1.0 PENGENALAN

Modul Latihan ***BIM Modeling Take-Off (CostX and Revit)*** ini merupakan salah satu program Latihan Jabatan Kerja Raya di bawah kompetensi *Building Information Modeling* (BIM).

Modul ini akan menerangkan penggunaan perisian CostX dan Revit secara 'hands-on' bagi skop BIM yang merangkumi :

- Pengenalan kepada format fail BIM yang berkaitan
- Penerangan struktur model BIM
- *Navigation Tools CostX*
- Manipulasi Model BIM bagi tujuan pengukuran kuantiti
- Penyediaan laporan kuantiti
- Penggunaan perisian Revit (Asas) untuk *Material Take-off*

2.0 PERISIAN COSTX

2.1 CostX secara asasnya adalah satu perisian yang dibangunkan untuk tujuan pengukuran kuantiti dan penyediaan Senarai Kuantiti (BQ) dengan ciri-ciri tambahan lain yang berbeza mengikut nilai pakej perisian.

CostX	CostX	CostX 2D	CostX Takeoff	CostX Takeoff 2D
2D drawings (incl. PDFs)	✓	✓	✓	✓
3D / BIM Model	✓		✓	
Workbooks	✓	✓		
Auto- Revisioning	✓		✓	
Subcontractor Comparison	✓	✓		
	□	□	□	□

Gambar 1 : Pakej Perisian CostX (sumber : https://www.exactal.com/en/costx/products)

- Network bandwidth of 1 GB or greater is highly recommended.
- Network bandwidth of 100 MB or greater is required.

Gambar 2 : Keperluan Sistem untuk Perisian CostX

3.0 *DRAWING FILES*

CostX berkeupayaan untuk beroperasi dengan pelbagai jenis format fail (lukisan) antaranya:

- Various 2D raster image files - BMP, GIF, JPEG, JPG, PNG, TIF, PDF
- 2D and 3D PDF Files
- 2D and 3D DWG™, DXF™ and DWF™ from Autodesk® AutoCAD®
- 2D and 3D DWF/DWFx™ from Autodesk® Revit®, AVEVA PDMS™ and other supporting applications
- 2D DGN™ from Bentley® Microstation®
- 3D 12Da from 12D Model®
- 3D IFC Files from all supporting applications such as Graphisoft® ArchiCAD®
- 3D SketchUp

Gambar 3 : Jenis-jenis format fail lukisan yang boleh digunakan dalam perisian CostX

Raster Format	Vector Format	2D CAD	BIM Models

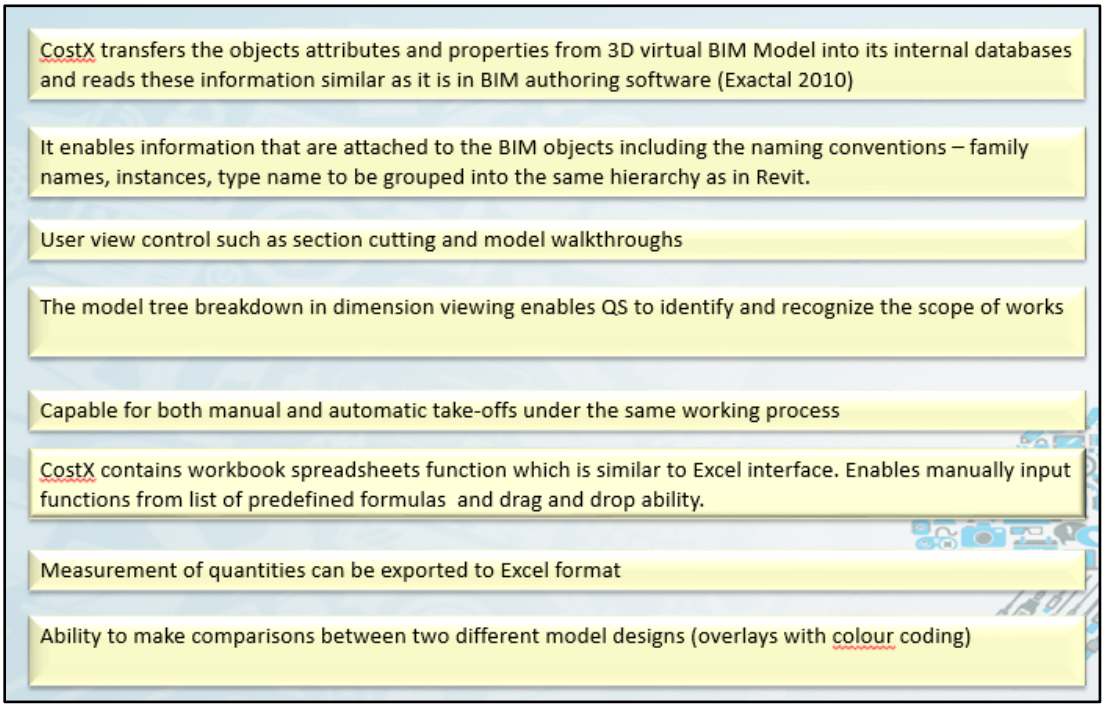
• Pixel based (bitmap)
• Provide least data and do not contain any vector or intelligence source CAD files
• Photograph /scanned image (including raster PDF)
• Cannot be enlarged without further loss of resolution
• Difficult to determine scale
	• Line based
	• Provide embedded intelligence of the CAD files
	• Vector PDF includes layer information (include during exporting CAD files to PDF)
	• Can be enlarged without loss of data
		• DWG, DWF/DWFx and DGN
		• Being rich in content
		  • *Layers* – used to categorise objects
		  • *Blocks* – Pre-defined grouping lines/typical
		  • *Polylines* – used to group a series of line into continuous entity to create shape
			• Export Revit Model to DWFx files
			• Multi-sheet DWFx contain 3D views and 2D views plans,elevations and sections
			• 3D views will be used to import BIM dimensions
			• 2D views and sheets to check and measure quantities

Gambar 4 : Ringkasan Jenis Format Fail/Lukisan yang Boleh Digunakan Dalam Perisian CostX

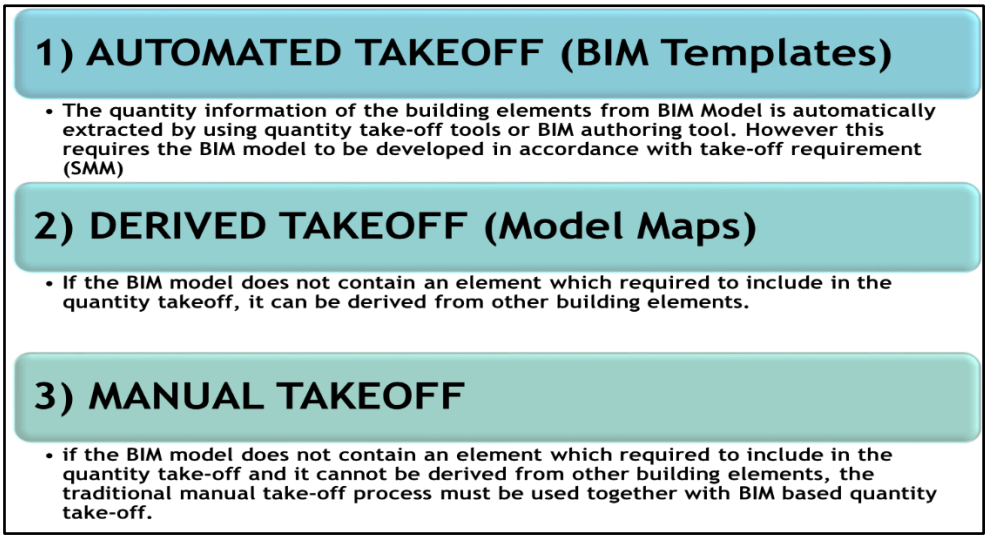
Bagi projek yang menggunakan Revit untuk pakej rekabentuk, disyorkan untuk mendapatkan salinan dalam format DWFx dan Lukisan 2D untuk semua pelan, *elevations* dan *sections untuk tujuan pengukuran kuantiti*

3.1 DWFx (*Design Web Format*) adalah salah satu jenis 'open file format' yang dibangunkan oleh Autodesk.

3.2 Ianya adalah satu format 'secured read-only' yang membolehkan data rekabentuk dalam format Revit diterjemahkan kepada pengguna lain.



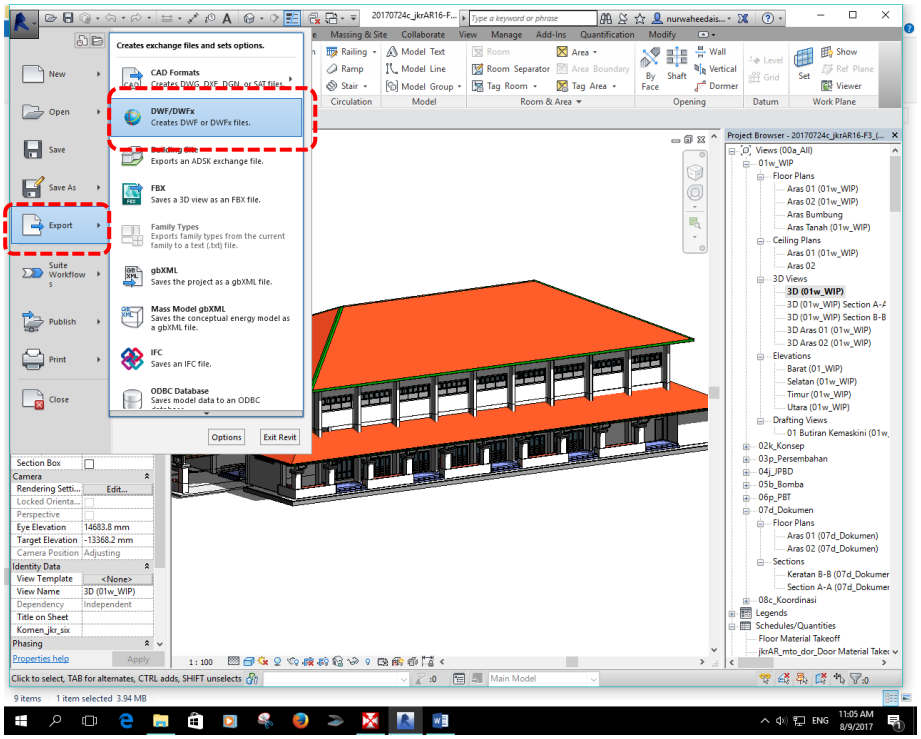
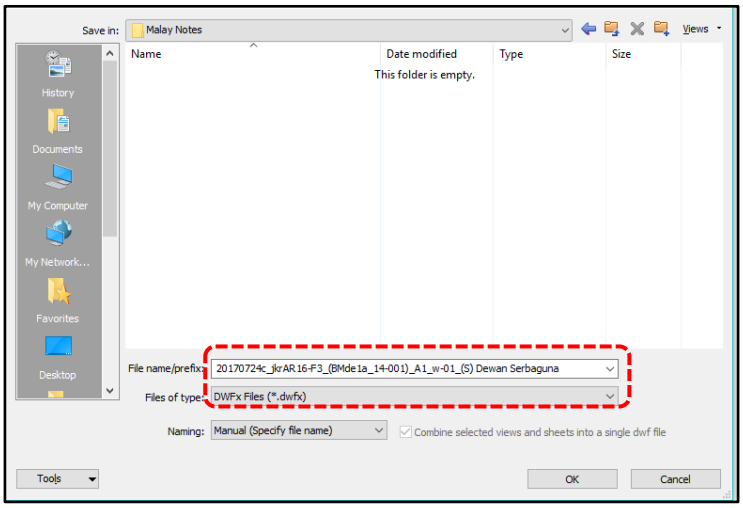
Gambar 5 : Ringkasan Penggunaan CostX



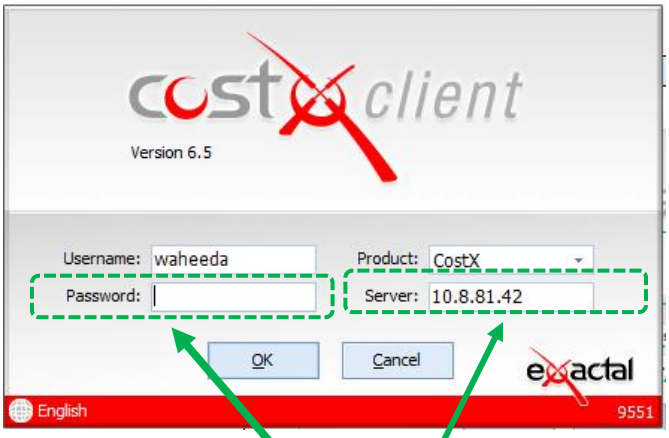
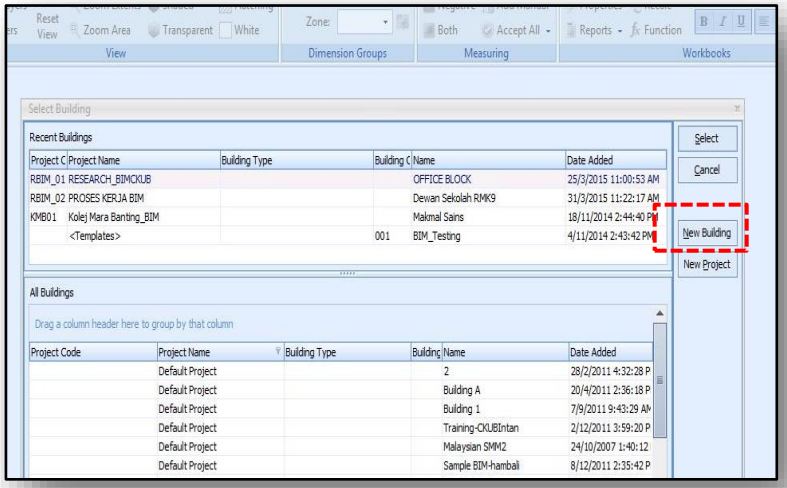
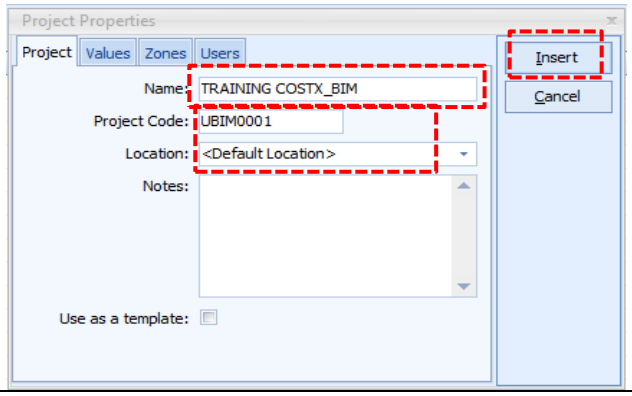
Gambar 6 : Kaedah Pengukuran Kuantiti Menggunakan Model BIM dalam CostX

