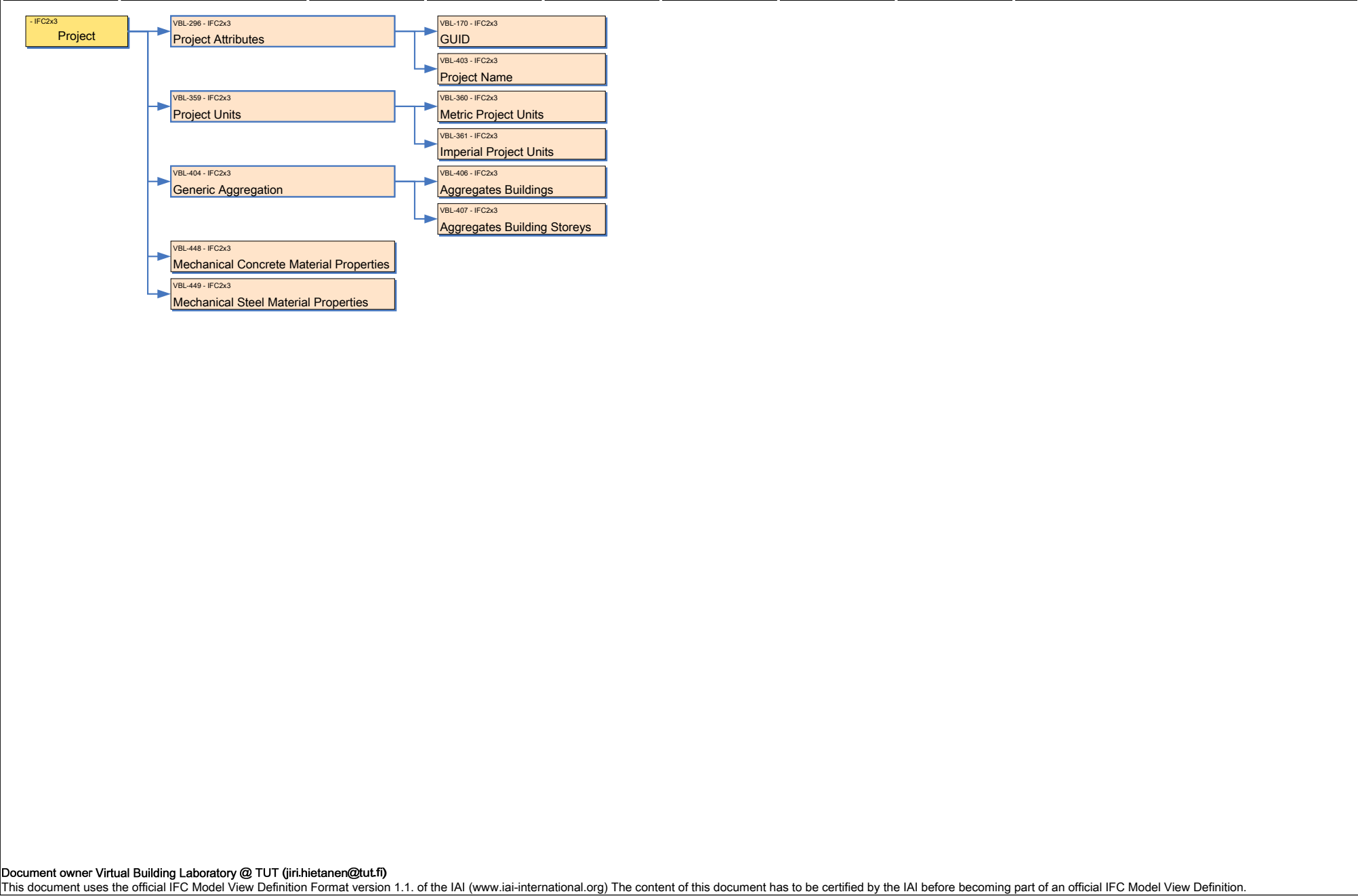


IFC Model View Definition Diagram : [VBL-001-IFC2x3] Structural design to structural analysis

| APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM AUTHORS | |
|------------------|-----------------------------|---|--|---|
| Generic | N/A | Generic | Sakari Lehtinen | |
| - IFC2x3 | Building | VBL-407 - IFC2x3 Aggregates Building Storeys | VBL-380 - IFC2x3 Linear Force Varying | VBL-343 - IFC2x3 Structural Linear Action Attributes |
| - IFC2x3 | Building Storey | VBL-406 - IFC2x3 Aggregates Buildings | VBL-445 - IFC2x3 Loaded by Three Level Hierarchy | VBL-202 - IFC2x3 Structural Object Placement |
| - IFC2x3 | Project | VBL-416 - IFC2x3 Aggregates Structural Analysis Models | VBL-266 - IFC2x3 Material Name | VBL-344 - IFC2x3 Structural Planar Action Attributes |
| - IFC2x3 | Site | VBL-185 - IFC2x3 Applied Load | VBL-448 - IFC2x3 Mechanical Concrete Material Properties | VBL-342 - IFC2x3 Structural Point Action Attributes |
| - IFC2x3 | Structural Analysis Model | VBL-338 - IFC2x3 Arbitrary Curved Edge Closed Profile Name and Section Association | VBL-449 - IFC2x3 Mechanical Steel Material Properties | VBL-231 - IFC2x3 Structural Point Connection Attributes |
| - IFC2x3 | Structural Curve Connection | VBL-337 - IFC2x3 Arbitrary Straight Edge Closed Profile Name and Section Association | VBL-360 - IFC2x3 Metric Project Units | VBL-446 - IFC2x3 Structural Profile Properties |
| - IFC2x3 | Structural Curve Member | VBL-235 - IFC2x3 Boundary Edge Support Conditions | VBL-171 - IFC2x3 Name | VBL-447 - IFC2x3 Structural Steel Profile Properties |
| - IFC2x3 | Structural Linear Action | VBL-233 - IFC2x3 Boundary Node Support Conditions | VBL-156 - IFC2x3 Owner and Status Information | VBL-207 - IFC2x3 Structural Surface Member Attributes |
| - IFC2x3 | Structural Planar Action | VBL-411 - IFC2x3 Building Attributes | VBL-339 - IFC2x3 Parametric Profile Name and Section Association | VBL-208 - IFC2x3 Surface Type |
| - IFC2x3 | Structural Point Action | VBL-186 - IFC2x3 Building Element Assignment | VBL-336 - IFC2x3 Planar Action Assignment | VBL-209 - IFC2x3 Thickness |
| - IFC2x3 | Structural Point Connection | VBL-412 - IFC2x3 Building Name | VBL-211 - IFC2x3 Planar Force | VBL-206 - IFC2x3 Topological Curved Edge Representation |
| - IFC2x3 | Structural Surface Member | VBL-413 - IFC2x3 Building Storey Attributes | VBL-212 - IFC2x3 Planar Force Varying | VBL-219 - IFC2x3 Topological Face Representation Curved Edge |
| | | VBL-414 - IFC2x3 Building Storey Name | | VBL-218 - IFC2x3 Topological Face Representation Straight Edge |
| | | VBL-223 - IFC2x3 Curve Connection with Eccentricity Assignment | VBL-221 - IFC2x3 Point Connection with Eccentricity Assignment | VBL-204 - IFC2x3 Topological Representation |
| | | VBL-222 - IFC2x3 Curve Connection without Eccentricity Assignment | VBL-220 - IFC2x3 Point Connection without Eccentricity Assignment | VBL-205 - IFC2x3 Topological Straight Edge Representation |
| | | VBL-182 - IFC2x3 Curve Member Type | VBL-296 - IFC2x3 Project Attributes | VBL-234 - IFC2x3 Topological Vertex Representation |
| | | VBL-183 - IFC2x3 Generic Activity Assignment | VBL-403 - IFC2x3 Project Name | |
| | | VBL-404 - IFC2x3 Generic Aggregation | VBL-359 - IFC2x3 Project Units | |
| | | VBL-232 - IFC2x3 Generic Applied Conditions | VBL-163 - IFC2x3 Services Buildings | |
| | | VBL-268 - IFC2x3 Generic Assignments | VBL-203 - IFC2x3 Shape Representation | |
| | | VBL-258 - IFC2x3 Generic Associations | VBL-322 - IFC2x3 Single Force | |
| | | VBL-157 - IFC2x3 Generic Group Assignment | VBL-310 - IFC2x3 Site Attributes | |
| | | VBL-174 - IFC2x3 Generic Loaded by | VBL-410 - IFC2x3 Site Name | |
| | | VBL-200 - IFC2x3 Generic Material Association | VBL-451 - IFC2x3 Structural Analysis Displacement | |
| | | VBL-201 - IFC2x3 Generic Object Placement | VBL-154 - IFC2x3 Structural Analysis Model Attributes | |
| | | VBL-199 - IFC2x3 Generic Profile Name and Section Association | VBL-164 - IFC2x3 Structural Analysis Model Building Assignment | |
| | | VBL-197 - IFC2x3 Generic Structural Connection Assignment | VBL-165 - IFC2x3 Structural Analysis Model Building Storey Assignment | |
| | | VBL-170 - IFC2x3 GUID | VBL-159 - IFC2x3 Structural Analysis Model Group Assignment | |
| | | VBL-175 - IFC2x3 Has Results | VBL-155 - IFC2x3 Structural Analysis Model Predefined Type | |
| | | VBL-361 - IFC2x3 Imperial Project Units | VBL-450 - IFC2x3 Structural Analysis Point Result | |
| | | VBL-331 - IFC2x3 Linear Action Assignment | VBL-236 - IFC2x3 Structural Curve Connection Attributes | |
| | | VBL-335 - IFC2x3 Linear Force | VBL-181 - IFC2x3 Structural Curve Member Attributes | |

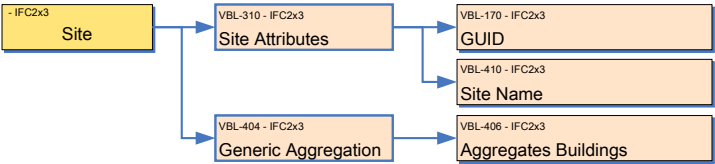
IFC Model View Definition Diagram : Project IFC2x3

| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | | Generic | Draft | 2 | 3.10.2007 | Jiri Hietanen |



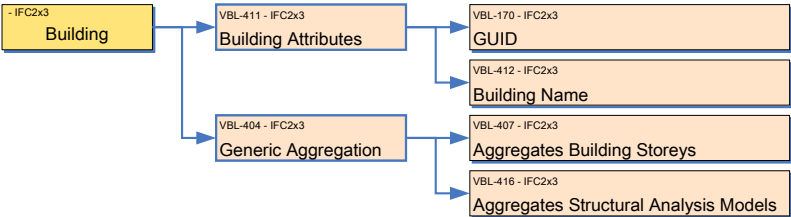
IFC Model View Definition Diagram : Site IFC2x3

| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | | Generic | Proposal | 2 | 3.10.2007 | Jiri Hietanen |

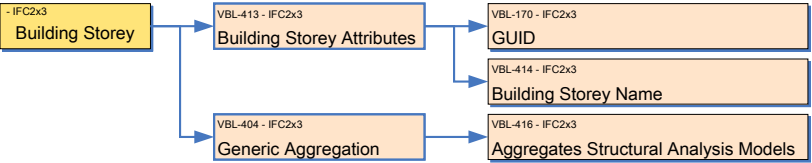


IFC Model View Definition Diagram : Building IFC2x3

| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | | Generic | Proposal | 2 | 3.10.2007 | Jiri Hietanen |



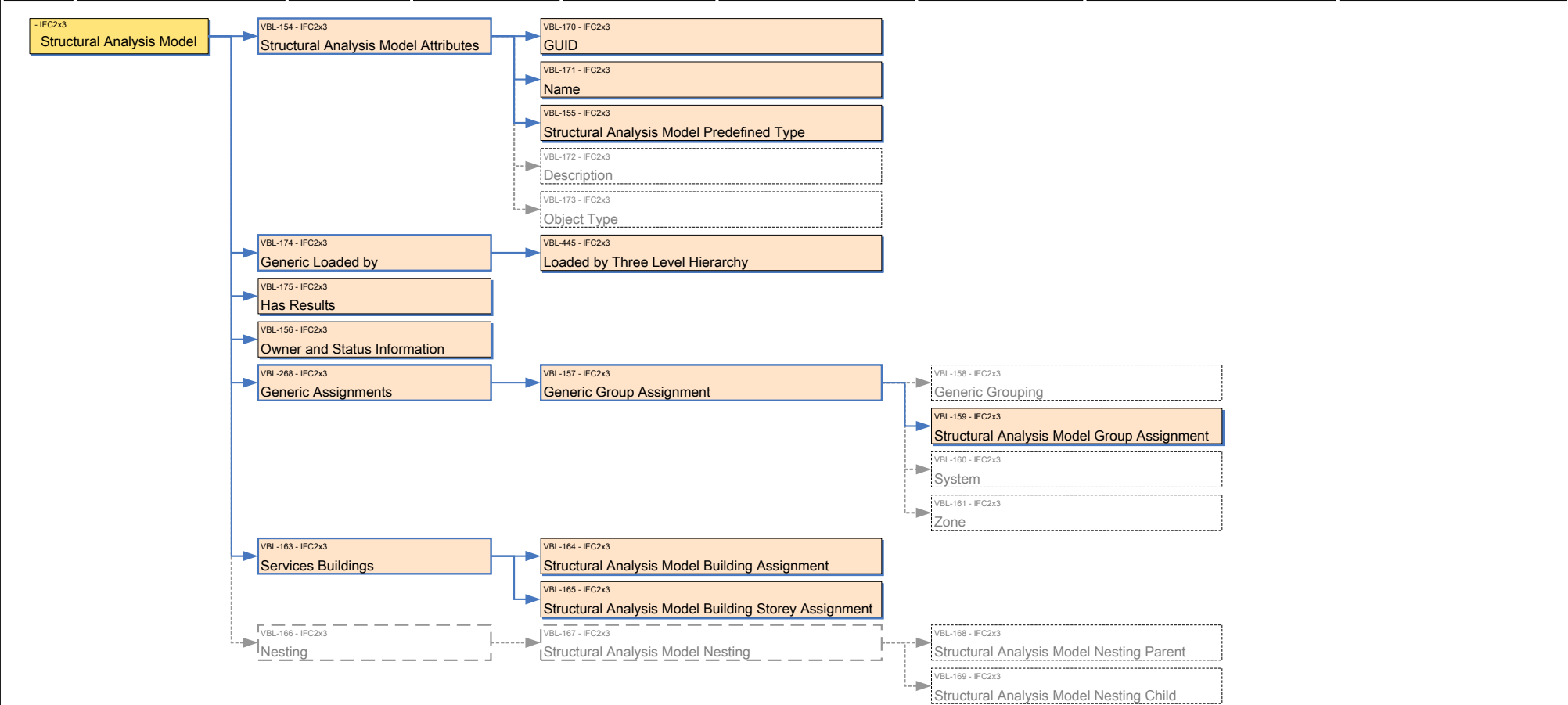
| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | | Generic | Proposal | 2 | 3.10.2007 | Jiri Hietanen |



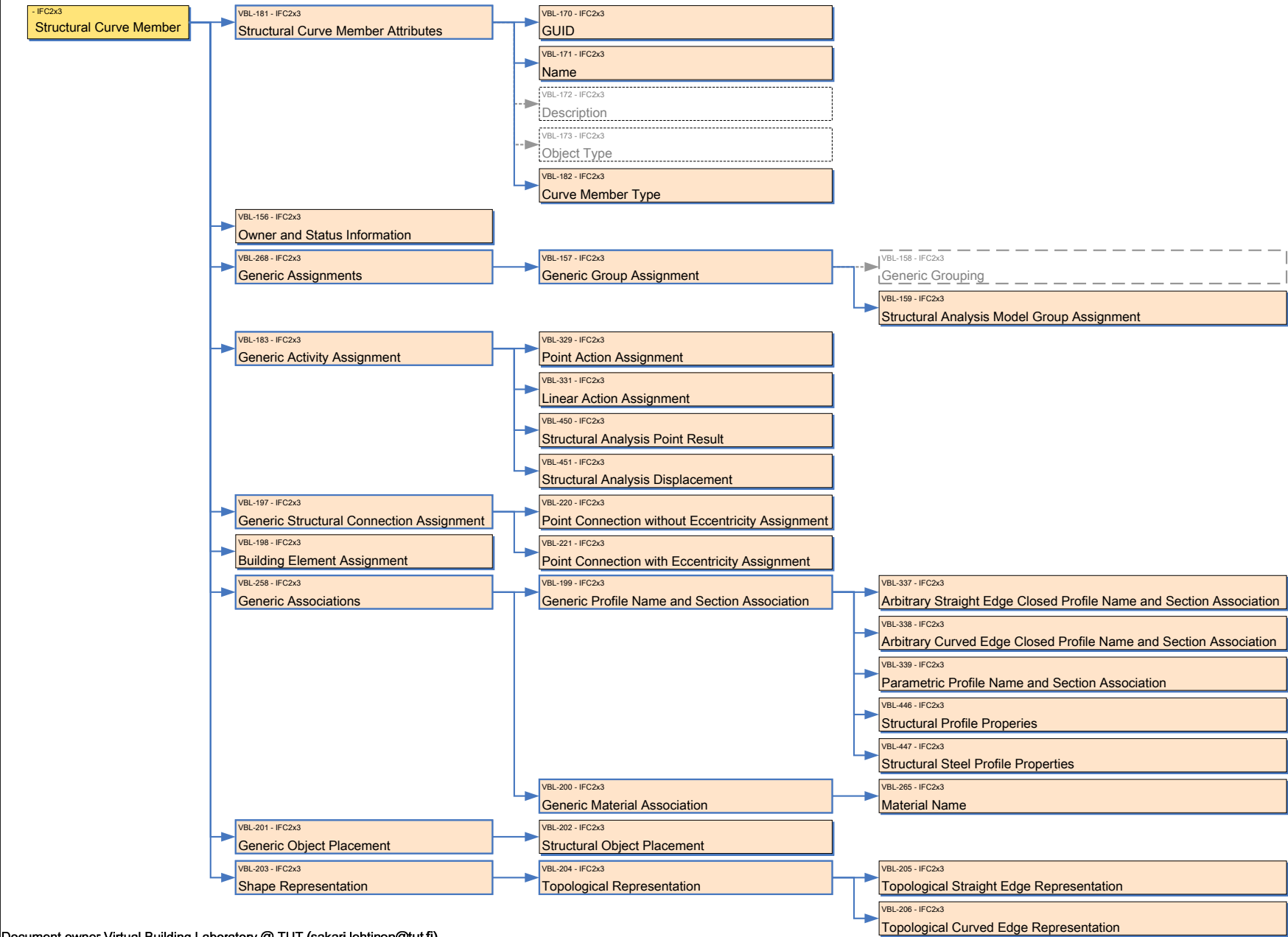
IFC Model View Definition Diagram : Structural Analysis Model IFC2x3

COVER PAGE

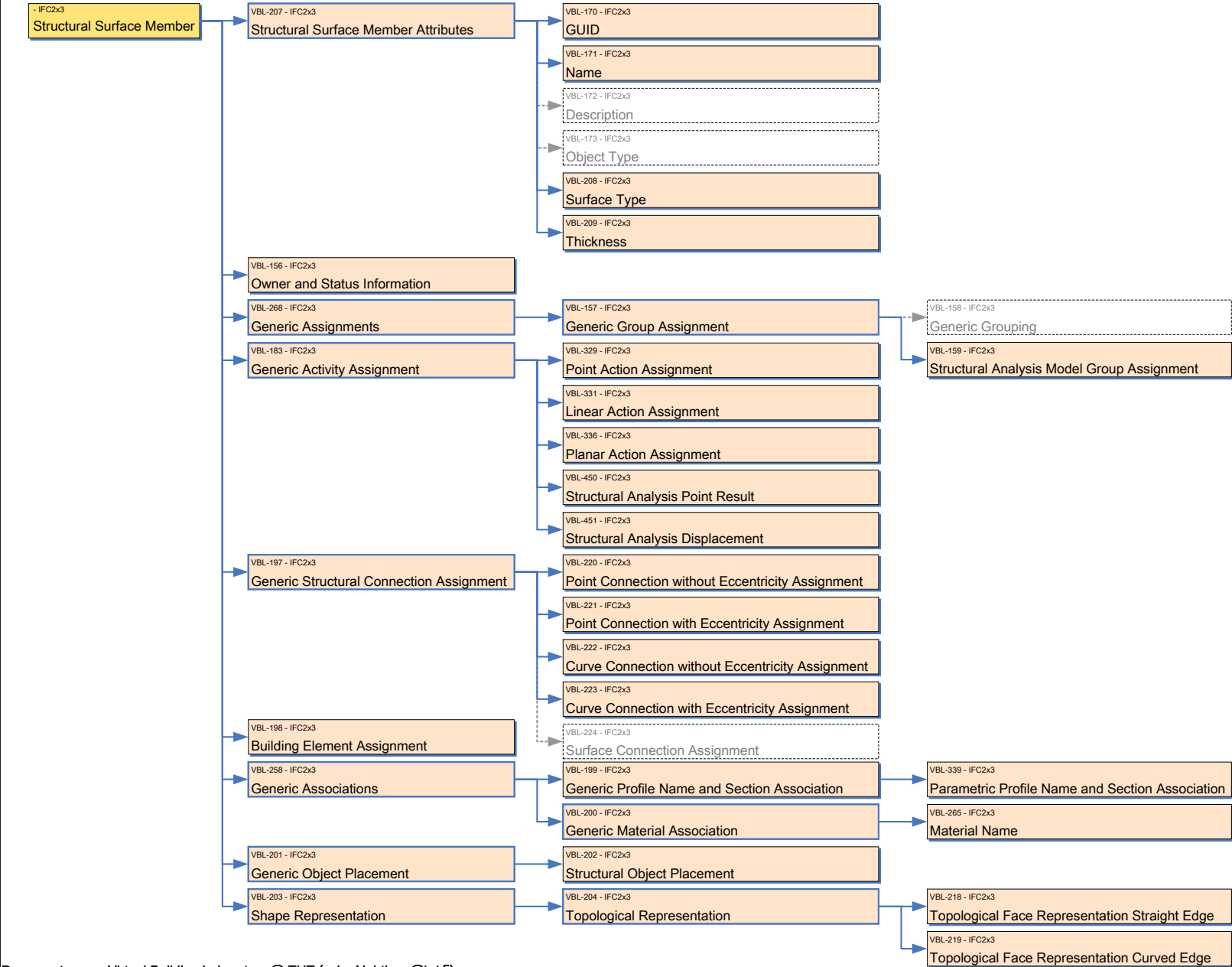
| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | Sakari Lehtinen |



| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | Sakari Lehtinen |



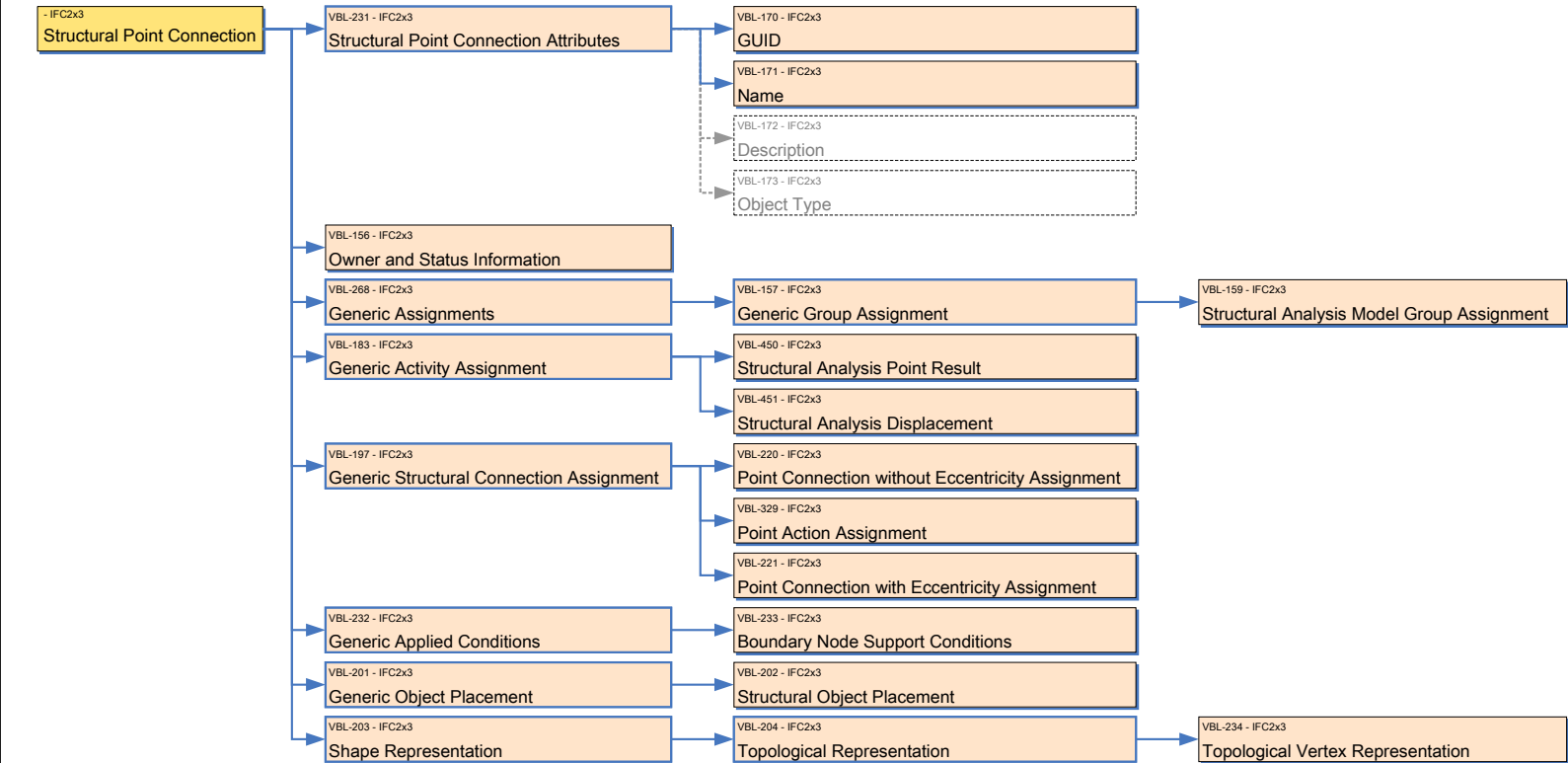
| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | Sakari Lehtinen |



IFC Model View Definition Diagram : Structural Point Connection IFC2x3

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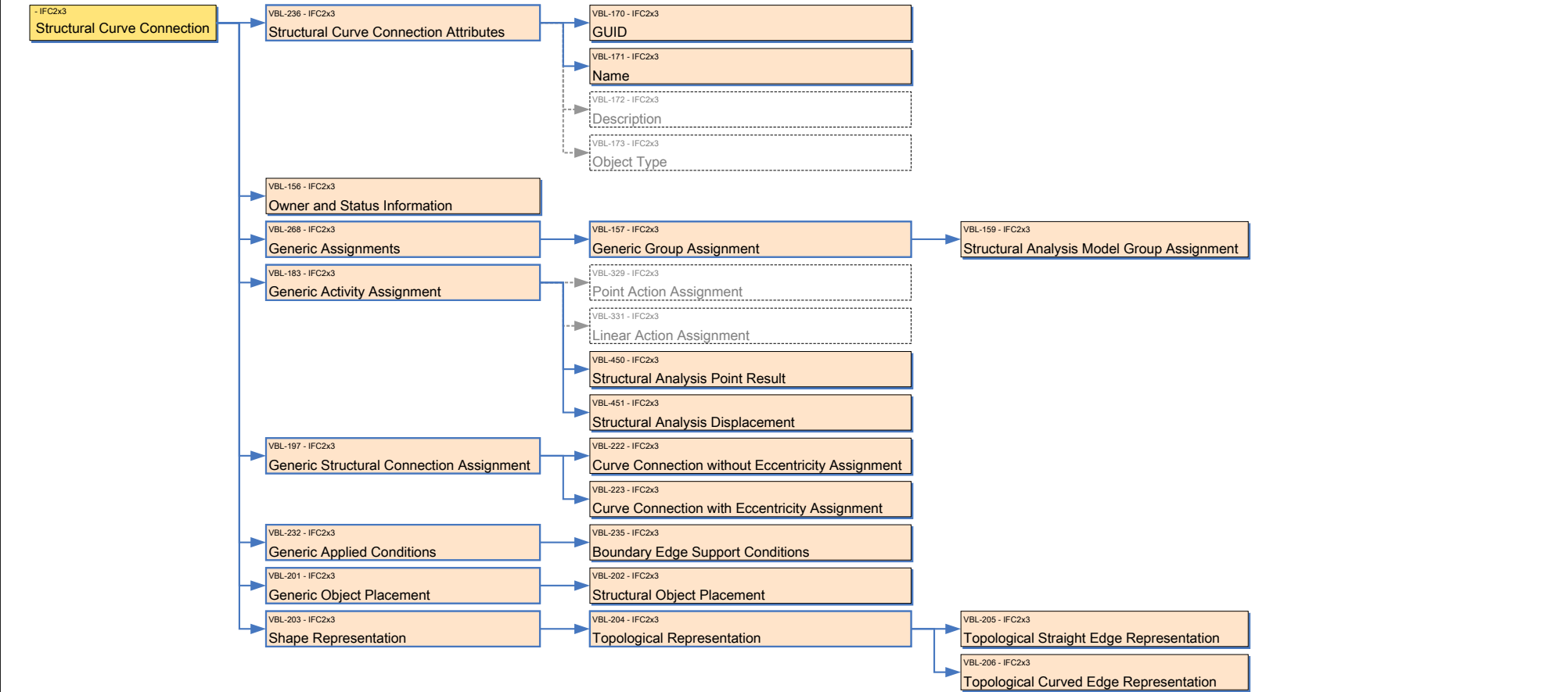
| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | Sakari Lehtinen |



