

# DIGITAL DRAWING FILE OPTIMISATION

# For Measurement & Estimating Purposes

Simple tips for a collaborative approach to improved drawing file intelligence



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## 1 Introduction

All construction projects will have a number of key objectives, and almost without exception these will include adherence to cost and budgetary constraints. Whilst there is nothing new in these requirements, the way and speed they can be achieved has improved significantly and continues to improve because of the use of CostX<sup>®</sup>. CostX<sup>®</sup> is an interoperable estimating software tool which supports the seamless transfer of digital design information between designers and non-CAD users for measurement and estimating purposes.

Amongst other powerful features, CostX<sup>®</sup> allows its users to measure from a variety of drawing file formats without running CAD software, and without the ability to amend or alter the files. The measurements are then utilized in the preparation of working documents required for the various stages of a project, such as option or change appraisals, estimates, bills of quantities, material schedules, tenders, and the like.

Whilst CostX<sup>®</sup> supports a wide variety of file formats, thus enabling its use on any project, file formats for design data vary and each inherently provides differing levels of data richness and functionality. CostX<sup>®</sup> users can leverage better drawing file intelligence in a way that can dramatically improve productivity, and this means that the arrangement and configuration of data for each drawing file format can be optimized to improve communication and yield the greatest benefit to the team. This enables work that traditionally could have taken days to complete to be done in hours, leading to improved project delivery and resulting in benefits to the client and design team alike.

Notwithstanding these benefits, electronic drawing files are commonly issued in the lesser intelligent file formats, usually basic 2D raster or vector PDF files, sometimes 2D or 3D CAD formats and only occasionally 3D object-based BIM models. Furthermore, the file data is often not configured in a way to best suit the measurement process and quantity extraction. This represents a missed opportunity because regardless of the file format used, the configuration of data for each drawing file format can easily be optimized to improve communication and yield the greatest benefit to the team.

This document aims to provide general tips and guidance for the more common file formats on how drawing files may be arranged and optimized to improve team communication, and specifically to assist in the quantities measurement and estimating activities. It is not intended to be a mandatory requirement for each file format, but rather to reflect some of the more common optimizations which are of benefit.

Generally, the simple suggestions made in this document will be broadly applicable and could readily be incorporated into workflows for most projects. However, they are by no means exhaustive and it is up to project teams to establish their own information exchange protocols and collaborative workflow methodologies to suit project requirements and individual circumstances.

## 2 What to Provide - Overview

Drawing file formats which can be used for measurement and estimating purposes range from simple 2D raster formats, through 2D PDF or CAD files, to 3D object-based DWF<sup>™</sup>, DWFx<sup>™</sup> and IFC BIM models. Each of these formats progressively provides increasing levels of drawing file intelligence which can be leveraged by CostX<sup>®</sup> users to dramatically improve measurement and estimating productivity.

Quantities are obtained either by on-screen measurement from 2D or 3D drawings, or by importing dimensional information directly from the BIM data model.

The details below reflect a general preference order based on the useable intelligence contained within various file formats, although CostX<sup>®</sup> supports the use of all of them.

#### 2.1 3D DWF<sup>™</sup> and DWFx<sup>™</sup> Files from Revit<sup>®</sup>

If Revit<sup>®</sup> is the software used to design the building, a multi-sheet DWF<sup>™</sup> or DWFx<sup>™</sup> export with a default 3D model view (or series of 3D views each showing different elements) and 2D sheets of all plans, elevations and sections will enable CostX<sup>®</sup> users to utilize the database information to automatically generate quantities from the 3D views, and augment the database quantities with additional measurement from the 2D or 3D drawing views or sheets.

With Revit<sup>®</sup>, DWF<sup>™</sup> and DWFx<sup>™</sup> files are preferred to IFC files, but if an IFC is specifically required refer to IFC Files from Revit<sup>®</sup>.

There are several optimizations which can assist the team when producing 3D models and views in Revit<sup>®</sup>, these are described in <u>3D DWF™ and DWFx™ Files from Revit<sup>®</sup></u>.

As Revit<sup>®</sup> is also capable of exporting individual DWG<sup>™</sup> files of the 2D views and sheets, these may also be requested where additional measurement functionality may be required. Please refer to <u>2D CAD files</u>.

#### 2.2 IFC Files

Provide an IFC 2X3 Extended Coordination View export with Base Quantities and with dimensional instance properties (quantities) mapped as a Property Set. Prior to export ensure that objects are mapped to their correct IFC categories, which may involve use of override settings and creation of additional IFC-specific parameters.

For more details refer to IFC Files and if ArchiCAD® has been used also refer to IFC files from ArchiCAD®.

In addition to the IFC, provide a full 2D set of plans, sections, elevations and details in 2D DWG<sup>™</sup> format as described in <u>2D CAD files</u>.

# 2.3 2D CAD Formats

For most other CAD packages, DWG<sup>M</sup> files can be used as an interoperable format between design disciplines to aid coordination, not least because the logical use of layers and blocks within them allows the identification and isolation of the relevant details, and this assists with the speed of measurement. There are several beneficial optimizations when producing DWG<sup>M</sup> files as described in <u>2D CAD files</u>. Note that CostX<sup>®</sup> cannot be used to alter or amend DWG<sup>M</sup> or any other CAD files. 2D DGN<sup>M</sup> files are also supported by CostX<sup>®</sup>.

#### 2.4 Vector-based PDFs

PDF files are a commonly issued output for design data, in part because this format is read-only and can be easily opened with a number or freely available and simple to use viewing packages. PDF files exported from a CAD package will usually contain vector coordinates however little else of the embedded intelligence of the CAD files from which they are generated.

Whilst vector PDF files can readily be used for measurement in CostX<sup>®</sup>, advanced measurement tools such as blocks and polylines which rely on CAD intelligence are not available. However if there is no choice but to issue vector PDF files there are a few optimizations which can enhance the data and thereby usability of the file, such as including layers in the PDF file to allow isolation of the relevant details which is of assistance for both review purposes and when taking measurements from the drawing. Please refer to <u>Vector based PDF Files and Their Limitations</u>.

#### 2.5 Raster Image Files (incl. Raster PDFs)

Raster image (JPEG, BMP, TIFF, etc) and raster PDF files provide the least data and do not contain any vector or other intelligence from the source CAD file. Sometimes, certain export settings in CAD programs will determine whether a PDF is produced as a vector or raster file, or a combination – it can be quite common for PDF files to contain both vector and raster components. Whilst raster or combined raster/vector files can readily be used for measurement in CostX<sup>®</sup>, it is preferable to issue the DWG<sup>™</sup> source files or all-vector PDFs as they have a far greater range of use. However if there is no alternative but to issue image raster files, the details in <u>Raster Image Files (incl. Raster PDFs) and Their Limitations</u> provide several optimization tips.

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# 3 General Guidance (All 2D File Formats)

Irrespective of the file format provided, one of the key features of CostX<sup>®</sup> is the ability to identify and track changes which occur on progressive drawing issues. Consequently there are a few general suggestions to consider when creating and issuing drawings for a project which include:

- 1. Try to use a consistent scale, orientation and position for progressive issues of each drawing.
- 2. Try to be consistent with the drawn information included on each drawing for progressive issues.
- 3. Consider establishing a drawing numbering/referencing structure and use it consistently for progressive issues.

# 4 Raster Image Files (incl. Raster PDFs) and Their Limitations

CAD programs are based on vector graphics, however the drawings are often published and issued in one of the raster image formats which means that the inherent resolution and intelligence is lost. Often the drawings are difficult to read but cannot be enlarged without further loss of resolution, and the scale can sometimes be difficult to determine accurately.

CostX<sup>®</sup> supports both raster and vector formats but uses different modes of measurement for each, reflecting the nature of the data available. Measurement of a raster image traces an overlay over the top of the drawing, whereas vector measurement attaches to the actual vector lines within the drawing. Hence vector measurement is faster and more accurate, and can identify changes in drawing revisions by detecting the amended vector co-ordinates of the measured lines.



For these reasons, although AutoCAD<sup>®</sup> and similar CAD programs can export/plot raster image files, the preference is to receive DWG<sup>™</sup> files or Vector based PDF files (refer to <u>2D CAD files</u> and <u>3D Drawing Files</u> and <u>BIM Models</u>). If you have no choice but to issue raster files instead of vector files it is critical to provide scale information, particularly as the image may get distorted during transmission. This seems basic but is neglected surprisingly often.

- 1. Provide X and Y scale bars and / or figured dimensions to allow the drawing scale to be calibrated more accurately.
- 2. Orientate the drawing to be appropriately rotated (e.g. square to the boundary of the image file).



- 3. Use a consistent scale and orientation for progressive drawing issues.
- 4. A JPG or PNG file format would be preferred over BMP and TIFF due to file size and quality considerations.
- 5. If plotting from a CAD package directly, choose an appropriate paper size setting (e.g. 1600 x 1280 pixels, A3 etc. or larger for very large drawings) to enhance resolution.

- Printer/plotter Na <u>m</u> e:	PublishToWeb JPG.pc3	~
Paper size		
Paper size		
Sun Hi-Res (	1600.00 x 1280.00 Pixels) ~	

6. Try not to use heavy lineweights, as these may obscure other drawn details.

Lineweight Settings		<	×
Lineweights 0.00 mm 0.05 mm 0.09 mm 0.13 mm 0.15 mm 0.18 mm	Units for Listing Millimeters (mm) Inches (in) Displayaneweight Min Max	Lineweights 0.30 mm 0.35 mm 0.40 mm 0.50 mm 0.53 mm 0.60 mm	Units for Listing Millimeters (mm) Inches (in) Default 0.40 mm Add the bay Scale Min Max
Current Lineweight: By	Layer	Current Lineweight: ByL	ayer
ОК	Cancel <u>H</u> elp	ОК	Cancel <u>H</u> elp

- 7. If scanning a drawing use a DPI setting of 100-150DPI generally, for drawings with very fine details use a DPI setting of 200-300DPI.
- 8. Try not to have views at different scales in the same image file. Where this is not possible try to arrange the views at one scale in one area of the sheet and views at a different scale in another area of the sheet rather than having details at different scales interspersed throughout the image.



# 5 Vector-based PDF Files and Their Limitations

A commonly issued output from CAD programs is a PDF file which contains vector co-ordinates but little else of the embedded intelligence of the source CAD files. This means that measurement can be done in vector mode but advanced measurement tools which rely on CAD intelligence such as polylines and blocks are not available. Also, layer information is commonly excluded from PDF files, which means that the drawing view cannot be filtered to facilitate the measurement process.

Owing to its superior resolution and accuracy, a vector PDF is preferable to a raster image but the preference would be to receive DWG<sup>™</sup> files (refer to <u>3D Drawing Files and BIM Models</u>). If you have no choice but to issue vector PDF files instead of CAD files, export as a PDF (in preference to plotting to a PDF printer) and be sure to include layer information. Note – vector PDFs with layers included can also be exported from a DWG<sup>™</sup> opened in AutoDesk<sup>®</sup> DWGTrueView<sup>™</sup>.

Import •		3D DWF	Export to PDF Options
Export •	DWF	Create and display a DWF or DWFx file of your 3D model in the DWF Viewer.	Quality
Publish +		PDF Create a PDF file and allow you to set page setu goverrides.	Vector quality     1200     dpi       Raster image quality     400     dpi
		Options	Merge control Lines Overwrite V
			Data           Image: Construction Font Handling
			Adds layer information in the PDF file so that you can turn layers on or off when viewing or printing PDF files.
			OK Can

If layers are enabled in PDF and CAD files, the estimating software can filter the display to make viewing and measurement much quicker and easier, by 1) eliminating unwanted data to reduce clutter and 2) isolating data for measurement.



Hence it is very helpful if layers are configured in a logical manner, for example:

- Put different building elements onto different layers.
- Put like items within an element onto the same layer or distribute them logically onto a series of layers.
- Ensure the layer states are correct for all layers before saving the file. Layers which are not required should be frozen.
- Use the hatching tools to create hatching or include it on a separate layer.



- 1. Provide scale annotation, scale bars and / or figured dimensions.
- 2. Orientate the drawing to be appropriately rotated (e.g. square to the boundary of the image file).
- 3. Use a consistent scale and orientation for progressive drawing issues.
- 4. Try not to have views at different scales in the same PDF file. Where this is not possible try to arrange the views at one scale in one area of the sheet and views at a different scale in another area of the sheet rather than having details at different scales interspersed throughout the image.



5. Try to include any hatching in the drawing on a different drawing layer(s) to other drawn details to enable it to be displayed or hidden as necessary.



6. If creating a PDF from AutoCAD<sup>®</sup> use the export to PDF option rather than printing to a PDF.



7. If creating a PDF from Revit<sup>®</sup>, select a hidden line or wireframe visual style so that the PDF will be in vector format. Styles such as shaded, colored, etc will result in raster or combined raster/vector content.

Properties	X
Floor Plan	-
Floor Plan: Level 0	🔽 🔓 Edit Type
Graphics	* ^
View Scale	1:100
Scale Value 1:	100
Display Model	Normal
Detail Level	Fine
Detail Number	8
Rotation on Sheet	None
Visibility/Graphics Overrides	Edit
Visual Style	Wireframe 💉
Graphic Display Options	Wireframe 📉 🗸
Properties help	Hidden Line

# 6 2D CAD Files

The 2D CAD formats such as DWG<sup>™</sup>, DWF/DWFx<sup>™</sup> and DGN<sup>™</sup> are capable of being rich in content and CostX<sup>®</sup> users (who cannot edit the drawing file as CostX<sup>®</sup> is read-only) can exploit this intelligence with various advanced measurement tools.

#### 6.1 Blocks

CostX<sup>®</sup> can make use of blocks by counting all instances of a block in a single action, hence it is very helpful if blocks are included in drawing files and are configured in a logical manner.



- Do not group multiple objects into a single block.
- Co-ordinate blocks with layers so that details can be isolated and then measured very quickly.
- Try not to use the same block for different (albeit visually similar) objects in a drawing, equally try not to use different blocks for the same object in a drawing.



• It is better to define individual composite 'objects' as blocks and not to create blocks comprising multiple objects.



## 6.2 Polylines

Simply put, CAD drawings are made up of multiple lines and arcs. The polyline command allows a series of lines or arcs to be combined into a single continuous entity to create highly complex shapes.

CostX<sup>®</sup> is able to recognize the geometry of polylines and automatically return the area and perimeter of the shape, no matter how complex, with a single action. Hence it is very helpful if floor plans, rooms, areas, etc. are defined by polylines in drawing files.



#### 6.3 X-Refs

Dependent files e.g. Xref's / non-standard fonts should be either bound in with the DWG<sup>™</sup> file or provided as separate files using the correct relative directory structure.

