Positioning Revit Models

Coordinating a Revit model with a survey drawing.

This white paper is written to illustrate the best workflow in setting up a coordinated site model (sometimes known as a container model) where all disciplines are using a mix of Revit and AutoCAD within the same organisation. This container model will then be used to host the Shared Coordinate system that can then be pushed or published to specific linked discipline's models.

If different companies are involved in the same Revit project, then the container model will be set up by the lead consultant and the other consultants will usually acquire coordinates from the agreed main container model. Once the task is complete, coordinate schedules can be run via Dynamo, or the API and components can be tagging for setting out drawings.

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Positioning Models – Introduction

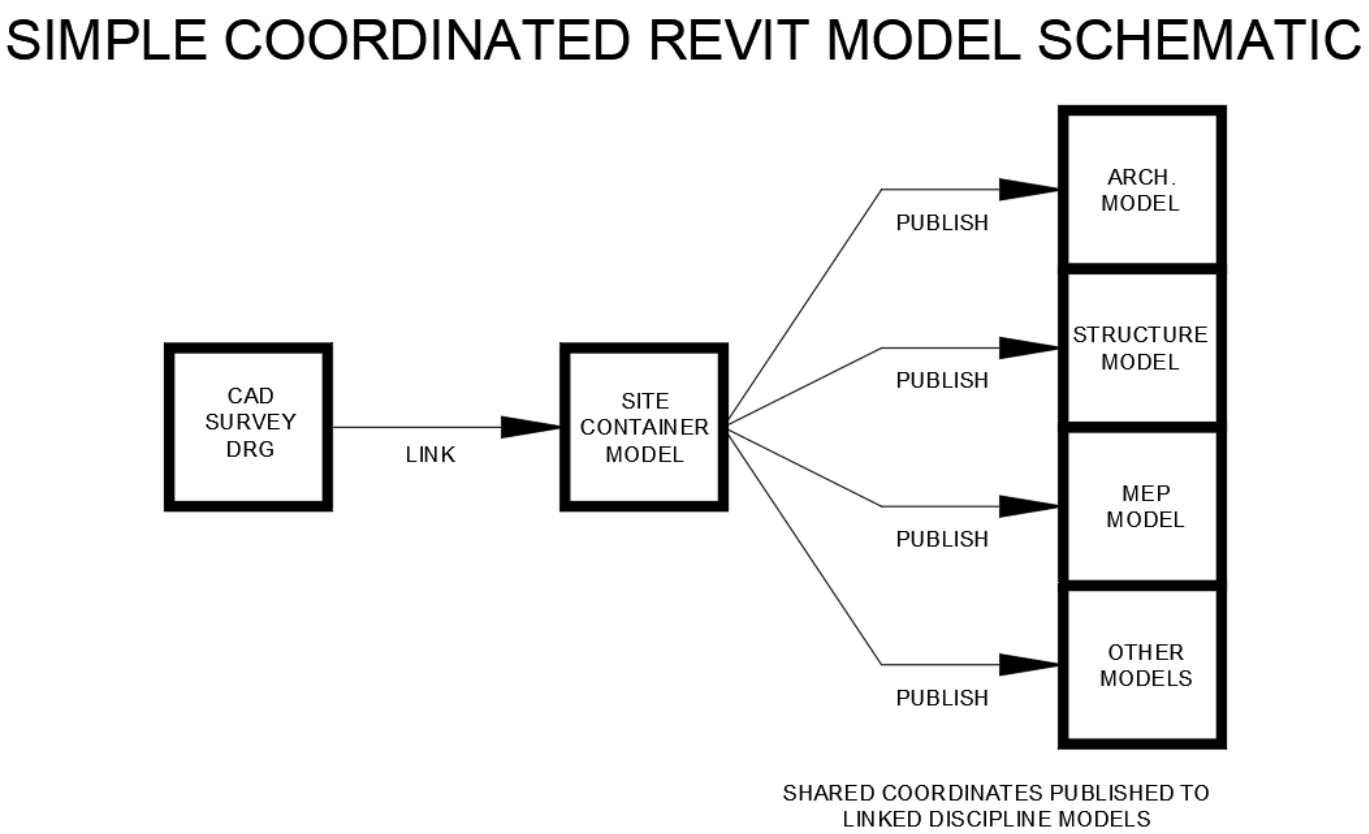


Fig. Example Schematic of a typical workflow setting coordinates of various discipline's models.

Within AutoCAD a CAD survey drawing has been audited and prepped. Units are checked and potential useful reference lines can be added to help establish useful reference points and angles. These may be useful later when linked into Revit.

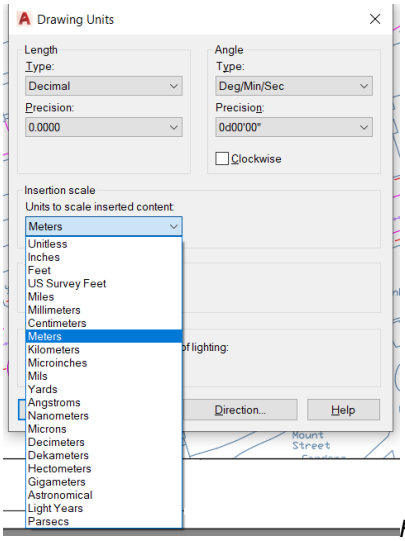


Fig. AutoCAD units should reflect the actual units the file has been drawn in!

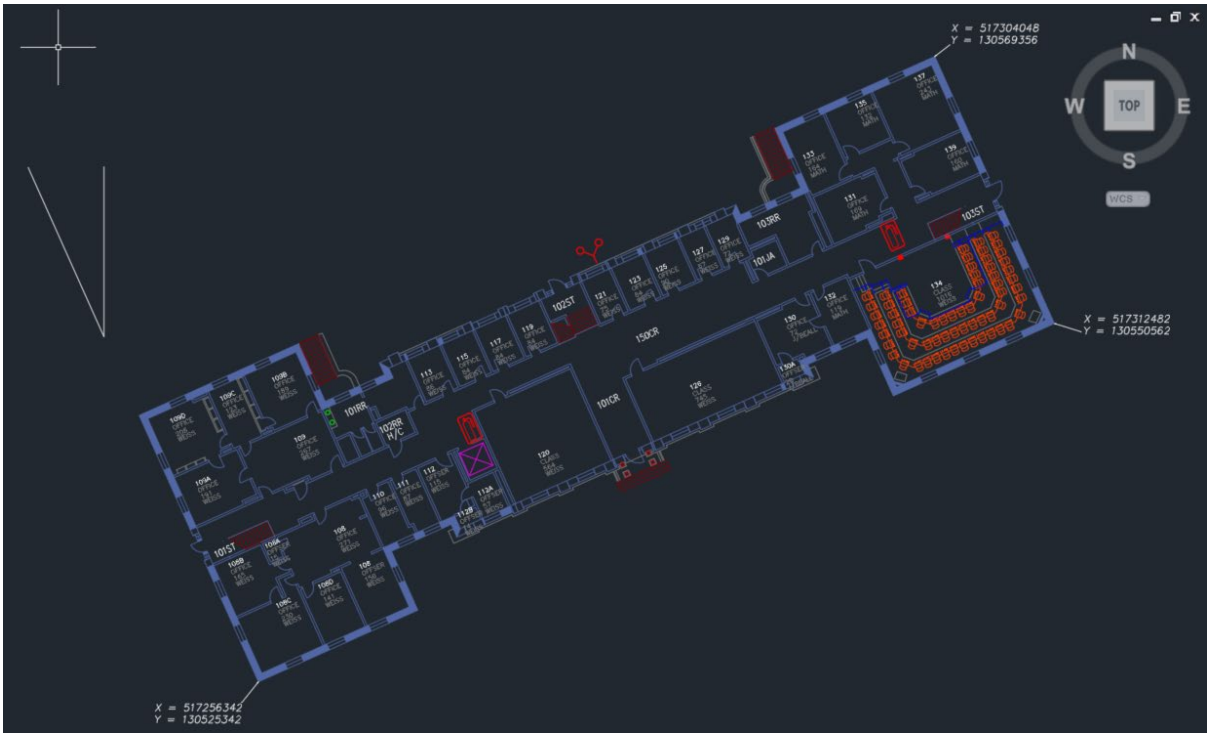


Fig. The original AutoCAD drawing, located correctly to the WCS

The first task is to coordinate the Revit and AutoCAD data. The AutoCAD drawing shown in the example above is drawn in the correct point in space relative to the World UCS origin.

Prior to this task it is advised to first note 3 coordinates on the AutoCAD drawing to aid with the coordination task once imported into Revit. Try and ensure the points are distributed as widely as possible across the site.

Copy and paste the notes from the ‘ID’ command or similar and note with a leader object. Alternatively, an attributed block with field driven attributes could be used for referencing once imported into Revit.

