (Dual –Tone Multi-Frequency, signal generator, record notice, etc.

IP provides dedicated resource functions in the intelligent network, allocates, controls and manages various dedicated resources, communicates with other entities in the network, and completes SRF resource functions as well as the maintenance, management and statistics functions of resources.

Relationships

Source	Type	Target
Intelligent peripheral	Generalization	Telecom active equipment

6.1.10.16 Master unit

A component of a repeater for coupling base station signals.

Relationships

Source	Type	Target
Master unit	Generalization	Telecom active equipment
IfcMobileTelecommunicationsApplianceTypeEnum.MASTERUNIT	Realization	Master unit

Source	Type	Target
IfcMobileTelecommunicationsAppliance.MASTERUNIT	Realization	Master unit
IfcMobileTelecommunicationsAppliance.MASTERUNIT	Realization	Master unit

6.1.10.17 CS media gateway

The CS-MGW is public switched telephone network / public land mobile network transport termination point for a defined network and interfaces UTRAN (Universal Terrestrial Radio Access Network) with the core network.

The MSC can be implemented in two different entities: the MSC server, handling only signalling, and the CS-MGW, handling user's data. An MSC server and a CS-MGW make up the full functionality of MSC.

Relationships

Source	Type	Target
CS media gateway	Aggregation	Mobile switching center
CS media gateway	Generalization	Gateway

6.1.10.18 Mobility management entity

MME is the control plane entity within EPS (Evolved Packet System) supporting functions. MME is used for user access control and mobility management.

Relationships

Source	Type	Target
Mobility management entity	Generalization	Telecom active equipment

6.1.10.19 Mobile switching center



The Mobile-services Switching Centre (MSC) constitutes the interface between the radio system and the fixed networks. It is an exchange which performs all the switching and signalling functions for mobile station located in a geographical area designated as the MSC area.

In order to obtain radio coverage of a given geographical area a number of base stations are normally required; i.e. each MSC would thus have to interface several base stations. In addition, several MSCs may be required to cover a country.

Relationships

Source	Type	Target
Mobile switching center	Generalization	Telecom active equipment
CS media gateway	Aggregation	Mobile switching center
IfcMobileTelecommunicationsAppliance.MOBILESWITCHINGCENTER	Realization	Mobile switching center
MSC server	Aggregation	Mobile switching center

6.1.10.20 MSC server

The MSC Server mainly comprises the call control (CC) and mobility control parts of an MSC.

An MSC Server and a CS-MGW make up the full functionality of an MSC.

The MSC Server is responsible for the control of mobile originated and mobile terminated CC CS Domain calls. It terminates the user-network signalling and translates it into the relevant network – network signalling. The MSC Server also contains a VLR to hold the mobile subscriber's service data and CAMEL related data.

Relationships

Source	Type	Target
MSC server	Aggregation	Mobile switching center
IfcMobileTelecommunicationsAppliance.MSCSERVER	Realization	MSC server

6.1.10.21 *Remote radio unit*

A component of a distributed base station that converts digital baseband signals into high-frequency (rf) signals and sends high-frequency (rf) signals to the antenna for radiation.

Relationships

Source	Type	Target
Remote radio unit	Generalization	Telecom active equipment
Remote radio unit	Aggregation	Base transceiver station
IfcMobileTelecommunicationsAppliance.REMOTERADIOUNIT	Realization	Remote radio unit
IfcMobileTelecommunicationsAppliance.REMOTERADIOUNIT	Realization	Remote radio unit

6.1.10.22 *Remote unit*

Remote unit is used to amplify a base station signal.

Relationships

Source	Type	Target
Remote unit	Generalization	Telecom active equipment
IfcMobileTelecommunicationsAppliance.REMOTEUNIT	Realization	Remote unit
IfcMobileTelecommunicationsApplianceTypeEnum.REMOTEUNIT	Realization	Remote unit
IfcMobileTelecommunicationsAppliance.REMOTEUNIT	Realization	Remote unit

6.1.10.23 *Service control point*



SCP has the service control function which includes the GSM-R intelligent network business logic. Through the SSP issued instructions, it completes the intelligent network business connection and billing control, in order to achieve some railway specific business.

At the same time, it also has the service data function, including user data and network data, for the service control function to extract real-time GSM-R intelligent network service.

Together with IP and SSP, it forms an intelligent network subsystem to separate network switching function from business control function and realize intelligent control of call.

Relationships

Source	Type	Target
Service control point	Generalization	Telecom active equipment

6.1.10.24 Service GPRS support node

The SGSN is a component of the GPRS core network. It is the GPRS support node of Mobile Station (MS) service, and it can achieve mobility management and packet routing and transfer.

The location register function in the SGSN stores subscription information and location information for each subscriber registered in the SGSN.

Relationships

Source	Type	Target
Service GPRS support node	Generalization	Telecom active equipment
IfcMobileTelecommunicationsAppliance.SERVICE_GPRS_SUPPORT_NODE	Realization	Service GPRS support node

6.1.10.25 Tandem MSC signaling transfer point

TMSC is responsible for connecting and unblocking long-distance calls, incoming calls and transfer traffic in the mobile switching center service area.

Relationships

Source	Type	Target
Tandem MSC signaling transfer point	Generalization	Telecom active equipment

6.1.10.26 Transcoding rate adaptation unit

TRAU is the data rate conversion unit, which performs transcoding function for speech channels and RA (Rate Adaptation) for data channels in the GSM network between BSC and MSC.

Responsible for providing voice coding and rate adaptation between BSC and MSC and converting 16 kbit/s voice or data into 64 kbit/s data.

Relationships

Source	Type	Target
Transcoding rate adaptation unit	Generalization	Telecom active equipment

6.1.11 Railway natural disaster and Foreign object intrusion monitoring system

6.1.11.1 Class diagram Railway natural disaster and Foreign object intrusion monitoring system

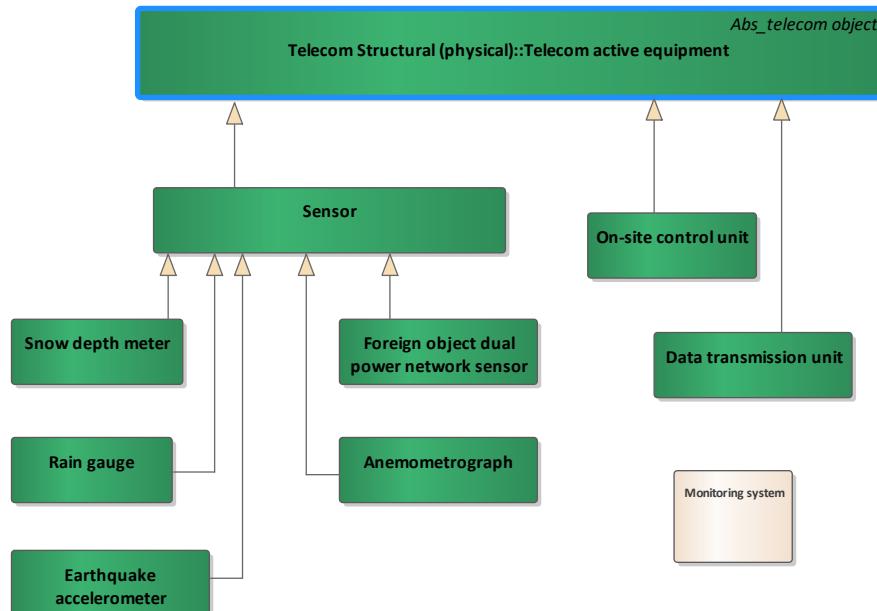


Table 63: Class diagram Railway natural disaster and Foreign object intrusion monitoring system

6.1.11.2 Monitoring system

Sensor-based system for building and infrastructure environmental monitoring and control.

Relationships

Source	Type	Target
Monitoring system	Realization	IfcDistributionSystem.MONIT ORINGSYSTEM

6.1.11.3 Anemometrograph

Device used to measure wind speed and direction.

Relationships

Source	Type	Target
Anemometrograph	Generalization	Sensor
Anemometrograph	Realization	IfcSensor.WINDSENSOR
Anemometrograph	Realization	IfcSensor.WINDSENSOR

Source	Type	Target
Anemometerograph	Realization	IfcSensorTypeEnum.WINDSENSOR

6.1.11.4 Data transmission unit

Device used to transfer data to on-site control unit, which can be fixed near the rain gauge, snow depth meter, foreign object dual power network sensor or earthquake accelerometer.

The data are amplified and modulated, and then sent to the on-site unit.

