



ISPRS EuroSDR GeoBIM benchmark¹
2019

Task 2 – Options for **geo-** **referencing IFC** data

Results of the tests delivered by participants



¹ <https://3d.bk.tudelft.nl/projects/geobim-benchmark/>

Table of Contents

<i>Autodesk Revit 2019</i>	3
<i>FME 2019.2</i>	4
<i>eveBIM 2.10.0.300</i>	15
<i>ArcGIS Pro</i>	18
<i>IfcGeoRefChecker 0.3.2.2</i>	21
<i>FZKViewer V 5.1</i>	23
<i>FME Desktop 2018.1</i>	26
<i>Autodesk Revit 2020.0.0.377</i>	28

Autodesk Revit 2019

Software	Software Name		Autodesk Revit 2019		Software house		Autodesk	
	Proprietary or open source software?				Kind of software			
	proprietary				BIM			
Computer	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space	
	Celsius, about 2012	windows 7 Enterprise	Intel(R) Xeon(R) CPU E-1620 0		16 GB	3000 GB	around 2 000 GB	
Test with Myran.ifc								
Before georef, how long does it take, approximately, to:	Zoom into the model to see more detail			it's almost immediate				
	Pan the model			it's almost immediate				
	Rotate the model			it's almost immediate				
	Query an object			it's almost immediate				
	Make a simple edit			it's almost immediate				
	Please, explain what edit was made			Changing size of window				
Georeferencing tool	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?				They are available in the standard version of the software			
CRS	Managed CRS		<ul style="list-style-type: none"> geographical CRS projected CRS 					
Model orientation	6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?					Yes		
	6.1.1) What is the workflow needed to correctly perform the operation?			Create a site plan and set its orientation to True north, then from the Manage tab use Position, Rotate True North				
Model location	7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?					Yes		
	7.1.1) What is the workflow needed to correctly perform the operation?			You should be able to modify the N/S and E/W parameters of the Project Base Point. But, I get an error message that it cannot be placed more than 16 kilometers from its startup location				
	7.3) Can all the supported coordinate reference systems and projections (cited in the answer to question 3) be used while performing the 'move' operation?					No		
	7.3.1) Which ones can be used for this task?			Could not find any predefined CRS in Revit				
After georefer, how long does it take, approximately, to:	Zoom into the model to see more detail			it's almost immediate				
	Pan the model			it's almost immediate				
	Rotate the model			it's almost immediate				
	Query an object			it's almost immediate				
	Make a simple analysis			it's almost immediate				
	Make a simple edit			it's almost immediate				
Settings	9.1) Are any pre-processing steps or configuration/setting changes needed in the software to enable a correct and consistent export of the georeferenced file?					No		
	9.2) short comments to the previous question			I do not think that any parameters need to be changed				
Export	10) How long does it take for the georeferenced model to be exported to IFC?					1-5 minutes		

FME 2019.2

Software	Software Name [version]		FME [2019.2]		Software house	Safe Software	
	Proprietary or open source software?		Kind of software				
	proprietary		Extract/Transform/Load				
	IFC Certification		Not certified				
Computer	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space
	Dell Latitude 3400 x64 i7-8586U	MS Windows 10.0.18362	x64 i7-8586U	GeForce MX-130 Nvidia	16	940	405
	Please report on any errors the software gives when importing the file	Warnings logged in Data Inspector Log while reading the dataset. Many of these are incidental and do not necessarily indicate an error or problem. The coordinate system was not found in the dataset, and some traits might have been dropped, though these are likely not significant. The warning included text as follows: "Worker 86976 > Coordinate system named IFC_COORDSYS_0 does not exist. Worker 86976 > ... Last line repeated 25 times ... Worker 97736 > Error encountered while copying traits to generated solids. Some solid components may be missing traits, appearances, measures or attributes Error encountered while copying traits to generated solids. Some solid components may be missing traits, appearances, measures or attributes Worker 97736 > ... Last line repeated 4 times ..."					
Before georef, how long does it take, approximately, to:	Zoom into the model to see more detail					less than a minute	
	Pan the model					it's almost immediate	
	Rotate the model					it's almost immediate	
	Query an object					it's almost immediate	
	Inspect the objects linked to the queried one through a relationship					less than a minute	
	Relationships such as parent id are read when the dataset is initially read, so these can be used to locate a parent feature using a filter query. Takes a few mouse clicks to do this and user needs to copy the parent_id, select the IFC_Stair feature type, open the filter query, select GlobalID and then paste the parent id value, so that's why it takes about a minute.						
	Make a simple analysis					less than a minute	
Please, explain what analysis was made	Note that these tests were also performed as part of Task 1 for Myran.ifc and Uptown.ifc. The attached FME workspace Myran_IFC_Analysis.fmw performs geometry validation using the Surfaces and Solids test group (GeometryValidator transformer) and calculates volumes (VolumeCalculator transformer)						
<p>Fig 1. MyranIFC_ Myran_IFC_Analysis.fmw FME workspace for performing analysis related to geometry validation and volume</p>							

How long does it take, approximately, to:
Make a simple edit 1-5 minutes

Please, explain what edit was made

FME Data Inspector does not have any edit functionality, so the edit was made in an FME Workspace that reads the whole IFC file, makes a change and then writes it back out. An AttributeCreator and GeometryPropertySetter are used to define new values for the IfcBuilding Address properties and then set them on the IfcBuilding element.

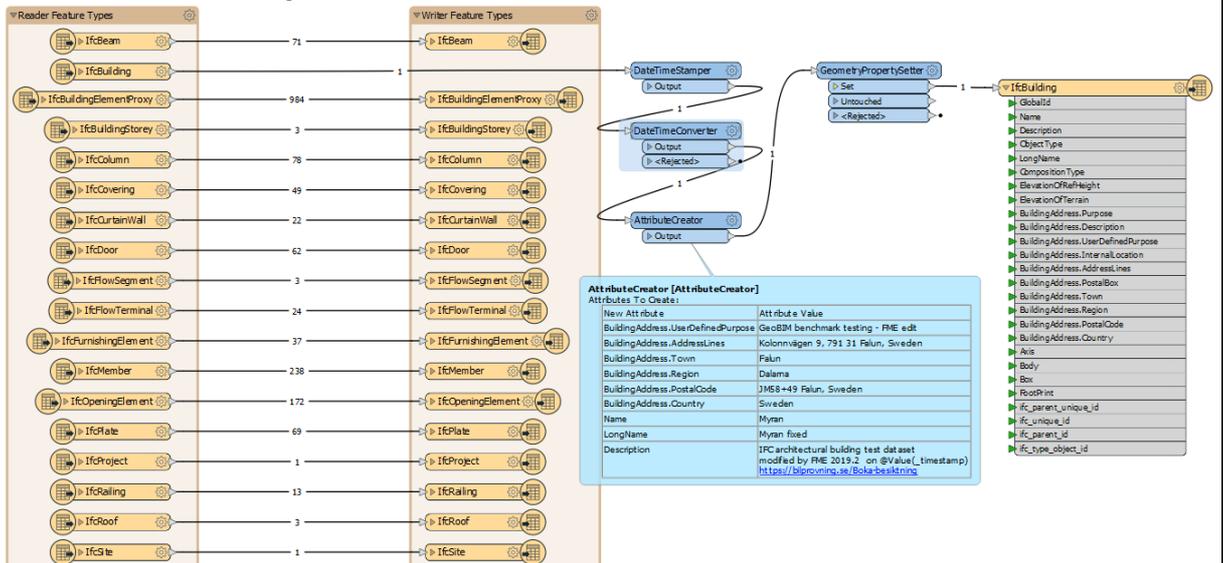


Fig 2. [Myran_IFCtoIFC_editBuilding.fmw](#) FME workspace to edit IFC Building Address, Name, LongName and Description. See also the [log file](#).

FME Data Inspector does not have any edit functionality, so the edit was made in an FME Workspace that reads the whole IFC file, makes a change and then writes it back out. An AttributeCreator and GeometryPropertySetter are used to define new values for the IfcBuilding Address properties and then set them on the IfcBuilding element.

Note that the time it takes to make the edit depends on how many edits are made. Once an edit workflow / workspace is developed, then modifying a single value and regenerating the ifc dataset can be done in less than a minute. Also, workflows can be defined that automate the update of features, perhaps from a status value retrieved from a real time online source, so it is possible to configure workflows that take 0 seconds of user time.

Link to the [Myran_IFCtoIFC.fmw](#)

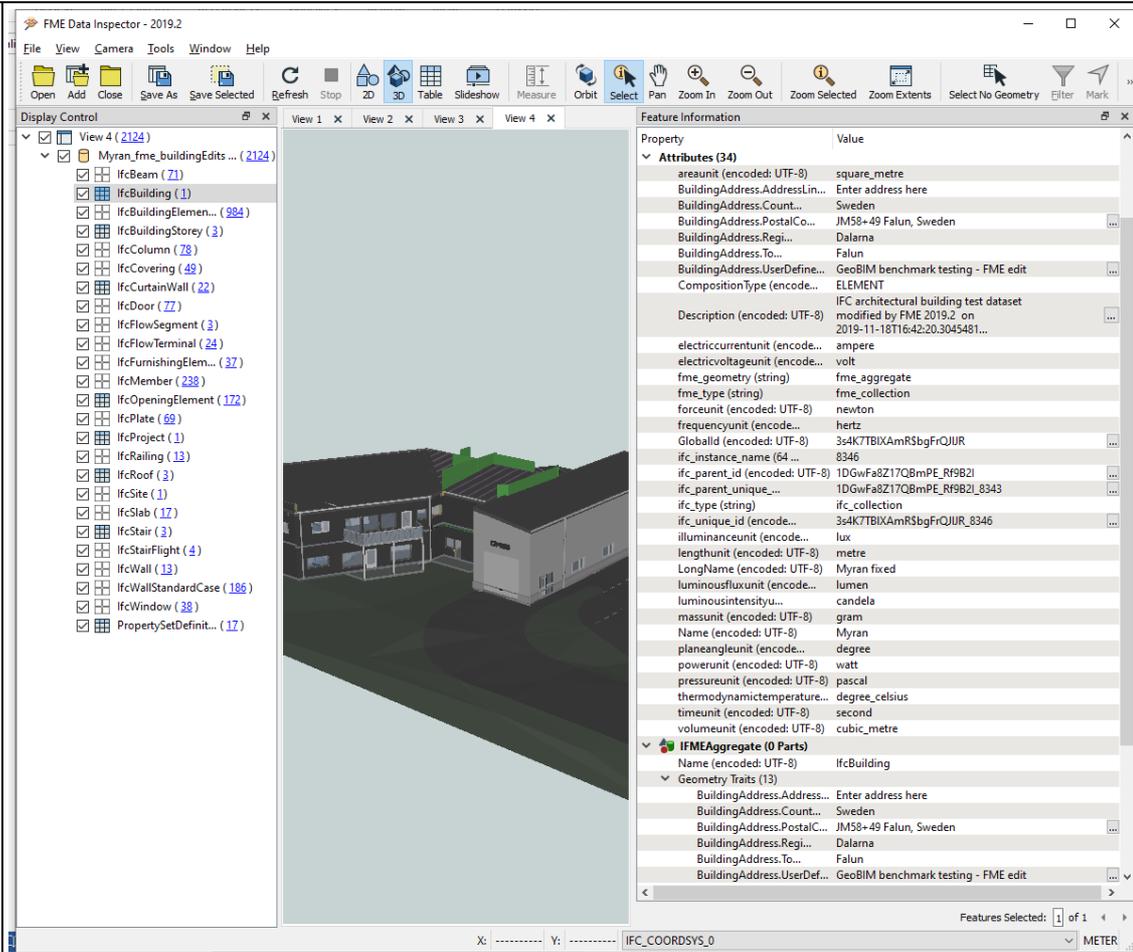


Fig 3. Output IFC showing edits made to IfcBuilding Name, Description and Address properties.

