AS323608

Coordinating Civil 3D and Revit with Shared Reference Points and Desktop Connector

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Learning Objectives

- Understand how Civil 3D and Revit handle real world coordinates
- What tools are available for model coordination and where to find them
- Use the Shared Reference Point Tool to import Revit model into Civil 3D
- Leverage BIM 360 to import Civil 3D surfaces into Revit

Description

Make manual site coordination a thing of the past. In this class we'll be going over how to coordinate Revit models with Civil 3D site. Using the Shared Reference Point tool, we'll walk through the setup so that our data is tied together and our Revit model imports accurately into Civil 3D. Once our data is tied together, we'll leverage BIM 360 and the Desktop App to convert Civil 3D surface data into topography that Revit can use. By the end of this class, we'll be able to send information back and forth between Revit and Civil 3D.

Speaker

Michael is an Enterprise Support Specialist that has been working with Autodesk out of the Boston office for a little over 4 and a half years. He earned his Bachelor's in Civil Engineering from Northeastern University where he specialized in Transportation. While at Northeastern, he worked as a surveyor for the Department of Public Works in Cambridge, and later at two large Multidisciplinary Engineering firms that he helps support in his current role. Outside of his normal duties, he's regularly publishing solutions on the Autodesk Knowledge Network, spends time helping users on the Autodesk Forum, and has presented webinars on AutoCAD and Civil 3D. This is Michael's second time at AU, and first time presenting.

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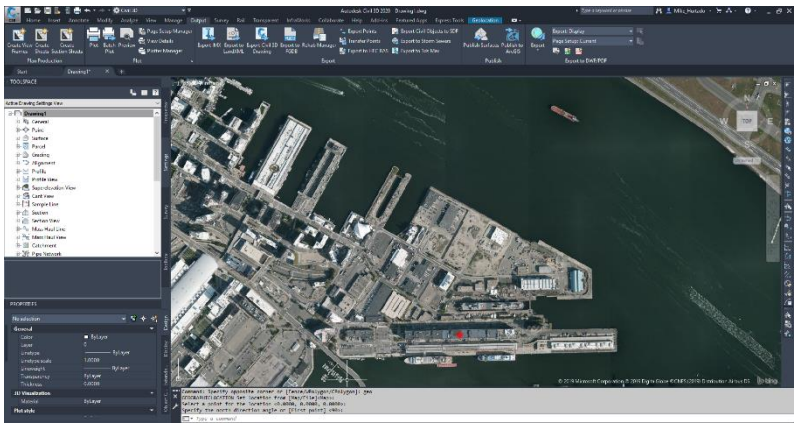
Understanding how Civil 3D and Revit handle Coordinate System

Revit and Civil 3D handle coordinate systems very differently. Revit is a powerful BIM tool where you're focusing on what's inside your building Civil 3D projects on the other hand heavily rely on making sure objects are georeferenced and comes preloaded with tools to help make sure this gets accomplished. With their different approaches to design, it can cause some headaches when collaborating between the two. Once we understand how each application handles coordinate systems, we'll have a better understanding of what we need to do to get our data coordinated and what tools we need to get it done. By the end of this demo we'll see that the process isn't all that daunting and we'll be comfortable coordinating between Civil 3D and Revit.

Coordinate Systems in Civil 3D

Civil 3D comes preloaded with a vast library of coordinate systems and can handle data that is far away from the drawing origin. With this, we're able to design sites that are tied to its real-world location, or georeferenced. To serve as a reference tool, maps are provided by Bing and can be turned on when a coordinate system has been set. Civil 3D also includes a lot of Map 3D functionality in the Planning and Analysis workspace, but we won't be going over those for the purposes of this class.

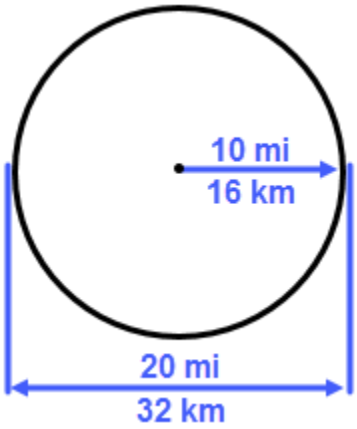


Autodesk's Boston Office in Civil 3D

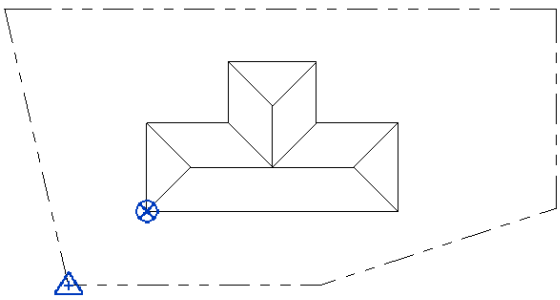
Coordinate Systems in Revit

Revit doesn't come preloaded with coordinate systems like Civil 3D. On top of this, there are limitations on the size of your model. From the Revit help documentation:

"When you create a Revit model, you are working on a modeling work plane that is 20 miles or 32 kilometers in diameter, with a radius of 10 miles or 16 kilometers from the internal origin. All geometry for the model, including geometry from an import or a link, should reside within the limits of the modeling work plane."



In addition to this, any imported data that is further than this modeling plane will be distorted and will not display correctly.



Project Base Point vs Survey Point

To get around this, Revit has two separate points, the Project Base Point and the Survey Point. The Project Base Point by default is located at the center of the modeling work plane and can be used to help with measurements within the site. The Survey Point helps tie the model into a real-world location. The Project Base Point can be identified by the following icon while the Survey Point looks like . It is important to note that both can be moved around our work plane.