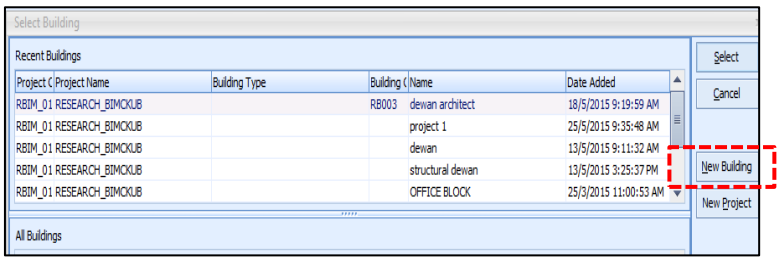
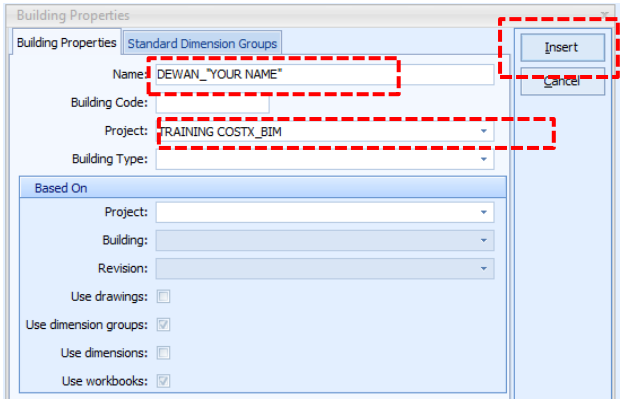
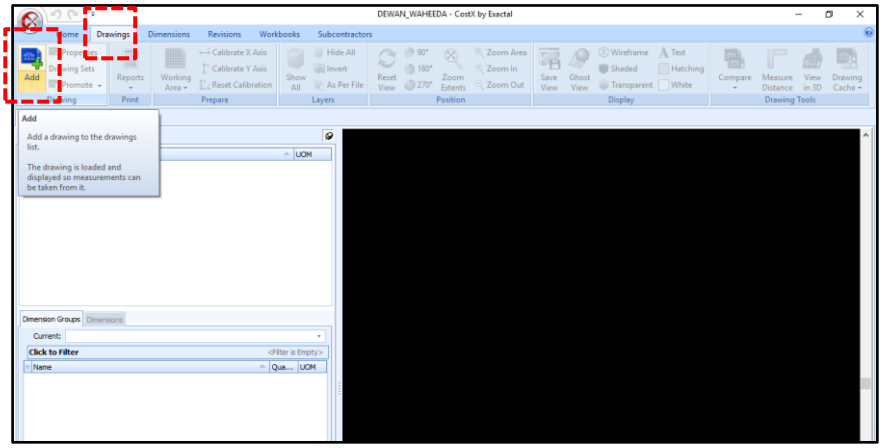
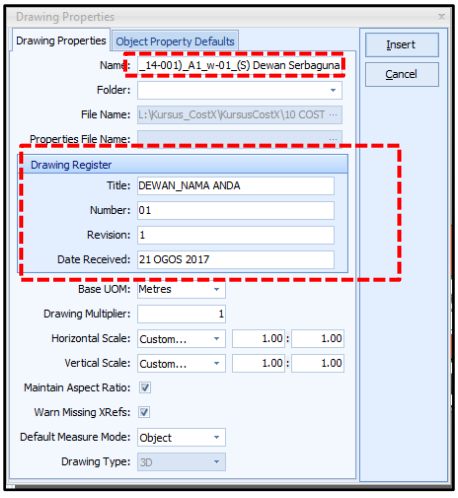
Dari segi saiz fail dan kualiti, format JPEG atau PNG adalah lebih baik daripada format BMP dan TIFF

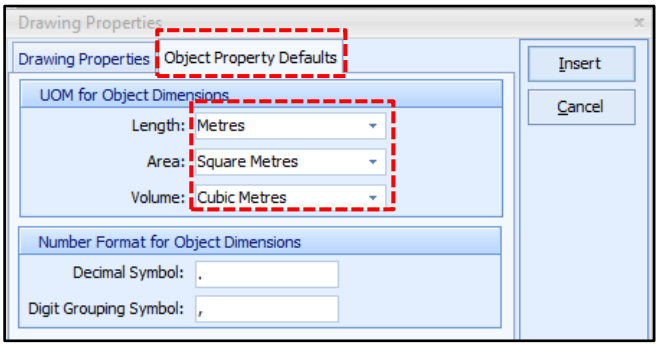
4.0 EKSPORT LUKISAN REVIT KE FORMAT DWFx

No.	Task	Description
1	Desktop → Klik berganda pada ***icon Revit*** → Klik ***Open*** → Pilih ***Project*** → Fail model 20170724c_jkrAR16-F3_(BMde1a_14-001)_A1_w-01_(S) Dewan Serbaguna_BIM (fail model Arkitek)	
2	Klik ***Export*** →Pilih ***DWF/DWFx*** dan tekan ***OK*** untuk semua jenis pilihan yang dipaparkan.	 Icon DWFx di dalam Folder
3	Simpan fail di di dalam Desktop → Folder ***Projek CostX*** dengan menekan butang ***OK***	

5.0 MEWUJUDKAN PROJEK BARU DAN KANDUNGAN

No.	Tugasan	Butiran
1	**Lancarkan perisian CostX pada Desktop** Masukkan : 1) ***Username:*** 2) ***Password :*** 3) ***Server:*** Klik ***OK***	 Logo CostX pada Desktop  Semak dengan pihak BTM/Admin CostX
2	**Wujudkan Projek (Baru)** Klik [***New Project***] → Masukkan [***Name***] :***TRAINING COSTX_BIM*** [***Location***] : ***Default Location*** Klik [***Insert***].	 

No.	Tugasan	Butiran
3	**Wujudkan Bangunan (Baru)** Klik [***New Building***] → [***Building Properties***] → Isikan maklumat : 1) ***[Name] : Dewan_NAMA ANDA*** 2) ***[Project]:*** Skrol dan cari nama Projek yang telah diwujudkan sebelum ini ***(TRAINING COSTX_BIM)*** Klik ***[Insert]***	 
4 5	**Masukkan Lukisan Format DWFx** Pada Ribbon CostX, klik tab ***[Drawings]*** → pilih ***[Add Drawing] → [Folder: Project CostX] (desktop)*** Daftarkan butiran fail lukisan yang akan digunakan dalam ***Drawing Properties:*** 1) Masukkan ***[Name] : Default Nama Lukisan Revit*** 2) ***[Drawing Register]:*** **Masukkan maklumat sebagaimana dikehendaki**	 

No.	Tugasan	Butiran
5	3) ***[UOM for Object Dimensions]:*** • Length : ***Meters*** • Area : ***Square Meters*** • Volume : ***Cubic Meters***	

6.0 *3D DRAWING NAVIGATION* DAN *VIEWING*

a) Zooming

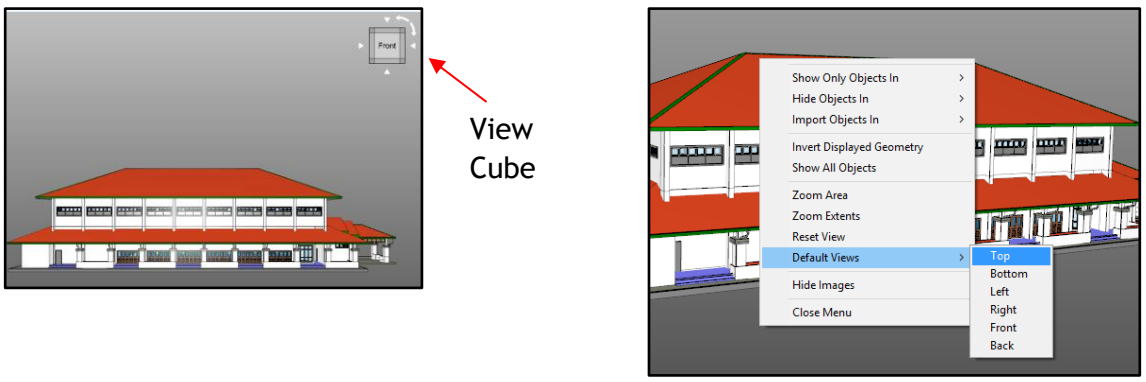
- Dalam ***Drawings Window***, letakkan kursor pada posisi tengah model bangunan.
- Skroll bebola tetikus ke hadapan untuk *zoom in* ke belakang untuk *zoom out*.

b) Panning - menggerakkan model ke sisi kiri dan kanan, atas dan bawah dalam Drawing Window

- Letakkan kursor pada posisi model bangunan
- Tekan dan teruskan memegang roda tetikus. Gerakkan tetikus ke kiri, kanan, atas dan bawah. Gerakkan tetikus mengikut arah jam dan sebaliknya.
- Untuk kembali ke pandangan asal model bangunan, klik pada *ribbon* ***[Drawings***], → pilih tab [***Position]*** → klik [***Reset View]***.

c) Rotating - View cube around the x,y or z axis.

- Gunakan ***View Cube*** yang terdapat pada sisi kanan ***Drawings Window*** untuk mendapatkan posisi/pandangan yang dikehendaki. Klik pada mana-mana permukaan, bucu atau sisi ***View Cube***.
- Kaedah lain, Klik kanan pada tetikus dan pilih ***[Default View]*** → pilih pandangan yang dikehendaki
- Untuk kembali ke pandangan asal model bangunan, klik pada ***ribbon Drawings***, → pilih tab ***Position*** → klik ***Reset View*** <u>ATAU</u> posisi kursor tetikus pada ***Drawings Window*** → klik kanan dan pilih [***Reset View]*** daripada menu yang dipapar.



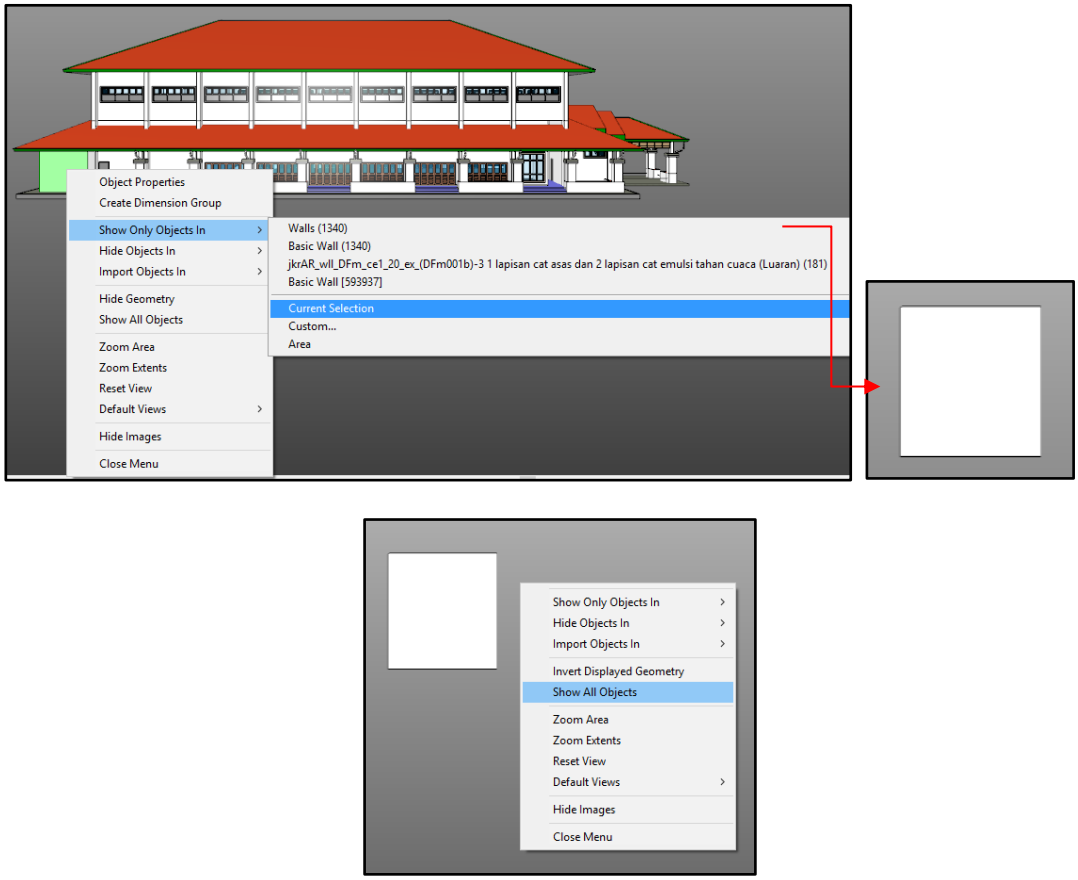
Gambar 7 : Opsyen Jenis-jenis Pandangan/Posisi

d) Viewing the Interior (walkthrough)

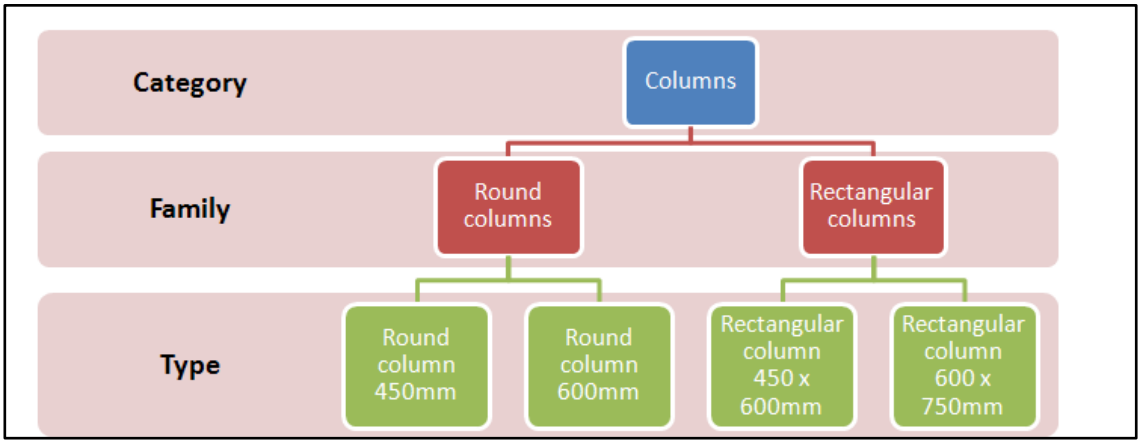
- Tekan butang/huruf/kekunci **"E"** pada papan kekunci dan gerakkan tetikus secara perlahan-lahan ke atas (*move in*) dan bawah (*move out*). Jangan skrol tetikus.

e) Filtering the view

- Navigasi pandangan bangunan mengikut posisi/pandangan yang dikehendaki. Posisikan kursor pada bahagian yang dikehendaki. Contoh : *External wall*
- Klik kanan, pilih ***[Show Only Objects In] → [Current Selection]***. Objek *External Wall* tersebut akan disembunyikan secara sementara.
- Klik kanan, pilih ***[Show All Objects]*** untuk kembalikan semula paparan objek tersebut.



Gambar 8 : *Filtering the view*

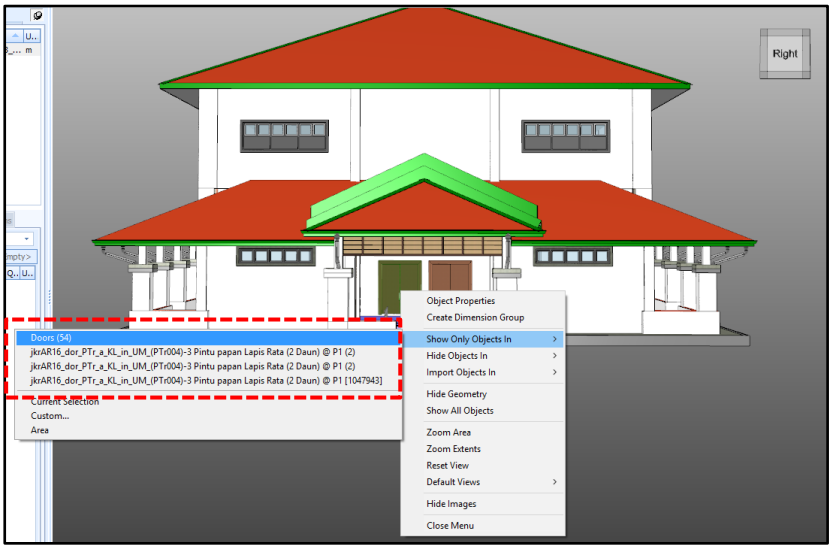


Gambar 9 : Struktur Model BIM dalam Revit

f) Filtering the view by selecting Object Properties

- Navigasi pandangan bangunan mengikut posisi/pandangan yang dikehendaki ***(Right)***. Posisikan kursor pada bahagian yang dikehendaki. Contoh : Pintu Masuk Utama
- Klik kanan, pilih ***[Show Only objects In]*** dan pilih ***[Doors]***. Objek lain selain daripada pintu akan disembunyikan secara sementara.
- Klik kanan, **pilih *[Show All Objects]*** untuk kembalikan semula paparan semua objek . Ulangi kaedah yang sama untuk item-item lain dalam model bangunan.