Georeferencing tool	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?	They are available in the standard version of the software
CRS	At what level is the CRS defined? 3.2) Can you give a short definition about the object CRS and/or the project CRS are defined and what are their specific features?	A project CRS is defined At the moment FME only has partial automatic CRS support for IFC. FME reads the RefLat, RefLong and uses these to define the origin of the dataset. However, FME on the whole has coordinate system support for a full range of datums and coordinate systems. So FME can be used to georeference a dataset from a local coordinate system and transform it to a projected or global coordinate system. Once georeferenced, the dataset can be written to any format that has full CRS support and the georeferencing will be automatically retained and written (for example when writing to CityGML, GML, Geopackage etc).

3.3) Attach screenshots

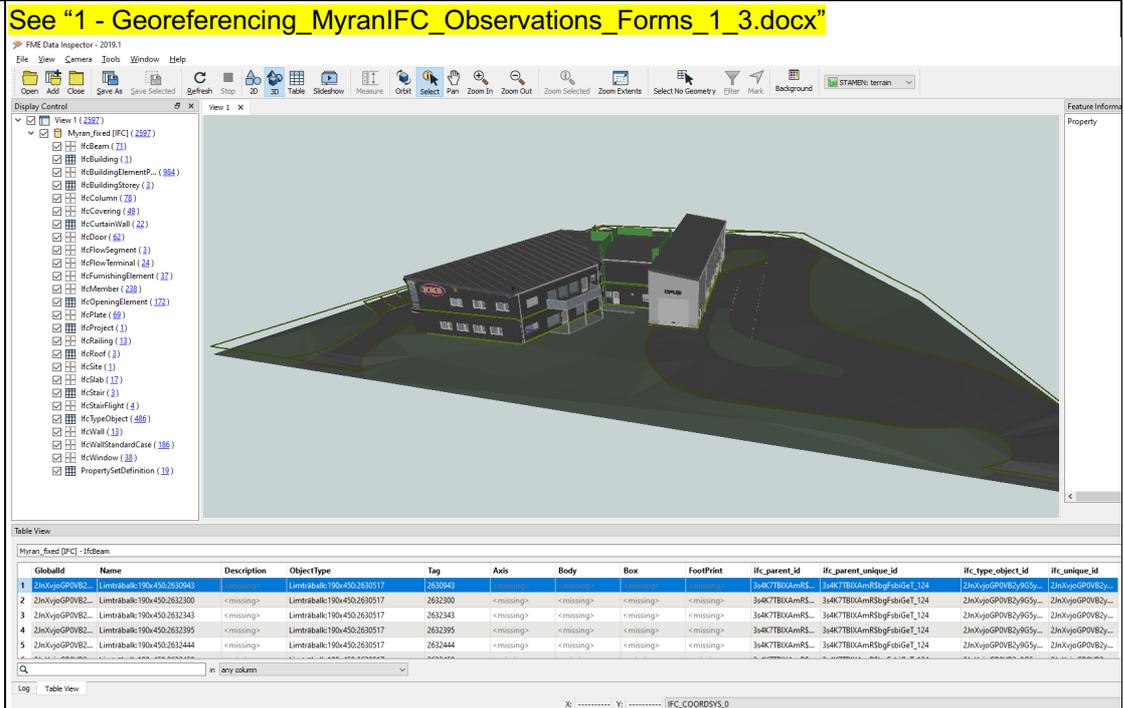


Fig 4. FME Data Inspector show dataset full extents – no georeferencing

3.4) short comments to the previous question

Task2 Georeferencing MyranIFC Observations Forms 1-3.docx contains some additional screen shots related to georeferencing. A complete doc for Task 2 observations will also be submitted via DropBox in a doc called: 'Task2 Georeferencing MyranIFC Observations AllForms.docx'

Coordinate System support references:
https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Coordinate_Systems/Home_cs.htm
https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Coordinate_Systems/CoordSys/coord_sys_about.htm
https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Coordinate_Systems/Workbench/How_FME_Identifies_Coordinate_Systems.htm
https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Coordinate_Systems/CoordSys/Included_Grid_Shift_Files.htm

Available types of georeferenced CRS:

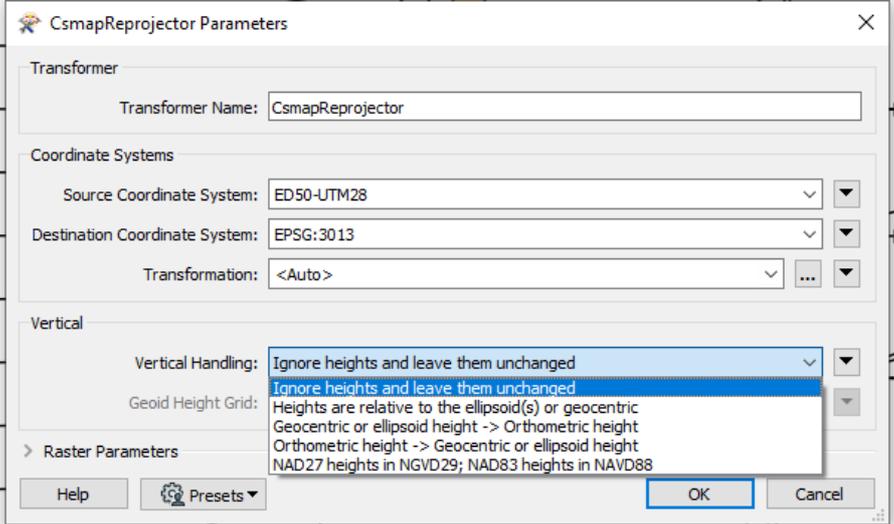
- geographical CRS
- projected CRS

4.2) Can you list the supported geographical and/or projected CRS?

coordsys.db contained in the root FME installation folder contains a list of all predefined, supported CRS's. In FME 2019.2 this list is 8871 entries long. FME also supports custom or user defined coordinate systems, user defined datums, horizontal and vertical datums and grid shifts. FME supports a range of CRS libraries including CSMAP, ESRI, GtransReprojector, GridInQuestReprojector to name a few.

4.3) Attach screenshots		
	<p>Fig 5. Some supported Swedish coordinate systems.</p>	

Height reference systems	5.1) What types of height reference systems are available?	FME supports height measurements in 5 possible different ways and can convert between them: • Leave unchanged • Relative to ellipsoid or geocentric • Ellipsoid height to orthometric height • Conversion between vertical datums • Use of Offsetter, Affine and AffineWarper transformers to specify a implement a specific height transformation.
	5.2) Can you list the supported height reference systems?	FME supports the following vertical grid formats: <ul style="list-style-type: none"> • Geoid96 (GEO) • Geoid99 (bin) • OSGM91 (txt) • Byn (byn) • Egm96 (grd) See: https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Coordinate_Systems/CoordSys/vertical_grids.htm Additional vertical grid shifts can be added.

5.3) Attach screenshots	<p>Heights in FME Coordinate Systems: https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Coordinate_Systems/CoordSys/coord_sys_heights.htm</p> 
	<p>Fig 6. CSMaPReprojector transformer settings showing FME vertical handling options</p>

5.4) short comments to the previous question	I'm uploading the current version of 'Task2 Georeferencing MyranIFC Observations.docx' as I go, so there will be overlap between items in this doc and previous uploads. The master doc will be uploaded to Dropbox\Task2
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Model orientation	6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?	Yes
	6.1.1) What is the workflow needed to correctly perform the operation?	For FME, for many formats, the CRS and georeferencing are read automatically. In the case of IFC, where CRS support is only partial, typically users can use a sequence of Scale, Offset, Rotator and CoordinateSystemSetter transformers within an FME workspace to orient a dataset correctly on the earth's surface and tag it with the correct CRS. In this case, it appears that FME automatically reads the orientation of the Myran.ifc dataset correctly so there is no need for a rotation.
Model location	7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?	Yes
	7.1.1) What is the workflow needed to correctly perform the operation?	For FME, for many formats, the CRS and georeferencing are read automatically. In the case of IFC, where CRS support is only partial, typically users can use a sequence of Scale, Offset, Rotator and CoordinateSystemSetter transformers within an FME workspace to orient a dataset correctly on the earth's surface and tag it with the correct CRS. In this case, it appears that FME automatically reads the orientation of the Myran.ifc dataset correctly so there is no need for a rotation. For this Myran.ifc dataset, a Scaler transformer is used to change the scale from mm to meters by multiplying coordinate values by 0.001. Then the offset values are applied with an Offsetter as follows: E: 145312.8320 m N: 6721748.645 m H: 340.5 m. Finally, the destination CRS is set to EPSG:3013 with a CoordinateSystemSetter.

See "4 - Georeferencing_MyranIFC_Observations.docx" in OSF

Georeferencing: Orientation

We used the georeferencing information available for Myran IFC on the GeoBIM website:

<https://3d.bk.tudelft.nl/projects/geobim-benchmark/ifcmyran.html#georeferencing-details>

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°.

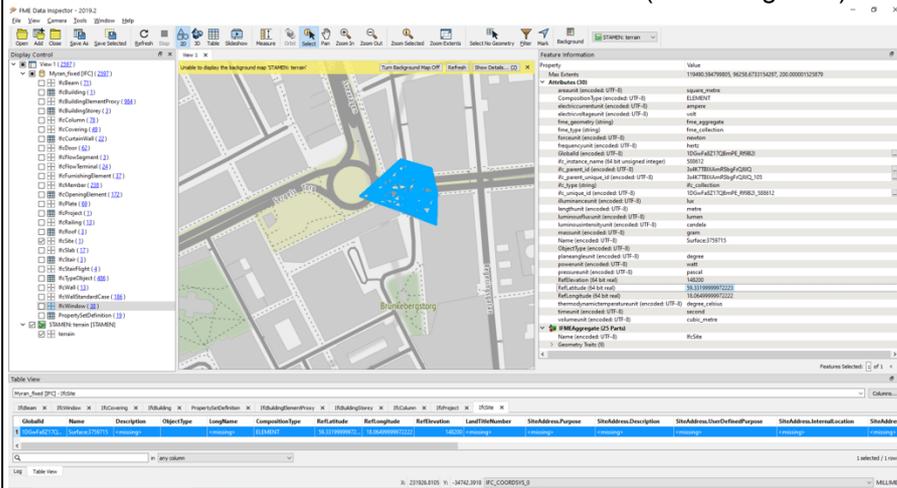


Fig 7. Default 2D placement without georeferencing

7.1.2) Attach screenshots

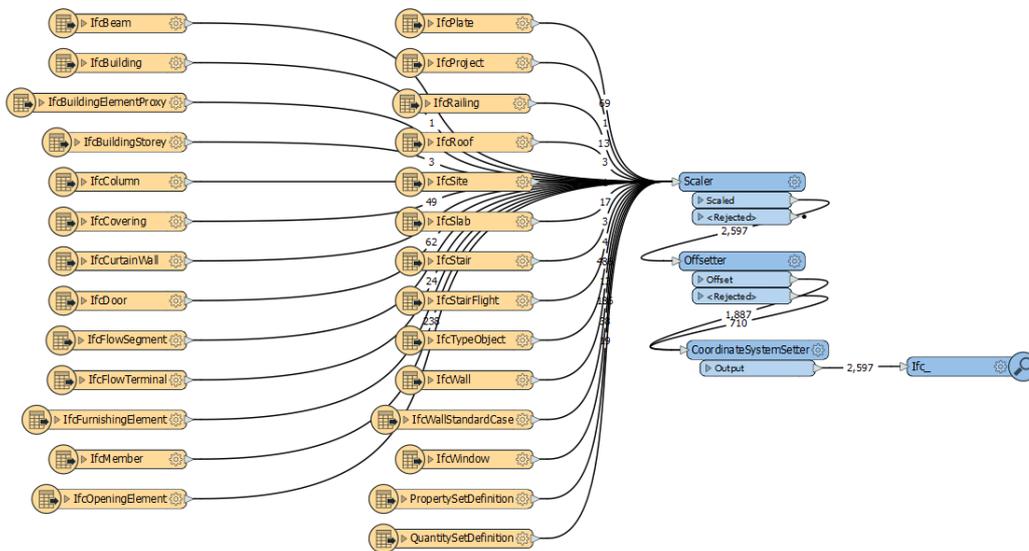


Fig 8. Myran_ViewIFC.fmw FME Workspace used to geolocate model using scale, offset and coordinate system settings in the Scaler, Offsetting and CoordinateSystemSetter transformers. See also the log file.

