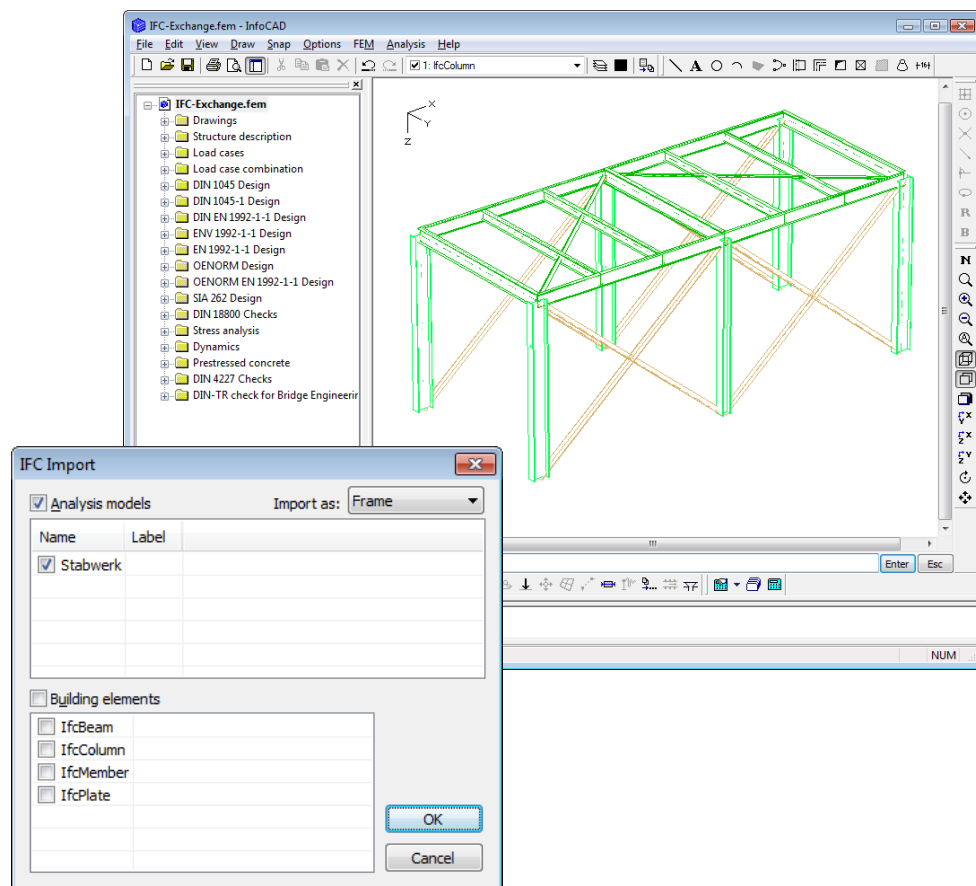


## IFC Data Transfer



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# IFC Data Transfer

The data exchange format IFC (Industry Foundation Classes) is a manufacturer-independent transnational interface, which supports the exchange of all geometric and alphanumeric BIM data.

buildingSMART International develops and establishes IFC as an open standard for the building industry. IFC is registered as an international standard in ISO 16739.

The data can be exchanged using the import or export function. The IFC version IFC 2x3 or IFC 4 can be used.

Additional project information can be transferred via the BIM Collaboration Format (BCF) using the BCF Editor.

## Coordinate System

In the IFC product model the z axis of the global coordinate system typically runs from below to above. This is counter to the convention used in InfoCAD. To avoid all objects standing on their heads after an export or import, they are turned 180° around the global x axis.

## Import

The data import consists of two functional areas:

- Importing the Analysis models (frames or model objects)
- Importing the Geometry of Building Elements

### 1. Importing Analysis models (frames or model objects)

The import is carried out for the static analysis models (IfcStructuralAnalysisModel) saved in the transfer file and selected by the user. The following table displays the relevant objects.

