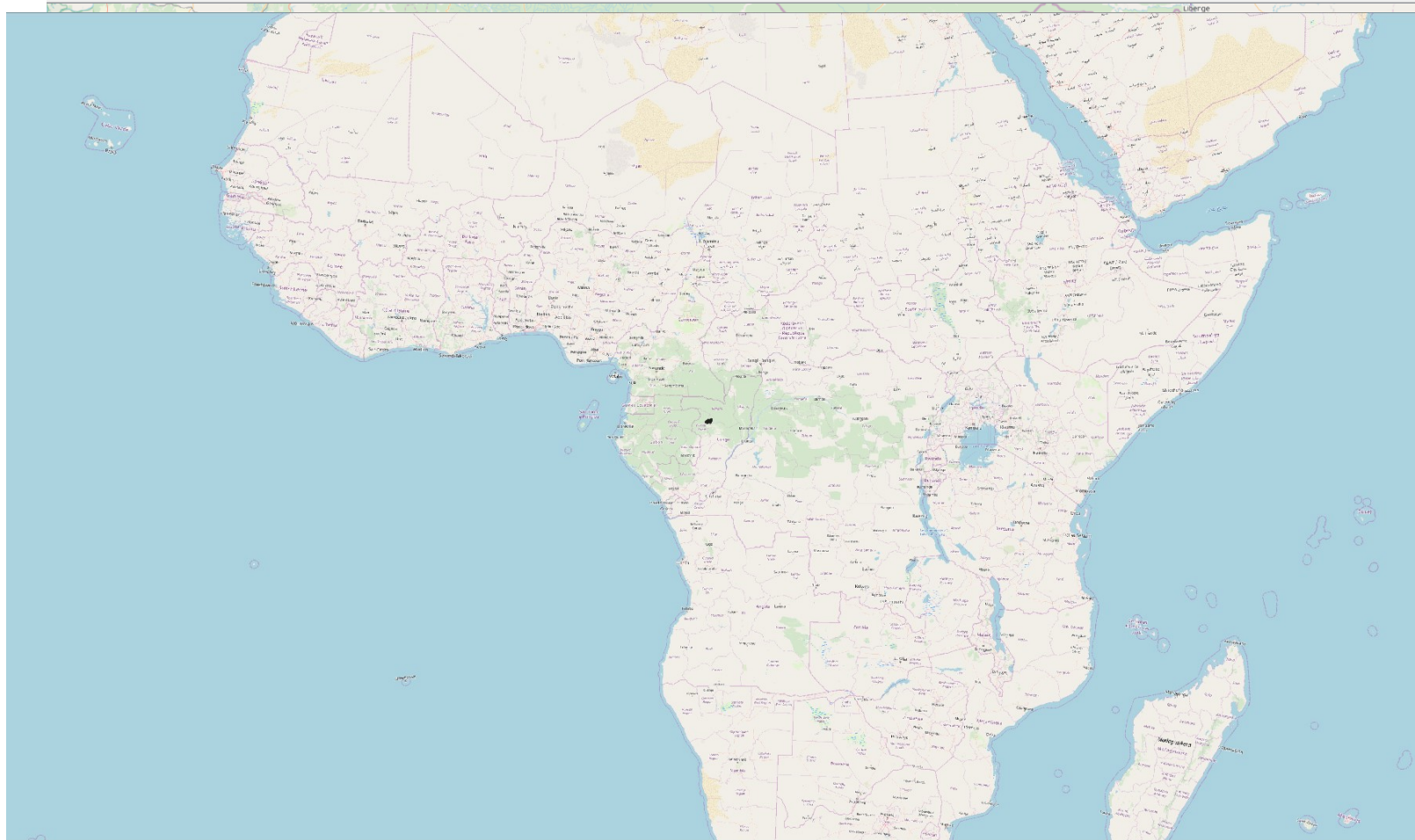


Georeferencing BIM – a Worked Example

GeoBIM Benchmark Workshop

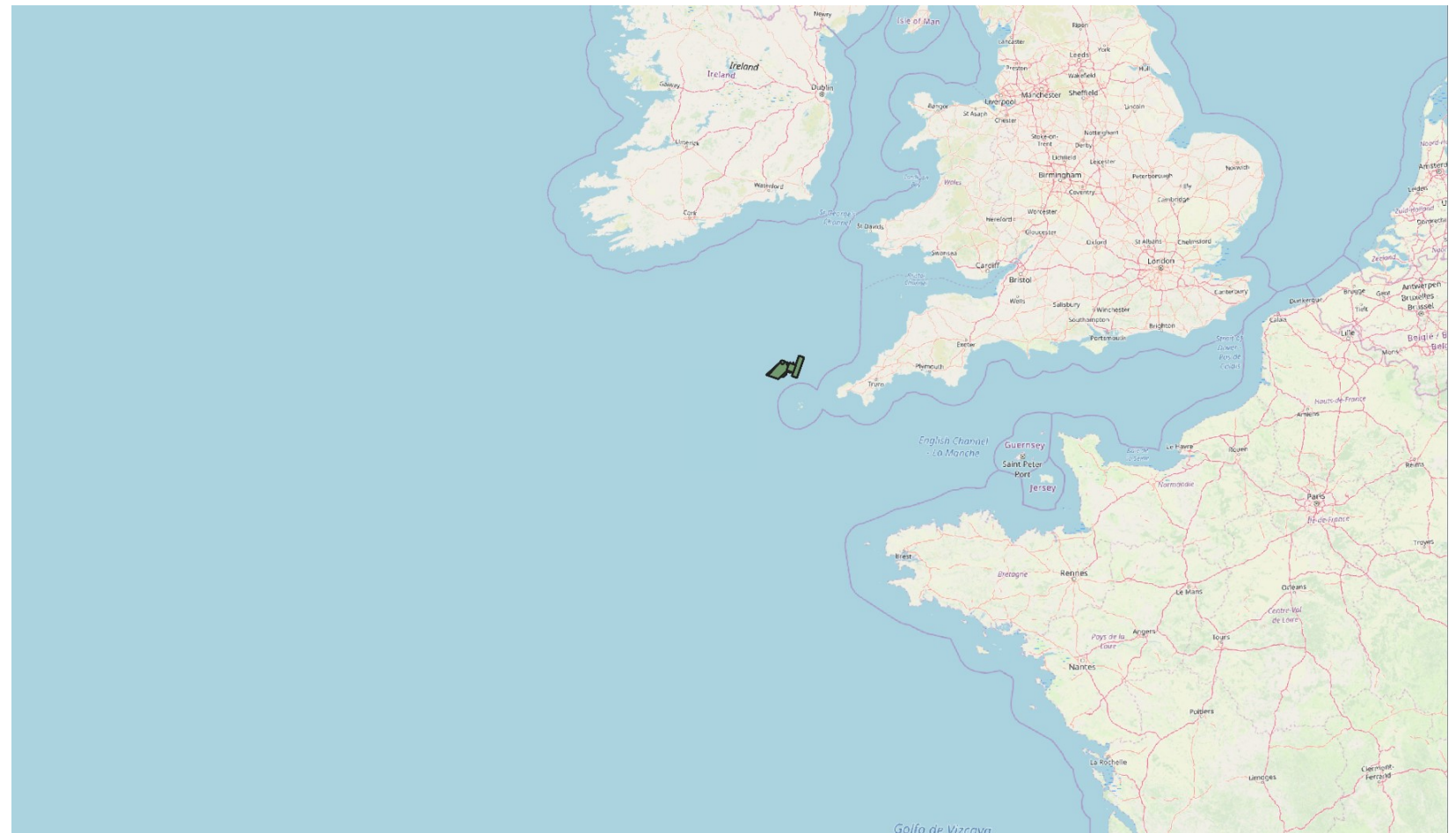
Dr Claire Ellul c.ellul@ucl.ac.uk

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"]]

```

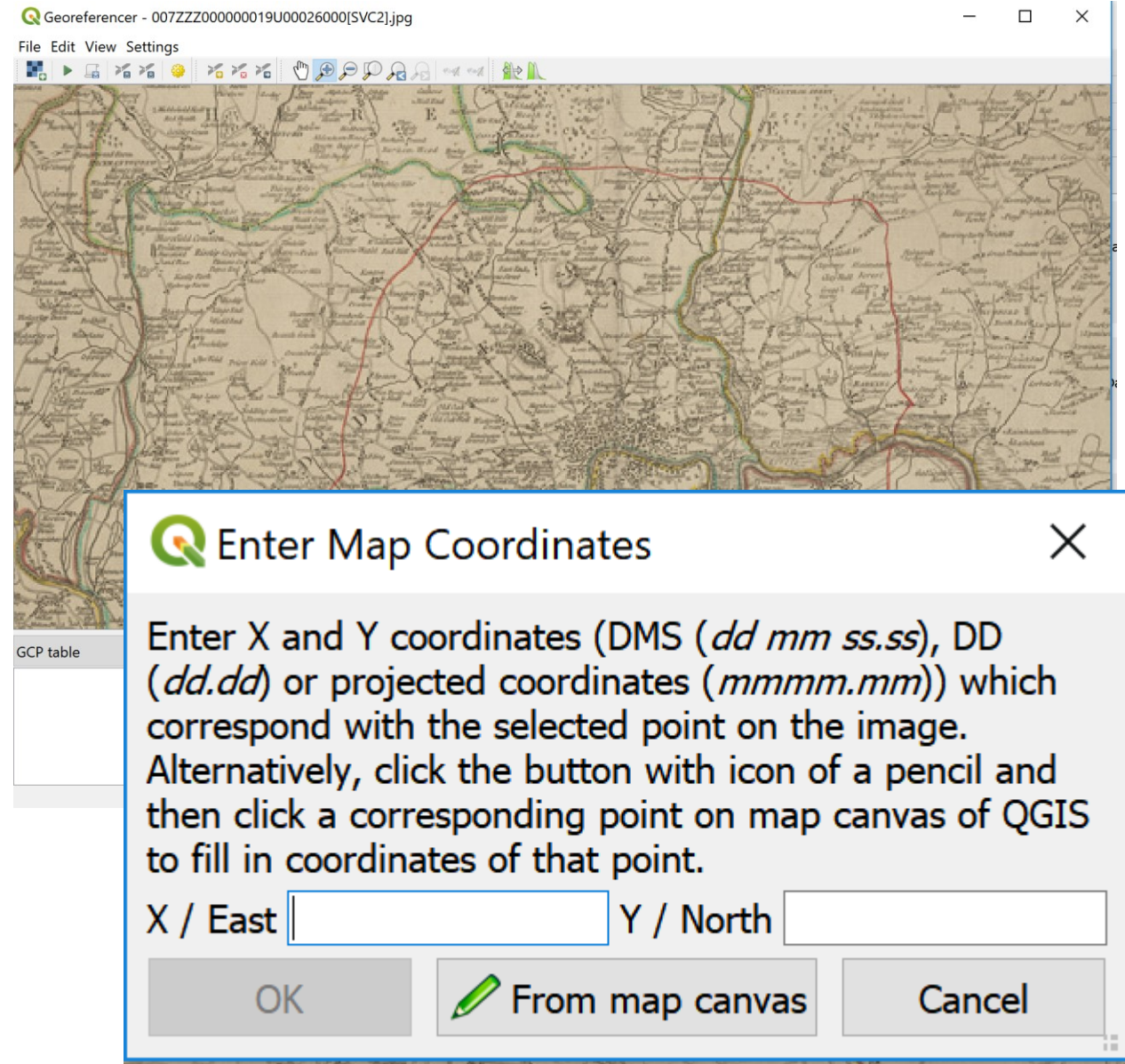
```

