

Georeferencing BIM – a Worked Example

GeoBIM Benchmark Workshop

Dr Claire Ellul c.ellul@ucl.ac.uk



Without Georeferencing – Myran Data IFC to Shapefile -3013





Without Georeferencing – Myran Data IFC to Shapefile 27700

 In FME, setting the EPSG 27700 and EPSG 3013 give different results





EPSG.io

PROJCS["OSGB 1936 / British National Grid", GEOGCS ["OSGB 1936". DATUM["OSGB_1936", SPHEROID["Airy 1830",6377563.396,299.3249646, AUTHORITY["EPSG","7001"]], TOWGS84[446.448,-125.157,542.06,0.15,0.247,0.842,-20.489], AUTHORITY["EPSG","6277"]], PRIMEM["Greenwich",0, AUTHORITY["EPSG","8901"]], UNIT["degree",0.0174532925199433, AUTHORITY["EPSG", "9122"]], AUTHORITY["EPSG","4277"]], PROJECTION["Transverse_Mercator"], PARAMETER["latitude_of_origin",49], PARAMETER["central_meridian",-2], PARAMETER["scale_factor",0.9996012717], PARAMETER["false_easting",400000], PARAMETER["false_northing",-100000], UNIT["metre",1, AUTHORITY["EPSG","9001"]], AXIS["Easting", EAST], AXIS["Northing", NORTH], AUTHORITY["EPSG","27700"]]

PROJCS["SWEREF99 15 45", GEOGCS["SWEREF99", DATUM["SWEREF99". SPHEROID["GRS 1980",6378137,298.257222101, AUTHORITY["EPSG","7019"]], TOWGS84[0,0,0,0,0,0,0]. AUTHORITY["EPSG","6619"]], PRIMEM["Greenwich",0, AUTHORITY["EPSG","8901"]], UNIT["degree",0.0174532925199433, AUTHORITY["EPSG", "9122"]], AUTHORITY["EPSG","4619"]], PROJECTION["Transverse_Mercator"], PARAMETER["latitude_of_origin",0], PARAMETER["central_meridian",15.75], PARAMETER["scale_factor",1], PARAMETER["false_easting",150000], PARAMETER["false_northing",0], UNIT["metre",1, AUTHORITY["EPSG","9001"]], AUTHORITY["EPSG","3013"]]

Once Upon a Time ..

- QGIS Georeferencer
 - Create ground control points by clicking on the map and adding the coordinates
 - Minimum of 3 for scale, rotate, translate
 - Ideally more





In BIM – Myran Data IFC to Shapefile

- No need to scale the drawing is already vector
 - However, might need to change the units
- Need to translate (move the image to the correct location)
- Many need to rotate (if the local coordinate system is not orientated north)





Myran Dataset

- Revit offers the options to
 - Change the units on the drawing from mm to m if necessary (scale)
 - Move the BIM geometry to the correct location (translate)
 - Rotate the BIM geometry
- FILE > OPEN > IFC and then saved the IFC as an RVT file





Import the Myran Dataset IFC into Revit

Autodesk Re	evit 2020
Error - cann	not be ignored 8 Errors, 0 Warnings
Can't keep	o elements joined.
	Autodesk Revit 2020
	Error - cannot be ignored 6 Errors, 0 Warnings
<	Can't make cut-out.
Resolve FIrst	
Un	\leq 1 of 6 \geq Show More Info Expand >>
	Resolve First Error:
	Delete Element(s) OK Cancel

Change the Project Units

 Manage > Settings > Project Units

<u>D</u> iscipline:	Common		
Uni	ts	Forma	at
Length		1235 m	ım
Area		1234.568	3 m ²
Volume		1234.568	3 m ³
Angle		12.35	o
Slope		12.35	o
Currency		1234.5	57
Mass Density		1234.57 k	g/m³
Time		1234.6	i s
Speed		1234.6 k	m/h
Decimal symbo 123,456,789.00	l/digit grouping: ~		



Options for Location Definition

- Manage > Project Location
- Location
- Coordinates
- Position





Option 1- Location

- MANAGE > LOCATION
- Address search e.g. using street name, postcode etc
- Result will depend on the geocoder





Option 1 - Location

• Be careful about templates!

