IFC 2x3 Reference Guide for ArchiCAD 15

GRAPHISOFT®

GRAPHISOFT®

Visit the GRAPHISOFT website at *http://www.graphisoft.com* for local distributor and product availability information.

IFC 2x3 Reference Guide for ArchiCAD 15

Trademarks

Contents

Introduction

IFC - Industry Foundation Classes - is a neutral file format that makes it possible to exchange information between different CAD systems and other systems in the building and facility management sectors. The IFC format is ISO-certified and can be integrated into any existing quality assurance polices your office may have. IFC is developed in part by the IAI - the International Alliance for Interoperability. Today there are over 600 members with 13 chapters around the world.

For more information, see: http://buildingsmart.com/.

GRAPHISOFT has played an active role within the IAI organization since 1996 and supports the IFC standard, which enables ArchiCAD to communicate with other disciplines within the context of the building model, and to coordinate a building project entirely in 3D. The building model can also be exported back to literally hundreds of other systems that support IFC.

BIM, or “Building Information Modeling,” is one of the biggest advances in the building industry’s working methods since the introduction of CAD software. BIM is NOT synonymous with 3D projects. Three-dimensional geometric representation is only one part of the digital deliverables. A project includes non-graphical information, such as calculations that are used in surveying, facility management and energy calculation. A prerequisite for a successful BIM project is that intelligent information can be exchanged between different software and even operating systems, throughout the stages of the building process. This interoperability demands a neutral file format with an open standard that supports different systems. IFC is such a system, enabling us to synchronize building models between the disciplines much more easily.

With its user-friendly interface and wide latitude for customization, the IFC add-on for ArchiCAD enables users to communicate in an efficient way, to focus on the needed elements and to locate any errors in design development. This chapter has been created to provide ArchiCAD users an insight into the IFC standard and how it works in ArchiCAD. The IFC version discussed in this Guide is 2x3 for GRAPHISOFT ArchiCAD.

> **Note:** If needed, the earlier IFC 2x2 version is available as an ArchiCAD Goodie from GRAPHISOFT’s website.

IFC Element Types

Each ArchiCAD modeling element, building-type object and annotation element has a mapped pair in the IFC structure (IFC element type). The following table summarizes the default IFC element types converted from the ArchiCAD elements.

ArchiCAD Element	Mapped IFC Element Type
Wall	IfcWall/IfcWallStandard Case
Door	IfcDoor
Window	IfcWindow
Skylight	IfcWindow
Roof	IfcRoof/IfcSlab (predefined type Roof)
Shell	IfcRoof (predefined type FreeForm)
Beam	IfcBeam
Column	IfcColumn
Slab	IfcSlab (predefined type Floor)
Stair	IfcStair
Ramp (Stair Maker)	IfcStair
Mesh	IfcSite geometry / IfcBuildingElementProxy
Curtain Wall	IfcCurtainWall
Zone	IfcSpace
Wall End	IfcWall
Corner Window	IfcWindow
Grid Element	IfcGridAxis
Grid System	IfcGrid

ArchiCAD Object > Subtype	Mapped IFC Element Type
Object > Wall	IfcWall
Object > Door	IfcDoor
Object > Window	IfcWindow
Object > Opening	IfcOpeningElement
Object > Roof	IfcSlab (predefined type Roof)
Object > Beam	IfcBeam
Object > Column	IfcColumn
Object > Pile	IfcPile
Object > Slab	IfcSlab (predefined type Floor)
Object > Precast Slab	IfcSlab
Object > Plate	IfcPlate
Object > Member	IfcMember
Object > Tendon	IfcTendon
Object > Stair	IfcStair
Object > Stair Flight	IfcStairFlight
Object > Ramp	IfcRamp
Object > Ramp Flight	IfcRampFlight
Object > Railing	IfcRailing

ArchiCAD Element	Mapped IFC Element Type
Lamp	IfcFlowTerminal
Dimension	IfcAnnotation
Level Dimension	IfcAnnotation
Text	IfcAnnotation
Label	IfcAnnotation
Fill	IfcAnnotation
Line	IfcAnnotation
Arc/Circle	IfcAnnotation
Polyline	IfcAnnotation
Radial Dimension	IfcAnnotation
Angle Dimension	IfcAnnotation
Spline	IfcAnnotation

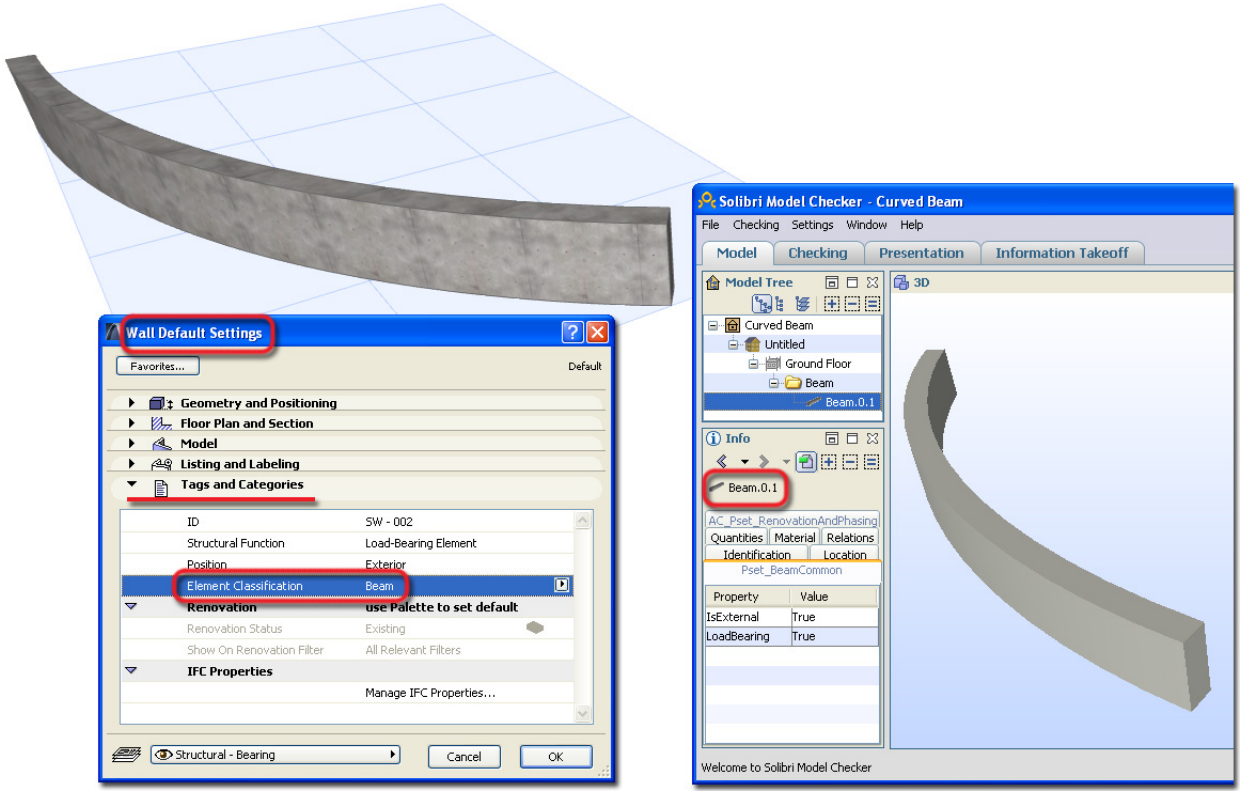
ArchiCAD Object > Subtype	Mapped IFC Element Type
Object > Curtain Wall	IfcCurtainWall
Object > Furnishing	IfcFurnishingElement
Object > Wood Truss	IfcBeam
Object > Foundation	IfcFooting
Object > Footing	IfcFooting
Object > Space	IfcSpace
Object > Covering	IfcCovering
Object > Reinforcing Bar	IfcReinforcingBar
Object > Reinforcing Mesh	IfcReinforcingMesh
Object > Wall End	IfcWall
Object > Electrical Element	IfcFlowTerminal
Object > Flow Fitting	IfcFlowFitting

Notes:

- The export of Grid elements and 2D elements occurs only if the appropriate option in the IFC Translator is enabled *(see Model Element Filter)*.
- The IFC standard does not support the intelligent export of dimensions. Therefore, exporting elements classified as IfcAnnotation will result in these elements falling apart into lines and texts.
- In the case of Objects, if you can classify an element of a particular Object subtype as a corresponding IFC element type (for example, an Object having a Wall-subtype can be classified as an IfcWall), then the object will be exported accordingly (e.g. as an IfcWall.) If no such IFC element type exists, then the Object will be exported as a general solid object (e.g. an Object having a Mechanical subtype will be exported as an "IfcBuildingElementProxy" element).

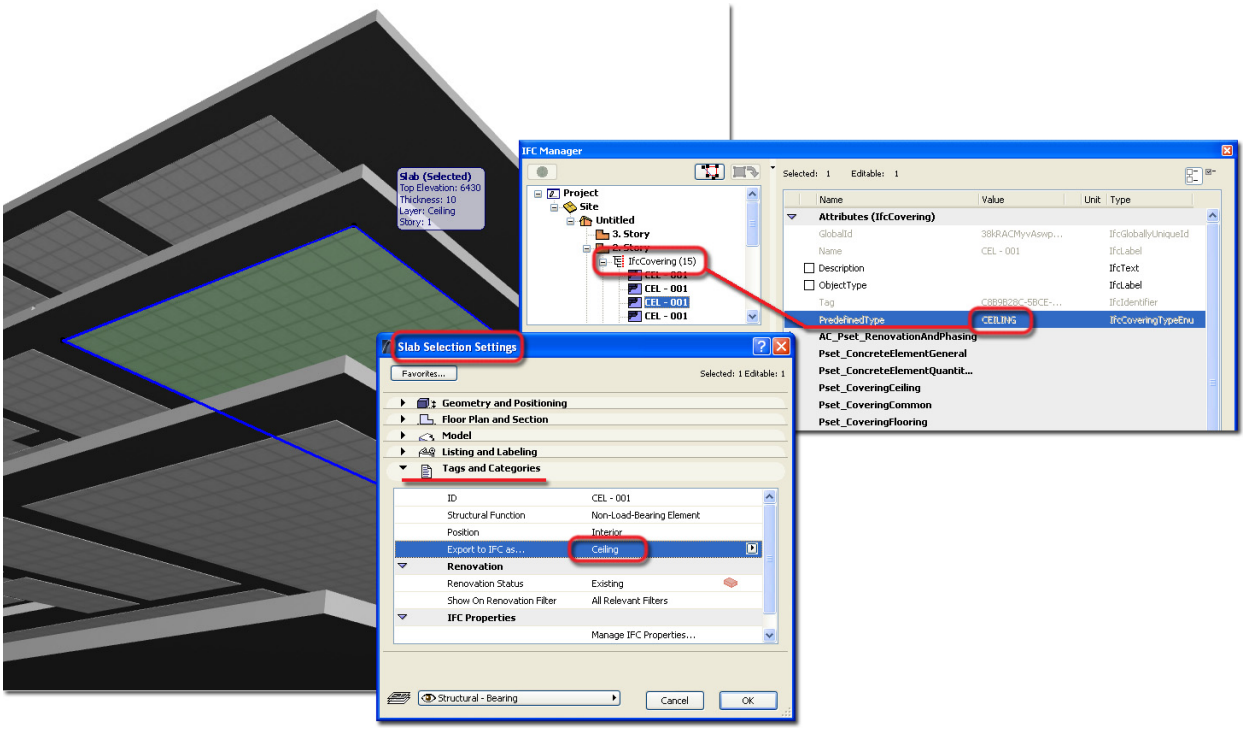
An ArchiCAD's element classification affects that element's IFC export type. The mapping displayed in the above table shows the default and recommended situation, when an element's element classification value (set under "Element Classification" in the Tags and Categories Panel of element settings) is the same as its ArchiCAD type.

But in some cases, you will have to model building elements that have no exact counterpart in the ArchiCAD toolbox; you will have to use an existing tool. For example, you might use the Wall tool to model a curved beam, or the Slab tool to model a ceiling. Using the default “ArchiCAD Type” value for these elements would export them as IfcWall or IfcSlab, respectively. To avoid this, use ArchiCAD’s Classification feature to handle these non-standard modeling and export tasks correctly. Except for annotation elements, all ArchiCAD elements can be classified for IFC export purposes, so, for example, the curved beam modeled with Wall tool can be exported as IfcBeam by modifying its Element Classification to Beam.



Similarly, your ceiling modeled with the Slab tool can be classified as Ceiling. This way, that Slab will be classified as an IfcCovering element of the Ceiling subtype in the IFC hierarchy of the architectural model (these settings can be confirmed using IFC Manager), as well as in the IFC model that will be exported.

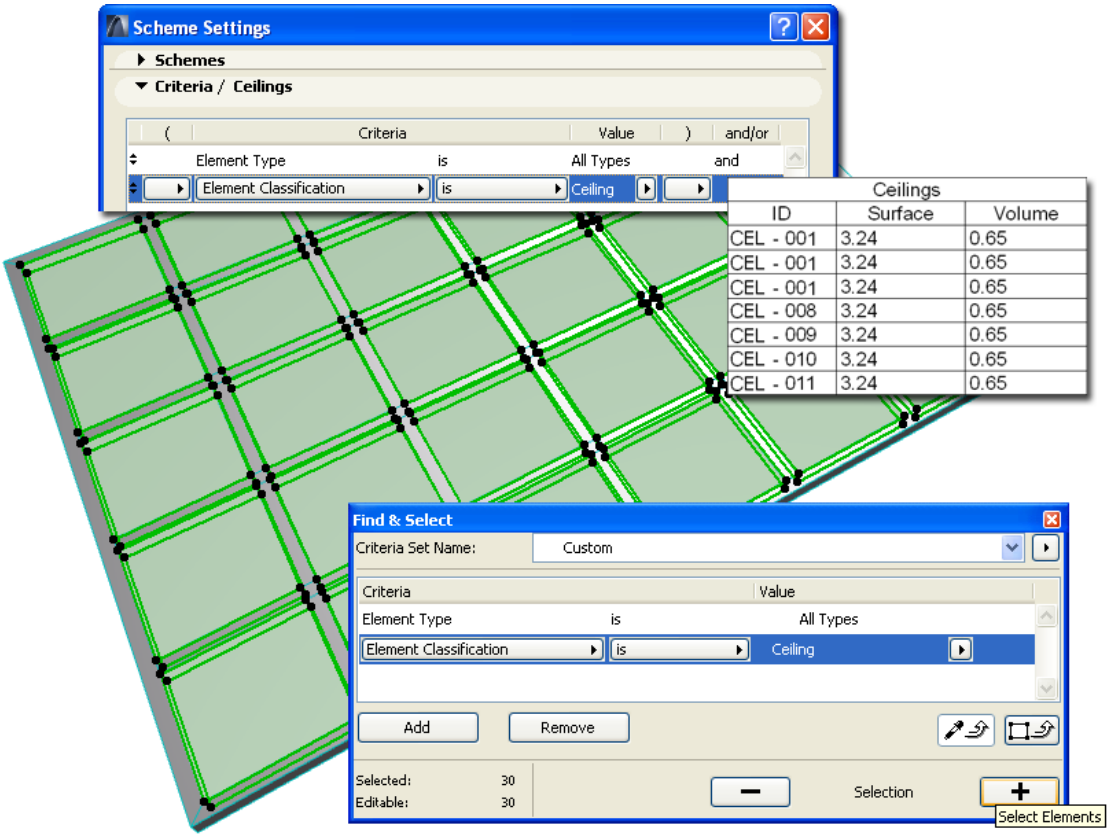
See also Element Settings vs. IFC Manager.



Notes:

- Do not change an ArchiCAD element's default classification unless your modeling logic requires such a change. In every other case, use the default "ArchiCAD Type" classification. For example, there is no reason to classify an ArchiCAD Wall as a "Wall": this would produce the same result as retaining the default value of "ArchiCAD Type", which automatically exports your wall as an ifcWall.
- Elements (e.g. because of modified classification) which are imported into ArchiCAD and which have no counterparts in ArchiCAD are converted into Objects: for example a curved beam will be converted to a Beam-subtype Object, or a ceiling to a Covering-subtype Object.

- Element classification has another advantage, not directly related to IFC exchange: you can use Find & Select and Interactive Schedules to filter by “Element Classification” criteria. For example, you can select or list just the slabs that were used to model ceilings.



The Position classification (in the Tags and Categories panel of Element Settings) will affect IFC import and export alike:

- Elements classified as “Exterior” will be exported with their “IsExternal” IFC property set to “True”.
- Elements classified as “Interior” will be exported with their “IsExternal” IFC property set to “False”.
- Elements imported with the “True” value of the “IsExternal” IFC property will be classified in their ArchiCAD Settings dialog box as “Exterior”.
- Elements imported with the “False” value of the “IsExternal” IFC property will be classified in their ArchiCAD Settings dialog box as “Interior”.

The effect of Structural Function classification (in the Tags and Categories panel of Element Settings) on IFC import and export:

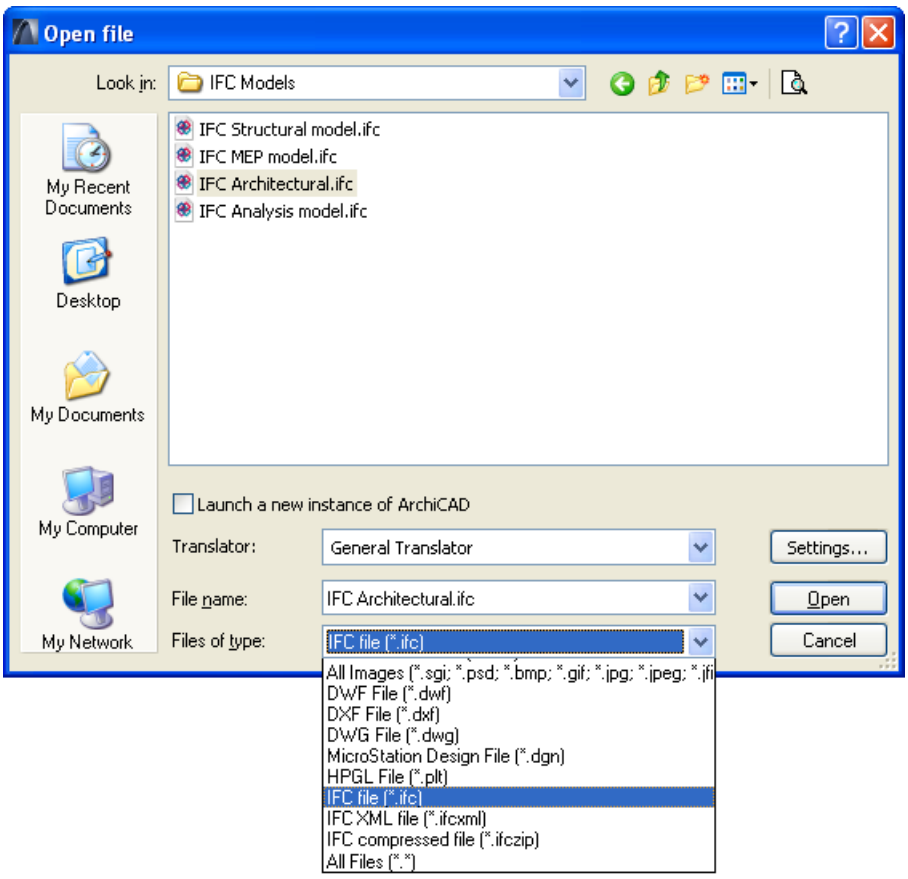
- Elements classified as “Load-Bearing” will be exported with their “LoadBearing” IFC property set to “True”.
- Elements classified as “Non-Load-Bearing” will be exported with their “LoadBearing” IFC property set to “False”.