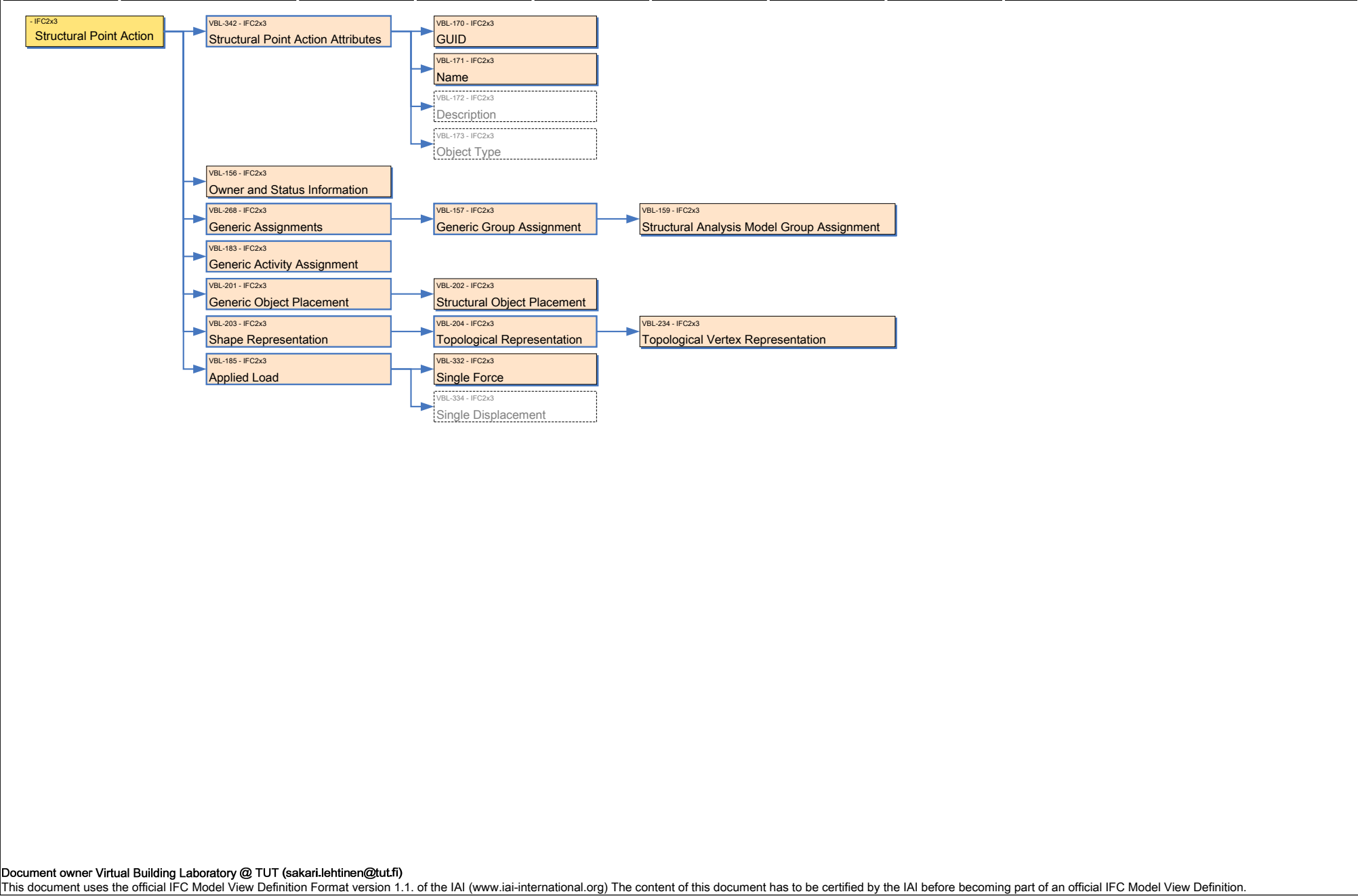
IFC Model View Definition Diagram : Structural Curve Connection IFC2x3

COVER PAGE

| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|----------------------------|
| VBL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | AUTHORS Sakari Lehtinen |



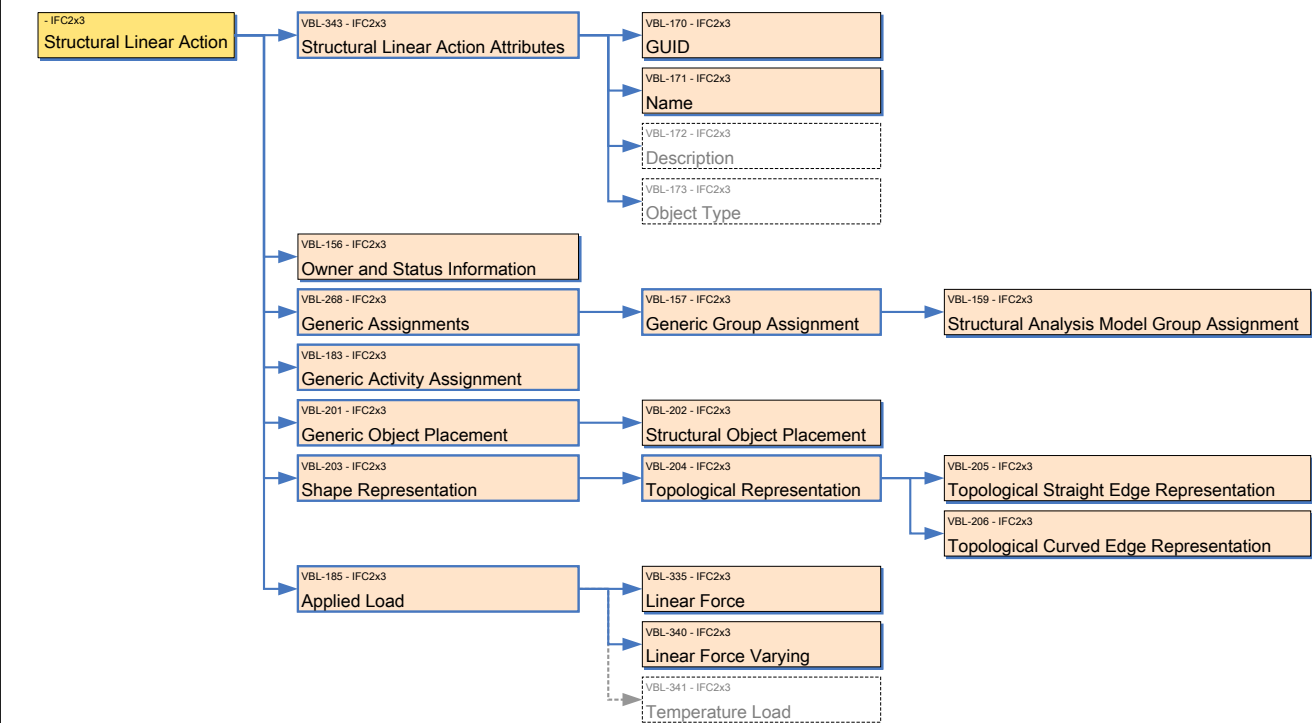
| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | Sakari Lehtinen |



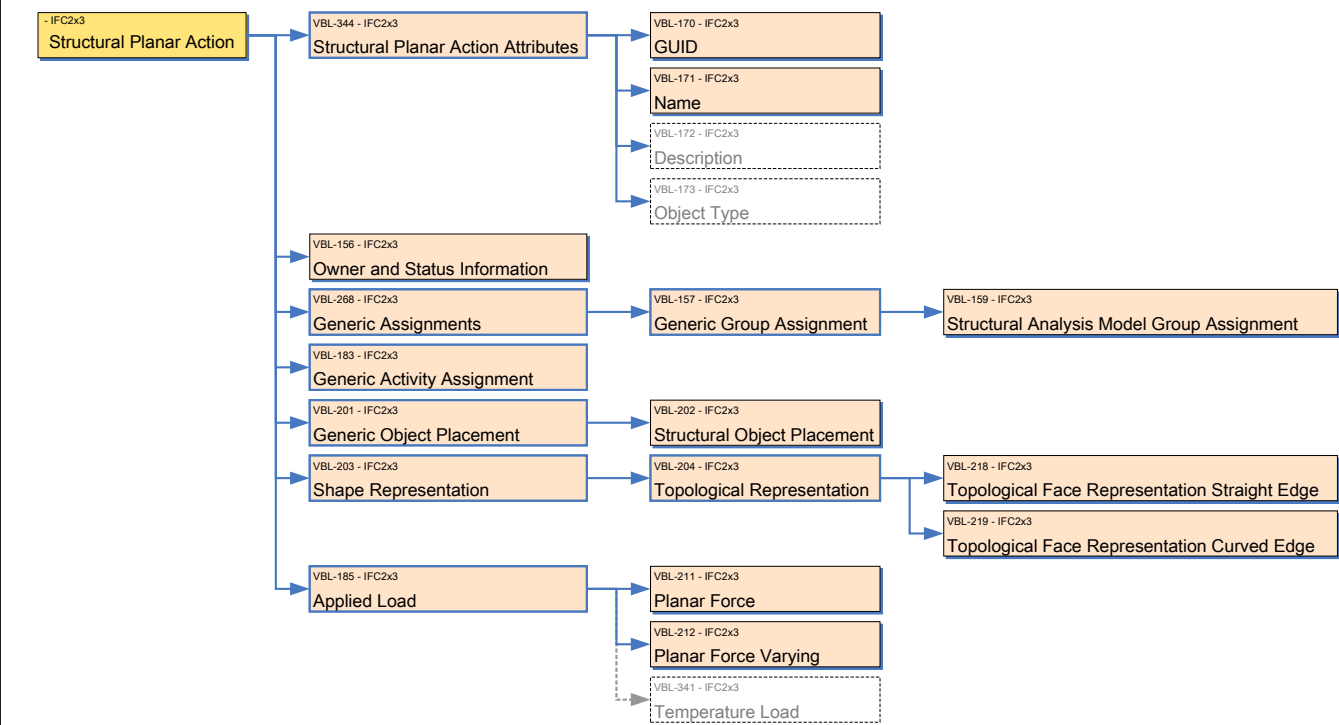
IFC Model View Definition Diagram : Structural Linear Action IFC2x3

COVER PAGE

| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | Sakari Lehtinen |



| VIEW ID | VIEW NAME | APPLICATION NAME | APP. VERSION | EXCHANGE TYPE | DIAGRAM STATUS | DIAGRAM VERSION | DIAGRAM DATE | DIAGRAM AUTHORS |
|---------|--|------------------|--------------|---------------|----------------|-----------------|--------------|-----------------|
| VBL-001 | Structural design to structural analysis | Generic | N/A | Generic | Proposal | 2 | 03.10.2007 | Sakari Lehtinen |

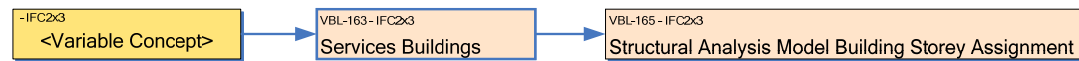


IFC Release Specific Concept Description (IFC2x3)

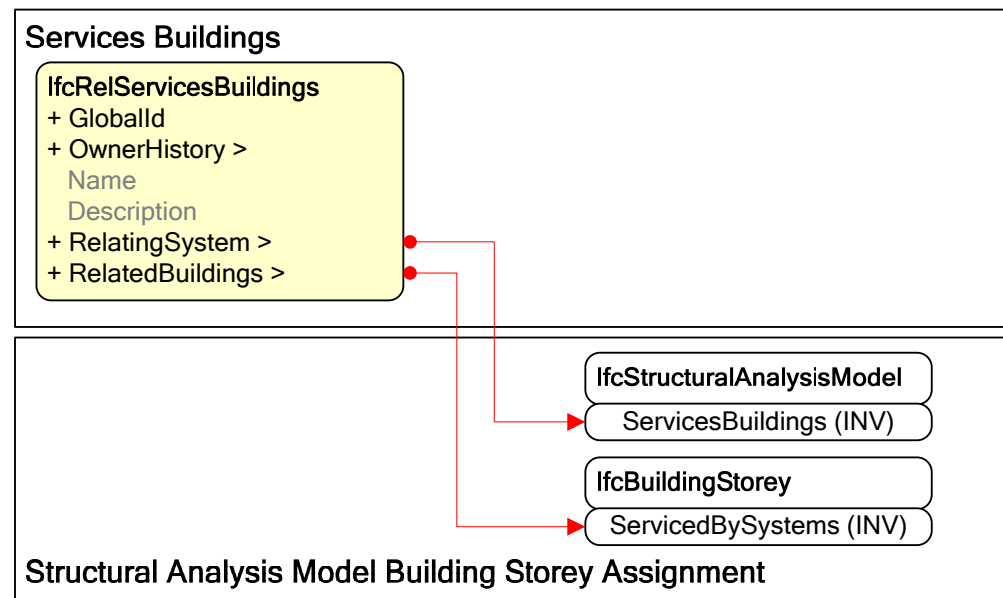
Structural Analysis Model Building Storey Assignment

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-165 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Related Building Storey'. | | | | |
| History | Created 23.10.2006, improved 27.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelServicesBuildings

| Attribute | Implementation agreements |
|------------------|---|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingSystem | Must be one IfcStructuralAnalysisModel. |
| RelatedBuildings | Must be one IfcBuildingStorey. NOTE: Each IfcBuildingStorey may have several IfcStructuralAnalysisModel assigned to it. |

Additional information

P21 example

```
#38=IFCPROJECT('0HJL2L0NbcPr2ge4njs9n', #2, 'RBHD project', $, $, $, (#39), #40);
#267=IFCRELAGGREGATES('0Y3UvSFajAL6hPc1c$pg7', #2, $, $, #38, (#62));
#62=IFCSITE('2mhas2GcnF$bHcQTy2b2an', #2, $, $, $, #46, $, $, .ELEMENT., $, $, $, $);
#61=IFCRELAGGREGATES('39hz_mNb0DKUuu7$UMJ81', #2, $, $, #62, (#37));
#37=IFCBUILDING('12pC6BnFT8NMzS30T1pJLZ', #2, 'Example Building', $, #45, $, $, .ELEMENT., $, $, $);
#57=IFCRELAGGREGATES('3WNGnCoS19ybIe2kjE1e83', #2, $, $, #37, (#58, #59, #60));
#58=IFCBUILDINGSTOREY('0DSrD5EFn4PMnWzC2fybjc', #2, 'Floor.1', $, $, #1495, $, $, .ELEMENT., $);
#36=IFCRELSERVICESBUILDINGS('2HuY18I_D3s7PGGIqk6Wxx', #2, $, $, #28, (#58));
#28=IFCSTRUCTURALANALYSISMODEL('2uRpA0c3HFLcW0f7ywxmPv', #2, 'Example model', $, $, .LOADING_3D., $, (#8, #16, #33), $);
```

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IFC Release Specific Concept Description (IFC2x3)

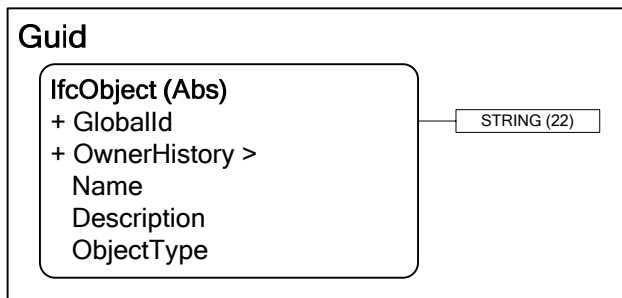
GUID

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-170 | Version | 1 | Status | Proposal |
| Relationships | Implements general concept VBL-024 'Software Internal ID'. | | | | |
| History | Created 23.10.2006 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

Definition from IAI: Holds an identifier that is unique throughout the software world. This is also known as a Globally Unique Identifier (GUID) or Universal Unique Identifier (UUID) by the Open Group. The identifier is generated using an algorithm published by the Object Management Group. The algorithm is explained at the open group [website](http://www.opengroup.org/tech/uuid/). The Microsoft Foundation Class (MFC) function "CoCreateGuid", which is an implementation of the above algorithm, has been used by many IFC implementers to create an identifier.

An identifier is a unique 128-bit number. Using 64 characters for the base the resulting compressed string needs 22 characters. For more information see the IFC's online documentation.

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IFC Release Specific Concept Description (IFC2x3)

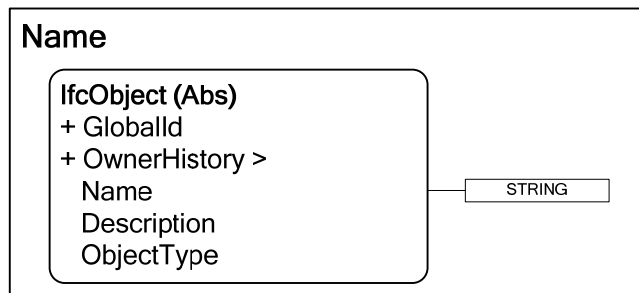
Name

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VL-171 | Version | 1 | Status | Proposal |
| Relationships | Implements general concept VL-025 'Human Readable Name'. | | | | |
| History | Created 23.10.2006 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

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IFC Release Specific Concept Description (IFC2x3)

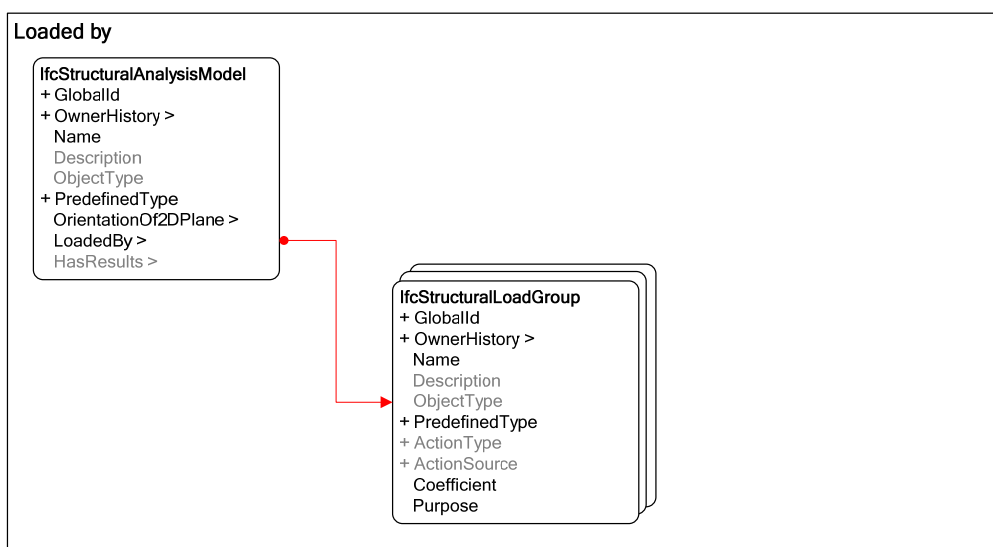
Loaded by

| | | | | | |
|----------------|---|---------|---|--------|----------|
| Reference | VBL-174 | Version | 4 | Status | Proposal |
| Relationships | Implements general concept VBL-116 "Structural Loaded by" | | | | |
| History | Created 23.10.2006, improved 27.9.2007, definition of the hierarchy improved 11.11.2007, original (version 3) Loaded by –concept has been moved to VBL-445 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

Different kind of load hierarchies may be exchanged by IFC. LoadedBy has references to all of the hierarchies of a structural analysis model. For more information see the leaf concepts.

Additional information

P21 example

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IFC Release Specific Concept Description (IFC2x3)

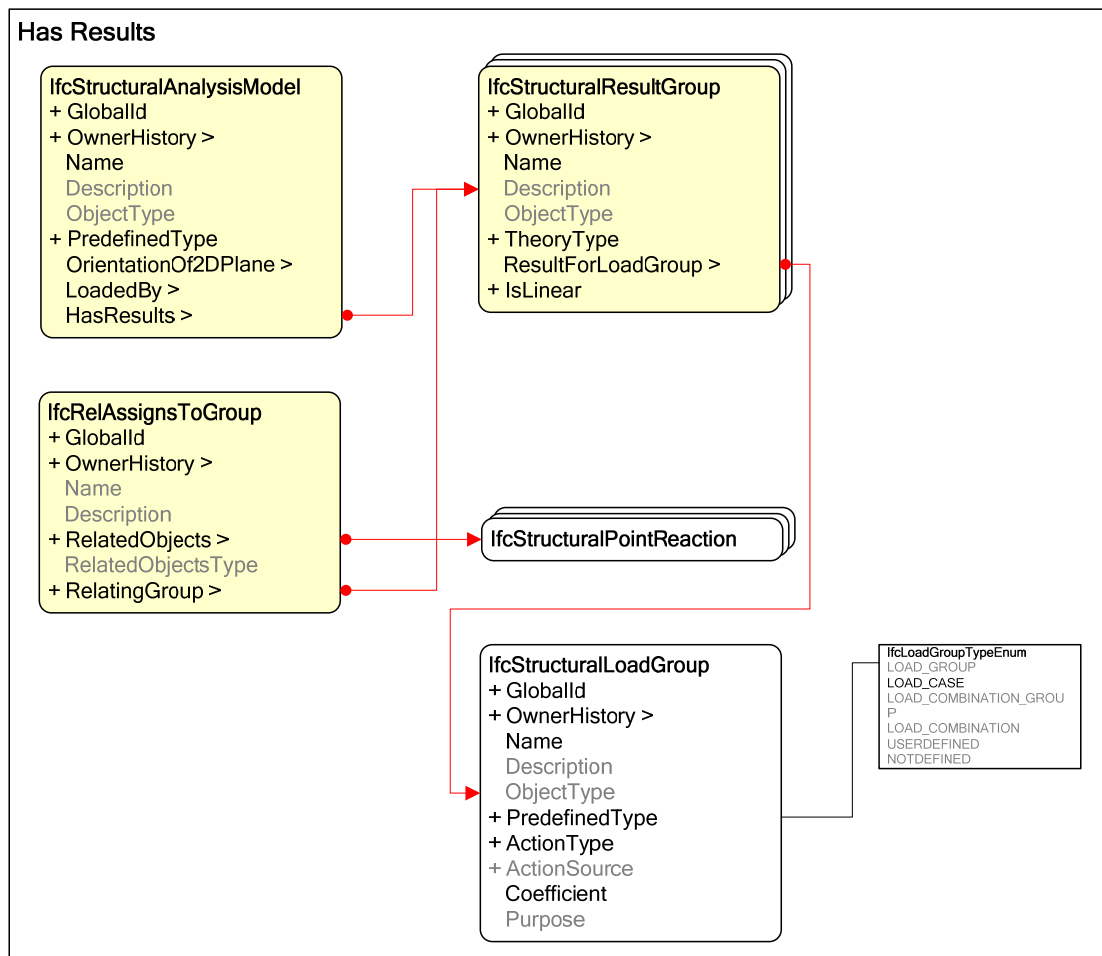
Has Result

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VL-175 | Version | 1 | Status | Proposal |
| Relationships | Implements general concept VL-116 "Structural Loaded by" | | | | |
| History | Created 4.2.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralAnalysisModel

| Attribute | Implementation agreements |
|----------------------|--|
| GlobalId | <Open> |
| OwnerHistory | <Open> |
| Name | <Open> |
| Description | <Open> |
| ObjectType | <Open> |
| PredefinedType | <Open> |
| OrientationOf2DPlane | <Open> |
| LoadedBy | <Open> |
| HasResults | Must be list of IfcStructuralResultGroups. |

IfcStructuralResultGroup

| Attribute | Implementation agreements |
|--------------------|--|
| GlobalId | <Open> |
| OwnerHistory | <Open> |
| Name | <Open> |
| Description | <Open> |
| ObjectType | <Open> |
| TheoryType | <Open> |
| ResultForLoadGroup | Reference to one IfcStructuralLoadGroup, which has 'LOAD_CASE' for PredefinedType. |
| IsLinear | <Open> |

IfcRelAssignsToGroup

| Attribute | Implementation agreements |
|--------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | <Open> |
| Description | <Open> |
| RelatedObjects | Must be list of IfcStructuralPointReactions. |
| RelatedObjectsType | <Open> |
| RelatingGroup | Must be IfcStructuralResultGroup. |

Additional information

P21 example

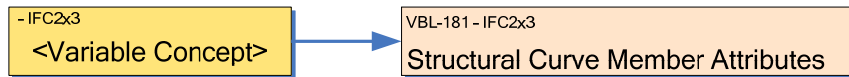
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IFC Release Specific Concept Description (IFC2x3)

Structural Curve Member Attributes

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VL-181 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 25.3.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



General

The concept groups the IfcStructuralCurveMember attributes defined inside the entity.

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IFC Release Specific Concept Description (IFC2x3)

Curve Member Type

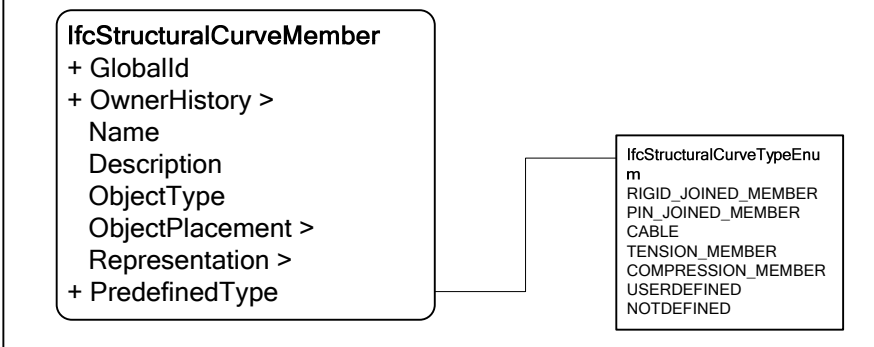
| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-182 | Version | 1 | Status | Proposal |
| Relationships | Implements general concept 'Structural Curve Member Type'. | | | | |
| History | Created 23.10.2006 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Curve Member Type



Implementation agreements

- *PredefinedType*:
 - o RIGID_JOINED_MEMBER is regarded as beam.
 - o PIN_JOINED_MEMBER is regarded as truss.