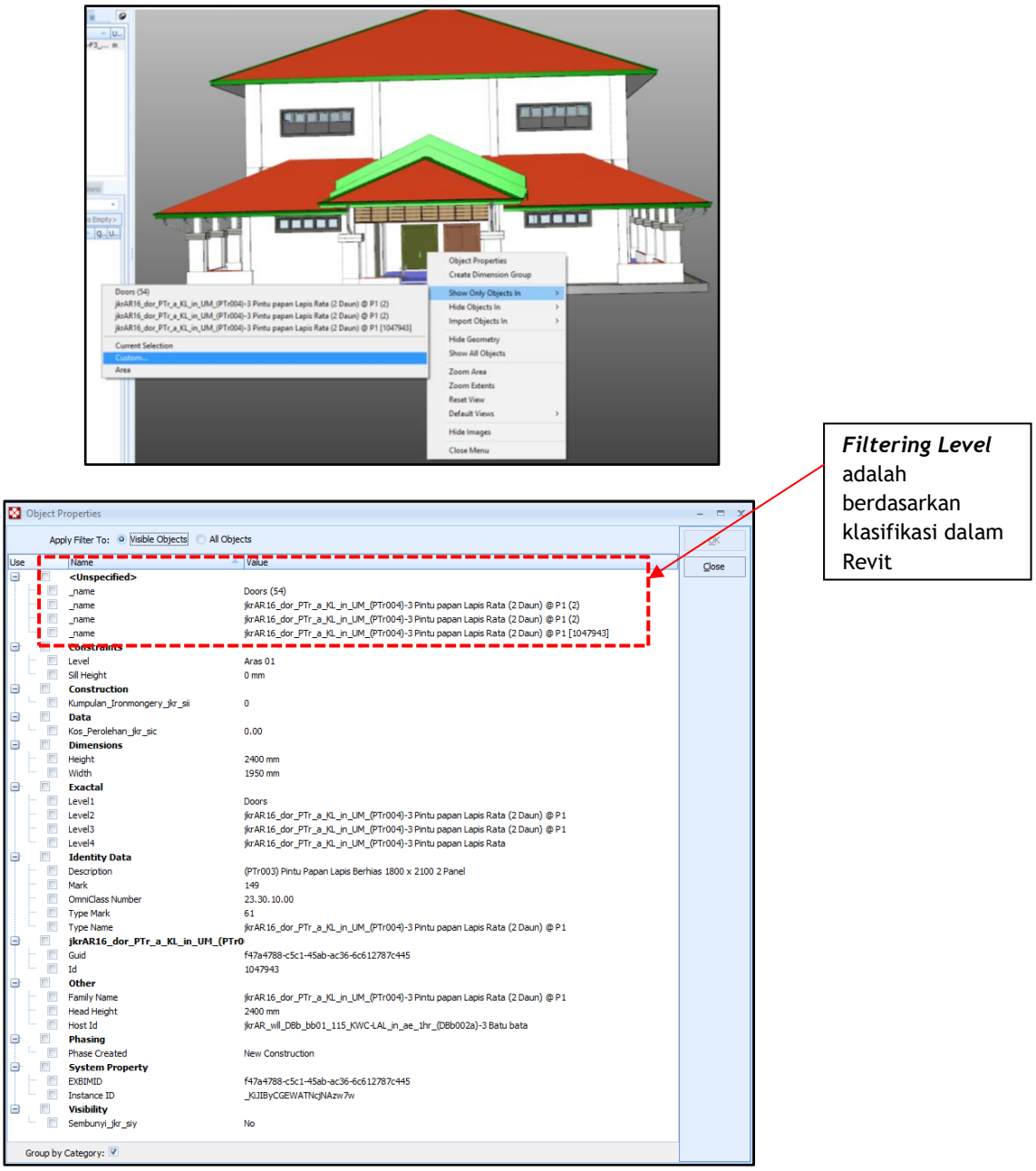
Filtering Level adalah berdasarkan klasifikasi dalam Revit



Gambar 10 : Contoh Filtering Level dalam Model Bangunan

g) Filtering the view by selecting Object Properties through customization

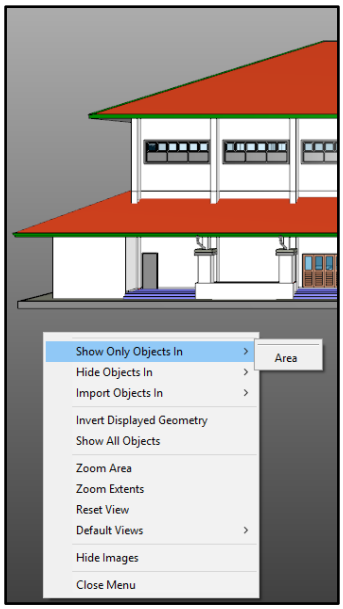
- Navigasi pandangan bangunan mengikut posisi/pandangan yang dikehendaki. Posisikan kursor pada bahagian yang dikehendaki. Contoh : Pintu Masuk Utama
- Klik kanan, pilih ***[Show Only objects In]*** dan klik ***[Custom]***.



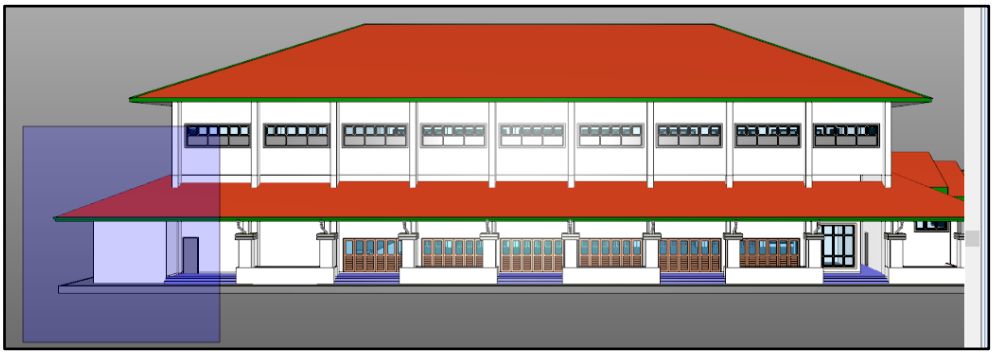
Gambar 11 : Contoh Filtering Level dalam Model Bangunan

h) Filtering the view within a defined area - to show objects in a particular area

- Navigasi pandangan bangunan mengikut posisi/pandangan yang dikehendaki. Posisikan kursor pada bahagian yang dikehendaki. Contoh : ***[Default views]*** → ***[front]***.
- Klik kanan, pilih ***[Show Only objects In]*** dan klik ***[Area]***.



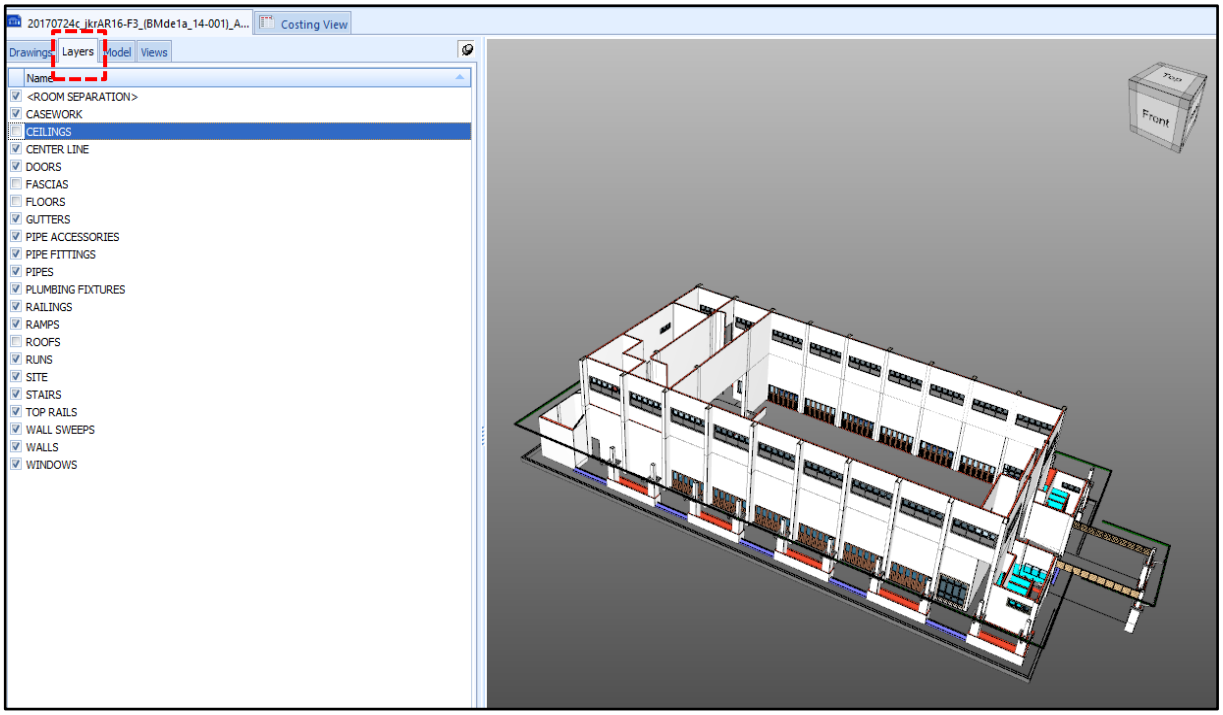
- *Highlight* ruang/kawasan/bilik yang ingin dilihat



- *Drawings Window* akan memaparkan ruang yang telah dipilih tersebut.

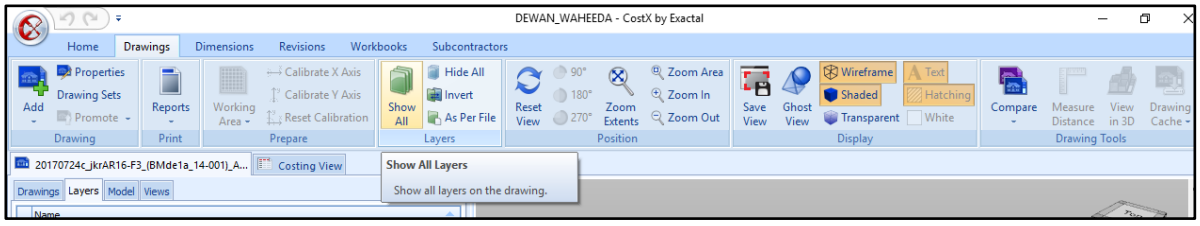
i) *Adjusting layers*

- Setiap ***layers*** dalam model bangunan mempunyai data/maklumat. ***Layers*** tersebut boleh disembunyikan atau dipaparkan mengikut keperluan dengan menandakan *checkbox* yang berkaitan di dalam tab ***[Layers]***.



Gambar 12 : Pilihan *Layers*

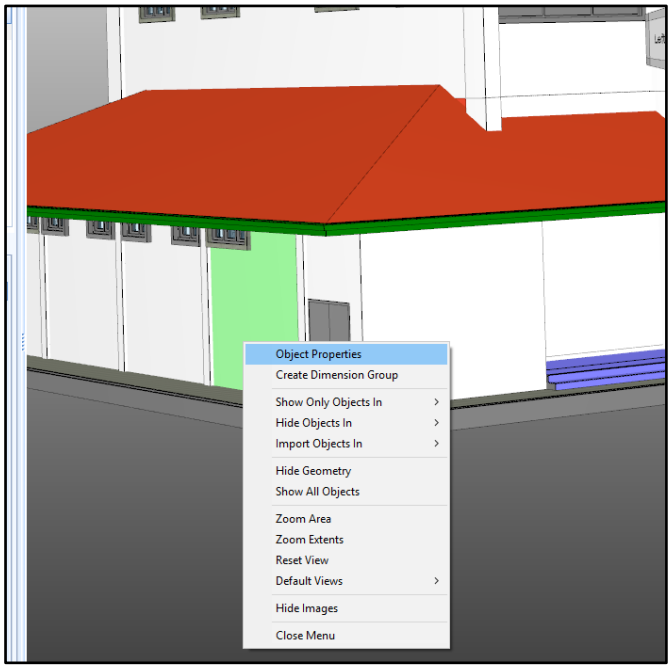
- Untuk kembalikan semula paparan semua *layer*, tandakan semua *checkbox* di dalam tab ***[Layer]*** tab atau pada menu ribbon, pilih ***[Drawings]*** dan klik butang ***[Show All Layers***].



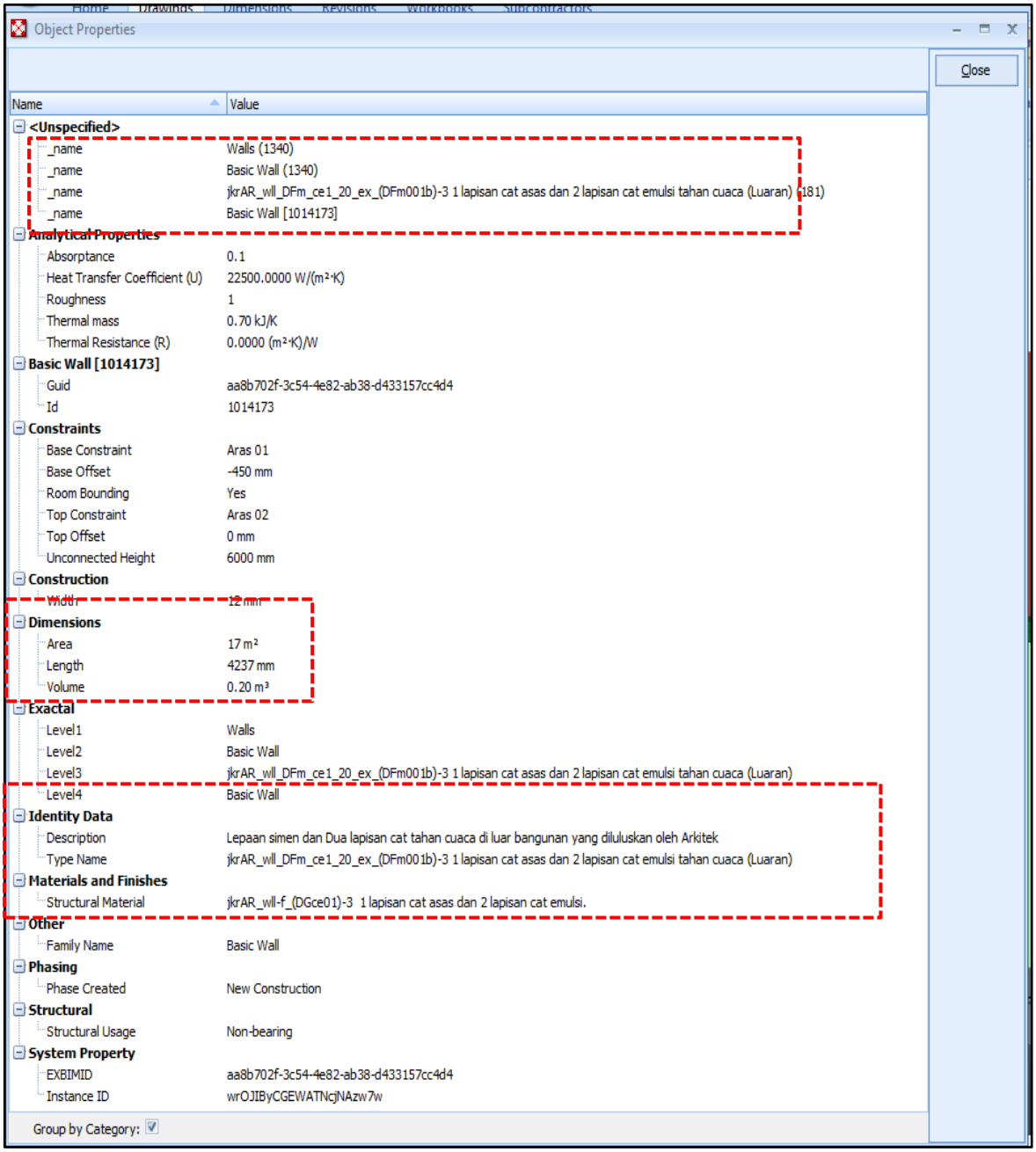
Gambar 13 : Kembalikan Paparan Semua *Layers*

j) View Object Properties

- Lukisan 3D BIM bersifat parametrik. Ianya mengandungi maklumat yang dibangunkan semasa proses rekabentuk dan akan dijana bersama semasa proses eksport fail dari Revit kepada DWFx.
- Posisi kursor mana-mana dinding luar (*external wall*) dewan sehingga objek berkenaan bewarna hijau. Klik kanan dan pilih opsyen ***[Object Properties]***. Paparan maklumat berkaitan dinding luar tersebut yang dibangunkan dalam Revit akan diperolehi.



Gambar 14 : Paparan *Object Properties*



Gambar 15 : Paparan *Object Properties* dengan Maklumat dari Revit

Introduction

This Training Exercise aims to build on the knowledge learnt in the Introduction to CostX® course in respect to working with three dimensional (3D) Building Information Models. It is comprised of several modules in which the tools available within CostX® will be utilized to extract parametric data from BIM Model files, measure quantities directly from 3D Models, and automatically update data for progressive design changes. The 3D Model files used in this training exercise are Design Web Format (DWF/DWFx™) and IFC files which have been published from Autodesk® Revit® Architecture.

Save the Associated Dataset files to a location on your computer or network that may be accessed during the training exercise and work through the training modules sequentially.

