1.1 General Usage

Code	Version	Status	Author	Copyright
IFC4x1	4.1.0.0	Official		© 1996-2019 buildingSMART International Ltd.

The following are within the entire scope of this release of IFC:

- BIM exchange format definitions that are required during the life cycle phases of buildings:
  - demonstrating the need;
  - conception of need;
  - outline feasibility;
  - substantive feasibility study and outline financial authority;
  - outline conceptual design;
  - full conceptual design;
  - coordinated design;
  - procurement and full financial authority;
  - production information;
  - construction;
  - operation and maintenance.

- BIM exchange format definitions that are required by the various disciplines involved within the life cycle phases:
  - architecture;
  - building service;
  - structural engineering;
  - procurement;
  - construction planning;
  - facility management;
  - project management;
  - client requirement management;
  - building authority for permits and approval.

- BIM exchange format definitions including:
  - project structure;
  - physical components;
  - spatial components;
  - analysis items;
  - processes;
  - resources;
  - controls;
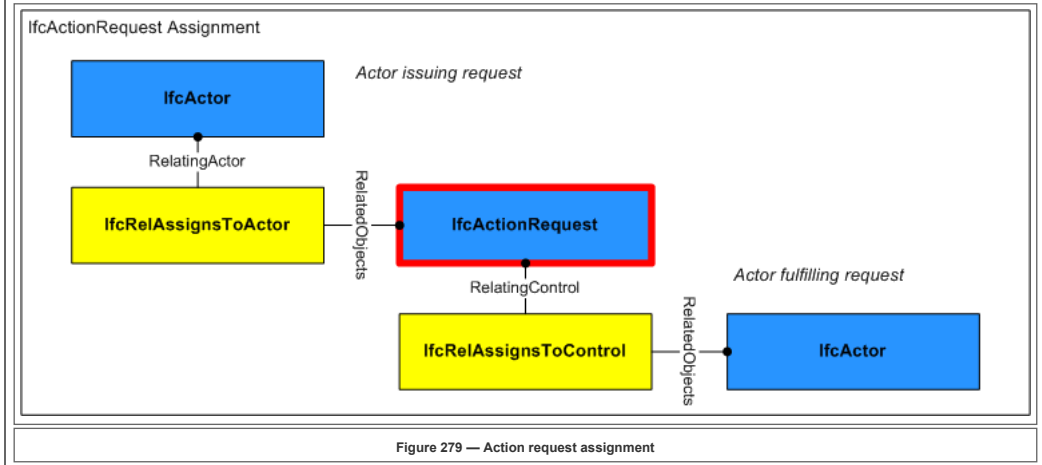 - actors;
  - context definition.

The following are outside the scope of this release of IFC:

- exchange format definitions outside of the domain of construction and facility maintenance;
- full project structure and component breakdown structures outside of building engineering, but providing a baseline for civil engineering to be extended in future releases;
- behavioral aspects of components and other information items.

Field	Mapping	Definition
(Query)	\IfcActionRequest	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Approval	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesApproval.RelatingApproval \IfcApproval.Name \IfcLabel	Approvals may be associated to indicate the status of acceptance or rejection using the IfcRelAssociatesApproval relationship where *RelatingApproval* refers to an IfcApproval and *RelatedObjects* contains the **IfcActionRequest**. Approvals may be split into sub-approvals using IfcApprovalRelationship to track approval status separately for each party where *RelatingApproval* refers to the higher-level approval and *RelatedApprovals* contains one or more lower-level approvals. The hierarchy of approvals implies sequencing such that a higher-level approval is not executed until all of its lower-level approvals have been accepted.
Aggregation		As shown in Figure 278, an **IfcActionRequest** may be aggregated into components. Figure 278 — Action request composition
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	The object definitions, either non-product object occurrences or non-product object types, that are being nestes. They are defined as the parts in the ordered whole/part relationship - i.e. there is an implied order among the parts expressed by the position within the list of *RelatedObjects*.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	As shown in Figure 279, an **IfcActionRequest** may be assigned to the following entities using relationships as indicated: • IfcActor (IfcRelAssignsToActor): Person or organization issuing the request such as a tenant or owner.

The **IfcActionRequest** may have assignments of its own using the IfcRelAssignsToControl relationship where *RelatingControl* refers to the **IfcActionRequest** and *RelatedObjects* contains one or more objects of the following types:

- IfcActor: Person or organization(s) fulfilling the request such as a facilities manager or contractor.

Figure 279 — Action request assignment

Field	Mapping	Definition
(Query)	**\IfcActor**	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Actor Assignment	\IfcActor.IsActingUpon[*] \IfcRelAssignsToActor.RelatedObjects[*] \IfcControl	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcActuator**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.
Control Flow	\IfcDistributionControlElement.AssignedToFlowElement[*] \IfcRelFlowControlElements.RelatingFlowElement \IfcDistributionFlowElement	Relationship to a distribution flow element

Field	Mapping	Definition
(Query)	**\IfcAirTerminalBox**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcAirTerminal**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcAirToAirHeatRecovery**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial	The name by which the material constituent is known.

	\IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

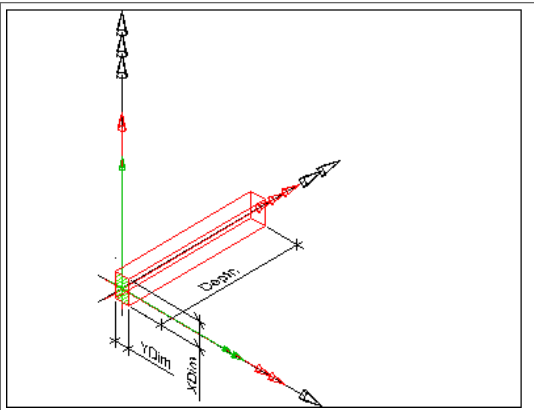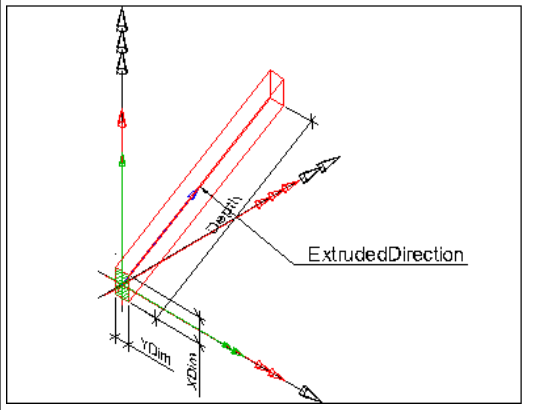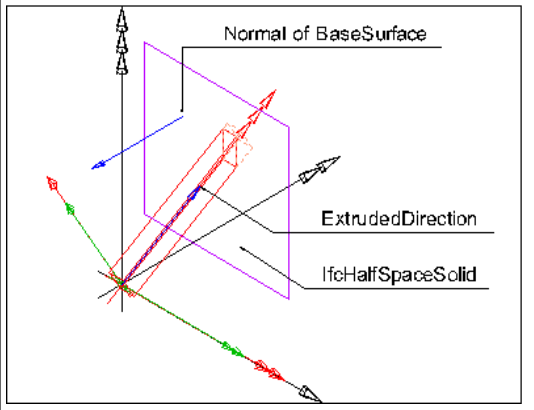| Field	Mapping	Definition
(Query)	**\IfcAlarm**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

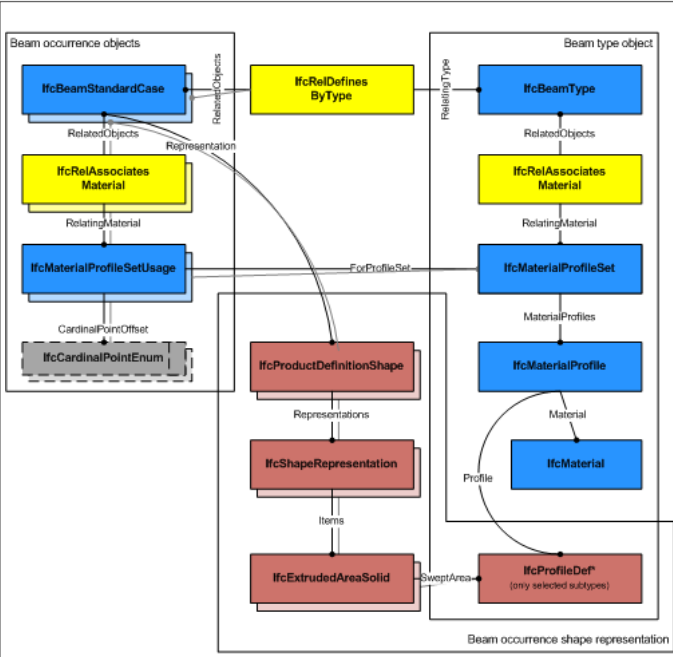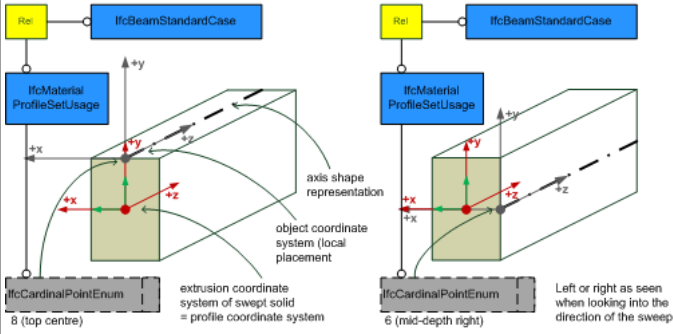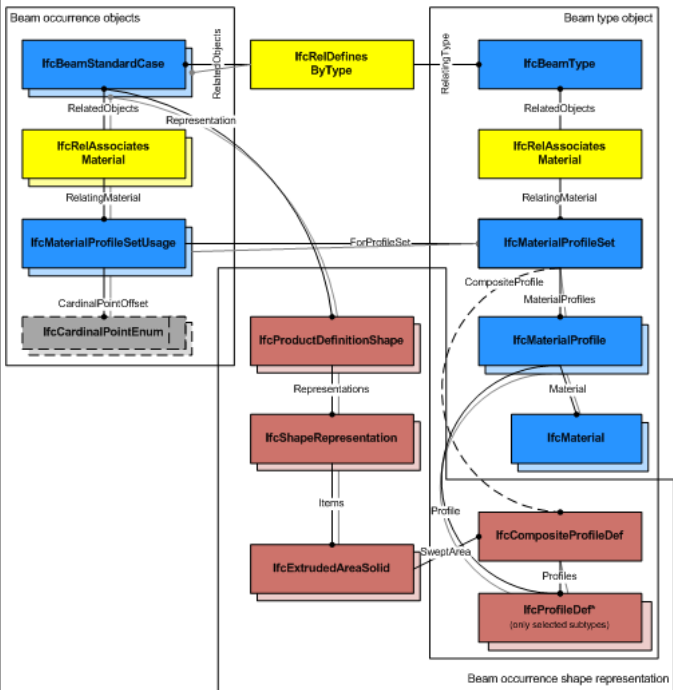| Field	Mapping	Definition
(Query)	**\IfcAlignment**	
Alignment Attributes	\IfcAlignment.Axis \IfcAlignmentCurve.Horizontal \IfcAlignment2DHorizontal.Segments[*] \IfcAlignment2DHorizontalSegment.CurveGeometry \IfcCircularArcSegment2D	Geometric representation of the horizontal alignment within the 2D X/Y coordinate space.

Field	Mapping	Definition
(Query)	**\IfcAnnotation**	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Annotation 2D Geometry	\IfcAnnotation.Representation \IfcProductDefinitionShape.Representations['Annotation'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
Annotation 3D Geometry	\IfcAnnotation.Representation \IfcProductDefinitionShape.Representations['Annotation'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcAsset**	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Classification	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	The operating function of an asset within an organization may be particularly valuable in situations where one organization provides and maintains core services and another organization adds and maintains terminal services. It can classify who owns and is responsible for the asset. Operating function can be designated through the use of one or more classification references.
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcAudioVisualAppliance**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Composition		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcBeam**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcBeam, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: - the *Spatial Containment* (defined here), or - the *Element Composition*.
Element Composition	\IfcElement.Decomposes[*] \IfcRelAggregates.RelatingObject \IfcElement.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Profile Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name \IfcLabel	The material of the IfcBeam is defined by the IfcMaterialProfileSet or as fallback by IfcMaterial, and it is attached either directly or at the IfcBeamType. NOTE It is illegal to assign an IfcMaterialProfileSetUsage to an IfcBeam. Only the subtype IfcBeamStandardCase supports this concept.
Axis 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis']	The 'Axis' 'Curve 3D' geometry can be used to represent the system axis and length of a beam that may extent the body length.

	\IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	NOTE The 'Axis' is not used to locate the material profile set, only the subtype IfcBeamStandardCase provides this capability.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation type: ■ Solid: IfcExtrudedAreaSolid, IfcRevolvedAreaSolid shall be supported ■ Profile: all subtypes of IfcProfileDef (with exception of IfcArbitraryOpenProfileDef) ■ Extrusion: All extrusion directions shall be supported. Figure 198 illustrates the 'SweptSolid' geometric representation. There are no restrictions or conventions on how to use the local placement (black), solid of extrusion placement (red) and profile placement (green). **Figure 198 — Beam swept solid** Figure 199 illustrates the use of non-perpendicular extrusion to create the IfcExtrudedAreaSolid. **Figure 199 — Beam non-perpendicular extrusion**
Body AdvancedSweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'AdvancedSweptSolid' representation type: ■ Solid: IfcSurfaceCurveSweptAreaSolid, IfcFixedReferenceSweptAreaSolid, IfcExtrudedAreaSolidTapered, IfcRevolvedAreaSolidTapered shall be supported. NOTE View definitions and implementer agreement can further constrain the allowed swept solid types. ■ Profile: see 'SweptSolid' geometric representation ■ Extrusion: not applicable
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'Clipping' representation type: ■ Solid: see 'SweptSolid' geometric representation ■ Profile: see 'SweptSolid' geometric representation ■ Extrusion: see 'SweptSolid' geometric representation ■ Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid (or its subtypes). Figure 199 illustrates use of IfcBooleanClippingResult between an IfcExtrudedAreaSolid and an IfcHalfSpaceSolid to create a clipped body. **Figure 199 — Beam clipping**
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*]	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
	\IfcObject	
(Query)	**\IfcBeamStandardCase**	
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The IfcBeamStandardCase defines in addition that the IfcBeamType should have a unique IfcMaterialProfileSet, that is referenced by the IfcMaterialProfileSetUsage that is assigned to all occurrences of this IfcBeamType.

EXAMPLE Figure 202 illustrates assignment of IfcMaterialProfileSetUsage and IfcMaterialProfileSet to the IfcBeamStandardCase as the beam occurrence and to the IfcBeamType. The same IfcMaterialProfileSet shall be shared by many occurrences of IfcMaterialProfileSetUsage. This relationship shall be consistent to the relationship between the IfcBeamType and the IfcBeamStandardCase.

Figure 202 — Beam profile usage

EXAMPLE Figure 203 illustrates alignment of cardinal points.

NOTE It has to be guaranteed that the use of *IfcCardinalPointEnum* is consistent to the placement of the extrusion body provided by *IfcExtrudedAreaSolid.Position*

NOTE The cardinal points **8** (top centre) and **6** (mid-depth right) are assigned according to the definition at IfcCardinalPointReference

Figure 203 — Beam cardinal points

EXAMPLE Figure 204 illustrates assignment of a composite profile by using *IfcCompositeProfile* for geometric representation and several IfcMaterialProfile's within the IfcMaterialProfileSet.

Figure 204 — Beam composite profiles

| Placement | \IfcProduct.ObjectPlacement | |

	\IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: ■ The local placement shall provide the location and directions for the standard beam, the x/y plane is the plane for the start profile and the z-axis is the extrusion axis for the beam body (in case of rotation, the tangent direction).

Axis 3D Geometry	\IfcElement.Representation
	\IfcProductDefinitionShape.Representations['Axis']
	\IfcShapeRepresentation.ContextOfItems
	\IfcGeometricRepresentationContext
		The following additional constraints apply to the 'Axis' representation, if the 'Body' shape representation has the *RepresentationType* : 'SweptSolid':
		
		■ *Axis*
		  ■ IfcPolyline having two *Points*, or IfcTrimmedCurve with *BasisCurve* of Type IfcLine for 'SweptSolid' provided as IfcExtrudedAreaSolid. The axis curve lies on the z axis of the object coordinate system.
		  ■ IfcTrimmedCurve with *BasisCurve* of Type IfcCircle for 'SweptSolid' provided as IfcRevolvedAreaSolid. The axis curve lies on the x/z plane of the object coordinate system, the tangent at the start is along the positive z-axis.

Figure 204 — Beam axis representation

EXAMPLE As shown in Figure 76, the axis shall be defined along the z axis of the object coordinate system. The axis representation can be used to represent the system length of a beam that may extent the body length of the beam.

Figure 205 — Beam axis cardinal point

EXAMPLE As shown in Figure 77, the axis representation shall be used to represent the cardinal point as the offset between the 'Axis' and the extrusion path of the beam. The extrusion path is provided as *IfcExtrudedAreaSolid.ExtrudedDirection* and should be parallel to the 'Axis' and the z axis. It has to be guaranteed that the value provided by *IfcMaterialProfileSetUsage.CardinalPoint* is consistent to the *IfcExtrudedAreaSolid.Position*.

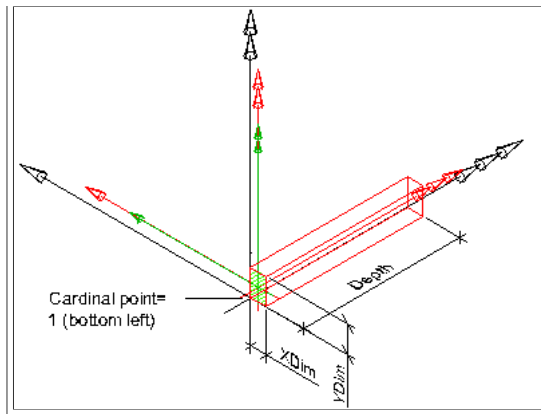|		
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation: ■ Solid: IfcExtrudedAreaSolid, IfcRevolvedAreaSolid shall be supported ■ Solid Position : The *IfcSweptAreaSolid.Position* shall exclusively been used to correspond to the cardinal point. The x/y offset of *Position* represents the cardinal point offset of the profile against the axis. No rotation shall be allowed. ■ Profile: All subtypes of IfcParameterizedProfileDef ■ Profile Position : For all single profiles, the *IfcParameterizedProfileDef.Position* shall be NIL, or having *Location* = 0.,0. and *RefDirection* = 1.,0. ■ Extrusion: Perpendicular to the profile direction. The *IfcExtrudedAreaSolid.ExtrudedDirection* shall be [0.,0.,1.]. ■ Orientation: The y-axis of the profile, as determined by *IfcSweptAreaSolid.Position.P[2]* shall point upwards. It indicates the "role" of the beam, a role=0° means y-axis of profile pointing upwards. Figure 205 illustrates a standard geometric representation with cardinal point applied as **1** (bottom left). The following interpretation of dimension parameter applies for rectangular beams with linear extrusions: ■ *IfcRectangleProfileDef.YDim* interpreted as beam height ■ *IfcRectangleProfileDef.XDim* interpreted as beam width The following interpretation of dimension parameter applies for circular beams: ■ *IfcCircleProfileDef.Radius* interpreted as beam radius.

Figure 205 — Beam body extrusion

Body AdvancedSweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'AdvancedSweptSolid' representation type: - Solid: IfcSurfaceCurveSweptAreaSolid, IfcFixedReferenceSweptAreaSolid, IfcExtrudedAreaSolidTapered, IfcRevolvedAreaSolidTapered shall be supported. NOTE View definitions and implementer agreement can further constrain the allowed swept solid types. - Solid Position : see 'SweptSolid' geometric representation - Profile: see 'SweptSolid' geometric representation - Profile Position : see 'SweptSolid' geometric representation - Extrusion: not applicable
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following constraints apply to the 'Clipping' representation: - Solid : see 'SweptSolid' geometric representation - Solid Position : see 'SweptSolid' geometric representation - Profile : see 'SweptSolid' geometric representation - Profile Position : see 'SweptSolid' geometric representation - Extrusion : see 'SweptSolid' geometric representation - Orientation : see 'SweptSolid' geometric representation - Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (her IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid (or its subtypes). Figure 206 illustrates a 'Clipping' geometric representation with use of IfcBooleanClippingResult between an IfcExtrudedAreaSolid and an IfcHalfSpaceSolid to create a clipped body, with cardinal point applied as **4** (mid-depth left) **Figure 206 — Beam body clipping**

Field	Mapping	Definition
(Query)	\IfcBeamType	
Material Profile Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name \IfcLabel	The material of the IfcBeamType is defined by the IfcMaterialProfileSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. NOTE It is illegal to assign an IfcMaterial to an IfcBeamType, if there is at least one occurrence of IfcBeamStandardCase for this type. The shared profile definition is defined by assigning an IfcMaterialProfileSet (see material use definition above). The IfcMaterialProfile refers to the subtype of IfcProfileDef that is the common profile for all beam occurrence, if used. It is only applicable if the IfcBeamType has only occurrences of type IfcBeamStandardCase (see definition of IfcBeamStandardCase for further information). NOTE The attribute *ProfileName* of the IfcProfileDef subtype, referenced in IfcMaterialProfile should contain a standardized profile name according to local standards. However, an additional geometric representation of the profile is necessary (such as IfcExtrudedAreaSolid). An importing application is allowed to check for the existence of the profile name: in case of identifying it as a standardized name, the corresponding profile geometry and possibly other cross sectional properties can be read from a library. Otherwise the geometric representation and possible non geometric IfcProfileProperties have to be used.
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The IfcBeamType may define the shared geometric representation for all beam occurrences. The *RepresentationMaps* attribute refers to a list of IfcRepresentationMap's, that allow for multiple geometric representations (e.g. with *IfcShaperepresentation*'s having an *RepresentationIdentifier* 'Box', 'Axis', or 'Body'). It is only applicable if the IfcBeamType has only occurrences of type IfcBeam (See geometric use definition of IfcBeam for further information). NOTE If the IfcBeamType has an associated IfcMaterialProfileSet, then no shared geometric representation shall be provided. NOTE The product shape representations are defined as *RepresentationMaps* (attribute of the supertype IfcTypeProduct), which get assigned by an element occurrence instance through the *IfcShapeRepresentation.Item[n]* being an IfcMappedItem. See IfcTypeProduct for further information. NOTE The values of attributes *RepresentationIdentifier* and *RepresentationType* of IfcShapeRepresentation are restricted in the same way as those for IfcBeam and IfcBeamStandardCase

Field	Mapping	Definition

(Query)	\IfcBoiler	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcBuilding	
Spatial Composition	\IfcSpatialElement.Decomposes[*] \IfcRelAggregates.RelatingObject \IfcProject.Name	NOTE By using the inverse relationship *IfcBuilding.Decomposes* it references IfcProject || IfcSite || IfcBuilding through *IfcRelAggregates.RelatingObject*. If it refers to another instance of IfcBuilding, the referenced IfcBuilding needs to have a different and higher *CompositionType*, i.e. COMPLEX (if the other IfcBuilding has ELEMENT), or ELEMENT (if the other IfcBuilding has PARTIAL).
Spatial Decomposition	\IfcObjectDefinition.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcSpatialElement.Name \IfcLabel	NOTE By using the inverse relationship *IfcBuilding.IsDecomposedBy* it references IfcBuilding || IfcBuildingStorey through *IfcRelAggregates.RelatedObjects*. If it refers to another instance of IfcBuilding, the referenced IfcBuilding needs to have a different and lower *CompositionType*, i.e. ELEMENT (if the other IfcBuilding has COMPLEX), or PARTIAL (if the other IfcBuilding has ELEMENT).
Spatial Container	\IfcSpatialElement.ContainsElements[*] \IfcRelContainedInSpatialStructure.RelatedElements[*] \IfcProduct	NOTE If there are building elements and/or other elements directly related to the IfcBuilding (like a curtain wall spanning several stories), they are associated with the IfcBuilding by using the objectified relationship IfcRelContainedInSpatialStructure. The IfcBuilding references them by its inverse relationship: ▪ *IfcBuilding.ContainsElements* -- referencing any subtype of IfcProduct (with the exception of other spatial structure element) by *IfcRelContainedInSpatialStructure.RelatedElements*.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for IfcBuilding is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. ▪ The *PlacementRelTo* relationship of IfcLocalPlacement shall point (if relative placement is used) to the IfcSpatialStructureElement of type *IfcSite*, or of type IfcBuilding (e.g. to position a building relative to a building complex, or a building section to a building). ▪ If the relative placement is not used, the absolute placement is defined within the world coordinate system.
FootPrint GeomSet Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The foot print representation of IfcBuilding is given by either a single 2D curve (such as IfcPolyline or IfcCompositeCurve), or by a list of 2D curves (in case of inner boundaries), if the building has an independent geometric representation. NOTE The independent geometric representation of IfcBuilding may not be allowed in certain model view definitions. In those cases only the contained elements and spaces have an independent geometric representation.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The body (or solid model) geometric representation (if the building has an independent geometric representation) of IfcBuilding is defined using faceted B-Rep capabilities (with or without voids), based on the IfcFacetedBrep or on the IfcFacetedBrepWithVoids. NOTE Since the building shape is usually described by the exterior building elements, an independent shape representation shall only be given, if the building is exposed independently from its constituting elements and such independent geometric representation may be prohibited in model view definitions.

Field	Mapping	Definition
(Query)	\IfcBuildingElement	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Surface 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Some IfcBuildingElement may be represented by an surface as an abstract geometric representation. See each subtype for specific guidance.

Field	Mapping	Definition
(Query)	\IfcBuildingElementPart	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

Field	Mapping	Definition
(Query)	\IfcBuildingElementProxy	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	NOTE The IfcBuildingElementProxyType can be used to share common information among many occurrences of the same proxy without establishing a particular semantic meaning of the type. If no IfcBuildingElementProxyType is attached (i.e. if only occurrence information is available) the *PredefinedType* should be provided. If set to .USERDEFINED. a user defined value has to be provided by the *ObjectType* attribute.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Material Solid	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterial	The material of the IfcBuildingElementProxy is defined by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. NOTE It is illegal to assign an IfcMaterial to an IfcBuildingElementProxy with the *PredefinedType* = ProvisionForVoid. Material information can also be given at the IfcBuildingElementProxyType, defining the common attribute data for all occurrences of the same type. It is then accessible by the inverse *IsTypedBy* relationship pointing to *IfcBuildingElementProxyType.HasAssociations* and via *IfcRelAssociatesMaterial.RelatingMaterial* to IfcMaterial. If both are

		given, then the material directly assigned to IfcBuildingElementProxy overrides the material assigned to IfcBuildingElementProxyType.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcBuildingElementProxy, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: • the *Spatial Containment* (defined here), or • the *Element Composition*.

Field	Mapping	Definition
(Query)	\IfcBuildingElementProxyType	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcBuildingStorey	
Spatial Composition	\IfcSpatialElement.Decomposes[*] \IfcRelAggregates.RelatingObject \IfcProject.Name	NOTE By using the inverse relationship *IfcBuildingStorey.Decomposes* it references (IfcBuilding || IfcBuildingStorey) through *IfcRelAggregates.RelatingObjectIfcBuildingStorey, the referenced IfcBuildingStorey needs to have a different and higher CompositionType, i.e. COMPLEX (if the other IfcBuildingStorey has ELEMENT), or ELEMENT (if the other IfcBuildingStorey has PARTIAL).*
Spatial Decomposition	\IfcObjectDefinition.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcSpatialElement.Name \IfcLabel	NOTE By using the inverse relationship *IfcBuildingStorey.IsDecomposedBy* it references IfcBuildingStorey || IfcSpace through *IfcRelAggregates.RelatedObjects*. If it refers to another instance of IfcBuildingStorey, the referenced IfcBuildingStorey needs to have a different and lower *CompositionType*, i.e. ELEMENT (if the other IfcBuildingStorey has COMPLEX), or PARTIAL (if the other IfcBuildingStorey has ELEMENT). NOTE Multi storey spaces shall be spatially contained by only a single building storey, usually it is the building storey where the base of the space lies.
Spatial Container	\IfcSpatialElement.ContainsElements[*] \IfcRelContainedInSpatialStructure.RelatedElements[*] \IfcProduct	If there are building elements and/or other elements directly related to the IfcBuildingStorey (like most building elements, such as walls, columns, etc.), they are associated with the IfcBuildingStorey by using the objectified relationship IfcRelContainedInSpatialStructure. The IfcBuildingStorey references them by its inverse relationship: • *IfcBuildingStorey.ContainsElements* -- referencing any subtype of IfcProduct (with the exception of other spatial structure element) by *IfcRelContainedInSpatialStructure.RelatedElements*. Elements can also be referenced in an IfcBuildingStorey, for example, if they span through several storeys. This is expressed by using the objectified relationship IfcRelReferencedInSpatialStructure. Systems, such as building service or electrical distribution systems, zonal systems, or structural analysis systems, relate to IfcBuildingStorey by using the objectified relationship IfcRelServicesBuildings.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for IfcBuildingStorey is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. • The *PlacementRelTo* relationship of IfcLocalPlacement shall point (if relative placement is used) to the IfcSpatialStructureElement of type IfcBuilding, or of type IfcBuildingStorey (e.g. to position a building storey relative to a building storey complex, or a partial building storey to a building storey). • If the relative placement is not used, the absolute placement is defined within the world coordinate system.
FootPrint GeomSet Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The foot print representation of IfcBuildingStorey is given by either a single 2D curve (such as IfcPolyline or IfcCompositeCurve), or by a list of 2D curves (in case of inner boundaries), if the building storey has an independent geometric representation. NOTE The independent geometric representation of IfcBuildingStorey may not be allowed in certain model view definitions. In those cases only the contained elements and spaces have an independent geometric representation.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The body (or solid model) geometric representation (if the building storey has an independent geometric representation) of IfcBuildingStorey is defined using faceted B-Rep capabilities (with or without voids), based on the IfcFacetedBrep or on the IfcFacetedBrepWithVoids. NOTE Since the building storey shape is usually described by the exterior building elements, an independent shape representation shall only be given, if the building storey is exposed independently from its constituting elements and such independent geometric representation may be prohibited in model view definitions.

Field	Mapping	Definition
(Query)	\IfcBuildingSystem	
Property Sets for Objects	\IfcObject	The IFC class identifier indicating the subtype of object.
Aggregation		
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	\IfcBurner	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcCableCarrierFitting	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcCableCarrierSegment**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The name by which the material profile is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcCableFitting**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	The name by which the material layer is known.
Connection		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcCableSegment**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The name by which the material profile is known.
Composition		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcChiller**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Composition		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcChimney**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcChimney, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: ■ the *Spatial Containment* (defined here), or ■ the *Element Composition*.

Field	Mapping	Definition

(Query)	\IfcChimneyType	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcCivilElement	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Classification	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	The *Identification* provides a unique identifier of the referenced item within the external source (classification, document or library). It may be provided as - a key, e.g. a classification notation, like NF2.3 - a handle - a uuid or guid It may be human readable (such as a key) or not (such as a handle or uuid) depending on the context of its usage (which has to be determined by local agreement).

