Standard for Information Model Data Storage of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

2016-07-07 Issued on July 7, 2016   With effect from July 8, 2016

China Railway BIM Alliance

Forward

According to the overall plan for informatization of railway engineering and requirements on construction management informatization of China Railway (CR), and under the guidance of railway BIM framework, this Standard is developed on the basis of IFC4

This Standard applies to railway communications, signaling, power transformation and overhead contact system (OCS).

China Railway BIM Alliance is responsible for the explanation of this Standard. In case that any corrections or supplements are needed in the use of this Standard, please send the suggestions to China Railway BIM Alliance.

Prepared mainly by

China Railway First Survey & Design Institute Group Co., Ltd.:

Wei Zhouquan, Ren Xiaochun, Zhang Feng, Yan Peng, Li Zhibiao, Wang Jia, Yang Changhui, Zhu Tieshuan, Song Yuanbin, Guo Shiyong, Wang Chaocun, Xiao Zhiqiang, Lu Changping, Jin Guang, Hao Shuai, Feng Yibo, Zhao Le, Gong Yansheng, Huang Wenxun, Zhang Xuewu, Wang Jilai, Wei Jialiang, Liu Yanming, Xu Xingwang, Wei Fanghua, Wang Peng, Xu Bo, Zhang Shengyan, Zhou Fujun, Jin Meng, Wang Wei

And also by

Engineering Management Center of China Railway:

Sheng Liming, Shen Dongsheng, Liu Yanhong, Chen Liang, Wang Jiang, Suo Ning, Chen Yun, Li Hui

China Academy of Railway Sciences:

Shi Tianyun, Wang Wanqi, Wang Huilin, Xie Yalong, Guo Ge, Lu Wenlong, Feng Yunmei, Liang Ce, Wang Nan, Niu Hongrui, Zhang Songfeng, Hao Rui, Liu Beisheng, Qian Jin, Zhang Jinghan, Liu Yuna, Zhu Yajing, Xu Xiaolei, Zhi Peng, Chen Jie, Wang Chao, Bao Liu

China Railway Eryuan Engineering Group Co., Ltd.:

Zhou Jian, Dong Fengxiang, Li Chaoyang, Zhang Yi, Yang Jia, Mai Yang, Wang Yanzhe, Shao Yan, Ye Mingzhu, Zhu Cong, Wu Hualin, Zheng Yi, Hu Shui, Yuan Lei, Liang Ying

The Third Railway Survey and Design Institute Group Corporation:

Li Hualiang, Yang Xukun, Liu Hang, Liu Xinyu, Che Shuang, Zheng Xinxin, Jiang Chuandong, Zhang Yanjun, Chai Tianjiao, Zhang Wenli, Xin Yu, Miao Hua, Lu Jing, Zhao Feifei, Yao Fengfeng, Su Lin, Wu Changhai, Hou Zhenyu, Peng Liangyong, Ma Jingbo, Chen Xingqiang, He Yongfa, Luo Jian

China Railway Siyuan Survey and Design Group Co., Ltd.:

Zhang Ting, Sun Jianming, Wu Huadan, Wu Jie, Zhang Lei, Shi Ruixia, Liu Chang, Li Hongmei, Zhou Jieyun, Liu Jizhou, Liu Zhengzi, Wei Xuchu, Shen Zhiling, Xu Yonghong

China Construction Communications Engineering Group Co., Ltd.:
Wang Yonyi, Zhang Kun, Huang Xin

Contents

Standard for Information Model Data Storage of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

1 General Provisions

1.1 Principles of Compilation

Compilation of this Standard shall comply with the principles below:

(1) Principle of compatibility. This Standard shall be fully compatible with IFC (Industry Foundation Class) standard issued by building SMART.

(2) Principle of portability. This Standard only applies to basic data model of electric power, traction power supply, communications, and signaling railway engineering. Elements in this data model may be used by different coding modes at different technology platforms.

(3) Principle of abstraction. This Standard only defines important elements of electric power, traction power supply, communications, and signaling railway engineering that are widely used both at home and abroad, and acknowledged and accepted by the whole field with a view to minimizing fixed model of this Standard.

(4) Principle of extensibility. Elements defined by this Standard may be further modified in combination with classification and coding of specific information or information in dictionary on the basis that the basic meaning is not exaggerated or changed so as to meet the requirements of specific users to store and exchange information.

(5) Principle of selectivity. Any element defined in this Standard is selectable for storing and exchanging information.

(6) Principle of repeatability. Any element defined in this Standard is repeatable in the application of exchanging and storing of data.

(7) Principle of accessibility. This Standard provides formalized and readable documents used for describing the standard between different authors as well as between the author and software developers without adding additional workload to relevant personnel.

1.2 Scope of Compilation

This Standard at present applies to the fields of railway communications, signaling, power transformation and OCS.

1.3 Scope of Application

This Standard is applicable to the formulation of BIM in railway engineering, development of railway BIM software and applied research of railway BIM.

1.4 Citation

The following standards and codes are cited in this Standard:

GB/T 16656.1—2008 Part 1: *Industrial Automation Systems and Integration—Product Data Representation and Exchange*: Overview and Fundamental Principle (ISO 10303-1:1994).
GB/T 16656.11—2010 Part 11: *Industrial Automation Systems and Integration—Product Data Representation and Exchange*: Description Methods: The EXPRESS Language Reference Manual (ISO 10303-11:2004).
GB/T 16656.21—2008 Part 21: *Industrial Automation Systems and Integration—Product Data Representation and Exchange*: Implementation Methods: Clear Text Encoding of the Exchange Structure (ISO 10303-21:2002).
ISO 16739: 2013 *Industry Foundation Classes.*

Building SMART Industry Foundation Classes IFC4x1.

2 Terms and Abbreviations

2.1 Terms

The following terms are applicable to this Standard.

Entity: a set of concepts or physical objects with common features

Attribute: abstract description of entity features.

Direct Attribute: information unit for direct description of entity features.

Inverse Attribute: information unit of relevant entities for defining feartures with a view to ensuring referential integrity.

Derived Attribute: information unit from the calculation of other attributes.

Property Set: set of attributes.

Schema: set of data items used for structuring parts of the model or the whole model.

Information Model: a type of abstract expression of data language used for defining concept and relationship in a certain field.

Spatial Structure Element: generally used for representing spatial entity of objects and their main composition.

Spatial Composition: referring to the composition relationship between parts and whole of spatial structure elements.

Spatial Decomposition: referring to the decomposition relationship between parts and whole of spatial structure elements.

Spatial Containment: referring to the relationship that spatial structure element contains entity.

Contained in Spatial Structure: referring to the relationship that entity is contained in spatial structure element.

Entity Composition: referring to the relationship that entity is contained in assembly.

Express-G: graphic subsets of EXPRESS language used for describing the relationship between concepts with graphical methods.

2.2 Abbreviations

The following abbreviations are applicable to this Standard.

AEC/FM: Architecture, Engineering, Construction and Facilities Management.

BIM: Building Information Modeling.

IFC: Industry Foundation Classes.

HVAC: Heating, Ventilation and Air Conditioning.

XML: Extensible Markup Language.

3 Basic Data Structure for Information Model of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

3.1 Basic Data Structure for Information Model of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

The basic data structure for information model of electric power, traction power supply, communications, and signaling railway engineering is developed based on the IFC4 and Version 1.0 of *Standard for Information Model Data Storage of Railway Engineering* to meet the requirements of electric power, traction power supply, communications, and signaling railway engineering. With a view to maintaining continuity of IFC standard, the following principles shall be complied with during the modification process.

(1) Electric power, traction power supply, communications, and signaling profession is extended only in the Domain Layer and the Interop Layer without adding new fields.

(2) Existing entities are mainly used for extension.

(3) Addition to attribute or predefined type are mainly used for extending entity.

(4) If the two principles above fail to comply with the requirements, new entities and corresponding common property set shall be added.

Extension shall be made on the basis of the above principles, as shown in Figure 3.1. There is no extension in Resource Layer and Core Layer. In Electrical Domain and Building Controls Domain of the Domain Layer, some entities are added or extended in the Interop Layer based on the characteristics of electric power, traction power supply, communications, and signaling profession.

3.2 Spatial Structure of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

Spatial structure of electric power, traction power supply, communications, and signaling railway engineering is shown in Figure 3.2. Several IfcDistributionSystems are included under IfcRailwayStation. The distribution system can be the system of communications, signaling, OCS, and power or power transformation.

Figure 3.3 is a circuit diagram of power distribution system in IFC4.electric power, traction power supply, communications, and signaling railway system is essentially similar to this system. One IfcDistributionSystem contains several sub-distribution systems through IfcRelAggregates; several devices, junction boxes and cables are contained in the distribution system through IfcRelAssignsToGroup; several ports are contained in the devices and cables through IfcRelNests; ports are connected to each other through IfcRelConnectsPorts.
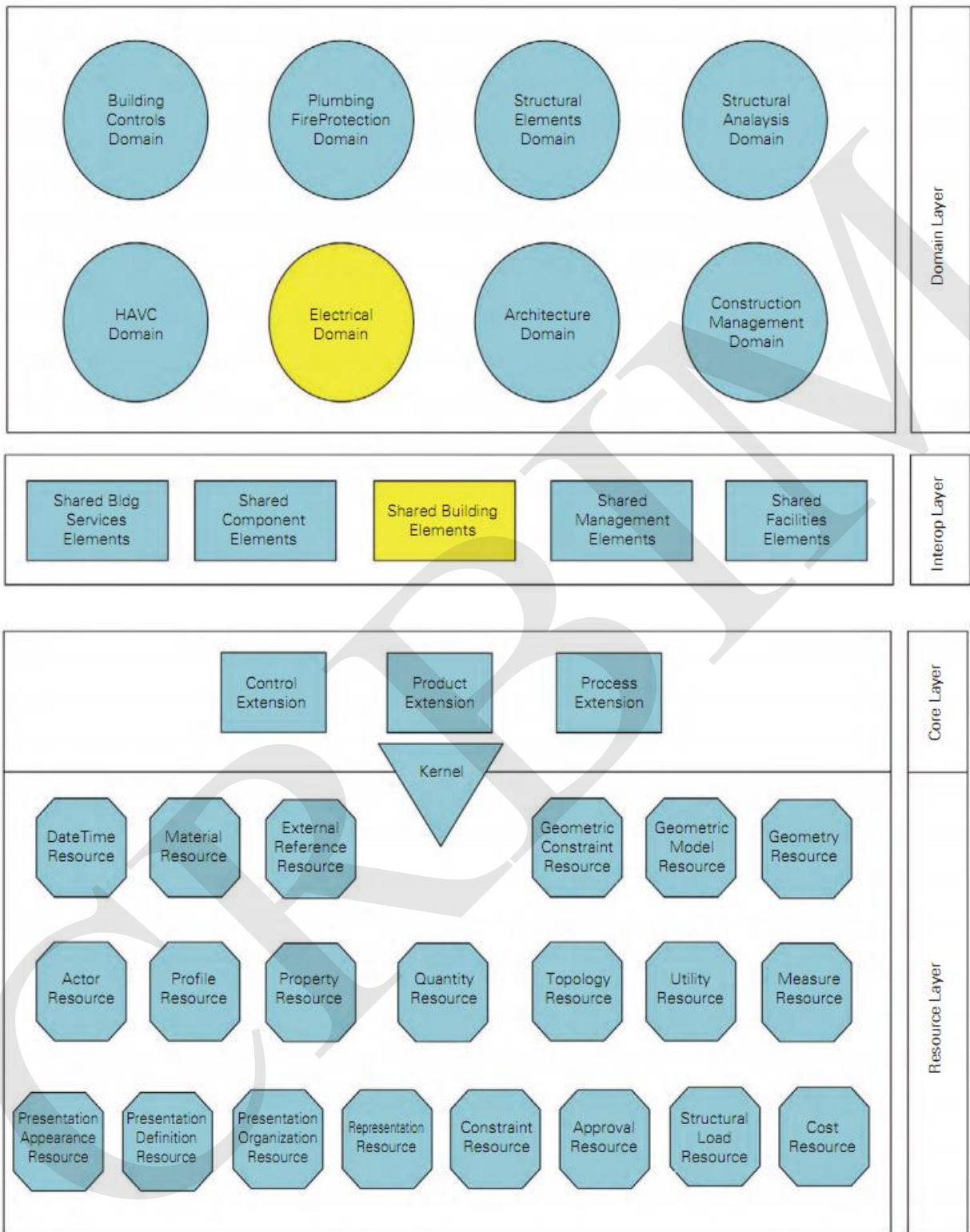
Figure 3.1 Basic Data Structure for Information Model of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering
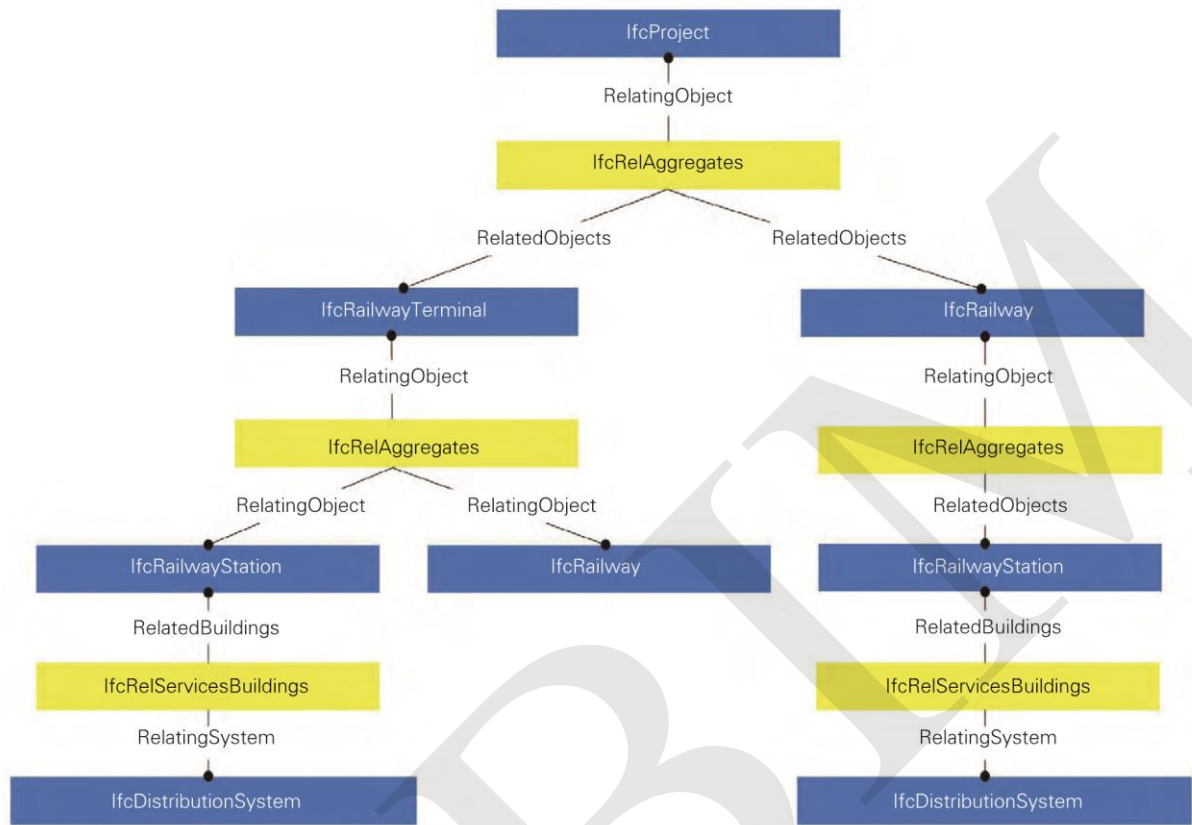
Figure 3.2 Spatial Structure of Electric Power, Traction Power Supply,
Communications, and Signaling Railway Engineering
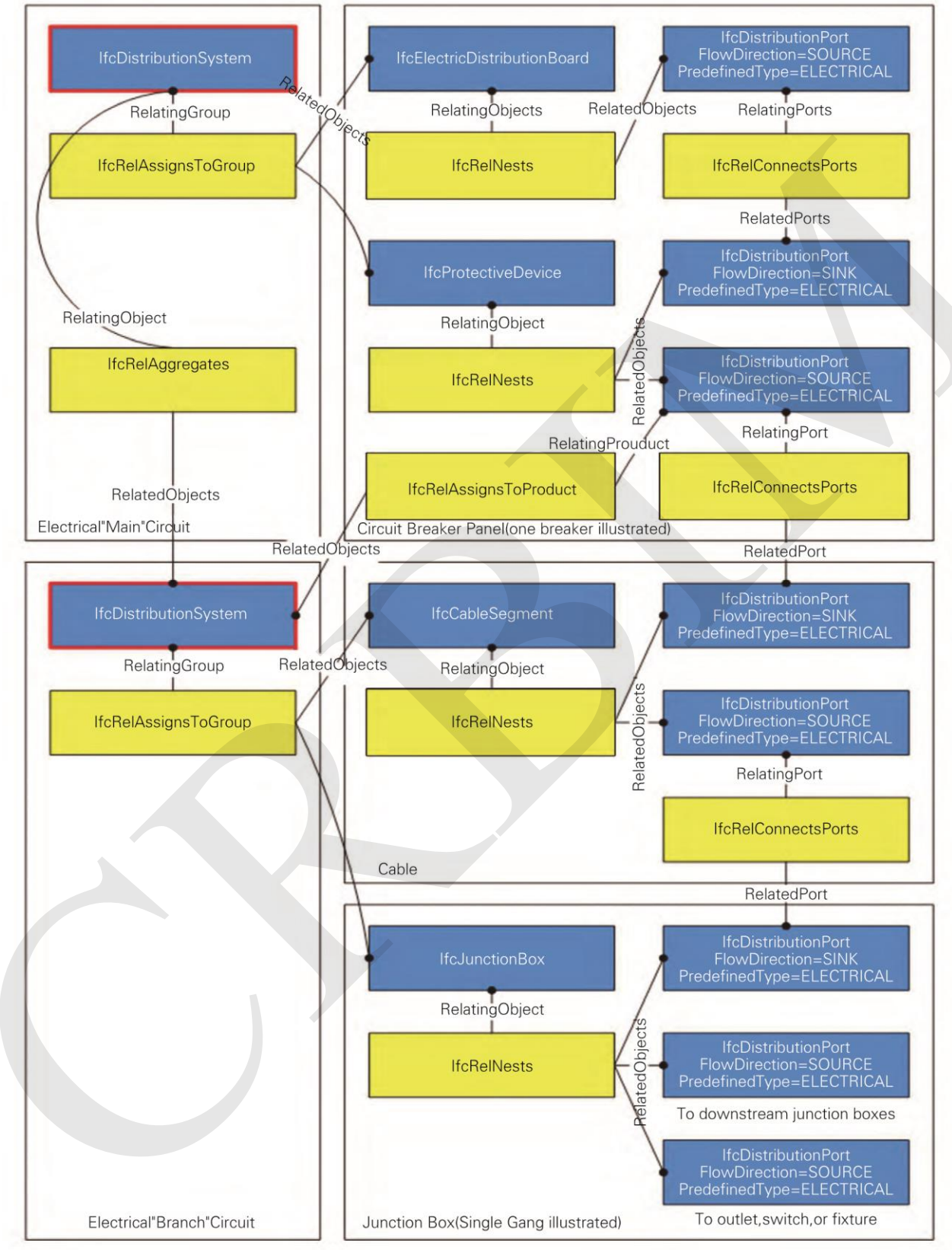
Figure 3.3 Relationship Diagram of Aggregation in Distribution System

4 Public Use of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

The basic data structure for information model of electric power, traction power supply, communications, and signaling railway engineering consists of IfcDistributionSystem, IfcDistributionElement and IfcDistributionElement.

