IFC Rail Project

WP3 – Mapping Diagrams Report

Diagrams of mapping from Conceptual model to Harmonized IFC UML model

Status: 1.0

Date: 23. Apr. 2020

Authors: IFC Rail Project

Contents

Executive Summary

The present document is a part of the official deliverables of the IFC Rail Project (Phase I), as shown in Figure 1 below. Please refer to the IFC Rail – Final Reprt document for further details.

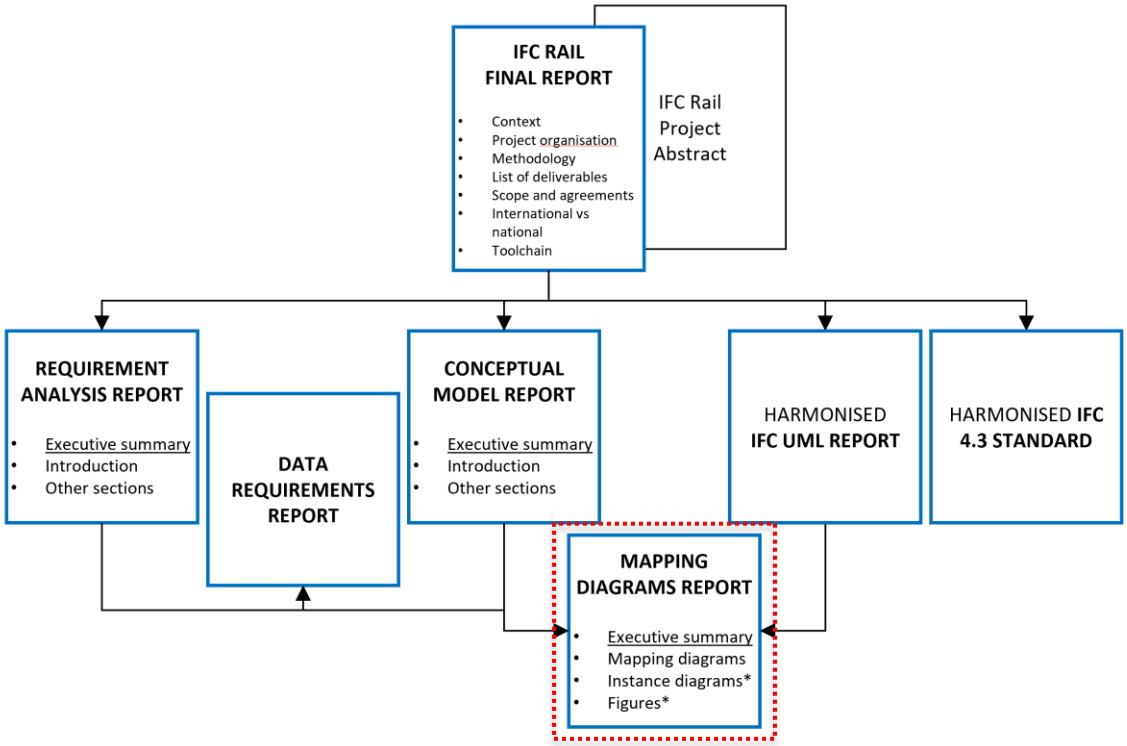


Figure 1 – IFC Rail documentation structure

This document represents one of the outcomes of the mapping activity performed by the Modelling Team of the Technical Service, with the help of the Domain Experts.

It contains all the diagrams representing the mapping between the Railway concepts and the IFC concepts, either existing or to be added to the current version of the standard. For this reason, to be fully understood it requires that both the input to this document are well known (Conceptual Model Report and Harmonized IFC UML Report) – as depicted in the diagram above.

A brief introduction explains the rules and conventions adopted by the Modelling Team when drawing the diagrams. This section shall support all Railway Experts (as any other subject not involved in the modelling activity) to read and understand the proposal.

Then, one paragraph per domain is reported. A chapter is dedicated to the mapping of two major proposal of the IFC Rail Project: (i) the Alignment extension, which include the railway cant; (ii) the Spatial Structure extension proposal. All these are inside the chapter “Common – Shared mapping diagrams”

NOTE: As the Conceptual Model Report, this document covers only the objects subject to Priority 1 (see the document IFC Rail – Final Report for further details).

1 Introduction[1]

The Harmonized IFC UML model is Platform Specific Model (PSM) made by IFC Rail Project, IFC Common Schema Project, IFC Road Project and IFC Ports & Waterways Project, and it is the result of two main activities, that run in parallel:

1. **The IFC extension proposal**, in which new IFC Concepts are proposed;
    a. The result of this activity is captured inside the document "Harmonized IFC UML Report"
2. **The IFC mapping**, in which rail Concepts are linked to existing/proposed IFC Concepts;
    a. The result of this activity is captured inside the present document, "IFC Rail Mapping Diagrams Report".

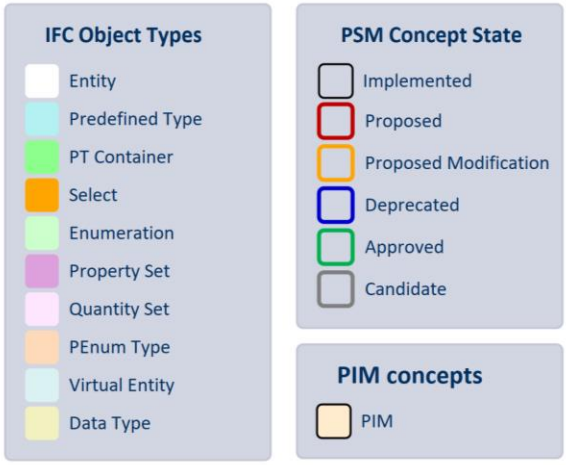
As per modelling rules, **every object mapped toward IFC must be explicitly represented in a diagram**. This is because the diagrams serve two purposes:

1. Support the extension of the IFC specification (mainly the EXPRESS schema);
2. Support railway experts to map their business objects toward the IFC standard, when needed.

NOTE: This document contains only the diagrams related to the bullet (2). For bullet (1), please refer to the Harmonized UML Report.

1.1 Colour Coding

All diagrams reported in this document follows the same convention as shown in the legend below. Details are explained in Section 1.1.1, 1.1.2 and 1.1.3.



1.1.1 IFC Object Types (PSM Colour Coding)

Semantic colour coding of elements is applied to the ***BACKGROUND*** of the object. **Error! Reference s ource not found.** provides a summary of the following clauses.

4.2.3.1. IFC entities (no stereotype) are coloured with ***WHITE*** background.

4.2.3.2. IFC predefined types (stereotype <<PredefinedType>>) are coloured with ***LIGHT CYAN*** background.

[1] Large parts of this chapter are from UML Modeling Guideline, which is common deliverable of bSI InfraRoom and RailwayRoom.

4.2.3.3. IFC predefined type containers (stereotype <<PTContainer>>) are coloured with ***GREEN*** background.

4.2.3.4. IFC virtual entities (stereotype <<VirtualEntity>>) are coloured with ***VERY LIGHT CYAN*** background.

4.2.3.5. IFC selects (stereotype <<Select>>) are coloured with ***ORANGE*** background.

4.2.3.6. IFC enumerations (stereotype <<Enumeration>>) are coloured with ***LIGHT GREEN*** background.

4.2.3.7. IFC property set enumerations (stereotype <<PEnumType>>) are coloured with ***LIGHT ORANGE*** background

4.2.3.8. IFC property sets (stereotype <<PropertySet>>) are coloured with ***MAGENTA*** background.

4.2.3.9. IFC quantity sets (stereotype <<QuantitySet>>) are coloured with ***LIGHT MAGENTA*** background.

4.2.3.10. IFC data types (stereotype <<Datatype>>) are coloured with ***YELLOW*** background.

Table 1 - Colour coding for elements of the platform specific model for IFC (PSM-IFC)

Status Definition	Colour	RGB Definition (Decimal)
IFC Entities	WHITE	{255, 255, 255}
IFC Predefined types	LIGHT CYAN	{179, 242, 242}
IFC Predefined Type Container	GREEN	{140, 255, 140}
IFC Virtual entities	VERY LIGHT CYAN	{217, 242, 242}
IFC Selects	ORANGE	{255, 165, 0}
IFC Enumerations	LIGHT GREEN	{204, 255, 204}
IFC property set enumeration	LIGHT ORANGE	{255, 218, 185}
IFC Property sets	MAGENTA	{221, 160, 221}
IFC Quantity sets	LIGHT MAGENTA	{255, 230, 255}
IFC Data types	YELLOW	{242,242,192}

1.1.2 Status Types Colour Coding

To manage status of Concepts (both in the PIM & PSM) the following status definitions shall be used:

- **WIP**: applies to elements that are in development and not fit for review.
- **Proposed**: applies to new elements added to the model.
- **Proposed Modification**: applies to existing elements that need to be changed (existing elements are those that have reached approved, Candidate or Implemented status within the model.
- **Approved**: applies to elements that have gone through expert panel review.
- **Candidate**: applies to elements that are included in a candidate standard release.
- **Implemented**: applies to elements that have gone through public review and contained in a full standard. This is most relevant to the IFC 4x2 definition currently used within the model.

- **Deprecated**: applies to element that have previously been implemented but are now marked for removal from the standard
- **Annotation**: applies to any other elements that do not relate to the structural modelling of the IFC UML model (e.g. notes & annotations).

***NOTE:** the 'WIP' status can be applied to any elements within the UML model, but is intended to be used on packages and classes that need to be identified as work in progress and excluded from generated documentation.*

These status definitions are expected to change over the lifecycle of a concept as shown in Figure 2. To allow these status definitions to be visible on diagrams the legend & colour coding defined in Table 2 and depicted in Figure 2 will be used. Status will be identified by the colouring of the element border with a thickness of 2 points (or twice the default).

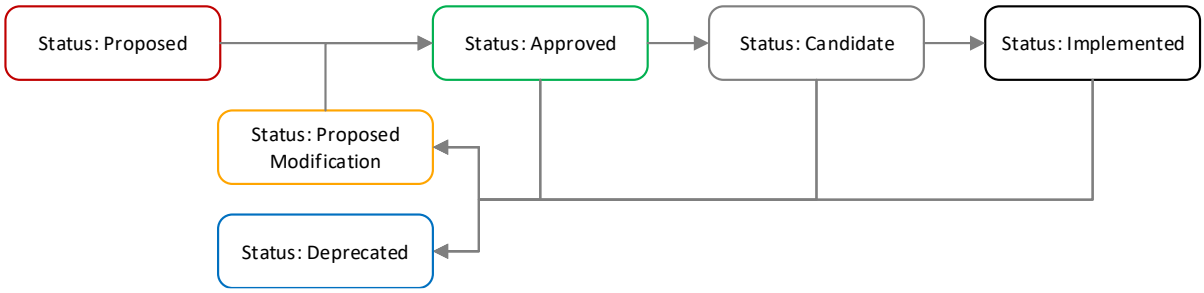


Figure 2 - Workflow for concept status evolution

Table 2 - Colour coding for element status definitions

Status Definition	Colour	RGB Definition (Decimal)
Proposed	RED	{192, 0, 0}
Proposed Modification	ORANGE	{255, 165, 0}
Approved	GREEN	{0, 176, 80}
Candidate	GREY	{127, 127, 127}
Implemented	BLACK (thickness: 1 or default)	{0, 0, 0}
Deprecated	BLUE	{0, 0, 205}

NOTE: WIP elements are not intended to be visually conveyed to a wider audience in forms such as diagrams and reports therefore does not require a colour coding or inclusion in legends.

1.1.3 PIM Colour coding

PIM concepts are all coloured with ***LIGHT YELLOW*** (RGB {25, 255, 230})background and ***BLACK*** border in this report.

1.2 General rules to trace mapping

- A correct mapping proposal is made by:
  - **A source Element**: usually an IFC Concept (existing or proposed);
  - **A target Element**: usually a Class from the Conceptual Model;
  - **A Realization**: which is the only association allowed to map objects from Conceptual to IFC (the IFC Concept is the source of the Realization association);
- Under no circumstances, a business object is mapped to an IFC abstract Concept;
- Abstract UML Classes can be mapped to concrete IFC Concept;

2 Track mapping diagrams

2.1 Track- and turnout panel (IFC Mapping)

2.1.1 Track panels (mapping)

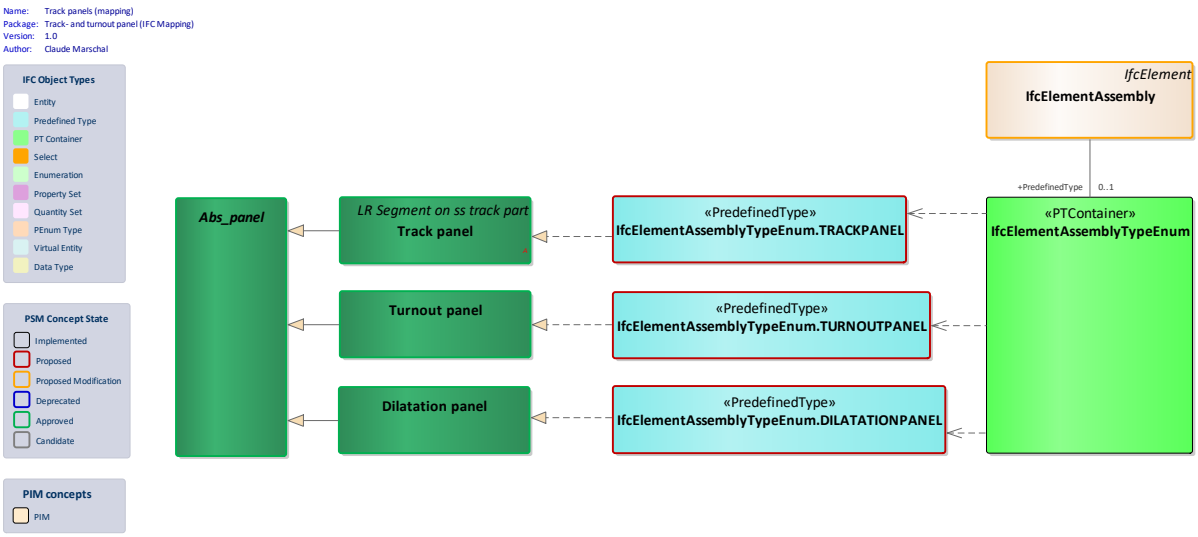


Table 1: Track panels (mapping)

2.2 Rail (IFC Mapping)

2.2.1 Track rail (mapping)

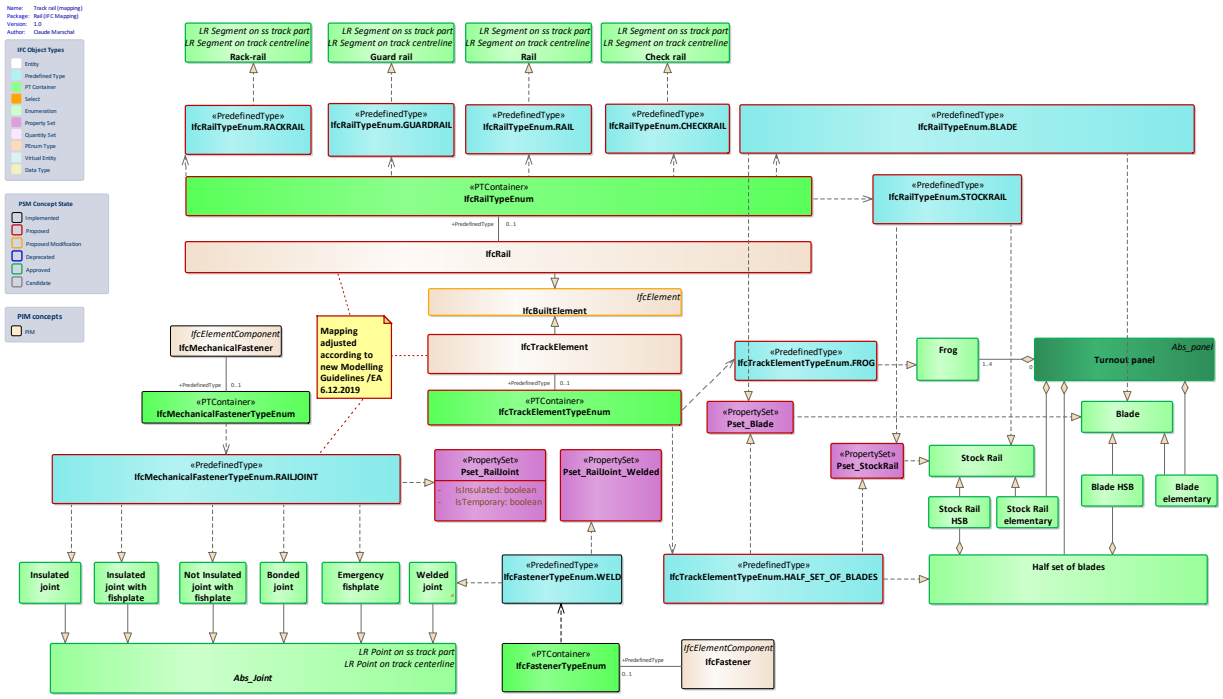


Table 2: Track rail (mapping)

2.3 Rail fastening (IFC Mapping)

2.3.1 Rail fastening (mapping)

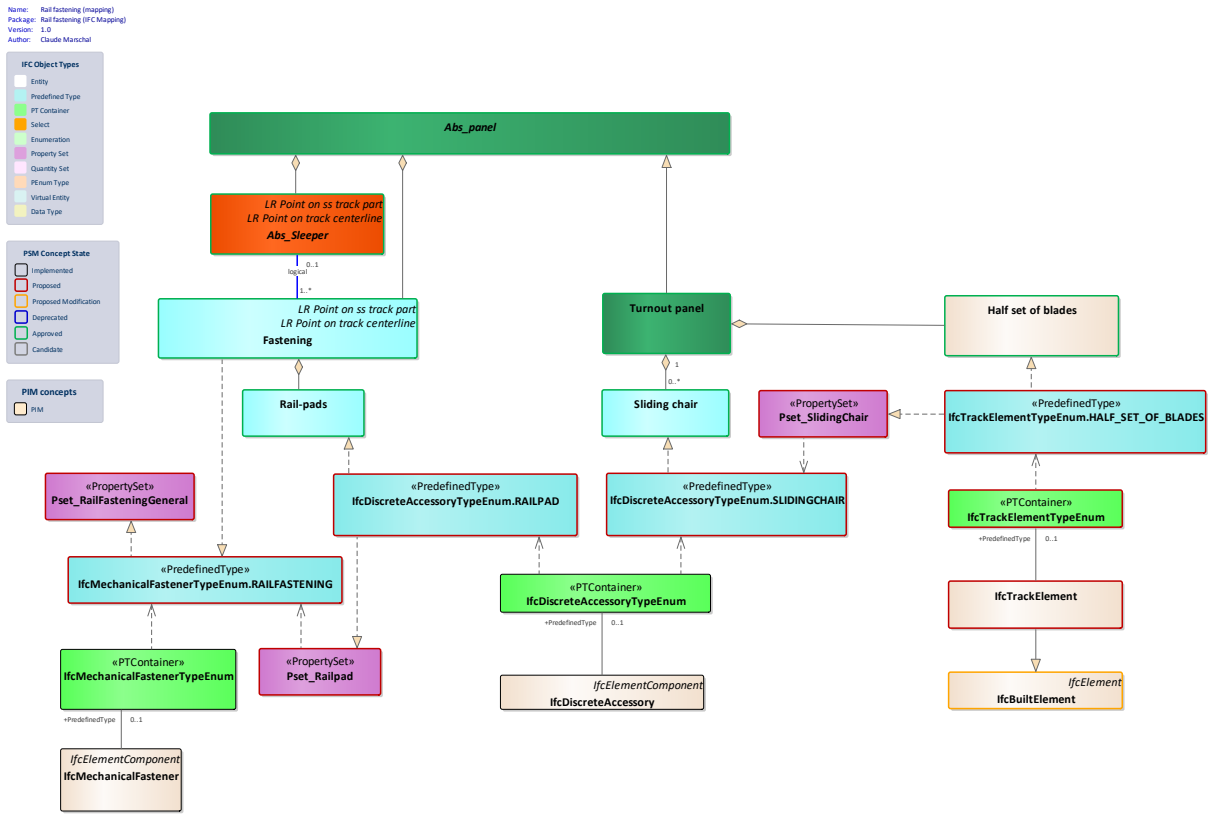


Table 3: Rail fastening (mapping)

2.4 Sleeper (IFC Mapping)

2.4.1 Sleeper (mapping)

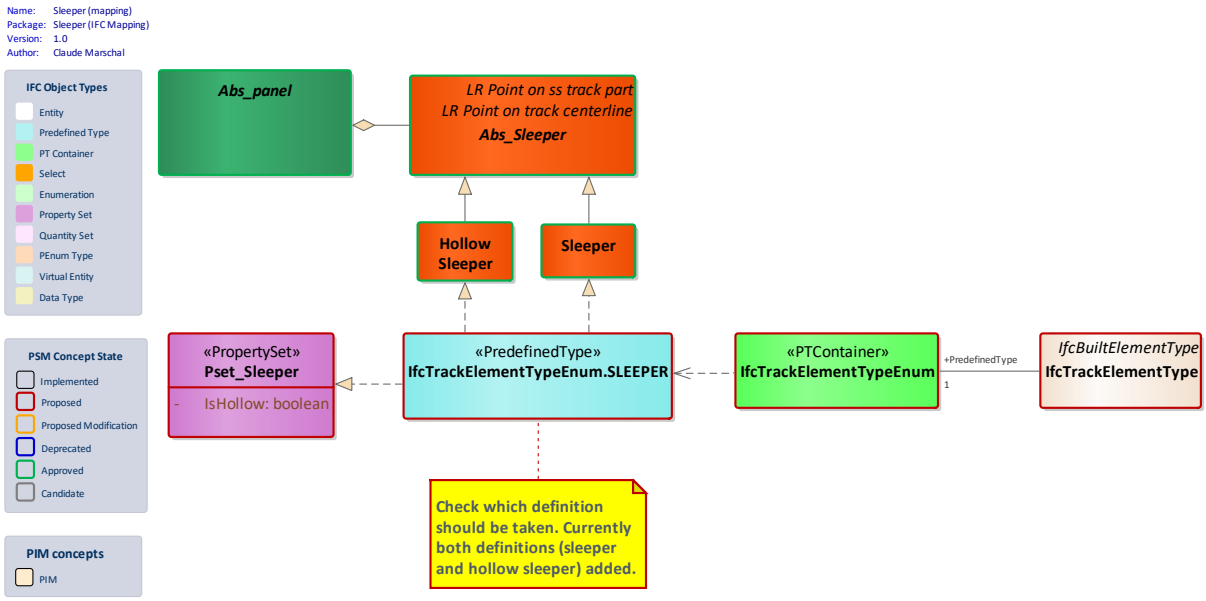


Table 4: Sleeper (mapping)

2.5 Strengthening equipment (IFC Mapping)

2.5.1 Strengthening equipment (mapping)

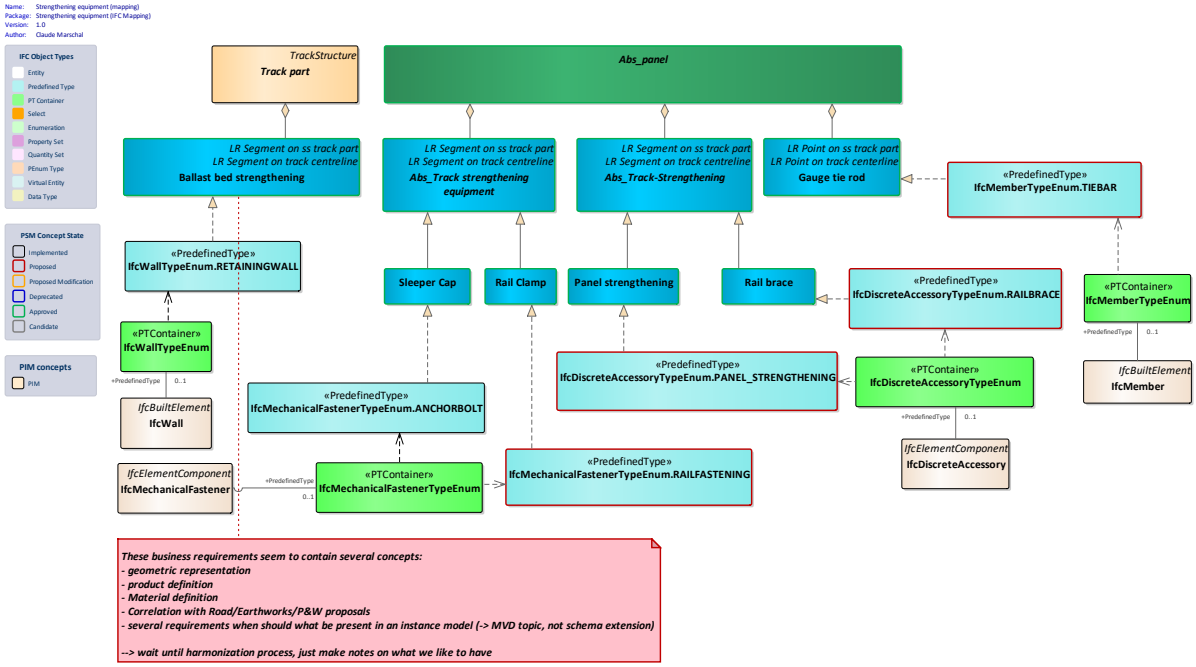


Table 5: Strengthening equipment (mapping)

2.6 Ballast (IFC Mapping)

2.6.1 Ballast (mapping)

Name: Ballast (mapping)
Package: Ballast (IFC Mapping)
Version: 1.0
Author: Claude Marschal