PROJCS["SWEREF99 15 45",
  GEOGCS["SWEREF99",
    DATUM["SWEREF99",
      SPHEROID["GRS 1980",6378137,298.257222101,
        AUTHORITY["EPSG","7019"]],
      TOWGS84[0,0,0,0,0,0],
      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"]]

```

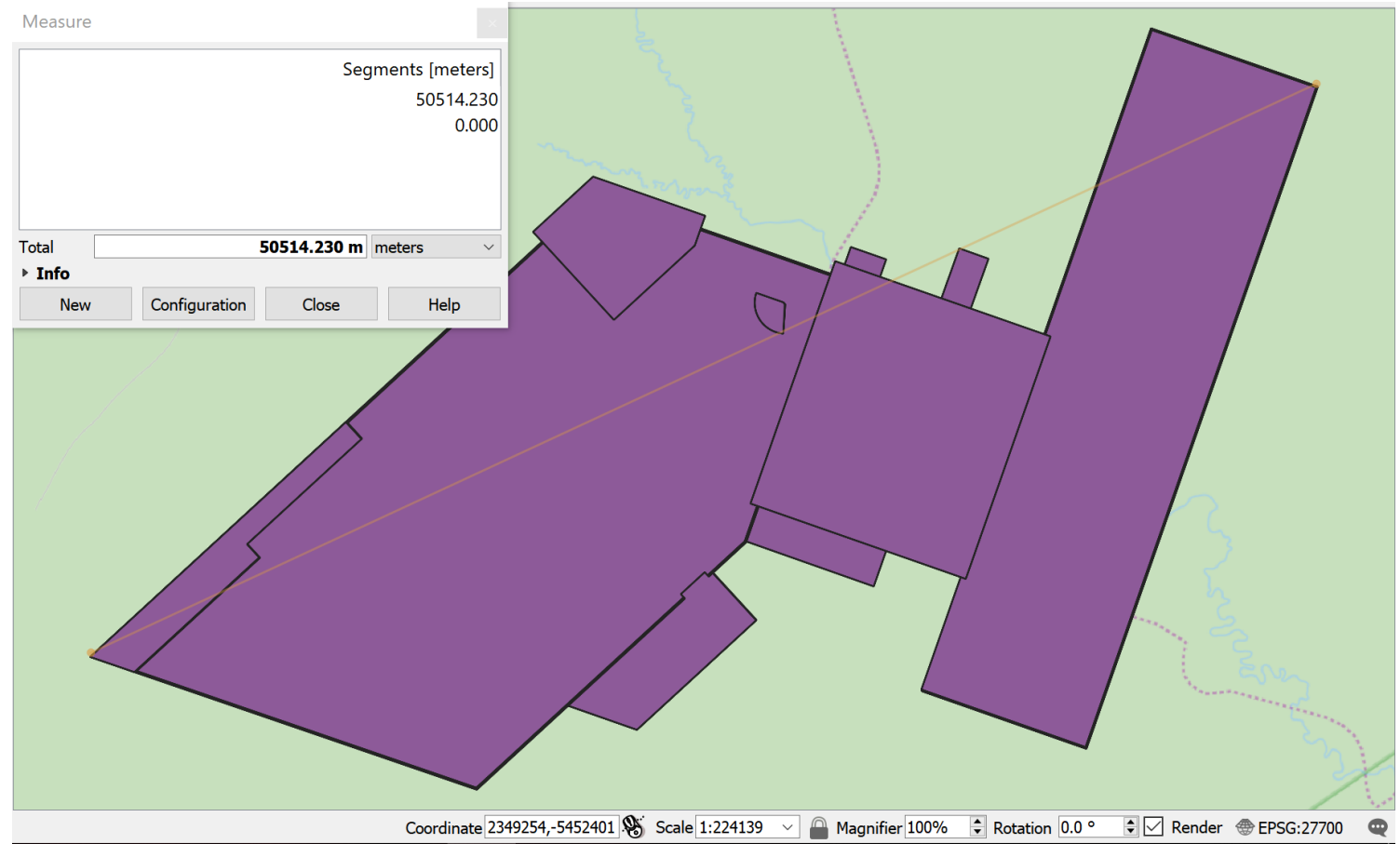
Once Upon a Time ..