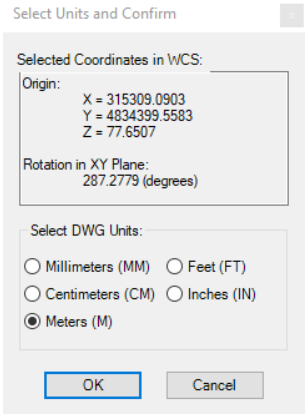
We'll be using the Survey Point to help tie the Revit model into the real world. While it is possible to manually do this, we'll be using a special tool to handle this for us.

Tools available for Model Coordination

Autodesk Shared Reference Point Tool

First up is the Autodesk Shared Reference Point tool. The Autodesk Shared Reference Point Tool first appeared in Autodesk Labs for the 2012 release of Civil 3D and Revit. It was then a part of the Productivity Tools for Civil 3D from 2013-2018. Since then it has been moved to the Autodesk Account Page.

The tool takes the information from a point in Civil 3D and exports it to an XML file. The XML contains the following information:



This information is then used to move our Survey Point so that it matches up with our Civil 3D drawing. The site will then be tied to our Civil 3D DWG and we'll be able to send information back and forth between the applications.

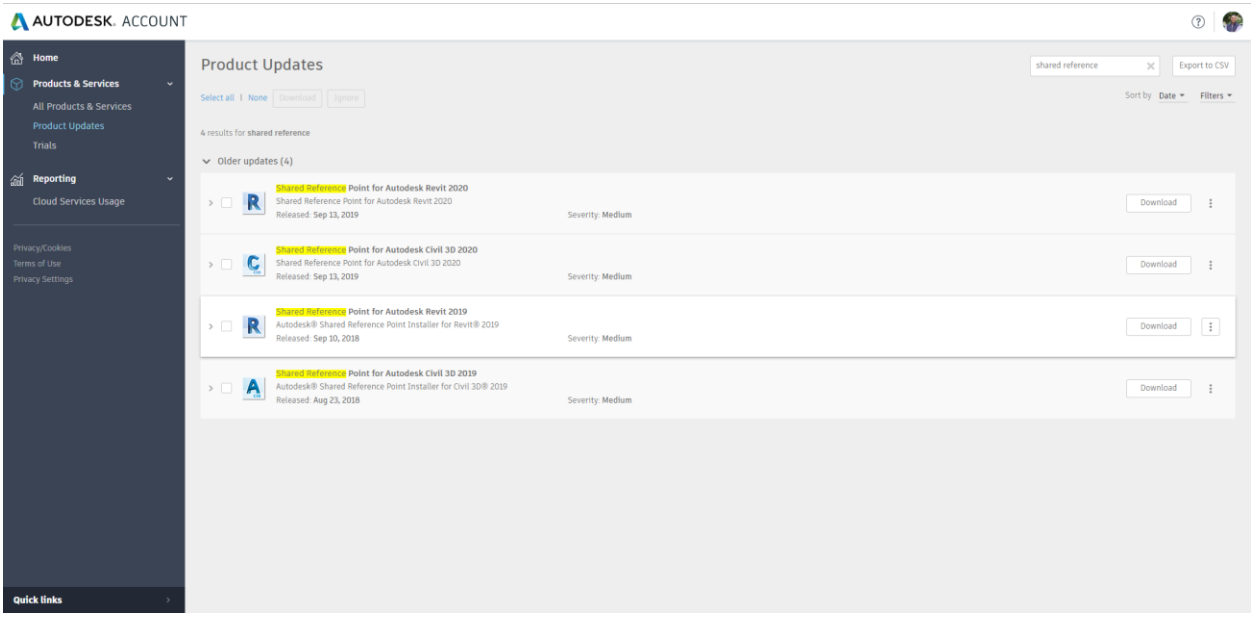
When downloading the Shared Reference Point Tool, it's important to note that there are two components; one for Civil 3D and one for Revit. The tools can be downloaded in the following location:

2018 and Older

The Shared Reference Point Tool was included with the productivity Tools and can be found in the Autodesk Knowledge Network : 2015 / 2016 / 2017 / 2018

2019 and Newer

The Shared Reference Point Tool can be found on the Autodesk Account Page. It can be found in the Updates and Add-ons section of each of the respective products, but can also be conveniently found in the Product Updates section:



Publish Surface Command

The Publish Surface command is a newer tool that was introduced in the 2019.1 update for Civil 3D and Revit. This workflow leverages BIM 360 to convert a Civil 3D surface into topography that Revit can use. To make sure that our surface comes into Revit in the correct location, the Revit model will need to be properly coordinated with Civil 3D which will already have been taken care of thanks to the Shared Reference Point Tool.