Relationships

Source	Type	Target
Data transmission unit	Realization	IfcCommunicationsAppliance.MODEM
Data transmission unit	Generalization	Telecom active equipment
Data transmission unit	Realization	IfcCommunicationsAppliance.MODEM
Data transmission unit	Realization	IfcCommunicationsApplianceTypeEnum.MODEM

6.1.11.5 Earthquake accelerometer

Device used to detect the seismic wave and measure the seismic intensity in case of earthquake.

Relationships

Source	Type	Target
Earthquake accelerometer	Realization	IfcSensor.EARTHQUAKESENSE
Earthquake accelerometer	Realization	IfcSensor.EARTHQUAKESENSE
Earthquake accelerometer	Generalization	Sensor
Earthquake accelerometer	Realization	IfcSensorTypeEnum.EARTHQUAKESENSOR

6.1.11.6 Foreign object dual power network sensor

Device which can alarm when foreign objects shock and break the dual power network.

Relationships

Source	Type	Target
Foreign object dual power network sensor	Realization	IfcSensor.FOREIGNOBJECTDETECTIONSENSOR
Foreign object dual power network sensor	Realization	IfcSensor.FOREIGNOBJECTDETECTIONSENSOR
Foreign object dual power network sensor	Generalization	Sensor
Foreign object dual power network sensor	Realization	IfcSensorTypeEnum.FOREIGNOBJECTDETECTIONSENSORS

6.1.11.7 On-site control unit

Device used to receive monitoring data from data transmission unit and send the monitoring data to central system, usually located in telecom equipment room.

Relationships

Source	Type	Target
On-site control unit	Generalization	Telecom active equipment
IfcController	Realization	On-site control unit
IfcController	Realization	On-site control unit
IfcController	Realization	On-site control unit

6.1.11.8 Rain gauge

Device used to collect and indicate rainfall related information.

Relationships

Source	Type	Target
Rain gauge	Realization	IfcSensorTypeEnum.RAINSENSENSOR
Rain gauge	Realization	IfcSensor.RAINSENSOR
Rain gauge	Generalization	Sensor
Rain gauge	Realization	IfcSensor.RAINSENSOR

6.1.11.9 Redundant array of independent disk

Redundant arrays of independent drives, used for data storage.

Relationships

Source	Type	Target
Redundant array of independent disk	Generalization	Telecom active equipment

6.1.11.10 Sensor

Supertype of all different kinds of sensors, collecting different kinds of information.

Relationships

Source	Type	Target
Sensor	Generalization	Telecom active equipment
Snow depth meter	Generalization	Sensor
Anemometerograph	Generalization	Sensor
Earthquake accelerometer	Generalization	Sensor
Rain gauge	Generalization	Sensor
Foreign object dual power network sensor	Generalization	Sensor

6.1.11.11 *Server*

Server is a device used to provide services for different telecommunication subsystems. Servers are widely used in order to permit data access and sharing among applications or devices.

Relationships

Source	Type	Target
Server	Generalization	Telecom active equipment

6.1.11.12 *Snow depth meter*

Device used to measure the depth of snowfall.

Relationships

Source	Type	Target
Snow depth meter	Generalization	Sensor
Snow depth meter	Realization	IfcSensor.SNOWDEPTHSEN SOR
Snow depth meter	Realization	IfcSensorTypeEnum.SNOWDEPTHSENSOR
Snow depth meter	Realization	IfcSensor.SNOWDEPTHSEN SOR

6.1.12 Relationships

6.1.12.1 *Fusion Splicing*

A relationship representing the act of joining two optical fibers end-to-end and fusing them together.

Relationships

Source	Type	Target
Fusion Splicing	Association	Fiber endpoint
Fiber endpoint	Association	Fusion Splicing

6.1.12.2 Junction

A relationship representing electric connection between cooper wires.

Relationships

Source	Type	Target
Junction	Association	Wire pair endpoint
Wire pair endpoint	Association	Junction

6.1.12.3 Laying Infrastructure Connection

A relationshipsip representing the connection of laying infrastructure such as tubes, gutters and ducts.

Relationships

Source	Type	Target
Laying Infrastructure Connection	Association	Telecom laying infrastructure connection point
Telecom laying infrastructure connection point	Association	Laying Infrastructure Connection

6.1.13 Support and laying infrastructure

6.1.13.1 Class diagram Support and laying infrastructure

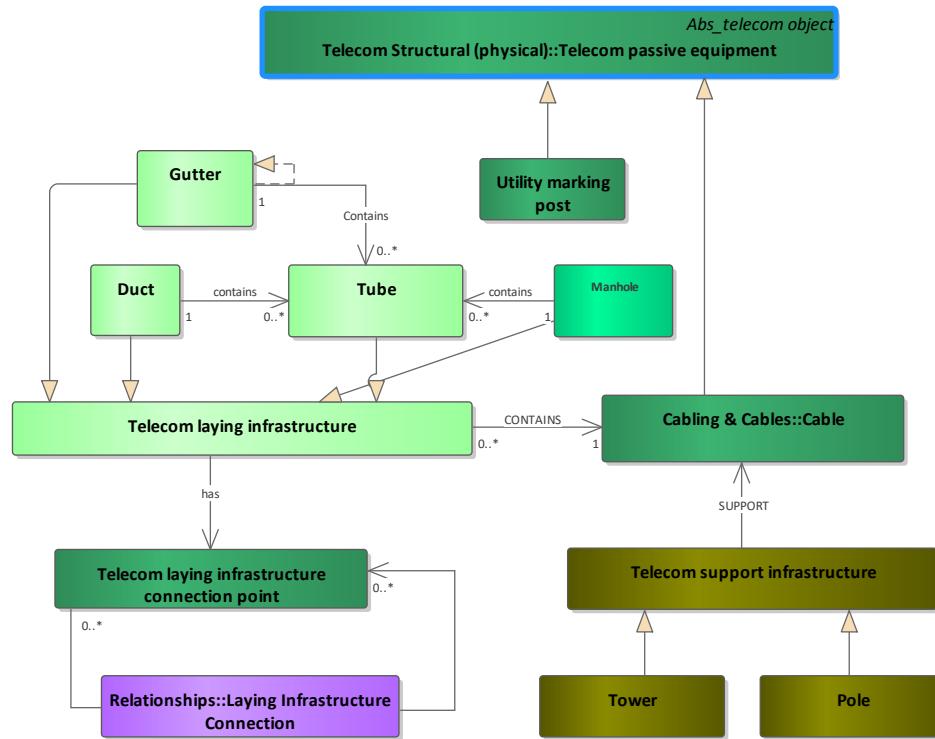


Table 64: Class diagram Support and laying infrastructure

6.1.13.2 Telecom laying infrastructure connection point

A joiner that connects two laying infrastructures such as ducts, gutters or tubes.

Relationships

Source	Type	Target
Telecom laying infrastructure connection point	Association	Laying Infrastructure Connection
Telecom laying infrastructure connection point	Realization	IfcCableCarrierFitting
Telecom laying infrastructure connection point	Realization	IfcCableCarrierFitting
Telecom laying infrastructure connection point	Realization	IfcCableCarrierFitting
Telecom laying infrastructure	Association	Telecom laying infrastructure connection point

Source	Type	Target
Laying Infrastructure Connection	Association	Telecom laying infrastructure connection point

6.1.13.3 Duct

A concrete/metallic/plastic duct that contains tubes and/or cables.

Relationships

Source	Type	Target
Duct	Generalization	Telecom laying infrastructure
Duct	Association	Tube
IfcDistributionChamberElement.FORMEDDUCT	Realization	Duct
IfcDistributionChamberElementTypeEnum.FORMEDDUCT	Realization	Duct
IfcDistributionChamberElement.FORMEDDUCT	Realization	Duct

6.1.13.4 Gutter

Metallic or plastic support for passing cables.

Relationships

Source	Type	Target
Gutter	Realization	IfcCableCarrierSegmentTypeEnum.CABLETRAYSEGMENT
Gutter	Association	Tube
Gutter	Generalization	Telecom laying infrastructure
Gutter	Realization	Gutter
Gutter	Realization	IfcCableCarrierSegment.CABLETRAYSEGMENT

Source	Type	Target
Gutter	Realization	IfcCableCarrierSegment.CABLESEGMENT
Gutter	Realization	Gutter

6.1.13.5 Telecom laying infrastructure

This class collects all the objects related to laying infrastructure aimed to support or contain cables.