- Elements imported with the “True” value of the “LoadBearing” IFC property (for example, from a Revit Structure IFC model) will be classified in their ArchiCAD Settings dialog box as “Load-Bearing”.
- Elements imported with the “False” value of the “LoadBearing” IFC property will be classified in their ArchiCAD Settings dialog box as “Non-Load-Bearing”.
- You can filter on the basis of the elements’ Structural Function classification during both the import and export processes. *(See Model Element Filter.)*

  Note: The current IFC standard supports the export of the “LoadBearing” IFC property only for the following elements: Wall, Slab, Column, Beam, Roof; elements classified as such in ArchiCAD; and objects having these sub-types. Thus, the “Structural Function” classification of elements such as Stair, Ramp and Curtain Wall will have an effect only within ArchiCAD - for example, for the purposes of **Find & Select**, **Scheduling**, or **Partial Structure Display**.

IFC File Types

Although ArchiCAD supports the import of earlier IFC file formats (such as 2x and 2x2), the most widely used format, and the one we recommend, is IFC 2x3. ArchiCAD opens (Open/Merge) and saves the following IFC 2x3 formats:



- ifc: the original normal, uncompressed format.
- ifcxml: this is recommended for architects whose partners' applications cannot read the original ifc format, but can manage xml databases (such as budget, energy calculations, etc.). This format will deliver the same model information as the plain .ifc format, but the elements and their properties are stored in a more informative structure. While this is also an uncompressed format, its file size can end up considerably larger than the normal ifc format.
- ifczip: the compressed version of both the normal and the xml-type formats, resulting in file size that is, on average, one-quarter of the original (file size varies depending on model size).

  Note: Before exporting, ask the receiving party which IFC2x3 file format his/her application is capable of importing. If the recipient cannot read .ifczip, then a zip extractor application can open the file into a normal .ifc or .ifcxml format.

IFC-Related Functions in ArchiCAD

To handle IFC, the IFC 2x3 Add-on is automatically inserted into the ArchiCAD environment during ArchiCAD installation.

> **Note:** The IFC add-on is updated with each ArchiCAD Hotfix. However, it is possible that the add-on is updated between ArchiCAD Hotfixes. Check the latest available IFC add-on release at: *http://www.graphisoft.com/ifc/*.

The following commands can be accessed from the **File** menu after the IFC Add-on is installed:

- **Open... (IFC)**

See Import: Open and Merge

- **Save as... (IFC)**

See Export: Save as IFC

- **Merge... (IFC)** (This command is only available from Floor Plan view.)

See Import: Open and Merge

- **IFC Translations Setup...**

See IFC Translators

- **IFC Manager...**

See Element Settings vs. IFC Manager

- **IFC Options...**

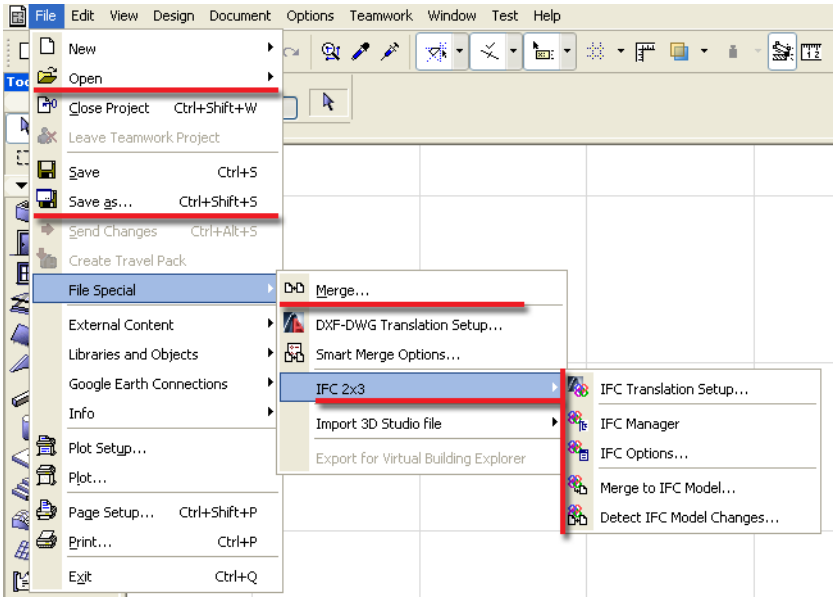
See IFC Options

- **Merge to IFC Model...**

See Merge to IFC Model

- **Detect IFC Model Changes...**

See Detect IFC Model Changes



Import: Open and Merge

Use the **File > Open** command to open an IFC file that was received or saved earlier as a new project. Open the entire model or its filtered parts. ArchiCAD will transform the imported elements into the corresponding ArchiCAD elements, taking their IFC element types into consideration.

Use the Merge command (in Floor Plan view, from **File > File Special > Merge**) to insert a received IFC model in whole or in part into a running ArchiCAD project. Using Merge will preserve your running project, without overwriting its data (this is the "Reference model" concept.) So the program will always automatically generate new values for all imported elements to avoid overwriting the GUIDs of the host project. However, even in this "Reference model", the merged elements are real ArchiCAD elements based on the IFC-ArchiCAD mapping convention *(see IFC Element Types)*. The process of merging an IFC file is similar to merging another PLN file to ArchiCAD: for example, you will define how to place the incoming stories into the existing story structure (see below).

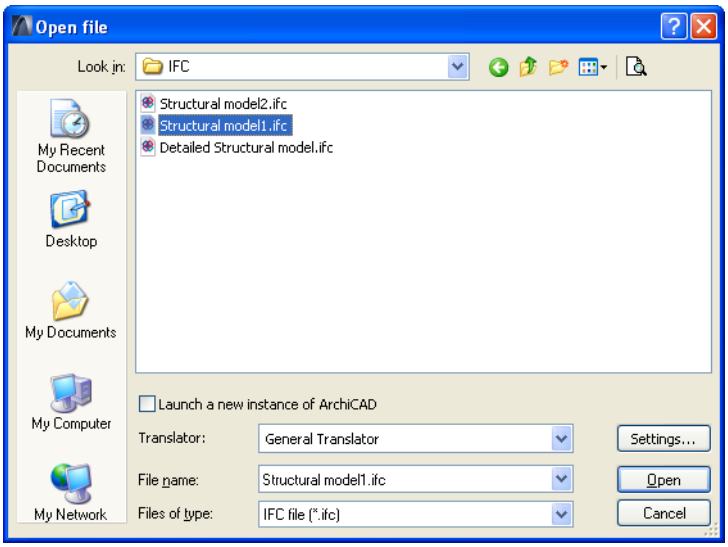
Notes:

- Only the Open process will retain the original GUIDs of the imported model elements. However, if the opened IFC file is saved as an ArchiCAD PLN, and then hotlinked, ArchiCAD *will* change the GUIDs, to protect the elements of the host project (again, in line with the Reference model concept).
- 2D drawing, annotation, and Grid elements are merged from an IFC file only if their import is enabled in the "Model Element Filter" settings of the IFC Translator.
- It is recommended that you save the ArchiCAD file before merging an IFC file.
- When importing a model, you may find that some elements - though defined as IfcWall, IfcSlab, etc. - will be imported to ArchiCAD as Objects (and not as Walls, Slabs, etc.). The reason is that their geometric representation is set to the simple "face-based surface" or "boundary representation" (BREP). This means that, apart from the element geometry, the element does not include information such as its reference axis. In the absence of such information, ArchiCAD interprets such "simplified" elements as Objects. Nevertheless, these elements will appear as "Wall" or "Slab" in the IFC settings interface in ArchiCAD or in an IFC Viewer, which display element types. With viewers, you should check these elements' geometric representations, such as face-based surface (ArchiCAD Object) or extruded (ArchiCAD Wall, Slab, etc.) In some cases, ArchiCAD's import engine is able to handle imported BREP elements and attempts to convert them into real ArchiCAD elements, primarily Slabs or Roofs.

In both types of imports (Open and Merge), both element geometry and element properties are imported. Some of these are stored with the element as ArchiCAD attributes, others as standard or custom IFC properties (*see IFC Terms and Definitions*). IFC properties can be checked in the Settings dialog box of the imported element, or, for the project as whole, in the IFC Manager *(see Element Settings vs. IFC Manager)*.

Elements imported via Open or Merge can be placed onto particular layers in ArchiCAD, as defined in the translator. For example, in the case of a merge, you can place the imported IFC model elements onto one or more new layers, keeping them separate from the elements of the running project.

Follow these steps to import IFC data using the Open and Merge processes.



Step 1: Choose IFC File Format to Import

In the Open or Merge dialog box, choose the IFC file format corresponding to the file to be imported. *(See IFC File Types.)*

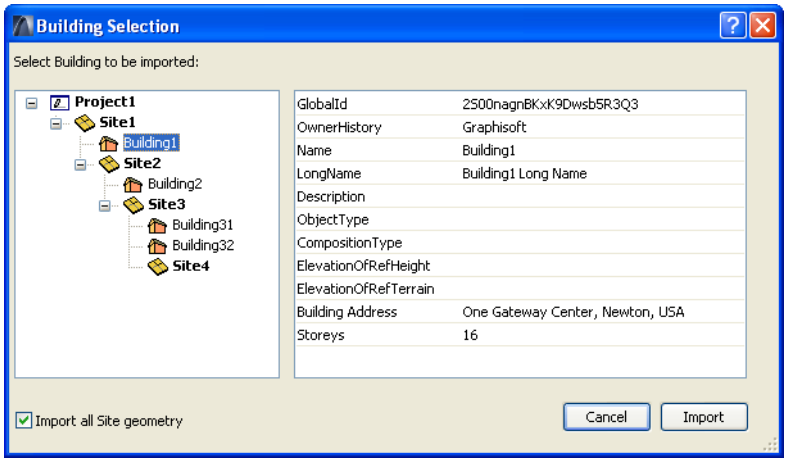
Step 2: Choose File to Import

Step 3: Choose Translator

Importing IFC elements occurs in conformity with the settings of the selected translator. Use the drop-down list to choose among the predefined or user-defined translators. The default translator for import to ArchiCAD is shown by default. Use the Settings button to edit a translator's settings, or to create a new translator. *(See IFC Translators.)* Click Open to import the IFC model. Additional steps follow, depending on the type of imported model and the chosen import method.

Step 4: Building Selection

If the IFC file contains multiple buildings, then a building selection dialog appears, since the import process can import only one building at a time.

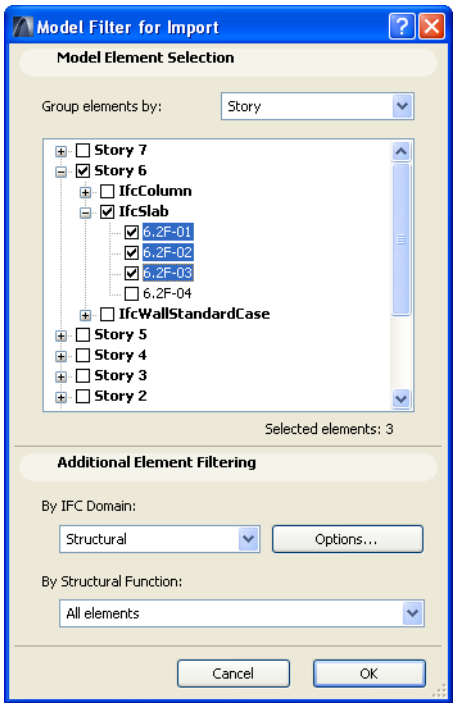


On the left of this selection dialog, view the site and building hierarchy in the tree structure. You can select only a building, and only one building. At right, information is shown on each selected building. If the “Import all Site geometry” option is not enabled, then the selected building will be imported with only the IFC Site geometry which is assigned to the building. To import the entire site model, regardless of the chosen building, activate the “Import all Site geometry” option.

Step 5: Filtering Input Content

This is an optional setting that is available if the Show Model Filter on import option is activated on the translator’s Import Options tab page. The Model Filter allows you to ignore the translator’s default settings and to apply custom element filters to the current import process (e.g. import just columns, or just the Ground Floor elements, or just the structural elements or HVAC elements, or

just elements, such as certain columns, selected from the model hierarchy, or any selection achieved by using filters - such as certain columns on the first floor only).



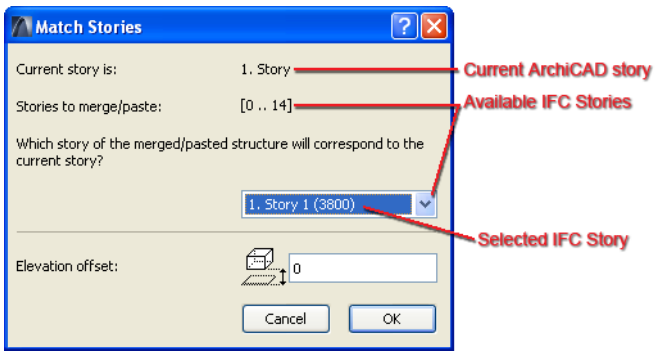
See Model Filter.

Step 6: Story Matching (only with Merge)

When merging an IFC file (as when merging a PLN), you must define the story of the receiving project on which to place the story structure of the incoming IFC data. (The physical height and relative elevations of the elements will not change.) In the appearing “Match Stories” dialog box, “Current Story” refers to the story of the running project which was active when you issued the **Merge** command. From the pop-up menu, choose the story of the incoming IFC project which should be placed onto the current story. In the list, each story of the IFC model is shown with its own elevation in parentheses. If you want to change the physical height of the imported story structure, you can do so by entering a positive or negative value in the Elevation offset field.

The result of merging stories: the story structure of the original project remains intact (it is not overwritten by the newly merged content), and new stories are created only above or below the existing ones (according to the IFC model).

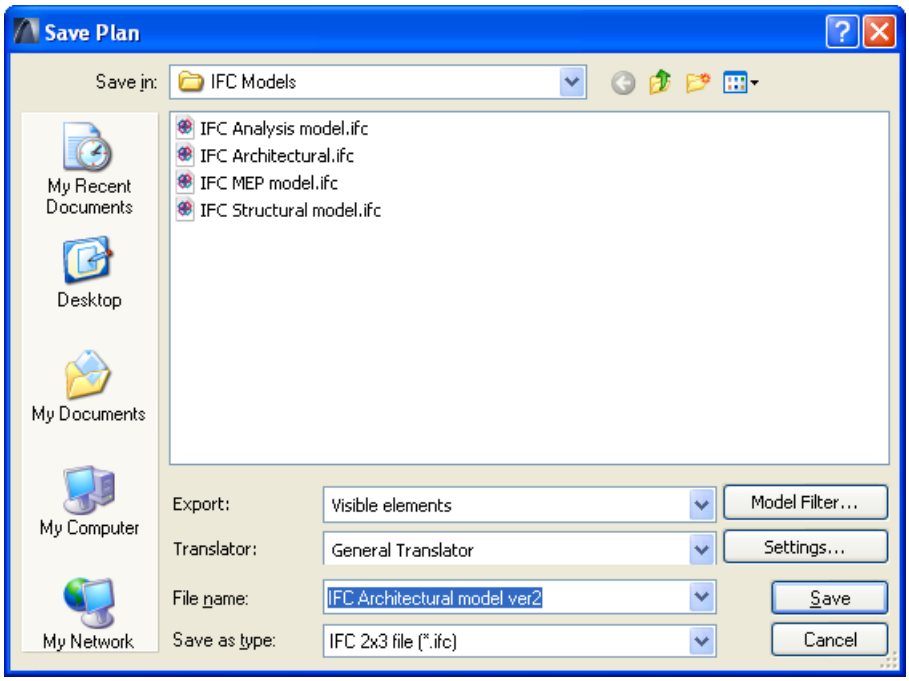
Note: If the imported IFC file contains only a single story, then the story chooser option is greyed, and only the elevation offset control is available.



Export: Save as IFC

The entire current ArchiCAD project, or just its filtered content, can be exported in IFC 2x3 formats, using the **File > Save as** command *(see IFC File Types)*. During export, the IFC model will be generated from the selected ArchiCAD elements by mapping them according to the elements' default type, or according to the elements' user-defined classification.

The Save process - like the Import process - is assisted by predefined translators, whose default settings you can modify or overwrite as you go *(see IFC Translators)*.



Filtering elements for export can be carried out using the following criteria:

- The **selected** elements in the current view (the view that was open when you issued the **Save as** command).
- The **visible** elements, based on display settings (Layers, Partial Structure display, etc.) in the current view (the view that was open when you issued the **Save as** command).
- The **entire** model with the current view's display setting, regardless of any selection or layer settings.

  Note: In order to export 2D drawing-type elements, annotation element or Grid elements, it is not enough to meet the criteria of the filters listed above (e.g. export based on selected or visible elements); you must also specifically enable the export of these elements in the "Model Element Filter" of the translator being used.

The filter to be applied may depend upon any of the following:

- the default filters in the translator,
- any manual resetting of the filters using the Export pop-up in the Save As IFC dialog box (this allows you to filter only the elements in the currently open view),

- any further filtering set up in the Model Filter (e.g. all model elements, or all visible elements, or all selected columns) *(see Model Filter)*.

Follow these steps to export IFC data:

Step 1: Choose IFC File Format to which to Export (Save as type)

From the Save as type field, choose the desired IFC file format for export.

See IFC File Types.

Step 2: Choose Translator

Exporting IFC elements occurs in conformity with the settings of the selected translator. Use the drop-down list to choose among the predefined or user-defined translators. The default translator for export from ArchiCAD is shown by default. Use the Settings button to edit a translator's settings, or to create a new translator. *(See IFC Translators for details on these settings.)* To quickly adjust the element filters for the current export - without modifying the translator's default settings - use the Export option in the Save As IFC dialog box, or the Model Filter function *(see Model Filter)*.

Step 3: Modify Element Filters as Needed (Export)

Possible filters:

- **Selected elements only** (available only if elements have been selected)
  Elements selected in the current view (the view that was open when you issued the **Save as** command) will be exported.
- **Entire project**
  The entire model (regardless of any selection, and regardless of the elements' show/hide status) will be exported.
- **Visible elements (on all stories)**
  The visible elements in the current view (the view that was open when you issued the **Save as** command) will be exported, regardless of any selection. ("Visible" means all elements that are set to be displayed (e.g. due to layer settings, model view options, partial structure display, etc.)

  Note: If you issue the **Save as** command from Floor Plan view ("Visible elements on all stories") means all elements currently displayed on *every* story of the project.
- **All elements on current story** (available only if Floor Plan is open)
  All elements (regardless of any selection, and regardless of the elements' show/hide status) on the current story of the Floor Plan will be exported.
- **Visible elements on current story** (available only if Floor Plan is open)
  All elements (regardless of any selection) that are visible on the current story of the Floor Plan will be exported.

Step 4: Model Filter (use as needed)

See Model Filter.

Step 5: Define File Name for Export

Use the file name field to define or choose the file name you wish to export, then click Save.