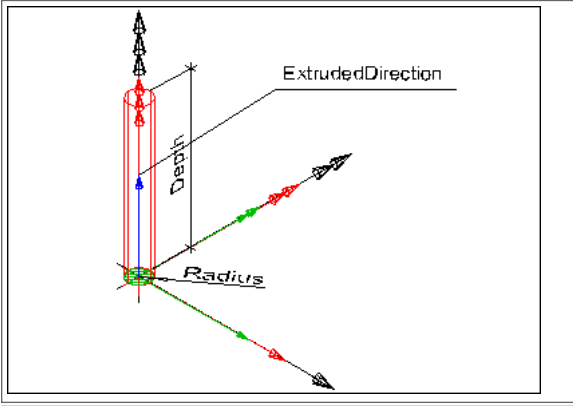| Field	Mapping	Definition
(Query)	\IfcCoil	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcColumn	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Profile Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name \IfcLabel	The material of the IfcColumn is defined by the IfcMaterialProfileSet or as fallback by IfcMaterial, and it is attached either directly or at the IfcColumnType. NOTE It is illegal to assign an IfcMaterialProfileSetUsage to an IfcColumn. Only the subtype IfcColumnStandardCase supports this concept.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcColumn, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: - the *Spatial Containment* (defined here), or - the *Element Composition*.
Axis 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The axis representation can be used to represent the system length of a column that may extent the body length of the column. NOTE The 'Axis' is not used to locate the material profile set, only the subtype IfcColumnStandardCase provides this capability.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation: - Solid: IfcExtrudedAreaSolid, IfcRevolvedAreaSolid shall be supported - Profile: all subtypes of IfcProfileDef (with exception of IfcArbitraryOpenProfileDef) - Extrusion: All extrusion directions shall be supported Figure 208 illustrates a 'SweptSolid' geometric representation. There are no restrictions or conventions on how to use the local placement (black), solid of extrusion placement (red) and profile placement (green). **Figure 208 — Column swept solid**

Figure 209 illustrates use of a special profile type (here IfcIShapeProfileDef) for the definition of the IfcExtrudedAreaSolid.
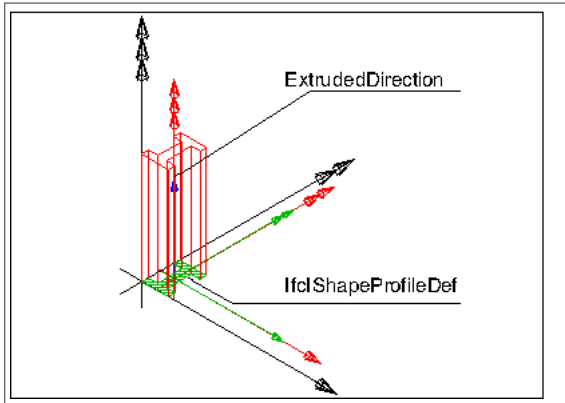

Figure 209 — Column extrusion of I-Shape

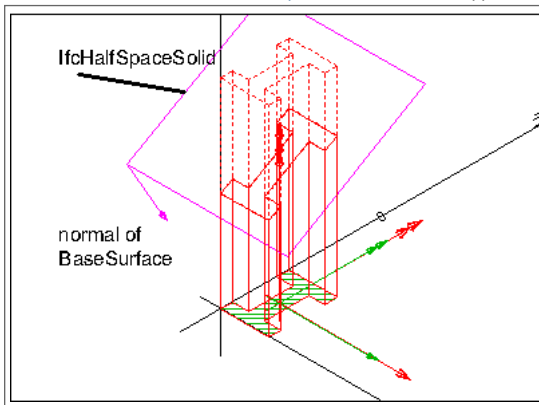| Body AdvancedSweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'AdvancedSweptSolid' representation type: ■ Solid: IfcSurfaceCurveSweptAreaSolid, IfcFixedReferenceSweptAreaSolid, IfcExtrudedAreaSolidTapered, IfcRevolvedAreaSolidTapered shall be supported. NOTE View definitions and implementer agreements can further constrain the allowed swept solid types. ■ Profile: see 'SweptSolid' geometric representation ■ Extrusion: not applicable
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following constraints apply to the 'Clipping' representation: ■ Solid: see 'SweptSolid' geometric representation ■ Profile: see 'SweptSolid' geometric representation ■ Extrusion: see 'SweptSolid' geometric representation ■ Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid. Figure 209 illustrates a 'Clipping' geometric representation with use of IfcBooleanClippingResult between an IfcExtrudedAreaSolid and an IfcHalfSpaceSolid to create a clipped body. **Figure 209 — Column clipping**
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcColumnStandardCase**	
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The IfcColumnStandardCase defines in addition that the IfcColumnType should have a unique IfcMaterialProfileSet, that is referenced by the IfcMaterialProfileSetUsage assigned to all occurrences of this IfcColumnType. Composite profile columns can be represented by refering to several IfcMaterialProfile's within the IfcMaterialProfileSet that is referenced from the IfcMaterialProfileSetUsage. Figure 212 illustrates assignment of IfcMaterialProfileSetUsage and IfcMaterialProfileSet to the IfcColumnStandardCase as the column occurrence and to the IfcColumnType. The same IfcMaterialProfileSet shall be shared by many occurrences of IfcMaterialProfileSetUsage. This relationship shall be consistent to the relationship between the IfcColumnType and the IfcColumnStandardCase.

Figure 212 — Column profile usage
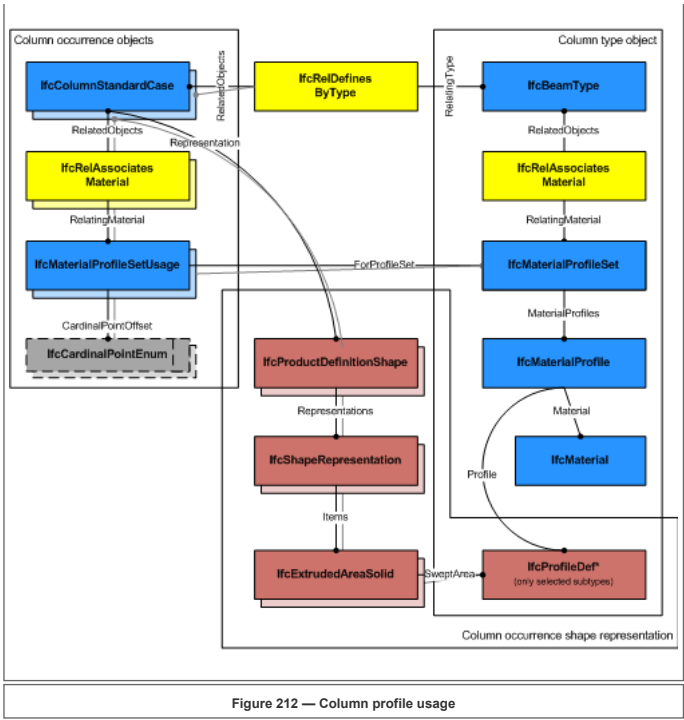
Figure 213 illustrates cardinal point alignment.

> NOTE   It has to be guaranteed that the use of *IfcCardinalPointEnum* is consistent to the placement of the extrusion body provided by *IfcExtrudedAreaSolid.Position*

> NOTE   The cardinal points **7** (top left), and **6** (mid-depth right) are assigned according to the definition at IfcCardinalPointReference

Figure 213 — Column cardinal points
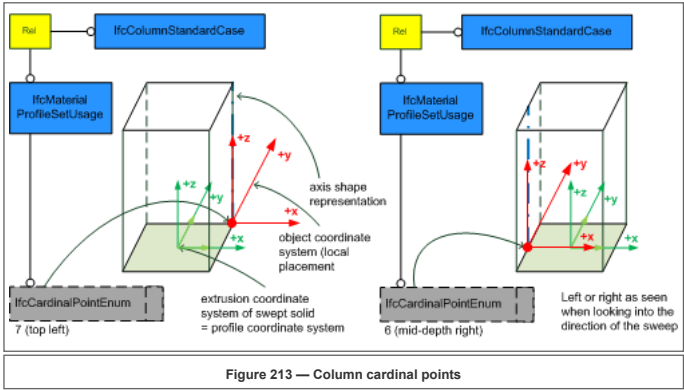
Figure 214 illustrates assignment of a composite profile by using *IfcCompositeProfile* for geometric representation and several IfcMaterialProfile's within the IfcMaterialProfileSet. The number of IfcMaterialProfile's within the IfcMaterialProfileSet is restricted to maximal 2 and requires the use of IfcExtrudedAreaSolidTapered, or IfcRevolvedAreaSolidTapered for the correct 'Body' shape representation.

Figure 214 — Column composite profiles

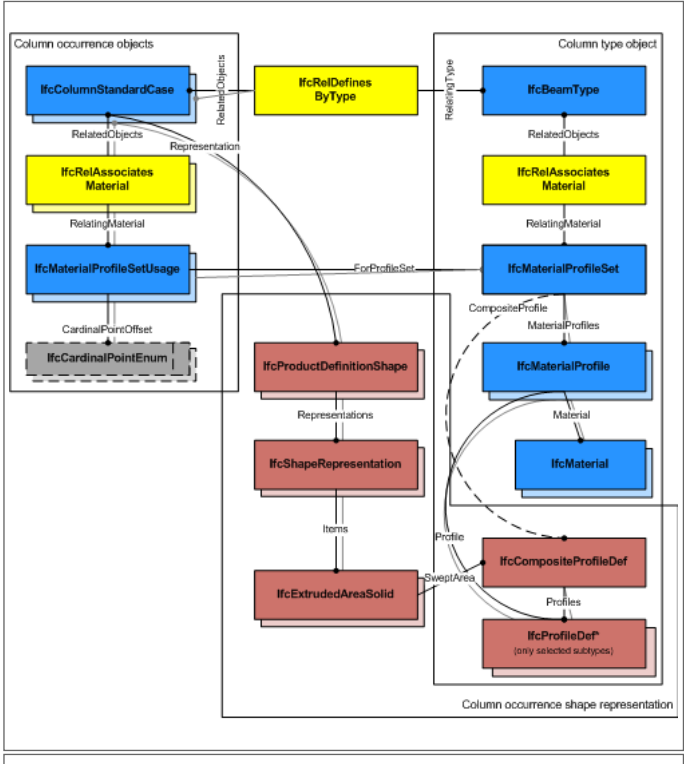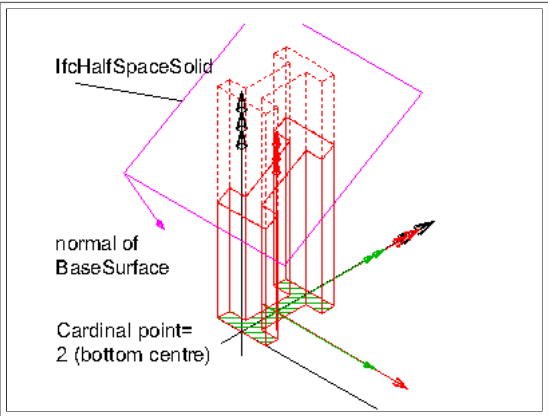| Product Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: ■ The local placement shall provide the location and directions for the standard column, the x/y plane is the plane for the start profile, and the z-axis is the extrusion axis for the column body (in case of rotation, the tangent direction).
Axis 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'Axis' representation, if the 'Body' shape representation has the *RepresentationType* : 'SweptSolid': ■ *Axis* 　■ IfcPolyline having two *Points*, or IfcTrimmedCurve with *BasisCurve* of Type IfcLine for 'SweptSolid' provided as IfcExtrudedAreaSolid. The axis curve lies on the z axis of the object coordinate system. 　■ IfcTrimmedCurve with *BasisCurve* of Type IfcCircle for 'SweptSolid' provided as IfcRevolvedAreaSolid. The axis curve lies on the x/z plane of the object coordinate system, the tangent at the start is along the positive z-axis. EXAMPLE As shown in Figure 214, the axis shall be defined along the z axis of the object coordinate system. The axis representation can be used to represent the system length of a column that may extent the body length of the column. **Figure 214 — Column axis representation** EXAMPLE As shown in Figure 215, the axis representation shall be used to represent the cardinal point as the offset between the 'Axis' and the extrusion path of the column. The extrusion path is provided as *IfcExtrudedAreaSolid.ExtrudedDirection* and should be parallel to the 'Axis'. It has to be guaranteed that the value provided by *IfcMaterialProfileSetUsage.CardinalPoint* is consistent to the *IfcExtrudedAreaSolid.Position*. **Figure 215 — Column axis cardinal point**
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation: ■ Solid: IfcExtrudedAreaSolid, IfcRevolvedAreaSolid shall be supported ■ Profile: all subtypes of IfcProfileDef (with exception of IfcArbitraryOpenProfileDef) ■ Profile Position : For all single profiles, the *IfcParameterizedProfileDef.Position* shall be NIL, or having *Location* = 0.,0. and *RefDirection* = 1.,0. ■ Extrusion: perpendicular to the profile direction. The *IfcExtrudedAreaSolid.ExtrudedDirection* shall be [0.,0.,1.]. ■ Orientation: The y-axis of the profile, as determined by *IfcSweptAreaSolid.Position.P[2]* shall point to the Y-Axis. It indicates the "role" of the column, a role=0° means y-axis of profile = Y-Axis of reference coordinate system. Figure 215 illustrates a standard geometric representation with cardinal point applied as **5** (mid-depth centre). The following interpretation of dimension parameter applies for rectangular columns: ■ *IfcRectangleProfileDef.YDim* interpreted as column width ■ *IfcRectangleProfileDef.XDim* interpreted as column depth The following interpretation of dimension parameter applies for circular columns: ■ *IfcCircleProfileDef.Radius* interpreted as column radius.

		Figure 215 — Column body extrusion	

Field	Mapping	Definition
Body AdvancedSweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'AdvancedSweptSolid' representation type: ■ Solid: IfcSurfaceCurveSweptAreaSolid, IfcFixedReferenceSweptAreaSolid, IfcExtrudedAreaSolidTapered, IfcRevolvedAreaSolidTapered shall be supported. 　NOTE View definitions and implementer agreement can further constrain the allowed swept solid types. ■ Profile: see 'SweptSolid' geometric representation ■ Profile Position : see 'SweptSolid' geometric representation ■ Extrusion: not applicable
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following constraints apply to the 'Clipping' representation: ■ Solid: see 'SweptSolid' geometric representation ■ Profile: see 'SweptSolid' geometric representation ■ Profile Position : see 'SweptSolid' geometric representation ■ Extrusion: see 'SweptSolid' geometric representation ■ Orientation: see 'SweptSolid' geometric representation ■ Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid (or its subtypes). Figure 216 illustrates a 'Clipping' geometric representation with use of IfcBooleanClippingResult between an IfcExtrudedAreaSolid and an IfcHalfSpaceSolid to create a clipped body, with cardinal point applied as **2** (bottom centre). Figure 216 — Column body clipping

Field	Mapping	Definition
(Query)	\IfcColumnType	
Material Profile Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name \IfcLabel	The material of the IfcColumnType is defined by the IfcMaterialProfileSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. 　NOTE It is illegal to assign an IfcMaterial to an IfcColumnType, if there is at least one occurrences of IfcColumnStandardCase for this type. The shared profile definition is defined by assigning an IfcMaterialProfileSet (see material use definition above). The IfcMaterialProfile refers to the subtype of IfcProfileDef that is the common profile for all column occurrence, if used. It is only applicable if the IfcColumnType has only occurrences of type IfcColumnStandardCase (see definition of IfcColumnStandardCase for further information). 　NOTE The attribute *ProfileName* of the IfcProfileDef subtype, referenced in IfcMaterialProfile should contain a standardized profile name according to local standards. However, an additional geometric representation of the profile is necessary (e.g. as IfcExtrudedAreaSolid). An importing application is allowed to check for the existence of the profile name: in case of identifying it as a standardized name, the corresponding profile geometry and possibly other cross sectional properties can be read from a library. Otherwise the geometric representation and possible non geometric IfcProfileProperties have to be used.
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The IfcColumnType may define the shared geometric representation for all column occurrences. The *RepresentationMaps* attribute refers to a list of IfcRepresentationMap's, that allow for multiple geometric representations (e.g. with IfcShapeRepresentation's having an *RepresentationIdentifier* 'Box', 'Axis', or 'Body'). It is only applicable if the IfcColumnType has only occurrences of type IfcColumn (See geometric use definition of IfcColumn for further information). 　NOTE If the IfcColumnType has an associated IfcMaterialProfileSet, then no shared geometric representation shall be provided. 　NOTE The product shape representations are defined as *RepresentationMaps* (attribute of the supertype IfcTypeProduct), which get assigned by an element occurrence instance through the *IfcShapeRepresentation.Item[n]* being an IfcMappedItem. See IfcTypeProduct for further information. 　NOTE The values of attributes *RepresentationIdentifier* and *RepresentationType* of IfcShapeRepresentation are restricted in the same way as those for IfcColumn and IfcColumnStandardCase.

Field	Mapping	Definition
(Query)	\IfcCommunicationsAppliance	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Composition		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcCompressor	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

	\IfcTypeObject.Name	
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

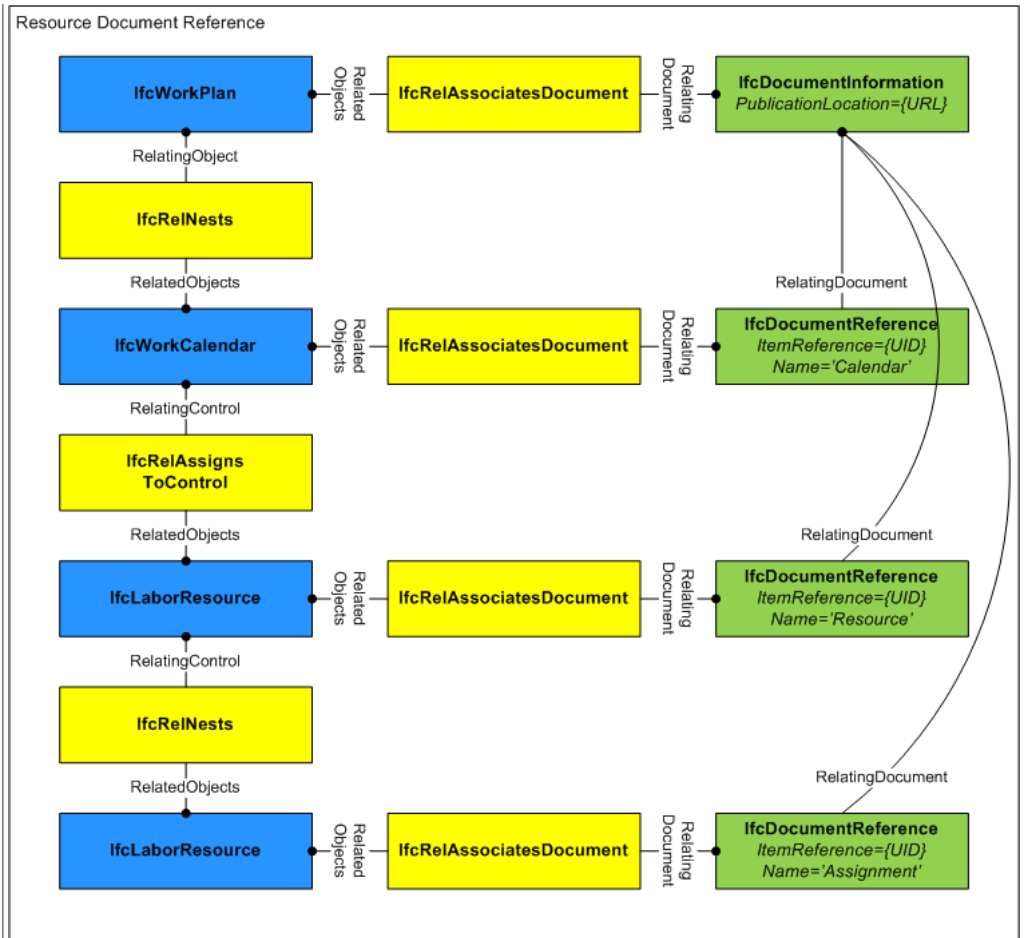| Field	Mapping	Definition
(Query)	\IfcCondenser	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcConstructionEquipmentResource	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Resource Assignment	\IfcResource.ResourceOf[*] \IfcRelAssignsToResource.RelatedObjects[*] \IfcActor	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.
Resource Cost	\IfcConstructionResource.BaseCosts[*] \IfcAppliedValue.Name \IfcLabel	A name or additional clarification given to a cost value.
Resource Quantity	\IfcConstructionResource.BaseQuantity \IfcPhysicalSimpleQuantity.Name \IfcLabel	Name of the element quantity or measure. The name attribute has to be made recognizable by further agreements.

Field	Mapping	Definition
(Query)	\IfcConstructionMaterialResource	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Resource Type Assignment	\IfcTypeResource.ResourceOf[*] \IfcRelAssignsToResource.RelatedObjects[*] \IfcTypeProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.
Resource Cost	\IfcConstructionResource.BaseCosts[*] \IfcAppliedValue.Name \IfcLabel	A name or additional clarification given to a cost value.
Resource Quantity	\IfcConstructionResource.BaseQuantity \IfcPhysicalSimpleQuantity.Name \IfcLabel	Name of the element quantity or measure. The name attribute has to be made recognizable by further agreements.

Field	Mapping	Definition
(Query)	\IfcConstructionProductResource	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Resource Assignment	\IfcResource.ResourceOf[*] \IfcRelAssignsToResource.RelatedObjects[*] \IfcActor	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.
Resource Cost	\IfcConstructionResource.BaseCosts[*] \IfcAppliedValue.Name \IfcLabel	A name or additional clarification given to a cost value.
Resource Quantity	\IfcConstructionResource.BaseQuantity \IfcPhysicalSimpleQuantity.Name \IfcLabel	Name of the element quantity or measure. The name attribute has to be made recognizable by further agreements.

Field	Mapping	Definition
(Query)	\IfcConstructionResource	
Document	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesDocument.Name \IfcLabel	Documents may be published for work plans consisting of schedules, calendars, tasks, and resources. The relationship IfcRelAssociatesDocument may be used to preserve mappings to such document where *RelatingDocument* points to an IfcDocumentReference and *RelatedObjects* includes the IfcConstructionResource as shown in Figure 184. *IfcDocumentReference.ItemReference* identifies the resource within the scope of the document, such as an integer or guid. The *IfcDocumentReference.ReferencedDocument* corresponds to the document which is uniquely identified by *IfcDocumentInformation.DocumentId* and/or *IfcDocumentInformation.PublicationLocation*. Such document mapping allows items in the document to be updated from the building information model and vice-versa.

Figure 301 — Construction resource document use

Constraint	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesConstraint.RelatingConstraint \IfcObjective.BenchmarkValues[*] \IfcMetric.DataValue \IfcMetricValueSelect	Constraints may be applied to a resource to indicate fixed work (such as total person-hours) or fixed usage (such as simultaneous workers).
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	The resource type may provide shared productivity and cost information, allowing tasks and resources to be selected according to lowest cost and/or shortest duration. Given an IfcProduct of a particular IfcTypeProduct type, an IfcTypeProcess may be selected from those assigned to the product type using IfcRelAssignsToProduct, and an IfcTypeResource may be selected from those assigned to the process type using IfcRelAssignsToProcess. Then IfcTask and IfcConstructionResource occurrences may be instantiated from the type definitions, applying productivity and rate information to assigned quantities to calculate *ResourceTime.ScheduleWork*. Task durations can then be calculated by dividing *ResourceTime.ScheduleWork* by *ResourceTime.ScheduleUsage*.
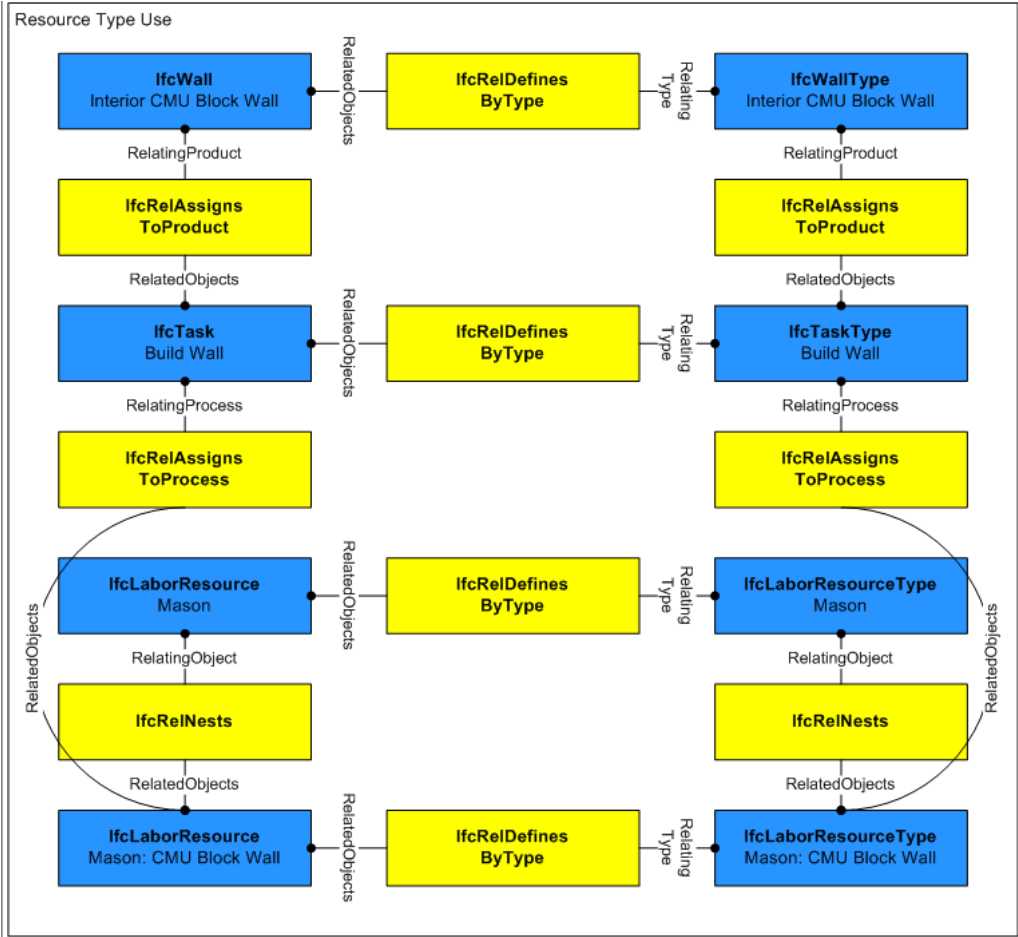
Figure 302 — Construction resource type use

\IfcObject

For time series properties as shown in Figure 180, each IfcTimeSeriesValue indicates a LIST of values, where the sequence of the value corresponds to the IfcCostValue at *IfcConstructionResource.CostRatesConsumed*. For example, if *CostRatesConsumed* has two IfcCostValue items in the LIST, "Standard" and "Overtime", then *IfcTimeSeriesValue(IfcDuration('T8H0M0S'),IfcDuration('T2H0M0S'))* would indicate 8 hours at Standard rate and 2 hours at Overtime rate. If the list of values at *IfcTimeSeriesValue.ListValues* is less than the size of *CostRatesConsumed*, then subsequent values are considered to be zero.
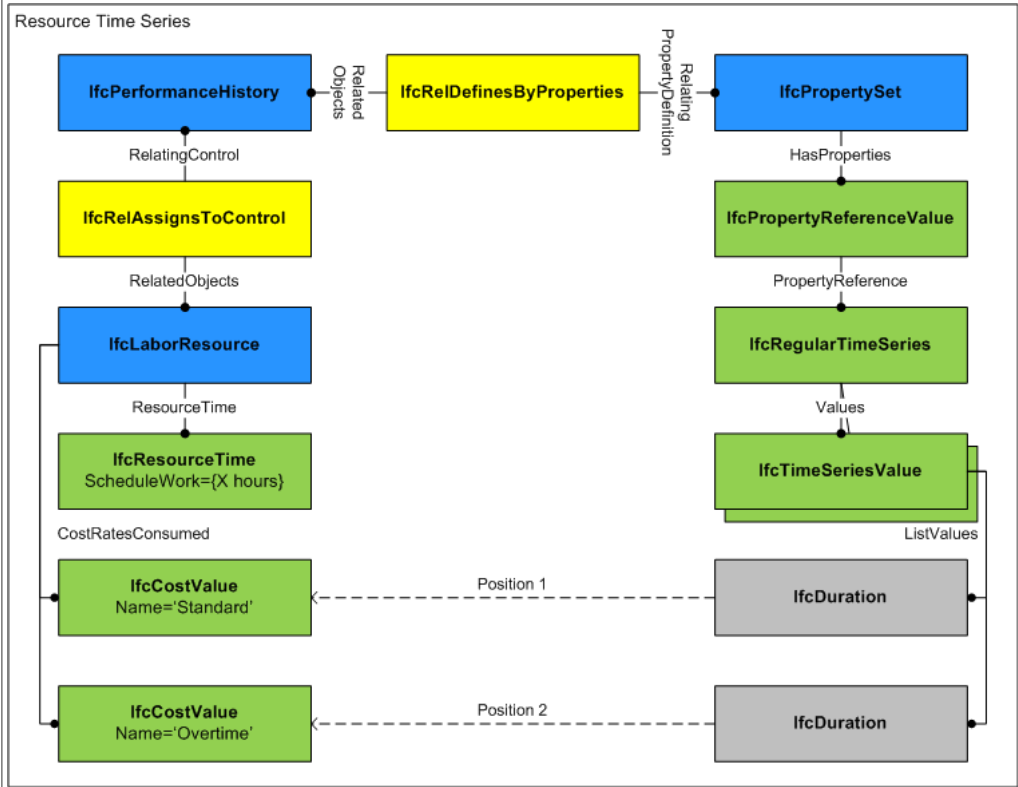
Figure 303 — Construction resource time series use

| Nesting | \IfcObjectDefinition.IsNestedBy[*]
\IfcRelNests.RelatedObjects[*]
\IfcObject | Resources may be decomposed into allocation pools using the IfcRelNests relationship as shown in Figure 181. For example, an IfcLaborResource for "Electrician" may be decomposed into three task-specific IfcLaborResource objects: "Electrical Rough-in", "First Floor Circuits", and "Second Floor Circuits". Both relating and related sides may represent the same *ResourceTime.ScheduleUsage* |

quantity (for example, 6 workers time-shared), or the related side may break out *ResourceTime.ScheduleUsage* quantities for reserved use (for example, 4 workers and 2 workers).

A common scenario is two nesting levels where the first-level resources have no task assignments; while second-level resources hav specific task assignments indicating that the resource is subdivided into allocations for specific tasks. While the model allows unlimite nesting of resources, implementer agreements may restrict to two nesting levels with task assignments specifically at the second level.
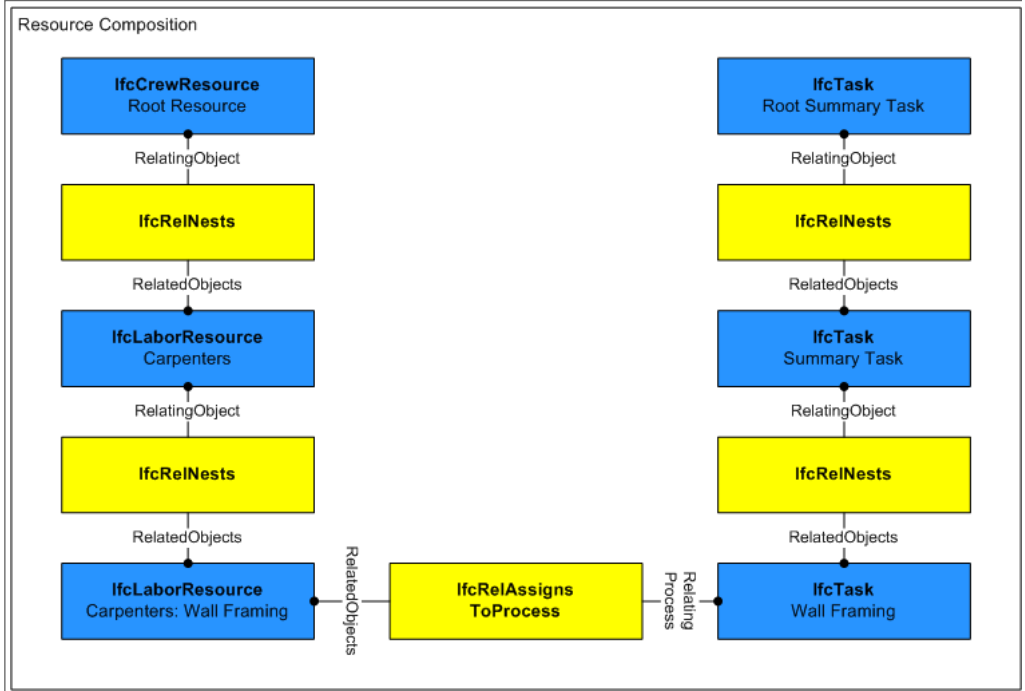
Figure 304 — Construction resource composition use

Field	Mapping	Definition
(Query)	\IfcControl	
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	Controls have assignments from products, processes, or other objects by using the relationship object IfcRelAssignsToControl.

Field	Mapping	Definition
(Query)	\IfcController	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be requi would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be requi would be enforced by a where rule.
Composition		Figure 298 illustrates controller composition use. **Figure 298 — Controller composition use**
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcCooledBeam	
Object	\IfcObject.IsTypedBy[*]	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be

Typing	\IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcCoolingTower**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Composition		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcCostItem**	
Classification	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	Instances of IfcCostItem are used for cost estimates, budgets, and other forms, where a variety of identification codes are use extensively to identify the meaning of the cost. Examples include project phase codes, CSI codes, takeoff sequence numbers, cost accounts. The model allows for all classes that are ultimately subtypes of IfcObject to inherit the ability to have one or mo instances of IfcClassificationReference to be assigned. Where identification codes are required, the generic IfcRelAssociatesClassification facility should be used.
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	An IfcCostItem can nest other instances of IfcCostItem through its relationships to IfcRelNests. This can be used to enable the development of complex groups of costs as may be found in cost schedules through to pages, sections and complete cost sch There is always a summary cost item as the root item of the tree representing the cost item nesting. Subsequent instances of IfcCostItem are assigned to the summary cost item using IfcRelNests. The summary cost item itself is assigned to IfcCostSch through the IfcRelAssignsToControl relationship. Figure 280 illustrates a cost item composition used for a cost schedule. Each line item has a quantity and separate unit costs *IfcCostValue.CostType* indicates the category of cost. The summary item has a hierarchy of costs calculated according to *IfcAppliedValueRelationship.ArithmeticOperator*, where *IfcCostValue.CostType* identifies the category to be totalled. The Tax component has *IfcCostValue.CostType* set to 'Material' which indicates it is the sum of all nested values of the 'Material' cate 3000 + $118 x 100 = $20800). The Subtotal component has *IfcCostValue.CostType* set to an asterisk ('*') which indicates it is of all nested values of all categories. **Figure 280 — Cost composition**
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	An IfcCostItem can be calculated based on quantities from objects through its relationship to IfcRelAssignsToControl. For quantity-based costing, IfcElement, IfcTask, or IfcResource occurrence subtypes may be used. Multiple elements may be assigned of the same or different types, using IfcPhysicalQuantity entities defined at each object. Each IfcPhysicalQuantity typ be identical (for example, all values are *IfcAreaQuantity*) such that they can be added together.