To use this workflow, you'll need a BIM 360 Docs account as well as well as the Desktop Connector. The Desktop Connector can be downloaded from the Autodesk Knowledge Network:

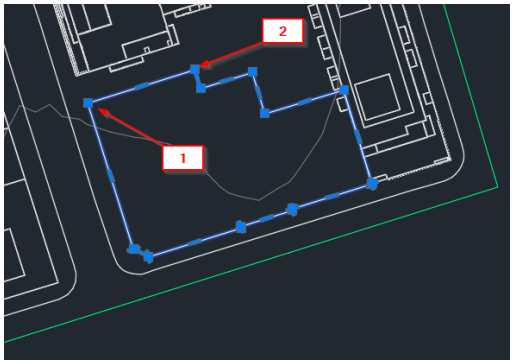
Install Desktop Connector for BIM 360

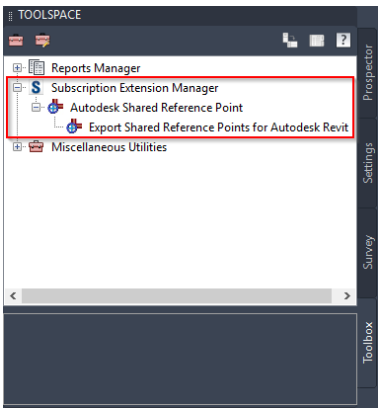
Using the Shared Reference Point Tool to import Revit models into Civil 3D

Since we now know that setting up the Survey Point is the first order of business when it comes to model coordination, let's dive into how to use the Shared Reference Point Tool. Once the tool has been downloaded and installed, our first step involves setting up the Shared Reference Point in Civil 3D.

Step 1 : Exporting Shared Reference Point from Civil 3D

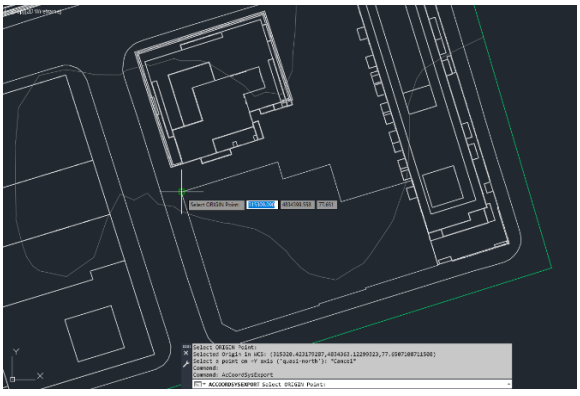
1.1 Before jumping into the tool, we're going to want to make sure that we have two points in Civil 3D and Revit that can use as reference. They will need to be at the same elevation. For the purposes of this demo, we're going to use the northern end of our building. Elevation is also key here, so make sure that you're picking points that we'll easily be able to access in both our model and our site. Something else to keep in mind is the order that you select the points in, otherwise your model will come in rotated 180° and at the wrong elevation.



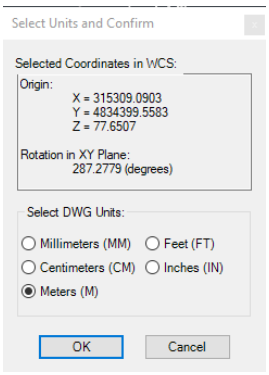


1.2 Access the Shared Reference Point Tool in Toolspace > Toolbox > Subscription Extension Manager. In Civil 3D, you'll only have the option to Export Shared Reference Points for Autodesk Revit.

1.3 Select your two points in Civil 3D. Remember the order that you pick them in!



1.4 Once the second point is selected, a window will pop up confirming the coordinates, elevation, and an option to pick units will pop up. If you have the information for the XYZ points, this would be a good time to double check that everything is ok.

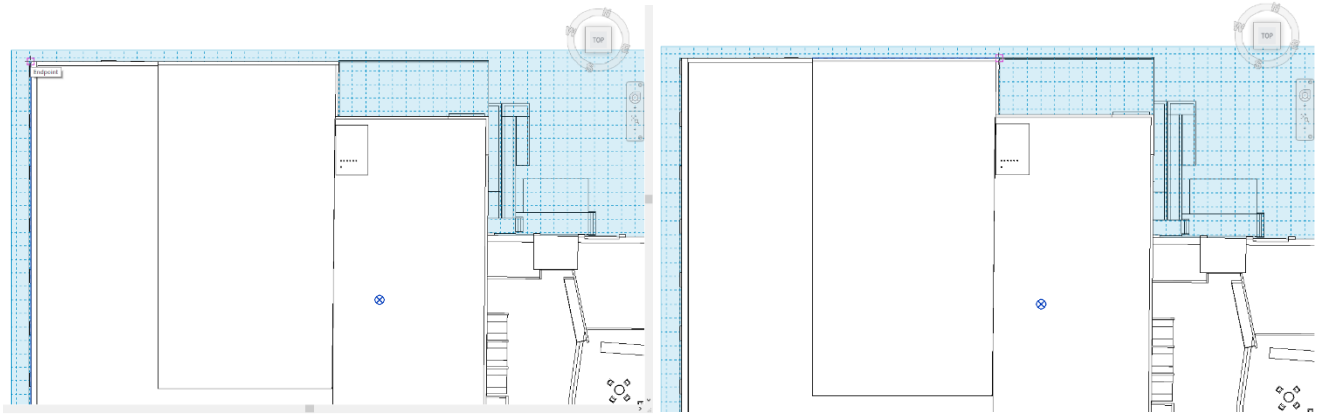


1.5 Select OK and choose a save location for the XML file. Remember where this is saved as we'll need to import it into Revit.