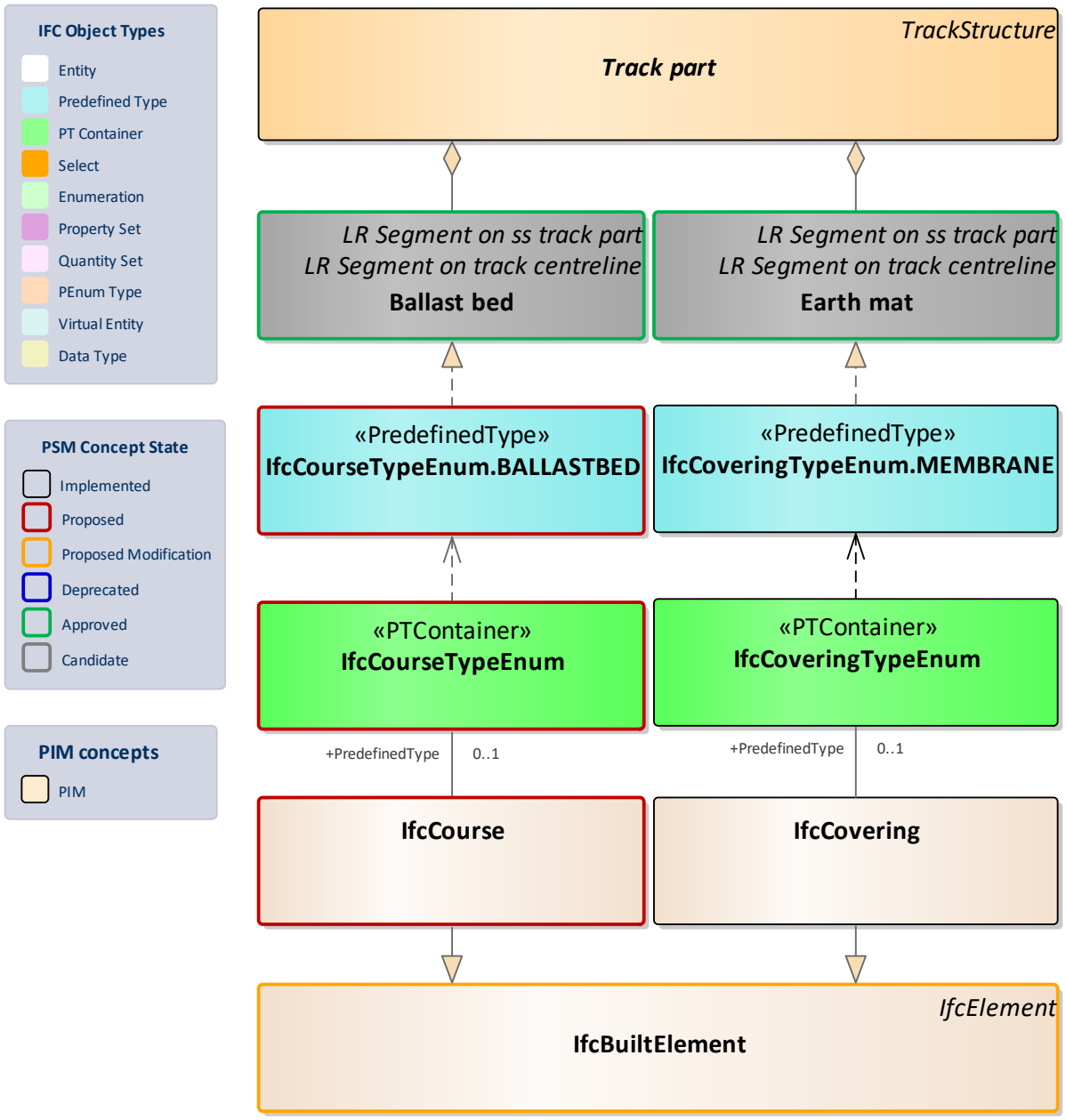


Table 6: Ballast (mapping)

2.7 Slab track (IFC Mapping)

2.7.1 Slab track (mapping)

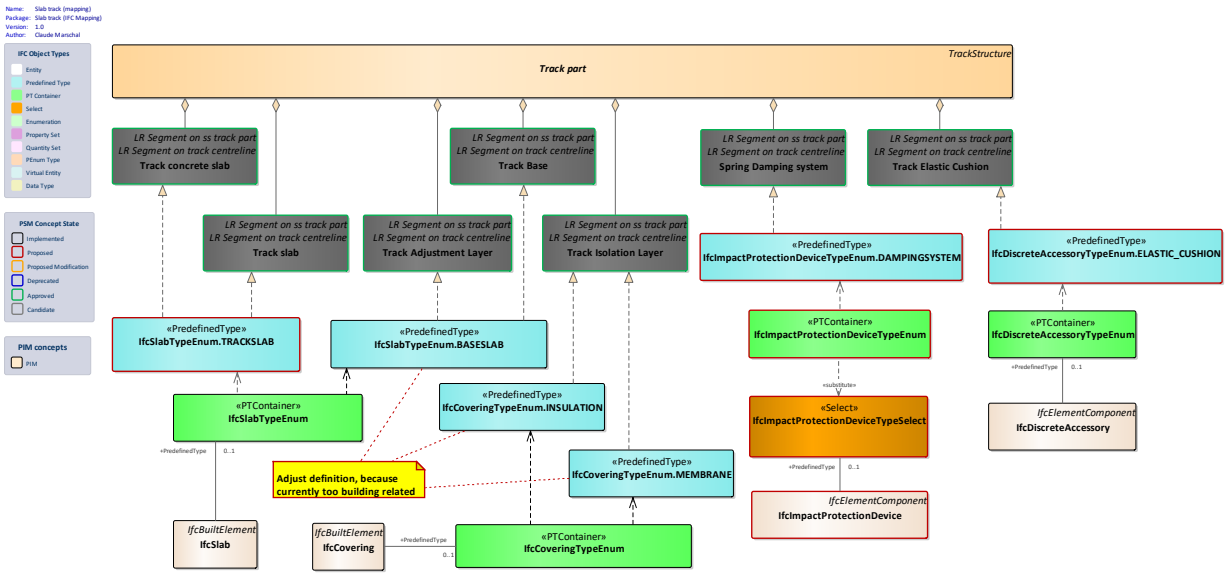


Table 7: Slab track (mapping)

2.8 Track coverage (IFC Mapping)

2.8.1 Track coverage (mapping)

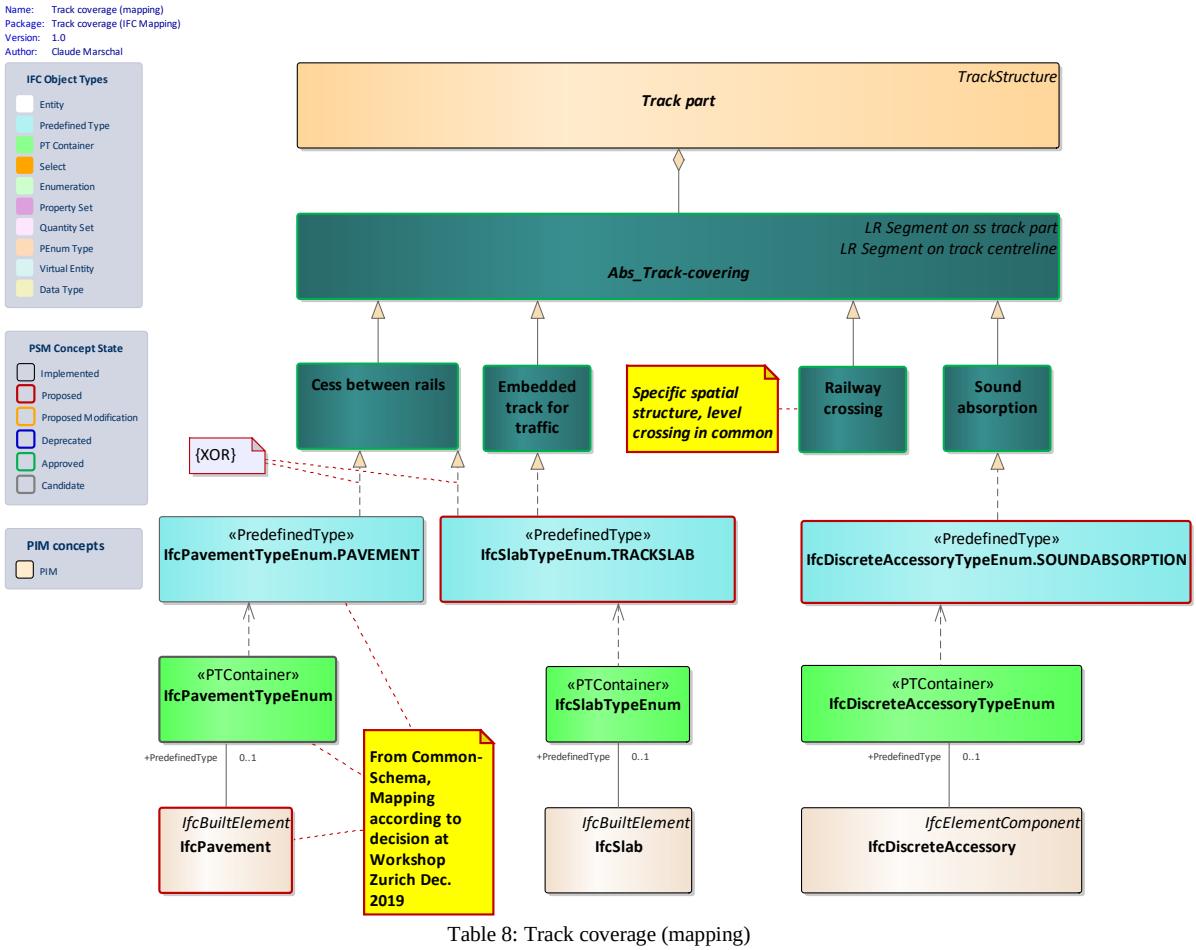


Table 8: Track coverage (mapping)

2.9 Track sidewalk (IFC Mapping)

2.9.1 Track sidewalk (mapping)

Name: Track sidewalk (mapping)
Package: Track sidewalk (IFC Mapping)
Version: 1.0
Author: Claude Marschal

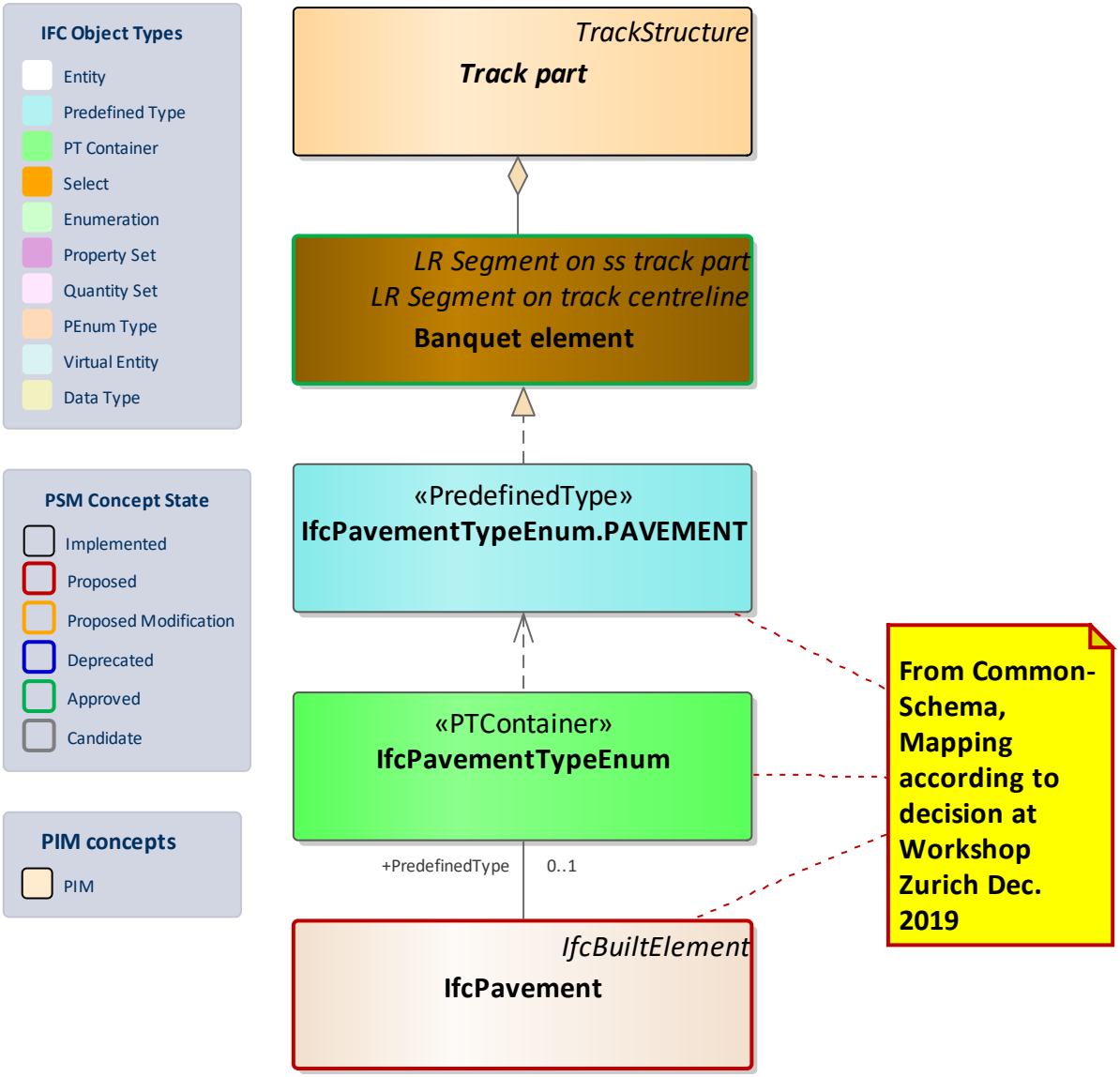


Table 9: Track sidewalk (mapping)

2.10 Track alignment stops (IFC Mapping)

2.10.1 Track alignment stops (mapping)

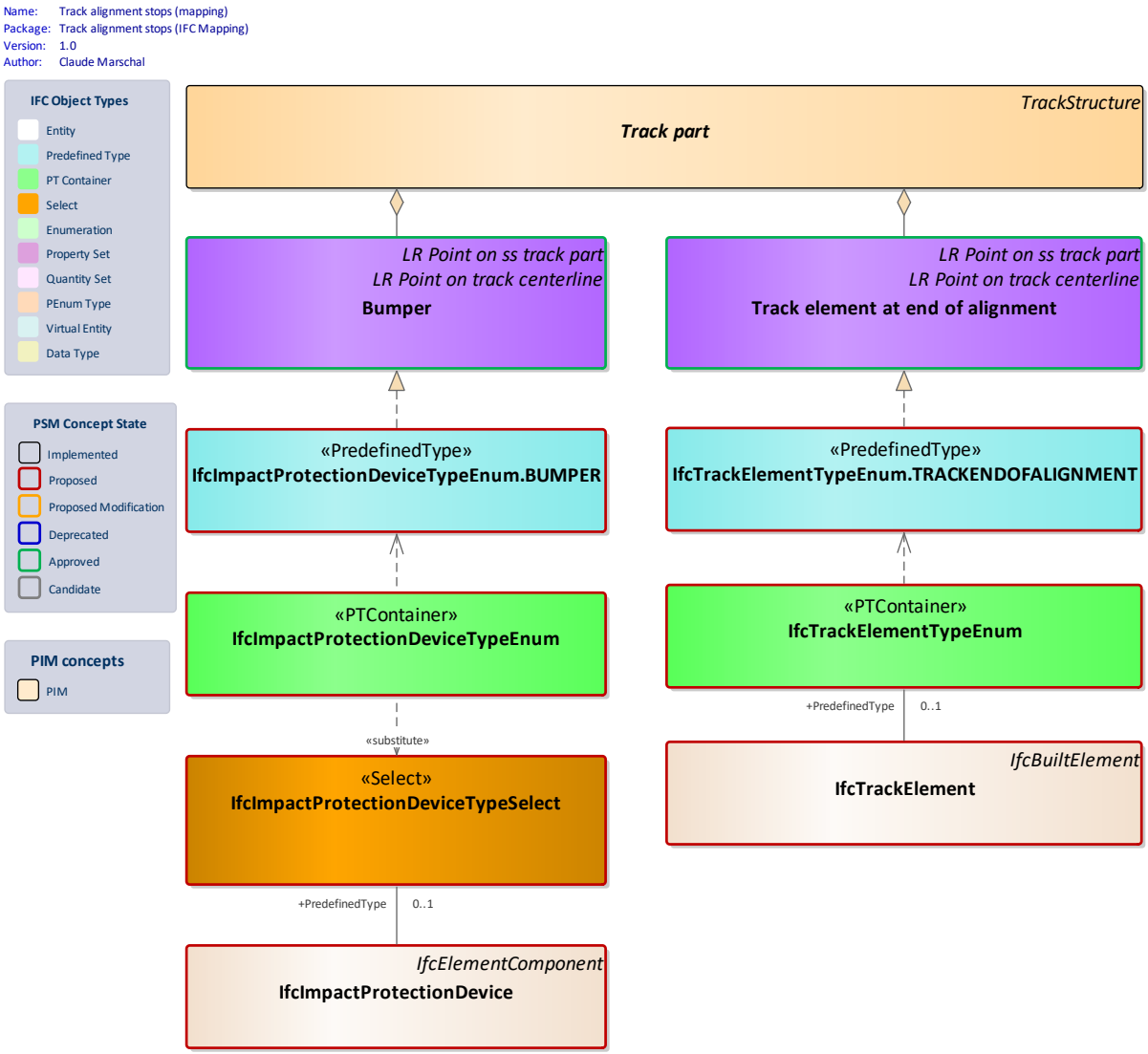


Table 10: Track alignment stops (mapping)

2.11 Survey (IFC Mapping)

2.11.1 Survey (mapping)

Name: Survey (mapping)
Package: Survey (IFC Mapping)
Version: 1.0
Author: Claude Marschal

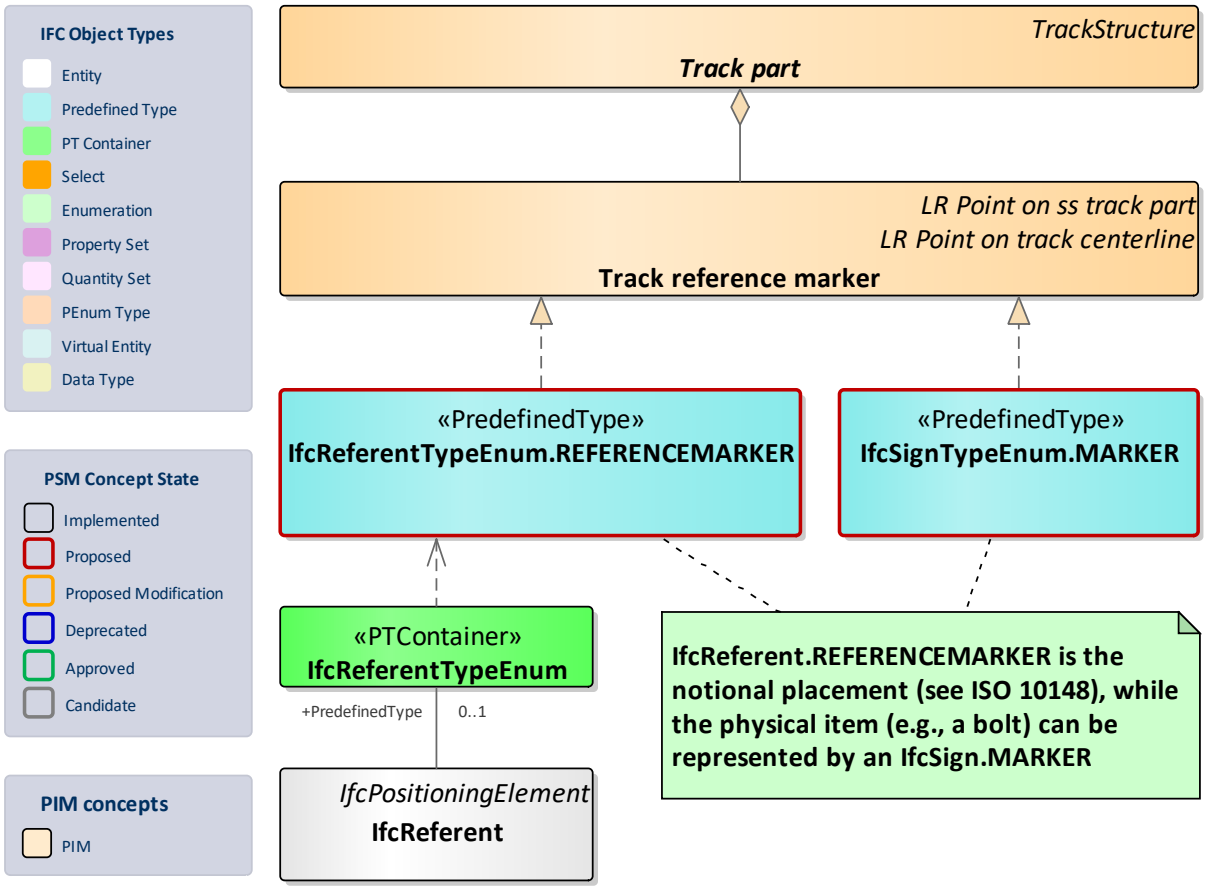


Table 11: Survey (mapping)

2.12 Other equipment (IFC Mapping)

2.12.1 Other equipment (mapping)

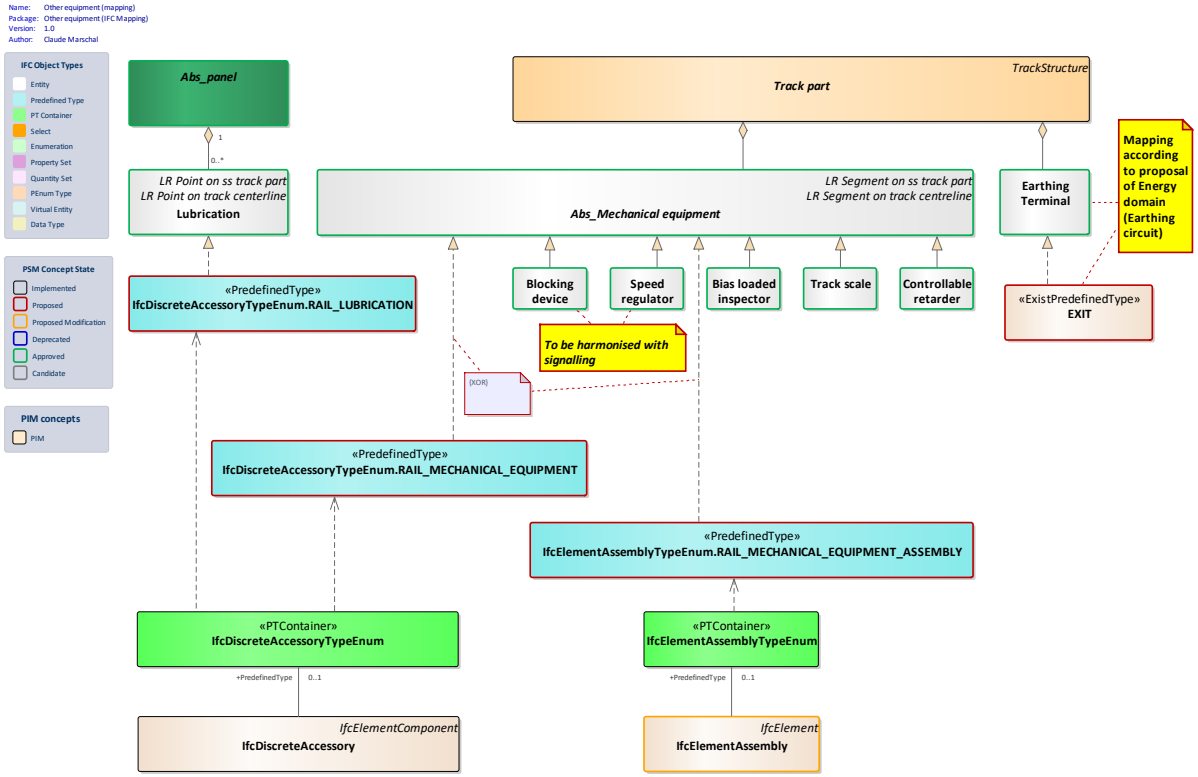


Table 12: Other equipment (mapping)