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



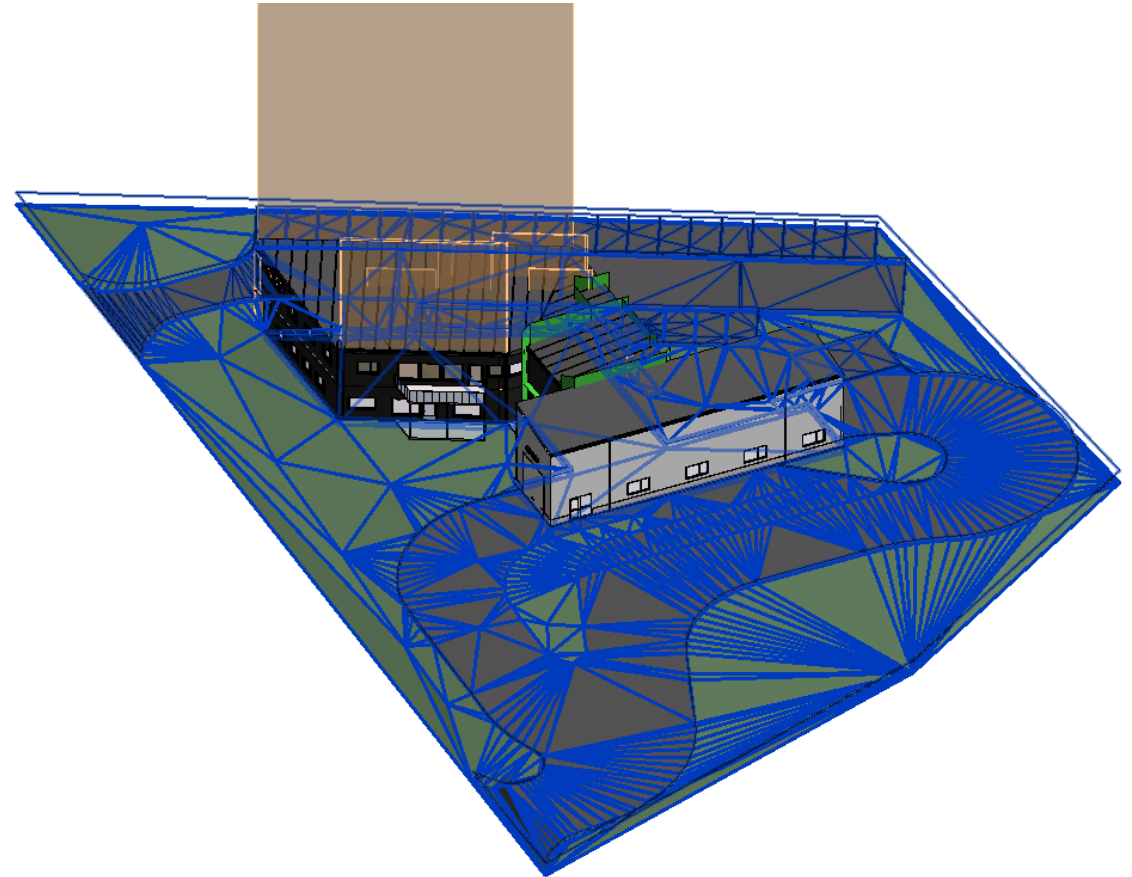
In BIM – Myran Data IFC to Shapefile

- 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)

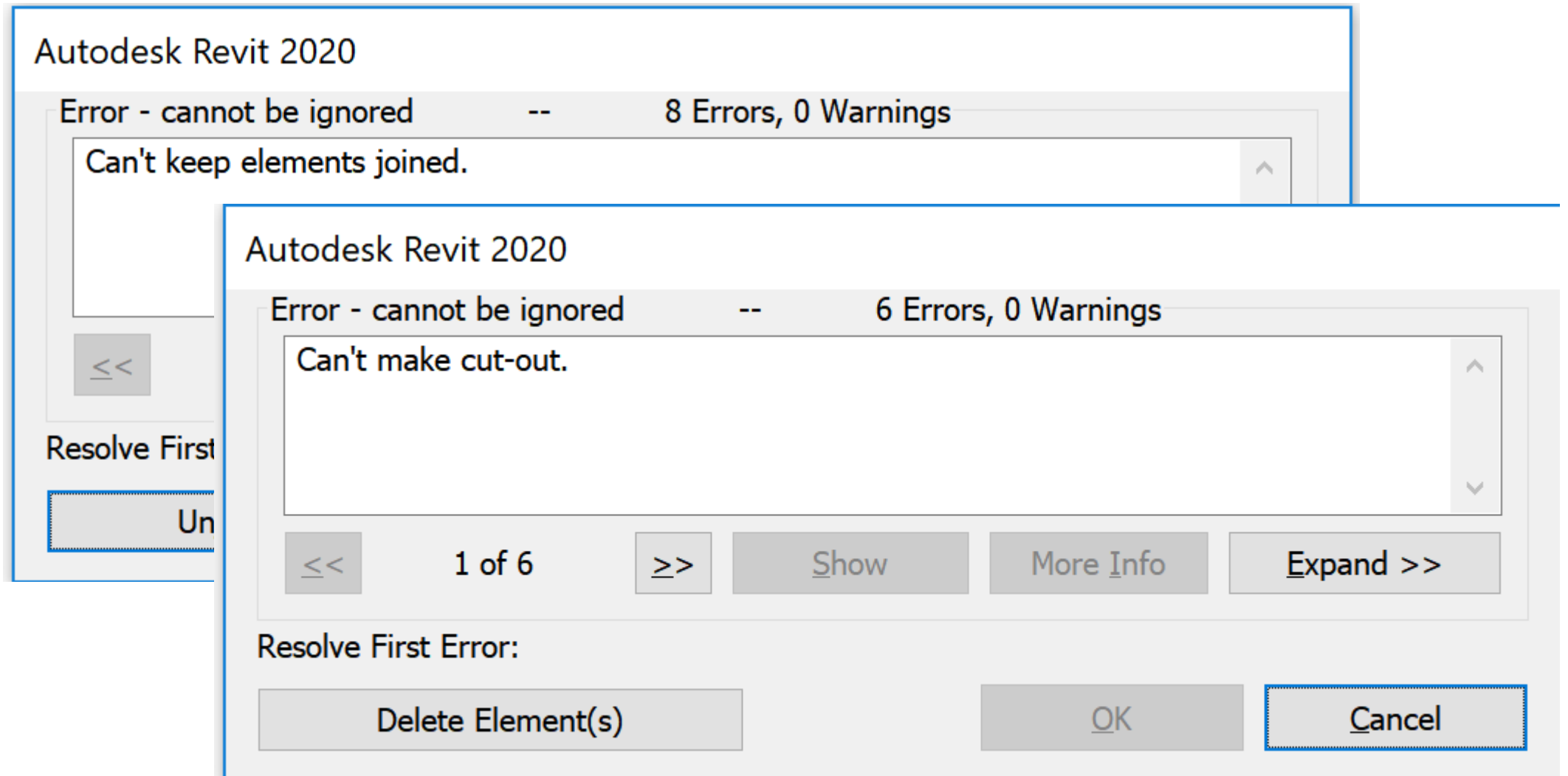


Myran Dataset

- 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 Revit 2020

Error - cannot be ignored -- 8 Errors, 0 Warnings

Can't keep elements joined.