Relationships

Source	Type	Target
Telecom laying infrastructure	Association	Telecom laying infrastructure connection point
Telecom laying infrastructure	Aggregation	Telecom laying infrastructure zone
Gutter	Generalization	Telecom laying infrastructure
Manhole	Generalization	Telecom laying infrastructure
Cable	Association	Telecom laying infrastructure
Duct	Generalization	Telecom laying infrastructure
Tube	Generalization	Telecom laying infrastructure

6.1.13.6 Manhole

Concrete covered opening used to install cable junctions or reserve cable.

Relationships

Source	Type	Target
Manhole	Realization	IfcDistributionChamberElement.TypeEnum.MANHOLE
Manhole	Generalization	Telecom laying infrastructure
Manhole	Realization	IfcDistributionChamberElement.MANHOLE
Manhole	Association	Tube

Source	Type	Target
Manhole	Realization	IfcDistributionChamberElement.MANHOLE

6.1.13.7 Pole

Metallic or concrete pole used to hold up cables or antennas.

Relationships

Source	Type	Target
Pole	Generalization	Telecom support infrastructure
IfcMember.POST	Realization	Pole
IfcMemberTypeEnum.POST	Realization	Pole
IfcMember.POST	Realization	Pole

6.1.13.8 Utility marking post

Concrete stake for cable location and route indication.

Relationships

Source	Type	Target
Utility marking post	Generalization	Telecom passive equipment
Utility marking post	Realization	IfcSign.PICTORAL
Utility marking post	Realization	IfcSign.PICTORAL
Utility marking post	Realization	IfcSignTypeEnum.PICTORAL

6.1.13.9 Telecom support infrastructure

A tall structure using for installing telecom devices such as antennas.

Relationships

Source	Type	Target
Telecom support infrastructure	Aggregation	Telecom infrastructure volume
Telecom support infrastructure	Realization	Pset_RailwayTelecomSupportingStructureReservation
Telecom active equipment	Association	Telecom support infrastructure
Pole	Generalization	Telecom support infrastructure
Tower	Generalization	Telecom support infrastructure
Cable	Association	Telecom support infrastructure

6.1.13.10 Tower

Metallic framed structure used to hold antennas or cables.

Relationships

Source	Type	Target
Tower	Realization	IfcElementAssemblyTypeEnum.MAST
Tower	Generalization	Telecom support infrastructure
Tower	Realization	IfcElementAssembly.MAST
Tower	Realization	IfcElementAssembly.MAST

6.1.13.11 Tube

Plastic or metallic tubes that contain cables.

Relationships

Source	Type	Target
Tube	Realization	IfcCableCarrierSegment.CON DUITSEGMENT
Tube	Generalization	Telecom laying infrastructure
Tube	Realization	IfcCableCarrierSegmentType Enum.CONDUITSEGMENT
Tube	Realization	IfcCableCarrierSegment.CON DUITSEGMENT
Gutter	Association	Tube
Manhole	Association	Tube
Duct	Association	Tube

6.1.14 Telecom interfaces

6.1.14.1 Class diagram Telecom interfaces

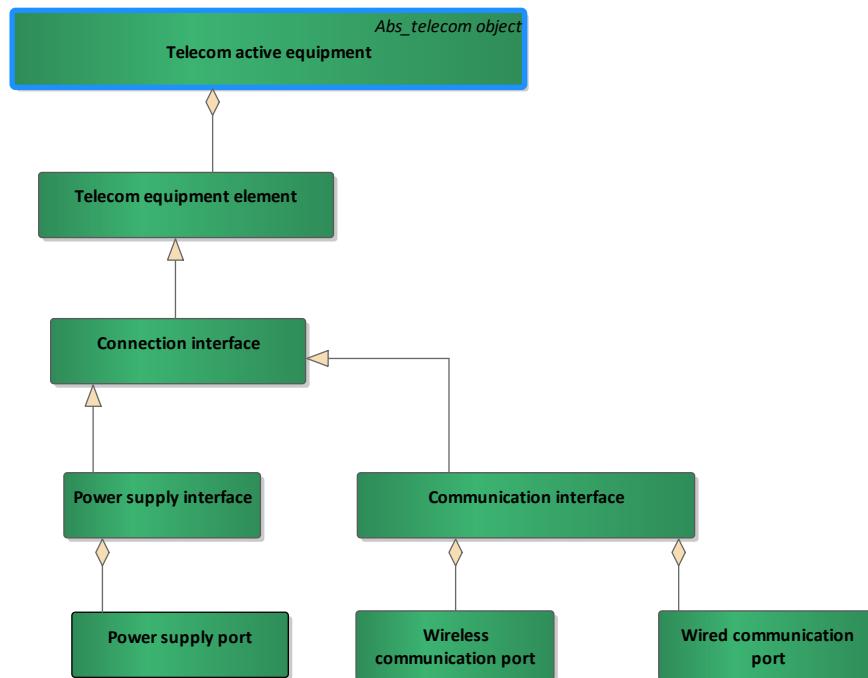


Table 65: Class diagram Telecom interfaces

6.1.14.2 Communication interface

An interface of an active telecom equipment, used for data input or output. It is a subtype of connection interface.

Relationships

Source	Type	Target
Communication interface	Generalization	Connection interface
Communication interface	Realization	IfcOutletTypeEnum.COMMUNICATIONSOUTLET
Communication interface	Realization	IfcOutlet.COMMUNICATIONSOUTLET
Communication interface	Realization	IfcOutlet.COMMUNICATIONSOUTLET
Wireless communication port	Aggregation	Communication interface
Wired communication port	Aggregation	Communication interface

6.1.14.3 Connection interface

An interface of an active telecom equipment, used for data input or output. It is a subtype of connection interface.

Relationships

Source	Type	Target
Connection interface	Generalization	Telecom equipment element
Communication interface	Generalization	Connection interface
Power supply interface	Generalization	Connection interface

6.1.14.4 Power supply interface

Power supply interface of a telecom active equipment, using which the equipment can be powered through power supply cables.

Relationships

Source	Type	Target
Power supply interface	Generalization	Connection interface
Power supply port	Aggregation	Power supply interface
IfcOutlet.POWEROUTLET	Realization	Power supply interface
IfcOutlet.POWEROUTLET	Realization	Power supply interface
IfcOutletTypeEnum.POWER OUTLET	Realization	Power supply interface

6.1.14.5 Power supply port

A subtype of power supply interface.

Relationships

Source	Type	Target
Power supply port	Aggregation	Power supply interface
Power supply port	Realization	IfcDistributionPort.CABLE
Power supply port	Association	Power Cable Connector
Power supply port	Realization	IfcDistributionPortTypeEnum. CABLE
Power supply port	Realization	IfcDistributionPort.CABLE

6.1.14.6 Wired communication port

Port of a telecom active equipment, used for wired connection.

Relationships

Source	Type	Target
Wired communication port	Realization	IfcDistributionPortTypeEnum. CABLE
Wired communication port	Realization	IfcDistributionPort.CABLE

Source	Type	Target
Wired communication port	Association	Telecom connector
Wired communication port	Aggregation	Communication interface
Wired communication port	Realization	IfcDistributionPort.CABLE

6.1.14.7 Wireless communication port

Port of a telecom active equipment, used for wireless connection.

Relationships

Source	Type	Target
Wireless communication port	Realization	IfcDistributionPortTypeEnum.WIRELESS
Wireless communication port	Realization	IfcDistributionPort.WIRELESS
Wireless communication port	Aggregation	Communication interface
Wireless communication port	Realization	IfcDistributionPort.WIRELESS

6.1.15 Ticketing system

6.1.15.1 Class diagram Ticketing system

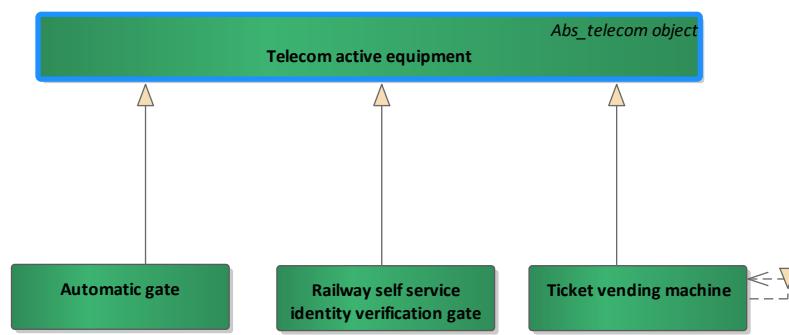


Table 66: Class diagram Ticketing system

6.1.15.2 Automatic gate

An equipment for ticket inspection and processing. Passengers are allowed or forbidden to pass according to the validity of tickets.