		X H	<u>.</u>	- 2 - 🗈 -	?				
		~~~	File	References			:: B		
			F	Reference 🔺	Status	Size	Туре		
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			🚰 Ba	asement	Open	170 VD	<b>Attach</b>		
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Manager III 🚺 Window	vs Tabs				Unload			- Pind Turns	
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External	Keterences Palette				Bind			◯ Insert	
Displays 1	he External Reference:				Xref Type	20	>		

If exporting to DWG<sup>™</sup> from Revit<sup>®</sup> the Xref views on sheets in the Save to Target Folder dialog option should not be ticked.



#### 6.4 Layers

CostX<sup>®</sup> is able to use layers where provided to filter the display to make viewing and measurement much quicker and easier, by 1) eliminating unwanted data to reduce clutter and 2) isolating data for measurement.



Hence it is very helpful if layers are provided and configured in a logical manner.

- Put different building elements onto different layers.
- Put like items within an element onto the same layer or distribute them logically onto a series of layers.
- Use the hatching tools to create hatching rather than using other tools to represent hatching. Try not to
  disassociate/explode hatching.



 Review the layer states for all layers before saving the DWG<sup>™</sup>, layers which are not intended to be seen should be frozen.

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	-	LF09\$0\$A-WAL	<b>•</b>		<b>1</b>	B	🗖 gr	CONTIN	Defa
	-	LF09\$0\$A-WAL	•	۲	e 🕯	B	📃 yel	CONTIN	Defa
f g, g, 7 7 g, 2 2	-	LF09\$0\$A-WAL	•	۰.	e 🖌	B	🗌 wh	CONTIN	Defa
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If exporting a DWG<sup>™</sup> file from Revit<sup>®</sup> arrange object categories into logical and appropriate layers, eg. separate the wall finishes from the structure.

			Modify DWG/DXF Export Setup Solid Export Setup SetSesson contribution	Utyers Lines Patterns Te Expertiseer options:	ot & Fants   G	alars   Sapart
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De Publish	B Sets export options for CAD and IFC.	Export Layers DGN		Catagory Gir-Wals	Loyer ArWALL-M.	2
Print.	 - Options Dift Revit	@IFC Options		Common Edger Curtain Wall	A-GLAZ GR.	2
				Freh1[4]	A WALL	2
				Hidden Lines Merchanal a	A-WALLHL	2
				Structure [1]	A-WALL	2
				Substate [2]	(4-164LLC	. 2

 Specifying appropriate Type Properties and Layers where the layers can be specified in conjunction with the Type Properties (e.g. specifying an Interior or Exterior function for walls) can also be beneficial.

pe Properties					
Family: System Family: I	Basic Wall 🛛 🗸	Load			
Type: Exterior - Insula	tion on Masonry 💊	Duplicate			
		Rename			
Type Parameters					P
Parameter		Value	Category	Layer	Cole
Structure		Edit	🗄 Walls	A-WALL-M	2
Wrapping at Inserts	Do not wrap		Walls/Interior	I-WALL	2
Wrapping at Ends	None 303.0		Walls/Exterior	A-WALL	2
Function	Exterior		Walls/Foundation	S-ENDN	2
Graphics	Interior		Walls/Retaining	SITE WALL	2
Coarse Scale Fill Pattern	Foundation		Windows	A.GLAZ	6

• Set the Export layer options to "new layers for overrides".



• Under the general tab, tick the check box to export rooms and areas as polylines.



#### 6.5 Model Space and Paper Space

CostX<sup>®</sup> will default to Model space views since these contain the active model and hence are the most accurate with no scaling required as they are generally at 1:1. If the file contains both Model Space and Paper Space, an option is provided to load either or both, but Model space is preferred.

Rather than multiple Paper space sheets with viewports to a single Model space view, a separate Model space DWG<sup>™</sup> file for each plan / elevation / section / etc. is preferred. On larger buildings, where plans etc. may normally be divided between several Paper space views (eg. to fit onto a series of A3 sheets), do not break the Model view up in the same way. It is preferred to measure on a single Model space view for an entire level/floor.



- Avoid using different unit scales in the same Model space, eg. if 1 unit represents 1mm avoid mixing this with another scale for 1 unit.
- Provide scale annotation, scale bars and / or figured dimensions on Paper space sheets.



Avoid where possible having views at different scales on the same Paper space sheet, where this is not
possible try to arrange the views at one scale in one area of the sheet and views at a different scale in
another area of the sheet rather than having details at different scales interspersed throughout the
image.

## 6.6 DWG<sup>™</sup> Files from ARCHICAD<sup>®</sup>

ARCHICAD<sup>®</sup> provides a variety of settings to improve the quality of exported DWG<sup>™</sup> files. These settings can be set up in the DXF-DWG Translation Setup under the File > Interoperability > DXF-DWG menu.

0	New +		
N CX	Open <u>Close Project</u> Ctrl+Shift+W	Wall - External + Wall-001	
ê	Leave Teamwork Project	× 🗍	how All 3D [3D / All]
B	Save Ctrl+S	10	
周	Save as Ctrl+Shift+S		
R	Export to BIMcloud		
$\Rightarrow$	Send Changes Ctrl+Alt+S		
to	Create Travel Pack		
8	Publish BIMx Hyper-model		
	Interoperability	🛞 IFC	•
	External Content	🗇 SAF	•
	Libraries and Objects	DXF-DWG	DXF-DWG Translation Setup
	Info +	Classifications and Properties	Smart Merge Options
13	Plot Setup	ALPHA Speckle Connector	
T	Plot	Import Point Clouds	
8	Page Setup Ctrl+Shift+P	Place Mesh from Surveyors Data	×
8	Print Ctrl+P	Send Model to Google Earth	
_	5-3 OH-0	Merge	•

- Under Save Options in the DXF-DWG Translation Setup, change the File Format to the newest version of AutoCAD<sup>®</sup> available.
- Change the Save Layout into: Paper Space with Cropped View's content.
- Change Place Drawings into: Single DXF/DWG file.
- Change Saving Floor Plan to: Convert only Objects to Blocks.

-				
Drawing Unit	File Format:		AutoCAD 2018 Drawing	~
Open Options	Convert Images to:		Image's original format	Ş
Attributes Miscellaneous	Template File:	(63) P		
Custom Functions	Save Layout into:		Paper Space with Cropped View's content	X
	Match File's Origin:		with Project Origin	~
	Place Drawings into:		Single DXF/DWG file V Settin	ıgs
	Saving Floor Plan:		Convert only Objects to Blocks	Ň
			Important: To use Smart Merge, save the Project	first.
	Save Zones as:		Stamp and Fill	×
	Saving 3D Data:		🔄 Omit Polygon Edges	
			Export File with Simplified Data Structure	

- Under Attributes > Layers > Methods in the DXF-DWG Translation Setup, choose Create Layers according to ARCHICAD Layers.
- Change Save elements on to: Visible Layers only.
- Create custom layers for Windows, Doors, Window and Door Markers, Zone Stamps and any other layers you might want independent control over.

Drawing Unit			
Open Options Save Options Attributes Layers Methods	Archicad Layers Save elements on: Visible Layers only	g to:	~
Pen-based layer names Layer name conversion Pens and Colors Line types Fills Font conversion Miscellaneous Custom Functions	Create custom layer for Archicad Items Windows Doors Skylights Cover Fills Cut Fills Drafting Fills	r: DXF/DWG Layer Archicad Windows Archicad Doors	Insert Source Layer
		Cancel	Save Settings & Close

Polylines for individual spaces (rooms) and one for the entire net area of the building must be drawn prior to export. Note that these closed polylines cannot contain any curves; curved segments must be approximated by small line segments. Locate the polylines according to the required measurement standards (inside face, centerline, etc.).

While not required, when exporting data from ARCHICAD<sup>®</sup>, it is also useful to make sure the pen colors are legible on both a black and white background.

Objects with multiple instances such as typical doors or the like may be exported with each instance as a unique block. It may be necessary to edit the file in an AutoDesk<sup>®</sup> application so that all alike objects are the same block.

# 6.7 AEC Entities in AutoCAD® Architecture Libraries

Sometimes if a drawing contains certain AEC entities from the AutoCAD® Architecture libraries there can be problems with the display rendering the geometry correctly.

A solution is to save the DWG<sup>™</sup> drawing with the AEC objects exploded which will enable the geometry to be displayed. The following are the steps to export the DWG<sup>™</sup> with exploded AEC entities in TrueView<sup>™</sup>.

- Open TrueView<sup>™</sup> (drawing file does not need to be opened).
- From the main menu select DWG Convert.
- You will need a suitable conversion setup to convert the drawing. If you have not created one follow these steps:
- Click the Conversions Setups button.
- Click the New button.
- Enter the name of the new conversion setup (such as "Explode AEC Entities").
- Make sure it is based on "Standard" and click Continue.
- Change Conversion package type to "Folder (set of files)".
- Select file format "AutoCAD 2013 Drawing Format with Exploded AEC Objects".
- Check the Conversion file folder and Path options to save the file in the desired location.
- Other options that may be useful are "Bind external references" and "Purge drawings".
- Click OK, then Close.
- Select the conversion setup for exploding the AEC entities ("Explode AEC Entities").
- Click the Add files button.
- Select the file(s) you want to convert and press OK.
- Click Convert.
- TrueView<sup>™</sup> should notify you once the conversion is complete.
- You can now close TrueView<sup>™</sup>.

# 7 3D Drawing Files and BIM Models

#### 7.1 Overview

It is important to differentiate between BIM models and 3D 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 like the following example of an AutoCAD<sup>®</sup> DWG<sup>™</sup> file is simply a collection of lines, arcs and text.



2D Plan View in CostX®

3D View in CostX®

Because they are based on geometric data, these graphical models cannot describe the physical 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, specific to their operating environment, that can represent the physical and performance attributes of entities in addition to their graphical properties.

In the case of the AEC industry this translates to a data model built around building entities and their associated inter-relationships. 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.

The process of optimizing the design by interrogating and analyzing the data within the model is referred to as Building Information Modelling (BIM). Consequently, the data model for a building is referred to as a "BIM model".

CostX<sup>®</sup> is able to view BIM models in DWF<sup>™</sup>, DWFx<sup>™</sup> and IFC format and access the database to extract information, with several extraction methods available. The opportunity therefore exists to use this dimensional data for quantification purposes, instead of measuring the quantities. This greatly improves productivity, and consequently reduces response times.

Issue of data-rich BIM model files therefore enables the CostX<sup>®</sup> user to collaborate in the design effort far more effectively, and designers can respond to this change by increasing the amount of object data held in the database. 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, particularly with early design intent models.

# 7.2 Methods of Data Extraction

There are three options available to CostX<sup>®</sup> users for data extraction from BIM models:

- by use of CostX<sup>®</sup> BIM Templates;
- by use of Model Maps;
- by creation of special object-based Dimension Groups.

#### 7.3 BIM Templates

CostX<sup>®</sup> ships with a selection of BIM Templates. These templates are XSLT files which have been written specifically to extract and sort data from 3D DWF<sup>™</sup> and DWFx<sup>™</sup> model files. The default template, called "Revit<sup>®</sup> General", categorizes the data in accordance with the Revit<sup>®</sup> object hierarchy of Element Category, Family name and Family type. By using the "Import Dimensions Using BIM Template" button and selecting the "Revit<sup>®</sup> General" template, CostX<sup>®</sup> will create a list of dimension groups using the Revit<sup>®</sup> Category to name the Dimension Group folder, and the Revit<sup>®</sup> Family Name + Family Type to name the dimension group. The quantity will generally be drawn from the first dimension property. An example is shown below.



The import routine is automatic and works on whatever model objects are being viewed on the CostX<sup>®</sup> screen at the time. This means that users can filter the view to limit the import to selected objects, or they can view the entire model in which case the import will provide them with a complete schedule of Dimension Groups listing the quantities of every object in the model, all at the single click of a button.

An optional alternate BIM Template called "by QSID or ELEMENT CODE" will search for a text parameter called QSID or ELEMENT CODE within the model and use this to group the Dimension Groups. These parameters need to be added into the model as <u>Shared Parameters</u> if this option is to be used.

These templates are written around model data being presented in standard Revit<sup>®</sup> family categories and will generally only produce satisfactory results when used with DWF<sup>™</sup> and DWFx<sup>™</sup> files exported from Revit<sup>®</sup>. For IFC files, Model Maps or object-based Dimension groups will be used.

#### 7.4 Model Maps

A Model Definition Tool allows CostX<sup>®</sup> users to view the model data in a schedule format and configure a Model Map to extract data from the model using any combination of object properties. This means that instead of generating quantities using the standard CostX<sup>®</sup> BIM templates, users have the option to define Model Maps to customize the quantities extraction. This provides an opportunity to provide additional data within the model to facilitate the model mapping process.

To assign the Model Definition, the CostX<sup>®</sup> user filters the model view to the required branch of the model tree, and then drags and drops the required data from the Schedule into the corresponding field in the Mapping Definition tab. Free text in quotes may also be entered.

In the example below, the data from the columns in the Schedule headed Level 1 and level 3 will be combined to name the dimension group folder, the Top Level data will categorize the dimension group, and the Measurement Type will be volume, using the data from the Volume field in the Schedule.

Mapping Definition	Preview									
Folder:	[Level 1] +" - "+[Level 3]	-					العلم	J-H-		
Dimension Group:	[Top Level] ···		_							
Measure Type:	Volume -									
Default Display:	Automatic -					IIU				
	I les default expressions for black			W 11	1 II ''F					- P
Dimension	In osc deforce xpressions for our p									
201										
201:										
ZC2:										
ZC3:		≡	<							
ZC4:			Schedule:							
ZC5:			* Length	Level 1	Level 2	Level3	Top Level 🔺	Top Offset	Type Name	Volume
705			3500 mm	Structural Columns	M_Concrete-Round-Column	750mm	GF - Ground Fl	1000 mm	750mm	1.546 m²
200:			3500 mm	Structural Columns	M_Concrete-Round-Column	750mm	GF - Ground FI	1000 mm	750mm	1.546 m <sup>3</sup>
ZC7:			3500 mm	Structural Columns	M_Concrete-Round-Column	750mm	GF - Ground Fl	1000 mm	750mm	1.546 m <sup>3</sup>
ZCB:			3500 mm	Structural Columns	M_Concrete-Round-Column	750mm	GF - Ground FI	1000 mm	750mm	1.546 m <sup>2</sup>
Multiplier:			3500 mm	Structural Columns	M Concrete-Round-Column	750mm	GF - Ground Fl	1000 mm	750mm	1.546 m <sup>3</sup>
Count:			3500 mm	Structural Columns	M_Concrete-Round-Column	750mm	GF - Ground Fl	1000 mm	750mm	1.546 m <sup>2</sup>
Les ette			3800 mm	Structural Columns	M_Concrete-Round-Column	450mm	L1 - Level 1	0 mm	450mm	0.569 m <sup>3</sup>
Length:			3800 mm	Structural Columns	M_Concrete-Round-Column	450mm	L1 - Level 1	0 mm	450mm	0.569 m <sup>3</sup>
Height:			3800 mm	Structural Columns	M_Concrete-Round-Column	450mm	L1-Level 1	0 mm	450mm	0.569 m²
Offset:			3800 mm	Structural Columns	M_Concrete-Round-Column	450mm	L1 - Level 1	0 mm	450mm	0.569 m <sup>3</sup>
Area:			3800 mm	Structural Columns	M_Concrete+Round-Column	450mm	L1-Level 1	0 mm	450mm	0.569 m <sup>2</sup>
Wall Area:			3800 mm	Structural Columns	M_Concrete-Round-Column	450mm	L1-Level 1	0 mm	450mm	0.569 m <sup>2</sup>
Wai Alea.			3800 mm	Structural Columns	M Concrete-Round-Column	450mm	L1 -Level 1	0 mm	450mm	0.569 m <sup>3</sup>
Volume:	Volume] ···		3800 mm	Structural Columns	M_Concrete-Round-Column	450mm	L1-Level 1	0 mm	450mm	0.569 m <sup>2</sup>
Mapping Definition	Preview			20	T	4				
Discussion Company										
Dimension Groups	Limensions									
Name	A Qua	intity	UOM							
E Structural Co	umns - 356x368x129UC		10-000			1H -				
- 🐨 💓 L1 - L	evel 1 (Structural Columns		0 m3							
	evel 1	_	36 m2							
(2-1	evel 2		36 m3	-	<b>ai b b b b</b>	-*/-				
Roof			34 m3							
Structural Co	umns - 750mm									
	11									

Model Maps are highly effective for DWF<sup>™</sup>, DWFx<sup>™</sup> and IFC files. Similar to BIM Templates, they automate high-volume extraction of model data, but in a custom configuration.

#### 7.5 Object-based Dimension Groups

These work in a similar way to Model maps but are individually created for specific objects or groups of objects.

# 8 3D Drawing Files from Revit®

The following tips will help to facilitate data extraction from RVT<sup>™</sup>, DWF<sup>™</sup> and DWFx<sup>™</sup> files.