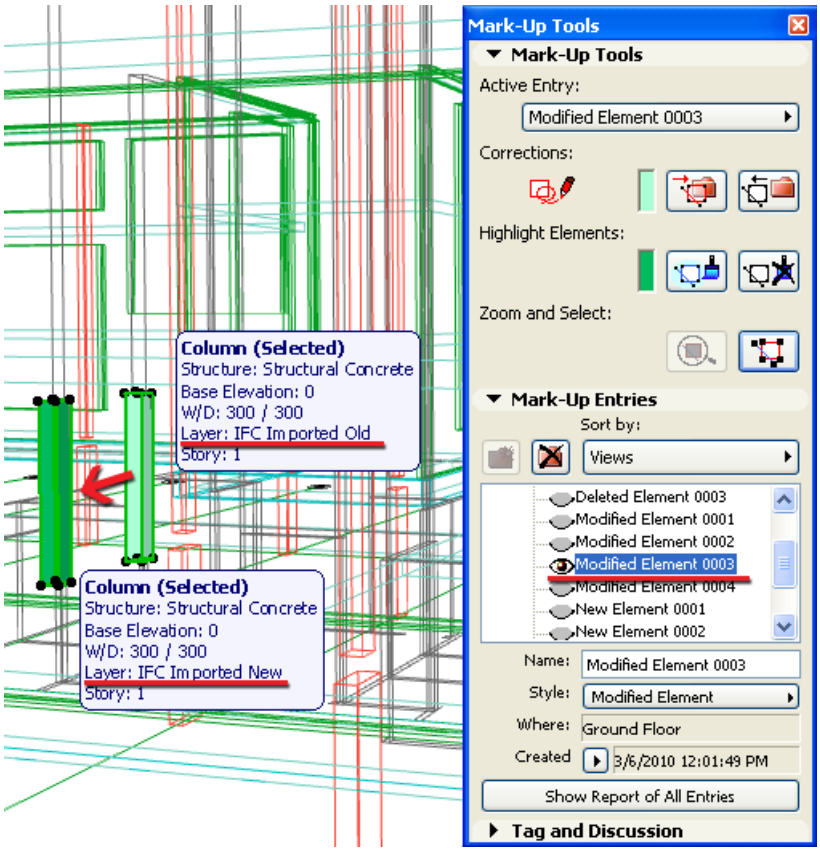
Hint: After exporting an IFC model, it is good practice to check the IFC model in an IFC viewer. There are many free IFC viewers on the market that can be readily downloaded:

- Solibri Model Viewer: *http://www.solibri.com*
- DDS-CAD Viewer: *http://www.dds-cad.net*
- Nemetschek IFC Viewer: *http://www.nemetschek.co.uk/ifc*

Additional information can be found at the Wiki address: *http://www.ifcwiki.org*.

Detect IFC Model Changes

The Detect IFC Model Changes function (**File > File Special > IFC 2x3**) detects the geometric differences between two versions of a single model that has been exported as IFC - that is, it compares two IFC files that are two versions of the same project. The elements affected by the modifications are generated and merged into the currently running project (that project can also be an empty one). Modifications can be viewed and managed using ArchiCAD's Mark-Up tool in both 2D and 3D views.



Naturally, you can restrict the change detection to only a part of the model (for example, to elements on the ground floor) or to particular element types (for example, just columns). Since the two file versions differ by timestamp, the following geometric differences are detected:

- **New Elements:** elements created in the newer version that did not exist in the earlier version.
- **Deleted Elements:** elements that existed in the earlier version but were deleted from the newer version.
- **Modified Elements:** elements that have been modified (in their position and/or size) from one version to the next.

Notes:

- It is important that the two IFC files being compared originate from *a single application* and a *single project*, because the comparison process (more specifically, the pairing of the modified elements) is based upon the elements' GUID numbers in the IFC model. If there are no

identical IFC GUIDs in the two versions, then all elements will be considered either new or deleted.

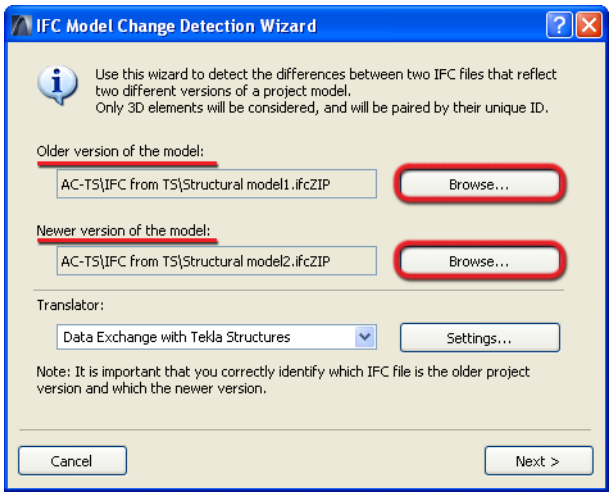
- It is also important that you correctly identify which IFC file is the older project version and which the newer version.
- The change detection applies only to 3D elements - not to any of the 2D elements (lines, grids, fills, etc.) that may optionally be stored in the IFC file.
- Since the changes are merged into the current ArchiCAD project, we recommend that you save the ArchiCAD project before issuing the **Detect IFC Model Changes** command.

  Hint: Independent of any model exchange workflow with other applications, the Detect IFC Model Changes function can also be used to compare two versions of an ArchiCAD project: you must have saved both versions of the project as IFC files. This works if the export process is set to store the GUID numbers in each of the two versions *(see Global Unique Identifiers (GUID))*.

Follow these steps to compare two IFC files:

Step 1: Browse for the two IFC Files

Use **File > File Special > IFC 2x3 > Detect IFC Model Changes** command to open the dialog box. Use the Browse buttons to locate and select the IFC model, noting the order in which the two files were created ("Older" and "Newer"). Keeping track of the versions is crucial to ensure the proper detection and interpretation of the changes.



Step 2: Choose Translator

From the pop-up list, choose an IFC Translator.

The Translator shown is the one defined as the default for IFC import. Translator settings which will be applied in this process include:

- The "IFC Domain" and "Structural function" Model Element Filters (these are the default filters for comparing elements); and
- The Material Conversion (Import Options) settings.

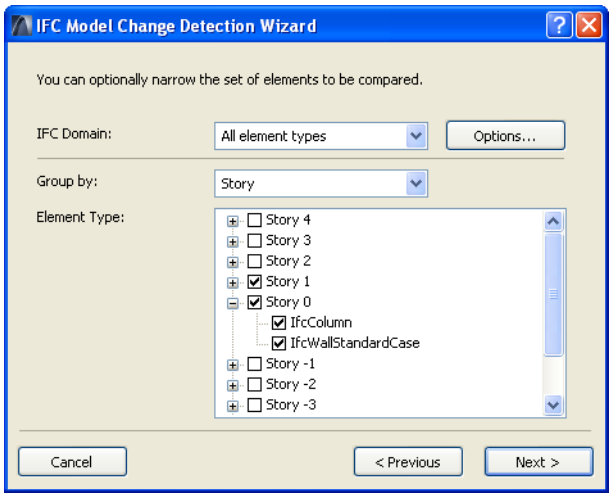
Assigning the elements to layers is not governed by any setting in the translator, but rather set in in later step (see Step 4 below).

See IFC Translators.

Step 3: Define the Element Types to be Compared

Although the translator chosen in Step 2 defines the default filters to be used for the elements being compared, you can use the next dialog box to further limit the model. In fact, you can define entirely different filters or customize them.

Thus, use this dialog box to optionally narrow the set of elements to be compared in the two files:

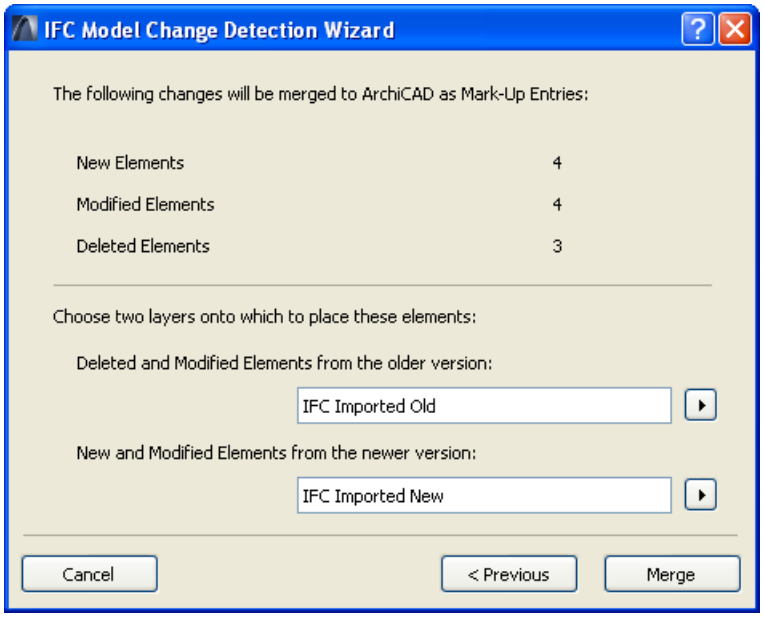


- Filtering by IFC Domain: Use one of the predefined domain filters to define the element types to be compared. The default value here is the IFC Domain (Model Element Filtering) setting of the translator chosen above. “All element types” will compare all elements from the two files. The “Structural” and “HVAC” domains will consider only structural elements or mechanical elements, respectively. The “Custom” domain filter can be created using the Options button - e.g., you can consider just beams (IfcBeam) or just columns (IfcColumn).
- Filtering by Structural Function: If the IFC files to be compared include elements classified by Structural Function (that is, LoadBearing property is assigned to elements), then use this setting to filter load-bearing elements, for example as part of a structural-architectural data exchange. The default value here is the Structural function (Model Element Filtering) setting of the translator chosen above.

  Note: You should use this filtering option only if you are certain that your fellow professional, with whom you are exchanging data, is using and able to export the LoadBearing IFC property.
- Filtering by Story/Layer/Owner/Element type: The elements of the two files are listed in a tree structure under Element Type. The initial filtering is carried out by the IFC Domain and Structural Function filters set above; this part of the dialog box enables further fine-tuning of the filter, by checking or unchecking element types one by one. Elements can be grouped in this structure, to make it easier to gain an overview. For example, you can group the element types by Story, by Layer, or by both Story and Layer. For example, you can combine an element filter with a story filter to compare just columns on the floor plan.

Step 4: Differentiate Between Elements from Each Version

Based on the filters you have set up, a list will summarize the detected changes, by number and by the type of the change. These changes will be merged to ArchiCAD as Mark-Up entries. To be able to differentiate between elements from each of the two versions, the affected elements will be placed on a separate layer when they are merged into the current ArchiCAD project. Naturally, you can define a different layer name for this purpose than the layer shown by default.



Step 5: Merge Changes to the Project

Click Merge to send the changes to the project with Mark-Up Entries. Only the detected changes of the filtered and compared elements (see Step 3) will be merged into the project and placed to the selected two different layers (see Step 4).

Step 6: Story Matching

When merging the differences between the IFC file versions, you must define the story of the receiving project on which to place the story structure of the incoming IFC data.

If the two files have differing story structures, you must do the story matching for each of them.

See Story Matching at Import: Open and Merge.

Step 7: Use Mark-Up tool

The Mark-Up Palette appears automatically and lists the changes as Mark-Up entries, using three mark-up styles: New, Deleted and Modified Elements. Thus, the elements are easily distinguishable on screen according to their specific style. Entries can be sorted by Style and by their Floor Plan View.

Elements from the two compared models are categorized separately by the Mark-Up function:

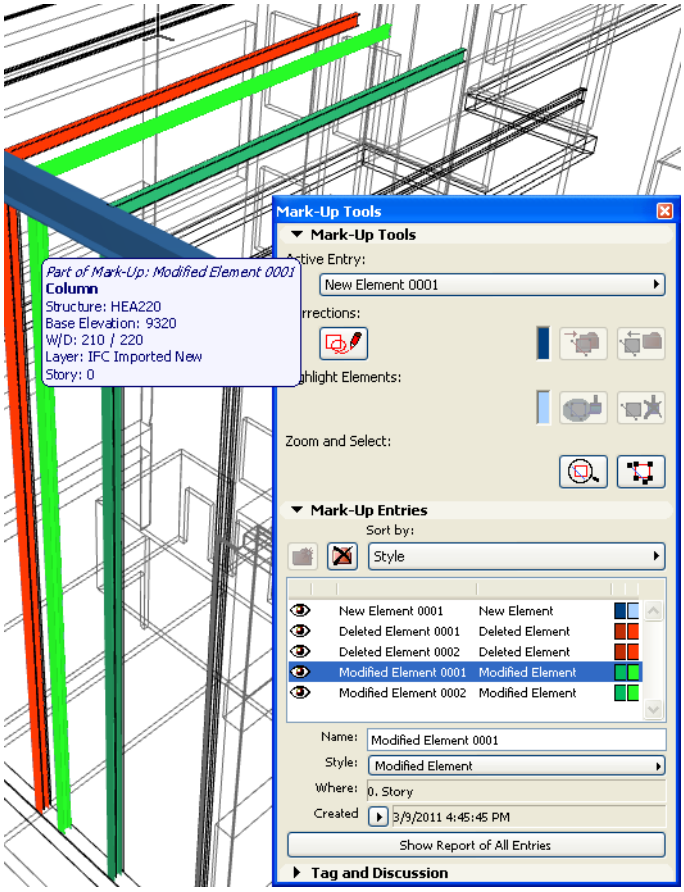
- Elements from the older version (that is, the Deleted and Modified elements from the older version) are shown as “Correction”
- Elements from the newer version (that is, the New and Modified elements from the newer version) are shown as “Highlighted”

Each of these categories uses different Mark-Up Styles and their elements can be edited accordingly.

Functions on the Mark-Up palette enable you to view, select or zoom to the elements in the entries.

Hint: The default colors for marking different change types can be modified in the Mark-Up Styles Palette (Options > Element Attributes > Mark-Up Styles).

Since the elements from each of the two model versions are categorized separately in Mark-Up, each modified element entry contains a pair of elements: one element from the older model version, shown as “Correction”, and a newer-version element, shown as “Highlighted.” Their different colors make it easy to distinguish them. Moreover, each element in the pair is placed on a different layer (see Step 4). You can check any element’s layer by reading its Info Tag, which appears when you hover your cursor over any element.



Elements detected as “Modified” become part of the project and are placed on separate layers depending on their version (older or newer). To each of these elements, the Mark-Up function assigns these elements a category: either New, Deleted or Modified.

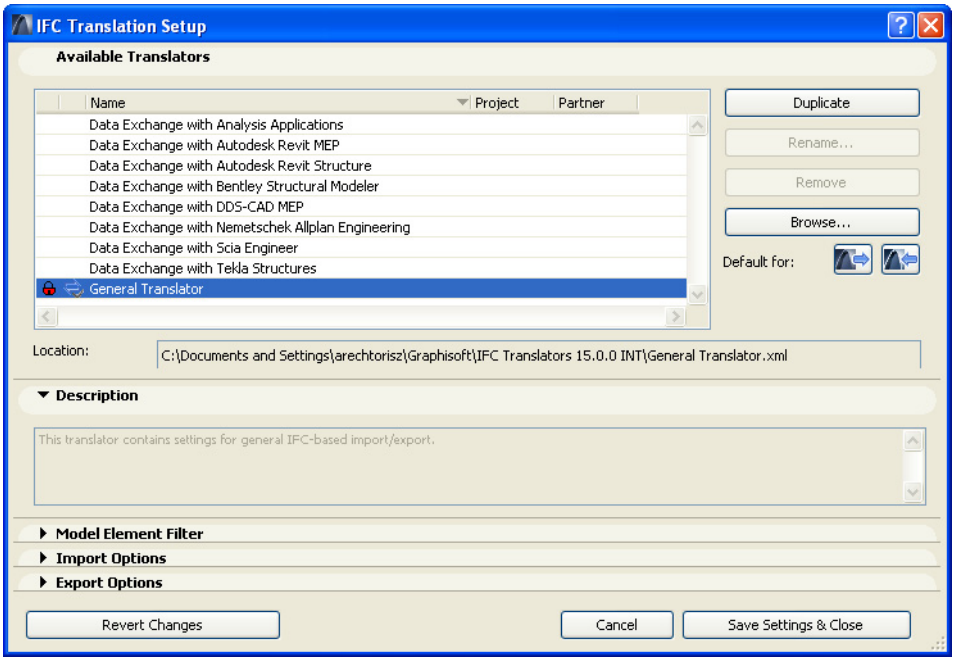
Now what can you do with them?

- **Deleted Element:** You can leave it in as part of the project (placing it on a separate layer); or you can delete it together with its Mark-Up Entry, by clicking Delete Entry in the Mark-Up Palette. You can also use Delete Entry *without* deleting the elements in the Entry.
- **New Element:** Since it has a Highlighted status, deleting its entry will not delete the element, it will just lose its Highlighted status. Then you can use the element as you wish (or even delete it from the project). A New element will be deleted together with its Mark-Up Entry only if you first remove its Highlighted status (click the Remove Highlight button).
- **Modified Element:** This pair of elements includes one each that is “Deleted” and “New”, with the same options as described above for “Deleted” and “New” elements. That is, if you do a Delete Entry, the older-version element can be either retained or deleted, while the newer-version element will remain intact, while losing its Highlighted status.

  Hint: If you delete a Mark-Up Entry by mistake, use Undo.

IFC Translators

Importing and exporting model data using IFC takes place according to the settings of the translator you are using. ArchiCAD provides predefined, factory-default translators, but you can define your own. View or modify translator settings, or create a new translator, at **File > File Special > IFC 2x3 > IFC Translation Setup**. The following is a description of the settings found in the IFC Translator Setup dialog box:



Available Translators

By default, you will see the predefined translators (offered for structural, MEP and general connections) shipped with ArchiCAD. Any newly created translators will also be listed here. The program's default translators for import and export are distinguished by a blue arrow symbol; these default translators will be shown when you execute the import or export commands. You can define any selected translator as the default (for export and/or import) by using the "Default for" icons.

The only way to create a new translator is to first duplicate an existing one (use the Duplicate button). Next, use the **Rename** command to give the copy a new name. The newly renamed translator will contain the same settings as the one you duplicated, but you are free to change any of the settings.

Each translator is stored in an XML file; these files can be exchanged among ArchiCAD users, and imported into ArchiCAD projects using the Browse option. The "Location" field below shows the path of the selected translator's XML file.

Use Remove to remove a translator you don't need from this list. (The translator's xml file is not deleted.)

Notes:

Modifications to translator settings take effect when you click **Save Settings & Close**.

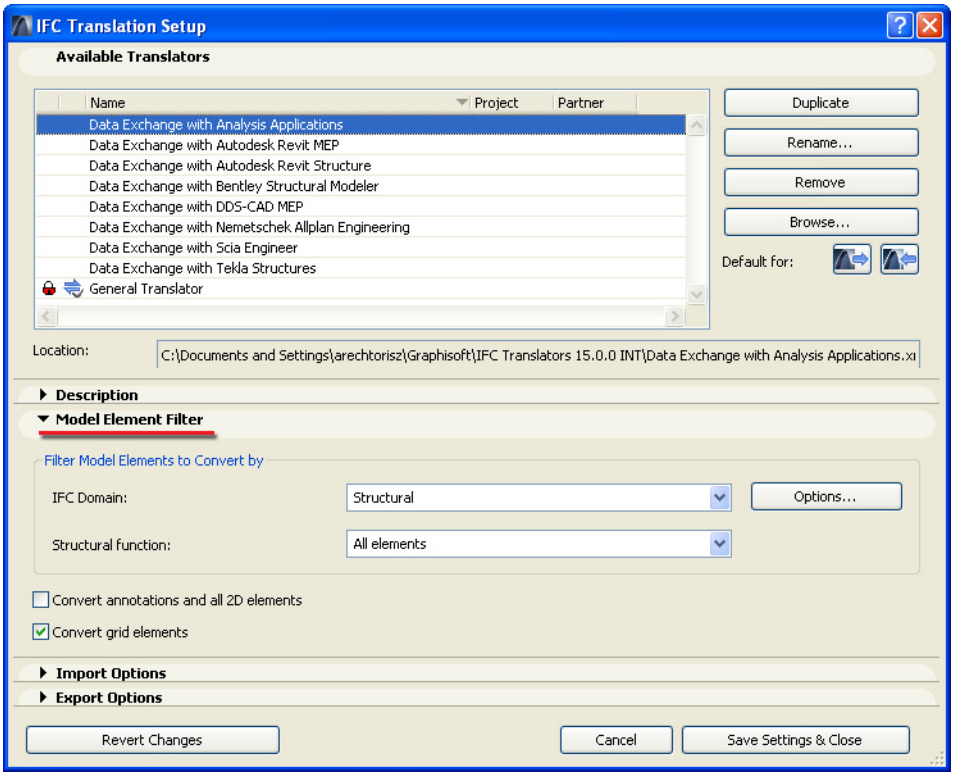
If you want a customized translator to revert to its original, factory-default settings, you will find the original translator file in the GRAPHISOFT\ArchiCAD15\Defaults\IFC Translator folder; use this file to overwrite the current translator, found at the place given in the Location field.