For rate-based costing (specifically for *IfcCostScheduleTypeEnum.SCHEDULEOFRATES*), a single IfcTypeProduct, IfcTypePr
or IfcTypeResource subtype may be used to reflect rates for occurrences of such types. This enables the possibility to genera
quantity-based cost schedule for occurrences based on types with rate-based cost schedules.

IfcRelAssignsToControl is also used in the opposite direction to link the root IfcCostItem to an IfcCostSchedule where *Relating*
is the IfcCostSchedule.

Figure 281 illustrates cost item assignment derived from building elements. The IfcRelAssignsToControl relationship indicates
elements for which quantities are derived. Not shown, costs may also be derived from building elements by traversing assignn
relationships from the assigned IfcProduct to IfcProcess to IfcResource, where all costs ultimately originate at resources. It is a
possible for cost items to have assignments from processes or resources directly.
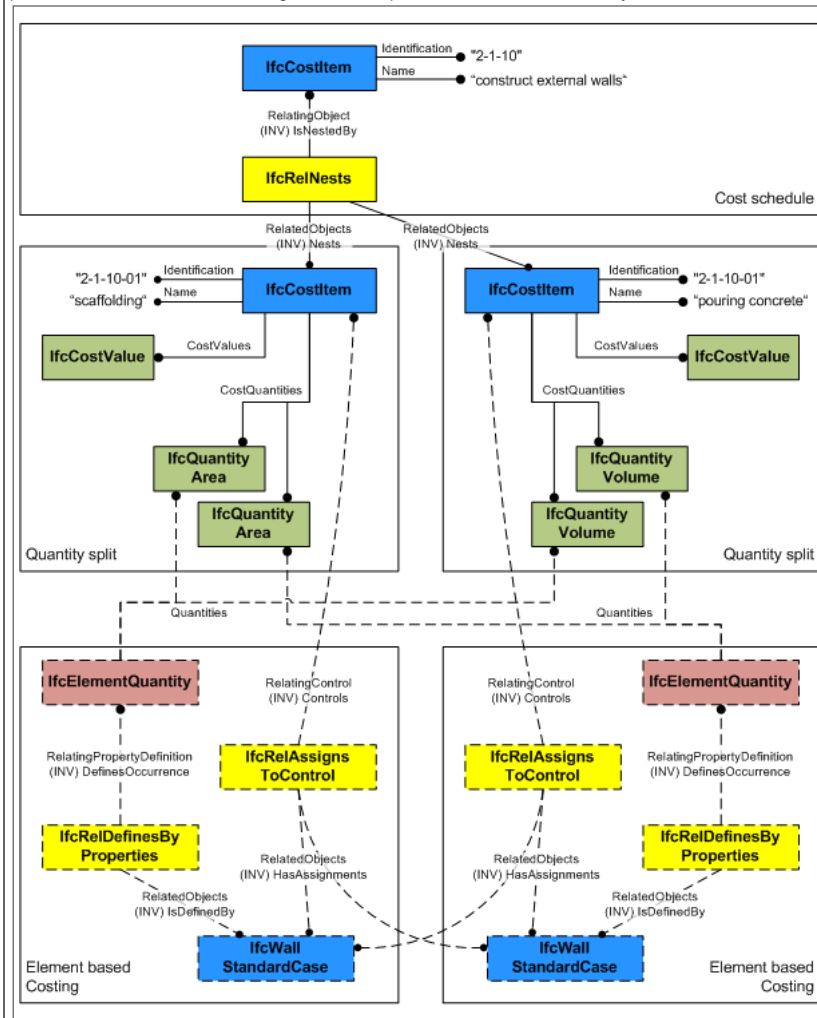
Figure 281 — Cost assignment

Field	Mapping	Definition
(Query)	**\IfcCostSchedule**	
Approval	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesApproval.RelatingApproval \IfcApproval.Name \IfcLabel	Approvals may be associated to indicate the status of acceptance or rejection using the IfcRelAssociatesApproval relationship where *RelatingApproval* refers to an IfcApproval and *RelatedObjects* contains the **IfcCostSchedule**. Approvals may be split into sub-approvals using IfcApprovalRelationship to track approval status separately for each party where *RelatingApproval* refers to the higher-level approval and *RelatedApprovals* contains one or more lower-level approvals. The hierarchy of approvals implies sequencing such that a higher-level approval is not executed until all of its lower-level approvals have been accepted.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	The **IfcCostSchedule** may be assigned to the following entities using relationships as indicated: ■ IfcActor (IfcRelAssignsToActor): Persons and organizations involved in the preparation, submittal, and as target users. The **IfcCostSchedule** may have assignments of its own using the IfcRelAssignsToControl relationship where *RelatingControl* refers to the **IfcCostSchedule** and *RelatedObjects* contains one or more objects of the following types: ■ IfcCostItem: Indicates costs published within this cost schedule, typically a single root cost item forming a hierarchy of nested cost items.

Field	Mapping	Definition
(Query)	**\IfcCovering**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcCovering has a containment relationship within the hierarchical spatial structure. ■ The IfcCovering is places within the project spatial hierarchy using the objectified relationship IfcRelContainedInSpatialStructure, referring to it by its inverse attribute *SELF\IfcElement.ContainedInStructure*. Subtypes of IfcSpatialStructureElement are valid spatial containers, with IfcSpace being the default container.
Material Layer Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	Coverings for surfaces (CEILING, FLOORING, CLADDING, CEILING, ROOFING) may have materials defined according to layers.

Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	Coverings for edges (MOLDING, SKIRTINGBOARD) may have materials defined according to profiles.
Surface Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'GeometricSet' representation of IfcCovering: - for planar base surfaces - bounded surface representation - for cylindrical base surfaces - swept surface representation

Figure 218 — Covering surface planar

EXAMPLE Figure 218 illustrates a planar surface representation where the area of IfcCovering is given by an IfcPolyLoop for planar base surfaces (here provided by the IfcRelSpaceBoundary). The implicit planar surface of the IfcPolyLoop shall be identical with the planar surface defined by the IfcRelSpaceBoundary.

Figure 219 — Covering surface cylindrical

EXAMPLE Figure 219 illustrates a cylindrical surface representation where the area of the IfcCovering is given by an IfcSurfaceOfLinearExtrusion for cylindrical base surfaces (here given by the IfcRelSpaceBoundary, such as caused by a round wall).

- The geometry representation of the IfcCovering is given by the *IfcTrimmedCurved* (the Curve parameter of the IfcArbitraryOpenProfileDef - in cases of faceted representation also an IfcPolyline). It is extruded within the plane of the base surface using the *Depth* parameter of the IfcSurfaceOfLinearExtrusion.

Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation of IfcCovering: - for planar base surfaces - swept area representation - for cylindrical base surfaces - swept area representation

Figure 220 — Covering body planar

EXAMPLE Figure 220 illustrates a body representation where the volume of IfcCovering is given by an IfcExtrudedAreaSolid for planar base surfaces (here given by the IfcRelSpaceBoundary). The extruded area (IfcArbitraryClosedProfileDef) shall be coplanar to the surface defined by the IfcRelSpaceBoundary.

Figure 221 — Covering body circular

EXAMPLE Figure 221 illustrates a body representation where the volume of the IfcCovering is given by an IfcExtrudedAreaSolid for cylindrical base surfaces (here given by the IfcRelSpaceBoundary - such as caused by a round wall).

- The geometry representation of the IfcCovering is given by the IfcCompositeCurve (the *OuterCurve* parameter of the IfcArbitraryClosedProfileDef - in cases of faceted representation also a closed IfcPolyline). It is extruded along the plane of the base surface using the *Depth* parameter of the IfcSurfaceOfLinearExtrusion.

Field	Mapping	Definition
(Query)	\IfcCoveringType	
Material Layer Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name \IfcLabel	The material of the IfcCoveringType is defined by IfcMaterialLayerSet for layer-based coverings or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship.
Material Profile Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name \IfcLabel	The material of the IfcCoveringType is defined by IfcMaterialProfileSet for profile-based coverings or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship.
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The IfcCoveringType may define the shared geometric representation for all covering occurrences. The *RepresentationMaps* attribute refers to a list of IfcRepresentationMap's, that allow for multiple geometric representations (e.g. with *IfcShaperepresentation*'s having an *RepresentationIdentifier* 'Box', 'Surface', or 'Body'). (See geometric use definition of IfcCovering for further information). NOTE If the IfcCoveringType has an associated IfcMaterialLayerSet, then no shared geometric representation shall be provided. NOTE The product shape representations are defined as *RepresentationMaps* (attribute of the supertype IfcTypeProduct), which get assigned by an element occurrence instance through the *IfcShapeRepresentation.Item[n]* being an IfcMappedItem. See IfcTypeProduct for further information. NOTE The values of attributes *RepresentationIdentifier* and *RepresentationType* of IfcShapeRepresentation are restricted in the same way as those for IfcCoveringType.

Field	Mapping	Definition
(Query)	\IfcCrewResource	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

Field	Mapping	Definition
(Query)	\IfcCurtainWall	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction may be imposed by view definitions or implementer agreements: ■ If the IfcCurtainWall establishes an aggregate, then all contained elements shall be placed relative to the *IfcCurtainWall.ObjectPlacement*.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'Axis' representation: ■ <u>Geometry</u> : IfcPolyline having two *Points*, or IfcTrimmedCurve with *BasisCurve* of type IfcLine or IfcCircle.

Field	Mapping	Definition
(Query)	\IfcCurtainWallType	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcDamper	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcDiscreteAccessory	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcDistributionChamberElement	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Constituents	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The material of the **IfcDistributionChamberElement** is defined by IfcMaterialConstituentSet or as a fallback by IfcMaterial, and attached by the *RelatingMaterial* attribute on the IfcRelAssociatesMaterial relationship. It is accessible by the *HasAssociations* inverse attribute. Material information can also be given at the IfcDistributionChamberElementType, defining the common attribute data for all occurrences of the same type. The following keywords for *IfcMaterialConstituentSet.MaterialConstituents[n].Name* shall be used:

- **'Base'**: The material from which the base of the duct is constructed.
- **'Cover'**: The material from which the access cover to the chamber is constructed.
- **'Fill'**: The material that is used to fill the duct (where used).
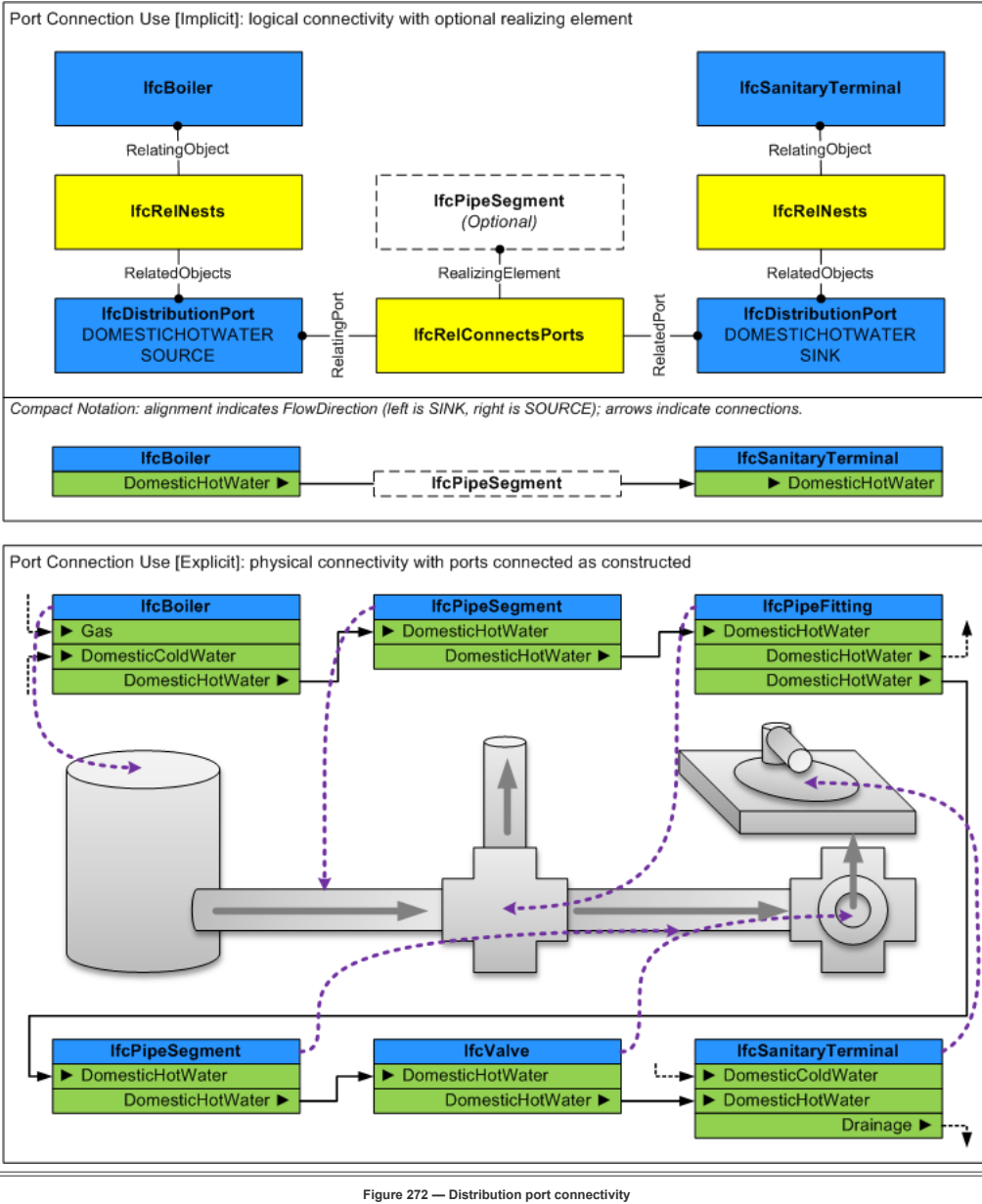- **'Wall'**: The material from which the wall of the duct is constructed.

Field	Mapping	Definition
(Query)	**\IfcDistributionControlElement**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be requir would be enforced by a where rule.
Object Classification	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	In addition to general product and project classification (UniFormat, etc.), classifications may also be applied to indicate a devi address or addressing scheme according to system-based device instance classification. Figure 271 illustrates classification usage. **Figure 271 — Distribution control classification**
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	The **IfcDistributionControlElement** may be assigned to the following entities using relationships as indicated: - IfcDistributionSystem (IfcRelAssignsToGroup): Indicates a system containing interconnected devices, where control elements are typ part of a control system having *PredefinedType=CONTROL*. - IfcPerformanceHistory (IfcRelAssignsToControl): Indicates realtime or historical infomation captured for the device.

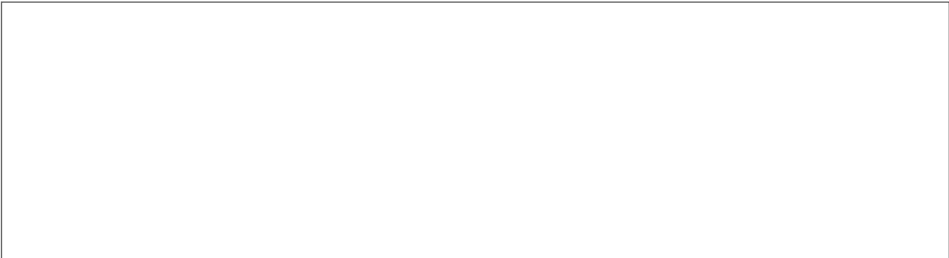| Field	Mapping	Definition
(Query)	**\IfcDistributionControlElementType**	
Product Type Assignment	\IfcTypeProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcTypeProcess	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcDistributionElement**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	The IfcDistributionElement defines the occurrence of any HVAC, electrical, sanitary or other element within a distribution system. Common information about distribution element types (or styles) is handled by subtypes of IfcDistributionElementType. The IfcDistributionElementType (if present) may establish the common type name, usage (or predefined) type, common material, common set of properties and common shape representations (using IfcRepresentationMap). The IfcDistributionElementType is attached using the *IfcRelDefinedByType.RelatingType* objectified relationship and is accessible by the inverse *IsDefinedBy* attribute. The assignment of types to distribution element occurrences is vital for providing the additional meaning, or ontology, of the distribution element. Many specialized type are defined in other schemas of this specification.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	The quantities relating to the IfcDistributionElement are defined by the IfcElementQuantity and attached by the IfcRelDefinesByProperties. A detailed specification for individual quantities is introduced at the level of subtypes of IfcDistributionElement.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcDistributionElement may be contained within the spatial containment tree. The IfcSpace is the default spatial container. NOTE The 'Spatial Containment' concept is mandatory in many model view definitions.

Field	Mapping	Definition
(Query)	**\IfcDistributionFlowElement**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Axis Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	This represents the 3D flow path of the item having *IfcShapeRepresentation.RepresentationType* of 'Curve3D' and containing a single IfcBoundedCurve subtype such as IfcPolyline, IfcTrimmedCurve, or IfcCompositeCurve. For elements containing directional ports (IfcDistributionPort with *FlowDirection* of SOURCE or SINK), the direction of the curve indicates direction of flow where a *SINK* port is positioned at the start of the curve and a *SOURCE* port is positioned at the end of the curve. This representation is most applicable to flow segments (pipes, ducts, cables), however may be used at other elements to define a primary flow path if applicable.
Clearance Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	This represents the 3D clearance volume of the item having RepresentationType of 'Surface3D'. Such clearance region indicates space that should not intersect with the 'Body' representation of other elements, though may intersect with the

'Clearance' representation of other elements. The particular use of clearance space may be for safety, maintenance, or other purposes.

Field	Mapping	Definition
(Query)	**\IfcDistributionFlowElementType**	
Axis Geometry	\IfcElementType.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	This represents the 3D flow path of the item having *IfcShapeRepresentation.RepresentationType* of 'Curve3D' and containing a single IfcBoundedCurve subtype such as IfcPolyline, IfcTrimmedCurve, or IfcCompositeCurve. For elements containing directional ports (IfcDistributionPort with *FlowDirection* of *SOURCE* or *SINK*), the direction of the curve indicates direction of flow where a *SINK* port is positioned at the start of the curve and a *SOURCE* port is positioned at the end of the curve. This representation is most applicable to flow segment types (pipes, ducts, cables), however may be used at other elements to define a primary flow path if applicable. If an element type is defined parametrically (such as a flow segment type defining common material profile but no particular length or path), then no representations shall be asserted at the type. NOTE The product representations are defined as representation maps (at the level of the supertype IfcTypeProduct, which get assigned by an element occurrence instance through the *IfcShapeRepresentation.Item[1]* being an IfcMappedItem.
Clearance Geometry	\IfcDistributionElementType.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	This represents the 3D clearance volume of the item having *RepresentationType* of 'Surface3D'. Such clearance region indicates space that should not intersect with the 'Body' representation between element occurrences, though may intersect with the 'Clearance' representation of other element occurrences. The particular use of clearance space may be for safety, maintenance, or other purposes.
Lighting Geometry	\IfcDistributionElementType.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	This represents the light emission of the item having *IfcShapeRepresentation.RepresentationType* of 'LightSource' and containing one or more IfcLightSource subtypes. This representation is most applicable to lamps and light fixtures, however may be used at other elements that emit light.

Field	Mapping	Definition
(Query)	**\IfcDistributionPort**	
Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The placement of a port indicates the position and orientation of how it may connect to a compatible port on another product. The placement shall be relative to the nesting IfcDistributionElement, IfcDistributionElementType, or enclosing IfcDistributionPort. The *Location* is the midpoint of the physical connection, unless otherwise indicated by cardinal point on a material profile. The *Axis* points in the direction of the physical connection away from the product if *FlowDirection* equals *SOURCE* (or *SOURCEANDSINK* or *NOTDEFINED*), or points opposite direction (to the product) if the *FlowDirection* equals *SINK*. NOTE The rationale for positioning the *Axis* in the direction of flow is to allow for the same geometry to be used, such as for connectors with polarized cross-section. The *RefDirection* points in the direction of the local X axis of the material profile, where the local Y axis points up if looking towards the *Axis* where the local X axis points right. Upon connecting elements through ports with rigid connections, each object shall be aligned such that the effective *Location*, *Axis*, and *RefDirection* of each port is aligned to be equal (with exception for circular profiles where the *RefDirection* need not be equal).
	\IfcObject	The IFC class identifier indicating the subtype of object.
Port Nesting	\IfcDistributionElement	Distribution ports are indicated on products and product types using the IfcRelNests relationship where *RelatingObject* refers to the enclosing IfcDistributionElement or IfcDistributionElementType respectively. The order of ports indicates logical ordering such within outlets, junction boxes, or communications equipment. Ports may be further nested into sub-ports, for indicating specific connections on components or pins.
Port Connectivity	\IfcDistributionPort.ConnectedTo[*] \IfcRelConnectsPorts.RelatedPort \IfcDistributionPort	**IfcDistributionPort** may be connected to other objects as follows using the indicated relationship: ■ **IfcDistributionPort** (IfcRelConnectsPorts) : Indicates a connection to another port having the same type and opposite flow direction. For port connections between elements, the *RelatingPort* is set to a port having *FlowDirection=SOURCE* and the *RelatedPort* is set to a port having *FlowDirection=SINK*. For aggregation scenarios, ports on a device may be mapped to aggregated devices within, in which case ports on the outer device indicate a single *FlowDirection* but have an additional connection internally to a port on an aggregated inner device. Refer to IfcUnitaryEquipment for an example. ■ IfcDistributionElement (through IfcRelConnectsPortToElement): For dynamic ports, indicates the containing element. Figure 272 illustrates distribution port connectivity.

Figure 272 — Distribution port connectivity

Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	The **IfcDistributionPort** may be assigned to the following entities using relationships as indicated: ▪ IfcDistributionSystem (through IfcRelAssignsToGroup): Indicates a system containing interconnected devices. ▪ IfcPerformanceHistory< (through IfcRelAssignsToControl): Indicates real time or historical infomation captured for the device.

Field	Mapping	Definition
(Query)	**\IfcDistributionSystem**	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Aggregation		
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	For the most common case of an IfcDistributionElement subtype containing ports of a particular *PredefinedType* that all belong to the same distribution system, the IfcDistributionElement is assigned to the IfcDistributionSystem via the IfcRelAssignsToGroup relationship, where IfcDistributionPort's are implied as part of the corresponding system based on their *PredefinedType*. An IfcDistributionElement may belong to multiple systems, however only one IfcDistributionSystem of a particular *PredefinedType*. For rare cases where an IfcDistributionElement subtype contains ports of the same *PredefinedType* yet different ports belong to different systems, alternatively each IfcDistributionPort may be directly assigned to a single IfcDistributionSystem via the IfcRelAssignsToGroup relationship, where the *PredefinedType* must match. Such assignment indicates that the IfcDistributionSystem assigned from the IfcDistributionPort overrides any such system of the same *PredefinedType* assigned from the containing IfcDistributionElement, if any. Additionally, an IfcDistributionSystem may in turn be assigned to an IfcDistributionPort indicating the host or origination of the system using IfcRelAssignsToProduct. EXAMPLE A gas-powered hot water heater may have three ports: GAS, DOMESTICCOLDWATER, and DOMESTICHOTWATER. The heater is a member of two systems (GAS and DOMESTICCOLDWATER), and hosts one system (DOMESTICHOTWATER) at the corresponding port. Figure 273 illustrates a distribution system for an electrical circuit.
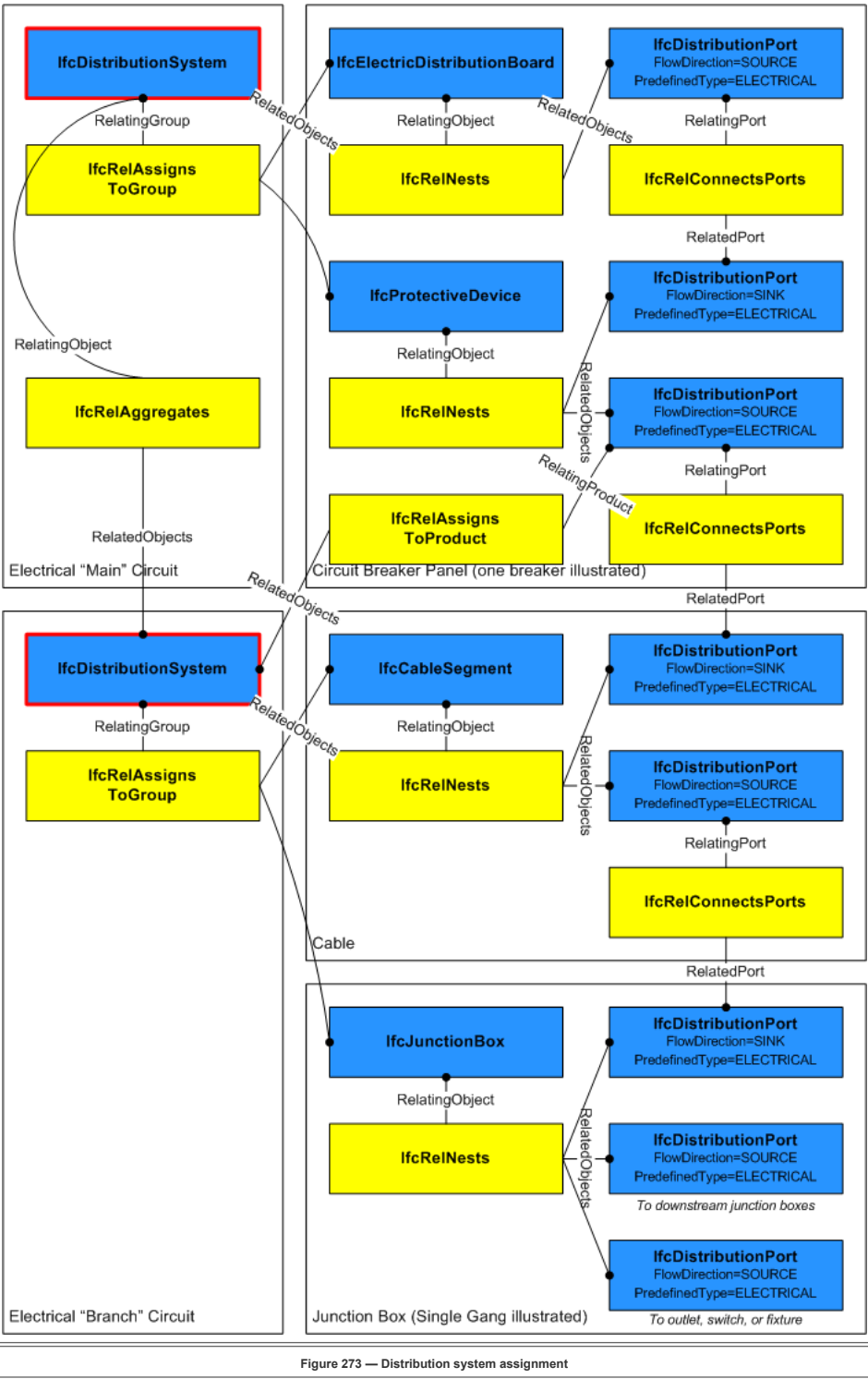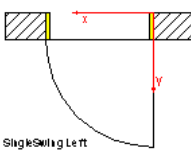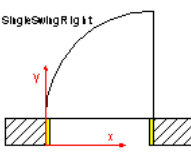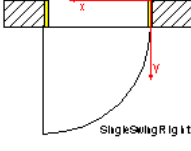
Figure 273 — Distribution system assignment

Field	Mapping	Definition
(Query)	\IfcDoor	
Door Attributes	\IfcDoor.Tag \IfcIdentifier	The opening direction is determined by the local placement of IfcDoor and the *OperationType* of the IfcDoorType as shown in Figure 221. NOTE There are different definitions in various countries on what a left opening or left hung or left swing door is (same for right). Therefore the IFC definition may derivate from the local standard and need to be mapped appropriately.

Opening directions	Definitions	Reference to other standards
SingleSwingLeft	The door panel (for swinging doors) opens always into the direction of the positive Y axis of the local placement. The determination of whether the door opens to the left or to the right is done at the level of the IfcDoorType. Here it is a left side opening door given by *IfcDoorType.OperationType* = SingleSwingLeft	refered to as LEFT HAND (LH) in US * refered to as DIN-R (right hung) in Germany

* it assumes that the 'inside/private/primary' space is above (top in the pictures) and the 'outside/public/secondary' space is below (bottom in the pictures).

Opening directions	Definitions	Reference to other standards
SingleSwingLeft	If the door should open to the other side, then the local placement has to be changed. It is still a left side opening door, given by *IfcDoorType.OperationType* = SingleSwingLeft	refered to as RIGHT HAND REVERSE (RHR) in US * refered to as DIN-R (right hung) in Germany
SingleSwingRight	If the door panel (for swinging doors) opens to the right, a separate door style needs to be used (here *IfcDoorTypee.OperationType* = SingleSwingRight) and it always opens into the direction of the positive Y axis of the local placement.	refered to as RIGHT HAND (RH) in US * refered to as DIN-L (left hung) in Germany
SingleSwingRight	If the door panel (for swinging doors) opens to the right, and into the opposite directions, the local placement of the door need to change. The door style is given by *IfcDoorType.OperationType* = SingleSwingRight.	refered to as LEFT HAND REVERSE (LHR) in US * refered to as DIN-L (left hung) in Germany
* it assumes that the 'inside/private/primary' space is above (top in the pictures) and the 'outside/public/secondary' space is below (bottom in the pictures).		

Figure 221 — Door swing

NOTE The *OverallWidth* and *OverallHeight* parameters are for informational purpose only.

Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be requi This would be enforced by a where rule.
Property Sets for Objects	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be requi This would be enforced by a where rule.
Material Constituent Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The material of the IfcDoor is defined by the IfcMaterialConstituentSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial relationship.
Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: 1. The *PlacementRelTo* relationship of IfcLocalPlacement shall point to the local placement of the same element (if given), in which IfcDoor is used as a filling (normally an IfcOpeningElement), as provided by the IfcRelFillsElement relationship; 2. If the IfcDoor is part of an assembly, e.g. an IfcCurtainWall, then the *PlacementRelTo* relationship of IfcLocalPlacement shall poi given) to the local placement of that assembly; 3. If the IfcDoor is not inserted into an IfcOpeningElement, then the *PlacementRelTo* relationship of IfcLocalPlacement shall point (i given) to the local placement of the same IfcSpatialStructureElement that is used in the *ContainedInStructure* inverse attribute o a referenced spatial structure element at a higher level. NOTE The product placement is used to determine the opening direction of the door.
Profile 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The door profile is represented by a three-dimensional closed curve within a particular shape representation. The profile is us to apply the parameter of the parametric door representation. Only a single closed curve shall be contained in the set of *IfcShapeRepresentation.Items*. A 'Profile' representation has to be provided if a parametric representation is applied to the door.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcDoor, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: - the *Spatial Containment* (defined here), or - the *Element Composition*. The IfcDoor may also be connected to the IfcOpeningElement in which it is placed as a filler. In this case, the spatial containm relationship shall be provided, see Figure 222. NOTE The containment shall be defined independently of the filling relationship, that is, even if the IfcDoor is a filling of an opening established by IfcRelFillsElement, it is also contained in the spatial structure by IfcRelContainedInSpatialStructure.

Figure 222 — Door spatial containment

Field	Mapping	Definition
(Query)	\IfcDoorStandardCase	
Profile 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The door profile is represented by a three-dimensional closed curve within a particular shape representation. The profile is used to app parameter of the parametric door representation. The following attribute values for the IfcShapeRepresentation holding this geometric representation shall be used: ■ *RepresentationIdentifier* : 'Profile' ■ *RepresentationType* : 'Curve3D' or 'GeometricCurveSet', in case of 'GeometricCurveSet' only a single closed curve shall be contained in the s *IfcShapeRepresentation.Items*. The following additional constraints apply to the 'Profile' representation type: ■ <u>Curve</u>: being an IfcPolyline defining a rectangle. ■ <u>Position</u>: The curve shall lie in the xz plane of the object placement coordinate (the y coordinate values of the IfcCartesianPoint's shall be 0.).

EXAMPLE Figure 223 illustrates applying the door lining parameters to the door profile shape representation. The profile defines the outer boundary to which the door lining parameters relate as:

- *IfcDoorLiningProperties.LiningDepth* starting at distance defined by *LiningOffset* going into the positive y direction.
- *IfcDoorLiningProperties.LiningThickness* offset into the inner side of the rectangle.
- *IfcDoorLiningProperties.LiningOffset* distance along the positive y direction to where the *LiningDepth* applies.
- *IfcDoorLiningProperties.ThresholdThickness* starting at the bottom edge of the rectangle into the inner side of the rectangle
- *IfcDoorLiningProperties.ThresholdDepth* starting at distance defined by *LiningOffset* going into the positive y direction.
- *IfcDoorLiningProperties.TransomOffset* starting at the bottom edge of the rectangle (along local x axis) into the inner side of the rectangle, distance provided as percentage of overall height. Distance to the centre line of the transom.