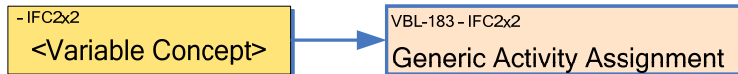
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IFC Release Specific Concept Description (IFC2x3)

Generic Activity Assignment

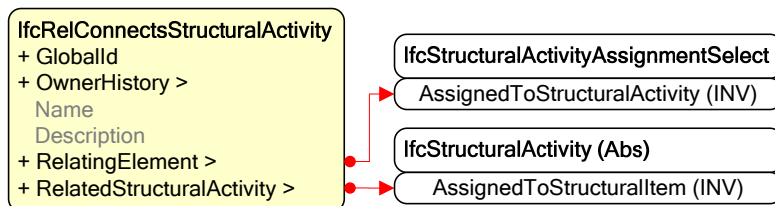
| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-183 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Activity Assignment



Implementation agreements

IfcRelConnectsStructuralActivity

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingElement | N/A |
| RelatedStructuralActivity | N/A |

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IFC Release Specific Concept Description (IFC2x3)

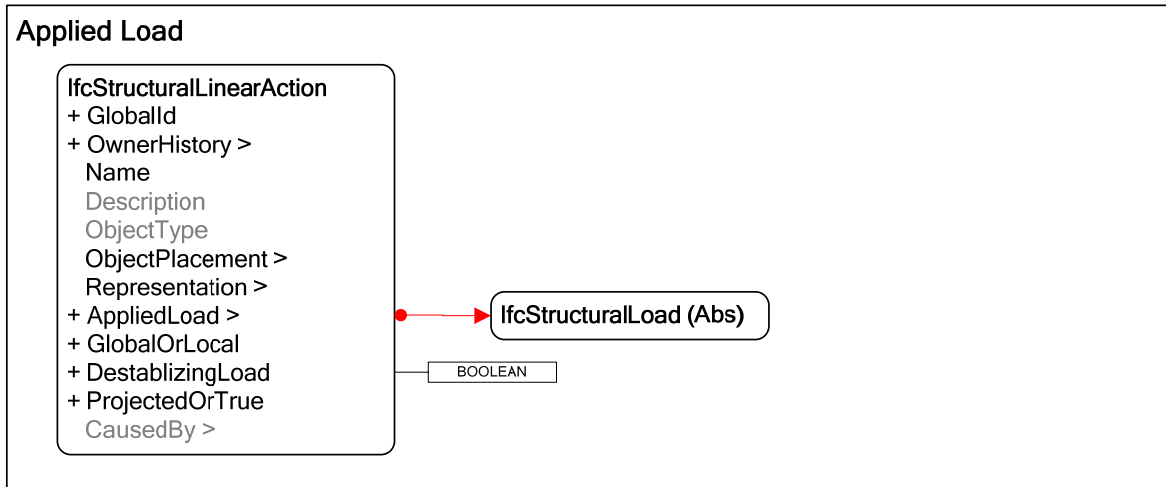
Applied Load

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-185 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralLinearAction

| Attribute | Implementation agreements |
|-------------------|---------------------------|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | Reserved. |
| ObjectType | Reserved. |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedLoad | N/A |
| GlobalOrLocal | N/A |
| DestabilizingLoad | N/A |
| CausedBy | N/A |
| ProjectedOrTrue | N/A |

Additional information

P21 example

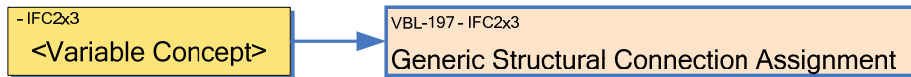
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IFC Release Specific Concept Description (IFC2x3)

Generic Structural Connection Assignment

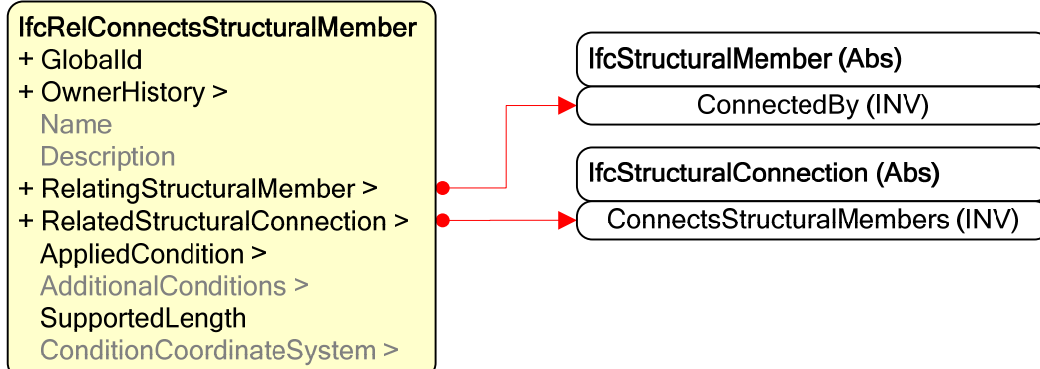
| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VL-197 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 23.10.2006 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Structural Connection Assignment



Implementation agreements

IfcRelConnectsStructuralMember

| Attribute | Implementation agreements |
|-----------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingStructuralMember | N/A |
| RelatedStructuralConnection | N/A |
| AppliedCondition | N/A |
| AdditionalConditions | N/A |
| SupportedLength | N/A |
| ConditionCoordinateSystem | N/A |

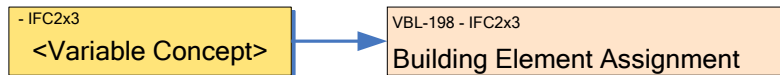
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IFC Release Specific Concept Description (IFC2x3)

Building Element Assignment

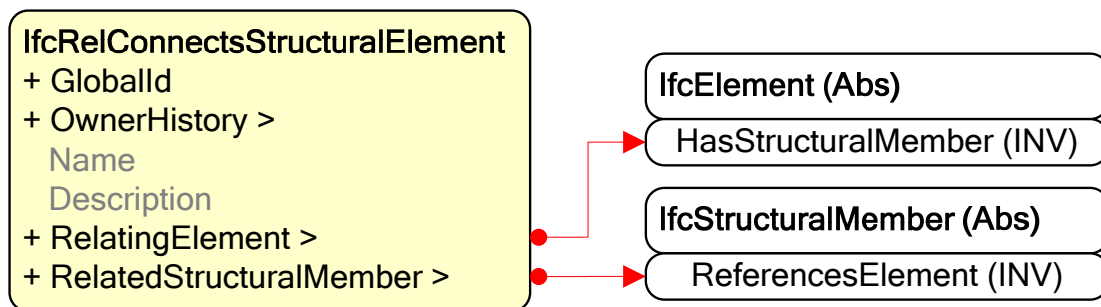
| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-198 | Version | 2 | Status | Proposal |
| Relationships | Implements generic concept 'Related Building Elements' | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Building Element Assignment



Implementation agreements

IfcRelConnectsStructuralElement

| Attribute | Implementation agreements |
|-------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingElement | N/A |
| RelatedStructuralMember | N/A |

Additional information

P21 example

```
#27=IFCSTRUCTURALSURFACEMEMBER('0AbYY4X996QLF7zcCd1MFx',#2,'Example surface member',$,$,#1592,#1623,.BENDING_ELEMENT.,200.0);
#1492=IFCSLAB('2A9CIGI8DCId8gtVuDZMXd',#2,'Example slab',$,$,#1593,#1594,$,.FLOOR.);
#1601=IFCRELCONNECTSSTRUCTURALELEMENT('1IF08Z1sPBnK_aU1kPuTuR',#2,$,$,(#27),#1492);
```

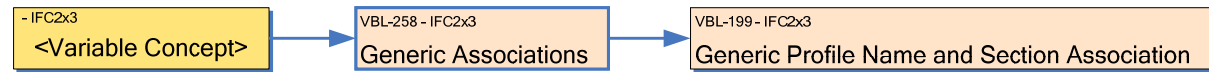
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IFC Release Specific Concept Description (IFC2x3)

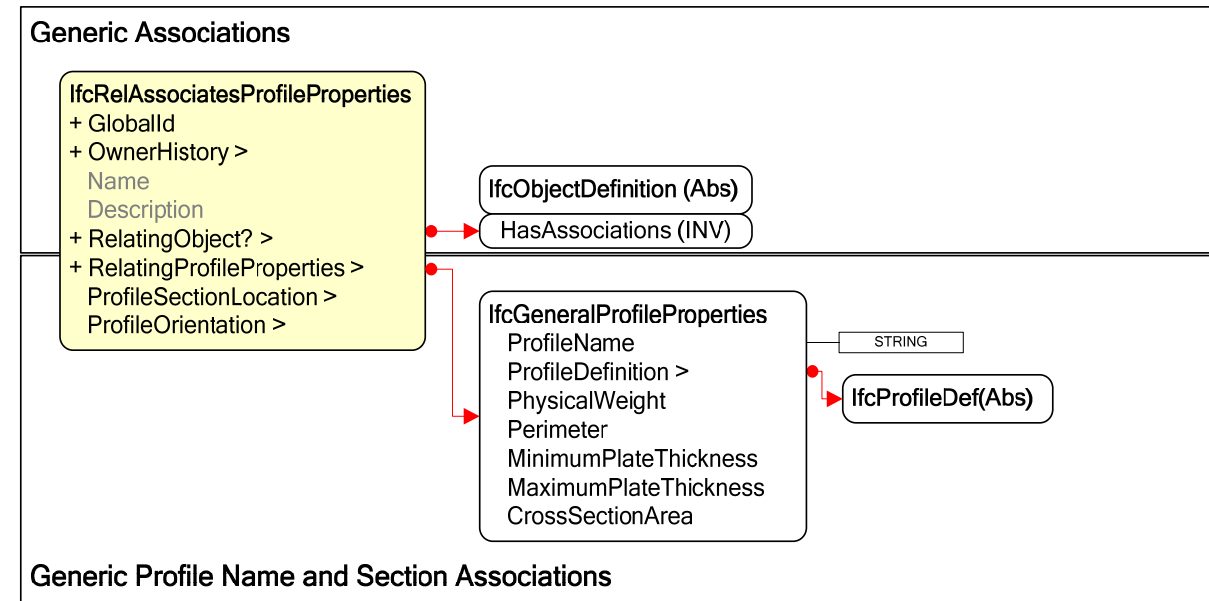
Generic Profile Name and Section Associations

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VL-199 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelAssociatesProfileProperties

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatingProfileProperties | N/A |
| ProfileSectionLocation | N/A |
| ProfileOrientation | N/A |

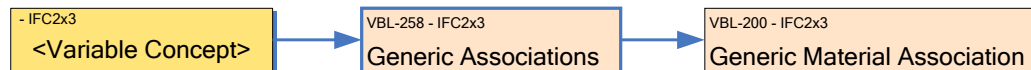
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IFC Release Specific Concept Description (IFC2x3)

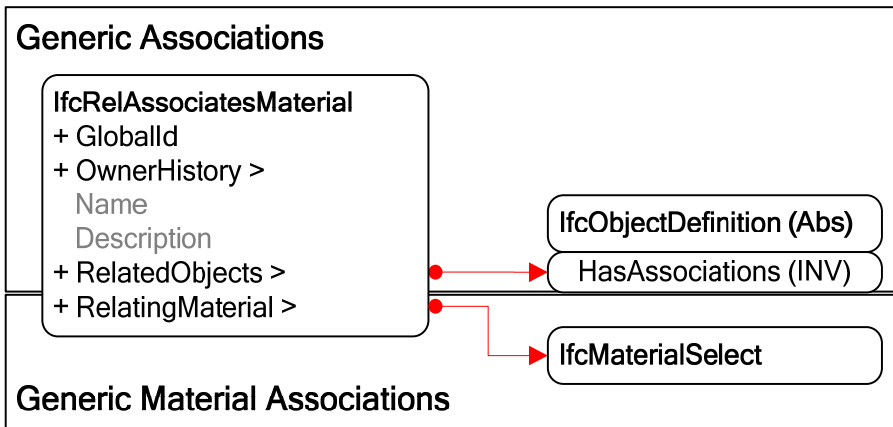
Generic Material Association

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VL-200 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelAssociatesMaterial

| Attribute | Implementation agreements |
|------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatingMaterial | N/A |

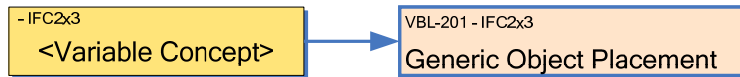
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IFC Release Specific Concept Description (IFC2x3)

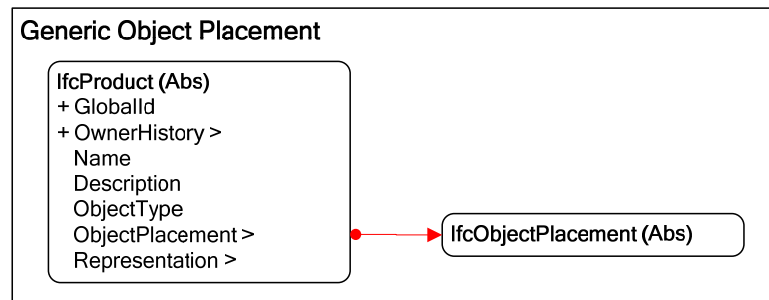
Generic Object Placement

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VL-201 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

Additional information

P21 example

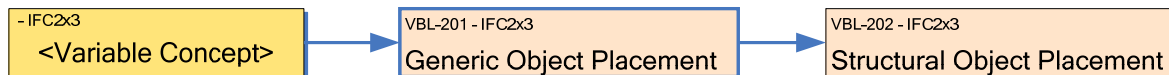
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IFC Release Specific Concept Description (IFC2x3)

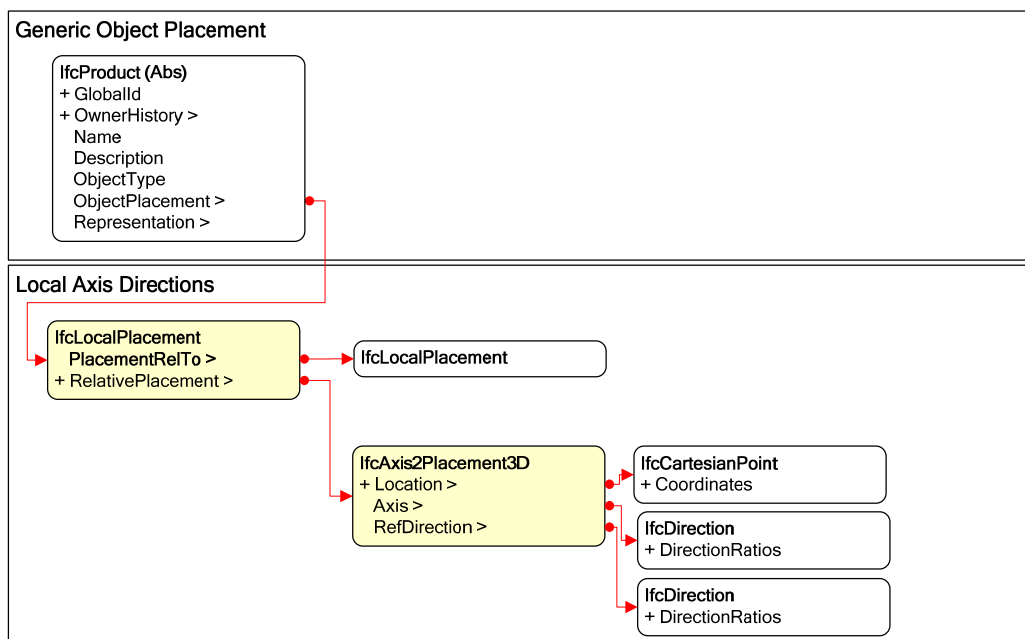
Structural Object Placement

| | | | | | |
|-----------------------|---|----------------|---|---------------|----------|
| Reference | VBL-202 | Version | 3 | Status | Proposal |
| Relationships | Implements general concept 'Structural Object Placement'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007, Name changed, PlacementRelTo added 11.11.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcLocalPlacement

| Attribute | Implementation agreements |
|-------------------|--|
| PlacementRelTo | The object placement of every structural object in the same structural analysis model must point to the same IfcLocalPlacement. This can be the IfcLocalPlacement of the IfcBuilding or IfcBuildingStorey. |
| RelativePlacement | N/A |

IfcAxis2Placement3D

| Attribute | Implementation agreements |
|--------------|---|
| Location | Giving Location is mandatory. However usually (0,0,0) coordinates are used. |
| Dim | N/A |
| Axis | N/A |
| RefDirection | N/A |
| P | N/A |

IfcDirection

| Attribute | Implementation agreements |
|-----------------|------------------------------|
| DirectionRatios | Must be in three dimensions. |
| Dim | N/A |

Additional information

P21 example

```
#9= IFCCARTESIANPOINT((0.,0.,0.));
#11= IFCDIRECTION((0.,0.,1.));
#13= IFCDIRECTION((1.,0.,0.));
#15= IFCAXIS2PLACEMENT3D(#9,#11,#13);
#41= IFCDIRECTION((0.,0.,1.));
#43= IFCGEOMETRICREPRESENTATIONCONTEXT($,$,3,$,#15,#41);

#89= IFCBUILDING('1qmHF$Bzr2YweDHmcbDum',#28,$,$,$,#90,$,$,.ELEMENT.,$,$,$);
#90= IFCLOCALPLACEMENT(#15,#43);

#246= IFCSTRUCTURALCURVEMEMBER('2Iekk$zf4khCF1qWGDGVP',#28,'1',$,$,#257,#274,.NOTDEFINED.);
#255= IFCCARTESIANPOINT((0.,0.,0.));
#257= IFCLOCALPLACEMENT(#90,#263);
#259= IFCDIRECTION((0.,-1.,0.));
#261= IFCDIRECTION((1.,0.,0.));
#263= IFCAXIS2PLACEMENT3D(#255,#259,#261);
#264= IFCCARTESIANPOINT((6.,0.,0.));
#266= IFCVERTEXPOINT(#264);
#267= IFCCARTESIANPOINT((10.,0.,0.));
#269= IFCVERTEXPOINT(#267);
#369= IFCDIRECTION((0.,0.,1.));
#373= IFCCARTESIANPOINT((8.,0.,0.));
#377= IFCAXIS2PLACEMENT3D(#373,#369,$);
#380= IFCCIRCLE(#377,2.);
#270= IFCEDGE CURVE(#266,#269,#380,.T.);
#271= IFCTOPOLOGYREPRESENTATION(#43,$,'Edge',( #270));
#274= IFCPRODUCTDEFINITIONSHAPE($,$,(#271));
```

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IFC Release Specific Concept Description (IFC2x3)

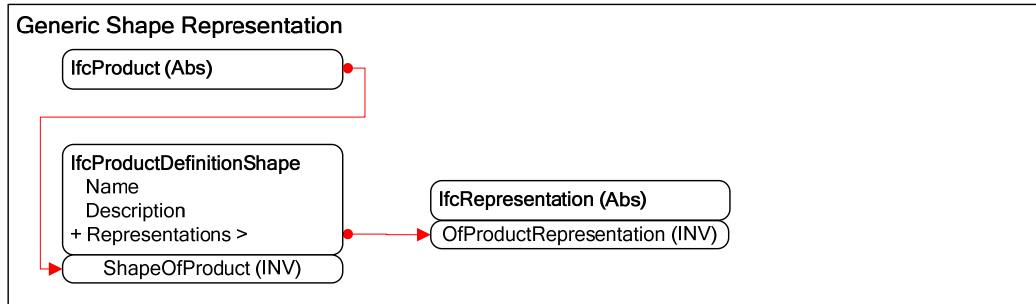
Generic Shape Representation

| | | | | | |
|-----------------------|--|----------------|---|---------------|-------|
| Reference | VBL-203 | Version | 2 | Status | Draft |
| Relationships | | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

Additional information

P21 example

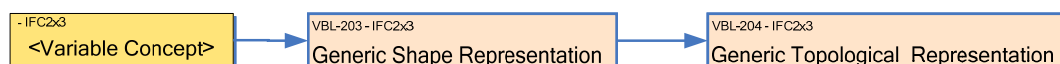
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IFC Release Specific Concept Description (IFC2x3)

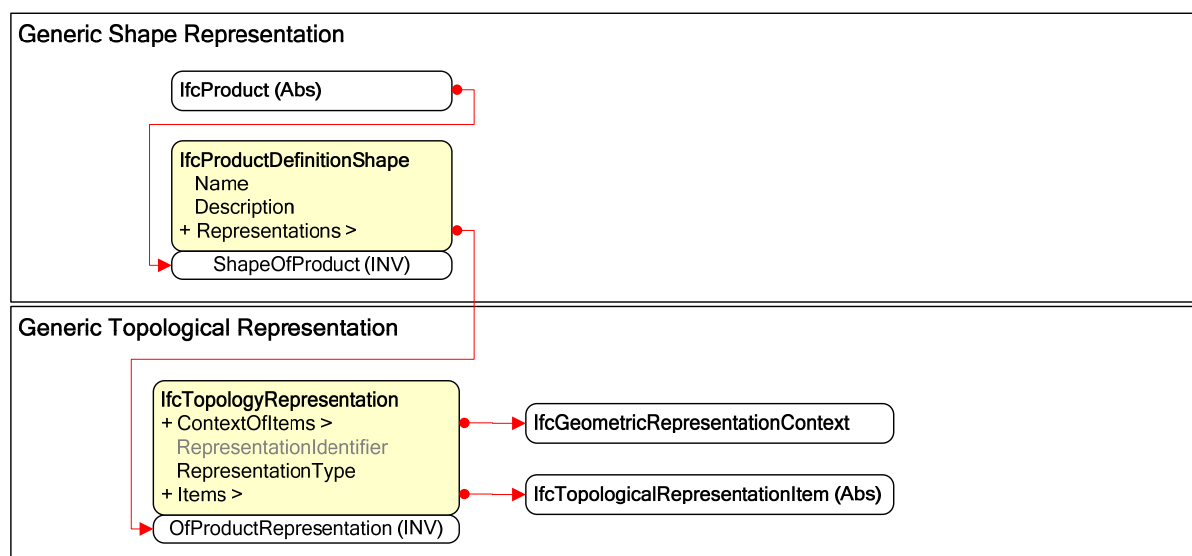
Generic Topological Representation

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-204 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcProductDefinitionShape

| Attribute | Implementation agreements |
|-----------------|--|
| Name | N/A |
| Description | N/A |
| Representations | Must be one IfcTopologyRepresentation. |

IfcTopologyRepresentation

| Attribute | Implementation agreements |
|--------------------------|---------------------------|
| ContextOfItems | N/A |
| RepresentationIdentifier | N/A |
| RepresentationType | Must be 'Edge' |
| Items | N/A |

Additional information

P21 example

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IFC Release Specific Concept Description (IFC2x3)

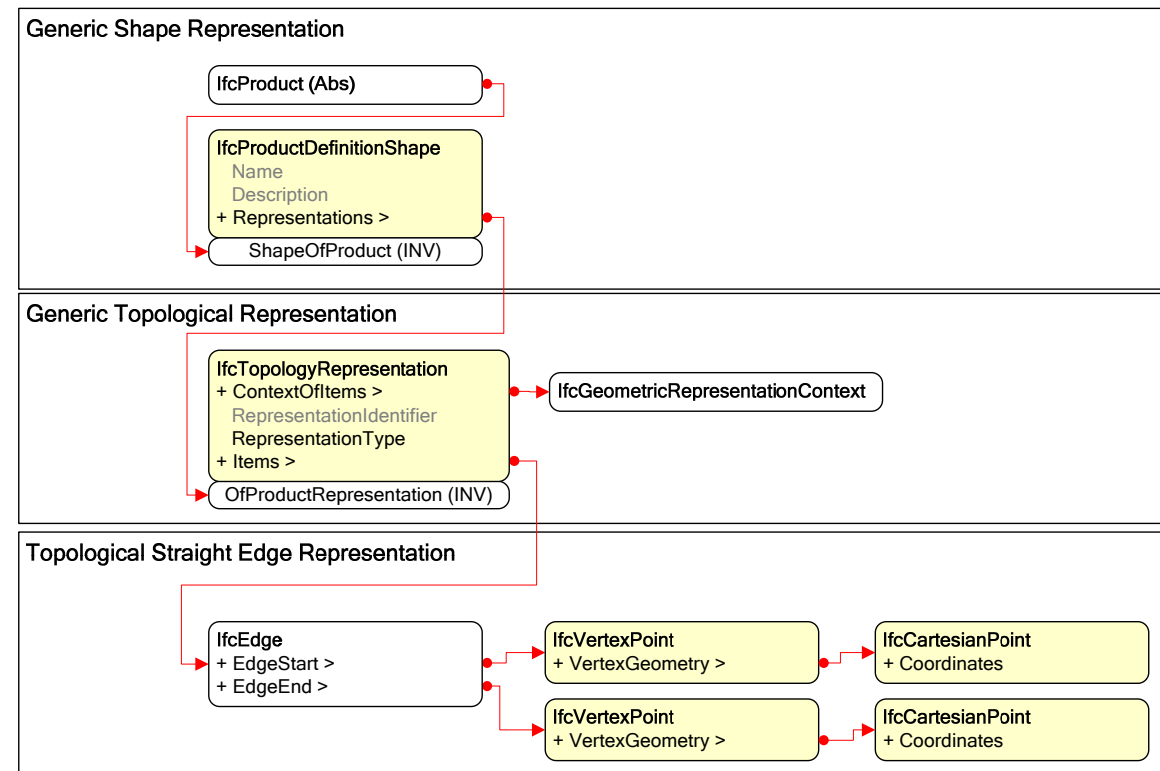
Topological Straight Edge Representation

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-205 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Straight Edge Representation'. | | | | |
| History | Created 23.10.2006, documentation improved 26.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcProductDefinitionShape

| Attribute | Implementation agreements |
|-----------------|---------------------------------------|
| Name | Reserved |
| Description | Reserved |
| Representations | Must be one IfcTopologyRepresentation |

IfcTopologyRepresentation

| Attribute | Implementation agreements |
|--------------------------|---------------------------|
| ContextOfItems | N/A |
| RepresentationIdentifier | Not used |
| RepresentationType | Must be 'Edge' |
| Items | Must be one IfcEdge |

IfcVertexPoint

| Attribute | Implementation agreements |
|----------------|---------------------------|
| VertexGeometry | Must be IfcCartesianPoint |

IfcCartesianPoint

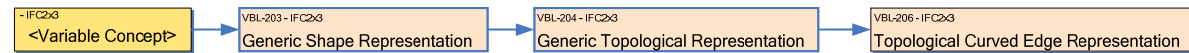
| Attribute | Implementation agreements |
|--|---------------------------|
| Coordinates | Must be three dimensions |
| Additional information | |
| P21 example | |
| <pre> #9= IFCCARTESIANPOINT((0.,0.,0.)); #11= IFCDIRECTION((0.,0.,1.)); #13= IFCDIRECTION((1.,0.,0.)); #15= IFCAXIS2PLACEMENT3D(#9,#11,#13); #41= IFCDIRECTION((0.,0.,1.)); #43= IFCGEOMETRICREPRESENTATIONCONTEXT(\$,\$,3,\$,#15,#41); #198= IFCSTRUCTURALCURVEMEMBER('0fhmaZzpr4TAZ0eyx039pR',#28,'1',\$,\$,#209,#226,.NOTDEFINED.); #207= IFCCARTESIANPOINT((7.7626830E-18,-2.5407477E-16,-3.0389222E-18)); #209= IFCLOCALPLACEMENT(\$,#215); #211= IFCDIRECTION((-8.5209382E-18,-1.,0.)); #213= IFCDIRECTION((1.,-8.5209382E-18,9.1856764E-18)); #215= IFCAXIS2PLACEMENT3D(#207,#211,#213); #216= IFCCARTESIANPOINT((7.7626830E-18,-2.5407477E-16,-3.0389222E-18)); #218= IFCVERTEXPOINT(#216); #219= IFCCARTESIANPOINT((10.,-3.3928416E-16,8.8817842E-17)); #221= IFCVERTEXPOINT(#219); #222= IFCEDGE(#218,#221); #223= IFCTOPOLOGYREPRESENTATION(#43,\$,'Edge',(#222)); #226= IFCPRODUCTDEFINITIONSHAPE(\$,\$,(#223)); </pre> | |
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IFC Release Specific Concept Description (IFC2x3)

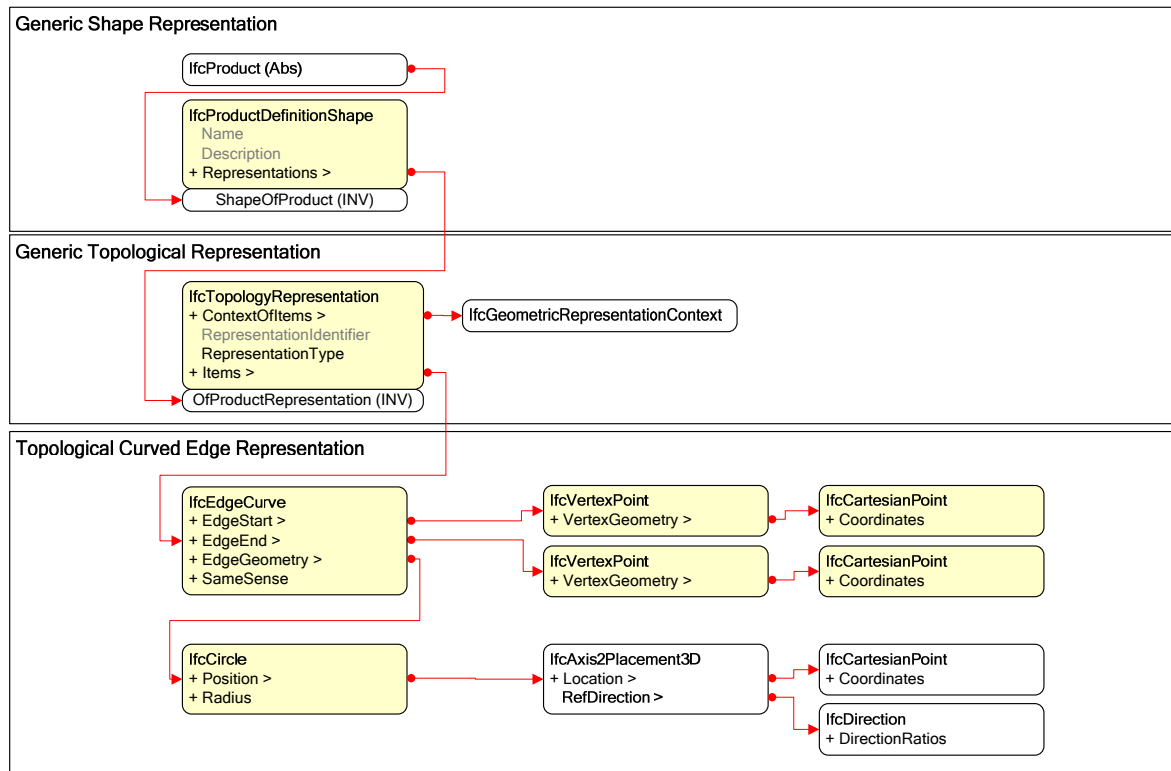
Topological Curve Edge Representation

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-206 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Curved Edge Representation'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcProductDefinitionShape

| Attribute | Implementation agreements |
|-----------------|---------------------------------------|
| Name | Not used. |
| Description | Not used. |
| Representations | Must be one IfcTopologyRepresentation |

IfcTopologyRepresentation

| Attribute | Implementation agreements |
|--------------------------|---------------------------|
| ContextOfItems | N/A |
| RepresentationIdentifier | Not used. |
| RepresentationType | Must be 'Edge' |
| Items | Must be IfcEdgeCurve. |

IfcEdgeCurve

| Attribute | Implementation agreements |
|--------------|---------------------------|
| EdgeStart | N/A |
| EdgeEnd | N/A |
| EdgeGeometry | Must be IfcCircle. |

| | |
|-------------------|-----------------------------|
| SameSense | N/A |
| IfcVertexPoint | |
| Attribute | Implementation agreements |
| VertexGeometry | Must be IfcCartesianPoint |
| IfcCartesianPoint | |
| Attribute | Implementation agreements |
| Coordinates | Must be three dimensions. |
| Dim | N/A |
| IfcCircle | |
| Attribute | Implementation agreements |
| Dim | N/A |
| Position | Must be IfcAxis2Placement3D |
| Radius | N/A |

Additional information

P21 example

```
#9= IFCCARTESIANPOINT((0.,0.,0.));
#11= IFCDIRECTION((0.,0.,1.));
#13= IFCDIRECTION((1.,0.,0.));
#15= IFCAxis2Placement3D(#9,#11,#13);
#41= IFCDIRECTION((0.,0.,1.));
#43= IFCGEOMETRICREPRESENTATIONCONTEXT($,$,3,$,#15,#41);

#246= IFCSTRUCTURALCURVEMEMBER('21Iekk$zf4khCF1qWGDGVP',#28,'1',$,$,#257,#274,.NOTDEFINED.);
#255= IFCCARTESIANPOINT((6.,0.,-2.2737368E-15));
#257= IFCLocalPlacement($,#263);
#259= IFCDIRECTION((0.,-1.,0.));
#261= IFCDIRECTION((1.,0.,0.));
#263= IFCAxis2Placement3D(#255,#259,#261);
#264= IFCCARTESIANPOINT((6.,0.,-2.2737368E-15));
#266= IFcVertexPoint(#264);
#267= IFCCARTESIANPOINT((10.,0.,-2.2737368E-15));
#269= IFcVertexPoint(#267);
#369= IFCDIRECTION((0.,0.,1.));
#373= IFCCARTESIANPOINT((8.,0.,0));
#377= IFCAxis2Placement3D(#373,#369,$);
#380= IFCCIRCLE(#377,2.);
#270= IFCEdgeCurve(#266,#269,#380,.T.);
#271= IFCTopologyRepresentation(#43,$,'Edge',(#270));
#274= IFcProductDefinitionShape($,$,(#271));
```

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| IFC Release Specific Concept Description (IFC2x3) | | | | | |
|---|--|---------|---|--------|----------|
| Structural Surface Member Attributes | | | | | |
| Reference | VL-207 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 25.3.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram

- IFC2x3

<Variable Concept>

VL-207 - IFC2x3

Structural Surface Member Attributes

General

The concept groups the IfcStructuralSurfaceMember attributes defined inside the entity.