Thereinto, the existing types or their enum items of IFC4 are adopted for some public elements or parts of electric power, traction power supply, communications, and signaling railway engineering, and other elements are extended by adding more types or enum items. Details are as follows:

(1) Please refer to Chapter 4 of this Standard for publis use of electric power, traction power supply, communications, and signaling railway engineering.

(2) IfcLamp and IfcLightFixture in IFC4 are used for lamp.

(3) IfcElectricFlowStorageDevice in IFC4 is used for capacitor.

(4) IfcElectricTimeControl in IFC4 is used for relay.

(5) IfcAlarm in IFC4 is used for alarm.

(6) IfcJunctionBox\DATA or POWER in IFC4 is used for junction box.

(7) IfcDistributionPort in IFC4 is used for port.

(8) IfcDistributionChamberElement\MANHOLE in IFC4 is used for cable shaft.

(9) IfcFooting in IFC4 is used for footing.

(10) IfcColumn in IFC4 is used for stand column.

(11) IfcCableCarrierSegment\CABLETRUNKINGSEGMENT in IFC4 is used for cable trunk.

(12) IfcCableCarrierSegment\CONDUITSEGMENT in IFC4 is used for conduit segment.

(13) IfcCableCarrierSegment\CABLELADDERSEGMENT in IFC4 is used for cable ladder.

(14) IfcCableCarrierSegment\CABLETRAYSEGMENT in IFC4 is used for cable tray.

(15) IfcCableFitting in IFC4 is used for cable fitting module, and predefined type shall be added.

(16) IfcCableSegment in IFC4 is used for cable segment, stranded segment and grounding wire segment, and predefined type shall be added.

(17) IfcProtectiveDevice in IFC4 is used for fuse disconnector and circuit breaker, and predefined type shall be added.

(18) IfcElectricDistributionBoard in IFC4 is used for consumer unit and distribution board, and predefined type shall be added.

(19) IfcTransformer in IFC4 is used for transformer and rectifier, and predefined type shall be added.

(20) IfcElectricFlowStorageDevice/UPS in IFC4 is used for uninterrupted power supply (UPS) device, and IfcElectricFlowStorageDevice\BATTERY for storage battery, and predefined type shall be added.

(21) IfcElectricFlowStorageDevice in IFC4 is used for switch power supply, and predefined type shall be added.

(22) IfcDeviceCabinet is a new entity connected with IfcFlowTerminal, mainly including box, direction box, protection box, nose plate, interface cabinet, track cabinet and communication cabinet.

(23) IfcInsulationDevice is a new entity connected with IfcFlowTreatmentDevice.

(24) IfcLightningProtection is a new entity connected with IfcFlowController.

(25) IfcGroundDevice is a new entity connected with IfcFlowController.

The connection of cable trunk, cable shaft and conduit segment is shown in Figure 4.1. The connection of cable trunk cable shaft and the distribution system of conduit segment is shown in Figure 4.2. EXPRESS-G diagram of public use of electric power, traction power supply, communications, and signaling railway engineering is shown in Figure 4.3.
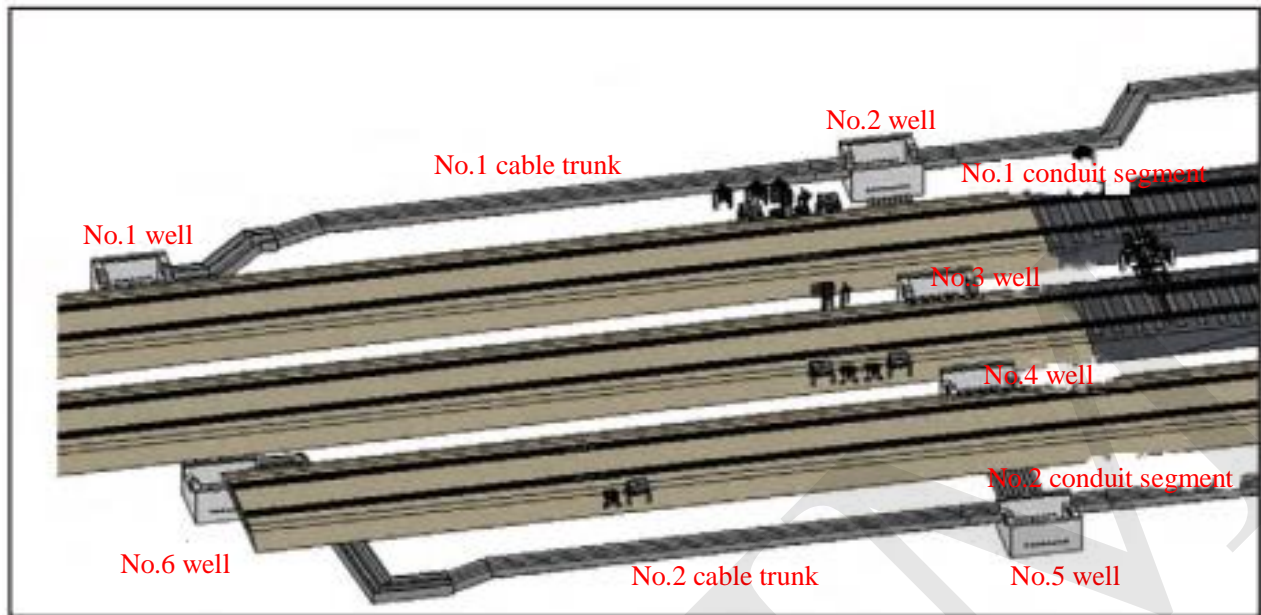
Figure 4.1 Connection of Cable Trunk, Cable Shaft and Conduit Segment

4.1 Types of Public Use
4.1.1 IfcCableCarrierSegmentTypeEnum

IfcCableCarrierSegmentTypeEnum is the enum of cable carrier segment type, which defines the types of cable carrier segments according to their functions. It is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
CABLELADDERSEGMENT;
CABLETRAYSEGMENT;
CABLETRUNKINGSEGMENT;CONDUITSEGMENT;USERDEFINED;NOTDEFINED.

Definition of new enum items:
CANTILEVER;
SUPPORTOR.

Description of EXPRESS:
TYPE IfcCableCarrierSegmentTypeEnum=ENUMERATION OF
(CABLELADDERSEGMENT,
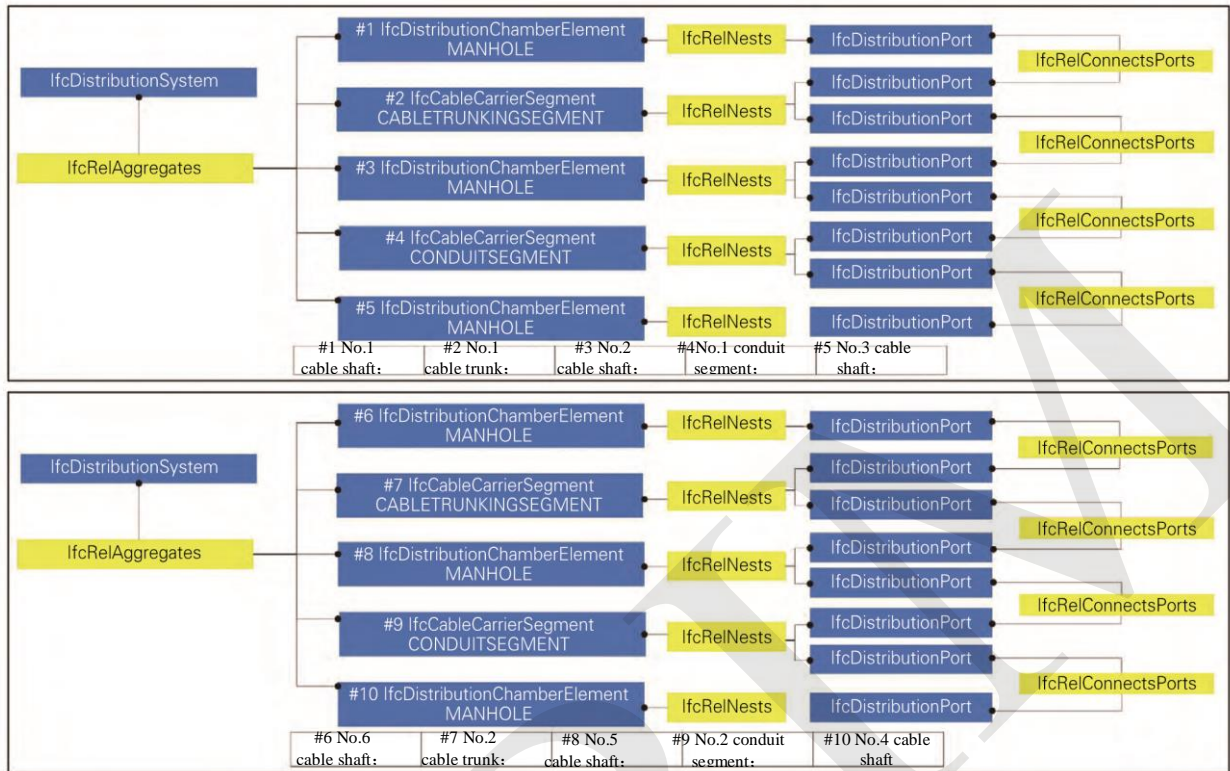
Figure 4.2 Connection of Cable Trunk, Cable Shaft and the Distribution System of Conduit Segment
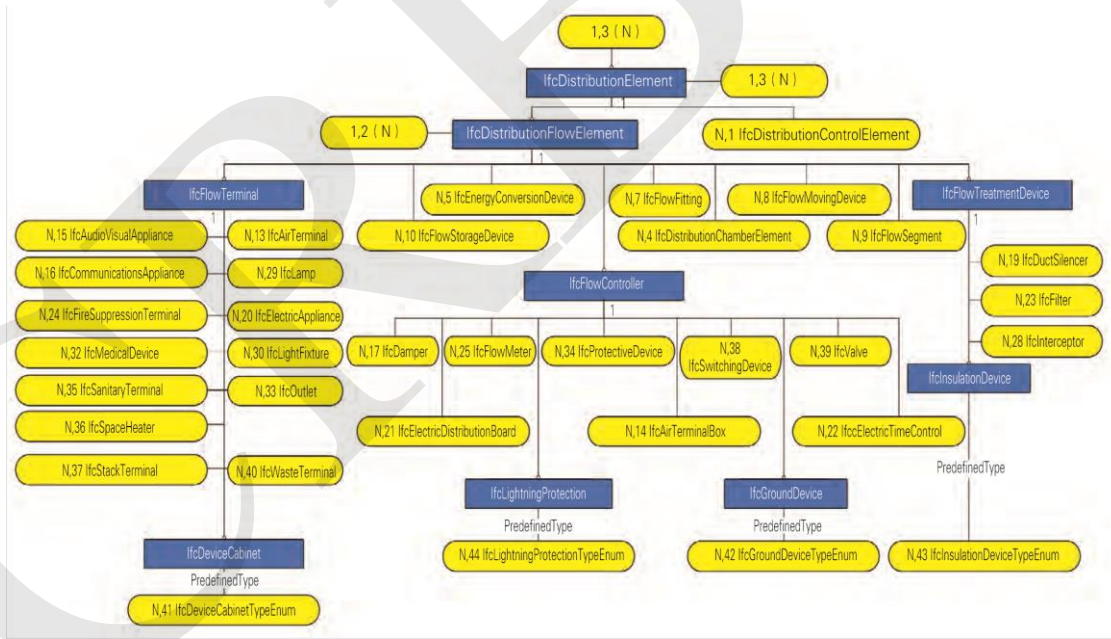
Figure 4.3 EXPRESS-G Diagram of Public Use of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

CABLETRAYSEGMENT,
CABLETRUNKINGSEGMENT,
CANTILEVER,
CONDUITSEGMENT,
SUPPORTOR,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.2 IfcCableSegmentTypeEnum

IfcCableSegmentTypeEnum is the enum of cable segment type, which defines the types of cable segments according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
BUSBARSEGMENT;
CABLESEGMENT;
CONDUCTORSEGMENT;
CORESEGMENT;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
INTEGRATEDGROUNDINGWIRESEGMENT;
STRANDEDSEGMENT.

Description of EXPRESS:
TYPE IfcCableSegmentTypeEnum=ENUMERATION OF
  (BUSBARSEGMENT,
  CABLESEGMENT,
  CONDUCTORSEGMENT,
  CORESEGMENT,
  INTEGRATEDGROUNDINGWIRESEGMENT,
  STRANDEDSEGMENT,
  USERDEFINED,
  NOTDEFINED);
END_TYPE;

4.1.3 IfcProtectiveDeviceTypeEnum

IfcProtectiveDeviceTypeEnum is the enum of protective device type, which defines the types of protective devices according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:

CIRCUITBREAKER;

EARTHLEAKAGECIRCUITBREAKER;

EARTHINGSWITCH;

FUSEDISCONNECTOR;

RESIDUALCURRENTCIRCUITBREAKER;
RESIDUALCURRENTSWITCH;
VARISTOR;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
POINTMACHINEPROTECTION;
RESISTOR;
SWITCHINGCABINET.

Description of EXPRESS:
TYPE IfcProtectiveDeviceTypeEnum=ENUMERATION OF
(CIRCUITBREAKER,
EARTHLEAKAGECIRCUITBREAKER,
EARTHINGSWITCH,
FUSEDISCONNECTOR,
POINTMACHINEPROTECTION,
RESIDUALCURRENTCIRCUITBREAKER,
RESIDUALCURRENTSWITCH,
RESISTOR,
VARISTOR,
SWITCHINGCABINET,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.4 IfcElectricDistributionBoardTypeEnum

IfcElectricDistributionBoardTypeEnum is the enum of electric distribution board type, which defines the types of electric distribution boards according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:

CONSUMERUNIT;
DISTRIBUTIONBOARD;
MOTORCONTROLCENTRE;
SWITCHBOARD;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:

POWERBOARD;
DATABOARD.

Description of EXPRESS:
TYPE IfcElectricDistributionBoardTypeEnum=ENUMERATION OF
(CONSUMERUNIT,
DATABOARD,
DISTRIBUTIONBOARD,
   MOTORCONTROLCENTRE,

   POWERBOARD,

   SWITCHBOARD,

   USERDEFINED,

   NOTDEFINED);

 END_TYPE;

4.1.5 IfcCableFittingTypeEnum

 IfcCableFittingTypeEnum is the enum of cable fitting type, which defines the types of cable fittings according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

 Definition of existing enum items:
 CONNECTOR;
 ENTRY;
 EXIT;
 JUNCTION;
 TRANSITION;
 USERDEFINED;
 NOTDEFINED.

 Definition of new enum items:
 TERMINALMOUDULE.

Description of EXPRESS:

TYPE IfcCableFittingTypeEnum=ENUMERATION OF

    (CONNECTOR,

    ENTRY,

    EXIT,

    JUNCTION,

    TERMINALMOUDULE,

    TRANSITION,

    USERDEFINED,

    NOTDEFINED);

  END_TYPE;

4.1.6 IfcTransformerTypeEnum

IfcTransformerTypeEnum is the enum of protective device type, which defines the types of power transformation devices according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:

CURRENT;

FREQUENCY;

INVERTER;

RECTIFIER;

VOLTAGE;

USERDEFINED;

NOTDEFINED.

Definition of new enum items:

LIGHTINGUNIT.

Description of EXPRESS:

TYPE IfcTransformerTypeEnum=ENUMERATION OF (CURRENT,

FREQUENCY,

INVERTER,

LIGHTINGUNIT,

RECTIFIER,

VOLTAGE,

USERDEFINED,

NOTDEFINED);

END_TYPE;

4.1.7 IfcDeviceCabinetTypeEnum

IfcDeviceCabinetTypeEnum is the enum of device cabinet type, which defines the types of device cabinets according to their functions.

Definition of new enum items:
BOX;

CABINET;

USERDEFINED;

NOTDEFINED.

Description of EXPRESS:

TYPE IfcDeviceCabinetTypeEnum=ENUMERATION OF (BOX,

CABINET,

USERDEFINED,

NOTDEFINED);

END_TYPE;

4.1.8 IfcInsulationDeviceTypeEnum

IfcInsulationDeviceTypeEnum is the enum of insulation device type, which defines the types of insulation devices according to their functions.

Definition of new enum items:
AIRCORECOIL;

INSULATEDJOINT;

INSULATIONEQUIPMENT;

INSULATOR;

USERDEFINED;

NOTDEFINED.

Description of EXPRESS:

TYPE IfcInsulationDeviceTypeEnum=ENUMERATION OF

(AIRCORECOIL,

INSULATEDJOINT,

INSULATIONEQUIPMENT,
INSULATOR,

USERDEFINED,

NOTDEFINED);

END_TYPE;

4.1.9 IfcLightningProtectionTypeEnum

IfcLightningProtectionTypeEnum is the enum of lightning protection type, which defines the types of lightning protection devices according to their functions.

Definition of new enum items:

LIGHTNINGROD;

LIGHTNINGSTRIP;

USERDEFINED;

NOTDEFINED.

Description of EXPRESS:

TYPE IfcLightningProtectionTypeEnum=ENUMERATION OF

(LIGHTNINGROD,

LIGHTNINGSTRIP,

USERDEFINED,

NOTDEFINED);

END_TYPE;

4.1.10 IfcGroundDeviceTypeEnum

IfcGroundDeviceTypeEnum is the enum of ground device type, which defines the types of ground devices according to their functions.

Definition of new enum items:

EARTHELECTRODE;

GROUNDBUS;

GROUNDINGMODULE;

IONELECTROD;

USERDEFINED;

NOTDEFINED.

Description of EXPRESS:

TYPE IfcGroundDeviceTypeEnum=ENUMERATION OF

  (EARTHELECTRODE,

   GROUNDBUS,

   GROUNDINGMODULE,

   IONELECTROD,

   USERDEFINED,

   NOTDEFINED);

 END_TYPE;

4.1.11 IfcAlarmTypeEnum

   IfcAlarmTypeEnum is the set of different alarm types. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

   Definition of existing enum items:

   BELL;

   BREAKGLASSBUTTON;
   LIGHT;

   MANUALPULLBOX;

   SIREN;

   WHISTLE;

   USERDEFINED;

   NOTDEFINED.

   Definition of new enum items:

   ALARMBUTTON.

   Description of EXPRESS:

   TYPE IfcAlarmTypeEnum=ENUMERATION OF (BELL,

    BREAKGLASSBUTTON,

    LIGHT,

    MANUALPULLBOX,

    SIREN,

WHISTLE,

                ALARMBUTTON,

                USERDEFINED,

                NOTDEFINED);

        END_TYPE;

4.1.12 IfcElectricFlowStorageDeviceTypeEnum

IfcElectricFlowStorageDeviceTypeEnum is the enum of flow storage device type. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:

BATTERY;

CAPACITORBANK;

HARMONICFILTER;

INDUCTORBANK;

UPS;

USERDEFINED;

NOTDEFINED.

