bSI UML Model Report

UML Model Report for IFC Extension for tunnel elements

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Document Information

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Revision History

Version	Status	Date	Notes
V01	DRAFT	2021-12-20	First draft
V02	DRAFT	2022-02-28	Second draft - model updates
V10	FINAL	2022-06-28	Final version (Pset and Qto excluded)
V11	FINAL	2022-10-20	Final version including changes after work with the IFC specification

Author List

IFC Tunnel

Contents

1 Introduction

The IFC Tunnel project extends the IFC data model into the domain of tunnels by describing the semantics and geometry for tunnels. The conceptual model documentation for IFC Tunnel is divided in these parts:

- IR-TUN_ConceptualModelReport - Excavation, support and lining_v1.1. Describes the domain taxonomy concepts specified within the excavation, support and lining domain and their mapping to existing, modified or proposed entities, predefined types or property sets in the IFC specification
- IR-TUN_ConceptualModelReport - Geotechnics_v1.1. Describes the domain taxonomy concepts in the geological and geotechnical domain and their mapping to existing, modified or proposed entities, predefined types or property sets in the IFC specification
- IR-TUN_ConceptualModelReport - Systems_v1.1. Describes the domain taxonomy concepts in the systems domain and their mapping to existing, modified or proposed entities, predefined types or property sets in the IFC specification
- **IR-TUN_ConceptualModelReport – IFC Extension_v1.1 (this document)**. Describes the proposed extensions to the IFC schema based on the requirements from the three above documents.
- IR-TUN_ConceptualModelReport – Annex I – Reading guide_v1.0. Describes the UML notation used in the above documents.

The IFC Tunnel project has based the definition of tunnel concepts in taxonomies specified by the three domain expert teams and on the previously distributed requirements analysis report (IR-TUN_Requirement-Analysis-Report_v1.0).

2 Basic conceptual breakdown

A tunnel project can be broken down in several ways and in multiple parallel aspects. By following the IFC modelling principles, three main breakdown structures can be considered for any tunnel model:

- spatial (project) breakdown structure;
- (physical) component breakdown structure;
- functional (system) breakdown structure.

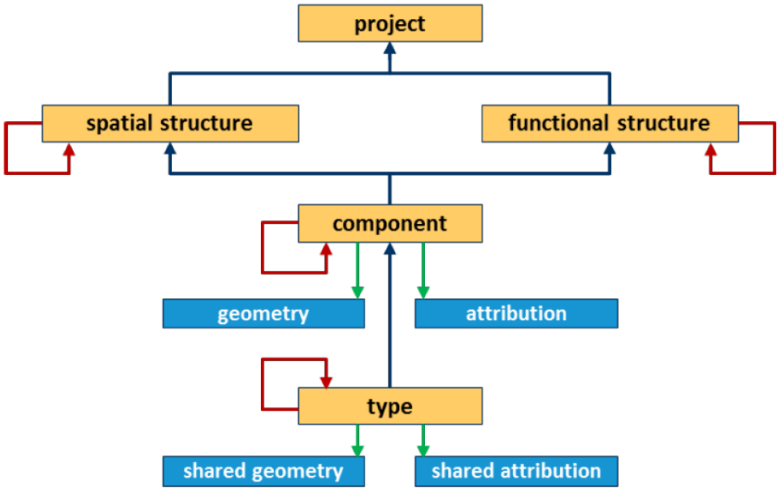


Figure 1 - Main conceptual structure of IFC

According to these principles, each road project will have a hierarchical spatial breakdown structure with at least three levels of hierarchy (and with optional further breakdown of IfcTunnel using IfcFacilityPart):

IfcProject > IfcSite > IfcTunnel

Here the existing concepts IfcProject and IfcSite are used from IFC4.3, while IfcTunnel is a new concept added by IFC Tunnel project. Another key concept used from IFC4.3 is IfcAlignment: a linear positioning element defining a reference system to position tunnel elements (regardless of where they might be contained in the project spatial hierarchy); the IfcAlignment itself usually would be contained in IfcSite and may be placed relative to the local placement of its container (IfcSite), or absolutely within the world coordinate system, established by IfcGeometricRepresentationContext in IfcProject.

IfcProject, being the root instance and the context for all other information items in a Tunnel model, declares the units of measure for the model (IfcUnitAssignment), as well as the geometric representation context for shape representations, establishing the project coordinate system (IfcGeometricRepresentationContext). Conversion between the project coordinate system and geospatial coordinate reference system (IfcProjectedCRS) can be defined in IfcMapConversion as easting, northing and elevation of the origin of the local coordinate system, as well as its rotation in xy-plane (the z axis of the local engineering coordinate system is always parallel to the z axis of the coordinate reference system); the IfcProjectedCRS may also handle the projection of a map from the geodetic coordinate reference system.

All physical components of tunnel or the surrounding ground, such as a IfcExcavation, IfcGeoScienceModel, as well as their parts (such as IfcGeoScienceFeature), are contained only once in the project hierarchy: top level components in physical hierarchy are always contained exactly once in the spatial breakdown structure through a containment relationship; other components are related to physical hierarchy through an aggregation relationship (hierarchical component breakdown). Several components may use a shared type definition (e.g. IfcPavement occurrences using same IfcPavementType). Both components (occurrences) and types may have dynamic association of properties (IfcRelDefinesByProperties) to complement the statically defined object attributes. Properties (IfcProperty) are organized in property sets (IfcPropertySet), and these will be elaborated separately for IFC Tunnel and harmonized with existing property sets already available.

This tunnel conceptual model report explains the new concepts that have been added, and those that are modified from IFC4.3; for IFC definitions that are used unchanged, please see http://ifc43-docs.standards.buildingsmart.org/.

3 Package: IFC Tunnel - PSM

A package containing the "Platform Specific Model" or "PSM" for IFC Tunnel. All packages contained here have the UML representation of all proposed new or modified IFC Entities, Predefined types and Property sets for the IFC Tunnel project.

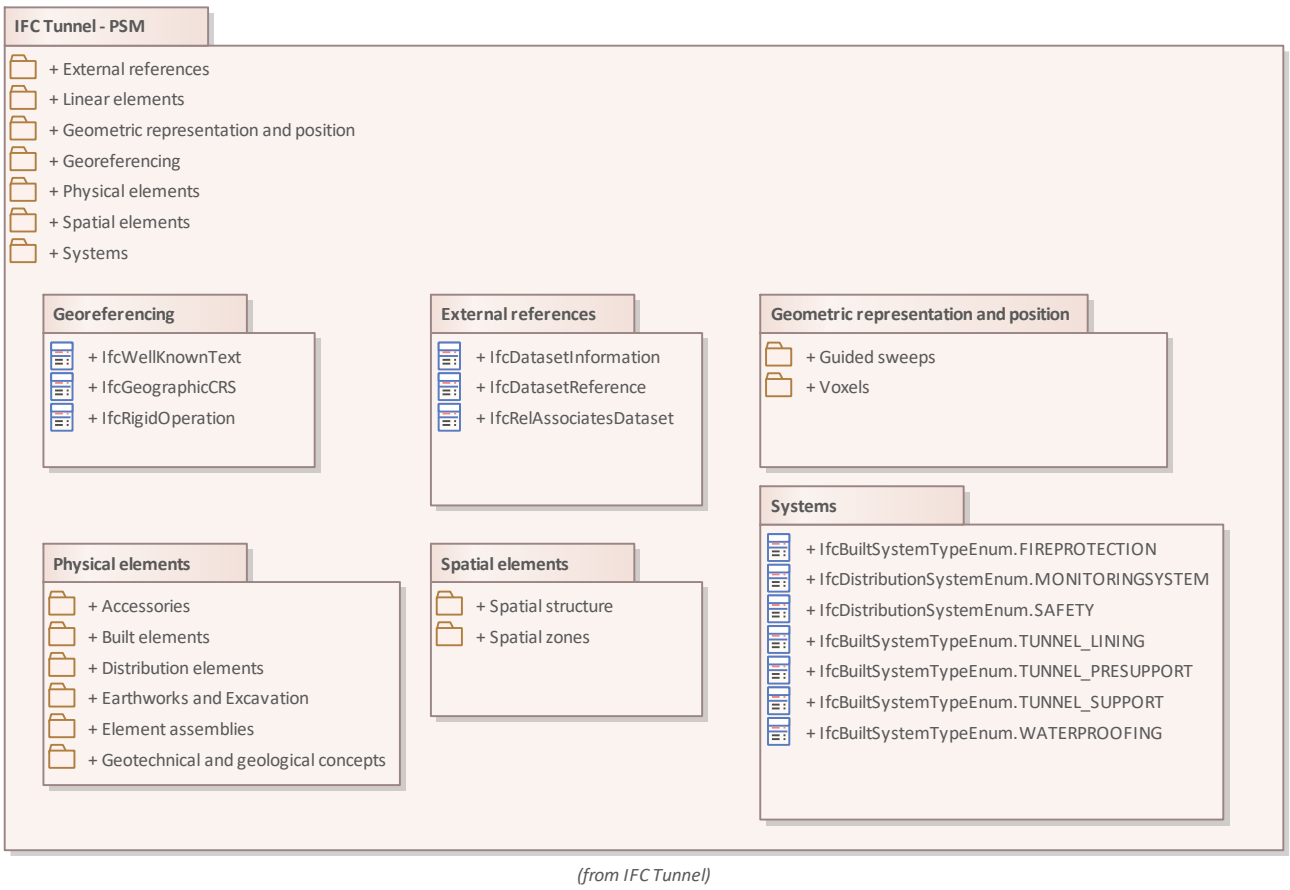


Figure 2: IFC Tunnel - PSM -

3.1 Package: External references

Package for resources used to reference external (to IFC) resources. For IFC Tunnel, there are requirements to be able to reference, from IFC entities, datasets for e.g. Voxels, extensive measure logs etc. where formats may already exist and be in use. A solution which is parallel to the existing IFC structure for e.g. documents has therefore been proposed.

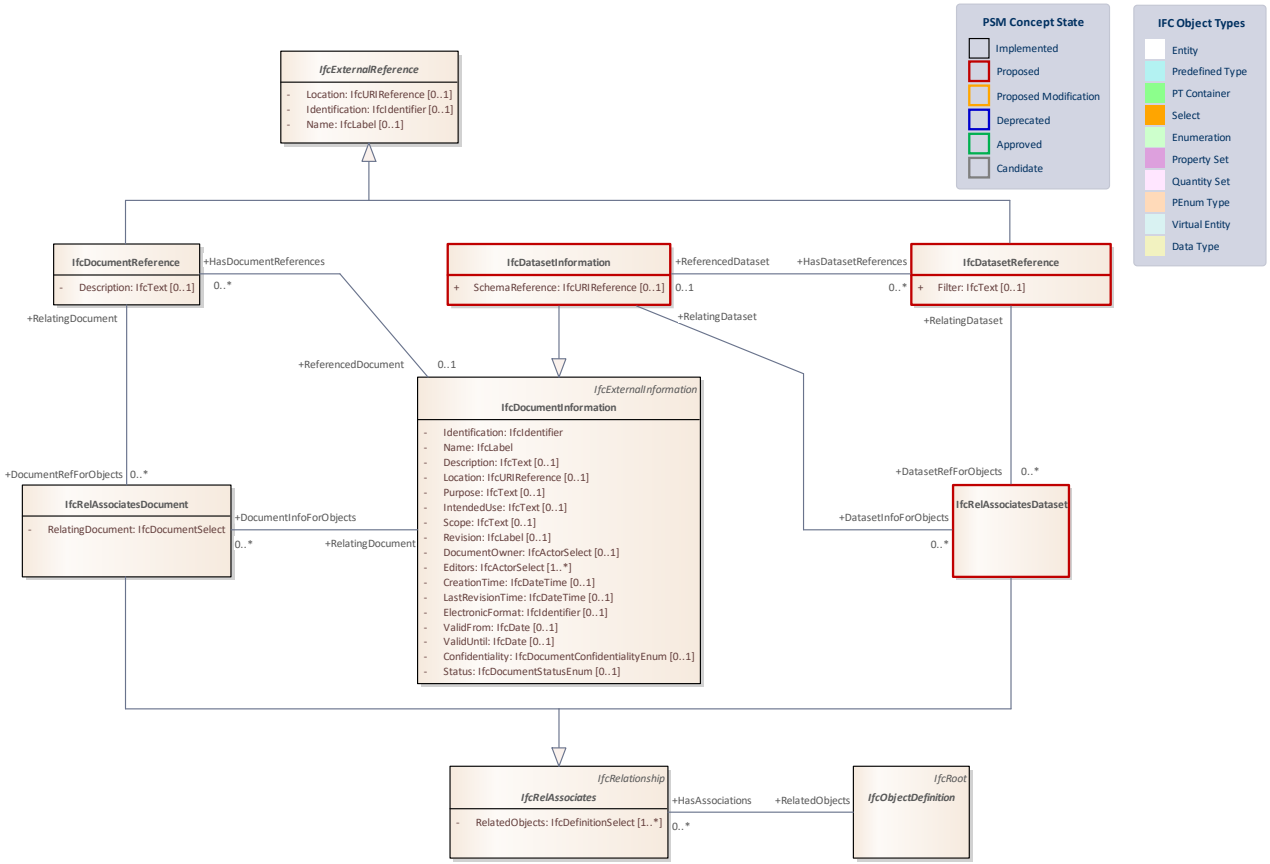


Figure 3: External datasets -

3.1.1 Class: IfcRelAssociatesDataset

Relationship that assigns an external dataset to a product.

Status: **Proposed**

Package: **External references**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcRelAssociates	
Subtypes	**EXISTING**	**PROPOSED**

3.1.2 Class: IfcDatasetReference

An _IfcDatasetReference_ is a reference to the location of a machine readable dataset. The reference is given by a system interpretable _Location_ attribute (a URI string) where the dataset can be found, and an optional inherited internal reference _Identification_, which refers to a system interpretable subset within the dataset (e.g. an identifier for a set of records in a data table). The optional inherited _Name_ attribute is meant to have meaning for human readers. Optional document metadata can also be captured through reference to _IfcDocumentInformation_.

Status: **Proposed**

Package: **External references**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcExternalReference	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
Filter	IfcText	[0..1]	The _IdentificationProperty_ provides a unique identifier of the item or property that shall contain the value specified by _Identification_

3.1.3 Class: IfcDatasetInformation

IfcDatasetInformation captures metadata of an external dataset. The actual content of the document is not defined in this specification; instead, it can be found following the Location attribute.

Status: **Proposed**

Package: **External references**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcDocumentInformation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
SchemaReference	IfcURIReference	[0..1]	Optional reference to a location of the schema defining the possible structure and content of the dataset.

3.2 Package: Geometric representation and position

This package contains IFC Tunnel additions regarding geometric representations.

3.2.1 Package: Voxels

Package for classes representing voxel geometry and voxel data. The Voxel model consists essentially of two parts:

- A geometric representation item defining the spatial extent of a voxel grid and its breakdown into voxel elements. This is the IfcVoxelGrid entity.
- An optimized structure for adding data to the voxel elements. This is the IfcVoxelData entity and its subtypes.

IfcVoxelData is assigned to its IfcProduct using the IfcRelAssignsToProduct relationship and since IfcVoxelData is a subtype of IfcProduct it may itself carry the IfcVoxelGrid as geometric representation.

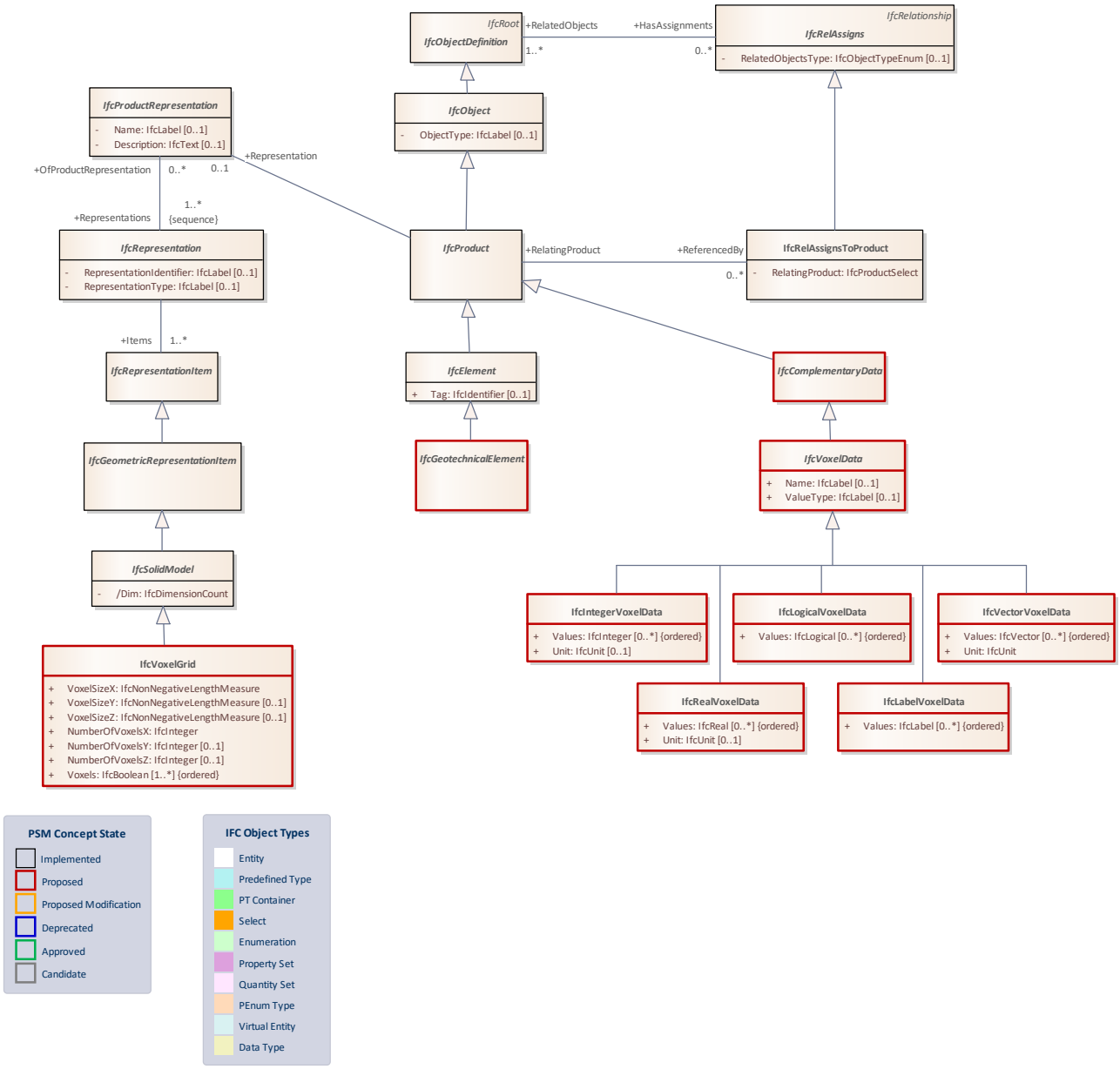


Figure 4: Voxels -

3.2.1.1 Class: IfcGeotechnicalElement

Abstract supertype for geotechnical entities.

Status: **Proposed**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract

Property sets	Pset_Uncertainty

Inheritance Statement		
Subtype Of	IfcElement	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeotechnicalStratum IfcGeotechnicalAssembly

3.2.1.2 Class: IfcComplementaryData

An abstract class for arbitrary data associated with another product using _IfcRelAssignsToProduct_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcProduct	
Subtypes	**EXISTING**	**PROPOSED**
		IfcObservation IfcVoxelData

3.2.1.3 Class: IfcIntegerVoxelData

The voxels represented by integer values.

Status: **Proposed**

Package: **Voxels**

Class Properties

Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcVoxelData	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
Values	IfcInteger	[0..*]	The values assigned to the voxels. First x, then y and lastly z.
Unit	IfcUnit	[0..1]	An optional unit for the integer values

3.2.1.4 Class: IfcLabelVoxelData

The voxels represented by label values.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcVoxelData	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
Values	IfcLabel	[0..*]	The values assigned to the voxels. First x, then y and lastly z.

3.2.1.5 Class: IfcLogicalVoxelData

The voxels represented by logical values.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcVoxelData	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
Values	IfcLogical	[0..*]	The values assigned to the voxels. First x, then y and lastly z.

3.2.1.6 Class: IfcRealVoxelData

The voxels represented by real values.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcVoxelData	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition

Values	IfcReal	[0..*]	The values assigned to the voxels. First x, then y and lastly z.
Unit	IfcUnit	[0..1]	An optional unit for the real values

3.2.1.7 Class: IfcVectorVoxelData

The voxels represented by vector values.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcVoxelData	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
Values	IfcVector	[0..*]	The values assigned to the voxels. First x, then y and lastly z.
Unit	IfcUnit		

3.2.1.8 Class: IfcVoxelData

Abstract class representing voxel data values that is assigned to _IfcProduct_ using the relationship _IfcRelAssignsToProduct_ and to a product representation, as _IfcVoxelGrid_, using _Representation_.

The number of values shall correspond to the number of voxels in the voxel grid.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcComplementaryData	
Subtypes	**EXISTING**	**PROPOSED**
		IfcVectorVoxelData IfcRealVoxelData IfcLogicalVoxelData IfcLabelVoxelData IfcIntegerVoxelData

Class Attributes

Name	Type	Multiplicity	Definition
Name	IfcLabel	[0..1]	An optional name for the IfcVoxelData
ValueType	IfcLabel	[0..1]	An optional value type used for the values defined in one of the subtypes. Only the names (as labels) of the types available in the IfcValue select type are allowed.

3.2.1.9 Class: IfcVoxelGrid

An _IfcVoxelGrid_ representation is a 3D solid shape representation that is compiled of a series of regular blocks placed inside a predefined grid.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcSolidModel	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
VoxelSizeX	IfcNonNegativeLengthMeasure		Size of voxels in the X axis.
VoxelSizeY	IfcNonNegativeLengthMeasure	[0..1]	Size of voxels in the Y axis. If not given, the value from _VoxelSizeX_ shall be taken.
VoxelSizeZ	IfcNonNegativeLengthMeasure	[0..1]	Size of voxels in the Z axis. If not given, the value from _VoxelSizeX_ shall be taken.
NumberOfVoxelsX	IfcInteger		Size of the voxel grid in the X axis.
NumberOfVoxelsY	IfcInteger	[0..1]	Size of the voxel grid in the Y axis. If not given, the value from _GridSizeX_ shall be taken.
NumberOfVoxelsZ	IfcInteger	[0..1]	Size of the voxel grid in the Z axis. If not given, the value from _GridSizeX_ shall be taken.
Voxels	IfcBoolean	[1..*]	Indication of voxels on the grid. The array is one dimentional where values are distributed in the following order: along X, then Y and finally Z.

3.3 Package: Georeferencing

This package contains IFC Tunnel additions regarding entities for georeferencing.