#### 8.1 Project Units

The total quantity of each object type is the cumulative value of the dimensions of each individual object. If the Project Units in Revit<sup>®</sup> are set to whole numbers (which is the default setting), each dimension will be rounded off which will affect the cumulative total. Therefore the Project Units need to be set to two or preferably three decimal places to provide an accurate cumulative total.

Collaborate	e View Manage	Add-Ins Modify 📼 🗸		Dimension G	roups Dimensions					-+-
0.0	Project Units		×	Current:	- no Decimals\System Panel - Solid		-			
Project				Click to F	ïlter	<filter e<="" is="" th=""><th>impty&gt;</th><th></th><th>&lt;</th><th></th></filter>	impty>		<	
Units	Discipline:	Common	~	* Name		Quantity	UOM		Schedule:	
🗘 Sec	Units Length Area Volume	Format 1235 [mm] 1235 m <sup>2</sup> 1234.57 m <sup>3</sup>	^	- 3 De	ecimals System Panel - Glazed (- 3 Decimals) System Panel - Solid (- 3 Decimals) Decimals	2,207 349	m2 m2		<ul> <li>Area</li> <li>2.172 m<sup>2</sup></li> <li>2.172 m<sup>2</sup></li> </ul>	Family Nar System Pa System Pa
	Angle Slope Currency	12.35° 12.35° 1234 57		>	System Panel - Glazed System Panel - Solid	1,922 300	m2 m2		0.982 m <sup>2</sup> 0.276 m <sup>2</sup>	System Pa System Pa
() 5	Mass Density	1234.57 kg/m <sup>3</sup>	laces	Differen	ce in quantities in CostX® i instead of no decin	if Project Un nals in sam	nits sei e mod	t to tel	three de	ecimals

#### 8.2 Family Naming Conventions

CostX<sup>®</sup> extracts dimension data (quantities) from the Revit<sup>®</sup> object properties. The default CostX<sup>®</sup> BIM Template (Revit<sup>®</sup> General) groups and sorts the quantities according to the family naming structure of the model.

Therefore, a more descriptive family naming convention can greatly improve communication.

Dimension Groups Dimensions Auto Count				
Current: Curtain Panels\System Panel Glazed	•			
Click to Filter	<filter empty="" is=""></filter>		- Walls	
* Name	Quantity UOM		70mm NON LOAD BEARING TIMBER STUD WALL	177 m2
nbl_Door_Ext-Revolving 4-Wing	12 m2		150mm NON LOAD BEARING STEEL STUD WALL	21 m2
System Panel Glazed	805 m2	E.		
Default naming – min	vimal detail		Descriptive naming	

In view of the above, try not to use mass or generic model families for objects in detailed models, and do not group disparate objects into a single mass or generic family, as this severely compromises the usefulness of the output data. Select an appropriate element category for each individual object.

Dimension Groups Dimensions Auto Count	
Current: <all></all>	-
Click to Filter	<filter empty="" is=""></filter>
* Name 🔺 Q	Quantity UOM ^
Mass     Hatten     H batten     H batten1     H batten2     H batten3     H batten4     batten5     H batten6	1 no 1
Massnaming	

# 8.3 System Assemblies

In Revit<sup>®</sup> multiple elements can be combined into a single assembly that can be independently scheduled, tagged, and filtered. Most model elements can be included in assemblies and layered elements such as walls, floors, flat roofs, etc are invariably modeled as assemblies.



Floor Assembly in Revit 2019®

When exported to a DWFx<sup>m</sup> an assembly such as the floor shown above appears as a composite whole and its component parts, or layers, are not separately identified within the 3D DWFx<sup>m</sup> view and are not represented on 2D views and sheets.

	Object Properties	
	Name	<ul> <li>Value</li> </ul>
	name	Floors (8)
Dimension Croups Dimensions	name	Floor (8)
Dimension Groups Dimensions	name	Concrete-Domestic 425mm (1)
Current: Floors\Floor Concrete-Domestic 425mm v	_name	Floor [495352]
Click to Filter <filter empty="" is=""></filter>	Analytical Properties	
	Constraints	
Vame Quantity UOM	"Height Offset From Level	0
	Level	Level 1
Floor Concrete-Domestic 425mm 38 m2	Dimensions	
	Area	38 m²
	"Elevation at Bottom	-425
	Elevation at Top	0
	Perimeter	24820
	Volume	16.35 m³
	Exactal	
	Level1	Floors
	Level2	Floor
	Level3	Concrete-Domestic 425mm
	Level4	Floor

CostX<sup>®</sup> screen shot of composite slab assembly

It is very important that the component details are communicated in full, and to assist in this one or more of the following solutions could be considered:

- Providing assembly information as a text or "Description" parameter.
- Using more descriptive Family / Type naming conventions.
- Providing detail sections as 2D sheets.
- Providing schedules detailing system assemblies.

Another option is to use the Revit<sup>®</sup> "Parts" function which will break the layered assembly into its component layers.

#### 8.4 Parts

In Revit<sup>®</sup>, many elements can be divided into discrete parts that can be independently scheduled, tagged, filtered, and exported. The Part function is designed to support aspects of construction workflows, such as pour schedules for example, by enabling a slab to be separated into areas or zones based on the pour sequence. Parts can also be generated from elements with layered structures, not just to separate the layers but also to allow the layers to be individually manipulated or sub-divided. Parts are dependent to elements and are automatically updated and regenerated when the original element from which they are derived is modified. Each part can also be independently scheduled and the schedule will also update when parts are modified.

If a layered assembly is separated into its constituent layers, the layer data will be available in a DWF/DFWx<sup>™</sup> export. Typically this might apply to elements such as:

- Walls (excluding stacked walls and curtain walls)
- Floors (excluding shape-edited floors)
- Roofs (excluding those with ridge lines)
- Ceilings
- Structural slab foundations

In the drawing area, select the elements from which you want to create parts, then in the Create tab of the Modify ribbon click on the Create Parts button to separate the layers. The DWF/DWFx<sup>™</sup> can now be exported with each layer of the assembly as an individual Part with its own discrete Object Properties.

Alternatively, to avoid disassembling your working model view, create a new default 3D view, select all elements in the view and click on the Create Parts button. Export the DWF/DWFx<sup>™</sup> file from this view.



For each part, the Identity Data properties have been expanded to contain details of the individual layer and this data is available for CostX<sup>®</sup> to create the separate Dimension Groups.

The Parts properties can also be viewed as branches of the Model Tree.



The disassembled slab will now import with the "Revit® General" BIM Template in separate constituent Parts.

		Object Properties	
		Name	Value
		<b>[1076996</b> ]	I
		Guid	bc5c9053-d88a-425f-9af9-47b
Dimension Groups Dimensions		Id	1076996
	-	Unspecified>	
		name	Floors (4)
Click to Filter <filter emp<="" is="" td=""><td>y&gt;</td><td>name</td><td>Floor (4)</td></filter>	y>	name	Floor (4)
* Name	M	name	Site - Hardcore (1)
Floors		name	Part [1076996]
Floor Concrete-Domestic 425mm (Part: Concrete, Cast In Situ - 175) 38 m	· · · · · · · · · · · · · · · · · · ·	Constraints	
Floor Concrete-Domestic 425mm (Part: Concrete, Sand/Cement Screed - 50) 38 m		Base Level	Level 1
Floor Concrete-Domestic 425mm (Part: Rigid insulation - 50) 38 m		🖃 Dimensions	
Floor Concrete-Domestic 425mm (Part: Site - Hardcore - 150) 38 m		Area	38 m²
		Excluded	No
		Height	150
		"Shape is modified	No
		Thickness	150
		Volume	5.77 m <sup>3</sup>
		Exactal	
		Level1	Floors
		Level2	Floor
		Level3	Site - Hardcore
		Level4	Part
		🖃 Identity Data	
		Construction	Finish
		Material	Site - Hardcore
		"Original Category	Floors
		Original Family	Floor
		Original Type	Concrete-Domestic 425mm
CostX <sup>®</sup> screen shot of disassembled slab Parts – dimen	sions imported with "Re	evit® General " BIM Ten.	nplate

The Parts properties can readily be used to create mapping definitions for Model Maps.

Din	mension Gro	Dimensions				
	Current:	Floor\Concrete, Cast In Situ 175mm thick		-		
C	Click to Fil	ter	<filter e<="" is="" th=""><th>mpty&gt;</th><th></th><th></th></filter>	mpty>		
*	Name	▲	Quantity	UOM		
	Floor					
>		Concrete, Cast In Situ 175mm thick	7	m3		
		Concrete, Sand/Cement Screed 50mm thick	38	m2		
	·	Rigid insulation 50mm thick	38	m2		
		Site - Hardcore 150mm thick	6	m3		

CostX<sup>®</sup> screen shot of disassembled slab Parts – dimensions imported with Model Map

#### 8.5 Areas/Rooms

Room and area data is very useful for estimating purposes, particularly during the earlier design stages when composite rates/m2 or ft2 are used to develop budget estimates. Use the Room and Area tools to include this in models.



Edit the Area Type Properties to show area data.



When exporting the file, open the DWF<sup>™</sup> Properties tab in the export dialog window and tick the "Rooms and Areas in a separate boundary layer" checkbox (if exporting a 2D or 3D DWF<sup>™</sup> view). The room data will now be exported with the file.



Room data in DWFx<sup>™</sup> shown in CostX<sup>®</sup>

If the file is to be exported as a DWG<sup>™</sup> then the export settings can be set to "Export rooms, spaces and areas as polylines".

	Architecture	Structure Steel Systems Insert Annotat	e Analyze Massing & Site
	0 P	Creates exchange files and sets options.	
	New 🕨	tamily to a text (,txt) the,	g Floor Curtain Curtain M * System Grid
	open ≯	GB gbXML XML Saves the model as a gbXML file.	
	Save	Saves an IFC file.	'hrough Main Stair 🛛 📳 02
G	Save As	ODBC Database Saves model data to an ODBC database.	0
	Export +	Images and Animations Saves animations or image files.	2
Ċ	]Print ▶	Reports Saves a schedule or Room/Area + report.	
	Close	Coptions	🚟 Export Setups DWG/DXF
	ciuse	Sets export options for CAD and IPC.	Export Setups DGN
		Options Exit Revit	HFC Options
3		19 - 45 10 - 19	i ii Ž

Modify DWG/DXF Export Setup								
Select Export Setup	Layers Room,	Lines space a Export r	Patterns nd area bou rooms, spac	Text & Fonts undaries: :es and areas a:	Colors s polyline	Solids	Units & Coordinates	General

#### 8.6 Shared Parameters

Additional Shared Parameters may be added within Revit<sup>®</sup> to enrich the data included in the DWF(x)<sup>™</sup> file. This data can then be accessed via Model Maps. Additionally there is a BIM Template available for elemental coding called "by QSID or ELEMENT CODE". This requires a text Shared Parameter to be created with the name QSID or ELEMENT CODE.

🔯 Object Properties		🔀 Object Properties	
Name	Z Value	Name	Value
Type Name	Concrete Suspended Slab	Keynote	200mm CONCRETE
🖃 Other		Type Name	Slab on Ground_Exposed Ag
Concrete Strength	N32	- Other	
Family Name	Floor	E-ELEMENT CODE	01 SUBSTRUCTURE N
QSID		Eamily Name	Floor
Reo Rate	120 🧏		11001 0
Structural		Scruccural	

If this is included in the model, the BIM template "by QSID or ELEMENT CODE" will sort the dimensions into QSID or Element folders instead of by Category.

mension Groups	Dimensions							
Current: 03 UPPER FLOORS\Floor Concrete Suspended Slab 200mm N32								
Click to Filter		<filter empty="" is=""></filter>						
Name		<ul> <li>Quantity UOM</li> </ul>						
01 SUBSTRU     02 COLUMN	JCTREIS							
03 UPPER F	LOORS							
Floo	or Concrete Suspended Slab 200mm N32	1,701 m2						
Floo	or Concrete Suspended Slab 220mm N32	2,289 m2						
	or Concrete Suspended Slab 250mm N32	420 m2						
Floo	or Concrete Suspended Slab 300mm N32	64 m2						
Floo	r Concrete Suspended Slab 350mm N32	161 m2						
04 STAIRC/	ASES							
105 ROOF								
06 EXTERN	AL WALLS							
	nension Groups Current: 03 UI Click to Filter Name 01 SUBSTRI 02 COLUMN 03 UPPER F 03 UPPER F 03 UPPER F Floc Floc 04 STAIRC/ 05 ROOF 06 EXTERNA	Immession Groups       Dimensions         Current:       03 UPPER FLOORS\Floor Concrete Suspended         Name       Image: Concrete Suspended         Image: Image: Old SUBSTRUCTRE       Image: Old SUBSTRUCTRE         Image: Old SUPPER FLOORS       Image: Old Supper FLOORS         Image: Image: Old Supper FLOORS       Image: Old Supper FLOORS         Image: Image: Old Supper FLOORS       Image: Old Supper FLOORS         Image: Image: Old Supper FLOORS       Image: Old Supper FLOORS         Image: Image: Old Supper FLOORS       Image: Old Supper FLOORS         Image: Image: Image: Old Supper FLOORS       Image: Old Supper FLOORS         Image: Image: Image: Old Supper FLOORS       Image: Old Supper FLOORS         Image: Image: Image: Image: Image: Old Supper FLOORS       Image: Old Supper FLOORS         Image: Imag						

Formula-based parameters can also be added to provide additional measurement data such as window areas or downpipe lengths.

pe Properties		>
Family: M_Fixed	M_Fixed ~	
Type: 0915 x 1220mm	0915 x 1220mm 🗸 🗸	
		Rename
Type Parameters		
Parameter	Value	= ^
Construction		*
Wall Closure	By host	
Construction Type		
Materials and Finishes		\$
Frame Exterior Material	Sash	
Frame Interior Material	Sash	
Glass Pane Material	Glass	
Sash	Sash	
Dimensions		\$
Height	1220.0	
Default Sill Height	915.0	
Width	915.0	
Window Inset	19.0	
Rough Width		
Rough Height		
Analytical Properties		\$
Analytic Construction	<none></none>	
Visual Light Transmittance		
Solar Heat Gain Coefficient		×
What do these properties do?		
< C Preview	Cancel	Apply
C Preview (	Cancel	Apply

Parameters should generally be added as Instance Parameters because not all Type Parameters get written to the DWF(x)<sup>M</sup> file. Refer to <u>Appendix A</u> for details on how to add Shared Parameters into Revit<sup>®</sup>. Use Autodesk<sup>®</sup> Design Review to review the content of DWF(x)<sup>M</sup> files.

The following examples are all taken from a single model in which the designer had added the following Shared Parameters based on advice from his estimator:

- A Building Level/Zone to allow the quantities to be grouped by location.
- A concrete mix strength to allow the quantities to be grouped by concrete strength.
- A reinforcement factor (Reo Rate) expressed in kg/m3 to allow an approximate reinforcement tonnage to be automatically generated.
- Also, ensure that concrete structural framing includes a length dimension in addition to volume to allow for calculation of additional estimate items such as formwork.



Volume of concrete and weight of steel grouped by CostX® into Building Level



Column formwork derived from length dimension in CostX®

Name	<ul> <li>Value</li> </ul>	
🖃 Constraints		
"Level/Zone	BASEMENT 1	
Reference Level	BASEMENT 1	
Dimensions		
"Length	12700.00	
- Volume	5.74 m <sup>3</sup>	
🖃 Exactal		
- Level1	Structural Framing	
Level2	BW_Conc_Beam	
- Level3	2400x400	
Level4	BW_Conc_Beam	
🖃 Identity Data		
Keynote	01100	
Model	Version A_24/06/2008	
Type Name	2400x400	
- Other		l
Concrete Strength	N32	
" Family Name	BW_Conc_Beam	
Project Level/Identify/Zone	BASEMENT 1	
QSID	03 UPPER FLOORS	
Reo Rate	120	

Dimension Groups Dimensions Current: Concrete W32 ÷ **Click to Filter** <Filter is Empty> Name Quantity UOM Concrete 3,942.02 m3 N32 2 N40 86.90 m3 N32 N50 107.37 m3 Original Name: N32 S20 211.36 m3 Original Folder: Concrete Count = 401.00 Volume = 3,942.02 m3 Weight = 474.26 Tonnes

*Volume of concrete and weight of steel grouped by CostX® into Concrete Strength* 

#### 8.7 Using RVT<sup>™</sup> Files

CostX<sup>®</sup> can load native RVT<sup>™</sup> files from Revit<sup>®</sup> versions 2015 to 2024. However, if your RVT<sup>™</sup> file version is older than 2024, it is highly recommended to upgrade the file to the 2024 version before adding it to CostX<sup>®</sup>. This is because when using RVT<sup>™</sup> files, they are upgraded in the background each time upon opening to Revit<sup>®</sup> 2024 format, hence files that are already in Revit<sup>®</sup> 2024 format will load far quicker than any previous formats.

Opening RVT<sup>™</sup> files is much more resource intensive than other 3D formats, use a high performance CPU and sufficient RAM to ensure good user experience. It is recommended that you have more than 8GB RAM when working with drawings in native RVT<sup>™</sup> format. For more information about the hardware requirements, refer to the CostX<sup>®</sup> Client System Requirements.

It is also possible to load Revit models in CostX<sup>®</sup> by exporting to other supported formats such as IFC or DWF, which generally require significantly less resources than the native RVT<sup>™</sup> format.

CostX<sup>®</sup> only supports 3D Views in RVT<sup>™</sup> files. The following items are not supported:

- 2D Views
- Sections on a View
- Schedule Views
- Linked files

If a RVT<sup>™</sup> file only contains unsupported views, a message similar to the below is presented upon opening. The views will then need to be re-created within Revit<sup>®</sup> by the file originator before the file can be opened.

ITWO costX by RIB - WARNING	×
Add Drawing	QK
No supported layout sheet found in selected drawing file(s). The most common causes for this are that the file only contains 2D views for a format that is only supported in 3D or if a file contains only 3D views when the licence type allows only 2D views to be loaded.	

If your RVT<sup>™</sup> file contains links to other Revit<sup>®</sup> files and you wish to view the linked data in CostX<sup>®</sup>, please use Revit<sup>®</sup> to bind the linked files together into a single file, and then add the combined file.