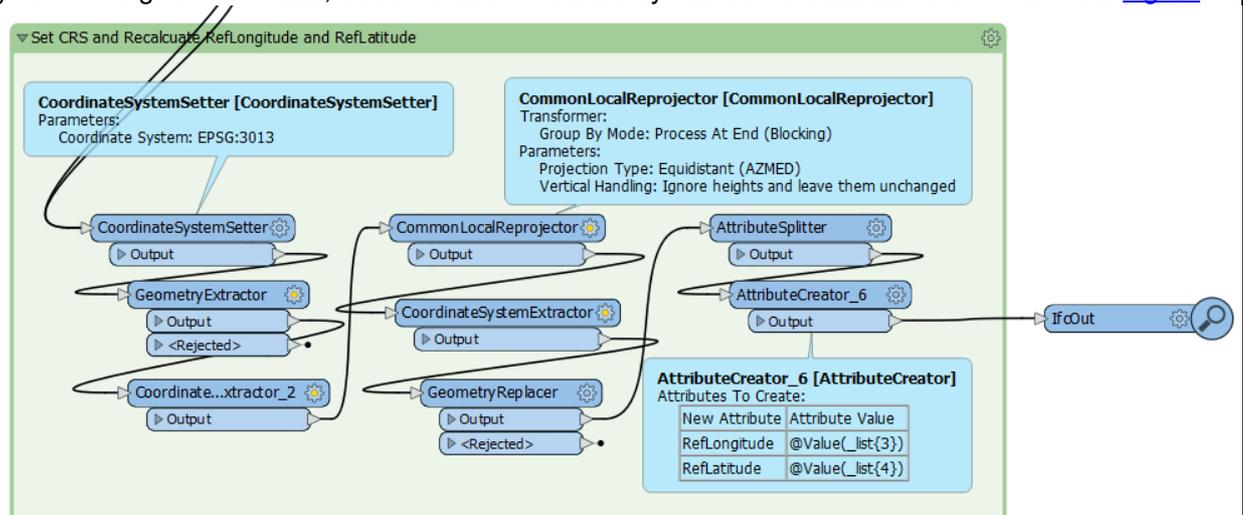


Fig 8a – Georeference IFC

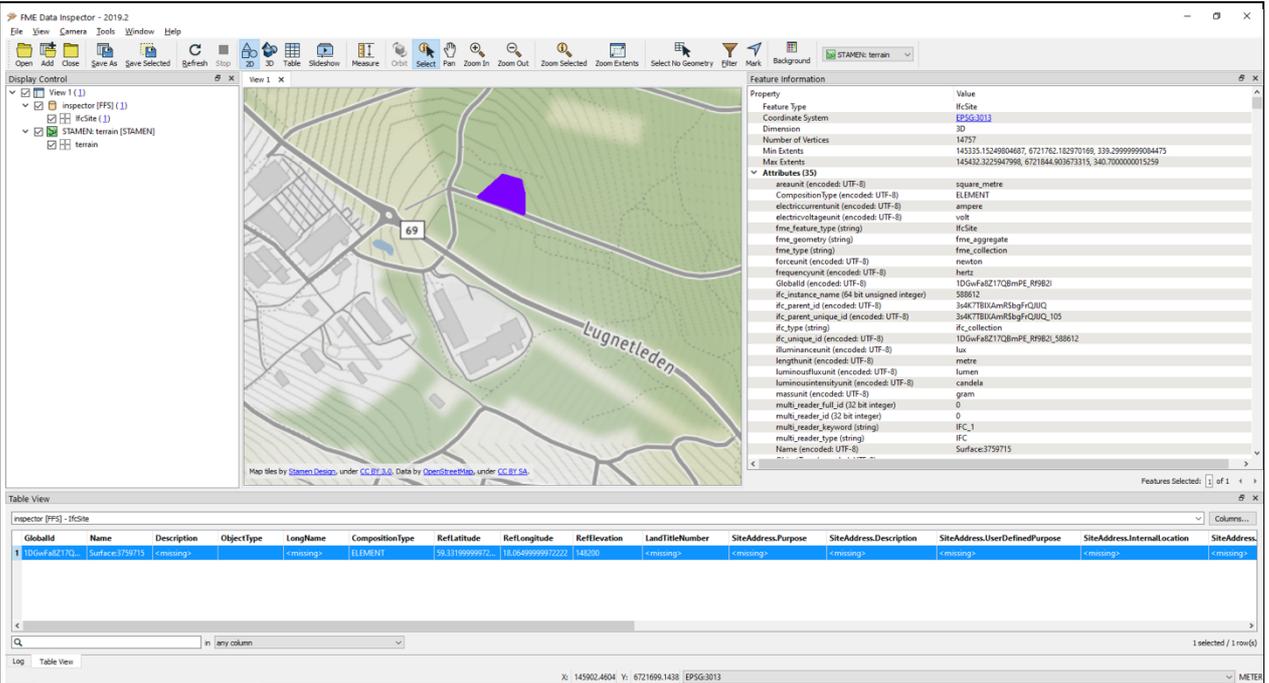


Fig 9. Georeferencing using Scale and Offset values and CoordinateSystemSetter (Myran_ViewIFC.fmw FME Workspace).

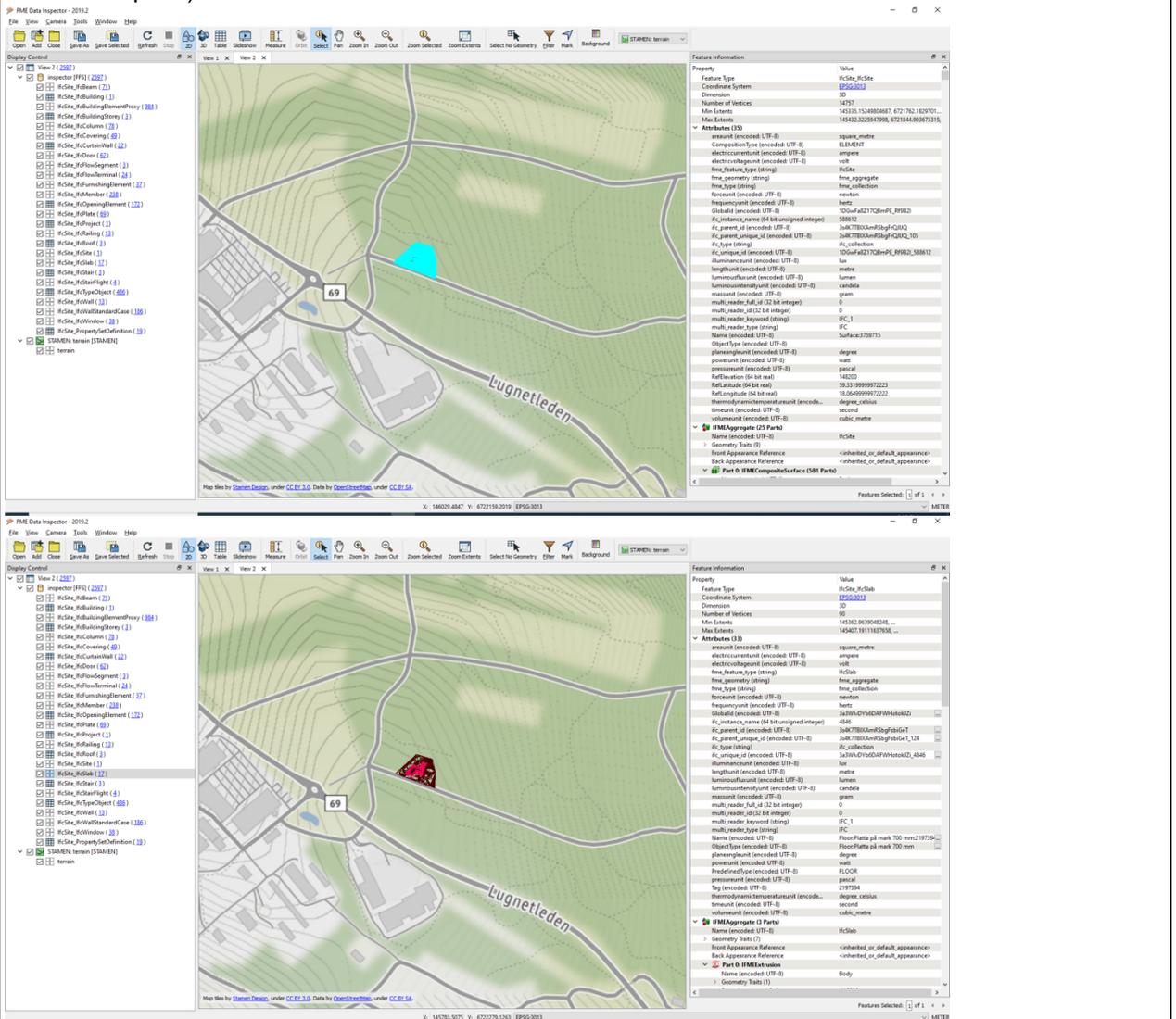


Fig.10 - Myran georeferenced – building slab

Move	7.3) Can all the supported coordinate reference systems and projections (cited in the answer to question 3) be used while performing the 'move' operation?		No
	7.3.1) Which ones can be used for this task?	The method above should work when moving between one projected coordinate system and another. To convert between geographic and projected it would be best to make use of a reprojection library as part of the workflow given that the transforms are typically more complex. However, in some cases an Affine transformation may be sufficient if the affine transformation coefficients are known, or a series of transformation vectors for known control points can be applied using an AffineWarper.	
After georeferencing, how long does it take approximately to	Zoom into the model to see more detail	it's almost immediate	
	Pan the model	it's almost immediate	
	Rotate the model	it's almost immediate	
	Query an object	it's almost immediate	
	Inspect the objects linked to the queried one through a relationship	less than a minute	
	Make a simple analysis	less than a minute	
	Make a simple edit	1-5 minutes	
Settings	9.1) Are any pre-processing steps or configuration/setting changes needed in the software to enable a correct and consistent export of the georeferenced file?		Yes
	9.1.1) Can you add a short description of the steps involved in the pre-processing?	FME uses the IfcSite RefLatitude and RefLongitude to geolocate the model. In the original source Myran_fixed.ifc dataset provided, these values seem to be not very accurate and places the model somewhere near Stockholm (RefLatitude=59.3319999972223, RefLongitude=18.0649999972222). To preserve the dataset geolocation so that FME can read it back in at the correct location, new values need to be derived for RefLongitude and RefLongitude. Once the dataset is correctly placed using the georeferencing parameters above, a CommonLocalReprojector is used to temporarily move the dataset to a local coordinate system. FME automatically names this local CRS with the long, lat of the centroid of the dataset. String parsing was then used to extract these values from the local CRS name. These values are then used to set correct values for RefLatitude and RefLongitude before the original geometry is restored and the updated IFC dataset is written.	
Export	10) How long does it take for the georeferenced model to be exported to IFC?	less than a minute	
<p>Exporting Georeferenced Model to IFC</p> <p>For FME, for many formats, the CRS and georeferencing are read automatically. In the case of IFC, where CRS support is only partial, typically users can use a sequence of Scale, Offset, Rotator and CoordinateSystemSetter transformers within an FME workspace to orient a dataset correctly on the earth's surface and tag it with the correct CRS.</p> <p>For this Myran.ifc dataset, a Scaler transformer is used to change the scale from mm to meters by multiplying coordinate values by 0.001. Then the offset values are applied with an Offsetter as follows: E: 145312.8320 m N: 6721748.645 m H: 340.5 m. Finally, the destination CRS is set to EPSG:3013 with a CoordinateSystemSetter.</p> <p>The method above should work when moving between one projected coordinate system and another. To convert between geographic and projected it would be best to make use of a reprojection library as part of the workflow given that the transforms are typically more complex. However, in some cases an Affine transformation may be sufficient if the affine transformation coefficients are known, or a series of transformation vectors for known control points can be applied using an AffineWarper.</p> <p>Because FME uses RefLongitude and RefLongitude to geolocate IFC upon read, it's important to update these values to accurately represent the dataset's location on the earth's surface.</p>			

FME uses the IFCSite RefLatitude and RefLongitude to geolocate the model. In the original source Myran_fixed.ifc dataset provided, these values seem to be not very accurate and places the model somewhere near Stockholm (RefLatitude=59.33199999972223, RefLongitude=18.06499999972222). To preserve the dataset geolocation so that FME can read it back in at the correct location, new values need to be derived for RefLongitude and RefLongitude. Once the dataset is correctly placed using the georeferencing parameters above, a CommonLocalReprojector is used to temporarily move the dataset to a local coordinate system. FME automatically names this local CRS with the long, lat of the centroid of the dataset. String parsing was then used to extract these values from the local CRS name. These values are then used to set correct values for RefLatitude and RefLongitude before the original geometry is restored and the updated IFC dataset is written.