Throughout this document you will see **(PFC 5-1)** references. These identify the relevant Process Flow Charts related to that particular section of the training, copies of which can be found on the www.exactal.com website.

Refer to the CostX® help files by pressing the F1 key, or by clicking the Help icon in  the top right hand corner of the screen for a full explanation on how to use and implement functions.

Prior to undertaking this training, the CostX® Advanced Manual is essential reading.

Formatting Conventions Used

Following are the formatting conventions used throughout this training exercise.

Bold Font	Directions for User
[Bold Font]	Functions fixed in CostX® for example button name, right click options, field names, etc.
{ Bold Font }	Options which a user can change, for example drawing name, dimension group name, model map name, workbook name.
“Bold Font”	Fields a user has to enter, for example building name, workbook name, dimension group name.

3D Drawing Files Overview

Before commencing with the training exercise it is necessary to understand the difference between 3D CAD drawings and 3D BIM Models.

CAD Drawings

Traditional 2D and 3D CAD programs use vector graphics to replicate the human process of drawing on paper. Vector graphics is the use of geometrical primitives such as points, lines, curves and shapes or polygons, which are all based on mathematical equations, to represent images. Regardless of whether it is rendered in 2D or 3D, a vector based CAD drawing is simply a collection of lines, arcs and text, drawn to graphically represent physical entities.

Because they are based on geometric data, these graphical representations cannot describe the properties and attributes of the entities they represent, nor the relationship of the entities to each other. To overcome this limitation, design-related industries have developed object-based data model applications in which the interface remains graphic, but geometry is only one of the properties of the entities, which will also contain physical and performance data such as spatial relationships, geographic information, quantities and properties of the building components.

BIM Models

BIM refers to (and is an acronym for) the process of virtual Building Information Modelling based on digital information exchange. Throughout this process, various disciplines can share the data model and manipulate it to progressively refine the design. Consequently the data model is often referred to as a BIM Model. A BIM Model is an arrangement of three dimensional virtual objects where each object is of a known function and type and where a set of rules exist which determine the inter-relationship with other virtual model objects. The objects are termed “intelligent” because they comply with these behavioural parameters. A door knows that it is a door, and when it is placed into a wall, the wall knows it has to have an opening to suit that particular door. The parametric properties are inter-related. If the door size is changed, the wall opening will change to suit.

All of the physical and functional characteristics of the building model are held in the central database. As the model changes, all of the objects within it parametrically adapt themselves to the new design. Since the database holds all the information for each of the model objects, it will always represent the latest iteration of the design – plus, as a database, it is capable of being interrogated in various ways to extract differing types of data. Hence, the more data that is added to it, the wider the range of analyses such as building performance, schedules and costs that can be leveraged from it.

CostX® and BIM Models

The BIM software primarily used by building designers includes Revit® by Autodesk®, MicroStation® by Bentley®, and ArchiCAD® by Graphisoft®. All have a native file format (RVT, DGN and PLN respectively) but these formats are not interoperable and the data models cannot be shared with outside parties. The medium of exchange will therefore generally be limited to drawing views (but not object data) exported to graphical CAD formats such as DWG™, or 2D drawings printed to paper or PDF.

However, Revit® is also able to publish 3D data in DWF™ format and all BIM software is able to export in a file format called IFC (Industry Foundation Classes) which is a neutral and open specification that is not controlled by a single vendor or group of vendors. Essentially a DWF™ is like an intelligent 3D PDF; it is read-only and contains restrictions on some of the model data provided – however it is still data rich because it is 3D and retains key parametric properties of the objects.

CostX® is able to view data models in DWF™, DWFx™ and IFC format and utilize the database information to automatically generate quantities. Of course, the quality of the output is reliant on the parametric coding of the objects within the database, but as designers continue to develop their object libraries the amount of data available will improve. However, for estimating or scheduling purposes it will generally be necessary to augment the BIM data with additional measurement from 2D or 3D drawing views.

Industry Foundation Classes (IFC) Files

IFC is a data model standard published by buildingSMART® for open BIM interoperability. It is intended to be a common format to enable data sharing and exchange across multiple applications and disciplines (referred to as “openBIM”).

IFC-compliant applications can both export and import IFC data models, and re-use or edit the data. Because each of the proprietary data model formats have their own architecture, the import and export process involves mapping or translating the data between their internal schema and the IFC schema – and back again.

Proprietary data models are tightly integrated with their host application and optimised to work with it. In contrast, the IFC model is more complex because it has to be more broadly structured to allow entities to be combined or related in various ways as required by the different proprietary applications with which it needs to work. For simplicity, most of the sample files used in this training are DWFx™, however in Module 8 we review an IFC file exported from Revit®, compare the data structure to a DWFx™ file exported from the same model, and generate quantities from the IFC model data.

Revit® Model Structure

Within the Revit® object library, information about the model objects (also termed Elements), is classified into a hierarchical structure of Categories, Families, and Types. The data held about the objects is referred to as the Type parameters. When placed into a building model, the occurrence of the object within the model is called an Instance. The data determining the behaviour of the object in a particular instance is referred to as Instance Parameters. The Instance Parameters will usually include certain dimensional data (quantities) of the object.

The following extract from the Revit® Architecture 2010 User's Guide overviews the classification system.

Revit Architecture

Revit Architecture 2010 User's Guide > Revit Essentials > What Is a Project? > Building with Elements >

Categories, Families, and Types

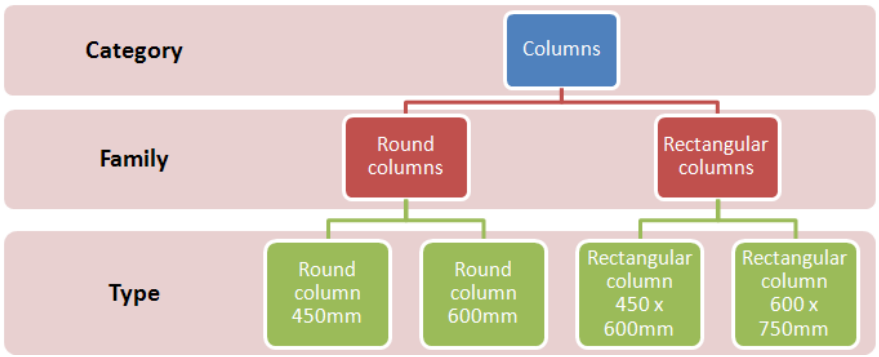
Revit Architecture classifies elements by categories, families, types, and instances.

Category: A category is a group of elements that you use to model or document a building design. For example, categories of model elements include walls and beams. Categories of annotation elements include tags and text notes.

Family: Families are classes of elements in a category. A family groups elements with a common set of parameters (properties), identical use, and similar graphical representation. Different elements in a family may have different values for some or all properties, but the set of properties—their names and meaning—is the same. For example, six-panel colonial doors could be considered one family, although the doors that compose the family come in different sizes and materials. Structural members (such as w shapes) are another family. See Revit Families.

Type: Each family can have different types. A type can be a specific size of a family, such as a 30" X 42"(A0) title block or a 32" x 84" (910 x 2110) door. A type can also be a style, such as default aligned or default angular style for dimensions. A family can have several types. For example, a table may be available in several sizes. Each size table is a different type within the same family.

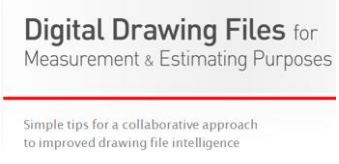
Instance: Instances are the actual items (individual elements) that are placed in the project and have specific locations in the building (model instances) or on a drawing sheet (annotation instances). Each instance belongs to a family and, within that family, a particular type.



Drawing File Optimisation

Exactal publishes a document which provides general tips and guidance to designers on how various drawing file types may be arranged and optimized for quantities measurement and estimating activities, and to assist in team communication. These are not mandatory requirements, but simply reflect some of the more common optimizations.

Read this document to gain an appreciation of the optimisations, and provide copies to designers you are working with as guidance for what you would like to receive from them.



Measurement Techniques Overview

In CostX®, Dimensions and their associated values are taken from drawings and collated into Dimension Groups, which aggregate the individual Dimension values. Dimension Groups are also collected together in Dimension Group Folders. Dimension values may be imported directly from quantity values (also known as object properties) contained within the data model for the various objects and may also be measured from the 3D drawing view. Some of the methods require the Dimension Group(s) to be created prior to importing or measuring dimensions and some of the methods will automatically create the required Dimension Groups and Folders as dimensions are imported. Each of the methods will be covered in a detailed measurement module. The methods are:

- Object Mode
- Importing Dimensions using a BIM Template
- Importing Dimensions using a Model Map
- 3D Measure Mode

These methods are summarized below and more detailed instructions are also included in the table which follows.

Object Mode

With this method dimensions with associated values are imported from object property values contained within the drawing file into the currently selected Dimension Group. This method requires the Dimension Group to be created and selected prior to importing dimension values. When the Dimension Group is created it is necessary to specify (map) which of the available object properties are imported and which Dimension Group value field they are imported into. Once the Dimension Group has been established the user can then choose the objects for which dimensions are to be imported by either by selecting them individually or by area in the drawing window or by selecting one or more common properties with which to match (select) objects.

Import Dimensions using a BIM Template

With this method Dimension Group folders and Dimension Groups are created automatically and dimensions with associated values are imported from object properties contained within the data model based on a set of rules contained within a BIM Import Template. The BIM Import Template specifies (maps) which of the available parametric object property values are imported and which Dimension Group value field they are imported into. The user can choose the objects for which dimensions are to be imported by filtering or hiding the displayed objects or layers before commencing the import process.

Import Dimensions using a Model Map

With this method Dimension Group folders and Dimension Groups are created automatically and dimensions with associated values are imported from object properties contained within the data model based on a set of rules defined by the user in a Model Map. The Model Map allows the user to specify (map) for different groups of objects which of the available object properties are imported and which Dimension Group value field they are imported into. The user can choose the objects for which dimensions are to be imported by either selectively defining the Model Map, or by filtering or hiding the displayed objects or layers before commencing the import process.

3D Measure Mode

With this method dimensions are measured on screen into the currently selected Dimension Group by selecting vertex points (e.g. corners or ends of objects on the drawing): one for a count type of Dimension Group, two or more for a length, and three or more for an area. This method requires the Dimension Group to be created and selected prior to measuring the dimensions, but does not require any mapping to the values contained in the data model because the dimensions are being measured from the drawing and not imported from the object properties.

Measuring – 3D Measure Mode

Create or select a Dimension Group of the correct measurement type, then:

- **Areas** - click on each vertex in sequence around the area to be measured, at the last corner, before returning to the start, press the Enter key. All vertex points must be in the same flat plane.
- **Lengths** – click on the vertex at one end of the length to be measured and move the mouse to the vertex at the other end of the length then click again. To add further segments to the length, prior to moving the mouse cursor hold down the Ctrl key and then click on the required additional vertex points, release the Ctrl key when the measurement is complete.
- **Counts** – click on a vertex to register a count.

TIP: If a previous measured dimension is highlighted (selected) when commencing the measurement of a new dimension, hold down the O + Ctrl keys (O + Shift for Lengths) when clicking on the first vertex point. Alternatively zoom in further or temporarily turn off the display of Measured Items.

Creating a Dimension Group for Object Mode Measurement

- Filter the displayed objects and / or adjust the view to suit.
- Highlight the object to be measured by moving the mouse cursor over it in the drawing window.
- Right click and select Create Dimension Group from the right click menu.
- In the Dimension Group Properties dialog box complete as a minimum the Name, Folder and Measurement Type. Additionally a Default Height and display Colours for the dimensions may also be entered or selected.
- If the Weight or the Custom fields are going to be used the Extended Properties section allows the Unit of Measure for the Weight value and an alternative Name and Unit of Measure for the three Custom values to be selected or defined.
- Select the Object Properties tab. For each of the required dimension fields in turn, click on the drop down arrow button to the right of the required dimension field and select the appropriate object property (the dimension property source). Once the required dimension fields have been completed click the Insert button.

Importing Individual Dimensions – Object Mode

- Filter the displayed objects and / or adjust the view to suit.
- Create a Dimension Group for Object Mode measurement (see above) for the object(s) intended to be measured.
- Highlight the object to be measured by moving the mouse cursor over it in the drawing window, the object will highlight in green.
- Click once with the left mouse button, the dimension will be created in the currently selected Dimension Group extracting values from the BIM object properties specified in the dimension property source fields previously set up in the Dimension Group properties dialog.

Importing Multiple Dimensions – Object Mode

- Filter the displayed objects and / or adjust the view to suit.
- Create a Dimension Group for Object Mode measurement (see above) for the objects intended to be measured.
- Highlight an object of the type to be measured by moving the mouse cursor over it in the drawing window, the object will highlight in green.
- Right click and choose the Import Objects In / Custom...option from the right click sub-menu.
- Place ticks in the checkboxes to the left of the required object properties fields. Only objects which are currently displayed and have matching values to all of the object properties ticked will be selected (and hence associated dimensions created in the Dimension Group).
- Click OK to import the dimensions.

Importing Multiple Dimensions – Using a BIM Template

- Ensure the required objects (i.e. the objects for which dimensions are to be imported) are visible in the drawing window. *To import dimensions for all objects contained in the drawing, right click over the drawing window and select the Show All Objects option before importing the dimensions. To import dimensions for selected object groups or selected objects filter and / or hide objects before importing the dimensions.*
- Click the Import button located in the BIM group on the Dimensions Ribbon Toolbar and select the Import Dimensions Using BIM Template option. If objects have been hidden or filtered a warning will be displayed.
- In the Select BIM Import Template dialog browse to and select the required BIM Import Template to use for the import and once selected click the Open button to commence the import.

Importing Multiple Dimensions – Using a Model Map

- Ensure the required objects (i.e. the objects for which dimensions are to be imported) are visible in the drawing window. *To import dimensions for all objects contained in the drawing, right click over the drawing window and select the Show All Objects option before importing the dimensions. To import dimensions for selected object groups or selected objects filter and / or hide objects before importing the dimensions.*
- Click the Import button located in the BIM group on the Dimensions Ribbon Toolbar and select the Import Dimensions Using Model Map option. If objects have been hidden or filtered a warning will be displayed.
- In the Select Model Map dialog select the required Model Map to use for the import and once selected click the Select button to commence the import.

Creating a Model Map

- Click the Model Maps button located in the BIM group on the Dimensions Ribbon Toolbar.
- Select either the Global or Project tab to create either a globally available (i.e. to all projects) or project specific model map respectively. Click the Insert button.
- In the Model Map Properties dialog box complete as a minimum the Name field. Additionally Notes may also be entered. Click OK to open the new model map.
- Select the first node in the model tree window for which a model map entry is to be defined.
- Complete each field required in the mapping definition window by either:
  - Dragging the required object property field (column) from the schedule window and dropping it into the required field in the mapping definition window.
  - Entering text (a text string) into a text based mapping definition field (e.g. Folder, Dimension Group, Dimension, Zone, Weight UOM or Custom 1-3 Name or UOM) enclosing it with " " (quotation marks).
  - To add a further object property or unformatted number in a field which generates a dimension value (e.g. Count, Length, Height, Area, Wall Area, Volume, Weight Value or Custom 1-3 Value) add the required mathematical operator (+ addition, - subtraction, * multiplication or / division) at the end of the object property name or unformatted number, then drag in the additional object property field or enter the required unformatted number.
  - To add a further object property or text string into a text based Mapping Definition field add the + (plus) sign at the end of the object property name or text string, then drag in the additional object property field or enter the required text string enclosing it with " " (quotation marks).
  - If required, select a specific Measurement Type of either Count, Length, Area or Volume using the Measurement Type drop down field. Alternatively leaving as Automatic will select the most appropriate measurement type based on the other completed fields.
- Repeat for each of the additionally required nodes in turn.
- Once the required entries have been defined in the model map click on the Close button.

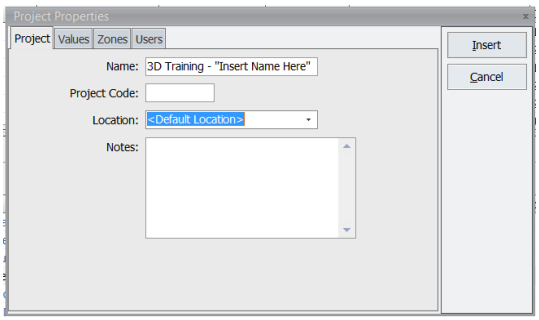
Module 1A Getting Started

Creating a New Project (PFC 1-3)

For this training exercise we will firstly create a new Project into which we will create our new Buildings for the modules.