Relationships

Source	Type	Target
Automatic gate	Generalization	Telecom active equipment
IfcDoorTypeEnum.TURNSTILE LE	Realization	Automatic gate
IfcDoor.TURNSTILE	Realization	Automatic gate
IfcDoor.TURNSTILE	Realization	Automatic gate

6.1.15.3 Railway self service identity verification gate

Railway Self-service Identity Verification Gate:

An equipment for consistency check of tickets, id card and face image. Passengers are allowed or forbid to pass according to the check result.

Relationships

Source	Type	Target
Railway self service identity verification gate	Generalization	Telecom active equipment
IfcDoor.TURNSTILE	Realization	Railway self service identity verification gate
IfcDoor.TURNSTILE	Realization	Railway self service identity verification gate
IfcDoorTypeEnum.TURNSTILE LE	Realization	Railway self service identity verification gate

6.1.15.4 Ticket vending machine



A self-service device with functions of choosing ticket, payment and ticket making, etc. With this device, passengers can buy and collect tickets themselves.

Ticket vending machine shall provide a stable, reliable, friendly self-service environment for passengers to purchase or collect tickets conveniently and effectively.

Relationships

Source	Type	Target
Ticket vending machine	Generalization	Telecom active equipment
Ticket vending machine	Dependency	Ticket vending machine
IfcElectricAppliance.VENDIN GMACHINE	Realization	Ticket vending machine
Ticket vending machine	Dependency	Ticket vending machine
IfcElectricAppliance.VENDIN GMACHINE	Realization	Ticket vending machine
IfcElectricApplianceTypeEnum.VENDINGMACHINE	Realization	Ticket vending machine

6.1.16 Time and frequency synchronization system

6.1.16.1 Primary reference clock

Primary Reference Clock (Frequency).

Relationships

Source	Type	Target
Primary reference clock	Generalization	Telecom active equipment

6.1.16.2 Synchronization support unit

Synchronization Support Unit (Frequency).

Relationships

Source	Type	Target
Synchronization support unit	Generalization	Telecom active equipment

6.1.17 Wired access network

6.1.17.1 Class diagram Wired access network

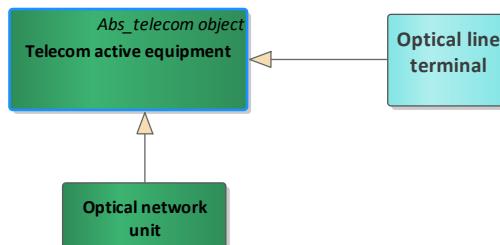


Table 67: Class diagram Wired access network

6.1.17.2 Optical line terminal

Terminal equipment for connecting fiber optic trunks.

Relationships

Source	Type	Target
Optical line terminal	Generalization	Telecom active equipment

6.1.17.3 Optical network unit

A kind of optical transmission network connection equipment which is installed at user side.

Relationships

Source	Type	Target
Optical network unit	Generalization	Telecom active equipment
IfcCommunicationsAppliance.OPTICALNETWORKUNIT	Realization	Optical network unit

Source	Type	Target
IfcCommunicationsAppliance.OPTICALNETWORKUNIT	Realization	Optical network unit

6.2 Telecom Spatial

6.2.1 Class diagram Telecom_Spatial_Model

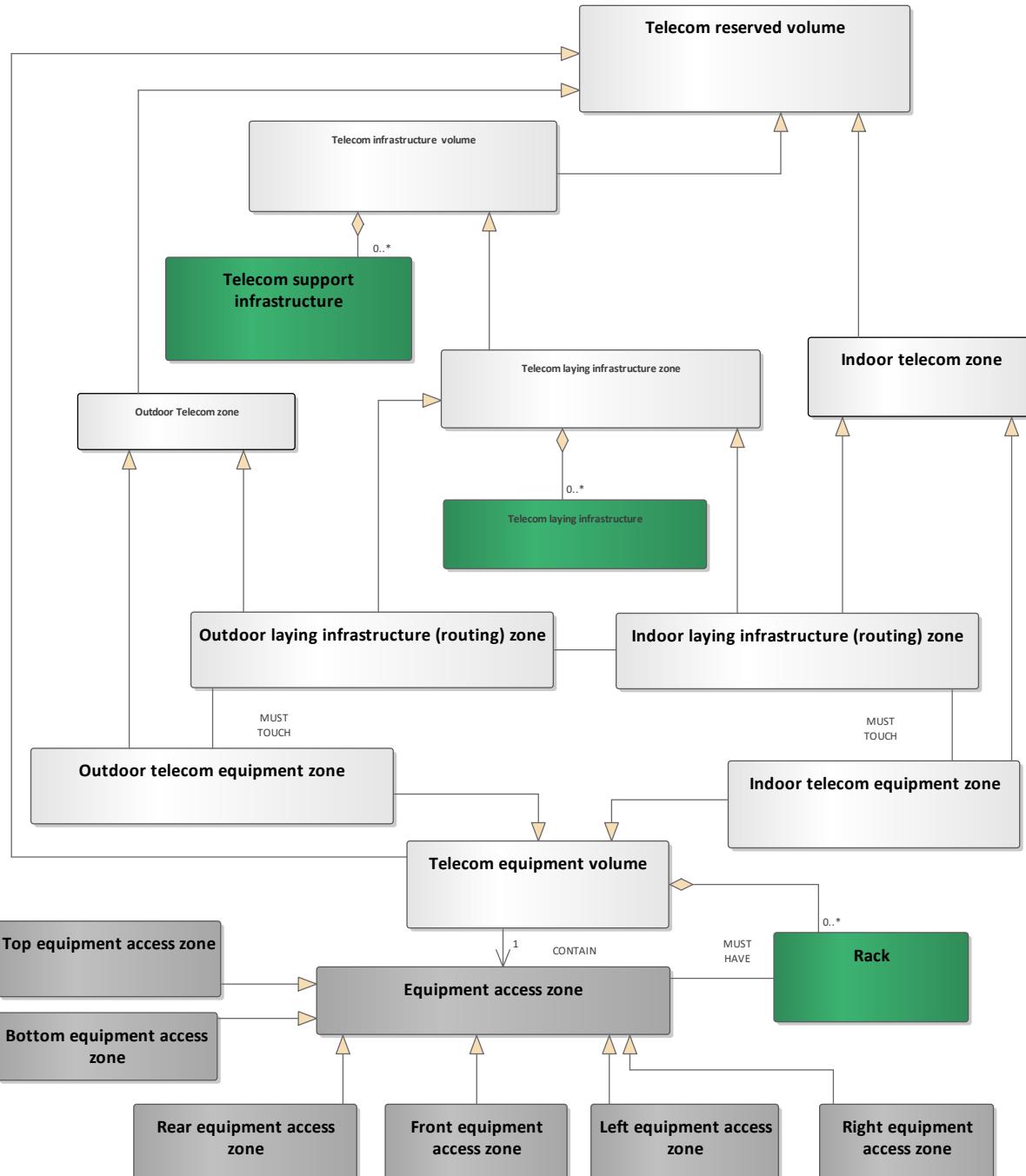


Table 68: Class diagram Telecom_Spatial_Model

6.2.2 Bottom equipment access zone

A space that allows to access to the equipment from the bottom side.

It is defined by the minimal distance that must be kept free in the bottom side of the equipment

Relationships

Source	Type	Target
Bottom equipment access zone	Generalization	Equipment access zone

6.2.3 Equipment access zone

Space that allows to access to the equipment. It is defined by the side, top, rear and front access zones.

Relationships

Source	Type	Target
Equipment access zone	Realization	Pset_RailwayTelecomEquipmentAccessReservation
Equipment access zone	Association	Rack
Bottom equipment access zone	Generalization	Equipment access zone
Telecom equipment volume	Association	Equipment access zone
Front equipment access zone	Generalization	Equipment access zone
Top equipment access zone	Generalization	Equipment access zone
Left equipment access zone	Generalization	Equipment access zone
Rear equipment access zone	Generalization	Equipment access zone
Right equipment access zone	Generalization	Equipment access zone

6.2.4 Front equipment access zone

A space that allows to access to the equipment from the front side.