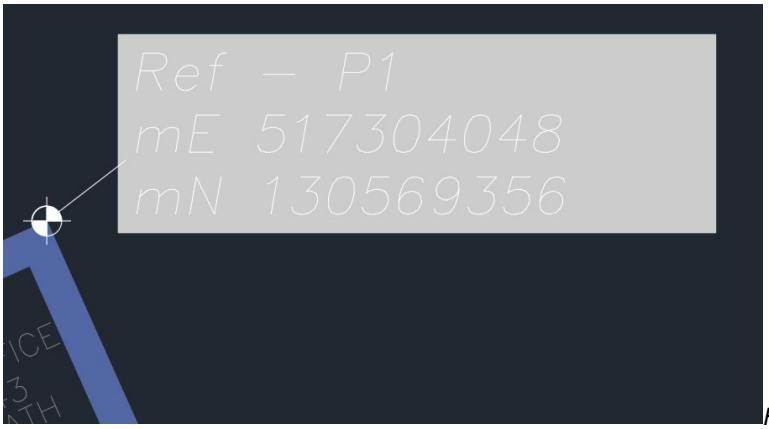
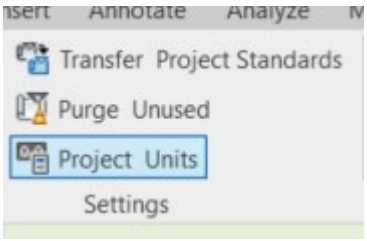


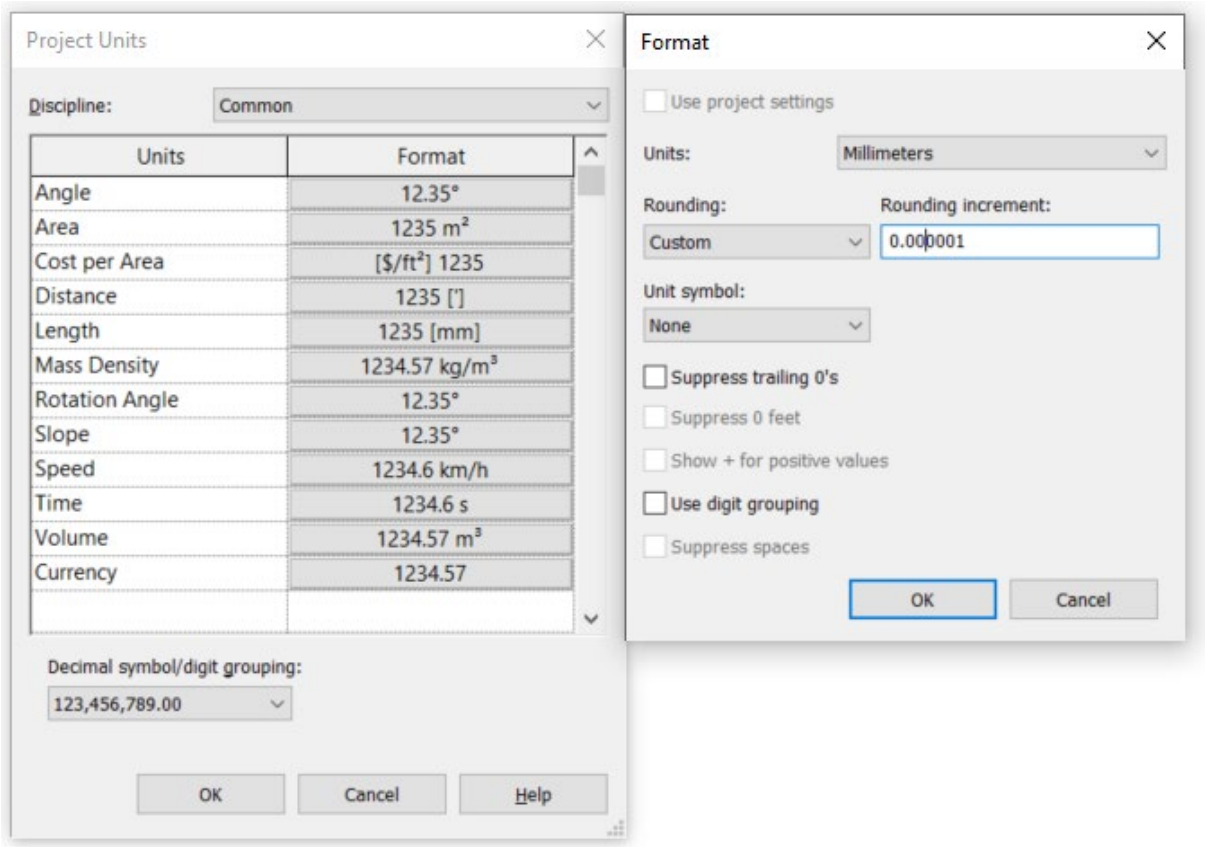
Fig. Coordinate Reference Point Using attributed fields

Positioning Models – Establish True North Site View

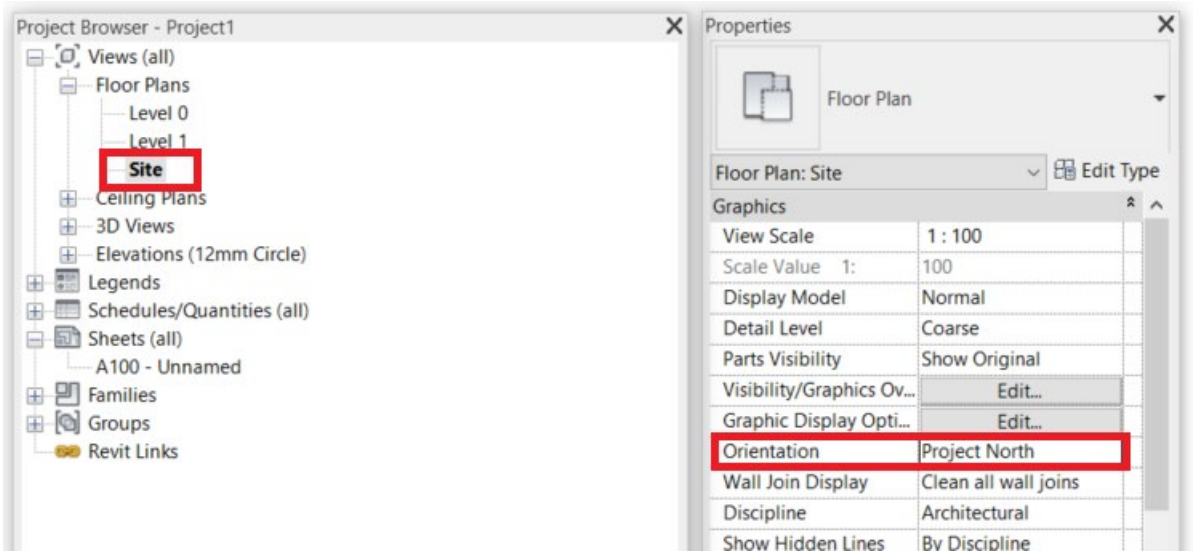
Switch to Revit and using a suitable project template, create a new project and save it as Site-Coordination Model or similar.



Set the project Unit Length field to 6 decimal places to help with positioning accuracy.



Open the Site View and set the view aspect to True North.

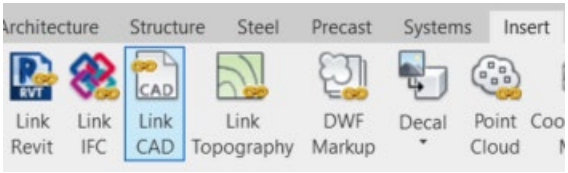


If necessary, duplicate this site view and set the copy to Project North, name the views accordingly.

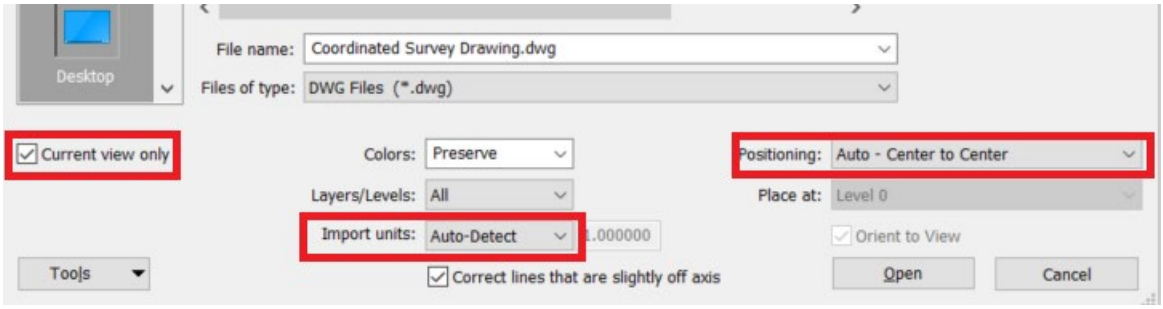
Make the True North Site Plan Active.

Positioning Models – Define True North Using 'Rotate True North' Function

In the Site View on the Insert Tab choose Link CAD.



Locate the AutoCAD drawing to link and set the options as shown in the image below.



Once complete the AutoCAD drawing should display as shown.

IMPORTANT. It is vital that the AutoCAD drawing units reflect the drawn units for appropriate scaling to take place. If left as unitless or at incorrect values the drawing will come in at a vastly incorrect size!

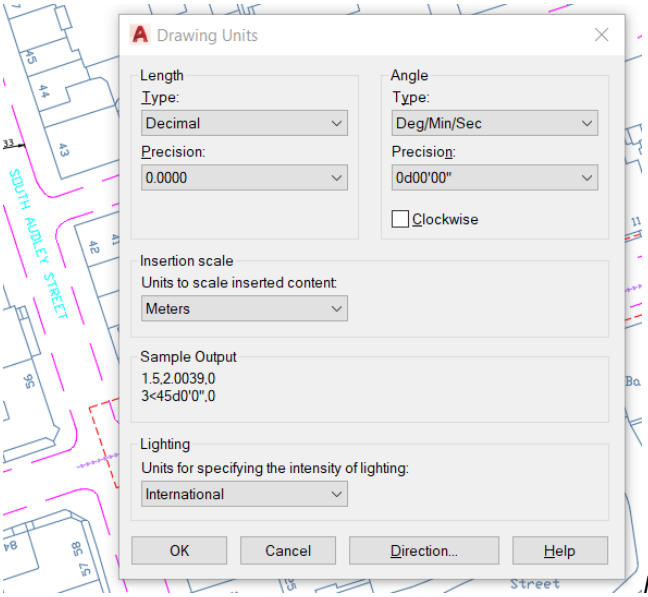


Fig. Survey drawings are typically drawn in metres.