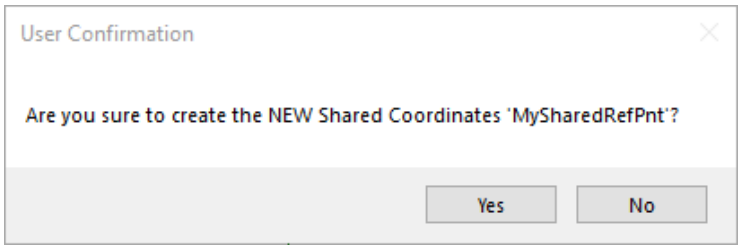
Step 2 : Import XML from Shared Reference Point into Revit

2.1 Head over to the Revit Toolbar > Add-Ins > Import Shared Coordinates from XML File

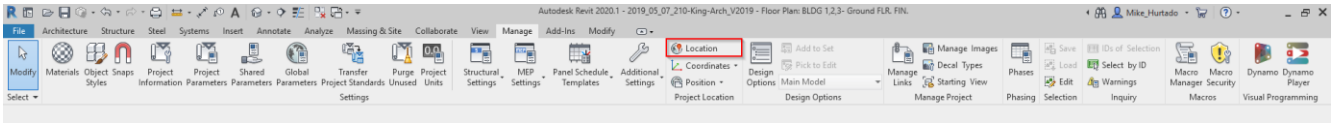
2.2 You'll be prompted to select the same two point that were previously selected in Civil 3D. Again, make sure that you're picking the same points in your Revit model and in the same order.



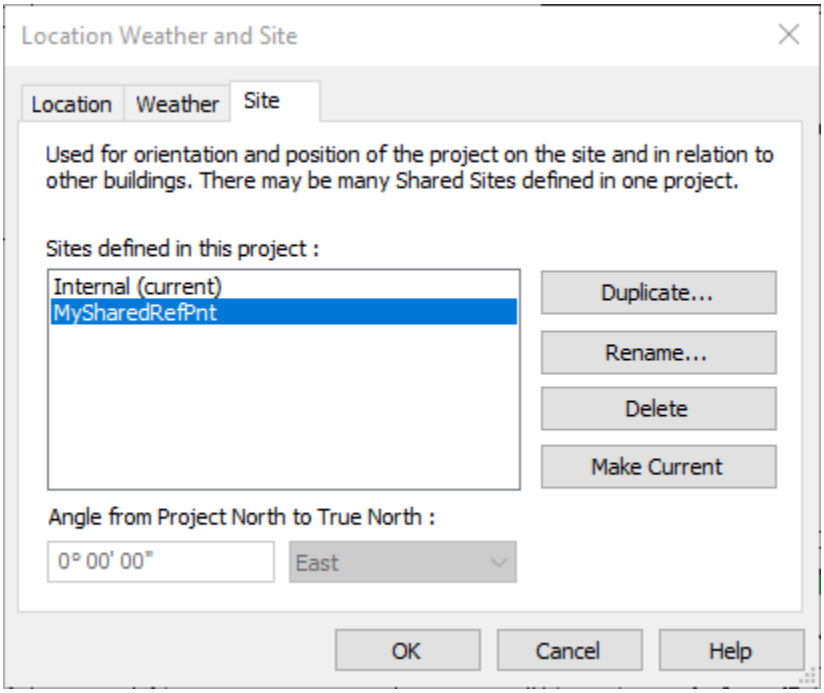
2.3 Once the second point is selected, you'll be prompted to import the XML file that was created in Civil 3D. Select the XML and a pop up will appear asking if you'd like to create Shared Coordinates. Select Yes.



2.4 A new site is created in the drawing where the Survey Point is updated. We aren't automatically updated to the new site, so we'll need to do it manually. In the Revit Toolbar > Manage > Location



2.5 A new site name "MySharedRefPnt" will be available! Highlight the site and select Make Current to update your Survey Point.

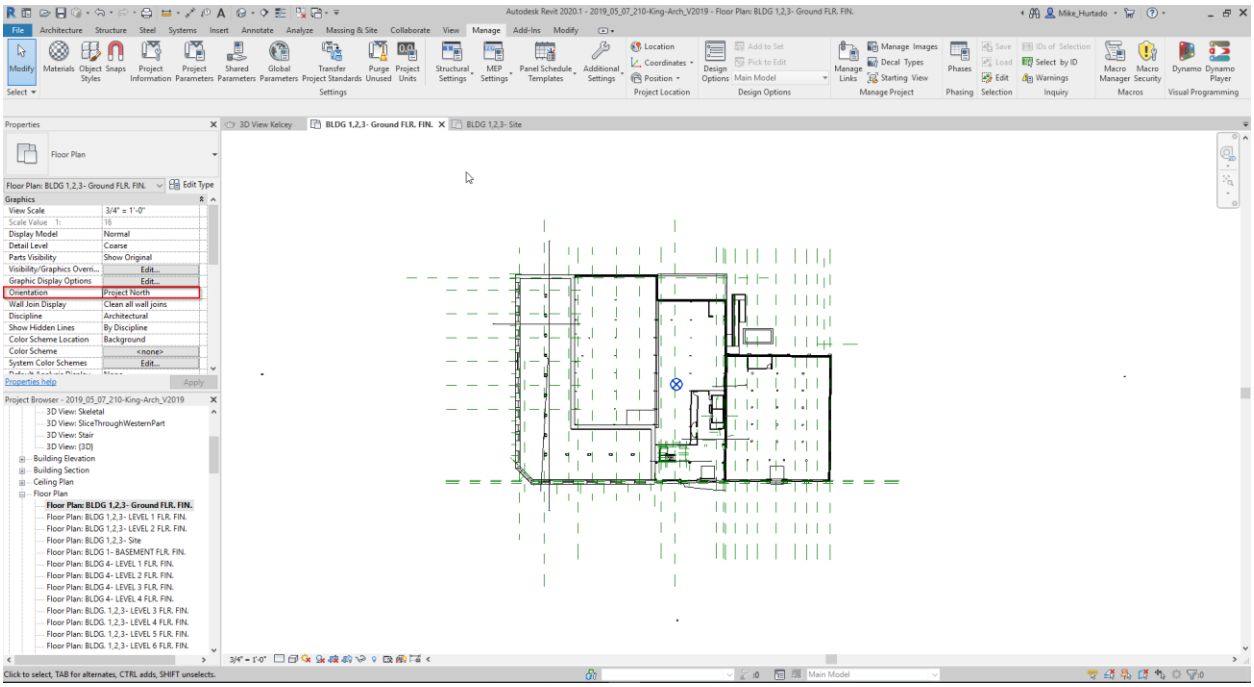


And with that our Revit project is now coordinated with our Civil 3D site! Sadly, there aren't any visual cues to let us know that the models properly coordinated which takes us to our next step.