Figure 223 — Door profile

Field	Mapping	Definition
(Query)	\IfcDoorType	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
Property Sets for Types	\IfcTypeObject.HasPropertySets[*] \IfcPropertySet.Name	Two subtypes of IfcPreDefinedPropertySet are applicable to IfcDoorType: ■ IfcDoorLiningProperties - a single instance to define the shape parameters of the door lining ■ IfcDoorPanelProperties - one or several instances to define the shape parameters of the door panel(s)

Field	Mapping	Definition
(Query)	\IfcDuctFitting	

Field	Mapping	Definition
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	The name by which the material layer is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcDuctSegment**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The name by which the material profile is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcDuctSilencer**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcElectricAppliance**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcElectricDistributionBoard**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcElectricFlowStorageDevice**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcElectricGenerator**	

Field	Mapping	Definition
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Composition		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcElectricMotor	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcElectricTimeControl	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcElement	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The object placement for any subtype of IfcElement is defined by the IfcObjectPlacement, either IfcLocalPlacement or IfcGridPlacement, which defines the local object coordinate system that is referenced by all geometric representations of that IfcElement.
CoG Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Name	The 'CoG', Center of Gravity, shape representation is used as a means to verify the correct import by comparing the CoG of the imported geometry with the explicitly provided CoG created during export.
Box Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations['Box'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	EXAMPLE Any IfcElement may be represented by a bounding box, which shows the maximum extend of the body within the object coordinate system established by the IfcObjectPlacement. As shown in Figure 151, the bounding box representation is given by an IfcShapeRepresentation that includes a single item, an IfcBoundingBox.
FootPrint Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The optional identifier of the representation as used within a project.
Body SurfaceOrSolidModel Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Any IfcElement (so far no further constraints are defined at the level of its subtypes) may be represented as a mixed representation, including surface and solid models.
Body SurfaceModel Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Any IfcElement (so far no further constraints are defined at the level of its subtypes) may be represented as a single or multiple surface models, based on either shell or face based surface models. It may also include tessellated models. EXAMPLE As shown in Figure 152, the surface model representation is given by an IfcShapeRepresentation, which includes a single item which is either an IfcShellBasedSurfaceModel, or an IfcFaceBasedSurfaceModel. In some cases it may also be useful to expose a simple

Figure 151 — Building element box representation

representation as a bounding box
representation of the same complex shape.

Figure 152 — Element surface model representation

Body Tessellation Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Any IfcElement (so far no further constraints are defined at the level of its subtypes) may be represented as a single or multiple tessellated surface models, in particular triangulated surface models.
Body Brep Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Any IfcElement (so far no further constraints are defined at the level of its subtypes) may be represented as a single or multiple Boundary Representation models (which are restricted to be faceted Brep's with or without voids). The Brep representation allows for the representation of complex element shape.

EXAMPLE As shown in Figure 153, the Brep representation is given by an IfcShapeRepresentation, which includes one or more items, all of type IfcFacetedBrep. In some cases it may be useful to also expose a simple representation as a bounding box representation of the same complex shape.

Figure 153 — Building element body boundary representation

Body AdvancedBrep Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	An IfcElement (so far no further constraints are defined at the level of its subtypes or by view definitions) may be represented as a single or multiple boundary representation models, which include advanced surfaces, usually refered to as NURBS surfaces. The 'AdvancedBrep' representation allows for the representation of complex free-form element shape. NOTE View definitions or implementer agreements may restrict or disallow the use of 'AdvancedBrep' geometry.
Body CSG Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Any IfcElement (so far no further constraints are defined at the level of its subtypes) may be represented a CSG primitive or CSG tree. The CSG representation allows for the representation of complex element shape. NOTE View definitions or implementer agreements may restrict or disallow the use of 'CSG' geometry.
Mapped Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Any IfcElement (so far no further constraints are defined at the level of its subtypes) may be represented using the 'MappedRepresentation'. This shall be supported as it allows for reusing the geometry definition of a type at all occurrences of the same type. The results are more compact data sets. The same constraints, as given for 'SurfaceOrSolidModel', 'SurfaceModel', 'Tessellation', 'Brep', and 'AdvancedBrep' geometric representation, shall apply to the IfcRepresentationMap.
Element Voiding	\IfcElement.HasOpenings[*] \IfcRelVoidsElement.RelatedOpeningElement \IfcOpeningElement.PredefinedType \IfcOpeningElementTypeEnum	Predefined generic type for an opening that is specified in an enumeration. There may be a property set given specifically for the predefined types.
Element Projecting	\IfcElement.HasProjections[*] \IfcRelProjectsElement.RelatedFeatureElement \IfcProjectionElement.PredefinedType \IfcProjectionElementTypeEnum	Predefined generic type for a projection element that is specified in an enumeration. There may be a property set given specificly for the predefined types.

Field	Mapping	Definition
(Query)	**\IfcElementAssembly**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Aggregation		The IfcElementAssembly shall represent an aggregate, i.e. it should have other elements, being subtypes of IfcElement, as contained (sub)parts. The table above only represents a selection of subtypes of IfcElement that are legitimate as parts in an IfcElementAssembly ▪ The IfcElementAssembly is an aggregate i.e. being composed by other elements and acting as an assembly using the objectified relationship IfcRelAggregates, refering to it by its inverse attribute SELF\IfcObjectDefinition.IsDecomposedBy. Components of an assembly are described by instances of subtypes of IfcElement. ▪ In this case, the contained subtypes of IfcElement shall not be additionally contained in the project spatial hierarchy, i.e. the inverse attribute SELF\IfcElement.ContainedInStructure of those IfcElement's shall be NIL. Figure 154 illustrates spatial containment and element aggregation relationships.

Figure 154 — Element assembly containment

Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcElementAssembly should have a relationship for its containment in the hierachical spatial structure of the project. Only if the IfcElementAssembly is itself a part of another assembly this relationship should be omitted.

Field	Mapping	Definition
(Query)	\IfcElementComponent	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Mapped Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The mapped item, IfcMappedItem, should be used if appropriate as it allows for reusing the geometry definition of a type at all occurrences of the same type. A single instance of a subtype of IfcElementComponent can stand for several actual element components at once. In this case, the IfcShapeRepresentation contains as many mapped items as there are element components combined within this occurrence object.

EXAMPLE Figure 274 illustrates multiple components modeled as a single occurrence object (here: IfcFastener)

Figure 274 — Element component mapped representation

Representation identifier and type are the same as in single mapped representation. The number of mapped items in the representation corresponds with the count of element components in the IfcElementQuantity.

Field	Mapping	Definition
(Query)	\IfcEngine	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcEvaporativeCooler	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

	\IfcTypeObject.Name	
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcEvaporator**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcEvent**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	The IfcEvent defines the anticipated or actual occurrence of any event; common information about event types is handled by IfcEventType.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	IfcEvent may be contained within an IfcTask using the IfcRelNests relationship. The event is considered active during the time period of the enclosing task (including any assigned IfcWorkCalendar); that is such event may be triggered within the task time period but not outside of it. As an IfcEvent is considered to be atomic, no use is anticipated for nesting processes inside the event.
Sequential Connectivity	\IfcProcess.IsPredecessorTo[*] \IfcRelSequence.RelatedProcess \IfcProcess	The relationship IfcRelSequence is used to indicate control flow. An IfcEvent as a predecessor (*IfcRelSequence.RelatingProcess*) indicates that the succeeding process (typically IfcProcedure or IfcTask) is triggered in response to the event. An IfcEvent as a successor (*IfcRelSequence.RelatedProcess*) indicates that the completion of the preceeding process causes the event to be triggered. As events have zero duration, the *IfcRelSequence.SequenceType* attribute has no effect on an IfcEvent but still applies to the opposite end of the relationship if IfcTask is used.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	An IfcEvent may be assigned to an IfcWorkCalendar to indicate times when such event is active using IfcRelAssignsToControl; otherwise the effective calendar is determined by the nearest IfcProcess ancestor with a calendar assigned.
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	For building operation scenarios, IfcEvent may be assigned to a product (IfcElement subtype) using IfcRelAssignsToProduct to indicate a specific product occurrence that sources the event. EXAMPLE An IfcSensor for a motion sensor may have a "Motion Sensed" event. If the IfcEvent is defined by an IfcEventType and the IfcEventType is assigned to a product type (using IfcRelAssignsToProduct), then the IfcEvent must be assigned to one or more occurrences of the specified product type using IfcRelAssignsToProduct.

Field	Mapping	Definition
(Query)	**\IfcFan**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcFastener**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.

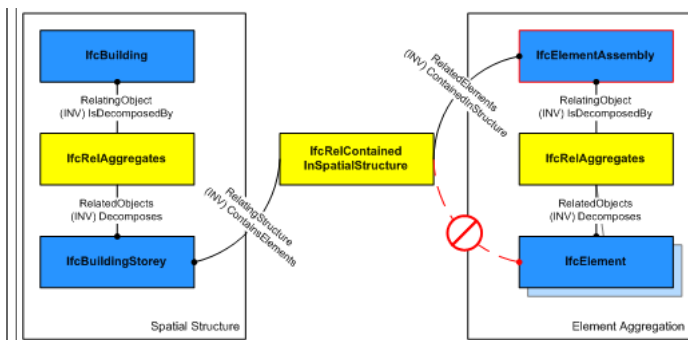| Field	Mapping	Definition
(Query)	**\IfcFeatureElement**	
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	As a subordinate part being fully dependent on the master element the IfcFeatureElement shall have no independent containment relationship to the spatial structure. ▪ The *SELF\IfcElement.ContainedInStructure* relationship shall be NIL.

Field	Mapping	Definition
(Query)	**\IfcFilter**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcFireSuppressionTerminal**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcFlowInstrument**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcFlowMeter**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcFlowSegment**	
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The material of the **IfcFlowSegment** is defined using one of the following entities: ■ IfcMaterialProfileSetUsage : for parametric segments, this defines the cross section and alignment to the 'Axis' representation, from which the 'Body' representation may be generated. ■ IfcMaterialProfileSet : for non-parametric segments (having fixed length or path), this may define the cross section for analysis purposes, however the 'Body' representation is independently generated. ■ IfcMaterialConstituentSet : for elements containing multiple materials where profiles are not applicable, this indicates materials at named parts. ■ IfcMaterial : for elements comprised of a single material where profiles are not applicable, this indicates the material. The material is attached by the *RelatingMaterial* attribute on the IfcRelAssociatesMaterial relationship. It is accessible by the *HasAssociations* inverse attribute. Material information can also be given at the IfcFlowSegmentType, defining the common attribute data for all occurrences of the same type. Standard names and material types are defined at subtypes.
Axis Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Standard representations are defined at the supertype IfcDistributionFlowElement. For parametric flow segments where IfcMaterialProfileSetUsage is defined and an 'Axis' representation is defined, then the 'Body' representation may be generated using the 'SweptSolid' or 'AdvancedSweptSolid' representation types by sweeping the profile(s) along the axis.

Field	Mapping	Definition
(Query)	**\IfcFooting**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The name by which the material profile is known.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	Geometric placement that defines the transformation from the related coordinate system into the relating. The placement can be either 2D or 3D, depending on the dimension count of the coordinate system.
Axis Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
Footprint	\IfcProduct.Representation	The optional identifier of the representation as used within a project.

Geometry	\IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcFurnishingElement	
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

Field	Mapping	Definition
(Query)	\IfcFurniture	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Material Constituents	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Aggregation		

Field	Mapping	Definition
(Query)	\IfcGeographicElement	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Property Sets for Objects	\IfcObject	The IFC class identifier indicating the subtype of object.
Classification Association	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	An IfcGeographicElement might be further qualified by referencing a feature catalog as a particular classification. The feature classification is assigned using the inverse relationship *HasAssociations* pointing to IfcClassificationReference. The attributes should have the following meaning: ■ Catalog : *IfcClassification.Name* ■ Identity: *IfcClassificationReference.Identification* ■ ElementName: *IfcClassificationReference.Name*
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

Field	Mapping	Definition
(Query)	\IfcGroup	
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	The IfcGroup establishes an arbitrary collection of objects through utilizing this concept.

Field	Mapping	Definition
(Query)	\IfcHeatExchanger	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcHumidifier	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcInterceptor	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*]	The name by which the material constituent is known.

	\IfcMaterialConstituent.Name \IfcLabel	
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcInventory**	
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcJunctionBox**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Element Connectivity	\IfcElement.ConnectedFrom[*]	Reference to the element connection relationship. The relationship then refers to the other element that is connected to this element.
Filling	\IfcElement.FillsVoids[*] \IfcRelFillsElement.RelatingOpeningElement \IfcOpeningElement.VoidsElements \IfcRelVoidsElement	Reference to the Voids Relationship that uses this Opening Element to create a void within an Element. The Opening Element can only be used to create a single void within a single Element.
Element Nesting	\IfcElement.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcElement.ObjectPlacement \IfcLocalPlacement	IFC4 ADD1 CHANGE Junction boxes no longer have ports defined, but rely on element nesting for indicating containment of electrical devices.

Field	Mapping	Definition
(Query)	**\IfcLaborResource**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Resource Assignment	\IfcResource.ResourceOf[*] \IfcRelAssignsToResource.RelatedObjects[*] \IfcActor	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.
Resource Cost	\IfcConstructionResource.BaseCosts[*] \IfcAppliedValue.Name \IfcLabel	A name or additional clarification given to a cost value.
Resource Quantity	\IfcConstructionResource.BaseQuantity \IfcPhysicalSimpleQuantity.Name \IfcLabel	Name of the element quantity or measure. The name attribute has to be made recognizable by further agreements.

Field	Mapping	Definition
(Query)	**\IfcLamp**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcLightFixture**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Connection		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.
Lighting Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	This represents the light emission of the item having *IfcShapeRepresentation.RepresentationType* of 'LightSource' and containing one or more IfcLightSource subtypes.

Field	Mapping	Definition
(Query)	**\IfcMaterial**	
	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcMechanicalFastener**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

	\IfcTypeObject.Name	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

Field	Mapping	Definition
(Query)	**\IfcMedicalDevice**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

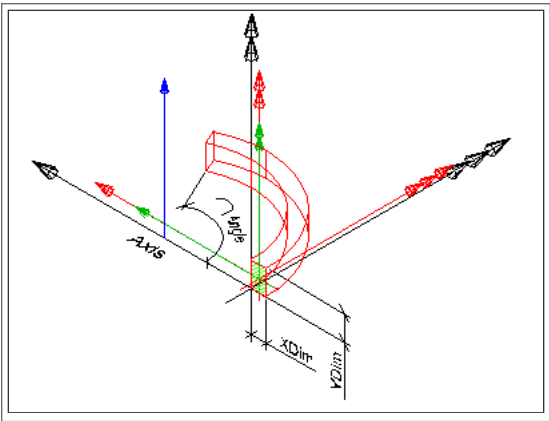| Field	Mapping	Definition
(Query)	**\IfcMember**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Profile Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name \IfcLabel	The material of the IfcMember is defined by the IfcMaterialProfileSet or as fallback by IfcMaterial, and it is attached either directly or at the IfcMemberType. NOTE It is illegal to assign an IfcMaterialProfileSetUsage to an IfcMember. Only the subtype IfcMemberStandardCase supports this concept.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcMember, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: ■ the *Spatial Containment* (defined here), or ■ the *Element Composition*.
Axis 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The axis representation can be used to represent the system length of a member that may extent the body length of the member. NOTE The 'Axis' is not used to locate the material profile set, only the subtype IfcMemberStandardCase provides this capability.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation: ■ <u>Solid</u>: IfcExtrudedAreaSolid, IfcRevolvedAreaSolid shall be supported ■ <u>Profile</u>: all subtypes of IfcProfileDef (with exception of IfcArbitraryOpenProfileDef) ■ <u>Extrusion</u>: All extrusion directions shall be supported. Figure 224 illustrates a 'SweptSolid' geometric representation. There are no restrictions or conventions on how to use the local placement (black), solid of extrusion placement (red) and profile placement (green). **Figure 224 — Member swept solid**
Body AdvancedSweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'AdvancedSweptSolid' representation type: ■ <u>Solid</u>: IfcSurfaceCurveSweptAreaSolid, IfcFixedReferenceSweptAreaSolid, IfcExtrudedAreaSolidTapered, IfcRevolvedAreaSolidTapered shall be supported. NOTE View definitions and implementer agreements can further constrain the allowed swept solid types. ■ <u>Profile</u>: see 'SweptSolid' geometric representation ■ <u>Extrusion</u>: not applicable *MappedRepresentation Representation Type*
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following constraints apply to the 'Clipping' representation: ■ <u>Solid</u>: see 'SweptSolid' geometric representation ■ <u>Profile</u>: see 'SweptSolid' geometric representation ■ <u>Extrusion</u>: see 'SweptSolid' geometric representation ■ <u>Boolean result</u>: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid (or its subtypes).

Figure 225 illustrates a 'Clipping' geometric representation with use of IfcBooleanClippingResult between an IfcExtrudedAreaSolid and an IfcHalfSpaceSolid to create a clipped body.
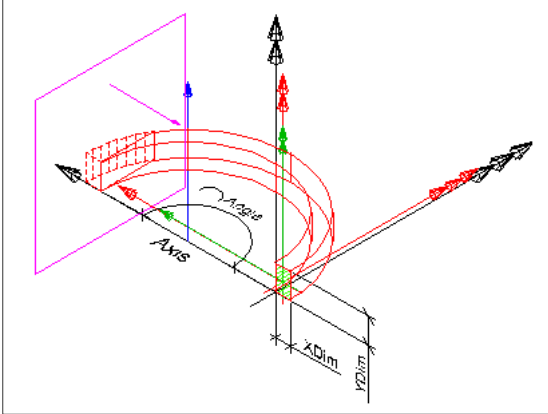
Figure 225 — Member clipping

Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcMemberStandardCase**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	The IfcMemberStandardCase defines in addition that the IfcMemberType should have a unique IfcMaterialProfileSet, that is referenced by the IfcMaterialProfileSetUsage assigned to all occurrences of this IfcMemberType.
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	Figure 227 illustrates assignment of IfcMaterialProfileSetUsage and IfcMaterialProfileSet to the IfcMemberStandardCase as the member occurrence and to the IfcMemberType. The same IfcMaterialProfileSet shall be shared by many occurrences of IfcMaterialProfileSetUsage. This relationship shall be consistent to the relationship between the IfcMemberType and the IfcMemberStandardCase. **Figure 227 — Member profile usage** Figure 228 illustrates assignment of a composite profile by using *IfcCompositeProfile* for geometric representation and several IfcMaterialProfile's within the IfcMaterialProfileSet. The number of IfcMaterialProfile's within the IfcMaterialProfileSet is restricted to maximal 2 and requires the use of IfcExtrudedAreaSolidTapered, or IfcRevolvedAreaSolidTapered for the correct 'Body' shape representation.
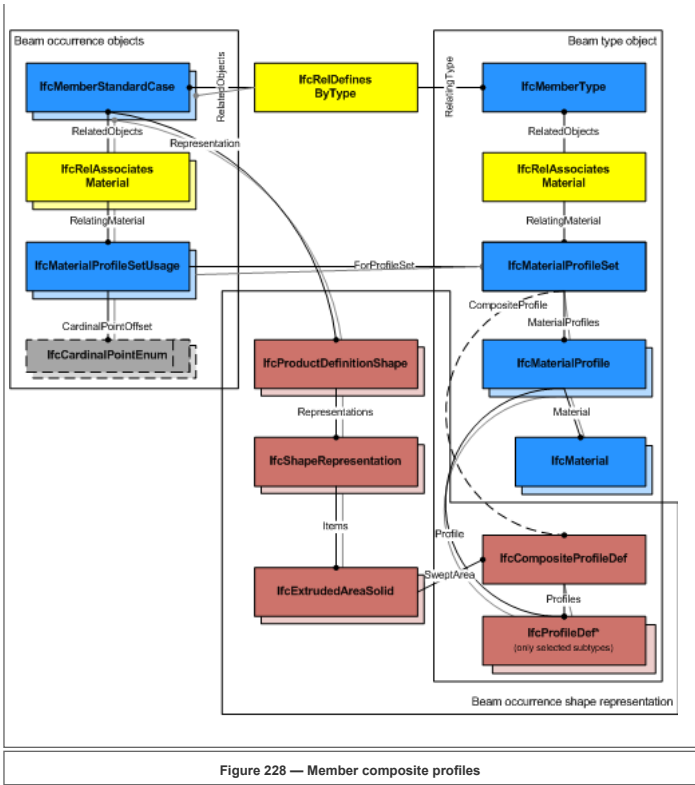
Figure 228 — Member composite profiles

The material of the IfcMemberStandardCase is defined by IfcMaterialProfileSetUsage and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. Composite profile members can be represented by refering to several IfcMaterialProfile's within the IfcMaterialProfileSet that is referenced from the IfcMaterialProfileSetUsage.

Material information can also be given at the IfcMemberType, defining the common attribute data for all occurrences of the same type. It is then accessible by the inverse *IsDefinedBy* relationship pointing to *IfcMemberType.HasAssociations* and via *IfcRelAssociatesMaterial.RelatingMaterial*. See **Type Use Definition** for additional agreements for standard members.

Product Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: ■ The local placement shall provide the location and directions for the standard member, the x/y plane is the plane for the start profile, and the z-axis is the extrusion axis for the member body (in case of rotation, the tangent direction).

Axis 3D Geometry	\IfcElement.Representation
	\IfcProductDefinitionShape.Representations['Axis']
	\IfcShapeRepresentation.ContextOfItems
	\IfcGeometricRepresentationContext
		The following additional constraints apply to the 'Axis' representation, if the 'Body' shape representation has the *RepresentationType* : 'SweptSolid':
		
		■ *Axis*
		    ■ IfcPolyline having two *Points*, or IfcTrimmedCurve with *BasisCurve* of Type IfcLine for 'SweptSolid' provided as IfcExtrudedAreaSolid. The axis curve lies on the z axis of the object coordinate system.
		    ■ IfcTrimmedCurve with *BasisCurve* of Type IfcCircle for 'SweptSolid' provided as IfcRevolvedAreaSolid. The axis curve lies on the x/z plane of the object coordinate system, the tangent at the start is along the positive z-axis.
		
		<table><tr><td>
		Figure 229 — Member axis representation</td><td>EXAMPLE As shown in Figure 101, the axis representation can be used to represent the system length of a member that may extent the body length of the member.</td></tr><tr><td></td><td>EXAMPLE As shown in Figure 102, the axis representation shall be used to represent the cardinal point as the offset between the 'Axis' and the extrusion path of the member. The extrusion path is provided as *IfcExtrudedAreaSolid.ExtrudedDirection* and should be parallel to the 'Axis'. It has to be guaranteed that the value provided by *IfcMaterialProfileSetUsage.CardinalPoint* is consistent to the *IfcExtrudedAreaSolid.Position*.</td></tr></table>

Figure 230 — Member axis cardinal point

| Body SweptSolid Geometry | \IfcElement.Representation
\IfcProductDefinitionShape.Representations[*]
\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext | The following additional constraints apply to the 'SweptSolid' representation:

- Solid: IfcExtrudedAreaSolid, IfcRevolvedAreaSolid shall be supported
- Profile: all subtypes of IfcProfileDef (with exception of IfcArbitraryOpenProfileDef)
- Profile Position : For all single profiles, the *IfcParameterizedProfileDef.Position* shall be NIL, or having *Location* = 0.,0. and *RefDirection* = 1.,0.
- Extrusion: perpendicular to the profile direction.
- Orientation: The y-axis of the profile, as determined by *IfcSweptAreaSolid.Position.P[2]* shall point to the Z-Axis. It indicates the "role" of the column, a role=0° means y-axis of profile = Z-axis of reference coordinate system. In the exception of a vertical member, the y-axis shall point to the Y-axis.

Figure 230 illustrates a 'SweptSolid' geometric representation with cardinal point applied as **1** (bottom left).

The following interpretation of dimension parameter applies for rectangular members:

- *IfcRectangleProfileDef.YDim* interpreted as member width
- *IfcRectangleProfileDef.XDim* interpreted as member depth

The following interpretation of dimension parameter applies for circular members:

- *IfcCircleProfileDef.Radius* interpreted as beam radius. |
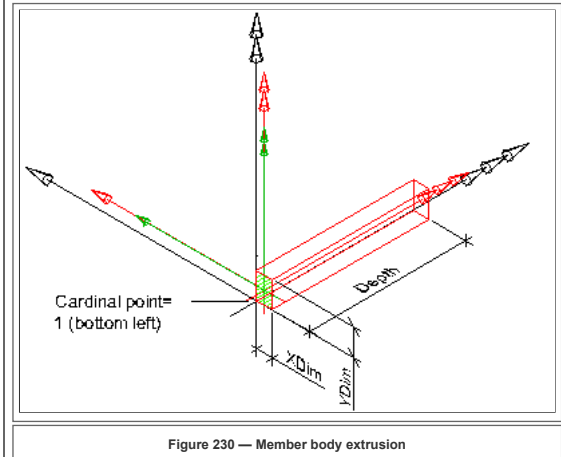
Figure 230 — Member body extrusion

| Body AdvancedSweptSolid Geometry | \IfcElement.Representation
\IfcProductDefinitionShape.Representations[*]
\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext | The following additional constraints apply to the 'AdvancedSweptSolid' representation type:

- Solid: IfcSurfaceCurveSweptAreaSolid, IfcFixedReferenceSweptAreaSolid, IfcExtrudedAreaSolidTapered, IfcRevolvedAreaSolidTapered shall be supported.
  NOTE View definitions and implementer agreement can further constrain the allowed swept solid types.
  NOTE Using IfcExtrudedAreaSolidTapered, or IfcRevolvedAreaSolidTapered requires the use of two IfcMaterialProfile's within the IfcMaterialProfileSet assinged to the IfcBeamStandardCase
- Profile: see 'SweptSolid' geometric representation
- Profile Position : see 'SweptSolid' geometric representation
- Extrusion: not applicable |
| Body Clipping Geometry | \IfcElement.Representation
\IfcProductDefinitionShape.Representations[*]
\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext | The following constraints apply to the advanced representation:

- Solid: see 'SweptSolid' geometric representation
- Profile: see 'SweptSolid' geometric representation
- Profile Position : see 'SweptSolid' geometric representation
- Extrusion: see 'SweptSolid' geometric representation
- Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid (or its subtypes).

Figure 231 illustrates an advanced geometric representation with use of IfcBooleanClippingResult between an IfcExtrudedAreaSolid and an IfcHalfSpaceSolid to create a clipped body, with cardinal point applied as **4** (mid-depth left). |

Figure 231 — Member body clipping

Field	Mapping	Definition
(Query)	\IfcMemberType	
Material Profile Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name \IfcLabel	The material of the IfcMemberType is defined by the IfcMaterialProfileSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. NOTE It is illegal to assign an IfcMaterial to an IfcMemberType, if there is at least one occurrences of IfcMemberStandardCase for this type. The shared profile definition is defined by assigning an IfcMaterialProfileSet (see material use definition above). The IfcMaterialProfile refers to the subtype of IfcProfileDef that is the common profile for all member occurrence, if used. It is only applicable if the IfcMemberType has only occurrences of type IfcMemberStandardCase (see definition of IfcMemberStandardCase for further information). NOTE The attribute *ProfileName* of the IfcProfileDef subtype, referenced in IfcMaterialProfile should contain a standardized profile name according to local standards. However, an additional geometric representation of the profile is necessary (e.g. as IfcExtrudedAreaSolid). An importing application is allowed to check for the existence of the profile name: in case of identifying it as a standardized name, the corresponding profile geometry and possibly other cross sectional properties can be read from a library. Otherwise the geometric representation and possible non geometric IfcProfileProperties have to be used.
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The IfcMemberType may define the shared geometric representation for all member occurrences. The *RepresentationMaps* attribute refers to a list of IfcRepresentationMap's, that allow for multiple geometric representations (e.g. with *IfcShaperepresentation*'s having an *RepresentationIdentifier* 'Box', 'Axis', or 'Body'). It is only applicable if the IfcMemberType has only occurrences of type IfcMember (See geometric use definition of IfcMember for further information). NOTE If the IfcMemberType has an associated IfcMaterialProfileSet, then no shared geometric representation shall be provided. NOTE The product shape representations are defined as *RepresentationMaps* (attribute of the supertype IfcTypeProduct), which get assigned by an element occurrence instance through the *IfcShapeRepresentation.Item[n]* being an IfcMappedItem. See IfcTypeProduct for further information. NOTE The values of attributes *RepresentationIdentifier* and *RepresentationType* of IfcShapeRepresentation are restricted in the same way as those for IfcMember and IfcMemberStandardCase

Field	Mapping	Definition
(Query)	\IfcMotorConnection	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcObjectDefinition	
Classification Association	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	Any object occurrence or object type can have a reference to a specific classification reference, i.e. to a particular facet within a classification system.

Field	Mapping	Definition
(Query)	\IfcObject	
Object User Identity	\IfcObject.Name \IfcLabel	An attribute *Name* and optionally *Description* can be used for all subtypes of IfcObject. For those subtypes, that have an object type definition, such as ifcBeam - IfcBeamType, the common *Name* and optionally *Description* is associated with the object type.
Object Predefined Type	\IfcObject.ObjectType \IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it holds the user defined type, if the enumeration of the attribute *PredefinedType* is set to USERDEFINED.
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Any object occurrence can be typed by being assigned to a common object type utilizing this concept. A particular rule, restricting the applicable subtypes of IfcTypeObject that can be assigned, is introduced by overriding this concept at the level of subtypes of IfcObject.
Property Sets for Objects	\IfcObject	Any object occurrence can hold property sets, each being a set of individual properties having name, description, value(s) and unit(s). A reference to applicable property sets, being part of this specification, is introduced at the level of sub types of IfcObject.
Property Sets with Override	\IfcObject	Any object occurrence can hold property sets, either directly at the object occurrence as element specific property sets, or at the object type, as type property sets. In this case, the properties that are provided to the object occurrence are the combinations of element specific and type properties. In case, that the same property (within the same property set, is defined both, in occurrence and type properties, the property value of the occurrence property overrides the property value of the type property.

Field	Mapping	Definition
(Query)	\IfcOccupant	
Actor Assignment	\IfcActor.IsActingUpon[*] \IfcRelAssignsToActor.RelatedObjects[*]	

Field	Mapping	Definition
	\IfcControl	

Field	Mapping	Definition
(Query)	\IfcOpeningElement	
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for IfcOpeningElement is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. ▪ The *PlacementRelTo* relationship of IfcLocalPlacement should point to the local placement of the same element, which is voided by the opening, i.e. referred to by *VoidsElement.RelatingBuildingElement*.

Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The 'Body' representation of IfcOpeningElement can be represented using the representation types 'SweptSolid', and 'Brep'. The representation type 'Brep' is explained at IfcFeatureElement
		
		 Swept Solid Representation Type with Horizontal Extrusion
		
		 The 'SweptSolid' geometric representation of IfcOpeningElement, using horizontal extrusion direction (for walls), is defined using the swept area solid geometry. The following attribute values for the IfcShapeRepresentation holding this geometric representation shall be used:
		
		 ▪ *RepresentationIdentifier* : 'Body'
		 ▪ *RepresentationType* : 'SweptSolid'
		
		 The following additional constraints apply to the swept solid representation:
		
		 ▪ <u>Solid</u>: IfcExtrudedAreaSolid is required, the set of *IfcShapeRepresentation.Items* may include a single, or multiple, instances of IfcExtrudedAreaSolid.
		 ▪ <u>Profile</u>: IfcRectangleProfileDef, IfcCircleProfileDef and IfcArbitraryClosedProfileDef shall be supported.
		 ▪ <u>Extrusion</u>: The profile shall be extruded horizontally (perpendicular to the extrusion direction of the voided element such as for wall openings), or vertically (in the extrusion direction of the voided element such as for for floor openings). If multiple instances of IfcExtrudedAreaSolid are used, the extrusion direction of each extrusion should be equal.
		
		      NOTE In case of non-parallel jambs, the shape representation shall be a 'SweptSolid' representation with vertical extrusion.
		
		 Figure 161 illustrates an opening with horizontal extrusion.
		
		      NOTE The local placement directions for the IfcOpeningElement are only given as an example, other directions are valid as well.
		
		 Figure 161 — Opening with full extrusion
		
		 Figure 162 illustrates an opening for a recess.
		
		      NOTE The local placement directions for the IfcOpeningElement are only given as an example, other directions are valid as well.
		
		      NOTE Rectangles are now defined centric, the placement location has to be set:
		
		 ▪ IfcCartesianPoint(XDim/2,YDim/2)

	\IfcProduct.ObjectPlacement	
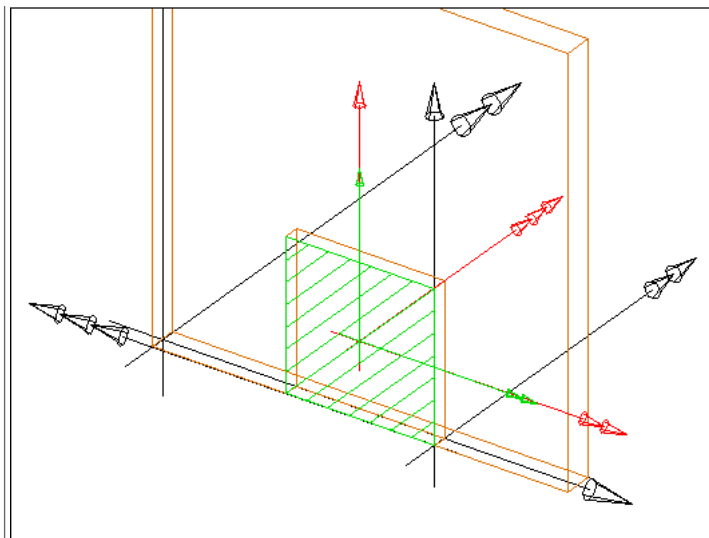
Figure 162 — Opening with recess extrusion

Swept Solid Representation with Vertical Extrusion

The 'SweptSolid' geometric representation of IfcOpeningElement, using vertical extrusion direction (for walls), is defined using the swept area solid geometry, however the extrusion direction may be vertical, i.e. in case of a wall opening, the extrusion would be in the direction of the wall height. The following attribute values for the IfcShapeRepresentation holding this geometric representation shall be used:

- *RepresentationIdentifier* : 'Body'
- *RepresentationType* : 'SweptSolid'

The following additional constraints apply to the swept solid representation:

- Solid: IfcExtrudedAreaSolid is required, the set of *IfcShapeRepresentation.Items* may include a single, or multiple, instances of IfcExtrudedAreaSolid.
- Profile: IfcRectangleProfileDef, IfcCircleProfileDef and IfcArbitraryClosedProfileDef shall be supported.
- Extrusion: The profile shall be extruded vertically, i.e. for wall openings along the extrusion direction of the voided element. If multiple instances of IfcExtrudedAreaSolid are used, the extrusion direction should be equal.