Location Weather and Site	×
Location Weather Site	
Define Location by: Internet Mapping Service ~ Project Address:	
Madrid, España Ý <u>S</u> earch	
Longitude: -3.683 Enter an address or dra Majagamonica Pozuelo deci arcón Tosrejón de Avdiazbilla Boadilla del Monte Alcorcón Velilla de San Antonio Vaciamadrid San Antonio San A	Printed and a long of the second
OK Cancel Help	



Option 2 – Coordinates

- Acquire coordinates get the coordinates from a linked project
- Publish coordinates share the coordinates of the current model with another project
- Specify coordinates at a point georeferenced the model (see next slides)
- Report shared coordinates click somewhere on the model and see the coordinates



Specify Coordinates at a Point

- The project base point defines the origin (0,0,0) of the project coordinate system. Use the project base point as a reference point for measurements across the site.
- The survey point identifies a real-world location near the model, such as a corner of the project site or the intersection of 2 property lines
- View > Graphics > Visibility Graphics > Site > Project Base Point
- View > Graphics > Visibility Graphics > Site > Survey Point



Specify Coordinates at a Point

- Option 1 use the pre-defined project base point with properly surveyed coordinates
 - View > visibility graphics > site > project base point
- Option 2 take the coordinates from a GIS map and find a matching point in the BIM

/isibility/Graphic	Overrides for Floor Pl	an: VÅN 1							×
Model Categories	Annotation Categories	Analytical Mo	del Categories	Imported Catego	ories Filters				
Show model	categories in this view					If a category is	s unchecked, i	t will not be vis	ible.
Eilter list:	<multiple> ~</multiple>								
		Pro	jection/Surfac	e	C	ut			^
Vis	ibility	Lines	Patterns	Transparency	ency Lines Patterns		Halftone	Detail Level	
🕢 🗹 Shaft C	Openings							By View	
🖃 🗹 Site								By View	
Bin	S							,	
Bin	s - Domestic								
Bou	undarv								
Dra	ainage RWP								
Dra	ainage SVP								
Hid	lden Lines								
🗹 🗹 Lan	ndscape								
Pac	ls								
Pro	viect Base Point								
Pro	perty Lines							1	
Stri	ipe								
Sur	vev Point								
🗹 Util	lities								
Spaces								By View	~
All	None	Invert	Е <u>х</u> ра	nd All	erride Host Layers] Cut Line St <u>y</u> les	5		<u>E</u> dit	
Categories t according to	that are not overridden a o Object Style settings.	re drawn	<u>O</u> bject Style	es					
					ОК	Cancel	Apply	Hel	þ



Original georeferencing details (for Task 1)

Coordinate reference system: none

Coordinates of the reference point (blue in Figure 1):

E: 152677.777 m

N: 6555555.555 m

H: 148.2 m

Rotation to the true North of the reference direction (blue in Figure 2): 32.3°.



Georeferencing parameters (for Task 2)

Coordinate reference system: EPSG::3013 SWEREF 99 15 45, RH2000

Coordinates of the reference point (blue in Figure 1):

E: 145312.8320 m

N: 6721748.645 m

H: 340.5 m

Rotation to the true North of the reference direction (blue in Figure 2): 48°.



Q



Х

Specify Coordinates at a Point

Specify Shared Coordina	ates >	<	Specify Shared Coordinat	es
Relocate this project in Sh known values at the point will move relative to globa	ared Coordinates by specifying you selected. Current project Ily positioned links.		Relocate this project in Shar known values at the point yo will move relative to globally	red Coordinates by specifying ou selected. Current project positioned links.
New Coordinates			New Coordinates	
North/South	0.0000 m		North/South:	6555555.5550 m
East/West	: 0.0000 m		East/West:	152677.7770 m
Elevation	: 148.2000 m		Elevation:	148.2000 m
Angle from Project North 0° 00' 00"	to True North East ~		Angle from Project North to 32° 18' 00"	East V
	OK Cancel			OK Cancel