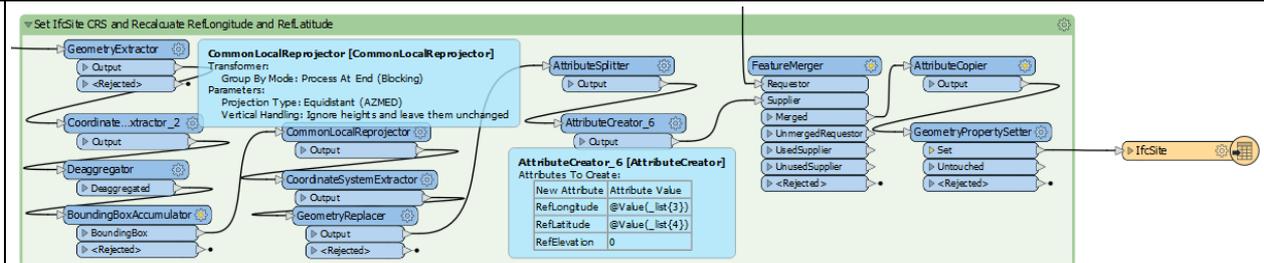


Fig 10. Recalculate RefLatitude and RefLongitude using CommonLocalReprojector and overwrite source incorrect values in order to correctly to geolocate the model for EPSG:3013 for writing to IFC.

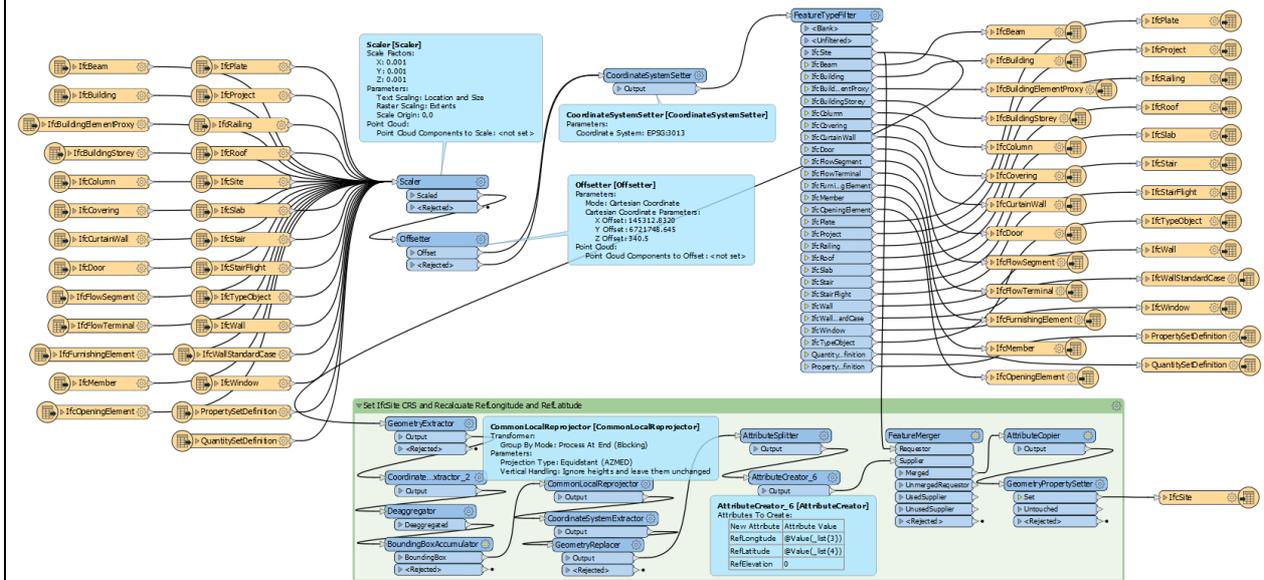


Fig 11. [MyranIFC_georeference.fmw](#) - complete georeferencing model which applies scale, offsets, sets the CRS name and recalculates RefLatitude and RefLongitude model before writing to IFC.

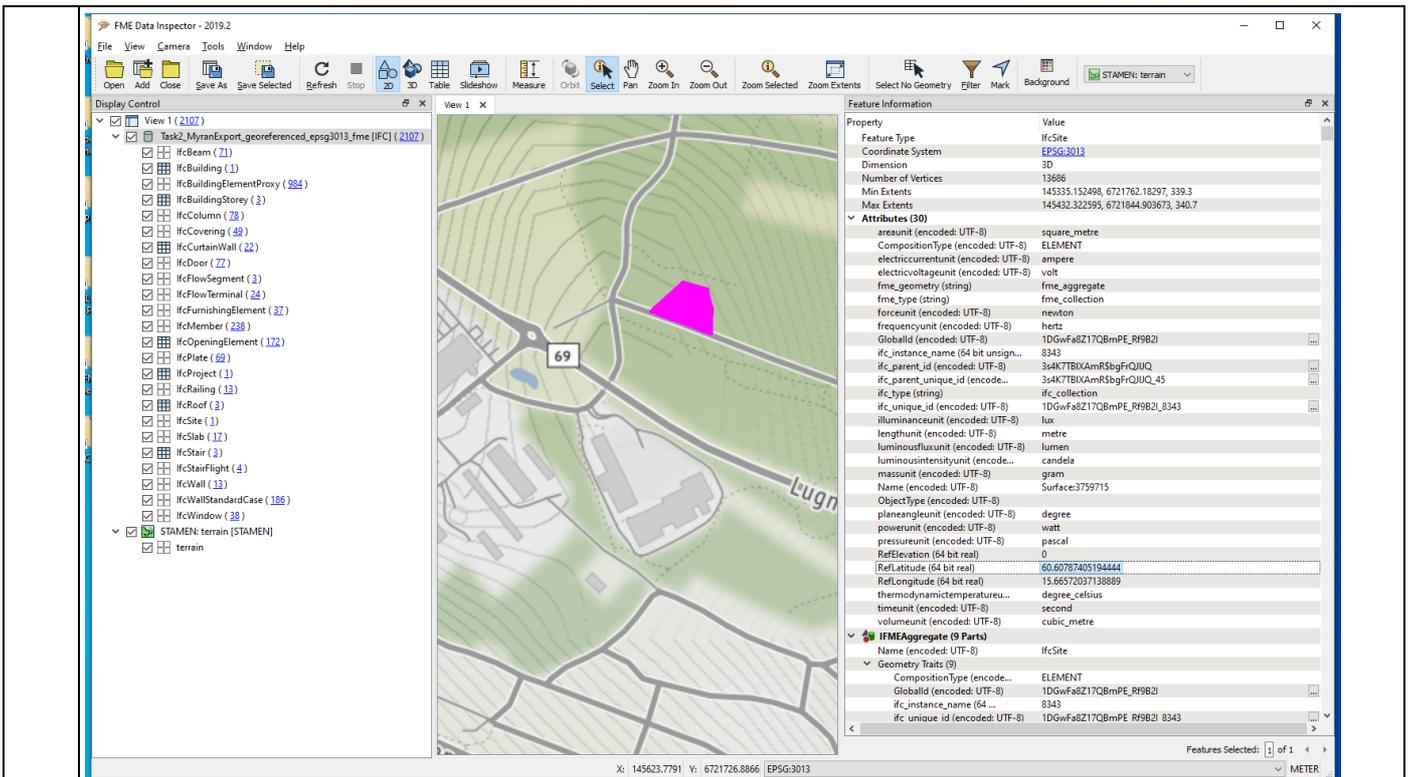


Fig 12. Viewing Task2_MyranExport_georeferenced_epsg3013_fme.ifc, the georeferenced output from [MyranIFC_georeference.fmw](#). See also the [log file](#). This is the view from FME Data Inspector without any preprocessing workspace. The only requirement is the user needs to set the CRS to EPSG:3013 on the IFC reader. Note data source = IFC (not FFS as is the case for preprocessed) and CRS = EPSG:3013 (not _FME0 or IFC_COORDSYS_1 as is the case for unknown CRS).

=== END OF Myran.ifc Task 2 ===

(other datasets not evaluated with FME)

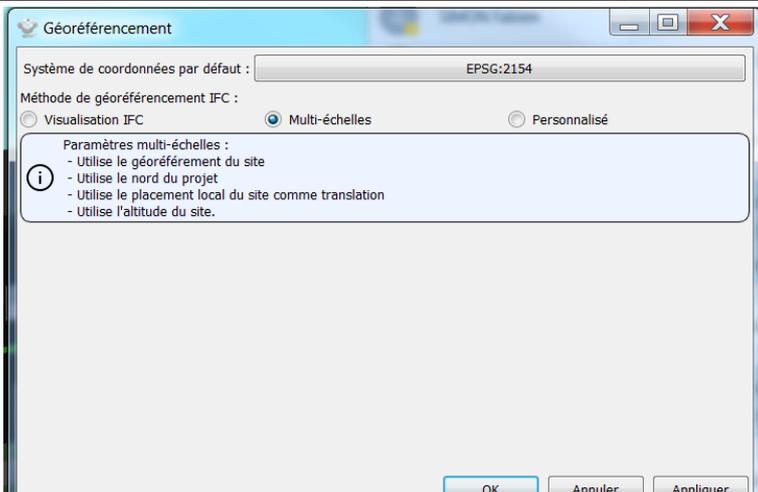
Would you like to share any other comments or observations?

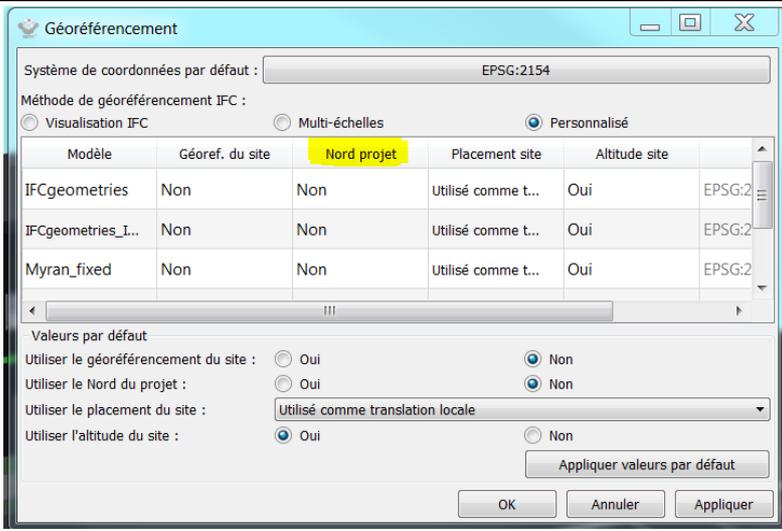
In general, IFC2X3 does not have full CRS support, so that is the main reason the FME IFC reader / writer does not have full CRS support. However, using the approach and conventions above, it is possible to create workflows that transform IFC datasets to be georeferenced using RefLatitude and RefLongitude so that all that is needed is for the user to know the CRS name and then they are able to read the IFC dataset as georeferenced and display it as such or convert directly to other formats which have full CRS support such as CityGML.