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IFC Release Specific Concept Description (IFC2x3)

Surface Type

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-208 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Structural Surface Type' | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Surface Type

IfcStructuralSurfaceMember
+ GlobalId
+ OwnerHistory >
Name
Description
ObjectType
ObjectPlacement >
Representation >
+ PredefinedType
Thickness

IfcStructuralSurfaceTypeEnum
BENDING_ELEMENT
MEMBRANE_ELEMENT
SHELL
USERDEFINED
NOTDEFINED

Implementation agreements

Additional information

P21 example

```
#27=IFCSTRUCTURALSURFACEMEMBER('0AbYY4X996QLF7zcCd1MFX',#2,'Example surface member',$,$,#1592,#1623,.BENDING_ELEMENT.,200.0);
```

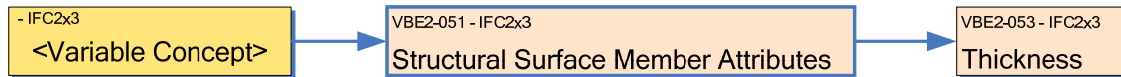
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IFC Release Specific Concept Description (IFC2x3)

Thickness

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-209 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Structural Surface Thickness'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Thickness

```
ifcStructuralSurfaceMember
+ GlobalId
+ OwnerHistory >
  Name
  Description
  ObjectType
  ObjectPlacement >
  Representation >
+ PredefinedType
  Thickness
```

REAL

Implementation agreements

Additional information

P21 example

```
#27=IFCSTRUCTURALSURFACEMEMBER('0AbYY4X996QLF7zcCd1MFX',#2,'Example surface member',$,$,#1592,#1623,.BENDING_ELEMENT.,200.0);
```

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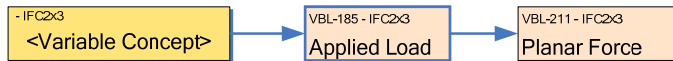
The content of this document has to be certified by the IAI before becoming part of an official IFC Model View Definition.

IFC Release Specific Concept Description (IFC2x3)

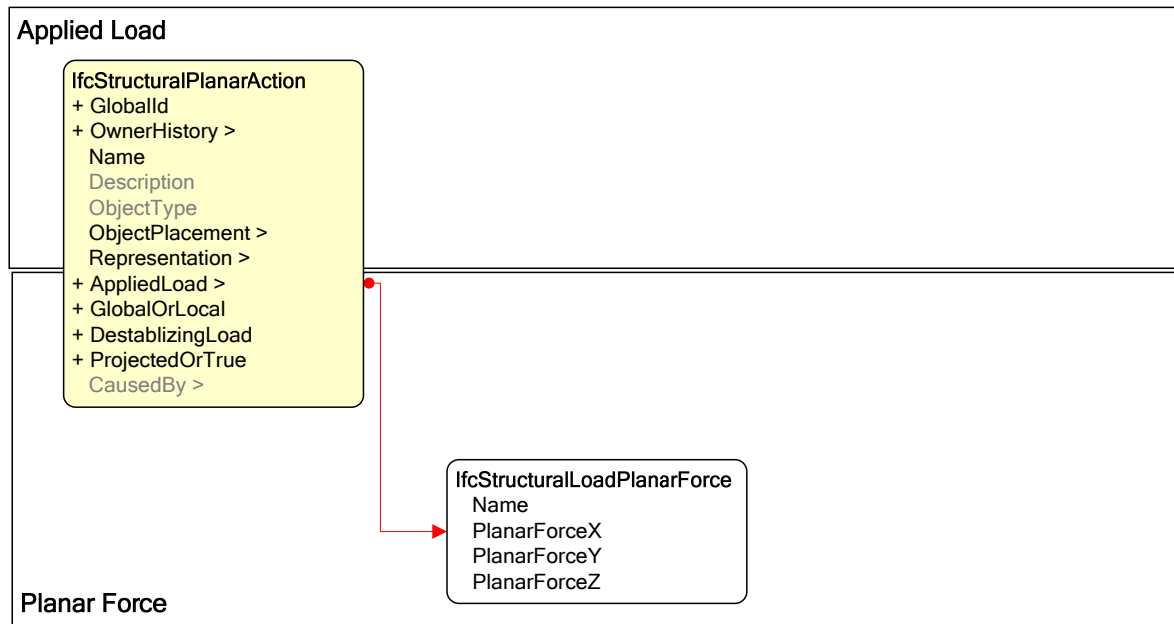
Planar Force

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-211 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Planar Force'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralPlanarAction

| Attribute | Implementation agreements |
|------------------|--------------------------------------|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | Reserved. |
| Description | Reserved. |
| ObjectType | N/A |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedLoad | Must be IfcStructuralLoadPlanarForce |
| GlobalOrLocal | N/A |
| DestablizingLoad | N/A |
| CausedBy | N/A |
| ProjectedOrTrue | N/A |

Additional information

P21 example

```
#39=IFCGEOMETRICREPRESENTATIONCONTEXT('3D Model', 'Design', 3, $, #64, $);  
#1887=IFCRELCONNECTSSTRUCTURALACTIVITY('2aShwLf2bC1srk9rfzXxup', #2, $, $, #27, #35);  
#35=IFCSTRUCTURALPLANARACTION('384VvF0wnDpN6ozCvAgshQ', #2, $, 'Example planar action', $, #1655, #1623, #1656, .LOCAL_COORDS., .F., .TRUE_LENGTH., $);  
#80=IFCAXIS2PLACEMENT3D(#42, #81, #44);  
#1655=IFCLOCALPLACEMENT($, #80);  
#1612=IFCCARTESIANPOINT((-100.0, 100.0, 2680.0));  
#1611=IFCCARTESIANPOINT((-100.0, -12100.0, 2680.0));  
#1610=IFCCARTESIANPOINT((7100.0, -12100.0, 2680.0));  
#1609=IFCCARTESIANPOINT((7100.0, 100.0, 2680.0));  
#1613=IFCPOLYLOOP((#1612, #1611, #1610, #1609));  
#1621=IFCFACEOUTERBOUND(#1613, .T.);  
#1615=IFCDIRECTION((0.0, 0.0, 1.0));  
#1614=IFCDIRECTION((0.0, -12200.0, 0.0));  
#1616=IFCAXIS2PLACEMENT3D(#1612, #1615, #1614);  
#1617=IFCPLANE(#1616);  
#1604=IFCFACESURFACE((#1621), #1617, .T.);  
#1622=IFCTOPOLOGYREPRESENTATION(#77, $, $, (#1604));  
#1623=IFCPRODUCTREPRESENTATION($, $, (#1622));  
#1656=IFCSTRUCTURALLOADPLANARFORCE($, 2000, 2000, 2000.0);
```

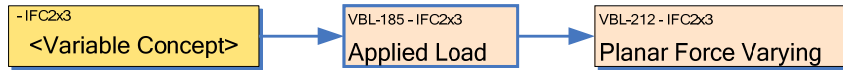
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IFC Release Specific Concept Description (IFC2x3)

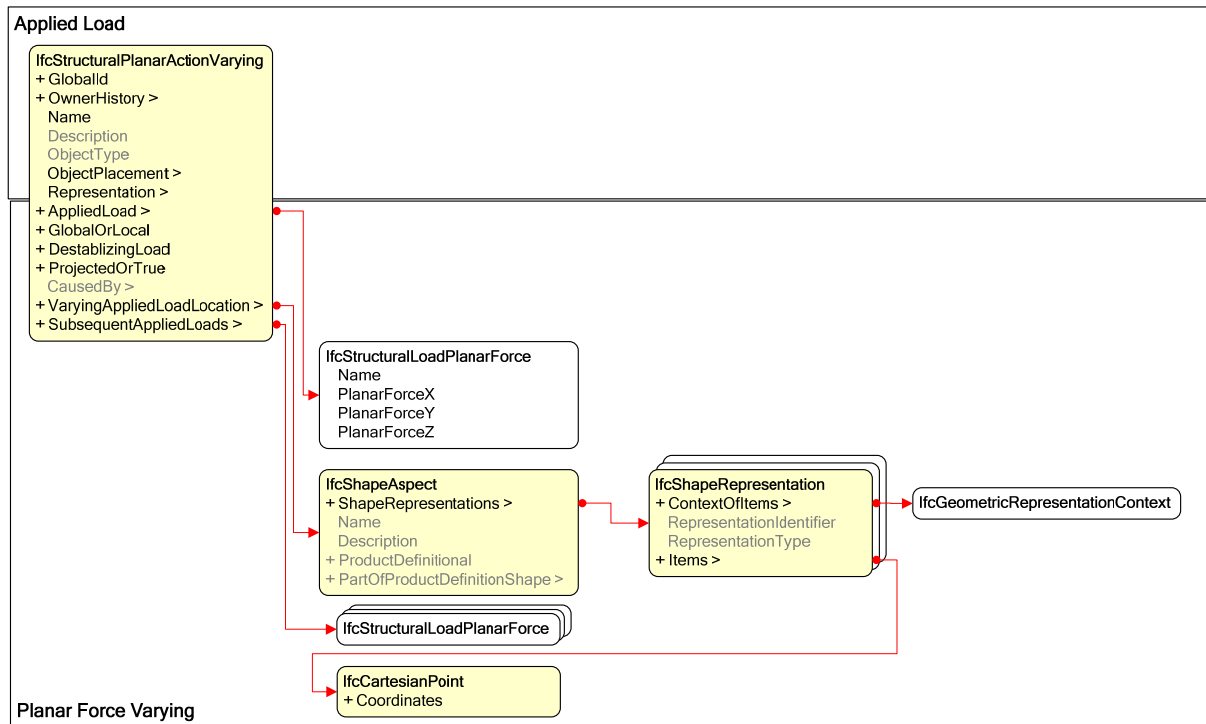
Planar Force Varying

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-212 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Planar Force Varying'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralPlanarActionVarying

| Attribute | Implementation agreements |
|----------------------------|---------------------------------------|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedLoad | Must be IfcStructuralLoadPlanarForce. |
| GlobalOrLocal | N/A |
| DestabilizingLoad | N/A |
| CausedBy | N/A |
| ProjectedOrTrue | N/A |
| VaryingAppliedLoadLocation | N/A |
| SubsequentAppliedLoads | Must be IfcStructuralLoadPlanarForce. |

VaryingAppliedLoads N/A

IfcShapeAspect

| Attribute | Implementation agreements |
|------------------------------|--------------------------------|
| ShapeRepresentations | Must be IfcShapeRepresentation |
| Name | Not used. |
| Description | Not used. |
| ProductDefinitional | Not used. |
| PartOfProductDefinitionShape | Not used. |

IfcShapeRepresentation

| Attribute | Implementation agreements |
|--------------------------|-------------------------------|
| ContextOfItems | N/A |
| RepresentationIdentifier | Not used. |
| RepresentationType | Not used. |
| Items | Must be one IfcCartesianPoint |

IfcCartesianPoint

| Attribute | Implementation agreements |
|-------------|-----------------------------|
| Coordinates | Must have three dimensions. |
| Dim | N/A |

Additional information

P21 example

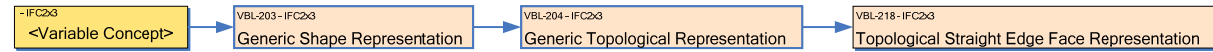
This document uses the official IFC Model View Definition Format version 1.1.0. of the IAI (www.iai-international.org)
The content of this document has to be certified by the IAI before becoming part of an official IFC Model View Definition.

IFC Release Specific Concept Description (IFC2x3)

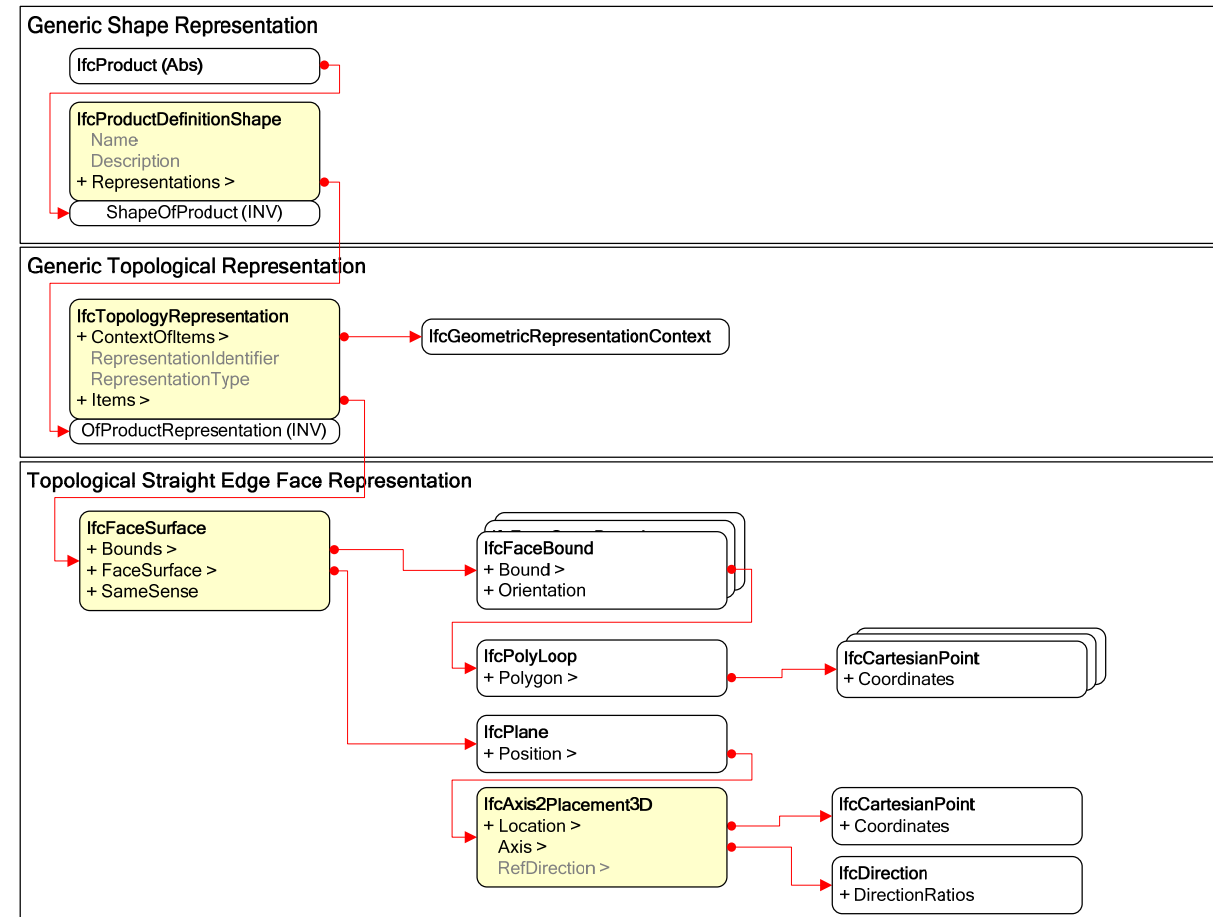
Topological Straight Edge Face Representation

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-218 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Surface Representation Straight Edge'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcProductDefinitionShape

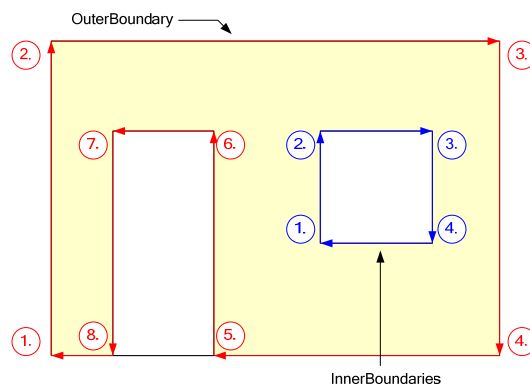
| Attribute | Implementation agreements |
|-----------------|--|
| Name | Reserved. |
| Description | Reserved. |
| Representations | Must be one IfcTopologyRepresentation. |

IfcTopologyRepresentation

| Attribute | Implementation agreements |
|--------------------------|-----------------------------|
| ContextOfItems | N/A |
| RepresentationIdentifier | Not used. |
| RepresentationType | Must be 'Face' |
| Items | Must be one IfcFaceSurface. |

IfcFaceSurface

| Attribute | Implementation agreements |
|---------------------|---|
| Bounds | Must be one IfcFaceOuterBound. Optionally also IfcFaceBounds as inner boundaries of the face. |
| FaceSurface | Must be IfcPlane. |
| SameSense | N/A |
| IfcFaceBound | |
| Attribute | Implementation agreements |
| Bound | Must be IfcPolyLoop. |
| Orientation | N/A |
| IfcAxis2Placement3D | |
| Attribute | Implementation agreements |
| Location | N/A |
| Dim | N/A |
| Axis | N/A |
| RefDirection | Not used. |
| P | N/A |



Additional information

P21 example

```
#1949=IFCSTRUCTURALSURFACEMEMBER('2tvI$vpGIFhc0NmM0e1p_7',#2,'Example Surfacemember',$,$,#1797,#1798,.SHELL.,200.0);

#1950=IFCCARTESIANPOINT((7100.0,100.0,0.0));
#1951=IFCCARTESIANPOINT((7100.0,-113.0,0.0));
#1952=IFCCARTESIANPOINT((7100.0,-113.0,2100.0));
#1953=IFCCARTESIANPOINT((7100.0,-1113.0,2100.0));
#1954=IFCCARTESIANPOINT((7100.0,-1113.0,0.0));
#1955=IFCCARTESIANPOINT((7100.0,-12100.0,0.0));
#1956=IFCCARTESIANPOINT((7100.0,-12100.0,2680.0));
#1957=IFCCARTESIANPOINT((7100.0,100.0,2680.0));
#1949=IFCPOLYLOOP((#1950,#1951,#1952,#1953,#1954,#1955,#1956,#1957,));
#1776=IFCFACEOUTERBOUND(#1949,.T.);

#2109=IFCCARTESIANPOINT((7100.0,-6435.0,480.0));
#2108=IFCCARTESIANPOINT((7100.0,-7623.0,480.0));
#2107=IFCCARTESIANPOINT((7100.0,-7623.0,2100.0));
#2106=IFCCARTESIANPOINT((7100.0,-6435.0,2100.0));
#2110=IFCPOLYLOOP((#2109,#2108,#2107,#2106));
#1778=IFCFACEBOUND(#2110,.T.);

#2043=IFCCARTESIANPOINT((7100.0,100.0,0.0));
#2044=IFCDIRECTION((-1.0,0.0,0.0));
#2045=IFCDIRECTION((0.0,-1.0,0.0));
#1954=IFCAXIS2PLACEMENT3D(#2043,#2044,#2045);
#1780=IFCPLANE(#1954);

#1768=IFCFACESURFACE((#1776,#1778),#1780,.T.);
#1948=IFCTOPOLOGYREPRESENTATION(#43,$,'Face',(#1768));
#1798=IFCPRODUCTDEFINITIONSHAPE($,$,(#1948));
```

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IFC Release Specific Concept Description (IFC2x3)

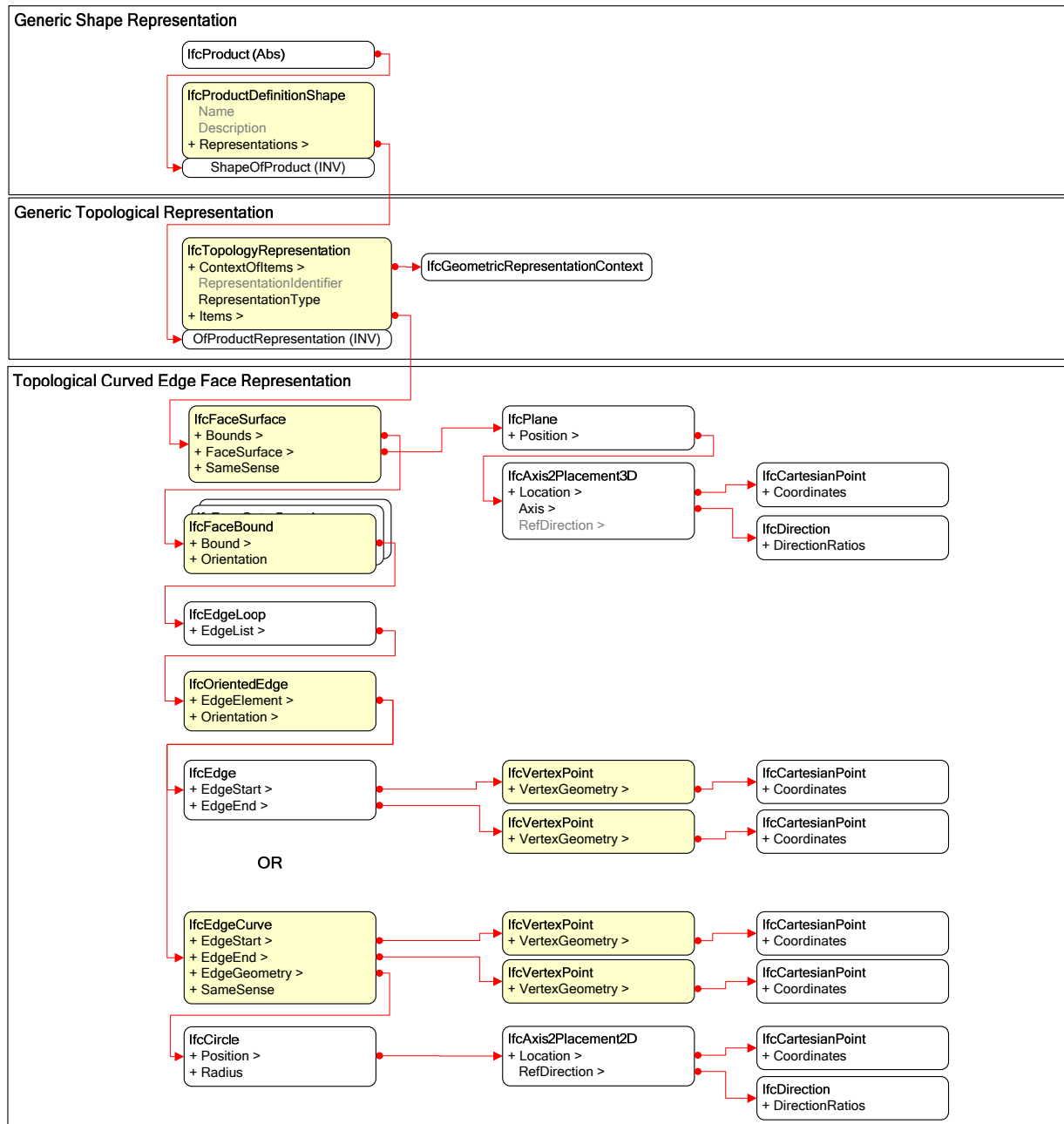
Topological Curved Edge Face Representation

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-219 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Surface Representation Curved Edge'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcProductDefinitionShape

Attribute

Implementation agreements

| | |
|---------------------------|---|
| Name | Reserved. |
| Description | Reserved. |
| Representations | Must be one IfcTopologyRepresentation. |
| IfcTopologyRepresentation | |
| Attribute | Implementation agreements |
| ContextOfItems | N/A |
| RepresentationIdentifier | Not used. |
| RepresentationType | Must be 'Face'. |
| Items | Must be one IfcFaceSurface. |
| IfcFaceSurface | |
| Attribute | Implementation agreements |
| Bounds | N/A |
| FaceSurface | Must be IfcPlane. |
| SameSense | N/A |
| IfcFaceBound | |
| Attribute | Implementation agreements |
| Bound | Must be IfcEdgeLoop. |
| Orientation | N/A |
| IfcOrientedEdge | |
| Attribute | Implementation agreements |
| EdgeStart | N/A |
| EdgeEnd | N/A |
| EdgeElement | Must be either IfcEdge or ifcEdgeCurve. |
| Orientation | N/A |
| .EdgeStart | N/A |
| .EdgeEnd | N/A |
| IfcVertexPoint | |
| Attribute | Implementation agreements |
| VertexGeometry | Must be IfcCartesianPoint. |
| IfcEdgeCurve | |
| Attribute | Implementation agreements |
| EdgeStart | N/A |
| EdgeEnd | N/A |
| EdgeGeometry | Must be IfcCircle. |
| SameSense | N/A |

The diagram illustrates a 2D face with a semi-circular outer boundary and a square inner hole. The outer boundary is defined by a red line with arrows pointing counter-clockwise, labeled 'OuterBoundary'. The inner boundary is defined by a blue line with arrows pointing clockwise. The vertices are numbered 1 through 4 in red circles for the outer boundary and blue circles for the inner boundary.