Vertical extrusions shall be used when an opening or recess has a non rectangular foot print geometry that does not change along the height of the opening or recess.

Figure 163 shows a vertical extrusion with multiple extrusion bodies for the opening. Each extrusion body has a different extrusion lenght.

NOTE The local placement directions for the IfcOpeningElement are only given as an example, other directions are valid as well.
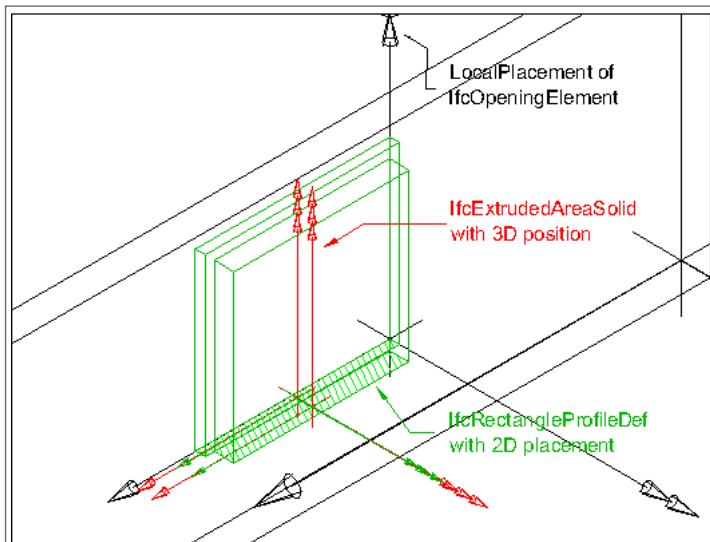
Figure 163 — Opening with multiple extrusions

Reference Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Name	Since there are no Boolean operations, either as IfcBooleanResult or implicitly by IfcRelVoidsElement the geometry of the IfcOpeningElement shall not be used to subtract the opening from the 'Body' shape representation of the voided element.

Field	Mapping	Definition
(Query)	**\IfcOpeningStandardCase**	
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following constraint is mandatory for IfcOpeningStandardCase ■ The *PlacementRelTo* relationship of IfcLocalPlacement should point to the local placement of the same element, which is voided by the opening, i.e. referred to by *VoidsElement.RelatingBuildingElement*.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The geometric representation of IfcOpeningStandardCase is defined using the following multiple shape representations for its definition: ■ Body: A SweptSolid representation defining the 3D subtraction shape of the standard opening **Body Representation** The body representation of IfcOpeningStandardCase is represented using the representation type 'SweptSolid'.

Swept Solid Representation Type with Horizontal Extrusion

The standard geometric representation of IfcOpeningStandardCase is defined using the 'SweptSolid' representation. The following attribute values for the IfcShapeRepresentation holding this geometric representation shall be used::

- *RepresentationIdentifier* : 'Body'
- *RepresentationType* : 'SweptSolid'

The following additional constraints apply to the swept solid representation:

- Solid: a single IfcExtrudedAreaSolid is required
- Profile: IfcRectangleProfileDef, IfcCircleProfileDef and IfcArbitraryClosedProfileDef shall be supported.
- Extrusion: The profile shall be extruded horizontally (i.e. perpendicular to the extrusion direction of the voided element) for wall openings, or vertically (i.e. in the extrusion direction of the voided element), for slab openings.

As shown in Figure 36, the orientation of the opening profile that is extruded for the opening body shall guarantee the following interpretation of dimension parameter for rectangular openings:

- *IfcRectangleProfileDef.YDim* interpreted as opening width
- *IfcRectangleProfileDef.XDim* interpreted as opening height

Figure 162 — Opening standard representation

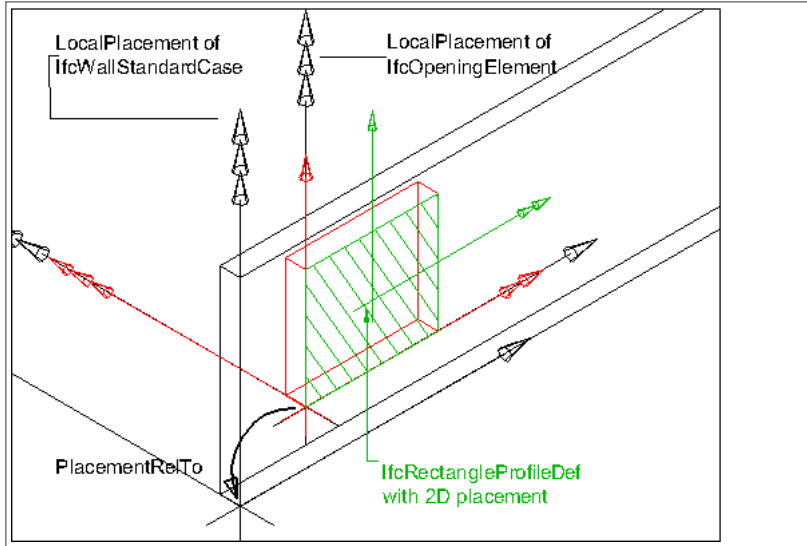| Field	Mapping	Definition
(Query)	**\IfcOutlet**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcPerformanceHistory**	
Property Sets for Performance	\IfcPerformanceHistory.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcPropertySet.HasProperties[*] \IfcPropertyReferenceValue.PropertyReference \IfcIrregularTimeSeries.Values[*] \IfcIrregularTimeSeriesValue.TimeStamp \IfcDateTime	The property sets relating to this entity are defined by IfcPropertySet and attached by the IfcRelDefinesByProperties relationship. They are accessible by the *IsDefinedBy* inverse attribute. Applicable property sets are defined at assigned entities (primarily IfcDistributionElement subtypes) where *IfcPropertySetTemplate.PropertySetType* is *PSET_PERFORMANCEDRIVEN*. In addition to standard property sets defined within this specification, if the underlying information source provides metadata (specific type information), then custom property sets may capture such data, where corresponding IfcPropertySetTemplate and IfcPropertyTemplate objects may be defined for such information to be accessed by other applications.
Classification	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	IfcPerformanceHistory may be classified using IfcRelAssociatesClassification where *RelatingClassification* refers to an IfcClassificationReference indicating a classification notation. Such classification notation may be used to identify the information such as an address within a building automation system, a work breakdown structure code for tasks, or a cost code for resource allocation.
Aggregation		IfcPerformanceHistory may be decomposed into components using IfcRelNests where *RelatingObject* refers to the enclosing IfcPerformanceHistory and *RelatedObjects* contains one or more IfcPerformanceHistory components. Composition indicates breakdown of further detail and may correspond to the hierarchy of objects it represents.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcPermit**	
Approval	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesApproval.RelatingApproval \IfcApproval.Name \IfcLabel	Approvals may be associated to indicate the status of acceptance or rejection using the IfcRelAssociatesApproval relationship where *RelatingApproval* refers to an IfcApproval and *RelatedObjects* contains the IfcPermit. Approvals may be split into sub-approvals using IfcApprovalRelationship to track approval status separately for each party where *RelatingApproval* refers to the higher-level approval and *RelatedApprovals* contains one or more lower-level approvals. The hierarchy of approvals implies sequencing such that a higher-level approval is not executed until all of its lower-level approvals have been accepted.
	\IfcObject	The IFC class identifier indicating the subtype of object.

Aggregation		
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	The object definitions, either non-product object occurrences or non-product object types, that are being nestes. They are defined as the parts in the ordered whole/part relationship - i.e. there is an implied order among the parts expressed by the position within the list of *RelatedObjects*.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	Figure 282 illustrates assignment relationships as indicated: ■ IfcActor (IfcRelAssignsToActor): Organization issuing the permit such as a local government agency or security organization. The **IfcPermit** may have assignments of its own using the IfcRelAssignsToControl relationship where *RelatingControl* refers to the **IfcPermit** and *RelatedObjects* contains one or more objects of the following types: ■ IfcActor: Organization(s) bound to the permit, typically a single contractor. **Figure 282 — Permit assignment**

Field	Mapping	Definition
(Query)	**\IfcPile**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The name by which the material profile is known.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	Geometric placement that defines the transformation from the related coordinate system into the relating. The placement can be either 2D or 3D, depending on the dimension count of the coordinate system.
Axis Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
Footprint Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The optional identifier of the representation as used within a project.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcPipeFitting**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	The name by which the material layer is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

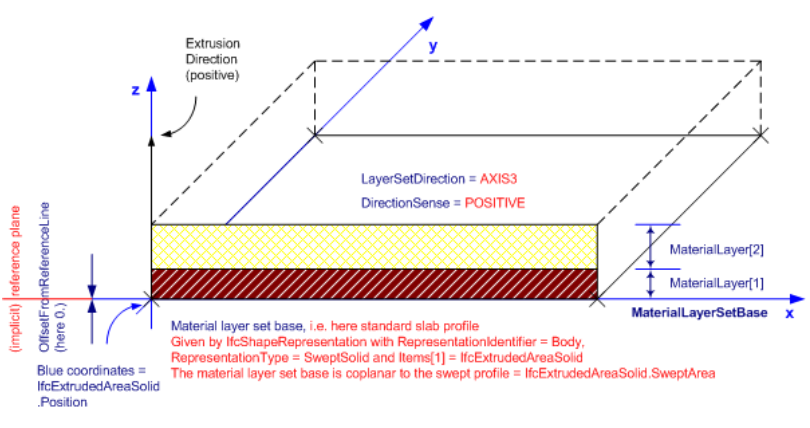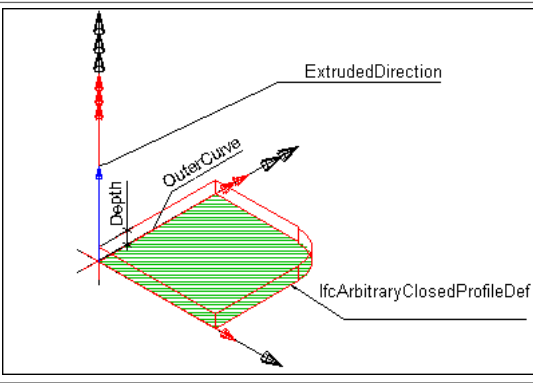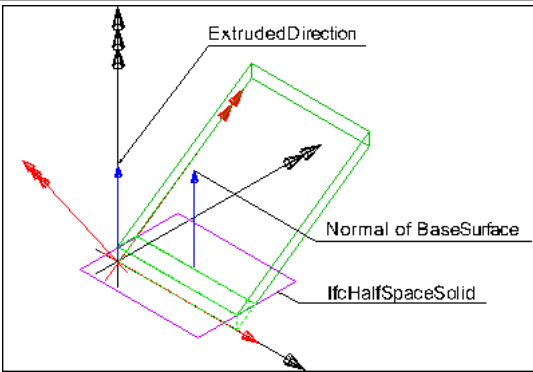| Field	Mapping	Definition
(Query)	**\IfcPipeSegment**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The name by which the material profile is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition

(Query)	\IfcPlate	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Layer Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name \IfcLabel	The material of the IfcPlate is defined by IfcMaterialLayerSet, or by IfcMaterial, and it is attached either directly or at the IfcPlateType. NOTE It is illegal to assign an IfcMaterialLayerSetUsage to an IfcPlate. Only the subtype IfcPlateStandardCase supports this concept.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcPlate, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: ■ the *Spatial Containment* (defined here), or ■ the *Element Composition*.
Surface 3D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	NOTE The 'Surface' can be used to define a surfacic model of the building (e.g. for analytical purposes, or for reduced Level of Detail representation).
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation: ■ Solid: IfcExtrudedAreaSolid is required, ■ Profile: *IfcArbitraryClosedProfileDef, IfcArbitraryProfileDefWithVoids, IfcRectangleProfileDef, IfcCircleProfileDef, IfcEllipseProfileDef* shall be supported. ■ Extrusion: The profile can be extruded perpendicularly or non-perpendicularly to the plane of the swept profile.
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	\IfcPlateStandardCase	
Material Layer Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	The material of the IfcPlateStandardCase is defined by IfcMaterialLayerSetUsage and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. Multi-layer plates can be represented by refering to several IfcMaterialLayer's within the IfcMaterialLayerSet that is referenced from the IfcMaterialLayerSetUsage. Material information can also be given at the IfcPlateType, defining the common attribute data for all occurrences of the same type. It is then accessible by the inverse *IsDefinedBy* relationship pointing to *IfcPlateType.HasAssociations* and via *IfcRelAssociatesMaterial.RelatingMaterial*. The IfcPlateStandardCase defines in addition that the IfcPlateType should have a unique IfcMaterialLayerSet, that is referenced by the IfcMaterialLayerSetUsage assigned to all occurrences of this IfcPlateType. Figure 233 illustrates assignment of IfcMaterialLayerSetUsage and IfcMaterialLayerSet to the IfcPlateStandardCase as the plate occurrence and to the IfcPlateType. The same IfcMaterialLayerSet shall be shared by many occurrences of IfcMaterialLayerSetUsage. This relationship shall be consistent to the relationship between the IfcPlateType and the IfcPlateStandardCase. **Figure 233 — Plate type definition** As shown in Figure 106, the following conventions shall be met: ■ The reference coordinate system is the coordinate system established by the *IfcExtrudedAreaSolid.Position*. ■ The reference plane is the plane defined by the extruded profile of *IfcExtrudedAreaSolid.SweptSolid*. The *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* is given as a distance from this plane. ■ The *IfcMaterialLayerSetUsage.DirectionSense* defines how the IfcMaterialLayer's are assigned to the reference plane. POSITIVE means in direction to the positive z-axis of the reference coordinate system. ■ The *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* is the distance parallel to the reference plane and always perpendicular to the base (XY) plane of the reference coordinate system. This is independent of a potential non-perpendicular extrusion given by *IfcExtrudedAreaSolid.ExtrudedDirection* <> 0.,0.,1. A positive value of *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* would then point into the positive z-axis of the reference coordinate system. ■ The *Thickness* of each IfcMaterialLayer shall be the parallel distance (measured perpendicular to the base plane). The *TotalThickness* of the IfcMaterialLayerSet is the sum of all layer thicknesses and in case of a perpendicular extrusion identical with *IfcExtrudedAreaSolid.Depth* ■ The *IfcMaterialLayerSetUsage.LayerSetDirection* i always AXIS3.

Figure 234 — Plate material layers

Product Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: ■ The local placement shall provide the location and directions for the standard plate, the x/y plane is the plane for the profile, and the z-axis is the extrusion axis for the plate body.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the swept solid representation: ■ Solid: IfcExtrudedAreaSolid is required, ■ Profile: *IfcArbitraryClosedProfileDef, IfcRectangleProfileDef, IfcRoundedRectangleProfileDef, IfcCircleProfileDef, IfcEllipseProfileDef* shall be supported. ■ Extrusion: The profile can be extruded perpendicularly or non-perpendicularly to the plane of the swept profile. ■ Material: The definition of the IfcMaterialLayerSetUsage, particularly of the *OffsetFromReferenceLine* and the *ForLayerSet.TotalThickness*, has to be consistent to the 'SweptSolid' representation.

Figure 234 — Plate body extrusion

EXAMPLE Figure 234 illustrates a 'SweptSolid' geometric representation. The following interpretation of dimension parameter applies for polygonal plates (in ground floor view): *IfcArbitraryClosedProfileDef.OuterCurve* being a closed bounded curve is interpreted as area (or foot print) of the plate.

Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following constraints apply to the 'Clipping' representation: ■ Solid: see 'SweptSolid' shape representation, ■ Profile: see 'SweptSolid' shape representation, ■ Extrusion: see 'SweptSolid' shape representation, ■ Material: see 'SweptSolid' shape representation, ■ Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid.

Figure 235 — Plate body clipping

EXAMPLE Figure 235 illustrates a 'Clipping' geometric representation with definition of a plate using advanced geometric representation. The profile is extruded non-perpendicular and the plate body is clipped at the eave.

Field	Mapping	Definition
(Query)	\IfcPlateType	
Material Layer Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name \IfcLabel	The material of the IfcPlateType is defined by the IfcMaterialLayerSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. NOTE It is illegal to assign an IfcMaterial to an IfcPlateType, if there is at least one occurrences of IfcPlateStandardCase for this type.

| | | The shared material layer set definition is defined by assigning an IfcMaterialLayerSet (see material use definition above). The IfcMaterialLayer refers to one or several of IfcMaterial that is the common for all plate occurrence, if used. It is only applicable if the IfcPlateType has only occurrences of type IfcPlateStandardCase (see definition of IfcPlateStandardCase for further information).

NOTE Since each individual instance of IfcPlateStandardCase defines its own IfcMaterialLayerSetUsage including the offset from the reference plane, the same IfcPlateType can be used independently of the reference plane alignment of its occurrences. |
| Body Geometry | \IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext | Definition of the representation context for which the different subtypes of representation are valid. |

Field	Mapping	Definition
(Query)	\IfcPositioningElement	
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for IfcGrid is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. ■ The *PlacementRelTo* relationship of IfcLocalPlacement shall point (if given) to the local placement of the same IfcSpatialStructureElement, which is used in the *ContainedInStructure* inverse attribute, or to a spatial structure element at a higher level, referenced by that. ■ If the relative placement is not used, the absolute placement is defined within the world coordinate system.
Footprint Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The 2D geometric representation of IfcGrid is defined using the 'GeometricCurveSet' geometry. The following attribute values should be inserted ■ *IfcShapeRepresentation.RepresentationIdentifier* = 'FootPrint'. ■ *IfcShapeRepresentation.RepresentationType* = 'GeometricCurveSet' . The following constraints apply to the 2D representation: ■ The IfcGeometricCurveSet shall be an (and the only) *Item* of the IfcShapeRepresentation. It should contain an IfcGeometricCurveSet containing subtypes of IfcCurve, each representing a grid axis. Applicable subtypes of IfcCurve are: IfcPolyline, IfcCircle, IfcTrimmedCurve (based on *BaseCurve* referencing IfcLine or *IfcCircle*), and IfcOffsetCurve2D. ■ Each subtype of IfcCurve may have a curve style assigned, using IfcStyledItem referencing IfcCurveStyle. ■ Optionally the grid axis labels may be added as IfcTextLiteral, and they may have text styles assigned, using IfcStyledItem referencing IfcTextStyle.

As shown in Figure 31, the IfcGrid defines a placement coordinate system using the *ObjectPlacement*. The XY plane of the coordinate system is used to place the 2D grid axes. The *Representation* of IfcGrid is defined using IfcProductRepresentation, referencing an IfcShapeRepresentation, that includes IfcGeometricCurveSet as *Items*. All grid axes are added as IfcPolyline to the IfcGeometricCurveSet.

Figure 164 — Grid layout
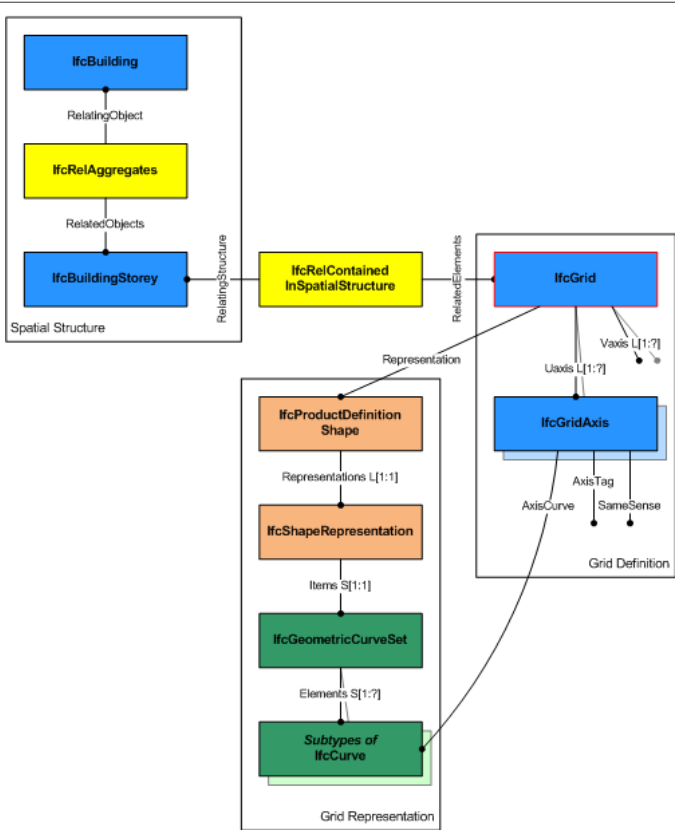
As shown in Figure 32, the attributes *UAxes* and *VAxes* define lists of IfcGridAxis within the context of the grid. Each instance of IfcGridAxis refers to the same instance of IfcCurve (here the subtype IfcPolyline) that is contained within the IfcGeometricCurveSet that represents the IfcGrid.

Figure 165 — Grid representation

| Field	Mapping	Definition
(Query)	\IfcProcedure	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	IfcProcedure defines the anticipated or actual occurrence of any procedure; common information about procedure types is handled by IfcProcedureType.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	The IfcProcedure may be contained within an IfcTask or IfcProcedure using the IfcRelNests relationship. An IfcProcedure may in turn nest other IfcProcedure or IfcEvent entities. Such nesting indicates decomposed level of detail.
Sequential Connectivity	\IfcProcess.IsPredecessorTo[*] \IfcRelSequence.RelatedProcess \IfcProcess	The relationship IfcRelSequence is used to indicate control flow. An IfcProcedure as a successor to an IfcEvent indicates that the procedure should be performed in response to the event. An IfcProcedure as a predecessor to an IfcEvent indicates that the event should be trigerred following the procedure. As procedures have arbitrary duration, the *IfcRelSequence.SequenceType* attribute has no effect on an IfcProcedure but still applies to the opposite end of the relationship if IfcTask is used.
Process Assignment	\IfcProcess.OperatesOn[*] \IfcRelAssignsToProcess.RelatedObjects[*] \IfcResource	NOTE A particular type of IfcProcedure is a caution, warning or other form of advisory note. Typically, it is anticipated that such a procedure would be assigned to the specific IfcProcess for which it gives advice using IfcRelAssignsToProcess.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	An IfcProcedure may be assigned to an IfcWorkCalendar to indicate times when such procedure may be performed using IfcRelAssignsToControl; otherwise the effective calendar is determined by the nearest IfcProcess ancestor with a calendar assigned. Advisory notes should be assigned to the specific IfcProcess for which it gives advice using IfcRelAssignsToProcess.
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	For building operation scenarios, IfcProcedure may be assigned to a product (IfcElement subtype) using IfcRelAssignsToProduct to indicate a specific product occurrence that performs the procedure. EXAMPLE An IfcActuator may have a "Close" procedure. If the IfcProcedure is defined by an IfcProcedureType and the IfcProcedureType is assigned to a product type (using IfcRelAssignsToProduct), then the IfcProcedure must be assigned to one or more occurrences of the specified product type using IfcRelAssignsToProduct.

Field	Mapping	Definition
(Query)	\IfcProcess	
	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcProduct	
Product Placement		The *Product Placement* establishes the object coordinate system and is required, if a geometric shape representation is provided for this product.
Product Geometric Representation	\IfcProduct.Representation \IfcProductDefinitionShape.Name	The geometric representation of any IfcProduct is provided by the IfcProductDefinitionShape allowing multiple geometric representations. It uses the *Product Placement* concept utilizing IfcLocalPlacement to establish an object coordinate system, within all geometric representations are founded. NOTE A detailed specification of how to apply the local placement and which shape representaions are applicable is provided at the level of subtypes of IfcProduct and is further determined by the model view definition and implementer agreements.

Field	Mapping	Definition
(Query)	\IfcProfileDef	
	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcProject	
Project Units	\IfcContext.UnitsInContext \IfcUnitAssignment.Units[*] \IfcDerivedUnit.UnitType \IfcDerivedUnitEnum	Name of the derived unit chosen from an enumeration of derived unit types for use in IFC models.
Project Representation Context	\IfcContext.RepresentationContexts[*] \IfcGeometricRepresentationContext.ContextIdentifier \IfcLabel	The optional identifier of the representation context as used within a project.
Project Global Positioning	\IfcContext.RepresentationContexts[*] \IfcGeometricRepresentationContext.HasCoordinateOperation[*] \IfcMapConversion.Eastings \IfcLengthMeasure	The representation context of the project refers to a global positioning, i.e. the local engineering coordinate system of the project has a mapping to a defined projected coordinate system (a rectangular map coordinate system, as used in GIS systems)
Project Classification Information	\IfcContext.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassification.Source \IfcLabel	Source (or publisher) for this classification.
Project Document Information	\IfcContext.HasAssociations[*] \IfcRelAssociatesDocument.RelatingDocument \IfcDocumentInformation.Location \IfcURIReference	Resource identifier or locator, provided as URI, URN or URL, of the document information for online references.
Project Library Information	\IfcContext.HasAssociations[*] \IfcRelAssociatesLibrary.RelatingLibrary \IfcLibraryInformation.Version \IfcLabel	Identifier for the library version used for reference.
Project Declaration	\IfcContext.Declares[*] \IfcRelDeclares.RelatedDefinitions[*]	The IfcProject is also the context for other information about the construction project such as a work plan. Non-product structures are assigned by their first level object to IfcProject using the IfcRelDeclares relationship. The IfcProject provides the context for work plans (or other non-product based) descriptions of the construction project. It is handled by the objectified relationship IfcRelDeclares. NOTE The spatial structure and the schedule structure can be decomposed. For example the IfcBuilding can be decomposed into IfcBuildingStorey's, and the IfcWorkPlan can be decomposed into IfcWorkSchedule's. NOTE The products and tasks can be decomposed further. For example the IfcCurtainWall can be decomposed into IfcMember and IfcPlate, the IfcTask can be decomposed into other IfcTask's. NOTE The products and tasks can have direct linking relationships. For example the IfcCurtainWall can be assigned to a IfcTask as an input or output for a construction schedule. Figure 131 illustrates the use of IfcProject as context for work plans or work schedules.

Figure 131 — Project spatial and work plan structure
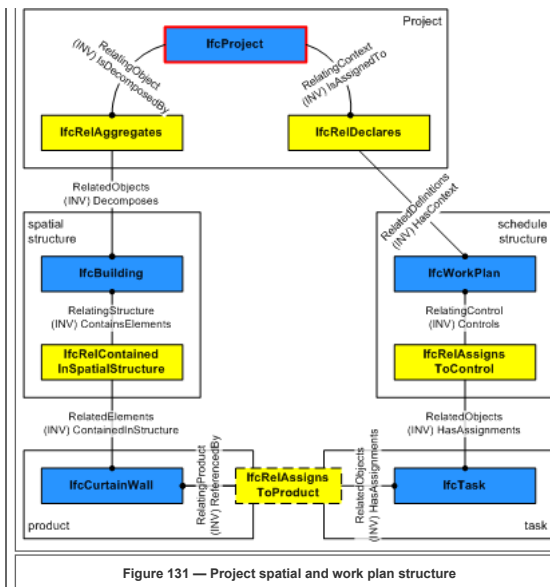
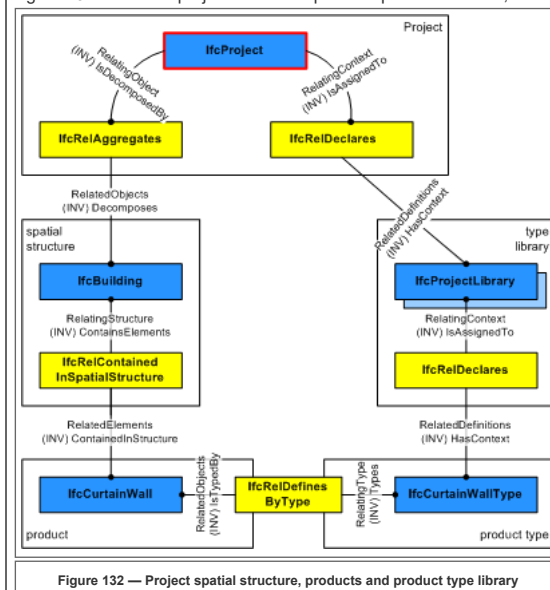| Spatial Decomposition | \IfcObjectDefinition.IsDecomposedBy[*]
\IfcRelAggregates.RelatedObjects[*]
\IfcSpatialElement.Name
\IfcLabel | The IfcProject is used to reference the root of the spatial structure of a building or other construction project (that serves as the primary project breakdown and is required to be hierarchical). The spatial structure elements are linked together, and to the IfcProject, by using the objectified relationship IfcRelAggregates.

The following constraints are applied to using the relationshio IfcRelAggregates in context of IfcProject

NOTE The anomaly to use the composition structure through IfcRelAggregates for assigning the uppermost spatial container to IfcProject is due to upward compatibility reasons with earlier releases of this standard.

■ IfcProject.Decomposes -- it shall be NIL, i.e. the IfcProject shall be on top of the root of the spatial structure tree.
■ IfcProject.IsDecomposedBy -- referencing (IfcSite \|\| IfcBuilding \|\| IfcSpatialZone) by using IfcRelAggregates.RelatedObjects. The IfcSite, IfcBuilding, or IfcSpatialZone being referenced shall be the root of the spatial structure.

Figure 132 illustrates project relationships with spatial structures, elements, and element type libraries.

Figure 132 — Project spatial structure, products and product type library |

Field	Mapping	Definition
(Query)	**\IfcProjectionElement**	
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for *IfcOpeningRecess* is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. ■ The *PlacementRelTo* relationship of IfcLocalPlacement should point to the local placement of the same element, to which the projection adds, i.e. referred to by *ProjectsElement.RelatingBuildingElement*.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The geometric representation of IfcProjectionElement is defined using the swept area solid geometry. The following attribute values for the IfcShapeRepresentation holding this geometric representation shall be used: ■ *RepresentationIdentifier* : 'Body' ■ *RepresentationType* : 'SweptSolid' The following additional constraints apply to the swept solid representation: ■ Solid: IfcExtrudedAreaSolid is required. ■ Profile: IfcRectangleProfileDef, IfcCircleProfileDef and IfcArbitraryClosedProfileDef shall be supported. ■ Extrusion: The profile shall be extruded horizontally (that is, perpendicular to the extrusion direction of the modified element), such as for wall projections, or vertically (that is, in the extrusion direction of the projected element), such as for floor projections. As shown in Figure 165, the following interpretation of dimension parameter applies for rectangular projection:

- *IfcRectangleProfileDef.YDim* interpreted as projection width
- *IfcRectangleProfileDef.XDim* interpreted as projection height
- *IfcExtrudedAreaSolid.Depth* is interpreted as projection depth

NOTE Rectangles are now defined centric, the placement location has to be set:

- IfcCartesianPoint(XDim/2,YDim/2)

NOTE The local placement directions for the IfcProjectionElement are only given as an example, other directions are valid as well.
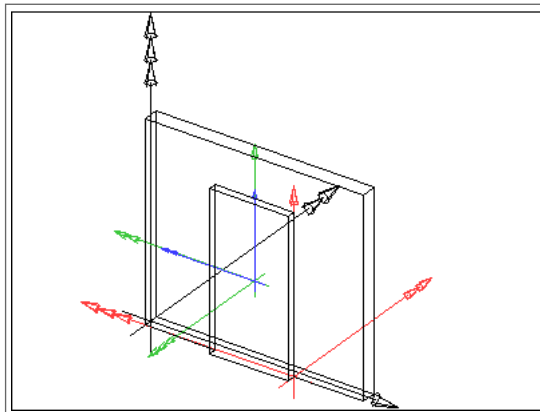
Figure 165 — Projection representation

The general b-rep geometric representation of IfcProjectionElement is defined using the Brep geometry. The Brep representation allows for the representation of complex element shape. The following attribute values for the IfcShapeRepresentation holding this geometric representation shall be used:

- *RepresentationIdentifier* : 'Body'
- *RepresentationType* : 'Brep'

Field	Mapping	Definition
(Query)	**\IfcProjectOrder**	
Approval	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesApproval.RelatingApproval \IfcApproval.Name \IfcLabel	Approvals may be associated to indicate the status of acceptance or rejection using the IfcRelAssociatesApproval relationship where *RelatingApproval* refers to an IfcApproval and *RelatedObjects* contains the **IfcProjectOrder**. Approvals may be split into sub-approvals using IfcApprovalRelationship to track approval status separately for each party where *RelatingApproval* refers to the higher-level approval and *RelatedApprovals* contains one or more lower-level approvals. The hierarchy of approvals implies sequencing such that a higher-level approval is not executed until all of its lower-level approvals have been accepted.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Aggregation		As shown in Figure 160, an **IfcProjectOrder** may be aggregated into components.
		Figure 283 — Project order composition
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	The object definitions, either non-product object occurrences or non-product object types, that are being nestes. They are defined as the parts in the ordered whole/part relationship - i.e. there is an implied order among the parts expressed by the position within the list of *RelatedObjects*.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	Figure 284 illustrates **IfcProjectOrder** assignment relationships as indicated:

Figure 284 illustrates **IfcProjectOrder** assignment relationships as indicated:

- IfcActor (IfcRelAssignsToActor): Organization issuing the order such as an owner or contractor.