Definition of new enum items:

SWITCHPOWERSUPPLY.

Description of EXPRESS:

TYPE IfcElectricFlowStorageDeviceTypeEnum=ENUMERATION OF (BATTERY,

        CAPACITORBANK,

        HARMONICFILTER,

        INDUCTORBANK,

        UPS,

        SWITCHPOWERSUPPLY,
        USERDEFINED,

        NOTDEFINED);

    END_TYPE;

4.2 Public Entity
4.2.1 IfcFlowTerminal

4.2.1.1 Definition of Entity

As IfcSignalingTerminal, IfcDeviceCabinet and IfcSignalMechanisms need to be newly added under IfcFlowTerminal, the IfcFlowTerminal shall be redescribed.

4.2.1.2 Definition of Attribute

The attribute of flow terminal shall remain the same as the original.

4.2.1.3 Description of EXPRESS

ENTITY IfcFlowTerminal

SUPERTYPE OF (ONEOF (IfcAirTerminal, IfcAudioVisualAppliance,

IfcCommunicationsAppliance, IfcDeviceCabinet IfcElectricAppliance,

IfcFireSuppressionTerminal, IfcLamp,

IfcLightFixture,

IfcMedicalDevice,

IfcOutlet,

IfcSanitaryTerminal,

IfcSignalMechanisms,

IfcSignalingTerminal,

IfcSpaceHeater,

IfcStackTerminal,

IfcWasteTerminal))

SUBTYPE OF (IfcDistributionFlowElement);

END_ENTITY;

4.2.2 IfcDeviceCabinet

4.2.2.1 Definition of Entity

IfcDeviceCabinet is used for IfcFlowTerminal equipment.

4.2.2.2 Definition of Attribute

PreDefinedType: It further divides device cabinets into cabinets and boxes according to their functions.

4.2.2.3 Description of EXPRESS

ENTITY IfcDeviceCabinet

SUBTYPE OF (IfcFlowTerminal);

PreDefinedType: OPTIONAL IfcDeviceCabinetTypeEnum;

WHERE

CorrectPredefinedType:
NOT (EXISTS (PredefinedType))
OR (PredefinedType <> IfcDeviceCabinetTypeEnum.USERDEFINED)
OR
((PredefinedType = IfcDeviceCabinetTypeEnum.USERDEFINED) AND EXISTS
(SELF\IfcObject.ObjectType));
CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
OR
('IFCELECTRICALDOMAIN.IFCDEVICECABINETTYPE' IN TYPEOF
(SELF\IfcObject.IsTypeBy [1].RelatingType));
END_ENTITY;

4.2.3 IfcFlowController

4.2.3.1 Definition of Entity

As As IfcSignalingRelay, IfcLightningProtection and IfcGroundDevice need to be newly added under IfcFlowController, the IfcFlowController shall be redescribed.

4.2.3.2 Definition of Attribute

The attribute of flow controller shall remain the same as the original.

4.2.3.3 Description of EXPRESS

ENTITY IfcFlowController
 SUPERTYPE OF (ONE OF (IfcAirTerminalBox,
  IfcDamper,
  IfcElectricDistributionBoard,
  IfcElectricTimeControl,
  IfcFlowMeter,
  IfcGroundDevice,
  IfcLightningProtection,
  IfcProtectiveDevice,
  IfcSignalingRelay,
  IfcSwitchingDevice,
  IfcValve))
  SUBTYPE OF (IfcDistributionFlowElement);
  END_ENTITY;

4.2.4 IfcFlowTreatmentDevice

4.2.4.1 Definition of Entity

As IfcInsulationDevice needs to be newly added under IfcFlowTreatmentDevice, the IfcFlowTreatmentDevice shall be redescribed.

4.2.4.2 Definition of Attribute

The attribute of flow treatment device shall remain the same as the original.

4.2.4.3 Description of EXPRESS

ENTITY IfcFlowTreatmentDevice
SUPERTYPE OF (ONEOF (IfcDuctSilencer, IfcFilter,

 IfcInterceptor,

IfcInsulationDevice))

 SUBTYPE OF (IfcDistributionFlowElement);

END_ENTITY;

4.2.5 IfcInsulationDevice

4.2.5.1 Definition of Entity

IfcInsulationDevice defines the major parts or elements used for electrical insulation between charged bodies of OCS and other devices or grounding bodies.

4.2.5.2 Definition of Attribute

PreDefinedType: It further divides insulation devices into aircorecoils, insulated joints, insulation parts, insulators and insulation bushings according to their structure forms.

4.2.5.3 Description of EXPRESS

ENTITY IfcInsulationDevice
 SUBTYPE OF (IfcFlowTreatmentDevice);
 PreDefinedType: OPTIONAL IfcInsulationDeviceTypeEnum;
 WHERE CorrectPredefinedType:

NOT (EXISTS (PredefinedType))

OR (PredefinedType <> IfcInsulationDeviceTypeEnum.USERDEFINED)

OR

((PredefinedType = IfcInsulationDeviceTypeEnum.USERDEFINED) AND EXISTS

(SELF\IfcObject.ObjectType));

CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)

OR

('IFCELECTRICALDOMAIN.IFCINSULATIONDEVICETYPE' IN TYPEOF
(SELF\IfcObject.IsTypeBy[1].RelatingType))
END_ENTITY;

4.2.6 IfcLightningProtection

4.2.6.1 Definition of Entity

IfcLightningProtection is used for reducing damage of properties and casualties on or near

buildings/structures from lightening.

4.2.6.2 Definition of Attribute

PreDefinedType: It further divides lightning protection devices into lighting strips and lightning rods according to their functions.

4.2.6.3 Description of EXPRESS

ENTITY IfcLightningProtection

SUBTYPE OF (IfcFlowController);
PreDefinedType: OPTIONAL IfcLightningProtectionTypeEnum;
WHERE

CorrectPredefinedType:

NOT (EXISTS (PredefinedType))

OR (PredefinedType <> IfcLightningProtectionTypeEnum.USERDEFINED)

OR

((PredefinedType = IfcLightningProtectionTypeEnum.USERDEFINED) AND EXISTS

(SELF\IfcObject.ObjectType));

CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)

OR

('IFCELECTRICALDOMAIN.IFCLIGHTNINGPROTECTIONTYPE' IN TYPEOF
(SELF\IfcObject.IsTypeBy[1].RelatingType))
END_ENTITY;

4.2.7 IfcGroundDevice

4.2.7.1 Definition of Entity

IfcGroundDevice includes grounding body and grounding wire. It is used for conducting lightning current into the earth.

4.2.7.2 Definition of Attribute

PreDefinedType: It further divides earthing devices into groundbuses, earth electrodes, grounding modules and ionelectrods according to their functions.

4.2.7.3 Description of EXPRESS

ENTITY IfcGroundDevice SUBTYPE OF (IfcFlowController);

PreDefinedType: OPTIONAL IfcGroundDeviceTypeEnum;

WHERE CorrectPredefinedType:

NOT (EXISTS (PredefinedType))

OR (PredefinedType <> IfcGroundDeviceTypeEnum.USERDEFINED)

OR

((PredefinedType = IfcGroundDeviceTypeEnum.USERDEFINED) AND EXISTS

(SELF\IfcObject.ObjectType));

CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)

OR

('IFCELECTRICALDOMAIN.IFCGROUNDDEVICETYPE' IN TYPEOF
(SELF\IfcObject.IsTypeBy[1].RelatingType))
END_ENTITY;

4.3 Public Use Property Set

4.3.1 Pset_DeviceCabinetCommon

Name of Property Set: Pset_DeviceCabinetCommon

Applicable Entity: IfcDeviceCabinet

Description: common property set of equipment cabinets

Pset_DeviceCabinetCommon.

Attribute List: see Table 4.3.1

Table 4.3.1   Attribute List of Pset_DeviceCabinetCommon

Name	Data type	Description
IsGrounding	P_SINGLEVALUE/IfcBoolean	Grounded or not
NumberOfLayers	P_SINGLEVALUE/IfcInteger	Number of layers
NumberOfColumns	P_SINGLEVALUE/IfcInteger	Number of colums

4.3.2 Pset_ElectriDistributionBoardTypePowerBoard

Name of Property Set: Pset_ElectriDistributionBoardTypePowerBoard

Applicable Entity: IfcElectriDistributionBoard

Description: property set of power boards
Attribute List: see Table 4.3.2

Table 4.3.2 Attribute List of Pset_ElectriDistributionBoardTypePowerBoard

Name	Data type	Description
Type	P_ENUMERATEDVALUE/IfcLabel/ PEnum_ElectriDistributionBoardDataBoardType: AC,DC	Type of electric distribution boards Divided as AC, DC

4.3.3 Pset_GroundDeviceTypeCommon

Name of Property Set: Pset_GroundDeviceTypeCommon

Applicable Entity: IfcGroundDevice

Description: common property set of ground devices
Attribute List: see Table 4.3.3

Table 4.3.3 Attribute List of Pset_GroundDeviceTypeCommon

Name	Data type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	ID cited
HasIon	P_SINGLEVALUE/IfcBoolean	Ion or not

4.3.4 Pset_ChainageCommon

Name of Property Set: Pset_ChainageCommon
Applicable Entity: outdoor devices or footing of electric power, traction power supply,

communications, and signaling railway engineering

Description: common property set of chainage

Attribute List: see Table 4.3.4

Table 4.3.4 Attribute List of Pset_ChainageCommon

Name	Data type	Description
CenterChinage	TypePropertySingleValue/IfcLengthMeasure	Center chinage
Elevation	TypePropertySingleValue/IfcLengthMeasure	Relative elevation

4.3.5 Pset_IfcLightningProtection

Name of Property Set: Pset_LightningProtection

Applicable Entity: IfcLightningProtection

Description: property set of lightning protection devices
Attribute List: see Table 4.3.5

Table 4.3.5 Attribute List of Pset_LightningProtection

Name	Data type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	ID cited

4.3.6 Pset_IfcLightningProtectionTypeLightningRod

Name of Property Set: Pset_LightningProtectionTypeLightningRod

Applicable Entity: IfcLightningProtection

Description: property set of lightning rod
Attribute List: see Table 4.3.6

Table 4.3.6 Attribute List of Pset_LightningProtectionTypeLightningRod

Name	Data type	Description
Type	P_ENUMERATEDVALUE/PEnum_Type:latticed,cylinder	Type：latticed，cylinder

4.3.7 Pset_IfcDistributionSystemTypeRailSystem

This Standard cites IfcDistributionSystem in IFC4 to define the meaning of system in electric power, traction power supply, communications, and signaling raliway engineering and the property set "Pset_DistributionSystemTypeRailSystem" is newly defined. The "Type" in this property set is used to further explain the type of the system.
Name of Property Set: Pset_DistributionSystemTypeRailSystem

Applicable Entity: IfcDistributionSystem

Description: railway sub-system type of the distribution system
Attribute List: see Table 4.3.7

Table 4.3.7 Attribute List of Pset_DistributionSystemTypeRailSystem

Name	Data type
Type	P_ENUMERATEDVALUE/IfcLabel： TransmissionSystem AccessNetwork DataCommunicationNetwork TelephoneExchange DispatchingCommunicationSystem Mobile VideoConferenceSystem VideoMonitoringSystem EmergencyCommunicationSystem IntegratedWiringSystem ClockSynchronizationSystem TimeSynchronizationSystem CommunicationIntegratedNetworkManagementSystem OpticalFiberMonitoringSystem LeakyCableMonitoringSystem TowerFiberMonitoringSystem TunnelEmergencyCommunication InterfaceMonitoringSystem PublicAddressSystem PassengerInformationDisplaySystem EnquirySystem IntrusionAlarmSystem HelpSystem TicketingSystem AccessControlSystem BaggageParcelManagementInformationSystem OMIS PSMIS FTMS OperationDispatchingSystem EMUManagementInformationSytem TrafficDispatching TrainOperationControl SectionBlock StationInterlocking SignalingInspectionAndMonitoring ElectromagneticCompatibility SnowMeltingOnPoint TransformerMainSystem ConpensatingSystem MonitoringSystem SCADASystem Power Supply And Enviroment Monitoring System PowerSupply LightningProtection Earthing BAS FAS OCS

5 Communication

The communication of this code defines three parts of contents including communication, information and natural disaster and foreign object intrusion monitoring system of railway.

The definition of communication is formed by quoting the IfcDistributionSystem, IfcDistributionElement and IfcDistributionPort in IFC4. Figure 5.1 shows the connection relation of elements and ports by taking the station ticketing system of railway for instance.

Among which, parts of the communication elements or components adopt the existing types or the existing type enumerations in IFC4, parts of the elements are expanded by the way of increasing enumeration as follows:

(1) The router adopts the IfcCommunicationsAppliance\ROUTER in IFC4.

(2) The IfcCommunicationsAppliance type in IFC4 is adopted and the predefined types including TRANSMISSIONEQUIPMENT、ACCESSNETWORKEQUIPMENT、EXCHANGEEQUIPMENT、NETWORKSWITCH、SYNCHRONIZATIONNETWORKEQUIPMENT、EMERGENCYHANDLINGEQUIPMENT、MONITORHANDLEEQUIPMENT、CONVERTER、WIRELESSCOMMUNICATIONEQUIPMENT、LOCOMOTIVEEQUIPMENT、PORTABLEDEVICES、DATASTORAGE are newly increased.

(3) The antenna adopts the IfcCommunicationsAppliance\ANTENNA in IFC4.

(4) The wind direction and speed meter adopts the IfcSensor\WINDSENSOR in IFC4.

(5) The IfcSensor type in IFC4 is adopted, and the predefined types including PLUVIOGRAPH, SNOWMETER, SEISMOMETER and CLEARANCEINTRUSIONMONITORINGDEVICE are newly increased.

(6) The socket of data or voice adopts the IfcOutlet\DATAOUTLET or TELEPHONEOUTLET in IFC4.

(7) The camera adopts the IfcAudioVisualAppliance\CAMERA in IFC4.The microphone adopts the IfcAudioVisualAppliance\MICROPHONE in IFC4.

(8) The clock adopts the IfcElectricTimeControl\TIMECLOCK in IFC4.

(9) All kinds of terminals of information enquiry, office and administration adopt the IfcCommunicationsAppliance\COMPUTER in IFC4.

(10) The display screen of passenger transport information adopts the IfcCommunicationsAppliance\DISPLAY in IFC4.

(11) The speaker adopts the IfcAudioVisualAppliance\SPEAKER in IFC4, the noise sensor adopts IfcSensor\SOUNDSENSOR in IFC4, the wireless calling station adopts the

IfcAudioVisualAppliance\RECEIVER in IFC4, the broadcast host adopts the IfcAudioVisualAppliance\PLAYER in IFC4, and the broadcast amplifier adopts the IfcAudioVisualAppliance\AMPLIFIER in IFC4.

(12) The sound and light alarm equipment adopts the IfcAlarm\LIGHT、BELL in IFC4.

(13) The IfcSensor type in IFC4 is adopted and the predefined type-INTRUSIONDETECTOR is increased.

(14) The IfcAlarm type in IFC4 is adopted and the predefined type-ALARMBUTTON is increased.

(15)The IfcAudioVisualAppliance type in IFC4 is adopted and the predefined types including RECORDER, CONFERENCEEQUIPMENT and CONSOLE are increased.

(16) The automatic ticketing machine adopts the IfcElectricAppliance\VENDINGMACHINE, the manual ticketing machine adopts the IfcCommunicationsAppliance\COMPUTERand the ticket printer adopts the IfcCommunicationsAppliance\PRINTER.

(17) The uninterruptible power supply adopts the IfcElectricFlowStorageDevice\UPS and the battery adopts the IfcElectricFlowStorageDevice\BATTERY.

(18) The switch power supply equipment adopts the IfcElectricFlowStorageDevice type in IFC4 and the predefined type-SWITCHPOWERSUPPLY is increased.

(19) The cable, light protection, earthing, ditch, ducts, pipeline and shafts refer to the common parts of the four electricity.
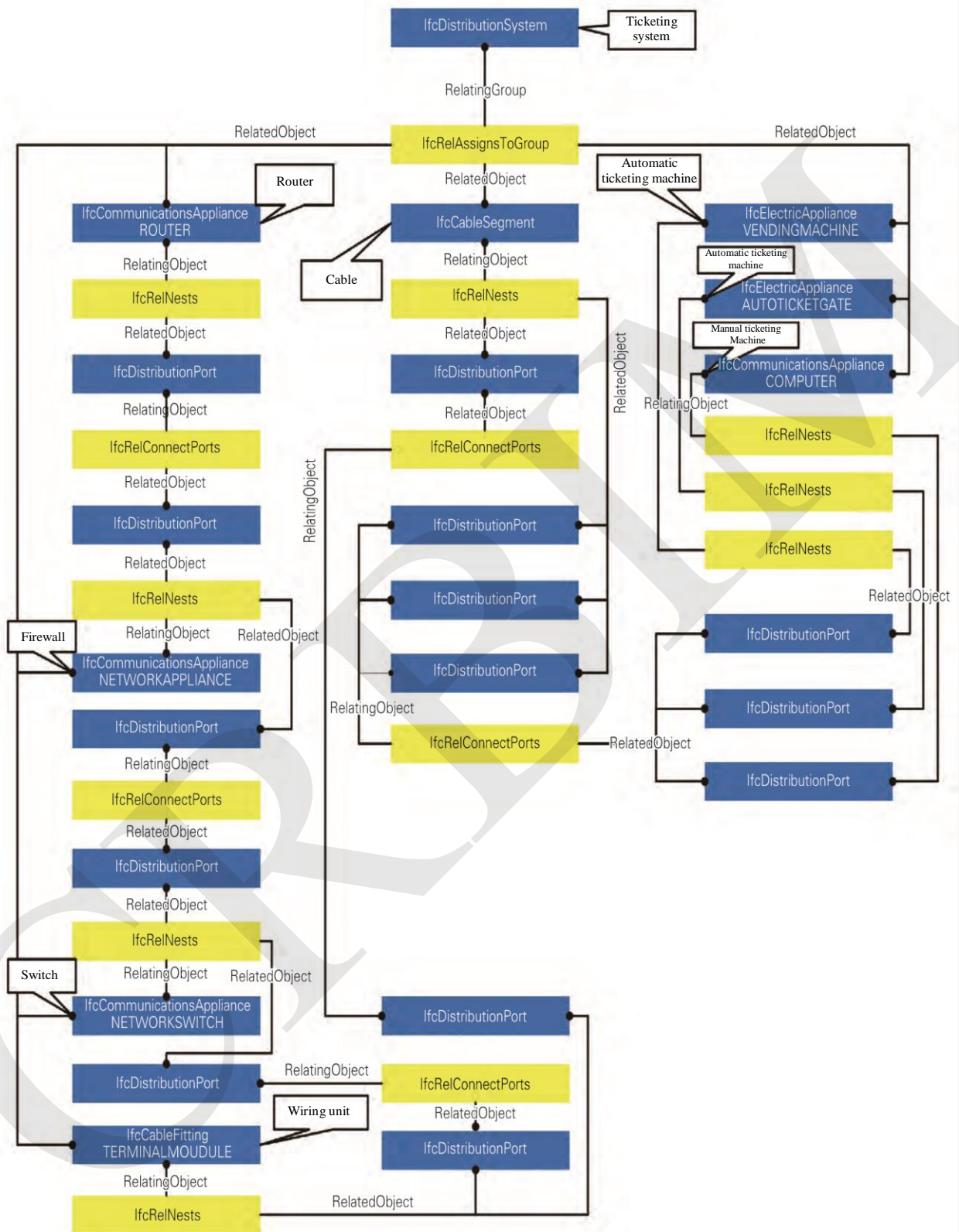
Figure 5.1 The connection relation figure of the station ticketing system equipment for railway

5.1 The Definition of Type

5.1.1 IfcAudioVisualApplianceTypeEnum

IfcAudioVisualApplianceTypeEnum is a set of different kinds of audio-visual equipment.