M1A.1 If a building is currently open **click** the **[Main Menu]** button and **select** the **[Close Building]** option.

M1A.2 **Click** on the **[New Project]** button at the right of the Select Building dialog



If the Select Building dialog is not currently displayed double click on the blank background below the ribbon toolbar). An empty Project Properties dialog will open.

M1A.3 **Enter** a **[Name]**: for the project as **"3D Training-" followed by your name**.

M1A.4 Use the dropdown menu in the **[Location:]** field to select **<Default Location>** then **click [Insert]**. Your new Project has now been created.

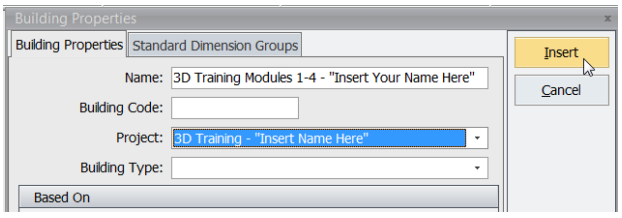
Creating a New Building (PFC 1-4)

Now the training project has been created we will create a new building for the first training module.

M1A.5 **Click** on the **[New Building]** button on the right of the dialog.

A new building may also be created from the Main Menu by selecting the New Building option e.g. if the Select Building dialog isn't displayed).

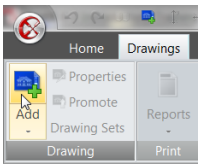
M1A.6 The **[Building Properties]** dialog will be displayed, enter **"3D Training Modules 1-4 -" followed by your name** in the **[Name:]** field.



M1A.7 In the **[Project:]** field use the drop down menu to **select** the **'3D Training-*Your Name*'** project that was previously created.

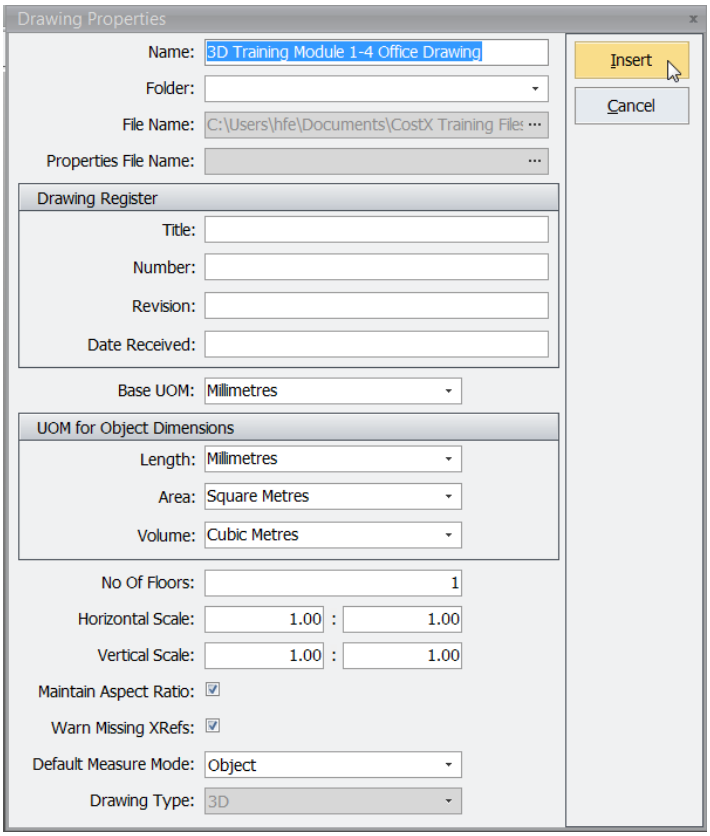
M1A.8 Ignore the Based On section and **click [Insert]**. This will create the new Building and the CostX® display will open in the Dimension View ready for you to add drawings etc.

Adding a 3D BIM Drawing (PFC 5-1)



M1A.9 **Click** on the **[Drawings]** Ribbon at the top of the screen to open the Drawings Ribbon Toolbar, then **click** on the **[Add]** button (see right), if the drop-down menu appears simply select the Add Drawing option.

M1A.10 A browser window will open, browse for and **select** the **{ 3D Training Module 1-4 Office Drawing.dwfx }** drawing from the dataset you saved previously to your computer or network drive then **click** on the **[Open]** button. The Drawing Properties dialog will be displayed:



M1A.11 Ensure the settings are as indicated above and **click [Insert]** to add the BIM drawing to the building.

M1A.12 The drawing will now be visible in the drawing window, displaying the default front view.

Module 1B Views and Drawing Navigation

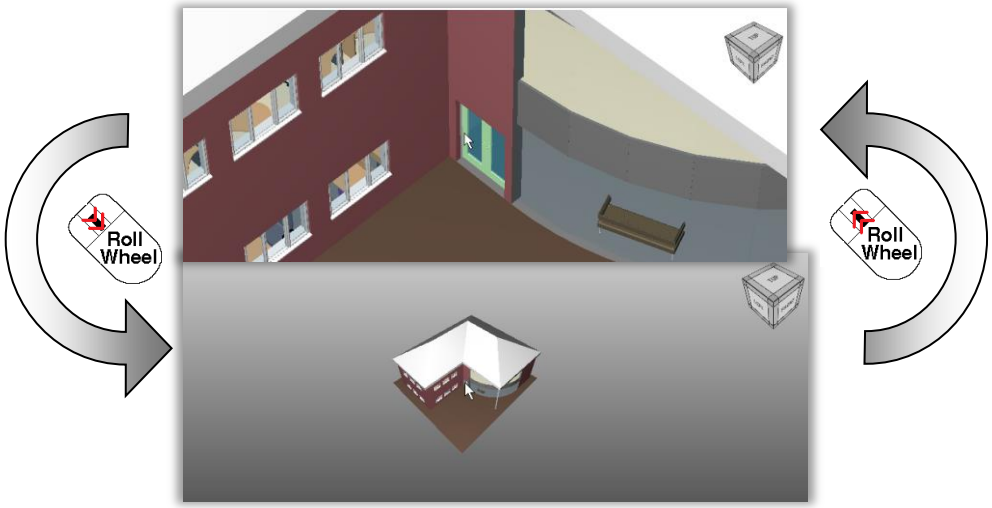
CostX® provides various methods to adjust the 3D Model view. These include zooming, panning and rotating drawings, hiding or showing only selected objects or layers, selecting a transparent or ghost view of objects, and moving through the building.

CostX® also provides two additional windows when working with BIM drawings; the Model Tab in which the object hierarchy can be displayed and selected, and the Schedule Window in which the object properties for the displayed objects can be reviewed.

Zooming (PFC 5-2)

Zooming is most easily undertaken by rolling the mouse scroll wheel forwards or backwards.

M1B.1 **Position the mouse over the middle of the model** of the building and roll the **scroll wheel forwards to zoom in and backwards to zoom out**. Note that the drawing is zoomed around the current mouse cursor position.

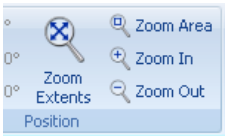


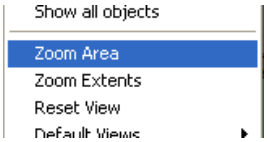
Zooming using the scroll wheel is also a fast technique to move from one area of the drawing to another as an alternative to panning (see below).

For example, if you are zoomed in to the left hand side of the building and wish to view the right hand side, roll the wheel backwards so the whole building is visible in the drawing window, move the cursor to the required position, and roll the wheel forwards.

Alternatively the + (plus) and – (minus) keys on the keyboard may be used to zoom the drawing in or out around the centre of the drawing window.

Zooming may also be performed using the zoom control buttons in the Position group of the Drawings Ribbon. The Zoom In and Zoom Out buttons will zoom the drawing in the same manner as the + / - keyboard shortcut keys. The Zoom Extents button will zoom the drawing out such that the entire model is visible in the drawing window whilst the Zoom Area button allows a rectangle to be dragged out over a specific area of the drawing to zoom in to that area, these tools are also available on the right mouse click menu.



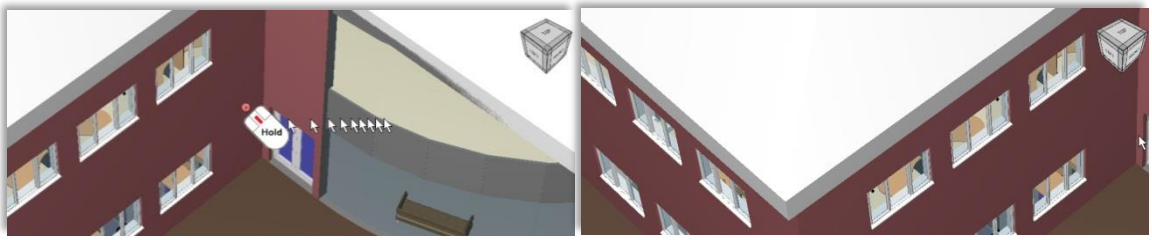


Panning (PFC 5-2)

Panning is the movement of the drawing from side to side and/or up and down in the drawing window. The simplest method to pan the drawing is via the mouse wheel by holding down the scroll wheel of the mouse and moving the mouse in the direction you wish to move the drawing.

M1B.2 **Position the mouse over the model** of the building and **press and hold down the scroll wheel** on the mouse.

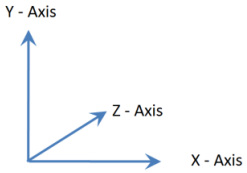
M1B.3 With the scroll wheel held down **move the mouse to the right**, the drawing is moved (panned) with the mouse cursor.



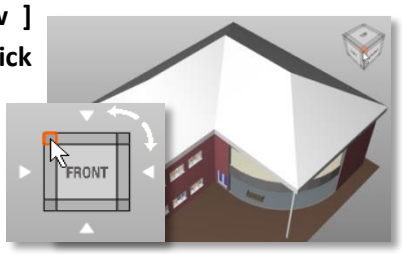
Alternatively the ↑ up, ↓ down, ← left and → right arrow keys on the keyboard and the vertical and horizontal scroll bars located to the right and below the drawing window may be used when the drawing has been zoomed in.

Rotating – View Cube (PFC 5-2)

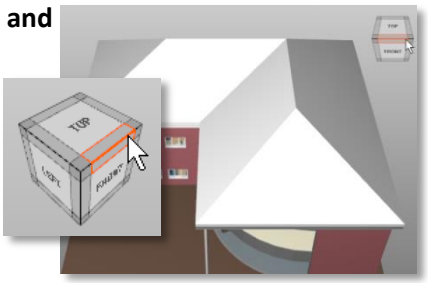
Rotating is the movement of the drawing around the x, y or z axis (shown right) to view the model from different viewing perspectives. The simplest method to rotate the drawing is by using the View Cube displayed in the upper right corner of the drawing window by clicking on any of the faces, edges or corners.



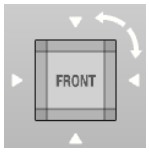
M1B.4 **Right click over the drawing** and **select** the **[Reset View]** option to reset the drawing to the default front view. Then **click on the upper left corner of the view cube** as shown right. The drawing will be rotated to an oblique view i.e. a view between the Front, Left and Top viewing perspectives.

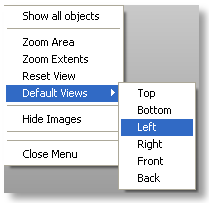


M1B.5 **Click on the edge of the view cube between the Top and Front** faces. The drawing will be rotated to a view half way between the Front and Top viewing perspectives.



M1B.6 **Click** on the **[Front]** face of the view cube. The drawing will now be rotated to the original Front viewing perspective.





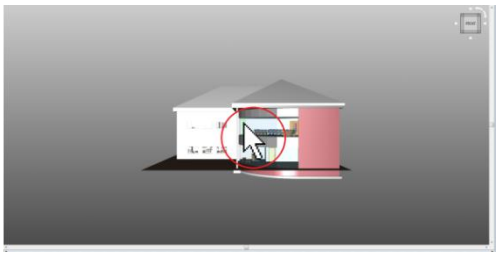
Default viewing perspectives may also be selected from the Default View option on the right click menu.

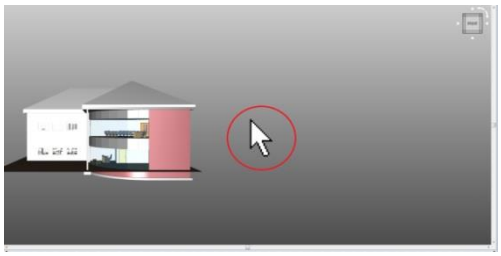
Rotating – Mouse

The drawing may also be freely rotated by holding down the left mouse button and moving the mouse in the required direction of rotation. The position of the mouse cursor between the centre and the extremities of the drawing window and moving the mouse in a combination of up/down/left/right directions will provide simultaneous rotation around all three axes.

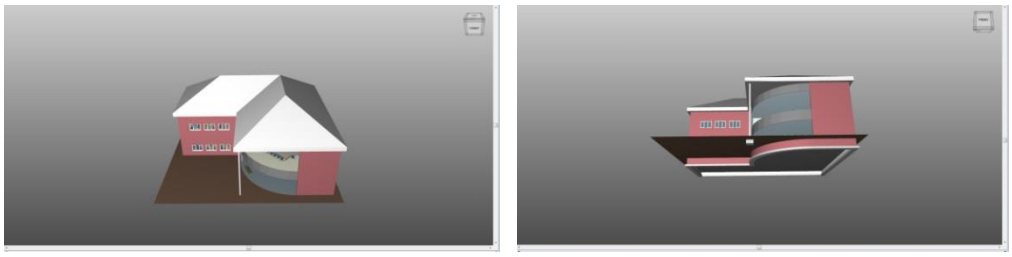
Rotation Around the X Axis

M1B.7 **Position the mouse cursor roughly in line with the horizontal centre of the drawing window** (the model does not need to be in the centre of the drawing window).



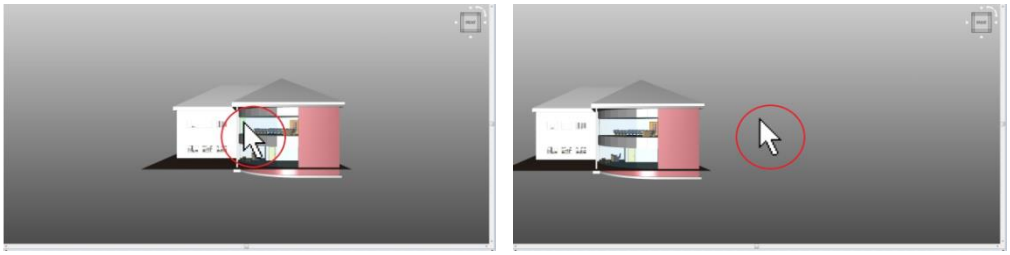


M1B.8 **Press and hold down the left mouse button, move the mouse forward / backward** to rotate the drawing around the X-Axis. **Release the mouse button when the required rotation has been achieved**.

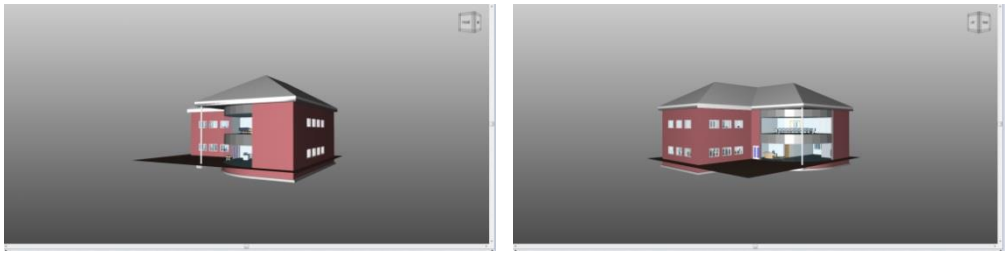


Rotation Around the Y Axis

M1B.9 **Position the mouse cursor roughly in line with the vertical centre of the drawing window** (the model does not need to be in the centre of the drawing window).

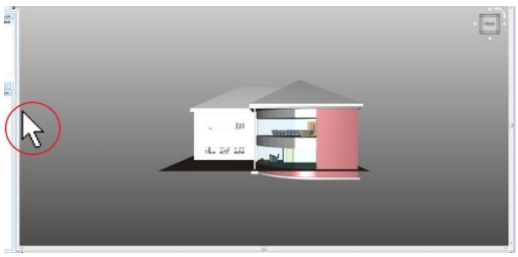


M1B.10 **Press and hold down the left mouse button, move the mouse left / right** to rotate the drawing around the Y-Axis. **Release the mouse button when the required rotation has been achieved**.