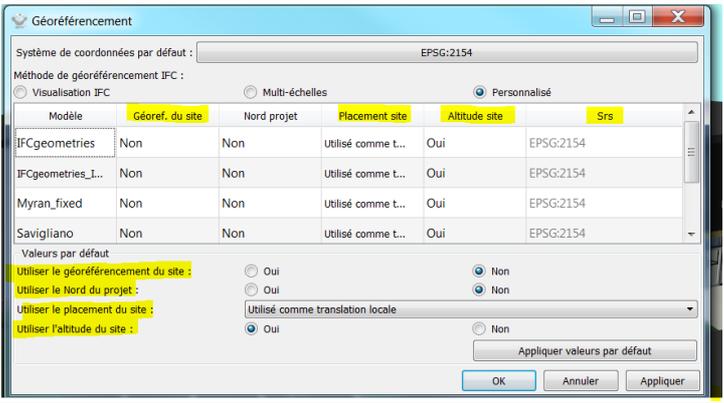
We anticipate that since IFC v4 has inherently better potential to support for CRS, we should be able to improve our CRS support soon. However, we still need to review what conventions are used across the BIM industry to ensure that whatever approach we take for IFC4 is as widely useful as possible.

For more info see: <https://thinkmoult.com/ifc-coordinate-reference-systems-and-revit.html>

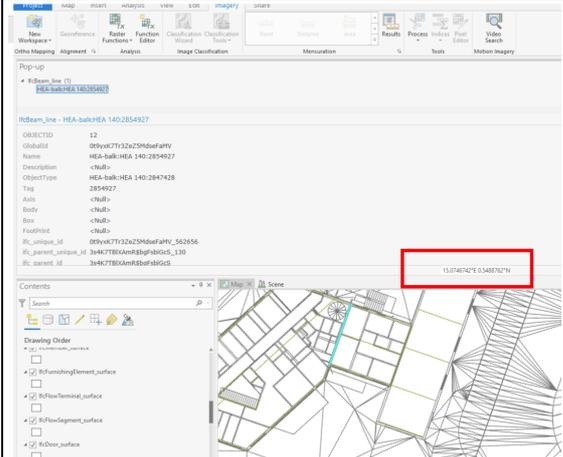
eveBIM 2.10.0.300

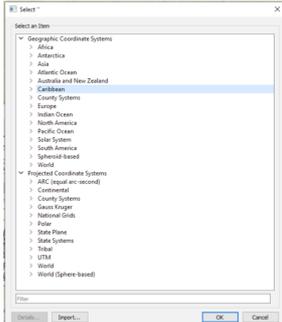
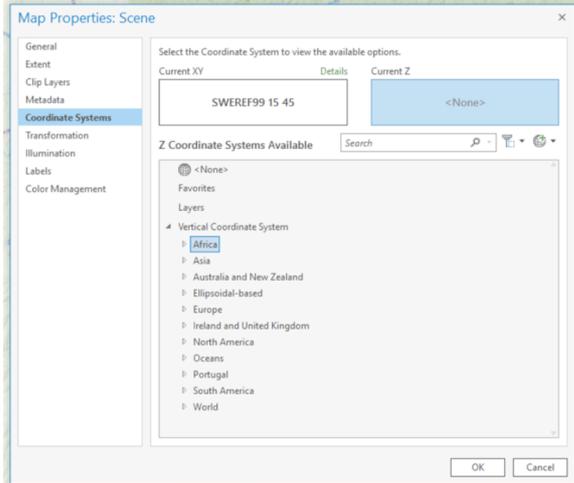
Software	Software Name [version]	eveBIM [2.10.0.300]		developer	CSTB https://logiciels.cstb.fr/contact/?dmd=telechargement&log=eveBIM%20derni%C3%A8re%20version&th=bim-et-maquette-numerique		
	Proprietary or open source software?				Kind of software		
	proprietary				3D viewer		
Computer	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space
	DELL precision 7510 2018	Windows 7 Professionnel 64 bit	Intel Core i7-6820HQ 2.70GHz	NVIDIA Quadro M2000M 4Go GDDR5	16	1000	347
How long does it take, approximately, to:	Zoom into the model to see more detail			it's almost immediate			
	Pan the model			it's almost immediate			
	Rotate the model			it's almost immediate			
	Query an object			it's almost immediate			
	Inspect the objects linked to the queried one through a relationship			it's almost immediate			
	Make a simple analysis			it's almost immediate			
	Please, explain what analysis was made			export all properties of the elements to an excel sheet			
	Make a simple edit			less than a minute			
	Please, explain what edit was made			Add properties to an element (add Description to an IfcStair)			
Georef tools	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?				They are available in the standard version of the software		
	2.2) short comments to the previous question (optional)	lots of possibilities for the georeferencing: 1) use by default the IFC local placement 2) Multi scale using the - site georeferencing - and the true north - and the ifclocalplacement - and the site elevation 3) personalized					
CRS	At what level is the CRS defined?	A project CRS is defined					
	3.2) Can you give a short definition about the object CRS and/or the project CRS are defined and what are their specific features?	EPSG 2154					
	3.3) Attach screenshots						

	3.4) short comments to the previous question (optional)	Possibility to change the default CRS
Georef CRS	What type of georeferenced CRS are available?	<ul style="list-style-type: none"> geographical CRS projected CRS
	4.2) Can you list the supported geographical and/or projected CRS?	EPSG WKT PROJ4 Aliases
Height reference system	5.1) What types of height reference systems are available?	vertical Datum
	5.2) Can you list the supported height reference systems?	Geodetic EGM84 geoid EGM96 geoid EGM2008 geoid
	5.3) Attach screenshots	<ul style="list-style-type: none"> Geodetic - the default; osgEarth uses the Horizontal datum ellipsoid as a reference EGM84 geoid EGM96 geoid - commonly called <i>MSL</i>; used in DTED and KML EGM2008 geoid
Model orientation	6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?	Yes
	6.1.1) What is the workflow needed to correctly perform the operation?	Affichage > Georeferencement > Personnalisé > select to "Nord du projet" YES or NO
	6.1.2) Attach screenshots	
6.2) short comments to the previous question (optional)	choose yes or no to the appropriate line. Possible to select by project the orientation	
Model move	7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?	Yes
	7.1.1) What is the workflow needed to correctly perform the operation?	In the same area possible to select YES or NO for "Georef du site" "placement du site" "altitude du site" "srs"

	7.1.2) Attach screenshots		
	7.2) short comments to the previous question	same location to personalize the georeferencing	
	7.3) Can all the supported coordinate reference systems and projections (cited in the answer to question 3) be used while performing the 'move' operation?		Yes
	7.4) short comments to the previous question (optional)	Possible to move the model in another srs	
After georef, how long does it take, approximately, to:	Zoom into the model to see more detail		it's almost immediate
	Pan the model		it's almost immediate
	Rotate the model		it's almost immediate
	Query an object		it's almost immediate
	Inspect the objects linked to the queried one through a relationship		it's almost immediate
	Make a simple analysis		it's almost immediate
	Make a simple edit		it's almost immediate
Settings	9.1) Are any pre-processing steps or configuration/setting changes needed in the software to enable a correct and consistent export of the georeferenced file?		No
Export	10) How long does it take for the georeferenced model to be exported to IFC?		it's almost immediate

ArcGIS Pro

Software	Software Name		ArcGIS Pro		Software house		ESRI	
	Proprietary or open source software?		Kind of software					
	proprietary		GIS					
Computer	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space	
	Assembled (Motherboard TUF Z390-PRO GAMING) 2018	Windows 10 Pro version 1809	Intel (R) Core (TH) i7-9700K CPU @3.60GHz 3.60GHz	Nvidia Geforce GTX 1660Ti	64 GB	465 GB + 3630 GB	353 GB + 77.9 GB	
How long does it take, approximately, to:	Zoom into the model to see more detail			it's almost immediate				
	Pan the model			it's almost immediate				
	Rotate the model			it's almost immediate				
	Query an object			it's almost immediate				
	Inspect the objects linked to the queried one through a relationship			it's almost immediate				
	Make a simple analysis			it's almost immediate				
	Please, explain what analysis was made			I used Layer 3D to Feature Class analysis which exports features layers with 3D display properties to 3D lines or multipatch features.				
	Make a simple edit			it's almost immediate				
	Please, explain what edit was made			I used to edit the project using "Modify features" with tools as move, rotate, etc..				
Georef tool	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?				They are available in the standard version of the software			
	2.2) short comments to the previous question (optional)		I have the georeference tool but ArcGis didn't allow me to use it on IFC file.					
CRS	3.1) At what levels is the CRS defined?			<ul style="list-style-type: none"> • Each object has its own CRS • A project CRS is defined 				
	3.2) Can you give a short definition about the object CRS and/or the project CRS are defined and what are their specific features?			Even if the project was upload with the correct CRS, ArcGIS pro did not positioned it in the right place. So all the coordinates, even if are shown for each feature, are not correct.				
3.3) Attach screenshots								

	<p>What types of georeferenced CRS are available?</p>	<ul style="list-style-type: none"> geographical CRS projected CRS
	<p>4.2) Can you list the supported geographical and/or projected CRS?</p>	<p>Geographical CRS: Africa, Antartica, Asia, Atlantic Ocean, Australia and New Zealand, Caribbean, County Systems, Europe, Indian Ocean, North America, Pacific Ocean, Solar system, South America, spheroid based, World</p> <p>Projected CRS: ARC (equal Arc - second), Continental, County Systems, Gauss Kruger, National Grids, Polar, State Plane, State Systems, Tribal, UTM, World, World (Sphere - based).</p>
	<p>4.3) Attach screenshots</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Height reference system</p>	<p>5.1) What types of height reference systems are available?</p>	<p>Vertical Coordinate System</p>
	<p>5.2) Can you list the supported height reference systems?</p>	<p>Vertical CS including: Africa Asia Australia and New Zealand Ellipsoidal - based Europe Ireland an UK North America Oceans Portugal South America World</p>
	<p>5.3) Attach screenshots</p>	
<p>Model orientation</p>	<p>6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?</p>	<p>No</p>
<p>Model move</p>	<p>7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?</p>	<p>No</p>

	7.3) Can all the supported coordinate reference systems and projections (cited in the answer to question 3) be used while performing the 'move' operation?	No
	7.3.1) Which ones can be used for this task?	I couldn't georeferenced the file.
After georef,	Zoom into the model to see more detail	the software does not allow this
	Pan the model	the software does not allow this
	Rotate the model	the software does not allow this
	Query an object	the software does not allow this
	Inspect the objects linked to the queried one through a relationship	the software does not allow this
	Make a simple analysis	the software does not allow this
	Make a simple edit	the software does not allow this
Settings	9.1) Are any pre-processing steps or configuration/setting changes needed in the software to enable a correct and consistent export of the georeferenced file?	No
	9.2) short comments to the previous question (optional)	I couldn't georeferenced the file. So, I couldn't export an IFC file.