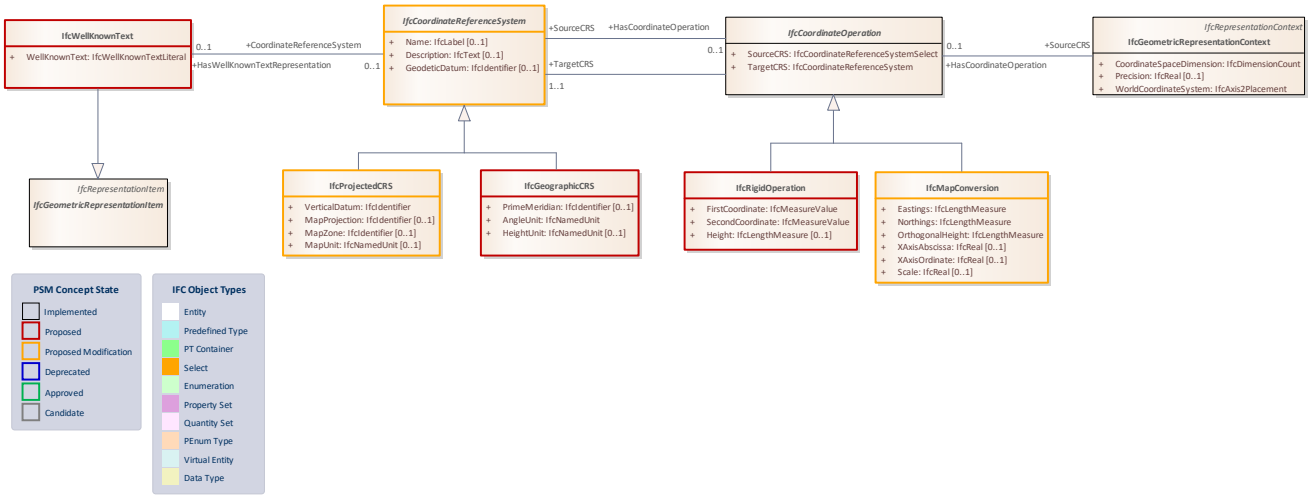


Figure 5: Georeferencing -

3.3.1 Class: IfcCoordinateReferenceSystem

The _IfcCoordinateReferenceSystem_ is a definition of a coordinate reference system by means of qualified identifiers only. The interpretation of the identifier is expected to be well-known to the receiving software.

{ .extDef}

> NOTE Definition from OpenGIS Abstract Specification, Topic 2:

> A coordinate reference system is a coordinate system which is related to the real world by a datum. The coordinate system is composed of a set of coordinate axes with specified units of measure. The datum specifies the relationship of a coordinate system to the earth. The resulting combination of coordinate system and datum is a coordinate reference system.

The unambiguous identifier by which the coordinate reference system is know, is stored in the _Name_ attribute. Well defined identifiers include the geodetic and often also the vertical datum. In these cases the _GeodeticDatum_ and the _VerticalDatum_ can be omitted.

> EXAMPLE The identifier ''EPSG:25832'' defines the geodetic datum ''ETRS89'' in additon to the projection and the zone. ''EPSG:5555'' defined the geodetic datum ''ETRS89'' and the vertical datum ''DHHN92''.

> NOTE One widely-used, publicly-available authority is the European Petroleum Survey Group (EPSG), and use of this authority is currently specified in several OGC Implementation Specifications. Software used to transport IFC engineering models into GIS applications (and vice versa) is expected to have knowledge about the OGC Implementation Specifications.

> HISTORY New entity in IFC4.

bSI Documentation

Status: **ProposedModification**

Package: **IfcRepresentationResource**

Class Properties			
Status	ProposedModification	**Is Abstract**	Abstract
Property sets			

Inheritance Statement

Subtype Of		
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeographicCRS

Class Attributes

Name	Type	Multiplicity	Definition
Name	IfcLabel	[0..1]	Name by which the coordinate reference system is identified.\X\0D > NOTE The name shall be taken from the list recognized by the European Petroleum Survey Group EPSG. It should then be qualified by the EPSG name space, for example as ''EPSG:5555''.
Description	IfcText	[0..1]	Informal description of this coordinate reference system.
GeodeticDatum	IfcIdentifier	[0..1]	

3.3.2 Class: IfcMapConversion

The map conversion deals with transforming the local engineering coordinate system, often called world coordinate system, into the coordinate reference system of the underlying map.

> NOTE The _IfcMapConversion_ does not handle the projection of a map from the geodetic coordinate reference system.

The map conversion allows to convert the local origin of the local engineering coordinate system to its place within a map (easting, northing, orthogonal height) and to rotate the x-axis of the local engineering coordinate system within the horizontal (easting/westing) plane of the map.

> NOTE The z axis of the local engineering coordinate system is always parallel to the z axis of the map coordinate system.

The scale factor can be used when the length unit for the 3 axes of the map coordinate system are not identical with the length unit established for this project (see\S\ _IfcProject.UnitsInContext_), if omitted, the scale factor 1.0 is assumed.

> HISTORY New entity in IFC4

bSI Documentation

Status: **ProposedModification**

Package: **IfcRepresentationResource**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcCoordinateOperation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
Eastings	IfcLengthMeasure		Specifies the location along the easting of the coordinate system of the target map coordinate reference system.\X\0D > NOTE for right-handed Cartesian coordinate systems this would establish the location along the x axis.
Northings	IfcLengthMeasure		Specifies the location along the northing of the coordinate system of the target map coordinate reference system.\X\0D > NOTE for right-handed Cartesian coordinate systems this would establish the location along the y axis

OrthogonalHeight	IfcLengthMeasure		Orthogonal height relativ to the vertical datum specified.\X\0D > NOTE for right-handed Cartesian coordinate systems this would establish the location along the z axis
XAxisAbscissa	IfcReal	[0..1]	Specifies the value along the easing axis of the end point of a vector indicating the position of the local x axis of the engineering coordinate reference system.\X\0D > NOTE1 for right-handed Cartesian coordinate systems this would establish the location along the x axis\X\0D \X\0D > NOTE2 together with the _XAxisOrdinate_ it provides the direction of the local x axis within the horizontal plane of the map coordinate system
XAxisOrdinate	IfcReal	[0..1]	Specifies the value along the northing axis of the end point of a vector indicating the position of the local x axis of the engineering coordinate reference system.\X\0D > NOTE1 for right-handed Cartesian coordinate systems this would establish the location along the y axis\X\0D \X\0D { .note}\X\0D > \X\0D \X\0D _XAxisAbscissa_ it provides the direction of the local x axis within the horizontal plane of the map coordinate system.
Scale	IfcReal	[0..1]	Scale to be used, when the units of the CRS are not identical to the units of the engineering coordinate system. If omited, the value of 1.0 is assumed.

3.3.3 Class: IfcProjectedCRS

IfcProjectedCRS is a coordinate reference system of the map to which the map translation of the local engineering coordinate system of the construction or facility engineering project relates. The _MapProjection_

and _MapZone_ attributes uniquely identify the projection to the underlying geographic coordinate reference system, provided that they are well-known in the receiving application. The projected coordinate reference system is assumed to be a 2D or 3D right-handed Cartesian coordinate system, the optional _MapUnit_ attribute can be used determine the length unit used by the map.

{ .extDef}

> NOTE Definition from OpenGIS Abstract Specification, Topic 2:

> A 2D (or with vertical coordinate axis 3D) coordinate reference system used to approximate the shape of the earth on a planar surface, but in such a way that the distortion that is inherent to the approximation is carefully controlled and known. Distortion correction is commonly applied to calculated bearings and distances to produce values that are a close match to actual field values.

The unambiguous identifier by which the coordinate reference system is know, is stored in the inherited _Name_ attribute. Well defined identifiers include the map projection and also the map zone information. In these cases the _MapProjection_ and the _MapZone_ attributes can be omitted.

> EXAMPLE The identifier ''EPSG:25832'' defines the map projection ''UTM'' and the zone ''32N'' in additon to the geodetic and vertical datum.

> HISTORY New entity in IFC4.

bSI Documentation

Status: **ProposedModification**

Package: **IfcRepresentationResource**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcCoordinateReferenceSystem	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
VerticalDatum	IfcIdentifier		
MapProjection	IfcIdentifier	[0..1]	Name by which the map projection is identified.\X\0D \X\0D { .examples}\X\0D > EXAMPLE map projects include: { .note}\X\0D > * UTM\X\0D > * Gaus-Krueger
MapZone	IfcIdentifier	[0..1]	Name by which the map zone, relating to the _MapProjection_, is identified. \X\0D \X\0D { .examples}\X\0D > EXAMPLE { .note}\X\0D > * for UTM, the zone number, like 32 for UTM32\X\0D > * for Gaus-Krueger, the zones of longitudinal width, like 3''',
MapUnit	IfcNamedUnit	[0..1]	Specifies the unit used for this Projected CRS.

3.3.4 Class: IfcGeographicCRS

IfcGeographicCRS is a coordinate reference system that is based on a geoid or ellipsoid. Geographic CRS typically requires two angles and a height (can be derived) to specify a location on a body such as ellipsoid, geoid etc

Status: **Proposed**

Package: **Georeferencing**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement	
Subtype Of	IfcCoordinateReferenceSystem

Subtypes	EXISTING	PROPOSED

Class Attributes

Name	Type	Multiplicity	Definition
PrimeMeridian	IfcIdentifier	[0..1]	
AngleUnit	IfcNamedUnit		
HeightUnit	IfcNamedUnit	[0..1]	Specifies the unit used for this Geographic CRS.

3.3.5 Class: IfcRigidOperation

A translation operation specifies an offset in the coordinate reference system. It does not specify any conversion or distortions only a translation.

Status: **Proposed**

Package: **Georeferencing**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcCoordinateOperation	
Subtypes	EXISTING	PROPOSED

Class Attributes

Name	Type	Multiplicity	Definition
FirstCoordinate	IfcMeasureValue		The offset according to the first coordinate axis.
SecondCoordinate	IfcMeasureValue		The offset according to the second coordinate axis.
Height	IfcLengthMeasure	[0..1]	The offset in elevation.

3.3.6 Class: IfcWellKnownText

Status: **Proposed**

Package: **Georeferencing**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcGeometricRepresentationItem	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
WellKnownText	IfcWellKnownTextLiteral		

3.4 Package: Linear elements

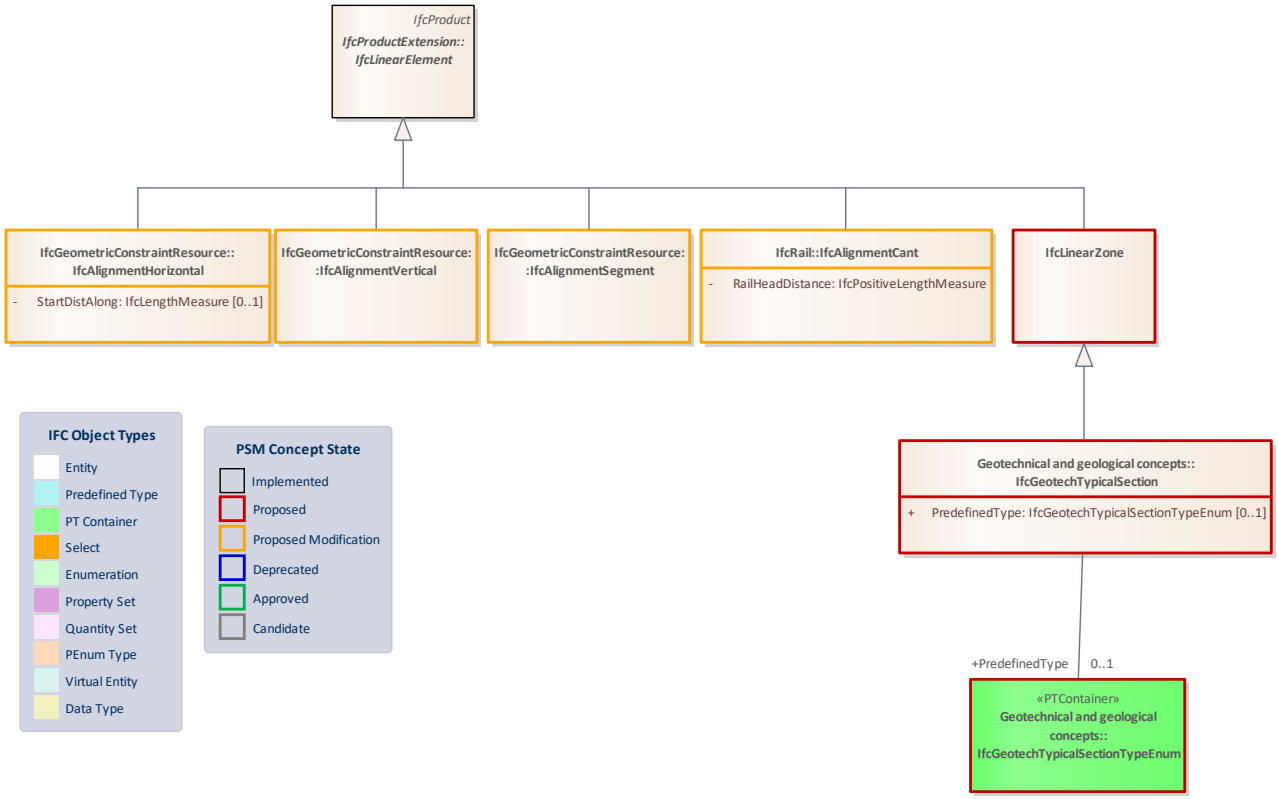


Figure 6: Linear elements -

3.4.1 Class: IfcAlignmentHorizontal

An _IfcAlignment2DHorizontal_ is a linear reference projected onto the horizontal x/y plane. Points along a horizontal alignment have two coordinate values, x and y in the local Cartesian engineering system.

The horizontal alignment is defined by segments that are connected end-to-start. The transition at the segment connection is not enforced to be tangential, if the \X2\201C\X0\tangential continuity\X2\201D\X0\ flag is set to false, otherwise a tangential continuity shall be preserved. Based on the context of the project, they are geo-referenced and convertible into Northing and Easting values.

> NOTE Georeferencing is provided by _IfcMapConversion_ through the _IfcGeometricRepresentationContext_ defined at _IfcProject_.

bSI Documentation

Status: **ProposedModification**

Package: **IfcGeometricConstraintResource**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
StartDistAlong	IfcLengthMeasure	[0..1]	The value of the distance along at the start of the horizontal alignment. If omited (standard) it is set to zero.

3.4.2 Class: IfcAlignmentSegment

An abstract entity defining common information about horizontal and vertical alignment segments.

> NOTE The start and end tag are defined as annotations, not as referents along the alignment. Only absolute distance expressions are in scope, not distances ahead or behind a referent, such as a station. However such information can be exchanged as tags.

bSI Documentation

Status: **ProposedModification**

Package: **IfcGeometricConstraintResource**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearElement	
Subtypes	**EXISTING**	**PROPOSED**

3.4.3 Class: IfcAlignmentVertical

An _IfcAlignment2DVertical_ is a height profile along the horizontal alignment. Points along a vertical alignment have two coordinate values. The first value is the distance along the horizontal alignment, the second value is the height according to the project engineering coordinate system. Based on the context of the project, they are geo-referenced and the height value is convertible into orthogonal height above/below the vertical datum.

> NOTE Georeferencing is provided by _IfcMapConversion_ through the _IfcGeometricRepresentationContext_ defined at _IfcProject_.

bSI Documentation

Status: **ProposedModification**

Package: **IfcGeometricConstraintResource**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearElement	
Subtypes	**EXISTING**	**PROPOSED**

3.4.4 Class: IfcAlignmentCant

An IfcAlignment2DCant is a lateral inclination profile defined along the horizontal alignment. All points defined in this profile have two coordinate values. The first value is the distance along the horizontal alignment, and the second value is the height relative to the projection of the point along vertical alignment.

Status: **ProposedModification**

Package: **IfcRail**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
RailHeadDistance	IfcPositiveLengthMeasure		Length measured as distance between the nominal centre points of the two contact patches of a wheelset and rails.

3.4.5 Class: IfcGeotechTypicalSection

Interval along the tunnel axis with similar ground conditions, as part of the GeotechSynthesis model that represents the connection between the ground model and the building. Includes key-properties like expected sidtribution of ground types (reference to GeotechUnits) and baseline-definition of expected ground conditions and potential hazards, and may also include key-information on design like excavation measures, distribution of support types etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearZone	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeotechTypicalSectionTypeEnum	[0..1]	Identifies the predefined type of a geostech typical section. This type may associate additional specific property sets.

3.4.6 PDT Container: IfcGeotechTypicalSectionTypeEnum

This enumeration defines the range of different types of geotech typical sections that can further specify an _IfcGeotechTypicalSection_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeotechTypicalSection	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	

3.4.7 Class: IfcLinearZone

A linear zone is the generalization of all linear elements that may be used to define linear zones where the linear elements of the same types may overlap linearly. Typical examples are longitudinal zones along an alignment where each zone represents some information such as interpretations of the terrain or underground conditions or design parameters for e.g. a road-, railway- or tunnel section.

Status: **Proposed**

Package: **Linear elements**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearElement	
Subtypes	**EXISTING**	**PROPOSED**

		IfcGeotechTypicalSection

3.5 Package: Physical elements

This package contains concepts that represents physical elements that make up constructed facilities. These elements are positioned and/or contained within the logical spatial structure of the project (refer to spatial elements). These elements typically have geometric shape, location, made of materials and other physical properties.

3.5.1 Package: Accessories

Representations different kinds of accessories included in or added to elements.

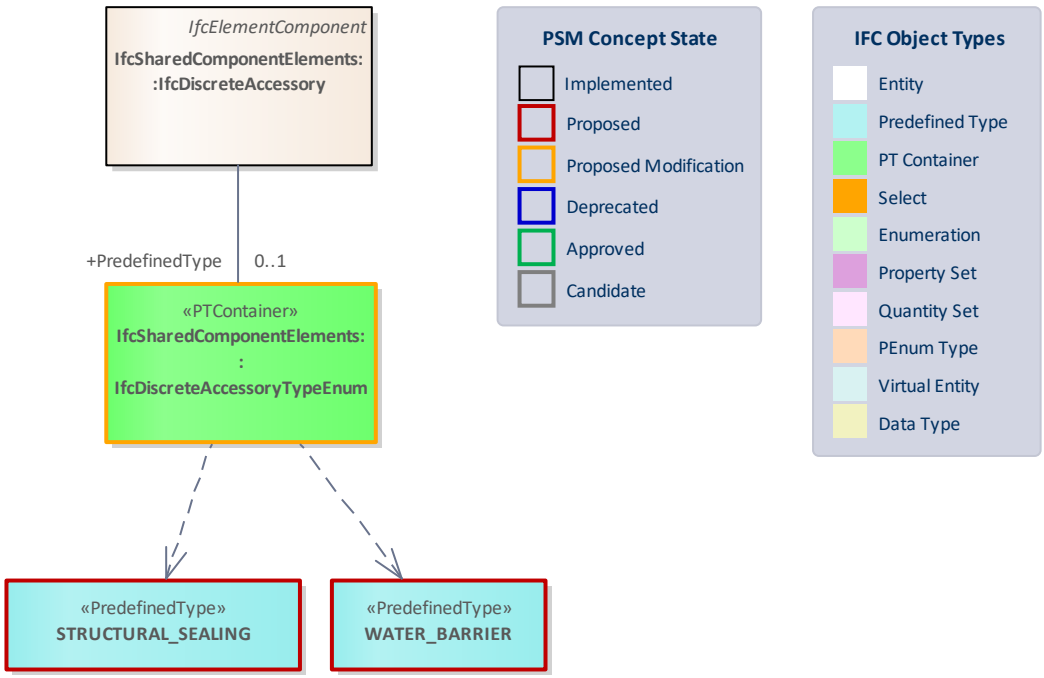


Figure 7: Accessories -

3.5.1.1 PDT Container: IfcDiscreteAccessoryTypeEnum

This enumeration defines the different types of discrete accessories.

> HISTORY New enumeration in IFC4.

bSI Documentation

Status: **ProposedModification**

Package: **IfcSharedComponentElements**

Container Properties			
Parent Entity	IfcDiscreteAccessoryType IfcDiscreteAccessory	**Stereotype**	«PTContainer»
Contains	**EXISTING** IfcDiscreteAccessoryTypeEnum.EXPANSION_JOINT_DEVICE IfcDiscreteAccessoryTypeEnum.ANCHORPLATE IfcDiscreteAccessoryTypeEnum.SHOE IfcDiscreteAccessoryTypeEnum.BRACKET	**PROPOSED**	IfcDiscreteAccessoryTypeEnum.STRUCTURAL_SEALING IfcDiscreteAccessoryTypeEnum.WATER_BARRIER IfcDiscreteAccessoryTypeEnum.BIRDPROTECTION IfcDiscreteAccessoryTypeEnum.RAIL_MECHANICAL_EQUIPMENT IfcDiscreteAccessoryTypeEnum.TENSIONINGEQUIPMENT IfcDiscreteAccessoryTypeEnum.LOCK IfcDiscreteAccessoryTypeEnum.SOUNDABSORPTION IfcDiscreteAccessoryTypeEnum.RAIL_LUBRICATION IfcDiscreteAccessoryTypeEnum.CABLEARRANGER IfcDiscreteAccessoryTypeEnum.INSULATOR IfcDiscreteAccessoryTypeEnum.RAILBRACE IfcDiscreteAccessoryTypeEnum.POINT_MACHINE_LOCKING_DEVICE IfcDiscreteAccessoryTypeEnum.ELASTIC_CUSHION IfcDiscreteAccessoryTypeEnum.POINTMACHINEMOUNTINGDEVICE IfcDiscreteAccessoryTypeEnum.SLIDINGCHAIR IfcDiscreteAccessoryTypeEnum.RAILPAD IfcDiscreteAccessoryTypeEnum.PANEL_STRENGTHENING

3.5.1.2 Predefined Type: WATER_BARRIER

Full Identifier: **IfcDiscreteAccessoryTypeEnum.WATER_BARRIER**

<<ToDo: Definition – comes from the cut-off requirement from the excavation, support & lining domain>>

Status: **Proposed**

Package: **Accessories**

Predefined Type Properties			
Predefined Type Container	IfcDiscreteAccessoryTypeEnum	**Parent Entity**	IfcDiscreteAccessoryType IfcDiscreteAccessory
Stereotype	«PredefinedType»		
Property sets			

3.5.1.3 Predefined Type: STRUCTURAL_SEALING

Full Identifier: **IfcDiscreteAccessoryTypeEnum.STRUCTURAL_SEALING**

<<ToDo: Definition – comes from the sealing hose/Bullflex requirement from the excavation, support & lining domain>>

Status: **Proposed**

Package: **Accessories**

Predefined Type Properties			
Predefined Type Container	IfcDiscreteAccessoryTypeEnum	**Parent Entity**	IfcDiscreteAccessoryType IfcDiscreteAccessory
Stereotype	«PredefinedType»		
Property sets			

3.5.2 Package: Built elements

This package addresses the modelling of elements that derive from IfcBuiltElement or IfcBuiltElementType. These comprise all elements that are primarily part of the construction of a built facility. Built elements are all physically existent and tangible things. Typical examples include walls, doors, beams or slabs.