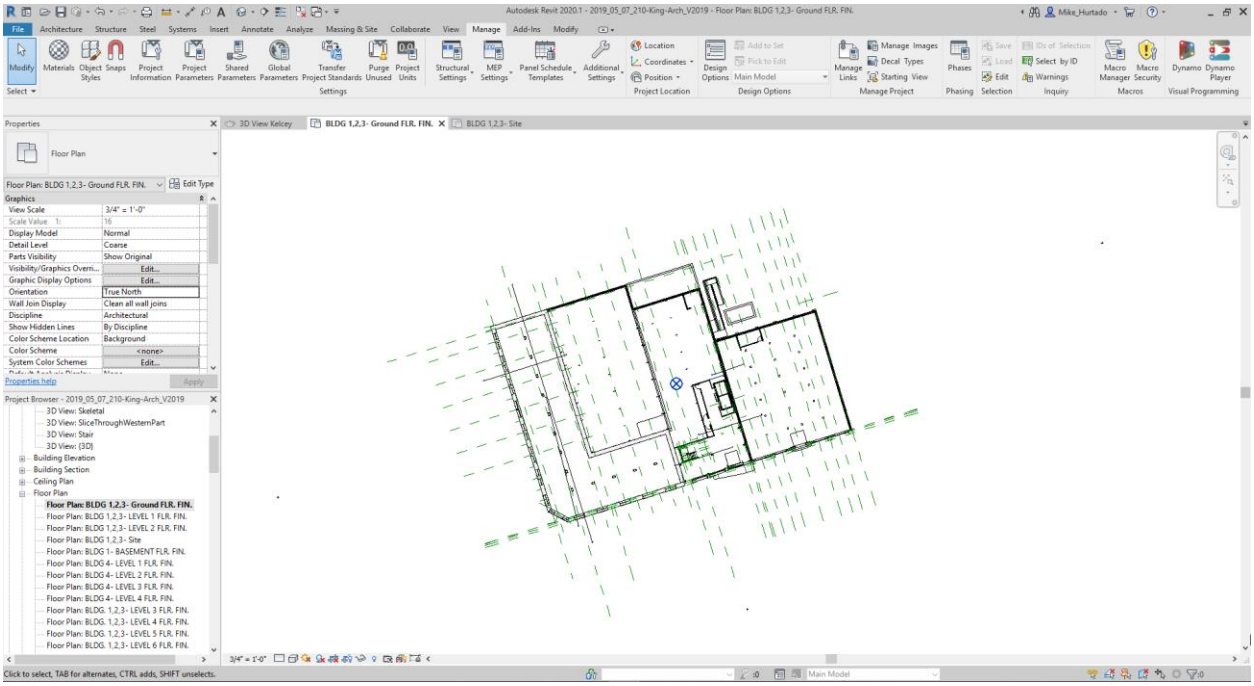
Tip: The site is named after the XML file. If you import an XML file with the same name, Revit will prompt you to overwrite the existing site. Alternatively, you can also change the name of the XML and have multiple sites in your Revit drawing.

2.6 Test if the Shared Reference Point Tool worked by checking the orientation of the model. In Revit properties, toggle the Orientation to True North and it should orient the same way that it is in Civil 3D.

Before:



After:

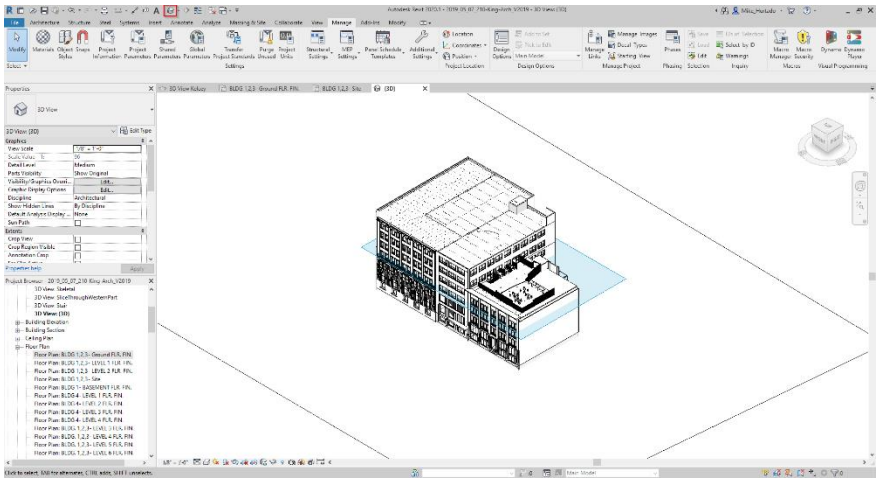


The Revit model should rotate to match what you're seeing in Civil 3D. If it rotates properly, then it's a good sign that our Shared Reference Point worked. We can move on and try importing our Revit model into Civil 3D.