Definition of existing enum items:

AMPLIFIER,

CAMERA,

DISPLAY,

MICROPHONE,

PLAYER,

PROJECTOR,

RECEIVER,

SPEAKER,

SWITCHER,

TELEPHONE,

TUNER,

USERDEFINED,

NOTDEFINED.

Definition of new enum items:

RECORDER,

CONFERENCEEQUIPMENT,

CONSOLE.

EXPRESS:

TYPEIfcAudioVisualApplianceTypeEnum=ENUMERATIONOF

(AMPLIFIER,

CAMERA,

CONFERENCEEQUIPMENT,

CONSOLE,

DISPLAY,

MICROPHONE,

PLAYER,

PROJECTOR,

RECEIVER,

RECORDER,

SPEAKER,

SWITCHER,

TELEPHONE,

TUNER,

USERDEFINED,

NOTDEFINED);

END_TYPE;

5.1.2 IfcCommunicationsApplianceTypeEnum

IfcCommunicationsApplianceTypeEnum is a set of different kinds of communication equipment.

Definition of existing enum items:

ANTENNA,

COMPUTER,

FAX,

GATEWAY,

MODEM,

NETWORKAPPLIANCE,

NETWORKBRIDGE,

NETWORKHUB,

PRINTER,

REPEATER,

ROUTER,

SCANNER,

USERDEFINED,

NOTDEFINED.

Definition of new enum items:

TRANSMISSIONEQUIPMENT,

ACCESSNETWORKEQUIPMENT,

EXCHANGEEQUIPMENT,

NETWORKSWITCH,

SYNCHRONIZATIONNETWORKEQUIPMENT

EMERGENCYHANDLINGEQUIPMENT,

MONITORHANDLEEQUIPMENT,

CONVERTER,

WIRELESSCOMMUNICATIONEQUIPMENT,

LOCOMOTIVEEQUIPMENT,

PORTABLEDEVICES,

DATASTORAGE.

EXPRESS:

TYPEIfcCommunicationsApplianceTypeEnum=ENUMERATIONOF

(ACCESSNETWORKEQUIPMENT,

ANTENNA,

COMPUTER,

CONVERTER,

DATASTORAGE,

EMERGENCYHANDLINGEQUIPMENT,

EXCHANGEEQUIPMENT,

FAX,

GATEWAY,

LOCOMOTIVEEQUIPMENT,

MODEM,

MONITORHANDLEEQUIPMENT,

NETWORKAPPLIANCE,

NETWORKBRIDGE,

NETWORKHUB,

NETWORKSWITCH,

PRINTER,

REPEATER,

PORTABLEDEVICES,

ROUTER,

SCANNER,

SYNCHRONIZATIONNETWORKEQUIPMENT,

TRANSMISSIONEQUIPMENT,

WIRELESSCOMMUNICATIONEQUIPMENT,

USERDEFINED,

NOTDEFINED);

END_TYPE;

5.1.3 IfcSensorTypeEnum

IfcSensorTypeEnum is a set of different kinds of sensor.

Definition of existing enum items:

CO2SENSOR,

CONDUCTANCESENSOR,

CONTACTSENSOR,

FIRESENSOR,

FLOWSENSOR,

FROSTSENSOR,

GASSENSOR,

HEATSENSOR,

HUMIDITYSENSOR,

IDENTIFIERSENSOR,

IONCONCENTRATIONSENSOR,

LEVELSENSOR,

LIGHTSENSOR,

MOISTURESENSOR,

MOVEMENTSENSOR,

PHSENSOR,

PRESSURESENSOR,

RADIATIONSENSOR,

RADIOACTIVITYSENSOR,

SMOKESENSOR,

SOUNDSENSOR,

TEMPERATURESENSOR,

WINDSENSOR,

USERDEFINED,

NOTDEFINED.

Definition of new enum items:

CLEARANCEINTRUSIONMONITORINGDEVICE,

GLASSBREAKSENSOR,

INFRAREDSENSOR,

SEISMOMETER,

SNOWMETER,

PLUVIOGRAPH,

WATERLOGGINGSENSOR,

INTRUSIONDETECTOR.

EXPRESS:

TYPEIfcSensorTypeEnum=ENUMERATIONOF

(CO2SENSOR,

CONDUCTANCESENSOR,

CONTACTSENSOR,

FIRESENSOR,

FLOWSENSOR,

FROSTSENSOR,

GASSENSOR,

HEATSENSOR,

HUMIDITYSENSOR,

IDENTIFIERSENSOR,

IONCONCENTRATIONSENSOR,

LEVELSENSOR,

LIGHTSENSOR,

MOISTURESENSOR,

MOVEMENTSENSOR,

PHSENSOR,

PRESSURESENSOR,

RADIATIONSENSOR,

RADIOACTIVITYSENSOR,

SMOKESENSOR,

SOUNDSENSOR,

TEMPERATURESENSOR,

WINDSENSOR,

CLEARANCEINTRUSIONMONITORINGDEVICE,

GLASSBREAKSENSOR,

INFRAREDSENSOR,

SEISMOMETER,

SNOWMETER,

PLUVIOGRAPH,

WATERLOGGINGSENSOR,

INTRUSIONDETECTOR,

USERDEFINED,

NOTDEFINED);

END_TYPE;

5.1.4 IfcElectricApplianceTypeEnum

IfcElectricApplianceTypeEnum is a set of different kinds of electric equipment.

Definition of existing enum items:

DISHWASHER,

ELECTRICCOOKER,

FREESTANDINGELECTRICHEATER,

FREESTANDINGFAN,

FREESTANDINGWATERHEATER

FREESTANDINGWATERCOOLER,

FREEZER,

HANDRYER,

KITCHENMACHINE,

MICROWAVE,

PHOTOCOPIER,

REFRIGERATOR,

TUMBLEDRYER,

VENDINGMACHINE,

WASHINGMACHINE,

USERDEFINED,

NOTDEFINED

Definition of new enum items:

AUTOMATICGATEMACHINE,

LUGGAGEINSPECTION;

PERSONNELSCREENING;

EXPRESS:

TYPEIfcElectricApplianceTypeEnum=ENUMERATIONOF

(DISHWASHER,

ELECTRICCOOKER,

FREESTANDINGELECTRICHEATER,

FREESTANDINGFAN,

FREESTANDINGWATERHEATER,

FREESTANDINGWATERCOOLER,

FREEZER,

HANDRYER,

KITCHENMACHINE,

MICROWAVE,

PHOTOCOPIER,

REFRIGERATOR,

TUMBLEDRYER,

VENDINGMACHINE,

WASHINGMACHINE,

AUTOMATICGATEMACHINE,

LUGGAGEINSPECTION,

PERSONNELSCREENING,

USERDEFINED,

NOTDEFINED);

END_TYPE;

5.2 The Definition of Attribute Set

5.2.1 Pset_AudioVisualApplianceTypeRecorder

Name of Property Set: Pset_AudioVisualApplianceTypeRecorder.

Applicable Entity: IfcAudioVisualAppliance.

Description: recorder attribute set.

Attribute List: see Table 5.2.1.

Table 5.2.1 The Attribute List of PsetAudioVisualApplianceTypeRecorder

Name	Data Type	Description
Recorder Type	P_ENUMERATEDVALUE/IfcLabel:Audio,Video	Record type: audio,video, audio and video
Equipment Capacity	P_SINGLEVALUE/IfcInteger	Equipment capacity

5.2.2 Pset_AudioVisualApplianceTypeConferenceEquipment

Name of Property Set: Pset_AudioVisualApplianceTypeConferenceEquipment.

Applicable Entity: IfcAudioVisualAppliance.

Description: conference equipment attribute set.

Attribute List: see Table 5.2.2.

Table 5.2.2 The Attribute List of Pset_AudioVisualApplianceTypeConferenceEquipment

Name	Data Type	Description
Conference Type	P_ENUMERATEDVALUE/IfcLabel:Telephone,Video	Conference type: telephone, video
Equipment Capacity	P_SINGLEVALUE/IfcIntege	Equipment capacity
Is Main Point	P_SINGLEVALUE/IfcBoolean	Whether is the main e quipment

5.2.3 Pset_AudioVisualApplianceTypeConsole

Name of Property Set:Pset_AudioVisualApplianceTypeConsole.

Applicable Entity: IfcAudioVisualAppliance.

Description: console attribute set.

Attribute List: see Table 5.2.3.

Table 5.2.3 The Attribute List of Pset_AudioVisualApplianceTypeConsole

Name	Data Type	Description
ConsoleType	P_ENUMERATEDVALUE/IfcLabel:Touch creen,Keyboard	Console type: touching screen, keyboard
ConsoleUsage	P_ENUMERATEDVALUE/IfcLabel:Dispatching Console,OnDuty Console	Console function: dispatching console, duty console
ConsoleCapacity	P_SINGLEVALUE/IfcInteger	Console capacity

5.2.4 Pset_CommunicationsApplianceTypeTransmissionEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeTransmission

Equipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: transmission equipment attribute set.

Attribute List: see Table 5.2.4.

Table 5.2.4 The Attribute List of PsetCommunicationsApplianceTypeTransmissionEquipment

Name	Data Type	Description
TransmissionType	P_ENUMERATEDVALUE/IfcLabel:SDH,PDH,DWDM	Transmission type: SDH, PDH, DWDM
EquipmentCapacity	P_SINGLEVALUE/IfcInteger	Equipment capacity
TransmissionMedium	P_SINGLEVALUE/IfcInteger	Transmission medium
ProtectedMode	/IfcLabel	Protected mode
Topology	/IfcLabel	Topology

5.2.5 Pset_CommunicationsApplianceTypeAccessNetworkEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeAccessNetworkEquipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: access network equipment attribute set.

Attribute List: see Table 5.2.5.

Table 5.2.5 The Attribute List of Pset_CommunicationsApplianceTypeAccessNetworkEquipment

Name	Data Type	Description
EquipmentType	P_ENUMERATEDVALUE/IfcLabel:Optical Access,Cable Access,PCM	Type of access network equipment: optical access, cable access, PCM
EquipmentCapacity	P_SINGLEVALUE/IfcInteger	Capacity of access network equipment
IsMain	P_SINGLEVALUE/IfcBoolean	Whether is the main equipment

5.2.6 Pset_CommunicationsApplianceTypeExchangeEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeExchangeEquipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: exchange equipment attribute set.

Attribute List: see Table 5.2.6.

Table 5.2.6 The Attribute List of Pset_CommunicationsApplianceTypeExchangeEquipment

Name	Data Type	Description
EquipmentType	P_ENUMERATEDVALUE/IfcLabel:Program Control Switching,Dispatching Switching,Mobile Switching, Softswitching	Type of access network exchange equipment: program control switching, dispatching switching, mobile switching, soft switching
EquipmentCapacity	P_SINGLEVALUE/IfcInteger	Capacity of exchange equipment
IsMain	P_SINGLEVALUE/IfcBoolean	Whether is the main equipment

5.2.7 Pset_CommunicationsApplianceTypeNetworkSwitch

Name of Property Set: Pset_CommunicationsApplianceTypeNetworkSwitch.

Applicable Entity: IfcCommunicationsAppliance.

Description: network switch attribute set.

Attribute List: see Table 5.7.

Table 5.7 The Attribute List of Pset_CommunicationsApplianceTypeNetworkSwitch

Name	Data Type	Description
WorkLayer	P_ENUMERATEDVALUE/IfcLabel:L2,L3	Work layer: L2, L3
EquipmentCapacity	P_SINGLEVALUE/IfcInteger	Port capacity
PortType	P_ENUMERATEDVALUE/IfcLabel:Optical Interface, Electrical Interface,POE	Port type: optical interface, electrical interface, POE interface

5.2.8 Pset_CommunicationsApplianceTypeSynchronizationNetworkEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeNetworkSwitch.

Applicable Entity: IfcCommunicationsAppliance.

Description: synchronization equipment attribute set.

Attribute List: see Table 5.2.8.

Table 5.2.8 The Attribute List of
Pset_CommunicationsApplianceTypeSynchronizationNetworkEquipment

Name	Data Type	Description
EquipmentType	P_ENUMERATEDVALUE/IfcLabel:Frequency,Time	Type of synchronization equipment: frequency, time
SourceType	P_ENUMERATEDVALUE/IfcLabel:GPS,BDS,Dual-Mode	Type of synchronization source: GPS, BDS, Dual-Mode
IsMain	P_SINGLEVALUE/IfcBoolean	Whether is the main equipment

5.2.9 Pset_CommunicationsApplianceTypeEmergencyHandlingEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeEmergencyHandlingEquipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: emergency handling equipment attribute set.

Attribute List: see Table 5.2.9.

Table 5.2.9 The Attribute List of

Pset_CommunicationsApplianceTypeEmergencyHandlingEquipment

Name	Data Type	Description
EquipmentType	P_ENUMERATEDVALUE/IfcLabel:Emergency Communication,Tunnel Emergency	Type of emergency handling equipment: emergency communication, tunnel emergency
IsMain	P_SINGLEVALUE/IfcBoolean	Whether is the main equipment

5.2.10 Pset_CommunicationsApplianceTypeMonitorHandleEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeMonitorHandleEquipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: monitoring equipment attribute set.

Attribute List: see Table 5.2.10.

Table 5.2.10 The Attribute List of

Pset_CommunicationsApplianceTypeMonitorHandleEquipment

Name	Data Type	Description
EquipmentType	P_ENUMERATEDVALUE/IfcLabel:Power Supply And Enviroment,Optical Fiber,Cable Jacket,Leaky Cable,Tower,Natural Disaster,Interface	Type of monitoring equipment: power supply and environment , optical fiber, cable jacket, leaky cable, tower, natural disaster, interface
Mounting Type	P_ENUMERATEDVALUE/IfcLabel:Wall-Mounted,Cabinet,Outside, Soil	Mounting type: wall-mounted, cabinet, outside, soil
IsMain	P_SINGLEVALUE/IfcBoolean	Whether is the main equipment

5.2.11 Pset_CommunicationsApplianceTypeConverter

Name of Property Set: Pset_CommunicationsApplianceTypeConverter.

Applicable Entity: IfcCommunicationsAppliance.

Description: converter attribute set.

Attribute List: see Table 5.2.11.

Table 5.2.11 The Attribute List of

Pset_CommunicationsApplianceTypeMonitorHandleEquipment

Name	Data Type	Description
EquipmentType	P_ENUMERATEDVALUE/IfcLabel:Protocol,Optical Fiber,Cable	Type of converter: protocol, optical fiber, cable
InputType	P_ENUMERATEDVALUE/IfcLabel:Optical Interface,Electrical Interface	Input type: Optical interface, electrical interface
OutputType	P_ENUMERATEDVALUE/IfcLabel:Optical Interface,Electrical Interface	Output type: optical interface, electrical interface
InputCount	P_SINGLEVALUE/IfcInteger	Input count
OutputCount	P_SINGLEVALUE/IfcInteger	Output count

5.2.12 Pset_CommunicationsApplianceTypeWirelessCommunicationEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeWirelessCommunicationEquipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: wireless communication equipment attribute set.

Attribute List: see Table 5.2.12.

Table 5.2.12 The Attribute List of
Pset_CommunicationsApplianceTypeWirelessCommunicationEquipment

Name	Data Type	Description
EquipmentType	P_ENUMERATEDVALUE/IfcLabel:GSM-R,LTE-R,Radio Train Dispatching Communication,Radio Station-Yard Communication,Satellite Communication,Microwave Communication	Type of wireless communication equipment :GSM-R, LTE-R, radio train dispatching communication, station-yard wireless communication, satellite communication, microwave Communication
WorkFrequency	P_BOUNDEDVALUE/IfcInteger	Work frequency

MountingType	P_ENUMERATEDVALUE/IfcLabel:Cabinet,WallMounted, Outside	Mounting type: cabinet, wall-mounted, outside
EquipmentCapacity	P_SINGLEVALUE/IfcInteger	Equipment capacity
IsMain	P_SINGLEVALUE/IfcBoolean	Whether is the mainequipment

5.2.13 Pset_CommunicationsApplianceTypePortableDevices

Name of Property Set: Pset_CommunicationsApplianceTypePortableDevices.

Applicable Entity: IfcCommunicationsAppliance.

Description: portable device attribute set.

Attribute List: see Table 5.2.13.

Table 5.2.13 The Attribute List of Pset_CommunicationsApplianceTypePortableDevices

Name	Data Type	Description
Equipment Type	P_ENUMERATEDVALUE/IfcLabel:Handheld station,OPH,GPH	Type of portable device: handheld station, OPH, GPH

5.2.14 Pset_CommunicationsApplianceTypeDataStorage

Name of Property Set: Pset_CommunicationsApplianceTypeDataStorage.

Applicable Entity: IfcCommunicationsAppliance.

Description: data storage equipment attribute set.

Attribute List: see Table 5.2.14.

Table 5.2.14 The Attribute List of Pset_CommunicationsApplianceTypeDataStorage

Name	Data Type	Description
Storage Mediums	P_ENUMERATEDVALUE/IfcLabel:Optical disc,Magnetic,Flash	Storage medium: optical disc, magnetic disc , flash
Storage Capacity	P_SINGLEVALUE/IfcInteger	Storage capacity

5.2.15 Pset_SensorWindSensorSnowMeterPluvioGraphInterfaceTypeCommon

Name of Property Set: Pset_SensorWindSensorSnowMeterPluvioGraphInterfaceCommon.

Applicable Entity: IfcSensor.

Description: interface universal attribute set for snow depth device, wind speed meter andpluviometer meter.

Attribute List: see Table 5.2.15.

<p align="center">Table 5.2.15 The Attribute List of</p>

<p align="center">Pset_SensorWindSensorSnowMeterPluvioGraphInterfaceCommon</p>

Name	Data Type	Description
Interface Type	P_ENUMERATEDVALUE/IfcLabel:RS-232,RS-422,RS-485	Interface type: RS-232, RS-422, RS-485

5.2.16 Pset_InsulationDeviceTypeCommon

Name of Property Set: Pset_InsulationDeviceTypeCommon.

Applicable Entity: IfcInsulationDevice.

Description: insulation device attribute set.

Attribute List: see Table 5.2.16.