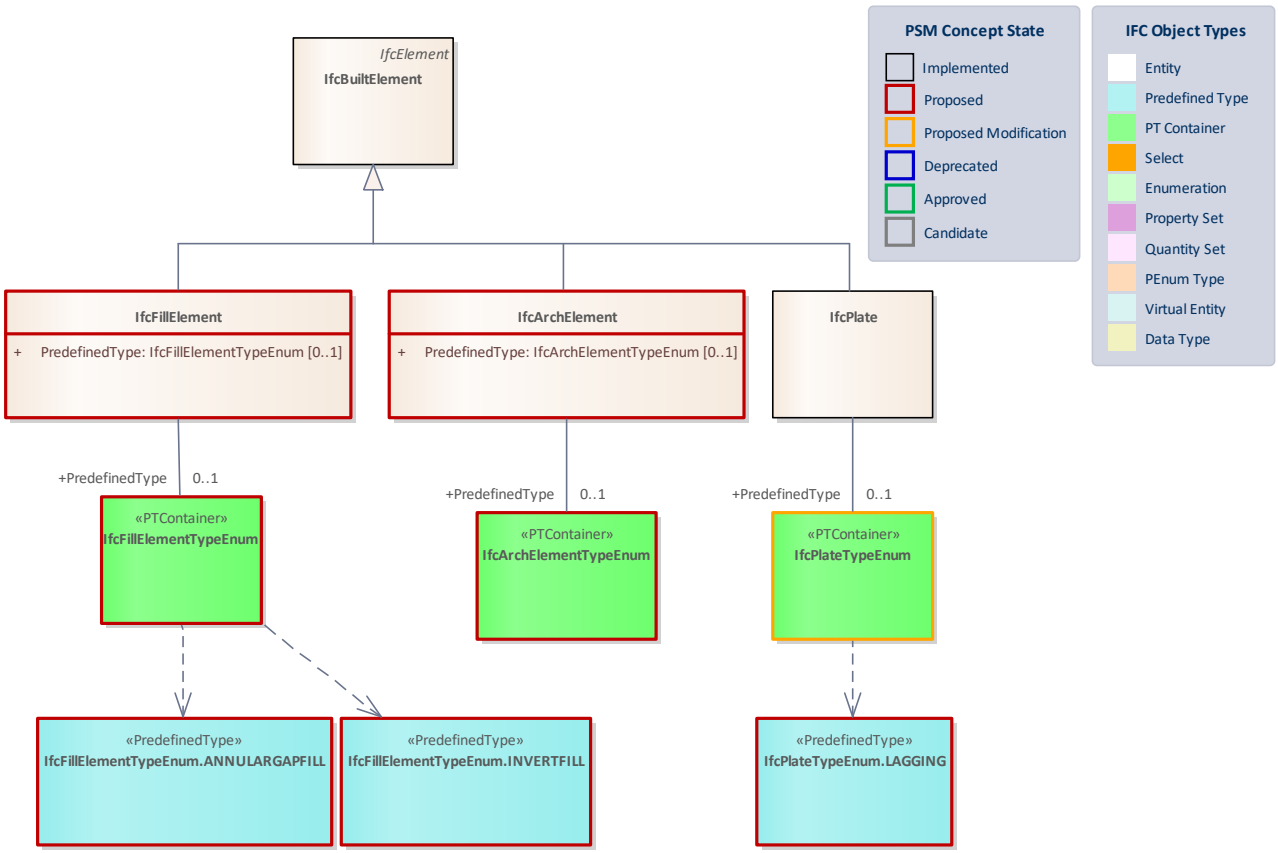


Figure 8: Built elements -

3.5.2.1 PDT Container: IfcPlateTypeEnum

This enumeration defines the different types of planar elements an _IfcPlate_ or _IfcPlateType_ object can fulfill.

> HISTORY New Enumeration in IFC2x2.

{ .change-ifc2x3}

> IFC2x3 CHANGE The additional identifiers CURTAIN_PANEL, SHEET have been added.

bSI Documentation

Status: **ProposedModification**

Package: **IfcSharedBldgElements**

Container Properties			
Parent Entity	IfcPlateType IfcPlate	**Stereotype**	«PTContainer»
Contains	**EXISTING** IfcPlateTypeEnum.WEB_PLATE IfcPlateTypeEnum.COVER_PLATE IfcPlateTypeEnum.SPLICE_PLATE IfcPlateTypeEnum.GUSSET_PLATE IfcPlateTypeEnum.SHEET IfcPlateTypeEnum.CURTAIN_PANEL IfcPlateTypeEnum.BASE_PLATE IfcPlateTypeEnum.FLANGE_PLATE IfcPlateTypeEnum.STIFFENER_PLATE	**PROPOSED** IfcPlateTypeEnum.LAGGING	

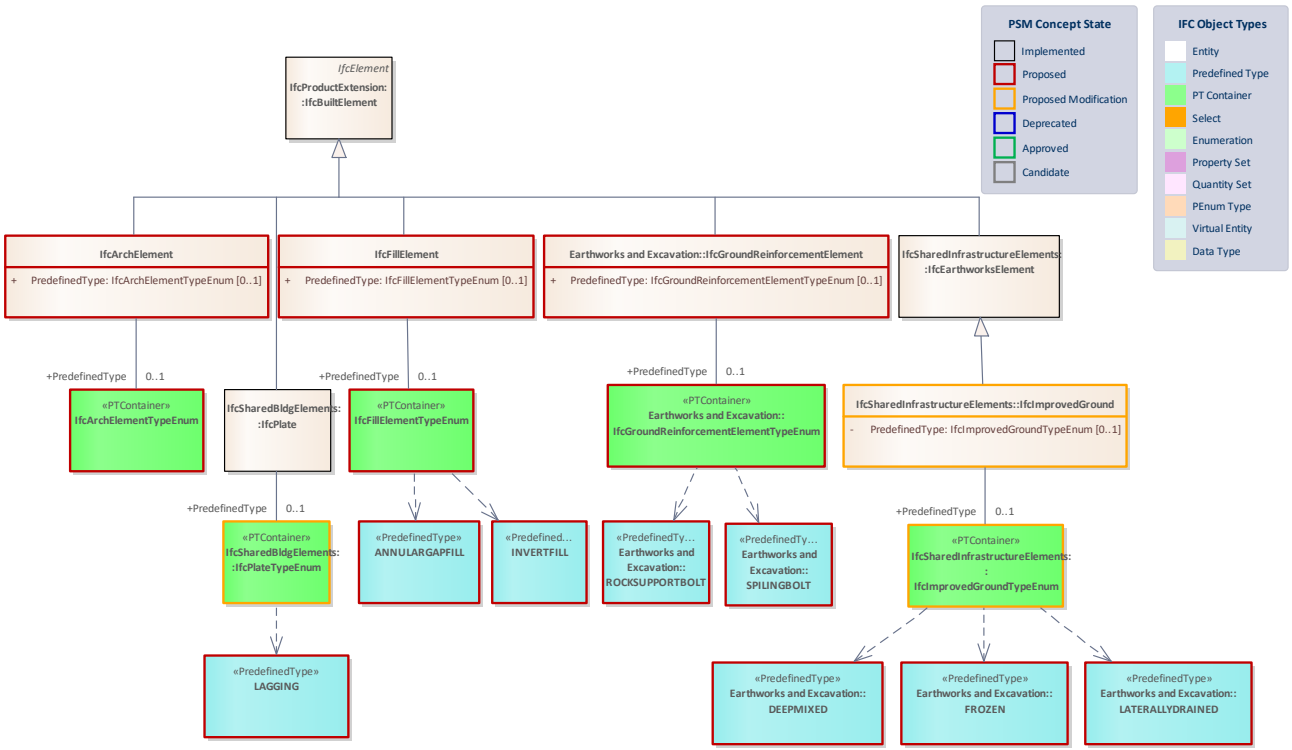


Figure 9: Built elements all tunnel extensions -

3.5.2.2 PDT Container: IfcPlateTypeEnum

This enumeration defines the different types of planar elements an _IfcPlate_ or _IfcPlateType_ object can fulfill.

> HISTORY New Enumeration in IFC2x2.

{ .change-ifc2x3}

> IFC2x3 CHANGE The additional identifiers CURTAIN_PANEL, SHEET have been added.

bSI Documentation

Status: **ProposedModification**

Package: **IfcSharedBldgElements**

Container Properties			
Parent Entity	IfcPlateType IfcPlate	**Stereotype**	«PTContainer»
Contains	**EXISTING** IfcPlateTypeEnum.WEB_PLATE IfcPlateTypeEnum.COVER_PLATE IfcPlateTypeEnum.SPLICE_PLATE IfcPlateTypeEnum.GUSSET_PLATE IfcPlateTypeEnum.SHEET IfcPlateTypeEnum.CURTAIN_PANEL IfcPlateTypeEnum.BASE_PLATE IfcPlateTypeEnum.FLANGE_PLATE IfcPlateTypeEnum.STIFFENER_PLATE	**PROPOSED** IfcPlateTypeEnum.LAGGING	

3.5.2.3 Class: IfcImprovedGround

Ground stabilized by some mechanical or chemical method.

Note: Renamed IfcReinforcedSoil.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcEarthworksElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcImprovedGroundTypeEnum	[0..1]	Identifies the predefined type of a reinforced soil elements from which the type modelled, may be set. This type may associate additional specific property sets.

3.5.2.4 PDT Container: IfcImprovedGroundTypeEnum

This container defines the different predefined types of soil reinforcement that can specify an IfcReinforcedSoil.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Container Properties			
Parent Entity	IfcImprovedGround	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
	IfcImprovedGroundTypeEnum.GROUTED IfcIfcImprovedGroundTypeEnum.ROLLERCOMPACTED IfcImprovedGroundTypeEnum.REPLACED IfcImprovedGroundTypeEnum.DYNAMICALLYCOMPACTED IfcImprovedGroundTypeEnum.VERTICALLYDRAINED	IfcImprovedGroundTypeEnum.LATERALLYDRAINED IfcImprovedGroundTypeEnum.DEEPMIXED IfcImprovedGroundTypeEnum.FROZEN	

	IfcImprovedGroundTypeEnum.SURCHARGEPRELOADED	

3.5.2.5 Class: IfcGroundReinforcementElement

A kind of element used for ground reinforcement.

Status: **Proposed**

Package: **Earthworks and Excavation**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcBuiltElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGroundReinforcementElementTypeEnum	[0..1]	

3.5.2.6 PDT Container: IfcGroundReinforcementElementTypeEnum

This enumeration defines the range of different types of ground reinforcement elements that can further specify an _IfcGroundReinforcementElementTypeEnum_.

Status: **Proposed**

Package: **Earthworks and Excavation**

Container Properties			
Parent Entity	IfcGroundReinforcementElement	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	

		IfcGroundReinforcementElementTypeEnum.ROCKSUPPORTBOLT IfcGroundReinforcementElementTypeEnum.SPILINGBOLT

3.5.2.7 Predefined Type: ROCKSUPPORTBOLT

Full Identifier: **IfcGroundReinforcementElementTypeEnum.ROCKSUPPORTBOLT**

<<ToDo: Definition – comes from the excavation domain requirements for face bolts, forepoling and anchors>>

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcGroundReinforcementElementTypeEnum	**Parent Entity**	IfcGroundReinforcementElement
Stereotype	«PredefinedType»		
Property sets			

3.5.2.8 Predefined Type: SPILINGBOLT

Full Identifier: **IfcGroundReinforcementElementTypeEnum.SPILINGBOLT**

<<ToDo: Definition – comes from the excavation domain requirements for spiling bars>>

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcGroundReinforcementElementTypeEnum	**Parent Entity**	IfcGroundReinforcementElement
Stereotype	«PredefinedType»		
Property sets			

3.5.2.9 Predefined Type: LATERALLYDRAINED

Full Identifier: **IfcImprovedGroundTypeEnum.LATERALLYDRAINED**

A method to set lateral drainage measures in the foundation, so that pore water in the soil is discharged and the foundation strength is improved.

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.2.10 Predefined Type: DEEPMIXED

Full Identifier: **IfcImprovedGroundTypeEnum.DEEPMIXED**

A ground improvement technique that improves soft, high moisture clays, peats, and other weak soils, by mechanically mixing them with dry cementitious binder.

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.2.11 Predefined Type: FROZEN

Full Identifier: **IfcImprovedGroundTypeEnum.FROZEN**

Artificial ground freezing is used for waterproofing and/or temporary consolidation to support the excavation of underground structures under water in loose soils or in jointed rocks. It is suitable for any type of soil and fractured rock. Most used technologies are either direct method (liquid nitrogen) or indirect method (brine).

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

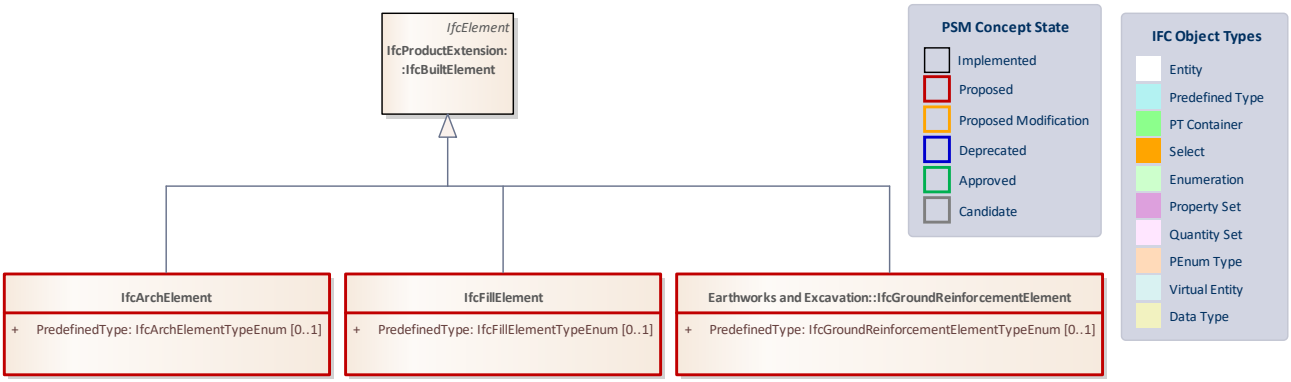


Figure 10: Built elements only new subtypes -

3.5.2.12 Class: IfcGroundReinforcementElement

A kind of element used for ground reinforcement.

Status: **Proposed**

Package: **Earthworks and Excavation**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement

Subtype Of	IfcBuiltElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGroundReinforcement ElementTypeEnum	[0..1]	

3.5.2.13 PDT Container: IfcArchElementTypeEnum

This enumeration defines the range of different types of arch elements that can further specify an _IfcArchElementTypeEnum_.

Status: **Proposed**

Package: **Built elements**

Container Properties			
Parent Entity	IfcArchElement	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	

3.5.2.14 Predefined Type: INVERTFILL

Full Identifier: **IfcFillElementTypeEnum.INVERTFILL**

The fill element used to fill the tunnel invert, i.e. The lowest section of a tunnel, i.e., the floor.

Status: **Proposed**

Package: **Built elements**

Predefined Type Properties			
Predefined Type Container	IfcFillElementTypeEnum	**Parent Entity**	IfcFillElement
Stereotype	«PredefinedType»		
Property sets			

3.5.2.15 Predefined Type: ANNULARGAPFILL

Full Identifier: **IfcFillElementTypeEnum.ANNULARGAPFILL**

The fill element used to fill the annular gap, e.g. between the tunnel lining and the surrounding ground.

Status: **Proposed**

Package: **Built elements**

Predefined Type Properties			
Predefined Type Container	IfcFillElementTypeEnum	**Parent Entity**	IfcFillElement
Stereotype	«PredefinedType»		
Property sets			

3.5.2.16 PDT Container: IfcFillElementTypeEnum

This enumeration defines the range of different types of fill elements that can further specify an _IfcFillElementTypeEnum_.

Status: **Proposed**

Package: **Built elements**

Container Properties			
Parent Entity	IfcFillElement	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcFillElementTypeEnum.ANNULARGAPFILL IfcFillElementTypeEnum.INVERTFILL	

3.5.2.17 Class: IfcFillElement

An element with the purpose of filling gaps between other elements.

Status: **Proposed**

Package: **Built elements**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcBuiltElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcFillElementTypeEnum	[0..1]	

3.5.2.18 Class: IfcArchElement

A unitary curved structure

Status: **Proposed**

Package: **Built elements**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcBuiltElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcArchElementTypeEnum	[0..1]	

3.5.2.19 Predefined Type: LAGGING

Full Identifier: **IfcPlateTypeEnum.LAGGING**

Lagging is the structural material (most often wood) that spans the distance between spars at an excavation site. Lagging, and the steel spars they connect to, provides temporary ground support as a safety measure during tunneling. The lagging is installed horizontally between vertically installed spars.

Status: **Proposed**

Package: **Built elements**

Predefined Type Properties			
Predefined Type Container	IfcPlateTypeEnum	**Parent Entity**	IfcPlateType IfcPlate
Stereotype	«PredefinedType»		
Property sets			

3.5.3 Package: Distribution elements

Elements that participate in a distribution system

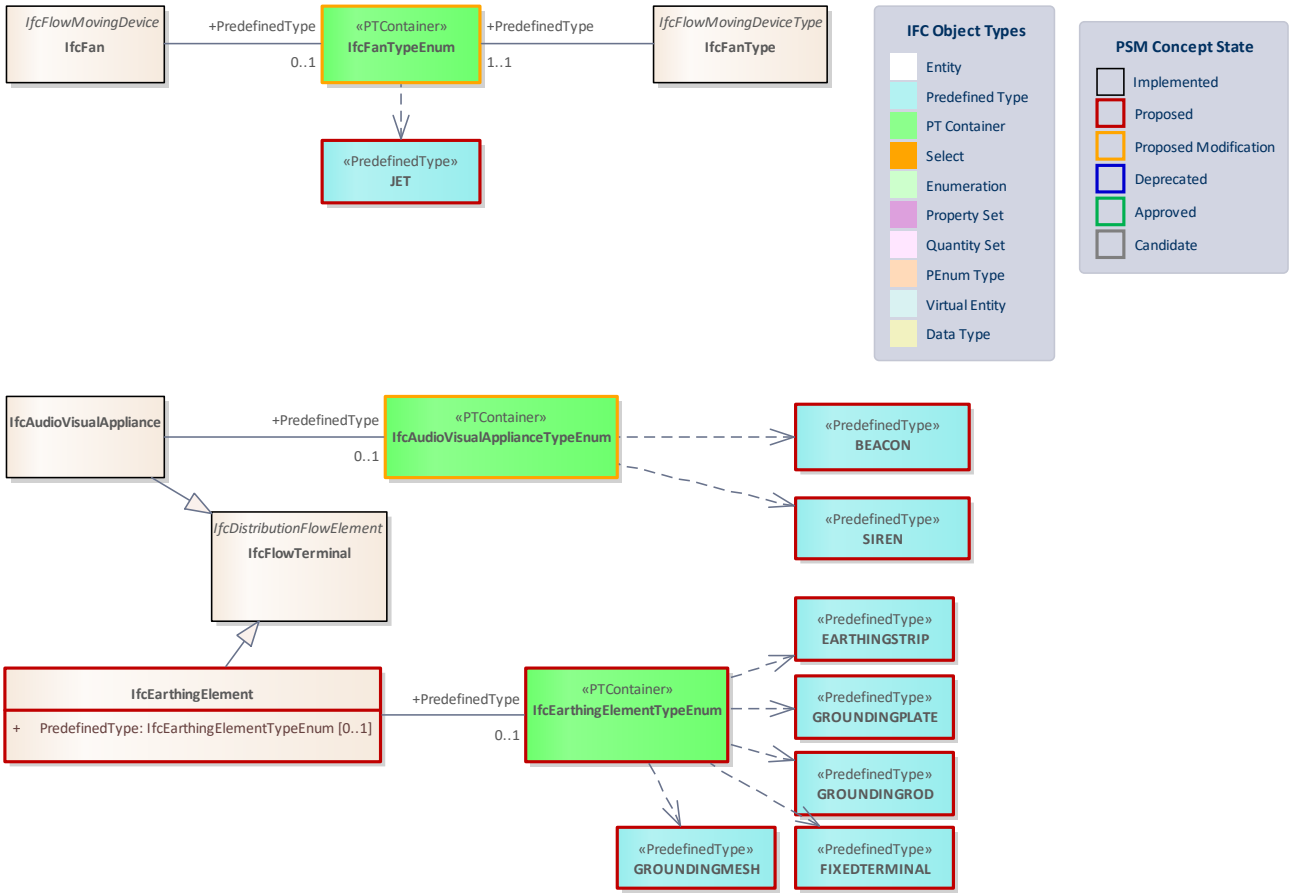


Figure 11: Distribution elements -

3.5.3.1 PDT Container: IfcAudioVisualApplianceTypeEnum

Defines the range of different types of audio-video devices that can be specified.

> HISTORY New enumeration in IFC4.

bSI Documentation

Status: **ProposedModification**

Package: **IfcElectricalDomain**

Container Properties			
Parent Entity	IfcAudioVisualApplianceType IfcAudioVisualAppliance	**Stereotype**	«PTContainer»

	EXISTING	PROPOSED
Contains	IfcAudioVisualApplianceTypeEnum.PLAYER IfcAudioVisualApplianceTypeEnum.SWITCHER IfcAudioVisualApplianceTypeEnum.MICROPHONE IfcAudioVisualApplianceTypeEnum.RECEIVER IfcAudioVisualApplianceTypeEnum.TUNER IfcAudioVisualApplianceTypeEnum.PROJECTOR IfcAudioVisualApplianceTypeEnum.CAMERA IfcAudioVisualApplianceTypeEnum.AMPLIFIER IfcAudioVisualApplianceTypeEnum.TELEPHONE IfcAudioVisualApplianceTypeEnum.DISPLAY IfcAudioVisualApplianceTypeEnum.SPEAKER	IfcAudioVisualApplianceTypeEnum.BEACON IfcAudioVisualApplianceTypeEnum.SIREN IfcAudioVisualApplianceTypeEnum.RAILWAY_COMMUNICATION_TERMINAL

3.5.3.2 PDT Container: IfcFanTypeEnum

Enumeration defining the typical types of fans.

> HISTORY New enumeration in IFC2x2.

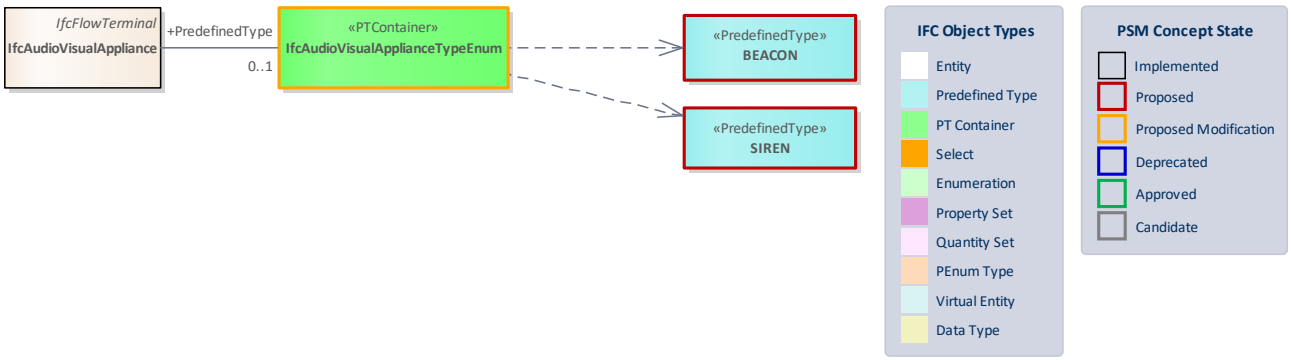
bSI Documentation

Status: **ProposedModification**

Package: **IfcHvacDomain**

Container Properties			
Parent Entity	IfcFanType IfcFan	**Stereotype**	«PTContainer»

	EXISTING	PROPOSED
Contains	IfcFanTypeEnum.PROPELLORAXIAL IfcFanTypeEnum.CENTRIFUGALBACKWARDINCLINEDCURVED IfcFanTypeEnum.CENTRIFUGALRADIAL IfcFanTypeEnum.VANEAXIAL IfcFanTypeEnum.CENTRIFUGALFORWARDCURVED IfcFanTypeEnum.CENTRIFUGALAIRFOIL IfcFanTypeEnum.TUBEAXIAL	IfcFanTypeEnum.JET



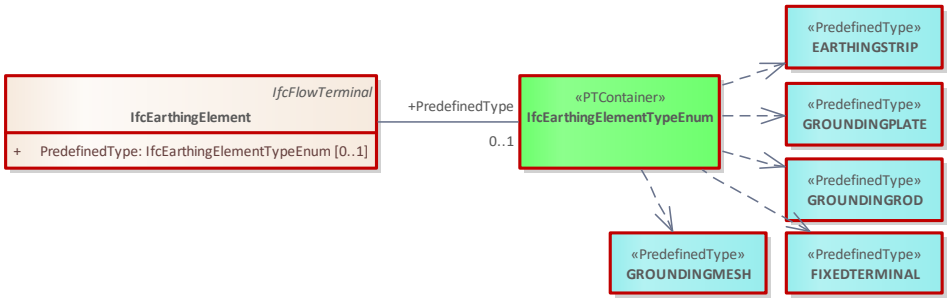


Figure 12: Distribution elements - Audio Visual Appliances -

3.5.3.3 PDT Container: IfcAudioVisualApplianceTypeEnum

Defines the range of different types of audio-video devices that can be specified.