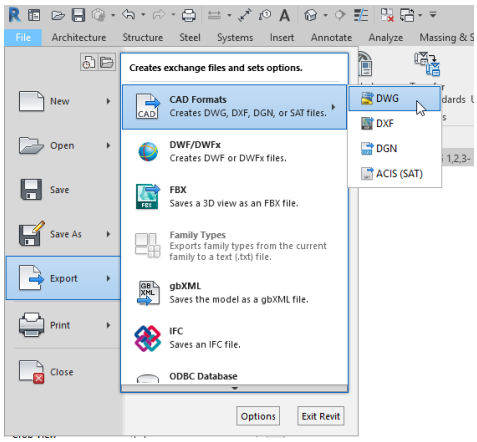
Step 3 : Importing Revit Model into Civil 3D

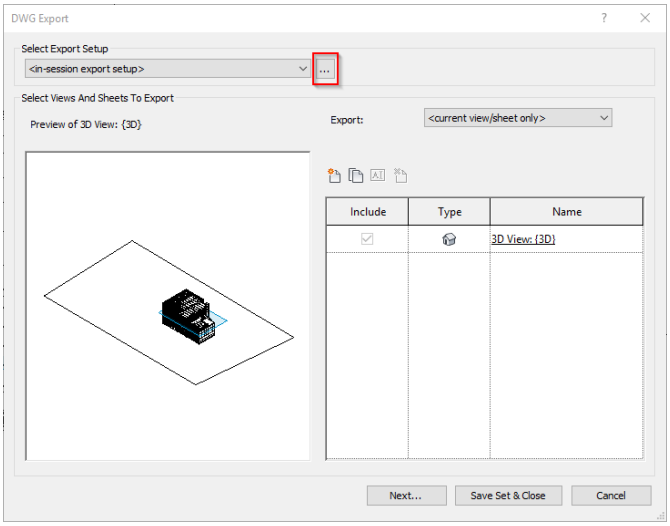
We're going to try exporting a 3D model of Revit and have it land in our Civil 3D site without having to make any adjustments.

3.1 To export a 3D model of Revit, press the default 3D view toggle

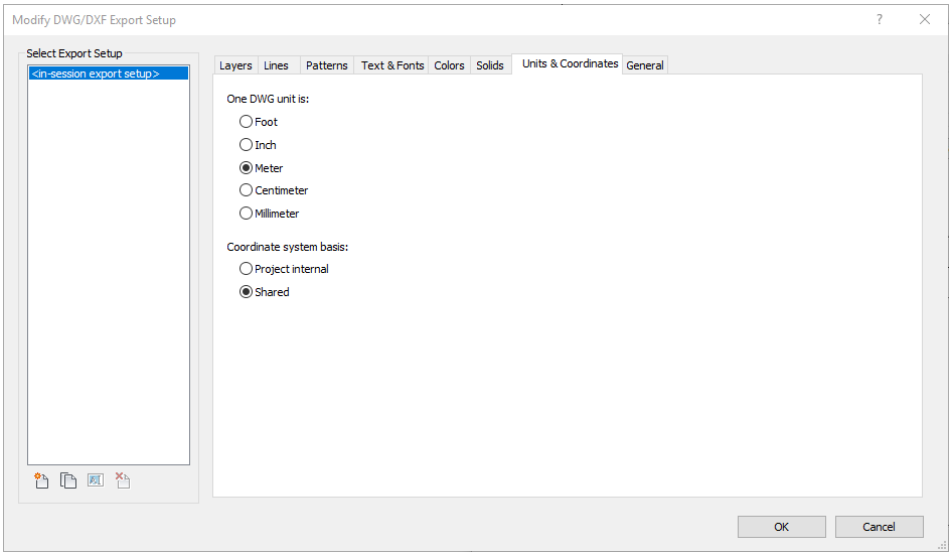


3.2 Select the Revit icon > Export > Cad Format > DWG



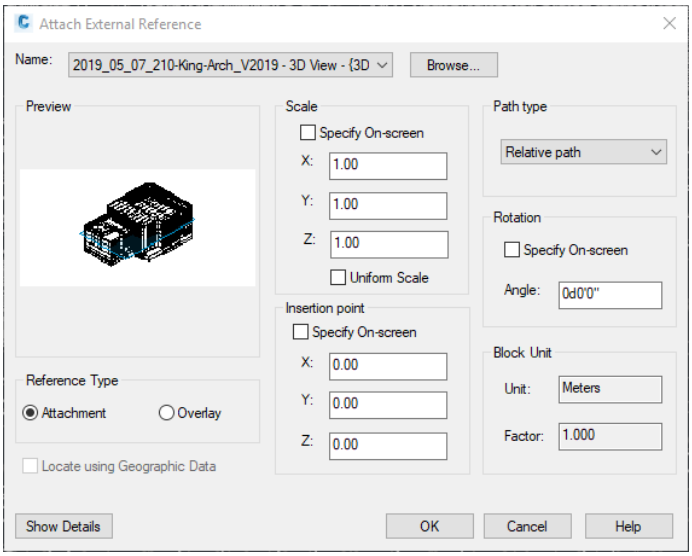


3.3 A few settings need to be tweaked for the Revit export to be coordinated with our Civil 3D DWG. Under the Modify DWG/DXG Export Setup dialog, make sure the correct units are set and that we're using the Shared Coordinate **NOT** the Project Internal Coordinate Base.



3.4 Once all the settings are correct, select OK and then Next… to save your DWG.

3.5 Back in our Civil 3D drawing, XREF the newly created DWG with all the settings. You'll want to insert the XREF at 0,0,0.