Once imported, Revit needs to be told the Project North, True North Deviation. As AutoCAD defaults to True North by default, but Revit thinks in terms of Project North, the user needs to rotate Revit's True North to the correct direction.

This can either be achieved with the aid of reference planes or grid lines drawn in Revit, or access linework from AutoCAD to set the rotational angle between Project and True North.

Using the standard Rotation Tool within Revit, rotate the linked CAD file to ensure the major axis of the building or site is Orthogonal to the view.

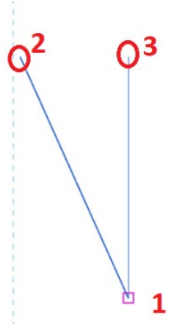


Fig rotating the linked file to define Project North. Point 1, Centre of Rotate. Point 2 Angle Start, Point 3 Angle End

In the displayed example some linework has already been set out in the AutoCAD file and this geometry will serve to set a rotational base point and angle reference.

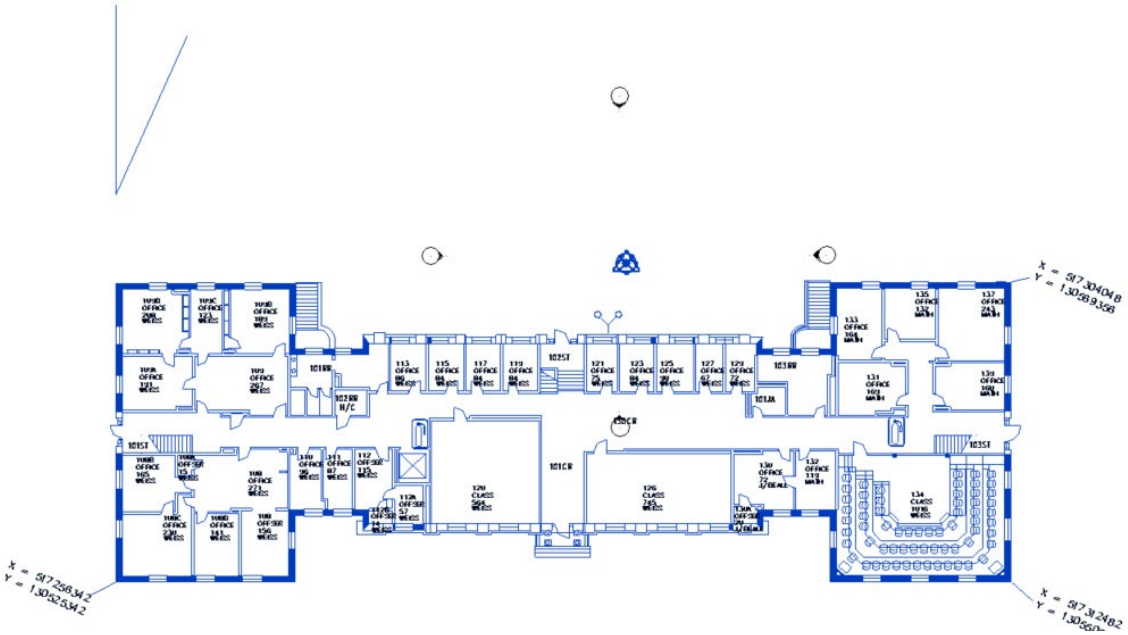


Fig. AutoCAD drawing aligned to Revit's Project North.

Now the AutoCAD drawing is aligned to Revit's Orthogonal Project North we can now establish the location of the True North Direction.

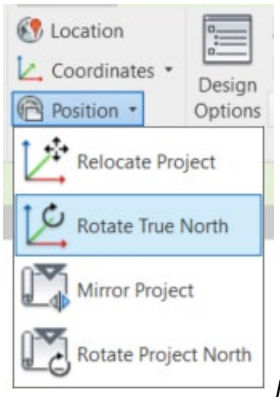
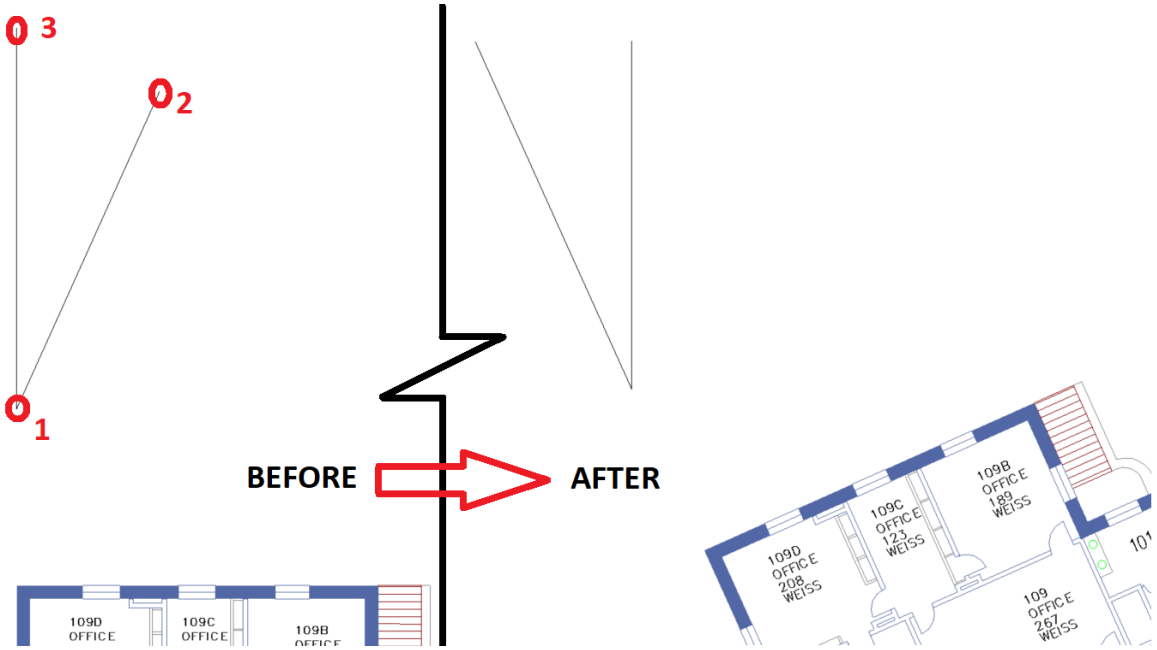


Fig. Rotate True North, is located on the Manage Tab, Project Location panel

This is done by using the 'Rotate True North' Command.

Place the rotation base point at an appropriate intersection - in this example the intersecting lines within the AutoCAD drawing.

Rotate the true North so that the reference line at an angle now points up the screen.



Once complete you should be able to toggle between Project North and True North settings (or view) and see the building orientate to the correct aspect.

Looking at the building from a Project North View

Looking at the building from a True North View

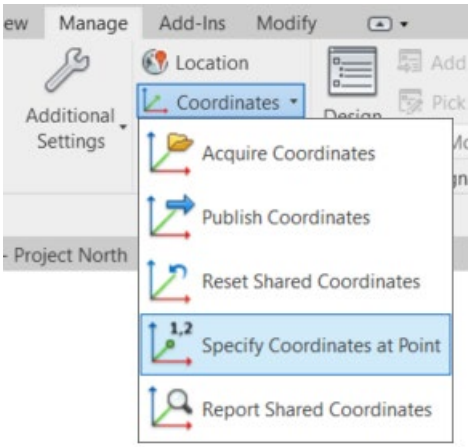
Once this task is complete, the next step is to establish coordinates within Revit and link back to AutoCAD.

Positioning Models – Specifying Coordinates

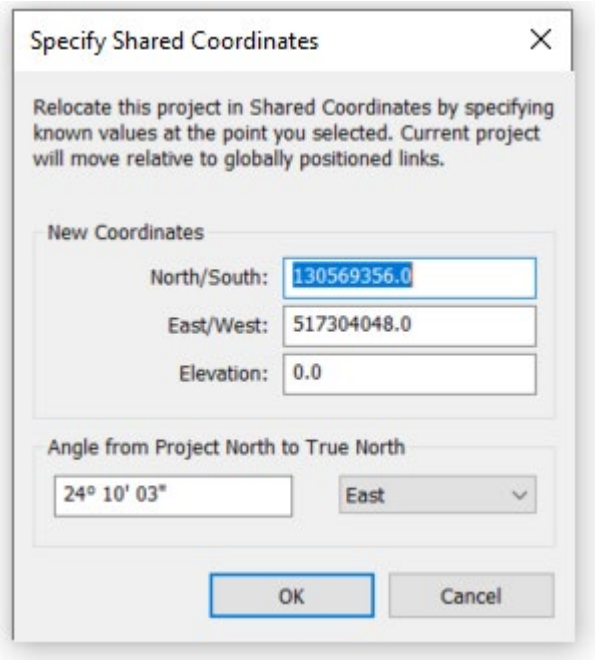
Once the site has been set to True North, coordinates can be set and published back to AutoCAD and create a coordinated link.

Locate an established corner of the CAD link where the coordinates from AutoCAD can be identified.

To ensure Revit has the same coordinates as the AutoCAD drawing the ‘Specify Coordinates at a Point’ command can be used. This command is also located under the Manage tab.



As a check a Coordinate Tag can be placed at the same point. Initially the values will not match, but once the coordination task has been achieved the tag value will be the same as the coordinate text within the AutoCAD drawing.



When specifying the coordinates, ensure the correct point is selected and enter the coordinates as shown on the CAD drawing. Revit tends to think in millimetres whilst surveyors tend to think in metres, but provided units are specified correctly in format and units, the coordinate tag should have the same value as the equivalent AutoCAD text.