3 Energy mapping diagrams

3.1 Auxiliary Services (IFC Candidate)

3.1.1 Auxiliary Services - Mapping

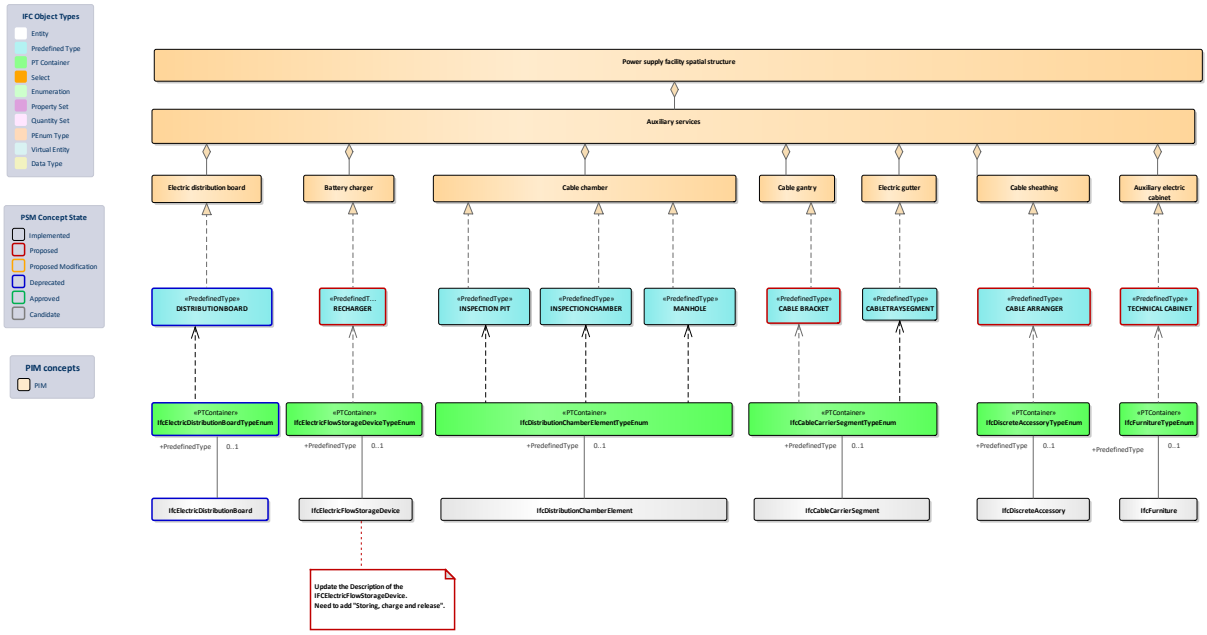


Table 13: Auxiliary Services - Mapping

3.2 Earthing Circuit (IFC Candidate)

3.2.1 Earthing Circuit - Mapping

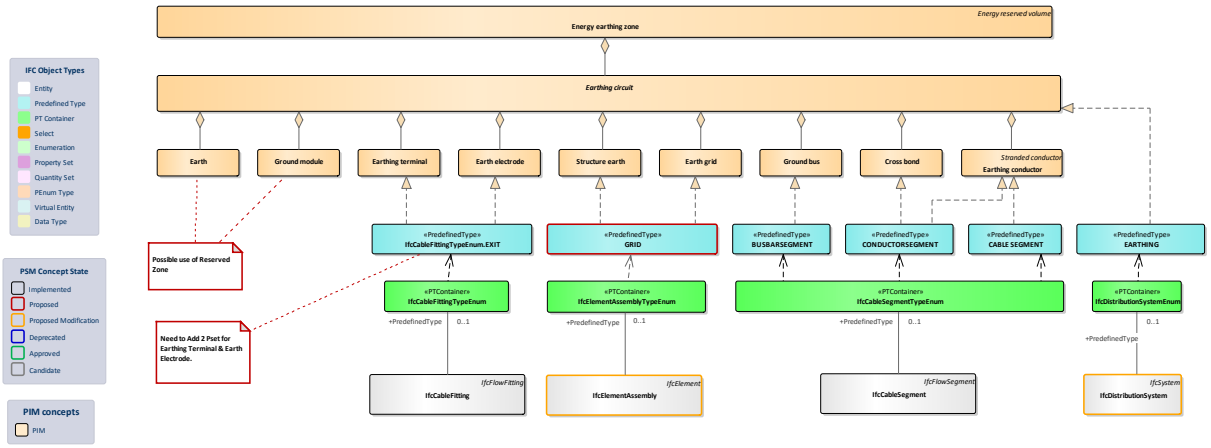


Table 14: Earthing Circuit - Mapping

3.3 Earthing Line (IFC Candidate)

3.3.1 Earthing Line - Mapping

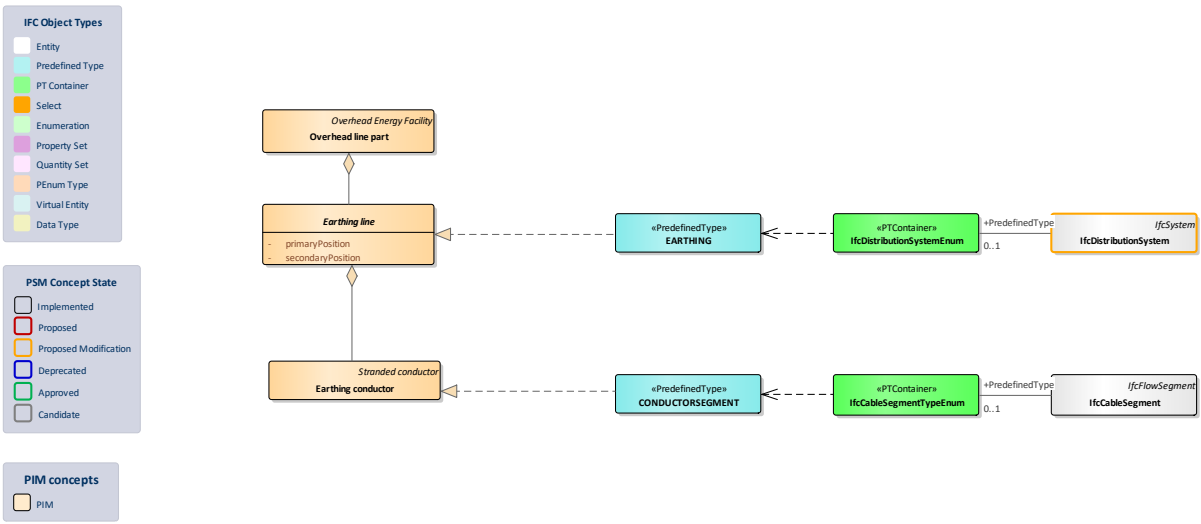


Table 15: Earthing Line - Mapping

3.4 Electric Power Converter (IFC Candidate)

3.4.1 Electric Power Converter - Mapping

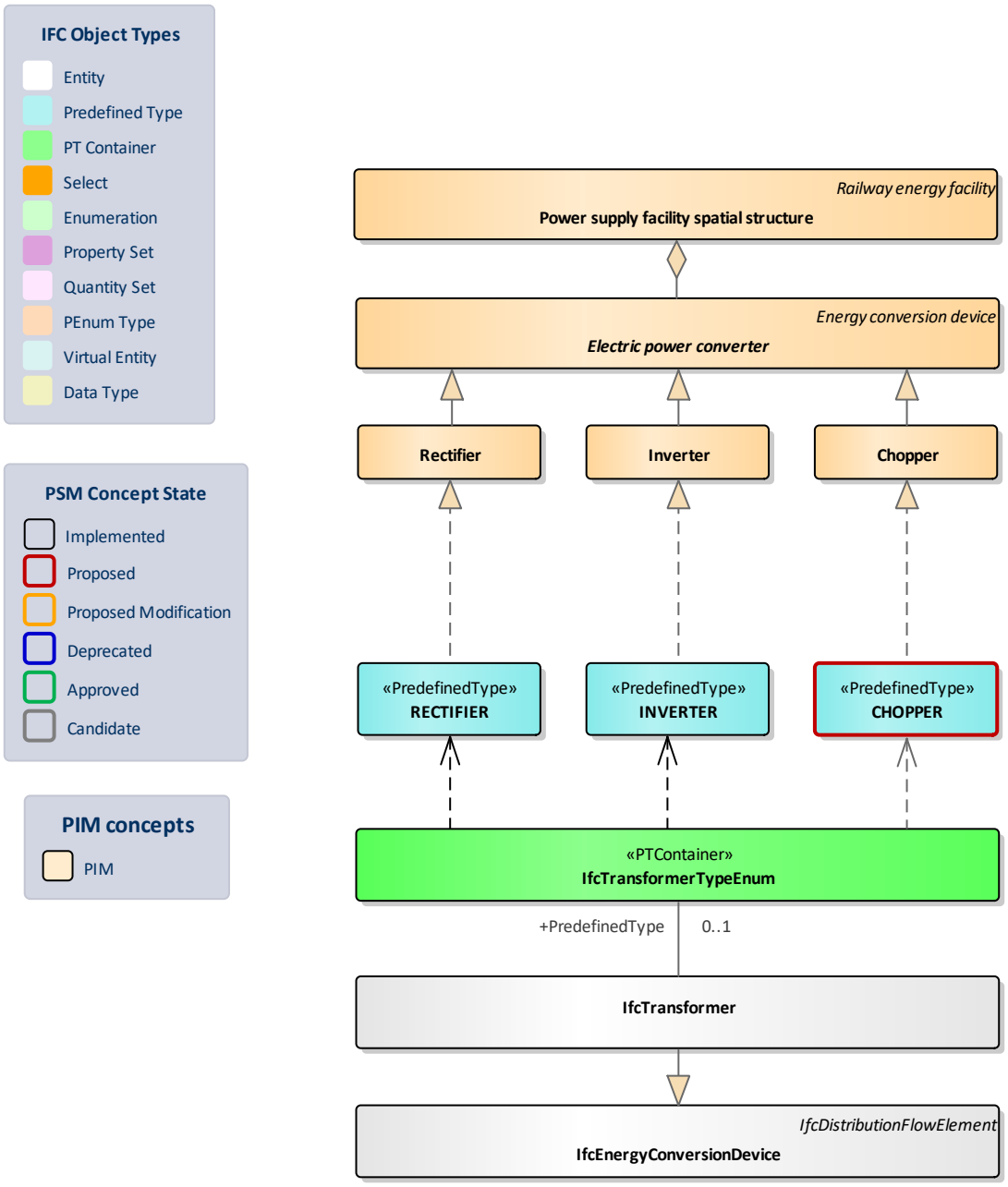


Table 16: Electric Power Converter - Mapping

3.5 Electric Storage (IFC Candidate)

3.5.1 Electric Storage - Mapping

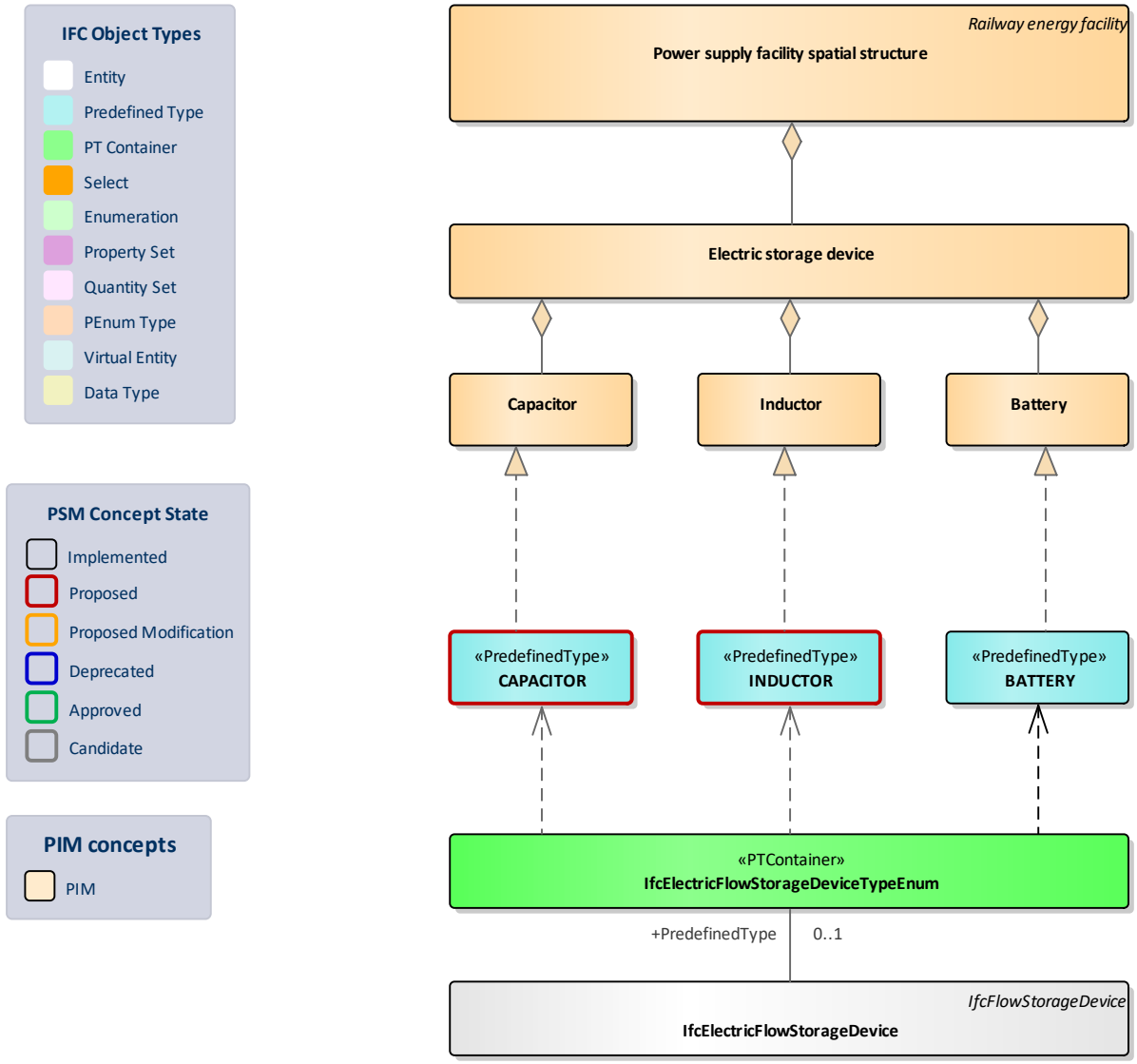


Table 17: Electric Storage - Mapping

3.6 Feeder Line (IFC Candidate)

3.6.1 Feeder Line - Mapping

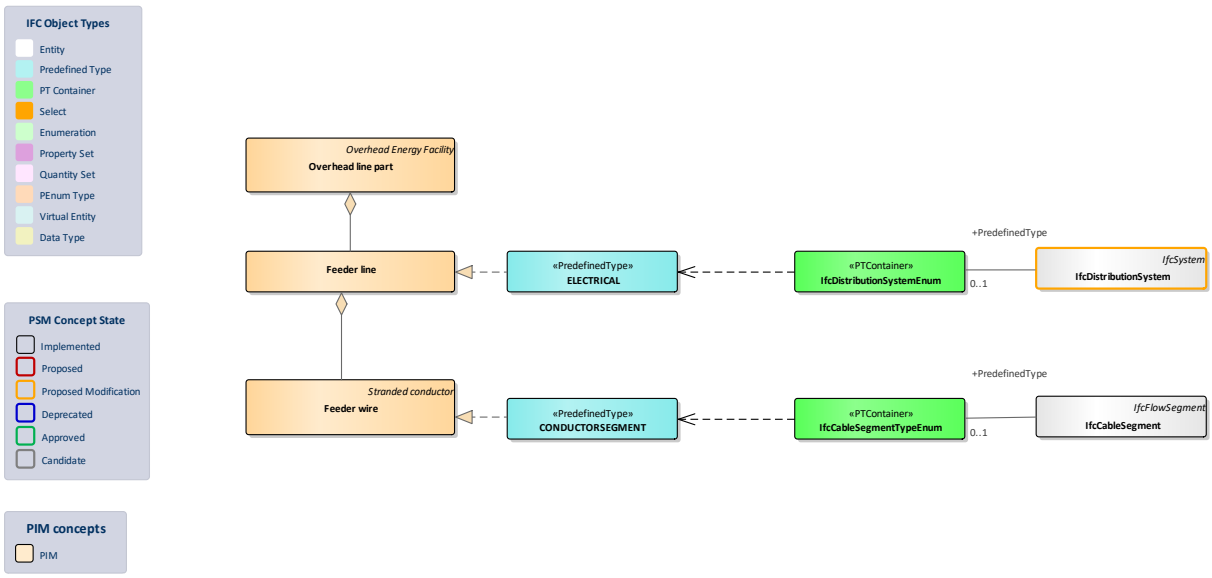


Table 18: Feeder Line - Mapping

3.7 Instrument Transformer (IFC Candidate) [OK2]

3.7.1 Instrument Transformer - Mapping

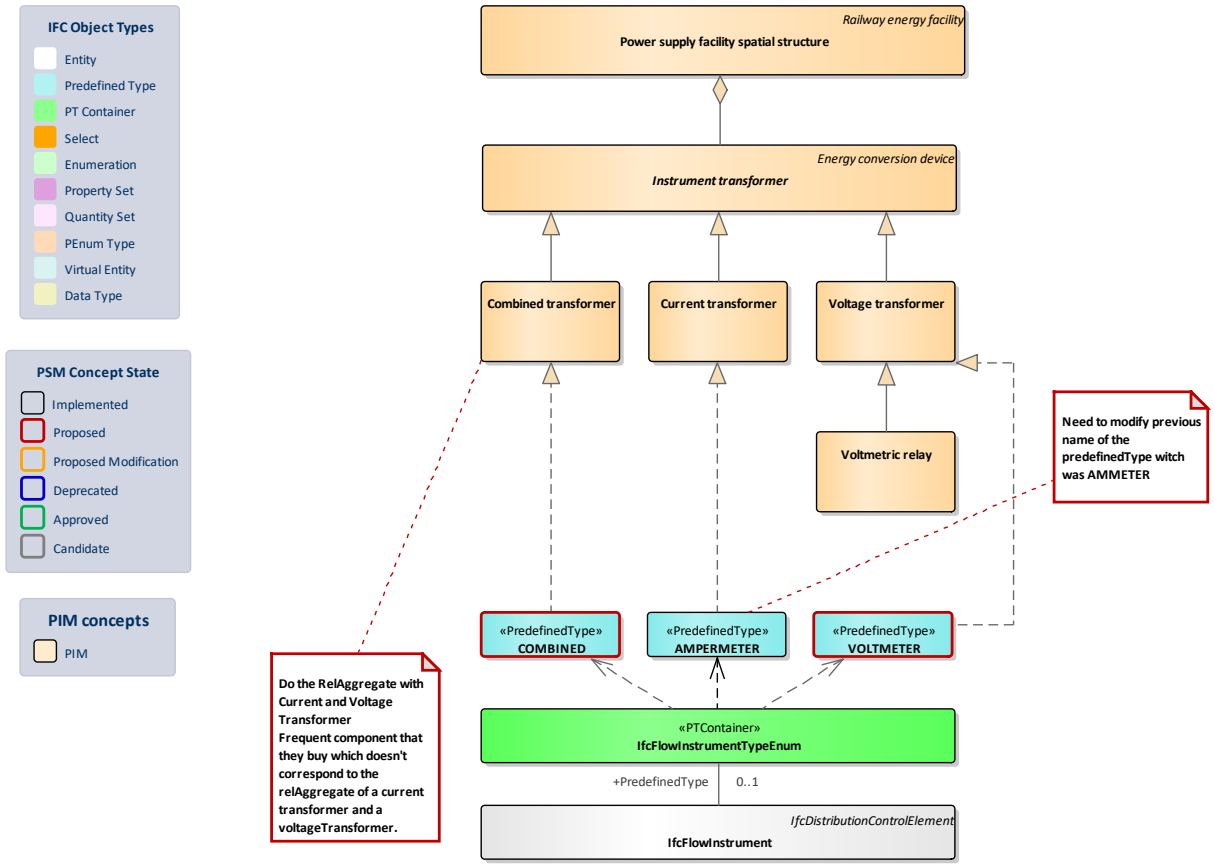


Table 19: Instrument Transformer - Mapping

3.8 Mooring (IFC Candidate)

3.8.1 Mooring - Mapping

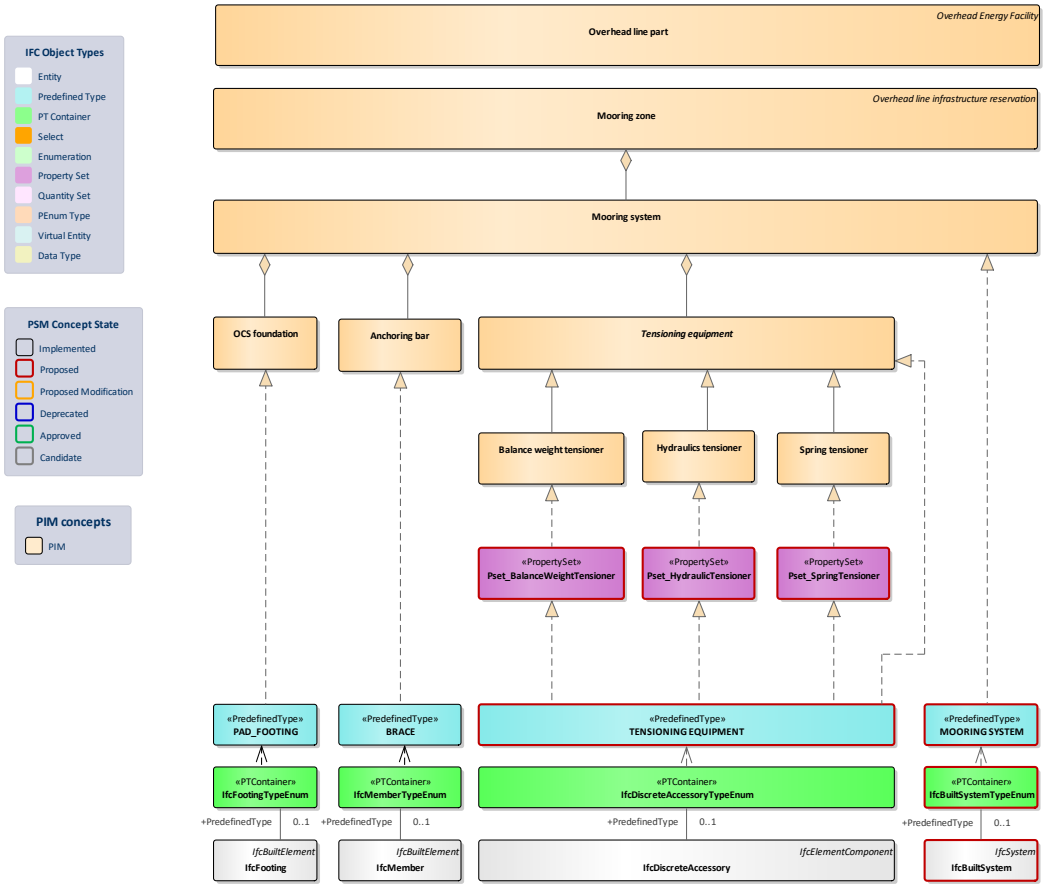


Table 20: Mooring - Mapping

3.9 Overhead Contact Line System (IFC Candidate)

3.9.1 Overhead Contact Line System - Mapping

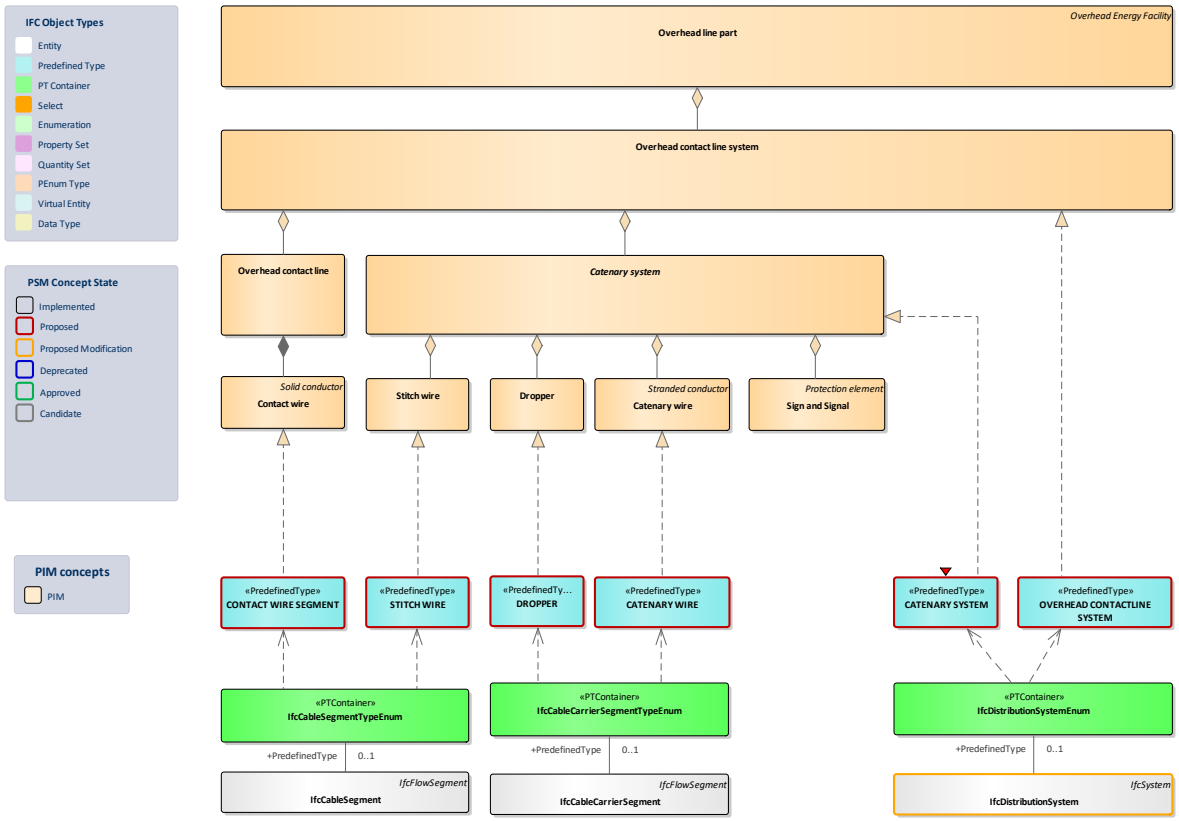