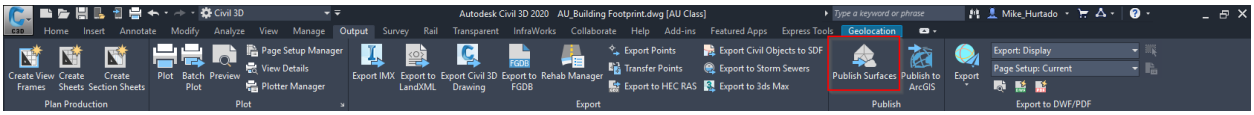


Using the Publish Surface Command to import Civil 3D Surface as Revit Topography

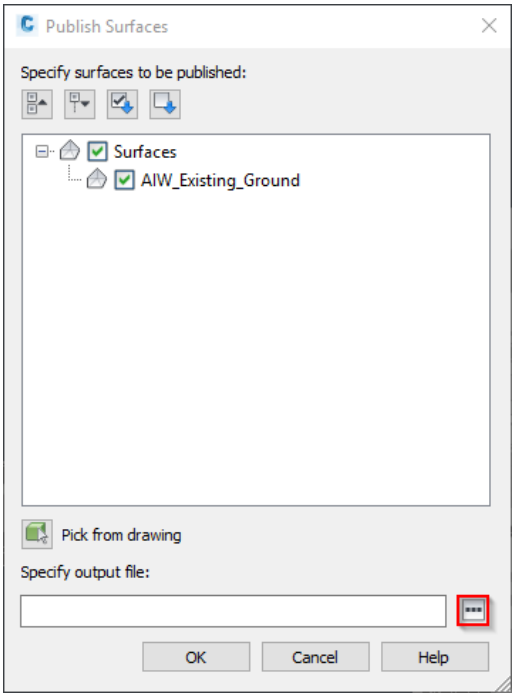
Now that we've managed to export our Revit model into Civil 3D, let's try going in the other direction. This is where the Publish Surface command comes into play.

Step 4: Using the Publish Surface Command from Civil 3D

4.1 The Publish Surface command can be found in the Civil 3D Ribbon > Output > Publish Surface



4.2 Select the surfaces for export and specify the location of the output file. Thanks to the Desktop Connector, your BIM 360 projects will be accessible via Windows Explorer. **Do not save locally.** You'll need to save it in a BIM 360 folder so that it is converted into topography that Revit can use. An important thing to note here, one file will be created each time you Publish Surface. Keep this in mind if you want to exclude surfaces or create separate files for each surface.



4.3 You'll have to wait for the output file to be generated. If using an outdated version of desktop connector, a notification will pop up in the system tray saying:

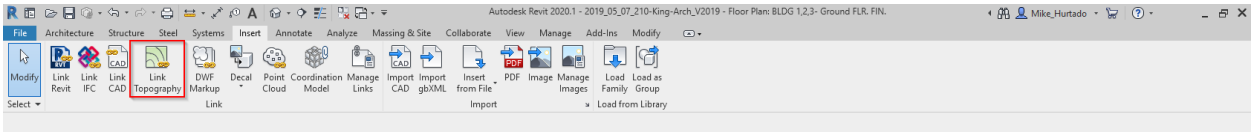
"The file and any associated files will be uploaded when you close this session"

You'll need to close Civil 3D completely for the file to start uploading. This step is crucial as it will allow the surface to be processed in BIM 360 and converted into a format that Revit can read. If you try to import the file into Revit before it is uploaded to BIM 360, it'll show up in

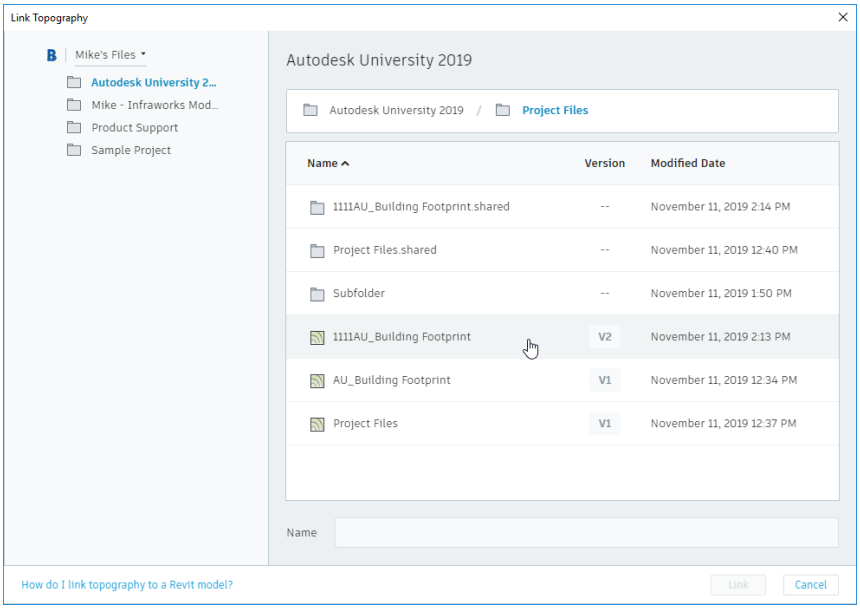
Windows Explorer, but it will produce an error when importing into Revit. To avoid this in the future update to the latest version of the Desktop Connector.