Some formatting and thought may have to be applied when inputting coordinates as typical map coordinates (along the corridor, then up the stairs or Eastings, Northings) are reversed because of the global coordinate's convention (Latitude and Longitude).

In the example below the coordinate tag has been configured to work in the Easting/Northing display convention.

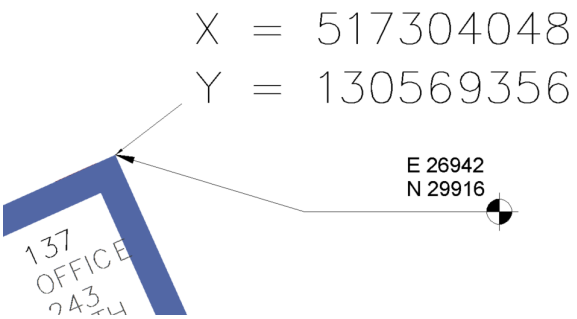


Fig. Initially the coordinate Tag and text do not match

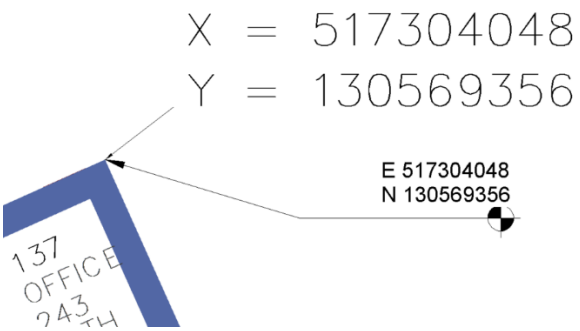


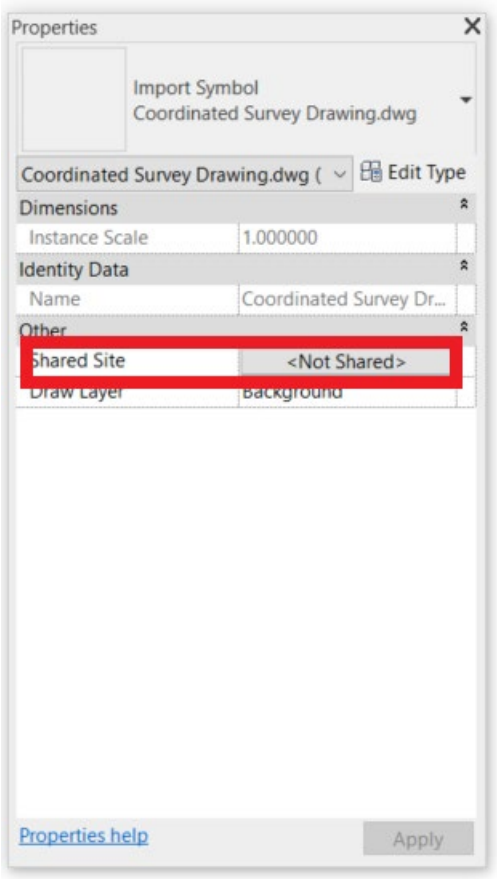
Fig. Once complete the annotations match

Once the basepoint is aligned, cross check the other two points and check that their coordinate values also tally with the original AutoCAD drawing. Now that coordinates have been established coordinate tags can be added to any Revit view.

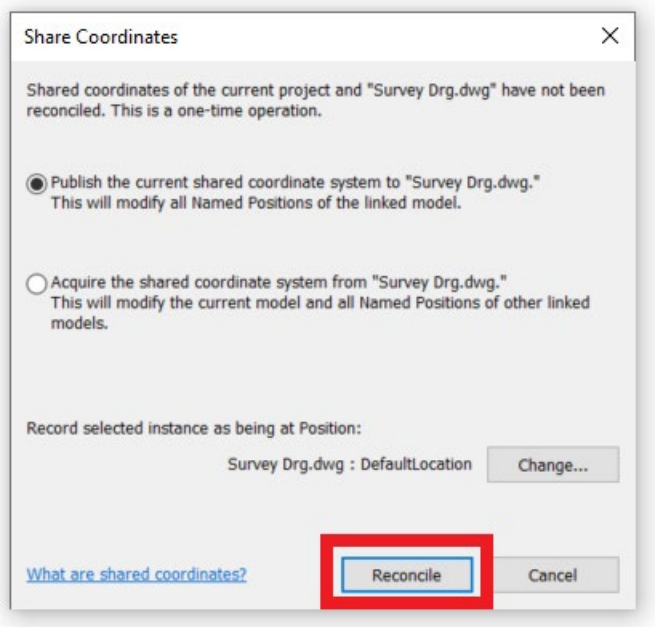
Positioning Models – Publishing Coordinates

With the Revit project now correctly set, the coordinates can be published back to AutoCAD to establish the link.

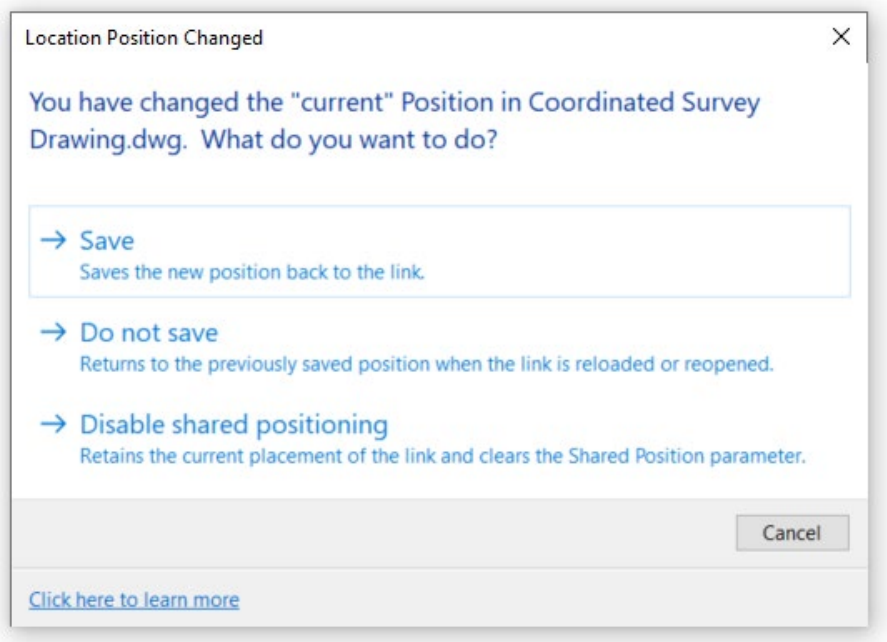
In the coordination model, select the CAD link and select ‘Shared Site’ in the Properties Palette.



Select the publish option in the resulting dialog and choose Reconcile.



Save the model and save the new position back to the linked file.



A link has now been established with the linked AutoCAD drawing. The coordinates between the Revit and AutoCAD file should correlate.

Now the Site Container Model has been established, coordinates can now be published back to the respective linked Revit models.

Positioning Models – Publishing Coordinates to Revit Models

Within the Site Container model, link in the Revit Model to which the Site Container Model's coordinate system is to be published.

Select the 'Auto - Centre to Centre' option for the positioning option.

Using some suitable references, locate and position the Revit model into the correct space. Revit's Align command is ideal for this task. First align the file in a plan view for the horizontal axis.

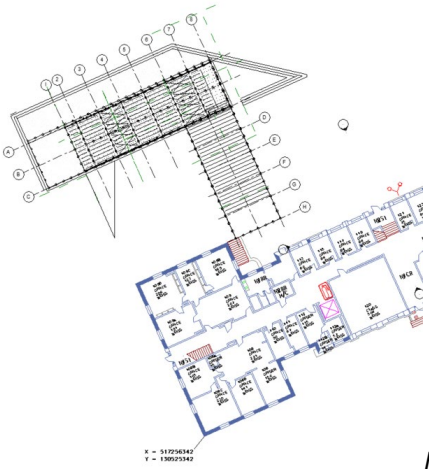


Fig. Lining up the building model to reference lines

Then locate the project in the vertical axis. It is likely the Site Containers levels do not correspond to the linked projects levels. Use the Align command, ensuring the corresponding references match.

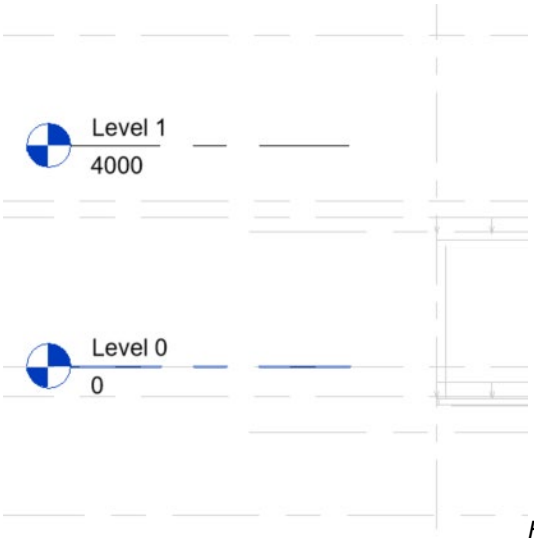


Fig. Align linked model levels to container model reference

If the heights need to be set, use the specify coordinates at point tool to set the ‘Z’ elevation of the project. Remembering to input the correct units.