# 8.8 Exporting RVT<sup>™</sup> Files to DWFx<sup>™</sup>

 Provide a multi-sheet DWFx<sup>™</sup> export containing the 3D view (or views) and the 2D views and sheets of all plans, elevations and sections etc. The 3D views will be used to import BIM dimensions, and the 2D views and sheets will be used to check and augment the quantities. Some users may also request the 2D sheets and views separately as DWG<sup>™</sup> files or the source Revit<sup>®</sup> RVT file.



 Review the visibility settings and verify all intended / required objects are not hidden in view before exporting the file.


Select a detail level on views / sheets etc. as fine to allow additional information to be available in the 2D DWF<sup>™</sup> files.

Properties						×
	Floc	or Plan				•
Floor Plan: 0	0-Gr	oun ~	80	Edit	Тур	e e
Graphics					\$	^
View Scale		1:100				
Scale Value	1:	100				
Display Mod	lel	Normal				
Detail Level		Fine		$\sim$		

• Select a hidden line or wireframe Graphic Display Option for views as appropriate for the content.

Properties			Graphic Display O	ptions	×
Floo	or Plan	•	✓ Model Display Style:	Hidden Line	<i></i>
Floor Plan: 00-G	roun 🗸 📴 Edit	Туре		Show Edges	
Graphics		* ^		Smooth lines with anti-aliasing	
View Scale	1:100		Transparency		٦
Scale Value 1:	100		manaparency.		
Display Model	Normal		Silhouettes:	<none></none>	1
Detail Level	Fine				
Parts Visibility	Show Original		▶ Shadows		
Detail Number	1		Sketchy Lines		
Rotation on S	None		Depth Cueing		
Visibility/Grap	Edit		- Depart cueling		
Graphic Displ	Edit		Lighting		

- Set the view range / clip settings appropriately on views / sheets.
- If the model contains linked CAD files with multiple instances of a typical object or group of objects, the multiple instances may all have the same object ID. With duplicate IDs, the quantities imported into CostX<sup>®</sup> from the DWFx<sup>™</sup> will derive from the source file, and not from the multiplicity of instances. For example, if a typical apartment is repeated twenty times in a model and the IDs are duplicated, the quantities will only relate to one apartment, not twenty. For this reason the Revit<sup>®</sup> project should be bound before exporting the DWFx<sup>™</sup> to remove the duplicate IDs. If it is preferred not to bind the project, then copy the project, bind the copy, and export from the copy.

## 8.9 Exporting RVT<sup>™</sup> Files to IFC

Refer to <u>IFC Files from Revit®</u> for more information.

# 9 3D DWF<sup>™</sup> and DWFx<sup>™</sup> Files from AutoCAD<sup>®</sup> MEP

### 9.1 Publish Settings

Provide as a minimum a DWFx<sup>™</sup> file containing the 3D Model view. The 2D views and sheets of plans, sections and details etc. can also be incorporated into a multi-sheet DWFx<sup>™</sup> file. The 3D Model view will be used to import BIM dimensions, and the 2D views and sheets will be used to check and augment the quantities. Some users may also request the 3D Model view and 2D sheets and views as the source AutoCAD<sup>®</sup> MEP DWG<sup>™</sup> file.

Publishing the 3D Model View Only to a DWFx<sup>™</sup> File

 Prior to commencing, open the 3D Model view and change the Viewport Configuration setting to Single and the Visual Styles setting to Shaded.



• From the main menu double click on the Publish option, alternatively enter publish on the command line and press the Enter key. The Publish dialog is displayed.

	Publish						×
	Sheet List:		Publish Option	s Information			
	None	- 🔄 日	Location: C:	) Drawings			
	Publish <u>t</u> o:		File type: Mult	i-sheet file			
	DWFx	~	Naming: Prom	pt for name			
			Layer informa	tion: Include			
			Merge control	: Lines overwrite			
	Automatically load all open drawings		D Lt L D				
			Publish Or	otions			
	Sheet Name		3D DWF	Page Setup		Status	
Export	Contract Science Scien		$\sim$	Cefault:	None>	Vo errors	
Publish •							
Print +							
	Selected Sheet Details	Publish Outpu	t				
	Source drawing	Number of co	pies:	C	] Include plot st	<u>a</u> mp	-
	Drawing location	1 *		ſ	Publish in back	around	
	Plot device	Precision:				g. e c	-
	Plot size	None		~	Open in viewe	r when done	
	Plot scale Page setup detail						
	→ Hide Details			Publish	Cance		Help
					Cance		

In the Publish to field on the Publish dialog, select DWFx. CostX<sup>®</sup> also supports the DWF<sup>™</sup> file format.



• Ensure the 3D Model view is included in the sheet list and remove any other sheets which are listed, leaving only the 3D Model view, sheets can be added or removed using the Add and Remove Sheets buttons located above the sheet name column.

×.	
Shee	et Name

• Place a tick in the 3D DWF checkbox to the right of the 3D Model view sheet name.

Sheet Name	3D DWF	Page Setup	Status
and SD Model-Model		🖶 <default::none> 🛛 🗸</default::none>	No errors
	13		

• Click on the Publish Options button. The Publish Options dialog is displayed (shown below).

	Default output location (plot to fi	ile) 🔻		
	Location	C:\Drawings\		
	General DWF options	· · · · · · · · · · · · · · · · · · ·		
	Туре	Multi-sheet file -		
	Naming	Prompt for name		
	Name	N/A		
	Layer information	Include		
erge control: Lines overwrite	Merge control	Lines overwrite		
lerge condition. Eines overwinte	DWF data options	*		
	Block information	N/A		
Publish Options	Block template file	N/A		
	AEC property set data	Include		
	AEC automatic properties	Include		
	AEC DWF Options	C:\Aecb DWF List.ppl		
	3D DWF options	*		
	Group by Xref hierarchy	No		
	Publish with materials	Yes		
	AEC Group Individual Objects	Object Type and Style		

- Under the DWF data options section, ensure the AEC property set data and the AEC automatic properties fields are selected as 'Include'.
- Also verify that the Published Properties List (PPL) file identified in the AEC DWF options field is the correct file and also verify that all of the required Property Sets have been selected in this PPL file.
- To verify (or amend) the selected Property Sets for the current drawing, click into the AEC DWF Options field and click on the 🖾 button displayed on the far right of the field.
- Select and open the PPL file, the AEC DWF Publishing Options dialog is displayed (shown left below). Click on the Add button, the Add Property Sets dialog is then displayed (shown right below), all property sets for the currently selected drawing will be displayed, ensure all of the required property sets are selected (checkboxes are ticked) then click the OK button to return to the AEC DWF Publishing Options dialog and click the OK button to close it and return to the Publish Options dialog.

AEC DWF Publishing Options		Add Property Sets		
Published Properties List:		Select the drawing from which to choos definitions to include in a published DWF	e property set P,	
C: VAecb DWF List pp		Silveo tentito		
Browse New		Browse		
AecPolygonObjects	ctFitt Add	DuctEngineeringData	PipeObject	Select All
CableTrayObject	ctFitt	DuctFittingTransitionStyles	RoomFinishObjects	Clear All
ConduitObject	ct-Fit Remove	DuctObject	SpaceEngineeringCalculatedData	
CostObjects	ctFitt	DuctStyles	SpaceEngineeringClassifications	
CurtainWallObjects	ctFitt	MEPDuctFabrication	SpaceEngineeringStyles	
DeviceObject De	ctFitt	MEPHangerObjects	SpaceObjects	
Devices-LightStyles	ctFitt	MEPHangers (Style Based)	C ThermalProperties	
DoorObjects Do	ctFitt	MEPMyPartsFanObjects	ZoneEngineeringObjects	
🗐 DoorStyles 📃 Du	ctFitt	MEPMvPartsPumpObjects		
🔲 DuctEngineeringData 📰 Du	ctFitt	MEPPartNumbering		
DuctFittingElbowObjects	ctObj	V Thew Style		
DuctFittingElbowStyles	ctObj	New Style 2		
•	(.e.	PipeFittingElbowStyles		
V Publish Property Set Data		PipeFittingLateralStyles		
Publish All Automatic Properties		PperittingTransitionStyles		
OK Can	el Help			
	1.8.2		Cances	neip

 Back in the Publish Options dialog under the 3D DWF options section ensure the AEC Group Individual Objects By field is selected as Object Type and Style.

3	D DWF options	1
	Group by Xref hierarchy	No
	Publish with materials	Yes
	AEC Group Individual Objects By	Object Type and Style

• Click OK to save the changes and close the Publish Options dialog and return to the Publish dialog.

 Back in the Publish dialog click on the Publish button, the Specify DWFx File file browser dialog will be displayed, navigate to the location in which to save the file and amend as desired the file name, when the required selections have been made click on the Select button to save the file to the selected location with the selected file name.

<u> </u>		
Publish	Cancel	Help

• A prompt may appear asking whether the current list of sheets should be saved, to save the current sheet list click Yes and choose a location and file name for the sheets list, otherwise click No to discard the sheets list.

#### Publishing the 3D Model View and 2D Sheets to a DWFx<sup>™</sup> File

The above noted process details how to create a DWFx<sup>™</sup> file containing only the 3D Model view, if additional 2D sheets / views have been created in the AutoCAD<sup>®</sup> MEP DWG<sup>™</sup> file they can also be included with the 3D Model view in the same multi-sheet DWFx<sup>™</sup> file, the process is the same as noted above except that the required sheets should be added to the sheets list and sheets which are not required should be removed from the sheets list in the Publish dialog using the Remove Sheets) buttons. Additionally ensure the Type field under the General DWF/PDF options on the Publish Options dialog is selected as Multi-sheet file.

G	General DWF/PDF options				
	Туре	Multi-sheet file			
	Naming	Promot for name			

## 9.2 Layer Setting Visibility

Before exporting the DWFx<sup>™</sup> file verify the layer settings are correct for the objects intended to be included in the published file.

• To display the layer settings click on the Layer Properties button located in the Layers section of the Home Ribbon Toolbar.



- For objects intended to be included in the published DWFx<sup>™</sup> file ensure the layer they are included on is turned on (the Symbol is displayed in the On column for the layer), the layer is scheduled to be included in the plot (the Symbol is displayed in the Plot column for the layer) and the layer is not frozen (the Symbol is displayed in the Freeze column for the layer).
  - ✓ H-PipeFitting-G
     ✓ H-Pipework-G
     ✓ H-Pipework-G
- For objects intended to be excluded from the published DWFx<sup>™</sup> file ensure the layer they are included on is turned off (the v symbol is displayed in the On column for the layer), the layer is scheduled to be excluded from the plot (the v symbol is displayed in the Plot column for the layer) and the layer is frozen (the v symbol is displayed in the Freeze column for the layer).

	H-CHWEquipment-G	8	Eø	23	đ	
0	H-CHWS-G	8	0	63	đ	

# 9.3 Property Sets and Property Definitions in AutoCAD® MEP

Object property data can be enriched to include additional information for measurement and estimating purposes by the creation of new Property Definitions within Property Sets. In Design terms Property Sets and Property Definitions within AutoCAD<sup>®</sup> MEP are typically used to create text based data for use with scheduling and tagging functions in the software, however the data can also be included within a published DWFx<sup>™</sup> file enriching the data for measurement and estimating purposes. Property Definition values can be manually specified i.e. a field in which a value can be entered/amended manually or be formula based i.e. a field in which a value soft or text concatenated based on values derived from one or more other property values for each object. Property sets can be created, for subsequent addition to objects, at an Object level (to be added to an individually selected object or to several/many selected objects or all objects of the same type - if all drawing objects are selected) or at a Style level (to be added to an object belonging to a specific style name within the host style (e.g. a specific size of duct or pipe within the duct style or pipe style) which then adds the property set automatically to all other objects belonging to the same specific style name.

Adding Property Sets and Property Definitions is a broad and relatively complex topic and it is envisaged that this will be undertaken by an experienced AutoCAD<sup>®</sup> MEP operator who is knowledgeable on this topic, the following however outlines the basic methodology, some of the text / options within the dialog boxes may vary to those indicated below based on the style of the source template or drawing on which the current drawing was based on.

#### 1: Naming Conventions for Additional Property Definitions

The requesting CostX<sup>®</sup> user / organization and the AutoCAD<sup>®</sup> MEP operator / organization should agree the need for, and format of, any required prefix for the names of the added property definitions to denote them as additional property set/property definition values as opposed to the default properties. As a suggestion a prefix of PSMD (Property Set Manual Definition) could be used for added manual property definitions, and PSFD (Property Set Formula Definition) could be used for formula based added property definitions.

#### 2: Creating a New Property Set

Click on the upper half of the Style Manager button located on the Manage Ribbon Toolbar (or select the Style Manager option if a sub-menu is displayed). The Style Manager dialog is displayed.



Property Sets are considered to be documentation objects. Therefore, expand the Documentation Objects folder listed beneath the required drawing name and select the Property Set Definitions folder.



Click on the 🖾 New Style button, in the right hand side of the Style Manager dialog under the General tab enter a Name for the new style and optionally a Description.

General	Applies To	Defi
Name:		
New S	tyle	
Descrip	tion:	

Click on the Applies To tab.

General	Applies To	Definition
Applies	To:	<ul> <li>Objects</li> </ul>
		O Styles and Definitions

Property sets can be created, for subsequent addition to objects, at an Object level (to be added to an individually selected object or to several/many selected objects or all objects of the same type - if all drawing objects are selected) or at a Style level (to be added to an object belonging to a specific style name within the host style (e.g. a specific size of duct or pipe within the duct style or pipe style) which then adds the property set automatically to all other objects in the drawing belonging to the same specific style name.

Generally CostX<sup>®</sup> users would be importing dimensions at an object grouping level rather than at a Style name grouping level, and would normally anticipate any manual or formula based property definition values to be added to all objects of the same type (all objects in the same object group), consequently property sets (and hence the property definitions created within the property set) should normally be created at an Object level and be subsequently added to all objects of the same type (all objects in the same object group). If however the property definitions to be created in the property set only apply to one or more specific style names the Style and Definitions options could be selected instead.

The following example indicates the grouping levels of objects & style names within CostX<sup>®</sup> for an example DWFx<sup>™</sup> file exported from AutoCAD<sup>®</sup> MEP.

Name	1.
Drawing	
Duct—	
🛨 2,000 x 800 mm DW 144 Rectangular Duct	— Object group level
🛨 600 mm Diameter Round Duct	
🛨 75 x 75 mm DW 144 Rectangular Duct	Chula issess arous la
🛨 800 x 800 mm DW 144 Rectangular Duct	atyle name group ie
Duct Fitting	

Select either the Objects or Styles and Definitions option as required (please refer to the paragraph above).

Place a tick in the checkbox to the left of the required Object or Style, if the Classification section of the dialog displays further checkboxes and classification descriptions these can be used to refine the objects or styles the property set will be available for addition to, place a tick in the checkbox to the left of the required classifications / sub-classifications (although as noted above generally the property set should be added to all objects of the same type, in which case all checkboxes should be selected (ticked).

Definitions	Classifications:
MInsert Block     Mineader     Mineader     Mineader     Mineader     Mineader     Minis Vew Block Reference     Midis Vew Part     Mij Opering     Mineader     ProF Underlay     ProF Underlay     Proe underlay	□ □ Pipe Type □ □ Pipe □ Pipe

To apply the property set to further Objects or Styles repeat this process for each additional object or style.

The Property Set has now been created and is ready to have Property Definitions defined within it.

#### 3: Creating a New Property Definition within a Property Set

As the values created by the property definitions may be used by the recipient of the published version of the drawing to filter objects and or extract dimensions for similar drawing objects (i.e. objects having one or more common property or belonging within the same object group or style name) the property definitions should be applicable to (and be subsequently added to) all objects of the same object type or style name type, generally property definitions which intend to add a fixed value or description applicable to all objects of the same type or style name type should be added as Manual Property Definitions and property definitions which intend to add values or descriptions which will vary between objects of the same type (but are derived from common property sources) should be added as Formula Based Property Definitions.