A translator that is locked cannot be modified; the settings described below cannot be changed in this case. However, if you duplicate a locked translator, you can change its settings.

Description

This field is a short textual description of the translator currently selected in the list. This field is empty for a newly created translator, but you can enter any text you like.

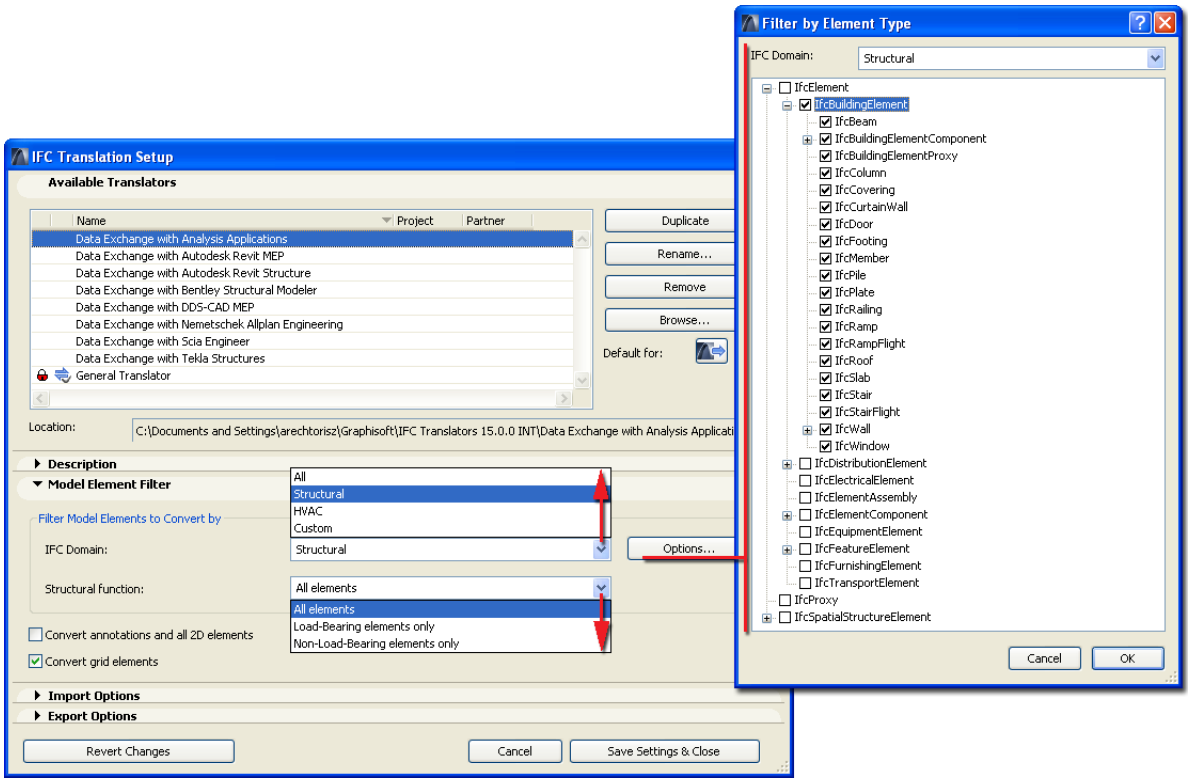
Model Element Filter



IFC Domain

Displays the default element-type filter for the selected translator. Use the IFC Domain to filter according to the following criteria for IFC import and export: "All" will include all elements from the model; "Structural" will include only the structural building elements; "HVAC" will include

only the mechanical elements. To see the exact composition of each Domain filter, click Options; modifying these options will create a “Custom” filter.



Structural Function

Use this as an additional (element-level) filter for export and import purposes, which will take into account the elements’ Structural Function classification at export and “LoadBearing” IFC property at import.

“All elements” will not take the elements’ Structural Function classification into account.

“Load-Bearing elements only” means that only those elements classified as “Load-Bearing” will be exported from ArchiCAD to IFC; and only those elements having the IFC Property “LoadBearing” with “True” value will be imported from the IFC file to ArchiCAD.

“Non-Load-Bearing elements only” means that only those elements classified as “Non-Load-Bearing” will be exported from ArchiCAD to IFC; and only those elements having the IFC Property “LoadBearing with “False” value will be imported from the IFC file to ArchiCAD.

Notes:

- If no Structural Function classification has taken place in the ArchiCAD project, or if you have not finished the classifying process in ArchiCAD, then you should choose “All Elements” here: either of the other two settings (“Load-Bearing only” or “Non-Load-Bearing only”) can result an empty IFC file, or one that is missing elements you might need.

- The default Model Element Filter set here can be overwritten during the export/import process using the Model Filter options.

See Model Filter.

Convert annotations and all 2D elements

If you check this box, the export process will include the following 2D elements in the IFC file: texts, labels, fills, lines, arcs, circles, polylines, splines and all dimension types.

However, the inclusion of 2D elements in the exported file is also affected by the “Export” option set at the Merge/Save As IFC process in the respective dialog boxes of these commands.

- If the 3D window is currently active, the 2D elements can be included only if the “Entire project” option is used.
- If the Floor Plan is active, the “Visible” option means only the visible 2D elements will be saved, and “Selected elements only” means that only the selected 2D elements will be saved.

These 2D elements will show up in the IFC structure as IfcAnnotation. Dimensions will be exploded into lines and texts, since the IFC standard does not include a dimension element.

During import, all IfcAnnotation-type elements (including exploded dimension elements) of the IFC file will be imported into ArchiCAD and converted into 2D elements (texts and lines) by checking the box.

Convert grid elements

If you check this box, the export process will include the Grid Elements and the grid members of the Grid Systems in the IFC file.

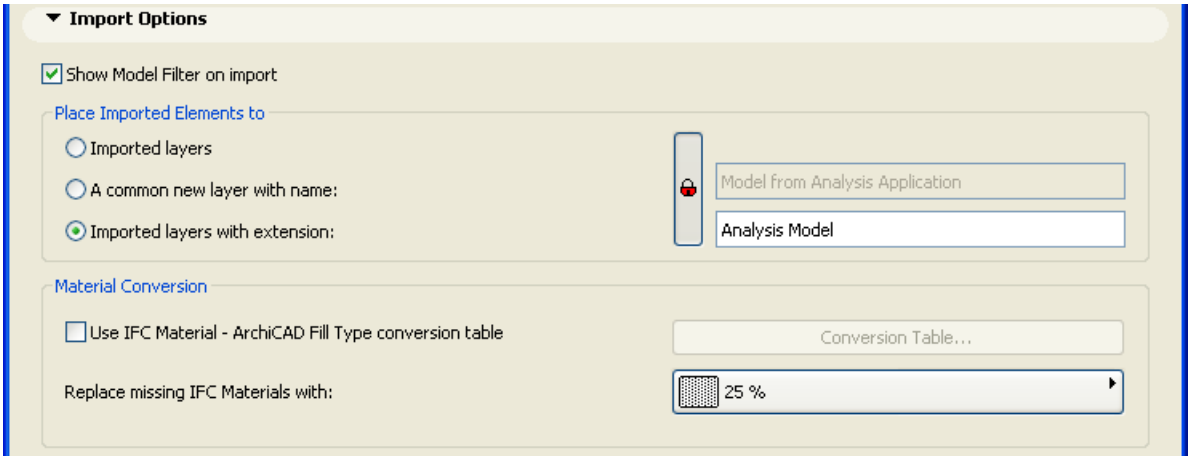
However, the inclusion of grids in the exported file is also affected by the settings of the “Export” options that are opened from the Merge and the Save As dialog boxes. Both in Floor Plan and 3D views, the “Visible” option means only the visible grids will be saved, and “Selected elements only” means that only the selected grids will be saved.

These grid elements will show up in the IFC structure as IfcGrid.

During import, all IfcGrid elements of the IFC file will be imported into ArchiCAD and converted into ArchiCAD-type grid elements by checking the box.

Import Options

For import (Open/Merge), the following options are customizable (provided that the translator is not locked):



- **Show Model Filter on import**

  If this option is active, then - after you issue the **Open or Merge (IFC)** command - the Model Filter window will open *(see Model Filter)*. This gives you the chance to overwrite, for the purposes of the current import process, the Model Element Filter settings of the translator you are using, to fine-tune the elements to be imported (e.g. import only certain element types, or just the elements from a certain story) *(see Model Element Filter)*.

- **Place Imported Elements to...**

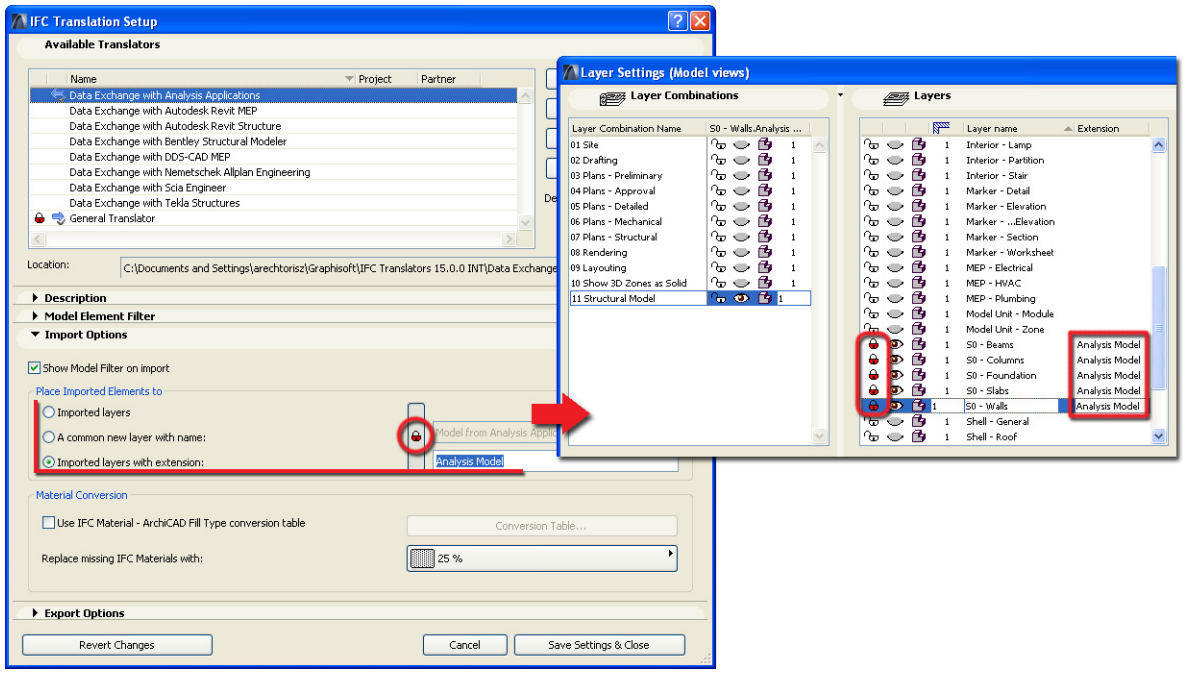
  Define the method for placing the imported elements onto ArchiCAD layers.

  - "Imported layers" means that ArchiCAD will create new layers that correspond to the IFC layer names, and will place the imported elements onto these layers.

  Note: If layers of the same name already exist in ArchiCAD, no new layers are created; the imported elements are placed onto the corresponding, existing ArchiCAD layers.

  - "A common new layer with name" means that the imported elements will be placed onto a newly created, single layer that you define (such as "IFC import" layer). In this case, the layer system stored in the IFC model will be deleted.

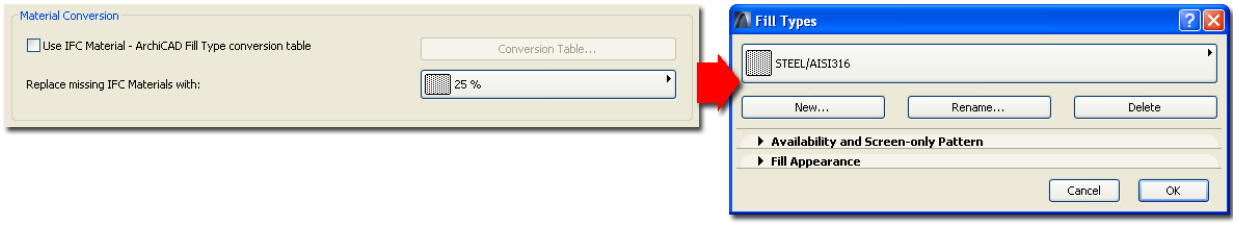
  - "Imported layers with extension" will create new ArchiCAD layers corresponding to the IFC layers of the imported file, but will add an extension to each of these layer names (such as "from engineer"). The advantage is that, following the file import, you will be able to sort the layers by extension in ArchiCAD's Layer Settings dialog box.



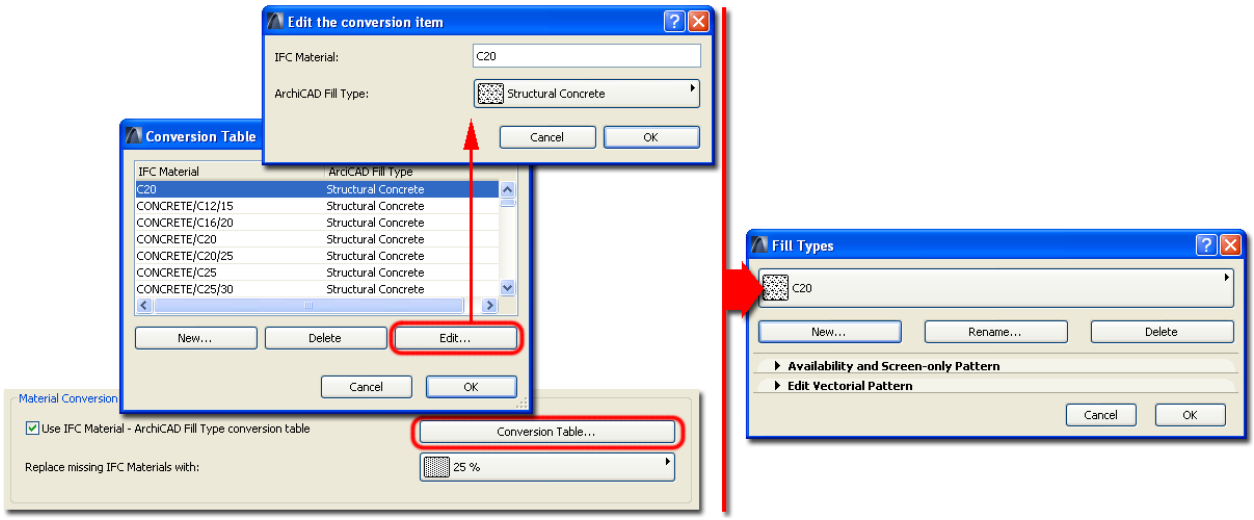
- **Material Conversion**

  It is possible to map the imported IFC materials to a corresponding Cut Fill type in ArchiCAD. This is recommended if the ArchiCAD file template (if you are using File > Open) or the running project (if you are using Merge) does not contain fill types of the same name as those of the imported materials.

1. If the “Use IFC Material - ArchiCAD Fill Type conversion table” option is not checked, then ArchiCAD will determine whether the imported IFC material names exist among the ArchiCAD project’s or template’s Cut Fills. If they do, then each imported material will be displayed using the corresponding Cut Fill. If such fills do not exist, then a single Cut Fill type set (at “Replace missing IFC Materials with” option) will be used to display all such imported materials, while preserving the original IFC material names.



2. If the “Use IFC Material - ArchiCAD Fill Type conversion table” option is checked, then the missing IFC materials will be displayed using the definitions in the Conversion Table (click “Conversion Table” to bring up this dialog). Here, map the Cut Fill types available in your project to the names of the imported IFC materials. For example, you might use ArchiCAD’s “Structural Concrete” fill to represent all concrete materials entitled “C20” that are imported from a structural program. As a result, ArchiCAD will create a new fill type: it is named “C20”, but it uses the existing “Structural Concrete” fill pattern (provided, of course, that the ArchiCAD project does not yet contain a Cut Fill type entitled “C20”).



If you have not mapped a particular imported material in this Conversion Table, then that material will automatically be displayed using the cut fill defined at “Replace missing IFC Materials with.”

Hints:

- Some of the default translators include predefined Conversion Tables, whose settings you are free to expand or edit in the translator’s duplicated copy (provided that the translator is not locked).

- You cannot import or export these Conversion Tables as separate XML files; you must import/export them together with entire translator file itself (use Browse to import).

Export Options

For export, the following options are customizable (provided that the translator is not locked).

Note: These settings are also valid for the special command called “**Merge to IFC Model**” *(See Merge to IFC Model)*.

- **Elements to export**

  Use the element filter for export *(see Step 2 at Export: Save as IFC)* to configure the current translator. This value determines the default filter used by the export process, but you can still change the filter in the export dialog.

  Note: If there are selected elements in the project when you start the export, this control automatically changes to “Selected elements only”, regardless of the translator’s default setting.

- **IFC View Definition**

  Choose whether you want to save the IFC model according to the widely used so-called “Coordination view” standard, or according to a simplified standard. The “Simplified view (BREP only)” choice means that every element will be exported with its BREP (boundary representation) geometry. Use this export option if your purpose in model exchange is to display model geometry - such as in a viewer or in an MEP program.

  Note: The BREP method comes closest to reproducing the shape of the element, together with its specialized sections and connections. However, the element’s parameters are lost, and BREP elements from an imported IFC file are transformed into non-editable elements. The BREP method comes closest to reproducing the shape of the element, together with its specialized sections and connections. However, the element’s parameters are lost, and BREP elements from an imported IFC file are transformed into non-editable elements.