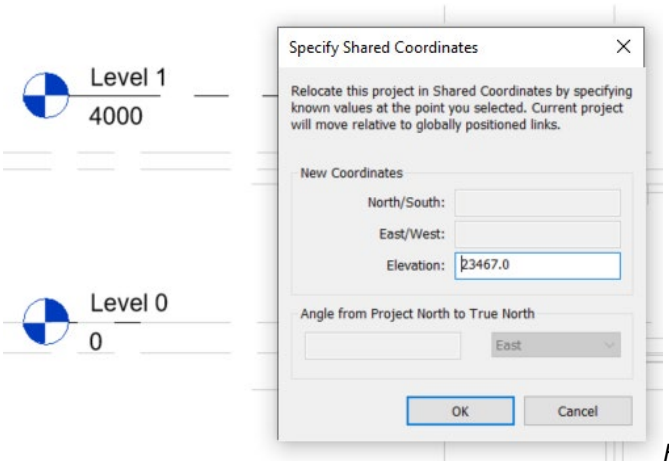
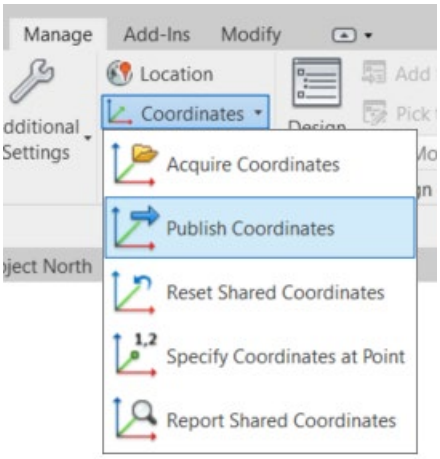
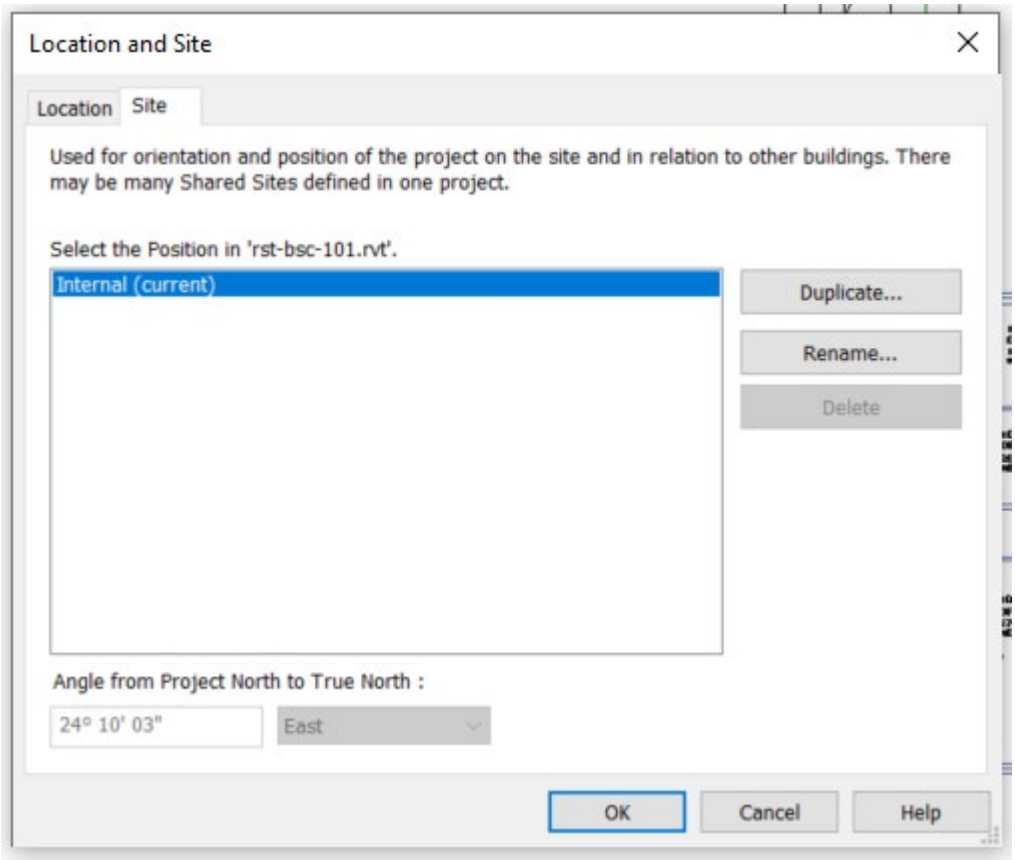


Fig. Specifying level height in container model

Once the project is correctly positioned the coordinates can be published back to the building model. This can either be achieved with the Site function or the Publish Coordinates function under the Manage tab.





Click OK on the dialogue to confirm.

The linked model is now set with the same coordinate system as the site container model.

NB. Site container models are essential in establishing a good working practice for coordinated Revit models. All coordinated models should be linked in the site container model and aligned as per the

described process. Coordinates should then be published from this model to the respective files both when setting up the model or when addressing any coordination errors later in the project.

In certain situations, a consultant may link the site container model into their discipline's file, line up the references and use the Acquire coordinates option. This will pull the shared coordinate system into their project and set their origin accordingly. Once this process has been completed the coordination model should be detached.

Think of the PUBLISH option as PUSHING a coordinate system to another file therefore modifying it, whilst ACQUIRE is PULLING a coordinate system to your project also modifying it.

In both cases the coordinate system is shared and should mean that if the Linked files are detached, they can be relinked with the Shared Coordinates positioning Option. The models should then appear in the right place and the correct coordinates.

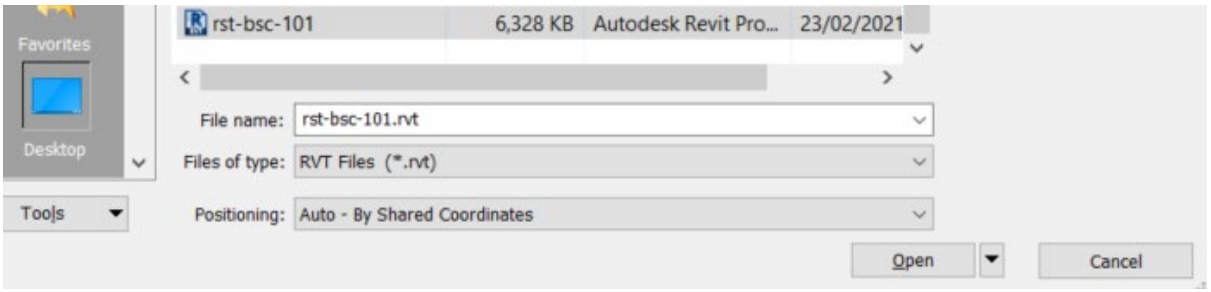


Fig. Once a Shared Coordinate System has been established, any related files can be linked together and appear in the correct place with this positioning option.

Positioning Models – Working with Civil 3D

Site Collaboration was introduced in Revit 2019.1, a much-improved level of interoperability between the Revit and Civil 3D products therefore saving time and improving accuracy when transferring site information and project location data between different project teams. Topography from Civil 3D can be easily linked into Revit using Autodesk Desktop Connector and BIM 360 Docs. This linked geometry can interact with topography in Revit. Therefore, can be used for hosting, tagging and scheduling within a project.

The first step is to open the surface file in Civil 3D. Because the accurate positioning on the surface is important, a coordinate has been placed, for the same reasons as when working with a vanilla AutoCAD drawing, so it can be checked after the Revit import. See Figs 1 & 2.