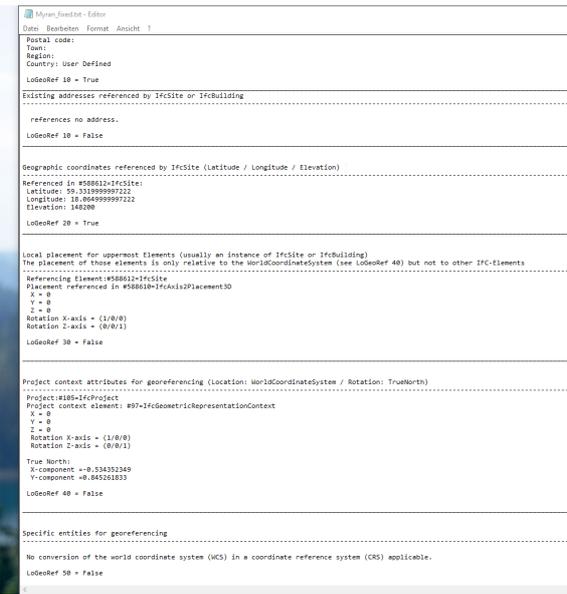
IfcGeoRefChecker 0.3.2.2 – Windows 10 Enterprise

Open source

Georef IFC Extractor

4 - Developer of the tested software

IfcGeoRefChecker 0.3.2.2

Software	Software Name [version]	IfcGeoRefChecker [0.3.2.2]		developer	Dresden, University of Applied Sciences / https://github.com/dd-bim/IfcGeoRef/releases		
	Proprietary or open source software?			Kind of software			
	open source			Georef IFC Extractor			
Computer	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space
	LENOVO T480s, 2018	Windows 10, Enterprise	Intel i5-8250U	Intel UHD Graphics 620	8	475	200
Before georeferencing, how long does it take, approximately, to:	Zoom into the model to see more detail				the software does not allow this		
	Pan the model				the software does not allow this		
	Rotate the model				the software does not allow this		
	Query an object				the software does not allow this		
	Inspect the objects linked to the queried one through a relationship				the software does not allow this		
	Make a simple analysis				the software does not allow this		
	Make a simple edit				the software does not allow this		
Georef tools	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?		They are available in the standard version of the software				
			Tool reads existent Georef information out of the IFC file				
	3.3) Attach screenshots see screenshot of protocol		 <pre> Muran_FixDate - Editor Date: 2020-01-10 10:10:10 Tool: Region: Country: User Defined LoGeoRef 10 = True Existing addresses referenced by IfcSite or IfcBuilding ----- references no address. LoGeoRef 10 = False Geographic coordinates referenced by IfcSite (Latitude / Longitude / Elevation) ----- Referenced in #588612=IfcSite Latitude: 59.3319999997222 Longitude: 18.0669999997222 Elevation: 140200 LoGeoRef 20 = True Local placement for uppermost Elements (usually an Instance of IfcSite or IfcBuilding) The placement of those elements is only relative to the WorldCoordinateSystem (see LoGeoRef 40) but not to other IFC-Elements ----- Referencing Element #588612=IfcSite Placement referenced in #588612=IfcAxis2Placement3D X = 0 Y = 0 Z = 0 Rotation X-axis = (1/0/0) Rotation Z-axis = (0/0/1) LoGeoRef 30 = False Project context attributes for georeferencing (Location: WorldCoordinateSystem / Rotation: TrueNorth) ----- Project #100=IfcProject Project context element: #97=IfcGeometricRepresentationContext X = 0 Y = 0 Z = 0 Rotation X-axis = (1/0/0) Rotation Z-axis = (0/0/1) True North: X-component = -0.534352349 Y-component = 0.845261833 LoGeoRef 40 = False Specific entities for georeferencing ----- No conversion of the world coordinate system (WCS) in a coordinate reference system (CRS) applicable. LoGeoRef 50 = False </pre>				
CRS	At what level the CRS is defined?		<ul style="list-style-type: none"> • only local CRS • geographical CRS • projected CRS 				

IfcGeoRefChecker 0.3.2.2 – Windows 10 Enterprise

Open source

Georef IFC Extractor

4 - Developer of the tested software

	4.2) Can you list the supported geographical and/or projected CRS?	geographical: WGS84_LatLon / projected: user-defined	
Height reference system	5.1) What types of height reference systems are available?	user-defined	
Model orientation	6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?	Yes	
	6.1.1) What is the workflow needed to correctly perform the operation?	<ul style="list-style-type: none"> -Update GeoRef ...via browser map (the building contour will be calculated) -save JSON with contour -load JSON with contour in the opened Building Locator -follow the steps -use rotate functionality to rotate the building around the base point -save the updated JSON -switch back to Checker window -open "Export Updates to IFC" -select wished Export option -export IFC 	
Model move	7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?	Yes	
	7.1.1) What is the workflow needed to correctly perform the operation?	<ul style="list-style-type: none"> -same workflow - or manual update for IFC attributes via --Update GeoRef -> ...via manual setup 	
	7.3) Can all the supported coordinate reference systems and projections (cited in the answer to question 3) be used while performing the 'move' operation?	Yes	
Export settings	9.1) Are any pre-processing steps or configuration/setting changes needed in the software to enable a correct and consistent export of the georeferenced file?	Yes	
	9.1.1) Can you add a short description of the steps involved in the pre-processing?	choose the wished georef for the IFC file (regarding LoGeoRef level, e.g. MapConversion, SitePlacement, ...)	
Export	10) How long does it take for the georeferenced model to be exported to IFC?	less than a minute	

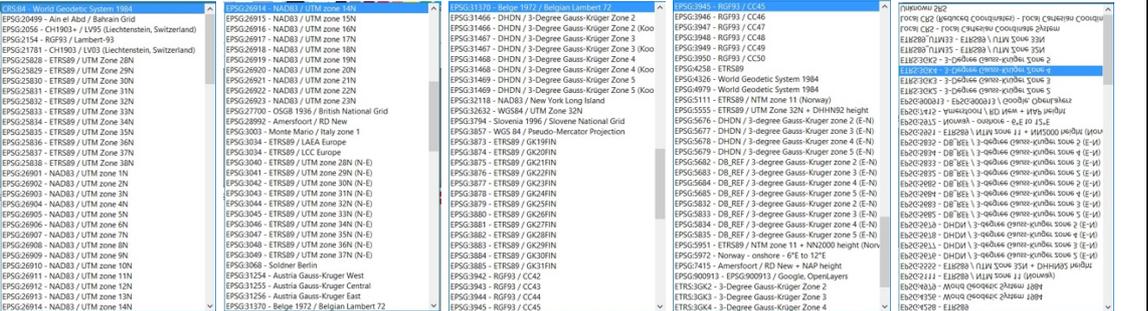
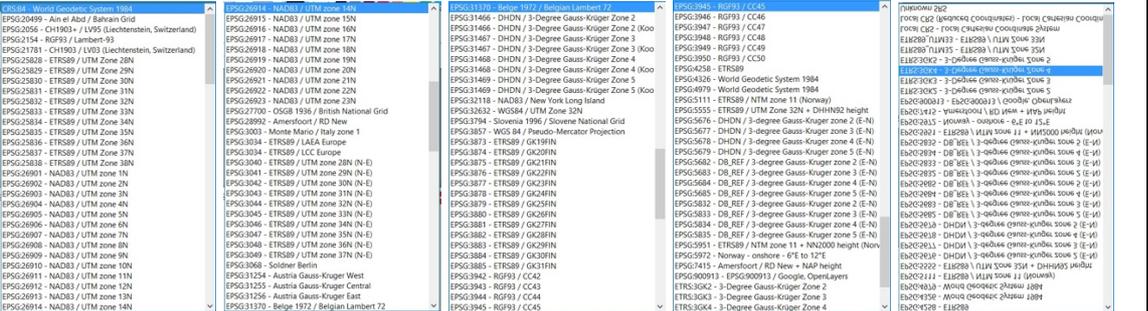
FZKViewer V 5.1 – Windows 10 Pro

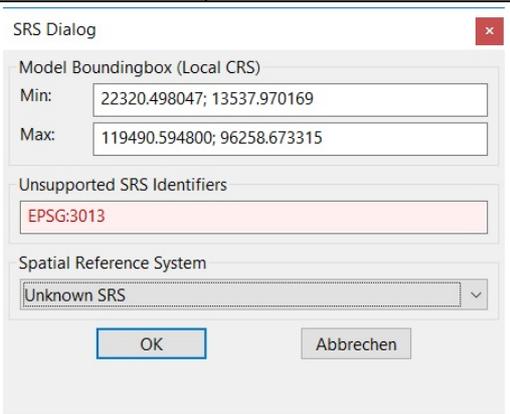
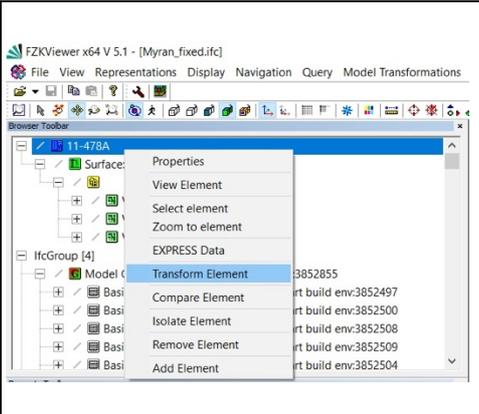
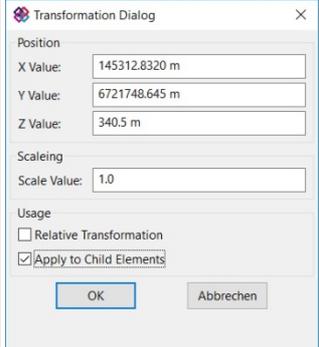
Proprietary

3D viewer

Level of tester expertise: 1 - Very beginner user (it is nearly the first time you use the software)

FZKViewer V 5.1

Software	Software Name [version]	FZKViewer [x64 V 5.1]			developer	Karlsruhe Institute for Technology. Institute for Automation and Applied Informatics		
	Proprietary or open source software?					Kind of software		
	proprietary					3D viewer		
Computer	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space	
	HP ZBook Studio G3, 2015	Windows 10 Pro	Intel(R) Core(TM) i7-6700HQ CPU@2.60GH z 2.59GHz	NVIDIA Quadro M1000M	32 GB	218 GB	30,6 GB	
How long does it take, approximately, to:	Zoom into the model to see more detail	less than a minute						
	Pan the model	less than a minute						
	Rotate the model	1-5 minutes						
	Query an object	less than a minute						
	Inspect the objects linked to the queried one through a relationship	it's almost immediate						
	Make a simple edit	the software does not allow this						
Georeferencing tools	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?	They are available in the standard version of the software						
	2.2) short comments to the previous question (optional)	We have used Myran_fixed. It is necessary to choose a CRS when the model is imported. By default shows "Local CRS – Local Cartesian Coordinate System" but we change it to "Unknown SRS" because the CRS EPSG:3013 is not available. The Local Placement position for the ifcProject is (0,0,0). To measure the SW performance we consider only when it works. Frequently it is not responding.						
CRS	Kind of CRS managed	projected CRS						
	4.2) Can you list the supported geographical and/or projected CRS?	Screenshots: 0_Open_parameters_SRS_1.JPG 0_Open_parameters_SRS_2.JPG 0_Open_parameters_SRS_3.JPG 0_Open_parameters_SRS_4.JPG 0_Open_parameters_SRS_5.JPG						
	4.3) Attach screenshots							
	Open parameters							