Additional information

P21 example

```
#9= IFCCARTESIANPOINT((0.,0.,0.));
#11= IFCDIRECTION((1.,0.,0.));
#15= IFCDIRECTION((0.,0.,1.));
#17= IFCAXIS2PLACEMENT3D(#9,#15,#11);
#34= IFCGEOMETRICREPRESENTATIONCONTEXT($,$,3,$,#17,#15);

#1022= IFCSTRUCTURALSURFACEMEMBER('0aTavr7ezE$8nRnSbp08J3',#30,'StructuralSurfaceMemberName',$,$,#1014,#1019,.NOTDEFINED.,0.2);
#970= IFCCARTESIANPOINT((6.,6.,7.));
#971= IFCVERTEXPOINT(#970);
#976= IFCCARTESIANPOINT((9.,6.,7.));
#977= IFCVERTEXPOINT(#976);
#988= IFCCARTESIANPOINT((9.,12.,7.));
#989= IFCVERTEXPOINT(#988);
#994= IFCCARTESIANPOINT((6.,12.,7.));
#995= IFCVERTEXPOINT(#994);
#369= IFCDIRECTION((0.,0.,1.));
#373= IFCCARTESIANPOINT((8.,12.,7.));
#377= IFCAXIS2PLACEMENT3D(#373,#369,$);
#380= IFCIRCLE(#377,2.);
#996= IFCEDGE(#971,#977);
#997= IFCEDGE(#977,#989);
#998= IFCEDGECURVE(#989,#995,#380,.T.);
#999= IFCEDGE(#994,#970);
#1000= IFCORIENTEDEDGE(#995,.T.);
#1001= IFCORIENTEDEDGE(#996,.T.);
#1002= IFCORIENTEDEDGE(#997,.T.);
#1003= IFCORIENTEDEDGE(#998,.T.);
#1006= IFCEDGELOOP((#1000,#1001,#1002,#1003));
#1008= IFCFACEOUTERBOUND(#1006,.T.);
#1228= IFCAXIS2PLACEMENT3D(#9,#11,#15);
#1229= IFCPLANE(#1228);
#1009= IFCFACESURFACE((#1008),#1229,.T.);
#1016= IFCTOPOLOGYREPRESENTATION(#34,$,'Face',(#1009));
#1019= IFCPRODUCTDEFINITIONSHAPE($,$,(#1016));

#1011= IFCCARTESIANPOINT((0.,0.,0.));
#1013= IFCAXIS2PLACEMENT3D(#1011,#15,#11);
#1014= IFCLOCALPLACEMENT($,#1013);
```

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IFC Release Specific Concept Description (IFC2x3)

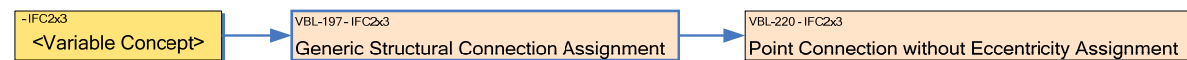
Point Connection without Eccentricity Assignment

| | | | | | |
|-----------------------|---|----------------|---|---------------|----------|
| Reference | VBL-220 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Non Eccentric Point Connection'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007, Condition coordinate system added 17.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

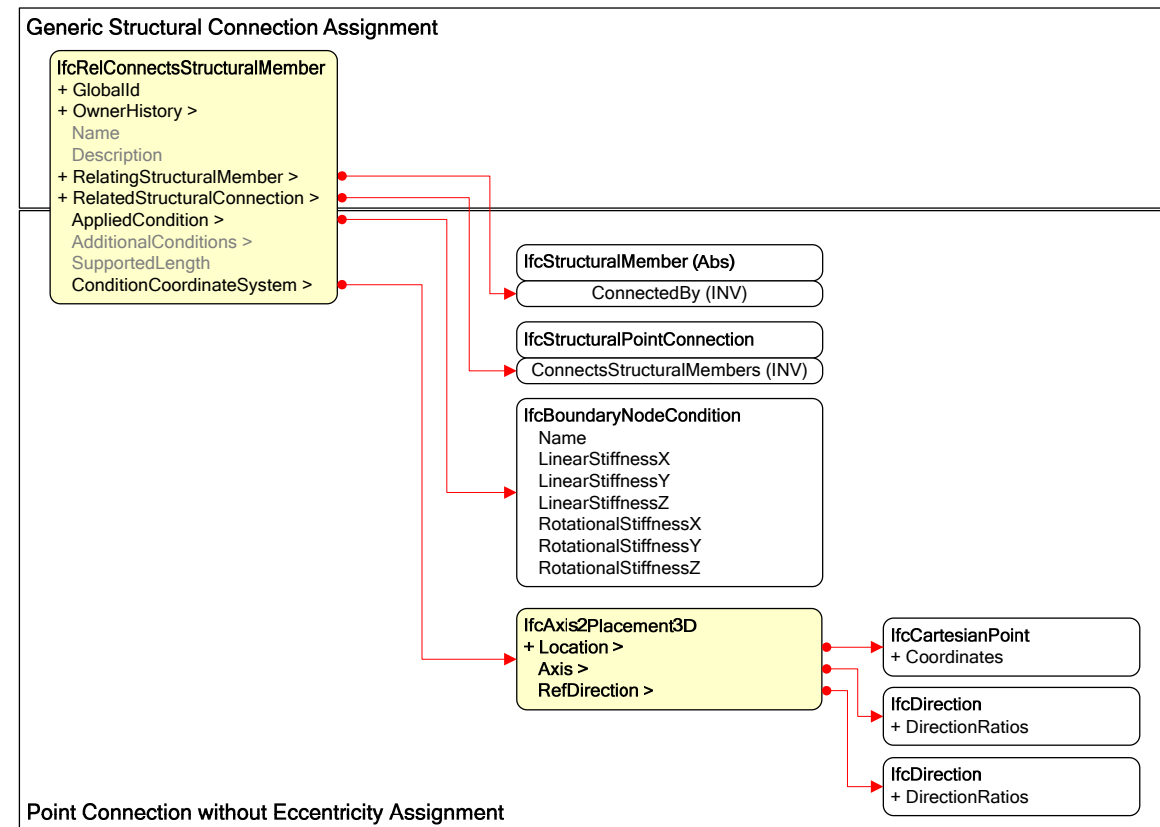
General

In the IfcBoundaryCondition value (-1.) represents an infinitive large value – or a fixed connectivity with infinitive stiffness, value zero (0.) represents no stiffness or a free connectivity, value NIL (\$) represents an unknown connectivity condition, any other value represents a finitive stiffness or spring connectivity in that direction or rotation.

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelConnectsStructuralMember

| Attribute | Implementation agreements |
|-----------------------------|---|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingStructuralMember | N/A |
| RelatedStructuralConnection | Must be IfcStructuralPointConnection |
| AppliedCondition | Must be IfcBoundaryNodeCondition. |
| AdditionalConditions | Not used. |
| SupportedLength | Not used. |
| ConditionCoordinateSystem | The applied conditions are defined in this given coordinate system. Coordination system is defined relative to global coordinate system. |

IfcAxis2Placement3D

| Attribute | Implementation agreements |
|--------------|--|
| Location | <i>Giving location is mandatory, but while in this case it doesn't have any special meaning (0,0,0) is used.</i> |
| Axis | N/A |
| RefDirection | N/A |

Additional information

P21 example

```
#292= IFCRELCONNECTSSTRUCTURALMEMBER('2p11VbFcXA7gh2nZDUW9Pw',#28,$,$,#246,#192,#291,$,$,#300);

#246= IFCSTRUCTURALCURVEMEMBER('21Iekk$zf4khCF1qWGDGVP',#28,'1',$,$,#257,#274,.NOTDEFINED.);
#192= IFCSTRUCTURALPOINTCONNECTION('30jwjLkoTC6eM1wk3_xb4W',#28,'Example node',$,$,#203,#216,#218);
#291= IFCBOUNDARYNODECONDITION($,-1.,-1.,-1.,-1.,-1.,-1.);
#297= IFCCARTESIANPOINT((0.,0.,0.));
#298= IFCDIRECTION((0.,0.,1.));
#299= IFCDIRECTION((1.,0.,0.));
#300= IFCAXIS2PLACEMENT3D(#297,#298,#299);
```

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IFC Release Specific Concept Description (IFC2x3)

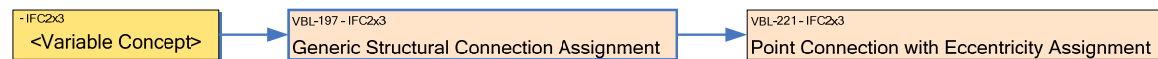
Point Connection with Eccentricity Assignment

| | | | | | |
|----------------|---|---------|---|--------|----------|
| Reference | VBL-221 | Version | 4 | Status | Proposal |
| Relationships | Implements general concept 'Eccentric Point Connection'. | | | | |
| History | <p>Created 23.10.2006</p> <p>Improved 28.9.2007</p> <p>PointOnRelatedElement has been changed to Not used,</p> <p>Condition coordination system added 17.1.2008</p> | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

General

In the IfcBoundaryCondition value (-1.) represents an infinitive large value – or a fixed connectivity with infinitive stiffness, value zero (0.) represents no stiffness or a free connectivity, value NIL (\$) represents an unknown connectivity condition, any other value represents a finitive stiffness or spring connectivity in that direction or rotation.

Usage in view definition diagram



Instantiation diagram

Generic Structural Connection Assignment

IfcRelConnectsWithEccentricity

- + GlobalId
- + OwnerHistory >
 - Name
 - Description
- + RelatingStructuralMember >
- + RelatedStructuralConnection >
 - AppliedCondition >
 - AdditionalConditions >
 - SupportedLength
 - ConditionCoordinateSystem >
- + ConnectionConstrains >

IfcStructuralMember (Abs)

ConnectedBy (INV)

IfcStructuralPointConnection

ConnectsStructuralMembers (INV)

IfcBoundaryNodeCondition

Name

LinearStiffnessX

LinearStiffnessY

LinearStiffnessZ

RotationalStiffnessX

RotationalStiffnessY

RotationalStiffnessZ

IfcAxis2Placement3D

+ Location >

Axis >

RefDirection >

IfcCartesianPoint

+ Coordinates

IfcDirection

+ DirectionRatios

IfcDirection

+ DirectionRatios

IfcConnectionPointGeometry

+ PointOnRelatingElement >

PointOnRelatedElement >

IfcVertexPoint

+ VertexGeometry >

IfcCartesianPoint

+ Coordinates

Point Connection with Eccentricity Assignment

Implementation agreements

IfcRelConnectsWithEccentricity

| Attribute | Implementation agreements |
|-----------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingStructuralMember | N/A |
| RelatedStructuralConnection | Must be IfcStructuralPointConnection. |
| AppliedCondition | Must be IfcBoundaryNodeCondition. |
| AdditionalConditions | Not used. |
| SupportedLength | Not used. |
| ConditionCoordinateSystem | Not used. |
| ConnectionConstraint | Must be IfcConnectionPointGeometry. |

IfcConnectionPointGeometry

| Attribute | Implementation agreements |
|------------------------|---------------------------|
| PointOnRelatingElement | Must be IfcVertexPoint. |
| PointOnRelatedElement | Not used. |

IfcAxis2Placement3D

| Attribute | Implementation agreements |
|--------------|--|
| Location | <i>Giving location is mandatory, but while in this case it doesn't have any special meaning (0,0,0) is used.</i> |
| Axis | N/A |
| RefDirection | N/A |

IfcVertexPoint

| Attribute | Implementation agreements |
|----------------|--|
| VertexGeometry | Must be IfcCartesianPoint. If the eccentricity point is the end node of the member, then the instance of the IfcVertexPoint, which is used by the member must be used. |

Additional information

P21 example

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IFC Release Specific Concept Description (IFC2x3)

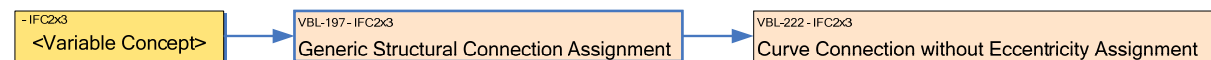
Curve Connection without Eccentricity Assignment

| | | | | | |
|-----------------------|---|----------------|---|---------------|----------|
| Reference | VBL-222 | Version | 3 | Status | Proposal |
| Relationships | Implements general concept 'Non Eccentric Curve Connection'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007, Condition coordinate system added 17.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

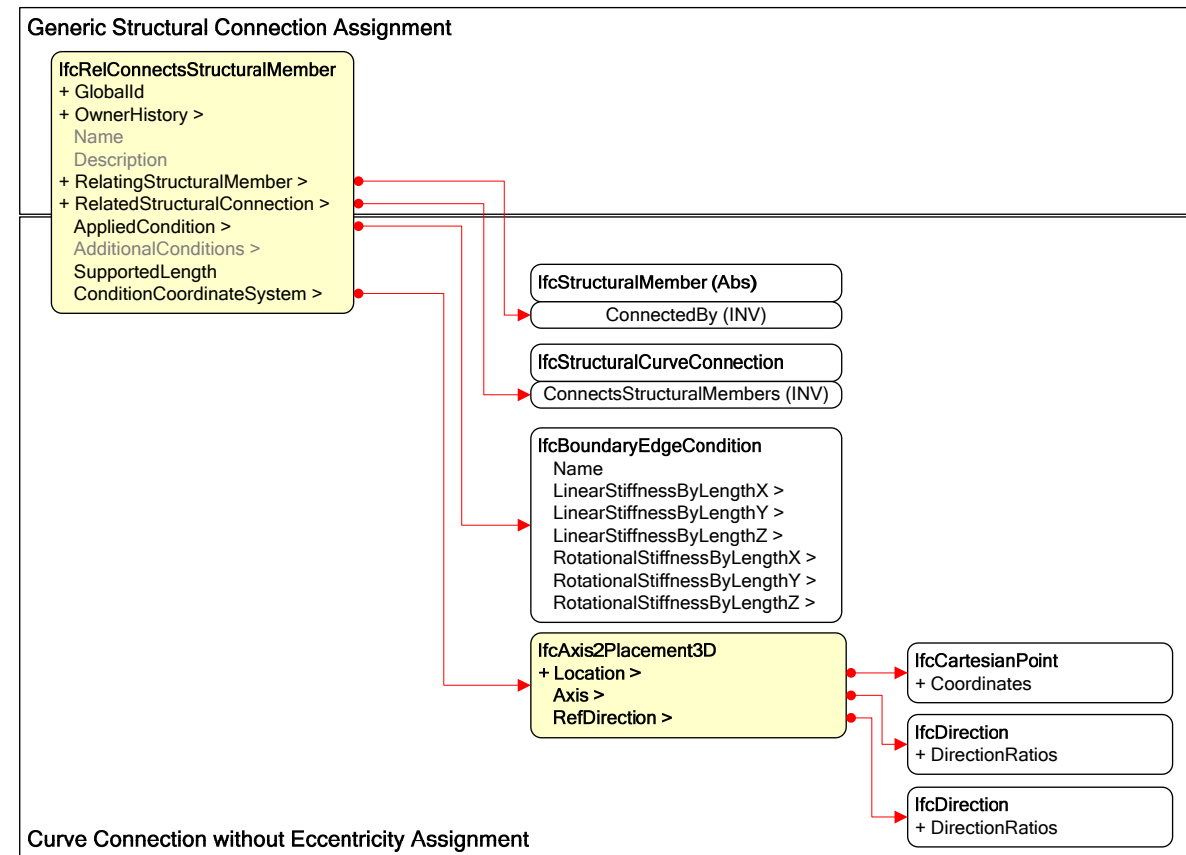
General

In the IfcBoundaryCondition value (-1.) represents an infinitive large value – or a fixed connectivity with infinitive stiffness, value zero (0.) represents no stiffness or a free connectivity, value NIL (\$) represents an unknown connectivity condition, any other value represents a finitive stiffness or spring connectivity in that direction or rotation.

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelConnectsStructuralMember

| Attribute | Implementation agreements |
|-----------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingStructuralMember | N/A |
| RelatedStructuralConnection | Must be IfcStructuralCurveConnection |
| AppliedCondition | Must be IfcBoundaryEdgeCondition. |
| AdditionalConditions | Not used. |
| SupportedLength | Only given if the support has actual width. Otherwise '\$' is used. Given in the units defined in the IfcProject's UnitsInContext. |
| ConditionCoordinateSystem | Not used. |

IfcAxis2Placement3D

| Attribute | Implementation agreements |
|--------------|--|
| Location | <i>Giving location is mandatory, but while in this case it doesn't have any special meaning (0,0,0) is used.</i> |
| Axis | N/A |
| RefDirection | N/A |

Additional information

P21 example

```
#1932=IFCRELCONNECTSSTRUCTURALMEMBER('3Un2VvhJL1rdAhx8AzIFo',#2,$,$,#27,#1477,#84,$,$,#300);  
  
#27=IFCSTRUCTURALSURFACEMEMBER('0AbYY4X996QLF7zcCd1MFX',#2,'Example surface member',$,$,#1592,#1623,.BENDING_ELEMENT.,200.0);  
#1477=IFCSTRUCTURALCURVECONNECTION('2$8aT4gQrDOL6W1ZENGRST',#2,'Example curve connection',$,$,#1740,#1741,$);  
#84=IFCBOUNDARYEDGECONDITION($,-1.0,-1.0,-1.0,-1.0,-1.0,-1.0);  
#297= IFCCARTESIANPOINT((0.,0.,0.));  
#298= IFCDIRECTION((0.,0.,1.));  
#299= IFCDIRECTION((1.,0.,0.));  
#300= IFCAxis2PLACEMENT3D(#297,#298,#299);
```

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IFC Release Specific Concept Description (IFC2x3)

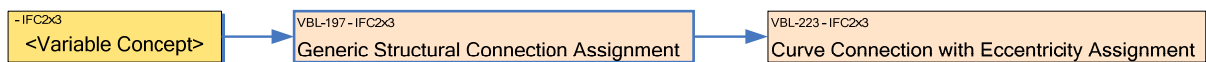
Curve Connection with Eccentricity Assignment

| | | | | | |
|-----------------------|---|----------------|---|---------------|----------|
| Reference | VBL-223 | Version | 3 | Status | Proposal |
| Relationships | Implements general concept 'Non Eccentric Curve Connection'. | | | | |
| History | Created 23.10.2006, Documentation improved 28.9.2007, Condition coordinate system added 17.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

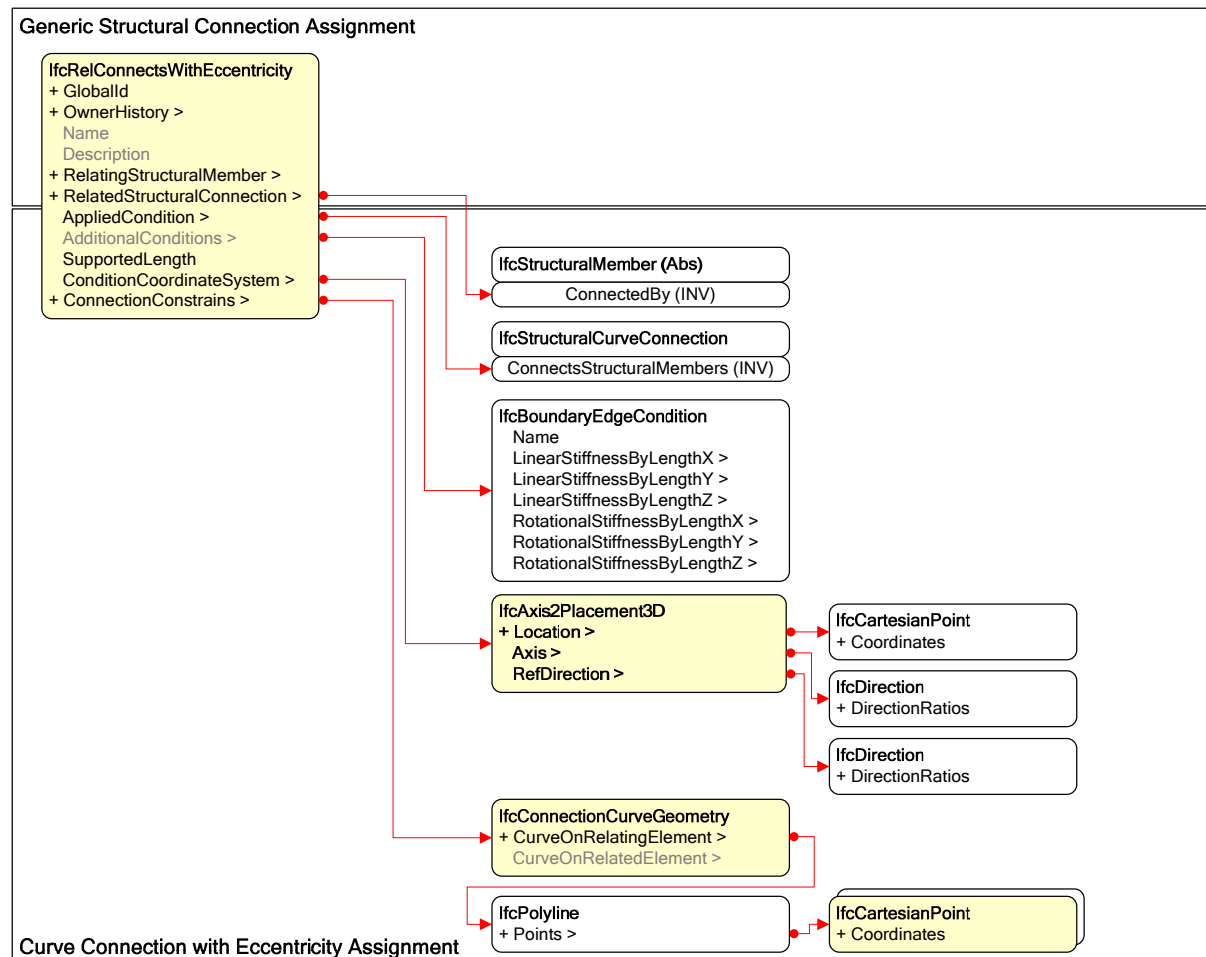
General

In the IfcBoundaryCondition value (-1.) represents an infinitive large value – or a fixed connectivity with infinitive stiffness, value zero (0.) represents no stiffness or a free connectivity, value NIL (\$) represents an unknown connectivity condition, any other value represents a finitive stiffness or spring connectivity in that direction or rotation.

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelConnectsWithEccentricity

| Attribute | Implementation agreements |
|-----------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingStructuralMember | N/A |
| RelatedStructuralConnection | Must be IfcStructuralCurveConnection. |
| AppliedCondition | Must be IfcBoundaryEdgeCondition. |
| AdditionalConditions | Not used. |
| SupportedLength | Only given if the support has actual width. Otherwise '\$' is used. Given in the units defined in the IfcProject's UnitsInContext. |
| ConditionCoordinateSystem | Not used. |
| ConnectionConstraint | Must be IfcConnectionCurveGeometry. |

IfcAxis2Placement3D

| Attribute | Implementation agreements |
|--------------|--|
| Location | <i>Giving location is mandatory, but while in this case it doesn't have any special meaning (0,0,0) is used.</i> |
| Axis | N/A |
| RefDirection | N/A |

IfcConnectionCurveGeometry

| Attribute | Implementation agreements |
|------------------------|---------------------------|
| CurveOnRelatingElement | Must be IfcPolyline. |
| CurveOnRelatedElement | Not used. |

IfcCartesianPoint

| Attribute | Implementation agreements |
|-------------|-----------------------------|
| Coordinates | Must have three dimensions. |
| Dim | N/A |

Additional information

P21 example

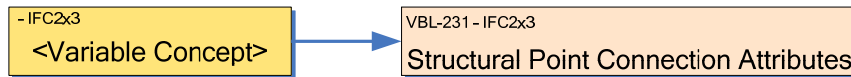
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IFC Release Specific Concept Description (IFC2x3)

Structural Point Connection Attributes

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VL-231 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 25.3.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



General

The concept groups the IfcStructuralPointConnection attributes defined inside the entity.

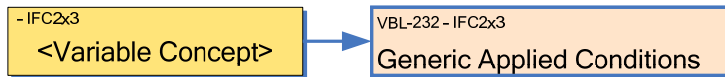
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IFC Release Specific Concept Description (IFC2x3)

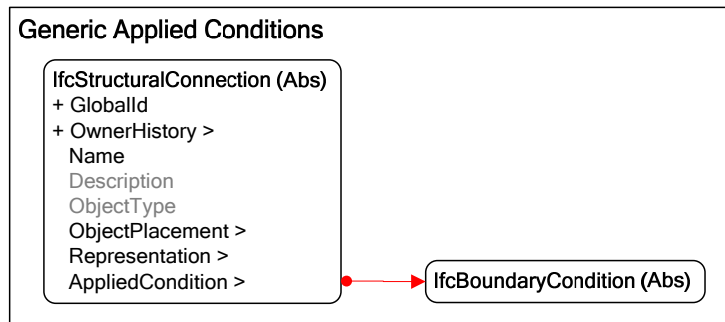
Generic Applied Conditions

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VL-232 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 23.10.2006 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

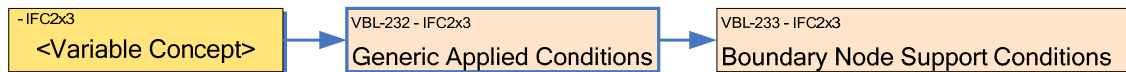
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IFC Release Specific Concept Description (IFC2x3)

Boundary Point Support Conditions

| | | | | | |
|-----------------------|---|----------------|---|---------------|----------|
| Reference | VBL-233 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Structural Point Support Conditions'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Applied Conditions

IfcStructuralPointConnection
 + GlobalId
 + OwnerHistory >
 Name
 Description
 ObjectType
 ObjectPlacement >
 Representation >
 AppliedCondition >

IfcBoundaryNodeCondition
 Name
 LinearStiffnessX
 LinearStiffnessY
 LinearStiffnessZ
 RotationalStiffnessX
 RotationalStiffnessY
 RotationalStiffnessZ

Boundary Node Support Conditions

Implementation agreements

IfcStructuralPointConnection

| Attribute | Implementation agreements |
|------------------|---|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedCondition | Must be IfcBoundaryNodeCondition. Used for defining the conditions of node supports. The connection conditions are defined in relation entities of the connections. |

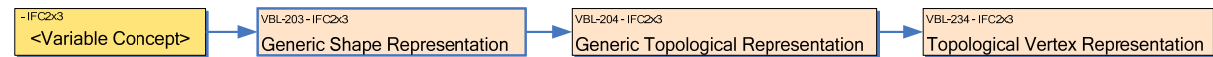
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IFC Release Specific Concept Description (IFC2x3)

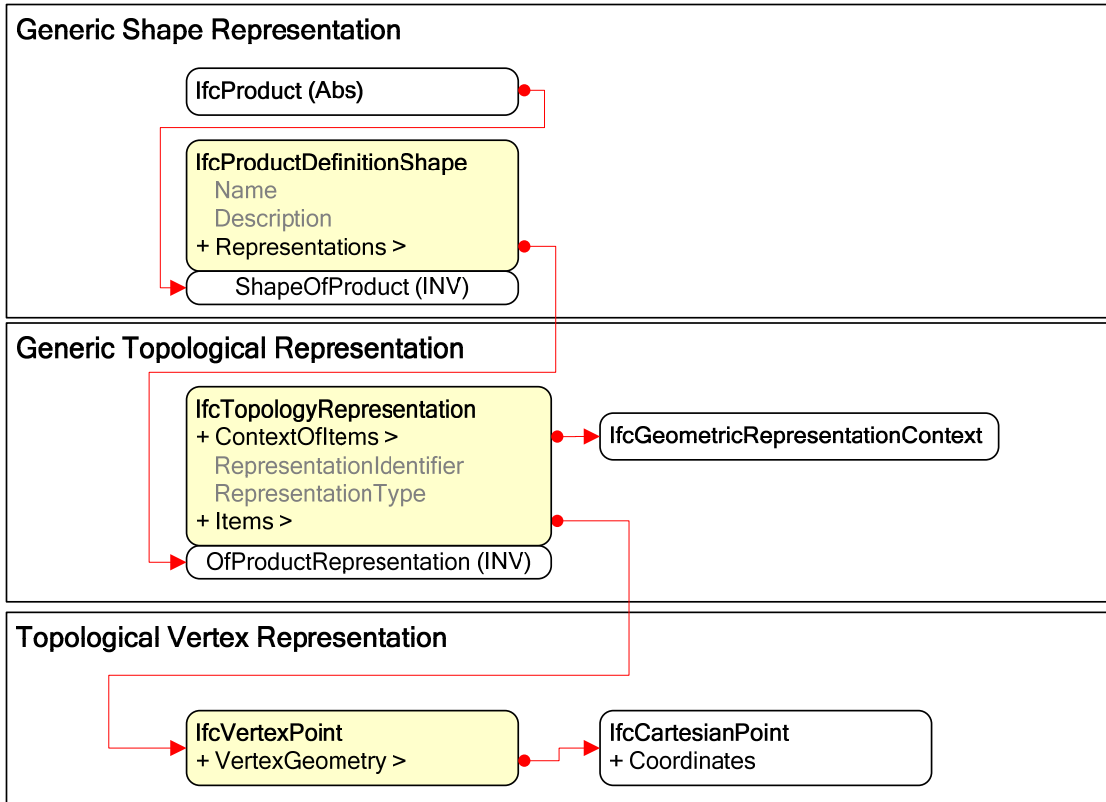
Topological Vertex Representation

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-234 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Vertex Representation'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcProductDefinitionShape

| Attribute | Implementation agreements |
|-----------------|--|
| Name | Reserved. |
| Description | Reserved. |
| Representations | Must be one IfcTopologyRepresentation. |

IfcTopologyRepresentation

| Attribute | Implementation agreements |
|--------------------------|----------------------------|
| ContextOfItems | N/A |
| RepresentationIdentifier | Not used. |
| RepresentationType | Must be 'Vertex' |
| Items | Must be one IfcVertexPoint |

IfcCartesianPoint

| Attribute | Implementation agreements |
|-------------|---------------------------|
| Coordinates | Must be three dimensions. |

Dim N/A

Additional information

P21 example

```
#1477=IFCSTRUCTURALPOINTCONNECTION('2$8aT4gQrDOL6wIzENGRST',#2,'Example connection',$,$,#1740,#1741,$);
```

```
#1727=IFCCARTESIANPOINT((7100.0,-1115.0,0.0));  
#1738=IFCVERTEXPOINT(#1727);  
#1931=IFCTOPOLOGYREPRESENTATION(#77,$,'Vertex',(#1738));  
#1741=IFCPRODUCTDEFINITIONSHAPE($,$,(#1931));
```

```
#43=IFCDIRECTION((0.0,0.0,1.0));  
#1725=IFCDIRECTION((0.0,-1.0,0.0));  
#1724=IFCAXIS2PLACEMENT3D($,#43,#1725);  
#1740=IFCLOCALPLACEMENT($,#1724);
```

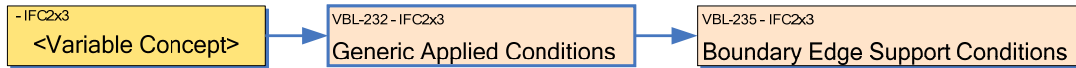
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IFC Release Specific Concept Description (IFC2x3)

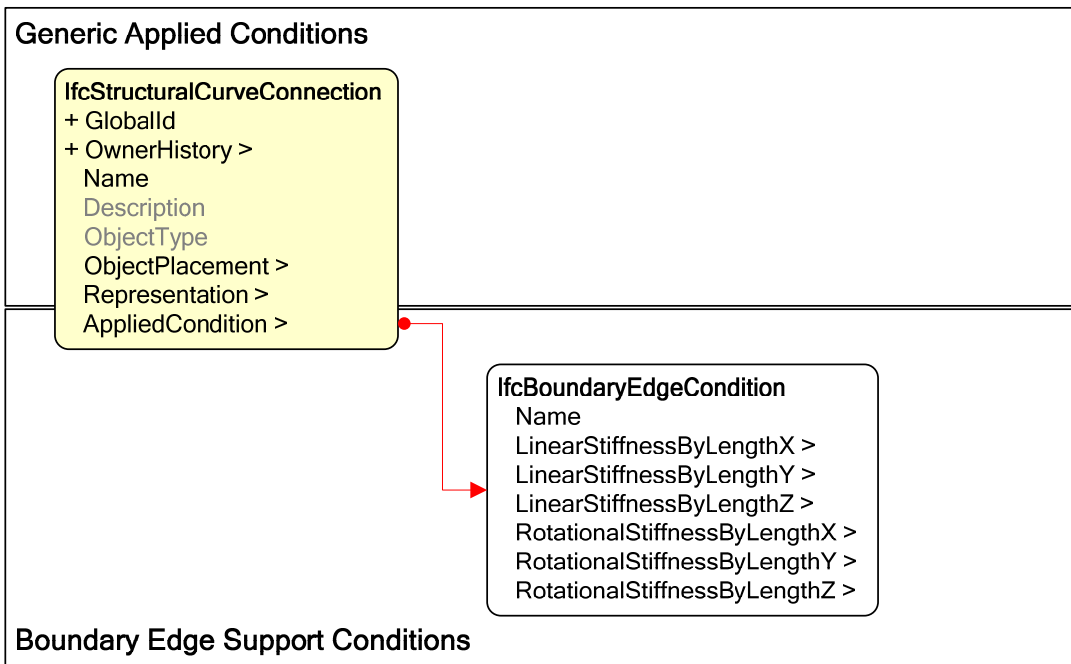
Boundary Edge Support Conditions

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-235 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Structural Edge Support Conditions'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralCurveConnection

| Attribute | Implementation agreements |
|------------------|---|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedCondition | Must be IfcBoundaryEdgeCondition. Used for defining the conditions of edge supports. The connection conditions are defined in relation entities of the connections. |

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| IFC Release Specific Concept Description (IFC2x3) | | | | | |
|---|--|---------|---|--------|----------|
| Structural Curve Connection Attributes | | | | | |
| Reference | VL-236 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 25.3.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram

- IFC2x3
<Variable Concept>

→

VL-236 - IFC2x3
Structural Curve Connection Attributes

General

The concept groups the IfcStructuralCurveConnection attributes defined inside the entity.