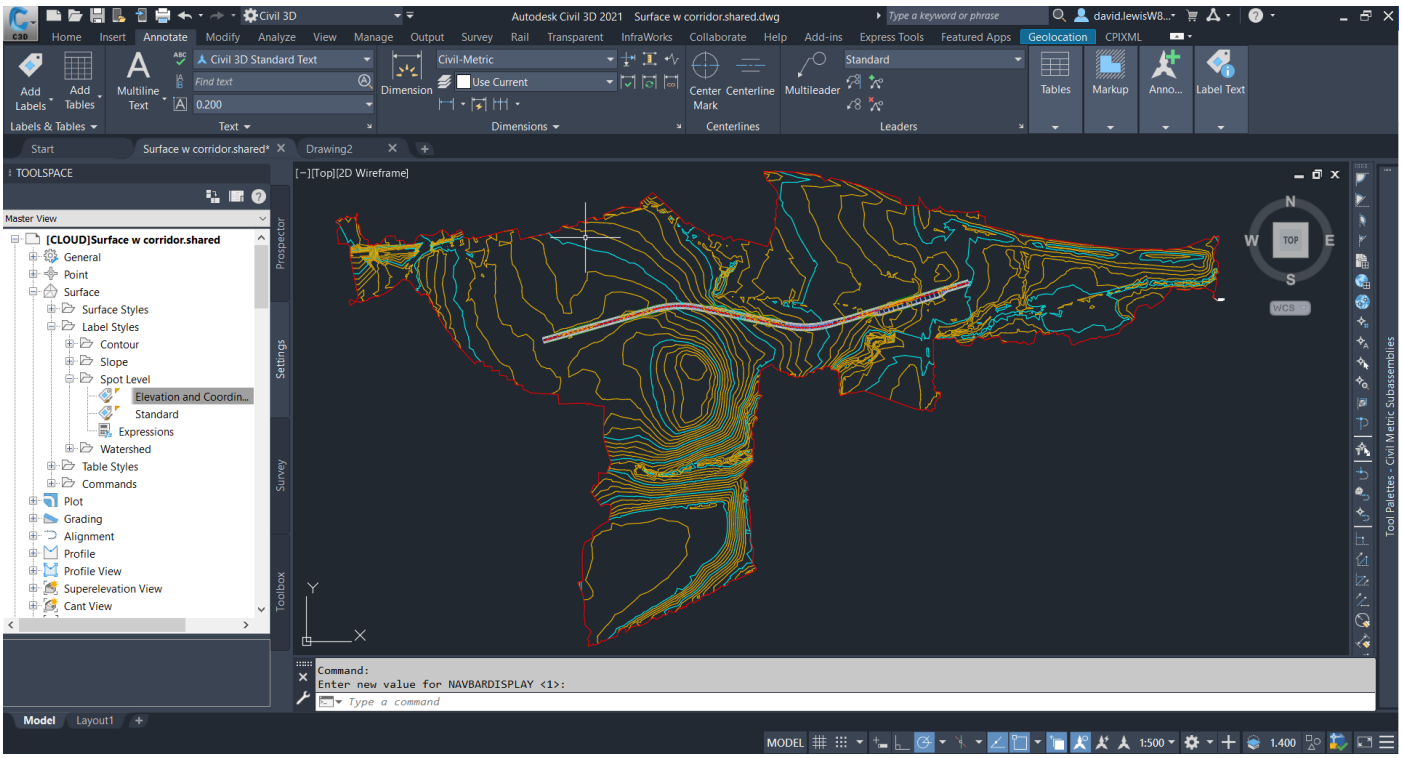


Fig 1

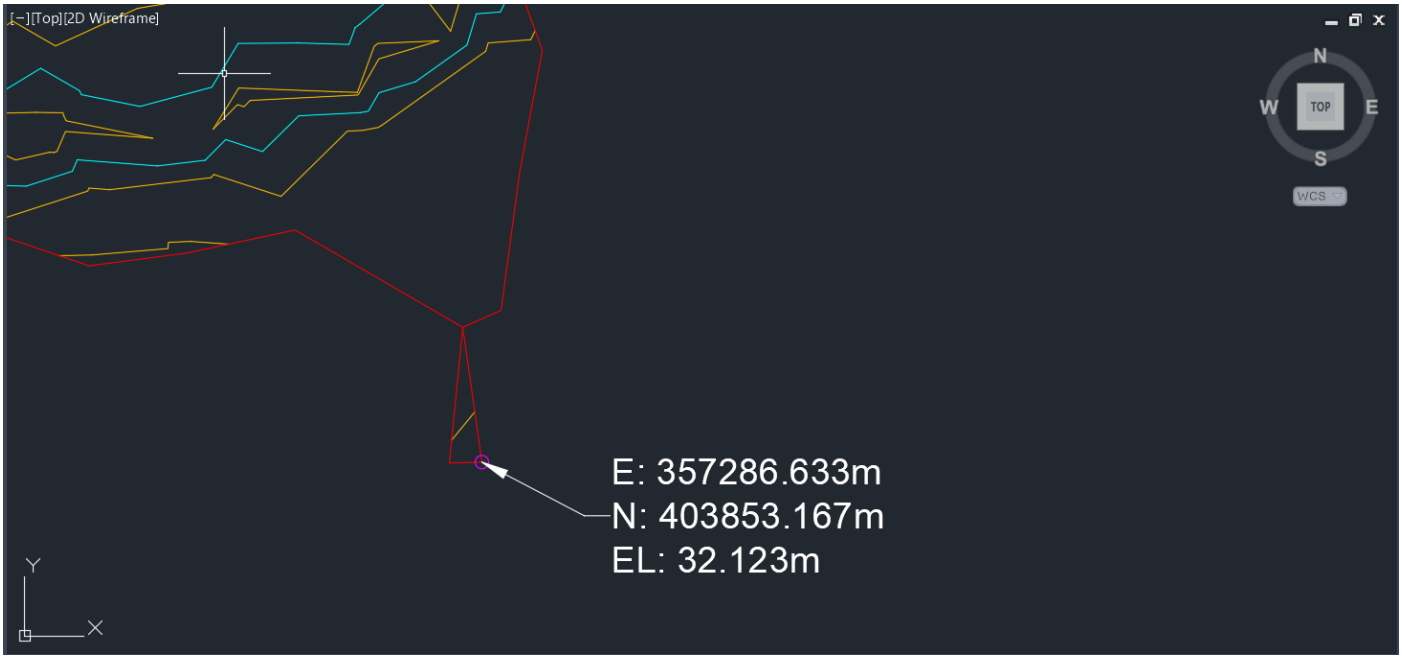


Fig 2

To export the surface, navigate to the Collaborate Tab and choose the Publish Surfaces option. Please note, this process will upload the file to a specified BIM 360 Docs Project on the Autodesk Construction Cloud (ACC) using the Desktop connector. These tools need to be installed and up to date otherwise the upload process will not work. See Figs 3 & 4.

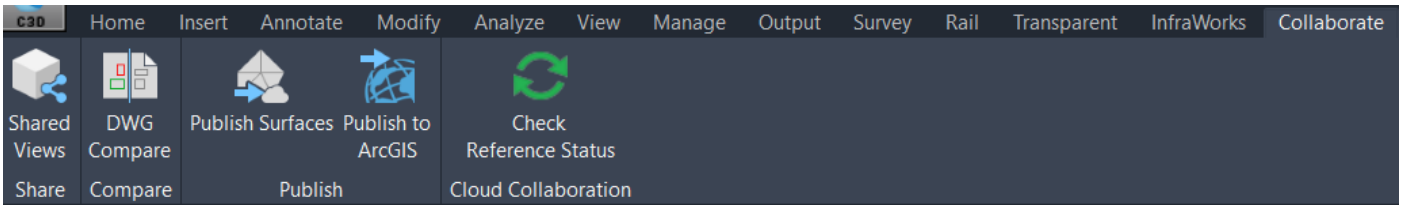


Fig 3

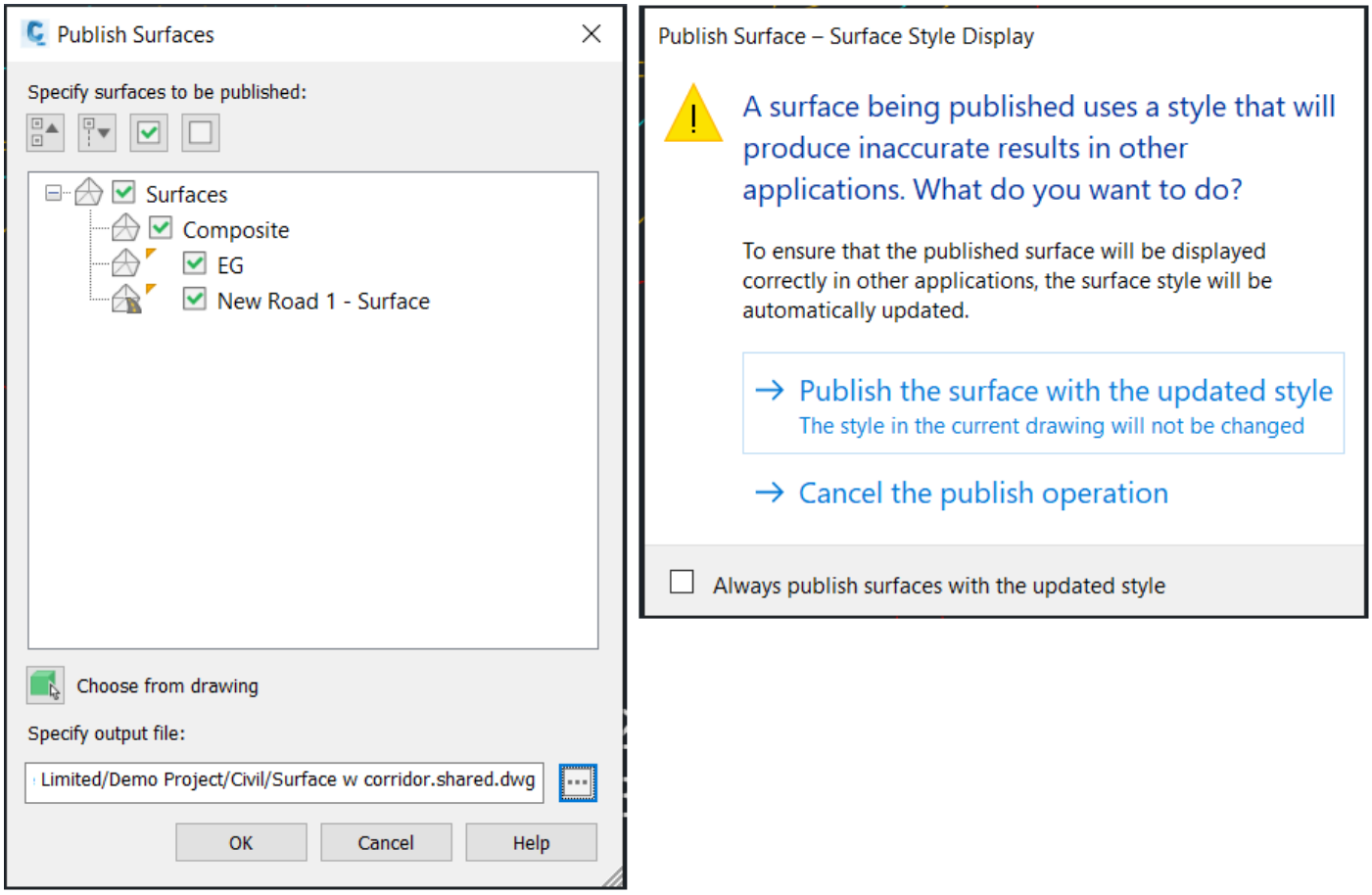


Fig 4

Once the Publish the surface option has been chosen, select the BIM 360 object in the list, then the Project and folder you wish to upload your file to. See Figs 5 & 6.