Table 21: Overhead Contact Line System - Mapping

3.10 OverHead Line Supporting (IFC Candidate)

3.10.1 OCS Support - Mapping

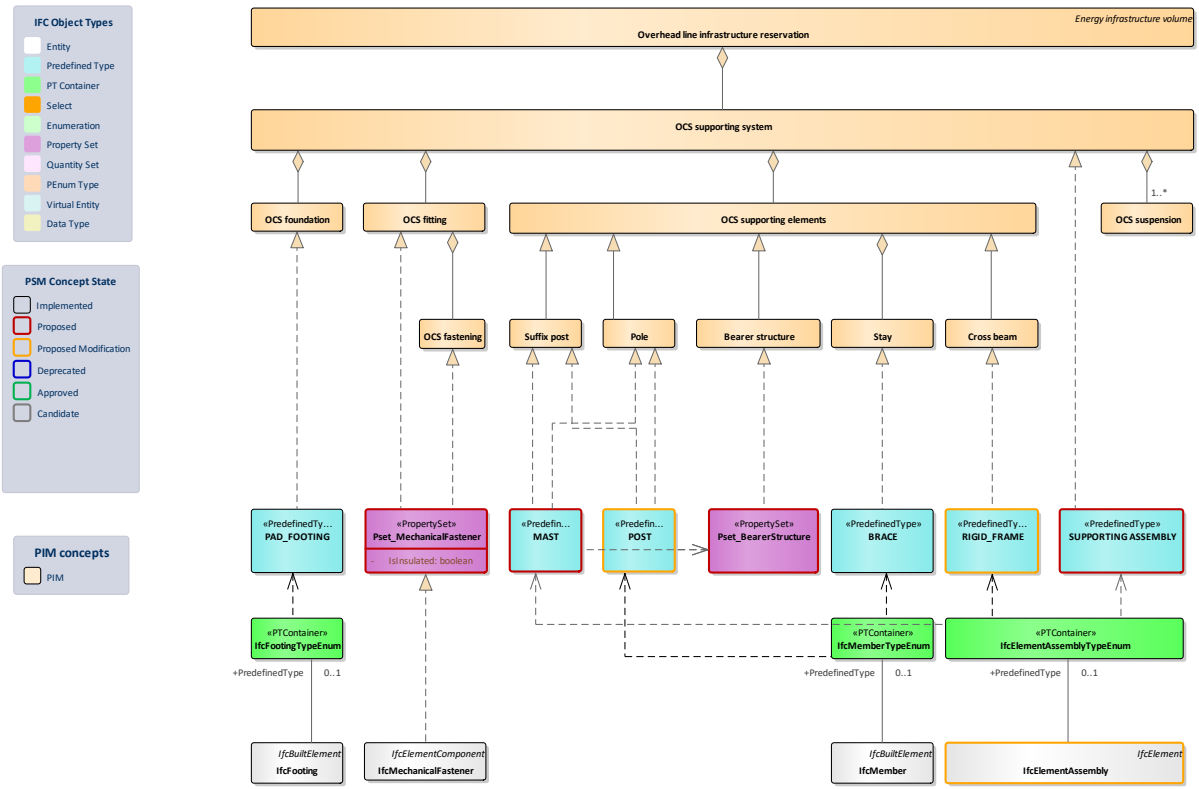


Table 22: OCS Support - Mapping

3.10.2 OCS Suspension - Mapping

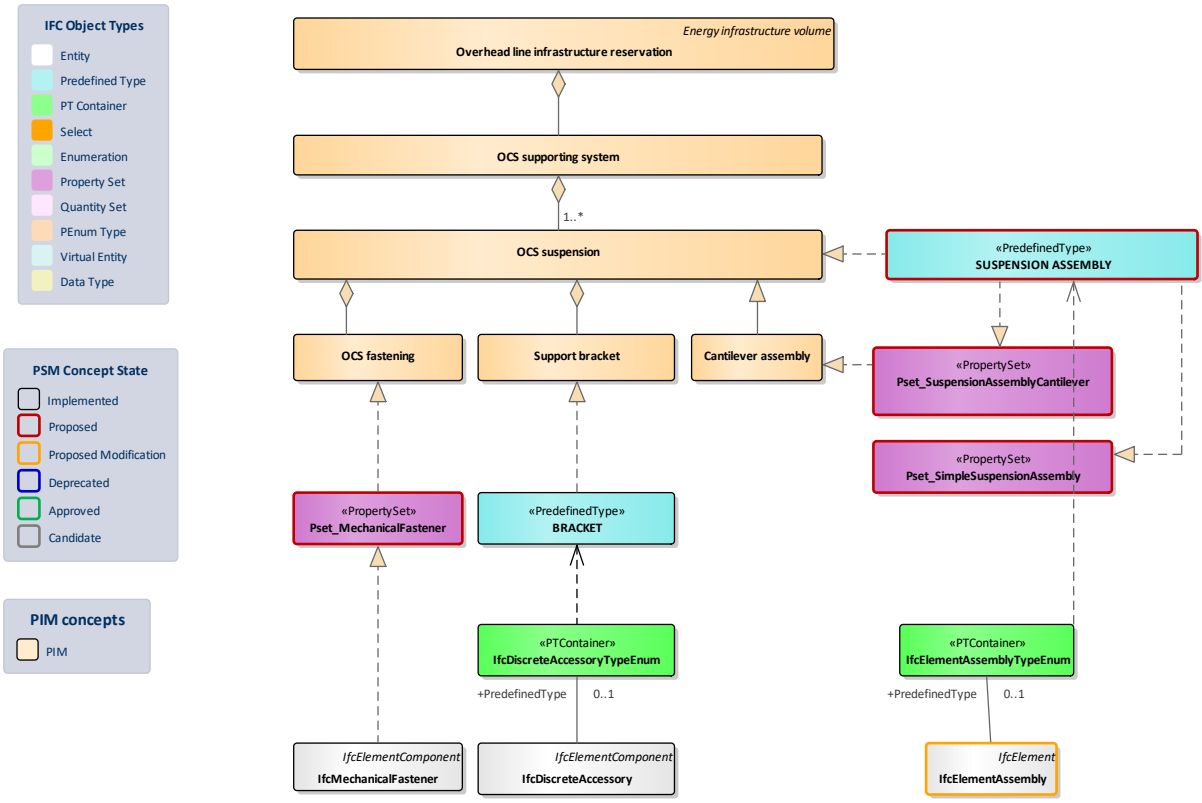


Table 23: OCS Suspension - Mapping

3.11 Power Transformer (IFC Candidate)

3.11.1 Power Transformer - Mapping

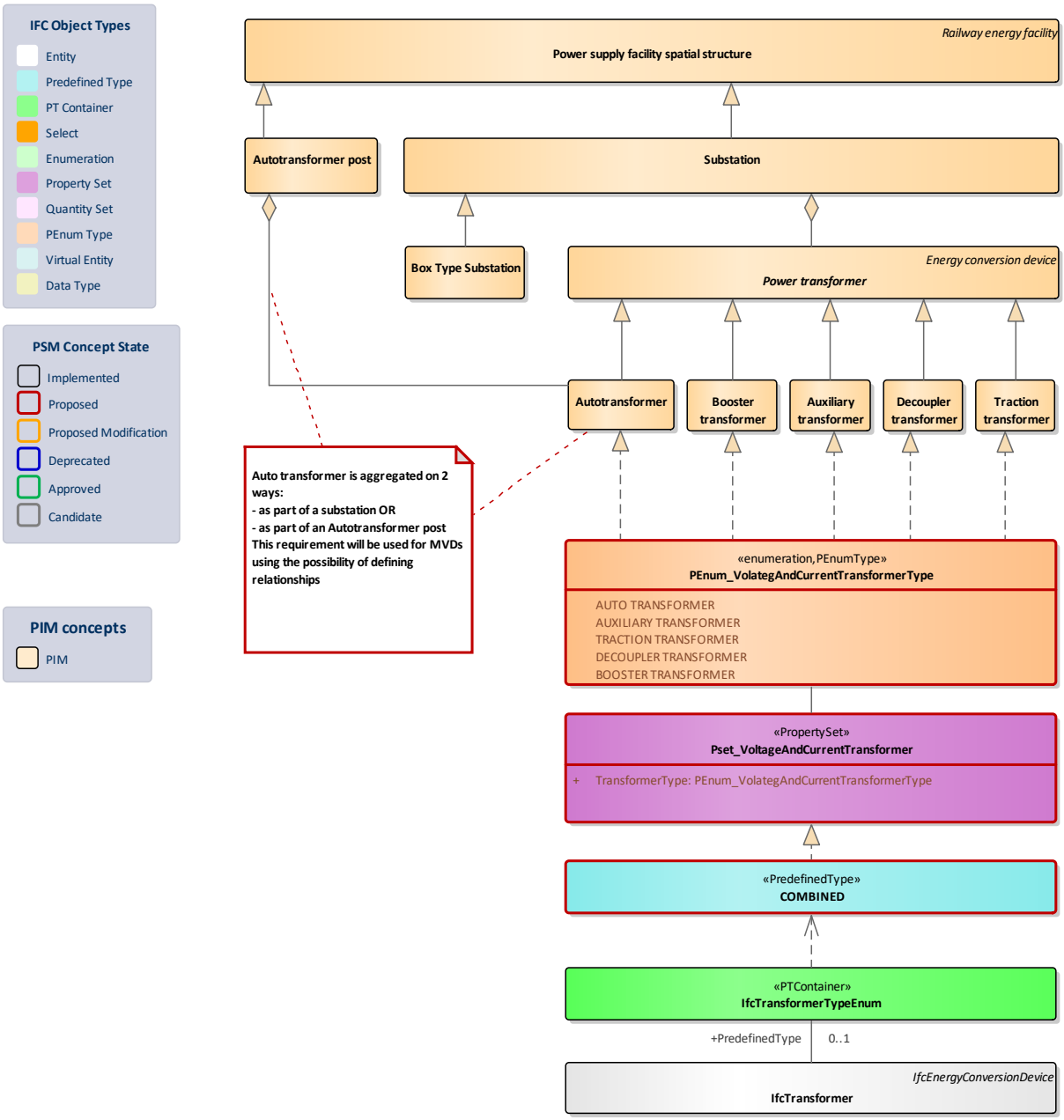


Table 24: Power Transformer - Mapping

3.12 Protecting Devices (IFC Candidate)

3.12.1 Protecting Devices - Mapping

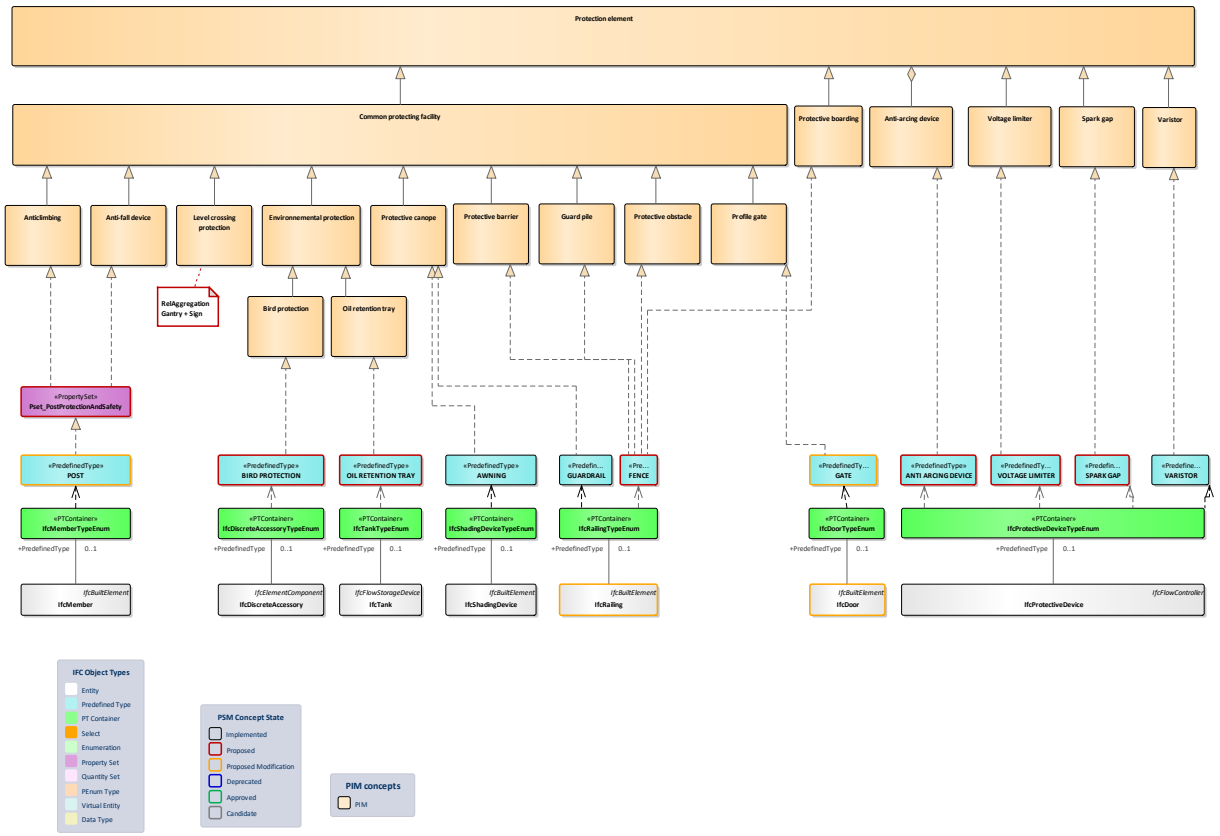


Table 25: Protecting Devices - Mapping

3.13 Regulating Devices (IFC Candidate)

3.13.1 Regulating Devices - Mapping

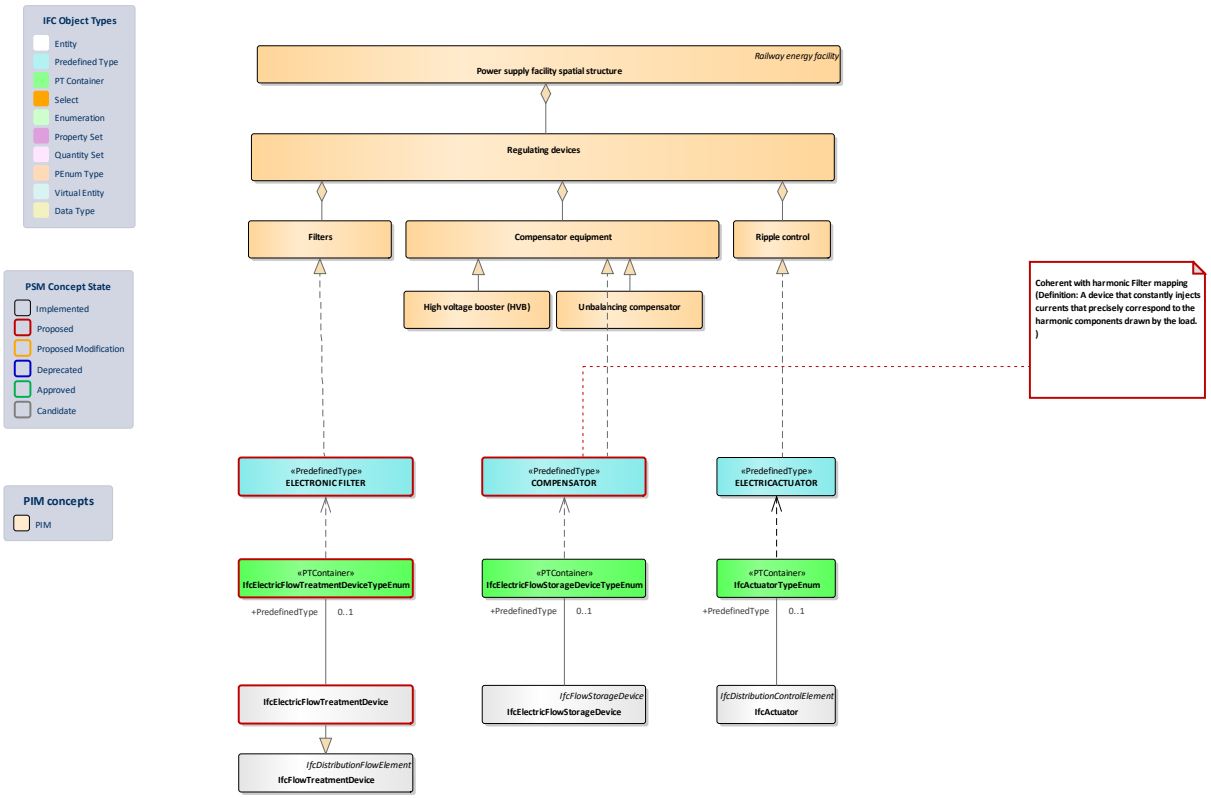


Table 26: Regulating Devices - Mapping

3.14 Return Circuit (IFC Candidate)

3.14.1 Return Circuit - Mapping

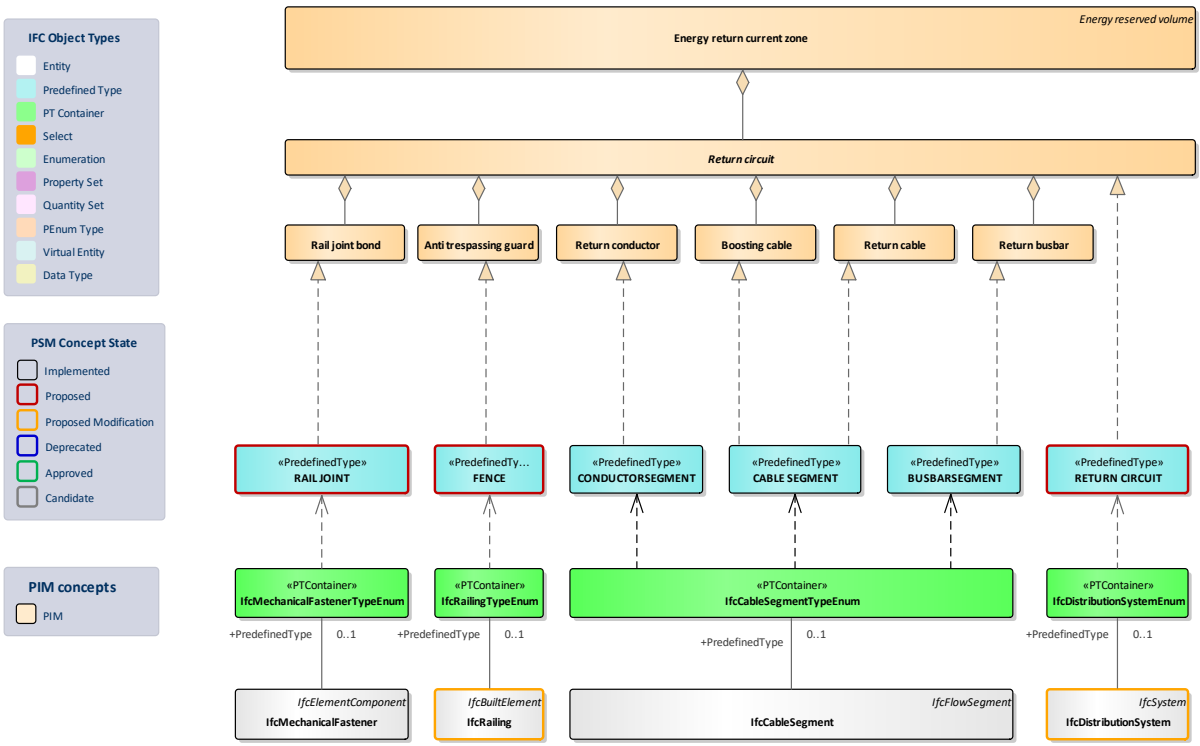


Table 27: Return Circuit - Mapping

3.15 Sectioning (IFC Candidate)

3.15.1 Sectioning - Mapping

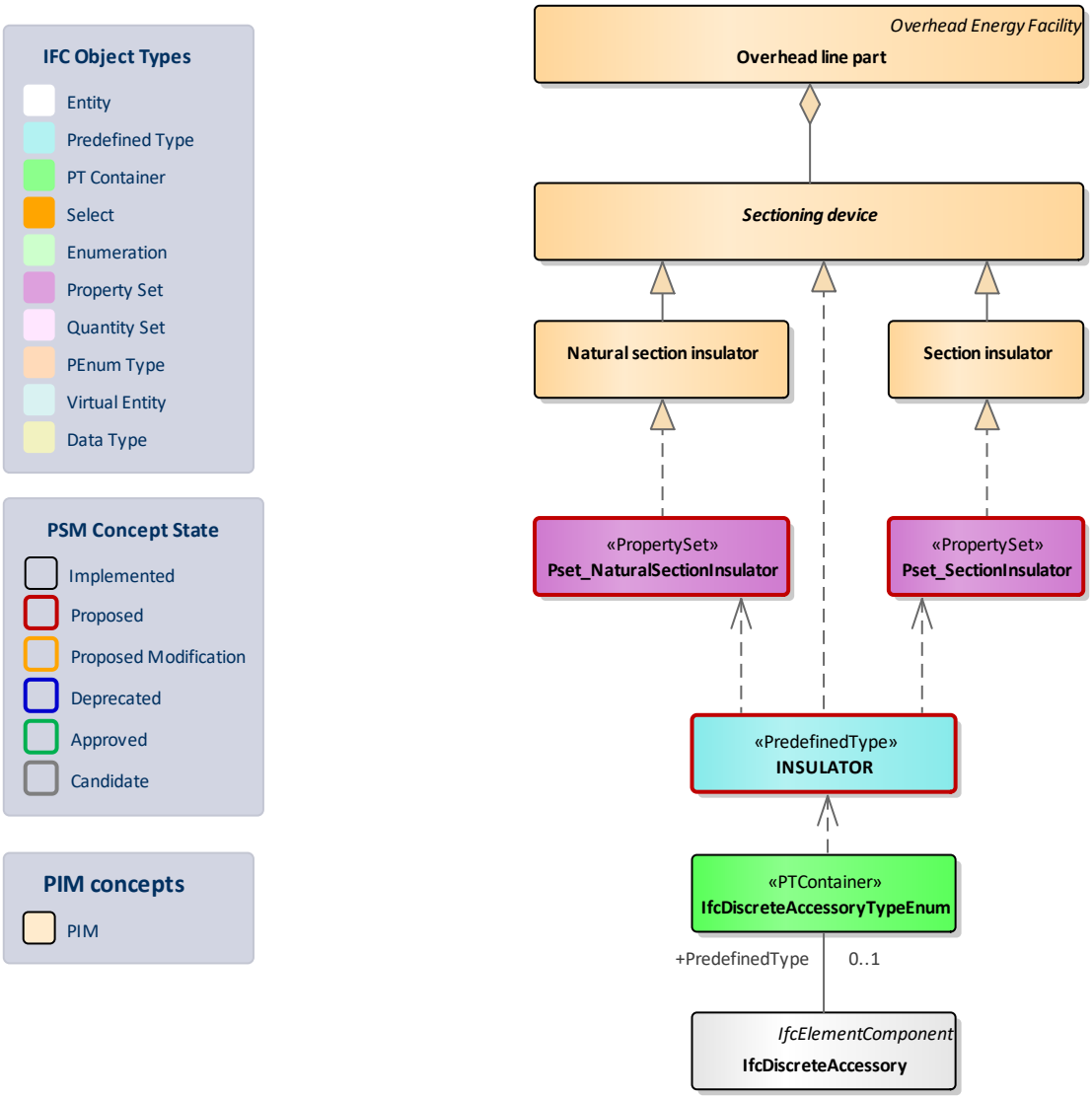


Table 28: Sectioning - Mapping

3.16 Shared (IFC Candidate)

3.16.1 Shared - Mapping

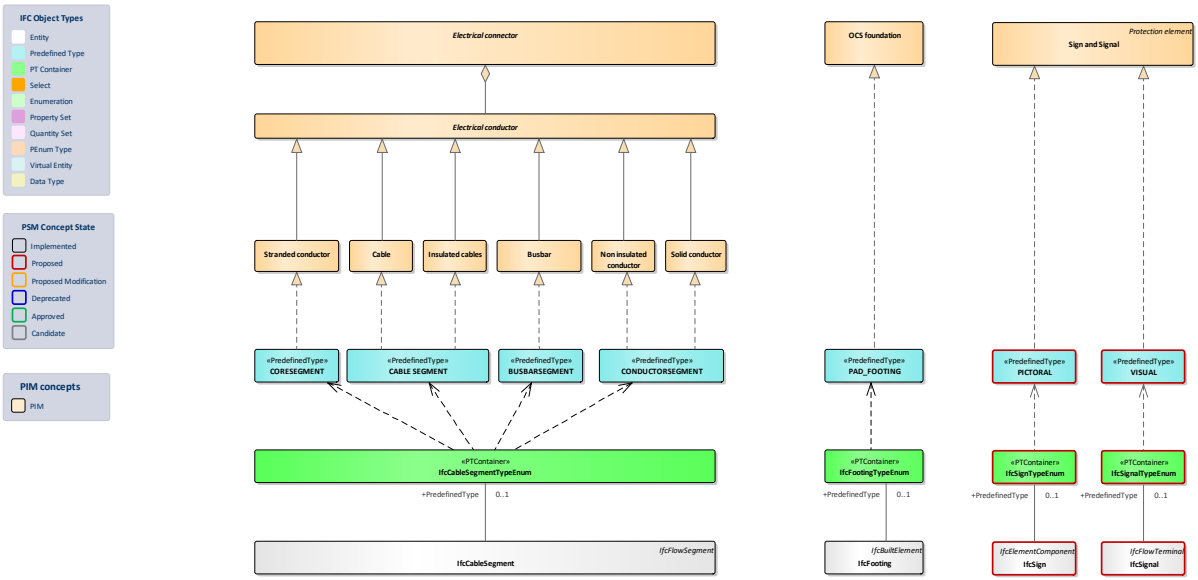


Table 29: Shared - Mapping

3.17 Substation Control Equipment and technical building (IFC Candidate)

3.17.1 SubstationControlEquipment - Mapping

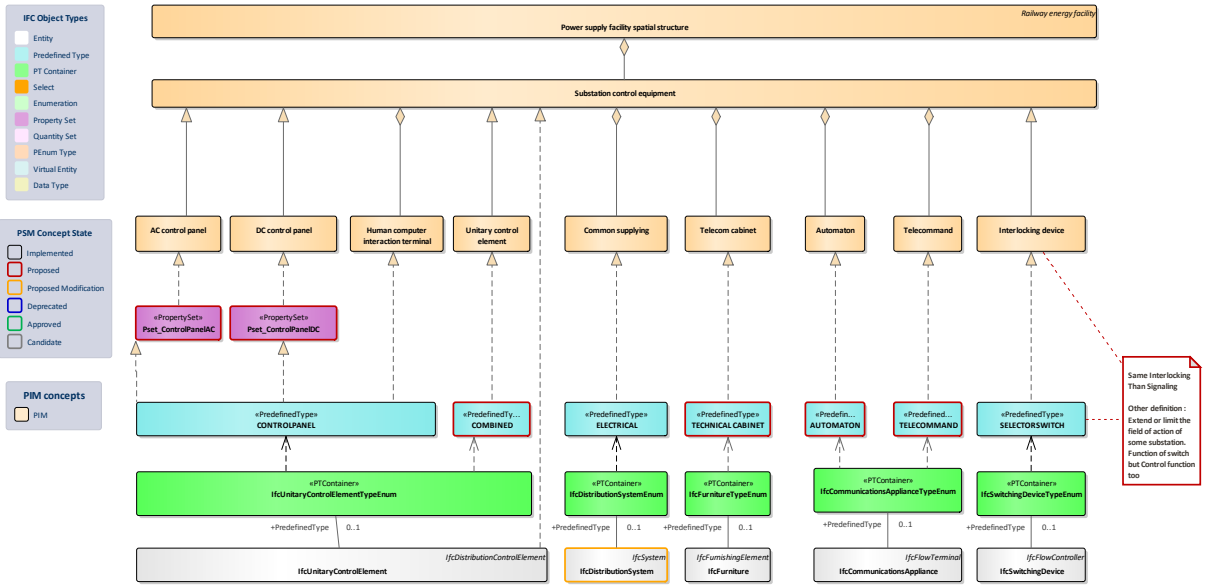


Table 30: SubstationControlEquipment - Mapping