If a new property set has just been created and is currently selected in the Style Manager dialog then click on the Definition tab. Otherwise open the Style Manager dialog, click on Manage Ribbon Tab and click on the upper half of the Style Manager button) and expand the Documentation Objects and Property Set Definitions folders listed under the required drawing and select the required property set definition object and then click on the Definition tab. Note: if a new property definition is being added to an existing property set it would be worthwhile reviewing the settings selected under the Applies To tab, if the new property definition which is to be created applies to a different selection of Objects or Styles it may be better to create a new property set and select the required properties or styles for the new property set rather than amending the existing one.

The new property definition can be either Manual or Formula Based (there are also further options, such as automatic, but the two mentioned previously are likely to be the most useful in respect to adding data for measurement purposes), click on the required Add ... Property Definition button located at the right hand side of the dialog.



#### Add Manual Property Definition

If a Manual Property Definition was selected (e.g. to provide a fixed text description or value to be added to all or multiple objects, or a blank property field which can be added and completed on an object by object basis) the New Property dialog is displayed.

<u>N</u> ame:	Aei1
Start With	"DEFAULT"

Enter the required name in the Name field and select the required Start With option (this can be either the text or value entered into the Default field (select the \*DEFAULT\* option or one of the values from the existing properties), then click the OK button.

In the Type field click on the drop down selection button and choose the required type setting for the new property definition.



In the Default field enter the default value for the new property definition. Optionally Units and Formatting may also be selected. Also ensure the Visible checkbox is ticked.

#### Add Automatic Property Definition

If a formula based property definition is to be used the properties which will be used in the formula will need to be added to the property set first as Automatic Property Definitions. Click on the Add Automatic Property definition button and select the required properties by placing a tick in the checkbox to the left of the required properties then click the OK button. Once added ensure the tick is removed from the Visible checkbox for each of the added automatic property definitions.

Automatic P	Property Sou	rce				12.5
Alphabetical	Categorized	1				
🗄 Pipe						
Abbre	rviation	0				- 13
4 Actus	I Cut Length	0				
St Catale	01 pc					
4 Catal	g Nominal.	. 🗆				
4 Catalo	og Source ID	0				Ð
A Catalo	ogWeight					
4 Color						
4 Color	· Test	D				
4 Conn	ection Dia_					1.0
4 Conn	ection Dom.	- [3				
4 Conn	ection Shape	: 🗇				
4 Conne	ection Type	0				
4 Custo	m					
ACat	ength.	12	2			
A Densi	N	1				

#### Add Formula Based Property Definition

If a Formula Based Property Definition was selected (e.g. to add values or descriptions which will vary between objects or style name types but which are derived from common property sources) the Formula Property Definition dialog is displayed. Enter the name for the property definition in the Name field and construct the required formula in the Formula field by double clicking (or right click and select Insert) on the required Property Definitions and VBScript codes augmented by directly entering any other requirements for the formula (e.g. quotation marks or other text or values).

Hame:	Puetrachets				
	🗵 Use formula for description				
Form.da:		Sample Result:			
[Cuti, ength]/1000		11.12045			
		Enter Sample Values:			
		Property	Value	Format	Date typ
		Sta [Cutt.enoth]	11120.45	5tandard	Automati
		1	111		
Insert Prope	rty Definitions:	Insert VBScript code:			
HE ME	PFartFilumbering w Style Cutlength PipeBrackets (Self)	Miscelaneous     Constants     Functions     Keywords			Î
B Pp	Ref1 Object oStyles	III Methods III Objects and Coli III Objects and Coli III Operators III Anthreatic	ectors		
		- / \ Med			

Note: For property values of property definitions to be added into the formula correctly they need to be inserted from the Insert Property Definition list and be inserted from the same property set as the formula based property definition is being added to, if VBScript functions have been used in the formula the formula should start with RESULT =.

To review a Sample Result of the formula enter sample values as required against each of the properties listed in the Enter Sample Values: section of the dialog, the result of the formula based on the sample values will be displayed in the Sample Result: section of the dialog, if necessary amend the formula until the desired result is obtained.

Once the required formula has been constructed, click the OK button to add the property definition. In the property definitions list select as appropriate any required Units and Formatting and ensure the Visible checkbox is ticked for the property definition.

To add further property definitions repeat the above process as required. Once the required property definitions have been added, click the OK button to close the Style Manager dialog.

#### 4: Adding an Object Based Property Set to an Object

As the property definitions may be used by the recipient of the published version of the drawing to filter similar drawing objects and or extract dimensions the property set should normally be added to all objects of the same type.

To ensure all of the required objects are displayed in the 3D Model view ensure all of the required layers are visible, not frozen and not locked.



If objects have been isolated end isolating the objects by clicking on the end isolate objects button on the information bar beneath the drawing window or use the end isolating objects option on the right click menu under the isolate objects option.

Either select the required object or objects or select the entire drawing (the object type to add the property set to can be filtered in subsequent steps) in the 3D Model view.

Display the Properties window (click on the Properties vertical tab usually docked on the left or right of the user interface, otherwise press Ctrl + 1 on the keyboard). Display the Extended Data section by clicking on the Extended Data vertical tab.



If multiple objects were selected use the drop down object type selection list to select the required object type.



At the bottom of the properties window click on the 🖻 Add Property Sets button, add or remove the ticks from the checkboxes to the left of the property set names in the Add Property Sets dialog to select or deselect them and click on the OK button when the required selections have been made.

The property set(s) will then be displayed in the extended data section of the properties window. If multiple objects are currently selected the property fields may be unavailable for editing and may display \*VARIES\* rather than formula based data. If Manual Property Definitions were created in the property sets these will display the entered default value (assuming the Start With option was selected as Default when

the property definition was created). If it was intended that a manual property was added and its value completed / amended on an individual object by object basis or to otherwise review property definition values for specific objects ensure only the required object is selected in the 3D Model view.

Ľ	vipe	•)[u	J GR LR
1	CLASSIFICATION		+
	Ріре Туре	📖 By style (Pipe)	
The second	DOCUMENTATION		٠
	Hyperlink		
	Notes		
	Reference documents	(O)	
1000	PROPERTY SETS		-
	New Style		*
Ĵ	🔩 PipeBrackets	11.12	
	Ref1	ABC1234	
1	PROPERTY SETS FROM STYLE		LI *
1000	PipeStyles		
	SupplierName	Autodesk, Inc.	
-			

It is also recommended to verify formula based property definition values for a number of objects to ensure they are displaying the calculated value which would be anticipated for the selected object.

#### 5: Adding a Style Based Property Set to an Object

As the property definitions may be used by the recipient of the published version of the drawing to filter similar drawing objects and or extract dimensions the property set should normally be added to all styles names within the style, this will need to be done for each style name in turn.

Select an object belonging to the required style name type in the 3D Model view and right click over it and select the Edit..... Style option.

Elle Select Component	
Edit Object Display	
Edit Duct Style	
🐻 Object Viewer	

The ... Style Properties – *style name* dialog is displayed.

eneral	Classifications	Display Properties	
-	-	Type:	Duct Style
Obj	ectARX	<u>N</u> ame:	2,000 x 800 mm DW 144 Rectangular Duct
G		Description:	
	Notes	Handle:	29B4B
Pro	operty Sets		

In *style name properties* dialog under the general tab click the Property Sets button. The Edit Property Set Data dialog is displayed.



Click on the Add Property Sets button at the bottom of the Edit Property Set Data dialog, the Add Property Sets dialog is displayed, add or remove the ticks from the checkboxes to the left of the property set names in the Add Property Sets dialog to select or de-select them and click on the OK button when the required selections have been made.

M5PPartNumbering		Select All
I PipeObject		Clear Al
		1
04	Connel	Links

The property set(s) will then be displayed in the Edit Property Set Data dialog, click on the OK button to close this dialog then click on the OK button on the *style name properties* dialog to close this dialog.

The property set(s) and property definitions within will then be added to the extended data section for the selected object and all objects belonging to the same style name type within the drawing.

To review these properties for the selected object open the properties window (click on the Properties vertical tab usually docked on the left or right of the user interface, otherwise press Ctrl + 1 on the keyboard) then select the Extended Data vertical tab.



If Manual Property Definitions were created in the property set this will display the entered default value (assuming the Start With option was selected as Default when the property definition was created) if it was intended that a manual property was added and its value completed / amended on an individual object by object basis review and amend as necessary the default values (this will also need to be done for each object individually). It is also recommended to verify formula based property definition values for a number of objects to ensure they are displaying the calculated value which would be anticipated for the selected object.

# 10 Drawing Files from Civil 3D®

Civil 3D<sup>®</sup> includes various export options for different file formats, with varying degrees of graphical and geometrical fidelity and information preservation.

The two main options for export into CostX<sup>®</sup> are DWF<sup>™</sup> /DWFx<sup>™</sup> and also IFC.



## 10.1 3D DWF<sup>™</sup> and DWFx<sup>™</sup>

Once "3D DWF" has been selected, from the dialog box the export options can be adjusted as follows, and then the file saved to the chosen location:

	Documents		Views Views	<u> </u>
Q	Name	Date modified	Туре	Add/Modify FTP Locations
		13/03/2017 14:40	Filef	Add Current Folder to Places
		05/08/2020 11:53	File fc	Add to Favorites
(A=A)		22/10/2019 14:33	File f	Ontions
		11/04/2019 10:16	File former	Options
		18/08/2017 14:04	File folder	
		01/09/2020 15:27	File folder	
		22/01/2020 14:43	File folder	
		31/03/2020 15:23	File folder	
		23/11/2018 12:52	File folder	
A		10/08/2018 09:39	File folder	
CREA MARKEDIN		06/01/2017 16:30	File folder	
DRVE - FUB		22/01/2018 15:59	File folder	
		05/12/2018 13:28	File folder	
		08/02/2019 14:19	File folder	
		22/08/2018 08:53	File folder	
		18/12/2019 14:43	File folder	×
Dropbox	<		្រ	6
	File name:		Save	

Within the "Civil DWF Publishing Options" the settings can be adjusted if required to suit the particular requirements of the project:

C Civil DWF Publishing Options
Object to Publish
All model space objects
○ Selected model space objects
🔍 🔔 O objects selected
3D DWF Organization
Group by Xref Hierarchy
Group individual objects by
Object Type and Style
OLayer
Options
Publish with materials
Include Properties from Objects
OK Cancel Help

### 10.2 IFC

Once "IFC" has been selected, from the dialog box the export options can be adjusted as follows, and then the file saved to the chosen location:

🔛 Export to IFC			$\times$
Project Number			_
Project Name			
Parking Tools - Metric			
Saved in			
C:\Program Files\Autodesk\AutoCAD 2021\C3	BD\Sample\Dynamic Blocks\Parking	Tools - Metric.ifc Browse	
Drawing Files	IFC Structure	Description	٦
Options	Building	Cancel Help	
Options Resource and Assignmen	K Export	Cancel Help	_

From the "IFC Export Options" the IFC Schema can be chosen (i.e. IFC 2x3 or IFC 4):

Header Objects View Select IFC Schema to e	xport to		
IFC 4	~		
Enter information to inc	lude in the IFC file header:		
Property	Value		
File Description			
Source File Name	Parking Tools - Metric.dwg		
Author First Name	Matthew		
Author Last Name	Donnison		
Organization	RIB International		
Authorization			
Application	Autodesk Civil 3D 2021 - English UK		
Version	13.3.854.0		
Location			

Under the 'Objects' tab the required objects can be selected:

💀 IFC Export Options >	<
Header Objects View	
Select objects to include in IFC file:	
Image: Select All       Image: Select All         Image: Select All       Image: Select All	
OK Cancel Help	

Under the 'View' tab the 'Quantity Add On' checkbox can be selected to export quantity property sets as IfcQuantity:

💀 IFC Export Options	Х
Header Objects View	
The view definition exported will be: CoordinationView_V2.0	
Include: Quantity Add On Space Boundary Add On	
Level - 1	
C Level - 2	
OK Cancel Help	

Further information can be found on the Autodesk<sup>®</sup> website, and further general guidance on IFC can be found in the <u>IFC Files</u> section.

# 11 IFC Files

### 11.1 The IFC Standard

The current IFC release is IFC 2x3 Edition 3 (Feb. 2003) as amended by IFC 2x3 TC (Technical Corrigendum) 1 (July 2007). TC1 did not amend the IFC 2x3 exchange file and both versions can be used.

IFC4 (formerly called 2x4) was released on 12 March 2013, published as ISO Standard 16739. Implementations will start appearing in authoring applications from 2016 onwards.

IFC cannot replicate the authoring functions of the various proprietary BIM applications, nor is that its intention. It is a file format whose purpose is to facilitate cross-discipline data sharing and exchange by providing a broadly based, vendor-neutral repository for data relating to building objects.

The process of sharing data via the IFC format is termed an IFC Exchange. In practical terms, the need to convert the host data to IFC format and the fact that the IFC is structured to support a multiplicity of data types across a wide range of disciplines can lead to a high level of complexity in the IFC model. IFC exchanges therefore follow what is termed an "Exchange Requirement" which specifies the data that needs to be present in any given exchange and thereby limits the scope of the exchange to more manageable proportions.

The buildingSMART<sup>®</sup> Standard for Processes, formerly called the IDM (Information Delivery Manual), defines typical exchange requirements for a given discipline or scenario, so that different audiences can focus on the data relevant to them. An associated IFC View Definition, or MVD (Model View Definition) defines a subset of the IFC schema that will satisfy the specified exchange requirements. In other words, when you export an IFC governed by an MVD, you are only exporting selected parts of the information which goes to make up the entire data model.

The MVD provides implementation guidance for all IFC concepts (classes, attributes, relationships, property sets, quantity definitions, etc.) used within the subset. It thereby represents the specification for the IFC export by BIM applications, so that their exports satisfy the exchange requirements.

The official buildingSMART<sup>®</sup> MVD for the AEC industry is the IFC2x3 Coordination View Version 2.0. This can be extended with add-on model view definitions to support additional exchange requirements including:

- The Quantity Take-off add-on view which adds the ability to transmit Base Quantities for spatial, building, building service and structural elements.
- The Space boundary add-on view it supports the use of BIM in thermal and energy analysis by adding building element to space relationships.
- The 2D Annotation add-on view it supports the exchange of additional 2D element representations and annotations of building models
- The IFC2x3 Structural Analysis View
- The IFC2x3 Basic FM HandOver view

Work is currently underway in defining the first IFC4 based BIM work flow support definitions (MVD) based around a Reference View and Design Transfer View.

For further information refer to <u>www.buildingsmart-tech.org</u>.