<p align="center">Table 5.2.16 The Attribute List of Pset_InsulationDeviceTypeCommon</p>

Name	Data Type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	Reference Identifier
Status	P_ENUMERATEDVALUE/IfcLabel/PEnum_ElementStatus:NEW, EX ISTING,DEMOLISH,TEMPORARY	Status: NEW, EX ISTING, DEMOLISH, TEMPORARY

6 Signaling

The signaling system of railway is the important train operation equipment used for universal dispatching and commanding train operation, ensuring train safety, enhancing transport efficiency, improving labor intensity, mainly includes train operation command system, train control system, section and blocking system, station interlocking system, centralized signaling monitoring system, power supply system, etc.

The signaling system and all subsystems are expressed by quoting the IfcDistributionSystem of IfcSharedBldgServiceElements model in IFC4.

The basic data structure of signaling information model is composed of IfcElement and IfcPort , among which, parts of the signal elements or components adopt the existing types or the existing type enumerations in IFC4, parts of the elements are expanded by the way of increasing type or enumeration as follows:

(1) The common parts of the railway four electricity refer to chapter 4 of this code.

(2) The relay adopts the IfcElectricTimeContro\RELAY in IFC4.

(3)The circuit breaker adopts the IfcProtectiveDevice\CIRCUITBREAKER in IFC4.

(4) The fuse disconnector adopts the IfcProtectiveDevice\FUSEDISCONNECTOR in IFC4.

(5) The lighting protection unit adopts the IfcProtectiveDevic\VARISTOR in IFC4.

(6) The resistance adopts the IfcProtectiveDevice in IFC4, and the pre-defined type-RESISTOR is newly increased.

(7) The isolating unit adopts the IfcProtectiveDevic in IFC4, and the pre-defined type-ISOLATIONUNIT is newly increased.

(8) The AC time limit open-phase protector and DC time limit protector adopt the IfcProtective Device in IFC4, and the pre-defined type-POINTMACHINEPROTECTION is newly increased.

(9) The alarm devices including DC time limit alarm device, filament burnout alarm device, fuse burnout alarm device, bent alarm device, etc adopt the IfcAlarm\BELL or IfcAlarm\LIGHT in IFC4.

(10) The capacitance adopts the IfcElectricFlowStorageDevice\CAPACITORBANK in IFC4.

(11) The transformer adopts the IfcTransformer\VOLTAGE in IFC4.

(12) The rectifier adopts the IfcTransformer\RECTIFIER in IFC4.

(13) The impedance bond transformer adopts the IfcTransformer in IFC4, and the pre-defined type-IMPEADANCEBOND is newly increased.

(14) The lighting unit adopts the IfcTransformer in IFC4, and the pre-defined type-LIGHTINGUNIT is newly increased.

(15) The direction box, terminal box, electrical wiring box adopt the IfcJunctionBox\POWER or IfcJunctionBox\DATA in IFC4.

(16) The terminal board adopts the IfcCableFitting in IFC4, and the pre-defined type-TERMINALBOARD is newly increased.

(17) The connecting terminal adopts the IfcDistributionPort\CABLE in IFC4.

(18) The signal cable, axle cable, balise cable and signal indoor soft wire adopt the CABLESEGMENT in IFC4.

(19) The integrated through earthing wire adopts the IfcCableSegmentTypeEnum in IFC4, and the pre-defined type-INTEGRATEDGROUNDINGWIRESEGMENT is newly increased.

(20) The insulated joint adopts the newly increased entity-IfcInsulationDevice, and the pre-defined type-INSULATEDJOINT is newly increased.

(21) The hollow coil insulated joint adopts the newly increased entity-IfcInsulationDevice, and the pre-defined type-AIRCORECOIL is newly increased.

(22) The box foundation adopts the IfcFooting\STRIP_FOOTING in IFC4.

(23) The high column signal adopts the IfcColumn\COLUMN in IFC4.

(24) The combined cabinet, track cabinet, distribution plate, interface cabinet, frequency shift cabinet, integrated cabinet, cabinet, transformer box and dual protection box adopt the newly increased entity-IfcDeviceCabinet in the commonparts of the railway four electricity.

(25) All kinds of circuit board in cabinet such as interlocking logic, electrical terminal, optical splitter, UPS, logical 24V power supply, interface 24V power supply in the computer based interlocking cabinet adopt the IfcElectricDistributionBoard in IFC4, and the pre-defined type-POWERBOARD or DATABOARD is newly increased.

(26) The signal, balise, axle counter, switch machine, turnouts mounted device, switch closure detector, lock stretcher adopt the newly increased entity-IfcSignalingTerminal which inherits the IfcFlowTerminal.

(27) The sender, receiver, attenuator, amplifier, balise coding unit, collector,electric cable simulation network plate, 25Hz track circuit protection box adopt the newly increased entity-IfcSignalingRelay which inherits the IfcFlowController.

(28) The signal machanisms adopt the newly increased entity- IfcSignalMechanisms which inherits the IfcFlowTerminal.

The equipments including CTC center equipment, CTC station extension, computer based interlocking equipment, train control center, temporary speed restriction server, RBC, track circuit maintenance equipment, computer monitoring center, computer monitoring station extension, feed end and receiving end of the track circuit adopt the IfcDistributionSystem\DATA in IFC4.

The signal element-Express-G is shown in the figure 6.1.
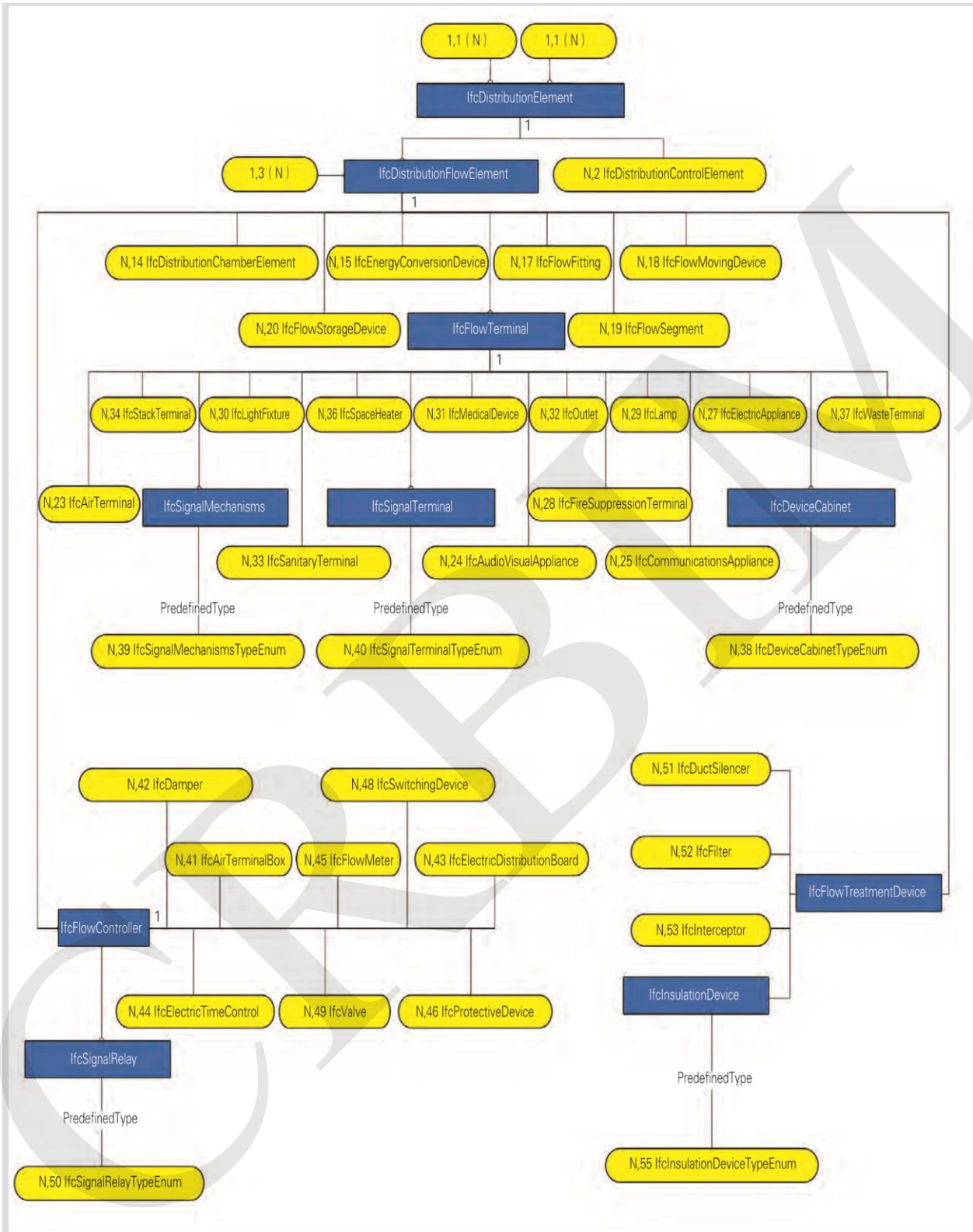
Figure 6.1 The signal element-Express-G figure

The signaling system is realized by the connection of all kinds of IfcElement and IfcPort. Figure 6.2 and 6.3 show the connection relation of signaling elements and ports by taking the signaling interlocking subsystem for instance. Figure 6.2 is the connection relation of the indoor equipment for signaling

interlocking subsystem. Figure 6.3 is the connection relation of the outdoor equipment for signaling interlocking subsystem. The indoor equipment connect the outdoor equipment's through outdoor cables.
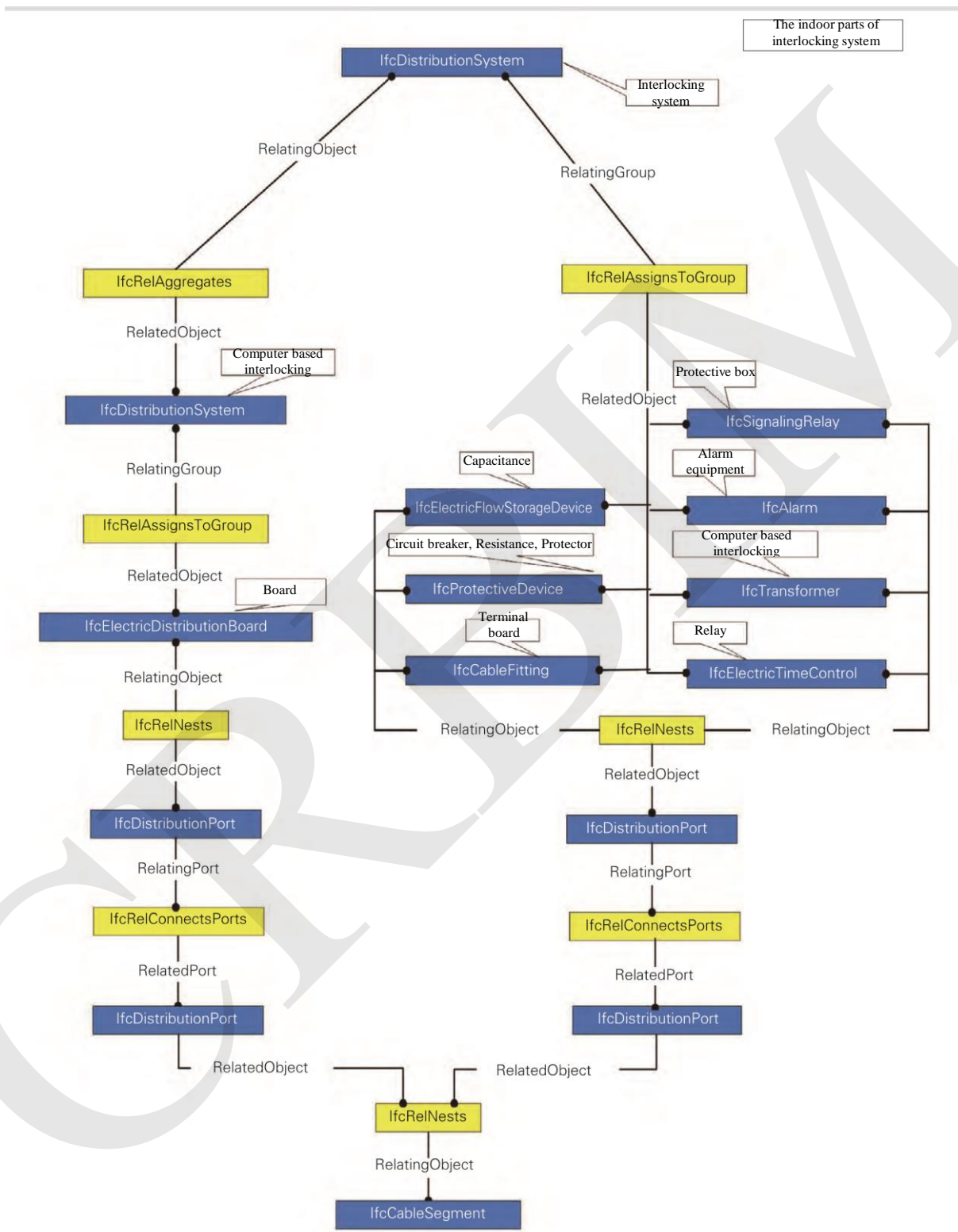
Figure 6.2 The connection relation of the indoor equipments for signaling interlocking subsystem

IfcDistributionSystem

The outdoor parts of interlocking system

RelatingObject

Interlocking system

RelatingGroup

IfcRelAggregates

RelatedObject

Feed end or receiving end of track circuit

IfcRelAssignsToGroup

RelatedObject

Direction box, Terminal

Light

Signal mechanism

Lighting unit

IfcDistributionSystem

RelatingGroup

IfcJunctionBox

IfcLamp

RelatingObject

IfcSignalMechanisms   IfcTransformer

RelatedObject   RelatedObject   RelatedObject

IfcRelAssignsToGroup

RelatedObject   RelatedObject   RelatedObject

Resistance, Fuse, Isolating box

IfcRelAggregates

IfcRelAggregates

RelatedObject

RelatedObject

IfcTransformer

Switch machine, Axle counter

RelatingObject   RelatingObject

RelatedObject

Terminal board

Signal

Feed end or receiving end of track circuit

Terminal board

IfcCableFitting   IfcSignalingTerminal   IfcSignalingTerminal   IfcProtectiveDevice   IfcCableFitting

RelatingObject   RelatingObject   RelatingObject   RelatingObject   RelatingObject

IfcRelNests   IfcRelNests   IfcRelNests   IfcRelNests

RelatedObject   RelatedObject   RelatedObject   RelatedObject

IfcDistributionPort   IfcDistributionPort   IfcDistributionPort   IfcDistributionPort

RelatingPort   RelatingPort   RelatingPort   RelatingPort

IfcRelConnectsPorts   IfcRelConnectsPorts   IfcRelConnectsPorts   IfcRelConnectsPorts

RelatedPort   RelatedPort   RelatedPort   RelatedPort

IfcDistributionPort   IfcDistributionPort   IfcDistributionPort   IfcDistributionPort

RelatedObject   RelatingObject   RelatedObject   RelatedObject

IfcRelNests

Outdoor cable   RelatingObject

IfcCableSegment

Figure 6.3 The connection relation of the outdoor equipments for signaling interlocking subsystem

The newly-increased IfcSignalingTerminal inherits the IfcFlowTerminal, the newly-increased IfcSignalingRelay inherits the IfcFlowController, the newly-increased IfcSignalMechanisms inherits the IfcFlowTerminal.

6.1 The Definition of Type

6.1.1 IfcSignalingTerminalTypeEnum

IfcSignalingTerminalTypeEnum is the signaling terminal type enumeration which defines the type of signaling terminal from the function perspective.

Definition of new enum items:

SIGNAL;

AXLECOUNTER;

BALISE;

ENDPOSITIONDETECTOR;

LOCKSTRETCHER;

POINTMACHINE;

MOUNTEDDEVICE;

USERDEFINED;

NOTDEFINED.

EXPRESS:

TYPEIfcSignalingTerminalTypeEnum=ENUMERATIONOF

(SIGNAL

AXLECOUNTER,

BALISE,

ENDPOSITIONDETECTOR,

LOCKSTRETECHER,

MOUNTEDDEVICE,

POINTMACHINE,

USERDEFINED,

NOTDEFINED);

END_TYPE;

6.1.2 IfcSignalingRelayTypeEnum

IfcSignalingRelayTypeEnum is the signaling relay type enumeration which defines the type of signaling relay from the function perspective.

Definition of new enum items:

ACQUISITION;

AMPLIFIER;

ATTENUATOR;

LEU;

RECEIVER;

SENDER;

SIMULATOR;

25HZTRACKCIRCUITPROTECTIONBOX;

USERDEFINED;

NOTDEFINED.

EXPRESS:

TYPEIfcSignalingRelayTypeEnum=ENUMERATIONOF

(ACQUISITION,

AMPLIFIER,

ATTENUATOR,

LEU,

RECEIVER,

SENDER,

SIMULATION,

25HZTRACKCIRCUITPROTECTIONBOX:

USERDEFINED,

NOTDEFINED);

END_TYPE;

6.1.3 IfcSignalMechanismsTypeEnum

IfcSignalMechanismsTypeEnum is the signal mechanisms type enumeration which defines the type of signal mechanisms from the structure and quantity of the signal light position perspective.

Definition of new enum items:

SINGLEMECHANISMS;

DOUBLEMECHANISMS;

TRIPLEMECHANISMS;

QUADRUPLEMECHANISMS;

USERDEFINED;

NOTDEFINED.

EXPRESS:

TYPEIfcSignalMechanismsTypeEnum=ENUMERATIONOF

(SINGLEMECHANISMS,

DOUBLEMECHANISMS,

TRIPLEMECHANISMS,

QUADRUPLEMECHANISMS,

USERDEFINED,

NOTDEFINED);

END_TYPE;

6.2 The Definition of Entity

6.2.1 IfcSignalingTerminal

6.2.1.1 The definition of entity

IfcSignalingTerminal inherits the IfcFlowTerminal and it defines the terminal equipment of the signaling system.

6.2.1.2 The definition of attribute

PreDefinedType：the pre-defined type. The signaling terminal is further subdivided into signal, axle counter, balise, switch closure detector, switch machine, lock stretcher and turnouts mounted device, etc from the function type perspective.

6.2.1.3 EXPRESS

ENTITY IfcSignalingTerminal

SUBTYPE OF (IfcFlowTerminal);

PreDefinedType: OPTIONALIfcSignalingTerminalTypeEnum;

WHERE

CorrectPredefinedType:

NOT (EXISTS(PredefinedType))

OR (PredefinedType<>IfcSignalingTerminalTypeEnum.USERDEFINED)

OR

((PredefinedType=IfcSignalingTerminalTypeEnum.USERDEFINED)

AND EXISTS(SELF\IfcObject.ObjectType));

CorrectTypeAssigned:

(SIZEOF(IsTypeBy)=0)

OR

('IFCELECTRICALDOMAIN.IFCSIGNALINGTERMINALTYPE'

INTYPEOF(SELF\IfcObject.IsTypeBy[1].RelatingType));

END_ENTITY;

6.2.2 IfcSignalingRelay

6.2.2.1The definition of entity

IfcSignalingRelay defines the non-overall engine equipment which do the operations including receiving, sending and handling signal, etc.