Resolve First Error

Un

Autodesk Revit 2020

Error - cannot be ignored -- 6 Errors, 0 Warnings

Can't make cut-out.

1 of 6

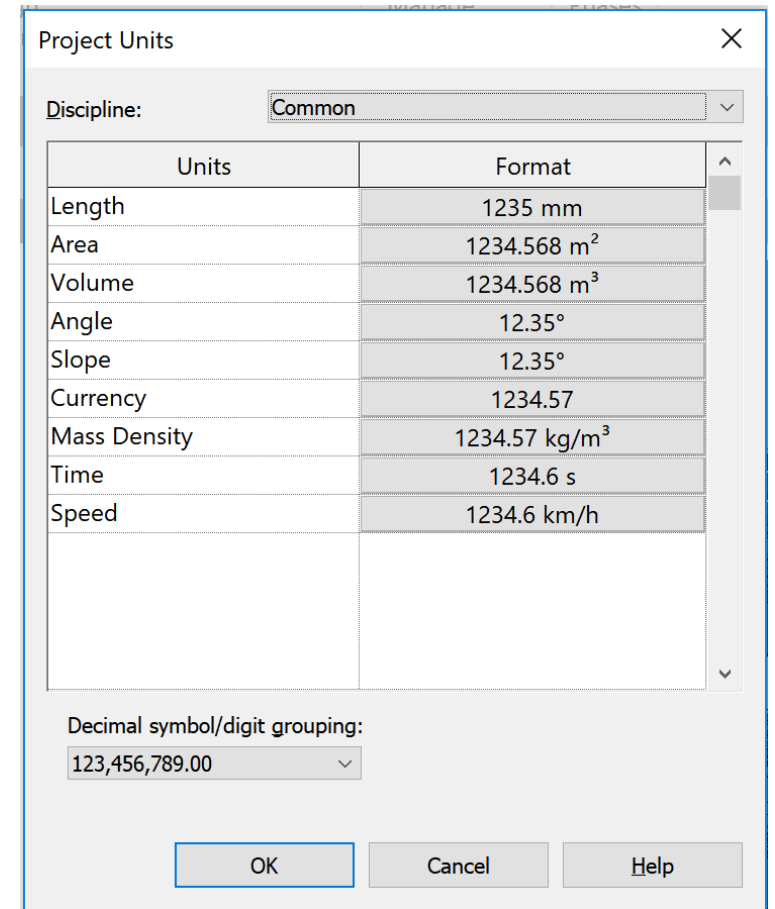
Show More Info Expand >>

Resolve First Error:

Delete Element(s) OK Cancel

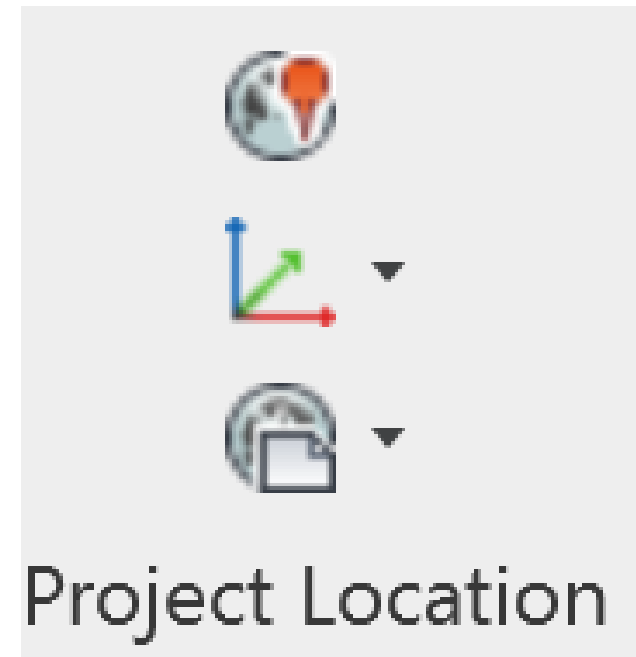
Change the Project Units

- Manage > Settings > Project Units



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

Location Weather and Site
✕

Location

Weather

Site

Define Location by:

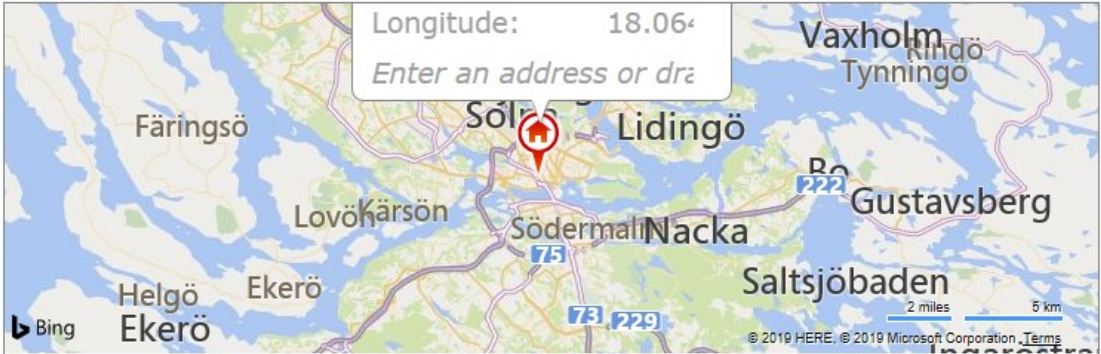
Internet Mapping Service ▾

Project Address:

User Defined ▾

Search

Longitude: 18.064
 Enter an address or dr



Use Daylight Saving time

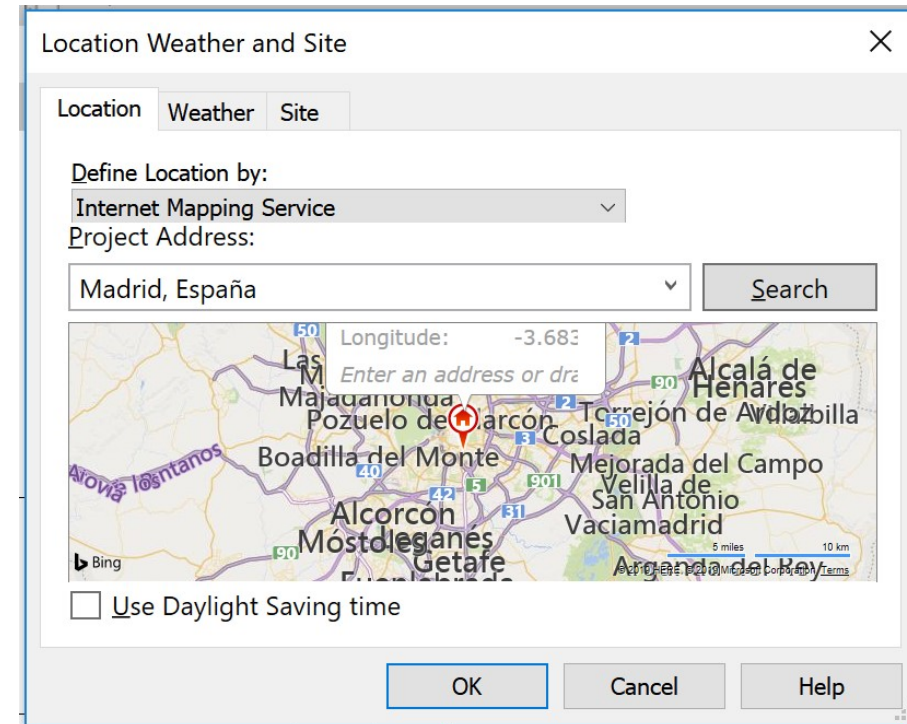
OK

Cancel

Help

Option 1 - Location

- Be careful about templates!



Option 2 – Coordinates

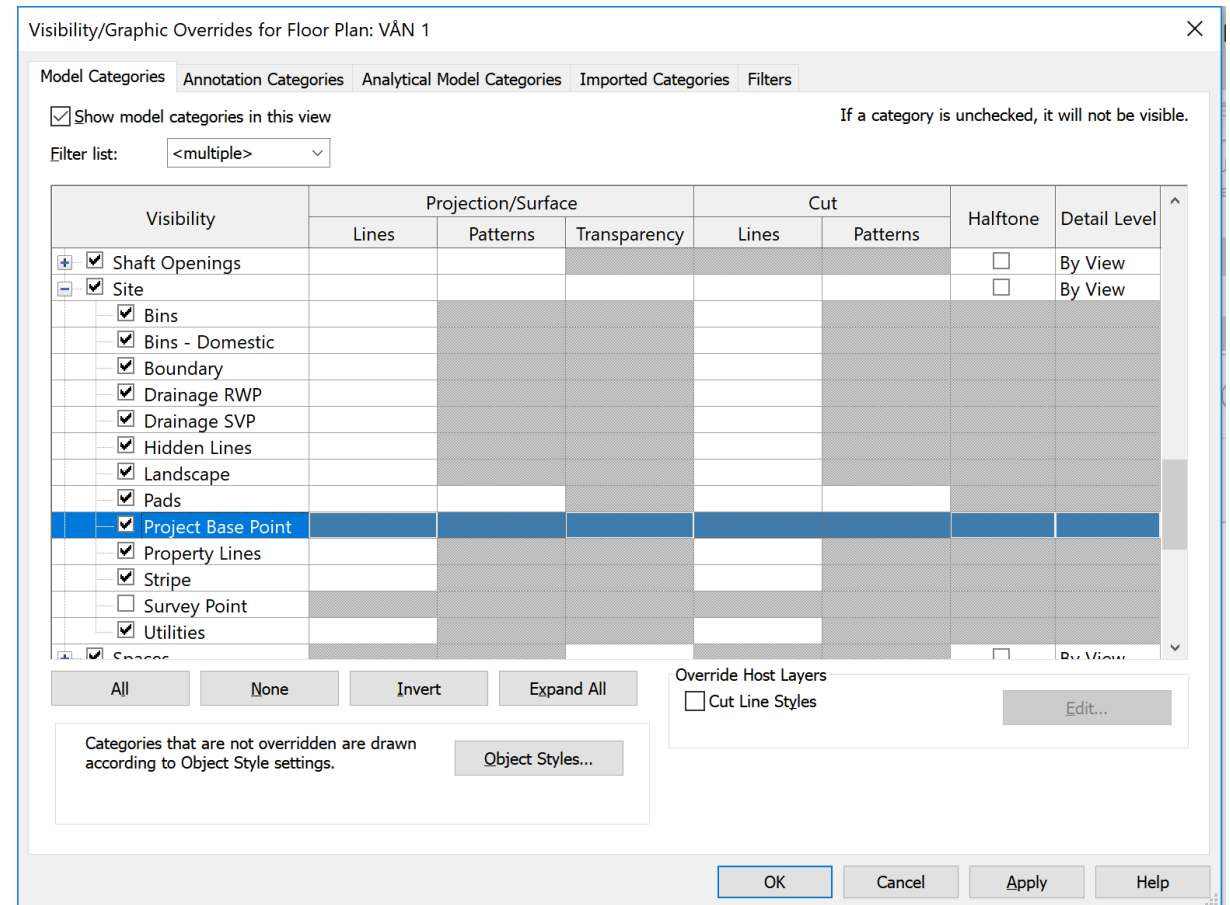