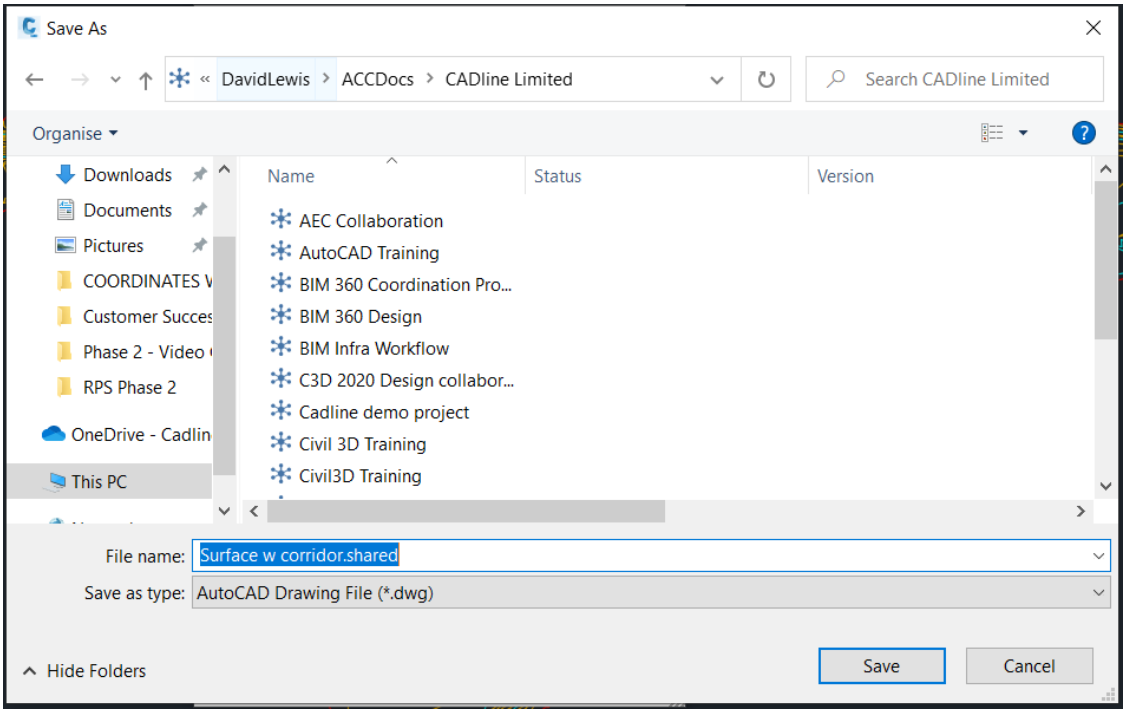

Save As
DavidLewis › ACCDocs › CADline Limited
Search CADline Limited
Organise
Downloads
Documents
Pictures
COORDINATES V
Customer Succes
Phase 2 - Video
RPS Phase 2
OneDrive - Cadlin
This PC
Name
Status
Version
AEC Collaboration
AutoCAD Training
BIM 360 Coordination Pro...
BIM 360 Design
BIM Infra Workflow
C3D 2020 Design collabor...
Cadline demo project
Civil 3D Training
Civil3D Training
File name: Surface w corridor.shared
Save as type: AutoCAD Drawing File (*.dwg)
Hide Folders
Save
Cancel

Fig 5

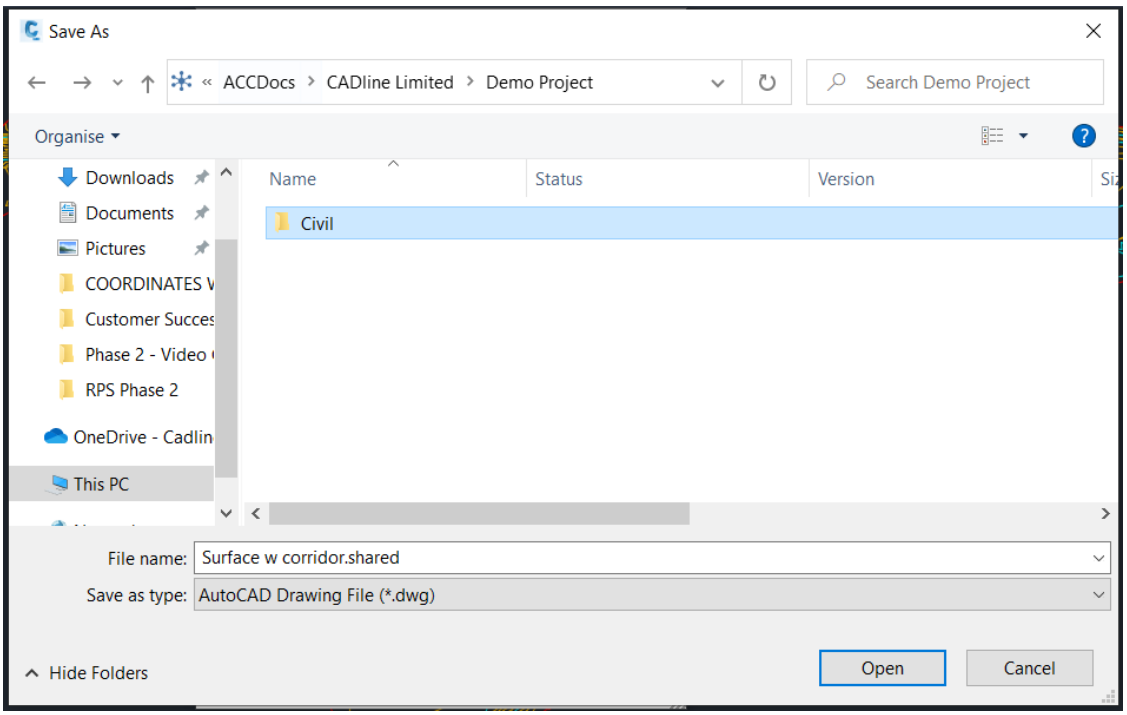

Save As
ACCDocs › CADline Limited › Demo Project
Search Demo Project
Organise
Downloads
Documents
Pictures
COORDINATES V
Customer Succes
Phase 2 - Video
RPS Phase 2
OneDrive - Cadlin
This PC
Name
Status
Version
Civil
File name: Surface w corridor.shared
Save as type: AutoCAD Drawing File (*.dwg)
Hide Folders
Open
Cancel

Fig 6

The process in Civil 3D is now complete. Next access Revit to import the surface. In the Revit file we switch to the Site Plan View and navigate to the Insert Tab and choose the Link Topography option. See Fig 7.

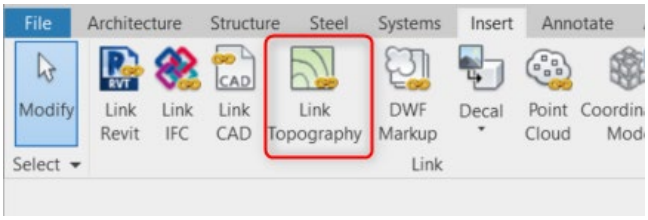


Fig 7

The process is linked to the BIM 360 Docs environment, so the dialogue box that opens will show only those projects. See Fig 8.

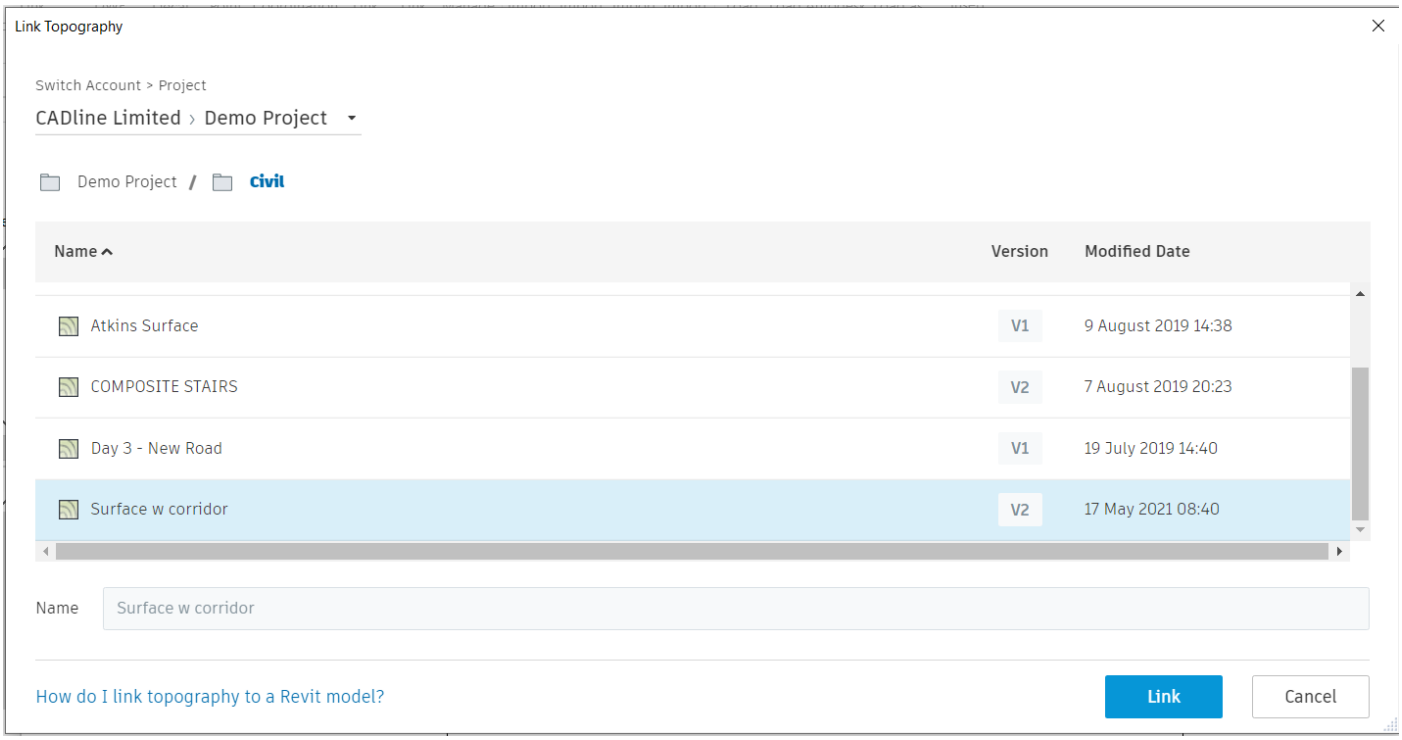


Fig 8

Choose the surface to import and then select the Link button. The surface is then imported. It will be placed at the centre of the screen if the screen limits are too vast. See Fig 9.