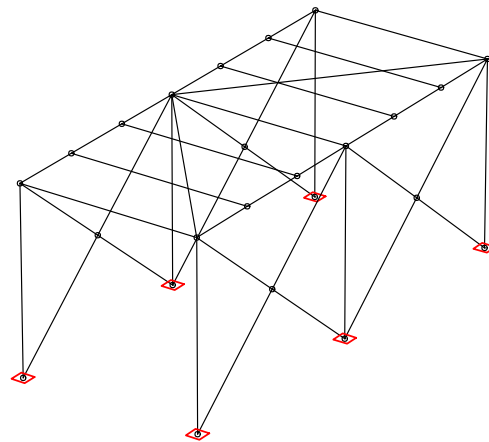
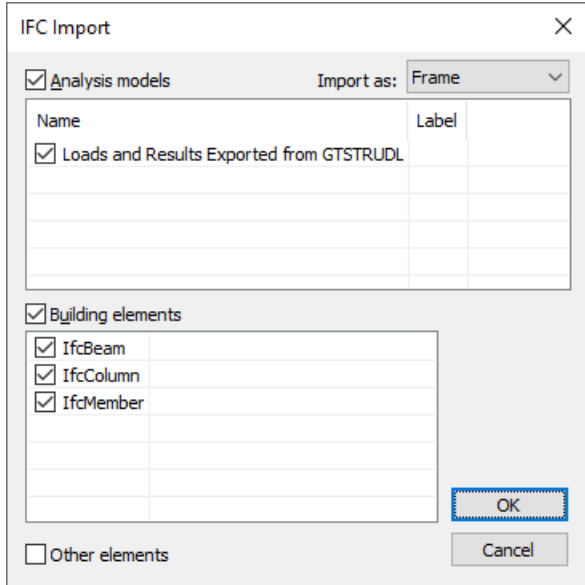
IFC Object	Imports as	Remarks
<b>IfcArbitraryClosedProfileDef</b> <b>IfcArbitraryProfileDefWithVoids</b>	Polygon section	The geometry must be described with IfcPolyline
<b>IfcAsymmetricIShapeProfileDef</b>	Polygon section	
<b>IfcBoundaryNodeCondition</b>	Support, beam joint	Beam joints must be defined in the beam system
<b>IfcCircleHollowProfileDef</b>	Tube profile or polygon section	
<b>IfcCircleProfileDef</b>	Polygon section	32 polygon points
<b>IfcIShapeProfileDef</b>	HEA, HEB, HEM or IPE profile or polygon section	
<b>IfcLShapeProfileDef</b>	L profile or polygon section	
<b>IfcMaterial</b>	Material	
<b>IfcRectangleHollowProfileDef</b>	Hollow profile or polygon section	
<b>IfcRectangleProfileDef</b>	Rectangle section	
<b>IfcRelAssociatesMaterial</b>	Beam material	
<b>IfcRelAssociatesProfileProperties</b>	Beam section	
<b>IfcRelConnectsStructuralMember</b>	Beam node	
<b>IfcStructuralCurveMember</b>	Beam or edge	Constant section
<b>IfcStructuralLinearAction</b>	Linear load	
<b>IfcStructuralLinearActionVarying</b>	Trapezoidal load	
<b>IfcStructuralLoadGroup</b>	Load case	
<b>IfcStructuralLoadLinearForce</b>	Line load	
<b>IfcStructuralLoadPlanarForce</b>	Area load	
<b>IfcStructuralLoadSingleDisplacement</b>	Support displacement	
<b>IfcStructuralLoadSingleForce</b>	Point load	
<b>IfcStructuralLoadTemperature</b>	Temperature load	
<b>IfcStructuralPlanarAction</b>	Area load	
<b>IfcStructuralPointAction</b>	Punctiform load	

IFC Object	Imports as	Remarks
<b>IfcStructuralPointConnection</b>	Node	
<b>IfcStructuralProfileProperties</b>	General beam section	Will be ignored if a different section is imported
<b>IfcStructuralSurfaceMember</b>	Model face	
<b>IfcTShapeProfileDef</b>	T profile or polygon section	
<b>IfcUShapeProfileDef</b>	U profile or polygon section	

To import analysis models, either the FEM or the RSW mode must be active.