3.18 Switch (IFC Candidate)

3.18.1 Switch - Mapping

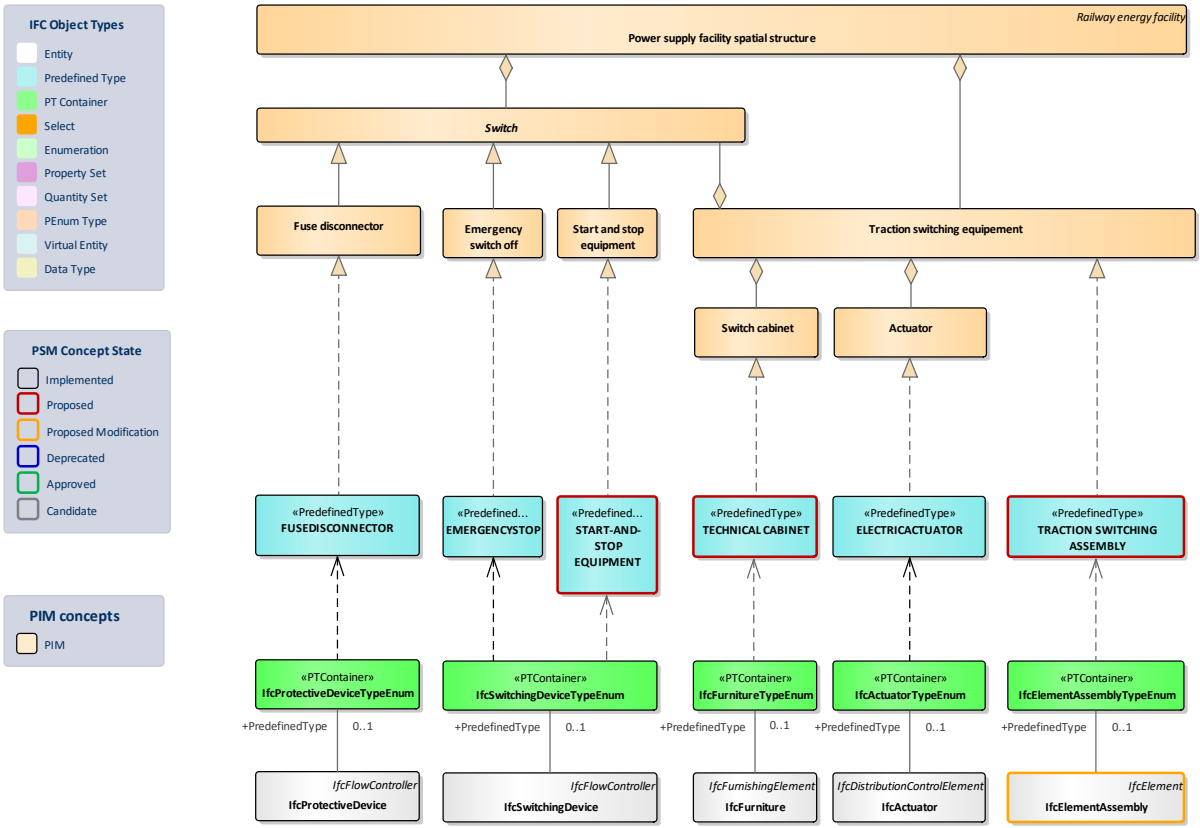


Table 31: Switch - Mapping

3.19 Underground Facilities (IFC Candidate)

3.19.1 Underground Facilities - Mapping

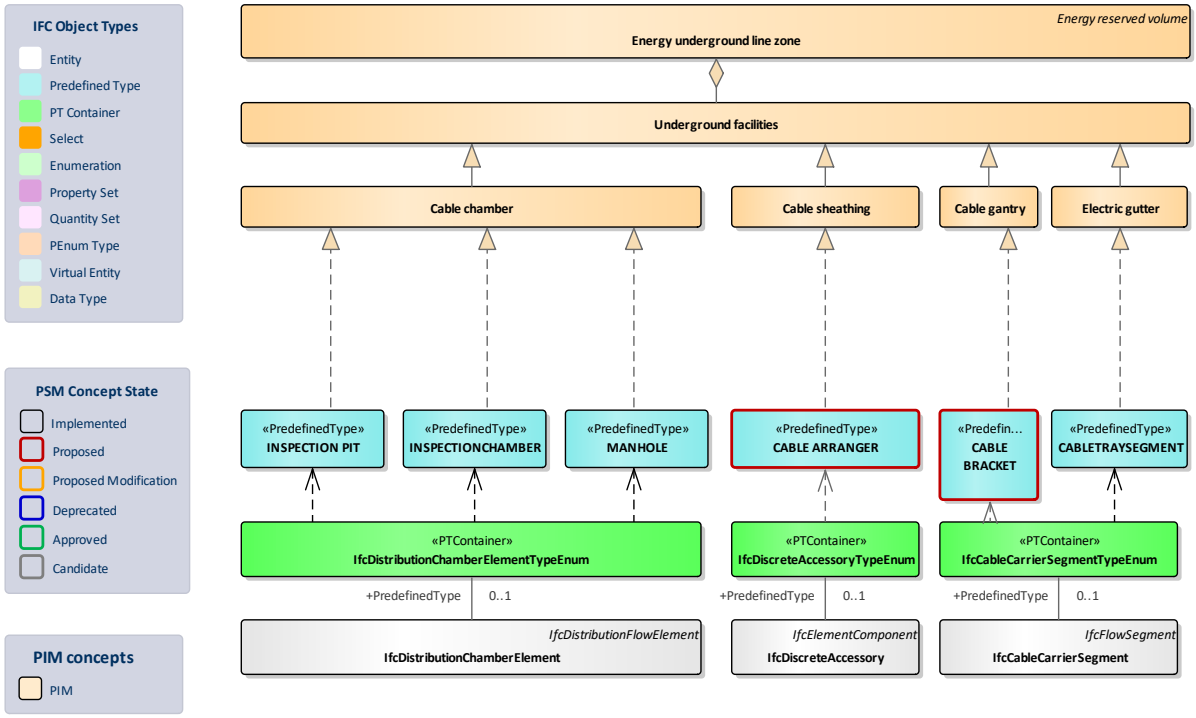


Table 32: Underground Facilities - Mapping

4 Signalling mapping diagrams

4.1 Axle counting equipment (IFC Mapping)

4.1.1 Axle counting equipment (mapping)

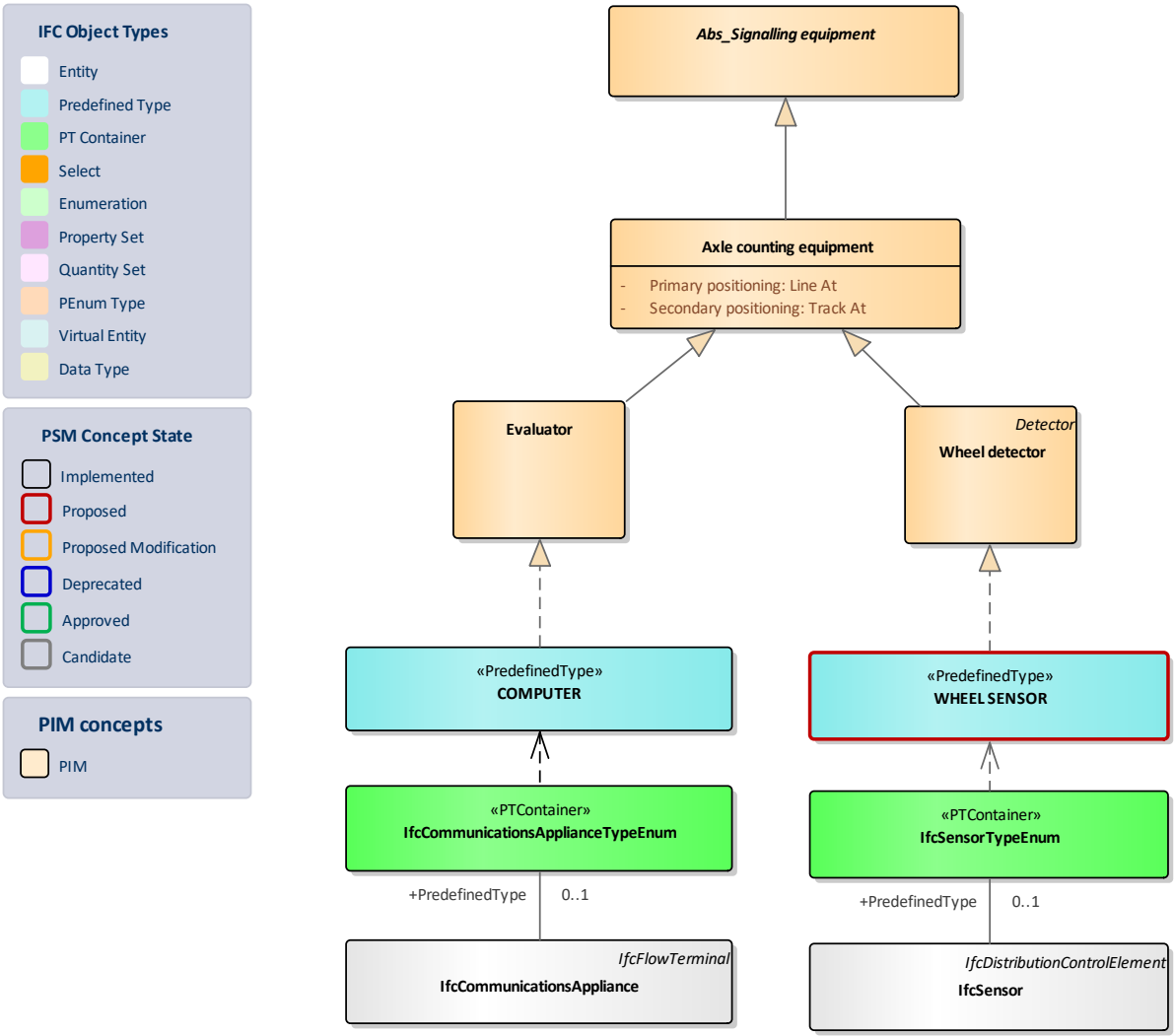


Table 33: Axle counting equipment (mapping)

4.2 Balise (IFC Mapping)

4.2.1 Balise (mapping)

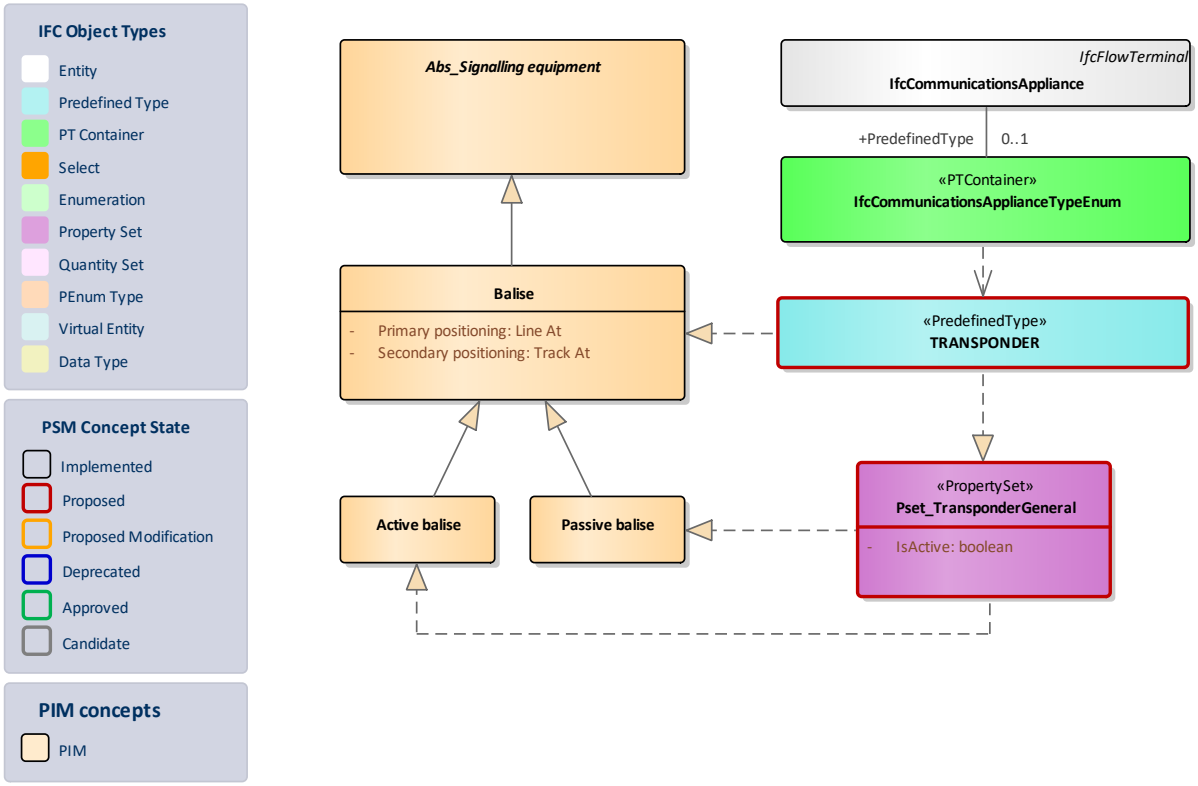


Table 34: Balise (mapping)

4.3 Cable and Wire (IFC Mapping)

4.3.1 Cable and Wire (mapping)

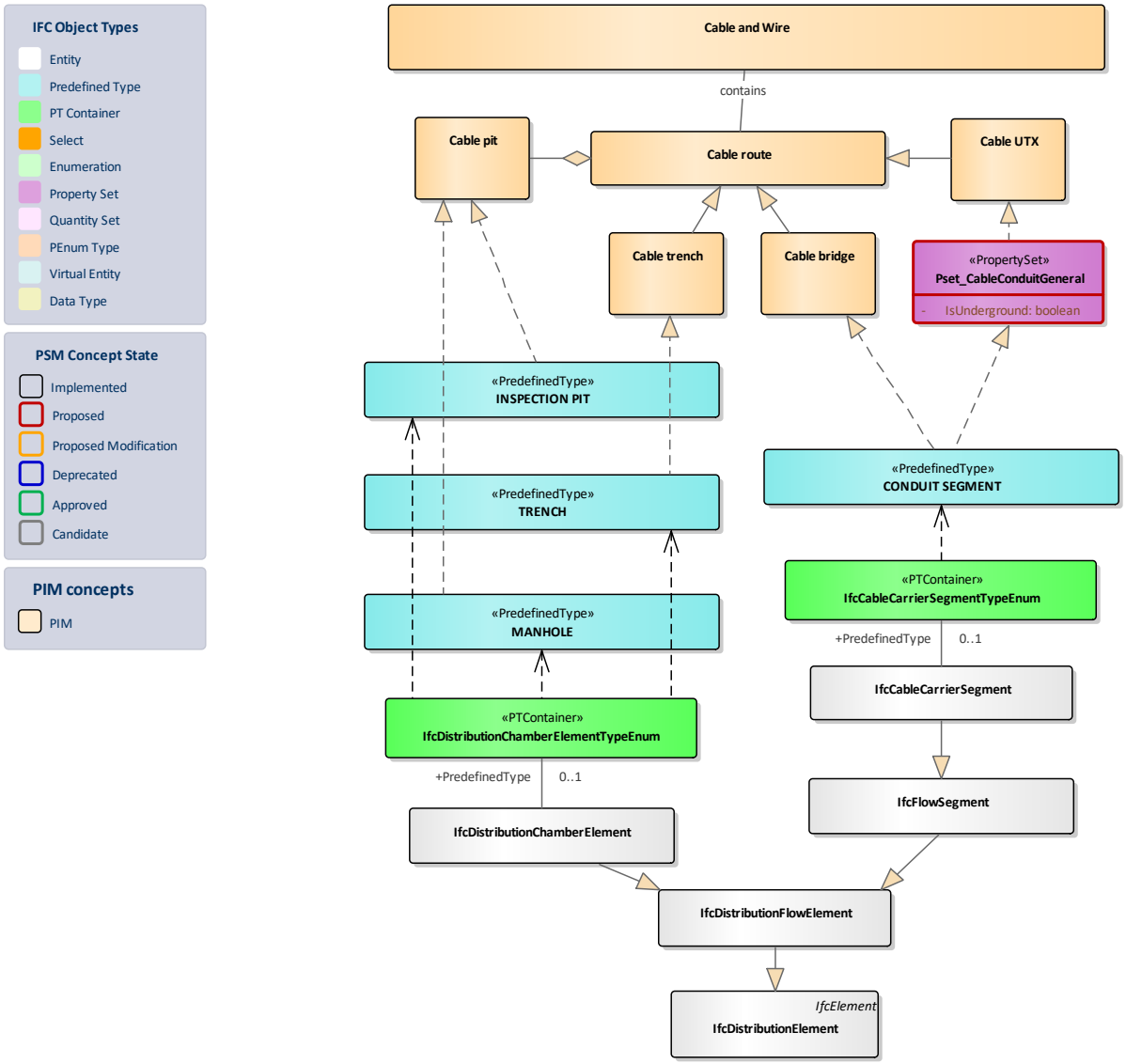


Table 35: Cable and Wire (mapping)

4.4 Detector types (IFC Mapping)

4.4.1 Detector types (mapping)

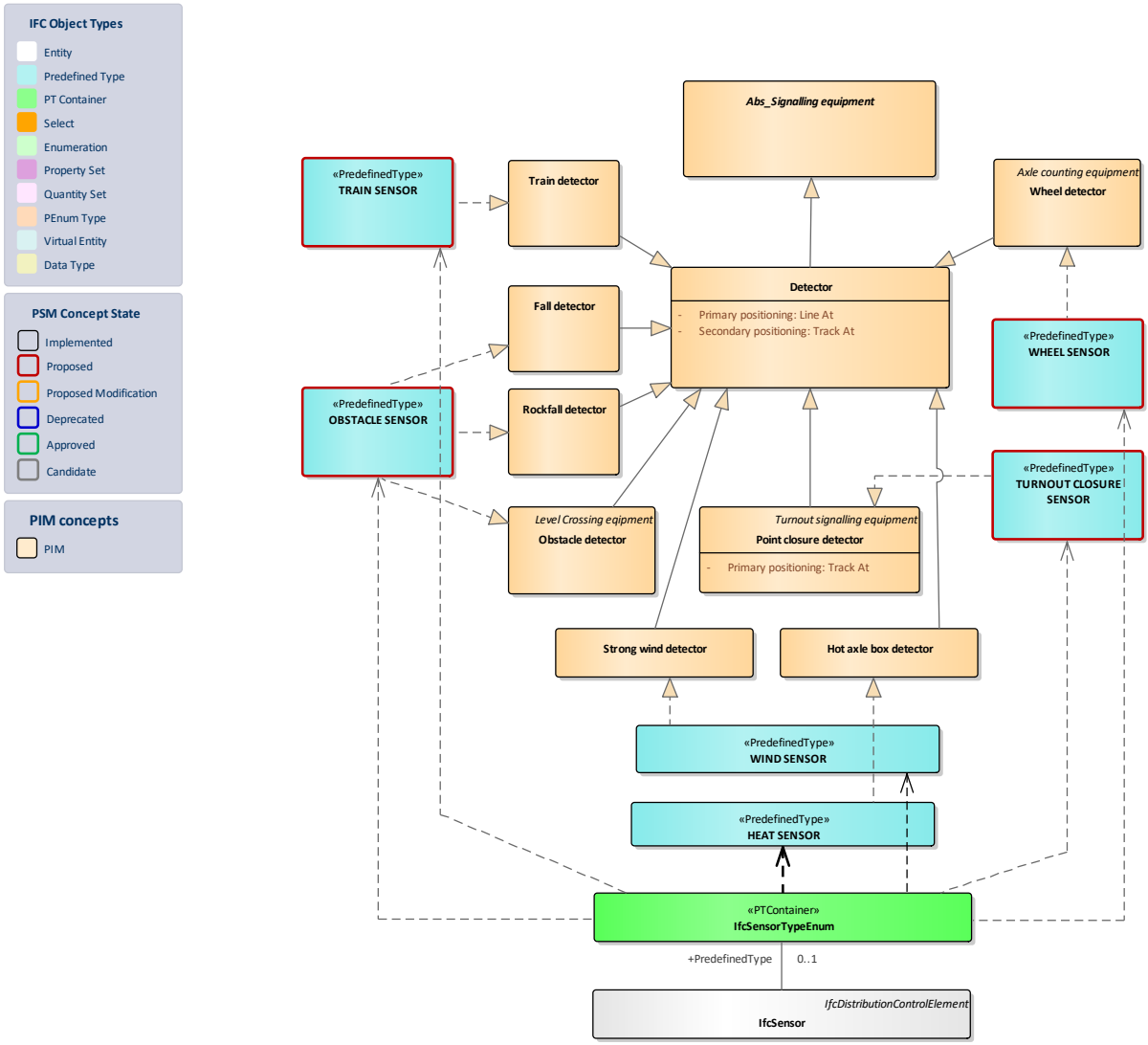


Table 36: Detector types (mapping)

4.5 Housing (IFC Mapping)

4.5.1 Housing + Trackside Battery (mapping)

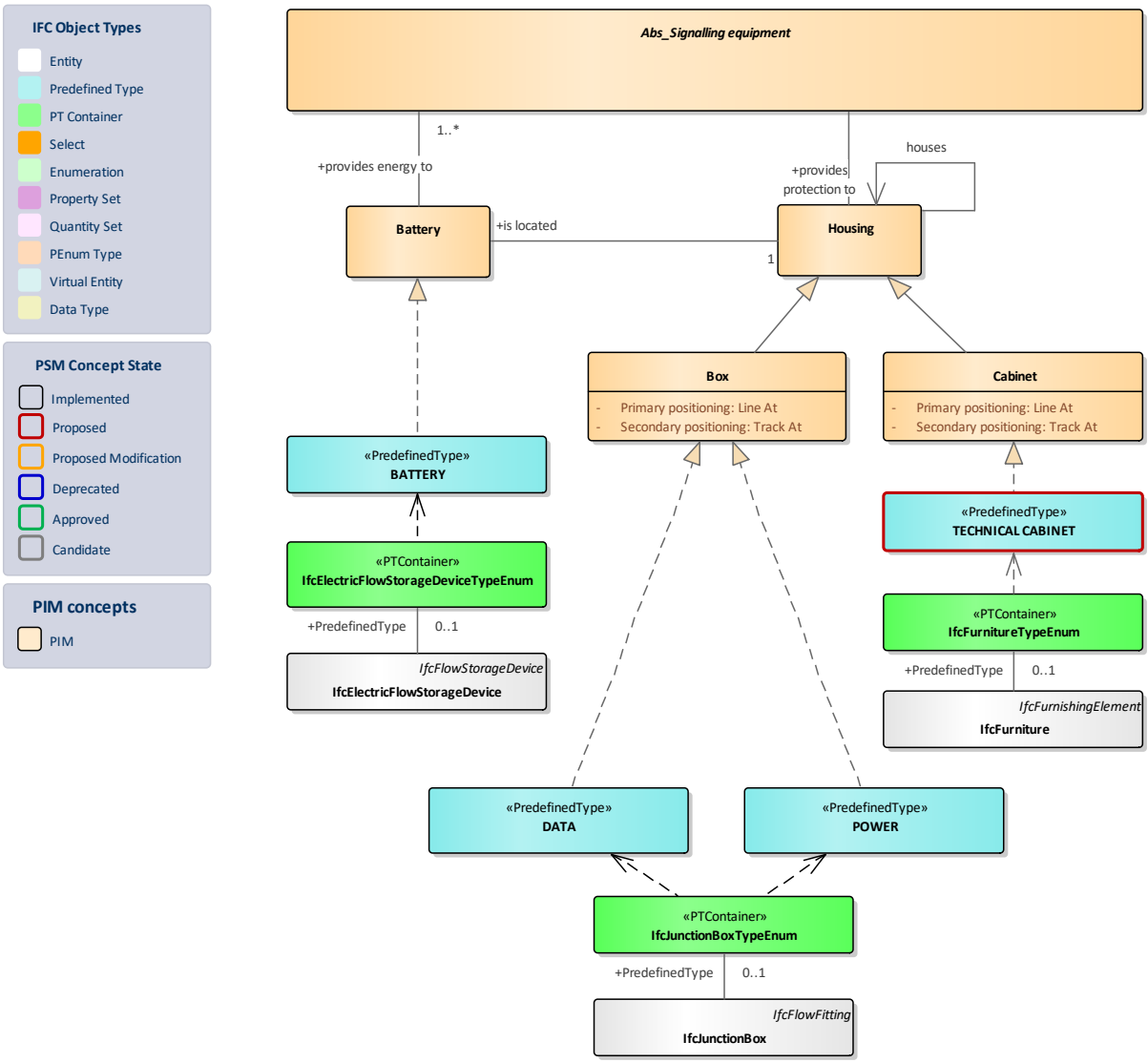


Table 37: Housing + Trackside Battery (mapping)

4.6 Level Crossing equipment (IFC Mapping)

4.6.1 Level Crossing equipment (mapping)

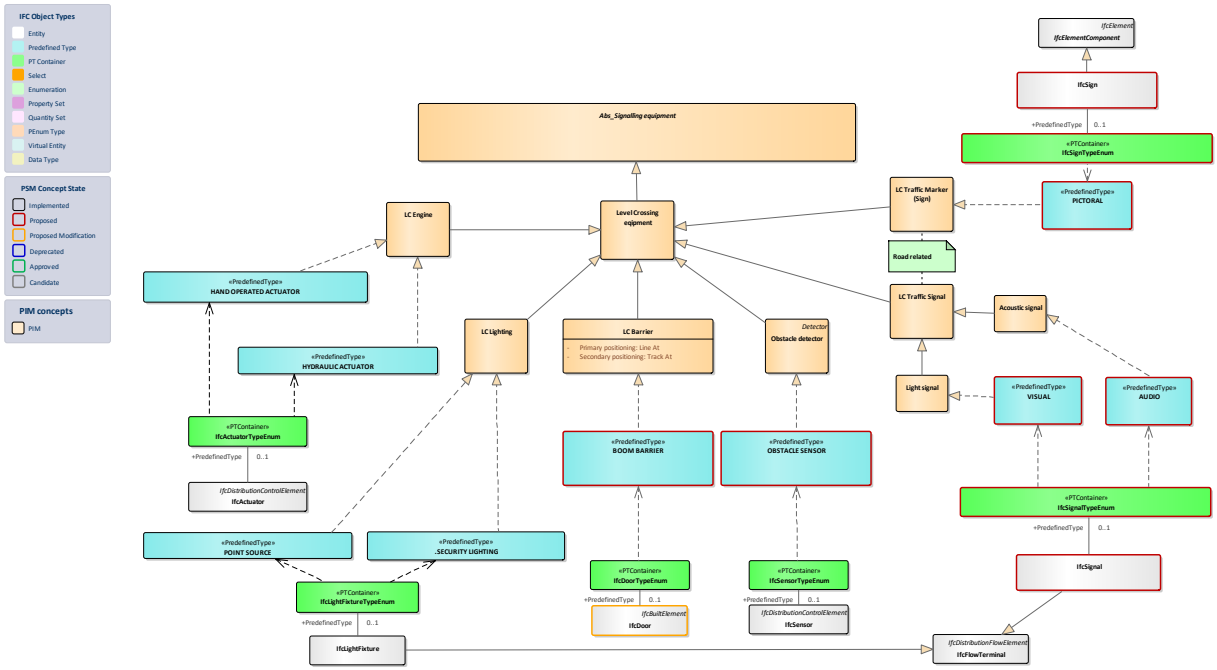


Table 38: Level Crossing equipment (mapping)

4.7 Local operation device (IFC Mapping)

4.7.1 Local operation device (mapping)

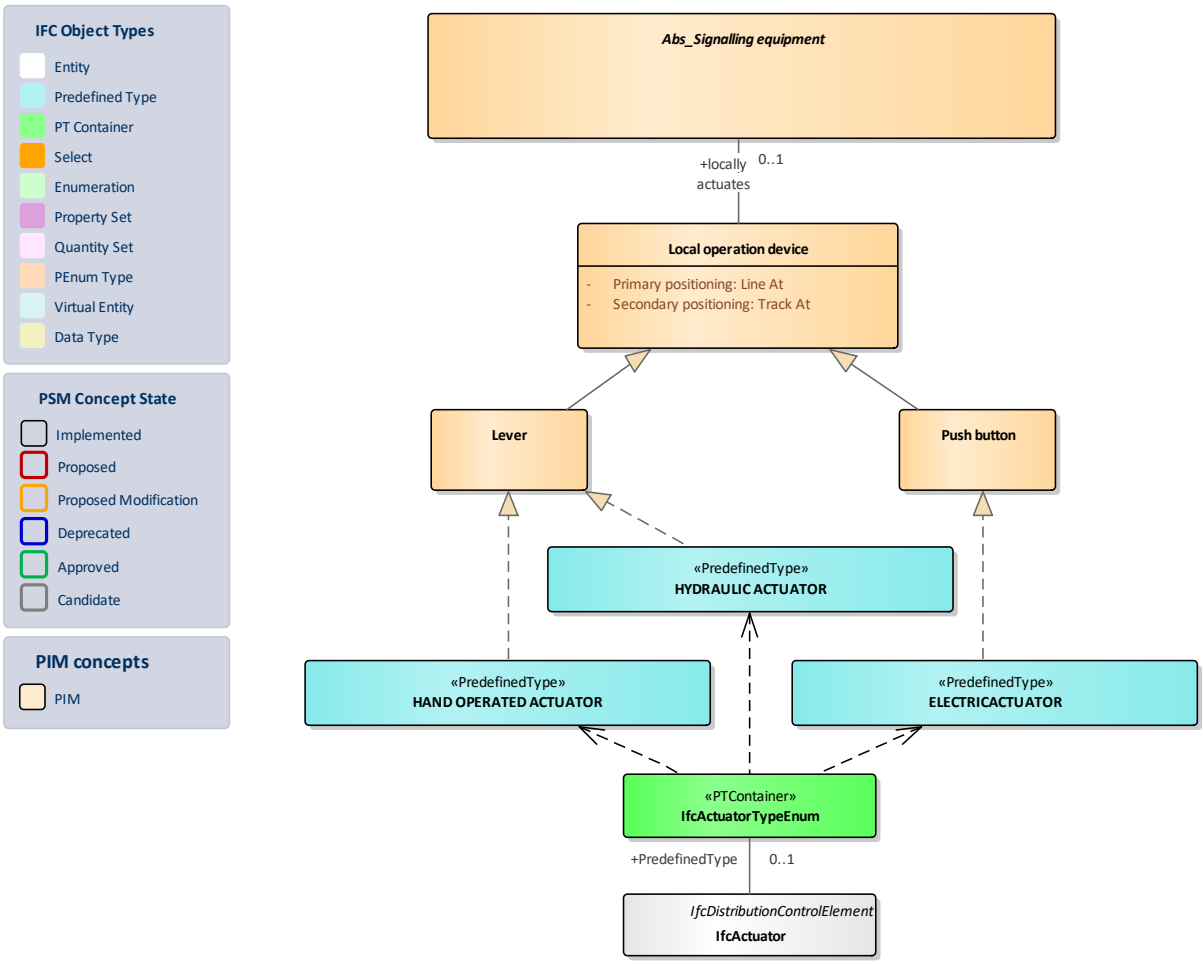


Table 39: Local operation device (mapping)