It is defined by the minimal distance that must be kept free in the front side of the equipment

Relationships

Source	Type	Target
Front equipment access zone	Generalization	Equipment access zone

6.2.5 Indoor laying infrastructure (routing) zone

An indoor space that is reserved for laying Telecom cables, ducts, tubes, gutters or manholes

Relationships

Source	Type	Target
Indoor laying infrastructure (routing) zone	Generalization	Indoor telecom zone
Indoor laying infrastructure (routing) zone	Generalization	Telecom laying infrastructure zone
Indoor laying infrastructure (routing) zone	Association	Outdoor laying infrastructure (routing) zone
Indoor laying infrastructure (routing) zone	Realization	Pset_RailwayTelecomIndoor Cabling
Indoor telecom equipment zone	Association	Indoor laying infrastructure (routing) zone

6.2.6 Indoor telecom equipment zone

Indoor space that is reserved to install telecom equipment

Relationships

Source	Type	Target
Indoor telecom equipment zone	Generalization	Indoor telecom zone
Indoor telecom equipment zone	Realization	Pset_RailwayTelecomIndoor Reservation
Indoor telecom equipment zone	Generalization	Telecom equipment volume
Indoor telecom equipment zone	Association	Indoor laying infrastructure (routing) zone

Source	Type	Target
Indoor telecom equipment zone	Association	Telecom active equipment

6.2.7 Indoor telecom zone

Indoor space that is reserved to install telecom equipment and facilities

Relationships

Source	Type	Target
Indoor telecom zone	Generalization	Telecom reserved volume
Indoor telecom zone	Realization	Pset_RailwayTelecomIndoorReservation
Indoor laying infrastructure (routing) zone	Generalization	Indoor telecom zone
Indoor telecom equipment zone	Generalization	Indoor telecom zone

6.2.8 Left equipment access zone

A space that allows to access to the equipment from the left side.

It is defined by the minimal distance that must be kept free in the left side of the equipment

Relationships

Source	Type	Target
Left equipment access zone	Generalization	Equipment access zone

6.2.9 Outdoor laying infrastructure (routing) zone

Outdoor space that is reserved for laying telecom cables, ducts, tubes, gutters or manholes

Relationships

Source	Type	Target
Outdoor laying infrastructure (routing) zone	Generalization	Telecom laying infrastructure zone
Outdoor laying infrastructure (routing) zone	Realization	Pset_RailwayTelecomOutdoorCabling
Outdoor laying infrastructure (routing) zone	Generalization	Outdoor Telecom zone
Outdoor laying infrastructure (routing) zone	Association	Outdoor telecom equipment zone
Indoor laying infrastructure (routing) zone	Association	Outdoor laying infrastructure (routing) zone

6.2.10 Outdoor telecom equipment zone

Outdoor space that is reserved to install telecom equipment

Relationships

Source	Type	Target
Outdoor telecom equipment zone	Generalization	Outdoor Telecom zone
Outdoor telecom equipment zone	Generalization	Telecom equipment volume
Outdoor telecom equipment zone	Realization	Pset_RailwayTelecomOutdoorReservation
Outdoor laying infrastructure (routing) zone	Association	Outdoor telecom equipment zone

6.2.11 Outdoor Telecom zone

An outdoor space that is reserved to install Telecom equipments and facilities

Relationships

Source	Type	Target
Outdoor Telecom zone	Generalization	Telecom reserved volume

Source	Type	Target
Outdoor laying infrastructure (routing) zone	Generalization	Outdoor Telecom zone
Outdoor telecom equipment zone	Generalization	Outdoor Telecom zone

6.2.12 Rear equipment access zone

A space that allows to access to the equipment from the rear side.

It is defined by the minimal distance that must be kept free in the rear side of the equipment

Relationships

Source	Type	Target
Rear equipment access zone	Realization	Pset_RailwayTelecomEquipmentAccessReservation
Rear equipment access zone	Generalization	Equipment access zone

6.2.13 Right equipment access zone

A space that allows to access to the equipment from the right side.

It is defined by the minimal distance that must be kept free in the right side of the equipment

Relationships

Source	Type	Target
Right equipment access zone	Realization	Pset_RailwayTelecomEquipmentAccessReservation
Right equipment access zone	Generalization	Equipment access zone

6.2.14 Telecom laying infrastructure zone

Space that is reserved for laying telecom cables.

Relationships

Source	Type	Target
Telecom laying infrastructure zone	Realization	Pset_RailwayTelecomInfrastructureReservation
Telecom laying infrastructure zone	Generalization	Telecom infrastructure volume
Indoor laying infrastructure (routing) zone	Generalization	Telecom laying infrastructure zone
Outdoor laying infrastructure (routing) zone	Generalization	Telecom laying infrastructure zone
Telecom laying infrastructure	Aggregation	Telecom laying infrastructure zone

6.2.15 Top equipment access zone

A space that allows to access to the equipment from the top side.

It is defined by the minimal distance that must be kept free in the top side of the equipment

Relationships

Source	Type	Target
Top equipment access zone	Generalization	Equipment access zone
Top equipment access zone	Realization	Pset_RailwayTelecomEquipmentAccessReservation

7 Common - Shared

This Package contents all the classes which are candidate for common schema and shared elements.
Currently it contents:

- The proposal for alignment
- The overview of possible instances of alignments and dependent linear reference systems for rail

- The possible positionings for objects which can be used as data types
- The definition of domain specific spatial structures

7.1 Positioning

7.1.1 Class diagram "Positioning"

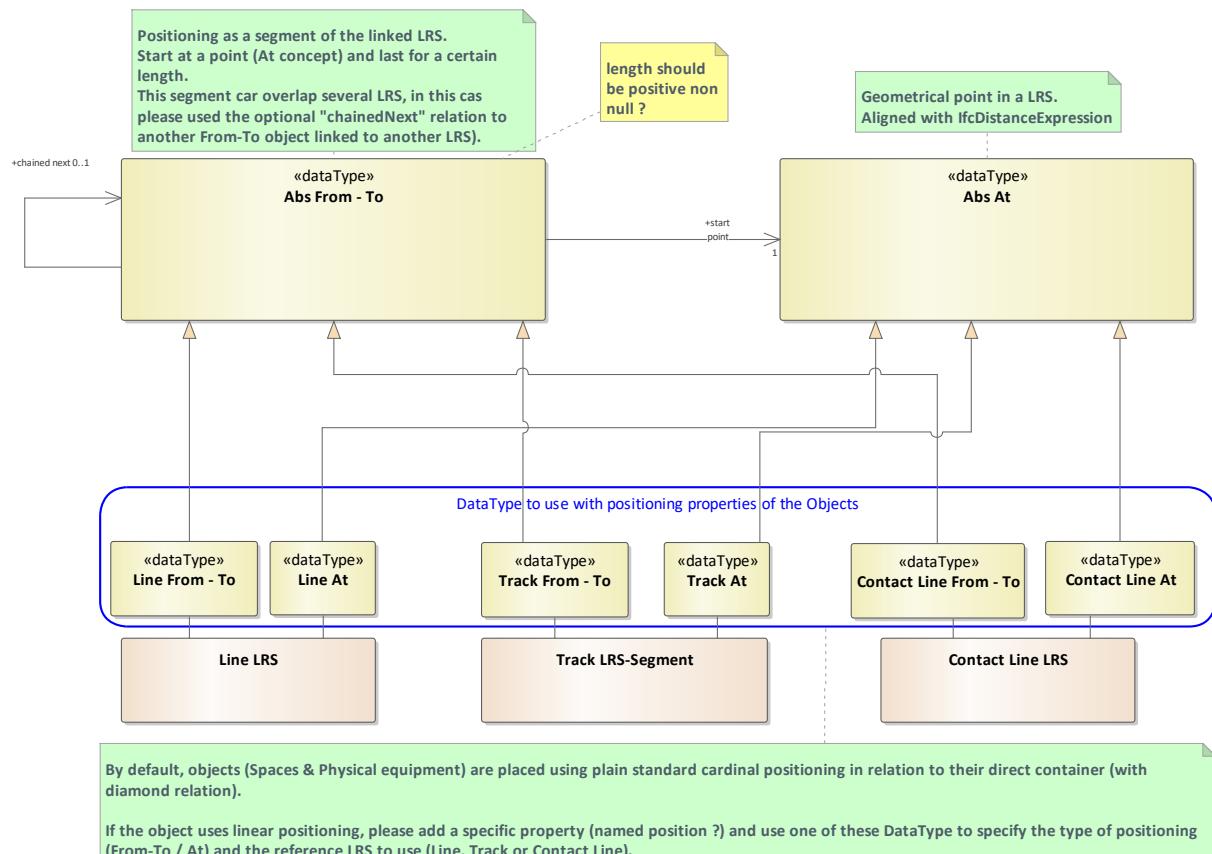


Table 69: Class diagram "Positioning"

7.1.2 Abs At

Abstracted At Data Type used to gather common properties used by all usage of the At (point-based type) positioning.