# 11.2 Quantities in the IFC 2x3 Coordination View v2.0

When exporting an IFC file, IFC-compliant architectural BIM software maps the IFC export to the requirements of the IFC2x3 Coordination View v2.0 model definition. The main purpose of the Coordination View is to allow sharing of model data between the architectural, structural and MEP disciplines for coordination purposes. The standard does not specify requirements for export of dimensions (termed "out of view").



Quantity Properties Out of View (buildingSMART® IFC 2X3 Coordination View Definition v.2.0)

Generally, this will mean that a standard IFC exported from architectural BIM software will not include explicit quantity data, unless the Quantity Take-Off add-on view extension has been used to include <u>Base</u> <u>Quantities</u> in the export or the dimensional instance properties (ie. quantities) of the host model have been specifically included in the IFC export as a Property Set. Note that some IFC Viewer software such as Solibri® Model Viewer calculates quantities and displays them as entity properties. These quantities are not an attribute of the IFC file, and have been separately calculated by the Viewer program from the IFC geometry. Consequently, the same IFC opened in CostX® (or other IFC Viewers such as Data Design System® DDS-CAD) will not have those quantities. Because the quantity values are not explicit model properties and are not based on the original model and intentions of the model author, their accuracy is dependent upon the calculations undertaken by the Viewer program and the data it uses as the basis of the calculations.

#### Property Sets

Some properties of an object are absolute. These fixed properties are termed Attributes. Other properties are more variable because they may be seen or interpreted differently by different parties, or may be contextual, or assigned to an object by a relationship. These types of properties can be grouped together as a "Property Set" and added to the object as additional parameters to suit particular situations. The properties within a set can be either standard (conforming to the rules of the IFC schema) in which case the set name will begin with the prefix "Pset\_" or they can be custom, which means they are created by the exporting application and the names of these sets will normally include the name of the exporting application.

### Proxies

When BIM applications export to IFC, the data has to be mapped from the host schema into the IFC schema. Many architectural object classifications have direct IFC counterparts and will be mapped accordingly, eg. an object having a Wall-subtype in ArchiCAD® will be classified as IfcWall. If an object has no corresponding IFC element type it will be exported as a Proxy. The default setting is to export the objects as a general solid object in a generic IfcBuildingElementProxy element. As a general solid object, it has geometry but no properties which is obviously undesirable and therefore to be avoided. It is possible to map objects to alternate IFC elements prior to export, to reduce the number of proxies, or proxies can be defined with geometry and property sets to behave like regular entities.

#### IFC Files and CostX®

Owing to differences in IFC implementation by the various authoring applications and the multiplicity of supported data types, IFC file configuration and data content will differ between projects. Consequently it is difficult to define a standard for automatic quantities extraction via a CostX<sup>®</sup> BIM Template. Data extraction from an IFC file is therefore supported with Model Maps and Object-based Dimension Groups (see <u>3D Drawing Files and BIM Models</u>).

Whilst the IFC is structured to accommodate proprietary data models, the responsibility for creating them lies with the authoring application that exports the IFC. If the correct associations are not explicitly made in the source file, they cannot proceed in the IFC and hence may not appear in a downstream application. Thus, how a model file is prepared for export to IFC is extremely important and is a critical factor in the ultimate success of the IFC exchange process.

### 11.3 Base Quantities

In 2006 buildingSMART<sup>®</sup> commenced work on a definition of model-based quantities to create an open standard for quantification of building spaces and elements, termed "Base Quantities". These are described in the document "Information Requirements for Model-based Quantities - Definition of Base Quantities" dated 2010-12-08.

To augment the IFC 2x3 Coordination View definition, the Quantity Take-off add-on view adds the ability to transmit Base Quantities for selected spatial, building, and structural elements. However, it is important to note that Base Quantities are not explicit dimensional properties of the model – they are separately calculated from the model geometry as part of the IFC export process.

F BeStarryWess W 2 Ca - [CID samaple 01;2-2-

### Most BIM authoring tools support the "QuantityTakeOffAddonView"

- extension of the IFC2x3 Coordination View (V 2.0)
- (some better then others)

IFC Element	Base quantities supported	File     File
IfcWall StandardCase	- Width - Length - Height - GrossFootprintArea - NetFootprintArea - GrossSideArea - NetSideArea - GrossVolume - NetVolume	Edwelforkunse Bick     Edwelforkunse Bick     Edwelforkunse Bick     Edwelforkunse Bick     Edwelforkeiten     Edwelforkei

FILE\_DESCRIPTION( ('ViewDefinition [CoordinationView\_V2.0, QuantityTakeOffAddOnView]', 'ExchangeRequirement[Architecture]'), '2;1');

Model Support Group Dr Thomas Liebich | AEC3 | ecobuild 2010



Currently, Base Quantities can generally be included in an IFC export as a tick-box option. They will however be an integral part of the forthcoming IFC 2X4 release.

		Select Derived Data to Export
Select Derived Data to Export:		Check one or more types of data to export to the IFC model.
		<ul> <li>IFC Base quantities</li> <li>Check this to export Quantity Takeoff parameters (size, area and volume) to IFC. Useful in cost estimation</li> </ul>
IFC Space Containment	Filter Containment	applications. The following table summarizes the base quantities by entity types automatically calculated and exported
IFC Space Boundaries		when using this option. The values of IfcSite's base quantities can be set manually at Info > Project Info
Graphisoft® Archie	cad®26	(Site Gloss Perimeter and Site Gloss Area). IFC Reference Guide for ArchiCAD®26

Base Quantity definitions have only been written for selected elements, and Base Quantities are only included in the export for those elements.



No Base Quantities are provided in the IFC for excluded elements such as Casework and Plumbing.

Footings and Roofs do not have Base Quantity definitions as these are "container" elements, meaning they are an aggregation of sub-components (slabs, beams, etc). The sub-components can contain their own quantity information but when aggregated into IfcRoof or IfcFooting the quantities are not identified. It is expected that these will be available in the IFC4 release.

It is also possible for Base Quantities to be manually entered by the user, overriding the automatic calculation during the export process. The Base Quantity specification only indicates the standardized means of measuring and recording the quantity data, to eliminate possible errors in receiving applications that may miscalculate any automatic derivation from the given geometry. Preferably, the dimensional instance properties of the model should be included in the IFC as a Property Set as these are explicit model properties unlike the Base Quantities which are separately calculated from the model geometry as part of the IFC export in accordance with a set of rules published by buildingSMART<sup>®</sup>.

## 11.4 IFC4 Quantities

For details of the new IFC4 standard, refer to <u>https://technical.buildingsmart.org/standards/ifc/ifc-schema-specifications/</u>. Two changes relating to support for new BIM workflows and 5D model exchanges which should appear in IFC4 implementations are stated as:

 Standardized quantities for QTO - Definition of international base quantities, defined as separate XML schema + configuration files linked to IFC spec. This includes the welcome addition of a BaseQuantities Definition for IfcRoof Element.

Industry Foundation Classes Release 4 (IFC4) © buildingSMART International Ltd 1996-2013			l Ltd 1996-2013	^					
Cover page Contents Foreword Introduction	<ol> <li>Scope</li> <li>Normative r</li> <li>Terms, defi abbreviated</li> <li>Fundament</li> </ol>	refe initio d te al c	ferences 5. Core schemas 6. Shared schemas titions and 7. Domain schemas terms 8. Resource schemas		A B C D	Computer interpretable listings Alphabetical listings Inheritance listings Diagrams	E.   F. (	Examples Change logs Bibliography Index	~
6.1.5 Quantity Sets	6.1.5 Quantity Sets A 6.1.5.11 Qto_RoofBaseQuantities						^		
6.1.5.1 Qto_BeemBaseQuantities         6.1.5.2 Qto_ChimneyBaseQuantities         6.1.5.3 Qto_ColumnBaseQuantities         6.1.5.4 Qto_CoveringBaseQuantities         6.1.5.5 Qto_CurtainWallQuantities         6.1.5.5 Qto_DoorBaseQuantities         6.1.5.6 Qto_DoorBaseQuantities         6.1.5.7 Qto_MemberBaseQuantities         6.1.5.8 Qto_PlateBaseQuantities         6.1.5.9 Qto_RailingBaseQuantities         6.1.5.9 Qto_RailingBaseQuantities         6.1.5.10 Qto_RampFlightBaseQuantities         6.1.5.11 Qto_StairFlightBaseQuantities         6.1.5.12 Qto_StairFlightBaseQuantities         6.1.5.13 Qto_StairFlightBaseQuantities         6.1.5.14 Qto_WindowBaseQuantities         6.1.5.15 Qto_WindowBaseQuantities		nition of all occurrences of roof. Dach. r surface of the roof. It is the sun nd other openings and cut-outs ar Dachhaut (Ansichtsfläche senkrec immten, gewölbten Flächen, nicht chenfenster, werden übermessen.	n of a e not ht zu	all roof slab gross t taken into ur Dachneigung, ch die projizierte					
6.2 IfcSharedBldgServic 6.2.1 Schema Definition	eElements		EN NetArea areas. Ro	: Total net area of the out of openings, like sky windo	er sur ws ar	face of the roof. It is the suma of nd other openings and cut-outs ar	f all ro e tak	oof slab net en into account.	

 Major efficiency improvement for 5D - Similar rework for cost items and construction resources, now linked to schedule and BIM. This relates to the definition of cost items within 4D schedules.

Industry Foundation Cl	asses Release 4 (IFC4)		© buildingSMART Internat	ional Ltd 1996-2013
Cover page1.Contents2.Foreword3.Introduction4.	Scope Normative references Terms, definitions and abbreviated terms Fundamental concepts and	<ol> <li>Core schemas</li> <li>Shared schemas</li> <li>Domain schemas</li> <li>Resource schemas</li> </ol>	<ul> <li>A. Computer interpretable listings</li> <li>B. Alphabetical listings</li> <li>C. Inheritance listings</li> <li>D. Diagrams</li> </ul>	E. Examples F. Change logs Bibliography Index
6.5.2.1 IfcActionRequestType 6.5.2.2 IfcCostItemTypeEnum 6.5.2.3 IfcCostScheduleTypeE 6.5.2.4 IfcPermitTypeEnum 6.5.2.5 IfcProjectOcrecTypeE	Enum 6.5.3.2 Ife Enum Enum Enum Enum Enum Enum	c <mark>CostItem</mark> e coût element		
5.3.2.3 incrospect/order/ypecnum       An IfcCostItem describes a cost or financial value together with descriptive information that         6.5.3.1 ifcActionRequest       its context in a form that enables it to be used within a cost schedule. An IfcCostItem can b         6.5.3.2 ifcCostItem       represent the cost of goods and services, the execution of works by a process, lifecycle cos         6.5.3.3 ifCostSchedule       more.			rmation that describes stItem can be used to lifecycle cost and	
6.5.3.4 IfcPermit 6.5.3.5 IfcProjectOrder 6.5.4 Property Sets 6.5.4.1 Pset_ActionRequest 6.5.4.2 Pset_PackingInstruction	i.3.4 IfcPermit       Each instance of IfcCostItem may have a name and a description. Depending on the use for cost is intended, these values should be asserted on the basis of agreement. For instance, t attribute could be used to provide a common value that enables distinct instances to be brow together in a nesting arrangement (see below) while the Description attribute may be used t text used for item description in a costing schedule.			the use for which the r instance, the <i>Name</i> es to be brought ay be used to provide
6.5.4.3 Pset_Permit 6.5.4.4 Pset_ProjectOrderCha 6.5.4.5 Pset_ProjectOrderMain 6.5.4.6 Pset_ProjectOrderMov	An IfcCost with one o quantities, reOrder The IfcCost	An IfcCostItem can link one or many IfcCostValue's representing a unit cost, total cost, or a unit co with one or many quantities used to generate the total cost. The quantities can be given as individ quantities, or those quantities are provided as element quantities by one or many building elements. The <i>IfcCostValue.CostType</i> attribute indicates the category of cost, which may be used to present		
6.5.2.1 IfcActionRequestType 6.5.2.2 IfcCostItemTypeEnum 6.5.2.3 IfcCostScheduleTypeE 6.5.3.4 IfcPermitTypeEnum 6.5.3.1 IfcActionRequest 6.5.3.2 IfcCostItem 6.5.3.3 IfcCostSchedule 6.5.3.3 IfcCostSchedule 6.5.3.3 IfcCostSchedule 6.5.3.5 IfcProjectOrder	Enum num num num An IfcCost purely cos within ano HISTORY IFC4 CH4 optional,	CostSchedule tschedule ttabelle Schedule brings together instanc t information as in an estimate fo ther presentation form such as a ' New ently in IFC2.0. NIGE Attribute ID renamed to Identifica attributes Preparedly, Submittedly, Tag	tes of IfcCostItem either for the purp r constructions costs or for including work order. tion and promoted to supertype IfcControl, f retUsers removed.	ose of identifying cost information YredefinedType made

## 11.5 IFC Files - Issues to Consider

- IFC is an open standard data specification. The responsibility for populating the data model with the appropriate parametric properties and relationships lies with the host authoring application.
- As an open standard, IFC by definition cannot exactly replicate a closed proprietary system. Hence an IFC is not an exact copy of a proprietary data model, but is an alternate representation based on its own open geometry standard (STEP). Different standards of IFC implementation by the various authoring applications can lead to data loss in the IFC exchange.
- Proprietary data models need to be mapped to their corresponding IFC categories which may involve translation routines, override settings, and creation of additional IFC-specific parameters.
- Objects that do not have corresponding place-holders in the IFC schema may need to be manually mapped to an alternate IFC element prior to export. If this is not done they will be exported as a general solid object Proxy (IfcBuildingElementProxy), which means that the geometry gets exported but not the properties.
- Export of quantities is not part of the IFC 2X3 Coordination View definition. Consequently, a standard IFC export from most IFC-compliant AEC applications will not include quantity data unless the model dimensional properties are specifically mapped to the IFC as a Property Set, or the Base Quantity addon is used. A MVD for IFC4 based around a Reference View and Design Transfer View has not yet been widely implemented but is expected to include Base Quantities by default. For further information refer to <u>https://technical.buildingsmart.org/standards/ifc/mvd/</u>.
- Base Quantity values are calculated from the model geometry as part of the IFC export process and are
  not explicit properties of the host model. The model dimensional properties should be included in the
  IFC as a Property Set in preference or in addition to Base Quantities.
- Base Quantity definitions have currently only been written for selected building elements and spaces, and the quantities included in a Coordination View IFC with Quantity Take-Off add-on will be limited to those elements.
- IFC files can be zipped to reduce their size for transmission purposes. They can also be further compacted by use of a utility such as Solibri<sup>®</sup> IFC Optimizer, described as a lossless IFC optimizer that purges redundant data from the IFC. The concern with such a process is the potential effect on data integrity and whether required information is lost or reformatted so that it is not recognized or processed correctly by downstream applications.

## 11.6 IFC Files - What to Provide

If the design package is Revit<sup>®</sup>, DWF(x)<sup> $\mathbb{M}$ </sup> files are preferred to IFC owing to their closer integration with the host application. Provide a multi-sheet DWFx<sup> $\mathbb{M}$ </sup> export as described in <u>3D DWF<sup> $\mathbb{M}$ </sup> and DWFx<sup> $\mathbb{M}$ </sup> Files from <u>Revit<sup>®</sup></u>.</u>

For other BIM software, or if an IFC is specifically required from Revit<sup>®</sup>, provide an IFC 2X3 Extended Coordination View export with Base Quantities (or IFC4 when available). For Revit<sup>®</sup> this is described in <u>IFC Files from Revit<sup>®</sup></u> and for ArchiCAD<sup>®</sup> in <u>IFC files from ArchiCAD<sup>®</sup></u>. Prior to export ensure that objects are mapped to their correct IFC categories, which may involve override settings and creation of additional IFC-specific parameters. Include the host model dimensional instance properties (quantities) as a Property Set in the IFC.