> HISTORY New enumeration in IFC4.

bSI Documentation

Status: **ProposedModification**

Package: **IfcElectricalDomain**

Container Properties

Parent Entity	IfcAudioVisualApplianceType IfcAudioVisualAppliance	**Stereotype**	«PTContainer»
Contains	**EXISTING** IfcAudioVisualApplianceTypeEnum.PLAYER IfcAudioVisualApplianceTypeEnum.SWITCHER IfcAudioVisualApplianceTypeEnum.MICROPHONE IfcAudioVisualApplianceTypeEnum.RECEIVER IfcAudioVisualApplianceTypeEnum.TUNER IfcAudioVisualApplianceTypeEnum.PROJECTOR IfcAudioVisualApplianceTypeEnum.CAMERA IfcAudioVisualApplianceTypeEnum.AMPLIFIER IfcAudioVisualApplianceTypeEnum.TELEPHONE IfcAudioVisualApplianceTypeEnum.DISPLAY IfcAudioVisualApplianceTypeEnum.SPEAKER		**PROPOSED** IfcAudioVisualApplianceTypeEnum.BEACON IfcAudioVisualApplianceTypeEnum.SIREN IfcAudioVisualApplianceTypeEnum.RAILWAY_COMMUNICATION_TERMINAL

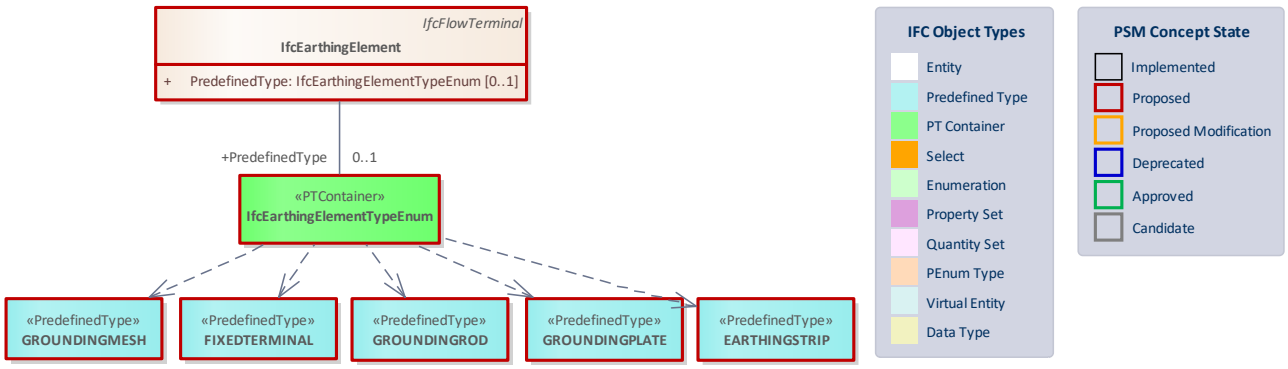


Figure 13: Distribution elements - Earthing -

Figure 14: Distribution elements - Jet fan -

3.5.3.4 PDT Container: IfcFanTypeEnum

Enumeration defining the typical types of fans.

> HISTORY New enumeration in IFC2x2.

bSI Documentation

Status: **ProposedModification**

Package: **IfcHvacDomain**

Container Properties			
Parent Entity	IfcFanType IfcFan	**Stereotype**	«PTContainer»
Contains	**EXISTING** IfcFanTypeEnum.PROPELLORAXIAL IfcFanTypeEnum.CENTRIFUGALBACKWARDINCLINEDCURVED IfcFanTypeEnum.CENTRIFUGALRADIAL IfcFanTypeEnum.VANEAXIAL IfcFanTypeEnum.CENTRIFUGALFORWARDCURVED IfcFanTypeEnum.CENTRIFUGALAIRFOIL IfcFanTypeEnum.TUBEAXIAL	**PROPOSED** IfcFanTypeEnum.JET	

3.5.3.5 Predefined Type: BEACON

Full Identifier: **IfcAudioVisualApplianceTypeEnum.BEACON**

A light or other visible object serving as a signal, warning, or guide

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties

Predefined Type Container	IfcAudioVisualApplianceTypeEnum	**Parent Entity**	IfcAudioVisualApplianceType IfcAudioVisualAppliance
Stereotype	«PredefinedType»		
Property sets			

3.5.3.6 Predefined Type: SIREN

Full Identifier: **IfcAudioVisualApplianceTypeEnum.SIREN**

A device that makes a loud prolonged signal or warning sound

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties			
Predefined Type Container	IfcAudioVisualApplianceTypeEnum	**Parent Entity**	IfcAudioVisualApplianceType IfcAudioVisualAppliance
Stereotype	«PredefinedType»		
Property sets			

3.5.3.7 Class: IfcEarthingElement

A terminal or busbar which is part of the earthing arrangement of an installation and which enables the electric connection of a number of conductors for earthing purposes.

Status: **Proposed**

Package: **Distribution elements**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcFlowTerminal	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcEarthingElementTypeEnum	[0..1]	

3.5.3.8 PDT Container: IfcEarthingElementTypeEnum

Status: **Proposed**

Package: **Distribution elements**

Container Properties			
Parent Entity	IfcEarthingElement	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcEarthingElementTypeEnum.EARTHINGSTRIP IfcEarthingElementTypeEnum.GROUNDINGPLATE IfcEarthingElementTypeEnum.GROUNDINGROD IfcEarthingElementTypeEnum.FIXEDTERMINAL IfcEarthingElementTypeEnum.GROUNDINGMESH	

3.5.3.9 Predefined Type: EARTHINGSTRIP

Full Identifier: **IfcEarthingElementTypeEnum.EARTHINGSTRIP**

According to EN 62561-2, for use in earth-termination and lightning protection systems as well as for ring equipotential bonding.

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties			
Predefined Type Container	IfcEarthingElementTypeEnum	**Parent Entity**	IfcEarthingElement

Stereotype	«PredefinedType»		
Property sets			

3.5.3.10 Predefined Type: FIXEDTERMINAL

Full Identifier: **IfcEarthingElementTypeEnum.FIXEDTERMINAL**

According to EN 62561-2, for installation in concrete as a corrosion-free connection to the earth-termination system for protective equipotential bonding and / or functional equipotential bonding of the down conductor

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties			
Predefined Type Container	IfcEarthingElementTypeEnum	**Parent Entity**	IfcEarthingElement
Stereotype	«PredefinedType»		
Property sets			

3.5.3.11 Predefined Type: GROUNDINGMESH

Full Identifier: **IfcEarthingElementTypeEnum.GROUNDINGMESH**

IEC 60050-531

An electrode in the form of a mesh, and designed to establish an equipotential plan.

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties			
Predefined Type Container	IfcEarthingElementTypeEnum	**Parent Entity**	IfcEarthingElement
Stereotype	«PredefinedType»		
Property sets			

3.5.3.12 Predefined Type: GROUNDINGPLATE

Full Identifier: **IfcEarthingElementTypeEnum.GROUNDINGPLATE**

IEC 62561-2

Earth electrode consisting of a metal plate buried in the ground

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties			
Predefined Type Container	IfcEarthingElementTypeEnum	**Parent Entity**	IfcEarthingElement
Stereotype	«PredefinedType»		
Property sets			

3.5.3.13 Predefined Type: GROUNDINGROD

Full Identifier: **IfcEarthingElementTypeEnum.GROUNDINGROD**

IEC 62561-2

Earth electrode consisting of a metal rod driven into the ground

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties			
Predefined Type Container	IfcEarthingElementTypeEnum	**Parent Entity**	IfcEarthingElement
Stereotype	«PredefinedType»		
Property sets			

3.5.3.14 Predefined Type: JET

Full Identifier: **IfcFanTypeEnum.JET**

A fan used for producing a high-velocity flow of air in a space. The typical function is to add momentum to the air within a tunnel. Inlets and outlets are not ducted.

Status: **Proposed**

Package: **Distribution elements**

Predefined Type Properties			
Predefined Type Container	IfcFanTypeEnum	**Parent Entity**	IfcFanType IfcFan
Stereotype	«PredefinedType»		
Property sets			

3.5.4 Package: Earthworks and Excavation

A package containing the proposed updated IFC model concerning Excavation, Fill and ground improvement and reinforcement.

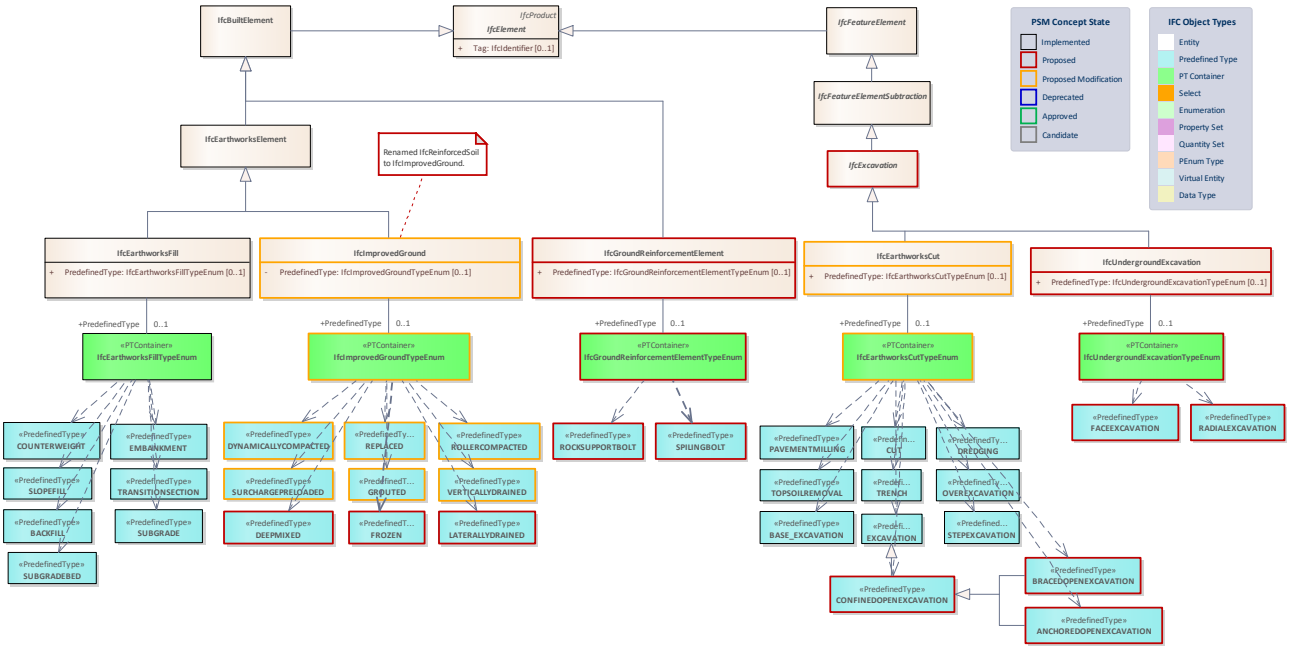


Figure 15: IFC Earthworks and Excavation -

3.5.4.1 PDT Container: IfcEarthworksCutTypeEnum

This container defines the different predefined types of earthworks cut elements that can specify an IfcEarthworksCut.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Container Properties			
Parent Entity	IfcEarthworksCut	**Stereotype**	«PTContainer»
Contains	**EXISTING** IfcEarthworksCutTypeEnum.BASE_EXCAVATION IfcEarthworksCutTypeEnum.CUT IfcEarthworksCutTypeEnum.PAVEMENTMILLING IfcEarthworksCutTypeEnum.STEPEXCAVATION IfcEarthworksCutTypeEnum.TOPSOILREMOVAL IfcEarthworksCutTypeEnum.OVEREXCAVATION IfcEarthworksCutTypeEnum.EXCAVATION IfcEarthworksCutTypeEnum.DREDGING IfcEarthworksCutTypeEnum.TRENCH	**PROPOSED** IfcEarthworksCutTypeEnum.CONFINEDOPENEXCAVATION IfcEarthworksCutTypeEnum.BRACEDOPENEXCAVATION IfcEarthworksCutTypeEnum.ANCHOREDOPENEXCAVATION	

3.5.4.2 Class: IfcEarthworksCut

The resulting void from modification of existing terrain or road structure by excavation of the surface or by other means of removing material.

NOTE Definition from ISO 6707-1: void that results from bulk excavation of material.

NOTE The material excavated and either used as fill or discarded as waste is not modelled as Cut, but may be handled as a different concept (Resource) in the future.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcExcavation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcEarthworksCutTypeEnum	[0..1]	Identifies the predefined type of a earthworks cut elements from which the type modelled, may be set. This type may associate additional specific property sets.

3.5.4.3 Class: IfcImprovedGround

Ground stabilized by some mechanical or chemical method.

Note: Renamed IfcReinforcedSoil.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcEarthworksElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcImprovedGroundTypeEnum	[0..1]	Identifies the predefined type of a reinforced soil elements from which the type modelled, may be set. This type may associate additional specific property sets.

3.5.4.4 PDT Container: IfcImprovedGroundTypeEnum

This container defines the different predefined types of soil reinforcement that can specify an IfcReinforcedSoil.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Container Properties			
Parent Entity	IfcImprovedGround	**Stereotype**	«PTContainer»
Contains	**EXISTING** IfcImprovedGroundTypeEnum.GROUTED IfcIfcImprovedGroundTypeEnum.ROLLERCOMPACTED IfcImprovedGroundTypeEnum.REPLACED IfcImprovedGroundTypeEnum.DYNAMICALLYCOMPACTED IfcImprovedGroundTypeEnum.VERTICALLYDRAINED IfcImprovedGroundTypeEnum.SURCHARGEPRELOADED	**PROPOSED** IfcImprovedGroundTypeEnum.LATERALLYDRAINED IfcImprovedGroundTypeEnum.DEEPMIXED IfcImprovedGroundTypeEnum.FROZEN	

3.5.4.5 Predefined Type: DYNAMICALLYCOMPACTED

Full Identifier: **IfcImprovedGroundTypeEnum.DYNAMICALLYCOMPACTED**

The method of using dynamic tamping machine to drop the heavy hammer freely from the high place, compacting the soil and quickly improving the bearing capacity of the foundation.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.4.6 Predefined Type: GROUTED

Full Identifier: **IfcImprovedGroundTypeEnum.GROUTED**

A method of injecting some curable slurry into cracks or pores of a geotechnical foundation to improve its physical and mechanical properties.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.4.7 Predefined Type: REPLACED

Full Identifier: **IfcImprovedGroundTypeEnum.REPLACED**

Dig out the soft soil in a certain range below the foundation ground and then backfill the area with high strength, low compressibility and no corrosive materials.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.4.8 Predefined Type: ROLLERCOMPACTED

Full Identifier: **IfcIfcImprovedGroundTypeEnum.ROLLERCOMPACTED**

A kind of compacting method that adopts rolling machinery, repeated rolling and vibration to make foundation soil compacted, strength increased and compressibility decreased.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.4.9 Predefined Type: SURCHARGEPRELOADED

Full Identifier: **IfcImprovedGroundTypeEnum.SURCHARGEPRELOADED**

A method that applies load to the foundation to discharge pore water, and the foundation is consolidated to improve the foundation strength. Unloading when the carrying capacity reaches the required level.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.4.10 Predefined Type: VERTICALLYDRAINED

Full Identifier: **IfcImprovedGroundTypeEnum.VERTICALLYDRAINED**

A method to set vertical drainage measures in the foundation, so that pore water in the soil is discharged and the foundation strength is improved.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

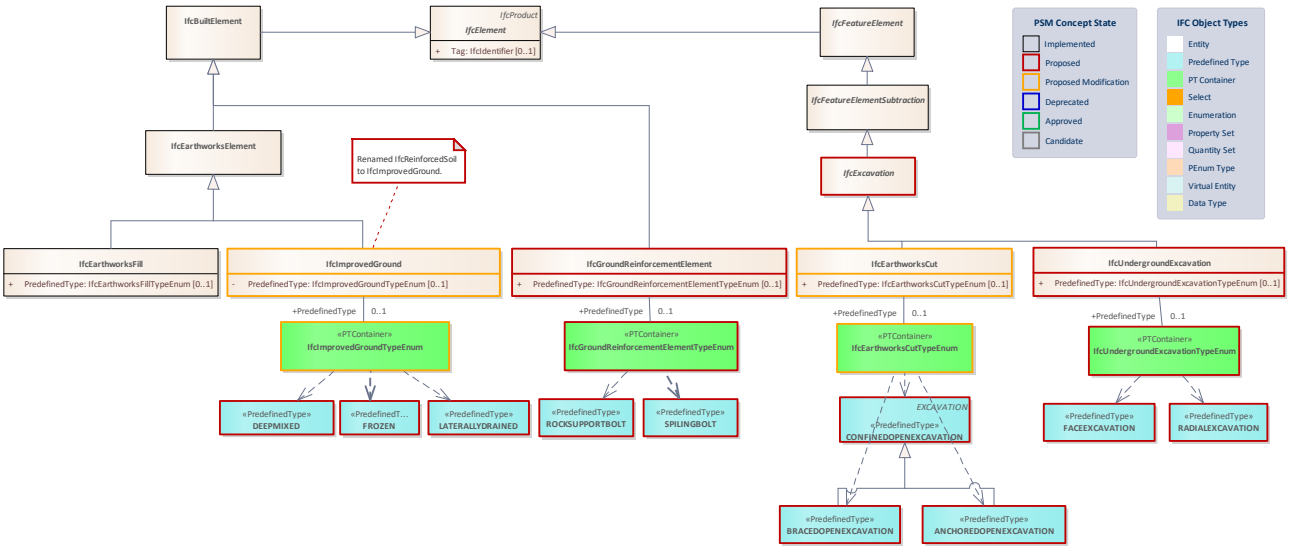


Figure 16: IFC Earthworks and Excavation only new predefined types -

3.5.4.11 PDT Container: IfcEarthworksCutTypeEnum

This container defines the different predefined types of earthworks cut elements that can specify an IfcEarthworksCut.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Container Properties			
Parent Entity	IfcEarthworksCut	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
	IfcEarthworksCutTypeEnum.BASE_EXCAVATION IfcEarthworksCutTypeEnum.CUT IfcEarthworksCutTypeEnum.PAVEMENTMILLING IfcEarthworksCutTypeEnum.STEPEXCAVATION IfcEarthworksCutTypeEnum.TOPSOILREMOVAL IfcEarthworksCutTypeEnum.OVEREXCAVATION IfcEarthworksCutTypeEnum.EXCAVATION IfcEarthworksCutTypeEnum.DREDGING IfcEarthworksCutTypeEnum.TRENCH	IfcEarthworksCutTypeEnum.CONFINEDOPENEXCAVATION IfcEarthworksCutTypeEnum.BRACEDOPENEXCAVATION IfcEarthworksCutTypeEnum.ANCHOREDOPENEXCAVATION	

3.5.4.12 Class: IfcEarthworksCut

The resulting void from modification of existing terrain or road structure by excavation of the surface or by other means of removing material.

NOTE Definition from ISO 6707-1: void that results from bulk excavation of material.

NOTE The material excavated and either used as fill or discarded as waste is not modelled as Cut, but may be handled as a different concept (Resource) in the future.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcExcavation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcEarthworksCutTypeEnum	[0..1]	Identifies the predefined type of a earthworks cut elements from which the type modelled, may be set. This type may associate additional specific property sets.

3.5.4.13 Class: IfcImprovedGround

Ground stabilized by some mechanical or chemical method.

Note: Renamed IfcReinforcedSoil.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcEarthworksElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcImprovedGroundTypeEnum	[0..1]	Identifies the predefined type of a reinforced soil elements from which the type modelled, may be set. This type may associate additional specific property sets.

3.5.4.14 PDT Container: IfcImprovedGroundTypeEnum

This container defines the different predefined types of soil reinforcement that can specify an IfcReinforcedSoil.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Container Properties			
Parent Entity	IfcImprovedGround	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
	IfcImprovedGroundTypeEnum.GROUTED IfcIfcImprovedGroundTypeEnum.ROLLERCOMPACTED IfcImprovedGroundTypeEnum.REPLACED IfcImprovedGroundTypeEnum.DYNAMICALLYCOMPACTED IfcImprovedGroundTypeEnum.VERTICALLYDRAINED IfcImprovedGroundTypeEnum.SURCHARGEPRELOADED	IfcImprovedGroundTypeEnum.LATERALLYDRAINED IfcImprovedGroundTypeEnum.DEEPMIXED IfcImprovedGroundTypeEnum.FROZEN	

3.5.4.15 Predefined Type: SPILINGBOLT

Full Identifier: **IfcGroundReinforcementElementTypeEnum.SPILINGBOLT**

<<ToDo: Definition – comes from the excavation domain requirements for spiling bars>>

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcGroundReinforcementElementTypeEnum	**Parent Entity**	IfcGroundReinforcementElement
Stereotype	«PredefinedType»		
Property sets			

3.5.4.16 Predefined Type: ROCKSUPPORTBOLT

Full Identifier: **IfcGroundReinforcementElementTypeEnum.ROCKSUPPORTBOLT**

<<ToDo: Definition – comes from the excavation domain requirements for face bolts, forepoling and anchors>>

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcGroundReinforcementElementTypeEnum	**Parent Entity**	IfcGroundReinforcementElement
Stereotype	«PredefinedType»		
Property sets			

3.5.4.17 PDT Container: IfcGroundReinforcementElementTypeEnum

This enumeration defines the range of different types of ground reinforcement elements that can further specify an _IfcGroundReinforcementElementTypeEnum_.

Status: **Proposed**

Package: **Earthworks and Excavation**

Container Properties			
Parent Entity	IfcGroundReinforcementElement	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGroundReinforcementElementTypeEnum.ROCKSUPPORTBOLT IfcGroundReinforcementElementTypeEnum.SPILINGBOLT	

3.5.4.18 Class: IfcGroundReinforcementElement

A kind of element used for ground reinforcement.

Status: **Proposed**

Package: **Earthworks and Excavation**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcBuiltElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGroundReinforcementElementTypeEnum	[0..1]	

3.5.4.19 Predefined Type: RADIALEXCAVATION

Full Identifier: **IfcUndergroundExcavationTypeEnum.RADIALEXCAVATION**

A lateral underground excavation where the tunnel profile is changed, e.g. widened..

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcUndergroundExcavationTypeEnum	**Parent Entity**	IfcUndergroundExcavation
Stereotype	«PredefinedType»		
Property sets			

3.5.4.20 Predefined Type: FACEEXCAVATION

Full Identifier: **IfcUndergroundExcavationTypeEnum.FACEEXCAVATION**

A longitudinal underground excavation either of the full face or parts of the full face.

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcUndergroundExcavationTypeEnum	**Parent Entity**	IfcUndergroundExcavation
Stereotype	«PredefinedType»		
Property sets			

3.5.4.21 PDT Container: IfcUndergroundExcavationTypeEnum

This enumeration defines the range of different types of underground excavation elements that can further specify an _IfcUndergroundExcavationTypeEnum_.

Status: **Proposed**

Package: **Earthworks and Excavation**

Container Properties			
Parent Entity	IfcUndergroundExcavation	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcUndergroundExcavationTypeEnum.RADIALEXCAVATION IfcUndergroundExcavationTypeEnum.FACEEXCAVATION	

3.5.4.22 Class: IfcUndergroundExcavation

The resulting void from an underground excavation where the uppermost terrain surface is not affected

Status: **Proposed**

Package: **Earthworks and Excavation**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcExcavation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcUndergroundExcavationTypeEnum	[0..1]	

3.5.4.23 Predefined Type: FROZEN

Full Identifier: **IfcImprovedGroundTypeEnum.FROZEN**

Artificial ground freezing is used for waterproofing and/or temporary consolidation to support the excavation of underground structures under water in loose soils or in jointed rocks. It is suitable for any type of soil and fractured rock. Most used technologies are either direct method (liquid nitrogen) or indirect method (brine).