Relationships

Source	Type	Target
Line At	Generalization	Abs At

Source	Type	Target
Track At	Generalization	Abs At
Abs From - To	Association	Abs At
Contact Line At	Generalization	Abs At

7.1.3 Abs From - To

Abstracted From-To DataType used to gather common properties used by all usage of the From - To (segment type) positioning.

Relationships

Source	Type	Target
Abs From - To	Association	Abs At
Abs From - To	Association	Abs From - To
Line From - To	Generalization	Abs From - To
Contact Line From - To	Generalization	Abs From - To
Track From - To	Generalization	Abs From - To
Abs From - To	Association	Abs From - To

7.1.4 Contact Line At

DataType to specify a point-based positioning relative to the Line.

Relationships

Source	Type	Target
Contact Line At	Association	Contact Line LRS
Contact Line At	Generalization	Abs At

7.1.5 Contact Line From - To



DataType to specify a linear positioning relative to the Contact Line.

Relationships

Source	Type	Target
Contact Line From - To	Association	Contact Line LRS
Contact Line From - To	Generalization	Abs From - To

[7.1.6 Line At](#)

DataType to specify a point-based positioning relative to the Line.

Relationships

Source	Type	Target
Line At	Generalization	Abs At
Line At	Association	Line LRS

[7.1.7 Line From - To](#)

DataType to specify a linear positioning relative to the Line.

Relationships

Source	Type	Target
Line From - To	Generalization	Abs From - To
Line From - To	Association	Line LRS

[7.1.8 Track At](#)

DataType to specify a point-based positioning relative to the Line.

Relationships

Source	Type	Target
Track At	Generalization	Abs At
Track At	Association	Track LRS-Segment

7.1.9 Track From - To

Data Type to specify a linear positioning relative to the Track.

Relationships

Source	Type	Target
Track From - To	Association	Track LRS-Segment
Track From - To	Generalization	Abs From - To

7.2 LRS & Alignment

7.2.1 Class diagram "LRS & Alignment"

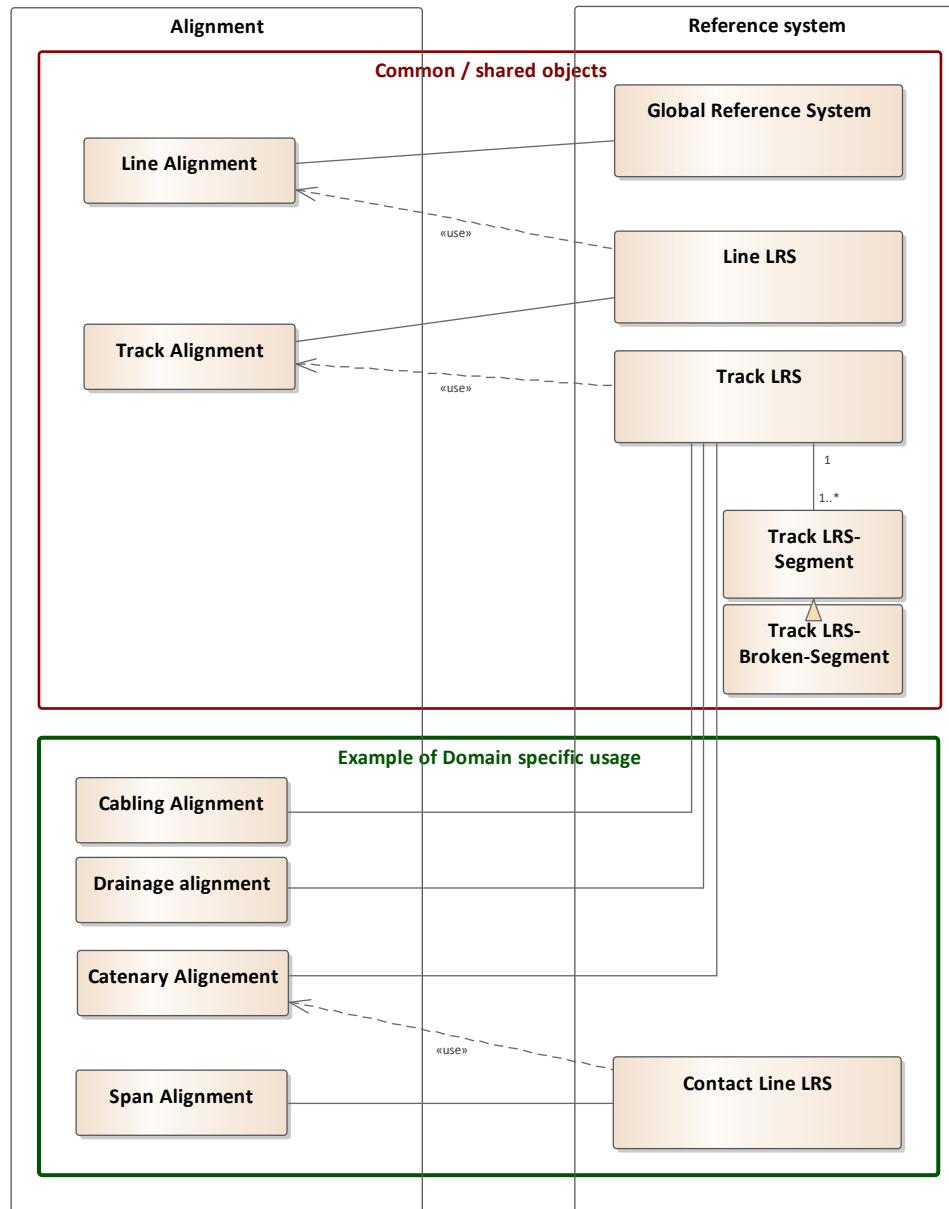


Table 70: Class diagram "LRS & Alignment"

7.2.2 Global Reference System

The Global position of the project in the World Geode.

Relationships

Source	Type	Target
Line Alignment	Association	Global Reference System

7.2.3 Line Alignment

This alignment represents the center of the railway.

Needed for early design to place the railway in its surrounding.

Relationships

Source	Type	Target
Line Alignment	Association	Global Reference System
Line LRS	Usage	Line Alignment

7.2.4 Line LRS

This Linear Reference System is based on the railway alignment and provides a gross, human useful reference system to place some infrastructures (station, bridges, tunnel) and the tracks.

Relationships

Source	Type	Target
Line LRS	Usage	Line Alignment
Line LRS	Association	Track Alignment
Line At	Association	Line LRS
Line From - To	Association	Line LRS

7.2.5 Track Alignment

Precise alignment of the track (center top of rail) calculated in respect with speed, tonnage and capacity planned in the project.

Relationships

Source	Type	Target
Line LRS	Association	Track Alignment
Track LRS	Usage	Track Alignment

7.2.6 Track LRS

Linear Reference System based on the track alignment, used to place some of the trackside objects commonly used within railway.

Relationships

Source	Type	Target
Track LRS	Association	Catenary Alignment
Track LRS	Realization	IfcAlignment
Track LRS	Association	Plain track super structure
Track LRS	Association	Track-Edge
Track LRS	Usage	Track Alignment
Access shaft	Association	Track LRS
Track substructure	Association	Track LRS
Cabling Alignment	Association	Track LRS
Track LRS-Segment	Association	Track LRS
Drainage alignment	Association	Track LRS
Drain pipe	Association	Track LRS
Drain channel	Association	Track LRS
Dilatation superstructure	Association	Track LRS
Specifications	Association	Track LRS

7.2.7 Track LRS-Segment

Linear Reference System based on the track alignment, used to place some of the trackside objects commonly used within railway.

Relationships

Source	Type	Target
Track LRS-Segment	Association	Track LRS
Track From - To	Association	Track LRS-Segment
Track At	Association	Track LRS-Segment
Track LRS-Broken-Segment	Generalization	Track LRS-Segment

7.2.8 Track LRS-Broken-Segment

Linear Reference System based on the track alignment, used to place some of the trackside objects commonly used within railway.

Relationships

Source	Type	Target
Track LRS-Broken-Segment	Generalization	Track LRS-Segment

7.2.9 Cabling Alignment

Example alignment base on the track LRS to position cable aside of the tracks.

Relationships

Source	Type	Target
Cabling Alignment	Association	Track LRS

7.2.10 Catenary Alignment

Alignment of the contact line based on the track LRS and calculated with external constraints (bridge / tunnel crossing).