	4.4) short comments to the previous question (optional)	It is not available the CRS EPSG::3013 SWEREF 99 15 45, RH2000.	
Height reference system	5.1) What types of height reference systems are available?	It is not possible to choose any 'world' height reference system.	
Model orientation	6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?	No	
Model move	7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?	Yes	
	7.1.1) What is the workflow needed to correctly perform the operation?	We load the model changing the Spatial Reference System to "Unknown SRS" (screenshot 2_Open_parameters.JPG). At the Browser toolbar we select the ifcProject and choose the right mouse option "Transform element" (screenshot 8_TransformElement.jpg). We enter the new coordinates at the dialog (screenshot 9_TransformElement_parameters.jpg)	
	7.1.2) Attach screenshots Open parameters		
	Transform elements - parameters		
	7.4) short comments to the previous question (optional)	We did not find any option to change the CRS while performing the 'move' operation.	
How long does it take,	Zoom into the model to see more detail	less than a minute	
	Pan the model	less than a minute	
	Rotate the model	less than a minute	
	Query an object	less than a minute	
	Inspect the objects linked to the queried one through a relationship	it's almost immediate	

FZKViewer V 5.1 – Windows 10 Pro

Proprietary

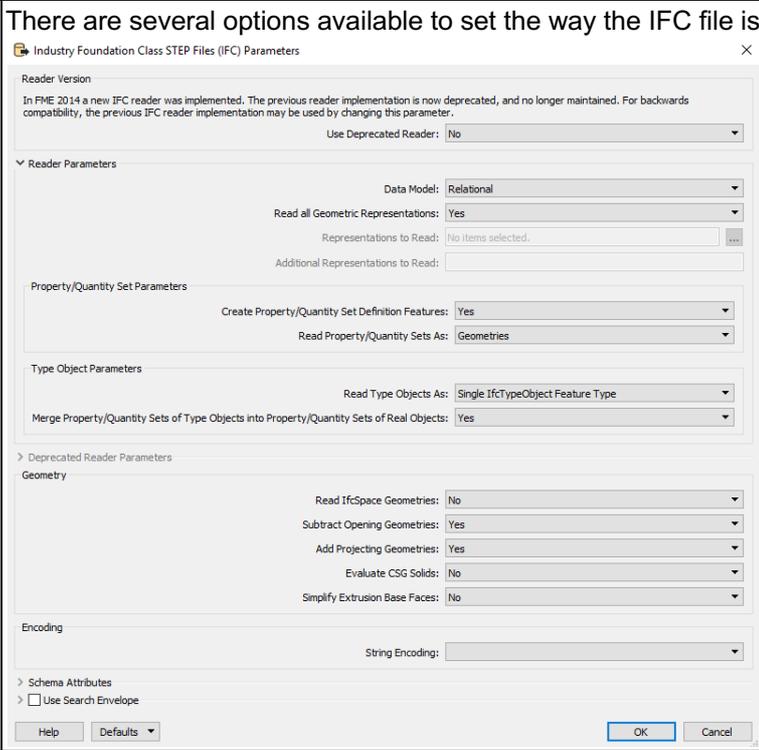
3D viewer

Level of tester expertise: 1 - Very beginner user (it is nearly the first time you use the software)

Export settings	9.1) Are any pre-processing steps or configuration/setting changes needed in the software to enable a correct and consistent export of the georeferenced file?		Yes
	9.1.1) Can you add a short description of the steps involved in the pre-processing?	Selection of export parameters, for the IFC2x3 and for IFC4 (10_ExportIFC_parameters_IFC2x3.jpg, 11_ExportIFC_parameters_IFC4.jpg).	
	10) How long does it take for the georeferenced model to be exported to IFC?	less than a minute	

FME Desktop 2018.1

	Software Name	FME Desktop 2018.1			Software house	Safe Software	
	Proprietary or open source software?				Kind of software		
	proprietary				Extract/Transform/Load		
	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space
	2018	Windows 10 Enterprise	Intel Core i7-8700 BOX (Coffee Lake)	GeForce GTX 1060 6GB Asus TURBO-GTX1060-6G	32	500	270
georeferencing, how long does it take, approximately	Zoom into the model to see more detail					less than a minute	
	Pan the model					it's almost immediate	
	Rotate the model					it's almost immediate	
	Query an object					it's almost immediate	
	Inspect the objects linked to the queried one through a relationship					it's almost immediate	
Georef tools	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?				They are available in the standard version of the software		
	Used FME workspaces		https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/FME_script/UpTown_georeference.fmw https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/FME_script/Myran_georeference.fmw https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/FME_script/Savigliano_georeference.fmw				
CRS	At what level the CRS is defined		<ul style="list-style-type: none"> Each object has its own CRS A project CRS is defined 				
	3.2) Can you give a short definition about the object CRS and/or the project CRS are defined and what are their specific features?		<p>The CRS that is assigned is:</p> <pre>PROJCS["IFC_COORDSYS_0", GEOGCS["WGS 84", DATUM["WGS_1984", SPHEROID["World Geodetic System of 1984, GEM 10C",6378137,298.257223563, AUTHORITY["EPSG","7030"]], AUTHORITY["EPSG","6326"]], PRIMEM["Greenwich",0], UNIT["degree",0.0174532925199433], AUTHORITY["EPSG","4326"]], PROJECTION["Azimuthal_Equidistant"], PARAMETER["latitude_of_center",59.33199999972223], PARAMETER["longitude_of_center",18.06499999972222], PARAMETER["false_easting",0], PARAMETER["false_northing",0], UNIT["MILLIMETER",0.001]]</pre>				
	What types of georeferenced CRS are available?		<ul style="list-style-type: none"> geographical CRS projected CRS 				
	4.2) Can you list the supported geographical and/or projected CRS?		https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Workbench/CoordSys/coord_sys_about.htm				

Height reference systems	5.1) What types of height reference systems are available?	Height reference systems are not explicitly supported	
	5.2) Can you list the supported height reference systems?	An EGM96 geoid grid is available to convert between WGS84 ellipsoid heights and tide-free EGM96/WGS84 orthometric heights, anywhere in the world. GEOID96/99/03 grids convert between NAD83 ellipsoid heights and NAVD88 orthometric heights in the United States. VERTCON converts between NGVD29 (a legacy vertical datum) and NAVD88 orthometric heights, also in the United States.	
Model orientation	6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?		Yes
	6.1.1) What is the workflow needed to correctly perform the operation?		Transform data using Rotator transformer
Move models	7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?		Yes
	7.1.1) What is the workflow needed to correctly perform the operation?		Transform data using Offsetter transformer
	7.3) Can all the supported coordinate reference systems and projections (cited in the answer to question 3) be used while performing the 'move' operation?		Yes
georeferencing, How long does it take, approximately	Zoom into the model to see more detail	it's almost immediate	
	Pan the model	it's almost immediate	
	Rotate the model	it's almost immediate	
	Query an object	less than a minute	
	Inspect the objects linked to the queried one through a relationship	it's almost immediate	
Export settings	9.1) Are any pre-processing steps or configuration/setting changes needed in the software to enable a correct and consistent export of the georeferenced file?		Yes
	9.1.1) Can you add a short description of the steps involved in the pre-processing?	<p>There are several options available to set the way the IFC file is read.</p> 	
10) How long does it take for the georeferenced model to be exported to IFC?		1-5 minutes	

Autodesk Revit 2020.0.0.377 – Windows 10 Pro

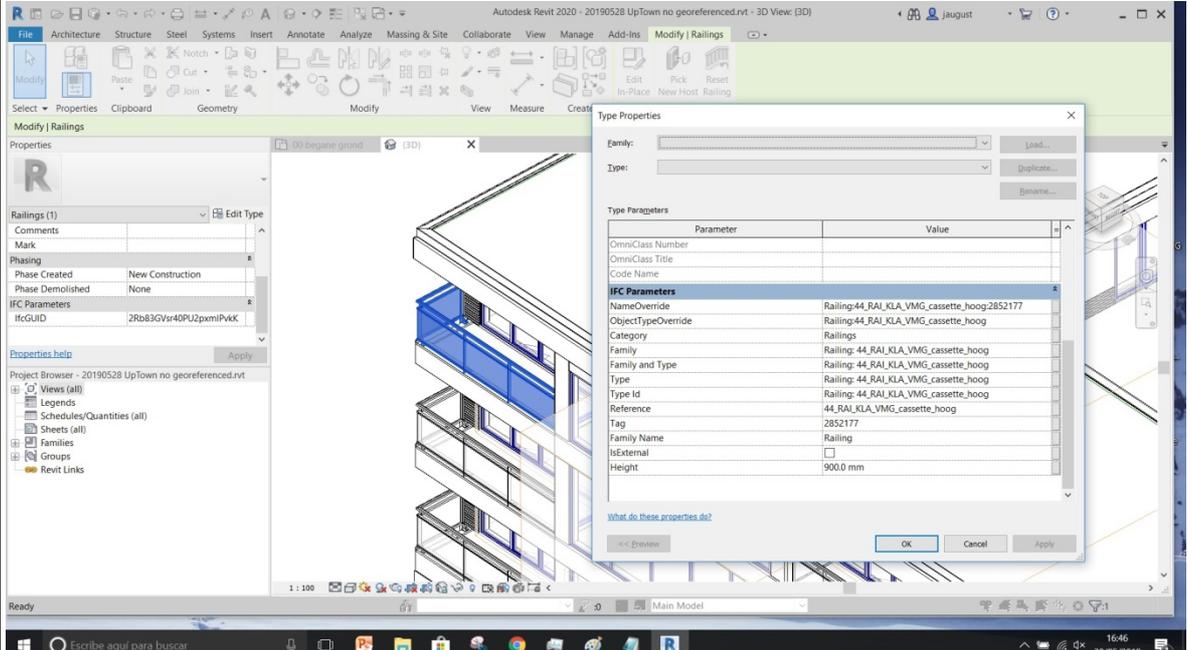
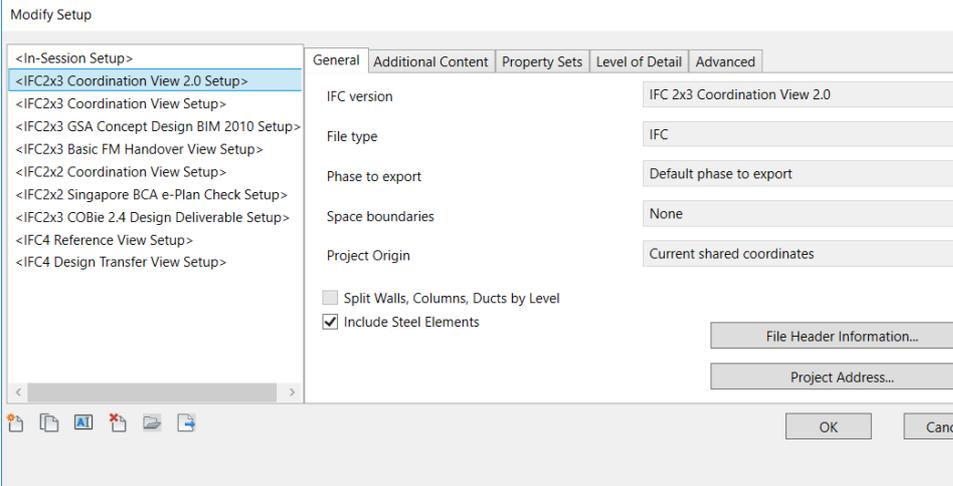
Proprietary