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.4.24 Predefined Type: DEEPMIXED

Full Identifier: **IfcImprovedGroundTypeEnum.DEEPMIXED**

A ground improvement technique that improves soft, high moisture clays, peats, and other weak soils, by mechanically mixing them with dry cementitious binder.

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.4.25 Class: IfcExcavation

The resulting void from modification of existing terrain or road structure by excavation or by other means of removing material.

NOTE Definition from ISO 6707-1: void that results from bulk excavation of material.

NOTE The material excavated and either used as fill or discarded as waste is not modelled as Cut, but may be handled as a different concept (Resource) in the future.

Status: **Proposed**

Package: **Earthworks and Excavation**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcFeatureElementSubtraction	
Subtypes	**EXISTING**	**PROPOSED**
		IfcUndergroundExcavation

3.5.4.26 Predefined Type: CONFINEDOPENEXCAVATION

Full Identifier: **IfcEarthworksCutTypeEnum.CONFINEDOPENEXCAVATION**

An open slope excavation where the sides are vertical or near vertical

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcEarthworksCutTypeEnum	**Parent Entity**	IfcEarthworksCut
Stereotype	«PredefinedType»		
Property sets			

3.5.4.27 Predefined Type: BRACEDOPENEXCAVATION

Full Identifier: **IfcEarthworksCutTypeEnum.BRACEDOPENEXCAVATION**

A confined open excavation where the vertical walls are braced.

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcEarthworksCutTypeEnum	**Parent Entity**	IfcEarthworksCut
Stereotype	«PredefinedType»		
Property sets			

3.5.4.28 Predefined Type: ANCHOREDOPENEXCAVATION

Full Identifier: **IfcEarthworksCutTypeEnum.ANCHOREDOPENEXCAVATION**

A confined open excavation where the vertical walls are anchored.

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcEarthworksCutTypeEnum	**Parent Entity**	IfcEarthworksCut
Stereotype	«PredefinedType»		
Property sets			

3.5.4.29 Predefined Type: LATERALLYDRAINED

Full Identifier: **IfcImprovedGroundTypeEnum.LATERALLYDRAINED**

A method to set lateral drainage measures in the foundation, so that pore water in the soil is discharged and the foundation strength is improved.

Status: **Proposed**

Package: **Earthworks and Excavation**

Predefined Type Properties			
Predefined Type Container	IfcImprovedGroundTypeEnum	**Parent Entity**	IfcImprovedGround
Stereotype	«PredefinedType»		
Property sets			

3.5.5 Package: Element assemblies

This package addresses the built elements that represent assemblies. Assemblies are aggregations of other elements and components to form a larger manufactured unit that can be built on site or prefabricated off-site.

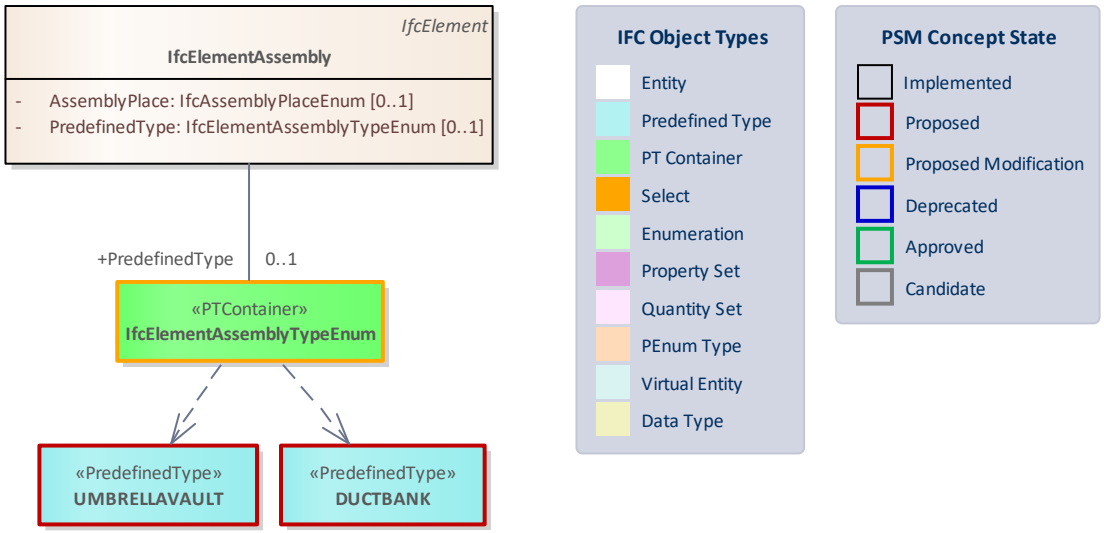


Figure 17: Element assemblies -

3.5.5.1 PDT Container: IfcElementAssemblyTypeEnum

This enumeration defines the basic configuration types for element assemblies.

> HISTORY New enumeration in IFC2x2.

bSI Documentation

Status: **ProposedModification**

Package: **IfcProductExtension**

Container Properties			
Parent Entity	IfcElementAssemblyType IfcElementAssembly	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
	IfcElementAssemblyTypeEnum.ABUTMENT IfcElementAssemblyTypeEnum.DECK IfcElementAssemblyTypeEnum.PYLON	IfcElementAssemblyTypeEnum.DUCTBANK IfcElementAssemblyTypeEnum.TRACKPANEL IfcElementAssemblyTypeEnum.DILATATIONPANEL	

	IfcElementAssemblyTypeEnum.ACCESSORY_ASSEMBLY IfcElementAssemblyTypeEnum.TRUSS IfcElementAssemblyTypeEnum.BRACED_FRAME IfcElementAssemblyTypeEnum.CROSS_BRACING IfcElementAssemblyTypeEnum.REINFORCEMENT_UNIT IfcElementAssemblyTypeEnum.BEAM_GRID IfcElementAssemblyTypeEnum.ARCH IfcElementAssemblyTypeEnum.SLAB_FIELD IfcElementAssemblyTypeEnum.PIER IfcElementAssemblyTypeEnum.RIGID_FRAME IfcElementAssemblyTypeEnum.GIRDER	IfcElementAssemblyTypeEnum.UMBRELLAVAULT IfcElementAssemblyTypeEnum.ENTRANCEWORKS IfcElementAssemblyTypeEnum.SUPPORTINGASSEMBLY IfcElementAssemblyTypeEnum.SUMPBUSTER IfcElementAssemblyTypeEnum.RAIL_MECHANICAL_EQUIPMENT_ASSEMBLY IfcElementAssemblyTypeEnum.MAST IfcElementAssemblyTypeEnum.TRACTION_SWITCHING_ASSEMBLY IfcElementAssemblyTypeEnum.SUSPENSIONASSEMBLY IfcElementAssemblyTypeEnum.SHELTER IfcElementAssemblyTypeEnum.TURNOUTPANEL IfcElementAssemblyTypeEnum.TRAFFIC_CALMING_DEVICE IfcElementAssemblyTypeEnum.GRID IfcElementAssemblyTypeEnum.SIGNALASSEMBLY

3.5.5.2 Predefined Type: UMBRELLAVAULT

Full Identifier: **IfcElementAssemblyTypeEnum.UMBRELLAVAULT**

A set of boreholes armed with high inertia tubes resting, on the one hand, on the advancement core (part of the ground not yet excavated at the front) and on the other hand, on a rigid support, placed behind the face.

Status: **Proposed**

Package: **Element assemblies**

Predefined Type Properties			
Predefined Type Container	IfcElementAssemblyTypeEnum	**Parent Entity**	IfcElementAssemblyType IfcElementAssembly
Stereotype	«PredefinedType»		
Property sets			

3.5.5.3 Predefined Type: DUCTBANK

Full Identifier: **IfcElementAssemblyTypeEnum.DUCTBANK**

A Duct Bank is two or more ducts or conduits used as part of a system.

A duct bank is designed to protect and group or consolidate data and electrical cables to and from a facility. The cables are laid in PVC pipes or conduits. These conduit are bundled together and protected with either steel or reinforced concrete casings.

Duct banks are often located underground. They can carry cables for all electrical wiring and data requirements in the facility as well as extra cables that are not for immediate use, but may be valuable for future requirements.

Status: **Proposed**

Package: **Element assemblies**

Predefined Type Properties			
Predefined Type Container	IfcElementAssemblyTypeEnum	**Parent Entity**	IfcElementAssemblyType IfcElementAssembly
Stereotype	«PredefinedType»		
Property sets			

3.5.6 Package: Geotechnical and geological concepts

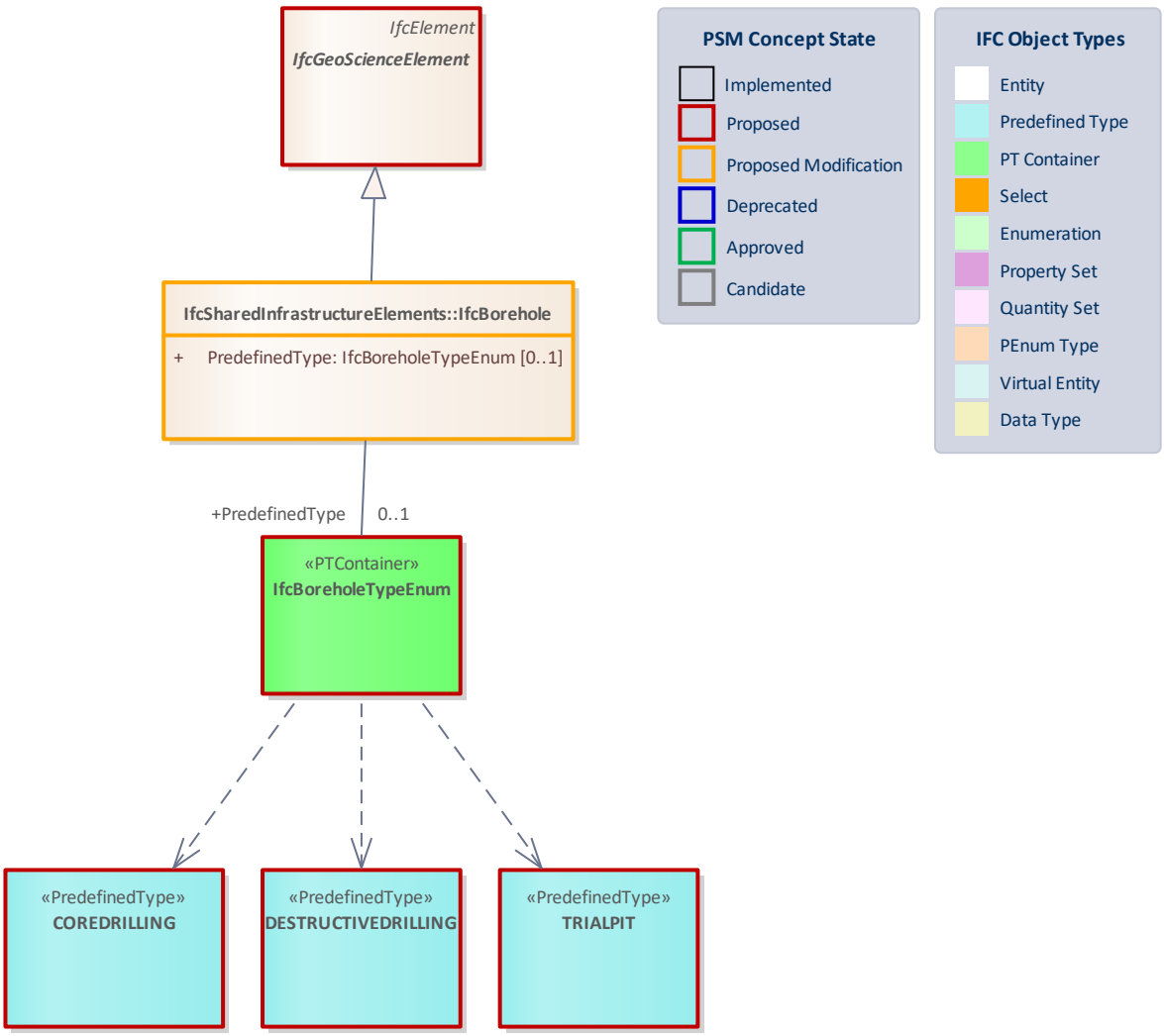


Figure 18: Borehole -

3.5.6.1 Class: IfcBorehole

Representation of the concept of a linear geological and geotechnical model, usually an interpretation but sometimes created direct from ground penetrating measurement

The assembly may contain one of more strata and other elements such as capping and lining. The contained subtypes of IfcGeotechnicalStratum will have shape representations made from straight or bent tubes reflecting the bore diameter, or discs if a 'Yabuki' top surface model is being used.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties

Status	ProposedModification	**Is Abstract**	
Property sets	Pset_BoreholeCommon		

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcBoreholeTypeEnum	[0..1]	Identifies the predefined type of a borehole. This type may associate additional specific property sets.

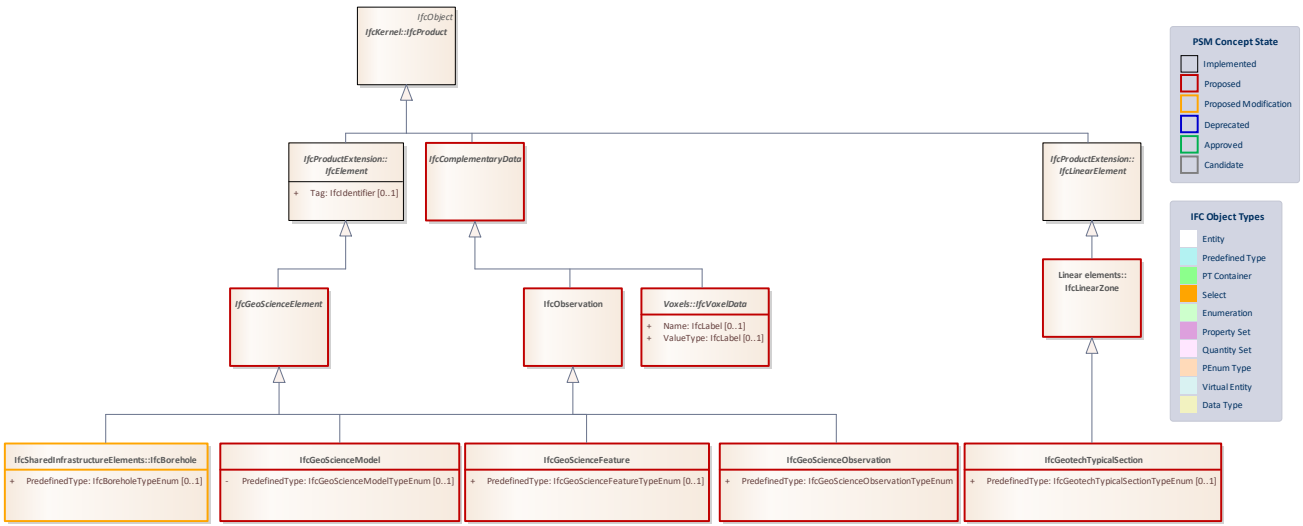


Figure 19: IFC Tunnel geoscience overview -

3.5.6.2 Class: IfcBorehole

Representation of the concept of a linear geological and geotechnical model, usually an interpretation but sometimes created direct from ground penetrating measurement

The assembly may contain one of more strata and other elements such as capping and lining. The contained subtypes of IfcGeotechnicalStratum will have shape representations made from straight or bent tubes reflecting the bore diameter, or discs if a 'Yabuki' top surface model is being used.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets	Pset_BoreholeCommon		

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcBoreholeTypeEnum	[0..1]	Identifies the predefined type of a borehole. This type may associate additional specific property sets.

3.5.6.3 Class: IfcVoxelData

Abstract class representing voxel data values that is assigned to _IfcProduct_ using the relationship _IfcRelAssignsToProduct_ and to a product representation, as _IfcVoxelGrid_, using _Representation_.

The number of values shall correspond to the number of voxels in the voxel grid.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcComplementaryData	
Subtypes	**EXISTING**	**PROPOSED**

		IfcVectorVoxelData IfcRealVoxelData IfcLogicalVoxelData IfcLabelVoxelData IfcIntegerVoxelData

Class Attributes

Name	Type	Multiplicity	Definition
Name	IfcLabel	[0..1]	An optional name for the IfcVoxelData
ValueType	IfcLabel	[0..1]	An optional value type used for the values defined in one of the subtypes. Only the names (as labels) of the types available in the IfcValue select type are allowed.

3.5.6.4 Class: IfcLinearZone

A linear zone is the generalization of all linear elements that may be used to define linear zones where the linear elements of the same types may overlap linearly. Typical examples are longitudinal zones along an alignment where each zone represents some information such as interpretations of the terrain or underground conditions or design parameters for e.g. a road-, railway- or tunnel section.

Status: **Proposed**

Package: **Linear elements**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearElement	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeotechTypicalSection

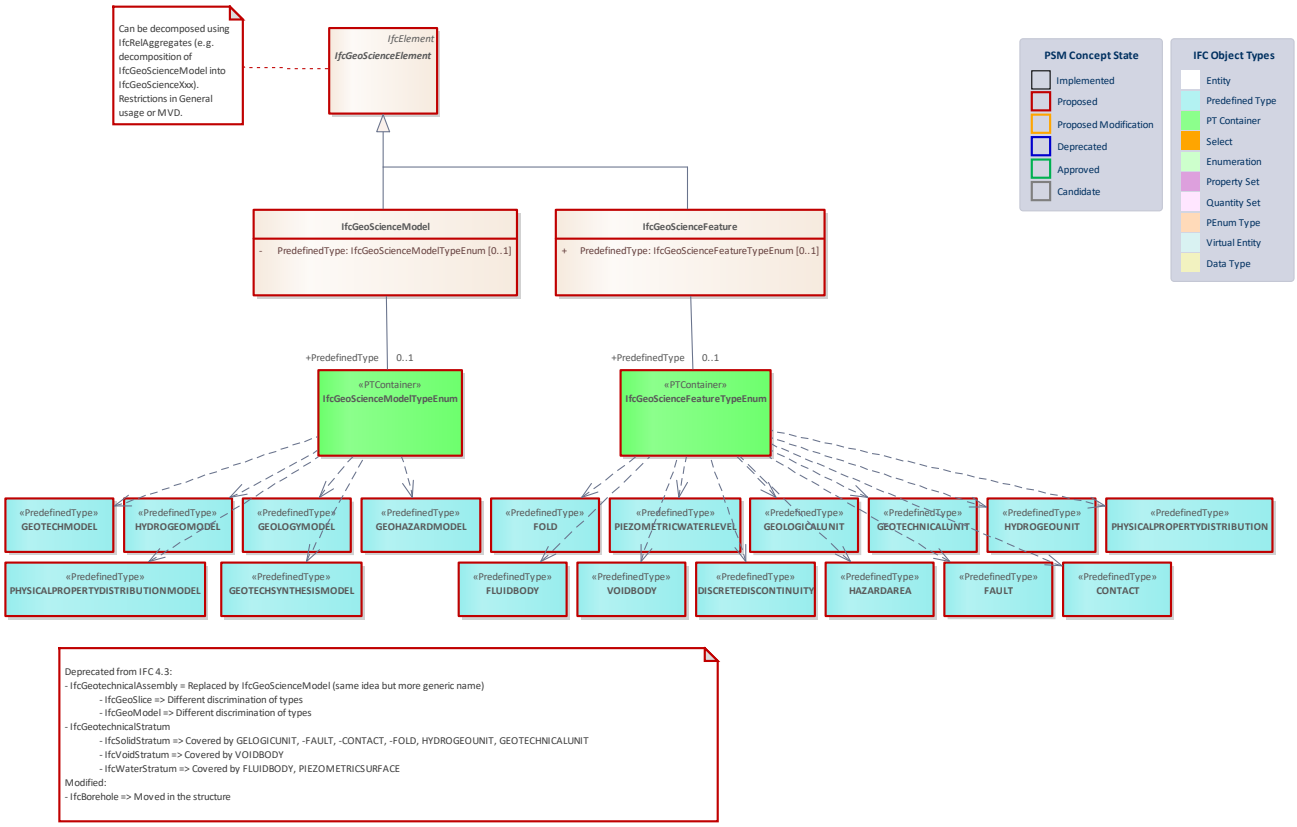


Figure 20: GeoScience elements -

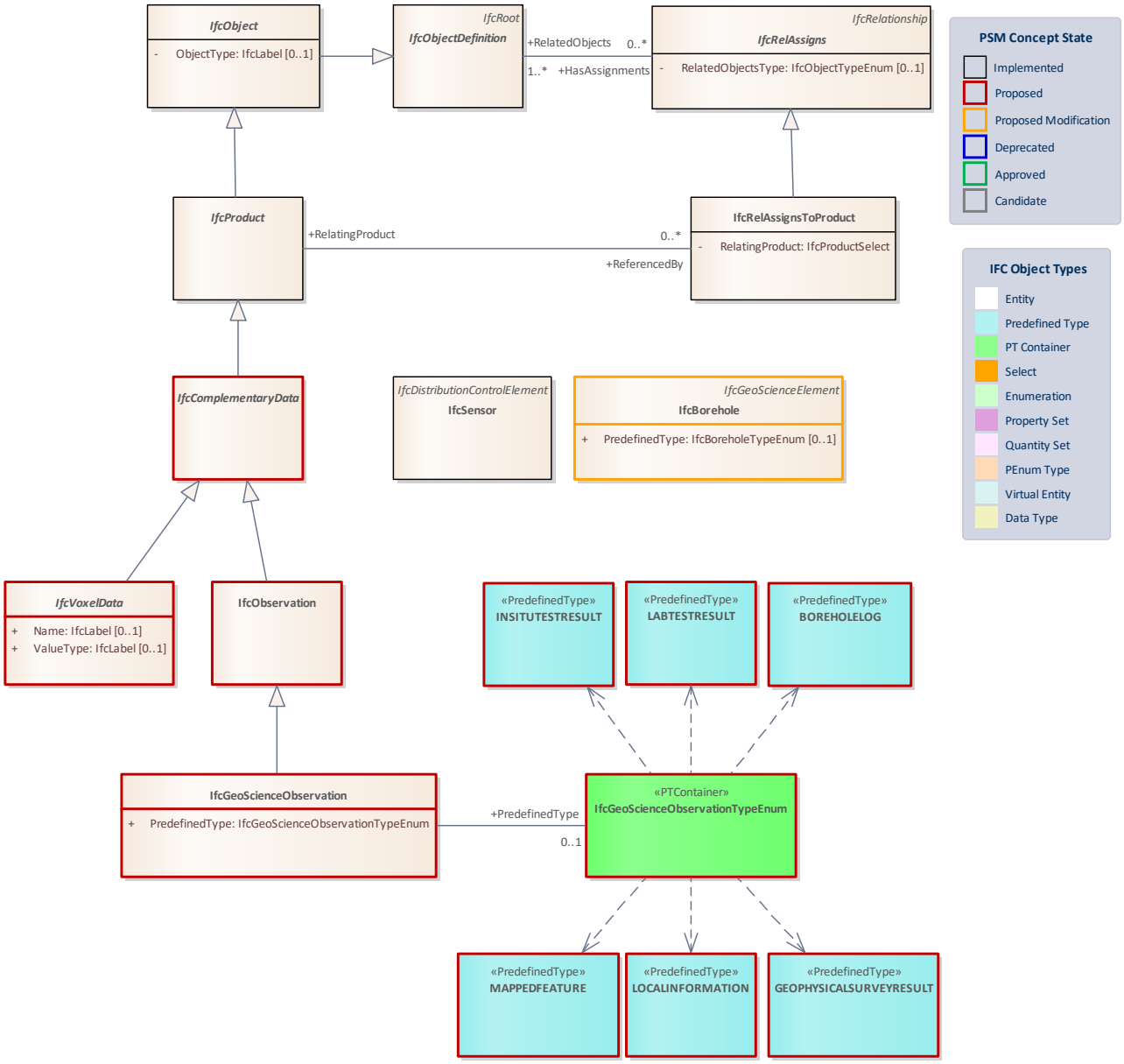


Figure 21: Observations -

3.5.6.5 Class: IfcBorehole

Representation of the concept of a linear geological and geotechnical model, usually an interpretation but sometimes created direct from ground penetrating measurement

The assembly may contain one of more strata and other elements such as capping and lining. The contained subtypes of IfcGeotechnicalStratum will have shape representations made from straight or bent tubes reflecting the bore diameter, or discs if a 'Yabuki' top surface model is being used.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets	Pset_BoreholeCommon		

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcBoreholeTypeEnum	[0..1]	Identifies the predefined type of a borehole. This type may associate additional specific property sets.