The **IfcProjectOrder** may have assignments of its own using the IfcRelAssignsToControl relationship where *RelatingControl* refers to the **IfcProjectOrder** and *RelatedObjects* contains one or more objects of the following types:

- IfcActor: Organization(s) contracted to fulfill the order, typically a single contractor, subcontractor, or supplier.

Figure 284 — Project order assignment

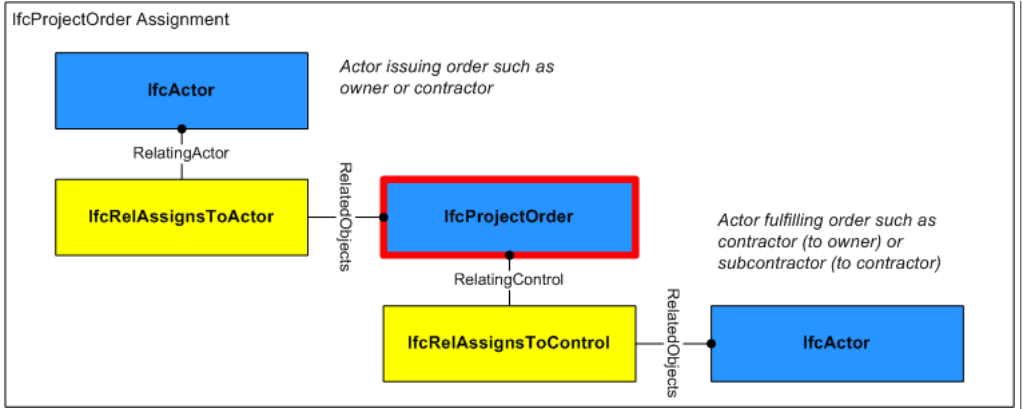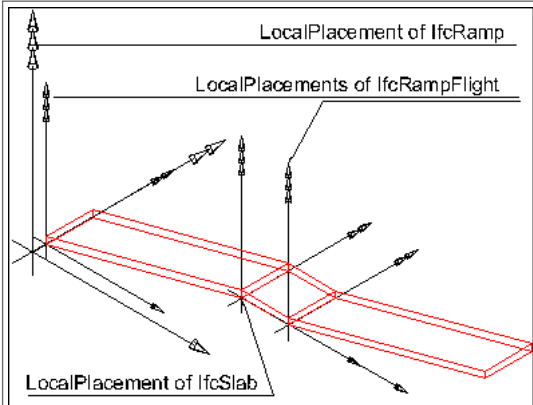| Field	Mapping	Definition
(Query)	**\IfcProtectiveDevice**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcProtectiveDeviceTrippingUnit**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Control Flow	\IfcDistributionControlElement.AssignedToFlowElement[*] \IfcRelFlowControlElements.RelatingFlowElement \IfcDistributionFlowElement	Relationship to a distribution flow element

Field	Mapping	Definition
(Query)	**\IfcPump**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcRailing**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Constituents	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The material of the IfcRailing is defined by the IfcMaterialConstituent or as fallback by IfcMaterial, and it is attached either directly or at the IfcRailingType.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcRailing, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: - the *Spatial Containment* (defined here), or - the *Element Composition*.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcRailingType**	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation	Definition of the representation context for which the different subtypes of representation are valid.

\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext

Field	Mapping	Definition
(Query)	\IfcRamp	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Material Solid	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterial	The material of the IfcRamp is defined by the IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. Material information can also be given at the IfcRampType, defining the common attribute data for all occurrences of the same type. It is then accessible by the inverse *IsDefinedBy* relationship pointing to *IfcRampType.HasAssociations* and via *IfcRelAssociatesMaterial.RelatingMaterial* to IfcMaterial. If both are given, then the material directly assigned to IfcRamp overrides the material assigned to IfcRampType.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcRamp, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: - the *Spatial Containment* (defined here), or - the *Element Composition*.
Element Decomposition	\IfcElement.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcElement.Name \IfcLabel	If the IfcRamp has components (referenced by *SELF\IfcProduct.IsDecomposedBy*) then no independent 'Body' geometric representation shall be defined for the IfcRamp. The IfcRamp is then geometrically represented by the geometric representation of its components. **Figure 236 — Ramp placement** EXAMPLE Figure 236 illustrates IfcRamp defining the local placement for all components.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction may be imposed by view definitions or implementer agreements: - If the IfcRamp establishes an aggregate, then all contained elements shall be placed relative to the *IfcRamp.ObjectPlacement*.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The walking line is represented by a two-dimensional open curve as the axis. The curve is directed into the upward direction (direction has to be interpreted as specified at the subtypes of IfcCurve). NOTE The 'Axis' representation of IfcRamp may be provided even if the IfcRamp has components with own shape representations.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	If the IfcRamp has no components defined (empty set of *SELF\IfcProduct.IsDecomposedBy*) then the IfcRamp 'Body' geometry may be represented by an own IfcShapeRepresentation.
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcRampFlight	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Solid	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterial	The material of the IfcRampFlight is defined by the IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcRampFlight, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: - the *Spatial Containment* (defined here), or - the *Element Composition*. NOTE Model view definitions or implementer agreements may force an IfcRampFlight to be solely used as a part within an IfcRamp container. In this case, no *Spatial containment* shall be used.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The walking line is represented by a two-dimensional open curve as the axis. The curve is directed into the upward direction (direction has to be interpreted as specified at the subtypes of IfcCurve). Figure 237 illustrates the axis representation which has the following constraints: - In case of straight flights the curve shall be a single item of type IfcPolyline. - In case of winding flights the curve shall be a single item of type IfcCompositeCurve. - In case of a curved flight or a spiral flight the curve shall be a single item of type IfcTrimmedCurve.
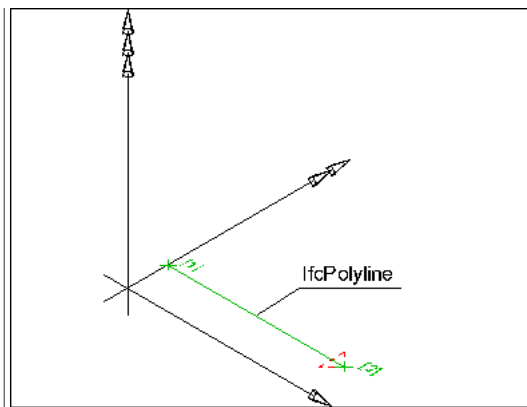
Figure 237 — Ramp flight axis

Footprint Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The flight foot print, including the flight boundary is represented by a two-dimensional geometric curve set. Figure 238 illustrates the footprint representation which has the following constraints: • In case of straight flights the curve set shall consist of a single item of type IfcPolyline. • In case of winding flights or curved flights the curve set shall consists of a single item of type IfcCompositeCurve. • In case of a spiral flight the curve set shall consists of a single item of type IfcConic or IfcPolyline. **Figure 238 — Ramp flight footprint**
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation type: • Solid: IfcExtrudedAreaSolid is required, • Profile: IfcRectangleProfileDef and IfcArbitraryClosedProfileDef shall be supported. • Extrusion: The profile shall be extruded in any direction relative to the XY plane of the position coordinate system of the IfcExtrudedAreaSolid. Therefore non-perpendicular sweep operation has to be supported. It might be further constrained to be in the direction of the global z-axis in implementers agreements. Figure 239 illustrates the body representation. **Figure 239 — Ramp flight body**
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
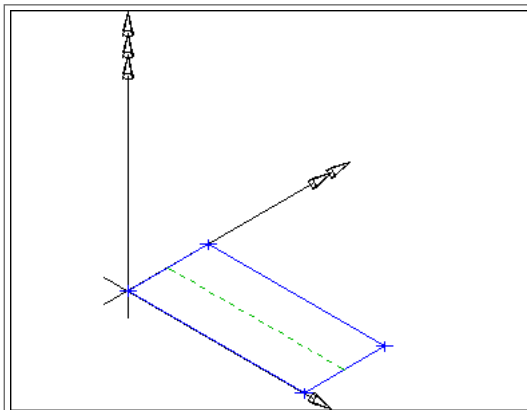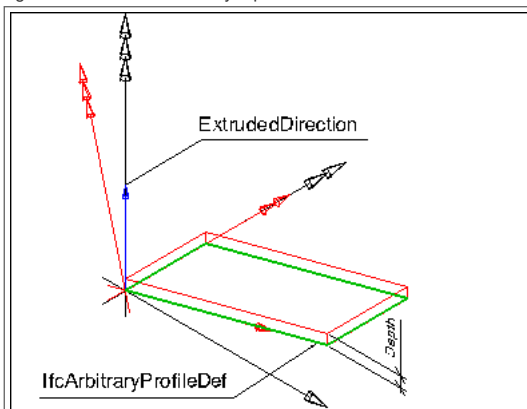
Field	Mapping	Definition
(Query)	**\IfcRampFlightType**	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcRampType**	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcReinforcingBar**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The name by which the material profile is known.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The representation map referenced by a 'Body' 'MappedRepresentation' should contain a representation of type 'AdvancedSweptSolid' which holds an IfcSweptDiskSolid (including subtype IfcSweptDiskSolidPolygonal). Multiple IfcMappedItem's can be used to represent several bars as one occurrence of IfcReinforcingBar.

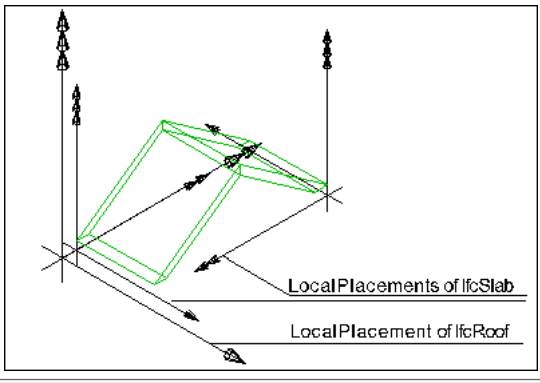| Field	Mapping	Definition
(Query)	**\IfcReinforcingMesh**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The representation map referenced by a 'Body' 'MappedRepresentation' could contain a representation of type 'AdvancedSweptSolid' which holds an IfcSweptDiskSolid (including subtype IfcSweptDiskSolidPolygonal). Multiple IfcMappedItem's can be used to represent the bars within a mesh as one occurrence of IfcReinforcingMesh.

Field	Mapping	Definition
(Query)	**\IfcRoof**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Element Decomposition	\IfcElement.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcElement.Name \IfcLabel	*Geometric representation by aggregated elements* If the IfcRoof has components (referenced by *SELF\IfcObject.IsDecomposedBy*) then no independent geometric representation shall defined for the IfcRoof. The IfcRoof is then geometrically represented by the geometric representation of its components. The components are accessed via *SELF\IfcObject.IsDecomposedBy[1].RelatedObjects*. The geometric representations that are supported for the aggregated elements are defined with each element. See geometric use definition for IfcSlab, IfcBeam, IfcColumn, IfcBuildingElementPart and other subtypes of IfcBuildingElement. Figure 243 illustrates roof placement, with an IfcRoof defining the local placement for all aggregated elements. **Figure 243 — Roof placement**
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction may be imposed by view definitions or implementer agreements: ■ If the IfcRoof establishes an aggregate, then all contained elements shall be placed relative to the *IfcRoof.ObjectPlacement*.

Field	Mapping	Definition
(Query)	**\IfcRoofType**	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcRoot**	
Identity	\IfcRoot.GlobalId \IfcGloballyUniqueId	IfcRoot assigns the globally unique ID. In addition it may provide for a name and a description about the concept.
Revision Control	\IfcRoot.OwnerHistory \IfcOwnerHistory.OwningUser	Ownership, history, and merge state is captured using IfcOwnerHistory.

\IfcPersonAndOrganization.ThePerson
\IfcPerson.Identification
\IfcIdentifier

Field	Mapping	Definition
(Query)	\IfcSanitaryTerminal	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Element Nesting	\IfcElement.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcElement.ObjectPlacement \IfcLocalPlacement	IFC4 ADD1 CHANGE Element nesting is now used for attaching faucets. Hot and cold water ports have been removed from subtypes that use attached faucets.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcSensor	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.
Control Flow	\IfcDistributionControlElement.AssignedToFlowElement[*] \IfcRelFlowControlElements.RelatingFlowElement \IfcDistributionFlowElement	Relationship to a distribution flow element

Field	Mapping	Definition
(Query)	\IfcShadingDevice	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Material Single	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterial	Material definition assigned to the elements or element types.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcShadingDevice, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: ■ the *Spatial Containment* (defined here), or ■ the *Element Composition.*

Field	Mapping	Definition
(Query)	\IfcShadingDeviceType	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcSite	
Spatial Composition	\IfcSpatialElement.Decomposes[*] \IfcRelAggregates.RelatingObject \IfcProject.Name	By using the inverse relationship *IfcSite.Decomposes* it references IfcProject || IfcSite through *IfcRelAggregates.RelatingO*... another instance of IfcSite, the referenced IfcSite needs to have a different and higher *CompositionType*, i.e. COMPLEX (if ... ELEMENT), or ELEMENT (if the other IfcSite has PARTIAL).
Spatial Decomposition	\IfcObjectDefinition.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcSpatialElement.Name \IfcLabel	By using the inverse relationship *IfcSite.IsDecomposedBy* it references (em>IfcSite || IfcBuilding || IfcSpace by *IfcRelAggregates.RelatedObjects*. If it refers to another instance of IfcSite, the referenced IfcSite needs to have a different a... *CompositionType*, i.e. ELEMENT (if the other IfcSite has COMPLEX), or PARTIAL (if the other IfcSite has ELEMENT).
Spatial Container	\IfcSpatialElement.ContainsElements[*] \IfcRelContainedInSpatialStructure.RelatedElements[*] \IfcProduct	If there are building elements and/or other elements directly related to the IfcSite (like a fence, or a shear wall), they are as... IfcSite by using the objectified relationship IfcRelContainedInSpatialStructure. The *IfcIfcSite* references them by its inverse ■ *IfcSite.ContainsElements* -- referencing any subtype of IfcProduct (with the exception of other spatial structure element) by *IfcRelContainedInSpatialStructure.RelatedElements*
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be re... enforced by a where rule.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for IfcSite is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines th... system that is referenced by all geometric representations. ■ The *PlacementRelTo* relationship of IfcLocalPlacement shall point to the IfcSpatialStructureElement of type "IfcSite", if relative pla... to position a site relative a a site complex, or a site section to a site). ■ If the relative placement is not used, the absolute placement is defined within the world coordinate system. If there is only one site... the default situation.
FootPrint GeomSet Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The foot print representation of IfcSite is given by either a single 2D curve (such as IfcPolyline or IfcCompositeCurve), or by... (in case of inner boundaries).

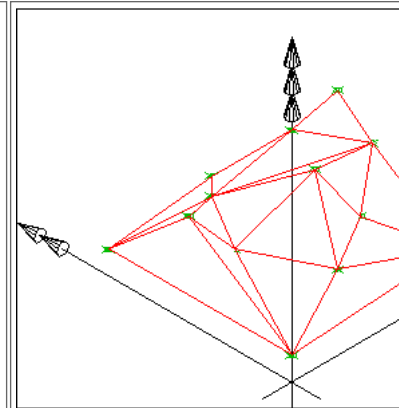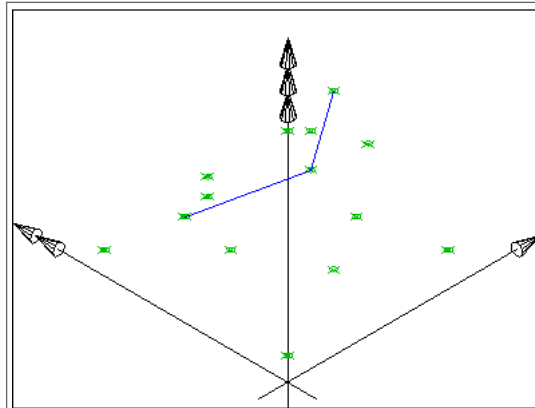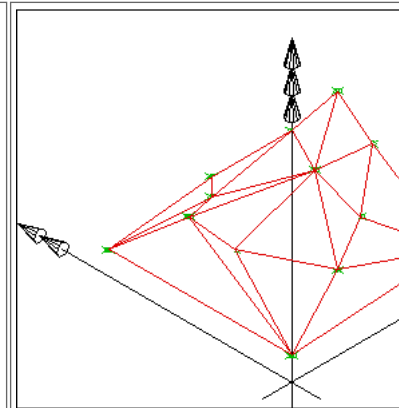|		

Survey Points Geometry	\IfcSite.Representation
	\IfcProductDefinitionShape.Representations[*]
	\IfcShapeRepresentation.ContextOfItems
	\IfcGeometricRepresentationContext
		The survey point representation of IfcSite is defined using a set of survey points and optionally breaklines. The breaklines a connect points given in the set of survey points. Breaklines, if given, are used to constrain the triangulation.
		
		The representation identifier and type of this geometric representation of IfcSite is:
		
		  ■ *IfcShapeRepresentation.RepresentationIdentifier* = 'SurveyPoints'
		  ■ *IfcShapeRepresentation.RepresentationType* = 'GeometricCurveSet'
		
		Figure 183 shows a set of survey points, given as 3D Cartesian points within the object coordinate system of the site. Figur result after facetation.
		
		The set of IfcCartesianPoint is included in the set of *IfcGeometricCurveSet.Elements*.
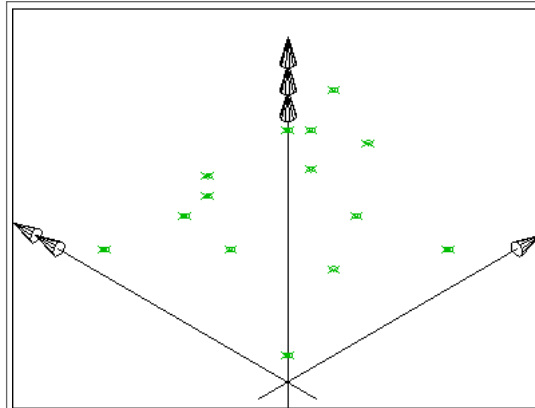		
		Figure 183 — Site survey points **Figure 184 — Site survey points facetat**
		
		Figure 185 shows A set of survey points, given as 3D Cartesian points, and a set of break points, given as a set of lines, co survey points, within the object coordinate system of the site. Figure 186 shows the result after facetation.
		
		The set of IfcCartesianPoint and the set of IfcPolyline are included in the set of *IfcGeometricCurveSet.Elements*.
		
		Figure 185 — Site breaklines **Figure 186 — Site breaklines facetatio**
		
		  NOTE The geometric representation of the site has been based on the ARM level description of the site_shape_representation given within the ISO 10303 Elements using explicit shape representation".

Body Geometry	\IfcElement.Representation
	\IfcProductDefinitionShape.Representations['Body']
	\IfcShapeRepresentation.ContextOfItems
	\IfcGeometricRepresentationContext
		The body representation of IfcSite is defined using a solid or surface model. Applicable solids are the IfcFacetedBrep or on IfcFacetedBrepWithVoids, applicable surface models are the IfcFaceBasedSurfaceModel and the IfcShellBasedSurfaceMo
		
		The representation identifier and type of this representation of IfcSite is:
		
		  ■ *IfcShapeRepresentation.RepresentationIdentifier* = 'Body'
		  ■ *IfcShapeRepresentation.RepresentationType* = 'Brep', or 'SurfaceModel'

Field	Mapping	Definition
(Query)	**\IfcSlab**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Layer Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name \IfcLabel	The material of the IfcSlab is defined by IfcMaterialLayerSet, or as fallback by IfcMaterial, and it is attached either directly or at the IfcSlabType. NOTE It is illegal to assign an IfcMaterialLayerSetUsage to an IfcSlab. Only the subtype IfcSlabStandardCase supports this concept.

Spatial Containment	\IfcElement.ContainedInStructure[*]
	\IfcRelContainedInSpatialStructure.RelatingStructure
	\IfcSpatialElement.Name
	\IfcLabel
		The IfcSlab, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships:
		
		  ■ the *Spatial Containment* (defined here), or
		  ■ the *Element Composition*.

Surface Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	NOTE The 'Surface' can be used to define a surfacic model of the building (e.g. for analytical purposes, or for reduced Level of Detail representation).

Body SweptSolid Geometry	\IfcElement.Representation
	\IfcProductDefinitionShape.Representations[*]
	\IfcShapeRepresentation.ContextOfItems
	\IfcGeometricRepresentationContext
		The following additional constraints apply to the swept solid representation:
		
		  ■ <u>Solid</u>: IfcExtrudedAreaSolid is required,
		  ■ <u>Profile</u>: *IfcArbitraryClosedProfileDef, IfcRectangleProfileDef, IfcCircleProfileDef, IfcEllipseProfileDef* shall be supported.

- Extrusion: The profile can be extruded perpendicularly or non-perpendicularly to the plane of the swept profile.

Figure 244 illustrates a 'SweptSolid' geometric representation.

NOTE   The following interpretation of dimension parameter applies for polygonal slabs (in ground floor view):

- *IfcArbitraryClosedProfileDef.OuterCurve*: closed bounded curve interpreted as area (or foot print) of the slab.
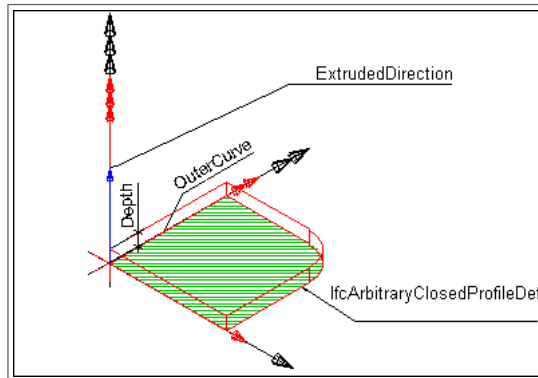

Figure 244 — Slab body extrusion

Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following constraints apply to the 'Clipping' representation: - Solid: see 'SweptSolid' shape representation, - Profile: see 'SweptSolid' shape representation, - Extrusion: see 'SweptSolid' shape representation, - Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid. Figure 245 illustrates a 'Clipping' geometric representation with definition of a roof slab using advanced geometric representation. The profile is extruded non-perpendicular and the slab body is clipped at the eave. **Figure 245 — Slab body clipping**
Voiding	\IfcElement.HasOpenings[*] \IfcRelVoidsElement.RelatedOpeningElement \IfcOpeningElement.PredefinedType \IfcOpeningElementTypeEnum	Predefined generic type for an opening that is specified in an enumeration. There may be a property set given specificly for the predefined types.
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.
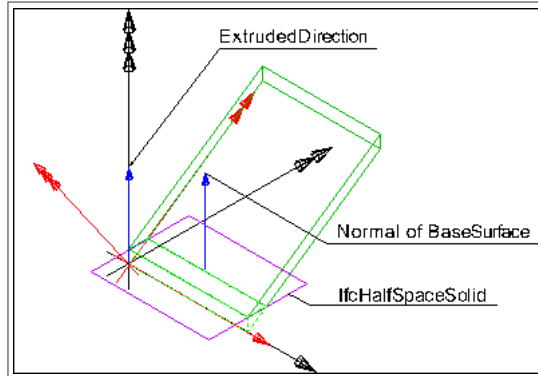
Field	Mapping	Definition
(Query)	**\IfcSlabElementedCase**	
Aggregation		The following guidance is provided for the components of the IfcSlabElementedCase. The following component entity types should be used: Precast hollow core slabs - double tee or plank components : IfcBeam - topping : IfcBuildingElementPart - others : IfcBuildingElementPart
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The use of local placement is defined at the supertype IfcSlab. The local placement of the IfcSlabElementedCase defines the parent coordinate systems for the parts within the decomposition. All parts shall be positioned relative to the IfcSlabElementedCase.
Surface Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	A three-dimensional surface being a subtype of IfcBoundedSurface defining the reference surface for the elemented slab. It maybe used as a simplified representation directly at the elemented slab. NOTE It is invalid to exchange a 'Body' shape representation of an IfcSlabElementedCase. The body geometry is defined by the parts within the decomposition. NOTE The 'Surface' can be used to define a surfacic model of the building (e.g. for analytical purposes, or for reduced Level of Detail representation). It should suppress the geometric details of the parts in the decomposition.

Field	Mapping	Definition
(Query)	**\IfcSlabStandardCase**	
Material Layer Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	Multi-layer slabs can be represented by refering to several IfcMaterialLayer's within the IfcMaterialLayerSet that is referenced from the IfcMaterialLayerSetUsage. Material information can also be given at the IfcSlabType, defining the common attribute data for all occurrences of the same type. It is then accessible by the inverse *IsDefinedBy* relationship pointing to *IfcSlabType.HasAssociations* and via *IfcRelAssociatesMaterial.RelatingMaterial*. The IfcSlabStandardCase defines in addition that the IfcSlabType should have a unique IfcMaterialLayerSet, that is referenced by the IfcMaterialLayerSetUsage assigned to all occurrences of this IfcSlabType.

Figure 248 — Slab type definition
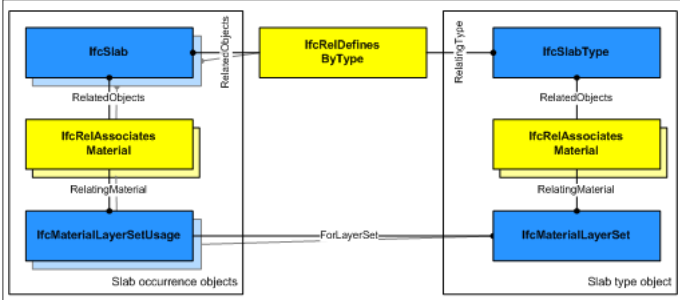
EXAMPLE Figure 248 illustrates assignment of IfcMaterialLayerSetUsage and IfcMaterialLayerSet to the IfcSlabStandardCase as the slab occurrence and to the IfcSlabType. The same IfcMaterialLayerSet shall be shared by many occurrences of IfcMaterialLayerSetUsage. This relationship shall be consistent to the relationship between the IfcSlabType and the IfcSlabStandardCase.

Figure 249 illustrates slab material usage, where the following conventions shall be met:

- The reference coordinate system is the coordinate system established by the *IfcExtrudedAreaSolid.Position*.
- The reference plane is the plane defined by the extruded profile of *IfcExtrudedAreaSolid.SweptSolid*. The *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* is given as a distance from this plane.
- The *IfcMaterialLayerSetUsage.DirectionSense* defines how the IfcMaterialLayer's are assigned to the reference plane. POSITIVE means in direction to the positive z-axis of the reference coordinate system.
- The *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* is the distance parallel to the reference plane and always perpendicular to the base (XY) plane of the reference coordinate system. This is independent of a potential non-perpendicular extrusion given by *IfcExtrudedAreaSolid.ExtrudedDirection* <> 0.,0.,1. A positive value of *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* would then point into the positive z-axis of the reference coordinate system.
- The *Thickness* of each IfcMaterialLayer shall be the parallel distance (measured perpendicular to the base plane). The *TotalThickness* of the IfcMaterialLayerSet is the sum of all layer thicknesses and in case of a perpendicular extrusion identical with *IfcExtrudedAreaSolid.Depth*
- The *IfcMaterialLayerSetUsage.LayerSetDirection* is always AXIS3.

Figure 249 — Slab material layers
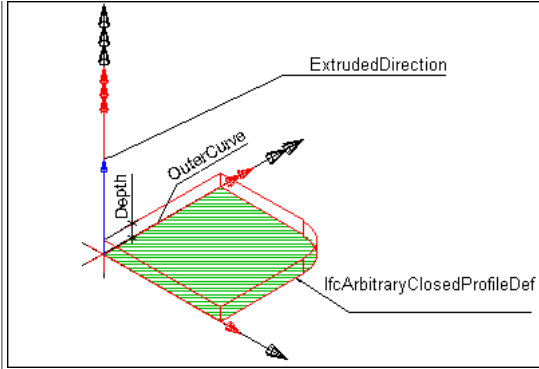
Product Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: ■ The local placement shall provide the location and directions for the standard slab, the x/y plane is the plane for the profile, and the z-axis is the extrusion axis for the slab body.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the swept solid representation: ■ Solid: IfcExtrudedAreaSolid is required, ■ Profile: *IfcArbitraryClosedProfileDef, IfcRectangleProfileDef, IfcCircleProfileDef, IfcEllipseProfileDef* shall be supported. ■ Extrusion: The profile can be extruded perpendicularly or non-perpendicularly to the plane of the swept profile. ■ Material: The definition of the IfcMaterialLayerSetUsage, particularly of the *OffsetFromReferenceLine* and the *ForLayerSet.TotalThickness*, has to be consistent to the 'SweptSolid' representation. EXAMPLE Figure 249 illustrates a 'SweptSolid' geometric

representation. The following interpretation of dimension parameter applies for polygonal slabs (in ground floor view): *IfcArbitraryClosedProfileDef.OuterCurve*: closed bounded curve interpreted as area (or foot print) of the slab.

Figure 249 — Slab body extrusion

| Body Clipping Geometry | \IfcElement.Representation
\IfcProductDefinitionShape.Representations[*]
\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext | The following constraints apply to the 'Clipping' representation:

■ Solid: see 'SweptSolid' shape representation,
■ Profile: see 'SweptSolid' shape representation,
■ Extrusion: see 'SweptSolid' shape representation,
■ Material: see 'SweptSolid' shape representation,
■ Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtrudedAreaSolid) and one or several IfcHalfSpaceSolid.

EXAMPLE Figure 250 illustrates a 'Clipping' geometric representation with definition of a roof slab using advanced geometric representation. The profile is extruded non-perpendicular and the slab body is clipped at the eave.

Figure 250 — Slab body clipping |

Field	Mapping	Definition
(Query)	\IfcSlabType	

Material Layer Set	\IfcObjectDefinition.HasAssociations[*]
	\IfcRelAssociatesMaterial.RelatingMaterial
	\IfcMaterialLayerSet.MaterialLayers[*]
	\IfcMaterialLayer.Name
	\IfcLabel
		The material of the IfcSlabType is defined by the IfcMaterialLayerSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship.
		
		    NOTE It is illegal to assign an IfcMaterial to an IfcSlabType, if there is at least one occurrences. of IfcSlabStandardCase for this type.
		
		The shared material layer set definition is defined by assigning an IfcMaterialLayerSet (see material use definition above). The IfcMaterialLayer refers to one or several of IfcMaterial that is the common for all slab occurrence, if used. It is only applicable if the IfcSlabType has only occurrences of type IfcSlabStandardCase (see definition of IfcSlabStandardCase for further information).
		
		    NOTE Since each individual instance of IfcSlabStandardCase defines its own IfcMaterialLayerSetUsage including the offset from the reference plane, the same IfcSlabType can be used independently of the reference plane alignment of its occurrences.

Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

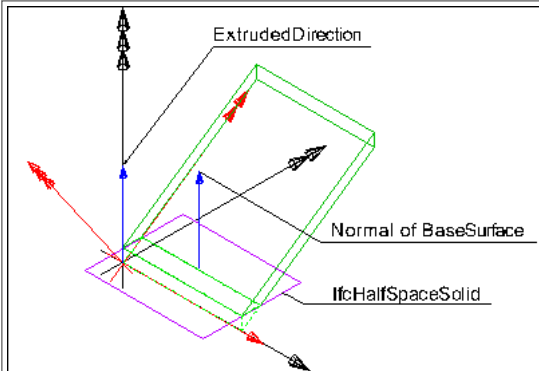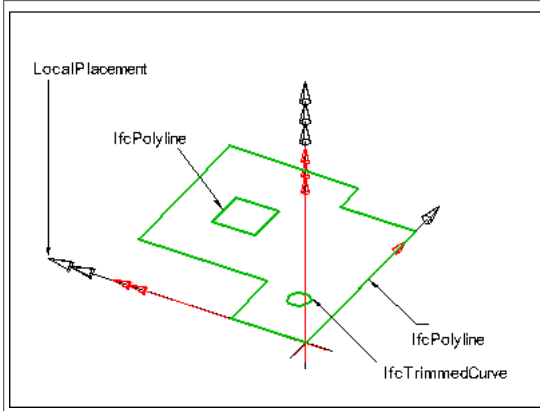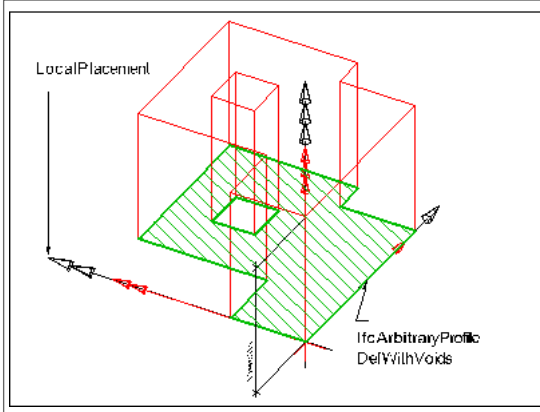| Field	Mapping	Definition
(Query)	\IfcSolarDevice	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcSpace	
Spatial Composition	\IfcSpatialElement.Decomposes[*] \IfcRelAggregates.RelatingObject \IfcProject.Name	By using the inverse relationship *IfcSpace.IsDecomposedBy* it references IfcSpace by *IfcRelAggregates.RelatedObjects*. If it refers to another instance of IfcSpace, the referenced IfcSpace needs to have a different and lower *CompositionType*, i.e. ELEMENT (if the other IfcSpace has COMPLEX), or PARTIAL (if the other IfcSpace has ELEMENT).
Spatial Decomposition	\IfcObjectDefinition.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcSpatialElement.Name \IfcLabel	By using the inverse relationship *IfcSpace.Decomposes* it references IfcSite || IfcBuildingStorey || IfcSpace by *IfcRelAggregates.RelatingObject*. If it refers to another instance of IfcSpace, the referenced IfcSpace needs to have a different and higher *CompositionType*, i.e. COMPLEX (if the other IfcSpace has ELEMENT), or ELEMENT (if the other IfcSpace has PARTIAL).

|		
Spatial Container	\IfcSpatialElement.ContainsElements[*] \IfcRelContainedInSpatialStructure.RelatedElements[*] \IfcProduct	If there are building elements and/or other elements directly related to the IfcSpace (like most furniture and distribution elements), they are associated with the IfcSpace by using the objectified relationship IfcRelContainedInSpatialStructure. The IfcSpace references them by its inverse relationship: ■ *IfcSpace.ContainsElements* -- referencing any subtype of IfcProduct (with the exception of other spatial structure element) by *IfcRelContainedInSpatialStructure.RelatedElements*.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Space Boundaries 1st Level	\IfcSpace.BoundedBy[*] \IfcRelSpaceBoundary1stLevel.RelatedBuildingElement \IfcElement	Reference to ~~Building~~ Element, that defines the Space Boundaries.
Space Boundaries 2nd Level	\IfcSpace.BoundedBy[*] \IfcRelSpaceBoundary2ndLevel.RelatedBuildingElement \IfcElement	Reference to ~~Building~~ Element, that defines the Space Boundaries.
Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for IfcSpace is defined at its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. ■ The *PlacementRelTo* relationship of IfcLocalPlacement shall point to the local placement of the IfcSpatialStructureElement of type IfcBuildingStorey or IfcSite if relative placement is used. ■ If the relative placement is not used, the absolute placement is defined within the world coordinate system.
FootPrint GeomSet Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The following constraints apply to the 2D representation: ■ An IfcBoundedCurve is required, using IfcPolyline for faceted space contours or IfcCompositeCurve for space contours with arc segments. For spaces with inner boundaries, a set of IfcBoundedCurve's is used, that should be grouped into an IfcGeometricCurveSet. **Figure 186 — Space footprint** EXAMPLE Figure 186 shows a two-dimensional bounded curve representing the foot print of IfcSpace.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following constraints apply to the standard representation: ■ Solid: IfcExtrudedAreaSolid is required, ■ Profile: IfcArbitraryClosedProfileDef is required, IfcArbitraryProfileDefWithVoids shall be supported. ■ Extrusion: The extrusion direction shall be vertically, i.e., along the positive Z Axis of the co-ordinate system of the containing spatial structure element. Figure 187 shows an extrusion of an arbitrary profile definition with voids into the swept area solid of IfcSpace. **Figure 187 — Space body swept solid**
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the advanced representation: ■ Solid: IfcExtrudedAreaSolid is required, ■ Profile: IfcArbitraryClosedProfileDef is required, IfcArbitraryProfileDefWithVoids shall be supported. ■ Extrusion: The extrusion direction shall be vertically, i.e., along the positive Z Axis of the co-ordinate system of the containing spatial structure element. ■ Boolean result: The difference operation with the second operand being of type IfcHalfSpaceSolid (or one of its subtypes) shall be supported. Figure 188 shows an extrusion of an arbitrary profile definition into the swept area solid. The solid and an half space solid are operands of the Boolean result of IfcSpace.
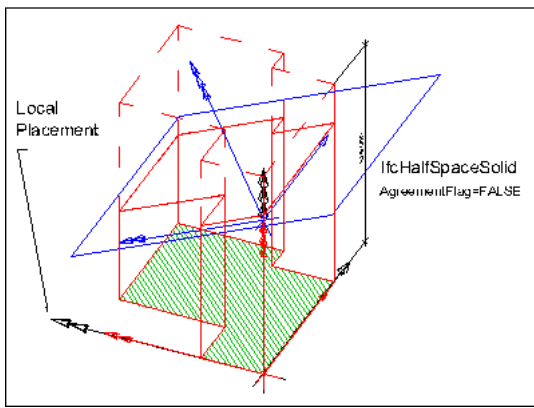
Figure 188 — Space body clipping

Body Brep Geometry\IfcElement.Representation
\IfcProductDefinitionShape.Representations[*]
\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext

The space can be represented by a brep geometry representation

Field	Mapping	Definition
(Query)	\IfcSpaceHeater	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcSpatialElement	
	\IfcObject	The IFC class identifier indicating the subtype of object.
FootPrint GeomSet Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The optional identifier of the representation as used within a project.

Field	Mapping	Definition
(Query)	\IfcSpatialStructureElement	
	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcStackTerminal	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcStair	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Material Solid	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterial	The material of the IfcStair is defined by the IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. Material information can also be given at the IfcStairType, defining the common attribute data for all occurrences of the same type. It is then accessible by the inverse *IsDefinedBy* relationship pointing to *IfcStair.HasAssociations* and via *IfcRelAssociatesMaterial.RelatingMaterial* to IfcMaterial. If both are given, then the material directly assigned to IfcStair overrides the material assigned to IfcStairType.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcStair, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: ▪ the *Spatial Containment* (defined here), or ▪ the *Element Composition*.
Element Decomposition	\IfcElement.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcElement.Name \IfcLabel	*Geometric representation by aggregated elements* If the IfcStair has components (referenced by *SELF\IfcObject.IsDecomposedBy*) with own 'Body' representation, then no 'Body' representation shall defined for the IfcStair. The IfcStair shape is then represented by the geometric representation of its components. The components are accessed via *SELF\IfcObject.IsDecomposedBy[1].RelatedObjects*.

Figure 251 illustrates stair placement, where the IfcStair defines the local placement for all components and the common 'Axis' representation, and each component has its own 'Body' representation.
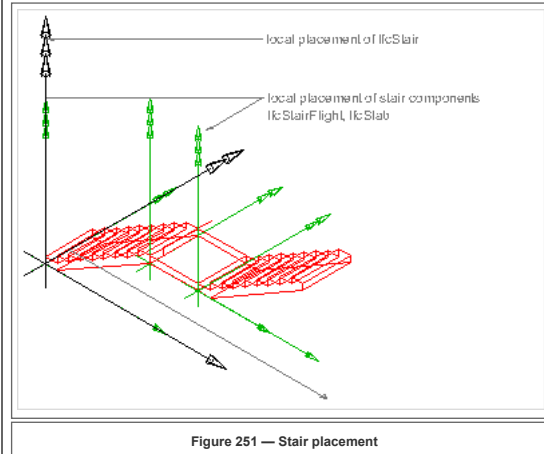

Figure 251 — Stair placement

Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction may be imposed by view definitions or implementer agreements: • If the IfcStair establishes an aggregate, then all contained elements shall be placed relative to the *IfcStair.ObjectPlacement*.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The walking line is represented by a two-dimensional open curve as the axis. The curve is directed into the upward direction (direction has to be interpreted as specified at the subtypes of IfcCurve). NOTE The 'Axis' representation of IfcStair may be provided even if the IfcStair has components with own shape representations.
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

| Field	Mapping	Definition
(Query)	**\IfcStairFlight**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Solid	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterial	The material of the IfcStairFlight is defined by the IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcStairFlight, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: • the *Spatial Containment* (defined here), or • the *Element Composition*. NOTE Model view definitions or implementer agreements may force an IfcStairFlight to be solely used as a part within an IfcStair container. In this case, no *Spatial containment* shall be used.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The walking line is represented by a two-dimensional open curve as the axis. The curve is directed into the upward direction (direction has to be interpreted as specified at the subtypes of IfcCurve). Figure 252 illustrates the axis representation which has the following constraints: • In case of straight flights the curve shall be a single item of type IfcPolyline. • In case of winding flights the curve shall be a single item of type IfcCompositeCurve. • In case of a curved flight or a spiral flight the curve shall be a single item of type IfcTrimmedCurve. **Figure 252 — Stair flight axis**
Footprint Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The flight foot print, including the flight boundary is represented by a two-dimensional geometric curve set. Figure 253 illustrates the footprint representation which has the following constraints: • In case of straight flights the curve set shall consists of a single item of type IfcPolyline. • In case of winding flights or curved flights the curve set shall consists of a single item of type IfcCompositeCurve. • In case of a spiral flight the curve set shall consists of a single item of type IfcConic or IfcPolyline.
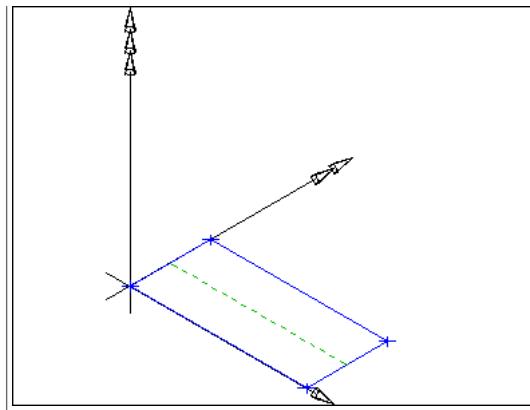
Figure 253 — Stair flight footprint

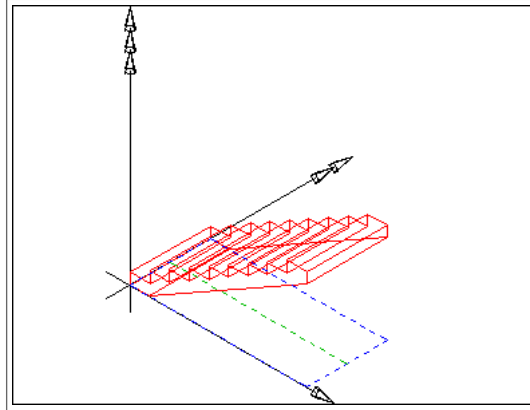| Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Figure 254 illustrates the 'Body' geometric representation using a 'SweptSolid' representation type. **Figure 254 — Stair flight body**

Field	Mapping	Definition
(Query)	**\IfcStairFlightType**	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcStairType**	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcStructuralAnalysisModel**	
Aggregation		
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcStructuralCurveAction**	
Structural Activity	\IfcStructuralActivity.AppliedLoad \IfcStructuralLoad	Load or result resource object which defines the load type, direction, and load values. In case of activities which are variably distributed over curves or surfaces, IfcStructuralLoadConfiguration is used which provides a list of load samples and their locations within the load distribution, measured in local coordinates of the curve or surface on which this activity acts. The contents of this load or result distribution may be further restricted by definitions at subtypes of IfcStructuralActivity.

Field	Mapping	Definition
(Query)	**\IfcStructuralCurveConnection**	
Reference Topology	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcTopologyRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcStructuralCurveMember**	
Structural Connectivity	\IfcStructuralMember.ConnectedBy[*] \IfcRelConnectsStructuralMember.RelatedStructuralConnection \IfcStructuralConnection	Reference to an instance of IfcStructuralConnection (or its subclasses) which is connected to the specified structural member.
Material Profile Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialProfileSetUsage.ForProfileSet \IfcMaterialProfileSet.MaterialProfiles[*] \IfcMaterialProfile.Name	The material of direct instances IfcStructuralCurveMember (in contrast to instances of the subtype IfcStructuralCurveMemberVarying) is defined by IfcMaterialProfileSetUsage and attached by the *IfcRelAssociatesMaterial.RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. Composite profile beams can be represented by refering to several IfcMaterialProfiles within the IfcMaterialProfileSet that is referenced from the IfcMaterialProfileSetUsage. In case of tapered members, the material profile usage subtype *IfcMaterialProfileSetUsageDual* is used which specifies IfcMaterialProfileSets separately at the start and the end of the tapered member. The material (IfcMaterial) in each IfcMaterialProfile(*Set*) is specified minimally by a name which corresponds with an agreed upon standardized structural material designation. An external reference to the source which specifies the material designation should be provided. Alternatively, structural material properties may be provided by means of *IfcMechanicalMaterialProperties* and *IfcExtendedMaterialProperties*.

The profile (IfcProfileDef) in each IfcMaterialProfile(Set) is specified minimally by a name which corresponds with an agreed upon standardized structural profile designation. An external reference to the source which specifies the profile designation should be provided. Alternatively or additionally, explicit profile geometry should be provided by using respective subtypes of IfcProfileDef. Alternatively or additionally, structural profile properties may be provided by means of subtypes of IfcProfileProperties.

An IfcProfileDef is a two-dimensional geometric object with a x_p,y_p coordinate system. The profile is inserted into the curve member model thus that the origin of x_p,y_p is located at the member's reference curve and that x_p,y_p are parallel with and directed like the local y,z.

NOTE Due to convention in structural mechanics, axis names of IfcStructuralCurveMember differ from axis names of building elements like IfcBeamStandardCase: The extrusion axis of IfcStructuralCurveMember is called x while the extrusion axis of IfcBeamStandardCase is called z. Hence x,y,z of IfcStructuralCurveMember correspond with z,x,y of IfcBeamStandardCase.

If the profile is meant to be inserted centrically in terms of structural section properties, it is necessary that the origin of x_p,y_p is identical with the geometric centroid of the profile (commonly also called centre of gravity). If subtypes of IfcParameterizedProfileDef are used which are only singly symmetric or are asymmetric, an explicit translation by *IfcParameterizedProfileDef.Position.Location* is required then.

If the profile is inserted at its geometric centroid, *IfcMaterialProfileSetUsage.CardinalPoint* shall be set to 10.

Otherwise, the profile is inserted eccentrically and a different cardinal point should be set accordingly.

NOTE Another eccentricity model is available independently of eccentric profile specification: The reference curve of the member may be located eccentrically relative to the reference points of the connected IfcStructuralPointConnections. The connection relationship is then established by IfcRelConnectsWithEccentricity. Whether one or the other or both eccentricity models may be used is subject to information requirements and local agreements.

Reference Topology	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcTopologyRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Direct instances of IfcStructuralCurveMember shall have a topology representation which consists of one instance of IfcEdge or a subtype, representing the reference curve of the curve member. See definitions at IfcStructuralItem for further specifications. Informal Propositions: 1. The reference curve must not be parallel with *Axis* at any point within the curve member's domain. The local coordinate system is established by the reference curve given by topology representation and by the attribute *Axis*. The local x axis is parallel with the tangent on the reference curve. The local z axis is located in the surface which is created by sweeping *Axis* along the reference curve and is directed according to *Axis*. The local y axis is directed such that x,y,z form a right-handed Cartesian coordinate system.

Field	Mapping	Definition
(Query)	\IfcStructuralCurveReaction	
Structural Activity	\IfcStructuralActivity.AppliedLoad \IfcStructuralLoad	Load or result resource object which defines the load type, direction, and load values. In case of activities which are variably distributed over curves or surfaces, IfcStructuralLoadConfiguration is used which provides a list of load samples and their locations within the load distribution, measured in local coordinates of the curve or surface on which this activity acts. The contents of this load or result distribution may be further restricted by definitions at subtypes of IfcStructuralActivity.

Field	Mapping	Definition
(Query)	\IfcStructuralLoadCase	
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	\IfcStructuralLoadGroup	
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	\IfcStructuralPointAction	
Structural Activity	\IfcStructuralActivity.AppliedLoad \IfcStructuralLoad	Load or result resource object which defines the load type, direction, and load values. In case of activities which are variably distributed over curves or surfaces, IfcStructuralLoadConfiguration is used which provides a list of load samples and their locations within the load distribution, measured in local coordinates of the curve or surface on which this activity acts. The contents of this load or result distribution may be further restricted by definitions at subtypes of IfcStructuralActivity.

Field	Mapping	Definition
(Query)	\IfcStructuralPointConnection	
Reference Topology	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcTopologyRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Instances of IfcStructuralPointConnection shall have a topology representation which consists of one IfcVertexPoint, representing the reference point of the point connection. See definitions at IfcStructuralItem for further specifications.

Field	Mapping	Definition
(Query)	\IfcStructuralPointReaction	
Structural Activity	\IfcStructuralActivity.AppliedLoad \IfcStructuralLoad	Load or result resource object which defines the load type, direction, and load values. In case of activities which are variably distributed over curves or surfaces, IfcStructuralLoadConfiguration is used which provides a list of load samples and their locations within the load distribution, measured in local coordinates of the curve or surface on which this activity acts. The contents of this load or result distribution may be further restricted by definitions at subtypes of IfcStructuralActivity.

Field	Mapping	Definition
(Query)	\IfcStructuralResultGroup	
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	\IfcStructuralSurfaceAction	
Structural Activity	\IfcStructuralActivity.AppliedLoad \IfcStructuralLoad	Load or result resource object which defines the load type, direction, and load values. In case of activities which are variably distributed over curves or surfaces, IfcStructuralLoadConfiguration is used which provides a list of load samples and their locations within the load distribution, measured in local coordinates of the curve or surface on which this activity acts. The contents of this load or result distribution may be further restricted by definitions at subtypes of IfcStructuralActivity.

Field	Mapping	Definition
(Query)	\IfcStructuralSurfaceMember	
Material Layer Set	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial	The material of direct instances IfcStructuralSurfaceMember (in contrast to instances of the subtype

Usage	\IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	IfcStructuralSurfaceMemberVarying) is defined by IfcMaterialLayerSetUsage and attached by the *IfcRelAssociatesMaterial.RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. The material is specified minimally by a name which corresponds with an agreed upon standardized structural material designation. An external reference to the source which specifies the material designation should be provided. Alternatively, structural material properties may be provided by means of IfcMaterialProperties. In the absense of material layer set usage, direct instances of IfcStructuralSurfaceMember are assumed to be located centrically relative to their reference surface. Their depth is provided in the attribute *Thickness*.
Reference Topology	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcTopologyRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Direct instances of IfcStructuralSurfaceMember shall have a topology representation which consists of one IfcFaceSurface, representing the reference surface of the surface member. See definitions at IfcStructuralItem for further specifications. The local coordinate system is established by the reference surface given by topology representation.
Structural Connectivity	\IfcStructuralMember.ConnectedBy[*] \IfcRelConnectsStructuralMember.RelatedStructuralConnection \IfcStructuralConnection	Reference to an instance of IfcStructuralConnection (or its subclasses) which is connected to the specified structural member.

Field	Mapping	Definition
(Query)	**\IfcStructuralSurfaceMemberVarying**	
	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcStructuralSurfaceReaction**	
Structural Activity	\IfcStructuralActivity.AppliedLoad \IfcStructuralLoad	Load or result resource object which defines the load type, direction, and load values. In case of activities which are variably distributed over curves or surfaces, IfcStructuralLoadConfiguration is used which provides a list of load samples and their locations within the load distribution, measured in local coordinates of the curve or surface on which this activity acts. The contents of this load or result distribution may be further restricted by definitions at subtypes of IfcStructuralActivity.

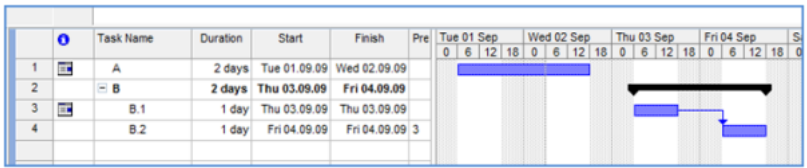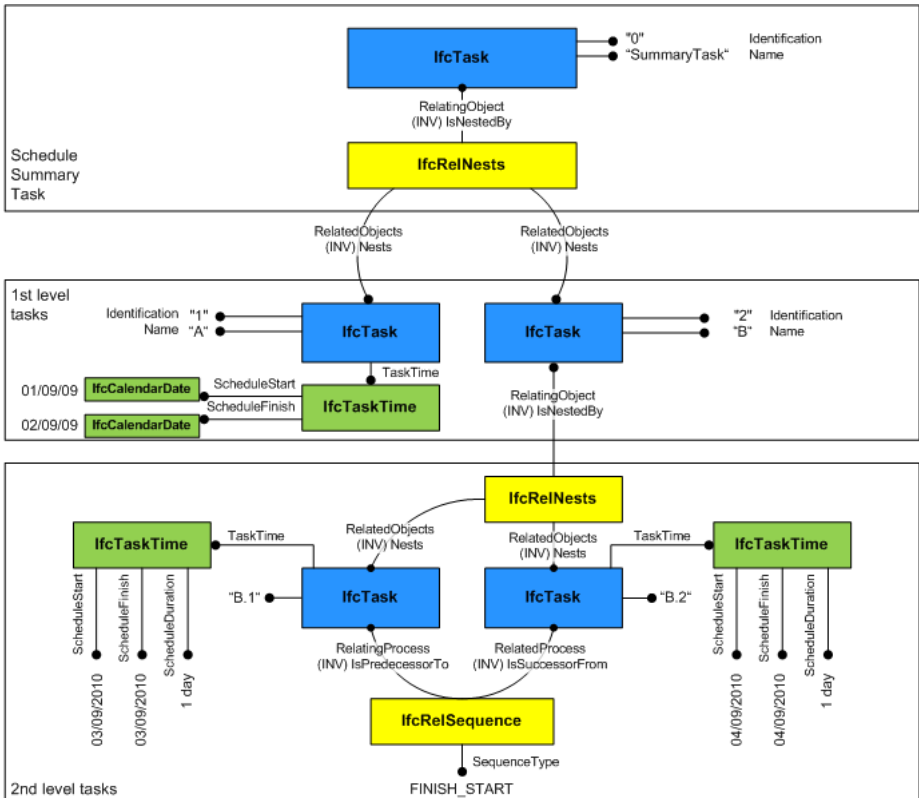| Field	Mapping	Definition
(Query)	**\IfcSubContractResource**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Resource Assignment	\IfcResource.ResourceOf[*] \IfcRelAssignsToResource.RelatedObjects[*] \IfcActor	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

Field	Mapping	Definition
(Query)	**\IfcSurfaceFeature**	
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for *IfcSurfaceFeatureElement* is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. ■ In case of features which are part of an element type, absolute placement into the type object's implied coordinate system shall be used. ■ In case of features which are voiding an element occurrence, the *PlacementRelTo* relationship of IfcLocalPlacement shall point to the local placement of the respective element.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcSwitchingDevice**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcSystem**	
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcSystemFurnitureElement**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Material Constituents	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.

Field	Mapping	Definition
(Query)	**\IfcTank**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.

Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	**\IfcTask**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	The IfcTask defines the anticipated or actual occurrence of any task; common information about task types is handled by IfcTaskType. EXAMPLE It includes fixed duration, fixed unit or fixed work. An IfcTask can be aggregated to a task type in order to specify a task sequence or any time related information, e.g. the duration of a task. Please see the documentation of IfcTaskType for further information.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	IfcTask may be contained within an IfcTask using the IfcRelNests relationship. An IfcTask may in turn nest other IfcTask, IfcProcedure or IfcEvent entities. Such nesting indicates decomposed level of detail. From IFC4 onwards it is required to have a summary task (root of all tasks), which is used to define a link to the work plan or work schedule. All subtasks of the summary tasks are then implicitly linked to this work plan or work schedule. Please note that the summary task is used for data organization and not meant to store typical task information as defined by the user. It is therefore recommended that the summary task is hidden from the user to avoid confusion. Please also note that IfcRelNests is used to show the dependency between regular tasks and recurring task definitions (please see the section about time and duration use definitions). As shown in Figure 142, the installation of a number of items of equipment within a particular space may be the subject of a single task which is identified as 'fix equipment in space 123'. IfcTask represents the occurrence of a work performance of a type of process in a construction plan. **Figure 142 — Task visualization** A task may nest other tasks as sub-items; the nesting relationship is modeled by IfcRelNests as shown in Figure 143. For example, the construction of a stud wall may be designated as a nesting task named 'install wall #1' including other tasks such as 'install dry wall', 'install studs', 'wall taping', and 'erect wall' as sub-processes. A value that indicates the relative tree view position of the task (in comparison to the tree view position of other tasks and the task hierarchy defined by IfcRelNests). The task order information that is used for viewing purposes is derived from the order defined by the IfcRelNests relationship and thus is independent of the logical task order defined through IfcRelSequence. The hierarchy and order defined through IfcRelNests enables to order the tasks in a tree view or list view structure. **Figure 143 — Task nesting relationships** A top-level task is declared within the IfcProject using the IfcRelDeclares relationship.
Sequential Connectivity	\IfcProcess.IsPredecessorTo[*] \IfcRelSequence.RelatedProcess \IfcProcess	The relationship IfcRelSequence is used to indicate control flow. An IfcTask as a successor to an IfcTask indicates logical sequence how these tasks should be performed. IfcTask's can be triggered or can trigger IfcEvent's, which is also defined through the relationship IfcRelSequence.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	Occurrences of IfcTask may be assigned to an IfcWorkControl (either a work plan or a work schedule) through IfcRelAssignsToControl. Please note that the IfcRelAssignsTasks relationship class has been removed in IFC4 and is no

		longer available.
Process Assignment	\IfcProcess.OperatesOn[*] \IfcRelAssignsToProcess.RelatedObjects[*] \IfcResource	It is suggested to use the 'summary task' (root element of the task hierarchy that is required for task management purposes) to assign all subtask to a work plan or work schedule. Resources used by tasks are assigned by IfcRelAssignsToProcess.
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.
Classification	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesClassification.RelatingClassification \IfcClassificationReference.Identification \IfcIdentifier	An IfcTask may be assigned a Work Breakdown Structure (WBS) code. A WBS code is dealt with as a classification of task and is associated to a task occurrence using the IfcRelAssociatesClassification relationship class. As well as being to designate the code, the classification structure also enables the source of the work breakdown structure classification to be identified.
Constraint	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesConstraint.RelatingConstraint \IfcObjective.BenchmarkValues[*] \IfcMetric.DataValue \IfcMetricValueSelect	Constraints may be applied to a task to indicate fixed task duration, fixed start or fixed finish, where IfcMetric.ReferencePath is set to the corresponding attribute on the IfcTaskTime entity.

Field	Mapping	Definition
(Query)	\IfcTaskType	
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	IfcTaskType may nest other IfcTaskType or IfcTask entities using the IfcRelNests relationship. Such nesting indicates decomposed level of detail. Nesting of IfcTask entities is used if a task type shall be detailed by a sequence of tasks or if there is a need to include additional time information such as the duration of subtasks. Please note that IfcTask entities being contained within an IfcTaskType are linked with their task occurrences via IfcRelDefinesByObject relationships. It is also possible to define a task type for these IfcTask entities via IfcRelDefinesByType relationships. For further information please see the documentation of IfcRelDefinesByObject.

Field	Mapping	Definition
(Query)	\IfcTendonAnchor	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	Geometric placement that defines the transformation from the related coordinate system into the relating. The placement can be either 2D or 3D, depending on the dimension count of the coordinate system.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcTendon	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Quantity Sets	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	Geometric placement that defines the transformation from the related coordinate system into the relating. The placement can be either 2D or 3D, depending on the dimension count of the coordinate system.
Body Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	See supertype IfcElementComponent. This method of representation allows for several tendons represented by a single instance of IfcTendon. The representation map should contain one IfcSweptDiskSolid.

Field	Mapping	Definition
(Query)	\IfcTransformer	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcTransportElement	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	IfcTransportElement defines the occuurence of any transportation device, common information about transportation device types (or styles) is handled by IfcTransportElementType. The IfcTransportElementType (if present) may establish the common type name, usage (or predefined) type, common material layer set, common set of properties and common shape representations (using IfcRepresentationMap). The IfcTransportElementType is attached using the IfcRelDefinedByType.RelatingType objectified relationship and is accessible by the inverse *IsTypedBy* attribute. If no IfcTransportElementType is attached (i.e. if only occurrence information is given) the *PredefinedType* should be provided. If set to .USERDEFINED. a user defined value can be provided by the *ObjectType* attribute.
	\IfcObject	The IFC class identifier indicating the subtype of object.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	■ The IfcTransportElement is placed within the project spatial hierarchy using the objectified relationship IfcRelContainedInSpatialStructure, refering to it by its inverse attribute *SELF\IfcElement.ContainedInStructure*. Subtypes of IfcSpatialStructureElement are valid spatial containers, with IfcBuilding being the default container.

Field	Mapping	Definition
(Query)	\IfcTubeBundle	

Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

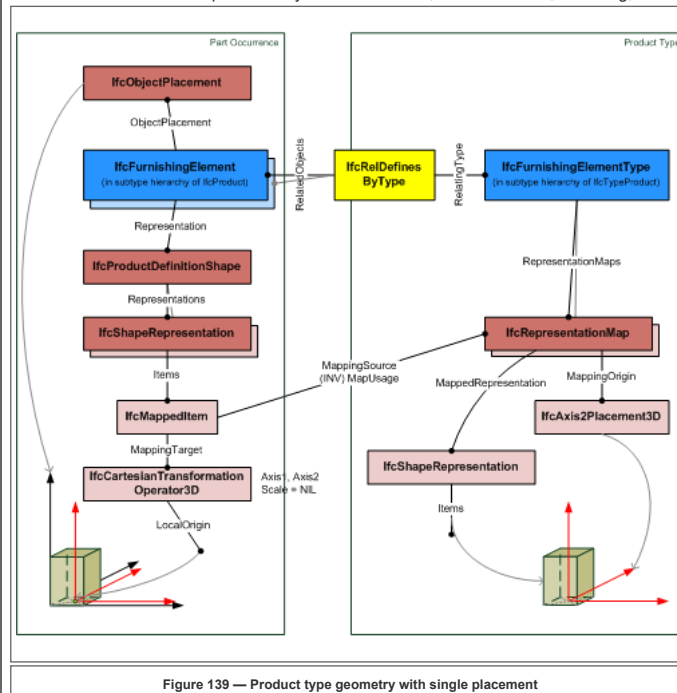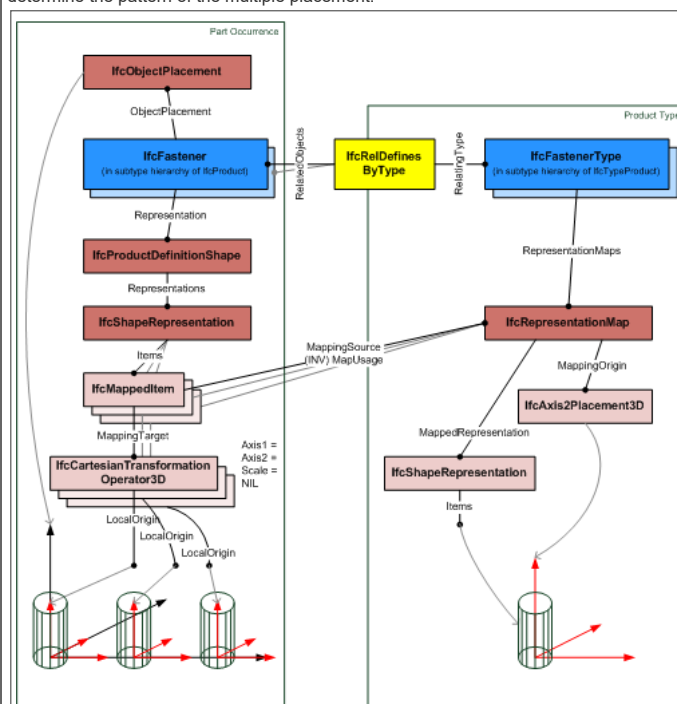| Field	Mapping	Definition
(Query)	\IfcTypeProduct	
Product Type Shape	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap	The *RepresentationMaps* define the type product shape and multiple geometric representations can be assigned. If a product occurrence is assigned to the type by using the IfcRelDefinesByType relationship, then these occurrences have to reference the representation maps. The reference is created by one or multiple IfcShapeRepresentation's having an IfcMappedItem as *Items*, that places the IfcRepresentationMap of the type product into the spatial contexts, i.e. by using an Cartesian transformation operator to transform the IfcRepresentationMap into the object coordinate system of the product occurrence. Figure 139 illustrates an example of referencing a representation map by the shape representation of a product occurrence. Here the Cartesian transformation operator only uses translation, but no rotation, mirroring, or scaling. **Figure 139 — Product type geometry with single placement** Figure 140 illustrates an example of referencing a representation multiple times map by the shape representation of a product occurrence. Here the Cartesian transformation operator only uses translation, but no rotation, mirroring, or scaling. The different translation values determine the pattern of the multiple placement. **Figure 140 — Product type geometry with multiple placement**

Field	Mapping	Definition

(Query)	\IfcUnitaryControlElement	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcUnitaryEquipment	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Composition		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcValve	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Connection		
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcVibrationIsolator	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.

Field	Mapping	Definition
(Query)	\IfcVirtualElement	
Footprint Geometry	\IfcProduct.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.RepresentationIdentifier \IfcLabel	The optional identifier of the representation as used within a project.
Surface Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The 3D geometric representation of IfcVirtualElement is d efined using a surface geometry. The following constraints apply to the 3D surface representation: ■ 'Surface3D': IfcSurfaceOfLinearExtrusion, IfcCurveBoundedPlane, IfcCurveBoundedSurface, IfcRectangularTrimmedSurface in case of an IfcSurfaceOfLinearExtrusion ■ Profile: IfcArbitraryOpenProfileDef ■ Extrusion: The extrusion direction shall be vertically, i.e., along the positive Z Axis of the co-ordinate system of the containing spatial structure element. in case of an IfcCurveBoundedPlane, IfcCurveBoundedSurface, IfcRectangularTrimmedSurface ■ Extrusion: The BasisSurface shall be a surface that is upright, i.e. standing perpendicular to the xy place of the co-ordinate system of the containing spatial structure element. ■ 'GeometricSet': a list of 3D surfaces within the constraints shown above.