Relationships

Source	Type	Target
Track LRS	Association	Catenary Alignment
Contact Line LRS	Usage	Catenary Alignment

[7.2.11 Contact Line LRS](#)

Linear Reference System based on the catenary Alignment and used to precisely specify the place of real contact line depending the mast implementation.

Relationships

Source	Type	Target
Contact Line LRS	Usage	Catenary Alignment
Contact Line At	Association	Contact Line LRS
Contact Line From - To	Association	Contact Line LRS
Span Alignment	Association	Contact Line LRS

[7.2.12 Drainage alignment](#)

Example alignment of drainage to evacuate water near the tracks.

Relationships

Source	Type	Target
Drainage alignment	Association	Track LRS

[7.2.13 Span Alignment](#)

Very precise traveling of the contact line during span, based on the contact line LRS and mast positions.

Relationships

Source	Type	Target
Span Alignment	Association	Contact Line LRS

7.3 Alignment Proposal

This class model describes the requirements for alignment for the rail domain. The model is structured in such a way that several classes are also valid for other domains (i.e. road) if not specified as railway.

7.3.1 Principles

In the field of railway the term alignment is usually used for the description of several geometries i.e. track centreline, catenary line, ...and for associated linear reference systems.

The requirements for the geometries are specifically defined in the alignment proposal as where the requirements for the linear referencing are defined in the chapters "LRS & Alignment" and "Positioning".

7.3.1.1 Principles diagram

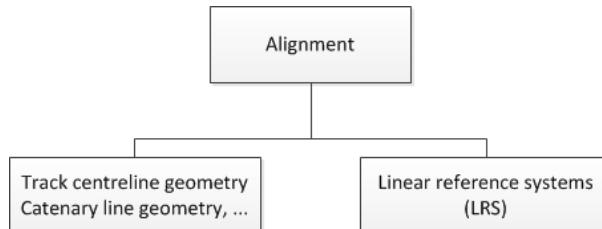


Table 71: Principles diagram

7.3.2 Overview

The class diagram distinguishes the parameterized description of alignment curves from the discretized representation.

7.3.2.1 Class diagram "Alignment (IFC Rail)"

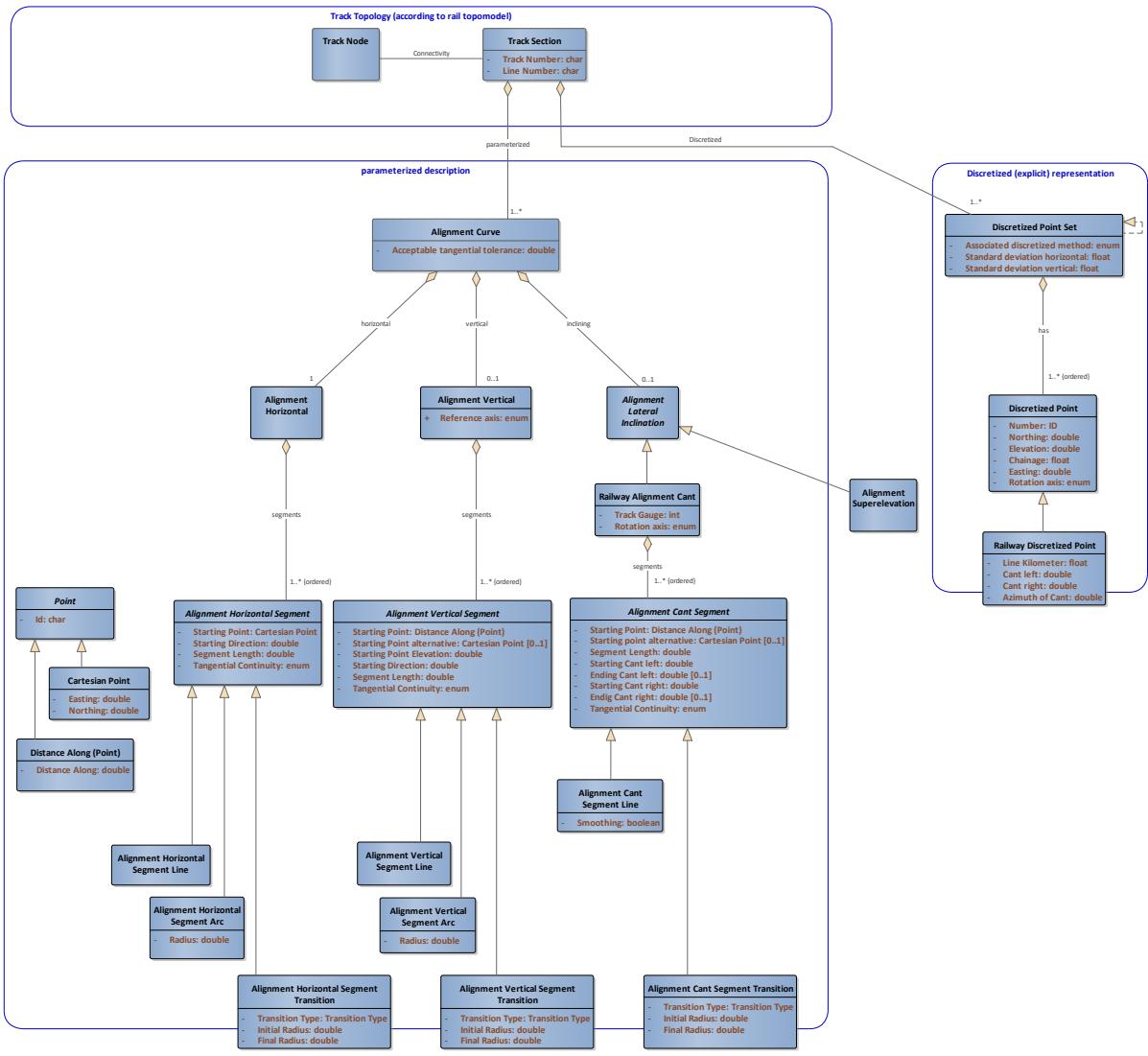


Table 72: Class diagram "Alignment (IFC Rail)"

7.3.3 Parameterized description

Package for the parameterized description of the alignment.

7.3.3.1 Alignment Curve

The alignment curve is a parameterized space curve which represents the geometry of any track section. It is defined by three alignments (= layouts), which are to be regarded as independent from each other:

1. an horizontal alignment (2D)
2. a vertical alignment (1D)
3. a cant alignment (1D) (synonym = superelevation)

Each of these three alignments is defined by a sequence of ordered geometric segments composed of various geometry types that are linked together in a chain.

Relationships

Source	Type	Target
Alignment Curve	Aggregation	Track Section
Alignment Vertical	Aggregation	Alignment Curve
IfcAlignment	Realization	Alignment Curve
Alignment Lateral Inclination	Aggregation	Alignment Curve
IfcAlignment	Realization	Alignment Curve
IfcAlignment	Realization	Alignment Curve
Alignment Horizontal	Aggregation	Alignment Curve

7.3.3.2 Alignment Horizontal

The horizontal alignment is composed of geometric segments with the following three geometry types:

- straight line
- arc of a circle
- transition curve

The horizontal alignment delivers the metric for the linear reference system used to position the vertical alignment segments and the cant segments.

The tolerance limits for lengthwise, crosswise and angle errors must be kept. Otherwise the chain will not be deemed to be linked together. If no absolute coordinates are known, the initial coordinates of the geometric elements are entered as (0,0) or using less precise coordinates (graphical coordinates) in the geodetic reference system. The type of geodetic reference system and/or the map projection must be given. The measurement respectively the calculation date must be stated.

Relationships

Source	Type	Target
Alignment Horizontal	Aggregation	Alignment Curve
IfcAlignmentHorizontal	Realization	Alignment Horizontal
IfcAlignmentHorizontal	Realization	Alignment Horizontal
Alignment Horizontal Segment	Aggregation	Alignment Horizontal
IfcAlignmentHorizontal	Realization	Alignment Horizontal

7.3.3.3 Alignment Horizontal Segment

Geometric segments are used to define the horizontal alignment. The segments are ordered. Each horizontal segment is defined with:

- a starting point known by its cartesian coordinates
- the starting direction in form of an azimuth [gon] or alternatively [rad](radian).
- the segment length in [m]
- the information on how the segment is connected to the following segment. This information is used to describe possible discontinuities (e.g. if there is a horizontal bend).

Additionally:

- a radius, for arc segments
- an initial and final radius for transition segments as well as the type of transition curve. Some transition curves require additional parameters.