3.5.6.6 Class: IfcVoxelData

Abstract class representing voxel data values that is assigned to _IfcProduct_ using the relationship _IfcRelAssignsToProduct_ and to a product representation, as _IfcVoxelGrid_, using _Representation_.

The number of values shall correspond to the number of voxels in the voxel grid.

Status: **Proposed**

Package: **Voxels**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcComplementaryData	
Subtypes	**EXISTING**	**PROPOSED**

		IfcVectorVoxelData IfcRealVoxelData IfcLogicalVoxelData IfcLabelVoxelData IfcIntegerVoxelData

Class Attributes

Name	Type	Multiplicity	Definition
Name	IfcLabel	[0..1]	An optional name for the IfcVoxelData
ValueType	IfcLabel	[0..1]	An optional value type used for the values defined in one of the subtypes. Only the names (as labels) of the types available in the IfcValue select type are allowed.

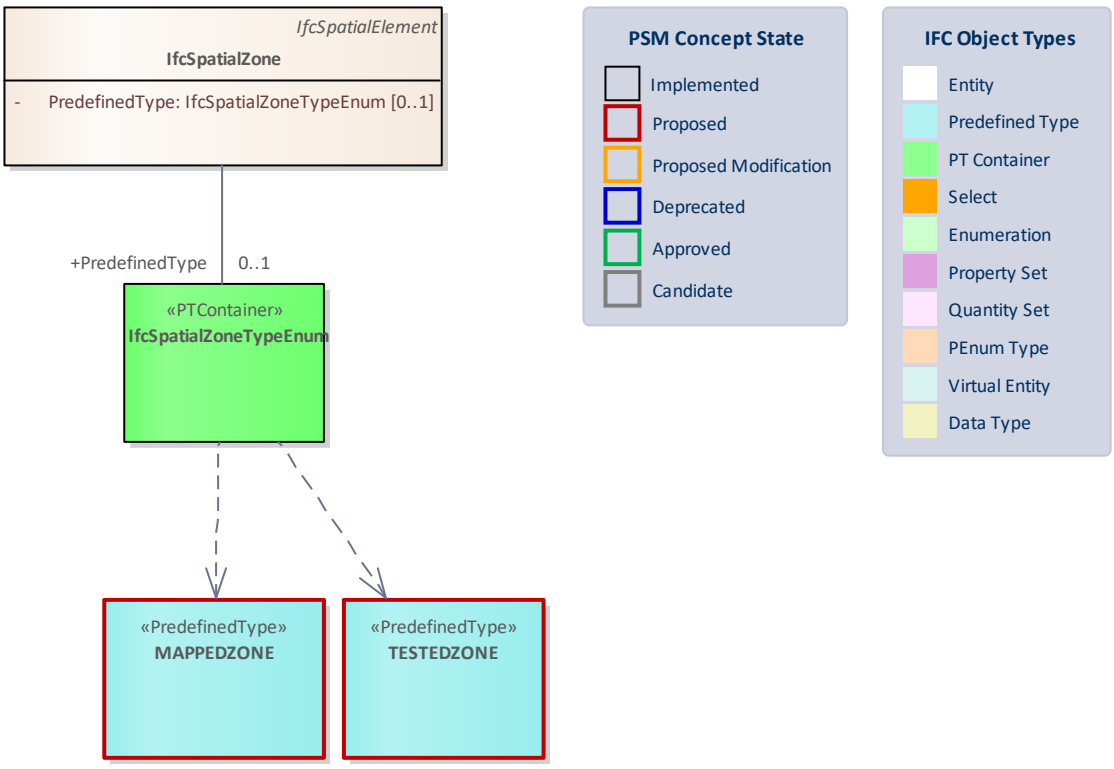


Figure 22: MappedZone/TestedZone - Package containing the added IFC concepts to cover geotechnical and geological requirements.

3.5.6.7 Predefined Type: MAPPEDZONE

Full Identifier: **IfcSpatialZoneTypeEnum.MAPPEDZONE**

A spatial zone used for collecting and recording observations of different kinds.

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.5.6.8 Predefined Type: TESTEDZONE

Full Identifier: **IfcSpatialZoneTypeEnum.TESTEDZONE**

A limited zone subjected to in situ tests. Space to carry the related information on test results, methodology and other metadata. Used similar to sample, but for In-situ test

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.5.6.9 PDT Container: IfcBoreholeTypeEnum

This enumeration defines the range of different types of boreholes that can further specify an _IfcBorehole_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties

Parent Entity	IfcBorehole	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcBoreholeTypeEnum.COREDRILLING IfcBoreholeTypeEnum.DESTRUCTIVEDRILLING IfcBoreholeTypeEnum.TRIALPIT	

3.5.6.10 Predefined Type: COREDRILLING

Full Identifier: **IfcBoreholeTypeEnum.COREDRILLING**

A drilling process in which borehole is performed by cutting out cylindrical rock or soil samples in the field, using a core barrel.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcBoreholeTypeEnum	**Parent Entity**	IfcBorehole
Stereotype	«PredefinedType»		
Property sets			

3.5.6.11 Predefined Type: DESTRUCTIVEDRILLING

Full Identifier: **IfcBoreholeTypeEnum.DESTRUCTIVEDRILLING**

A drilling process in which the boring is performed using destructive tools

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcBoreholeTypeEnum	**Parent Entity**	IfcBorehole
Stereotype	«PredefinedType»		

Property sets	

3.5.6.12 Predefined Type: TRIALPIT

Full Identifier: **IfcBoreholeTypeEnum.TRIALPIT**

An excavation made for the purpose of observing shallow subsurface conditions, performing field tests and obtaining soil samples.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcBoreholeTypeEnum	**Parent Entity**	IfcBorehole
Stereotype	«PredefinedType»		
Property sets			

3.5.6.13 Class: IfcComplementaryData

An abstract class for arbitrary data associated with another product using _IfcRelAssignsToProduct_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcProduct	
Subtypes	**EXISTING**	**PROPOSED**
		IfcObservation IfcVoxelData

3.5.6.14 Class: IfcGeoScienceElement

An abstract entity for geotechnical and geological concepts.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcElement	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeoScienceFeature IfcGeoScienceModel

3.5.6.15 Class: IfcGeoScienceFeature

Represents a geological or geotechnical feature as an interpretation of factual data such as observations, measurements and tests.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition

PredefinedType	IfcGeoScienceFeatureTypeEnum	[0..1]	Identifies the predefined type of a geoscience feature. This type may associate additional specific property sets.

3.5.6.16 PDT Container: IfcGeoScienceFeatureTypeEnum

This enumeration defines the range of different types of geoscience features that can further specify an _IfcGeoScienceFeatureTypeEnum_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceFeature	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceFeatureTypeEnum.HAZARDAREA IfcGeoScienceFeatureTypeEnum.HYDROGEOUNIT IfcGeoScienceFeatureTypeEnum.GEOLOGICALUNIT IfcGeoScienceFeatureTypeEnum.FAULT IfcGeoScienceFeatureTypeEnum.GEOTECHNICALUNIT IfcGeoScienceFeatureTypeEnum.FOLD IfcGeoScienceFeatureTypeEnum.FLUIDBODY IfcGeoScienceFeatureTypeEnum.CONTACT IfcGeoScienceFeatureTypeEnum.PIEZOMETRICWATERLEVEL IfcGeoScienceFeatureTypeEnum.DISCRETEDISCONTINUITY IfcGeoScienceFeatureTypeEnum.VOIDBODY IfcGeoScienceFeatureTypeEnum.PHYSICALPROPERTYDISTRIBUTION	

3.5.6.17 Predefined Type: CONTACT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.CONTACT**

OGC GeoSciML.Contact : A contact is a general concept representing any kind of surface separating two geologic units, including primary boundaries such as depositional contacts, all kinds of unconformities, intrusive contacts, and gradational contacts, as well as faults that separate geologic units.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.18 Predefined Type: DISCRETEDISCONTINUITY

Full Identifier: **IfcGeoScienceFeatureTypeEnum.DISCRETEDISCONTINUITY**

AFTES.GT1R1A1. Any interuption of the continuity in the rock material with its attendant mechanical, hydraulic and thermal properties.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.19 Predefined Type: FAULT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.FAULT**

OGC GeoSciML.ShearDisplacementStructure : A shear displacement structure includes all brittle to ductile style structures along which displacement has occurred, from a simple, single 'planar' brittle or ductile surface to a fault system comprised of tens of strands of both brittle and ductile nature. This structure may have some significant thickness (a deformation zone) and have an associated body of deformed rock that may be

considered a deformation unit (which geologicUnitType is 'DeformationUnit') which can be associated to the ShearDisplacementStructure using GeologicFeatureRelation from the GeoSciML Extension package

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.20 Predefined Type: FLUIDBODY

Full Identifier: **IfcGeoScienceFeatureTypeEnum.FLUIDBODY**

OGC GroundWaterML2.FluidBody : A distinct body of some fluid (liquid, gas) that fills the voids of a container such as an aquifer, system of aquifers, water well, etc. In hydrogeology this body is usually constituted by groundwater, but the model allows for other types of fillers e.g. petroleum.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.21 Predefined Type: FOLD

Full Identifier: **IfcGeoScienceFeatureTypeEnum.FOLD**

OGC GeoSciML.Fold : A fold is formed by one or more systematically curved layers, surfaces, or lines in a rock body. A fold denotes a structure formed by the deformation of a geologic structure, such as a contact which the original undeformed geometry is presumed, to form a structure that may be described by the translation of an abstract line (the fold axis) parallel to itself along some curvilinear path (the fold profile). Folds have a hinge zone (zone of maximum curvature along the surface) and limbs (parts of the deformed surface not in

the hinge zone). Folds are described by an axial surface, hinge line, profile geometry, the solid angle between the limbs, and the relationships between adjacent folded surfaces if the folded structure is a Layering fabric.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.22 Predefined Type: GEOLOGICALUNIT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.GEOLOGICALUNIT**

OGC GeoSciML.GeologicUnit : Conceptually, a GeologicUnit may represent a body of material in the Earth whose complete and precise extent is inferred to exist (e.g., North American Data Model GeologicUnit, Stratigraphic unit in the sense of NACSN, or International Stratigraphic Code), or a classifier used to characterize parts of the Earth (e.g. lithologic map unit like 'granitic rock' or 'alluvial deposit', surficial units like 'till' or 'old alluvium'). It includes both formal units (i.e. formally adopted and named in an official lexicon) and informal units (i.e. named but not promoted to a lexicon) and unnamed units (i.e., recognizable, described and delineable in the field but not otherwise formalised). In simpler terms, a geologic unit is a package of earth material (generally rock or soil).

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.23 Predefined Type: GEOTECHNICALUNIT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.GEOTECHNICALUNIT**

A surface or a volume in which the mechanical behaviour and other design-relevant characteristics are characterized using the same geotechnical parameters values. Several alternative classifications (=GeotechModels) can be required in a project for different design tasks.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.24 Predefined Type: HAZARDAREA

Full Identifier: **IfcGeoScienceFeatureTypeEnum.HAZARDAREA**

INSPIRE NaturalRiskZones.HazardArea : Discrete spatial objects representing a natural hazard.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.25 Predefined Type: HYDROGEOUNIT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.HYDROGEOUNIT**

OGC GroundWaterML2.HydroGeoUnit : Any soil or rock unit or zone that by virtue of its hydraulic properties has a distinct influence on the storage or movement of groundwater (after ANS, 1980).

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.26 Predefined Type: PHYSICALPROPERTYDISTRIBUTION

Full Identifier: **IfcGeoScienceFeatureTypeEnum.PHYSICALPROPERTYDISTRIBUTION**

Additional option (alternative to discrete models) to describe a +/- continuous spatial distribution of any physical parameter (geotechnical key-parameters, permeabilty, likelyhood of. e.g. a fault or any other uncertainty-related information)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.27 Predefined Type: PIEZOMETRICWATERLEVEL

Full Identifier: **IfcGeoScienceFeatureTypeEnum.PIEZOMETRICWATERLEVEL**

OGC GroundWaterML2.FluidBodySurface : A surface on a fluid body within a local or regional area, e.g. piezometric, potentiometric, water table, salt wedge, etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		

Property sets	

3.5.6.28 Predefined Type: VOIDBODY

Full Identifier: **IfcGeoScienceFeatureTypeEnum.VOIDBODY**

a discrete air filled geological feature, including caves and other voids

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

3.5.6.29 Class: IfcGeoScienceModel

Model of geological structured as considered relevant for the project, as a base for the definition of building- and design-related geotechnical models, hydrogeological models and GeoHazardModel

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	EXISTING	PROPOSED

Class Attributes

Name	Type	Multiplicity	Definition

PredefinedType	IfcGeoScienceModelTypeEnum	[0..1]	Identifies the predefined type of a geoscience model. This type may associate additional specific property sets.

3.5.6.30 PDT Container: IfcGeoScienceModelTypeEnum

This enumeration defines the range of different types of geoscience models that can further specify an _IfcGeoScienceModel_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceModel	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceModelTypeEnum.PHYSICALPROPERTYDISTRIBUTIONMODEL IfcGeoScienceModelTypeEnum.HYDROGEOMODEL IfcGeoScienceModelTypeEnum.GEOLOGYMODEL IfcGeoScienceModelTypeEnum.GEOTECHMODEL IfcGeoScienceModelTypeEnum.GEOTECHSYNTHESISMODEL IfcGeoScienceModelTypeEnum.GEOHAZARDMODEL	

3.5.6.31 Predefined Type: GEOHAZARDMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOHAZARDMODEL**

Model of natural ("geogenic") hazards like rock fall, avalanches, seismicity,...

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel

Stereotype	«PredefinedType»		
Property sets			

3.5.6.32 Predefined Type: GEOLOGYMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOLOGYMODEL**

Model of geological structured as considered relevant for the project, as a base for the definition of building- and design-related geotechnical models, hydrogeological models and GeoHazardModel

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

3.5.6.33 Predefined Type: GEOTECHMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOTECHMODEL**

Model with project and design-task specific geotechnical classification (e.g. material with similar characteristics regarding geomechanical properties or excavation)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

3.5.6.34 Predefined Type: GEOTECHSYNTHESISMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOTECHSYNTHESISMODEL**

Link between the design and modelled geology and geotechnical conditions:

summarized interpretation with regard to building, construction method,… in relation to a section of the alignment or building structure.

Typical definition of "baseline conditions" as usually included in a geotech. longitudinal section

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

3.5.6.35 Predefined Type: HYDROGEOMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.HYDROGEOMODEL**

Model of hydrogeological conditions with parameters like permeability and definition of boundary conditions for hydrogeological modelling

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

3.5.6.36 Predefined Type: PHYSICALPROPERTYDISTRIBUTIONMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.PHYSICALPROPERTYDISTRIBUTIONMODEL**

Additional option (alternative to discrete models) to describe a +/- continuous spatial distribution of any physical properties (geotechnical key-parameters, permeabilty, likelyhood of. e.g. a fault or any other uncertainty-related information)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

3.5.6.37 Class: IfcGeoScienceObservation

Detailed collected information, including measured parameters, descriptions etc related to geoscientific observations. that can be assigned to physical or spatial elements using _IfcRelAssignsToProduct_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcObservation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeoScienceObservationTypeEnum		Identifies the predefined type of a geoscience observation element. This type may associate additional specific property sets.

3.5.6.38 PDT Container: IfcGeoScienceObservationTypeEnum

This enumeration defines the range of different types of geoscience observations that can further specify an _IfcGeoScienceObservation_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceObservation	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE IfcGeoScienceObservationTypeEnum.LOCALINFORMATION IfcGeoScienceObservationTypeEnum.GEOPHYSICALSURVEYRESULT IfcGeoScienceObservationTypeEnum.INSITUTESTRESULT IfcGeoScienceObservationTypeEnum.LABTESTRESULT IfcGeoScienceObservationTypeEnum.BOREHOLELOG	

3.5.6.39 Predefined Type: BOREHOLELOG

Full Identifier: **IfcGeoScienceObservationTypeEnum.BOREHOLELOG**

Any kind of observation or measurement result related to intervals or points on the borehole axis

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

3.5.6.40 Predefined Type: GEOPHYSICALSURVEYRESULT

Full Identifier: **IfcGeoScienceObservationTypeEnum.GEOPHYSICALSURVEYRESULT**

A systematic collection of geophysical data that was gathered either at or near the ground surface or by using boreholes and measuring the whole volume in between (crosshole).

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

3.5.6.41 Predefined Type: INSITUTESTRESULT

Full Identifier: **IfcGeoScienceObservationTypeEnum.INSITUTESTRESULT**

Result from a test carried out on site directly in place, e.g. in a borehole, a gallery or from the surface.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

3.5.6.42 Predefined Type: LABTESTRESULT

Full Identifier: **IfcGeoScienceObservationTypeEnum.LABTESTRESULT**

Result from a test on a rock/soil (geologic) or fluid specimen carried out in a laboratory

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

3.5.6.43 Predefined Type: LOCALINFORMATION

Full Identifier: **IfcGeoScienceObservationTypeEnum.LOCALINFORMATION**

Other observations made locally (e.g. at a point) such as discontinuities, water inflow, weathering, rockburst etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

3.5.6.44 Predefined Type: MAPPEDFEATURE

Full Identifier: **IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE**

Distinctly mapped structures that have been observed on MappedZones such as lineation, fold axis, discontinuity surfaces etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties

Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

3.5.6.45 Class: IfcGeotechTypicalSection

Interval along the tunnel axis with similar ground conditions, as part of the GeotechSynthesis model that represents the connection between the ground model and the building. Includes key-properties like expected sidtribution of ground types (reference to GeotechUnits) and baseline-definition of expected ground conditions and potential hazards, and may also include key-information on design like excavation measures, distribution of support types etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearZone	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeotechTypicalSectionTypeEnum	[0..1]	Identifies the predefined type of a geostech typical section. This type may associate additional specific property sets.

3.5.6.46 PDT Container: IfcGeotechTypicalSectionTypeEnum

This enumeration defines the range of different types of geotech typical sections that can further specify an _IfcGeotechTypicalSection_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeotechTypicalSection	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	

3.5.6.47 Class: IfcObservation

A generic representation of an observation that can be assigned to another product using _IfcRelAssignsToProduct_

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcComplementaryData	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeoScienceObservation

3.6 Package: Spatial elements

This package contains concepts that represent spatial elements and relationships that might be used to define a hierarchical project structure, in terms of locations and volumes. In addition, this package addresses the definition of common non-hierarchal elements such as spatial zones. The spatial structure is key to the organization of physical elements and also can act as an implicit placement structure within non-longitudinal structures.

3.6.1 Package: Spatial zones

This package contains elements participating in a non-hierarchical and potentially overlapping spatial decomposition of the project under some functional consideration.

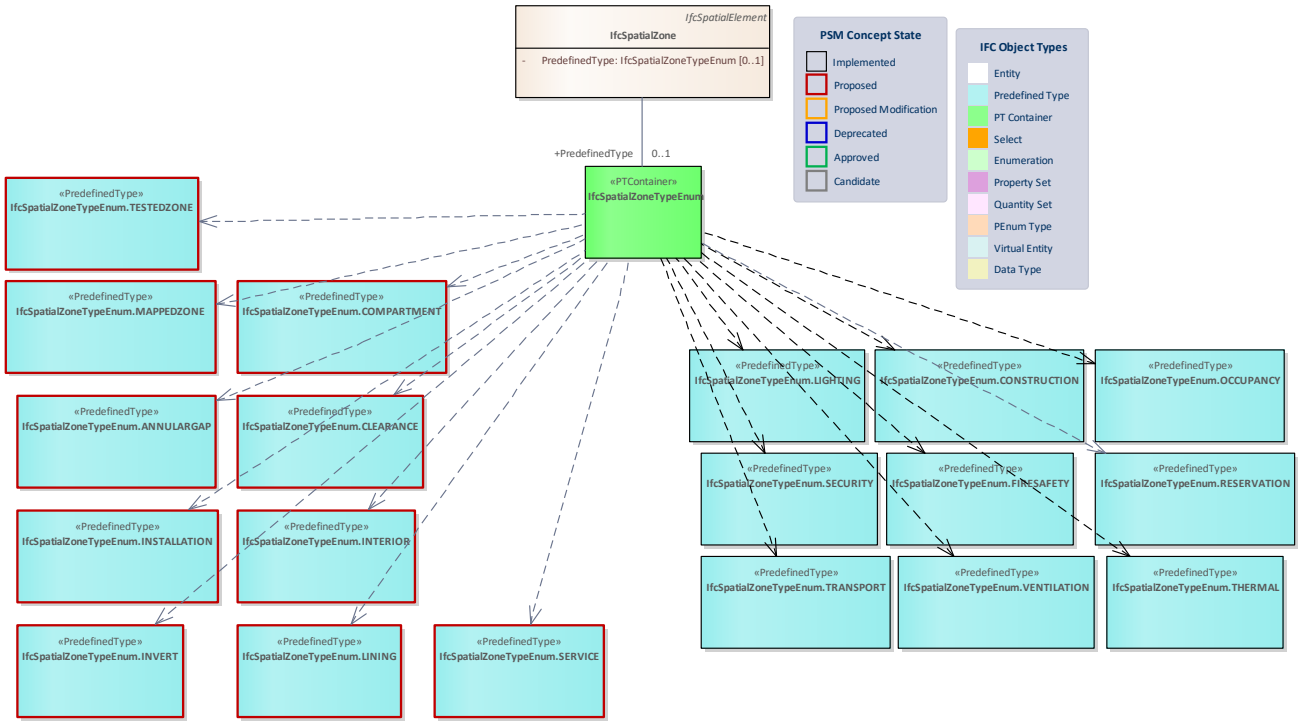


Figure 23: Spatial zones -

3.6.1.1 Predefined Type: TESTEDZONE

Full Identifier: **IfcSpatialZoneTypeEnum.TESTEDZONE**

A limited zone subjected to in situ tests. Space to carry the related information on test results, methodology and other metadata. Used similar to sample, but for In-situ test

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.2 Predefined Type: COMPARTMENT

Full Identifier: **IfcSpatialZoneTypeEnum.COMPARTMENT**

<<ToDo: Definition. Comes from teh need to describe the different compartments achieved in tunneling using cut-off>>

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.3 Predefined Type: MAPPEDZONE

Full Identifier: **IfcSpatialZoneTypeEnum.MAPPEDZONE**

A spatial zone used for collecting and recording observations of different kinds.