Step 5: Importing the Surface into Revit

5.1 With the surface published and on BIM 360, all that's left is to link it into Revit. The Link Topography tool can be found in the Revit Toolbar > Insert > Link Topography

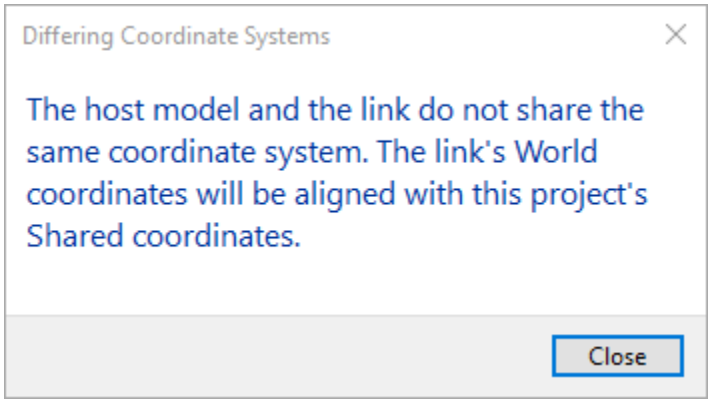


5.2 A Link Topography window will pop up that pulls information from your local BIM 360 cache. Select the file that was created in Civil 3D (Ignore the .shared folder).

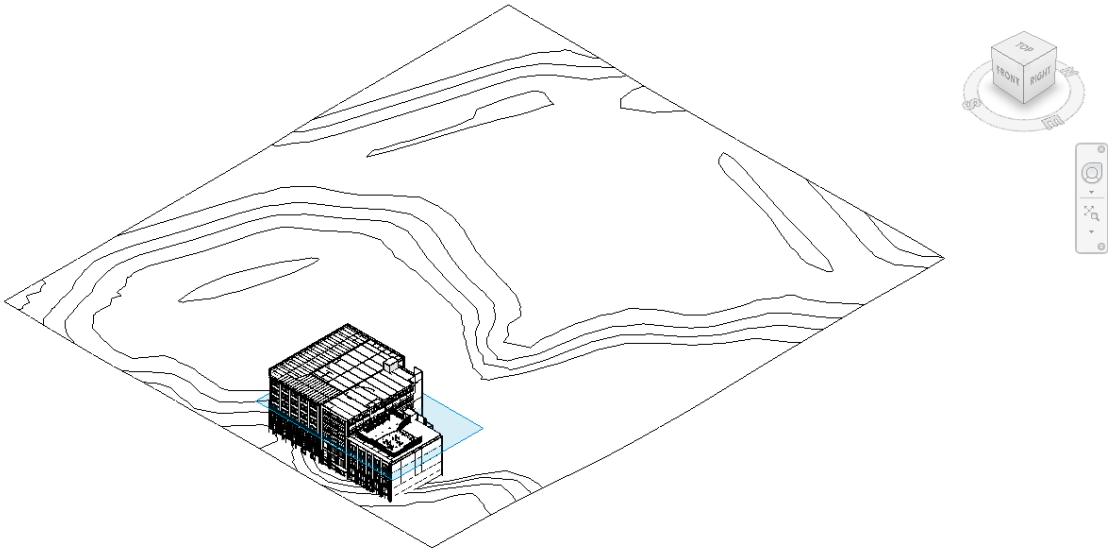


If you get any error messages, or if the file isn't showing up, check the BIM 360 Docs web page to see if it uploaded properly.

5.3 You'll get a message saying that the coordinate systems don't match, but this can be ignored. Select Close.



5.4 Depending on which view you're in, you may not be able to see your topography. Switch over to a 3D view and double check that everything came in correctly:



Topography Linked in Revit

Congratulations! Your topography is now linked into your Revit model. Since the surface is linked, if any changes are made in Civil 3D and the surface is republished, the versioning will be updated in BIM 360 Docs and you'll see the changes in your Revit model.

Common Issues

Can't select second point with Shared Reference Point Tool

An error will normally pop up in the command line saying the following:

"Selected Point has a different WCS Elevation to Origin – please try again…

To resolve this, you'll need to make sure that the elevation of the second point matches that of the first.

Exported Revit Model very far from Civil 3D site

There are a couple possible causes for this:

1) Mismatching units in Revit and Civil 3D model. Make sure that the Revit model units match those of the INSUNITS in Civil 3D.

--OR--

2) Exported Revit isn't using shared coordinate system.

Model shifts a bit in X or Y plane in Civil 3D

If a model comes in a little off in Civil 3D, it may be due to the difference between US Survey Feet and International Feet. The conversion between the two is:

.999998 US Survey Feet = 1 International Foot

Revit doesn't support US Survey Foot and when we're talking about building design it doesn't make a big difference. When we're talking about georeferencing however, this can lead to data this is slightly off. To work around it, set **INSUNITS** in Civil 3D to **2** for Feet.

Model shifts in Z plane in Civil 3D

The elevation is based off the first point selected with the Shared Reference Tool. Make sure:

1) Your point is on the correct surface in Civil 3D (i.e. don't pick the existing surface if your design surface is going to be at a different elevation)

2) You're selecting the correct point in Revit. Make sure the floor plan that you're selecting is at the correct level.

“Failed to link the topography through Autodesk Desktop Connector. Please try again later.”

The most common cause of this issue is that the surface hasn’t been processed in BIM360. In older versions of the Desktop Connector, files wouldn’t upload to BIM360 until Civil 3D was closed. Either close out of Civil 3D or update the Desktop Connector to get around this issue. Check the BIM 360 Docs web page to make sure that the file has been properly uploaded. Once it shows up in the web page, then try to Link Topography in Revit.

Helpful Links

Revit: About the Maximum Distance

Revit: About Base Point and Survey Point

Link Topography to the Building Model

Civil 3D: About GIS Coordinate Systems

Two Right Feet? U.S. Survey Feet vs. International Feet

Stay on Point! Using a Shared Reference Point across Autodesk Products by John Sayre