6.2.2.2 The definition of attribute

PreDefinedType：the pre-defined type. The signaling relay is further subdivided into amplifier, attenuator, collector, simulation network plate, receiver, sender, 25Hz track circuit protection box, etc from the function type perspective.

6.2.2.3 EXPRESS

ENTITYIfcSignalingRelay

SUBTYPEOF(IfcFlowController);

PreDefinedType:OPTIONALIfcSignalingRelayTypeEnum;

WHERE

CorrectPredefinedType:

NOT(EXISTS(PredefinedType))

OR(PredefinedType<>IfcSignalingRelayTypeEnum.USERDEFINED)

OR

((PredefinedType=IfcSignalingRelayTypeEnum.USERDEFINED)

ANDEXISTS(SELF\IfcObject.ObjectType));

CorrectTypeAssigned:

(SIZEOF(IsTypeBy)=0)

OR

('IFCELECTRICALDOMAIN.IFCSIGNALINGRELAYTYPE'

INTYPEOF(SELF\IfcObject.IsTypeBy[1].RelatingType));

END_ENTITY;

6.2.3 IfcSignalMechanisms

6.2.3.1 The definition of entity

IfcSignalMechanisms inherits the IfcFlowTerminal and it is a component of signal. The signal mechanisms equipments are defined from the light position structure of the signal mechanisms perspective.

6.2.3.2 The definition of attribute

PreDefinedType：the pre-defined type. The signal mechanisms is further subdivided into SINGLEMECHANISMS, DOUBLEMECHANISMS, TRIPLEMECHANISMS and QUADRUPLEMECHANISMS, etc from the light position structure of the signal mechanisms perspective.

6.2.3.3 EXPRESS

ENTITYIfcSignalMechanisms

SUBTYPEOF(IfcFlowTerminal);

PreDefinedType:OPTIONALIfcSignalMechanismsTypeEnum;

WHERE

CorrectPredefinedType:

NOT(EXISTS(PredefinedType))

OR(PredefinedType<>IfcSignalMechanismsTypeEnum.USERDEFINED)

OR

((PredefinedType=IfcSignalMechanismsTypeEnum.USERDEFINED)

ANDEXISTS(SELF\IfcObject.ObjectType));

CorrectTypeAssigned:

(SIZEOF(IsTypeBy)=0)

OR

('IFCELECTRICALDOMAIN.IFCSIGNALMECHANISMSTYPE'

INTYPEOF(SELF\IfcObject.IsTypeBy[1].RelatingType));

END_ENTITY;

6.3 The Definition of Attribute Set

6.3.1 Pset_SignalTerminalandProcessorCommon

Name of Property Set: Pset_SignalTerminalandProcessorCommon.

Applicable Entity: IfcSignalingTerminal/IfcSignalingRelay.

Description: signaling terminal and signaling relay universal attribute set.

Attribute List: see Table 6.3.1.

Table 6.3.1 The Attribute List of Pset_SignalTerminalCommon

Name	Data Type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	Reference identifier
Status	P_ENUMERATEDVALUE/IfcLabel/PEnum_ElementStatus:NEW, EXISTING,DEMOLISH,TEMPORARY	Status: NEW, EXISTING, DEMOLISH, TEMPORARY
SignalSource	P_TABLEVALUE/IfcIdentifier/IfcLabel	Signal source
NominalSupplyVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Nominal voltage
NominalSupplyCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Nominal current
NominalFrequency	P_SINGLEVALUE/IfcFrequencyMeasure	Nominal frequency
NominalPower	P_SINGLEVALUE/IfcPowerMeasure	Nominal power

NominalResistance	P_SINGLEVALUE/IfcElectricResistance Measure	Nominal resistance
IsInside	P_SINGLEVALUE/IfcBoolean	Whether is inside:TRUE indicates inside, FALSE indicates outside
Humidity		Humity
AirPressure	P_SINGLEVALUE/IfcPressureMeasure	Air pressure
EMC	P_SINGLEVALUE/IfcBoolean	Whether is EMC:TRUE indicates EMC，FALSE indicates non-EMC
CorrosionResistance	P_SINGLEVALUE/IfcBoolean	Whether is corrosion resistance: TRUE indicates corrosion resistance，FALSE indicates non-corrosion resistance
ConsumingCycle	P_SINGLEVALUE/IfcTimeMeasure	Consuming cycle

6.3.2 Pset_SignalTerminalPHistory

Name of Property Set: Pset_SignalTerminalPHistory.

Applicable Entity: IfcSignalingTerminal.

Description: performance history of signaling terminal attribute set.

Attribute List: see Table 6.3.2.

Table 6.3.2 The Attribute List of Pset_SignalTerminalPHistory

Name	Data Type	Description
PowerState	P_REFERENCEVALUE/IfcTimeSeries/IfcBoolean	Power status
SignalSource	P_REFERENCEVALUE/IfcTimeSeries /IfcIdentifier	Signaling source
SignalContent	P_REFERENCEVALUE/IfcTimeSeries/IfcText	Signaling content

6.3.3 Pset_SignalTerminalOccurrence

Name of Property Set: Pset_SignalTerminalOccurrence.

Applicable Entity: IfcSignalingTerminal.

Description: signaling terminal ambient attribute set.

Attribute List: see Table 6.3.3.

Table 6.3.3 The Attribute List of Pset_SignalTerminalPHistory

Name	Data Type	Description
DesignAmbient Temperature	P_BOUNDEDVALUE/IfcThermodynamicTemperatureMeasure	Design ambient temperature

6.3.4 Pset_SignalTerminalTypeSignal

Name of Property Set: Pset_SignalTerminalTypeSignal.

Applicable Entity: IfcSignalingTerminal.

Description: signal attribute set.

Attribute List: see Table 6.3.4.

Table 6.3.4 The Attribute List of Pset_SignalTerminalTypeSignal

Name	Data Type	Description
FunctionType	P_ENUMERATEDVALUE/IfcLabel/ PEnum_SignalTerminalSignalType: STARTINGSIGNAL HOME SIGNAL ROUTESIGNAL SHUNTINGSIGNAL BLOCKSIGNAL DISTANTSIGNAL APPROACHSIGNAL REPEATINGSIGNAL HUMPSIGNAL	Signal function type: starting signal, home signal, route signal, shunting signal, block signal, distant signal, approach signal, repeating signal, hump signal

6.3.5 Pset_SignalTerminalTypeBalise

Name of Property Set: Pset_SignalTerminalTypeBalise.

Applicable Entity: IfcSignalingTerminal.

Description: balise attribute set.

Attribute List: see Table 6.3.5.

Table 6.3.5 The Attribute List of Pset_SignalTerminalTypeBalise

Name	Data Type	Description
BaliseType	P_ENUMERATEDVALUE/IfcLabel/ PEnum_SignalTerminalBaliseType: ACTIVE, PASSIVE	Balise type: ACTIVE, PASSIVE
ResponseTime	P_SINGLEVALUE/IfcTimeMeasure	Response time

6.3.6 Pset_SignalTerminalTypePointMachine

Name of Property Set: Pset_SignalTerminalTypePointMachine.

Applicable Entity: IfcSignalingTerminal.

Description: switch machine attribute set.

Attribute List: see Table 6.3.6.

Table 6.3.6 The Attribute List of Pset_SignalTerminalTypePointMachine

Name	Data Type	Description
PointMachineType	P_ENUMERATEDVALUE/IfcLabel/ PEnum_SignalTerminalPointMachineType: AC,DC,HYDRAULIC	Type of switch machine: AC, DC, HYDRAULIC
WorkMode	P_ENUMERATEDVALUE/IfcLable/ PEnum_SignalTerminal WorkMode:SERIES, REVERSIBLE,SHORT-TIME	Work Mode: SERIES, REVERSIBLE, SHORT-TIME
Resistance	P_SINGLEVALUE/ IfcElectricResistanceMeasure	Maximum single line resistance
RotationalSpeed	P_SINGLEVALUE/ IfcRotationalFrequencyMeasure	Minimum rotational speed
OperationTime	P_SINGLEVALUE/IfcTimeMeasure	Maximum operation time
OperationRodTravers	P_BOUNDEDVALUE/IfcLengthMeasure	Throw rod stroke

6.3.7 Pset_SignalTerminalTypeEndPositionDetector

Name of Property Set: Pset_SignalTerminalTypeEndPositionDetector.

Applicable Entity: IfcSignalingTerminal.

Description: switch closure detector attribute set.

Attribute List: see Table 6.3.7.

Table 6.3.7 The Attribute List of Pset_SignalTerminalTypeEndPositionDetector

Name	Data Type	Description
Traverse	P_SINGLEVALUE/IfcLengthMeasure	Maximum stroke
DetectDistance	P_SINGLEVALUE/IfcLengthMeasure	Maximum inspection distance

6.3.8 Pset_SignalProcessorPHistory

Name of Property Set: Pset_SignalProcessorPHistory.

Applicable Entity: IfcSignalingRelay.

Description: signaling repeater performance history attribute set.

Attribute List: see Table 6.3.8.

Table 6.3.8 The Attribute List of Pset_SignalProcessorTypeAcquisition

Name	Data Type	Description
PowerState	P_REFERENCEVALUE/IfcTimeSeries/IfcBoolean	Power supply state
SignalSource	P_REFERENCEVALUE/IfcTimeSeries/IfcIdentifier	Signaling source
SignalContent	P_REFERENCEVALUE/IfcTimeSeries/IfcText	Signaling content

6.3.9 Pset_SignalProcessorTypeAcquisition

Name of Property Set: Pset_SignalProcessorTypeAcquisition.

Applicable Entity: IfcSignalingRelay.

Description: collection device attribute set.

Attribute List: see Table 6.3.9.

Table 6.3.9 The Attribute List of Pset_SignalProcessorTypeAcquisition

Name	Data Type	Description
ISVoltage	P_SINGLEVALUE/IfcBoolean	Whether to collect voltage
Voltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Voltage collected
IS Current	P_SINGLEVALUE/IfcBoolean	Whether to collect current
Current	P_SINGLEVALUE/IfcElectricCurrentMeasure	Current collected
IS Frequency	P_SINGLEVALUE/IfcBoolean	Whether to collect frequency
Frequency	P_SINGLEVALUE/IfcFrequencyMeasure	Frequency collected

6.3.10 Pset_SignalMechanismsCommon

Name of Property Set: Pset_SignalMechanismsCommon.

Applicable Entity: IfcSignalMechanisms.

Description: signal mechanisms common attribute set.

Attribute List: see Table 6.3.10.

Table 6.3.10 The Attribute List of Pset_SignalBoxCommon

Name	Data Type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	Reference Identifier
Status	P_ENUMERATEDVALUE/IfcLabel/PEnum_Element Status:NEW, EXISTING,DEMOLISH,TEMPORARY	Status: NEW, EXISTING, DEMOLISH, TEMPORARY
IsHorizontal	P_SINGLEVALUE/IfcBoolean	Whether is horizontal: TRUE indicates that the light position is arranged

		as horizontal, FALSE indicates vertical

7 Power Transformation

The basic data structure for power transformation model consists of IfcElement and IfcPort.

Thereinto, the existing types or their enum items of IFC4 are adopted for some elements or parts of power transformation, other elements are extended by adding more types or enum items. Details are as follows:

(1) Please refer to Chapter 4 of this Standard for public use of electric power, traction power supply, communications, and signaling railway engineering.

(2) Exsiting types of IfcLamp and IfcLightFixture in IFC4 are used for lamp.

(3) Exsiting type of IfcElectricGenerator in IFC4 is used for electric generator.

(4) Existing type of IfcSolarDevice in IFC4 is used for solar device.

(5) IfcTransformer\VOLTAGE, IfcTransformer\VOLTAGE and IfcTransformer\CURRENT in IFC4 are used for transformer, voltage transformer and current transformer respectively.

(6) IfcElectricFlowStorageDevice\HARMONICFILTER in IFC4 is used for filter device.

(7) IfcSwitchingDevice\SWITCHDISCONNECTOR and IfcSwitchingDevice\LOADSWITCH in IFC4 are used for switch disconnector and load switch respectively.

(8) IfcElectricDistributionBoard\DISTRIBUTIONBOARD in IFC4 is used for AC/DC screen.

(9)IfcElectricFlowStorageDevice/CAPACOTORBANK and IfcElectricFlowStorageDevice\INDUCTORBANK in IFC4 is used for compensation device and anti-lightning coils respectively.

(10) IfcJunctionBox\POWER in IFC4 is used for both terminal box and centralized grounding box.

(11) IfcProtectiveDevice\CIRCUITBREAKER, IfcProtectiveDevice\VARISTOR and IfcProtectiveDevice\FUSEDISCONNECTO in IFC4 are used for circuit breaker, arrester and fuse respectively, and predefined type of switching cabinet shall be added to IfcProtectiveDevice Type.

(12) IfcUnitaryControlElementType in IFC4 is used for secondary device cabinet, and predefined type shall be added. IfcCompositeApparatus is a new entity connected with IfcEnergyConversionDevice.

(13) IfcCompositeApparatus is a new entity connected with IfcEnergyConversionDevice.

(14) IfcSensorType in IFC4 is used for automatic fire detector.

(15) New enum item MONITORHANDLEEQUIPMENT of IfcCommunicationsAppliance is used for master engine of automatic fire monitoring equipment (as detailed above).

(16) New enum item MONITORHANDLEEQUIPMENT of IfcCommunicationsAppliance is used for master engine of monitoring equipment for BAS (Building Automation System) (as detailed above).

EXPRESS-G of power transformation is shown in Figure 7.1, and logical relationship of power transformation is shown in Figure 7.2.

7.1 Definition of Type
7.1.1 IfcCompositeApparatusTypeEnum

IfcCompositeApparatusTypeEnum is the enum of composite apparatus type, which defines the types of composite apparatuses according to their functions.

Definition of new enum items:
GIS;
HGIS;
USERDEFINED;
NOTDEFINED.

Description of EXPRESS:

TYPE IfcCompositeApparatusTypeEnum=ENUMERATION OF (GIS,

HGIS,

USERDEFINED,

NOTDEFINED);

END_TYPE;

7.1.2 IfcBoxTypeSubstationTypeEnum

IfcBoxTypeSubstationTypeEnum is the enum of box-type substation type, which defines the types of box-type substations according to their functions.

Definition of new enum items:

SUBSTATION;

SECTIONPOST;

SUBSECTIONPOST;

USERDEFINED;

NOTDEFINED.
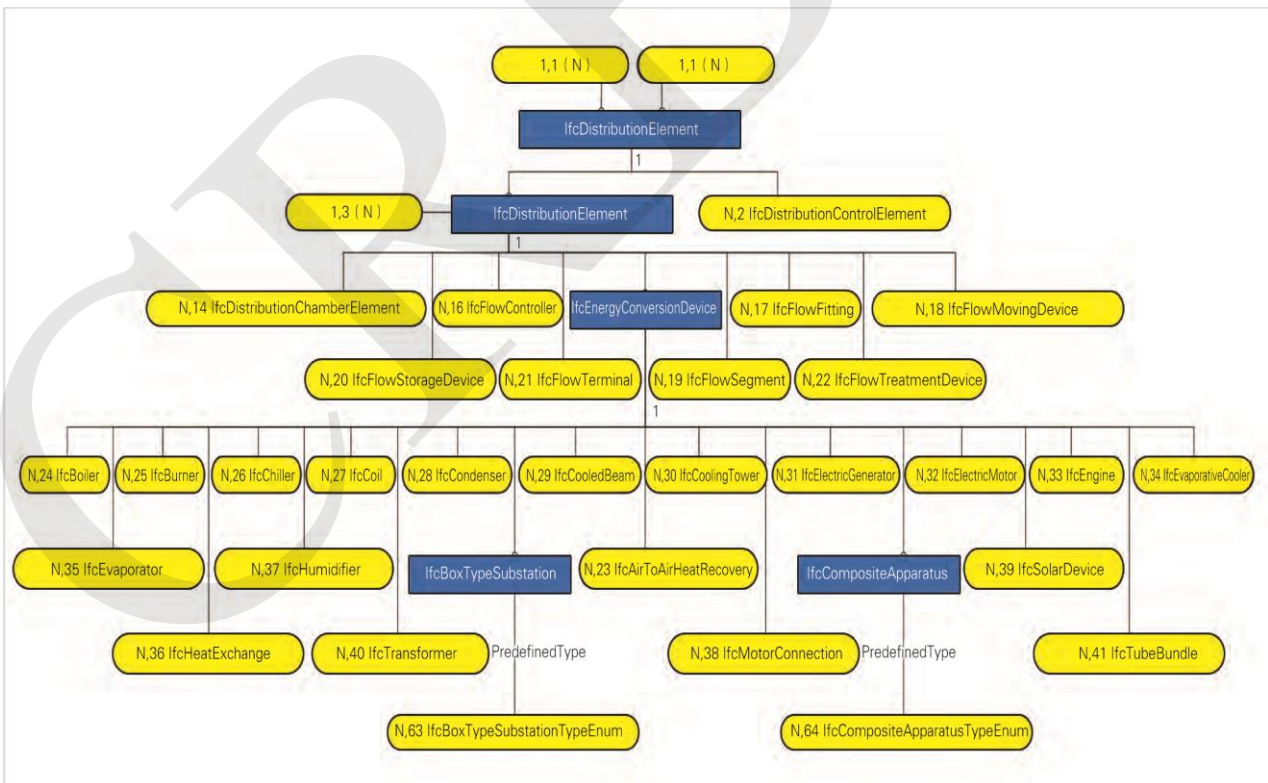
Figure 7.1 EXPRESS-G Diagram of Power Transformation

Description of EXPRESS:

TYPE IfcBoxTypeSubstationTypeEnum=ENUMERATION OF

  (SECTIONPOST,

   SUBSECTIONPOST,

   SUBSTATION,

   USERDEFINED,

   NOTDEFINED);

 END_TYPE;

7.1.3 IfcUnitaryControlElementTypeEnum

IfcUnitaryControlElementTypeEnum is the enum of unitary control type, which defines the types of unitary control according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
ALARMPANEL;

CONTROLPANEL;

GASDETECTIONPANEL;

INDICATORPANEL;
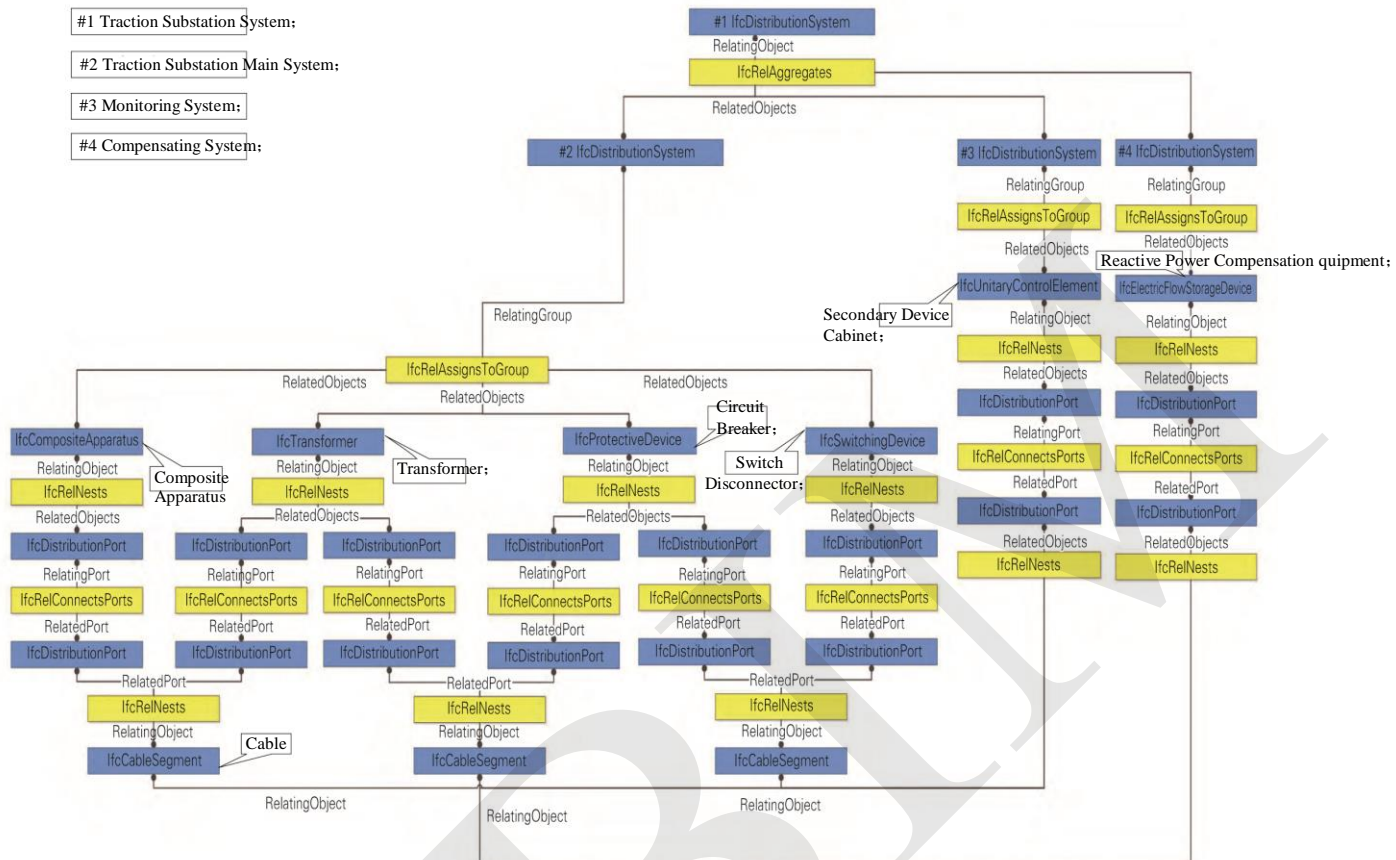
Figure 7.2 Logical Relationship Diagram of Power Transformation

MIMICPANEL;
HUMIDISTAT;
THERMOSTAT;
WEATHERSTATION;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
SECONDARYDEVICECABINET.