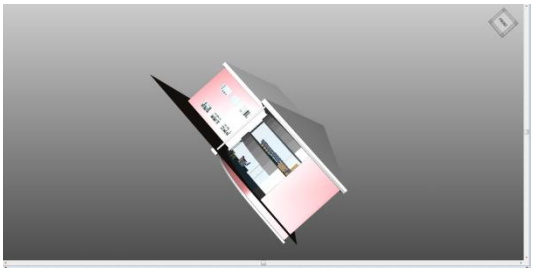
Rotation Around the Z Axis

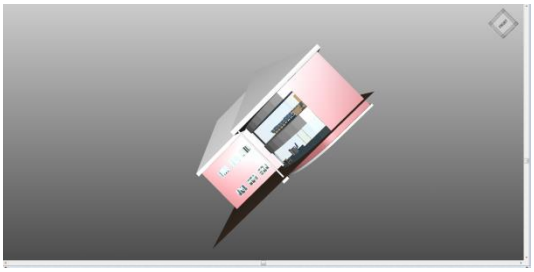
M1B.11 **Position the mouse cursor roughly in line with the vertical centre** of the drawing and at the extremity of the drawing window (either to the left or the right).



M1B.12 **Press and hold down the left mouse button, move the mouse forward / backward** to rotate the drawing around the Z-Axis. **Release the mouse button when the required rotation has been achieved**.

The same rotation is also possible by positioning the mouse cursor roughly in line with the horizontal centre of the drawing and at the extremity of the drawing window (either top or bottom) and moving the mouse left or right.





If necessary rotate the drawing in stages (i.e. release the mouse button, reposition the mouse towards the centre or extremities of the drawing window as required to achieve rotation around the required axis and then continue to rotate the drawing).

The view cube rotates dynamically with the drawing and it is often useful to review the rotation of the drawing by reference to the view cube.

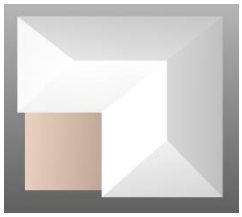
Viewing the Interior

Most building models will include the external elements such as walls, roofs etc. which in a 3D view may obscure the interior of the building. CostX® therefore facilitates the review and selection of such internally modelled objects in a number of ways.

Move Through the Building (PFC 5-2)

Moving through a building model is undertaken by holding down the 'E' key on the keyboard and moving the mouse slowly forwards or backwards (up or down) to move in and out of the building. When the 'E' Key has been released the drawing may be panned and zoomed as required.

M1B.13 **Right click over the drawing** and **select** the default **[Top view]** (shown right) from the right click Default Views menu option.

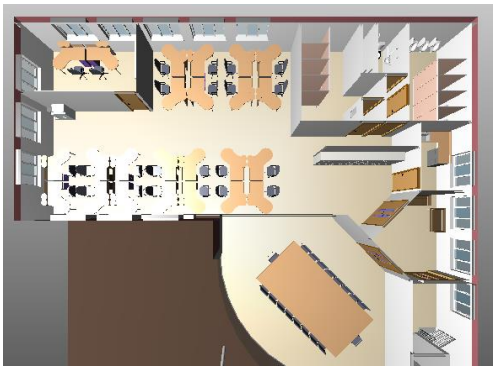


M1B.14 **Hold down the 'E' key** on the keyboard and **move the mouse slowly forwards** to move down through the building.

The display size (zoom) of the building may become extended beyond the drawing window boundaries, if this occurs release the 'E' key then position the mouse cursor over the centre of the drawing window and roll the mouse scroll wheel backwards to zoom out as necessary, then hold down the 'E' key once more and continue to move the mouse forwards to continue to move down through the building.

M1B.15 When a suitable internal view of the ground floor is obtained **release the 'E'** key. It is now possible to position the mouse cursor over the visible internal objects highlighting them in green and thus allowing object specific options to be selected from the right click menu (e.g. Show Only Objects In, Hide Objects In, Object Properties etc.)

M1B.16 **Hold down the 'E' key** once more and **move the mouse slowly backwards** to move back up through the building until an internal view of the upper floor is obtained.



M1B.17 **Right click over the drawing window** and **select** the **[Reset View]** option from the right click menu when the review is complete. (Alternatively hold down the 'E' key and move the mouse sufficiently far backwards to back completely out of the partial view).

The Move Through feature can be paused and resumed as many times as required to review the model detail simply by releasing or holding down the 'E' key.

Filtering the View

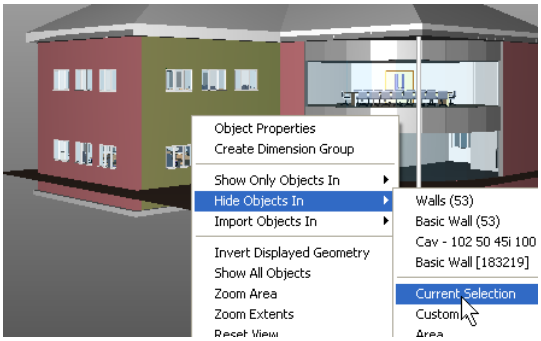
Hiding objects (PFC 5-2)

Hiding objects is used to temporarily remove an object or group of objects from the drawing view to be able to review and select other objects that lie behind or are otherwise obscured.

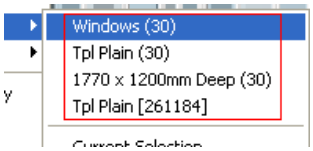
M1B.18 **Rotate the drawing to a position between the Left and Front views**.

M1B.19 **Position the mouse cursor over the external wall** as shown (zoom in as necessary).

M1B.20 **Right click** and hover the mouse over the **[Hide Object** In **]** option and **choose** the **[Current Selection]** option. The wall object will be temporarily hidden. **Repeat this process and hide the adjacent external wall to the left**.



After right clicking over an object and selecting the Hide Objects In option, the first four sub-menu options above the separator line represent four increasingly refined filtering levels to choose from.



The filtering levels will generally accord to the following:

Category *(i.e. the element category of the objects e.g. ceilings, doors, columns or floors)*

Family *(i.e. a logical grouping of objects having the same key attributes within the category e.g. for Doors - Overhead-Sectional, Single-Internal, Double-Internal, Double-External)*

Type *(i.e. a logical grouping of objects having the same size/purpose etc. within the Family e.g. for Doors/Single-Internal - 810x2110mm, 910x2110mm, 1010x2110mm)*

Instance *(e.g. a specific single object)*

When the required group or sub-group is chosen all objects belonging in that grouping level will be hidden from view.

M1B.21 **Position the mouse cursor over one the external window objects** as highlighted right (zoom in as necessary), **right click** and hover the mouse over the **[Hide Objects In]** option and **choose the Uppermost Windows option**. All of the objects in the Windows group will be temporarily hidden.

M1B.22 It is now possible to position the mouse cursor over the visible internal objects highlighting them in green and thus allowing object specific options to be selected from the right click menu (e.g. Show Only Objects In, Hide Objects In, Object Properties etc.)

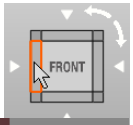
M1B.23 Re-display all the objects again by **right clicking anywhere on the drawing** and select the **[Show All Objects]** option from the right click menu.

Show Only Objects In (Filtering Objects by Group) (PFC 5-2)

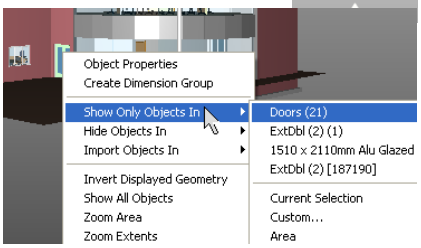
Showing Only Objects In a group (i.e. filtering by an object group) allows objects belonging to a specific group or sub-group (e.g. Doors or Internal Doors) or objects with common object properties and values (e.g. level/floor) to be displayed in isolation in the drawing window.

The sub-menu grouping levels which are displayed reflect the grouping hierarchy for the specific object highlighted, with the object Category at the top, then the Family, then the Type, then the Instance (refer to the definitions in the Hiding Objects section above).

M1B.24 Rotate the drawing to a view half way between the Front and Left viewing perspectives (**click on the edge of the view cube to the left of the Front face** - as shown right).

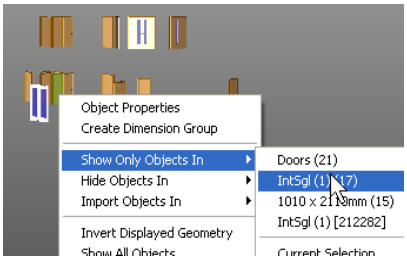


M1B.25 **Position the mouse cursor over the external glazed door**, it will then be highlight in green, **right click** and hover the mouse cursor over the **[Show Only Objects In]** menu option.

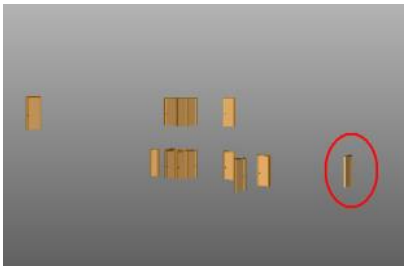


M1B.26 **Select the top 'Doors' option** from the sub-menu, the drawing view will be filtered to display just door objects (i.e. all of the objects which belong in the Door Category).

M1B.27 **Right click over one of the internal single doors** and **select** the **[Show only Object In]**, then **Select the second 'IntSgl'** option from the sub-menu, the drawing view will be filtered to display just Internal Single door objects (i.e. all of the objects which belong in the IntSgl Family).



M1B.28 **Right click over the furthest right internal single door** (shown right circled red) and **select** the **[Show only Object In]**, then **select the third '810 x 2110mm'** option from the sub-menu, the drawing view will be filtered to display only the two 810 x 2110mm Internal Single door objects (i.e. all of the objects of this specific Type).



M1B.29 **Right click over one of the two remaining doors** and **select** the **[Show only Object In]**, then **Select the fourth option** from the sub-menu, the drawing window will be filtered to display only this specific door object (i.e. this specific door Instance).

It is possible, in the same manner, to select any of the grouping levels at any time, e.g. to redisplay a higher grouping level for the objects or further filter the shown objects.

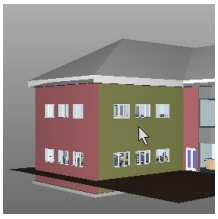
M1B.30 **Right click over the remaining door** and **select** the **[Show only Object In]**, then **Select the second 'IntSgl' option** once more from the sub-menu, the drawing window will re-display all Internal Single door objects, next right click over one of the other larger doors and select the third '1010 x 2110mm" option from the sub-menu, the drawing window will now be filtered to display only the 1010 x 2110mm door objects.

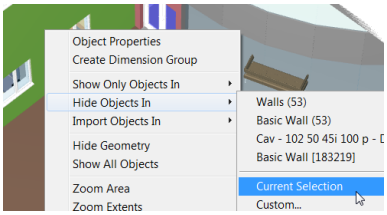
Show Only Objects In / Custom… (Filtering by Selecting Object Properties)

In addition to filtering objects by the sub-menu options it is also possible to customize the filter by selecting the **[Show Only Objects In / Custom..]** option from the right click menu and then choosing the required selection criteria.

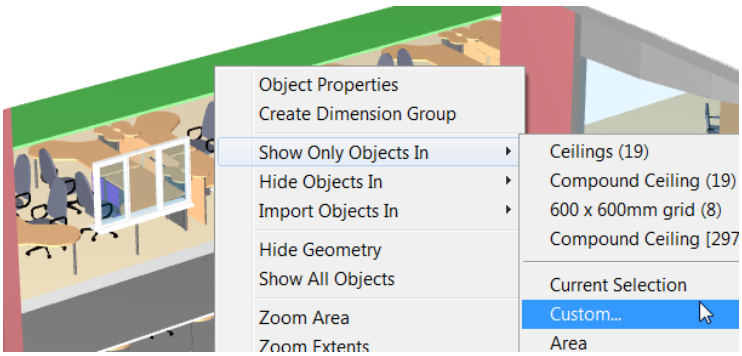
M1B.31 Firstly **right click over the drawing** and **select the [Show All Objects]** option from the right click menu to redisplay all of the hidden objects.

M1B.32 **Position the mouse cursor over the external wall** object as highlighted right, then **right click and select** the **[Hide Objects In/ Current Selection]** option.





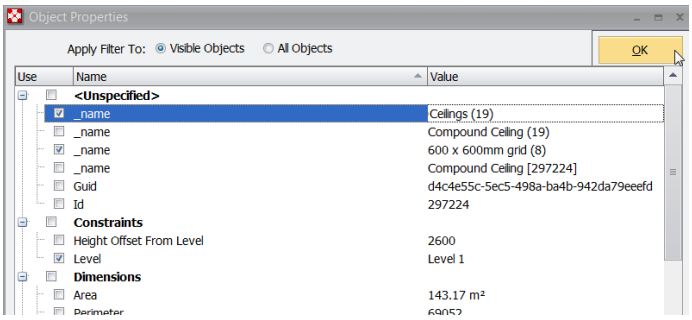
M1B.33 **Position the mouse cursor over The upper Level internal ceiling object** as highlighted below, **right click over the ceiling** and hover the **mouse over** the **[Show Only Objects In]** option then **choose** the **[Custom…]** option from the displayed sub-menu.



The Object Properties dialog is opened.

M1B.34 **Ensure the Visible Objects option is selected** in the radio buttons at the top of the Object Properties dialog box.

M1B.35 **Place a tick** in the checkbox to the **left of the object property named '_name' and with a value of 'Ceilings'**. Also **place a tick** in the checkbox to the **left of the object property named '_name' with a value of '600 x 600mm grid'** and the **checkbox to the left of the object property named 'Level' with a value of 'Level 1'**.

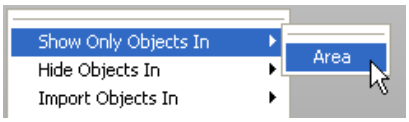


M1B.36 **Click** the **[OK]** button to apply the filter, the drawing window will be further filtered to display only 600 x 600mm grid ceilings located within Level 1 of the building.

Show Only Objects in / Area (Filtering Objects Within a Defined Area)

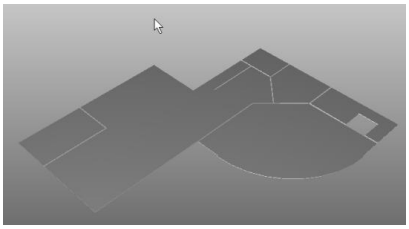
In addition to filtering objects it is also possible to show only objects in a particular area, this will show only objects which fit (in their entirety) within an area dragged out over the drawing.

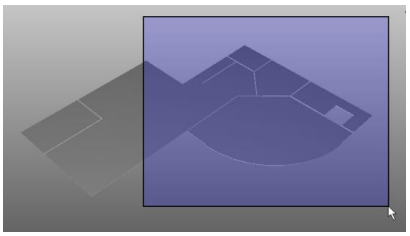
M1B.37 **Right click anywhere over the drawing** and hover the mouse over the **[Show Only Objects In]** option and **select** the **[Area]** option from the sub-menu.

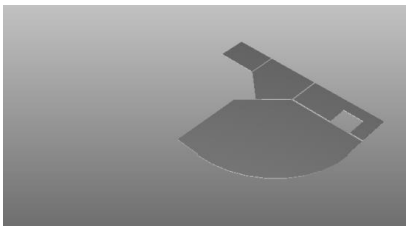


M1B.38 Position the mouse cursor as shown below left and then **hold down the left mouse button to define the upper left corner** of the area, as shown in the Screen Shot below.

M1B.39 Continue to **hold down the mouse button and drag the cursor to the bottom right corner** as shown below right, then **release the mouse button**. The view will display only the ceiling objects which were entirely within the defined area preview.

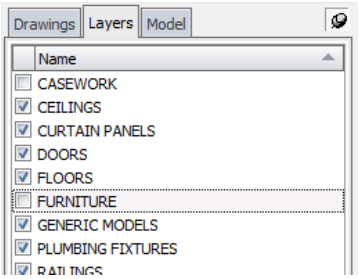






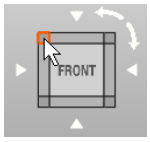
Adjusting Layers (PFC 5-2)

When a 3D BIM drawing is added, the building layers corresponding to the various Element Categories are created, these can be reviewed and may be toggled between being shown and hidden after selecting the Layers tab. The layer functions work independently to the other display options such as hiding or filtering objects.