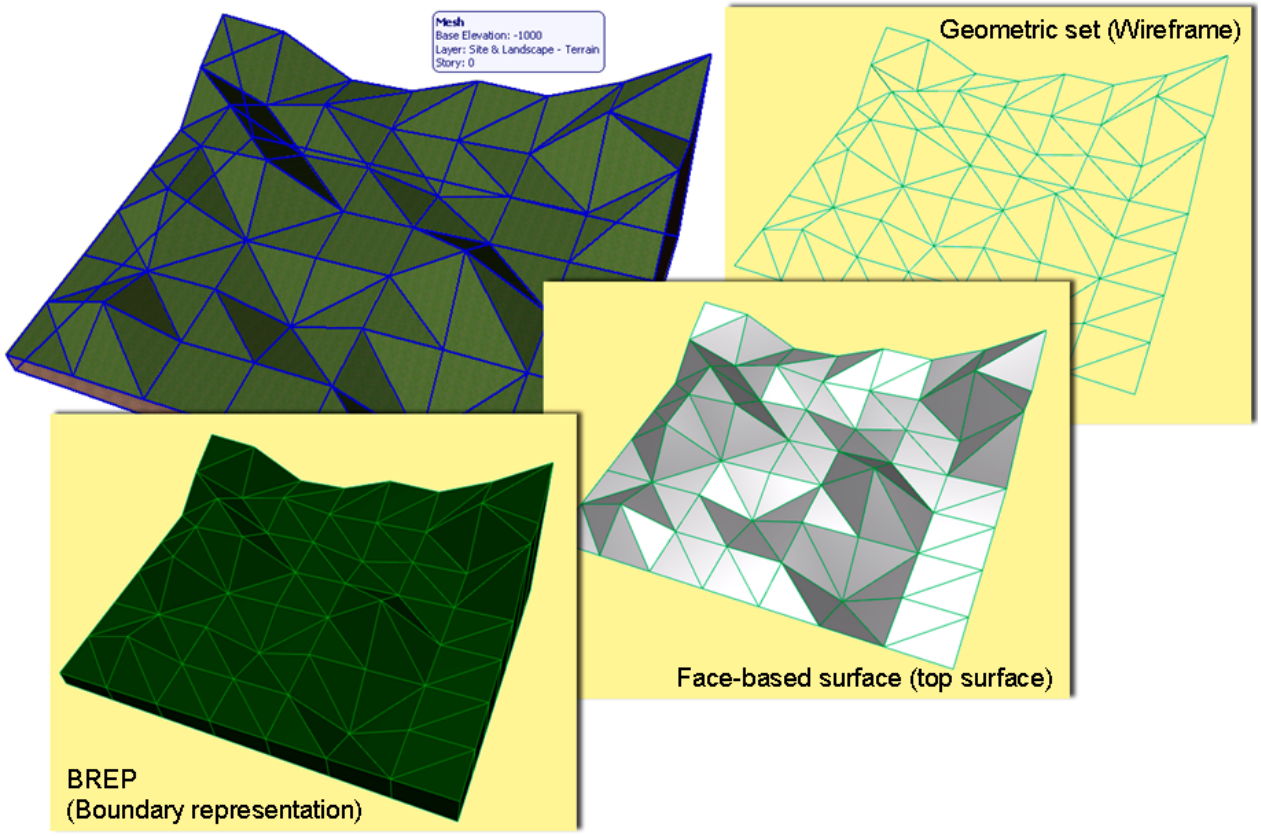
  Furthermore, choosing “Simplified view” will affect your later Export Options: the BREP will be in effect for Complex Element Options and for IFC Site Options.

- **IFC Site**

  In ArchiCAD, the IfcSite geometry *(see IFC Terms and Definitions)* can be created with Mesh elements and with Objects with subtype Ifx2x_Site. Depending on whether these elements are visible/selected in the view from which you begin the export, and depending on your choices

at “Export” options, these elements will be exported. Use the drop-down list to apply a geometric representation to these elements in the IFC model.

Make your choice depending on which kind of site geometry your partner’s application is able to read:



- **Boundary representation (BREP)**

  Geometric representation of Meshes/site-type objects as solid bodies enclosed by their superficies and boundary surfaces. BREP is a simple form of boundary representation model in which all faces are planar and all edges are straight lines.

  Note: With Simplified view (see above), this is always the option in effect: Mesh and site-type elements will be exported as BREP.

- **Face-based surface (top surface)**

  Geometric representation of the superficies (top surface) only of the Meshes/site Objects.

- **Geometric set (Wireframe)**

  Geometric representation of Meshes/site Objects as contours and points.

  Note: ArchiCAD is able to import all three kinds of IFC site geometry representations. When importing an IFC file to ArchiCAD, every IfcSite element will be converted into an object having the subtype Ifc2x_Site.

- **Global Unique Identifiers (GUID)**

  The “Keep existing” option means that IFC GUIDs of elements assigned automatically by ArchiCAD will be keep in the exported IFC model. The “Keep existing” option is necessary

for the efficient use of the Detect IFC Model Changes function *(see Detect IFC Model Changes)*. Moreover, this option is also useful for the same reason when using other programs to compare two IFC model versions arrived from ArchiCAD.

The alternative option is “Generate new”. Each new exported IFC file will generate brand-new GUIDs for the elements, so that each new exported version is entirely separate from the previous versions.

- **Complex Element Options**

  These options apply to the export of special elements and their inter-connections. The possible methods of geometry export are the following:

- **Extruded geometry**

  This is the standard IFC geometry representation, which retains the elements’ parameter values (such as thickness, height, location of reference line or edge, skin structure of composite materials) - however, certain specialized sections are not retained. This is the format usually supported by static analysis programs, because while it is important to retain and possibly to modify the elements’ parameters, their special cut angles (such as the slanted edge of a slab) are not important.

- **Precise geometry (BREP)**

  This Boundary representation (BREP) method comes closest to reproducing the shape of the element, together with its specialized sections and connections. However, the element’s parameters are lost, and BREP elements from an imported IFC file are transformed into non-editable elements. Since this method provides the most exact reproduction of element geometry, it is useful in the “reference model” workflow, which can be most useful for structural editing or preparation programs (such as Tekla Structures).

These two IFC geometry methods can be used to represent the following special geometrical situations:

Walls with complex end connection

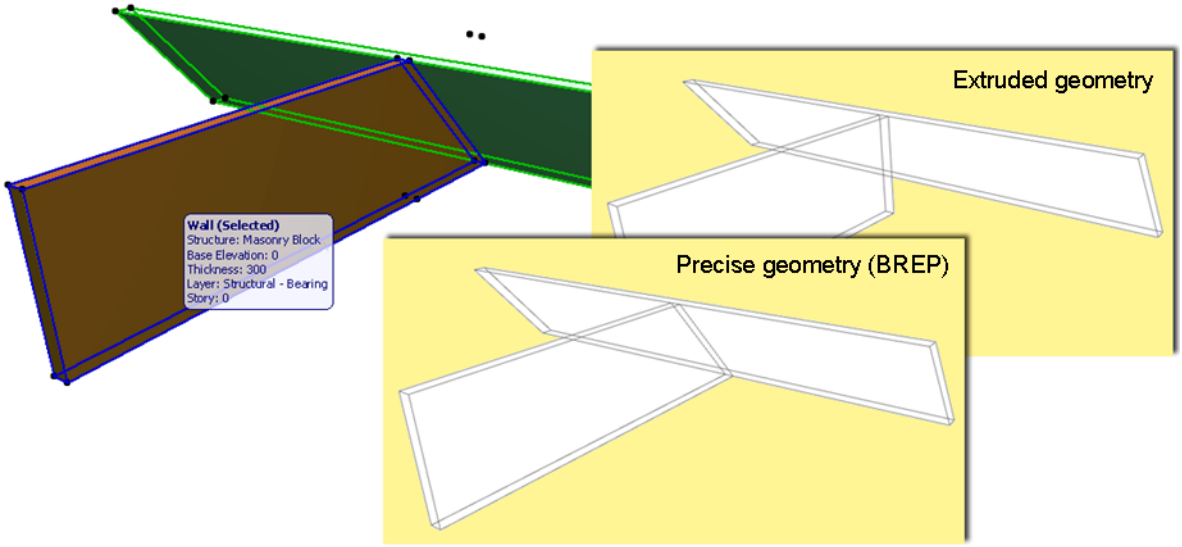
With the Precise geometry (BREP) method:

- If you have one non-simple wall (that is, a wall that is Slanted, Double Slanted or Complex) connected to another wall of any geometry, then both of these walls will be exported with BREP geometry representation.
- If any two connecting walls are not of the same height, then both of these walls will be exported with BREP geometry representation.

With the Extruded geometry method:

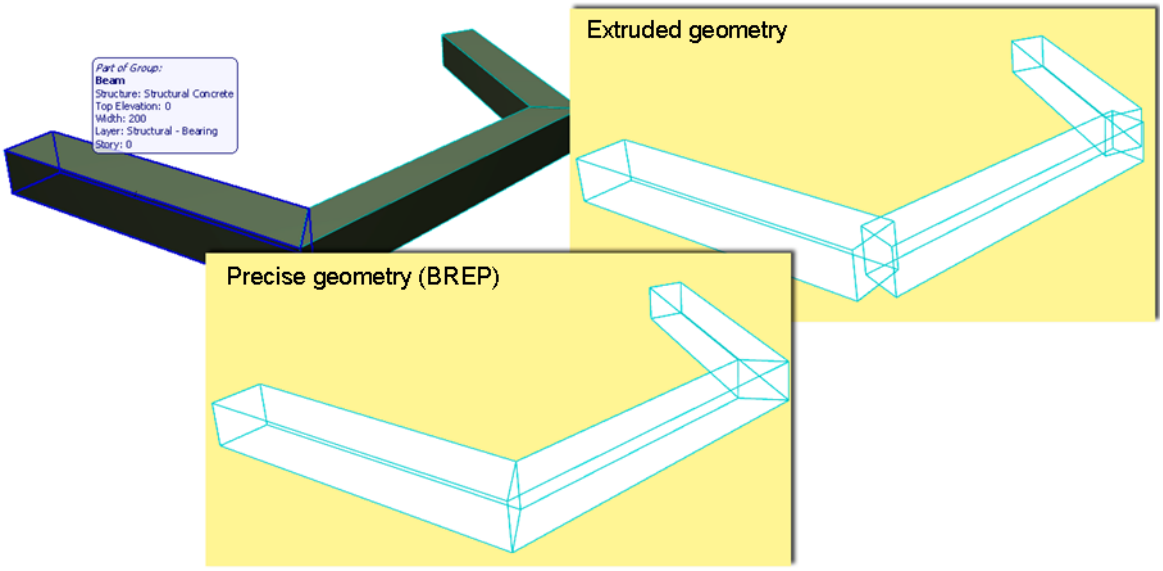
- Most walls will be exported using the extruded geometry representation, if the wall’s geometry allows for it. Otherwise (as in the case of Slanted Curved Walls), they will be exported as BREP.

The difference between BREP and Extruded geometry representations is well illustrated by the case of a simple straight wall connected to a slanted wall:



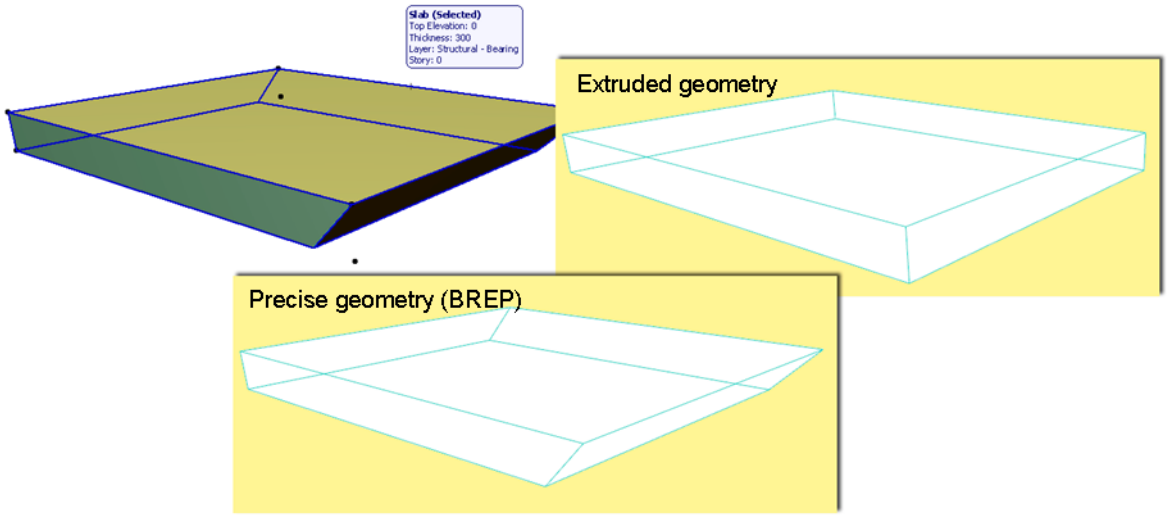
Chained beams

With the Extruded geometry method, chained beams will be exported according to their precise geometry, without any added automatically intersections. With the BREP method, they will be exported as they are displayed in ArchiCAD, including the automatic intersections.



Slabs with slanted edge

With the Extruded geometry method, slabs will be exported with vertical edges, even though their original geometry included a slanted edge. With the BREP method, such slabs will be exported using their correct original geometric representation.



Non-straight composite walls

The following options affect slanted or double-slanted composite walls and those with complex profiles:

- As building element parts: The ArchiCAD wall element is logically made into an IfcWall that includes three building element parts. The advantage of this option is that each building element is assigned the IFC material or profile that is represented by its cut fill in ArchiCAD.

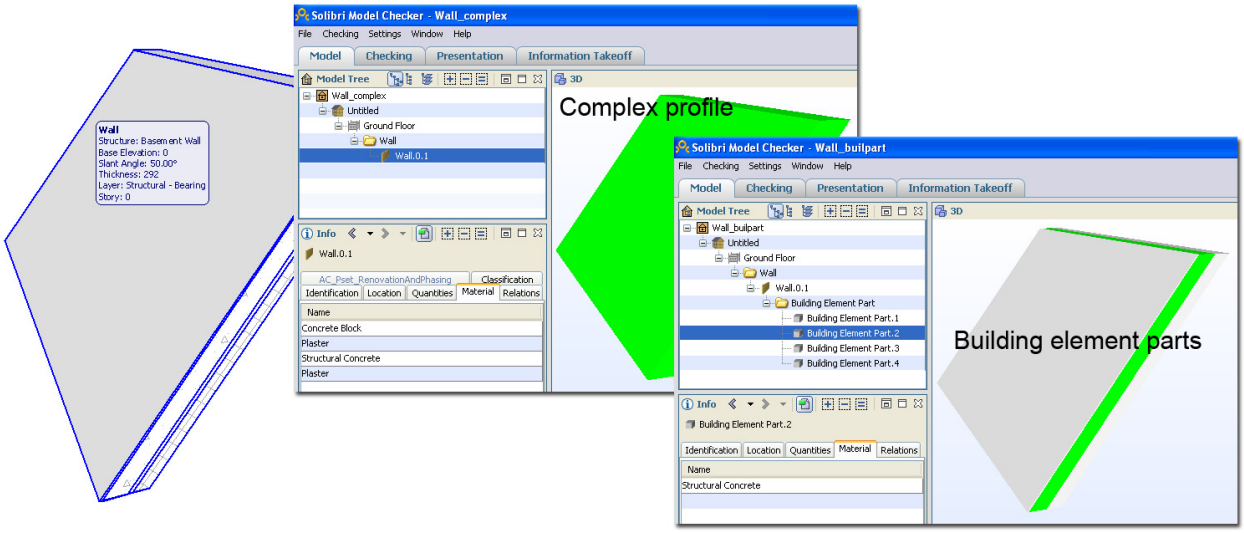
Note: Certain applications (such as Revit Structure) do not support this geometric representation, so in that case the next option is recommended.

- As complex profiles: The ArchiCAD wall element is logically made into an IfcWall element, to which a profile geometry or material list will be assigned, in the form of an IFC material. (The receiving application will not know the precise order of the different components/skins.)

Note: This option is affected by the Partial Structure Display currently in effect, if the view's visible elements are being exported. For example, if the "Core Only" Partial Structure Display

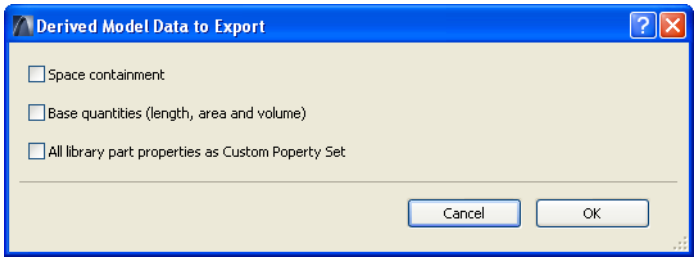
is in effect, then the “As complex profiles” option will have no effect on a slanted composite wall that has a single core, because in this case the wall will not count as a composite element.

Note: This option will affect only walls saved as “extruded” - thus, for example, it will not have any effect if the Simplified view is being used. *(See IFC View Definition).*



Derived Model Data to Export

The following options enable you to export additional data in addition to the elements, which can be useful for data exchange with energy analysis or cost estimation programs:



- **Space containment**

  Check this box if you want to send the model to a facility management application. Space containment defines the relationship between ArchiCAD Zones (IFC equivalent is IfcSpaces) and Furnishing, Mechanical (HVAC) and other contained elements within the space.

- **Base quantities (length, area and volume)**
  Check this box to add Quantity Takeoff parameters to Wall, Column, Beam, Slab, Roof (slab) and Zone elements in the IFC file. This data is useful in the Interoperability with cost estimation applications.

  For example, the following quantities (IfcElementQuantity) can be exported together with a Wall:

  - Height,

  - Perimeter,

  - Gross volume,

  - Net volume (volume reduced e.g. by columns embedded into the wall),

  - Gross Floor Area (doors are not considered),

  - Net Floor Area (area reduced by door footings),

  - Gross Wall Area (openings are not considered),

  - Net Wall Area (area reduced by openings).

- **All Library Part items as custom Pset**
  This option adds all library part properties of the Object, Door, Window, Zone etc.elements to the exported IFC file.

  Note: Choosing this option will significantly increase the IFC file size.

  Hint: As an advanced option, you can use customizable rules to export only certain Library Part elements. For example, you can export only the Fire rating parameter with Doors and Windows. *(see IFC Options).*

  Hint: If the IFC project is expected to do a “round trip” (you will merge it back into ArchiCAD), then it is advantageous to check this box.

IFC Model Units

Choose metric or imperial units (Length, Angle, Area and Volume) for the IFC export.

Note: When doing an import, the imported elements and data are always displayed using ArchiCAD’s model unit preference.

IFC file encoding

Use this option to define the character coding used by the .ifc or .ifc zip file *(see IFC File Types).*

- ANSI: This is the default option for compatibility reasons, since earlier ArchiCAD versions and many other applications (e.g. structural, MEP) use only ANSI.
- Unicode: The recommended option if you are exchanging an IFC model with a receiving application using a different platform (e.g. ArchiCAD 15 on MacOS vs. Windows) or a different language environment (such as a different language version of ArchiCAD).

  Note: Switch to the Unicode option only if you are certain that your data exchange partner’s application supports it.

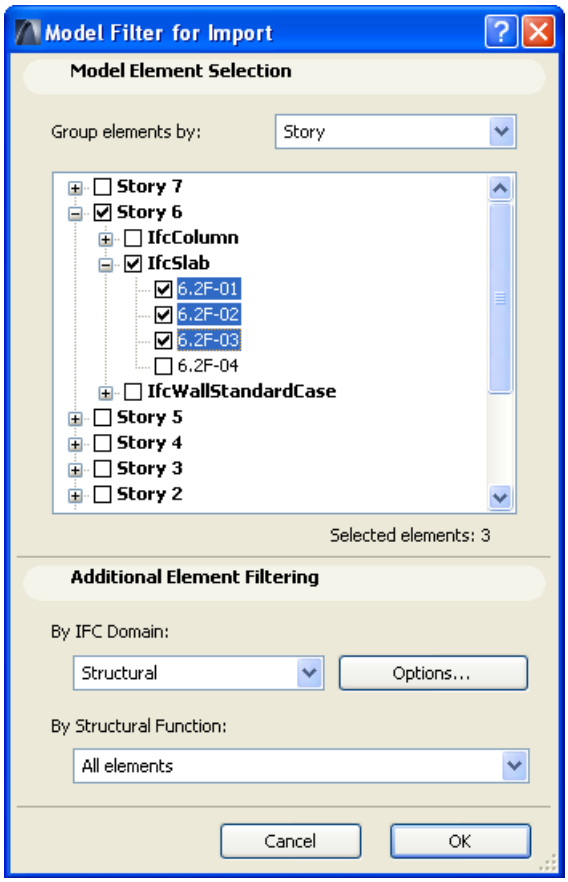
  Note: The Unicode option has no effect when saving to .ifcxml format, because exporting to that format always uses UTF 8 coding.