Relationships

Source	Type	Target
Alignment Horizontal Segment	Aggregation	Alignment Horizontal
Alignment Horizontal Segment Arc	Generalization	Alignment Horizontal Segment
Alignment Horizontal Segment Line	Generalization	Alignment Horizontal Segment

Source	Type	Target
Alignment Horizontal Segment Transition	Generalization	Alignment Horizontal Segment

7.3.3.4 Alignment Horizontal Segment Line

Geometric primitive. All required attributes are defined in the class "Alignment Horizontal Segment".

Relationships

Source	Type	Target
Alignment Horizontal Segment Line	Generalization	Alignment Horizontal Segment
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Line
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Line
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Line

7.3.3.5 Alignment Horizontal Segment Arc

Geometric primitive for Arc of circle.

Attributes are defined in the class "Alignment Horizontal Segment" except the radius..

Relationships

Source	Type	Target
Alignment Horizontal Segment Arc	Generalization	Alignment Horizontal Segment
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Arc
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Arc
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Arc

7.3.3.6 Alignment Horizontal Segment Transition

Geometric primitive for transition curves.

Attributes are defined in the class "Alignment Horizontal Segment" except the type of transition curve and initial and final radius..

Relationships

Source	Type	Target
Alignment Horizontal Segment Transition	Generalization	Alignment Horizontal Segment
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Transition
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Transition
IfcAlignmentHorizontalSegment	Realization	Alignment Horizontal Segment Transition

7.3.3.7 Alignment Vertical

The vertical alignment is composed of geometric segments with the following three geometry types:

- Straight line (= constant gradient)
- Segment arc
- Transition curves

The tolerance limits for the vertical offset and angle errors (= abrupt change of the gradient) must be kept to, otherwise the chain will be deemed to be broken.

The vertical alignment can either follow the track axis or the lower or the upper rail.

Relationships

Source	Type	Target
Alignment Vertical	Aggregation	Alignment Curve
Alignment Vertical Segment	Aggregation	Alignment Vertical
IfcAlignmentVertical	Realization	Alignment Vertical
IfcAlignmentVertical	Realization	Alignment Vertical
IfcAlignmentVertical	Realization	Alignment Vertical

7.3.3.8 Alignment Vertical Segment

Geometric segments are used to define the vertical alignment. The segments are ordered. Each vertical segment is defined with:

- a starting point known by its distance along the horizontal alignment [m]
- the starting point elevation in [m]
- the starting direction as a gradient [%]
- the segment length in [m]
- the information on how the segment is connected to the following segment. This information is used to describe possible discontinuities (e.g. if there is a vertical bend).

Additionally:

- a radius, for arc segments [m]
- the initial and final radius for transition segments as well as the type of transition curve. Some transition curves require additional parameters.

The elevation (= Cartesian Z-coordinate) of the starting point, the segment length and the starting gradient are defined for each geometric element.

Relationships

Source	Type	Target
Alignment Vertical Segment	Aggregation	Alignment Vertical
Alignment Vertical Segment Transition	Generalization	Alignment Vertical Segment
Alignment Vertical Segment Arc	Generalization	Alignment Vertical Segment

Source	Type	Target
Alignment Vertical Segment Line	Generalization	Alignment Vertical Segment

7.3.3.9 Alignment Vertical Segment Line

Geometric primitive. All required attributes are defined in the class "Alignment Vertical Segment".

Relationships

Source	Type	Target
Alignment Vertical Segment Line	Generalization	Alignment Vertical Segment
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Line
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Line
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Line

7.3.3.10 Alignment Vertical Segment Arc

Geometric primitive for Arc of circle.

Attributes are defined in the class "Alignment Vertical Segment" except the radius..

Relationships

Source	Type	Target
Alignment Vertical Segment Arc	Generalization	Alignment Vertical Segment
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Arc
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Arc

Source	Type	Target
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Arc

7.3.3.11 Alignment Vertical Segment Transition

Geometric primitive for transition curves.

Attributes are defined in the class "Alignment Vertical Segment" except the type of transition curve and initial and final radius..

Relationships

Source	Type	Target
Alignment Vertical Segment Transition	Generalization	Alignment Vertical Segment
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Transition
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Transition
IfcAlignmentVerticalSegment	Realization	Alignment Vertical Segment Transition

7.3.3.12 Alignment Lateral Inclination

Abstract class as a placeholder for railway cant or road superelevation.

Relationships

Source	Type	Target
Alignment Lateral Inclination	Aggregation	Alignment Curve
Alignment Superelevation	Generalization	Alignment Lateral Inclination
Railway Alignment Cant	Generalization	Alignment Lateral Inclination

7.3.3.13 Railway Alignment Cant

The railway cant alignment is composed of geometric segments with the two following geometry types

- Straight line for constant cant or constant change of cant
- Transition curve for curved cant

Relationships

Source	Type	Target
Railway Alignment Cant	Generalization	Alignment Lateral Inclination
IfcAlignmentCant	Realization	Railway Alignment Cant
IfcAlignmentCant	Realization	Railway Alignment Cant
IfcAlignmentCant	Realization	Railway Alignment Cant
Alignment Cant Segment	Aggregation	Railway Alignment Cant

7.3.3.14 Alignment Cant Segment

Geometric segments are used to define the railway cant. The segments are ordered. Each cant segment is defined with:

- a starting point known by its distance along the horizontal alignment [m]
- the segment length in [m]
- the start cant value in [mm]
- the end cant value in [mm]
- the information on how the segment is connected to the following segment. This information is used to describe possible discontinuities (e.g. invalid sudden change of cant or missing cant information if end point and starting point differ over a threshold).

Additionally:

- an information which describes if a smoothing was applied between two cant segments

Relationships

Source	Type	Target
Alignment Cant Segment	Aggregation	Railway Alignment Cant
Alignment Cant Segment Line	Generalization	Alignment Cant Segment
Alignment Cant Segment Transition	Generalization	Alignment Cant Segment

7.3.3.15 Alignment Cant Segment Line

Geometric primitive. All needed attributes are defined in the class "Alignment Cant Segment".

Relationships

Source	Type	Target
Alignment Cant Segment Line	Generalization	Alignment Cant Segment
IfcAlignmentCantSegment	Realization	Alignment Cant Segment Line
IfcAlignmentCantSegment	Realization	Alignment Cant Segment Line
IfcAlignmentCantSegment	Realization	Alignment Cant Segment Line

7.3.3.16 Alignment Cant Segment Transition

Geometric primitive for transition curves.

Attributes are defined in the class "Alignment Cant Segment" except the type of transition curve and initial and final radius.

Relationships

Source	Type	Target
Alignment Cant Segment Transition	Generalization	Alignment Cant Segment
IfcAlignmentCantSegment	Realization	Alignment Cant Segment Transition
IfcAlignmentCantSegment	Realization	Alignment Cant Segment Transition

Source	Type	Target
IfcAlignmentCantSegment	Realization	Alignment Cant Segment Transition

7.3.3.17 Alignment Superelevation

Class as placeholder for the requirements of IFC-Road.

Relationships

Source	Type	Target
Alignment Superelevation	Generalization	Alignment Lateral Inclination

7.3.3.18 Transition Type

Type of transition curves.

Relationships

7.3.4 Discretized representation

Package for the discretized description of the alignment.

7.3.4.1 Discretized Point Set

Class for grouping a set of discretized points. Each point set represents a track axis alignment. The alignment curve is a non-parameterized space curve that follows the ordered sequence of discretized points by straight lines (or splines) between consecutive points. This is an alternative representation the geometry of any track section described in the parameterized description.

Relationships

Source	Type	Target
Discretized Point Set	Aggregation	Track Section

Source	Type	Target
Discretized Point Set	Realization	Discretized Point Set
Discretized Point	Aggregation	Discretized Point Set
Discretized Point Set	Realization	Discretized Point Set

7.3.4.2 Discretized Point

Elementary point as part of an ordered point set.

Relationships

Source	Type	Target
Discretized Point	Aggregation	Discretized Point Set
Railway Discretized Point	Generalization	Discretized Point

7.3.4.3 Railway Discretized Point

Additional attributes specially needed for rail.

Relationships

Source	Type	Target
Railway Discretized Point	Generalization	Discretized Point

7.3.5 Topology reference

7.3.5.1 Track Node

Relationships

Source	Type	Target
Track Node	Association	Track Section

7.3.5.2 Track Section

Relationships

Source	Type	Target
Track Node	Association	Track Section
Discretized Point Set	Aggregation	Track Section
Alignment Curve	Aggregation	Track Section