4.8 Lock (IFC Mapping)

4.8.1 Lock (mapping)

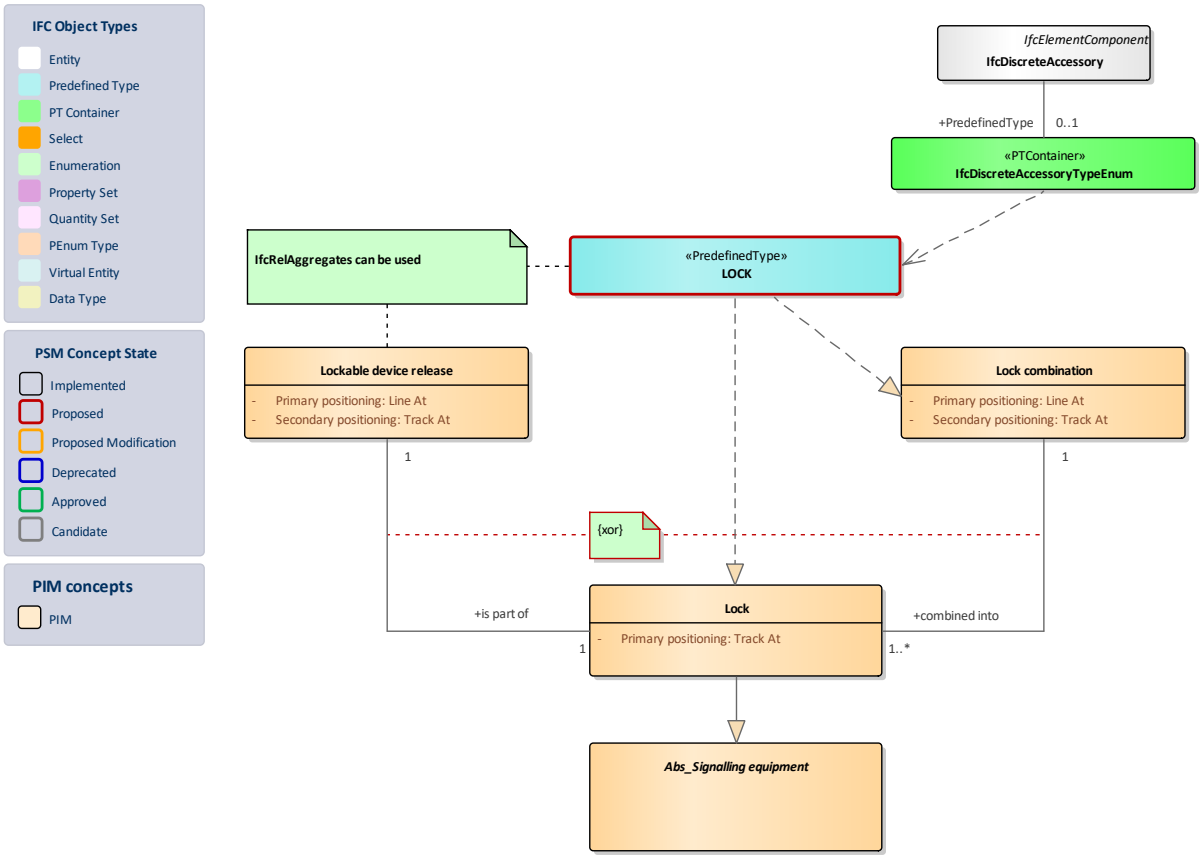


Table 40: Lock (mapping)

4.9 Signal (IFC Mapping)

4.9.1 Signal (mapping)

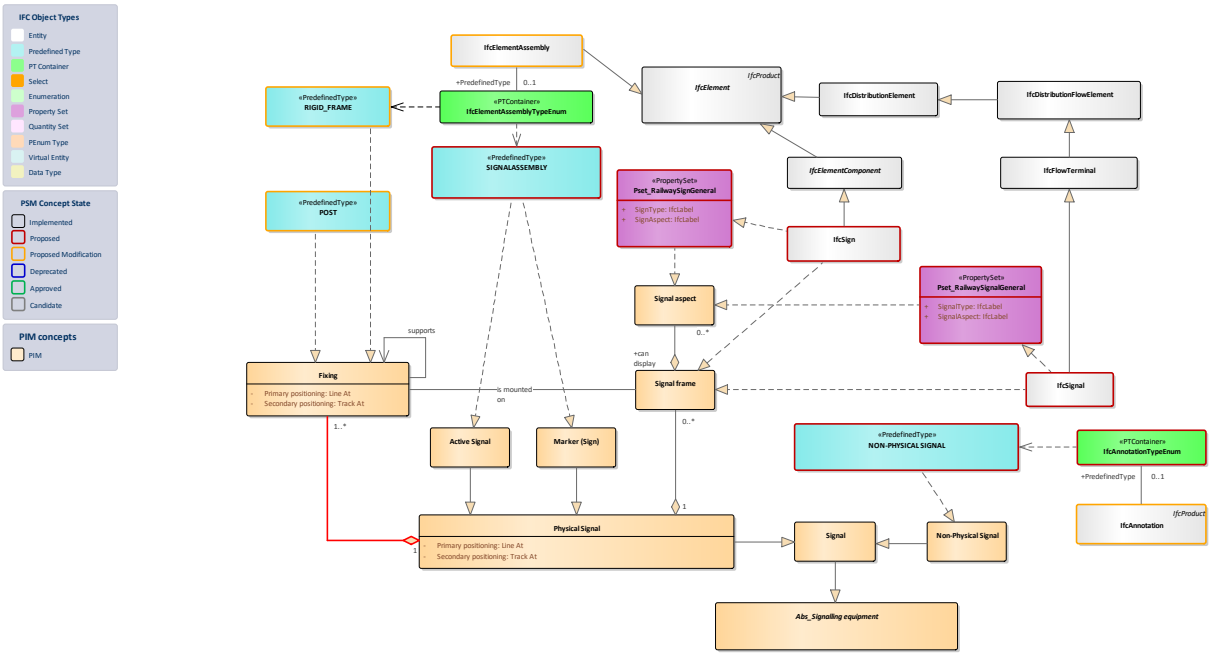


Table 41: Signal (mapping)

4.10 Track Circuit (IFC Mapping)

4.10.1 Track Circuit (mapping)

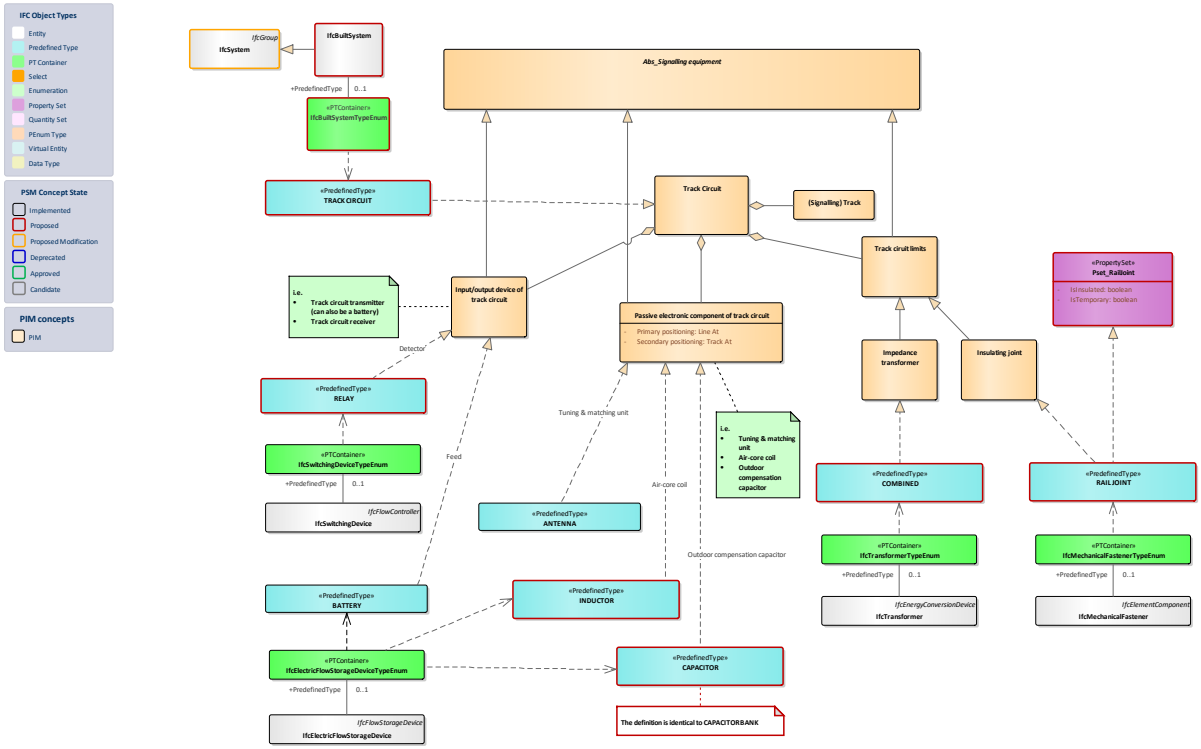


Table 42: Track Circuit (mapping)

4.11 Train protection equipment (IFC Mapping)

4.11.1 Train protection equipment (mapping)

Table 43: Train protection equipment (mapping)

4.12 Turnout signalling equipment (IFC Mapping)

4.12.1 Turnout signalling equipment (mapping)

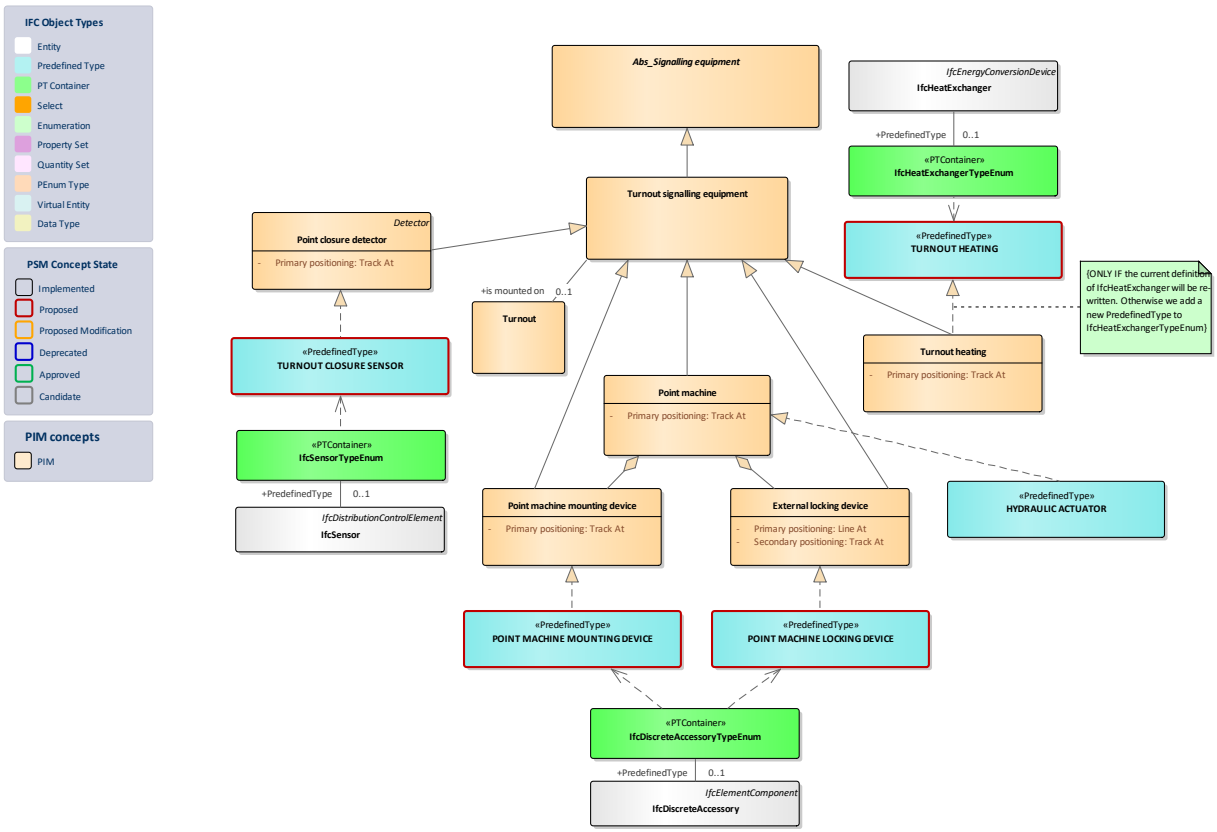


Table 44: Turnout signalling equipment (mapping)

4.13 Vehicle barring/breaking device (IFC Mapping)

4.13.1 Vehicle barring/breaking device (mapping)

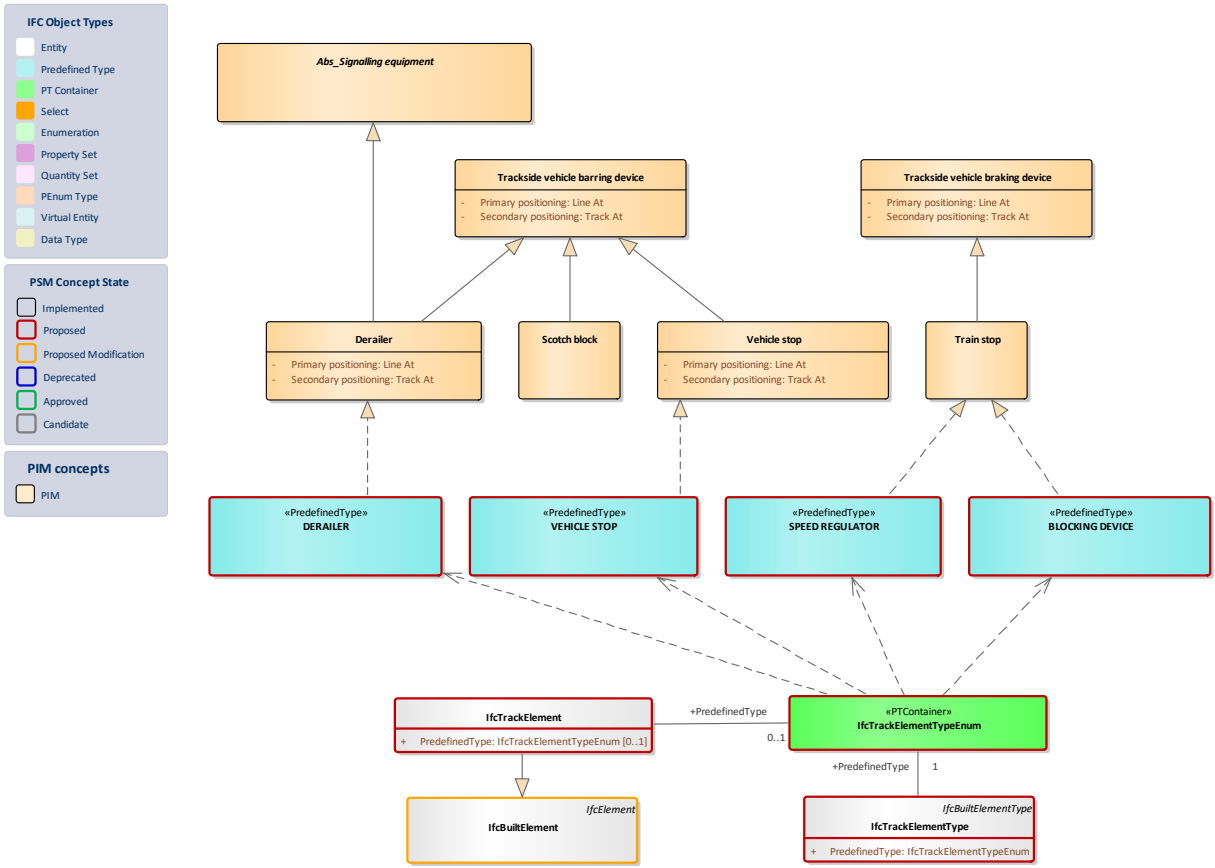


Table 45: Vehicle barring/breaking device (mapping)

5 Telecom mapping diagrams

5.1 Cabling & Cables (IFC Mapping)

5.1.1 Cables (mapping)

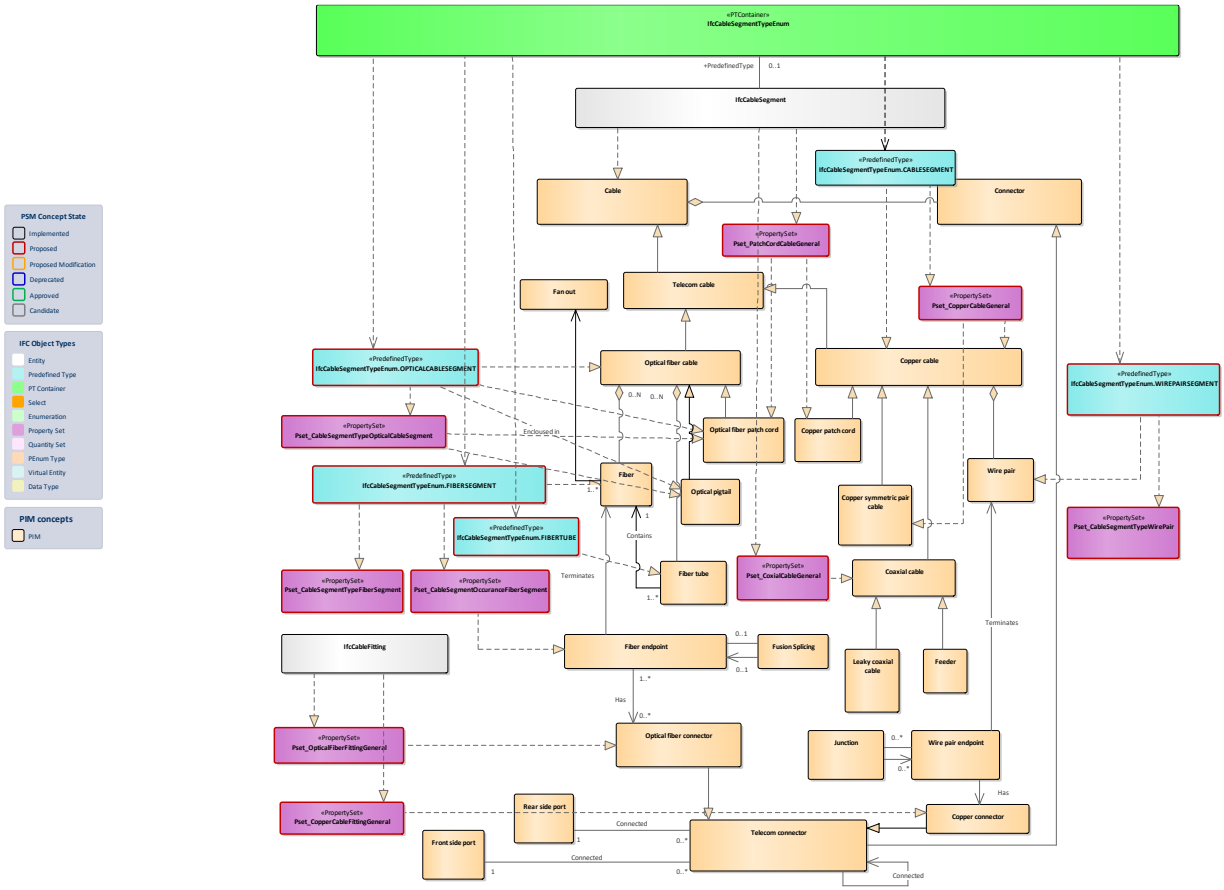


Table 46: Cables (mapping)

5.2 Cabling (mapping)

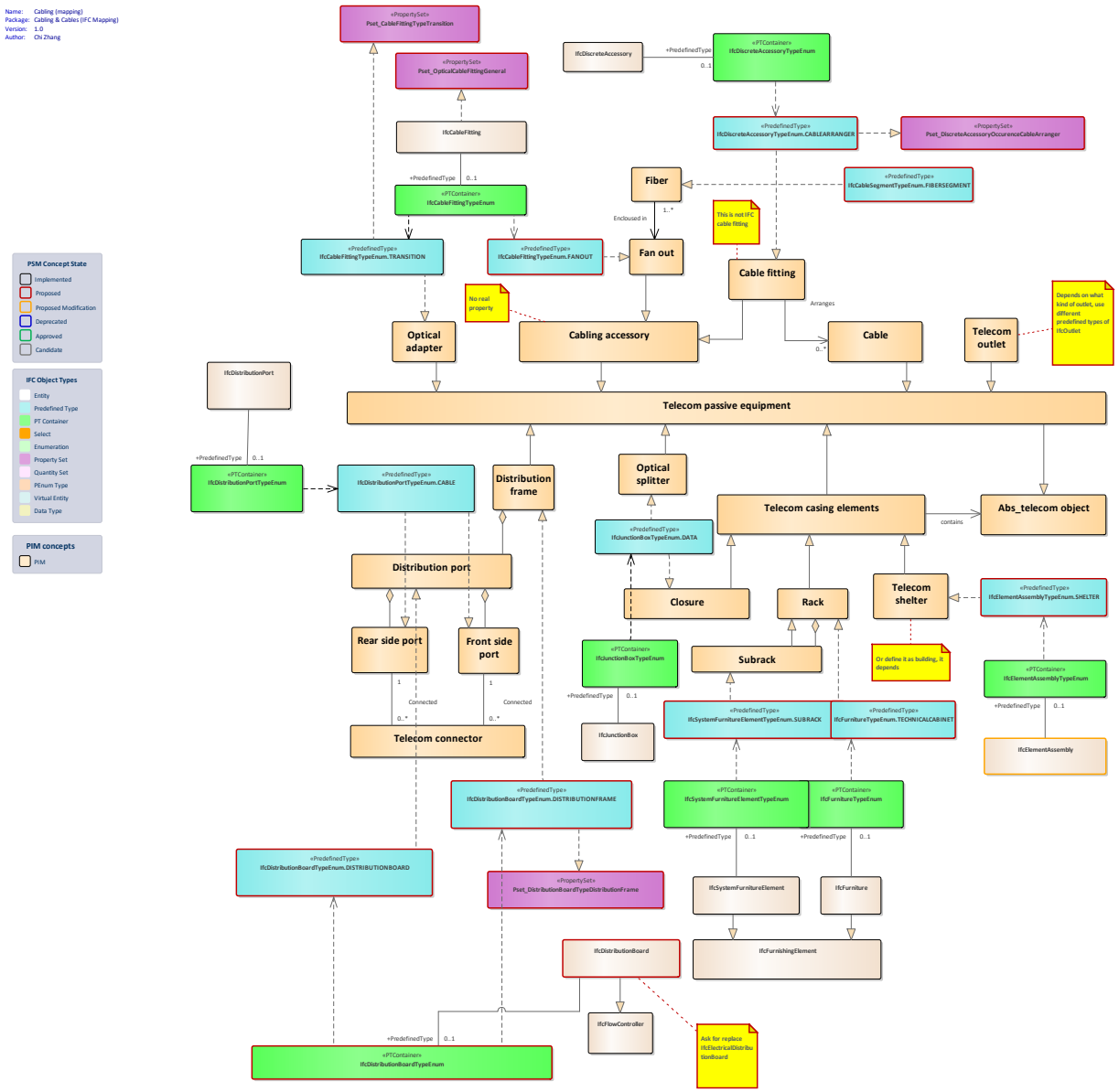


Table 47: Cabling (mapping)

5.3 Fixed telephony system (IFC Mapping)

5.3.1 Fixed telephony system (mapping)

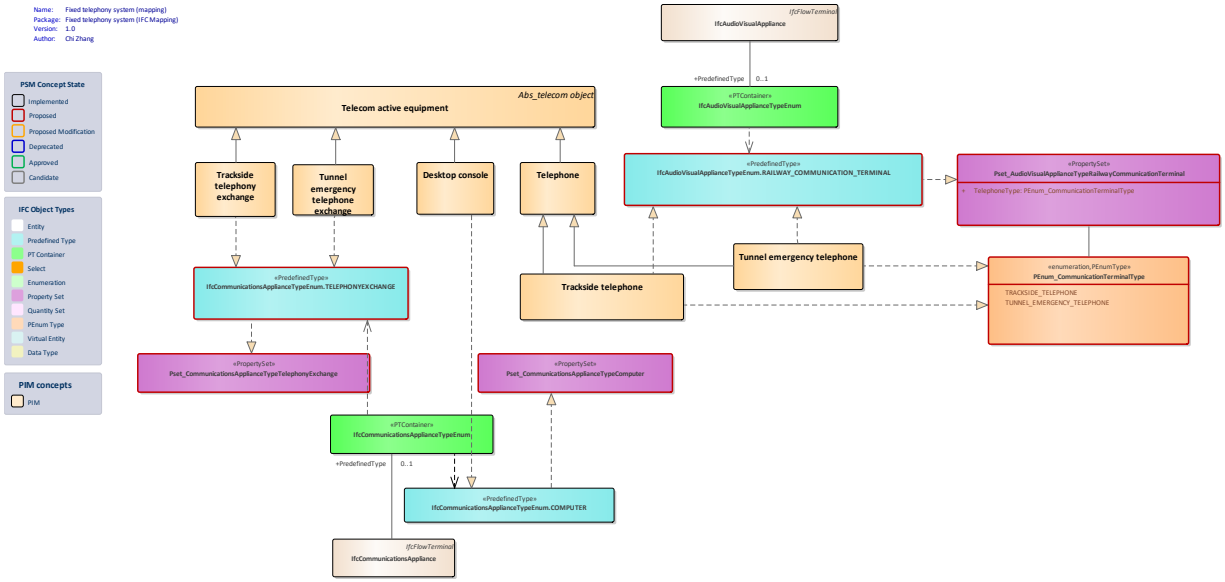


Table 48: Fixed telephony system (mapping)

5.4 Fixed transmission network (IFC Mapping)

5.4.1 Fixed transmission network (mapping)

Name: Fixed transmission network (mapping)
Package: Fixed transmission network (IFC Mapping)
Version: 1.0
Author: Florian Hulin