Description of EXPRESS:
 TYPE IfcUnitaryControlElementTypeEnum=ENUMERATION OF
(ALARMPANEL,
CONTROLPANEL,
GASDETECTIONPANEL,

INDICATORPANEL,

MIMICPANEL,

HUMIDISTAT,

SECONDARYDEVICECABINET,

THERMOSTAT,

WEATHERSTATION,

USERDEFINED,

NOTDEFINED);

END_TYPE;

7.2 Definition of Entity

7.2.1 IfcEnergyConversionDevice

7.2.1.1 Definition of Entity

As energy conversion entity needs to be newly added under energy conversion devices, energy conversion devices shall be redescribed.

7.2.1.2 Definition of Attribute

The attribute of energy conversion device shall remain the same as the original.

7.2.1.3 Description of EXPRESS

ENTITY IfcEnergyConversionDevice

 SUPERTYPE OF (ONE OF (IfcAirToAirHeatRecovery, IfcBoiler,

IfcBoxTypeSubstation, IfcBurner,

IfcChiller,

IfcCoil,

IfcCompositeApparatus,

IfcCondenser,

IfcCooledBeam,

IfcCoolingTower,

IfcElectricGenerator,

IfcElectricMotor,

IfcEngine,

IfcEvaporativeCooler,

IfcEvaporator,

IfcHeatExchanger,

IfcHumidifier,

IfcMotorConnection,

IfcSolarDevice,

IfcTransformer,

IfcTubeBundle,

IfcUnitaryEquipment))

 SUBTYPE OF (IfcDistributionFlowElement);

END_ENTITY;

7.2.2 IfcCompositeApparatus

7.2.2.1 Definition of Entity

IfcCompositeApparatus defines the composite apparatus devices in the power transformation system.

7.2.2.2 Definition of Attribute

PreDefinedType: It further divides composite apparatus into GIS and HGIS composite apparatus according to their functions.

7.2.2.3 Description of EXPRESS

ENTITY IfcCompositeApparatus

 SUBTYPE OF (IfcEnergyConversionDevice);

 PreDefinedType: OPTIONAL IfcCompositeApparatusTypeEnum;

 WHERE CorrectPredefinedType:

NOT (EXISTS (PredefinedType))

OR (PredefinedType <> IfcCompositeApparatusTypeEnum.USERDEFINED)

OR

 ((PredefinedType = IfcCompositeApparatus.TypeEnum. USERDEFINED) AND EXISTS

  (SELF\IfcObject.ObjectType));

    CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)

     OR

('IFCELECTRICALDOMAIN.IFCCOMPOSITEAPPARATUSTYPE' IN TYPEOF (SELF\IfcObject.IsTypeBy [1].RelatingType));
 END_ENTITY;

7.2.3 IfcBoxTypeSubstation

7.2.3.1 Definition of Entity

IfcBoxTypeSubstation defines the box-type substation devices in the power transformation system.

7.2.3.2 Definition of Attribute

PreDefinedType: It further divides signaling terminals into substation, section post and subsection post according to their functions.

7.2.3.3 Description of EXPRESS

ENTITY IfcBoxTypeSubstation

SUBTYPE OF (IfcEnergyConversionDevice);

PreDefinedType: OPTIONAL IfcBoxTypeSubstationTypeEnum;

WHERE CorrectPredefinedType:

NOT (EXISTS(PredefinedType))

OR (PredefinedType <>IfcBoxTypeSubstationTypeEnum.USERDEFINED)

OR

((PredefinedType = IfcBoxTypeSubstationTypeEnum. USERDEFINED) AND EXISTS

(SELF\IfcObject.ObjectType));

CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)

OR
('IFCELECTRICALDOMAIN.IFCBOXTYPESUBSTATIONTYPE' IN TYPEOF
(SELF\IfcObject.IsTypeBy [1].RelatingType));
END_ENTITY;

7.3 Definition of Property Set

7.3.1 Pset_CompositeApparatusTypeCommon

Name of Property Set: Pset_CompositeApparatusTypeCommon

Applicable Entity: IfcCompositeApparatus

Description: common property set of composite apparatus
Attribute List: see Table 7.3.1

Table 7.3.1 Attribute List of Pset_CompositeApparatusTypeCommon

Name	Data type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	ID cited
RatedVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Rated voltage
RatedCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Rated current
RatedFrequency	P_SINGLEVALUE/IfcFrequencyMeasure	Rated frequency
PhaseNumber	P_ENUMERATEDVALUE/PEnum_PhaseNumber:single phase,three phase	Phase number: single phase, three phase

AltitudeAbove SeaLevel	P_SINGLEVALUE/IfcInteger	Altitude above sea level
Type	P_ENUMERATEDVALUE/PEnum_Type:GIS,HGIS	Type: GIS, HGIS

7.3.2 Pset_BoxTypeSubstationTypeCommon

Name of Property Set: Pset_BoxTypeSubstationTypeCommon

Applicable Entity: IfcBoxTypeSubstation

Description: property set of box type substation
Attribute List: see Table 7.3.2

Table 7.3.2 Attribute List of Pset_BoxTypeSubstationTypeCommon

Name	Data type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	ID cited
RatedVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Rated voltage
AltitudeAbove SeaLevel	P_SINGLEVALUE/IfcInteger	Altitude above sea level

7.3.3 Pset_BoxTypeSubstationTypeSubstation

Name of Property Set: Pset_BoxTypeSubstationTypeSubstation

Applicable Entity: IfcBoxTypeSubstation

Description: property set of box type substation
Attribute List: see Table 7.3.3

Table 7.3.3 Attribute List of Pset_BoxTypeSubstationTypeSubstation

Name	Data type	Description
ApparentPower	P_SINGLEVALUE/IfcPowerMeasure	Apparent power
IncomingFeederCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Incoming feeder current
FeederCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Feeder current
FeederNumber	P_SINGLEVALUE/IfcLable	Number of feeders
PrimaryVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Primary voltage
SecondaryVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Secondary voltage
TransformerNumber	P_SINGLEVALUE/IfcLable	Number of transformers

7.3.4 Pset_BoxTypeSubstationTypeSubSectionPost

Name of Property Set: Pset_BoxTypeSubstationTypeSubSectionPost

Applicable Entity: IfcBoxTypeSubstation

Description: property set of box type subsection post
Attribute List: see Table 7.3.4

Table 7.3.4 Attribute List of Pset_BoxTypeSubstationTypeSubSectionPost

Name	Data type	Description
IncomingFeederCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Incoming feeder current
FeederCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Feeder current
IncomingFeederNumber	P_SINGLEVALUE/IfcInteger	Number of incoming feeders
FeederNumber	P_SINGLEVALUE/IfcInteger	Number of feeders

7.3.5 Pset_BoxTypeSubstationTypeSectionPost

Name of Property Set: Pset_BoxTypeSubstationTypeSectionPost

Applicable Entity: IfcBoxTypeSubstation
Description: property set of box type section post
Attribute List: see Table 7.3.5

Table 7.5 Attribute List of Pset_BoxTypeSubstationTypeSectionPost

Name	Data type	Description
ParallelCircuitBreakerCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Parallel circuit breaker current

7.3.6 Pset_IfcProtectiveDeviceTypeSwitchingCabinet

Name of Property Set: Pset_ProtectiveDeviceTypeSwitchingCabinet

Applicable Entity: IfcProtectiveDevice
Description: property set of switching cabinet
Attribute List: see Table 7.3.6

Table 7.3.6 Attribute List of Pset_ProtectiveDeviceTypeSwitchingCabinet

Name	Data type	Description
PhaseNumber	P_ENUMERATEDVALUE/PEnum_PhaseNumber: single phase,twophase,three phase	Phase number: single, two phase, three phase
AltitudeAbove SeaLevel	P_SINGLEVALUE/IfcInteger	Altitude above sea level
Type	P_ENUMERATEDVALUE/PEnum_Type:GIS,AIS	Type: GIS, AIS

7.3.7 Pset_IfcUnitaryControlElementTypeSecondaryDevicePanel

Name of Property Set: Pset_UnitaryControlElementTypeSecondaryDevicePanel

Applicable Entity: IfcUnitaryControlElement
Description: property set of secondary device panel
Attribute List: see Table 7.3.7

Table 7.3.7 Attribute List of Pset_UnitaryControlElementTypeSecondaryDevicePanel

Name	Data type	Description
Type	P_ENUMERATEDVALUE/PEnum_Type:Integrated AutomationSystem,CatenarySwitch,Online	Type: Integrated automation system, catenary switch, online monitoring
ObjectNumber	P_SINGLEVALUE/IfcInteger	Number of objects

7.3.8 Pset_IfcElectricDistributionBoardTypeDistributionBoard

Name of Property Set: Pset_ ElectricDistributionBoardTypeDistributionBoard

Applicable Entity: Ifc ElectricDistributionBoard
Description: newly added property set of electric distribution board
Attribute List: see Table 7.3.8

Table 7.3.8 Attribute List of Pset_ElectricDistributionBoardTypeDistributionBoard

Name	Data type	Description
Type	P_ENUMERATEDVALUE/PEnum Type :AC, DC	Type: AC, DC
FeederNumber	P_SINGLEVALUE/IfcInteger	Number of objects

8 Overhead Contact System (OCS)

The basic data structure for OCS model consists of IfcElement and IfcPort.

Thereinto, the existing types or their predefined types in IFC4 are adopted for some elements of OCS, while other elements are extended by adding more types or predefined types. Details are as follow:

(1) Please refer to Chapter 4 of this Standard for public use of electric power, traction power supply, communications, and signaling railway engineering.

(2) IfcCableSegment\CONDUCTORSEGMENT and IfcCableSegment\CABLESEGMENT in IFC4 are used for contact wire and cable respectively; IfcCableSegment in IFC4 shall be adopted for various stranded segments such as messenger wire and additive wire, and predefined type of STRANDEDSEGMENT shall be added.

(3) IfcCableCarrierSegment in IFC4 is used for cantilever of OCS and supporter of additive wire, and predefined type CANTILEVER and SUPPORTOR shall be added.

(4) IfcFooting in IFC4 is used for the footing of bracing wire and OCS pole foundation.

(5) IfcColumn\COLUMN in IFC4 is used for OCS pole.

(6) IfcElementAssembly\BEAM_GRID in IFC4 is used for crossbeam; IfcElementAssembly\BRACED_FRAME in IFC4 is used for boundary frame.

(7) IfcCableFitting in IFC4 is used for cable connector and terminal as well as metal fittings for cables.

(8) IfcSwitchingDevice\SWITCHDISCONNECTOR in IFC4 is used for disconnectors of OCS.

(9) IfcProtectiveDevice\VARISTOR in IFC4 is used for arresters.

(10) IfcCableAuxiliary is a newly added entity connected with IfcFlowFitting. Its predefined type includes anchor compensation, bracing wire, dropper, electric connection and mid-point anchor.

EXPRESS-G of OCS elements is shown in Figure 8.1; distribution relationship diagram of traction substation system-OCS-electric locomotive-backflow is shown in Figure 8.2; structure of OCS is shown in Figure 8.3.

8.1 Definition of Type
8.1.1 IfcCableAuxiliaryTypeEnum

IfcCableAuxiliaryTypeEnum is the enum of cable auxiliary element type, which defines cable auxiliary element types according to their functions.

Definition of new enum items:
ANCHORCOMPENSITON;
BRACINGWIRE;
DROPPER;
ELECTRICCONNECTION;
MIDPOINTANCHOR;
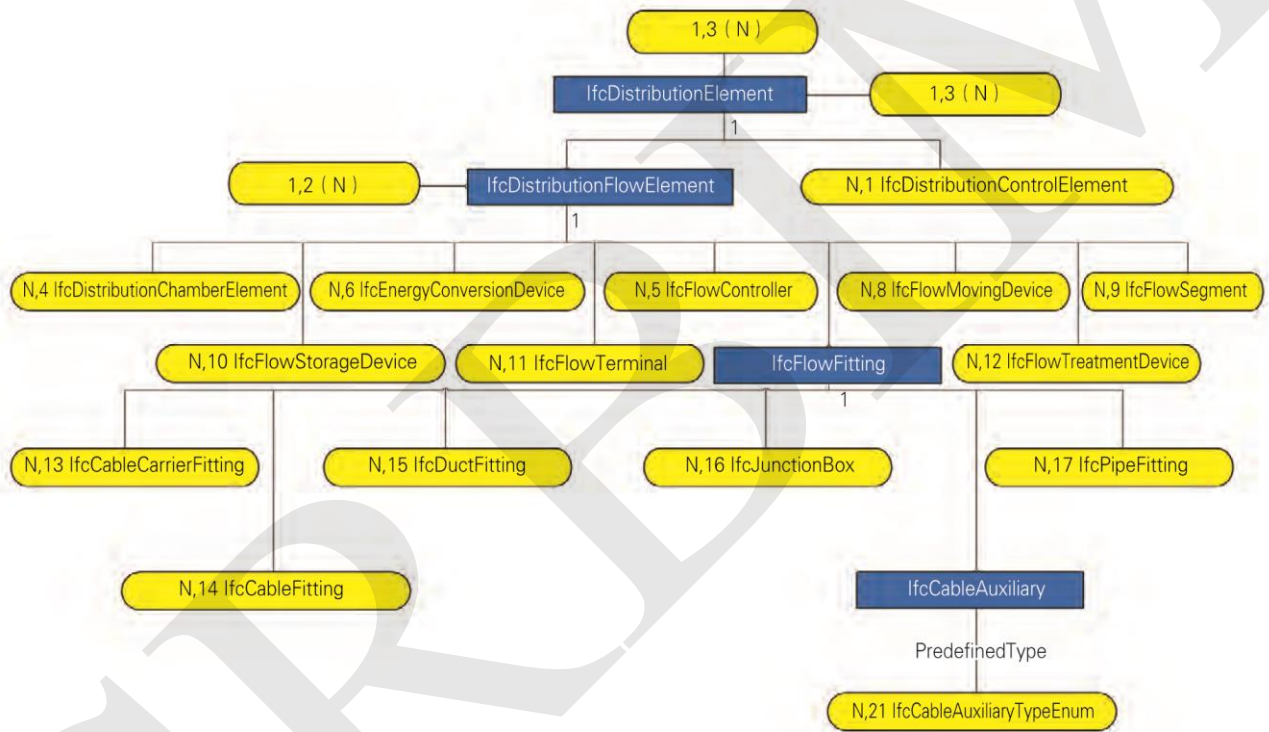
Figure 8.1 EXPRESS-G Diagram of OCS Elements
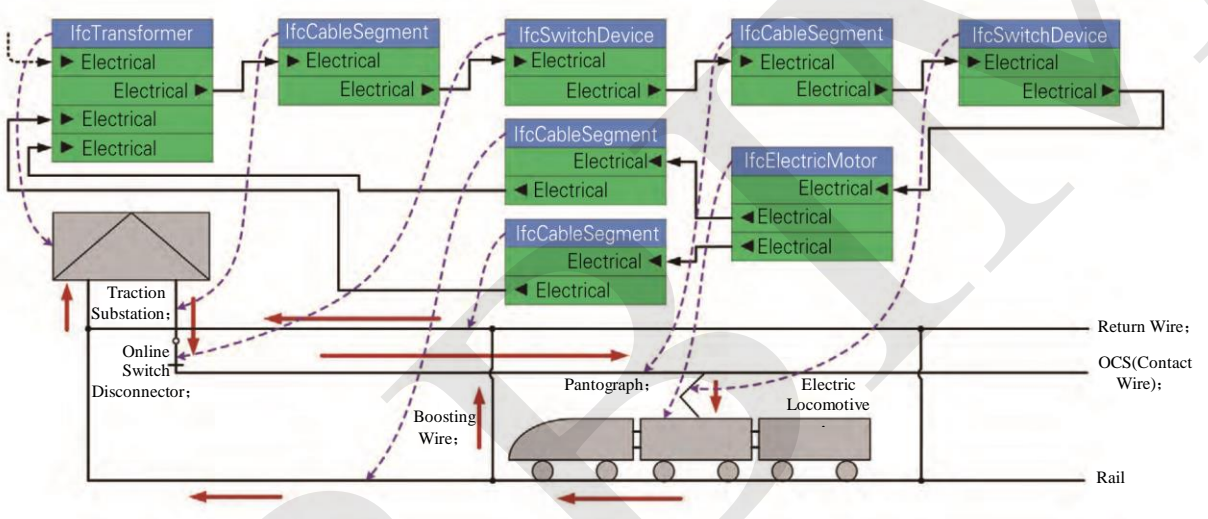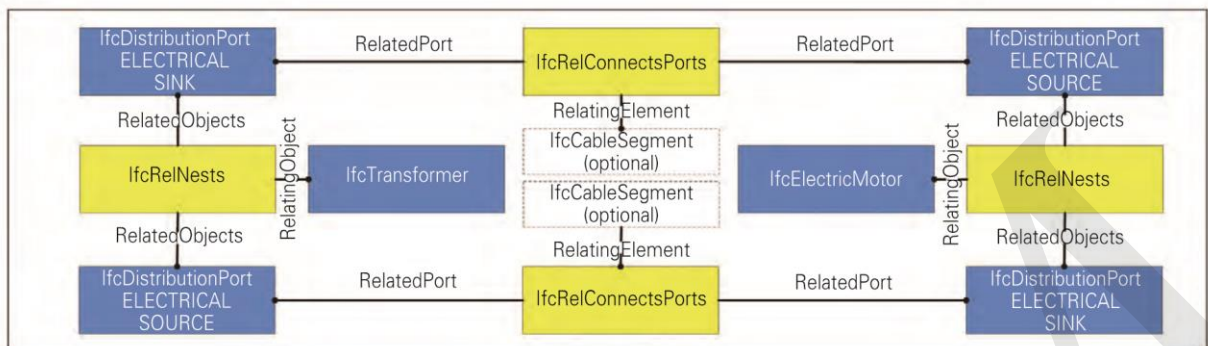
Figure 8.2 Distribution Relationship Diagram of Traction Substation System-OCS-Electric Locomotive-Backflow
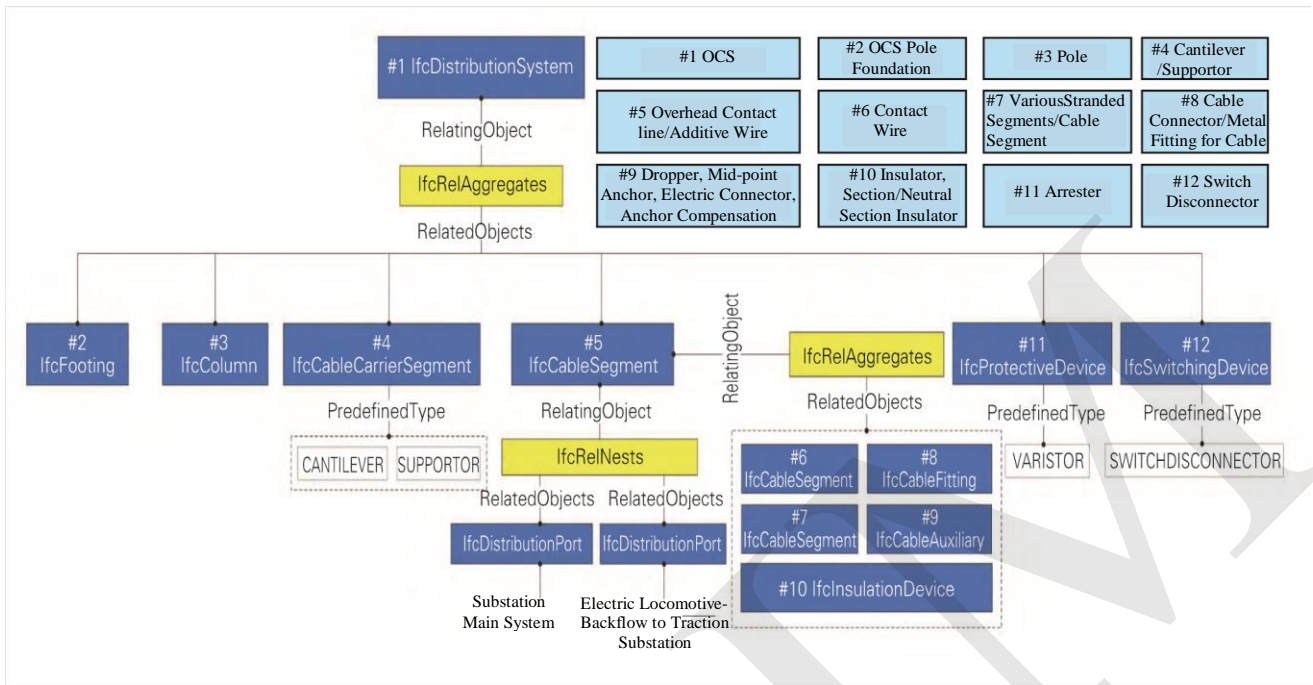
Figure 8.3 Structure Diagram of OCS