Model Filter

Each IFC translator contains defined settings for filtering the elements to be imported or exported: *see Model Element Filter*. However, the Model Filter options - which are accessible during the import/export process itself - enable you to fine-tune these settings. You can even filter elements one by one from a list. The Model Filter function varies depending on whether it is applied during import or export:

- During export: Model Filter appears in the dialog box accompanying the Save as IFC process. Based on the "Export" settings here ("Selected elements only", "Visible elements", etc.), the exportable elements are listed: you can now further filter these elements by checking/unchecking their boxes.
- During import: The Model Filter can be shown optionally (from Import Options of the applied IFC translator). Model Filter in this case lists all the elements being imported from the IFC model, enabling you to further filter them by story or function (e.g. structural or HVAC), or one by one.

Model Filter options:



A tree lists the exportable or importable elements. Use this list to further filter the elements to be exported/imported.

Element filtering can be made easier by sorting the list items or grouping them as follows (Group elements by):

- IFC Element Type: for example, in case of model import, the IfcWall group contains elements exported by an application as IfcWall; and in case of model export, the IfcWall group contains ArchiCAD Walls whose classification is set to “ArchiCAD Type”, as well as all other elements that are classified as “Wall”.
- Story: IFC element types and elements are listed by their story location in the model (e.g. Ground Floor).
- Layer: IFC element types and elements are listed by layer.
- Element Owner: element types and elements are listed according to who created them. (In ArchiCAD, you can define this person - the “Model Element Author” - at IFC Options. This name is saved in the IFC file as IfcOwnerHistory.)

Further element filtration can be done by IFC Domain (Structural, HVAC or customized settings) and/or by Structural Function, as described at Translator settings. *(See IFC Translators.)*

Note: Filtering by Structural Function works differently for IFC Import and IFC Export:

- At IFC Import, the filter considers the “LoadBearing” IFC property.

- At IFC Export, the filter considers the ArchiCAD elements’ “Structural Function” classification.

Advanced IFC Skills

This section describes additional IFC options, functions and tools for ArchiCAD users who have experience in exchanging data using IFC.

IFC Terms and Definitions

This chapter summarizes the main definitions related to IFC in ArchiCAD and the standard IFC scheme.

GUID

A Globally Unique Identifier (GUID) is a string assigned to each element, both in ArchiCAD and in an IFC file. As its name indicates, a GUID enables a program to identify and differentiate elements, since each element has been assigned a unique ID.

> **Note:** Although the assignment of IFC GUIDs, during IFC export, is based on ArchiCAD GUIDs, these two types of GUIDs should not be confused. *(See Attribute, below)*.

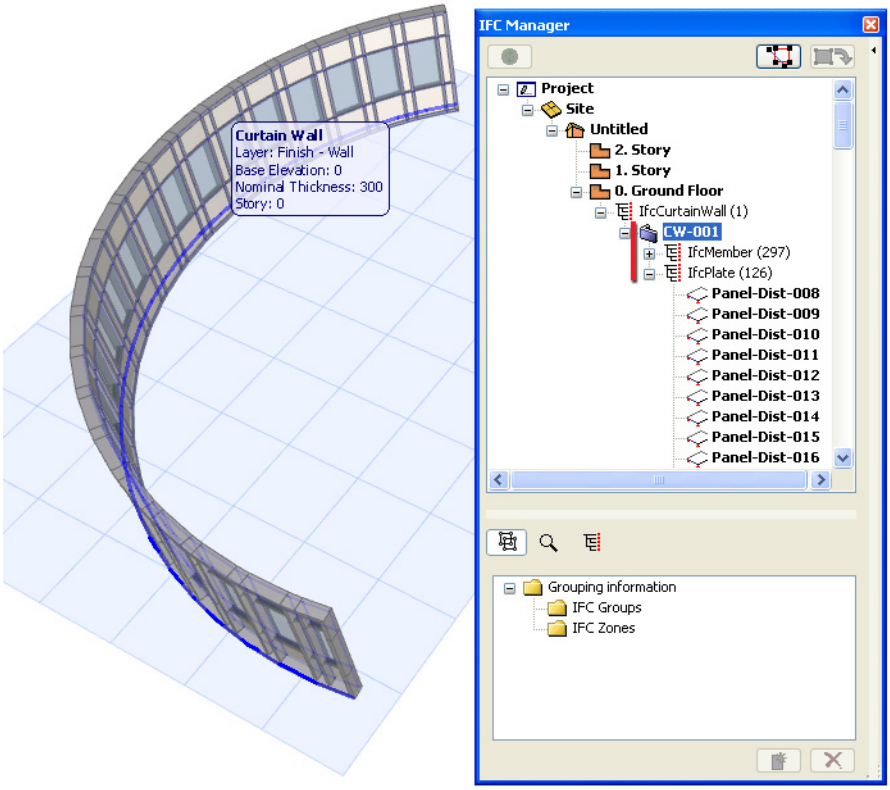
IFC Entity

Project information from ArchiCAD saved in IFC is represented as a set of entities - such as elements, material, and their relationships. Each entity (for example, an IfcWall) includes a fixed number of attributes, plus any number of additional properties. The IFC scheme encompasses several hundred entities, of which the building element type entities (such as IfcWall and IfcColumn) represent only 25.

IFC Container

An IFC entity that does not have a geometry, but does have attributes and properties (see below); its geometry is defined by its components. For example, a Curtain Wall placed in ArchiCAD is a container (IfcCurtainWall), whose components include frames (IfcMember) and panels (IfcPlate). Similarly, a stair (IfcStair) imported from an external application is also a container, whose

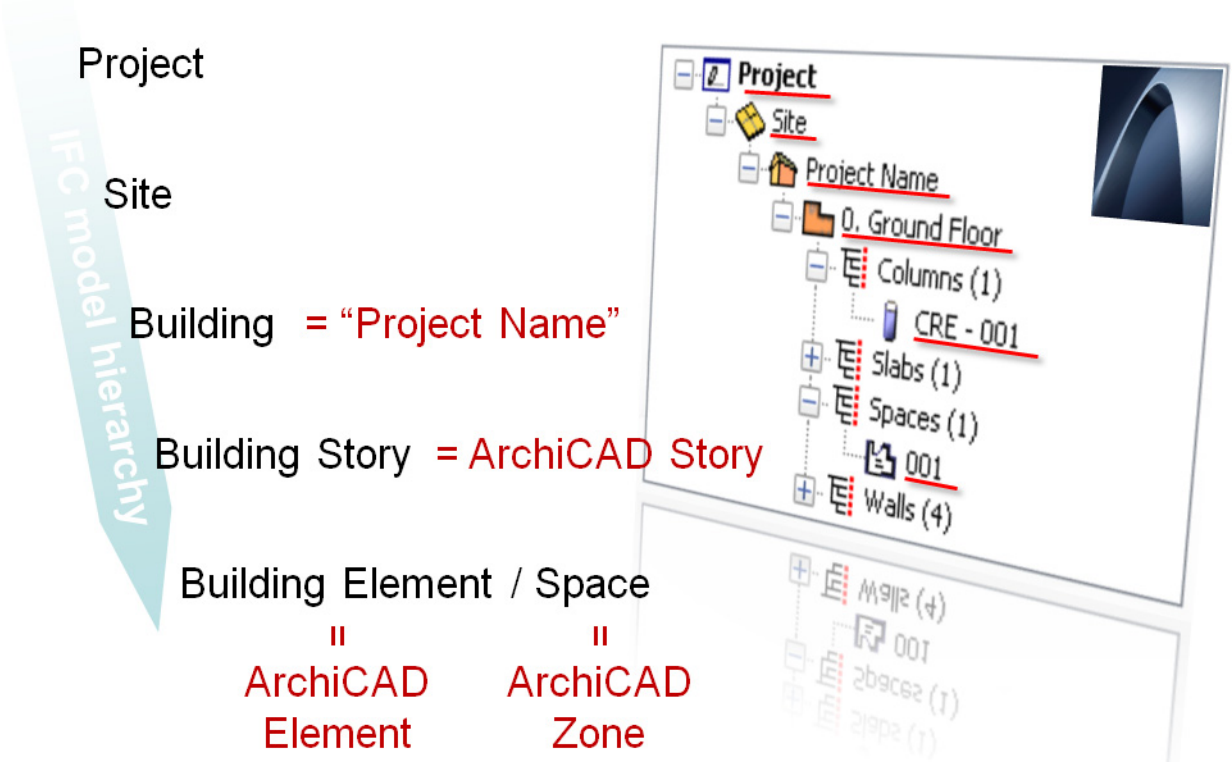
geometry-defining components are the IfcStair (comprising its steps) plus IfcRailings (its railings).



IFC Model Hierarchy

An IFC model is composed of entities built up in a hierarchical order. As shown in the following illustration, each story level has its corresponding story in ArchiCAD (for example, when you

import an IFC model). Use the **IFC Manager** command to gain an overview of this hierarchy. *(See Element Settings vs. IFC Manager.)*



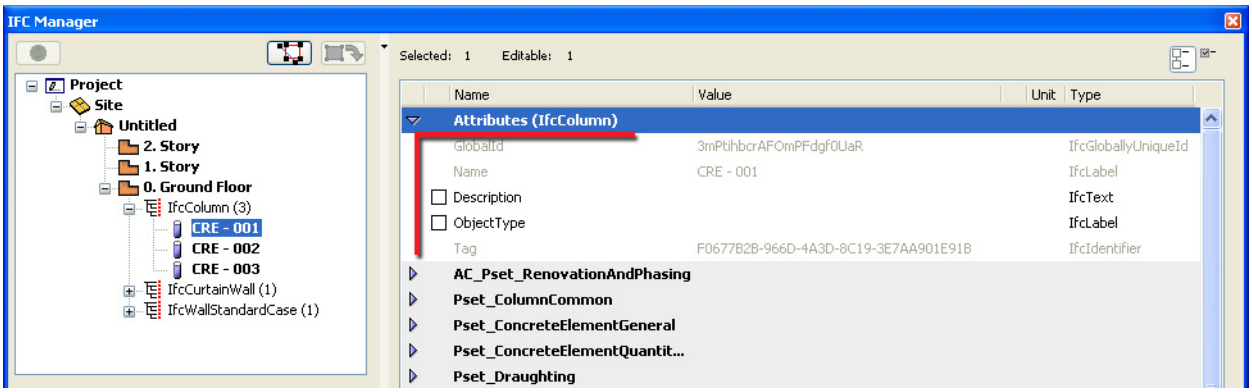
Note: IfcSite is the geographic position of the IfcProject. It can have a geometry but a geometry is not required. In ArchiCAD, site geometry is represented by Mesh elements and Site-type Objects.

ArchiCAD can import one Building only. But it can import more than one Site, even though the Site is above the Building in the hierarchy. Thus, when importing an IFC file that contains multiple Buildings, you can choose only one to import *(see Step 4: Building Selection)*. However, other applications can export a Building's topography into multiple IfcSites. In this case, importing the Building will import all of the sites, merged into the one IfcSite that actually contains the imported Building. The result is that you will end up with a single IfcSite and a single IfcBuilding, but the IfcSite includes all of the sites.

Attribute

An attribute in the IFC scheme (not to be confused with ArchiCAD attributes) helps to define an IFC Entity. The attributes of a selected element (entity) can be displayed and checked with the IFC Manager *(see Element Settings vs. IFC Manager)*. For example, the IfcWall has the following

attributes: GlobalId (= IFC GUID), Name (=element's ArchiCAD ID), Description, ObjectType and Tag (=element's ArchiCAD GUID).



Property

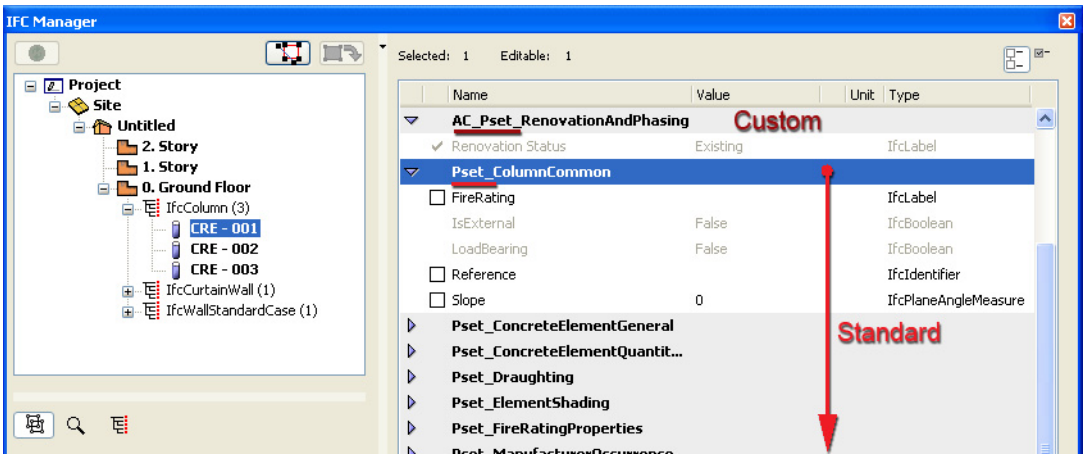
Properties are additional parameters assigned to an IFC entity. IFC properties can be either standard (conforming to the rules of the IFC scheme), which are stored in property sets whose names begin with the prefix "Pset_"; or they can be custom, which are created by the exporting application using any property name and stored in any property set (the names of these property sets usually contain the name of the exporting application).

Note: Library Part parameters can be exported from an ArchiCAD model as custom properties. Creation of custom properties is possible through the **IfcOption** command, using the "All Library Part items as custom Pset" export option *(see All Library Part items as custom Pset)*. Usually (if you are not using mapping rules), a Library Part parameter is exported from ArchiCAD under its localized name, and in the property set having the prefix "AC_Pset_(Libpart name)".

Properties, whether standard or custom, can be viewed and (if not protected) edited in ArchiCAD in the Tags and Categories panel of the elements' Settings dialog box, or - at the level of the full model - in the IFC Manager. *(See Element Settings vs. IFC Manager.)*

Some standard properties will become ArchiCAD attributes: Layer, Fill Type (IfcMaterial), Composite, Material (IfcSurfaceStyleRendering), and Complex Profile. Two IFC properties (LoadBearing and IsExternal) will become native ArchiCAD properties used for classification

purposes. All of these properties can be searched using Find & Select, or listed using the Interactive Schedule.



Since IFC properties are a native part of ArchiCAD projects and stored with the elements, the following functions in ArchiCAD will include IFC parameters:

- Parameter transfer between elements (Pick Up/Inject Parameters)
- Copy/Paste elements
- Element Favorites
- Project Template parameters

Note: You cannot directly hotlink an IFC file, but an IFC file saved as an ArchiCAD file can be hotlinked in turn to another ArchiCAD file. In this case the hotlinked file includes all of the IFC properties.

IFC Element Type

An IFC Element Type includes properties that are referred to by multiple elements. For example, IfcWindowStyle, to which many windows (IfcWindow) refer. Each IFC Element Type has its own IFC GUID, just like IFC Elements.

Note: The properties of an IFC Element Type (which can be imported via an IFC model from an external application, or automatically generated within ArchiCAD, as for example when placing windows) are not editable. They can be viewed in IFC Manager using the “Element types” view. *(See Element Settings vs. IFC Manager.)*

Element Settings vs. IFC Manager

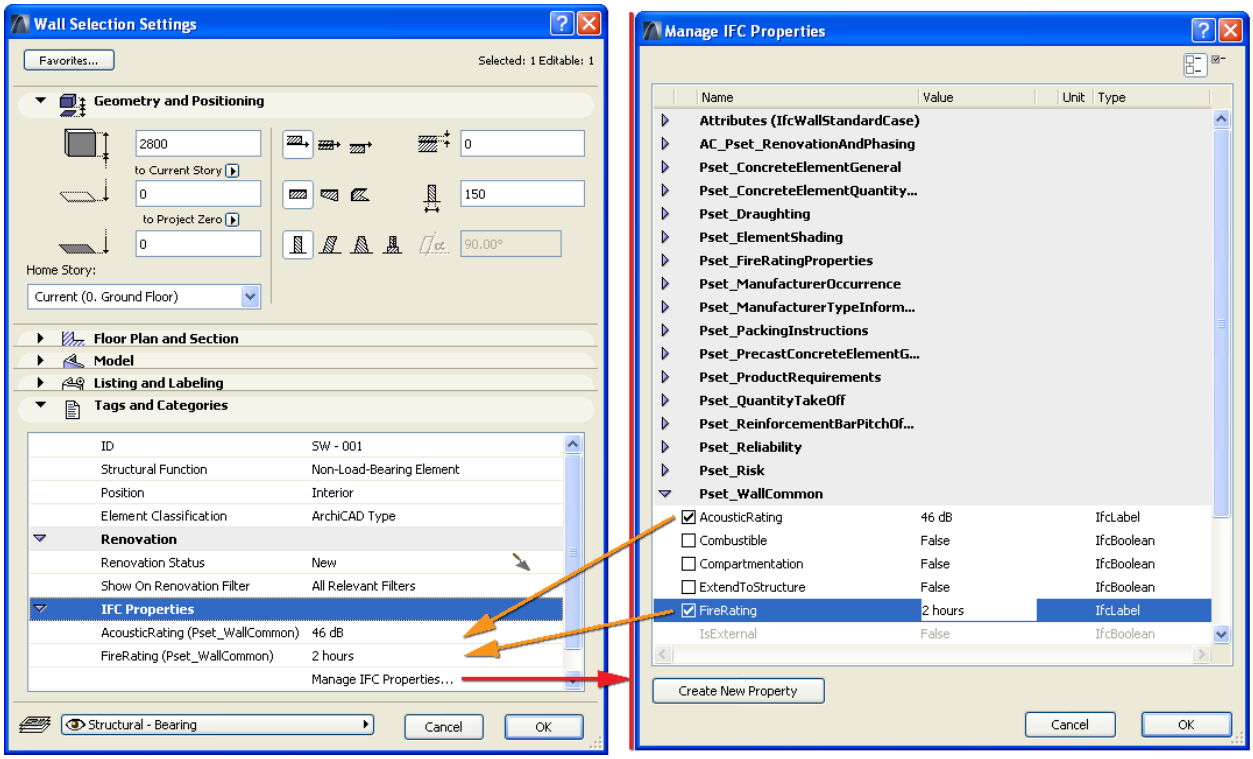
The IFC options in Element Settings dialog boxes, and the management-navigation capabilities of the IFC Manager to display “everything in the IFC model”, are often referred to in this manual. This section summarizes all the functions and capabilities of these two features, and the differences between them.

Settings Dialog

ArchiCAD elements created out of imported IFC model elements display their standard and custom IFC properties, at the element level, in their respective Settings dialog boxes (Tags and Categories panel).

> **Note:** Imported IFC elements and their properties (depending on the translator used) generally (by default) are protected against modification in accordance with the Reference model concept. Of course, by activating the layers of those elements, those elements too can be modified as needed.

Similarly, you can use the IFC options in Element Settings to add standard and custom IFC properties to ArchiCAD elements *(see Create New Property)* prior to IFC export. To do this, you can use the **Manage IFC properties** button.



Notes:

- Naturally, properties created in the IFC Manager (whether or not they have a value assigned to them) will be listed in the Settings dialogs of the affected elements.