- Acquire coordinates – get the coordinates from a linked project
- Publish coordinates – share the coordinates of the current model with another project
- Specify coordinates at a point – georeferenced the model (see next slides)
- Report shared coordinates – click somewhere on the model and see the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



Original georeferencing details (for Task 1)

Coordinate reference system: none

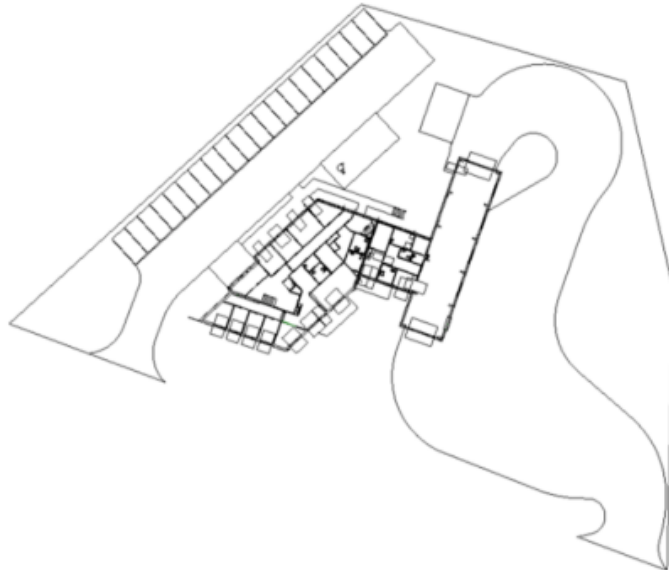
Coordinates of the reference point (blue in Figure 1):

E: 152677.777 m

N: 655555.555 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

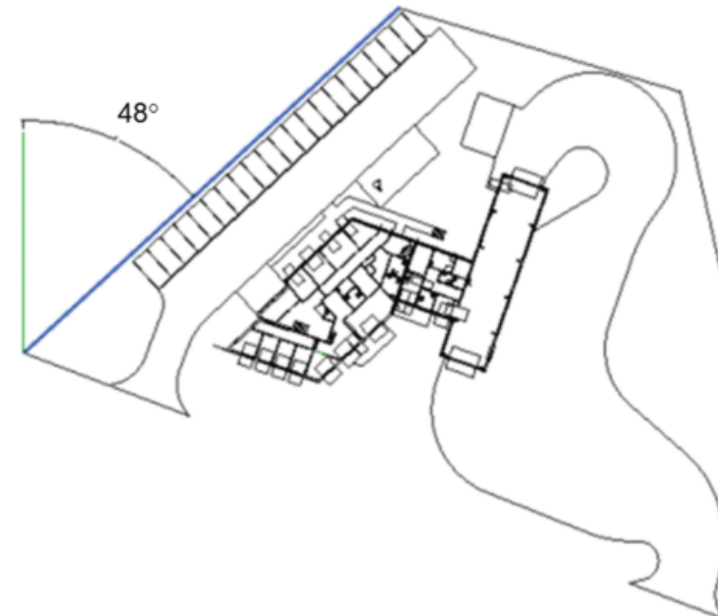
Coordinates of the reference point (blue in Figure 1):

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°



Specify Coordinates at a Point

Specify Shared Coordinates
✕