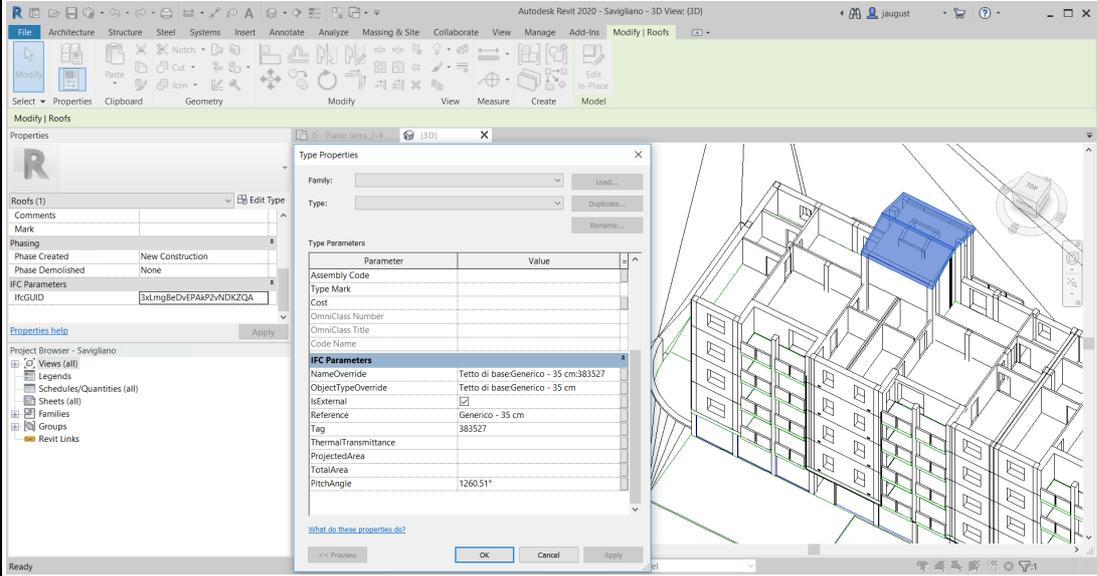
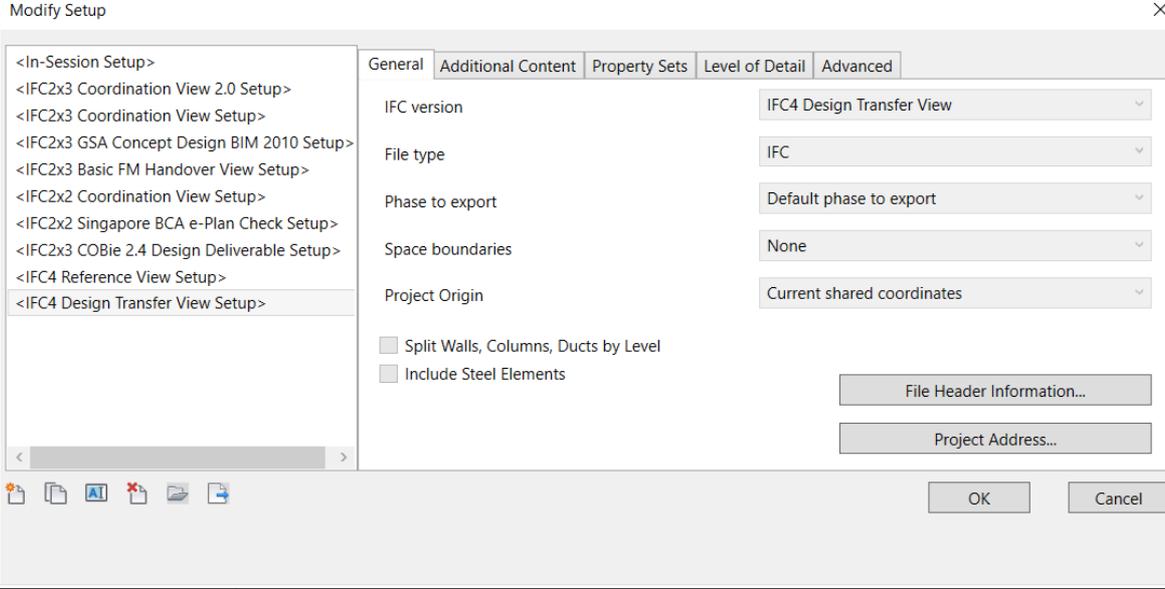
BIM

1 - Very beginner user (it is nearly the first time he/she use the software)

Autodesk Revit 2020.0.0.377

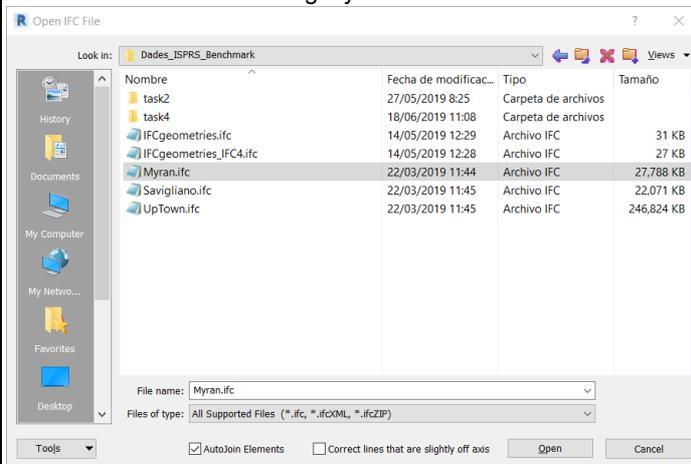
Software	Software Name		Revit [2020.0.0.377 (20190327_2315(x64))]		Software house		Autodesk		
	Proprietary or open source software?				Kind of software				
proprietary				BIM					
Computer	Model and year	Operating system and version	CPU	GPU	Memory (RAM)	Hard drive capacity	Hard drive free space		
	HP ZBook Studio G3, 2015	Windows 10 Pro	Intel(R) Core(TM) i7-6700HQ CPU@2.60GH z 2.59GHz	NVIDIA Quadro M1000M	32 GB	218 GB	25 GB		
Test with Myran.ifc									
Before georeferencing, how long does it take, approximately,	Zoom into the model to see more detail		it's almost immediate						
	Pan the model		it's almost immediate						
	Rotate the model		it's almost immediate						
	Query an object		it's almost immediate						
	Make a simple edit		it's almost immediate						
	Please, explain what edit was made		Delete window F18.02 and delete related wall openings.						
Georeferencing tool	2.1) Are georeferencing tools available in the standard version of the software or are specific extensions or plugins required?				They are available in the standard version of the software				
	2.2) short comments to the previous question (optional)				The imported file in Revit has the Project Base Point = (0,0,148) and the Survey Point = (0,0,0).				
Model orientation	6.1) As part of the georeferencing process, does the software allow the user to rotate the model in order to set the correct orientation towards cartographic North?						Yes		
	6.1.1) What is the workflow needed to correctly perform the operation?		From 3D View, in TOP orientation, with Properties/Phasing/Phase Filter=None we visualize the Site/Project Base Point in Properties/Graphics/Visibility Graphics Overrides. Then modify the Angle to True North of the Project Base Point.						
Model move	7.1) As part of the georeferencing process, does the software allow the user to move the model to the correct 'world' coordinates?					Yes			
	7.1.1) What is the workflow needed to correctly perform the operation?				Modify N/S and E/W of the Project Base Point.				
After georeferencing, how long does it take, approximately,	Zoom into the model to see more detail			it's almost immediate					
	Pan the model			it's almost immediate					
	Rotate the model			it's almost immediate					
	Make a simple edit			it's almost immediate					
10) How long does it take for the georeferenced model to be exported to IFC?				less than a minute					
Test with UpTown.ifc									
How long does it take, approximately,	Zoom into the model to see more detail		it's almost immediate						
	Pan the model		it's almost immediate						
	Rotate the model		it's almost immediate						
	Query an object		it's almost immediate						

<p>Make a simple edit</p>	<p>it's almost immediate</p>	
<p>Please, explain what edit was made</p>	<p>Delete one element: Railing:44_RAI_KLA_VMG_cassette_hoog:2852177.</p> 	
<p>After georeferencing, how long does it take, approximately, to:</p>	<p>Zoom into the model to see more detail</p>	<p>it's almost immediate</p>
	<p>Pan the model</p>	<p>it's almost immediate</p>
	<p>Rotate the model</p>	<p>it's almost immediate</p>
	<p>Query an object</p>	<p>It's almost immediate</p>
	<p>Make a simple edit</p>	<p>it's almost immediate</p>
<p>9.1.1) Can you add a short description of the steps involved in the pre-processing?</p>	<p>Selection of <IFC2x3 Coordination View 2.0 Setup> and default parameters.</p> 	
<p>10) How long does it take for the georeferenced model to be exported to IFC?</p>	<p>20 minutes – 1 hour (41 minutes)</p>	
<p>Test with Savigliano.ifc</p>		
<p>long does it</p>	<p>Zoom into the model to see more detail</p>	<p>it's almost immediate</p>
<p>Pan the model</p>	<p>it's almost immediate</p>	
<p>Rotate the model</p>	<p>it's almost immediate</p>	
<p>Query an object</p>	<p>it's almost immediate</p>	

	<p>Make a simple edit</p>	<p>it's almost immediate</p> <p>Delete one element: Roof:IfcGUID 3xLmgBeDvEPAkP2vNDKZQA.</p> 
<p>long does</p>	<p>Zoom into the model to see more detail</p>	<p>it's almost immediate</p>
	<p>Pan the model</p>	<p>it's almost immediate</p>
	<p>Rotate the model</p>	<p>it's almost immediate</p>
	<p>Query an object</p>	<p>It's almost immediate</p>
	<p>Make a simple edit</p>	<p>it's almost immediate</p>
<p>9.1.1) Can you add a short description of the steps involved in the pre-processing?</p>	<p>Modify Setup</p> <ul style="list-style-type: none"> <In-Session Setup> <IFC2x3 Coordination View 2.0 Setup> <IFC2x3 Coordination View Setup> <IFC2x3 GSA Concept Design BIM 2010 Setup> <IFC2x3 Basic FM Handover View Setup> <IFC2x2 Coordination View Setup> <IFC2x2 Singapore BCA e-Plan Check Setup> <IFC2x3 COBie 2.4 Design Deliverable Setup> <IFC4 Reference View Setup> <IFC4 Design Transfer View Setup> 	
<p>10) How long does it take for the georeferenced model to be exported to IFC?</p>	<p>Less than a minute.</p>	<p>Finalization</p>

14) Would you like to share any other comments or observations?

1. Import Myran.ifc into Revit takes 3 minutes and 45 seconds, with the options AutoJoin Elements=ON and Correct lines that are slightly off axis=OFF.



2. Import Myran.ifc into Revit with the same options gives errors. See

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527 Myran.ifc.log](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527_Myran.ifc.log)

and error reports:

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527 Myran_Error_Report_1.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527_Myran_Error_Report_1.html)

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527 Myran_Error_Report_2.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527_Myran_Error_Report_2.html) ,

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527 Myran_Error_Report_3.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190527_Myran_Error_Report_3.html)

3. Import UpTown.ifc into Revit takes 4 hours and 27 minutes, with the options AutoJoin Elements=ON and Correct lines that are slightly off axis=OFF.

4. Import UpTown.ifc into Revit with the same options gives errors. See the attached log

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528 UpTown.ifc.log](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528_UpTown.ifc.log)

and error reports:

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528 UpTown_Error_Report_1.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528_UpTown_Error_Report_1.html)

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528 UpTown_Error_Report_2.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528_UpTown_Error_Report_2.html)

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528 UpTown_Error_Report_3.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528_UpTown_Error_Report_3.html)

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528 UpTown_Error_Report_4.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528_UpTown_Error_Report_4.html)

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528 UpTown_Error_Report_5.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190528_UpTown_Error_Report_5.html)

5. Import Savigliano.ifc into Revit takes 4 minutes, with the options AutoJoin Elements=ON and Correct lines that are slightly off axis=OFF.

6. Import Savigliano.ifc into Revit with the same options gives errors. See the attached log

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190717 Savigliano.ifc.log](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190717_Savigliano.ifc.log)

and error reports:

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190717 Savigliano_Error_Report_1.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190717_Savigliano_Error_Report_1.html)

and

[https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190717 Savigliano_Error_Report_2.html](https://3d.bk.tudelft.nl/projects/geobim-benchmark/linkedfiles/T2/20190717_Savigliano_Error_Report_2.html)

7. Import Savigliano.ifc into Revit. It seems that some roofs cannot be visualized (for example, IfcGUID=2W3r2Zrw12RQ5NDhqzMP_).