Field	Mapping	Definition
(Query)	\IfcVoidingFeature	
Property Sets for Objects	\IfcObject	The IFC class identifier indicating the subtype of object.
Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The local placement for IfcVoidingFeatureElement is defined in its supertype IfcProduct. It is defined by the IfcLocalPlacement, which defines the local coordinate system that is referenced by all geometric representations. ■ In case of features which are part of an element type, absolute placement into the type object's implied coordinate system shall be used. ■ In case of features which are voiding an element occurrence, the PlacementRelTo relationship of IfcLocalPlacement shall point to the local placement of the respective element.

	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Body'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	**\IfcWall**	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material Layer Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name \IfcLabel	The material of the IfcWall is defined by IfcMaterialLayerSet, or as fallback by IfcMaterial, and it is attached either directly or at the IfcWallType. NOTE It is illegal to assign an IfcMaterialLayerSetUsage to an IfcWall. Only the subtype IfcWallStandardCase supports this concept.
Path Connectivity	\IfcElement.ConnectedFrom[*] \IfcRelConnectsPathElements.RelatedElement \IfcElement	Reference to a subtype of IfcElement that is connected by the connection relationship in the role of *RelatedElement*.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcWall, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment relationships: ■ the *Spatial Containment* (defined here), or ■ the *Element Composition*.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	NOTE The 'Axis' is not used to locate the material layer set, only the subtype IfcWallStandardCase provides this capability.
Surface Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	NOTE The 'Surface' can be used to define a surfacic model of the building (e.g. for analytical purposes, or for reduced Level of Detail representation).
Body SweptSolid Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'SweptSolid' representation: ■ Solid: IfcExtrudedAreaSolid is required, ■ Profile: IfcArbitraryClosedProfileDef is required. ■ Extrusion: All extrusion directions shall be supported. NOTE If the wall body can be described by a vertical extrusion of a polygonal footprint with constant thickness along the axis (where vertical = into the direction of the global Z axis), the subtype IfcWallStandardCase should be used. If the extrusion is not equal to global Z, then the IfcWall should be used.
Body Clipping Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
Voiding	\IfcElement.HasOpenings[*] \IfcRelVoidsElement.RelatedOpeningElement \IfcOpeningElement.PredefinedType \IfcOpeningElementTypeEnum	Predefined generic type for an opening that is specified in an enumeration. There may be a property set given specificly for the predefined types.
Product Assignment	\IfcProduct.ReferencedBy[*] \IfcRelAssignsToProduct.RelatedObjects[*] \IfcObject	Related objects, which are assigned to a single object. The type of the single (or relating) object is defined in the subtypes of IfcRelAssigns.

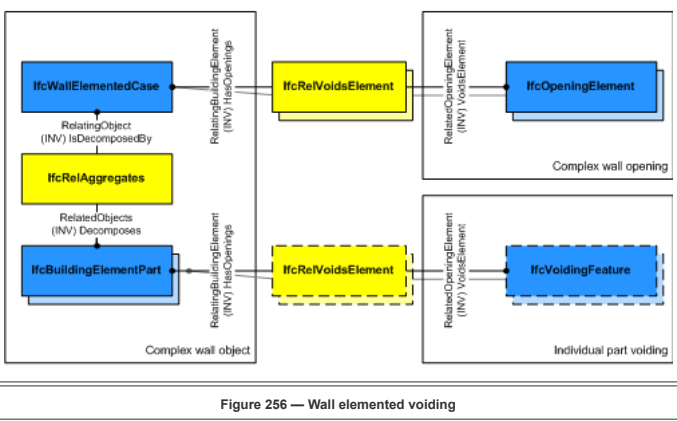| Field	Mapping	Definition
(Query)	**\IfcWallElementedCase**	
Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The use of local placement is defined at the supertype IfcWall. The local placement of the IfcWallElementedCase defines the parent coordinate systems for the parts within the decomposition. All parts shall be positioned relative to the IfcWallElementedCase.
Surface Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The 'Surface Geometry' shape representation can be used to define a surfacic model of the building (e.g. for analytical purposes, or for reduced Level of Detail representation). It could suppress the geometric details of the parts in the decomposition. NOTE It is invalid to exchange a 'Body' shape representation of an IfcWallElementedCase. The body geometry is defined by the parts within the decomposition.
Element Decomposition	\IfcElement.IsDecomposedBy[*] \IfcRelAggregates.RelatedObjects[*] \IfcElement.Name \IfcLabel	An elemented wall is decomposed into parts for particular components such as framing and panels on each side. There must be an object corresponding to each type of part, however there may be single object instance indicating multiple placements (via mapping geometry) for each part, or multiple instances corresponding to each placement. For minimizing file size, it is recommended to use a single object with multiple placement unless there are specific connectivity relationships indicated (e.g. a junction box connected to a specific stud).
Element Voiding	\IfcElement.HasOpenings[*] \IfcRelVoidsElement.RelatedOpeningElement \IfcOpeningElement.PredefinedType \IfcOpeningElementTypeEnum	As shown in Figure 256, openings within the composite wall are directly assigned to IfcWallElementedCase using IfcRelVoidsElement pointing to IfcOpeningElement and apply to all aggregated parts. If individual parts have cutting and other voiding features, then the decomposed parts have a separate voiding relationship IfcRelVoidsElement pointing to IfcVoidingFeature.

Figure 256 — Wall elemented voiding

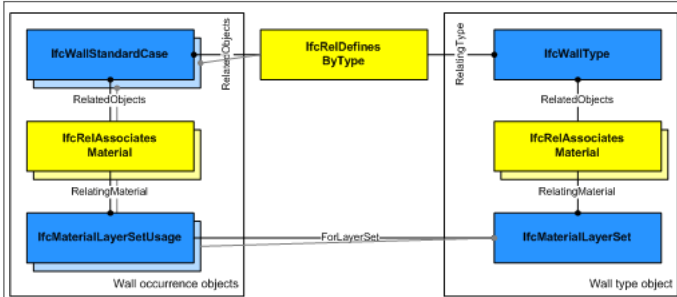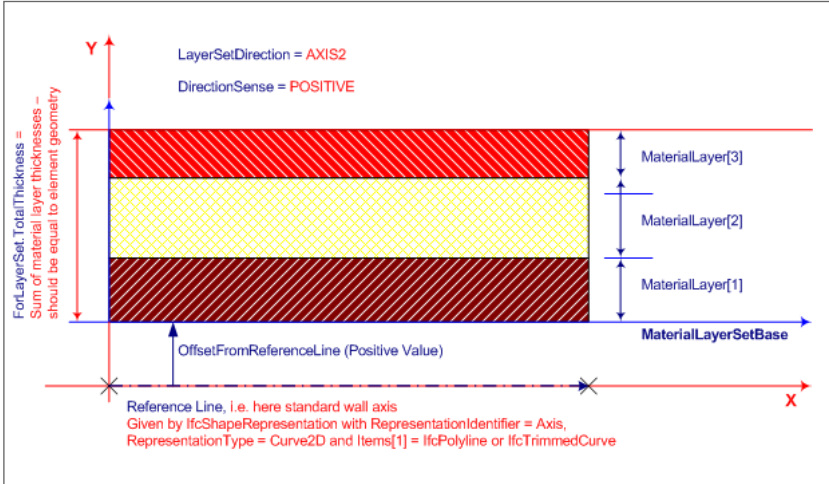| Field	Mapping	Definition
(Query)	\IfcWallStandardCase	
Material Layer Set Usage	\IfcProduct.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSetUsage.ForLayerSet \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name	Multi-layer walls can be represented by refering to several IfcMaterialLayer's within the IfcMaterialLayerSet that is referenced from IfcMaterialLayerSetUsage. Material information can also be given at the IfcWallType, defining the common attribute data for all occurrences of the same type accessible by the inverse *IsDefinedBy* relationship pointing to *IfcSlabType.HasAssociations* and via *IfcRelAssociatesMaterial.Rela* The IfcWallType should then have a unique IfcMaterialLayerSet, that is referenced by the IfcMaterialLayerSetUsage assigned to a occurrences of this IfcWallType. EXAMPLE Figure 258 illustrates assignment IfcMaterialLayerSetUsage and IfcMaterialLaye the wall type and the wall occurrence. **Figure 258 — Wall Standard Object Typing** Figure 259 illustrates material layer usage, where the following conventions shall be met: ■ The reference coordinate system is the local coordinate system established by the *ObjectPlacement* of the IfcWallStandardCase. ■ The reference axis is the axis defined by the IfcShapeRepresentation with *RepresentationType*='Axis' as one of the *Representation.Repr* the IfcWallStandardCase. ■ The *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* is given as a distance from this axis. ■ The *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* is the distance parallel to the reference axis and always within the base (XY) pl reference coordinate system. A positve value of *IfcMaterialLayerSetUsage.OffsetFromReferenceLine* would then point into the positive y- reference coordinate system. ■ The *IfcMaterialLayerSetUsage.DirectionSense* defines how the IfcMaterialLayer's are assigned to the reference axis. POSITIVE means i the positive y-axis of the reference coordinate system. ■ The *Thickness* of each IfcMaterialLayer is provided starting from the *OffsetFromReferenceLine* and in the direction given by *DirectionSen* applied without any gap or overlap between two consecutive layers. The *TotalThickness* of the IfcMaterialLayerSet is the sum of all layer ■ The *IfcMaterialLayerSetUsage.LayerSetDirection* is always AXIS2. **Figure 259 — Wall material layers**
Product Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: ■ The local placement shall provide the location and directions for the standard wall, the x/y plane is the plane for the profile, and the z-axis extrusion axis for the wall body.
Axis 2D Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations['Axis'] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The wall axis is represented by a two-dimensional open curve within a particular shape representation. The wall axis is used to ap material layer set usage parameter to the wall geometry. ■ *Axis*

- IfcPolyline having two *Points*, or IfcTrimmedCurve with *BasisCurve* of Type IfcLine for the 'SweptSolid' provided as IfcExtrudedAreaS
  curve lies on the x/y plane and is parallel to the x-axis of the object coordinate system.
- IfcTrimmedCurve with *BasisCurve* of Type IfcCircle for 'SweptSolid' provided as IfcExtrudedAreaSolid. The axis curve lies on the x/y
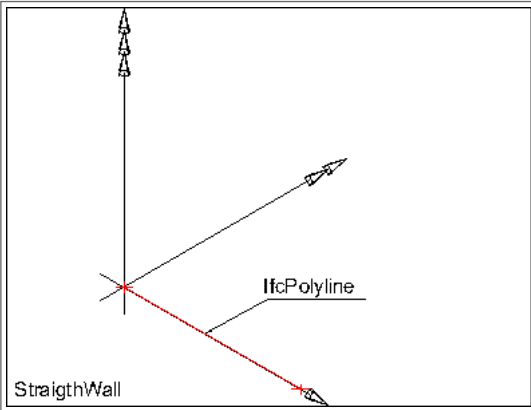 object coordinate system, the tangent at the start is along the positive x-axis.

EXAMPLE Figure 260 illustrates an axis representation for a straight w
case of a straight wall, the set of items shall include a single geometric
representation item of type IfcPolyline or IfcTrimmedCurve with the
BasisCurve being an IfcLine. The IfcPolyline or IfcTrimmedCurve shall
parallel (here in a special case co-linear) to the x-axis of the object coo
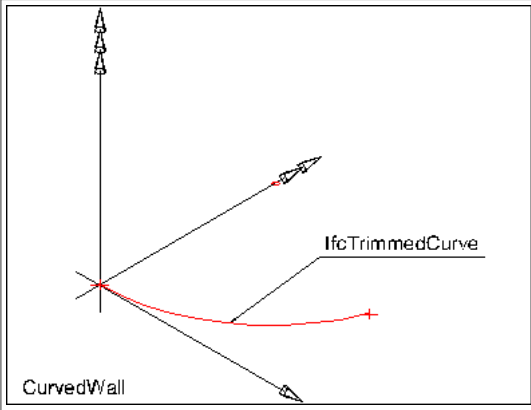system. The direction shall be identical to the direction of the x-axis.

Figure 260 — Wall axis straight

EXAMPLE Figure 261 illustrates an axis representation for a curved w
case of a curved wall, the set of items shall include a single geometric
representation item of type IfcTrimmedCurve. The curve shall have a
BasisCurve of type IfcCircle. The tangent of the IfcTrimmedCurve shall
parallel at start to the x-axis of the object coordinate system. The direc
shall be identical to the direction of the x-axis.

Figure 261 — Wall axis curved

| Body SweptSolid Geometry | \IfcElement.Representation
\IfcProductDefinitionShape.Representations[*]
\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext | The following additional constraints apply to the 'SweptSolid' representation: |

The following additional constraints apply to the 'SweptSolid' representation:

- Solid: IfcExtrudedAreaSolid is required,
- Profile: IfcArbitraryClosedProfileDef and IfcRectangleProfileDef shall be supported.
- Extrusion: The profile shall be extruded vertically, i.e., in the direction of the z-axis of the co-ordinate system of the referred spatial structu
  might be further constraint to be in the direction of the global z-axis in implementers agreements. The extrusion axis shall be perpendicul
  profile, i.e. pointing into the direction of the z-axis of the Position of the IfcExtrudedAreaSolid.

The profile of a wall is described in the ground view and extruded vertically. The profile (also identical with the foot print of the wall
by the IfcArbitraryClosedProfileDef (excluding its subtypes). The profile is given with all wall connections already resolved.

Figure 262 illustrates a body representation for a straight wall. In case of a straight wall, the two sides of the profile shall be paralle
axis, that is, the wall has a single unchanged thickness.

Figure 263 illustrates a body representation for a curved wall. In case of a curved wall, the two sides of the profile shall be parallel
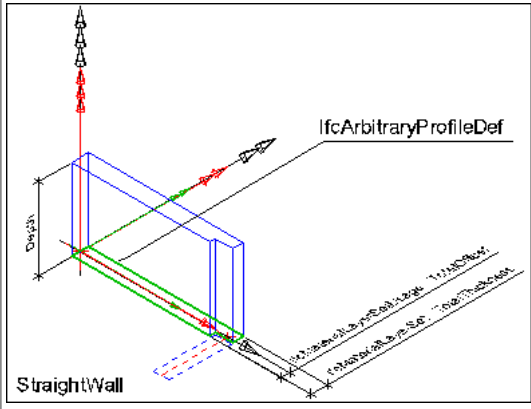offset) to the wall axis, that is, the wall has a single unchanged thickness.

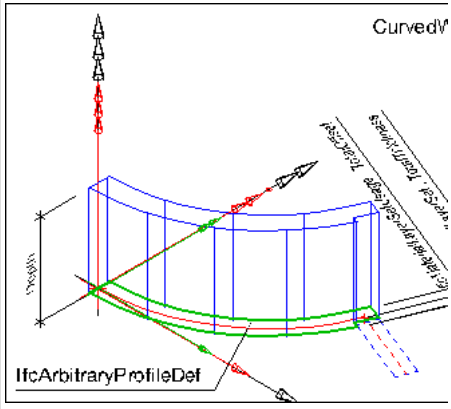
Figure 262 — Wall body extrusion straight

Figure 263 — Wall body extrusion curved

| Body Clipping Geometry | \IfcElement.Representation
\IfcProductDefinitionShape.Representations[*]
\IfcShapeRepresentation.ContextOfItems
\IfcGeometricRepresentationContext | The following constraints apply to the 'Clipping' representation: |

The following constraints apply to the 'Clipping' representation:

- Solid: see standard geometric representation
- Profile: see standard geometric representation
- Extrusion: see standard geometric representation
- Boolean result: The IfcBooleanClippingResult shall be supported, allowing for Boolean differences between the swept solid (here IfcExtru
  and one or several IfcHalfSpaceSolid (or subtypes).

Figure 264 illustrates a clipping for a straight wall using an IfcPolygonalBoundedHalfSpace as *SecondOperand* in the
IfcBooleanClippingResult.

Figure 265 illustrates a clipping for a curved wall using an IfcHalfSpaceSolid as *SecondOperand* in the IfcBooleanClippingResult.
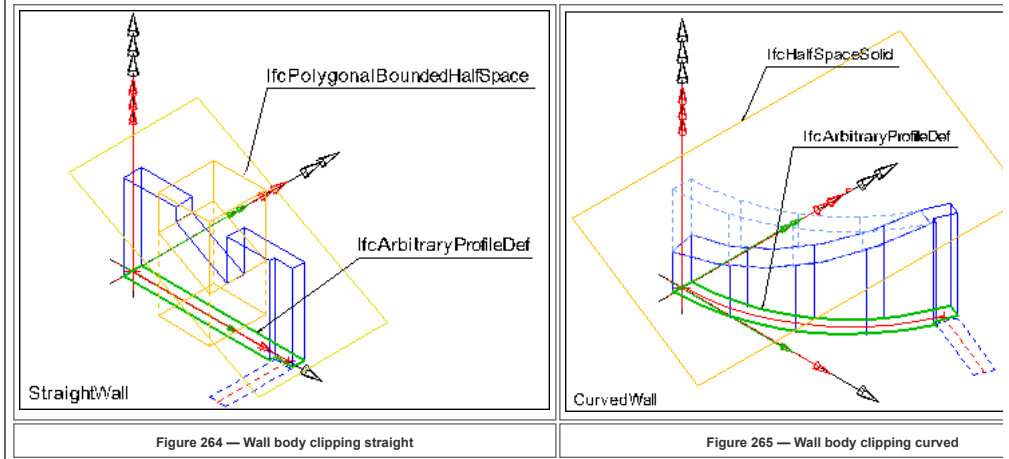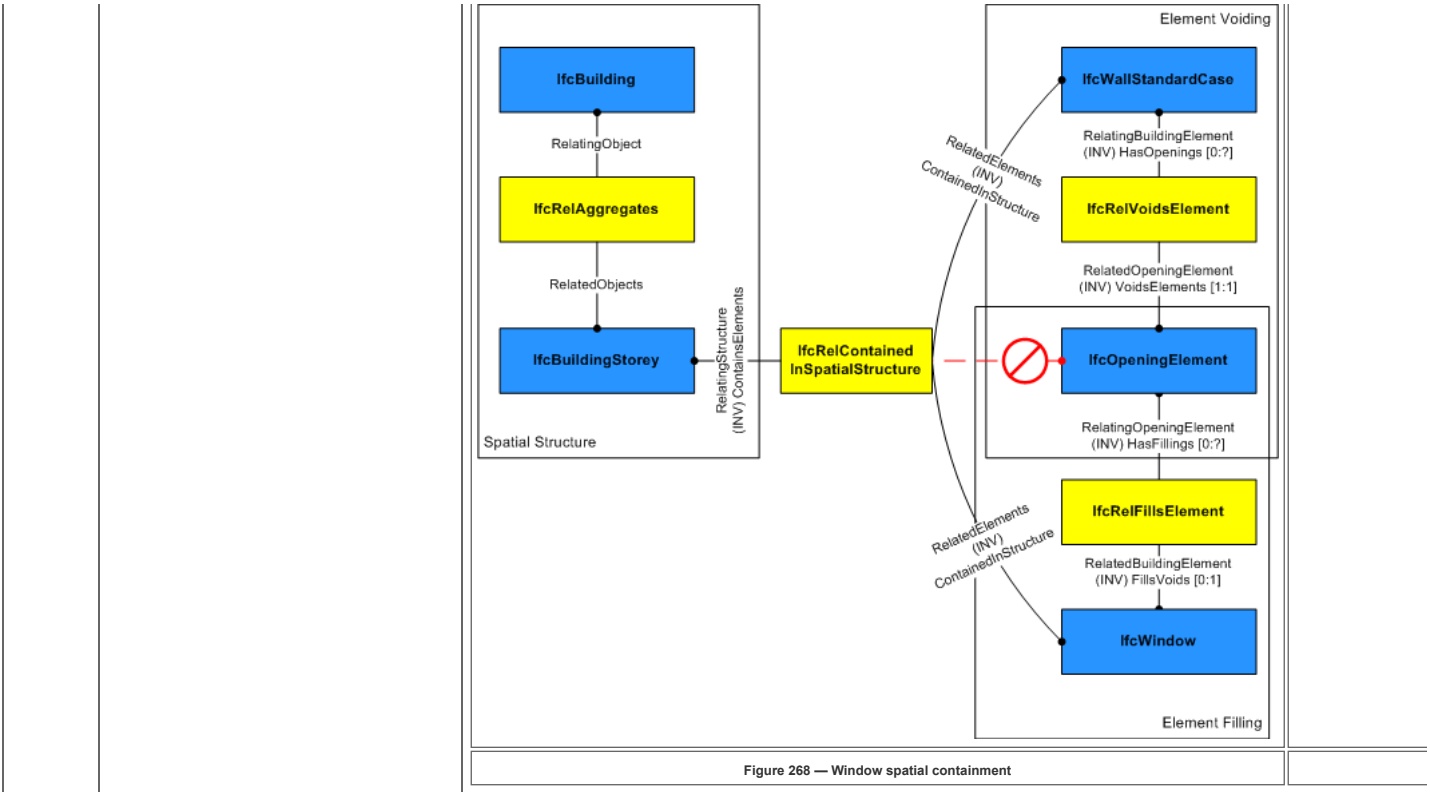

Figure 264 — Wall body clipping straight	Figure 265 — Wall body clipping curved

Field	Mapping	Definition
(Query)	\IfcWallType	
Material Layer Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialLayerSet.MaterialLayers[*] \IfcMaterialLayer.Name \IfcLabel	The material of the IfcWallType is defined by the IfcMaterialLayerSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. NOTE It is illegal to assign an IfcMaterial to an IfcWallType, if there is at least one occurrences. of IfcWallStandardCase for this type. The shared material layer set definition is defined by assigning an IfcMaterialLayerSet (see material use definition above). The IfcMaterialLayer refers to one or several of IfcMaterialLayer that is the common for all wall occurrence, if used. It is only applicable if the IfcWallType has only occurrences of type IfcWallStandardCase (see definition of IfcWallStandardCase for further information). NOTE Since each individual instance of IfcWallStandardCase defines its own IfcMaterialLayerSetUsage including the offset from the wall axis, the same IfcWallType can be used independently of the axis alignment of its occurrences.
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.

Field	Mapping	Definition
(Query)	\IfcWasteTerminal	
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
	\IfcObject	The IFC class identifier indicating the subtype of object.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
Material	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The name by which the material constituent is known.
Port	\IfcDistributionElement	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcWindow	
Door Attributes	\IfcDoor.Tag \IfcIdentifier	The tag (or label) identifier at the particular instance of a product, e.g. the serial number, or the position number. It is the identifier at the occurrence l
	\IfcObject	The IFC class identifier indicating the subtype of object.
Object Typing	\IfcObject.IsTypedBy[*] \IfcRelDefinesByType.RelatingType \IfcTypeObject.Name	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be requi enforced by a where rule.
	\IfcObject.IsDefinedBy[*] \IfcRelDefinesByProperties.RelatingPropertyDefinition \IfcElementQuantity.Name \IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be requi enforced by a where rule.
Material Constituent Set	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesMaterial.RelatingMaterial \IfcMaterialConstituentSet.MaterialConstituents[*] \IfcMaterialConstituent.Name \IfcLabel	The material of the IfcWindow is defined by the IfcMaterialConstituentSet or as fall back by IfcMaterial and attached by the IfcRelAssociatesMaterial.*RelatingMaterial*. It is accessible by the inverse *HasAssociations* relationship. If the fall back single IfcMaterial is referenced, it applies to the lining and framing of the window.
Spatial Containment	\IfcElement.ContainedInStructure[*] \IfcRelContainedInSpatialStructure.RelatingStructure \IfcSpatialElement.Name \IfcLabel	The IfcWindow, as any subtype of IfcBuildingElement, may participate alternatively in one of the two different containment rel ■ the *Spatial Containment* (defined here), or ■ the *Element Composition*. The IfcWindow may also be connected to the IfcOpeningElement in which it is placed as a filler. In this case, the spatial conta shall be provided, see Figure 268. NOTE The contai defined independe relationship, that i IfcWindow is a filli established by Ifcl it is also contained structure by an IfcRelContainedIn

Figure 268 — Window spatial containment

Product Local Placement	\IfcProduct.ObjectPlacement \IfcLocalPlacement.RelativePlacement \IfcAxis2Placement3D	The following restriction is imposed: 1. The *PlacementRelTo* relationship of IfcLocalPlacement shall point to the local placement of the same element (if given), in which as a filling (normally an IfcOpeningElement), as provided by the IfcRelFillsElement relationship. 2. If the IfcWindow is not inserted into an IfcOpeningElement, then the *PlacementRelTo* relationship of IfcLocalPlacement shall poir placement of the same IfcSpatialStructureElement that is used in the *ContainedInStructure* inverse attribute or to a referenced s element at a higher level. 3. If the relative placement is not used, the absolute placement is defined within the world coordinate system. NOTE The product placement is used to determine the opening direction of the window.

Profile 3D Geometry	\IfcElement.Representation
	\IfcProductDefinitionShape.Representations[*]
	\IfcShapeRepresentation.ContextOfItems
	\IfcGeometricRepresentationContext
		The window profile is represented by a three-dimensional closed curve within a particular shape representation. The profile is parameter of the parametric window representation. The following attribute values for the IfcShapeRepresentation holding this representation shall be used:
		
		- *RepresentationIdentifier* : 'Profile'
		- *RepresentationType* : 'Curve3D', only a single closed curve shall be contained in the set of *IfcShapeRepresentation.Items*.
		
		A 'Profile' representation has to be provided if:
		
		- a parametric representation shall be applied to the window AND
		
		    - the window is 'free standing', or
		    - the opening into which the window is inserted is not extruded horizontally (i.e. where the opening profile does not match the wind

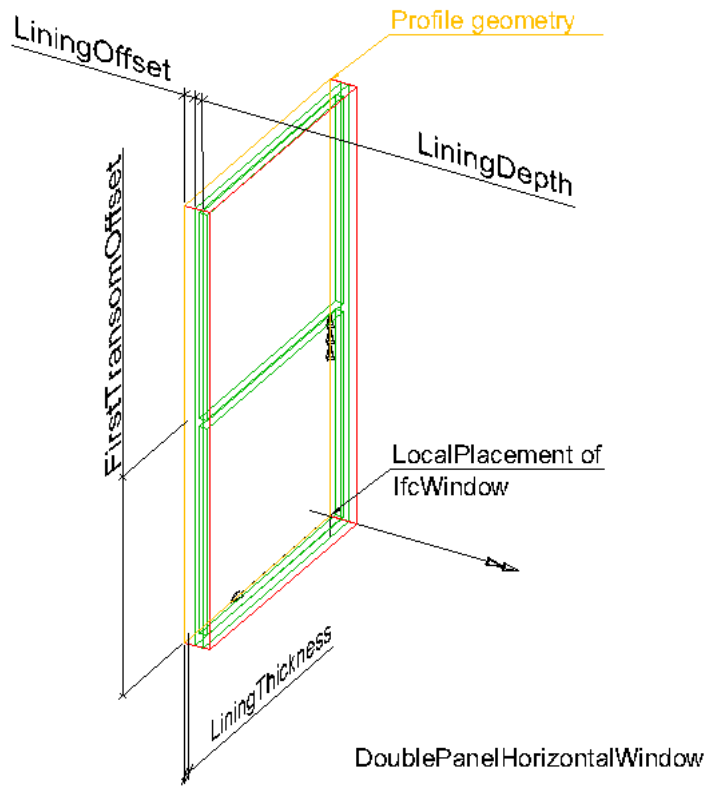| Field	Mapping	Definition
(Query)	**\IfcWindowStandardCase**	
Profile Geometry	\IfcElement.Representation \IfcProductDefinitionShape.Representations[*] \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	The following additional constraints apply to the 'Profile' representation type: - <u>Curve</u>: being an IfcPolyline defining a rectangle. - <u>Position</u>: The curve shall lie in the xz plane of the object placement coordinate (the y coordinate values of the IfcCartesianPoint's shall be 0.). As shown in Figure 269, the profile defines the outer boundary to which the window lining parameters relate as: - *IfcWindowLiningProperties.LiningDepth* starting at distance defined by *LiningOffset* going into the positive y direction. - *IfcWindowLiningProperties.LiningThickness* offset into the inner side of the rectangle. - *IfcWindowLiningProperties.LiningOffset* distance along the positive y direction to where the *LiningDepth* applies. - *IfcWindowLiningProperties.FirstTransomOffset* starting at the bottom edge of the rectangle (along local x axis) into the inner side of the rectangle, distance provided as percentage of overall height. Distance to the centre line of the transom. *SecondTransomOffset* defined accordingly. - *IfcWindowLiningProperties.FirstMullionOffset* starting at the left edge of the rectangle (along local z-axis) into the inner side of the rectangle, distance provided as percentage of overall width. Distance to the centre line of the mullion. *SecondMullionOffset* defined accordingly.

Figure 269 — Window profile

Field	Mapping	Definition
(Query)	\IfcWindowType	
Body Geometry	\IfcTypeProduct.RepresentationMaps[*] \IfcRepresentationMap.MappedRepresentation \IfcShapeRepresentation.ContextOfItems \IfcGeometricRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
Property Sets for Types	\IfcTypeObject.HasPropertySets[*] \IfcPropertySet.Name	Two subtypes of IfcPreDefinedPropertySet are applicable to IfcWindowType: ■ IfcWindowLiningProperties - a single instance to define the shape parameters of the window lining ■ IfcWindowPanelProperties - one or several instances to define the shape parameters of the window panel(s)

Field	Mapping	Definition
(Query)	\IfcWorkCalendar	
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	The base calendar of a work calendar is defined by IfcRelAssignsToControl, where *IfcRelAssignsToControl.RelatingControl* is linked with the base calendar and *IfcRelAssignsToControl.RelatedObjects* is linked with work calendars that are derived from the base calendar. Although not restricted by the IfcRelAssignsToControl relationship it is only allowed to have one base calendar.

Field	Mapping	Definition
(Query)	\IfcWorkControl	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	From IFC4 onwards the assignment of tasks to the work control is handled by the IfcRelAssignsToControl relationship. *IfcRelAssignsTasks* as used in previous IFC releases has been deleted and can not be used any longer. Another change in IFC4 is that it is not necessary to assign each task to a work control as it is regarded to be sufficient if the summary task (root task in the task hierarchy defined through IfcRelNests relationships) is assigned to a work control.

Field	Mapping	Definition
(Query)	\IfcWorkPlan	
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.

Field	Mapping	Definition
(Query)	\IfcWorkSchedule	
Property Sets	\IfcObject	The IFC class identifier indicating the subtype of object.
Document	\IfcObjectDefinition.HasAssociations[*] \IfcRelAssociatesDocument.Name \IfcLabel	The documents of the IfcWorkSchedule can be referenced by the *IfcRelAssociatesDocuments* relationship.
Control Assignment	\IfcControl.Controls[*] \IfcRelAssignsToControl.RelatedObjects[*] \IfcObject	An IfcWorkSchedule controls a set of tasks and resources defined through IfcRelAssignsToControl. Additionally, through the IfcWorkControl abstract supertype, the actors creating the schedule can be specified and schedule time information such as start time, finish time, and total float of the schedule can also be specified.
Nesting	\IfcObjectDefinition.IsNestedBy[*] \IfcRelNests.RelatedObjects[*] \IfcObject	A work schedule can include other work schedules as sub-items through IfcRelNests relationship.
Aggregation		A work schedule can include other work schedules as sub-items. If not included in another work schedule it might be a part of a work plan (IfcWorkPlan) defined through IfcRelAggregates relationship.

Field	Mapping	Definition
(Query)	\IfcZone	
	\IfcObject	The IFC class identifier indicating the subtype of object.
Group Assignment	\IfcGroup.IsGroupedBy[*] \IfcRelAssignsToGroup.RelatedObjects[*] \IfcProduct	An IfcZone is a spatial system under which individual IfcSpace's (and other IfcZone's) are grouped. In contrary to the IfcSpatialZone entity, IfcZone is a mere grouping, it can not define an own geometric representation and placement. Therefore it cannot be used for

spatial zones having a different shape and size compared to the shape and size of aggregated spaces.

NOTE The IfcZone is regarded as the spatial system (as compared to the building service, electrical, or analytical system), the name remains IfcZone for compatibility reasons, instead of using a proper naming convention, like IfcSpatialSystem.

NOTE One of the purposes of a zone is to define a fire compartmentation. In this case it defines the geometric information about the fire compartment (through the contained spaces) and information, whether this compartment is ventilated or sprinkler protected. In addition the fire risk code and the hazard type can be added, the coding is normally defined within a national fire regulation. All that information is available within the relevant property sets. Again, if an independent shape has to be provided to the fire compartment, then the entity IfcSpatialZone shall be used.

In case of a zone denoting a (fire) compartment, the following types should be used, if applicable, as values of the *ObjectType* attribute:

- **'FireCompartment'**: a zone of spaces, collected to represent a single fire compartment.
- **'ElevatorShaft'**: a collection of spaces within an elevator, potentially going through many storeys.
- **'RisingDuct'**: A collection of vertical airspaces.
- **'RunningDuct'**: A collection of horizontal airspaces.