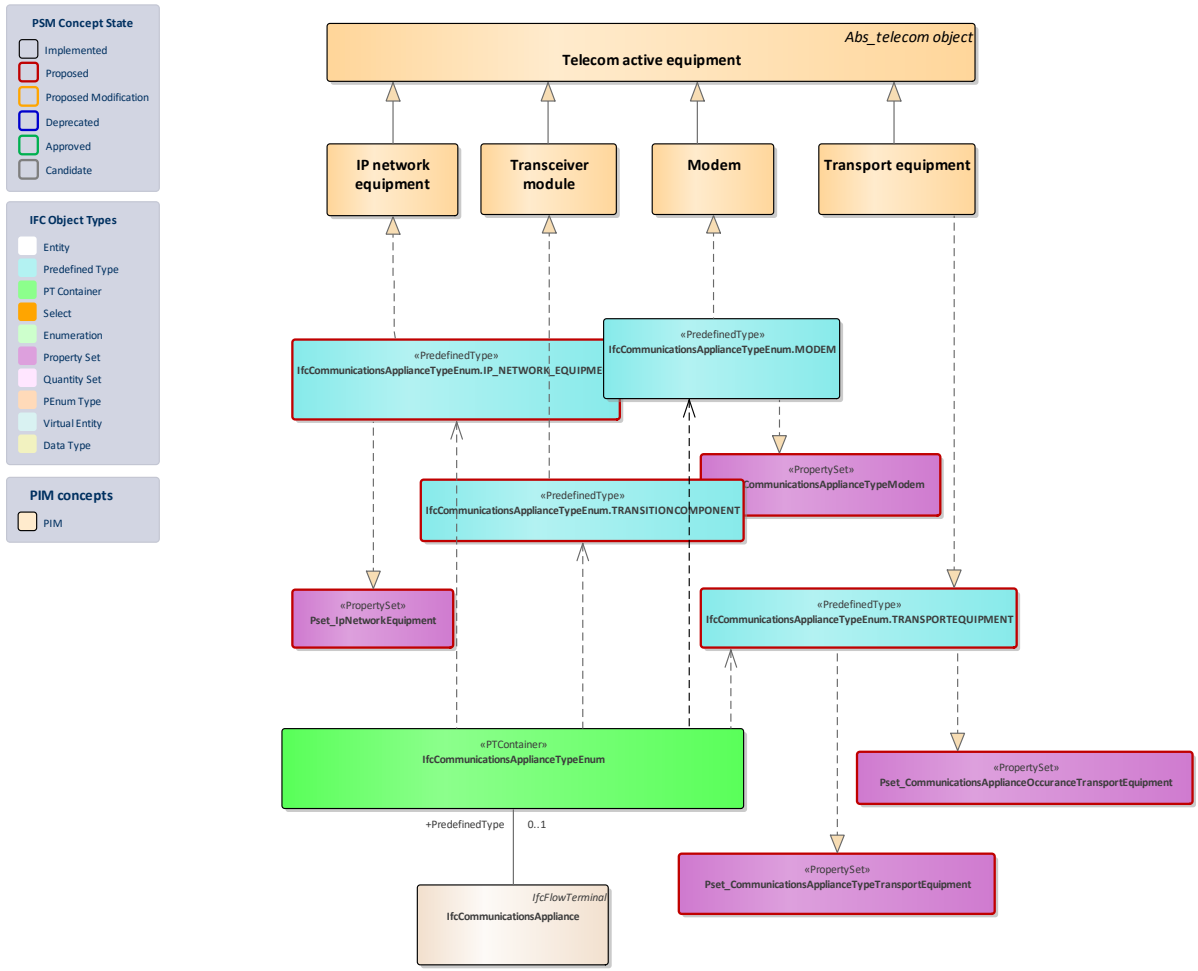


Table 49: Fixed transmission network (mapping)

5.5 Mobile network (GSMR - WiFi - LTE) (IFC Mapping)

5.5.1 Mobile network (GSMR - WiFi - LTE) (mapping)

Name: Mobile network (GSMR - WiFi - LTE) (mapping)
Package: Mobile network (GSMR - WiFi - LTE) (IFC Mapping)
Version: 1.0
Author: Chi Zhang

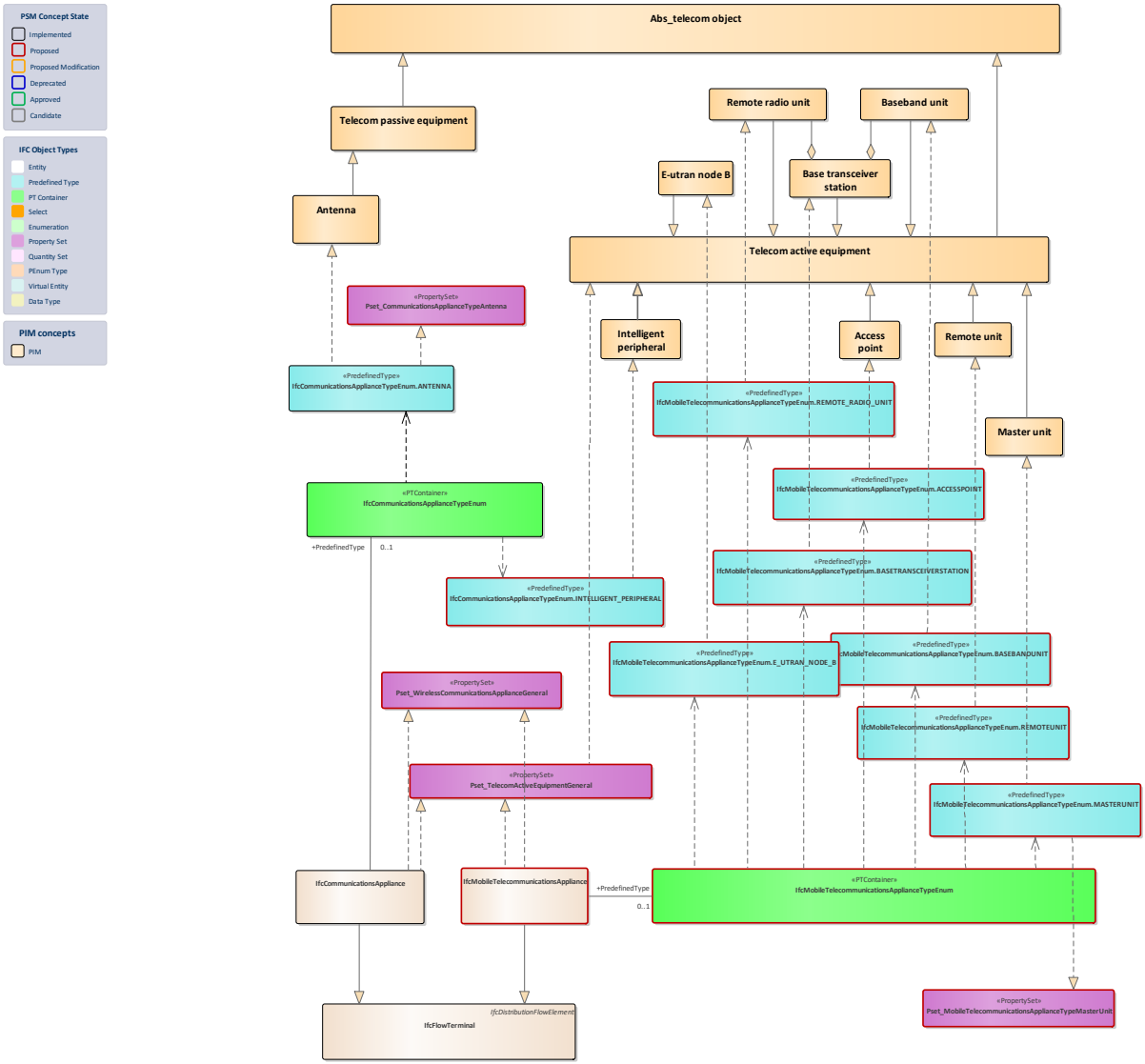


Table 50: Mobile network (GSMR - WiFi - LTE) (mapping)

5.6 Railway natural disaster and Foreign object intrusion monitoring system (IFC Mapping)

5.6.1 Railway natural disaster and Foreign object intrusion monitoring system (mapping)

Name: Railway natural disaster and Foreign object intrusion monitoring system (mapping)
Package: Railway natural disaster and Foreign object intrusion monitoring system (IFC Mapping)
Version: 1.0
Author: Chi Zhang

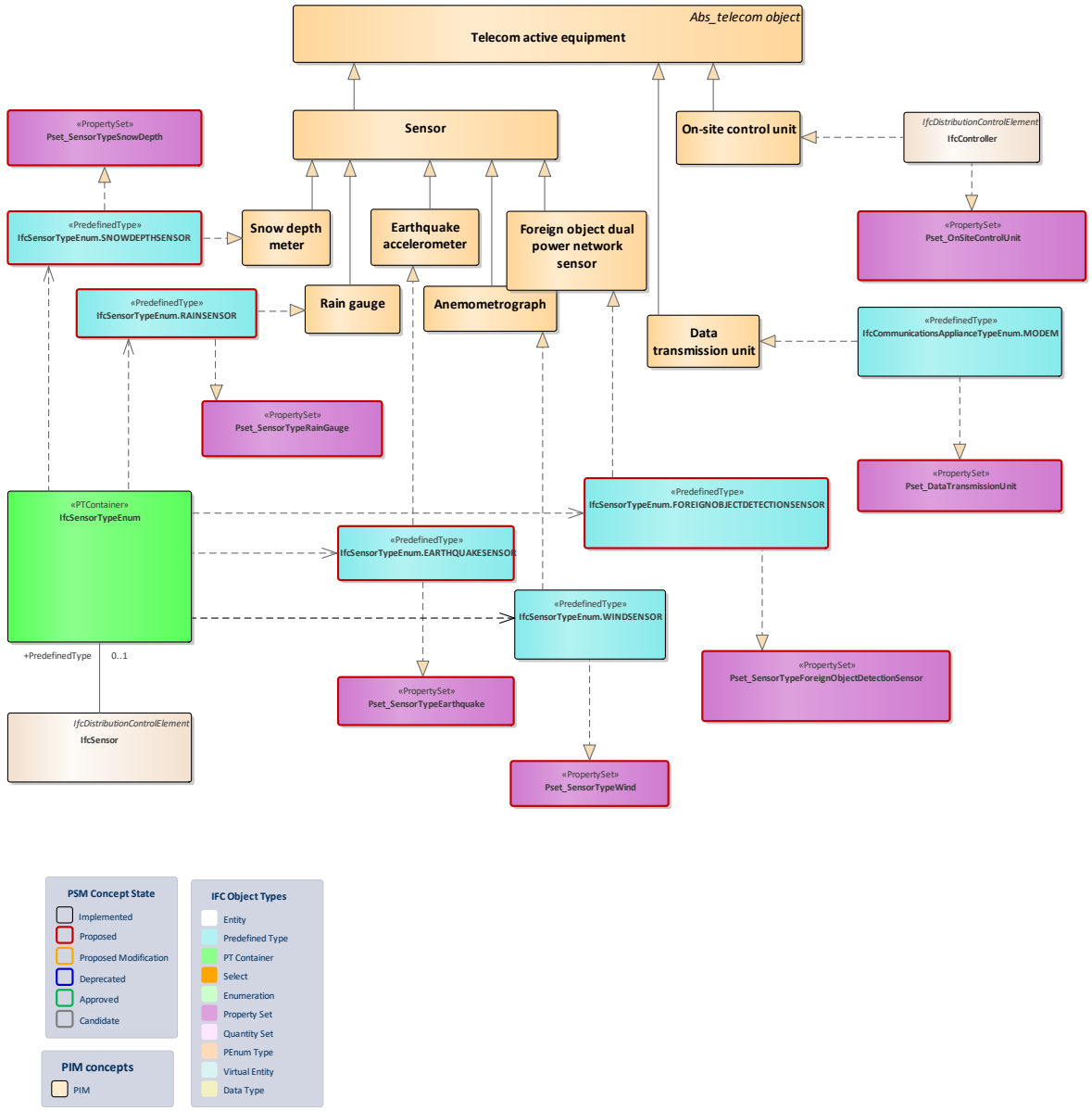


Table 51: Railway natural disaster and Foreign object intrusion monitoring system (mapping)

5.7 Support and laying infrastructure (IFC Mapping)

5.7.1 Support and laying infrastructure (mapping)

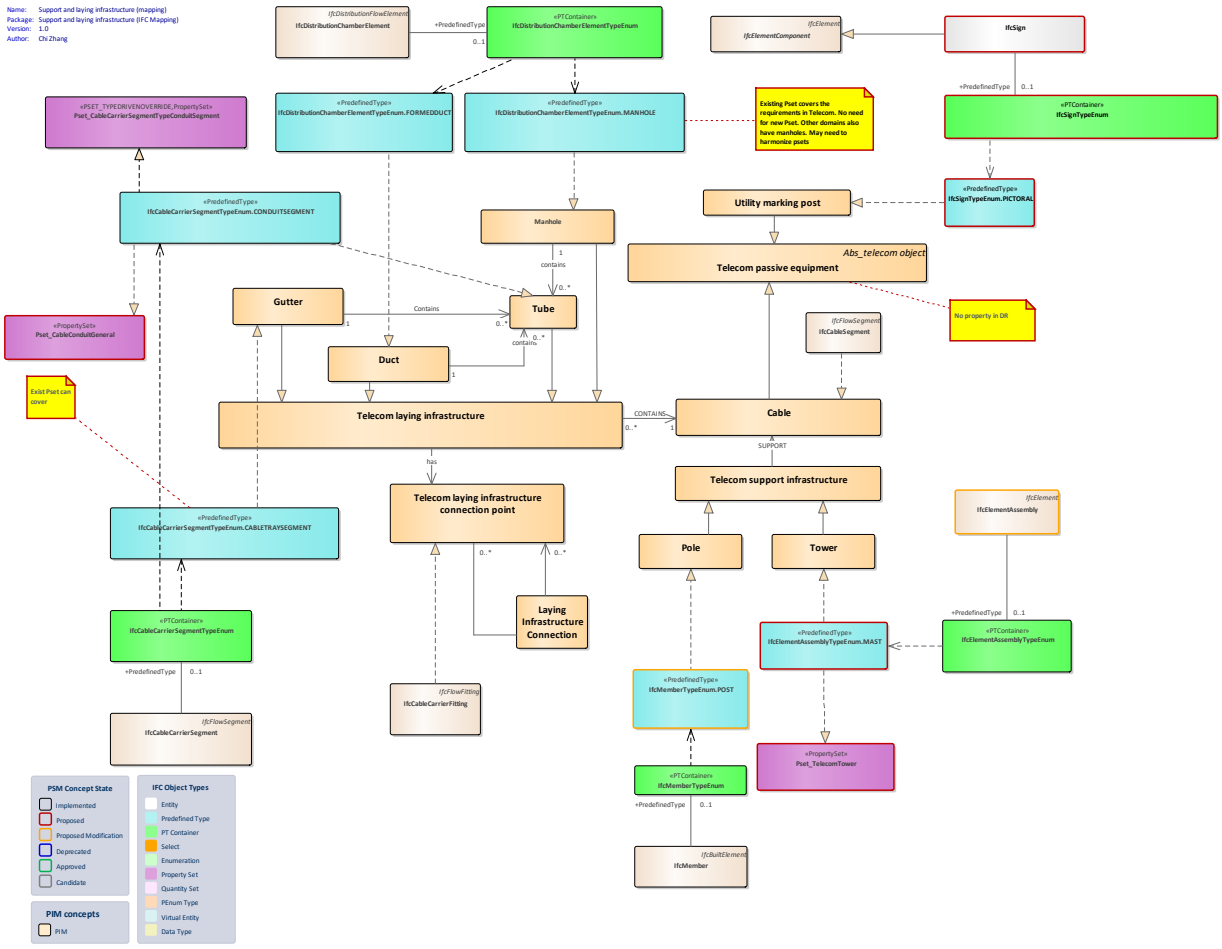


Table 52: Support and laying infrastructure (mapping)

5.8 Telecom interfaces (IFC Mapping)

5.8.1 Telecom interfaces (mapping)

Name: Telecom interfaces (mapping)
Package: Telecom interfaces (IFC Mapping)
Version: 1.0
Author: Chi Zhang

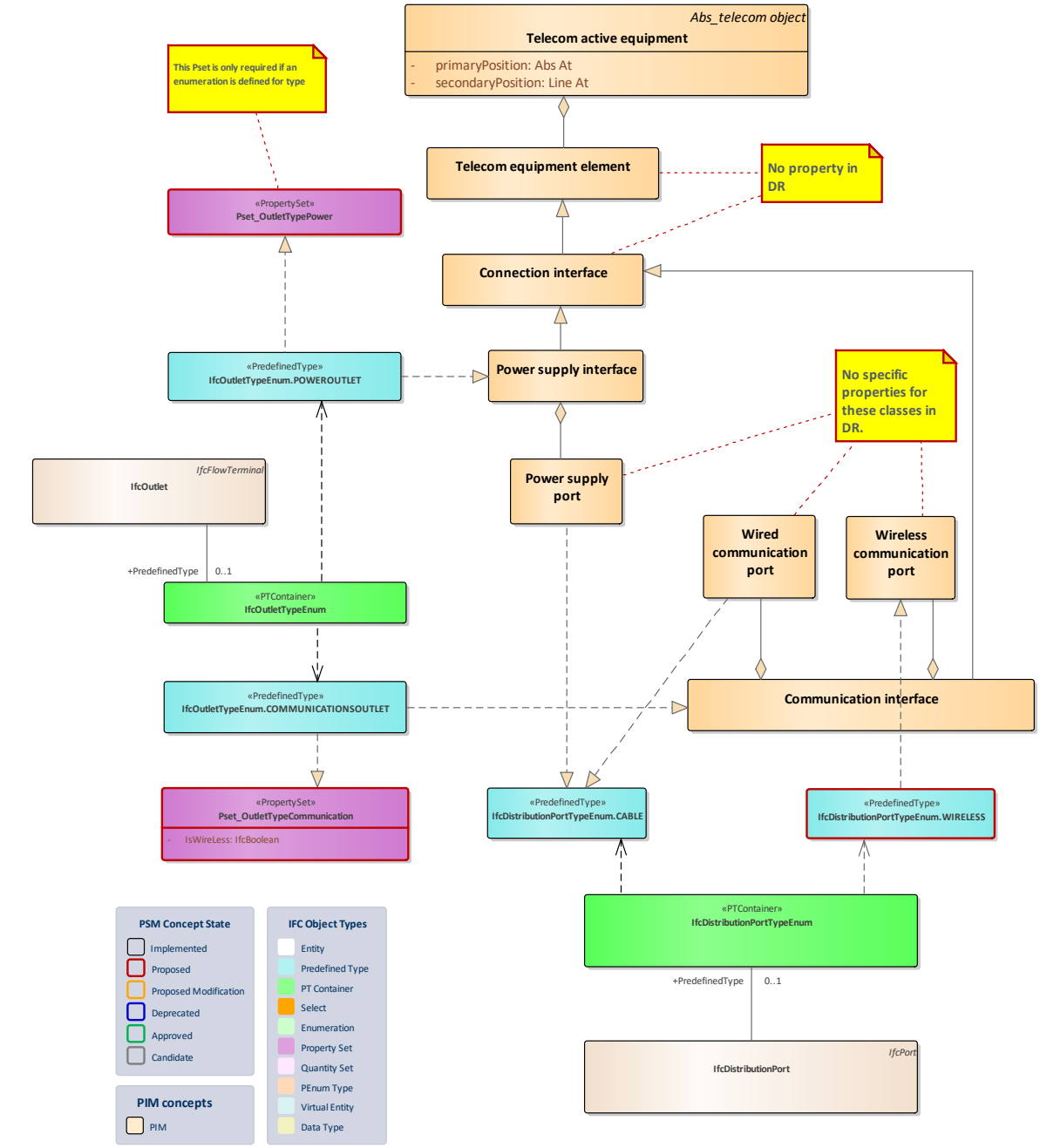


Table 53: Telecom interfaces (mapping)

5.9 Ticketing system (IFC Mapping)

5.9.1 Ticketing system (mapping)

Name: Ticketing system (mapping)
Package: Ticketing system (IFC Mapping)
Version: 1.0
Author: Chi Zhang

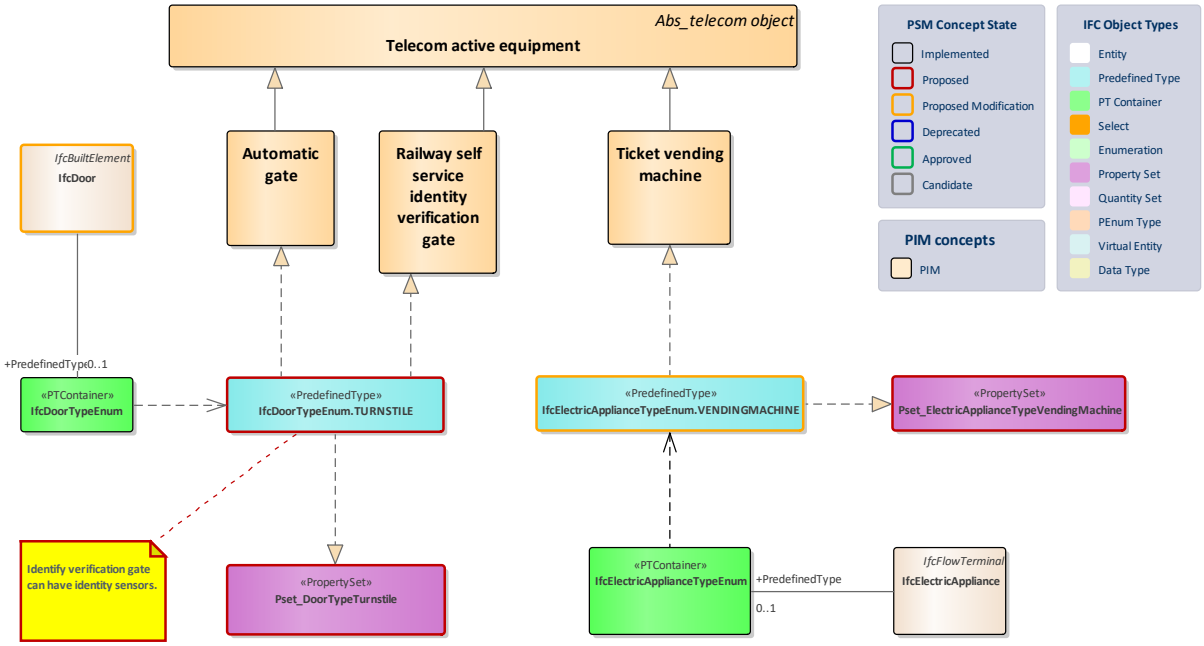


Table 54: Ticketing system (mapping)

5.10 Wired access network (IFC Mapping)

5.10.1 Wired access network (mapping)

Name: Wired access network (mapping)
Package: Wired access network (IFC Mapping)
Version: 1.0
Author: Chi Zhang

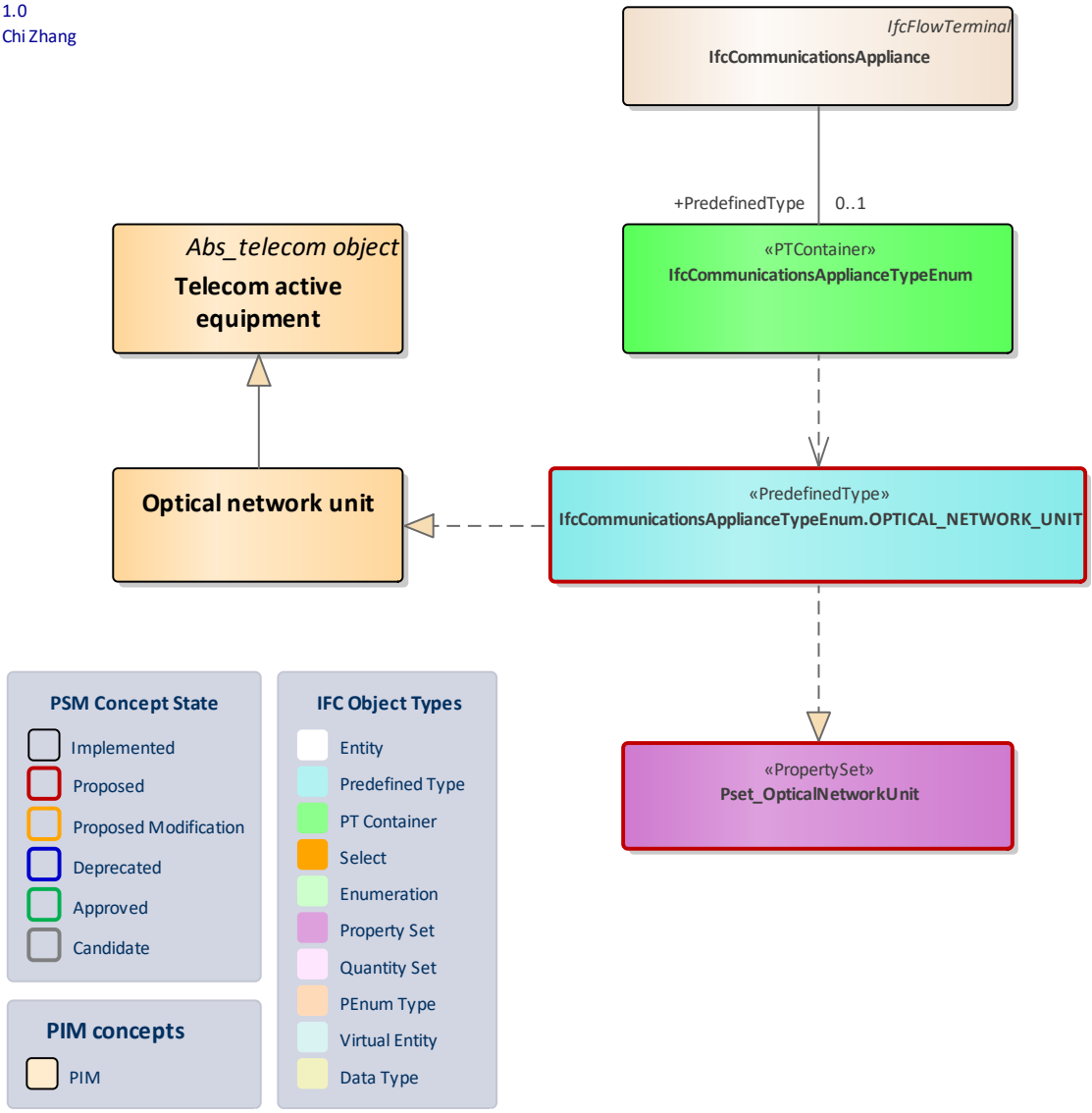


Table 55: Wired access network (mapping)