**Example**

The following illustrations display the import of a framework from file *gtstrudl\_physical.ifc*. Source: <http://cic.nist.gov/vrml/cis2.html> (NIST, National Institute of Standards and Technology)



Dialog for selecting the import data

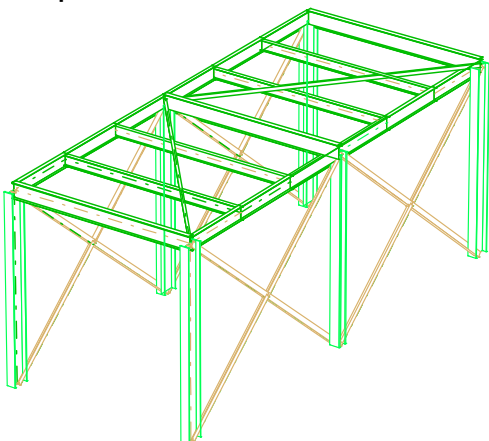
Imported framework

The file contains a analysis model with the name 'Loads and Results Exported from GTSTRUDL' and also building elements of various types that have been deselected for import.

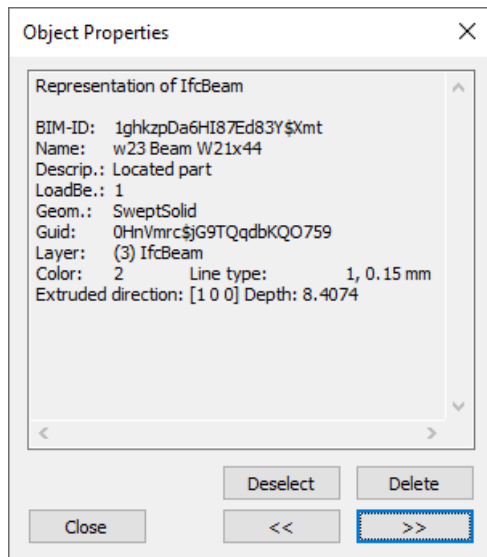
**2. Importing the Geometry of the Building Elements**

This functional area calls for construction model objects saved in the transfer file whose type is derived from *IfcBuildingElement*. They include, for example, *IfcBeam*, *IfcColumn*, *IfcSlab* and *IfcWall(StandardCase)*. Only objects with the geometric display *SweptSolid*, *Clipping*, *Brep*, and *MappedRepresentation* are considered. In InfoCAD special drawing objects are generated from these that make it possible to continue to use the geometry of the building elements. The snap modes *End*, *Middle*, and *Normal* allow you to use, for instance, characteristic points for measurements or for the design of model objects.

**Example**



Building elements from the *gtstrudl\_physical.ifc* file. Source: <http://cic.nist.gov/vrml/cis2.html> (NIST, National Institute of Standards and Technology)



The figure above shows several further characteristics that are imported in addition to the geometry of the building elements. These include

- *GlobalId*: identification of the building element
- *Name*, *Descrip.*: description
- *Material*: associated material description
- *LoadBe(aring)*: displays whether the element bears load (1) or not (0)