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.4 Predefined Type: INSTALLATION

Full Identifier: **IfcSpatialZoneTypeEnum.INSTALLATION**

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.5 Predefined Type: INVERT

Full Identifier: **IfcSpatialZoneTypeEnum.INVERT**

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.6 Predefined Type: CLEARANCE

Full Identifier: **IfcSpatialZoneTypeEnum.CLEARANCE**

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		

Property sets	

3.6.1.7 Predefined Type: SERVICE

Full Identifier: **IfcSpatialZoneTypeEnum.SERVICE**

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.8 Predefined Type: INTERIOR

Full Identifier: **IfcSpatialZoneTypeEnum.INTERIOR**

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.9 Predefined Type: LINING

Full Identifier: **IfcSpatialZoneTypeEnum.LINING**

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.1.10 Predefined Type: ANNULARGAP

Full Identifier: **IfcSpatialZoneTypeEnum.ANNULARGAP**

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

3.6.2 Package: Spatial structure

Spatial elements that might be used to define a spatial structure. That spatial structure is often used to provide a project structure to organize a building project.

3.6.2.1 Package: Spaces

Spaces represent areas or volumes bounded actually or theoretically. Spaces are areas or volumes that provide for certain functions within a facility, facility part or building storey and is part of the hierarchical and non-overlapping spatial structure.

For IFC Tunnel, no space types were added. The diagram shows existing spaces plus the IFC 4.3 concept for defining a kinematic envelope.

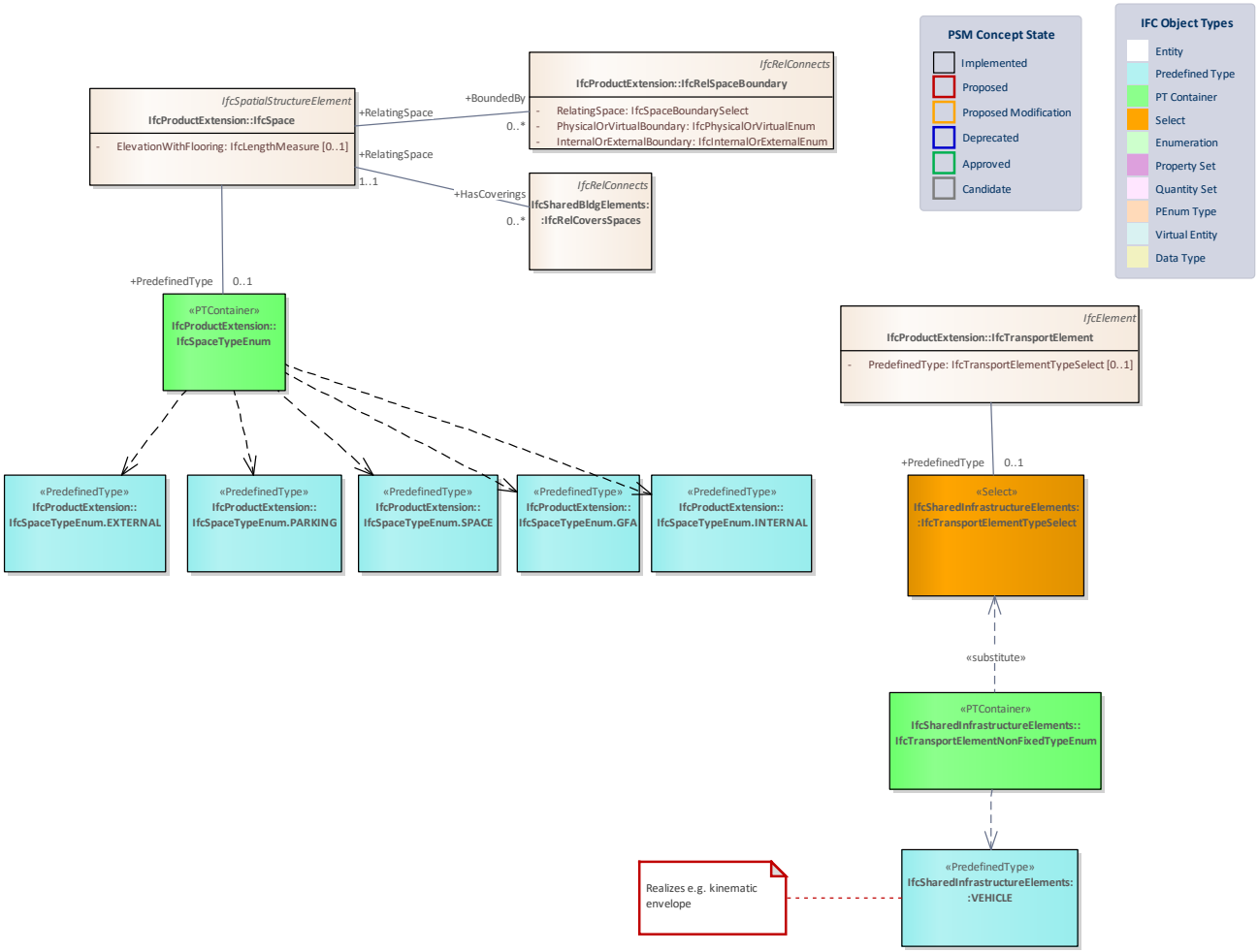


Figure 24: Spaces -

3.6.2.2 Package: Facility parts

Facility parts represent the further sub-division of facilities in managed and location based parts or volumes. each of these parts also have a mid level functional requirement in relation to their parent facility.

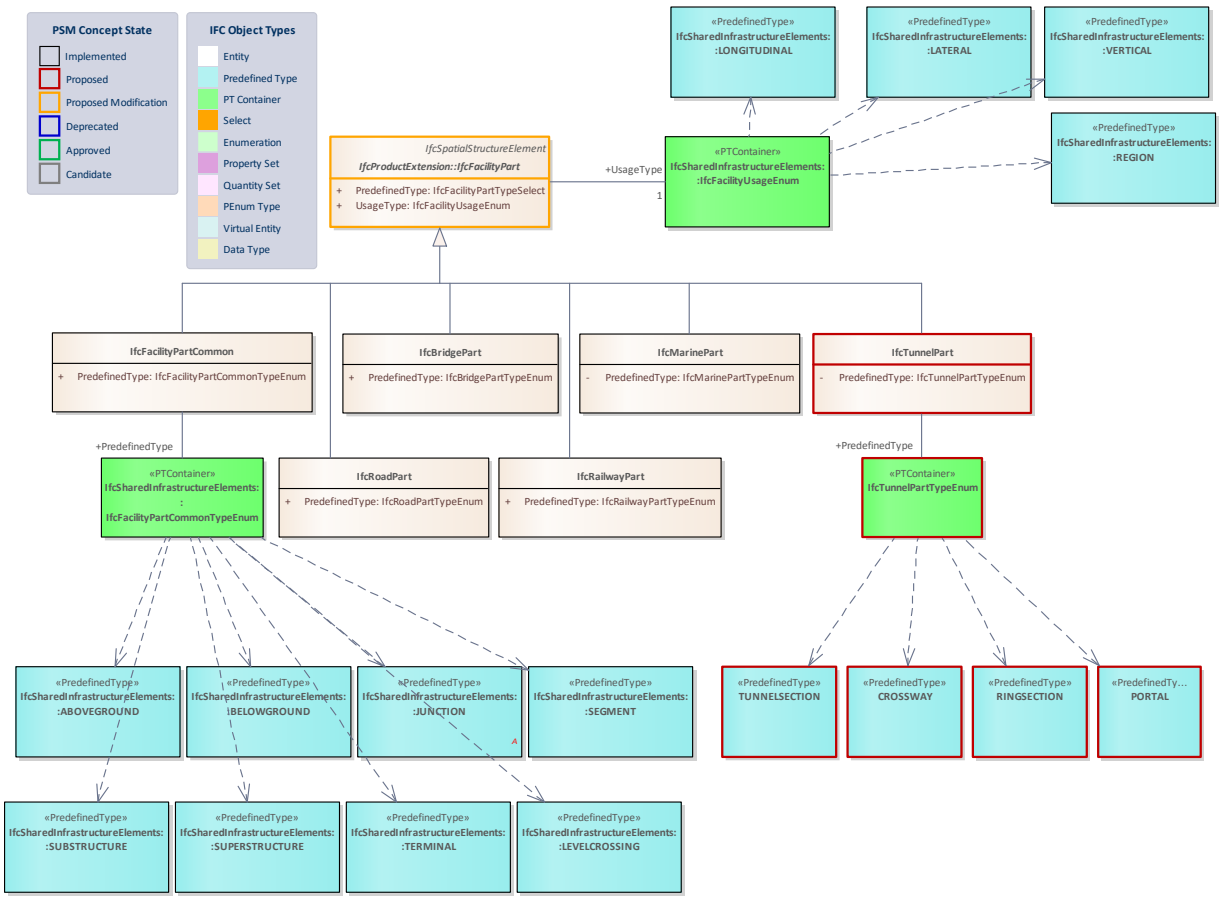


Figure 25: Facility parts -

3.6.2.2.1 Class: IfcFacilityPart

IfcFacilityPart provides for spatial breakdown of built facilities. It may be further specialised according to the type of facility being broken down.

bSI Documentation

Status: **ProposedModification**

Package: **IfcProductExtension**

Class Properties			
Status	ProposedModification	**Is Abstract**	Abstract
Property sets	Qto_FacilityPartBaseQuantities		

Inheritance Statement

Subtype Of	IfcSpatialStructureElement	
Subtypes	**EXISTING**	**PROPOSED**
	IfcFacilityPartCommon IfcBridgePart IfcMarinePart IfcRoadPart IfcRailwayPart	IfcTunnelPart

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcFacilityPartTypeSelect		
UsageType	IfcFacilityUsageEnum		

3.6.2.2.2 Class: IfcTunnelPart

Status: **Proposed**

Package: **Facility parts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcFacilityPart	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcTunnelPartTypeEnum		

3.6.2.2.3 PDT Container: IfcTunnelPartTypeEnum

Predefined types for IfcFacilityPart concernning tunnel facilities.

Status: **Proposed**

Package: **Facility parts**

Container Properties			
Parent Entity	IfcTunnelPart	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcTunnelPartTypeEnum.TUNNELSECTION IfcTunnelPartTypeEnum.RINGSECTION/ROUND IfcTunnelPartTypeEnum.PORTAL IfcTunnelPartTypeEnum.CROSSWAY	

3.6.2.2.4 Predefined Type: CROSSWAY

Full Identifier: **IfcTunnelPartTypeEnum.CROSSWAY**

A place in a tunnel system where several routes meet, link or cross each other.

The use of this type shall be accompanied by UsageType=.LONGITUDINAL.

Status: **Proposed**

Package: **Facility parts**

Predefined Type Properties			
Predefined Type Container	IfcTunnelPartTypeEnum	**Parent Entity**	IfcFacilityPart IfcTunnelPart
Stereotype	«PredefinedType»		
Property sets			

3.6.2.2.5 Predefined Type: PORTAL

Full Identifier: **IfcTunnelPartTypeEnum.PORTAL**

The longitudinal section which is the entrance to or exit from a tunnel.

The use of this type shall be accompanied by UsageType=.LONGITUDINAL.

Status: **Proposed**

Package: **Facility parts**

Predefined Type Properties			
Predefined Type Container	IfcTunnelPartTypeEnum	**Parent Entity**	IfcFacilityPart IfcTunnelPart
Stereotype	«PredefinedType»		
Property sets			

3.6.2.2.6 Predefined Type: RINGSECTION

Full Identifier: **IfcTunnelPartTypeEnum.RINGSECTION/ROUND**

A longitudinal section corresponding to a ring as used in segmental lining in the context of mechanized tunneling.

The use of this type shall be accompanied by UsageType=.LONGITUDINAL.

Status: **Proposed**

Package: **Facility parts**

Predefined Type Properties			
Predefined Type Container	IfcTunnelPartTypeEnum	**Parent Entity**	IfcFacilityPart IfcTunnelPart
Stereotype	«PredefinedType»		
Property sets			

3.6.2.2.7 Predefined Type: TUNNELSECTION

Full Identifier: **IfcTunnelPartTypeEnum.TUNNELSECTION**

A longitudinal section of a tunnel of an arbitrary length.

The use of this type shall be accompanied by UsageType=.LONGITUDINAL.

Status: **Proposed**

Package: **Facility parts**

Predefined Type Properties			
Predefined Type Container	IfcTunnelPartTypeEnum	**Parent Entity**	IfcFacilityPart IfcTunnelPart
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3 Package: Facilities

Package for defining the IFC Tunnel facility.

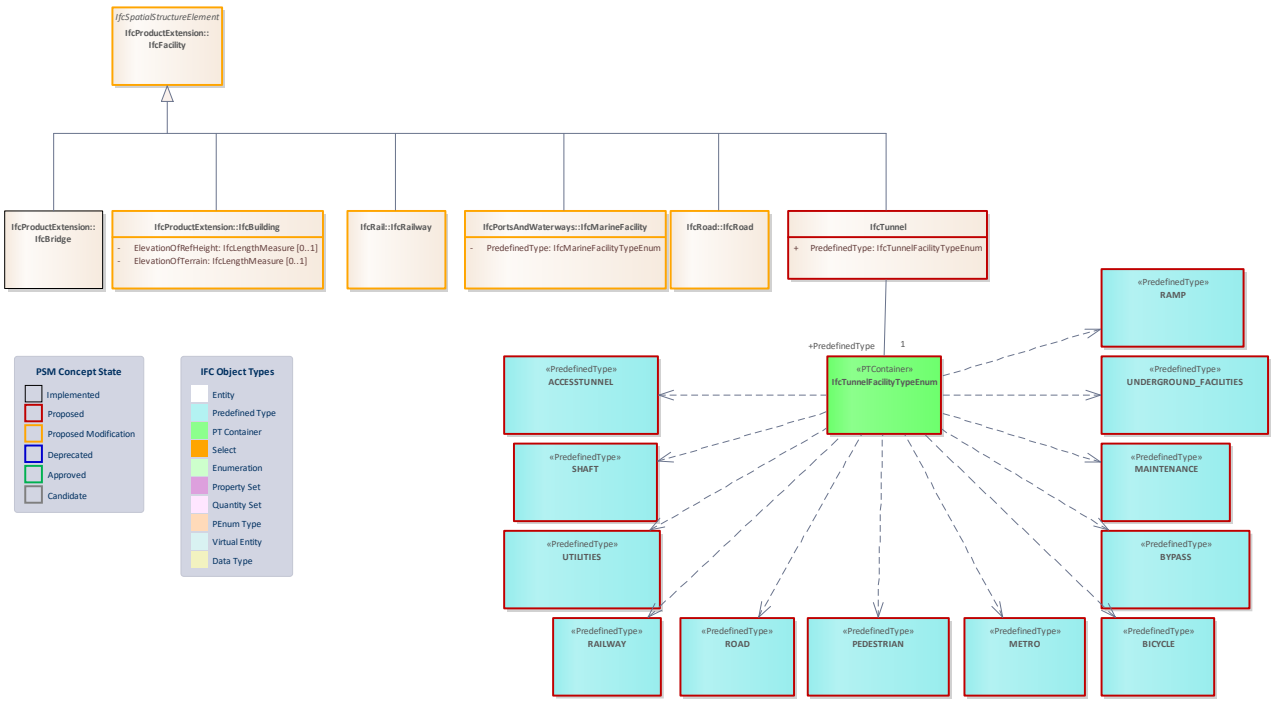


Figure 26: Facilities -

3.6.2.3.1 Class: IfcMarineFacility

A marine facility represents any major structure or entity that is specific to the ports and waterways domain. examples of this include quays, jetties, shipyards, breakwaters etc.

Status: **ProposedModification**

Package: **IfcPortsAndWaterways**

Class Properties

Status	ProposedModification	**Is Abstract**	
Property sets	Pset_MarineFacilityTransportation Qto_MarineFacilityBaseQuantities		

Inheritance Statement		
Subtype Of	IfcFacility	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcMarineFacilityTypeEnum		Identifies the predefined type of a marine facility from which the type modelled, may be set. This type may associate additional specific property sets.

3.6.2.3.2 Class: IfcBuilding

A building represents a structure that provides shelter for its occupants or contents and stands in one place. The building is also used to provide a basic element within the spatial structure hierarchy for the components of a building project (together with site, storey, and space).

NOTE Definition from ISO 6707-1:

Construction work that has the provision of shelter for its occupants or contents as one of its main purpose and is normally designed to stand permanently in one place.

A building is (if specified) associated to a site. A building may span over several connected or disconnected buildings. Therefore building complex provides for a collection of buildings included in a site. A building can also be decomposed in (vertical) parts, where each part defines a building section. This is defined by the composition type attribute of the supertype *IfcSpatialStructureElements* which is interpreted as follow:

- **COMPLEX**: building complex
- **ELEMENT**: building
- **PARTIAL**: building section

The IfcBuilding is used to build the spatial structure of a building (that serves as the primary project breakdown and is required to be hierarchical). The spatial structure elements are linked together by using the objectified relationship IfcRelAggregates. Figure 150 shows the IfcBuilding as part of the spatial structure. It also serves as the spatial container for building and other elements.

NOTE Detailed requirements on mandatory element containment and placement structure relationships are given in view definitions and implementer agreements.

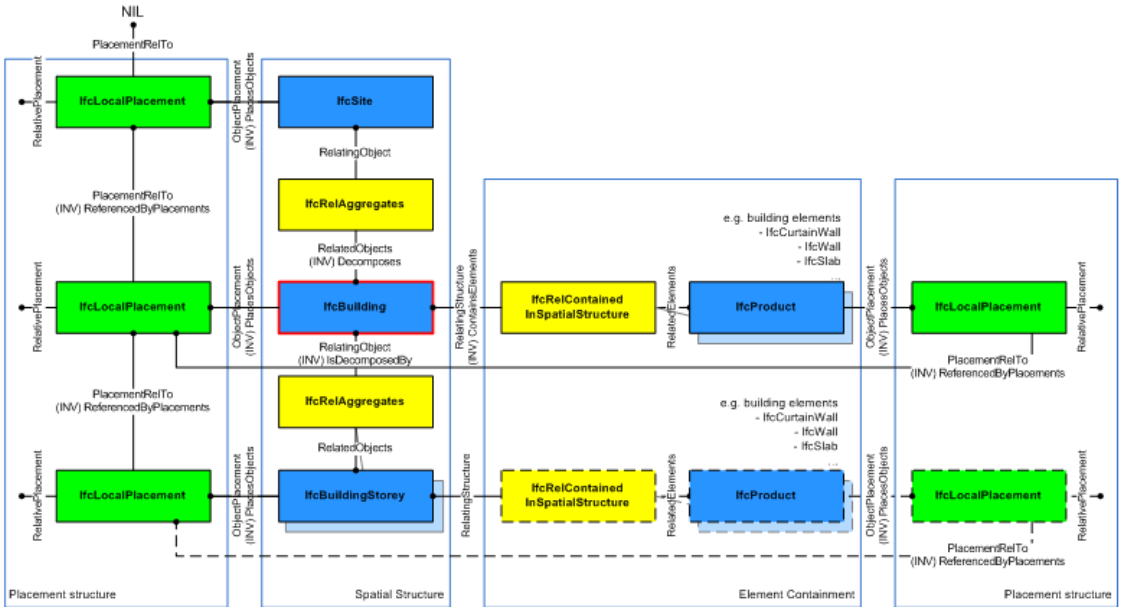


Figure 150 — Building composition

Systems, such as building service or electrical distribution systems, zonal systems, or structural analysis systems, relate to IfcBuilding by using the objectified relationship IfcRelReferencedInSpatialStructure.

Figure 151 describes the heights and elevations of the IfcBuilding . It is used to provide the height above sea level of the project height datum for this building, that is, the internal height 0.00. The height 0.00 is often used as a building internal reference height and equal to the floor finish level of the ground floor.

- base elevation of building provided by: *IfcBuilding.ElevationOfRefHeight*, it is usually the top of construction slab.
- base elevation of terrain at the perimeter of the building provided by: *IfcBuilding.ElevationOfTerrain*, it is usually the minimum elevation is sloped terrain
- total height of building, also referred to as ridge height (top of roof structure, e.g the ridge against terrain): provided by BaseQuantity with Name="TotalHeight"

- eaves height of building (base of roof structure, e.g the eaves against terrain): provided by BaseQuantity with Name="EavesHeight"

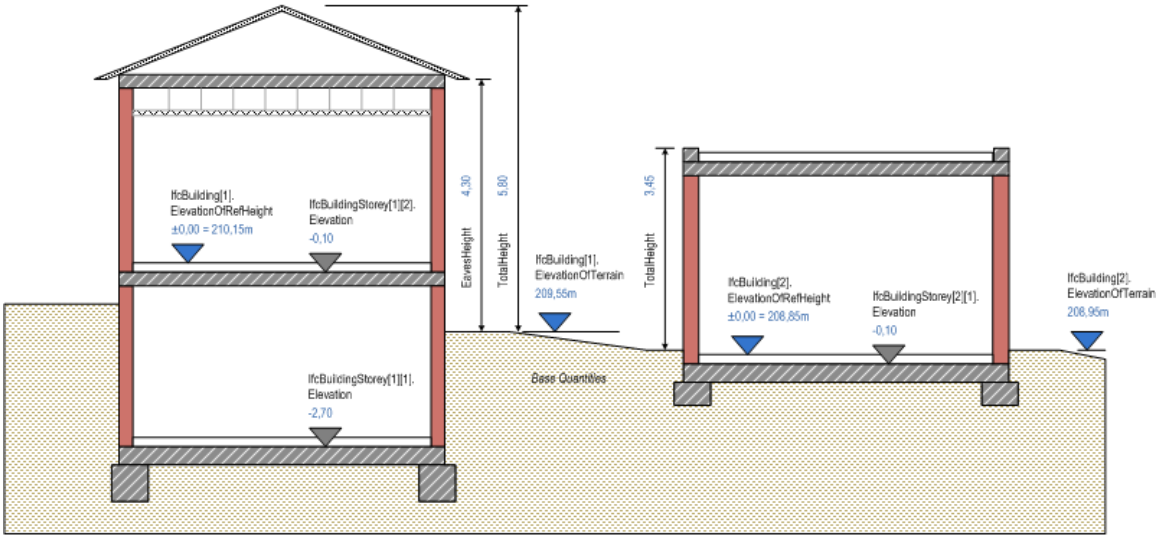


Figure 2 — Building elevations

HISTORY New entity in IFC1.0.

bSI Documentation

Status: **ProposedModification**

Package: **IfcProductExtension**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcFacility	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
ElevationOfRefHeight	IfcLengthMeasure	[0..1]	Elevation above sea level of the reference height used for all storey elevation measures, equals to height 0.0. It is usually the ground floor level.
ElevationOfTerrain	IfcLengthMeasure	[0..1]	Elevation above the minimal terrain level around the foot print of the building, given in elevation above sea level.

3.6.2.3.3 Class: IfcFacility

A Facility (derived from SpatialStructureElement) may be an IfcBuilding, an IfcBridge, an IfcRailway, an IfcRoad, an IfcMarineFacility (or any other type of built facility defined in the future, such as REMOVE{IfcRoad, IfcRailway and} IfcTunnel).

bSI Documentation

Status: **ProposedModification**

Package: **IfcProductExtension**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcSpatialStructureElement	
Subtypes	**EXISTING**	**PROPOSED**
	IfcBridge	IfcTunnel

3.6.2.3.4 Class: IfcRailway

An IfcRailway is a spatial structure element as a route from one location to another for guided passage of wheeled vehicles on rails. An IfcRailway acts as a basic spatial structure element that supports to break down a railway project into manageable parts.

Note: Definition according to ISO 6706: 2017: national or regional transport system for guided passage of wheeled vehicles on rails.

Status: **ProposedModification**

Package: **IfcRail**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets	Pset_RailwayPowerSupplyFacility Pset_RailwayFacility Pset_RailwayEnergyFacility		

Inheritance Statement		
Subtype Of	IfcFacility	
Subtypes	**EXISTING**	**PROPOSED**

3.6.2.3.5 Class: IfcRoad

A route built on land to allow travel from one location to another, including highways, streets, cycle and foot paths, but excluding railways. As a type of Facility, Road provides the basic element in the project structure hierarchy for the components of a road project (i.e. any undertaking such as design, construction or maintenance).