Review the resultant IFC by use of an IFC Viewer such as DDS-CAD Viewer. Bear in mind that some IFC Viewer software such as Solibri<sup>®</sup> Model Viewer calculates quantities and displays them as entity properties. These quantities are not an attribute of the IFC, and have been separately calculated by the Viewer program from the IFC geometry. Consequently, the same IFC opened in CostX<sup>®</sup> will not have those quantities.

Hence you may potentially see three alternate sets of quantities - the model dimensions, the IFC Base Quantities and the Solibri® Quantities.

Of these, the model dimensions are preferred because they are explicit properties of the model itself. Next are the Base Quantities which are calculated from the model geometry in accordance with a set of rules published by buildingSMART<sup>®</sup>. The Solibri Quantities are not part of the IFC and will not be available when the IFC is opened in CostX<sup>®</sup>.

In addition to the IFC, provide a full 2D set of plans, sections, elevations and details in 2D DWG<sup>™</sup> format as described in <u>2D CAD files</u>. 2D DGN<sup>™</sup> files are also supported by CostX<sup>®</sup>. The IFC will be used to import BIM dimensions, and the 2D views and sheets will be used to check and augment the quantities.

## 12 IFC Files from Revit®

Refer to <u>3D Drawing Files from Revit®</u> for Revit® optimizations prior to export.

To export an IFC from Revit<sup>®</sup>, there are two alternate User Interface options. The standard interface which installs with older versions of Revit<sup>®</sup> has no configuration options available to the user, in this case the alternate User Interface can be downloaded for free from either SourceForge or the Autodesk Exchange Apps Store and with that, you can create user-defined Property Sets.

Newer versions of Revit<sup>®</sup> do not require this step.

https://sourceforge.net/projects/ifcexporter/?source=directory

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IEC For Povit				
This is the .NET code for	the Revit 2012-2017 IFC C	pen source	-	
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+ 4.5 Stam (3)		CONTRACTOR OF THE OWNER		-
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Description				
Description				

To export an IFC, select the Export button under the main menu.

	5 · 12 · 12 · 12 · 12 · 12 · 12 · 12
5 D	Creates exchange files and sets options.
Nevr +	CAD Formats CAD Creates DWG, DXF, DGN, or SAT files.
Open •	OWF/DWFx Creates DWF or DWFx files.
Save	Building Site Exports an ADSK exchange file.
Save As	FBX Saves a 3D view as an FBX file.
Export +	Family Types Exports family types from the current family to a text (.td) file.
Suite Workflow	gbXML KML Saves the model as a gbXML file.
Publish •	Saves an IFC file.
Print +	ODBC Database Saves model data to an ODBC database.
Close	Images and Animations Saves animations or image flies.

With the older standard interface, only tick box options are available as shown below. Be sure to tick the Export base quantities box. The Revit<sup>®</sup> dimensional properties will be included as a Property Set by default.

	File name:	Revit Structure (UniFormat)	~	
~	Files of type:	IFC 2x3 (*.ifc)	~	
	Current view	only Split walls and columns by story Export base quantities		Cancel
	Include space b	oundaries: Ist Level +		

With the alternate interface (included with newer versions of Revit<sup>®</sup>), there are several configuration options available.

	Export IFC	×
File name:	C:\DOCS\BIM Documents\Guidance Notes for Des	igners\Revit Browse
Current selected setup:	<in-session setup=""> v</in-session>	Modify setup
IFC Version:	IFC 2x3 Coordination View 2.0	
Projects to export:		
✓ rstparameters		
How do I specify an export setur	<u>.2</u>	Export Cancel

- In the Export IFC dialog, for File name, click Browse, and navigate to the target folder for the IFC file.
- Enter a name for the IFC file, and click Save.
- For Current selected setup, select the IFC setup to use to create the file.
- The <In-Session Setup> option is a modifiable setup which is not saved between sessions. You can
  configure the options as desired to export the project to IFC. There are 9 built-in setups. These setups
  correspond to the IFC version options. These setups cannot be modified or deleted, but they can be
  duplicated to create a customized version.

_	Export IFC	×					
File name: uidance Notes for Designers\Revit IFC Export\rst_parameters.ifc Browse							
Current selected setup:	<in-session setup=""></in-session>	Modify setup					
IFC Version:	<in-session setup=""></in-session>						
Projects to export:	IFC2x3 Coordination View 2.0						
✓ rstparameters	<ul> <li>IFC2x3 GSA Concept Design BIM 2010</li> <li>IFC2x3 Basic FM Handover View</li> </ul>						
	IFC2x2 Coordination View						
	IFC2x2 Singapore BCA e-Plan Check						
	IFC2x3 Extended FM Handover View						
How do I specify an export setup?	IFC4 Reference View	Export Cancel					
· · · · · · · · · · · · · · · · · · ·	IFC4 Design Transfer View	Cancer					

- Optional: Click Modify setup... to customize the IFC setup options.
- The Modify Setup dialog displays. You can modify the In-Session Setup or add additional named setups using the Create or Duplicate options. The new setup configurations you create are saved with the project, and can be reused if the same model is exported.

	Modify Setup	×
<in-session setup=""> <ifc2x3 2:0="" coordination="" setup="" view=""> <ifc2x3 coordination="" setup="" view=""> <ifc2x3 2010="" bim="" concept="" design="" gsa="" setup=""> <ifc2x3 2010="" bim="" concept="" design="" gsa="" setup=""> <ifc2x3 fm="" handover="" sasic="" setup="" view=""> <ifc2x2 coordination="" setup="" view=""> <ifc2x2 bca="" check="" e-plan="" setup="" singapore=""> <ifc2x3 extended="" fm="" handover="" setup="" view=""> <ifc4 reference="" setup="" view=""> <ifc4 design="" setup="" transfer="" view=""></ifc4></ifc4></ifc2x3></ifc2x2></ifc2x2></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></in-session>	Modify Setup           General         Additional Content         Property Sets         Level of Detail           IFC version         File type         Phase to export           Space boundaries         Split Walls, Columns, Ducts by Level	Advanced IFC 2x3 Coordination View 2.0  IFC Default phase to export None File Header Information Project Address OK Cancel
Create a new setup based on the select	ed setup.	×
<in-session setup=""> <ifc2x3 2.0="" coordination="" setup="" view=""> <ifc2x3 5etup="" coordination="" view=""> <ifc2x3 2010="" 8im="" concept="" design="" gsa="" setup=""> <ifc2x3 basic="" fm="" handover="" setup="" view=""> <ifc2x3 8ca="" check="" e-plan="" engapore="" setup=""> <ifc2x3 8ca="" check="" e-plan="" setup="" singapore=""> <ifc2x4 8ca="" check="" e-plan="" setup="" singapore=""> <ifc2x4 fm="" handover="" setended="" setup="" view=""> <ifc4 reference="" setup="" view=""> <ifc4 design="" setup="" transfer="" view=""> &lt;</ifc4></ifc4></ifc2x4></ifc2x4></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></in-session>	General Additional Content Property Sets Level of Detail IFC version New export setup 3 Name IFC Export to CostX	Advanced IFC 2x3 Coordination View 2.0 IFC Default phase to export None View 2.0 View 2.
		File Header Information Project Address

 Under each of the tabs there are various optional settings. Under General, a zipped IFC will be a smaller file size than an IFC. Tick the Split Walls.. check box if this is required by the recipient.

OK

Cancel

	Modify Setup	X
<in-session setup=""> <ifc2x3 2.0="" coordination="" setup="" view=""> <ifc2x3 coordination="" setup="" view=""> <ifc2x3 2010="" bim="" concept="" design="" gsa="" setup=""> <ifc2x3 basic="" fm="" handover="" setup="" view=""> <ifc2x2 coordination="" setup="" view=""> <ifc2x2 bca="" check="" e-plan="" setup="" singapore=""> <ifc2x3 extended="" fm="" handover="" setup="" view=""> <ifc4 reference="" setup="" view=""> <ifc4 reference="" setup="" view=""> <ifc4 design="" setup="" transfer="" view=""> IFC Export to CostX</ifc4></ifc4></ifc4></ifc2x3></ifc2x2></ifc2x2></ifc2x3></ifc2x3></ifc2x3></ifc2x3></in-session>	General     Additional Content     Property Sets     Level of Detail       IFC version       File type       Phase to export       Space boundaries       Image: Im	Advanced IFC 2x3 Coordination View 2.0  IFC IFC IFC IFC IFC IFC IFC Zipped IFC Zipped IFC XML File Header Information
< >>		Project Address OK Cancel

1 D A 1

• The Additional Content tab is optional. Under the Property Sets tab, tick the two boxes as shown below. The Export schedules... and other options can be selected if relevant/required.

Modify Setup
<in-session setup=""> <ifc2x3 2.0="" coordination="" setup="" view=""> <ifc2x3 coordination="" setup="" view=""> <ifc2x3 2010="" bim="" concept="" design="" gsa="" setup=""> <ifc2x3 2010="" bim="" concept="" design="" gsa="" setup=""> <ifc2x3 coordination="" setup="" view=""> <ifc2x3 coordination="" setup="" view=""> <ifc2x3 extended="" fm="" handover="" setup="" view=""> <ifc2x3 extended="" fm="" handover="" setup="" view=""> <ifc4 design="" setup="" transfer="" view=""> <ifc4 design="" setup="" transfer="" view=""> IFC Export to CostX  Classification Settings</ifc4></ifc4></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></in-session>
Image: Market State     OK     Cancel

• Under the Advanced tab, tick the Export parts... option if the Parts tool has been used.

Modify Setup						
<in-session setup=""> <ifc2x3 2.0="" coordination="" setup="" view=""> <ifc2x3 coordination="" setup="" view=""> <ifc2x3 2010="" bim="" concept="" design="" gsa="" setup=""> <ifc2x3 extended="" fm="" handover="" setup="" view=""> <ifc2x3 extended="" fm="" handover="" setup="" view=""> <ifc4 design="" setup="" transfer="" view=""> <ifc4 design="" setup="" transfer="" view=""></ifc4></ifc4></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></ifc2x3></in-session>						
Cancel						

Refer to the Revit® help files for more details on IFC Export Setup Options.

# 13 IFC files from ARCHICAD®

### 13.1 Sources of Information

The Graphisoft<sup>®</sup> learn portal is a good source of information. After creating an account and logging in, you can search for the IFC Reference Guide for Archicad<sup>®</sup> (available for various versions) which is an essential reference for information on IFC management when using Archicad<sup>®</sup>.

The following pages contain some suggested settings to help optimize IFC files exported from ARCHICAD<sup>®</sup> 26 for use in CostX<sup>®</sup>.

### 13.2 IFC Export Settings

From the main File menu select Save as... . In the menu dialog there are a number of selections to be made.

File	Edit View	Design	Document				
D	New						
ß	Open						
C.	<u>C</u> lose Project	Ctrl+	Shift+W	Export:	Visible elements (on all stories)	~	Filter
ĉ×	Leave Teamwo	rk Projec	t	Translator:	CostX Export	~	Options
B	<u>S</u> ave		Ctrl+S	File name:	IFC Export to CostXlifc	~	Save
B	Save <u>a</u> s	Ctrl-	+Shift+S	Save as type:	IFC Files (*.ifc)	~	Cancel

In the Save as type field, select IFC file (\*.ifc).

In the File name field, enter a name for the IFC file

In the Translator field, a list of existing translators is available from a drop-down list. The default General Translator does not export quantities so is not recommended. In some regions, the ARCHICAD<sup>®</sup> installer will include a CostX<sup>®</sup> Translator but if not the Options button can be used to edit another translator or create a new Translator (see <u>IFC Translators</u>).

The Filter button can be used to filter the elements for the current export so that the content of the IFC can be limited to the specific requirements of the information exchange. The reason for filtering the elements rather than including all of them is to keep the IFC file size down and make model navigation easier for the recipient. These settings can be fine-tuned with the Model Filter options.

Export:	Visible elements (on all stories) 🗸 🗸	Filter
Translator:	Entire project Visible elements (on all stories)	Options
File name:	IFC Export to CostX.ifc ~	Save
Save as type:	IFC Files (*.ifc) $\checkmark$	Cancel

Owing to their potential complexity, IFC files can reach very large file sizes leading to problems with file transmission and the hardware capabilities of the recipient.

Consequently, it may be necessary to create a set of IFC files with each one limited to particular elements or disciplines.

IFC files can be zipped to reduce their size for transmission purposes. They can also be further compacted by use of a utility such as Solibri<sup>®</sup> IFC Optimizer, described as a lossless IFC optimizer that purges redundant data from the IFC. The concern with such a process is the potential effect on data integrity and whether required information is lost or reformatted so that it is not recognized or processed correctly by downstream applications.

### 13.3 IFC Translators

Although the Export settings can be used to modify the content of an IFC, exports generally will be governed by the settings of the selected Translator. These settings can be configured within the IFC Translation set-up to suit the requirements of the intended recipient and filter the IFC to limit its file size.

In some regions the ARCHICAD<sup>®</sup> installer will include a default CostX<sup>®</sup> Translator. To view the translator properties, edit or create a CostX<sup>®</sup> Translator, open IFC Translators as follows:

Select File > Interoperability > IFC > IFC Translators.

9	Publish BIMx Hyper-model		Q		
	Interoperability		🛞 IFC		Ste IFC Project Manager Ctrl+Alt+I
	External Content	, :	🕏 SAF	•	IFC Translators
	Libraries and Objects	,	DXF-DWG	•	RC Local Preferences
	Info		Classifications and Properties	•	En Merge to IFC Model
R	Plot Setup	1	ALPHA Speckle Connector		B Detect IFC Model Changes
T	Plot	1	Import Point Clouds		B Update with IFC Model

To create a new translator, either use the Create New button or duplicate an existing translator, re-name and edit it as required.

2	IFC Translators			7	×
T	9		Name of Translator for Export:		
	Name		CostX Export		
	Translators for import	+ $+$	Description		
	AECOsim Building Designer Import				
	Allplan Engineering Import		Optimized model-based export to Exactal Costs for quantity taxe-off purposes.		-
	DDScad MEP Import				
	Exact Geometry Import				
	General Import				
	Modeling Applications Import		* SETTINGS		
	Revit MEP Import		IEC Schemer		m
	Revit Structure Import		I'V SCIENCE		w
	Scia Engineer Import		Model View Definition: Coordination View Version 2.0	~	٢
	Structural Analysis Model Import		Name of Custom M/D		
	Tekla Structures Import		Hame of Cottom MVD.		
	Trimble Nova import		Comunition Businetto		
٠	Translators for Export	+	Conversion Preserv.		
	AECOsim Building Designer Export		Model Filten		
	Allplan Engineering Export		All 3D elements	~	
	BIM4You (4D/5D) Export		La contra c	-	
	Costx Export		Type Mapping:		
	DDScad MEP Export		ARCHICAD Classification - v 2.0 IFC2x3	~	-
	Exact Geometry Export		Geometry Conversion:		
	Ceneral Parametric Export			-	
	IFC4 Design Transfer View-based Export		Optimized for Costx	~	-
	IFC4 Reference View-based Export		Property Mapping:		
	iTWO (SD) Export		Standard IFC2x3 Properties	1	
	Revit Export for Reference Model				-
	Revit MEP Export		Data Conversion:		
	Revit Structure Export		Optimized for CostX	1	-
	Scia Engineer Export			-	
	Tekla Structures Export		Unit Conversion:	-	
	Trimble Nova Export		Metric (AUD)	1	-

The Data Exchange with RIB CostX<sup>®</sup> translator settings are as follows:

		Available Presets:						
		Optimized for Aliplan E	Optimized for Allplan Engineering					
		Optimized for 8IM41ou	Optimized for 8IM41ou					
		Optimized for CostX						
		Ontimized for DDSred	NED					
Model Filter for IEC Evonst	1	New	Rename	Delete	1			
Construction with the second		* SETTINGS						
vailable Presets:		Conversion of Archicad	elements					
al 30 elements		Export only geometries	which "Participate in Colli-	sion_ 🗹				
III 3D elements (Coordination View	v (Surface Geometry))	Export geometry of IFC	Type Products					
III 3D elements with Door / Windo	w 2D Views	Export gross geometry	of elements					
Innetworking alamante only		Export all model element	nts' geometry as:	BREP				
New P	ename	Elements in Solid Element	ent Operations	BREP				
* SETTINGS		Elements with Junction	1	EREP				
section 2		Define IFC model posit	ion by:	Survey Point and P	oject Origin			
elect 3D Elements to Export		Hierarchical Archicad el	ements					
y Structural Function:	All elements	~ Curtain Wall		Keep hierarchy				
y IFC Domain:	All	Stair		Keep hierarchy				
Chan		Railing		Keep hierarchy				
Vincelement		IFC Schema related exp	ort options					
VitcSpatialElement		Material preservation n	node (IFC2x3 only)	Explode only when	necessary 1.			
		Composite structures a	nd Complex Profiles					
		Split complex Building	Elements into parts	0				
			nt.	- 55				
elect 2D Elements to Export								
Grid System and Elements								
Lines, Texts, Labels, Fills								
Door / Window 2D Views								
+ COMPATIBILITY		+ COMPATIBILITY						
+ RELATED TRANSLATORS		+ RELATED TRANSLA	TORS					
		_						
	Cancel OK			Cancel	OK			

#### DIGITAL DRAWING FILE OPTIMISATION

Cata Conversion for InC Expert	
kvailable Presets:	
Mapped properties and derived data	
Mapped properties only	
Optimized for CostX	
Ontimized for (TMO)	
New Rename Delete 🔁	