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IFC Release Specific Concept Description (IFC2x3)

Generic Associations

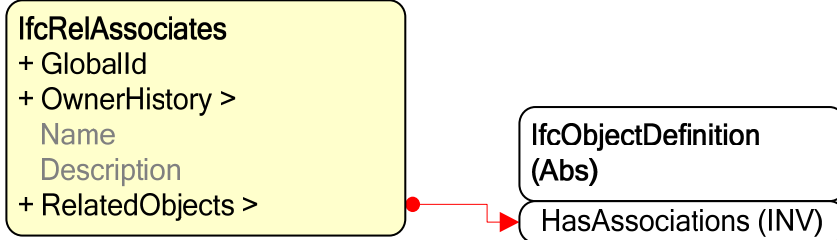
| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-258 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Associations



Implementation agreements

IfcRelAssociates

| Attribute | Implementation agreements |
|----------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |

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IFC Release Specific Concept Description (IFC2x3)

Material Name

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-265 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Material Name'. | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Associations

IfcRelAssociatesMaterial

+ GlobalId
+ OwnerHistory >
Name
Description
+ RelatedObjects >
+ RelatingMaterial >

IfcObjectDefinition (Abs)

HasAssociations (INV)

Generic Material Associations

Material Name

IfcMaterial
+ Name

Implementation agreements

IfcRelAssociatesMaterial

| Attribute | Implementation agreements |
|------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatingMaterial | Must be IfcMaterial. |

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IFC Release Specific Concept Description (IFC2x3)

Generic Assignments

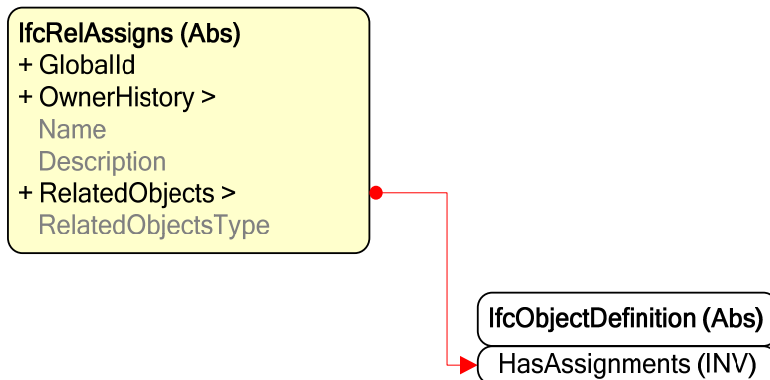
| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-268 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Assignments



Implementation agreements

IfcRelAssigns

| Attribute | Implementation agreements |
|--------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatedObjectsType | N/A |

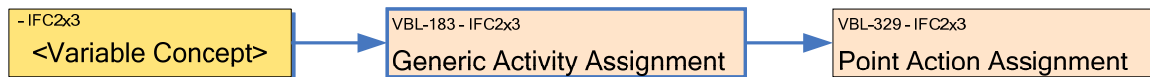
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IFC Release Specific Concept Description (IFC2x3)

Point Action Assignment

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-329 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Point Action Assignment'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Activity Assignment

IfcRelConnectsStructuralActivity
 + GlobalId
 + OwnerHistory >
 Name
 Description
 + RelatingElement >
 + RelatedStructuralActivity >

IfcStructuralActivityAssignmentSelect
 AssignedToStructuralActivity (INV)

Point Action Assignment

IfcStructuralPointAction
 AssignedToStructuralItem (INV)

Implementation agreements

IfcRelConnectsStructuralActivity

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingElement | N/A |
| RelatedStructuralActivity | Must be IfcStructuralPointAction. |

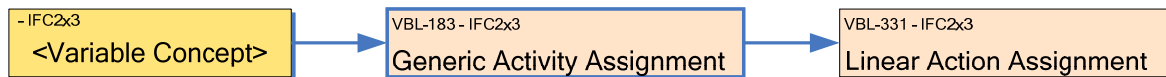
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IFC Release Specific Concept Description (IFC2x3)

Linear Action Assignment

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-331 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Linear Action Assignment'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Activity Assignment

IfcRelConnectsStructuralActivity
+ GlobalId
+ OwnerHistory >
Name
Description
+ RelatingElement >
+ RelatedStructuralActivity >

IfcStructuralActivityAssignmentSelect
AssignedToStructuralActivity (INV)

Linear Action Assignment

IfcStructuralLinearAction
AssignedToStructuralItem (INV)

Implementation agreements

IfcRelConnectsStructuralActivity

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingElement | N/A |
| RelatedStructuralActivity | Must be IfcStructuralLinearAction. |

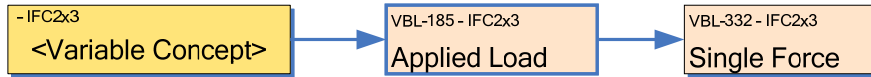
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IFC Release Specific Concept Description (IFC2x3)

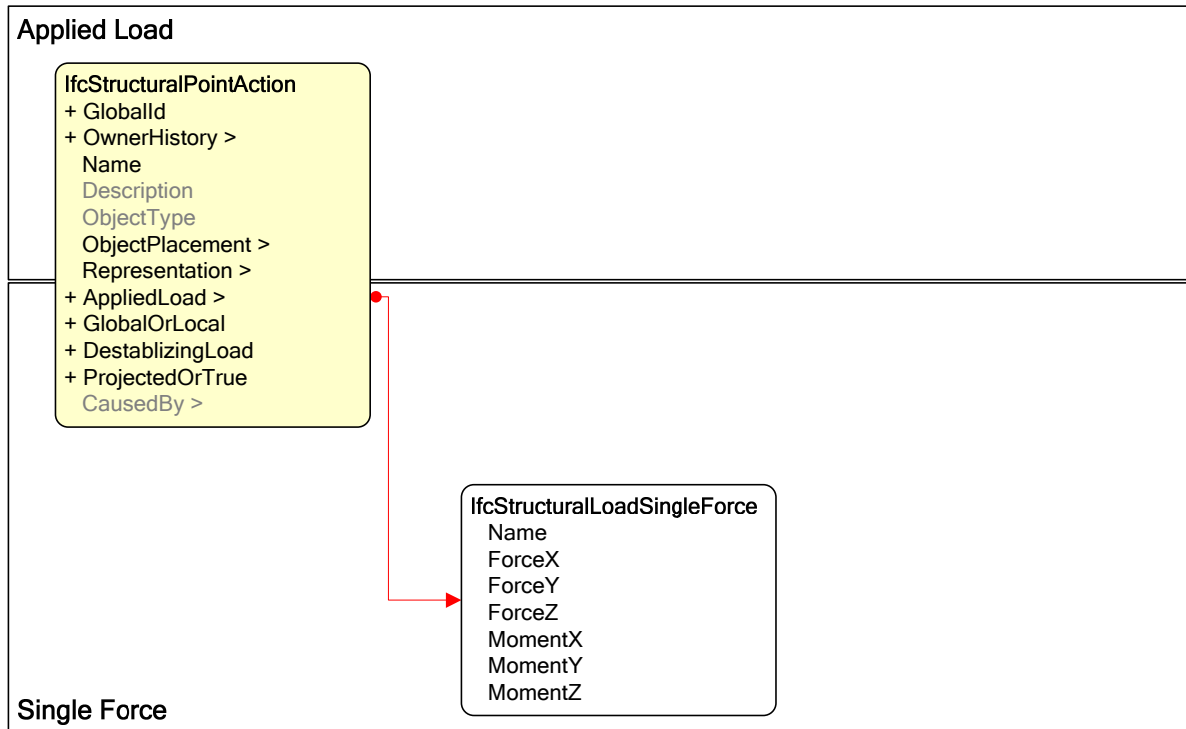
Single Force

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-332 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Single Force'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralPointAction

| Attribute | Implementation agreements |
|------------------|---------------------------------------|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedLoad | Must be IfcStructuralLoadSingleForce. |
| GlobalOrLocal | N/A |
| DestablizingLoad | N/A |
| CausedBy | N/A |

Additional information

P21 example

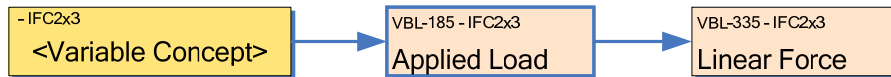
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IFC Release Specific Concept Description (IFC2x3)

Linear Force

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-335 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Linear Force'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Applied Load

IfcStructuralLinearAction
+ GlobalId
+ OwnerHistory >
Name
Description
ObjectType
ObjectPlacement >
Representation >
+ AppliedLoad >
+ GlobalOrLocal
+ DestablizingLoad
+ ProjectedOrTrue
CausedBy >

IfcStructuralLoadLinearForce
Name
LinearForceX
LinearForceY
LinearForceZ
LinearMomentX
LinearMomentY
LinearMomentZ

Linear Force

Implementation agreements

IfcStructuralLinearAction

| Attribute | Implementation agreements |
|------------------|---------------------------------------|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedLoad | Must be IfcStructuralLoadLinearForce. |
| GlobalOrLocal | N/A |
| DestablizingLoad | N/A |
| CausedBy | N/A |
| ProjectedOrTrue | N/A |

Additional information

P21 example

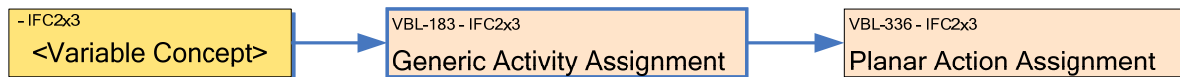
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IFC Release Specific Concept Description (IFC2x3)

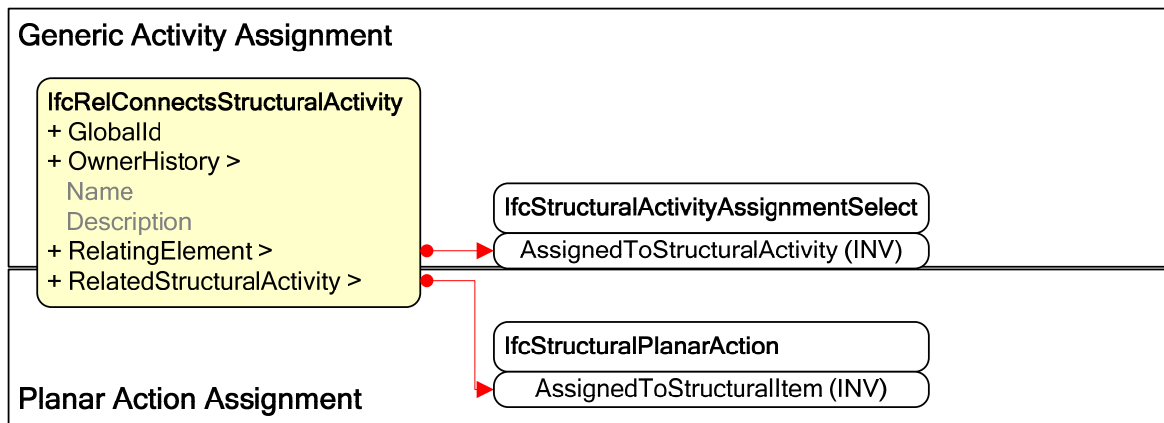
Planar Action Assignment

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-336 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Planar Action Assignment'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelConnectsStructuralActivity

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingElement | N/A |
| RelatedStructuralActivity | Must be IfcStructuralPlanarAction. |

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IFC Release Specific Concept Description (IFC2x3)

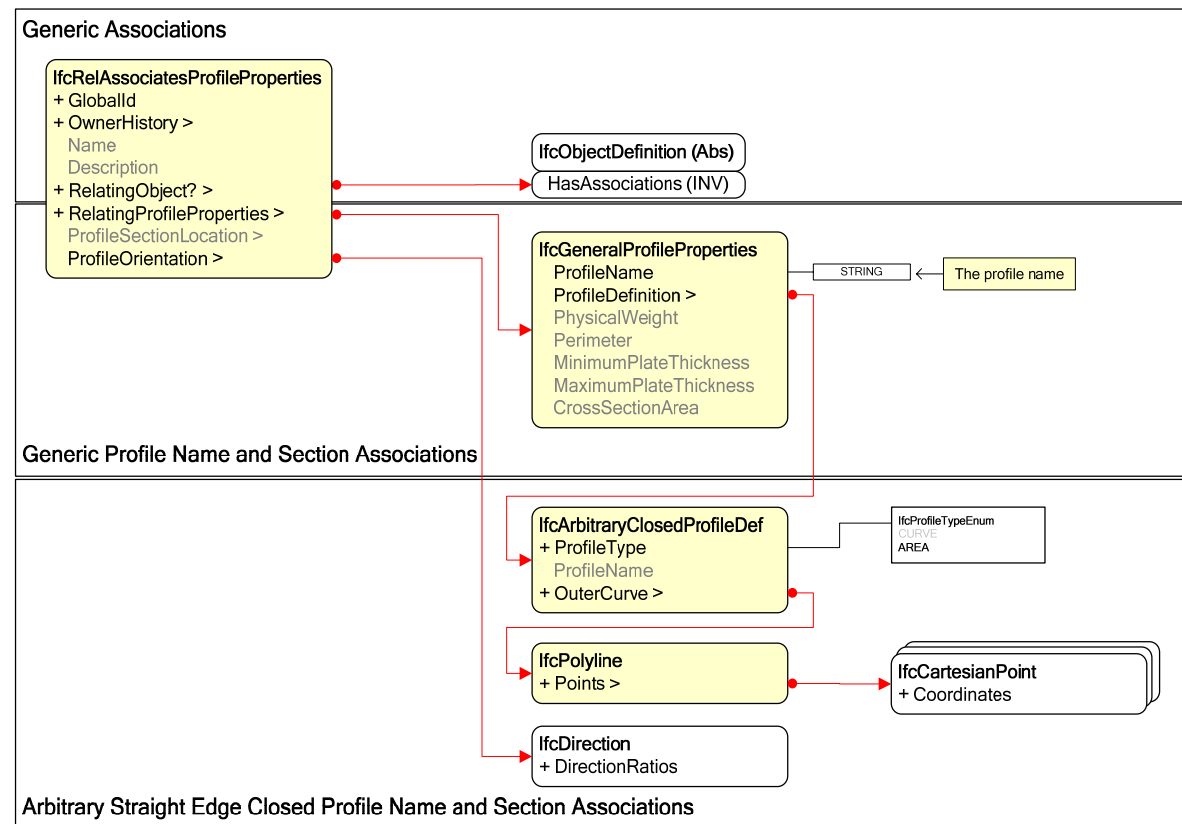
Arbitrary Straight Edge Closed Profile Name and Section Associations

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VLB-337 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelAssociatesProfileProperties

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatingProfileProperties | Must be IfcGeneralProfileProperties. |
| ProfileSectionLocation | Not used. |
| ProfileOrientation | For IfcStructuralCurveMember it is a rotation about the longitudinal axis of the underlying curve, the x axis is determined by a line from the start vertex to the end vertex. |
| | If the longitudinal axis is not parallel to the structural z axis of the structural |

coordinate system of the analysis model, i.e. the curve member is a beam (or non-vertical member), the ProfileOrientation defaults to [0.,0.,1.] (if the z axis is not orthogonal to the x axis, an adjustment is made to maintain orthogonality). The β angle is then measured from the structural z axis to determine the location of the structural z axis of the profile.

If the longitudinal axis is parallel to the structural z axis of the structural coordinate system of the analysis model, i.e. the curve member is a column, the ProfileOrientation defaults to [1.,0.,0.]. The β angle is then measured from the structural x axis to determine the location of the structural z axis of the profile. If the ProfileOrientation attribute is given as an IfcDirection, it would default to:
For 'beams' as [0., sin β , cos β]
For 'columns' as [cos β , -sin β , 0.]

IfcGeneralProfileProperties

| Attribute | Implementation agreements |
|-----------------------|---|
| ProfileName | The profile name associated to the structural member is entered here. |
| ProfileDefinition | Must be IfcArbitraryClosedProfileDef. |
| PhysicalWeight | Not used. |
| Perimeter | Not used. |
| MinimumPlateThickness | Not used. |
| MaximumPlateThickness | Not used. |
| CrossSectionArea | Not used. |

IfcArbitraryClosedProfileDef

| Attribute | Implementation agreements |
|-------------|---------------------------|
| ProfileType | Must be AREA. |
| ProfileName | Not used. |
| OuterCurve | Must be IfcPolyline. |

IfcPolyline

| Attribute | Implementation agreements |
|-----------|---|
| Dim | N/A |
| Points | The polyline must be closed. The given first and the last point must be the same. Coordinated must have three dimensions. |

Additional information

P21 example

```
#246= IFCSTRUCTURALCURVEMEMBER('2IIEkk$zf4khCF1qWGDGVP', #28, '1', $, $, #257, #274, .NOTDEFINED.);
#255= IFCCARTESIANPOINT((6., 0., -2.2737368E-15));
#257= IFCLLOCALPLACEMENT($, #263);
#259= IFCDIRECTION((0., -1., 0.));
#261= IFCDIRECTION((1., 0., 0.));
#263= IFCAxis2PLACEMENT3D(#255, #259, #261);
#264= IFCCARTESIANPOINT((6., 0., -2.2737368E-15));
#266= IFCVERTEXPOINT(#264);
#267= IFCCARTESIANPOINT((10., 0., -2.2737368E-15));
#269= IFCVERTEXPOINT(#267);
#369= IFCDIRECTION((0., 0., 1.));
#373= IFCCARTESIANPOINT((8., 0., 0.));
#377= IFCAxis2PLACEMENT3D(#373, #369, $);
#380= IFCCIRCLE(#377, 2.);
#383= IFCTRIMMEDCURVE(#380, (#266, $), (#269, $), .F., $);
#270= IFCEGECURVE(#266, #269, #383, .T.);
#271= IFCTOPOLOGYREPRESENTATION(#43, $, 'Edge', (#270));
#274= IFCPRODUCTDEFINITIONSHAPE($, $, (#271));

#116= IFCCARTESIANPOINT((-0.2, -0.2));
#117= IFCCARTESIANPOINT((0.2, -0.2));
#118= IFCCARTESIANPOINT((0.2, 0.2));
#119= IFCCARTESIANPOINT((-0.2, 0.2));
#120= IFCPOLYLINE((#116, #117, #118, #119, #116));
#121= IFCARBITRARYCLOSEDPROFILEDEF(.AREA., $, #120);
#122= IFCGENERALPROFILEPROPERTIES('HEA300', #121, $, $, $, $);
#288= IFCRELASSOCIATESPROFILEPROPERTIES('2h1ejvQrbc2uzDRESGxMY', #28, $I$, (#246), #122, $);
```

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IFC Release Specific Concept Description (IFC2x3)

Arbitrary Curved Edge Closed Profile Name and Section Associations

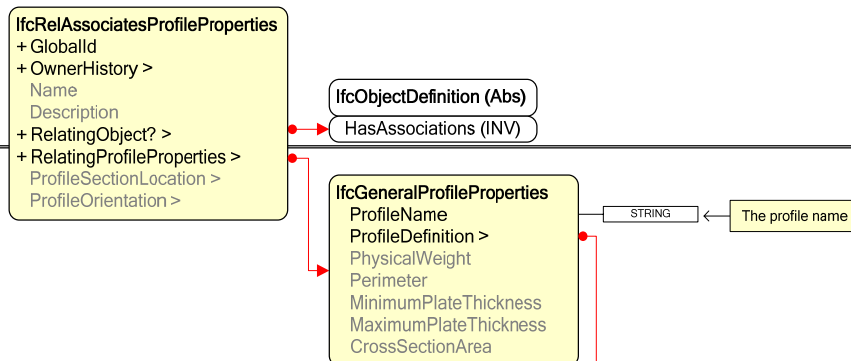
| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VLB-338 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram

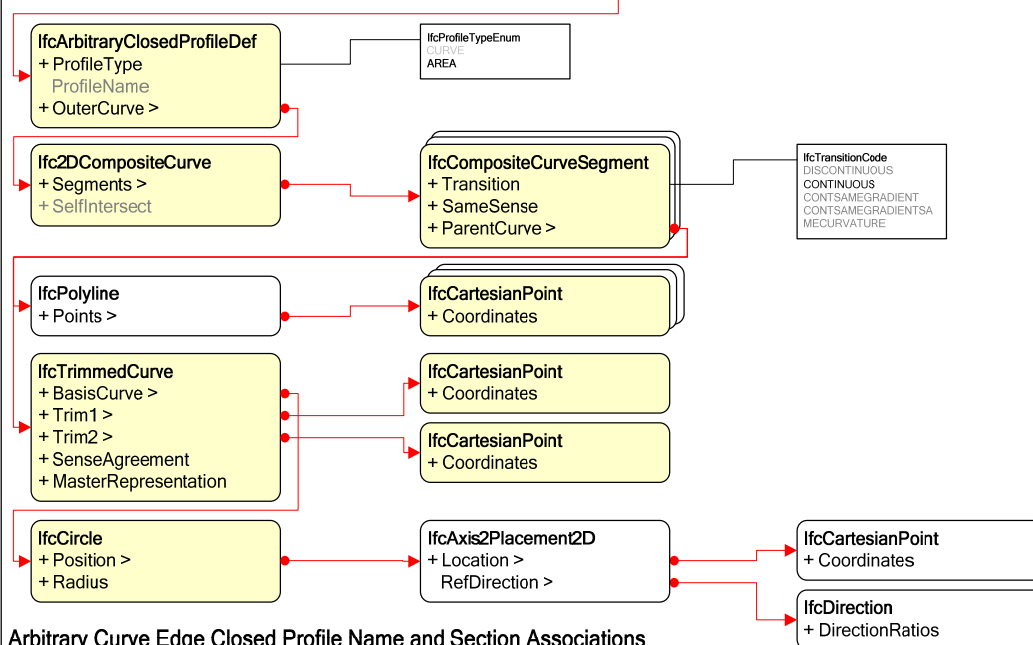


Instantiation diagram

Generic Associations



Generic Profile Name and Section Associations



Arbitrary Curve Edge Closed Profile Name and Section Associations

Implementation agreements

IfcRelAssociatesProfileProperties

| Attribute | Implementation agreements |
|--------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |

| Description | Reserved. |
|------------------------------|---|
| RelatedObjects | N/A |
| RelatingProfileProperties | Must be IfcGeneralProfileProperties. |
| ProfileSectionLocation | Not used. |
| ProfileOrientation | Not used. |
| IfcGeneralProfileProperties | |
| Attribute | Implementation agreements |
| ProfileName | The profile name associated to the structural member is entered here. |
| ProfileDefinition | Must be IfcArbitraryClosedProfileDef. |
| PhysicalWeight | Not used. |
| Perimeter | Not used. |
| MinimumPlateThickness | Not used. |
| MaximumPlateThickness | Not used. |
| CrossSectionArea | Not used. |
| IfcArbitraryClosedProfileDef | |
| Attribute | Implementation agreements |
| ProfileType | Must be AREA. |
| ProfileName | Not used. |
| OuterCurve | Must be Ifc2DCompositeCurve. |
| Ifc2DCompositeCurve | |
| Attribute | Implementation agreements |
| Dim | N/A |
| Segments | N/A |
| SelfIntersect | Not used. |
| NSegments | N/A |
| ClosedCurve | N/A |
| IfcCompositeCurveSegment | |
| Attribute | Implementation agreements |
| Transition | Must be CONTINUOUS. |
| SameSense | N/A |
| ParentCurve | Must be IfcPolyline or/and IfcTrimmedCurve. |
| Dim | N/A |
| IfcTrimmedCurve | |
| Attribute | Implementation agreements |
| Dim | N/A |
| BasisCurve | Must be IfcCircle. |
| Trim1 | Must be IfcCartesianPoint. |
| Trim2 | Must be IfcCartesianPoint. |
| SenseAgreement | N/A |
| MasterRepresentation | N/A |
| IfcCircle | |
| Attribute | Implementation agreements |
| Dim | N/A |
| Position | Must be IfcAxis2Placement2D |
| Radius | N/A |
| IfcCartesianPoint | |
| Attribute | Implementation agreements |
| Coordinates | Must be two dimensions. |
| Dim | N/A |

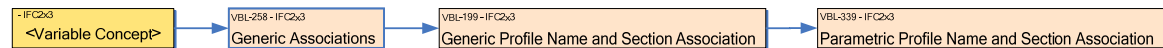
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IFC Release Specific Concept Description (IFC2x3)