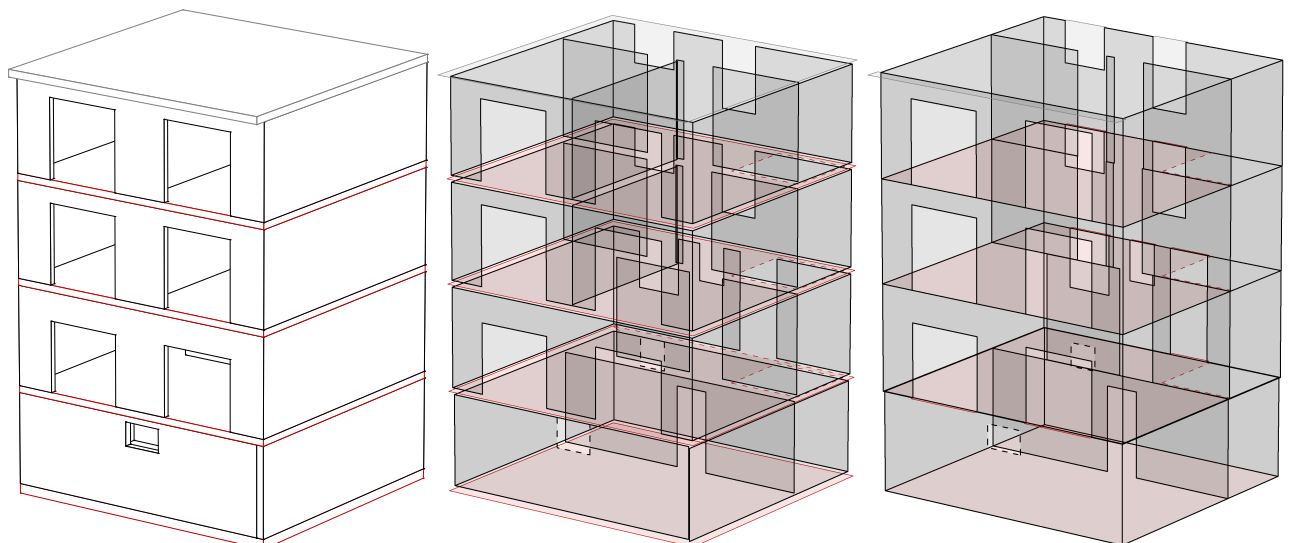
### Transformation into Model Objects

Imported building elements whose geometric display is based on the extrusion of a base area (*IfcExtrudedAreaSolid*) and the building elements

- *IfcBeam*
- *IfcColumn*
- *IfcMember*
- *IfcSlab*
- *IfcWall(StandardCase)*

can be transformed, with the help of the program, into model objects (select *Convert* from the context menu, FEM mode). As part of this process, linear elements are turned into edges with the meaning *Free beam*. The generated beam section corresponds to the profile definition used for the base area. Objects originating from *IfcSlab* and *IfcWall* whose base area consists of a traverse with exactly four points are converted into model surfaces.

The following illustration displays some of the building elements from the file *AC-90Smiley-West-14-07-2005.ifc*, as well as the resulting model surfaces. Source <http://www.iai.fzk.de/www-extern>.



Geometry of the building elements

Model objects, not joined

Model objects, joined

Because the model objects are created based on the wall or slab axis surfaces, gaps usually exist between neighboring objects. As a remedy, all objects are joined with one another during the transformation and, if necessary, marginally reduced or enlarged. In addition, openings that are close to the edge are adjusted. The described operations help to improve the continuity between the model objects. This can eliminate the need for manual corrections in many cases.

## Export

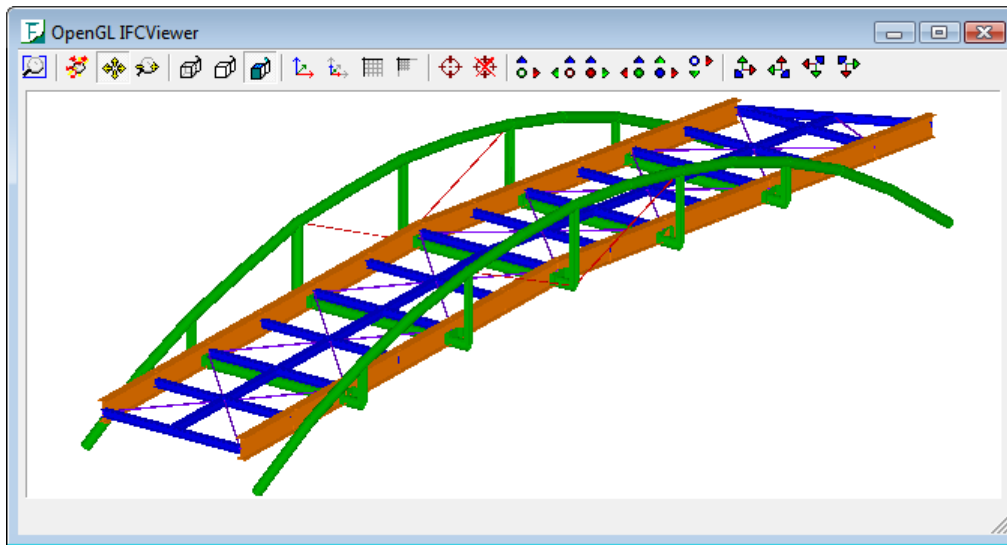
The function applies to model objects and frameworks. The following data will be exported:

### Model objects

- Model edges with meaning 'free beam'
- Model faces

### Framework, if no model objects exist

- Static analysis model without results
- Construction model of the 3D framework with the objects *IfcBeam*, *IfcColumn*



Framework exported with InfoCAD displayed in *IfcStoreyView*  
(Forschungszentrum Karlsruhe, Institut für angewandte Informatik)



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