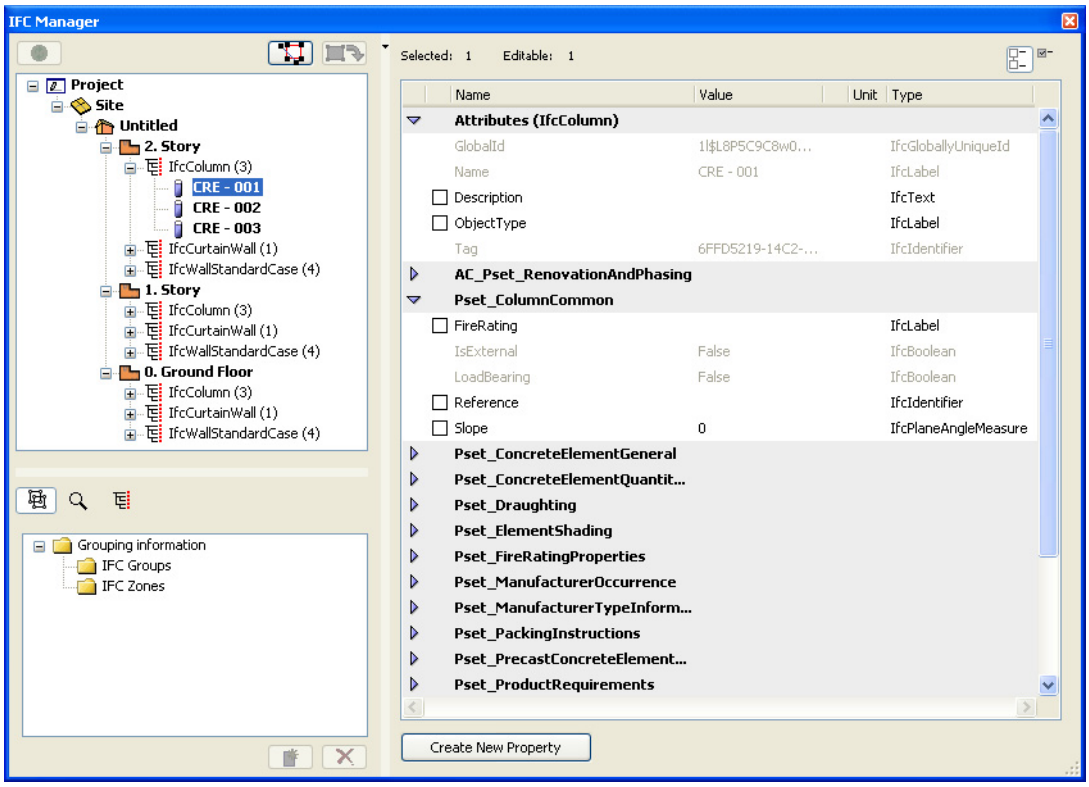
- In the IFC properties list, only those properties are shown which are not inherited, and those which are editable attributes (e.g. Description). For example: the LoadBearing property will

not appear here, because that is directly assigned in the Tags and Categories panel as a Structural Function classification. Similarly, the IsExternal property does not appear, because it is assigned as the Position in the Tags and Categories panel.

- The first column of the IFC properties list shows property names in alphabetical order, followed by the PSET name in parentheses (or, in case of attributes, the designation "Attribute"). The second column shows the value of the property; if the value is editable, an editing control at the end of the row is available.

IFC Manager

The IFC Manager (**File > File Special > IFC 2x3**) provides a hierarchical overview of the current project's IFC model database. Features of the IFC Manager:



- Lists the IFC entities generated from the elements of the current ArchiCAD project.
- Query the IFC attribute, property and property set settings added to ArchiCAD elements.
- Edit IFC properties and property sets.
- Add new properties (in addition to the default ones) to IFC entities (and thereby to project elements) for later IFC export.
- Create new properties and custom property sets *(see Create New Property)*.
- Find elements (IFC entities) both in the IFC and ArchiCAD models by their IFC GUIDs.
- Navigate easily between the ArchiCAD model and the derived IFC model.
- Update the entire ArchiCAD project with the modifications of the IFC model, and
- Group elements and Zones.

The Containment Structure tree displays the IFC model hierarchy *(see IFC Terms and Definitions)* and lists IFC entities one by one according to their "IFC Element Type" classification.

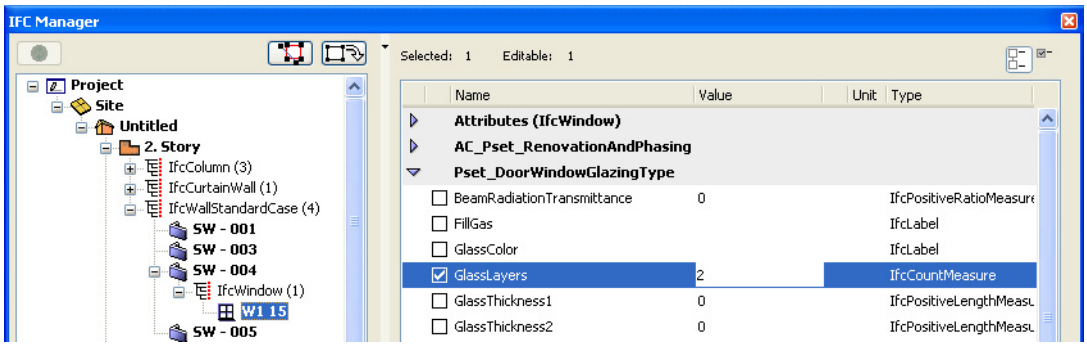
The right side of the dialog box displays the attributes and properties of any element you have selected on the left (in case of multi-selection, the properties of the last-selected element are shown). At the top of the list, the numbers of selected/editable elements are shown. To the right, use the radio buttons to adjust the list view:

- Entire list: All attributes, standard property sets and custom properties are shown.

- Filtered list: Only those parameters are shown, grouped, which will be handled and, in case of export, saved to the exported file: that is, editable attributes only (other attributes are not displayed); only those standard properties that are checked; plus all custom properties.

Here is an example of how you can activate standard properties and assign values to them:

Add double glassing as a new property to a selected window by typing "2" in the Value field of the Pset_DoorWindowGlazingType > GlassLayers property.

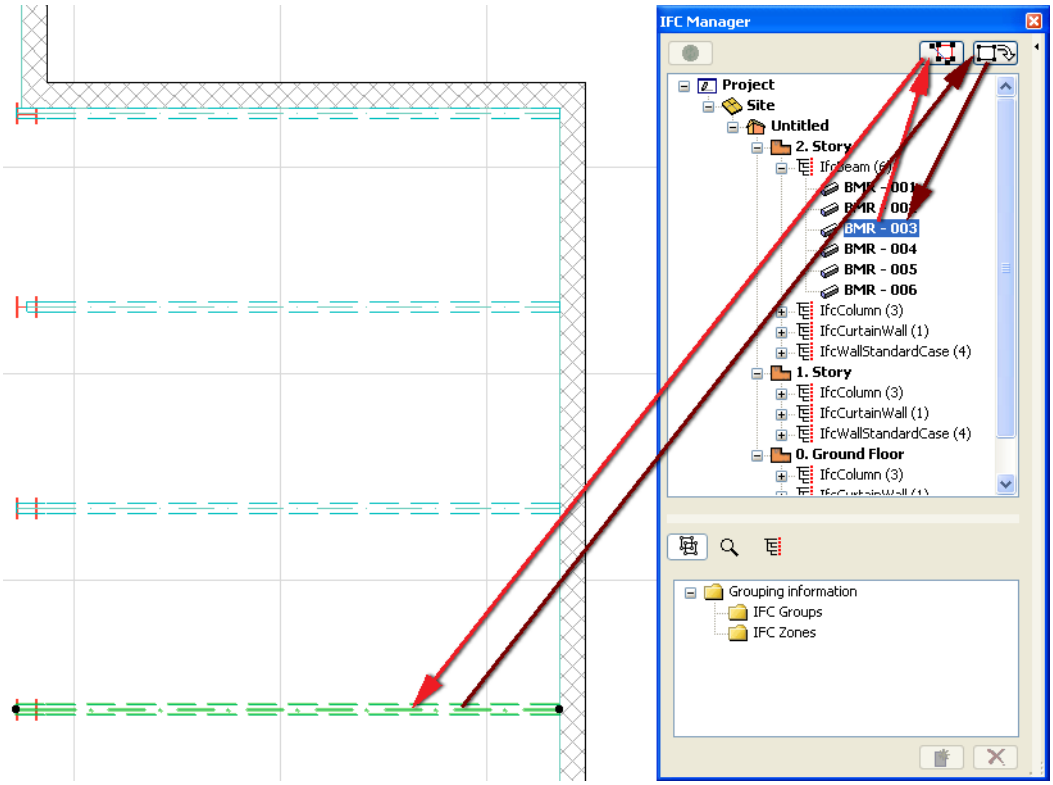


Note: In Teamwork, the following data in the IFC Manager can be reserved and modified: Project Building, Site, IfcGroup and IfcZone (see below for explanations of these last two items). IFC properties of model elements (e.g. Wall, Column, Beam) can be modified via IFC Manager only if those elements are not reserved by any other user.

The IFC Manager palette is a modeless dialog box, so you can keep it open while working in the ArchiCAD project:

- If elements are created or deleted in the ArchiCAD model, the containment tree will not register these changes automatically. If a refresh is needed, a message appears below ("Tree is not up to date!") To synchronize the tree view of the IFC Manager with the model, click on the activated synchronize button above the list. (If this button is grey, it means the tree view is up to date.)
- To find one or more IFC entities in the ArchiCAD model, select them in the tree dialog, and then click **Show Selected Tree Element**. The program then attempts to display and select the elements in the active window (Floor Plan or 3D Window only). In Floor Plan view, if the element is not visible, then ArchiCAD automatically switches to the Home Story of the selected element. If it is still not visible, then a warning dialog appears. In the 3D Window, if the element is not visible, a warning dialog appears. In case of multiple selected elements, the last selected element will be the one shown in the program.

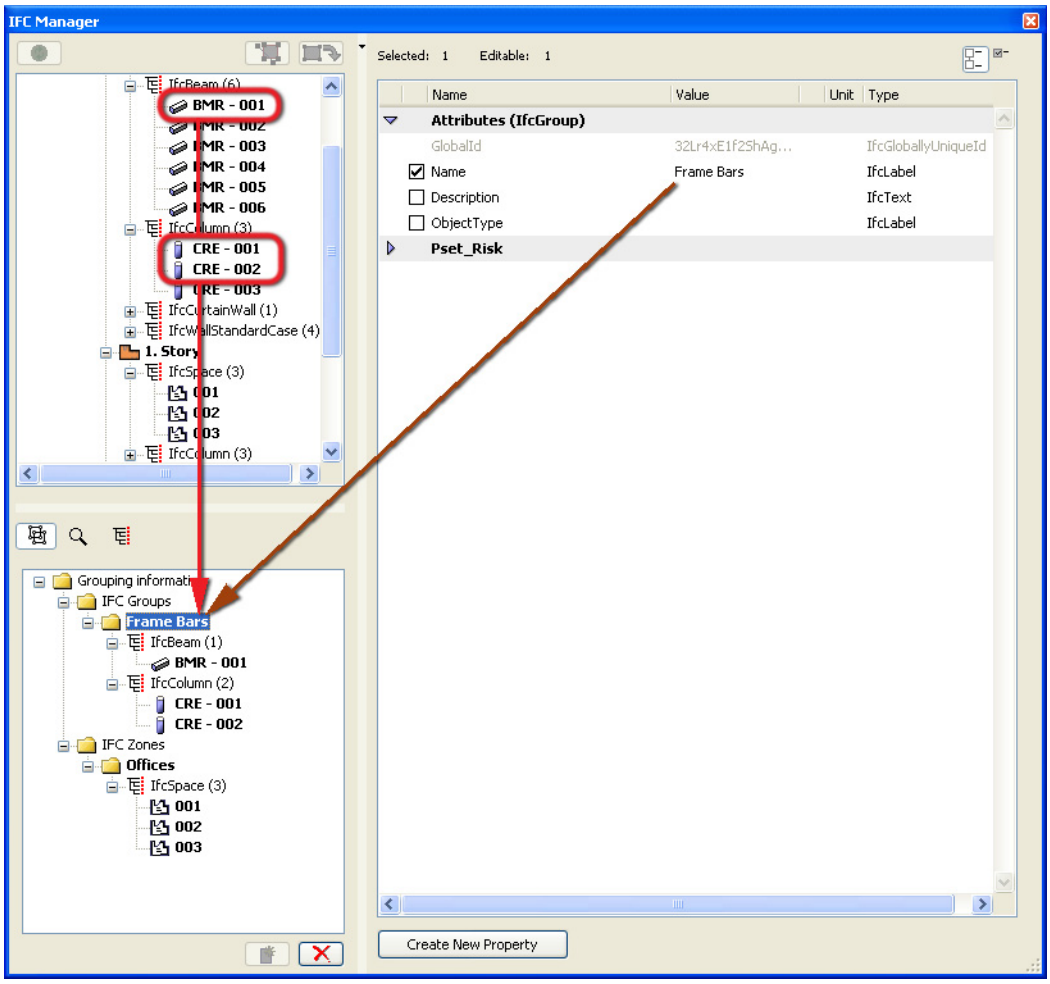
- Click the third button, **Show Selection in Tree**, to show any ArchiCAD model element selected in the current Floor Plan or 3D view in the Containment Structure tree hierarchy. (It is recommended to use this button if the tree structure has already been synchronized with the model.)



For some applications (primarily facility management and cost estimation applications), placing certain IFC entities into a single group can be advantageous. You can apply any new Properties and Property sets to these groups. Click the Grouping Information icon (first icon under the tree) to switch to group editing mode, where you can use two kinds of groups:

- IFC Groups: These can contain IFC entities of any combination (such as two columns and one beam).

- IFC Zones: These can contain only IfcSpaces generated from ArchiCAD Zones (you might group all zones having the same function).



To create an “IFC Group”/“IFC Zone” group:

1. Select the group type by clicking on the IFC Groups/IFC Zones folder under Grouping information.
2. Click the New button under the Grouping information section.
3. Give a name to the new Group/Zone on the right side of the dialog in the Name attribute field.
4. Edit Attributes and/or the content of the available properties.
5. Define new properties with Create New Property option if needed (see later).
6. Drag and drop entities (elements) into the targeted folder (i.e. group) from the Containment Structure tree list.

You can locate elements in the tree hierarchy based on their IFC GUID. Switch to the Search mode using the second icon under the tree (Find by GUID) Type the GUID or any portion of it into the field below the tree, then click “Search by GUID”. Choosing any item in the Search result list will show the location of the assigned element in the tree view.

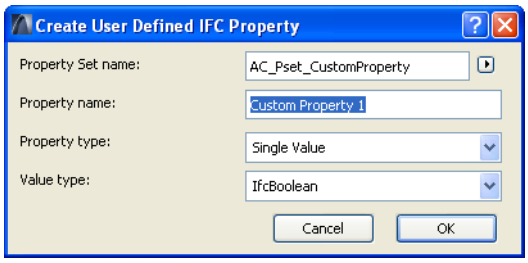
The IFC Manager locates and displays all the IFC Element Types *(see IFC Terms and Definitions)* that exist in the project, plus all the elements which refer to them. To see this, switch to the Element Types view mode using the third icon underneath the tree. In the appearing list, click on an IFC Element Type, then view all of its properties and attributes in the list on the right (these are not editable here).

Create New Property

Custom properties and custom property sets can be created for any element (not just for Library Parts, as described at: *IFC Options*): click Create New Property.

In Element Settings, you can create a new property at the element level. For example, by selecting certain columns in the project, you can assign a new property to each of them - the same way that you can assign a new height to any selected columns. Indeed, you can use Favorites in the Settings dialog to ensure that a certain element type (e.g. all Walls) be assigned the new property each time a new Wall is created.

In IFC Manager, you can create new properties not just for elements, but at the model level for the entire project, site, building, or stories. You can add new Custom Properties and Property Sets to IFC Groups as well.



After you click Create New Property, a dialog box appears where you can create a new property for a new or existing custom Property Set. Follow these steps:

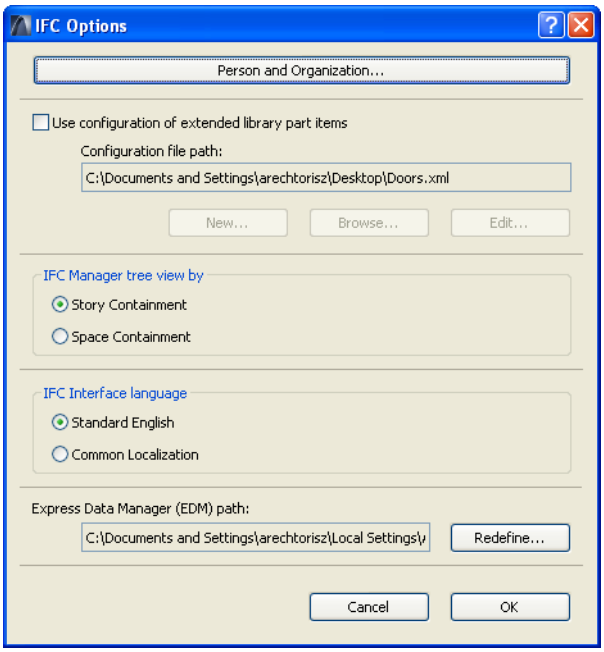
1. Create or select a custom Property Set (Property Set name)
2. Define the new property with its name (Property name).
3. Set the property's type by selecting the proper type.
4. According to the property type, set its value type.

   Note: To avoid errors (and to keep the standard property definition rules), do not use the standard PSET_prefix when giving a name to your custom Property Sets.

After you create the new Property, it will appear in the defined (selected) Property Set in IFC Manager's list, as well as in the element Settings dialog among the listed properties. To delete a custom property defined earlier, select it in the list and click the red X next to it. If a custom Property Set no longer contains any properties, it will be deleted from the list automatically.

IFC Options

Most of the IFC options can be customized with IFC Translator Setup *(see IFC Translators)*. However, additional settings that are usually modified infrequently, are found at **File > File Special > IFC 2x3 > IFC Options**).



Person and Organization

Use this page to enter general information about the project owner (Person) and organization. This information (IfcOwnerHistory) will be added to each exported element.

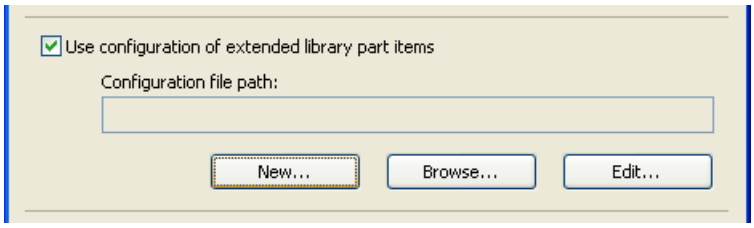
> **Note:** At model filtering of export/import, the IFC elements can be grouped by the Owner information (Person name) set here or received from other applications.