Parametric Profile Name and Section Associations

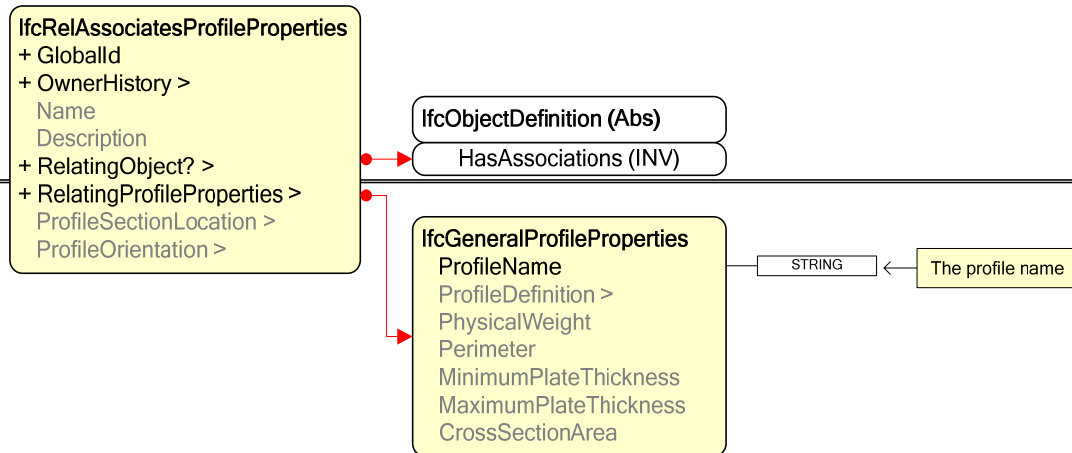
| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VL-339 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Generic Associations



Parametric Profile Name and Section Associations

Implementation agreements

IfcRelAssociatesProfileProperties

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatingProfileProperties | Must be IfcGeneralProfileProperties. |
| ProfileSectionLocation | Not used. |
| ProfileOrientation | Not used. |

IfcGeneralProfileProperties

| Attribute | Implementation agreements |
|-----------------------|---|
| ProfileName | The profile name associated to the structural member is entered here. |
| ProfileDefinition | Not used. The profile library values of the profile of the importing application will be used. The profile is recognized by its profile name. |
| PhysicalWeight | Not used. |
| Perimeter | Not used. |
| MinimumPlateThickness | Not used. |
| MaximumPlateThickness | Not used. |
| CrossSectionArea | Not used. |

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IFC Release Specific Concept Description (IFC2x3)

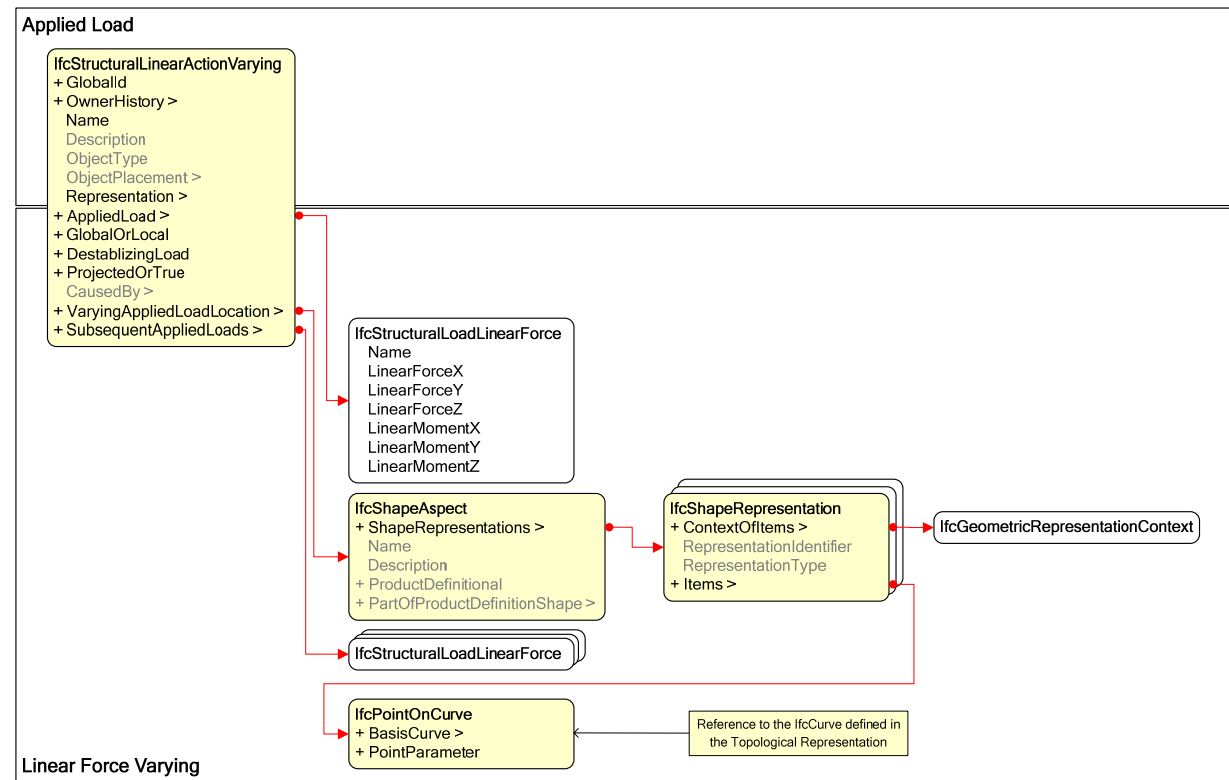
Linear Force Varying

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-340 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept 'Linear Force Varying'. | | | | |
| History | Created 23.10.2006, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralLinearActionVarying

| Attribute | Implementation agreements |
|-------------------|---------------------------------------|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| ObjectPlacement | N/A |
| Representation | N/A |
| AppliedLoad | Must be IfcStructuralLoadLinearForce. |
| GlobalOrLocal | N/A |
| DestabilizingLoad | N/A |
| CausedBy | N/A |
| ProjectedOrTrue | N/A |

| VaryingAppliedLoadLocation | N/A |
|------------------------------|--|
| SubsequentAppliedLoads | Must be IfcStructuralLoadLinearForce. |
| VaryingAppliedLoads | N/A |
| IfcShapeAspect | |
| Attribute | Implementation agreements |
| ShapeRepresentations | Must be IfcShapeRepresentation |
| Name | Not used. |
| Description | Not used. |
| ProductDefinitional | Not used. |
| PartOfProductDefinitionShape | Not used. |
| IfcShapeRepresentation | |
| Attribute | Implementation agreements |
| ContextOfItems | N/A |
| RepresentationIdentifier | Not used. |
| RepresentationType | Not used. |
| Items | Must be one IfcPointOnCurve. |
| IfcPointOnCurve | |
| Attribute | Implementation agreements |
| BasisCurve | Reference to the IfcCurve defined in the topological representation of the action. |
| PointParameter | N/A |
| Dim | N/A |

Additional information

P21 example

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| IFC Release Specific Concept Description (IFC2x3) | | | | | |
|---|--|---------|---|--------|----------|
| Structural Point Action Attributes | | | | | |
| Reference | VBL-342 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 25.3.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram

- IFC2x3
<Variable Concept>

→

VBL-342 - IFC2x3
Structural Point Action Attributes

General

The concept groups the IfcStructuralPointAction attributes defined inside the entity.

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| IFC Release Specific Concept Description (IFC2x3) | | | | | |
|---|--|---------|-----|--------|----------|
| Structural Linear Action Attributes | | | | | |
| Reference | VBL-343 | Version | 1.0 | Status | Proposal |
| Relationships | | | | | |
| History | Created 25.3.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram

- IFC2x3
<Variable Concept>

→

VBL-343 - IFC2x3
Structural Linear Action Attributes

General

The concept groups the IfcStructuralLinearAction attributes defined inside the entity.

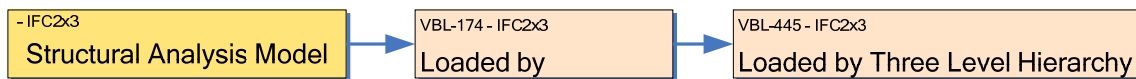
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IFC Release Specific Concept Description (IFC2x3)

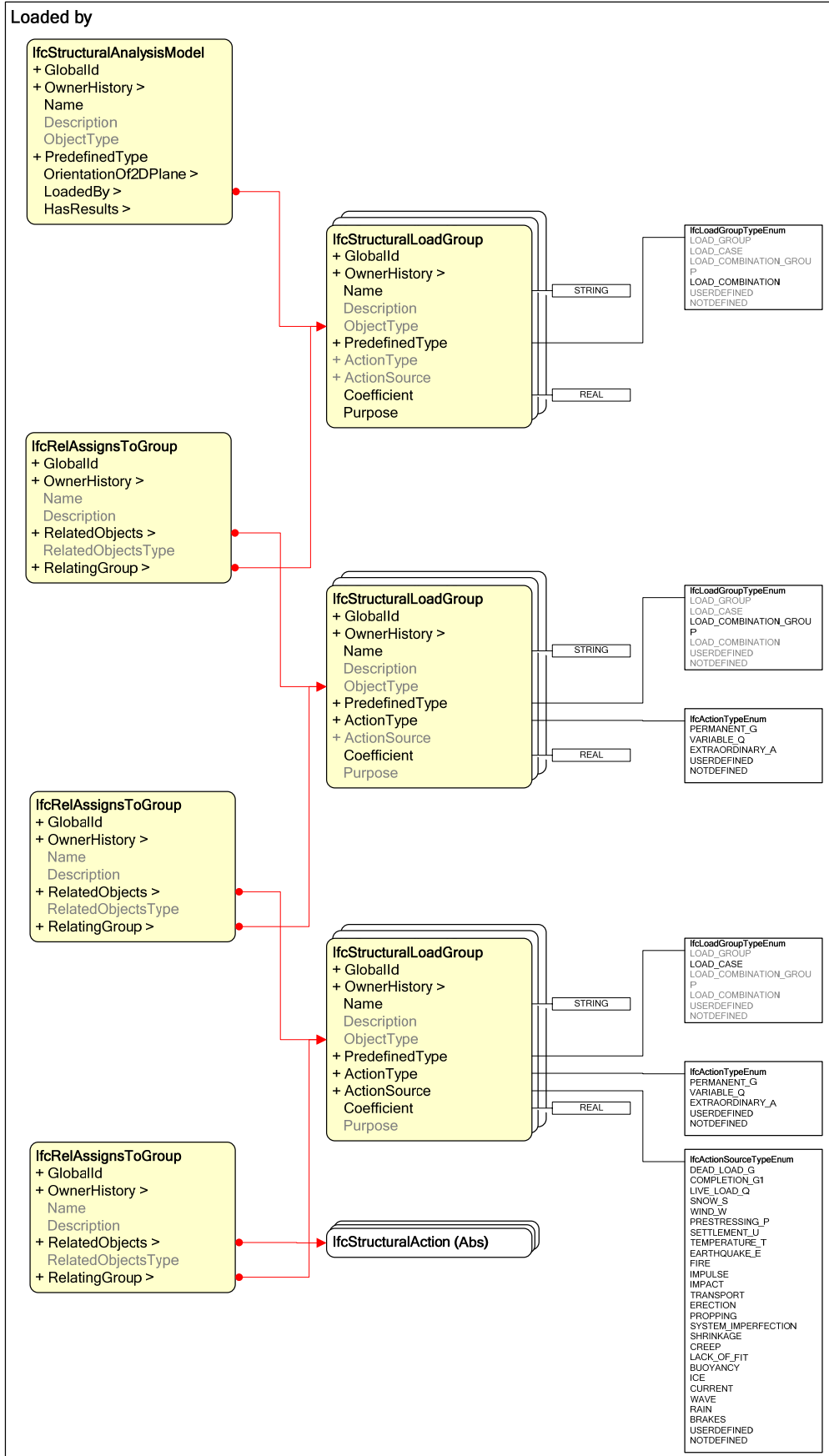
Loaded by Three Level Hierarchy

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-445 | Version | 3 | Status | Proposal |
| Relationships | Implements general concept VBL-116 "Structural Loaded by" | | | | |
| History | Created 23.10.2006, improved 27.9.2007, definition of the hierarchy improved 11.11.2007, Old Loaded by –concept is now this one 17.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcStructuralAnalysisModel

| Attribute | Implementation agreements |
|----------------------|---|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| PredefinedType | N/A |
| OrientationOf2DPlane | N/A |
| LoadedBy | <i>LoadedBy</i> . Must be list of IfcStructuralLoadGroups, which have LOAD_COMBINATION for PredefinedType |
| HasResults | N/A |

IfcStructuralLoadGroup

| Attribute | Implementation agreements |
|----------------|--|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| ObjectType | N/A |
| PredefinedType | Different values must be used in the different levels of the hierarchy. See the instantiation diagram above. |
| ActionType | Different values must be used in the different levels of the hierarchy. See the instantiation diagram above. |
| ActionSource | Different values must be used in the different levels of the hierarchy. See the instantiation diagram above. |
| Coefficient | N/A |
| Purpose | For 'load combination' the allowed values are: 'ULS', 'SLS', 'ALS'. 'ULS' is for Ultimate Loading System. 'SLS' is for Service Loading System. 'ALS' is for Accident Loading System. This only used for IfcStructuralLoadGroup, which has LOAD_COMBINATION for PredefinedType. |

IfcRelAssignsToGroup

| Attribute | Implementation agreements |
|--------------------|--|
| GlobalId | N/A |
| OwnerHistory | N/A |
| Name | N/A |
| Description | N/A |
| RelatedObjects | For instances which are related to IfcStructuralLoadGroups having LOAD_COMBINATION for PredefinedType, these must be IfcStructuralLoadGroups having LOAD_COMBINATION_GROUP as PredefinedType. For instances which are related to IfcStructuralLoadGroups having LOAD_COMBINATION_GROUP for PredefinedType, these must be IfcStructuralLoadGroups having LOAD_CASE as PredefinedType. For instances which are related to IfcStructuralLoadGroups having LOAD_CASE for PredefinedType, these must be IfcStructuralActions. |
| RelatedObjectsType | N/A |
| RelatingGroup | N/A |

Note that the whole hierarchy must always be implemented, when supporting this concept. If the exchanged load combination doesn't need all the levels of the hierarchy, then dummy levels has to be modeled.

Additional information

P21 example

```
#28=IFCSTRUCTURALANALYSISMODEL('2uRpA0c3HFLcw0F7ywxmPv', #2, $, $, $, .LOADING_3D., $, (#16, #8, #33), $);

#8=IFCSTRUCTURALLOADGROUP('3o8YgqQiTAnr_inVK7zuUk', #2, 'wind west', $, $, .LOAD_COMBINATION., .NOTDEFINED., .NOTDEFINED., $, 'ULS');
#5=IFCRELASSIGNSTOGROUP('0AuJ8TqP5074IBcmw_cony', #2, $, $, (#6, #7, #4), $, #8);
#4=IFCSTRUCTURALLOADGROUP('18BcrV7eT4570iFRtYfeDT', #2, 'west wind group', $, $, .LOAD_COMBINATION_GROUP., .PERMANENT_G., .NOTDEFINED., 1.0, $);
#6=IFCSTRUCTURALLOADGROUP('17j21LDEF56b1H56Y6YKot', #2, 'Dead group', $, $, .LOAD_COMBINATION_GROUP., .PERMANENT_G., .NOTDEFINED., 1.0, $);

#48=IFCSTRUCTURALLOADGROUP('0XQWfHCwb8$Mj40o8GIJen', #2, 'Live load', $, $, .LOAD_CASE., .VARIABLE_Q., .LIVE_LOAD_Q., 1.05, $);
#47=IFCRELASSIGNSTOGROUP('1NiOLPxp14RLAoEIV28uZc', #2, $, $, (#48), $, #7);
#1619=IFCLOCALPLACEMENT(#10, #80);
#1620=IFCSTRUCTURALLOADPLANARFORCE($, $, $, 2000.0);
#50=IFCSTRUCTURALPLANARACTION('2sz9$Tnfn0_MlwyqkZ3IH', #2, $, $, $, #1619, #1623, #1620, .LOCAL_COORDS., .F., .TRUE_LENGTH., $);
#49=IFCRELASSIGNSTOGROUP('1CvJJH7Of8w5Sm83GvYJua', #2, $, $, (#50), $, #48);
#52=IFCSTRUCTURALLOADGROUP('2WxGuYDQHAjt_CbfUVKc2M', #2, 'Dead load', $, $, .LOAD_CASE., .VARIABLE_Q., .DEAD_LOAD_G., 1.35, $);
#51=IFCRELASSIGNSTOGROUP('37N6Cd4BD7fSkC2sezRbCv', #2, $, $, (#52), $, #6);

#7=IFCSTRUCTURALLOADGROUP('0vEmI3geXBCrbBU17Pr3Q', #2, 'Live group', $, $, .LOAD_COMBINATION_GROUP., .PERMANENT_G., .NOTDEFINED., 1.0, $);
#1=IFCRELASSIGNSTOGROUP('1kQX$XACI3u7Ta3_Tpu6xp', #2, $, $, (#3), $, #4);
#3=IFCSTRUCTURALLOADGROUP('1eZWYewL9EfDqMZe4RIE1D', #2, 'west wind load', $, $, .LOAD_CASE., .VARIABLE_Q., .WIND_W., 1.05, $);
#9=IFCRELASSIGNSTOGROUP('08uWZebKL6xNaymvWATv$S', #2, $, $, (#10, #11), $, #3);
#10=IFCSTRUCTURALLINEARACTION('2u6Aq3yeJD94UEDv_Q34kp', #2, $, $, $, #1560, #1590, #1562, .LOCAL_COORDS., .F., .TRUE_LENGTH., $);
#1562=IFCSTRUCTURALLOADLINEARFORCE($, $, $, 1000.0, $, $);
#11=IFCSTRUCTURALLINEARACTION('3FsgEdybn8w5mb1oia5f0T', #2, $, $, $, #1563, #1585, #1565, .LOCAL_COORDS., .F., .TRUE_LENGTH., $);
#1565=IFCSTRUCTURALLOADLINEARFORCE($, $, $, 1000.0, $, $);

#16=IFCSTRUCTURALLOADGROUP('3bl076Iaj5ucfBVInJRGuC', #2, 'wind north', $, $, .LOAD_COMBINATION., .NOTDEFINED., .NOTDEFINED., $, 'ULS');
#15=IFCRELASSIGNSTOGROUP('2mwq0IyOzByaw9JwectemC', #2, $, $, (#6, #7, #14), $, #16);
#14=IFCSTRUCTURALLOADGROUP('3E0JRnLfB8NC7ozeMuQZ$g', #2, 'North wind group', $, $, .LOAD_COMBINATION_GROUP., .PERMANENT_G., .NOTDEFINED., 1.0, $);
#12=IFCRELASSIGNSTOGROUP('0q9qcwpOz3Y6VMFh16J0F8', #2, $, $, (#13), $, #14);
#13=IFCSTRUCTURALLOADGROUP('0G1jZxQe14osxsKXcrXbZR', #2, 'North wind load', $, $, .LOAD_CASE., .VARIABLE_Q., .WIND_W., 1.05, $);

#33=IFCSTRUCTURALLOADGROUP('14pc1HkCn1h6yy0OLp$hvW', #2, 'Snow', $, $, .LOAD_COMBINATION., .NOTDEFINED., .NOTDEFINED., $, 'ULS');
#32=IFCRELASSIGNSTOGROUP('3qs5ex1FHCEdtC_QzdtNXh', #2, $, $, (#6, #7, #31), $, #33);
#30=IFCSTRUCTURALLOADGROUP('0BwhsvBeLACT3kXI052tZe', #2, 'Snow load', $, $, .LOAD_CASE., .VARIABLE_Q., .SNOW_S., 1.0, $);
#31=IFCSTRUCTURALLOADGROUP('18eDeuJYH714uTbnVq1LJo', #2, 'Snow group', $, $, .LOAD_COMBINATION_GROUP., .PERMANENT_G., .NOTDEFINED., 1.0, $);
#29=IFCRELASSIGNSTOGROUP('0w7oUpDCZe74$K_2PwYma5', #2, $, $, (#30), $, #31);
```

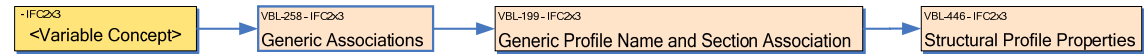
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IFC Release Specific Concept Description (IFC2x3)

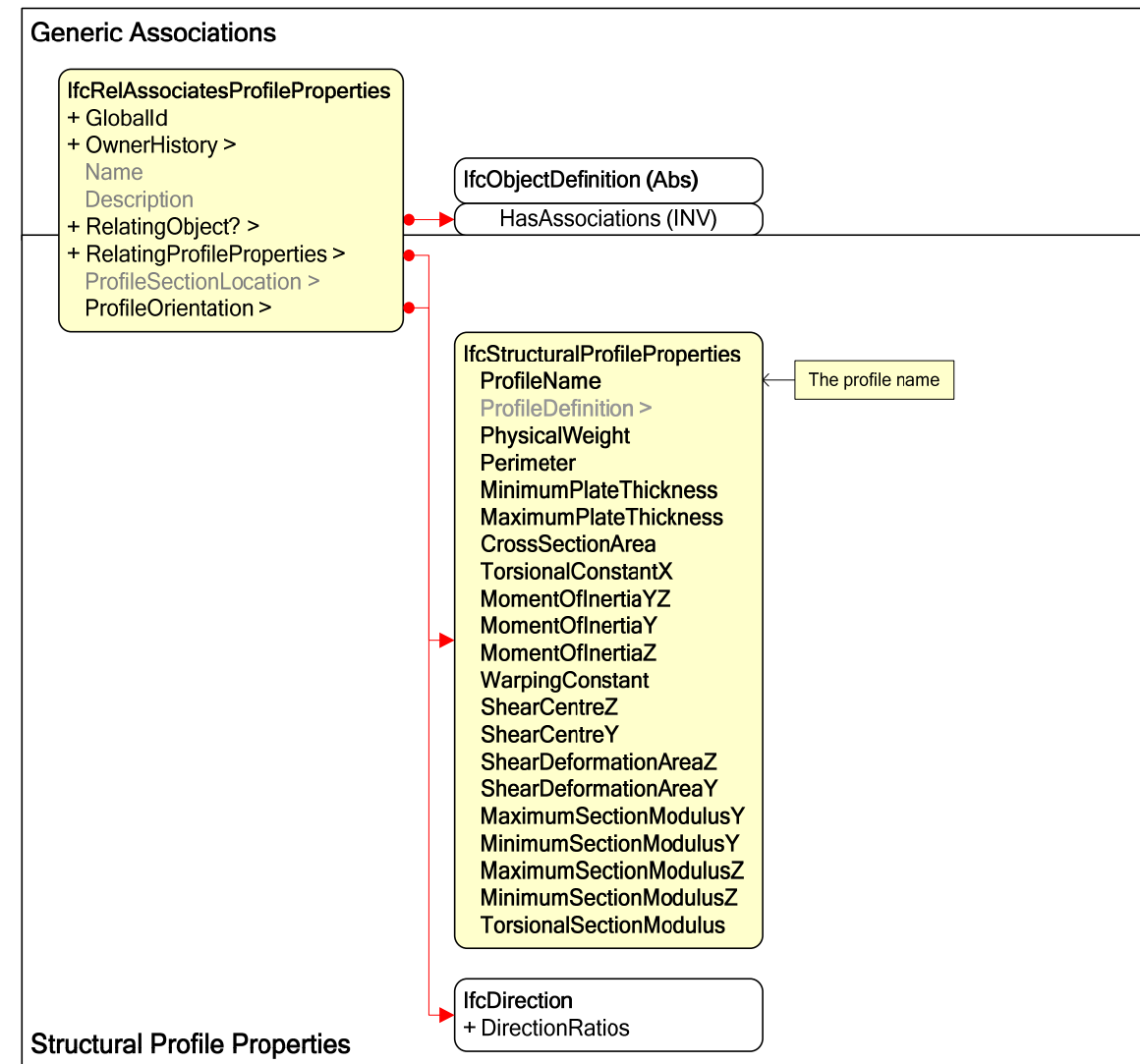
Structural Profile Properties

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VL-446 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 31.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelAssociatesProfileProperties

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatingProfileProperties | Must be IfcGeneralProfileProperties. |
| ProfileSectionLocation | Not used. |
| ProfileOrientation | Must be IfcDirection. |

IfcStructuralProfileProperties

| Attribute | Implementation agreements |
|-------------------------|---|
| ProfileName | The profile name associated to the structural member is entered here. |
| ProfileDefinition | Not used. The profile library of the importing application will be used. The profile is recognized and mapped to the library by its name. |
| PhysicalWeight | <Open> |
| Perimeter | <Open> |
| MinimumPlateThickness | <Open> |
| MaximumPlateThickness | <Open> |
| CrossSectionArea | <Open> |
| TorsionalConstantX | <Open> |
| MomentOfInertiaYZ | <Open> |
| MomentOfInertiaY | <Open> |
| MomentOfInertiaZ | <Open> |
| WarpingConstant | <Open> |
| ShearCentreZ | <Open> |
| ShearCentreY | <Open> |
| ShearDeformationAreaZ | <Open> |
| ShearDeformationAreaY | <Open> |
| MaximumSectionModulusY | <Open> |
| MinimumSectionModulusY | <Open> |
| MaximumSectionModulusZ | <Open> |
| MinimumSectionModulusZ | <Open> |
| TorsionalSectionModulus | <Open> |
| CentreOfGravityInX | <Open> |
| CentreOfGravityInY | <Open> |

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IFC Release Specific Concept Description (IFC2x3)

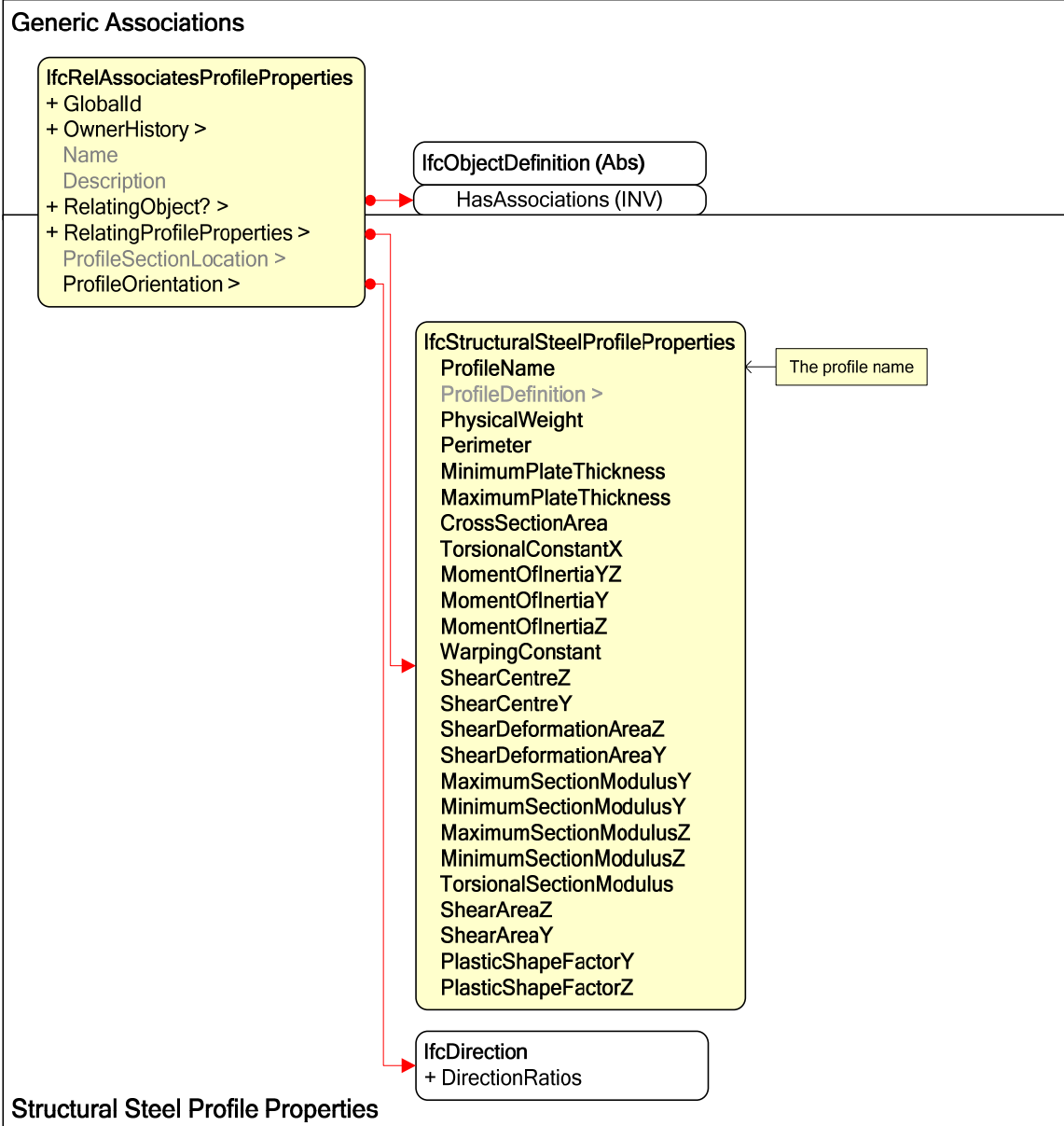
Structural Steel Profile Properties

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VL-447 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 31.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelAssociatesProfileProperties

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatingProfileProperties | Must be IfcGeneralProfileProperties. |
| ProfileSectionLocation | Not used. |
| ProfileOrientation | Must be IfcDirection. |

IfcStructuralSteelProfileProperties

| Attribute | Implementation agreements |
|-------------------------|---|
| ProfileName | The profile name associated to the structural member is entered here. |
| ProfileDefinition | Not used. The profile library of the importing application will be used. The profile is recognized and mapped to the library by its name. |
| PhysicalWeight | <Open> |
| Perimeter | <Open> |
| MinimumPlateThickness | <Open> |
| MaximumPlateThickness | <Open> |
| CrossSectionArea | <Open> |
| TorsionalConstantX | <Open> |
| MomentOfInertiaYZ | <Open> |
| MomentOfInertiaY | <Open> |
| MomentOfInertiaZ | <Open> |
| WarpingConstant | <Open> |
| ShearCentreZ | <Open> |
| ShearCentreY | <Open> |
| ShearDeformationAreaZ | <Open> |
| ShearDeformationAreaY | <Open> |
| MaximumSectionModulusY | <Open> |
| MinimumSectionModulusY | <Open> |
| MaximumSectionModulusZ | <Open> |
| MinimumSectionModulusZ | <Open> |
| TorsionalSectionModulus | <Open> |
| CentreOfGravityInX | <Open> |
| CentreOfGravityInY | <Open> |
| ShearAreaZ | <Open> |
| ShearAreaY | <Open> |
| PlasticShapeFactorY | <Open> |
| PlasticShapeFactorZ | <Open> |

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IFC Release Specific Concept Description (IFC2x3)

Mechanical Concrete Material Properties

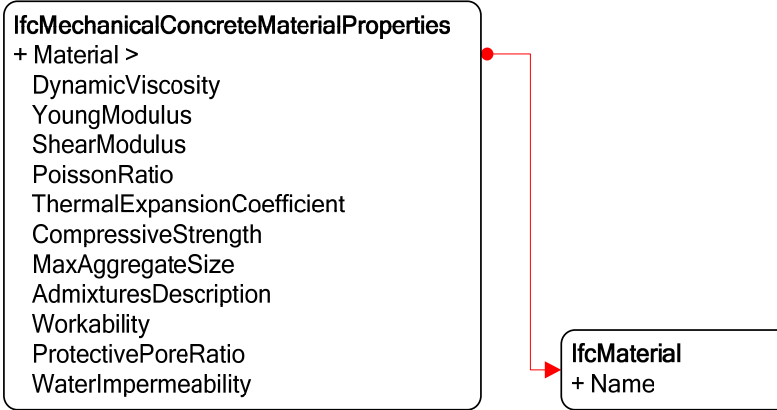
| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-448 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 31.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Mechanical Concrete Material Properties



Implementation agreements

|

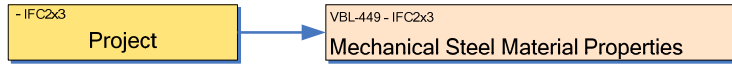
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IFC Release Specific Concept Description (IFC2x3)

Mechanical Steel Material Properties

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-449 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 31.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram

Mechanical Steel Material Properties

IfcMechanicalSteelMaterialProperties

+ Material >

DynamicViscosity

YoungModulus

ShearModulus

PoissonRatio

ThermalExpansionCoefficient

YieldStress

UltimateStress

UltimateStrain

HardeningModule

ProportionalStress

PlasticStrain

Relaxations >

IfcMaterial

+ Name

Implementation agreements

|

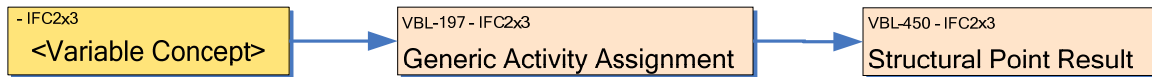
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IFC Release Specific Concept Description (IFC2x3)

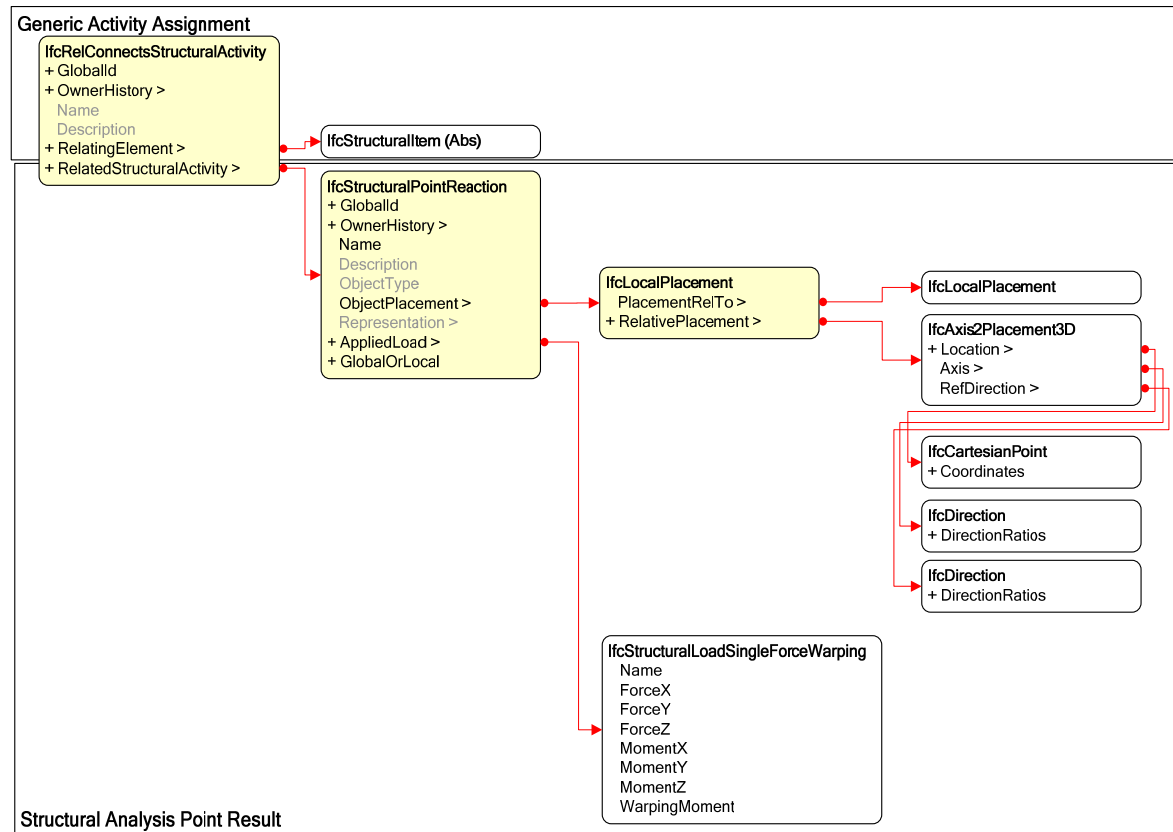
Structural Point Result

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-450 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 31.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelConnectsStructuralActivity

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | <i>Reserved.</i> |
| Description | <i>Reserved.</i> |
| RelatingElement | <i>Must be some of the IfcStructuralItem's subtypes.</i> |
| RelatedStructuralActivity | <i>Must be IfcStructuralPointReaction.</i> |

IfcStructuralPointReaction

| Attribute | Implementation agreements |
|-----------------|---|
| GlobalId | <Open> |
| OwnerHistory | <Open> |
| Name | 'MIN' if minimum values are presented. 'MAX' if maximum values are presented. 'END' if values for end or start points of the member are presented. 'INT' if values for intermediate points of the member are presented. Note that for MIN and MAX the different forces and moments are usually in the different points, so different instances of IfcReaction for them has to be created. |
| Description | <Open> |
| ObjectType | <Open> |
| ObjectPlacement | Must be IfcLocalPlacement. The point for the internal forces is presented in the local coordinate system of the StructuralItem. The point must be on the axis of the relative curve member or within the surface of the relative surface member. |
| Representation | <Open> |
| AppliedLoad | Must be IfcStructuralLoadSingleForceWarping. Note that not all the values must not be presented for all the instances. |
| GlobalOrLocal | <Open> |

IfcLocalPlacement

| Attribute | Implementation agreements |
|-------------------|--|
| PlacementRelTo | References to the IfcLocalPlacement of the relative Structural Item. |
| RelativePlacement | The point where the internal forces affect are given in the local coordinate system of the relative structural item. |

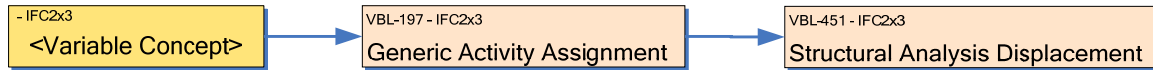
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IFC Release Specific Concept Description (IFC2x3)

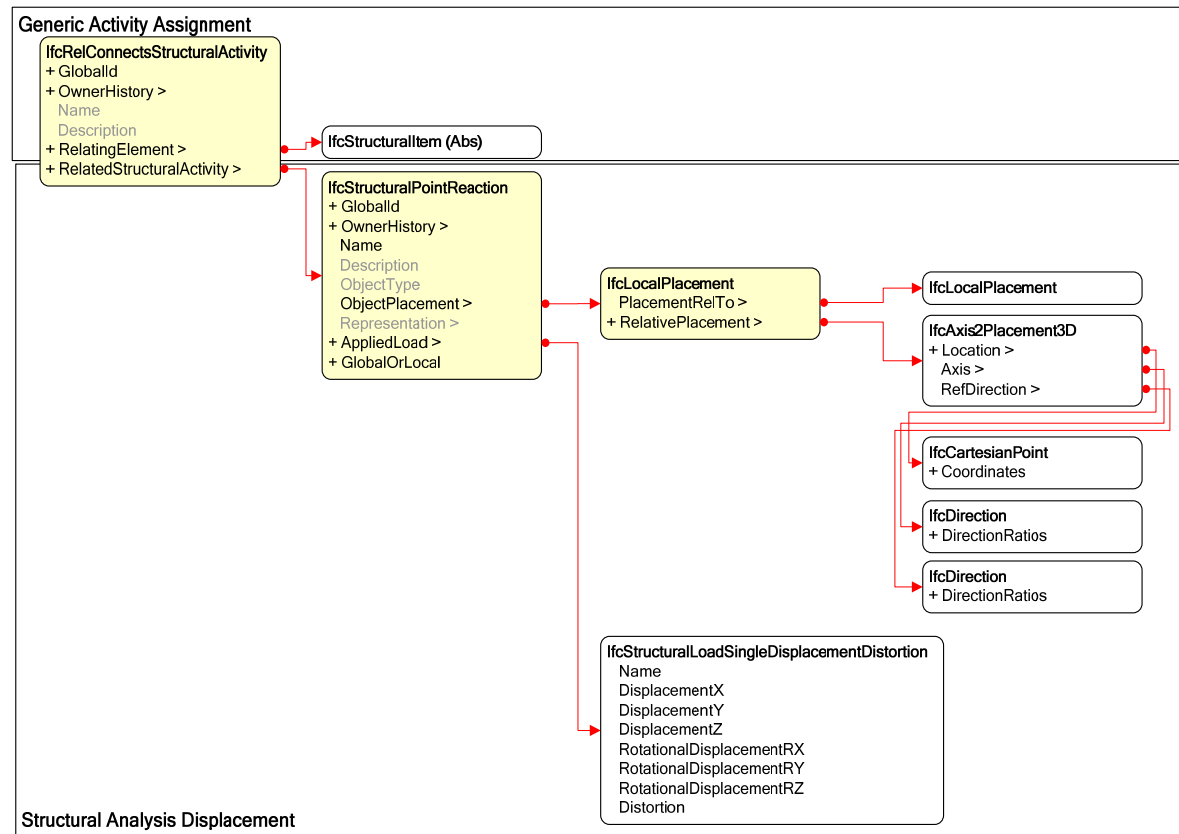
Structural Analysis Displacement

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-451 | Version | 1 | Status | Proposal |
| Relationships | | | | | |
| History | Created 31.1.2008 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelConnectsStructuralActivity

| Attribute | Implementation agreements |
|---------------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | <i>Reserved.</i> |
| Description | <i>Reserved.</i> |
| RelatingElement | <i>Must be some of the IfcStructuralItem's subtypes.</i> |
| RelatedStructuralActivity | <i>Must be IfcStructuralPointReaction.</i> |

IfcStructuralPointReaction

| Attribute | Implementation agreements |
|-----------------|---|
| GlobalId | <Open> |
| OwnerHistory | <Open> |
| Name | 'MIN' if minimum values are presented. 'MAX' if maximum values are presented. 'END' if values for end or start points of the member are presented. 'INT' if values for intermediate points of the member are presented. Note that for MIN and MAX the different forces and moments are usually in the different points, so different instances of IfcReaction for them has to be created. |
| Description | <Open> |
| ObjectType | <Open> |
| ObjectPlacement | Must be IfcLocalPlacement. The point for the internal forces is presented in the local coordinate system of the StructuralItem. The point must be on the axis of the relative curve member or within the surface of the relative surface member. |
| Representation | <Open> |
| AppliedLoad | Must be IfcStructuralLoadSingleDisplacementDistortion. Note that not all the values must be presented for all the instances. |
| GlobalOrLocal | <Open> |

IfcLocalPlacement

| Attribute | Implementation agreements |
|-------------------|---|
| PlacementRelTo | References to the IfcLocalPlacement of the relative Structural Item. |
| RelativePlacement | The point where the displacement takes place is given in the local coordinate system of the relative structural item. |

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| IFC Release Specific Concept Description (IFC2x3) | | | | | |
|---|--|---------|-----|--------|----------|
| Structural Analysis Model Attributes | | | | | |
| Reference | VLB-154 | Version | 1.0 | Status | Proposal |
| Relationships | | | | | |
| History | Created 25.3.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram

- IFC2x3
<Variable Concept>

→

VLB-154 - IFC2x3
Structural Analysis Model Attributes

General

The concept groups the IfcStructuralAnalysisModel attributes defined inside the entity.

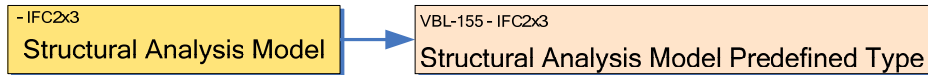
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IFC Release Specific Concept Description (IFC2x3)

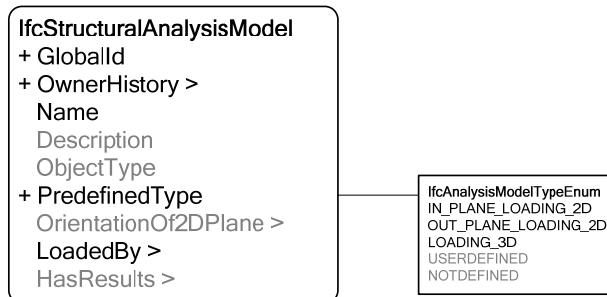
Structural Analysis Model Predefined Type

| | | | | | |
|-----------------------|---|----------------|-----|---------------|----------|
| Reference | VBL-155 | Version | 1.0 | Status | Proposal |
| Relationships | Implements generic static concept 'Structural Analysis Model Type'. | | | | |
| History | Created 5.10.2006 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

This type definition is used to distinguish between different types of structural analysis models. The analysis models are differentiated by their dimensionality.

- *PredefinedType*. Allowed values are: IN_PLANE_LOADING_2D, OUT_PLANE_LOADING_2D, LOADING_3D.
- *OrientationOf2DPlane*. Used only with IN_PLANE_LOADING_2D, OUT_PLANE_LOADING_2D. The orientation is needed to define the upright direction to the focused plane (z-axes). This is needed because all data for the structural analysis model (structural members, structural activities) are defined by using 3-D space.

Additional information

P21 example

```
#28=IFCSTRUCTURALANALYSISMODEL('2uRpA0c3HFLcw0f7ywxmPv', #2, 'Example model', $, $, .LOADING_3D., $, (#8, #16, #33), $);
```

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IFC Release Specific Concept Description (IFC2x3)

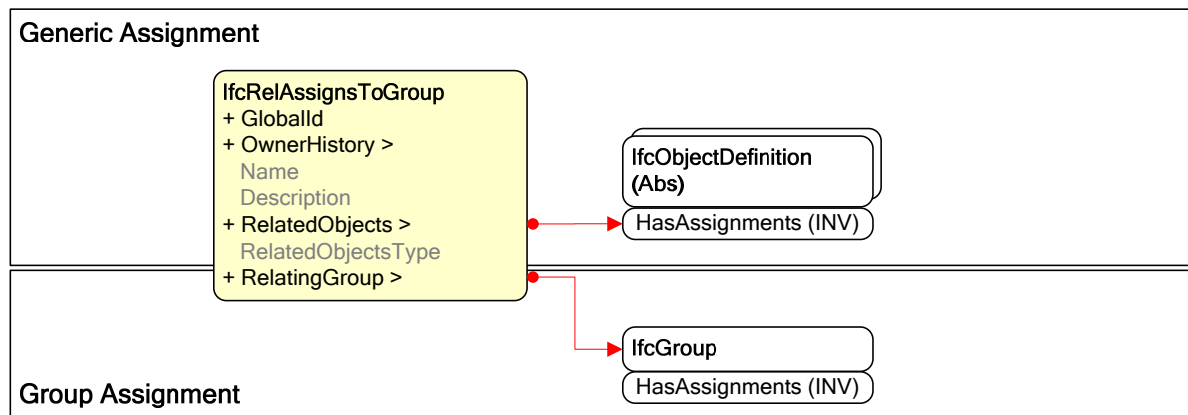
Group Assignment

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-157 | Version | 2 | Status | Proposal |
| Relationships | Extends adapter concept 'Generic Assignment' | | | | |
| History | Created 16.3.2007, improved 28.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelAssignsToGroup

| Attribute | Implementation agreements |
|--------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | N/A |
| RelatedObjectsType | N/A |
| RelatingGroup | N/A |

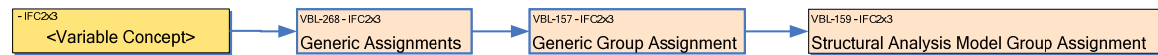
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IFC Release Specific Concept Description (IFC2x3)

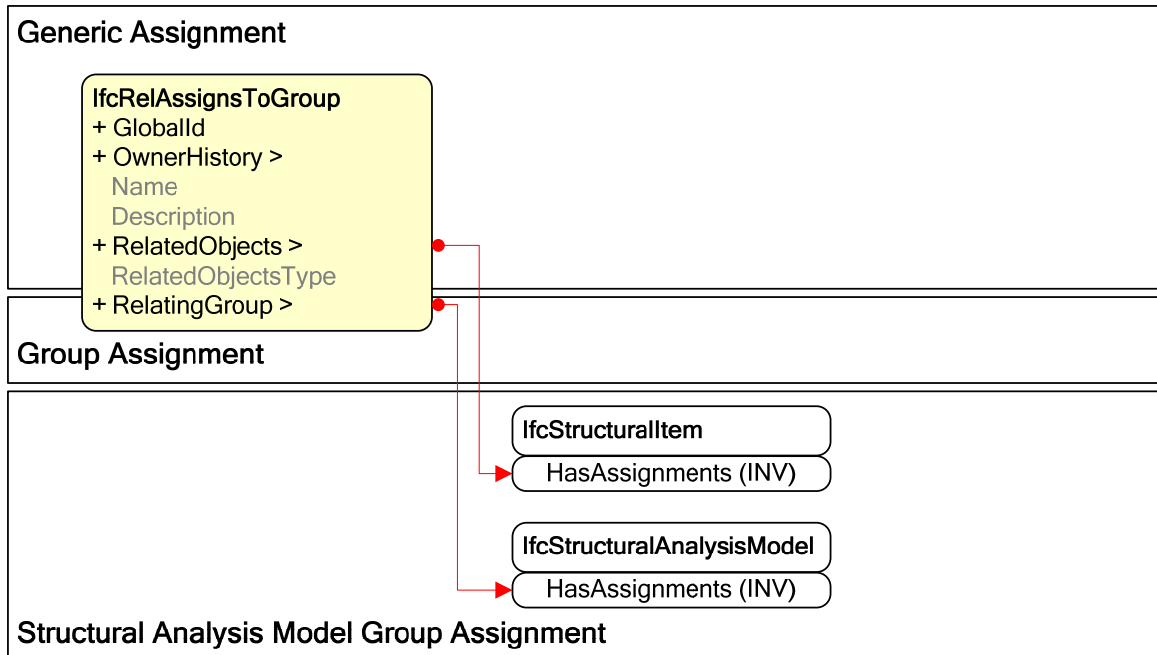
Structural Analysis Model Group Assignment

| | | | | | |
|----------------|--|---------|---|--------|----------|
| Reference | VBL-159 | Version | 2 | Status | Proposal |
| Relationships | Implements general concept VBL-115 "Structural Analysis Model Members" | | | | |
| History | Created 23.10.2006, improved 27.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

Structural Analysis Model Group Assignment lists all the structural items used in the specific instance of an analysis model.

IfcRelAssignsToGroup

| Attribute | Implementation agreements |
|--------------------|---|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatedObjects | List of all the IfcStructuralItems assigned to the IfcStructuralAnalysisModel. Objects in the list may be any subtype of IfcStructuralItem. |
| RelatedObjectsType | Not used. |
| RelatingGroup | Must be one IfcStructuralAnalysisModel. |

Additional information

P21 example

```
#28=IFCSTRUCTURALANALYSISMODEL('2uRpA0c3HFLcW0f7ywxmPv',#2,'Example model',$,$,.LOADING_3D.,$(#8,#16,#33),$);  
#20=IFCRELASSIGNSTOGROUP('3gnnVaLdnEZr_KwapBkzEf',#2,$,$,($21,#22,#23,#24),$,$28);  
#21=IFCSTRUCTURALCURVEMEMBER('32vI$VpG1FHc0NMm0e1p_7',#2,'Example curvemember',$,$,#1897,#1898,.RIGID_JOINED_MEMBER.);  
#22=IFCSTRUCTURALSURFACEMEMBER('2tvI$VpG1FHc0NMm0e1p_7',#2,'Example surfacemember',$,$,#1797,#1798,.SHELL.,200.0);  
#23=IFCSTRUCTURALPOINTCONNECTION('88pMJnCjf7x4CA10uJHq4J',#2,'Example pointconnection',$,$,#1797,#1789,$);  
#24=IFCSTRUCTURALCURVECONNECTION('30pMJnCjf7x4CA10uJHq4J',#2,'Example curveconnection',$,$,#1796,#1788,$);
```

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IFC Release Specific Concept Description (IFC2x3)

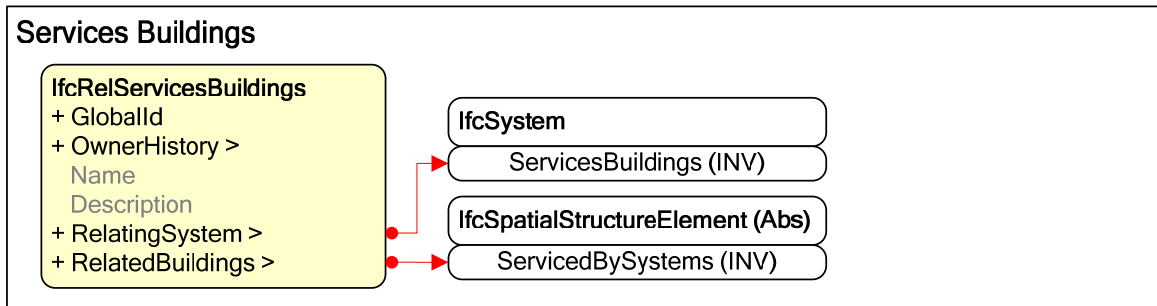
Services Buildings

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-163 | Version | 2 | Status | Proposal |
| Relationships | | | | | |
| History | Created 23.10.2006, improved 27.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelServicesBuildings

| Attribute | Implementation agreements |
|------------------|--|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingSystem | N/A |
| RelatedBuildings | N/A |

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IFC Release Specific Concept Description (IFC2x3)

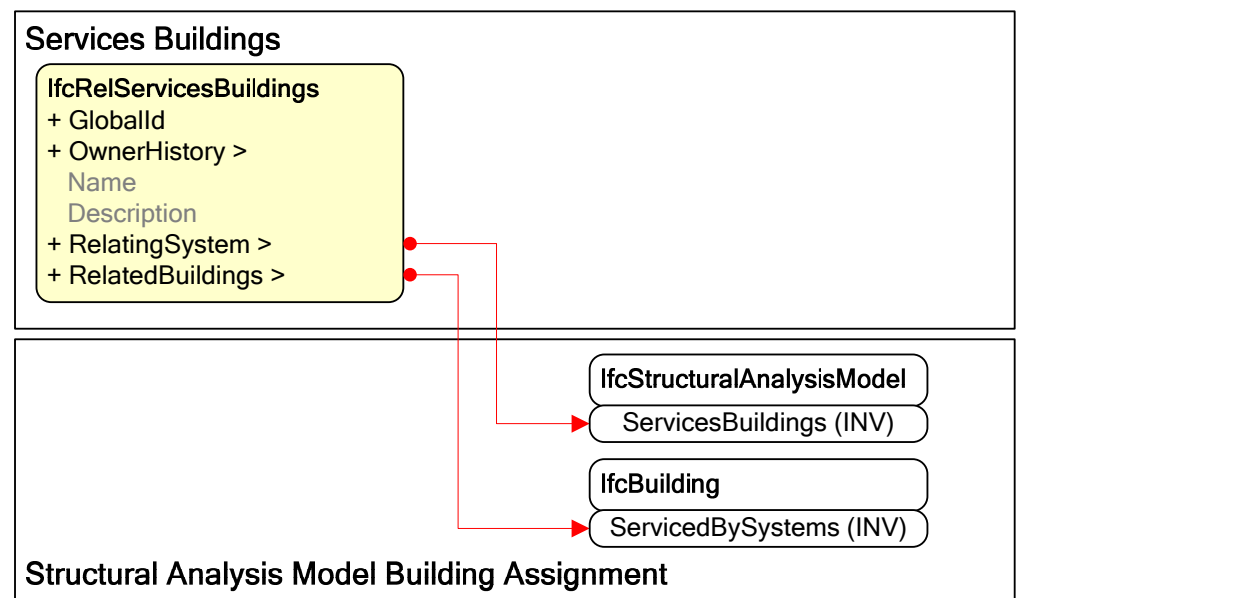
Structural Analysis Model Building Assignment

| | | | | | |
|-----------------------|--|----------------|---|---------------|----------|
| Reference | VBL-164 | Version | 2 | Status | Proposal |
| Relationships | Implements generic concept "Related Building" | | | | |
| History | Created 23.10.2006, improved 27.9.2007 | | | | |
| Authors | Sakari Lehtinen | | | | |
| Document Owner | Virtual Building Laboratory @ TUT (sakari.lehtinen@tut.fi) | | | | |

Usage in view definition diagram



Instantiation diagram



Implementation agreements

IfcRelServicesBuildings

| Attribute | Implementation agreements |
|------------------|---|
| GlobalId | Providing a GUID is mandatory, but the GUID is allowed to change. |
| OwnerHistory | Providing an OwnerHistory is mandatory, but it is allowed to use dummy data. |
| Name | Reserved. |
| Description | Reserved. |
| RelatingSystem | Must be one IfcStructuralAnalysisModel. |
| RelatedBuildings | Must be one IfcBuilding. NOTE: Each IfcBuilding may have several IfcStructuralAnalysisModel assigned to it. |

| Additional information |
|---|
| <p> View additional information for this article </p> |

P21 example

```
#38=IFCPROJECT('0HJL2L0NbCPr2gE4njs9n',#2,'RBHD project',$,$,$,(#39),#40);  
#267=IFCRELAGGREGATES('0Y3UvSFajAL6hp1c$Pgr7',#2,$,$,#38,(#62));  
#62=IFCSITE('$2mhas2GcnFbHCQty2b2an',#2,$,$,#46,$$,ELEMENT,$,$,$,$);  
#61=IFCRELAGGREGATES('39hz_mbnB0DKuuu7$UMj81',#2,$,$,#62,(#37));  
#37=IFCBUILDING('12pc6BnfT8NMzS30tlpjLZ',#2,'Example Building',$,$45,$$.ELEMENT,$,$,$);  
#57=IFCRELAGGREGATES('3WNGnC0S19ybIe2kJe1e83',#2,$,$,#37,(#58,#59,#60));  
#58=IFCBUILDINGSTOREY('0DSrD5EfN4PMmwzC2fybjC',#2,'Floor.1',$,$,#1495,$$,ELEMENT,$);  
  
#36=IFCRELSERVICESBUILDINGS('2HuY18I_D3s7PGGIqk6wxx',#2,$,$,#28,(#37));  
  
#28=IFCSTRUCTURALANALYSISIMODEL('2uRpA0c3HFLcw0f7ywxMpV',#2,'Example model',$,$$.LOADING_3D,$$(#8,#16,#33),$);
```

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