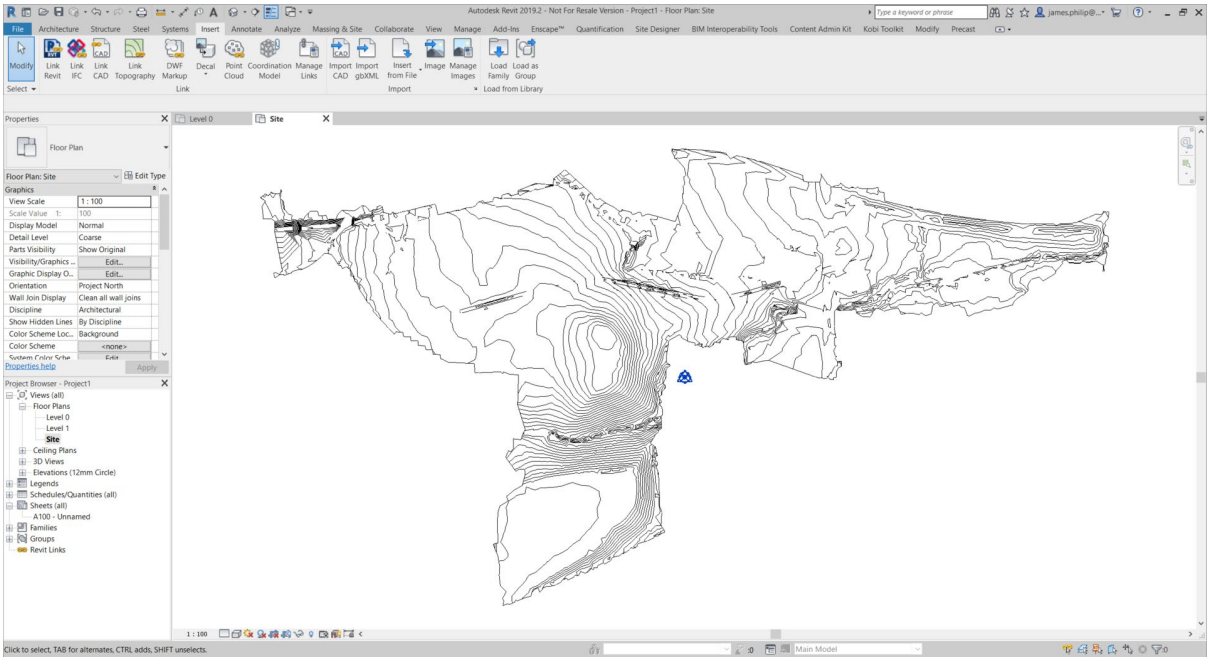


Fig 9

To relocate the Surface to the correct world coordinates, select the surface and in the Properties Palette, choose the Not Shared Button in the Shared Site Category and Reconcile from the next dialogue box. See Fig 10.

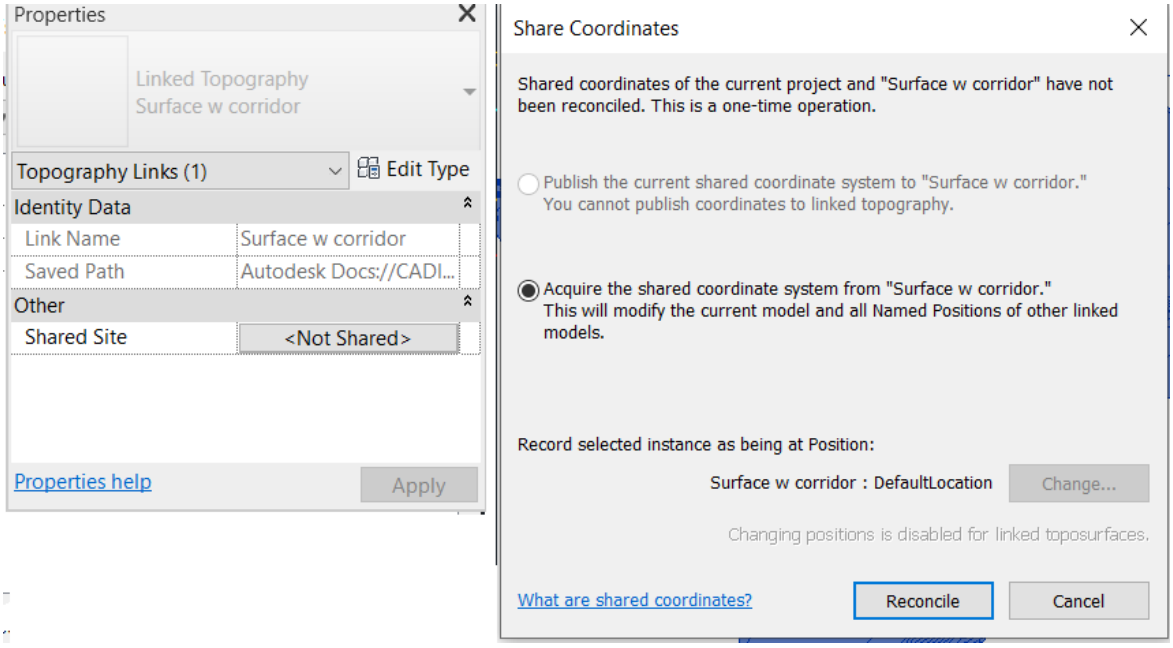


Fig 10

The final part of the process is to check that the surface has been placed to the correct world coordinates. Place a coordinate tag on a known reference point. The information should have the same coordinates that are reported in the Civil 3D file. See Fig 11.

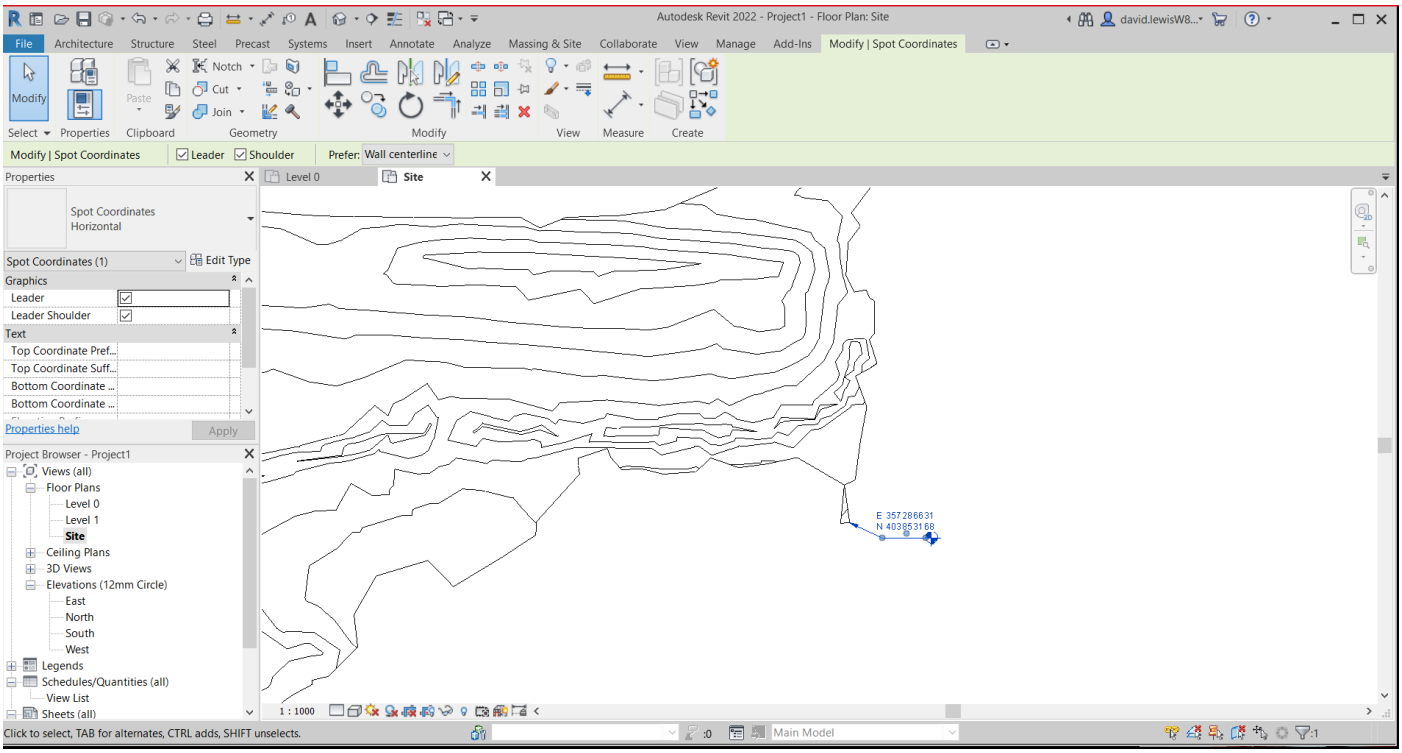


Fig 11