Specify Coordinates at a Point





Report Shared Coordinates

 Check by clicking on Manage > Project Location > Coordinates > Report Shared



Export to IFC

<in-session setup=""></in-session>	General	Additional Content	Property Sets	Level of Det	ail Advanced		
<ifc2x3 2.0="" coordination="" setup="" view=""> <ifc2x3 coordination="" setup="" view=""></ifc2x3></ifc2x3>	IFC ve	rsion		IFC	2x3 Coordinatio	on View 2.0	
<ifc2x3 2010="" bim="" concept="" design="" gsa="" setup=""> <ifc2x3 basic="" fm="" handover="" setup="" view=""></ifc2x3></ifc2x3>	File ty	De		IFC			
<ifc2x2 coordination="" setup="" view=""> <ifc2x2 bca="" check="" e-plan="" setup="" singapore=""></ifc2x2></ifc2x2>	Phase	to export		Def	Default phase to export		
<ifc2x3 2.4="" cobie="" deliverable="" design="" setup=""> <ifc4 reference="" setup="" view=""></ifc4></ifc2x3>	Space boundaries			Nor	None		
<ifc4 design="" setup="" transfer="" view=""></ifc4>	Projec	t Origin		Cur	rent shared coc	ordinates	
	🗌 Spli	t Walls, Columns, Duo ude Steel Elements	ts by Level				
						File Header Informat	tion
< >>						Project Address.	
) [h 💷 💾 🗁 📑						ОК	Cance



FME IFC to Shapefile

🌮 Set Trai	nslation	Parameters		×		
Reader						
Format:	Industr	y Foundation Class	STEP/XML Fi	les (IFC) 🗸 🗸		
Dataset:	20\weba	ndmobile\sweden	-data\Myran_f	fixed.ifc 🗔 💌		
Parame	ters	Coord. System:	EPSG:3013	~		
Multiple S Merge Separa Writer	ource Da source d ate destin	ataset Options datasets to one de nation for each so	stination urce dataset			
Format:	Esri Sha	apefile		\sim		
Dataset:	Dataset: eden-data\myran-shapefiles-not-georeferenced 🗔 💌					
Parameters Coord. System: Same as source ~						
<u>H</u> elp			ОК	Cancel		

Industry Foundation Class STEP/XML Files (IFC) Parameters				×
Reader Version				^
In FME 2014 a new IFC reader was implemented. The previous reader implementation is no compatibility, the previous IFC reader implementation may be used by changing this param	w deprecated, and no longer ma eter.	aintained. For ba	ckwards	
Use Deprecated Reader:	No		\sim	
✓ Reader Parameters				
IFC Version:	<auto detect=""></auto>		~	
Data Model:	Relational		~	
Read all Geometric Representations:	Yes		~	
Representations to Read:	No items selected.			
Additional Representations to Read:				
Property/Quantity Set Parameters				
Create Property/Quantity Set Definition Features	: Yes		\sim	
Read Property/Quantity Sets As	: Geometries		\sim	
Type Object Parameters				
Read Type Objects As	: Single IfcTypeObject Feature	Туре	~	
Merge Property/Quantity Sets of Type Objects into Property/Quantity Sets of Real Objects	: Yes		\sim	
Depresented Pander Parameters				
Geometry				
, Read IfrSpace Geometries:	No		~	
Subtract Opening Geometries:	Yes		~	
Add Projecting Geometries:	Yes		~	
Evaluate CSG Solids:	No		~	
Simplify Extrusion Base Faces:	No		~	
Encoding				
String Encoding:			~	1
Help		OK	Cancel	



Myran – Georeferenced and Correctly Scaled





Myran – Georeferenced and Correctly Scaled





IFC – Not Georeferenced versus Georferenced

#588608= IFCCARTESIANPOINT((0.,0.,0.));

#588610=

IFCAXIS2PLACEMENT3D(#588608,\$,\$); #588611=

IFCLOCALPLACEMENT(\$,#588610); #588612=

IFCSITE('1DGwFa8Z17QBmPE_Rf9B2I', #41,'Surface:3759715',\$,",#588611,#588 606,\$,.ELEMENT.,(59,19,55,199999),(18, 3,53,999999),148200.,\$,\$); #4016781= IFCCARTESIANPOINT((33.8693163757324,41.0 554707641601,-1.2000000915529)); #4016783= IFCAXIS2PLACEMENT3D(#4016781,\$,\$); #4016784= IFCLOCALPLACEMENT(#124,#4016783); #4016785= IFCSITE('1DGwFa8Z17QBmPE Rf9B2I',#41,'Surf ace:3759715:3759715 : Surface:3759715:328157',\$,'Surface:3759715:375 9715 : Surface:3759715',#4016784,#4016779,\$,\$,\$,\$,\$,\$,\$);



Georeferencing in Revit

- NB you don't need to do the scale/rotate/translate in Revit
- See here for some alternative approaches:
 - <u>https://3d.bk.tudelft.nl/pdfs/18_georeferencing.pdf</u>

About the Geo-referencing of BIM models

Abdoulaye Diakité

<u>https://pro.arcgis.com/en/pro-app/help/data/revit/adding-revit-data-to-arcgis-pro.htm</u> (Esri alternative)