NOTE Definition from ISO 6707-1: Way mainly for vehicles.

NOTE Definition from PIARC: Line of communication (travelled way) using a stabilized base other than rails or air strips, primarily for the use of road motor vehicles running on their own wheel.

Status: **ProposedModification**

Package: **IfcRoad**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcFacility	
Subtypes	**EXISTING**	**PROPOSED**

3.6.2.3.6 Predefined Type: UNDERGROUND_FACILITIES

Full Identifier: **IfcTunnelFacilityTypeEnum.UNDERGROUND_FACILITIES**

A tunnel mainly built for other underground facilities.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.7 Predefined Type: MAINTENANCE

Full Identifier: **IfcTunnelFacilityTypeEnum.MAINTENANCE**

A tunnel mainly built to enable tunnel maintenance.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.8 Predefined Type: ROAD

Full Identifier: **IfcTunnelFacilityTypeEnum.ROAD**

A tunnel mainly built for road traffic.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.9 Predefined Type: RAILWAY

Full Identifier: **IfcTunnelFacilityTypeEnum.RAILWAY**

A tunnel mainly built for railway traffic.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.10 Predefined Type: PEDESTRIAN

Full Identifier: **IfcTunnelFacilityTypeEnum.PEDESTRIAN**

A tunnel mainly built for pedestrians.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.11 Predefined Type: METRO

Full Identifier: **IfcTunnelFacilityTypeEnum.METRO**

A tunnel mainly built for metro traffic.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.12 Predefined Type: BICYCLE

Full Identifier: **IfcTunnelFacilityTypeEnum.BICYCLE**

A tunnel mainly built for bicycle traffic.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.13 Predefined Type: ACCESSTUNNEL

Full Identifier: **IfcTunnelFacilityTypeEnum.ACCESSTUNNEL**

Passage from surface to areas of underground excavation

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.14 PDT Container: IfcTunnelFacilityTypeEnum

Predefined types for IfcTunnel.

Status: **Proposed**

Package: **Facilities**

Container Properties			
Parent Entity	IfcTunnel	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcTunnelFacilityTypeEnum.SHAFT IfcTunnelFacilityTypeEnum.PEDESTRIAN IfcTunnelFacilityTypeEnum.ROAD IfcTunnelFacilityTypeEnum.RAILWAY IfcTunnelFacilityTypeEnum.MAINTENANCE IfcTunnelFacilityTypeEnum.UNDERGROUND_FACILITIES IfcTunnelFacilityTypeEnum.METRO IfcTunnelFacilityTypeEnum.ACCESSTUNNEL IfcTunnelFacilityTypeEnum.BYPASS IfcTunnelFacilityTypeEnum.BICYCLE IfcTunnelFacilityTypeEnum.UTILITIES IfcTunnelFacilityTypeEnum.RAMP	

3.6.2.3.15 Class: IfcTunnel

An artificial underground passage, especially one built through a hill or under a building, road, or river.

NOTE Definition from PIARC : Long enclosed transport route.

Status: **Proposed**

Package: **Facilities**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcFacility	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcTunnelFacilityTypeEnum		

3.6.2.3.16 Predefined Type: BYPASS

Full Identifier: **IfcTunnelFacilityTypeEnum.BYPASS**

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.17 Predefined Type: UTILITIES

Full Identifier: **IfcTunnelFacilityTypeEnum.UTILITIES**

A tunnel built for utilities such as water, gas or high voltage transmission.

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.18 Predefined Type: RAMP

Full Identifier: **IfcTunnelFacilityTypeEnum.RAMP**

A tunnel connecting tunnels at different levels or a tunnel with the above ground

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		
Property sets			

3.6.2.3.19 Predefined Type: SHAFT

Full Identifier: **IfcTunnelFacilityTypeEnum.SHAFT**

an underground vertical or inclined passageway

Status: **Proposed**

Package: **Facilities**

Predefined Type Properties			
Predefined Type Container	IfcTunnelFacilityTypeEnum	**Parent Entity**	IfcTunnel
Stereotype	«PredefinedType»		

Property sets	

3.7 Package: Systems

This package contains systems that organize related parts which are composed for a common purpose or function or to provide a service. Systems are functionally related aggregations of products.

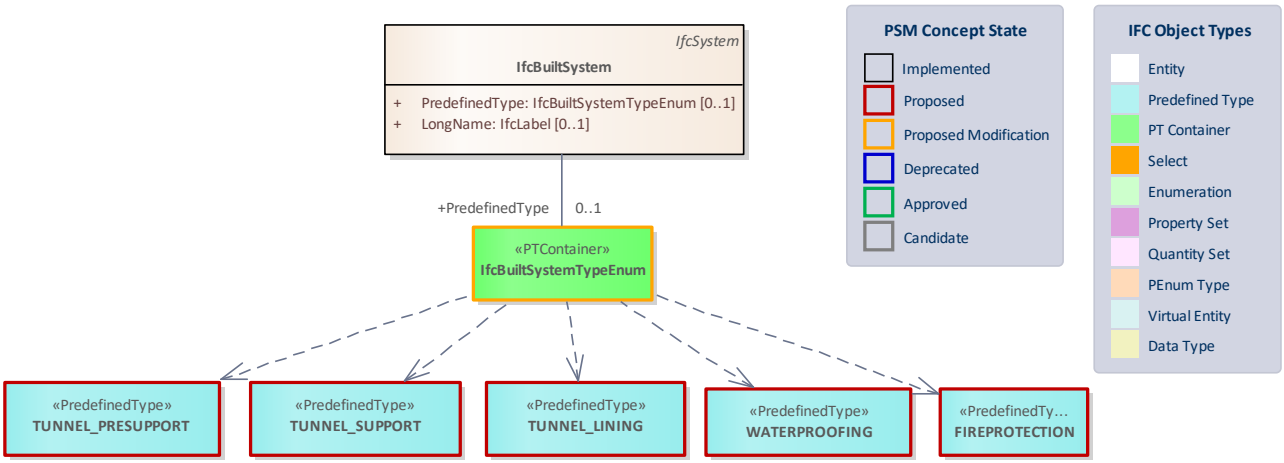


Figure 27: IfcBuiltSystem -

3.7.1 PDT Container: IfcBuiltSystemTypeEnum

This enumeration identifies different types of built systems.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Container Properties			
Parent Entity	IfcBuiltSystem	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcBuiltSystemTypeEnum.FIREPROTECTION IfcBuiltSystemTypeEnum.SHADING IfcBuiltSystemTypeEnum.MOORINGSYSTEM IfcBuiltSystemTypeEnum.OUTERSHELL IfcBuiltSystemTypeEnum.TUNNEL_PRESUPPORT IfcBuiltSystemTypeEnum.TRANSPORT	

		IfcBuiltSystemTypeEnum.FOUNDATION IfcBuiltSystemTypeEnum.TUNNEL_SUPPORT IfcBuiltSystemTypeEnum.PRESTRESSING IfcBuiltSystemTypeEnum.LOADBEARING IfcBuiltSystemTypeEnum.TUNNEL_LINING IfcBuiltSystemTypeEnum.REINFORCING IfcBuiltSystemTypeEnum.EROSIONPREVENTION IfcBuiltSystemTypeEnum.TRACKCIRCUIT IfcBuiltSystemTypeEnum.WATERPROOFING IfcBuiltSystemTypeEnum.MOORING IfcBuiltSystemTypeEnum.FENESTRATION

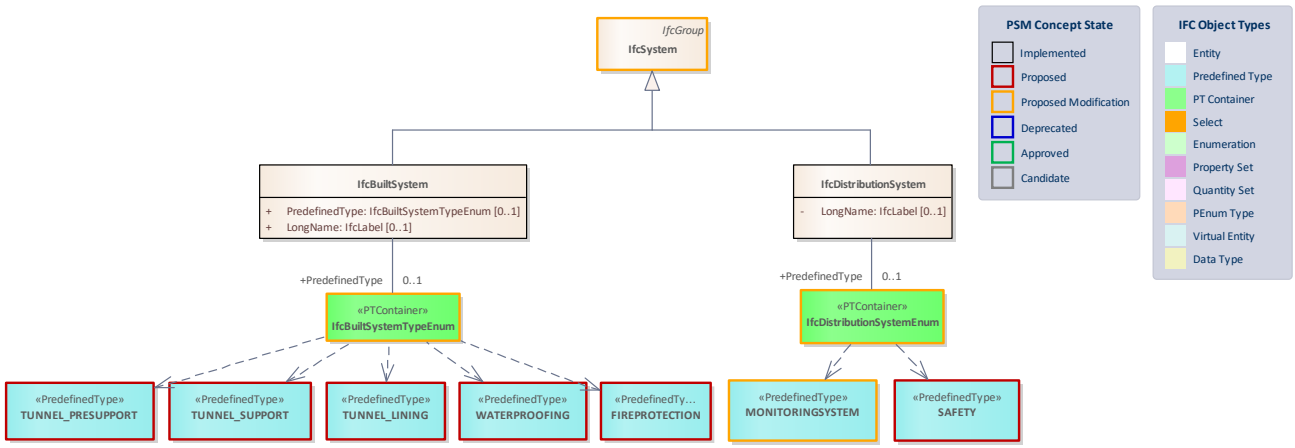


Figure 28: Systems extensions complete -

3.7.2 Class: IfcSystem

A system is an organized combination of related parts within an AEC product, composed for a common purpose or function or to provide a service. A system is essentially a functionally related aggregation of products. The grouping relationship to one or several instances of _IfcProduct_ (the system members) is handled by _IfcRelAssignsToGroup_.

> NOTE The use of _IfcSystem_ often applies to the representation of building services related systems, such as the piping system, cold water system, etc. Members within such a system may or may not be connected using the connectivity related entities (through _IfcDistributionPort_).

> HISTORY New entity in IFC1.0

bSI Documentation

Status: **ProposedModification**

Package: **IfcProductExtension**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets	Pset_MaintenanceTriggerPerformance Pset_MaintenanceTriggerCondition Pset_MaintenanceStrategy Pset_MaintenanceTriggerDuration		

Inheritance Statement		
Subtype Of	IfcGroup	
Subtypes	**EXISTING**	**PROPOSED**
	IfcBuiltSystem IfcDistributionSystem IfcZone	

3.7.3 PDT Container: IfcDistributionSystemEnum

This enumeration identifies different types of distribution systems. It is used to designate systems by their function as well as ports of devices within such systems to restrict connectivity to compatible connections.

> HISTORY New enumeration in IFC4.

Ports for cable carriers may be connected using _IfcCableCarrierSegment_ and _IfcCableCarrierFitting_. Type objects for cable carrier segments and fittings (_IfcCableCarrierSegmentType_ and _IfcCableCarrierFittingType_ that are not specific to a particular system type may have ports with _PredefinedType_ of NOTDEFINED which indicates that occurrences of such objects may connect to ports of any other cable-carrier based port. Valid enumerations for cable carriers are the same as that for cables, and may be asserted if ports of the contained cables are all of the same type.

bSI Documentation

Status: **ProposedModification**

Package: **IfcSharedBldgServiceElements**

Container Properties			
Parent Entity	IfcDistributionSystem IfcDistributionPort	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
	IfcDistributionSystemEnum.MONITORINGSYSTEM IfcDistributionSystemEnum.COMPRESSEDAIR IfcDistributionSystemEnum.EARTHING IfcDistributionSystemEnum.VENTILATION IfcDistributionSystemEnum.TELEPHONE IfcDistributionSystemEnum.HEATING IfcDistributionSystemEnum.DISPOSAL IfcDistributionSystemEnum.TV IfcDistributionSystemEnum.HAZARDOUS IfcDistributionSystemEnum.CONVEYING IfcDistributionSystemEnum.OIL IfcDistributionSystemEnum.EXHAUST IfcDistributionSystemEnum.REFRIGERATION IfcDistributionSystemEnum.LIGHTNINGPROTECTION IfcDistributionSystemEnum.DATA IfcDistributionSystemEnum.CHEMICAL IfcDistributionSystemEnum.DRAINAGE IfcDistributionSystemEnum.SEWAGE IfcDistributionSystemEnum.AIRCONDITIONING IfcDistributionSystemEnum.FIREPROTECTION IfcDistributionSystemEnum.OPERATIONAL IfcDistributionSystemEnum.CONDENSERWATER IfcDistributionSystemEnum.CONTROL IfcDistributionSystemEnum.SECURITY IfcDistributionSystemEnum.DOMESTICCOLDWATER IfcDistributionSystemEnum.DOMESTICHOTWATER IfcDistributionSystemEnum.VENT IfcDistributionSystemEnum.WASTEWATER IfcDistributionSystemEnum.ELECTRICAL IfcDistributionSystemEnum.LIGHTING IfcDistributionSystemEnum.FUEL IfcDistributionSystemEnum.AUDIOVISUAL	IfcDistributionSystemEnum.SAFETY IfcDistributionSystemEnum.CATENARY_SYSTEM IfcDistributionSystemEnum.OVERHEAD_CONTACTLINE_SYSTEM IfcDistributionSystemEnum.RETURN_CIRCUIT	

	IfcDistributionSystemEnum.VACUUM IfcDistributionSystemEnum.STORMWATER IfcDistributionSystemEnum.RAINWATER IfcDistributionSystemEnum.CHILLEDWATER IfcDistributionSystemEnum.COMMUNICATION IfcDistributionSystemEnum.ELECTROACOUSTIC IfcDistributionSystemEnum.WATERSUPPLY IfcDistributionSystemEnum.GAS IfcDistributionSystemEnum.SIGNAL IfcDistributionSystemEnum.POWERGENERATION IfcDistributionSystemEnum.MUNICIPALSOLIDWASTE	

3.7.4 PDT Container: IfcBuiltSystemTypeEnum

This enumeration identifies different types of built systems.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Container Properties			
Parent Entity	IfcBuiltSystem	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcBuiltSystemTypeEnum.FIREPROTECTION IfcBuiltSystemTypeEnum.SHADING IfcBuiltSystemTypeEnum.MOORINGSYSTEM IfcBuiltSystemTypeEnum.OUTERSHELL IfcBuiltSystemTypeEnum.TUNNEL_PRESUPPORT IfcBuiltSystemTypeEnum.TRANSPORT IfcBuiltSystemTypeEnum.FOUNDATION IfcBuiltSystemTypeEnum.TUNNEL_SUPPORT IfcBuiltSystemTypeEnum.PRESTRESSING IfcBuiltSystemTypeEnum.LOADBEARING IfcBuiltSystemTypeEnum.TUNNEL_LINING IfcBuiltSystemTypeEnum.REINFORCING IfcBuiltSystemTypeEnum.EROSIONPREVENTION IfcBuiltSystemTypeEnum.TRACKCIRCUIT	

		IfcBuiltSystemTypeEnum.WATERPROOFING IfcBuiltSystemTypeEnum.MOORING IfcBuiltSystemTypeEnum.FENESTRATION

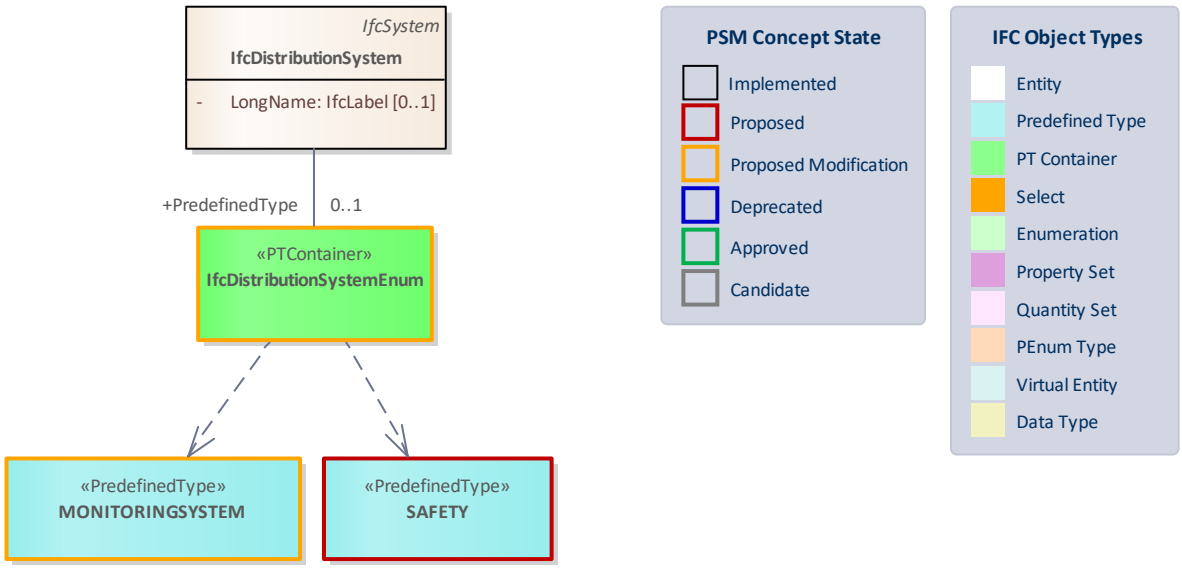


Figure 29: IfcDistributionSystem -

3.7.5 PDT Container: IfcDistributionSystemEnum

This enumeration identifies different types of distribution systems. It is used to designate systems by their function as well as ports of devices within such systems to restrict connectivity to compatible connections.

> HISTORY New enumeration in IFC4.

Ports for cable carriers may be connected using _IfcCableCarrierSegment_ and _IfcCableCarrierFitting_. Type objects for cable carrier segments and fittings (_IfcCableCarrierSegmentType_ and _IfcCableCarrierFittingType_ that are not specific to a particular system type may have ports with _PredefinedType_ of NOTDEFINED which indicates that occurrences of such objects may connect to ports of any other cable-carrier based port. Valid enumerations for cable carriers are the same as that for cables, and may be asserted if ports of the contained cables are all of the same type.

bSI Documentation

Status: **ProposedModification**

Package: **IfcSharedBldgServiceElements**

Container Properties			
Parent Entity	IfcDistributionSystem IfcDistributionPort	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
	IfcDistributionSystemEnum.MONITORINGSYSTEM IfcDistributionSystemEnum.COMPRESSEDAIR IfcDistributionSystemEnum.EARTHING IfcDistributionSystemEnum.VENTILATION IfcDistributionSystemEnum.TELEPHONE IfcDistributionSystemEnum.HEATING IfcDistributionSystemEnum.DISPOSAL IfcDistributionSystemEnum.TV IfcDistributionSystemEnum.HAZARDOUS IfcDistributionSystemEnum.CONVEYING IfcDistributionSystemEnum.OIL IfcDistributionSystemEnum.EXHAUST IfcDistributionSystemEnum.REFRIGERATION IfcDistributionSystemEnum.LIGHTNINGPROTECTION IfcDistributionSystemEnum.DATA IfcDistributionSystemEnum.CHEMICAL IfcDistributionSystemEnum.DRAINAGE IfcDistributionSystemEnum.SEWAGE IfcDistributionSystemEnum.AIRCONDITIONING IfcDistributionSystemEnum.FIREPROTECTION IfcDistributionSystemEnum.OPERATIONAL IfcDistributionSystemEnum.CONDENSERWATER IfcDistributionSystemEnum.CONTROL IfcDistributionSystemEnum.SECURITY IfcDistributionSystemEnum.DOMESTICCOLDWATER IfcDistributionSystemEnum.DOMESTICHOTWATER IfcDistributionSystemEnum.VENT IfcDistributionSystemEnum.WASTEWATER IfcDistributionSystemEnum.ELECTRICAL IfcDistributionSystemEnum.LIGHTING IfcDistributionSystemEnum.FUEL	IfcDistributionSystemEnum.SAFETY IfcDistributionSystemEnum.CATENARY_SYSTEM IfcDistributionSystemEnum.OVERHEAD_CONTACTLINE_SYSTEM IfcDistributionSystemEnum.RETURN_CIRCUIT	

	IfcDistributionSystemEnum.AUDIOVISUAL IfcDistributionSystemEnum.VACUUM IfcDistributionSystemEnum.STORMWATER IfcDistributionSystemEnum.RAINWATER IfcDistributionSystemEnum.CHILLEDWATER IfcDistributionSystemEnum.COMMUNICATION IfcDistributionSystemEnum.ELECTROACOUSTIC IfcDistributionSystemEnum.WATERSUPPLY IfcDistributionSystemEnum.GAS IfcDistributionSystemEnum.SIGNAL IfcDistributionSystemEnum.POWERGENERATION IfcDistributionSystemEnum.MUNICIPALSOLIDWASTE	

3.7.6 Predefined Type: WATERPROOFING

Full Identifier: **IfcBuiltSystemTypeEnum.WATERPROOFING**

Grouping of elements used to protect the facility against damage from moisture or the unintentional entry of water as well as the danger posed by aggressive water or soils and the effects of chemicals.

Status: **Proposed**

Package: **Systems**

Predefined Type Properties			
Predefined Type Container	IfcBuiltSystemTypeEnum	**Parent Entity**	IfcBuiltSystem
Stereotype	«PredefinedType»		
Property sets			

3.7.7 Predefined Type: TUNNEL_SUPPORT

Full Identifier: **IfcBuiltSystemTypeEnum.TUNNEL_SUPPORT**

Grouping of elements designed and installed to guarantee the long term stability of the underground structure.

Status: **Proposed**

Package: **Systems**

Predefined Type Properties			
Predefined Type Container	IfcBuiltSystemTypeEnum	**Parent Entity**	IfcBuiltSystem
Stereotype	«PredefinedType»		
Property sets			

3.7.8 Predefined Type: TUNNEL_PRESUPPORT

Full Identifier: **IfcBuiltSystemTypeEnum.TUNNEL_PRESUPPORT**

A grouping of rigid elements installed before excavation at the tunnel face at the top perimeter of the tunnel section.

Status: **Proposed**

Package: **Systems**

Predefined Type Properties			
Predefined Type Container	IfcBuiltSystemTypeEnum	**Parent Entity**	IfcBuiltSystem
Stereotype	«PredefinedType»		
Property sets			

3.7.9 Predefined Type: TUNNEL_LINING

Full Identifier: **IfcBuiltSystemTypeEnum.TUNNEL_LINING**

A functional grouping of tunnel lining elements.

Status: **Proposed**

Package: **Systems**

Predefined Type Properties			
Predefined Type Container	IfcBuiltSystemTypeEnum	**Parent Entity**	IfcBuiltSystem
Stereotype	«PredefinedType»		

Property sets	

3.7.10 Predefined Type: MONITORINGSYSTEM

Full Identifier: **IfcDistributionSystemEnum.MONITORINGSYSTEM**

Sensor-based system for building and infastructure environmental monitoring and control.

Proposed widening of definition (remove environmental): Sensor-based system for building and infastructure monitoring and control..

Status: **ProposedModification**

Package: **Systems**

Predefined Type Properties			
Predefined Type Container	IfcDistributionSystemEnum	**Parent Entity**	IfcDistributionSystem IfcDistributionPort
Stereotype	«PredefinedType»		
Property sets			

3.7.11 Predefined Type: SAFETY

Full Identifier: **IfcDistributionSystemEnum.SAFETY**

A system aimed for protecting the safety of people, vehicles and other equipment from unwanted events.

Status: **Proposed**

Package: **Systems**

Predefined Type Properties			
Predefined Type Container	IfcDistributionSystemEnum	**Parent Entity**	IfcDistributionSystem IfcDistributionPort
Stereotype	«PredefinedType»		
Property sets			

3.7.12 Predefined Type: FIREPROTECTION

Full Identifier: **IfcBuiltSystemTypeEnum.FIREPROTECTION**

Measures for passive fire protection including containing fire and preventing it from spreading further.

Status: **Proposed**

Package: **Systems**

Predefined Type Properties			
Predefined Type Container	IfcBuiltSystemTypeEnum	**Parent Entity**	IfcBuiltSystem
Stereotype	«PredefinedType»		
Property sets			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