Relocate this project in Shared Coordinates by specifying known values at the point you selected. Current project will move relative to globally positioned links.

New Coordinates

North/South:

East/West:

Elevation:

Angle from Project North to True North

East ▾

Specify Shared Coordinates
✕

Relocate this project in Shared Coordinates by specifying known values at the point you selected. Current project will move relative to globally positioned links.

New Coordinates

North/South:

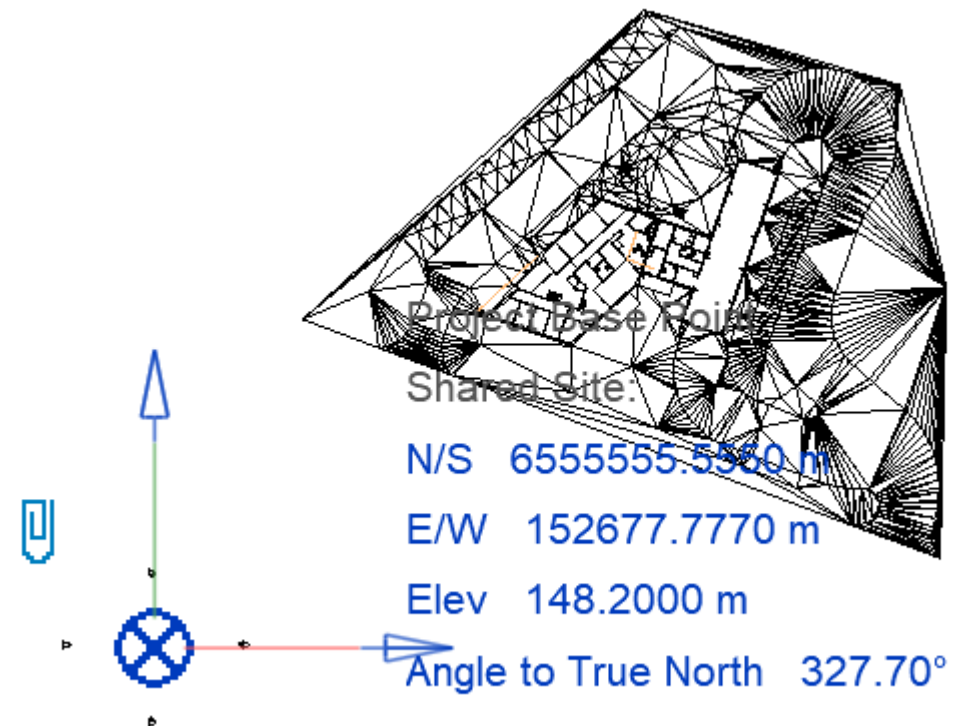
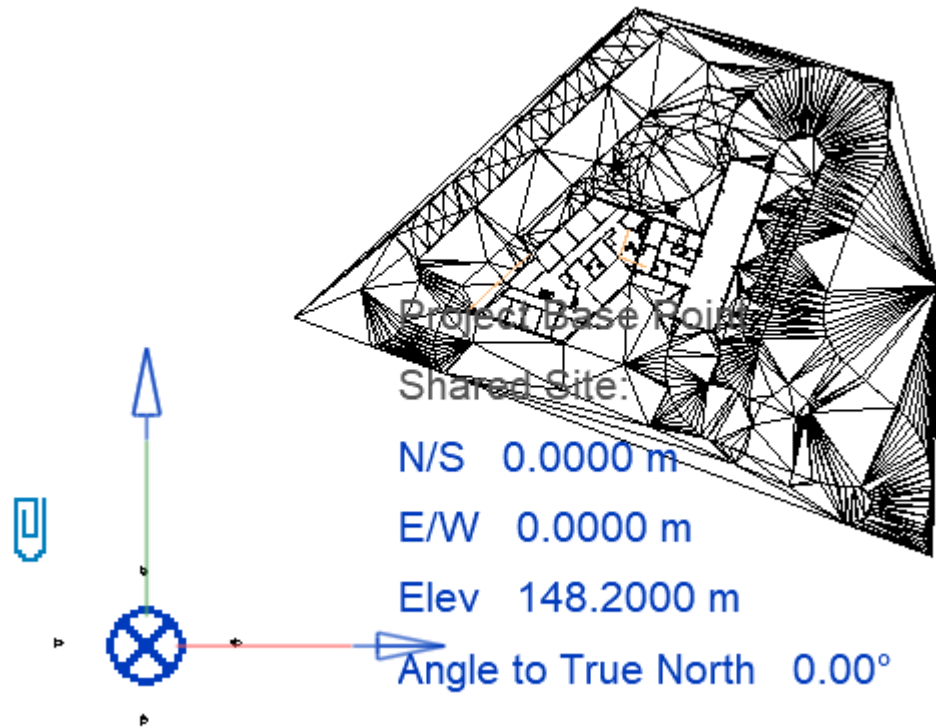
East/West:

Elevation:

Angle from Project North to True North

East ▾

Specify Coordinates at a Point



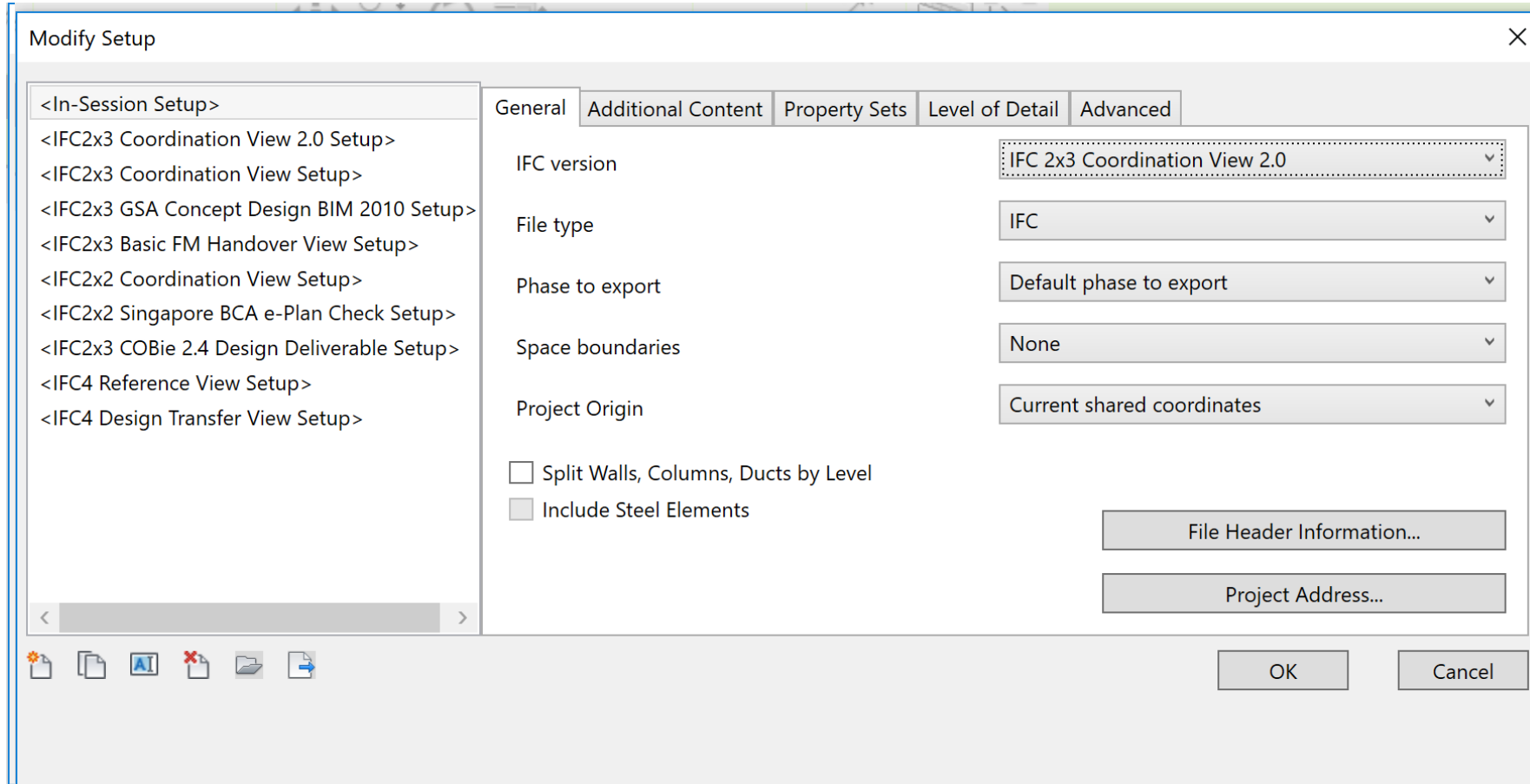
Report Shared Coordinates

- Check by clicking on Manage > Project Location > Coordinates > Report Shared
- Be careful – if you haven't changed the units the values will be in mm

N/S: 49585.2 m E/W: 22320.5 m Elevation: 148200.0 m

N/S: 53.6553 m E/W: 46.8444 m Elevation: 147.8830 m

Export to IFC



FME IFC to Shapefile

Set Translation Parameters

Reader

Format: Industry Foundation Class STEP/XML Files (IFC) ▾

Dataset: Z:\webandmobile\sweden-data\Myran_fixed.ifc ... ▾

Parameters... Coord. System: EPSG:3013 ▾

Multiple Source Dataset Options

Merge source datasets to one destination

Separate destination for each source dataset

Writer

Format: Esri Shapefile ▾

Dataset: sweden-data\myran-shapefiles-not-georeferenced ... ▾

Parameters... Coord. System: Same as source ▾

Help OK 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 now deprecated, and no longer maintained. For backwards compatibility, the previous IFC reader implementation may be used by changing this parameter.