USERDEFINED;

NOTDEFINED.

Description of EXPRESS:

TYPE IfcCableAuxiliaryTypeEnum=ENUMERATION OF

  (ANCHORCOMPENSATION,

   BRACINGWIRE,

   DROPPER,

ELECTRICCONNECTION,

   MIDPOINTANCHOR,

   USERDEFINED,

   NOTDEFINED);

 END_TYPE;

8.2 Definition of Entity
8.2.1 IfcFlowFitting
8.2.1.1 Definition of Entity

  As IfcCableAuxiliary needs to be newly added under the IfcFlowFitting, flow fittings shall be redescribed.

8.2.1.2 Definition of Attribute

The attribute of flow fitting shall remain the same as the original.

8.2.1.3 Description of EXPRESS

ENTITY IfcFlowFitting

 SUPERTYPE OF (ONEOF

(IfcCableAuxiliary,

IfcCableCarrierFitting,

  IfcCableFitting,

  IfcDuctFitting,

IfcJunctionBox,

IfcPipeFiiting))

 SUBTYPE OF (IfcDistributionFlowElement);

END_ENTITY;

8.2.2 IfcCableAuxiliary

8.2.2.1 Definition of Entity

IfcCableAuxiliary defines cable auxiliary device installed between the cables or at the two ends of cables within the cable system, which connects and fixes cables as well as enhancing the current-carrying capacity.

8.2.2.2 Definition of Attribute

PreDefinedType: It further divides cable auxiliary elements into anchor compensation, bracing wire, dropper, electric connection and mid-point anchor according to their functions.

8.2.2.3 Description of EXPRESS

ENTITY IfcCableAuxiliary

SUBTYPE OF (IfcFlowFitting);

PreDefinedType: OPTIONAL IfcCableAuxiliaryTypeEnum;

WHERE
CorrectPredefinedType:

NOT (EXISTS (PredefinedType))

OR (PredefinedType <> IfcCableAuxiliaryTypeEnum.USERDEFINED)

OR

((PredefinedType = IfcCableAuxiliaryTypeEnum.USERDEFINED) AND EXISTS

  (SELF\IfcObject.ObjectType));

CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)

OR

('IFCELECTRICALDOMAIN.IFCCABLEAUXILIARYTYPE' IN TYPEOF
  (SELF\IfcObject.IsTypeBy [1].RelatingType));
END_ENTITY;

8.3 Definition of Property Set

8.3.1 Pset_CableCarrierSegmentTypeCantilever

Name of Property Set: Pset_CableCarrierSegmentTypeCantilever

Applicable Entity: IfcCableCarrierSegment/CANTILEVER

Description: property set of cantilever
Attribute List: see Table 8.3.1

Table 8.3.1 Attribute List of Pset_CableCarrierSegmentTypeCantilever

Name	Data Type	Description
CantileverType	P_ENUMERATEDVALUE/IfcLable/PEnum_Cantilever Type:SINGLE,TRANSITION,CENTER,TURNOUT,REGISTRATION	Cantilever type. Divided as: NGLE,transition, center, turnout, registration
IsInsulationInstallation	P_SINGLEVALUE/IfcBoolean	Cantilever type. Divided as: NGLE,transition, center, turnout, registration
NumberOfTracks	P_ENUMERATEDVALUE/IfcLable/ PEnum_ NumberOfTracks:SINGLE,MORE	Number of tracks. Dvided as: single, more
StructureType	P_SINGLEVALUE/IfcLabel	Structure type
FixedMode	P_ENUMERATEDVALUE/IfcLable/PEnum_ FixedMode: FIXED,SEMI-FIXED,ROTATION	Fixed Mode. Dvided as: fixed, semi-fixed, rotation
ColumnType	P_SINGLEVALUE/IfcLabel	Column type
InstallationType	P_SINGLEVALUE/IfcLabel	Installation type
InstallationMode	P_ENUMERATEDVALUE/IfcLable/PEnum_Operating Mode: STRAIGHT,CURVEOUTSIDE,CURVEINSIDE	Installation mode. Divided as: straight, curveoutside, curveinside
RegistrationMode	P_ENUMERATEDVALUE/IfcLable/PEnum_ RegistrationStyle: PULL-OFF,PUSH-OFF	Registration mode. Divived as: pull-off, push-off
ContactWireSuspension Height	P_SINGLEVALUE/IfcPositiveLengthMeasure	Contact wire suspension height

MessengerWire SuspensionHeight	P_SINGLEVALUE/IfcPositiveLengthMeasure	Messenger wire suspension height
StaggerValue	P_SINGLEVALUE/IfcPositiveLengthMeasure	Stagger value
BracketDistance	P_SINGLEVALUE/IfcPositiveLengthMeasure	Bracket distance
IsRunningConductor	P_SINGLEVALUE/IfcBoolean	Running conductor or not
IsPositionLimited	P_SINGLEVALUE/IfcBoolean	Position limited or not

8.3.2 Pset_CableCarrierSegmentTypeSupportor

Name of Property Set: Pset_CableCarrierSegmentTypeSupportor

Applicable Entity: IfcCableCarrierSegment/SUPPORTOR
Description: property set of supportor
Attribute List: see Table 8.3.2

Table 8.3.2 Attribute List of Pset_CableCarrierSegmentTypeSupportor

Name	Data Type	Description
SupportorType	P_ENUMERATEDVALUE/IfcLable/ P Enum_ SupportorType: VERTICAL,V-TYPE,TOP	Supportor type. Divided as: vertical, v-type, top
IsInsulationInstallation	P_SINGLEVALUE/IfcBoolean	Insulated or not
ColumnType	P_SINGLEVALUE/IfcLabel	Column type
InstallationType	P_SINGLEVALUE/IfcLabel	Installation type
SupportorCableType	P_ENUMERATEDVALUE/IfcLable/ P Enum_ SupportorCable:NF,GW,AF,PW,F,LF	Supportor cable type. Divided as: NF, GW, AF, PW, F, LF
InstallationHeight	P_SINGLEVALUE/IfcPositiveLengthMeasure	Installation Height

8.3.3 Pset_CableSegmentTypeStrandedSegment

Name of Property Set: Pset_ CableSegmentTypeStrandedSegment

Applicable Entity: IfcCableSegment/STRANDEDSEGMENT
Description: property set of stranded segment
Attribute List: see Table 8.3.3

Table 8.3.3 Attribute List of Pset_CableSegmentTypeStrandedSegment

Name	Data Type	Description
StrandedSegmentType	P_SINGLEVALUE/IfcLabel	Type
OverallDiameter	P_SINGLEVALUE/IfcPositiveLengthMeasure	Overall diameter
CalculatedSectionalArea	P_SINGLEVALUE/IfcAreaMeasure	Calculated sectional area
RatedTensileStrength	P_SINGLEVALUE/IfcForceMeasure	Rated tensile strength
ElasticityModulus	P_SINGLEVALUE/IfcPressureMeasure	Elasticity modulus
ExpansionCoefficient	P_SINGLEVALUE/IfcReal	Expansion coefficient
Resistance	P_SINGLEVALUE/IfcElectricResistanceMeasure	DC resistance
ContinuousCurrent	P_SINGLEVALUE/IfcElectricCurrentMeasure	Continuous current
AllowableTemperature	P_SINGLEVALUE/IfcThermodynamicTemperature Measure	Allowable temperature
UnitWeight	P_SINGLEVALUE/IfcMassPerLengthMeasure	Unit weight

8.3.4 Pset_InsulationDeviceTypeInsulationEquipment

Name of Property Set: Pset_InsulationDeviceTypeInsulationEquipment

Applicable Entity: IfcInsulationDevice/INSULATIONEQUIPMENT

Description: property set of insulation equipment
Attribute List: see Table 8.3.4

Table 8.3.4 Attribute List of Pset_InsulationDeviceTypeInsulationEquipment

Name	Data Type	Description
InsulationEquipmentType	P_ENUMERATEDVALUE/IfcLable/ PEnum_InsulationEquipmentType: SECTION,NEUTRALSECTION	Insulation equipment type. Divided as: section, neutral section
RatedVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Rated voltage
HighestOperatingVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Highest operating voltage
MinimumLeakageDistance	P_SINGLEVALUE/IfcPositiveLengthMeasure	Minimum leakage distance
MinimumAirGapDistance	P_SINGLEVALUE/IfcPositiveLengthMeasure	Minimum air gap distance
Resistance	P_SINGLEVALUE/IfcElectricResistanceMeasure	Insulation resistance

Name	Data Type	Description
FoulingResistanceVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Fouling resistance voltage
MaximumDeflection	P_SINGLEVALUE/IfcPositionLengthMeasure	Maximum deflection
MinimumTensileLoad	P_SINGLEVALUE/IfcForceMeasure	Minimum tensile load
IsArcSuppression	P_SINGLEVALUE/IfcBoolean	Arc suppression or not

8.3.5 Pset_InsulationDeviceTypeInsulator

Name of Property Set: Pset_InsulationDeviceTypeInsulator

Applicable Entity: IfcInsulationDevice/INSULATOR
Description: property set of insulator
Attribute List: see Table 8.3.5

Talbe 8.3.5 Attribute List of Pset_InsulationDeviceTypeInsulator

Name	Data Type	Description
InsulatorType	P_ENUMERATEDVALUE/IfcLable/ PEnum_InsulatorType: POLE,ROD,PIN,SUSPENSION,DISK	Insulator type. Divided as: pole, rod, pin, suspension, disk
RatedVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Rated voltage
HighestOperatingVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Highest operating voltage
FoulingResistanceVoltage	P_SINGLEVALUE/IfcElectricVoltageMeasure	Fouling resistance voltage
MinimumNominalCreepage Distance	P_SINGLEVALUE/IfcPositiveLengthMeasure	Minimum nominal creepage distance
MinimumTensileLoad	P_SINGLEVALUE/IfcForceMeasure	Minimum tensile load
MinimumBendingFailure Load	P_SINGLEVALUE/IfcForceMeasure	Minimum bending failure load

8.3.6 Pset_CableAuxiliaryTypeCommon

Name of Property Set: Pset_CableAuxiliaryTypeCommon

Applicable Entity: IfcCableAuxiliary

Description: common property set of cable auxiliary elements.
Attribute List: see Table 8.3.6

Table 8.3.6 Attribute List of Pset_CableAuxiliaryTypeCommon

Name	Data Type	Description
Reference	P_SINGLEVALUE/IfcIdentifier	ID cited
Status	P_ENUMERATEDVALUE/IfcLabel/PEnum_ElementStatus: NEW,EXISTING,DEMOLISH,TEMPORARY	Status. Divided as: new, existing, demolish, temporary

8.3.7 Pset_CableAuxiliaryTypeAnchorCompensation

Name of Property Set: Pset_ CableAuxiliaryTypeAnchorCompensation

Applicable Entity: IfcCableAuxiliary/ANCHORCOMPOSATION
Description: common property set of anchor compensation
Attribute List: see Table 8.3.7

Table 8.7 Attribute List of Pset_CableAuxiliaryTypeAnchorCompensation

Name	Data Type	Description
AnchorCompensationType	P_ENUMERATEDVALUE/IfcLable/PEnum_AnchorCompensationType: PULLEY,RATCHET,SPRING	Anchor compensation type. Divided as: pulley, ratchet, spring
OperatingMode	P_SINGLEVALUE/IfcLabel	Operating mode
ColumnType	P_SINGLEVALUE/IfcLabel	Column type
WeightType	P_ENUMERATEDVALUE/IfcLable/ PEnum_WeightType: CONCRETE,IRON,COMPOSITION	Weight type. Divided as: concrete, iron, composition
RatedTension	P_SINGLEVALUE/IfcForceMeasure	Rated tension
TensionVariation	P_SINGLEVALUE/IfcRatioMeasure	Tension variation
TransmissionRatio	P_SINGLEVALUE/IfcRatioMeasure	Transmission ratio
TransmissionEfficiency	P_SINGLEVALUE/IfcRatioMeasure	Transmission efficiency
MaximumWorkingLoad	P_SINGLEVALUE/IfcForceMeasure	Maximum working load
IsBreakLineLock	P_SINGLEVALUE/IfcBoolean	Break line lock or not
TemperatureRange	P_SINGLEVALUE/IfcLabel	Temperature range

8.3.8 Pset_CableAuxiliaryTypeBracingWire

Name of Property Set: Pset_CableAuxiliaryTypeBracingWire

Applicable Entity: IfcCableAuxiliary/BRACINGWIRE
Description: property set of bracing wire

Attribute List: see Table 8.3.8

Table 8.3.8 Atribute List of Pset_CableAuxiliaryTypeBracingWire

Name	Data Type	Description
BracingWireType	P_ENUMERATEDVALUE/IfcLable/ PEnum_BracingWireType: SINGLE,DOUBLE	Bracing wire type. Divided as: single, double

8.3.9 Pset_CableAuxiliaryTypeDropper

Name of Property Set: Pset_CableAuxiliaryTypeDropper

Applicable Entity: IfcCableAuxiliary/DROPPER
Description: property set of dropper
Attribute List: see Table 8.3.9

Table 8.3.9 Attribute List of Pset_CableAuxiliaryTypeDropper

Name	Data Type	Description
DropperType	P_ENUMERATEDVALUE/IfcLable/ PEnum_DropperType:FLEXIBLE,RIGID	Dropper Type. Divided as: flexible, rigid
RegulatingVariable	P_SINGLEVALUE/IfcPositiveLengthMeasure	Regulating variable

8.3.10 Pset_CableAuxiliaryTypeElectricalConnection

Name of Property Set: Pset_CableAuxiliaryTypeElectricalConnection

Applicable Entity: IfcCableAuxiliary/ELECTRICCONNECTION
Description: property set of electric connection
Attribute List: see Table 8.3.10

Table 8.3.10 Attribute List of Pset_CableAuxiliaryTypeElectricalConnection

Name	Data Type	Description
ElectricalConnectionType	P_ENUMERATEDVALUE/IfcLable/ PEnum_ElectricalConnectionType: TRACK,TURNOUT,OVERLAP,TRANSVERSE ,SWITCH	Electrical connection type. Divided as: track, turnout, overlap, transverse, switch

8.3.11 Pset_CableAuxiliaryTypeMidPointAnchor

Name of Property Set: Pset_CableAuxiliaryTypeMidPointAnchor

Applicable Entity: IfcCableAuxiliary/ MIDPOINTANCHOR
Description: property set of mid-point anchor
Attribute List: see Table 8.3.11.

Table 8.3.11 Attribute List of Pset_CableAuxiliaryTypeMidPointAnchor

Name	Data Type	Description
MidPointAnchorType	P_ENUMERATEDVALUE/IfcLable/ PEnum_MidPointAnchorType:ANTIBREAKIN G,ANTICR EEPING	Mid-point anchor type. Divided as: antibreaking, anticreeping