Configuration of extended library part items

Use these controls (check the box) to convert selected or all parameters of ArchiCAD Library Parts (Object, Door, Window, Skylight, Stair, Zone and Lamp) to IFC properties. In essence, this is a mapping process that is carried out according to an applied configuration file (mapping rule). Since the configuration file is editable (see later), this option allows you to do the following:

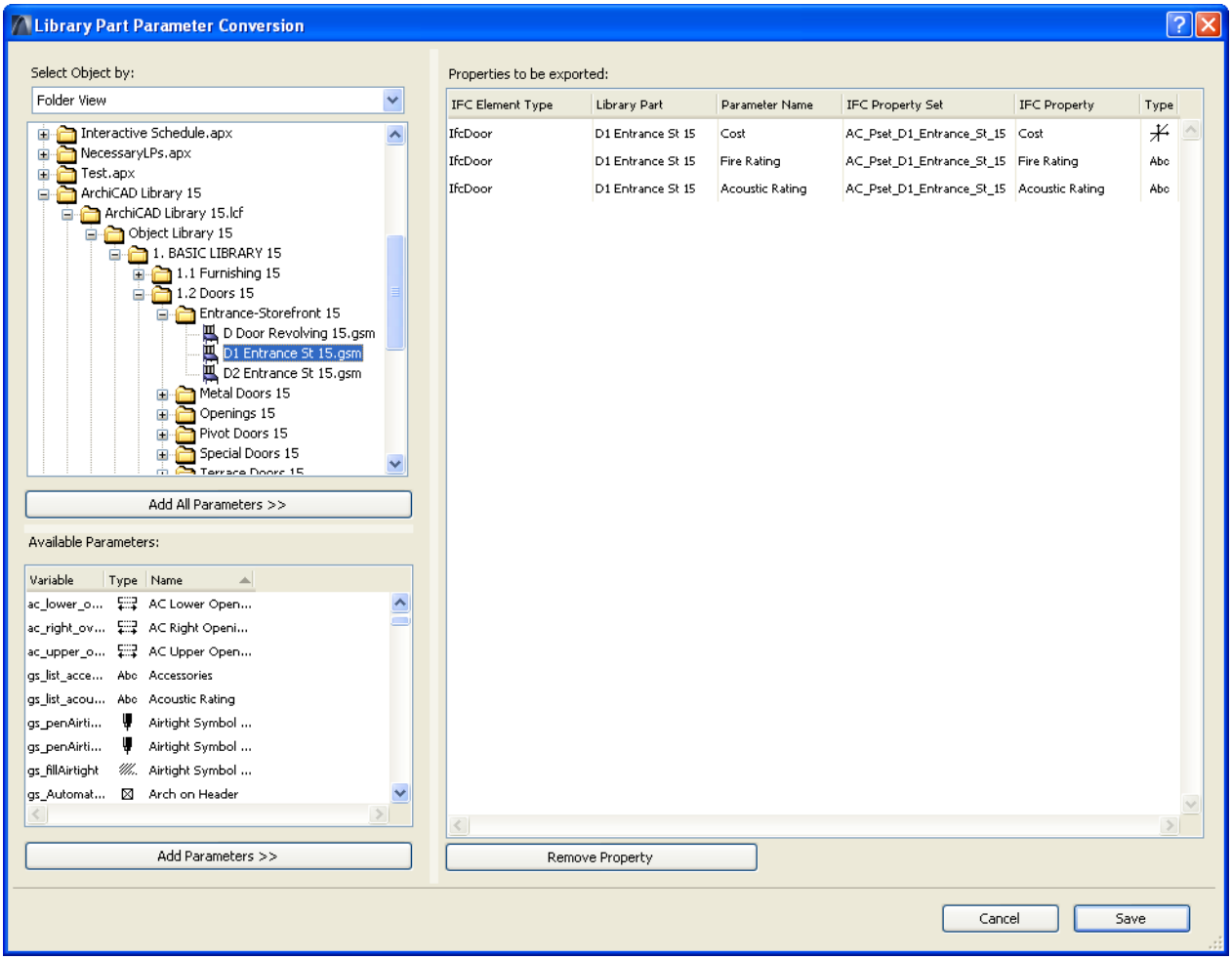
- to store custom properties in custom property sets by default, and to prepare them for export
- to prepare certain library part parameters to be stored and exported as standard IFC properties, in standard PSETs, if a corresponding parameter exists in the IFC scheme (for example, ArchiCAD's "Fire Rating" parameter corresponds to the standard IFC property "FireRating")
- to harmonize library part parameters with IFC parameters handled by other applications' import/export processes. This means that the conversion file named in this option will be used by ArchiCAD's IFC import processes (Open/Merge and Detect IFC Model Changes), so that -

for example - the custom properties of an IfcSpace (such as a Revit Room) imported from another program will be mapped to the values of an ArchiCAD Zone library part.

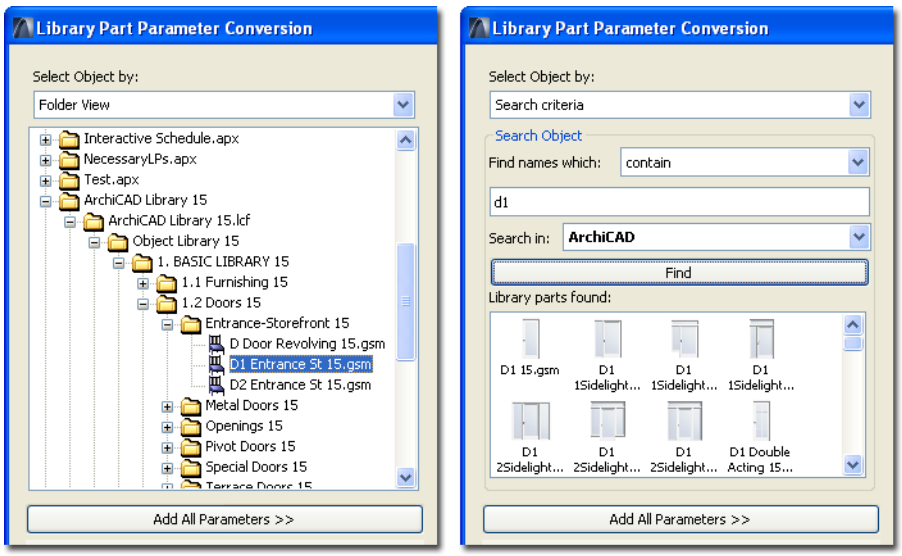


Several configuration files (using the extension .xml) can be created, saved, browsed for or modified (use the New, Browse, Edit buttons). The mapping process always relies upon a single configuration file that is selected here and whose name is displayed in the Configuration file path field. The effect of the mapping process defined in the configuration file will be seen in both the Element Settings dialog boxes and in IFC Manager.

When creating a new configuration file or editing an existing one, you will use the appearing dialog box with the following main controls:



The Object list at the top left displays the libraries currently loaded in the project (Folder View). You can change among the following views: Folder View (used Objects only) and Search criteria, which enable you to search for an object based on numerous criteria.



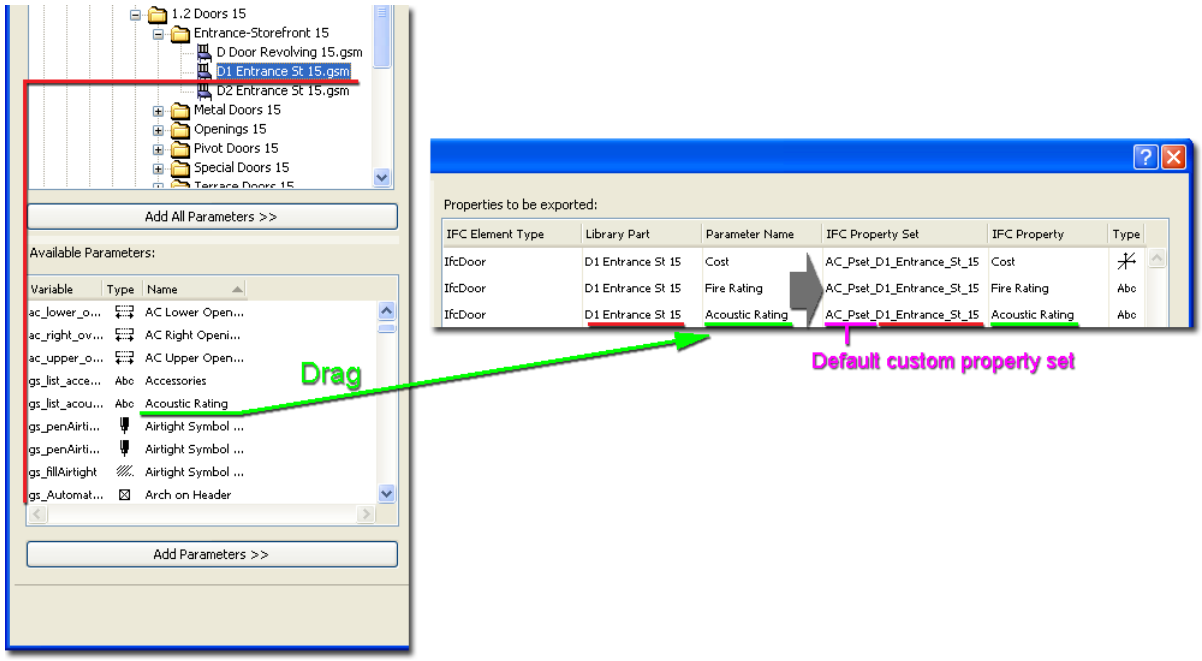
The list at the lower left (Parameters) displays all the Library Part parameters of the Object selected from the list above. (If multiple objects are selected, this list is empty.)

The Configuration list on the right shows those parameters whose conversion to IFC properties will take place using the current configuration file. Parameters can be placed in this list in the following ways:

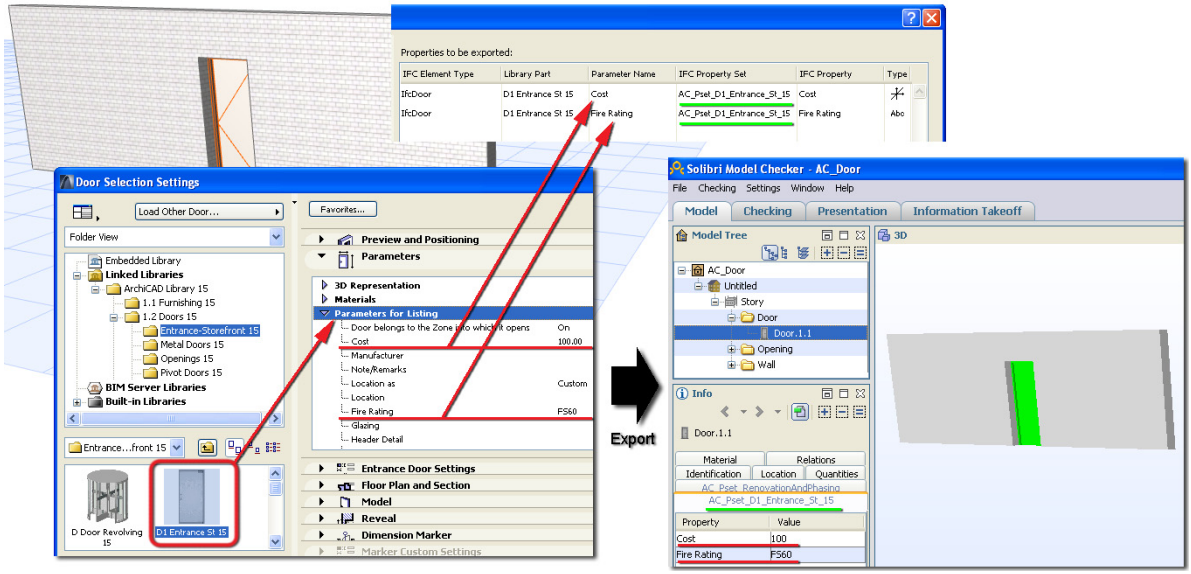
- by dragging any or all parameters of multiple selected Objects into this list, or by clicking the Add All Parameters button;
- or, if a single Object is selected, by dragging any or all of its parameters into the list (or by clicking Add Parameters).

In the Configuration list, all parameters belonging to a particular Object are stored in their own custom property set (AC_Pset_ Object name), using the IFC property name that corresponds to

the parameter's localized name. The IFC Element Type (such as IfcDoor) is automatically created based on the Object's GDL subtype, and can be modified as needed.



For example: We have assigned the Cost and Fire Rating parameters to a Door, using the Door Settings dialog box. We want to export these parameters (and their values) as custom properties, together with the Door, to an IFC file. All we need to do is drag the two parameters of the Door into the Configuration list. The values of the Door parameters will be assigned to these IFC Properties during export. You can see the result, for example, by using Solibri Model Viewer.

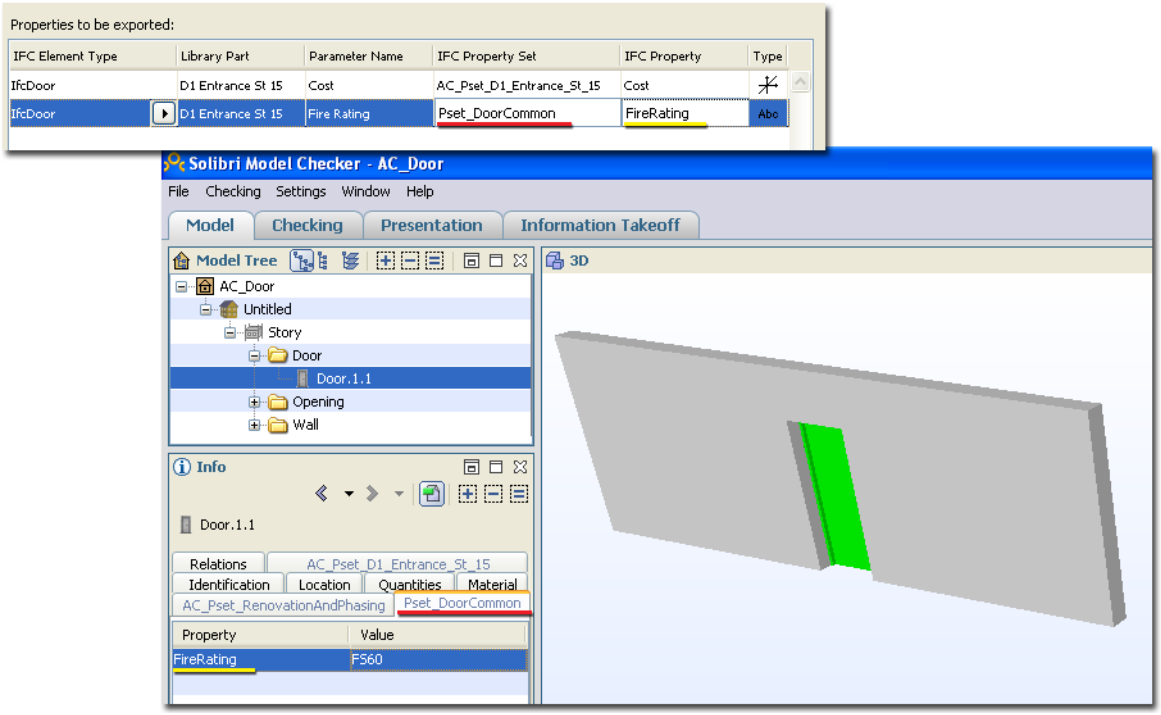


To complete and save the configuration file in XML format, click Save. The Save button is active if you have activated the **Use configuration of extended library part items** in the IFC Options dialog box, and if the file is shown in the “Configuration file path” field.

> **Note:** The chosen configuration file is also used when you save additional custom property sets (Derived Model Data to Export > All Library Part properties as Custom Property Set). *(See Derived Model Data to Export.)*

As needed, you can modify the property and property set names in the Configuration list. This way, you can export certain properties as standard IFC properties. (ArchiCAD uses the configuration file during the import process, too: you can pair incoming custom properties with their counterparts in ArchiCAD, if any exist. For example, if a custom zone arrives from Revit, you can define which ArchiCAD Zone parameters should correspond to those parameters.)

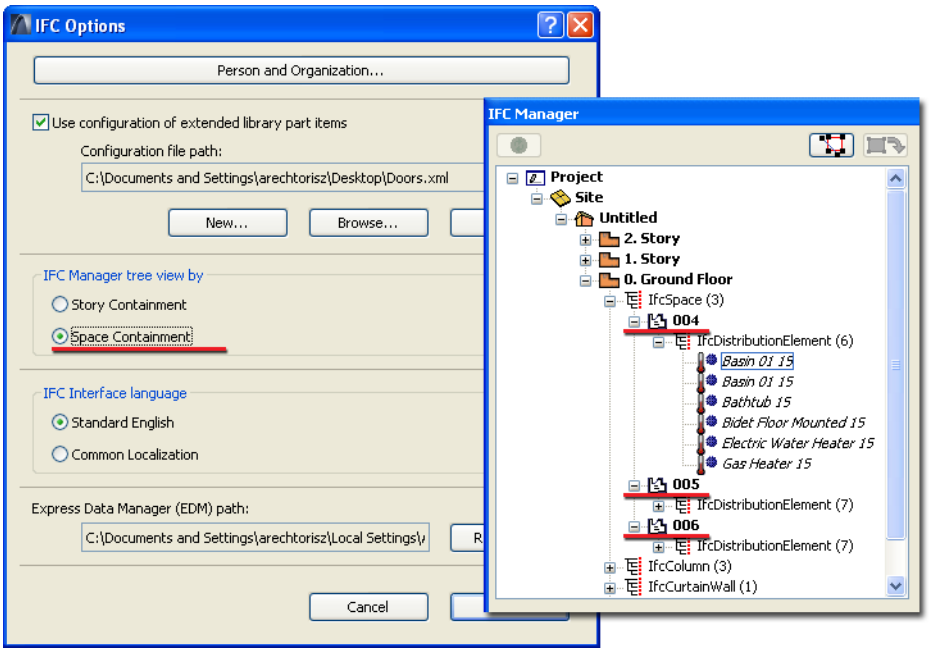
Example: We would like to export a Fire Rating parameter, which is assigned to a Door, as a standard IFC property. This is possible, since this parameter has a counterpart in the IFC scheme, namely “FireRating,” in the “Pset_DoorCommon” property set. All we need to do is rename the existing parameter and property sets accordingly.



IFC Manager Tree View

Use this control to vary the tree view used by the IFC Manager. If the ArchiCAD model (even after IFC model import) contains ArchiCAD Zones (IfcSpaces) which contain Objects (such as

MEP elements), then you can switch the IFC Manager tree view to a view (Space Containment) which lists the Object content belonging to each Zone.



IFC Interface language

The standard language of IFC 2x3 is English, thus the default and recommended setting for the interface is English. In localized ArchICAD versions, some standard IFC key words (such as entity, property, attribute names) may be shown in the local language, but this has no effect on the export, just helps users comprehend IFC terms on the interface.

Express Data Manager (EDM) path

The EDM (Express Data Manager) toolkit is the engine which creates an ArchiCAD model from the imported IFC model, and which also creates an IFC file out of the exported ArchiCAD model. The default engine is the recommended one, but you can use the Redefine option here to modify it as needed.

Merge to IFC Model

This command is at **File > File Special > IFC 2x3 > Merge to IFC Model**.

Merge to IFC Model is an alternative way to export to IFC. This command enables you to merge only certain IFC elements (model filtering) or, alternatively, the entire content of the current ArchiCAD project into an existing (unopened) IFC file. Use this command if you want to add selected content from an ArchiCAD model to an IFC file from another discipline (e.g. MEP system) that was created for the same project.

The steps involved and the available options (Translator, Model Filter, etc.) are identical to those of the Save as IFC process *(see Export: Save as IFC)* - with the following exceptions:

- The **Merge to IFC Model** command, unlike the **Save as IFC** command, does not create an entirely new IFC file. It writes model content, elements, and element parameters into a selected, existing IFC file.

  Note: The content of the existing IFC file is protected: merging a file to IFC will only add to it, without replacing any of it. This means that if an element to be merged has the same IFC GUID as an existing element in the IFC file, then the ArchiCAD element will be merged using a new (IFC) GUID. Thus, elements will never be overwritten as a result of a merge. This also means that the **Merge to IFC Model** command is *not* suitable for merging changes from one version of an IFC file to another version of the same file!
- Using the **Merge to IFC Model** command will always retain the identical IFC GUID of the elements that exist in both files. Since the elements in common will always have identical IFC GUIDs, these elements can be updated to reflect modifications (e.g. changes in the element's position or its parameters). This also means that the export setting of Global Unique Identifiers (GUID) in the applied IFC translator *(see IFC Translators)* has no effect on the Merge to IFC Model process - that option affects only the "Save as IFC" process.