6 Common – Shared mapping diagrams

6.1 Alignment (IFC Mapping)

6.1.1 Alignment Curve - Mapping

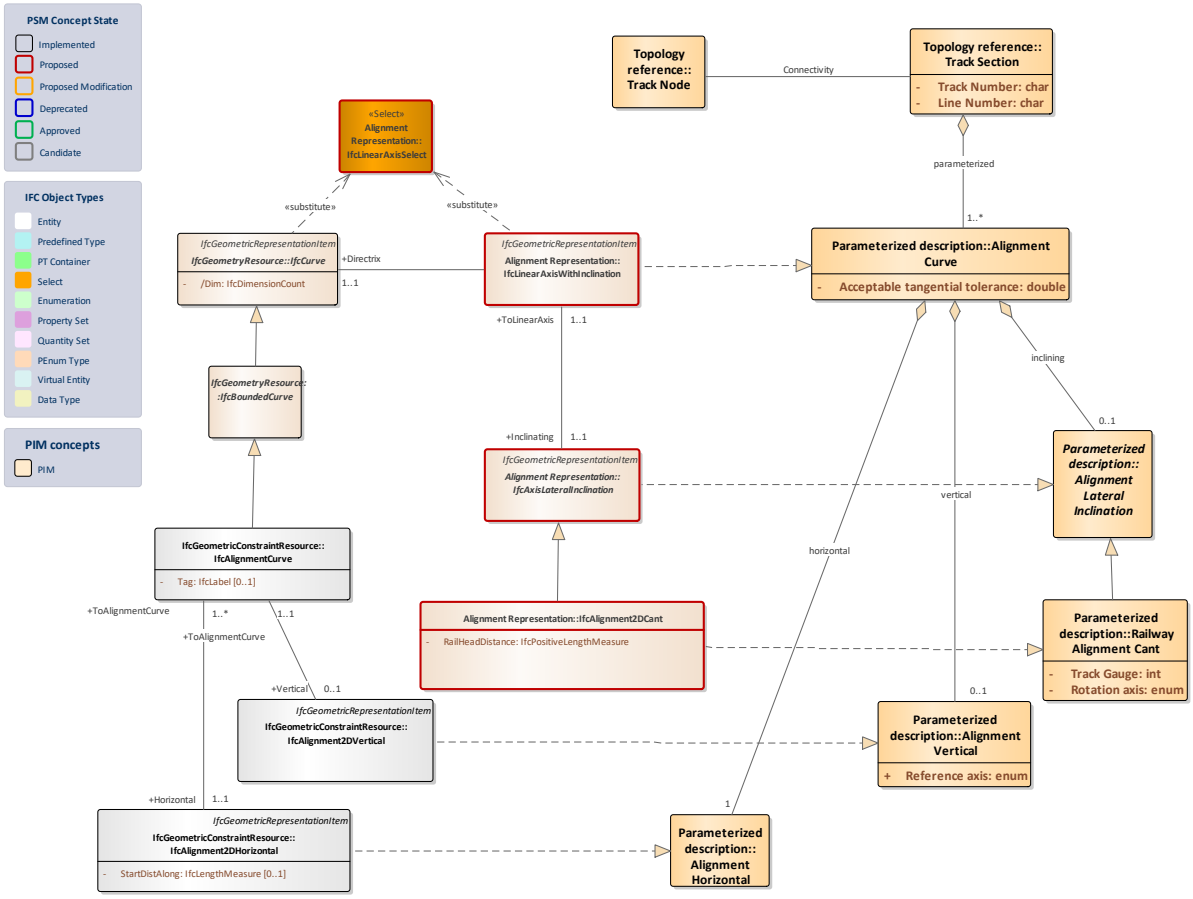


Table 57: Alignment Curve - Mapping

6.1.2 Cant Alignment - Mapping

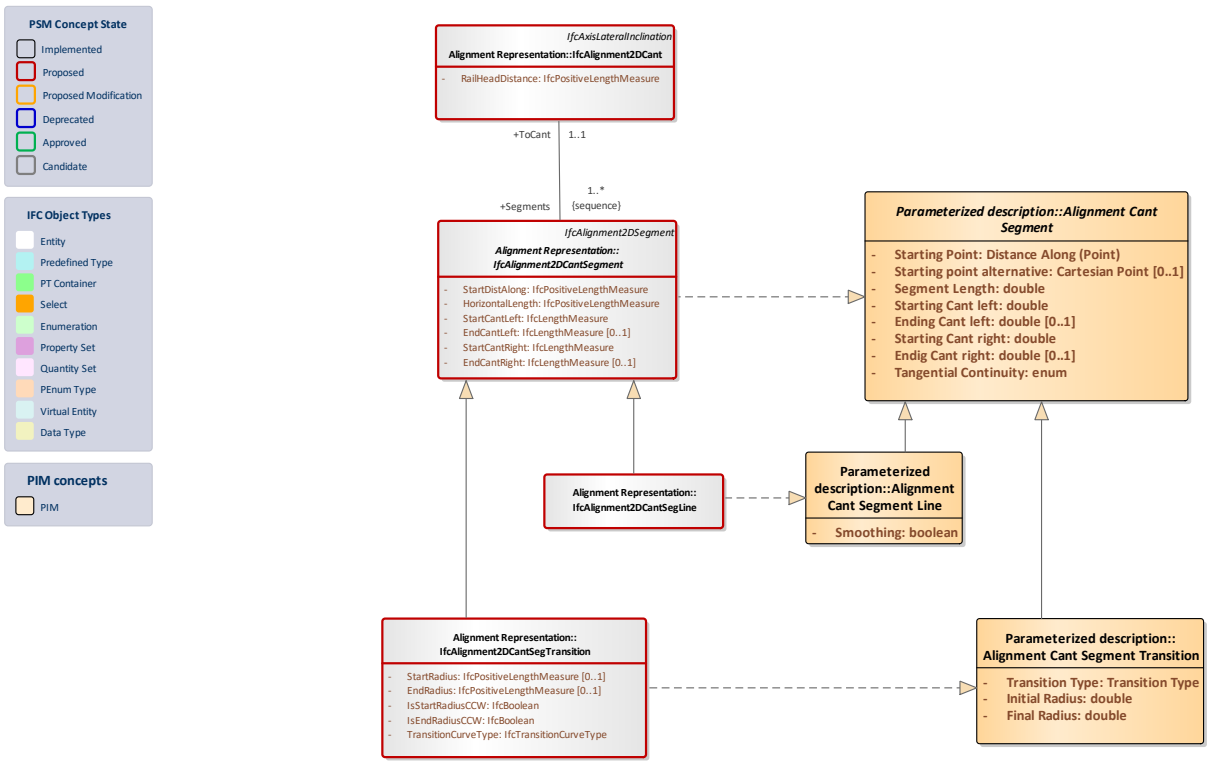


Table 58: Cant Alignment - Mapping

6.1.3 Horizontal Alignment - Mapping

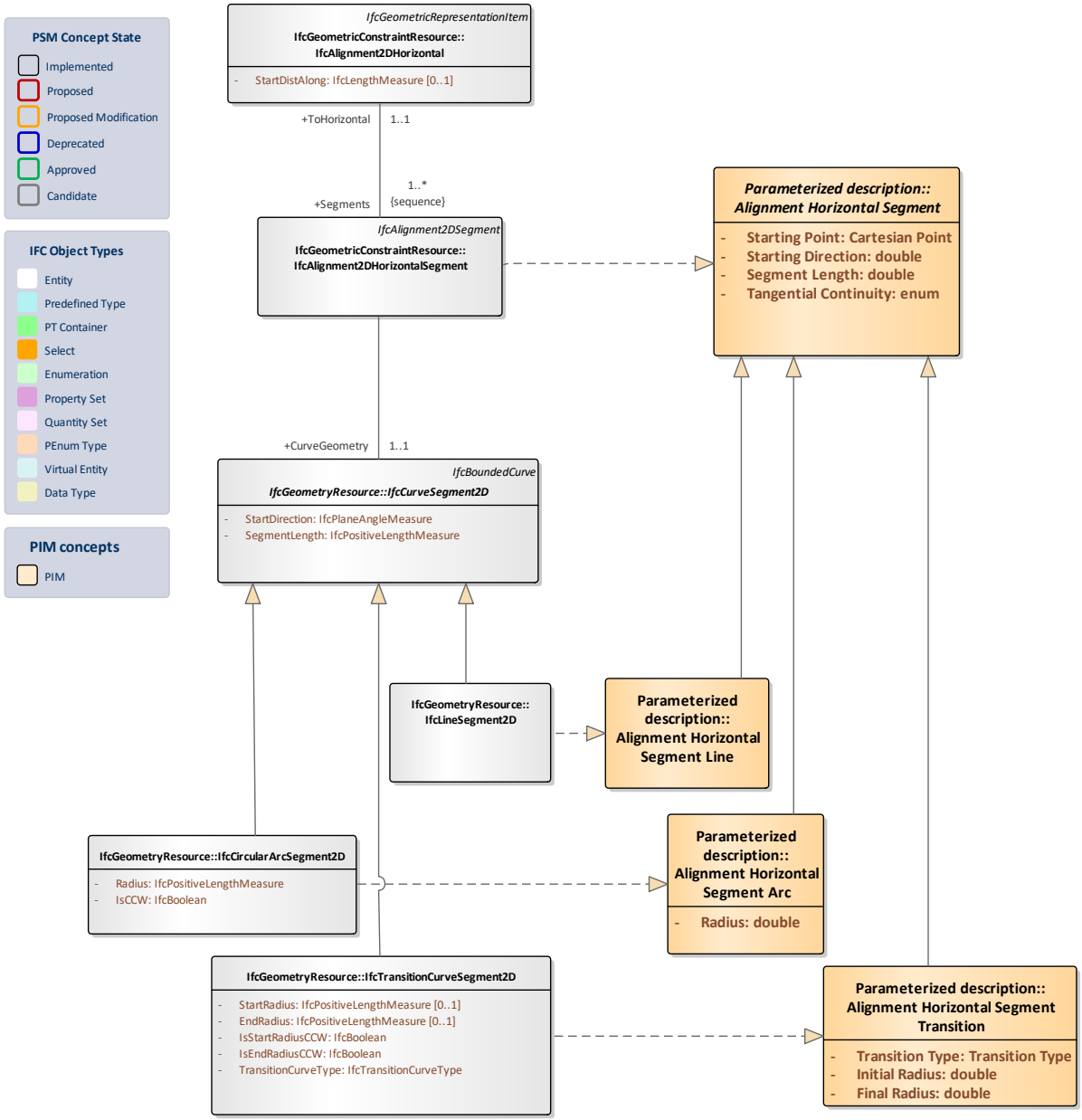


Table 59: Horizontal Alignment - Mapping

6.1.4 Vertical Alignment - Mapping

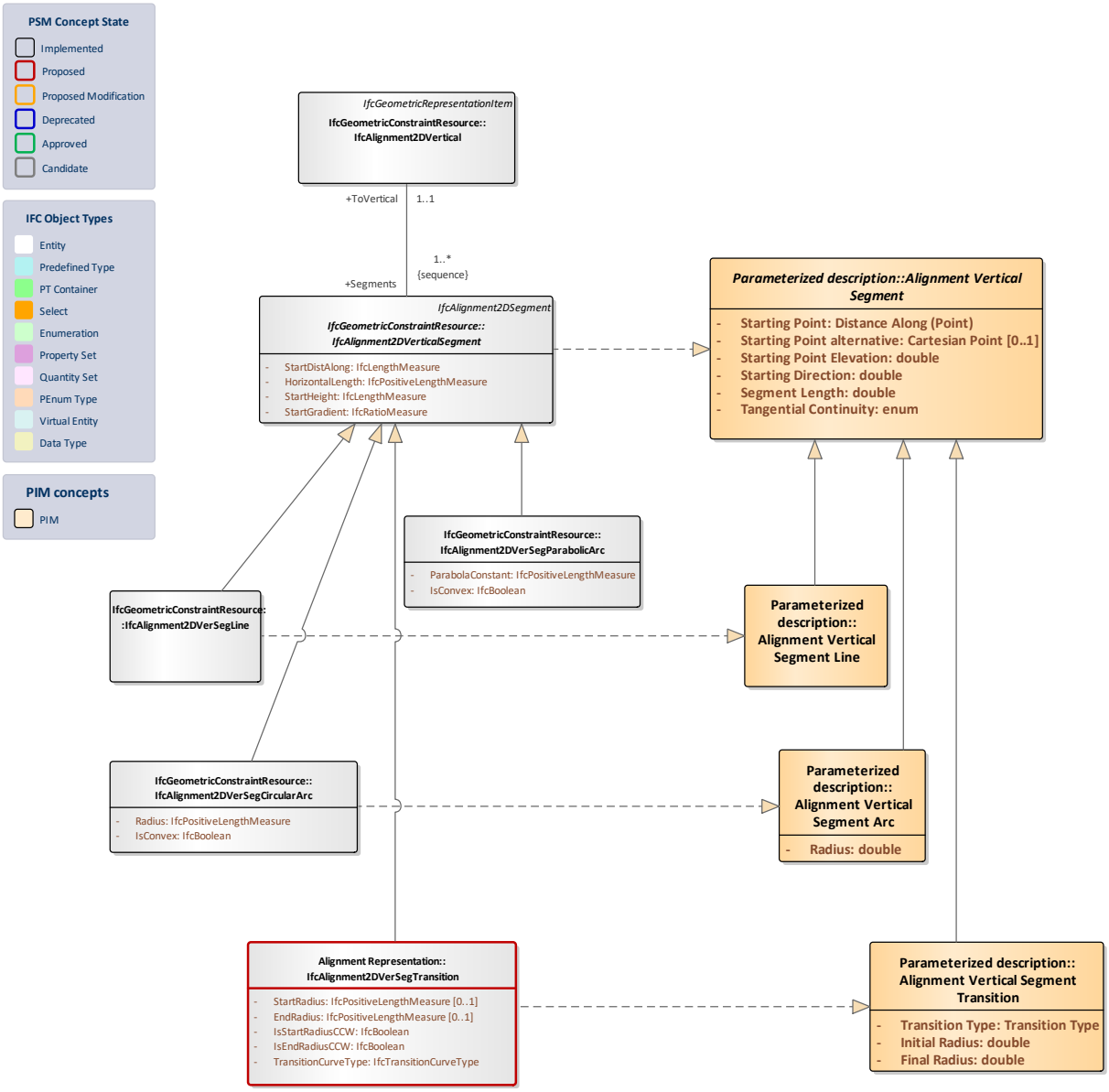


Table 60: Vertical Alignment - Mapping

6.2 Spatial (IFC Mapping)

6.2.1 Track spatial structure (mapping)

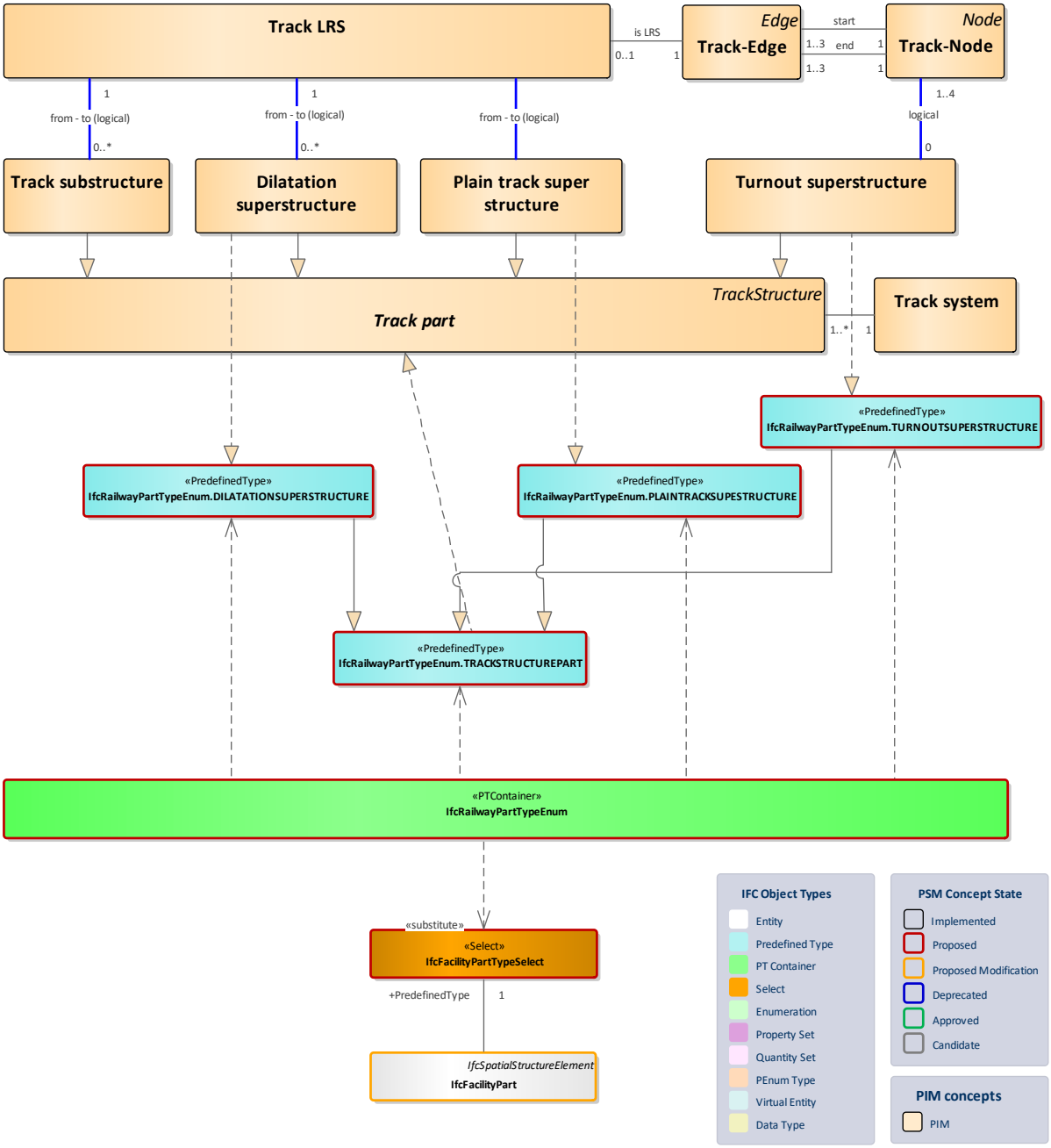


Table 61: Track spatial structure (mapping)

6.2.2 Shared spatial structure - overview (mapping)

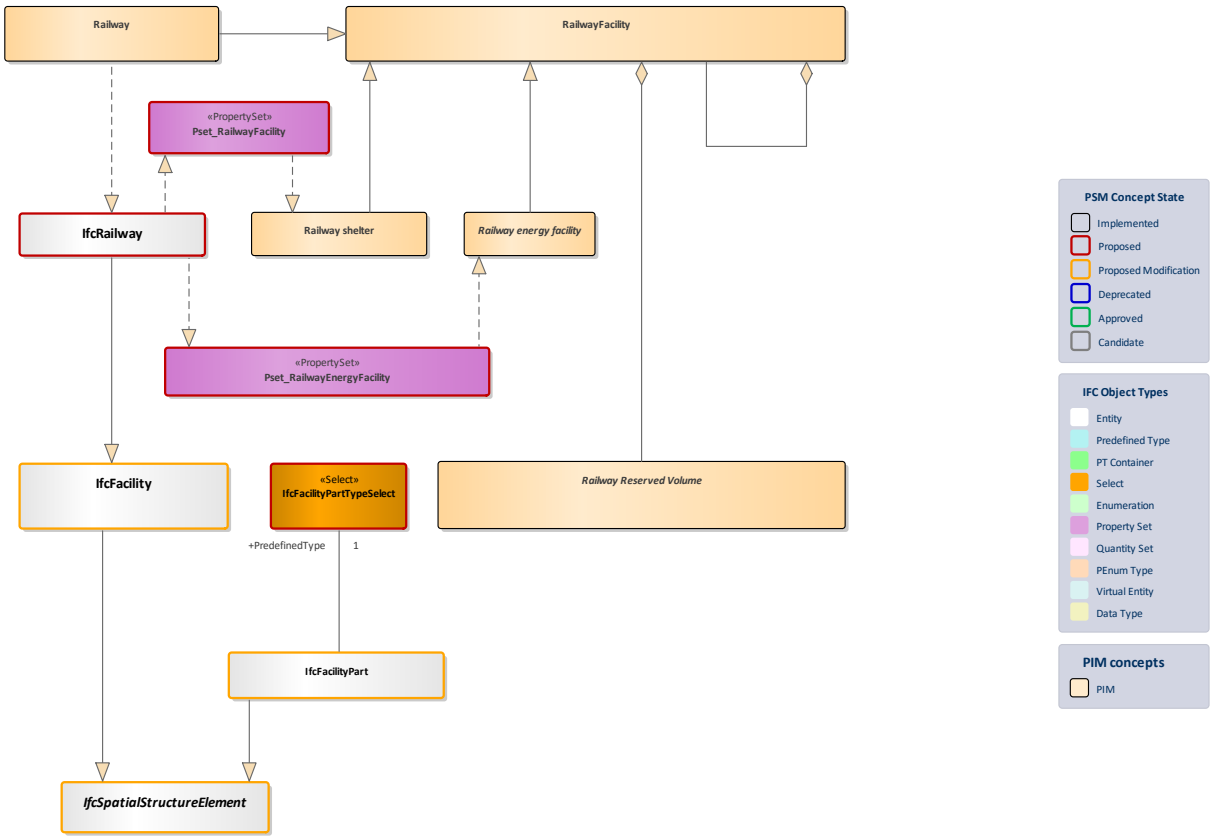


Table 62: Shared spatial structure - overview (mapping)

6.2.3 Shared spatial structure - railway (mapping)

Name: Shared spatial structure - railway (mapping)
Author: Matthieu Perin
Version: 1.0
Created: 8/5/2020 2:50:54 PM
Updated: 8/5/2020 5:03:32 PM

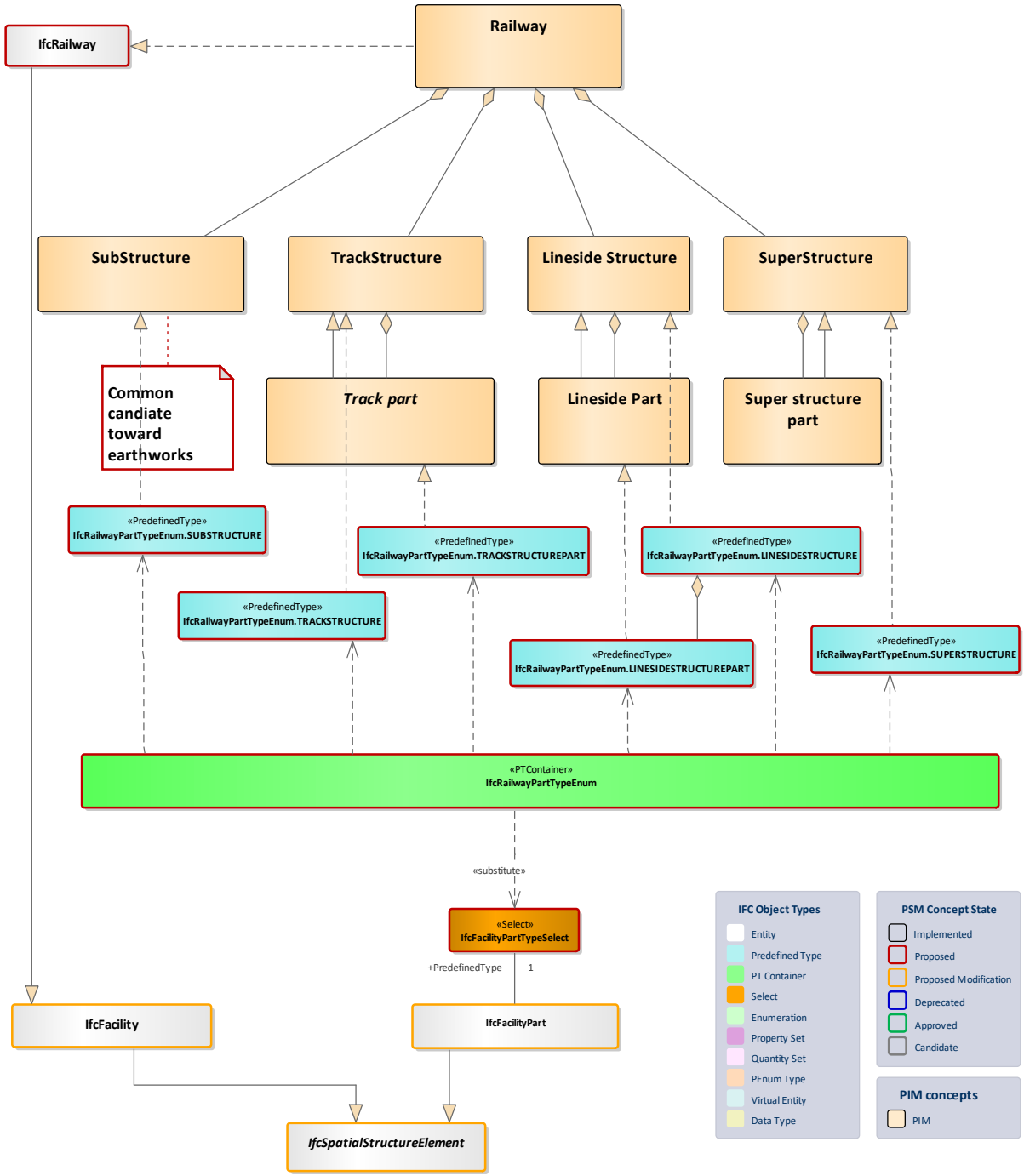


Table 63: Shared spatial structure - railway (mapping)

6.2.4 Shared spatial structure - domain reserved volumes (mapping)

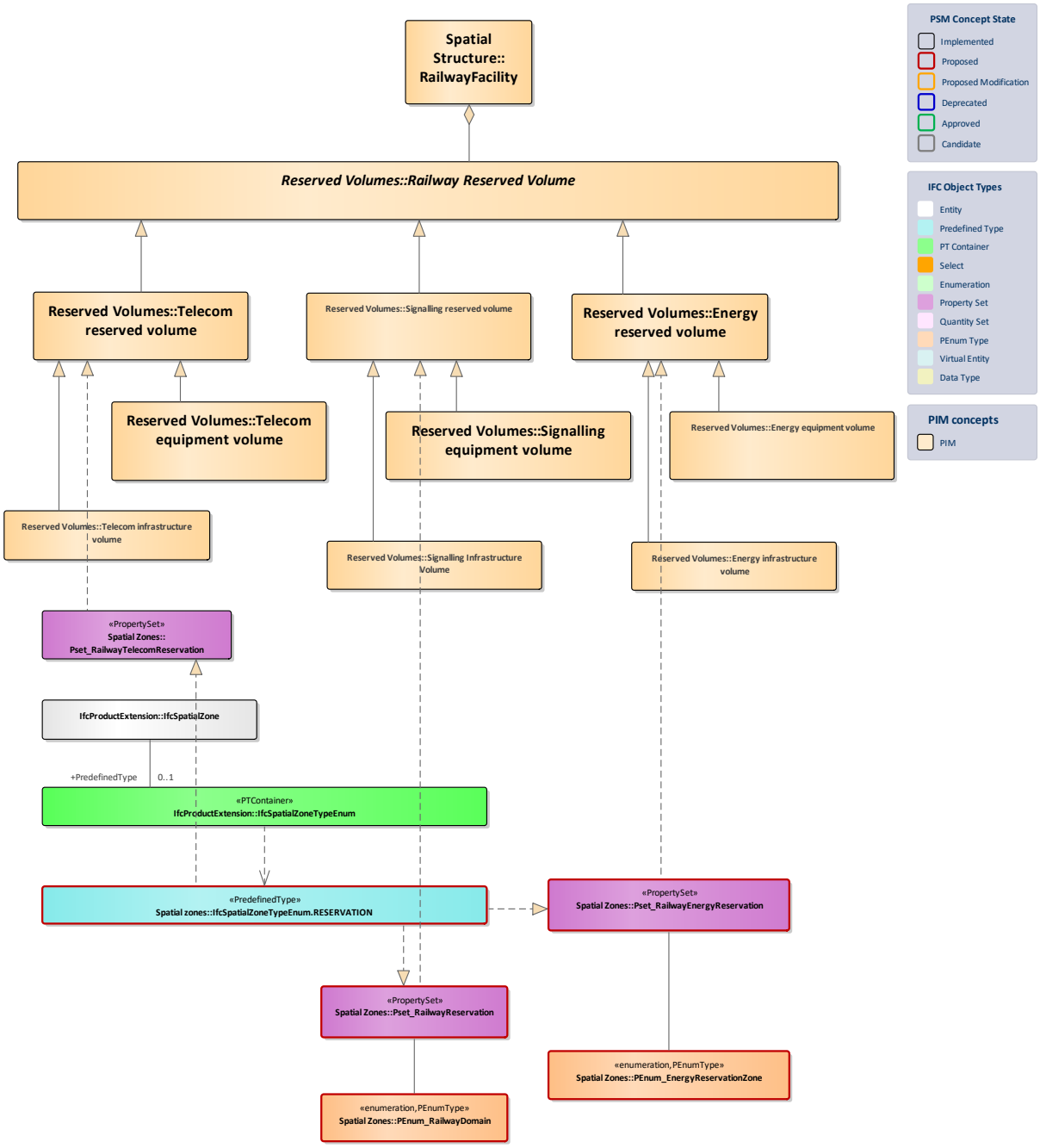


Table 64: Shared spatial structure - domain reserved volumes (mapping)