+ SETTINGS	Vitit Conversion for IFC Export 7
elect Archicad Data to Export:	Available Presets:
Glassifications	Metric (AUD)
Element Properties	Metric (EUR)
Building Material Properties and Classifications	Metric (GBP)
Element parameters Quantity-type data only	Adaptive Into Infants (E) (D)
Component parameters	NewRenameDelete5
Door-Window parameters	
Zone Categories	* STINGS
	Length Unit: Millimeter
sport IFC Properties:	Angle Unit: Degree
All IFC Properties	Tran Helt
Only Properties set in Property Mapping for the selected Translator	Area Unit.
And under a successful and the Annual Second Second	Volume Unit: Cubic Meter
elect Derived Data to Export:	Currency Unit: AUD
FC Base Quantities	Time Unit: Year
JIFC Space Containment Filter Containment	RELATED TRANSLATORS
IFC Space Boundaries	This Preset is currently used in the following Translators for Export:
· COMPATIBILITY	CostX Export (IFC2x3, Coordination View Version 2.0)
RELATED TRANSLATORS	
Cancel OK	Cancel OK

# 14 Appendix A - Shared Parameters in Revit®

Object property data can be enriched to include additional information by the creation of new Shared Parameters for measurement and estimating purposes. A Shared Parameter which contains UniFormat coding, for example, would allow the object dimensions and quantities to be extracted from the DWFx<sup>™</sup> and presented elementally. (This is different to UniFormat Assembly Coding covered in 4 below). Formulabased parameters can also be added to provide additional measurement data such as window areas or downpipe lengths.

### 14.1 Creating a New Shared Parameter

In the Manage ribbon menu click on Shared Parameters.



In the Edit Shared Parameters box, create a folder (in this case called *ASTM UniFormal*) to hold the parameter file in a suitable location. In the Groups section of the Edit Shared Parameters window click New to create a new parameter group. Enter a name for your group (in this example, *ASTM UniFormal*) then click OK.

	New Parame	ter Group 🛛 🛛	Groups
Edit Shared Parameters	Name:	ASTM UniFormat	Non
Shared parameter file:		OK Cancel	Rename
C:\DOCS\Autodesk University\AU 2011\C Browse Create		ОК Са	incel Help

Still in the Edit Shared Parameters window click New under the Parameters section. This will create a new shared parameter within the previously created parameters group. Enter a name (in this example *UniFormat level 1*), leave the discipline as Common and use the drop-down menu to select a type of parameter (in this example Text). Click OK.

			Shared parameter file:	
arameter Properties 🛛 🛛 🖡		Parameters	Ci/DOCS(Autodesk University(AU 2013)C	ovise Cre
		New	Parameter group:	
Name:			ASIMUniformat	Y
ASTM UniFormat Level 1		Properties	UniFormat Level 1	Parameters
			Uniformat Level 2 Uniformat Level 30	New.
Discipline:	_	Move		Propertie
Common 🗸 🗸				Moye.
Turne of Deverseberg		Delete		Delata
Type of Parameter:	_			Groups
Text 💙		Groups		New.
		New		Renatio
OK Cancel				Deleta

The new Shared Parameter(s) will be listed in the Edit Shared Parameters window. Click OK to complete the configuration.

## 14.2 Adding the Shared Parameter to the Project

The new Shared Parameter needs to be added to the project, so from the Manage ribbon click on the Project Parameters button.



In the Project Parameters window click Add.

In the Parameter Type section of the Parameter Properties window select the Shared parameter option then click Select.

Parameter Type	Categories	
O Project parameter	Shared Parameters	
<ul> <li>(Can appear in schedules but not in tags)</li> <li>Shared parameter</li> <li>(Can be shared by multiple projects and families, exported to appear in schedules and tage)</li> </ul>	Choose a parameter group, and a parameter. Parameter group: ASTM1.nFormat:	
Parameter Data	Paramoters: LiniFormat Level 1 LiniFormat Level 2	
Name: <na parameter="" selected=""> O Type</na>	UniFormat Level 3	

The Shared Parameters window will open. Use the drop-down menu to select the Parameter group (in this example *ASTM UniFormat*) then select the Parameter (*UniFormat Level 1*) and click OK.

Ensure that the Instance option button is selected, then In the Categories section, use the checkbox to select those categories that the parameter applies to (In this example the parameter will be applied to all objects so click the Check All button). Click OK.

Select any other parameters and then click OK in the Parameter Properties box. Then click OK in the Project Parameters window to create the new parameters in the project.



The new Shared Parameters are now available to be applied to the objects within the model.
## 14.3 Applying Shared Parameters to Objects in the Model

### Option 1 – Edit the instance properties

Select an object in the model to display its Instance Properties in the task pane. (In this example the *UniFormat Levels 1, 2 and 3* shared parameters will be listed under the Text heading.)

If there are more than one instance of the same object in the model click the right mouse button and use the Select All Instances option to update them all in one operation.

Click into the field beside the shared parameter (in this example UniFormat Level 3). Type in a suitable entry for the selected object(s) and click Apply.



Repeat this process for all objects in the model for which the additional shared parameter information is to be applied.

#### Option 2 – Enter the parameters in a schedule

In the View ribbon, create a new Schedule, assign the required properties and enter the relevant details against the objects.

new schedute			Fields Filter Sorting/Grouping Formatting	Appearance
Category:		Name:	Avaiable fields:	Scheduled fields (in orde
C // // // // // // // // // //	egory>	ASTM UniFormat	Acsembly Code Acsembly Description	Add -> Family Type Level
Areas (Gro	ntable)	Schedule building components	ac B C Cabegory	UniFormat Level 1 UniFormat Level 2 UniFormat Level 3
Assemblie 📃 📃	s	C) Schedule kews	Comments Gost	

		ASTM	1 UniFormat		
Family	Туре	Level	UniFormat Level 1	UniFormat Level 2	UniFormat Level 3
M_Concrete-Round-Column	450mm	01 - Entry Level			
M_Concrete-Round-Column	450mm	01 - Entry Level			
UC-Universal Column-Column	356x368x129UC	01 - Entry Level	B SHELL	B10 Super Structure	B1020 Roof Construction
UC-Universal Column-Column	356x368x129UC	01 - Entry Level	B SHELL	B10 Super Structure	B1020 Roof Construction
UC-Universal Column-Column	356x368x129UC	01 - Entry Level	B SHELL	B10 Super Structure	B1020 Roof Construction
UC-Universal Column-Column	356x368x129UC	01 - Entry Level	B SHELL	B10 Super Structure	B1020 Roof Construction
UC-Universal Column-Column	356x368x129UC	01 - Entry Level	B SHELL	B10 Super Structure	B1020 Roof Construction
UC-Universal Column-Column	356x368x129UC	01 - Entry Level	B SHELL	B10 Super Structure	B1020 Roof Construction
UC-Universal Column-Column	356x368x129UC	01 - Entry Level	B SHELL	B10 Super Structure	B1020 Roof Construction
M_Concrete-Rectangular Beam	400 × 800mm				

### *Option 3 – Edit the Family Type to set default Instance Parameters*

Select an object, right click and select Edit Family. The Edit view for the Family will open. Click the Family Types button in the Properties section of the ribbon.



The Family Types edit box will open. Click the Add button in the Parameters section.

Family Typ	es		1 227	
Name:	00 × 1800 × 900mm		*	
Parameter	Value	Formula	Lock	Family Types
Construction	tu M. Dilo Stool Di	<b>1</b>	*	New
Materials and			······	Rename
Footing Materia	( Concrete - Cas	<u> </u>		Delete
Dimensions			*	
Width	1800.0	=		
Thickness	900.0	=	V	Devemotors
Length	800.0	=	V	Parameters
Cut-off	150.0	=	V	Add
Clearance	400.0	=		
Identity Data			×	Modify

In the Parameter Properties box, check Shared Parameter and click the Select button, then select the required Parameter and click OK.

Parameter Properties	Shared Parameters
Parameter Type O Family parameter	Choose a parameter group, and a parameter.
(Cannot appear in schedules or tags)	Parameter group:
<ul> <li>Shared parameter</li> </ul>	ASTM UniFormat II
(Can be shared by multiple projects and families, exported to ODB appear in schedules and tags)	Parameters: UniFormat Level 1
Select	UniFormat Level 2 UniFormat Level 3
Parameter Data	
Norse	

You will return to the Parameter Properties box and the parameter data will be shown. Make sure the Instance option is selected. Click OK.

Parameter Properties	
Parameter Type	
<ul> <li>Family parameter</li> </ul>	
(Cannot appear in schedules or tags)	
<ul> <li>Shared parameter</li> </ul>	
(Can be shared by multiple projects an appear in schedules and tags)	d families, exported to
	Select
Parameter Data	
Name:	
UniFormat Level 1	🔘 Туре
Discipline:	
Common	💿 Instance
Type of Parameter:	Reporting Par
Text	(Can be used to from a geometric
Group parameter under:	report it in a forr
Text 💌	schedulable para
ОК	Cancel

In the Family Types box, enter the values and click Apply and OK.

Family Types				
Name: 800 × 1800 × 900mm			~	
Parameter	Value	Formu	la 🔼	Family Types
Construction	·	·		New
Pile Type <structural foundations=""></structural>	M_Pile-Steel Pipe : 400mm Di	<b> </b> =		Deserve
Text				Rename
UniFormat Level 3 (default)	A1020 Special Foundations	<b>H</b>		Delete
JniFormat Level 2 (default)	A10 Foundations	=		
UniFormat Level 1 (default)	A Substructure	=		
Materials and Finishes				
Footing Material (default)	Concrete - Cast-in-Place Con	<b>_</b>		Parameters
Dimensions	-			Add
Width	1800.0			
Thickness	900.0	_		Modify
Lenath	800.0	=		
Cut off	150.0		······ 🚩	Remove
<			>	
	ОК	Cancel	Apply	Help

Now click the Load into Project button in the Family Editor section of the ribbon, and then click Overwrite the Existing Version.

0	Family Already Exists
Load into	You are trying to load the family M_Pile Cap-2 Pile, which exists in this project. What do you want to do?
Family Editor	<ul> <li>Overwrite the existing version</li> <li>Overwrite the existing version and its parameter value</li> </ul>

The data has now been added to every instance of the Family Type.

		×	
M_Pile Cap- 800 x 1800	2 Pile x 900mm	•	
Structural Foundations (1	) 🛛 🔽 🔂 Edit T	ype	
Constraints	\$	: 🔨	
Level	01 - Entry Level		
Host	Floor : Generic 300mm	II	
Offset	-300.0	<b>`</b>	
Moves With Grids			
Text		:	
UniFormat Level 1	A Substructure		
UniFormat Level 2	A10 Foundations		
UniFormat Level 3	A1020 Special Found		
Materials and Finishes	*	: 💌 📗	
Properties help	Apply	<u>ر</u>	

Individual instances which require to have different parameter values can now be edited either by selecting the object and editing its instance properties, or in the schedule.

IM_FISS-ROUND Structural Lubing	HSS114.3A0.0	1		1	1
M_HSS-Round Structural Tubing	HSS114.3X8.6				
M_HSS-Round Structural Tubing	HSS114.3X8.6				
M_Pile Cap-2 Pile	800 x 1800 x 900m	01 - Entry Level	A Substructure	A10 Foundations	A1020 Special Foundations
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile Cap-2 Pile	800 x 1800 x 900m	01 - Entry Level	A Substructure	A10 Foundations	A1020 Special Foundations
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile Cap-2 Pile	800 x 1800 x 900m	01 - Entry Level	A Substructure	A10 Foundations	A1020 Special Foundations
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile Cap-2 Pile	800 x 1800 x 900m	01 - Entry Level	A Substructure	A10 Foundations	A1020 Special Foundations
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			
M_Pile Cap-2 Pile	800 × 1800 × 900m	01 - Entry Level	A Substructure	A10 Foundations	A1020 Special Foundations
M_Pile-Steel Pipe	400mm Diameter	01 - Entry Level			

The dimensions may now be extracted and sorted by UniFormat codes.

Dimension Groups Dimensions.		Dimension Groups Dimensions	
Current: <all></all>		Current:	*
Click to Filter	<filter empty="" is=""></filter>	Click to Filter	<filter empty="" is=""></filter>
* Name	Quantity UOM	* Name	Quantity UOM
A10 Foundations A1020 Special Foundations - M_Pile Cap-2 Pile A1020 Special Foundations - M_Pile-Steel Pipe 400mm Diameter A1020 Special Foundations - M_Pile-Steel Pipe 500mm Diameter A1020 Special Foundations - M_Pile-Steel Pipe 500mm Diameter A1020 Special Foundations - M_Pile-Steel Pipe 500mm Diameter B10 Super Structure B10 Super Structure	83 m3 573 m 721 m 1,741 m2	Floors     Floor 160mm Concrete With 50mm Metal Deck     Floor Concrete Deck - Tapered Insulation     Floor Generic 300mm     Floor Generic Concrete 300mm     Structural Columns	71 m2 1,622 m2 1,741 m2 3,105 m2
B1010 Floor Construction - Generic Concrete 300mm     B1010 Floor Construction - M_Concrete-Rectangular Beam     B1010 Floor Construction - M_Concrete-Round-Column     B1020 Roof Construction - Concrete Deck - Tapered Insulation     B1020 Roof Construction - M_Concrete-Rectangular Beam     B1020 Roof Construction - M_Concrete-Round-Column     B1020 Roof Construction - M_HSS-Round Structural Tubing     B1020 Roof Construction - UB-Universal Beam 254x102x28UB	3,105 m2 268 m3 78 m3 1,622 m2 91 m3 34 m3 35 m 21 m	M_Concrete-Round-Column 450mm     M_Concrete-Round-Column 750mm     UC-Universal Column-Column 356x368x129UC     Structural Foundations     M_Pile Cap-2 Pile 800 x 1800 x 900mm     M_Pile Cap-4 Pile 2000 x 2000 x 900mm     M_Pile-Steel Pipe 400mm Diameter     M_Pile-Steel Pipe 500mm Diameter     Structural Feature	718 m 18 m 25 m 83 m3 143 m3 72 m3 142 m3
B1020 Roof Construction - UB-Universal Beam 305x165x40UB B1020 Roof Construction - UC-Universal Column-Column 356x3 B20 Exterior Endosure B2010 Exterior Walls - Exterior - 300mm Concrete	34 m 25 m 423 m2	Subcura Frammy     M_Concrete-Rectangular Beam 300 x 600mm     M_Concrete-Rectangular Beam 400 x 800mm     M_Concrete-Rectangular Beam 600 x 900     M_HSS-Round Structural Tubing HSS114.3X8.6     UB-Universal Beam 254x102x28UB     UB-Universal Beam 255x155x401 B	94 m 1,737 m 158 m 35 m 21 m 34 m

# 14.4 UniFormat Assembly Codes

All model elements in Revit<sup>®</sup> include fields for Assembly Code and Assembly Code Description properties. You can populate these fields from a hierarchical list of UniFormat codes drawn from a data file held in the Revit<sup>®</sup> 2012 Program directory (uniformat.txt).

• Select an object in the model and click on the Edit Type button.



• In the Type Properties box, click the Assembly Code value box, then click on the menu button to open the UniFormat Classification hierarchy. Select a code and click OK.

Type Propert	ies				
Family:	M_Concrete-	Round-Colur	in 💌		Load
Туре:	450mm		*		ouplicate
					Rename
Type Darame	tore				
	Darameter		1	Valua	
	Farameter			Value	
Dimension	5		450.0		~
U			450.0		
Identity Da	ata				*
Model					
Manufacture					
Type Comme	ents				
URL					
Description			•		
Assembly De	scription				
Assembly Co	ide				<u> </u>
Type Mark					45
Cost					
OmniClass N	umber				
Umniciass II	cie		<u>.</u>		
_					
Choose Assemb	oly Code				
Show classificatio	ns for:	Structural	Columns	~	]
Uniformat Classi	ification				Revit Category
No classific	ation				
🖃 🗝 B - Shell					
⊟ B10 - S	uperstructure				
⊌ B1	uru - Fioor Constr 	ruction per Floor Frami	na . Vertical Element	~	Structural Columns
	B1010240	Columns - CIP			Structural Columns
	B1010245 -	Columns - Pre	cast 🗟		Structural Columns
	B1010250 -	Columns - Ste	el		Structural Columns
	B1010255 -	Columns - Wo	od		Structural Columns
	J20 - Roof Constr	ruction			

• Alternate classifications are available in the drop-down at the top of the dialog.

• The Assembly Code and its associated Assembly Description will be added into the Type Properties.

ype Proper	ties		
Family:	M_Concrete-Round-Colun	חח 💌	Load
_			
Type:	450mm	<b>*</b>	Duplicate
			Rename
Type Param	eters		
	Parameter	V.	alue
Dimensio	าร		\$
Ь		450.0	
Identity D	ata		\$
Keynote			
Model			
Manufactur	er		
Type Comm	ients		
URL			
Description			
Assembly D	escription	Columns - CIP	
Assembly ⊂	ode	B1010240	
Type Mark			
Cost			
OmniClass I	Vumber		

- Click Apply to update the Type properties of all applicable objects then OK to exit the dialog.
- Create a Schedule to check that all objects have been assigned a code. Codes can also be assigned within the Schedule.

	Multi-Category Schedule									
Family	Туре	Assembly Code	Assembly Description							
M_Concrete-Rectangular Beam	$600 \times 900$	B1010300	Upper Floor Framing - Horizontal Elements							
M_Concrete-Rectangular Beam	600 × 900	B1010300	Wpper Floor Framing - Horizontal Elements							
M_Concrete-Rectangular Beam	600 × 900	B1010300	Upper Floor Framing - Horizontal Elements							
M_Concrete-Rectangular Beam	600 × 900	B1010300	Upper Floor Framing - Horizontal Elements							
M_Concrete-Rectangular Beam	600 x 900	B1010300	Upper Floor Framing - Horizontal Elements							
M_Concrete-Rectangular Beam	600 × 900	B1010300	Upper Floor Framing - Horizontal Elements							
M. Concrete-Rectangular Beam	600 v 900	B1010300	I Inner Floor Framing - Horizontal Flements							

• A DWFx<sup>™</sup> file exported from the model will include the Assembly Code (but not the Assembly Description) which can be used in CostX<sup>®</sup> to group the dimensions.

D	im	ens	sion Gr	oups	Dimens	sions								
Current: A1010130\M_Pile Cap-2 Pile 800 x 1800 x 900mm +														
	Click to Filter <filter empty="" is=""></filter>													
8	1	Nar	me						٠	Quantity	UOM			
	(	Ð	A1010	130										
	>		- 6	M_	Pile Cap-	2 Pile 80	0 x 1800	x 900mm	1	62.21	m3			
				M_	Pile Cap-	4 Pile 18	00 x 180	0 x 900m	m	87.48	m3			
	(	Ð	A1020	130										
	l	Đ	B1010	240										
	(	÷	B1010	300										