Layers may be toggled between being shown and hidden individually (after the Layers tab has been selected) by clicking over the relevant checkbox to add or remove the tick. Layers which are currently shown are indicated with a tick and layers which are hidden are un-ticked.

M1B.40 **Right click over the drawing** and **select** the **[Show All Objects]** option to redisplay the previously hidden objects, the drawing should still be rotated to an oblique view, if not **click on the upper left corner of the view cubes Front face**.



M1B.41 **Click** on the **[Layers]** tab located above the drawings list window.

M1B.42 **Click** in turn over the **checkboxes to the left of the Roofs, Roof Soffits, Floors and Ceilings** to turn off (hide) each of these layers. As each layer is turned off the associated objects within each layer are removed from view.

Layers may also be hidden (with the Layers tab selected) by clicking with the left mouse button whilst the mouse cursor is positioned over and is highlighting an object in the drawing window.

M1B.43 **Position the mouse cursor over one of the wall objects**, it will be highlighted in orange, **click once with the left mouse button**, the wall layer is then turned off.

Holding down the Shift key whilst an object is highlighted will highlight all other objects in the same layer.

M1B.44 **Position the mouse cursor over one of the furniture objects** and then **hold down the Shift key** on the keyboard, all objects in the layer will be highlighted, **click once with the left mouse button**, the furniture layer is then turned off.

The Drawings Ribbon Toolbar also contains several buttons which control the display of layers and when used in combination with the other layer control techniques can provide a quick method to isolate a specific layer.

M1B.45 **Click** on the **[Drawings] Ribbon** to display the Drawings Ribbon (if it isn't currently displayed).

M1B.46 **Click** on the **[Show all layers]** (or the Show layers as per file) button, all layers will now be displayed in the drawing window.

M1B.47 **Position the mouse cursor over one of the wall objects** and **click once with the left mouse button** to turn off the wall layer (alternatively remove the tick adjacent to the Walls layer name in the layers list window).

M1B.48 **Click** on the **[Invert layers]** button, the drawing window will now show all the layers that are previously hidden and hide all the layers that were previously shown, leaving in this instance just the walls layer visible.

An alternative method is to turn off all layers and then select the required layers to be displayed in the layers list window.

M1B.49 **Click** on the **[Hide All layers]** button, all layers will now be hidden.

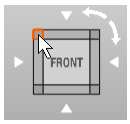
M1B.50 **Place a tick in the checkbox adjacent to the Furniture layer** in the layers list window, the Furniture layer only will now be displayed.

M1B.51 Before moving on **turn all layers back on** (**Click** on the **[Show All layers]** button) and click on the Drawings list tab to exit layers mode.

Transparent View (PFC 5-2)

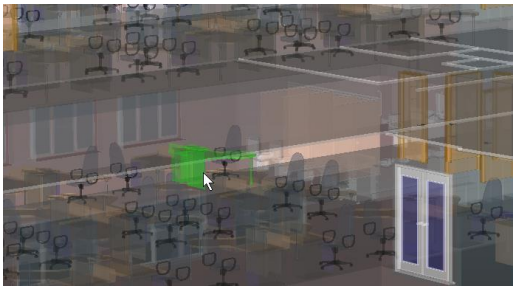
By default 3D BIM objects are displayed in CostX® with a solid shading. It is possible to toggle the display between a solid and transparent appearance using the Transparent button on the Drawings Ribbon Toolbar. When the transparent view is turned on it is possible review and select (highlight) objects previously obscured from view i.e. objects within the interior of a building model for example.

M1B.52 The drawing should still be rotated to an oblique view, if not **right click over the drawing** and **select** the **[Reset View]** option to reset the drawing to the default front view and then **click** on the **upper left corner of the view cube** (as shown right) to select an oblique view.



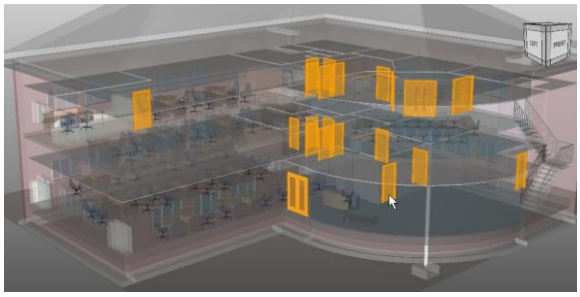
M1B.53 **Click** on the **[Transparent]** button located on the **[Drawings] Ribbon** to turn on the transparent view.

M1B.54 Slowly **move the mouse cursor over the drawing** and notice how internal objects are now visible and can be highlighted (i.e. allowing the various right click menu options such as Show Only Objects In to be used), try also rotating the drawing to alternative viewing perspectives.



M1B.55 **Click** on the **[Transparent]** button located on the **[Drawings] Ribbon** once more to turn off the transparent view.

The transparent view may also be used in conjunction with the Layers List view (i.e. when the Layers tab is selected), allowing layer contents to be reviewed and / or turned off as necessary.



One of the other main uses of the transparent view is that it allows dimensions or Dimension Groups once imported or measured to be reviewed in context with the overall model

Ghost View

Ghost View shows hidden objects or layers in faint outline, which helps to identify the placement of displayed objects within the model.

M1B.56 **Position the mouse cursor over an external door** in the drawing window, it will be highlighted green, **right click** and **select [Show Only Objects In] ...Doors** to filter the view to show only doors.

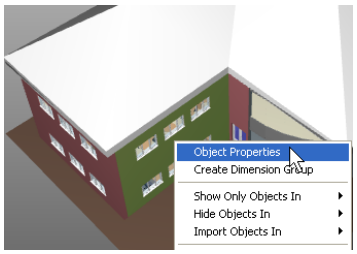
M1B.57 **Click** the **[Ghost View]** button on the **[Drawings] ribbon** to show all hidden objects in Ghost mode.

M1B.58 **Click** the **[Ghost View]** button again to turn off Ghost mode.

View Object Properties

Each object in a BIM drawing has set of parametric properties. This information may be viewed for individual objects by right clicking over the object and selecting the **Object Properties** option, the object properties will then be displayed in a new window.

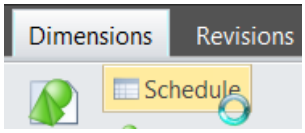
M1B.59 **Position the mouse cursor over the wall object** (shown right) in the drawing window, it will be highlighted green, **right click** and **select** the **[Object Properties]** option.

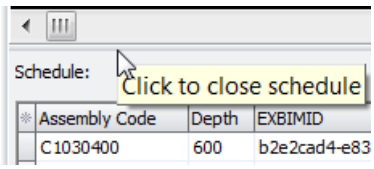


M1B.60 A window will open allowing the properties specific to the selected object to be reviewed. **Click** on the **[Close]** button to close the dialog.

View Multiple Objects Properties / Schedule Window

The object properties for multiple objects can be reviewed simultaneously in the Schedule Window. The Schedule displays as a table below the main drawing window and schedules the object properties for all objects currently displayed in the drawing window. The Schedule Window can be displayed or hidden by clicking on either the Schedule button located on the Dimensions Ribbon Toolbar or by clicking on the schedule window resizing bar located beneath the main drawing window.





The schedule window may also be resized vertically to reveal more or less rows by dragging the schedule window resizing bar up or down.

M1B.61 **Click** on the **[Dimensions]**Tab to display the Dimensions Ribbon Toolbar and then on the **[Schedule]** button to display the Schedule Window beneath the drawing window.

M1B.62 **Position the mouse cursor over an external door in the drawing window**, it will be highlighted green, **right click** and **select [Show Only Objects In]... Doors** to filter the view to show only doors. The Schedule will display only the door data.

The columns and rows displayed in the schedule window are automatically selected as objects are filtered, hidden and / or layers are turned on or off etc.

If required the columns displayed in the schedule window may be manually customized by clicking on the customize columns button  *in the upper left corner of the schedule window and adding or removing ticks from the relevant checkboxes (click on the customize columns button*  *again to close the selection window).*

CostX® also provides an option to copy the displayed object data from the schedule window to the Windows® clipboard, from where it can then be pasted into a workbook or other software application. Right click over the schedule window (in the desired row, column or cell as necessary) and select the required copy option from the right click menu.

Model Tab / Model List Window

The Model List Window displays the hierarchy of the BIM model in the form of nodes at different levels representing the object groups, sub-groups and items.

The various nodes of the model tree can be expanded and reduced by clicking on + & - buttons to the left of the node description.

M1B.63 **Click** on the **[Model]** tab located above the drawings list window to display the Model List Window, also referred to as the Model Tree. **Click** on the **'Drawing' node** to display all objects in the model. **Open the [Schedule]**.

M1B.64 Then **click** on the **'Doors' node**, notice that the drawing and schedule windows have now been filtered to display only the door objects. **Move the cursor over the displayed doors**, which will highlight in green as you move over them. As each door highlights, the corresponding row in the Schedule will also highlight.

M1B.65 **Click on various rows in the Schedule**. As each row is selected, the corresponding door in the view will highlight.

M1B.66 **Select in turn each branch under the 'Doors' Node** in the model list window. As each node is selected both the drawing window and schedule window are progressively filtered.

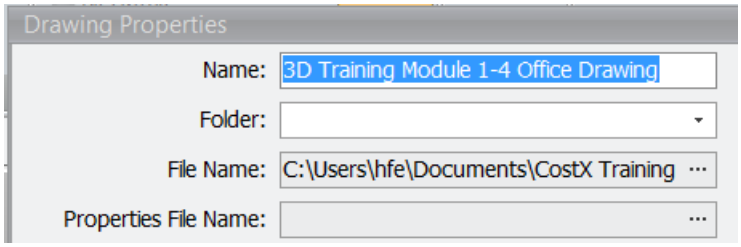
M1B.67 Hold the **Ctrl key** and **click on a selection of branches and sub-branches** under various nodes. All the selected items will display.

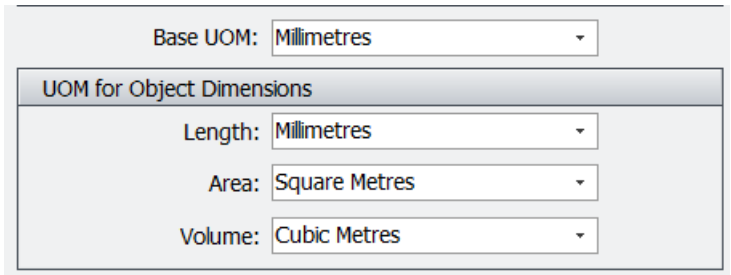
M1B.68 **Click** on the **'Doors' node**, then hold the **Shift key** and **click on the Plumbing Fixtures node**. Both nodes and all intervening nodes will be selected.

> *Using the model list window in conjunction with the schedule window is a quick and efficient method to review object properties for the model and is a key model navigation tool to use when importing BIM dimensions or measuring quantities.*

Module 1C Units of Measure (UOM) for Object Dimensions

When a drawing is added to the building, the Base UOM and UOM for Object Dimensions settings are retained from the previously added drawing. They may not be appropriate for the newly added drawing, and should be verified to ensure they are applicable. This is an important point to emphasise because UOM in BIM models are commonly not defined. There is no way to automate this validation, which needs to be done by the user.





In CostX®, the Drawing Properties dialog can be reopened after the drawing has been added, and the UOM can be revised. Hence it is possible to load the drawing using the default settings, then verify the UOM either by reviewing dimensional data in the schedule window, or by measuring or importing a known length, area and volume dimension as a check prior to commencing the actual measurement exercise.

Therefore having added the drawing we shall verify the units of measurement within the drawing file to ascertain that the units of measurement are correct.

As most building models will contain Floor objects and as most floor objects will have Area, Length (Perimeter), and Volume values, these are often a good choice of objects to review in the first instance to ascertain if units of measurement have been defined within the drawing file.

M1C.1 **Click** on the **[Model] tab** to display the Model List Window then **select** the **'Floors' node**.

M1C.2 Display the Schedule Window by **clicking** on the **[Schedule] button** on the **[Dimensions] Ribbon**.

M1C.3 In the schedule window **locate the columns relating to the floor objects area, length and volume**, these are named Area, Perimeter and Volume respectively.

M1C.4 Check whether the values in these columns have units of measurement specified.

To widen a column in the schedule window position the mouse cursor to the right hand side of the column heading 

(the mouse cursor will change to the 'drag' ⇹ shape) press and hold down the left mouse button and drag the mouse to the right to widen the column, release the mouse button when the required size has been achieved.

M1C.5 **If the values have a unit of measurement defined it will be appended after the actual value** and all values of the same type (i.e. area, length and volume type values) will also have the same unit of measurement specified.

	Area	Perimeter	Volume
	324.97 m²	82056	73.12 m³
	331.55 m²	81821	74.60 m³
	343.62 m²	82352	164.94 m³
	3.63 m²	7622	0.73 m³

M1C.6 If the values do not have a unit of measurement appended after the value all values of that type in the drawing file will similarly be undefined in terms of the UOM and should be verified.

- *When the BIM file is created by the designer there is an option which allows units of measurement to be assigned to Length, Area & Volume values types (e.g. m2 or mm2). Where these have been assigned they will be used.*

- *For any values in the BIM file where such units of measurement have not been assigned, the units specified in the UOM for Object Dimensions section of the dialog will be used instead.*

- *In this example units of measurement have been specified in the BIM file for Area and Volume values types but not for the Length value type (the Perimeter values are a length type of value). Therefore if the Perimeter value is imported it will automatically be assumed to be in the Unit of Measure specified in the*

Length field in the UOM for Object Dimensions section of the Drawing Properties dialog, which in this case is specified as Millimetres.

For this drawing file the Area and Volume values do have a UOM specified, m2 and m3 respectively, however the Length values does not. We will need to verify a BIM length value against a known length to identify the correct UOM. Door, Column or Beam objects will commonly have a Width value and the size is usually stated in one of the description fields, so this can be used to verify the UOM.

M1C.7 **Click** on the **'Doors' node** in the model list window to filter the door objects in the schedule window and scroll across the schedule columns to review the various object descriptions to see if one has a stated size. We can see that the first item in the schedule window has a stated size of 1510 x 2110mm.

M1C.8 **Locate the Width column** (which contains length type of values) to see how the value relates to the stated size. We can see that the value is expressed as 1510 for this item which confirms the length values are in millimeters (if the value was expressed as 1.510 it would have confirmed that length values were in meters).

Having now determined the units of measure for Area, Length and Volume values in the BIM model we can now double check the correct settings have been specified in the Drawing Properties dialog.

M1C.9 **Click** on the **[Drawings] list** tab to redisplay the drawings list window and then **double click** on the **[3D Training Module 1-4 Office Drawing]** in the list to reopen the Drawing Properties dialog, **check, and if necessary amend, the UOM** for Object Dimensions settings to ensure they match the UOM's we have just determined from the schedule window, click Update to close the Drawing Properties dialog.

If UOM's are not defined in the drawing file and it isn't possible to confirm the units solely with reference to the object data, then the UOM's can be identified by importing a known length, area or volume dimension into a Dimension Group and verifying the imported dimension value. If for example the UOM should be meters rather than millimetres, or imperial rather than metric etc., the Dimension Group value will usually be obviously incorrect.

In the following example of a schedule (structural floor) you will notice that none of the Area, Perimeter or Volume fields have a UOM appended, indicating that units of measurement have not been defined in the drawing file.

Schedule:

Area	Assembly Code	Family Name	Height Offset From Level	Level	Level1	Level2	Level3	Level4	Perimeter	Structural	Structural Usage	Type Name	Volume
22379216	B1010	Floor	0	FOUNDATION	Floors	Floor	152 Concrete	Floor	20154	Yes	Slab	152 Concrete	3.41
19441977	B1010	Floor	0	FOUNDATION	Floors	Floor	152 Concrete	Floor	18570	Yes	Slab	152 Concrete	2.96
19412034	B1010	Floor	0	FOUNDATION	Floors	Floor	152 Concrete	Floor	18285	Yes	Slab	152 Concrete	2.96
1637910912	B1010	Floor	-51	Level 4	Floors	Floor	152 Concrete	Floor	211304	Yes	Slab	152 Concrete	249.62
1698870024	B1010	Floor	0	GROUND LEVEL	Floors	Floor	152 Concrete	Floor	212362	Yes	Slab	152 Concrete	258.91

Importing dimensions from this model using a BIM Template would yield the following result. Notice the large quantity for the Floor Area.