Use Deprecated Reader: No ▾

Reader Parameters

IFC Version: <auto detect> ▾

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 ▾

Read Property/Quantity Sets As: Geometries ▾

Type Object Parameters

Read Type Objects As: Single IfcTypeObject Feature Type ▾

Merge Property/Quantity Sets of Type Objects into Property/Quantity Sets of Real Objects: Yes ▾

Deprecated Reader Parameters

Geometry

Read IfcSpace Geometries: No ▾

Subtract Opening Geometries: Yes ▾

Add Projecting Geometries: Yes ▾

Evaluate CSG Solids: No ▾

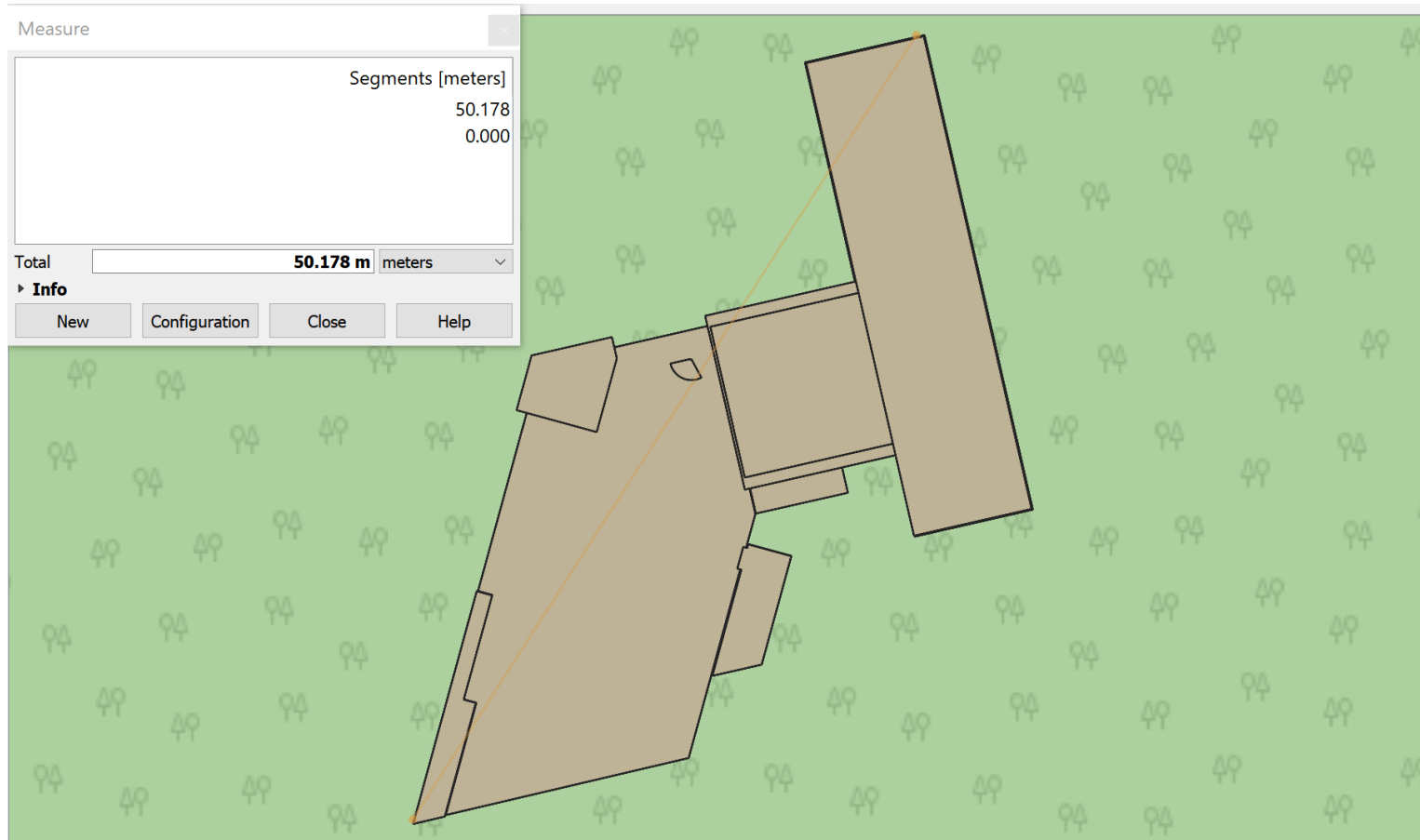
Simplify Extrusion Base Faces: No ▾

Encoding

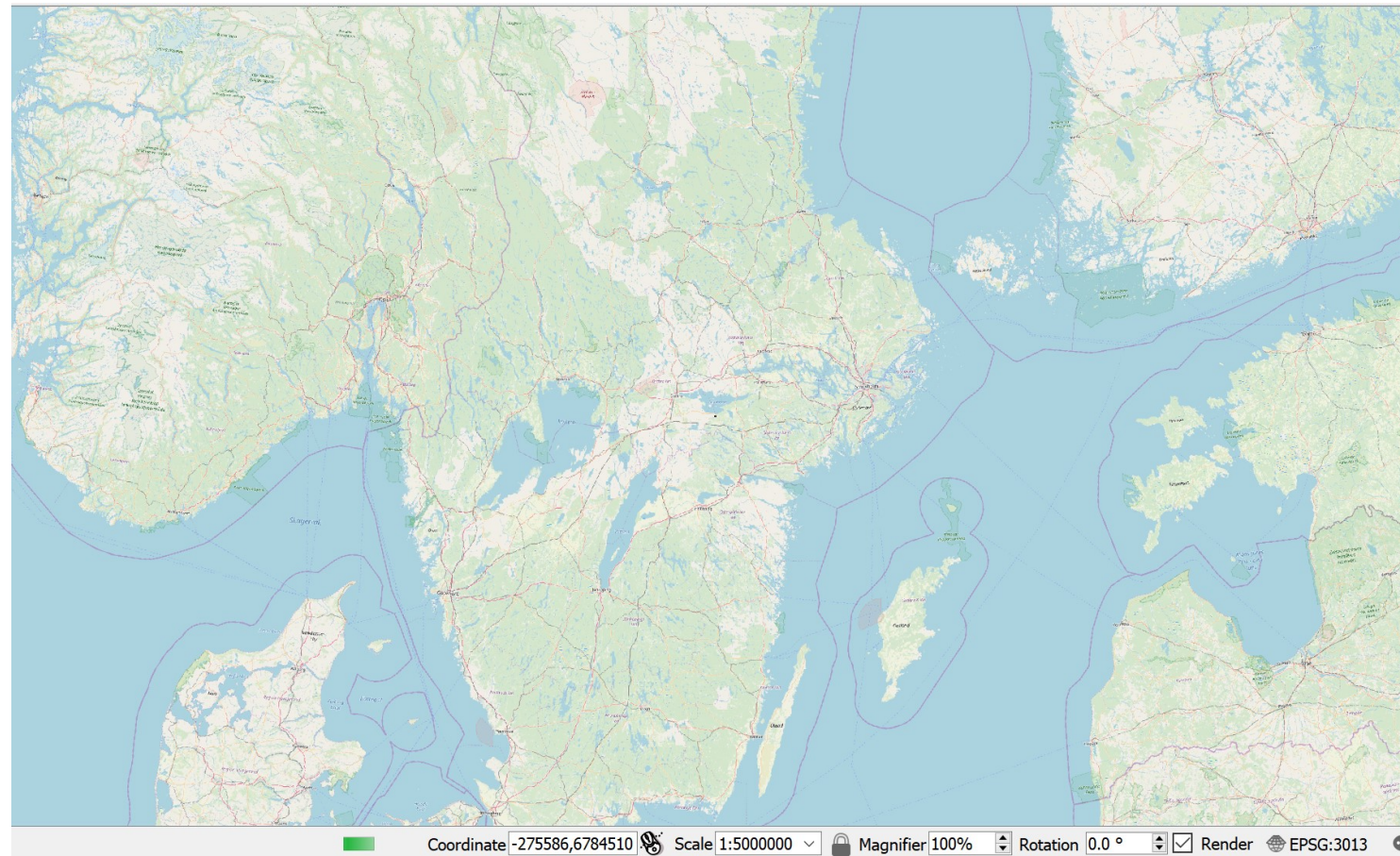
String Encoding: ... ▾

Help Presets OK Cancel

Myran – Georeferenced and Correctly Scaled



Myran – Georeferenced and Correctly Scaled



IFC – Not Georeferenced versus Georeferenced

```
#588608=
IFCARTESIANPOINT((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=
IFCARTESIANPOINT((33.8693163757324,41.0
554707641601,-1.20000000915529));
#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:
 - https://3d.bk.tudelft.nl/pdfs/18_georeferencing.pdf

About the Geo-referencing of BIM models

Abdoulaye Diakité

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