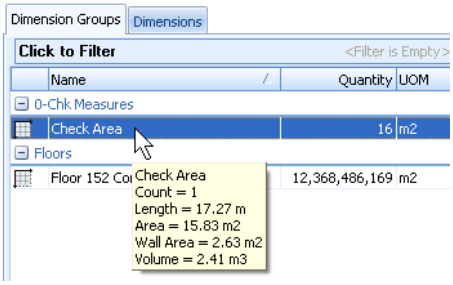
Dimension Groups | Dimensions

Floor 152 Concrete

Name	Flrs	Length	Area	Volume
194883	1	212.36	1,698,870,024.00	258.91
249765	1	14.63	12,345,782.00	1.88
249887	1	17.27	15,834,807.00	2.41
250019	1	14.63	12,345,782.00	1.88

When an unrealistic figure arises, a wrong UOM can be assumed.

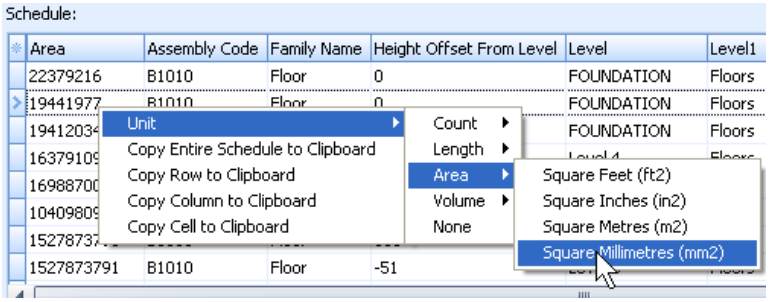
Using a blank dimension group to carry out a 3D Measure of a small sample will give you a comparable figure, from which the correct UOM can be determined.



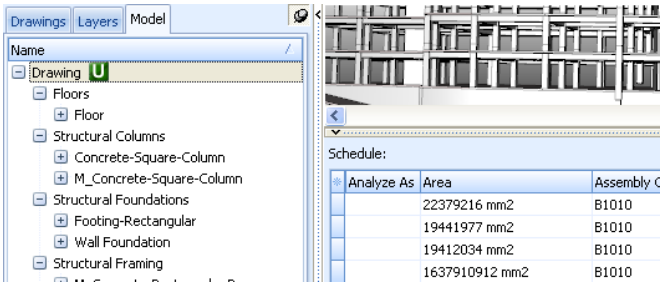
Hence we can see from comparing the two different area values that the BIM area value is in fact in mm2.

Having now established the actual UOM's for Area, Length and Volume type values we could now delete the temporary Dimension Groups and folders we imported / created for the check measurements and then review and amend as needed the UOM details in the Drawing Properties dialog prior to undertaking the actual measurement.

TIP: When units have not been assigned, it is possible to specify the units of measurement within the Schedule Window, either for the entire drawing or any of the hierarchical nodes (i.e. object groups) selected in the model tree list window. Open the Schedule, hover the cursor over the relevant column heading, then use the right click menu option "Unit" to assign units to the values.

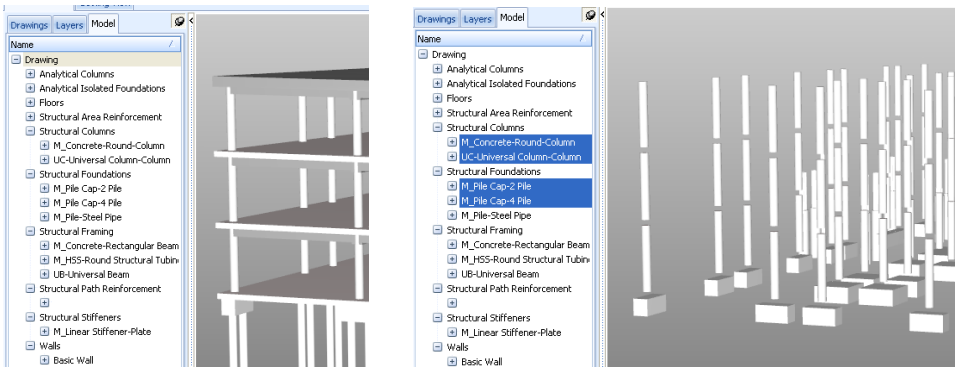


The Units will appear in the Schedule and a green U symbol will be inserted against the relevant branch of the Model tree.

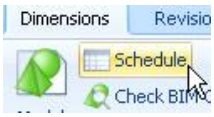


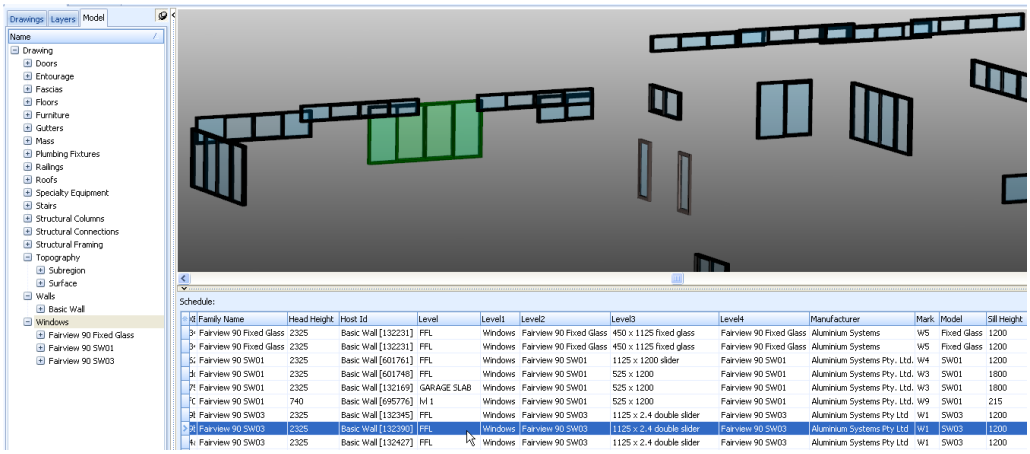
10.2 BIM Model Navigation

- The Model tab opens a Model Tree, which provides an at-a-glance view of the entire hierarchical structure of the objects within a 3D BIM model. The tree format of the tab allows any part of the model to be easily selected, progressively filtered, and displayed. Simply click on the required branch of the tree. Hold the Ctrl key and click to select multiple branches for display.



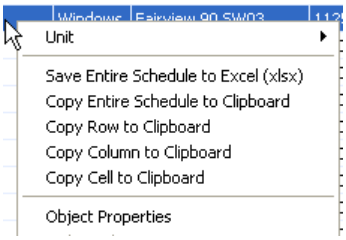
- The Schedule button opens a Model Schedule which schedules all the parametric properties of the model objects selected in the model view. The schedule may be filtered to specific categories within the model tree, eg. to create a window or door schedule.





With the Schedule open in the Model tab, click on a line in the Schedule to highlight the corresponding object in the view. Conversely, hover the cursor over an object in the view, and the corresponding line of the Schedule will highlight.

Right click menu options in the Schedule include export or copy of data and display of Object Properties.



10.3 User-Defined Model Properties

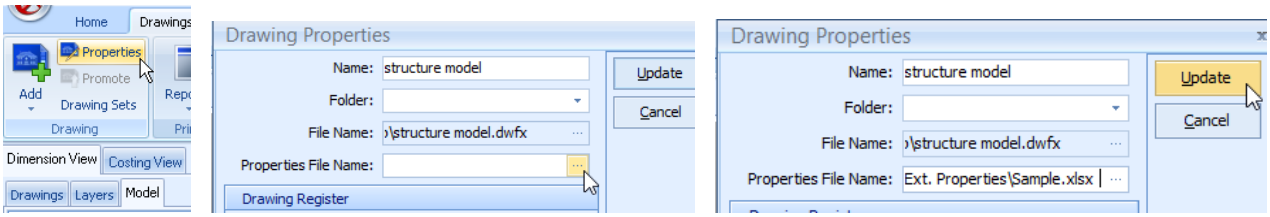
This powerful feature allows the CostX® user to insert additional data into the Schedule which will be attached to its corresponding object within the model. Examples of user-defined data might include elemental or trade coding, formula calculations to create additional dimensions such as girths, life-cycle data, etc.

- Use the Model Tree to filter the view as required. Open the Schedule, and use the Right click menu option Save Entire Schedule to Excel (xlsx). Save the resultant Excel® file to a suitable location.

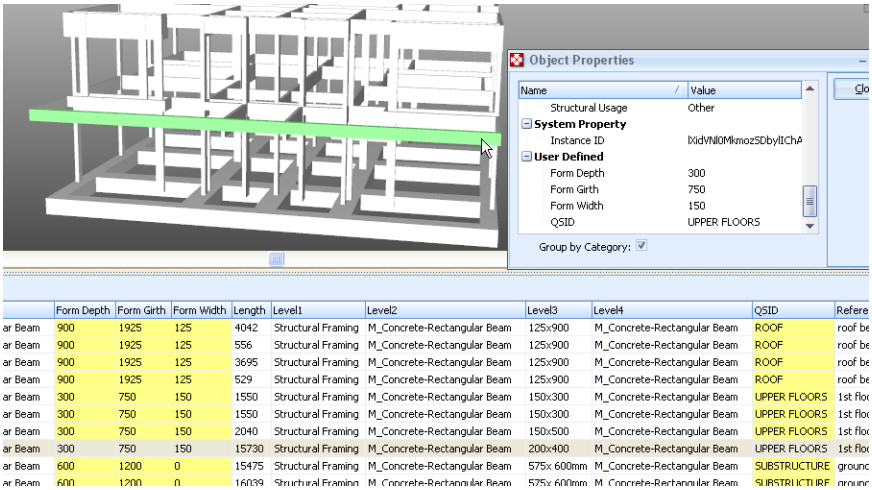
- Open the Excel® file and insert new columns to enter the additional data. Each row of the Schedule corresponds to a specific object in the model, so enter the additional column data into the relevant row to attach the data to its corresponding object.

- When the data has been added, save the amended Excel® file.

- Now open the Drawing Properties dialogue by clicking the Properties button. In the Drawing Properties box click on the ellipsis (…) button to open a browser window and navigate to the saved Excel® file. Click Open to attach the file to the drawing properties and then click Update to close the Drawing Properties box.



- The Schedule will re-load and the added columns will be highlighted in yellow and will also appear in the Object Properties as User Defined properties.



- The data is now available for measurement purposes.

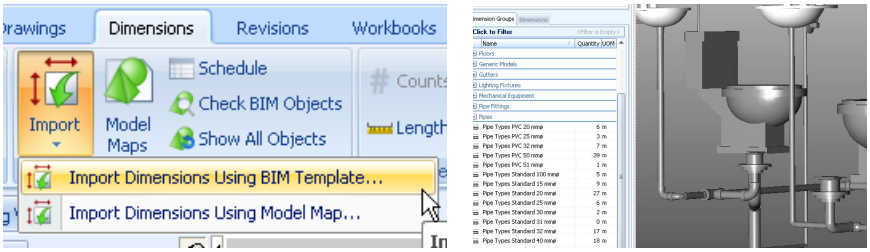
- Refer to the CostX® Advanced Manual for more detail on the User-defined properties function.

10.4 Import Quantities from BIM Models

CostX® has the ability to extract BIM Object properties from 3D Model drawing files or multi-sheet 3D and 2D files, with several measurement options available to optimise data extraction. The measured objects highlight in green on the 3D view and also on all associated 2D sheets in the same Drawing Set. The following is a brief overview of the BIM import functions. Refer to the CostX® Advanced Manual for more detail.

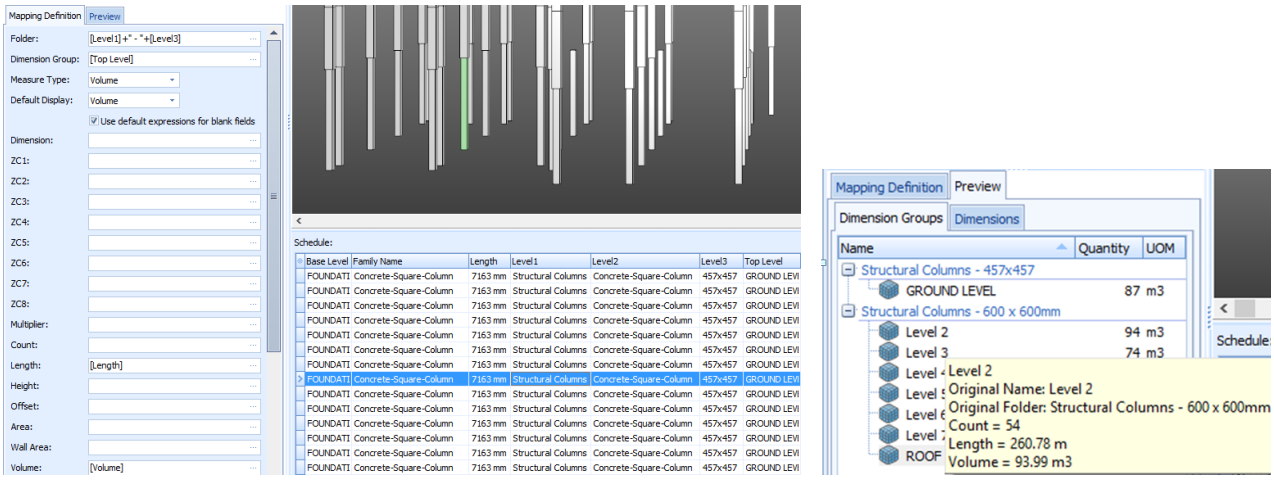
- The "Add Dimension Group" function (or right click "Create Dimension Group") allows you to select specific BIM Properties to use for measurement of individual objects.

- The "Import Dimensions from BIM Properties" function will automatically create dimension groups and generate quantities from a 3D model view for all displayed model objects using a standard CostX® BIM Template.



- The "Import Dimensions Using Model Maps" function tool will automatically create dimension groups and generate quantities from a 3D model view for all displayed model objects using a user defined Model Map.

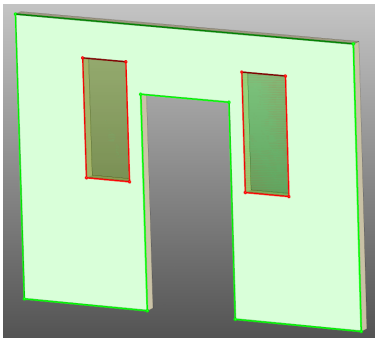
- The Model Maps function allows users to configure templates, called Model Maps, which can extract data from a BIM model using any combination of object properties in the Schedule. The Model Maps are created by dragging and dropping the relevant object properties into the desired Model Map fields. A Preview tab previews the resultant quantities and their associated Dimension Group structure.



10.5 3D Measurement

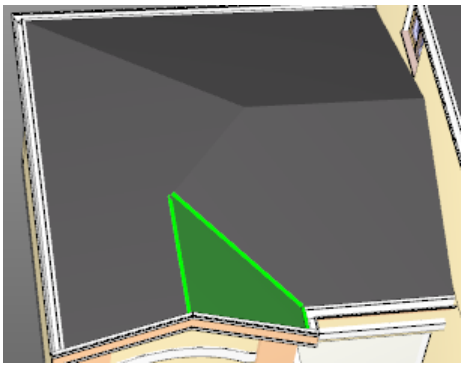
- Areas, lengths and counts can readily be measured on-screen from 3D drawings. If the 3D Drawing is a BIM model, CostX® will default to Object Mode to access the object properties for you to import the BIM data. If you wish to measure quantities rather than import them, de-select object Mode and select Point Mode instead, by clicking the Point button.

- Select a Dimension Group to measure the quantities into, then click to vertices (intersections) of lines and planes to create area boundaries and length dimensions (similar to Point Mode measurement in 2D).

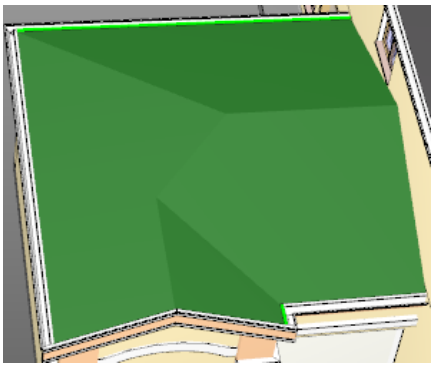


- A 3D "Quickpoint" function allows areas and lengths in a single plane to be captured in a single click by holding the Shift key.

- In addition, depending on the properties of the drawing , a shortcut Smartkey (L key) will automatically takeoff entire surface areas, including complex curved 3D shapes, in a single click.



3D Quickpoint (Shift Key)



3D Surface Area ("L" Key)

- The Measure Distance tool also operates in 3D.