Exercise 1: Georeference a BIM file

Technical note

Navigation in the 3D scene environment can be affected by variables based on individual system parameters, such as graphics cards and memory. If necessary, go to ArcGIS Pro Help: Set display options to help improve performance.

Software requirements

- ArcGIS Pro 3.1

Introduction

Building information modeling (BIM) files, such as Autodesk's Revit files, are a common source of GIS content, but before it can be used in ArcGIS Pro, the data must have a defined geographic location on the earth.

All Revit files contain georeferencing information, and it is becoming more and more common for architects and engineers to assign real-world–that is, geographic–coordinates through the Revit Survey Point and Project Base Point parameters. ArcGIS Pro integrates these coordinates when present and can place the model in its correct location. When these coordinates are available, no manual georeferencing is required.

However, sometimes BIM and CAD design files will only use a local coordinate system instead of a geospatial coordinate system within a model. Because these coordinate systems do not contain inherently geographic locations, the BIM data must be georeferenced to a valid, recognized, and standardized geospatial coordinate system.

In this exercise, you will sign in to ArcGIS Online to download and install ArcGIS Pro. Then, you will examine building models and georeference the associated BIM data to its correct location on Earth.

Note: The exercises in this course include View Result links. Click these links to confirm that your results match what is expected.

Scenario

Imagine that your architectural firm is working with the city of Utrecht in the Netherlands on two new building projects. You have two Revit files of the building models and need to show them in their planned locations. The city of Utrecht provided you with a high-resolution 3D mesh of the city and environs. You will examine building models and georeference them to their correct locations.

Estimated completion time: 45 minutes

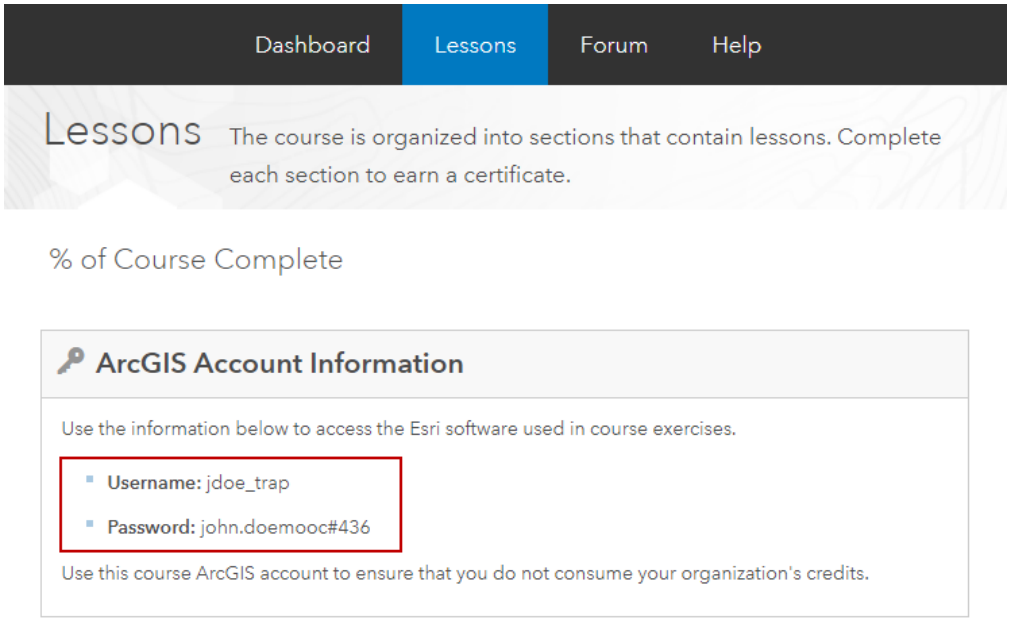
Expand all steps | Collapse all steps

- Step 1: Access your MOOC credentials

In this step, you will visit the MOOC home page to locate your course account username and password. Then you will sign in to ArcGIS Online with your MOOC credentials.

a On the MOOC home page, next to Dashboard, click Lessons.

b Under Lessons, locate the ArcGIS Account Information section and notice the username and password, as indicated in the following graphic.



This information is your course ArcGIS account username and password. You will use these credentials to download ArcGIS Pro and complete all the MOOC exercises. The username for this account ends with _trap (for example, jdoe_trap). You may want to write down the username and password for quick reference. You can also return to the Lessons tab at any time to locate your credentials.

Note: If you registered for the MOOC within the past few hours, your account may not be ready. Refresh the page in an hour or so to determine if your account is available.

c Open a web browser in private or incognito mode.

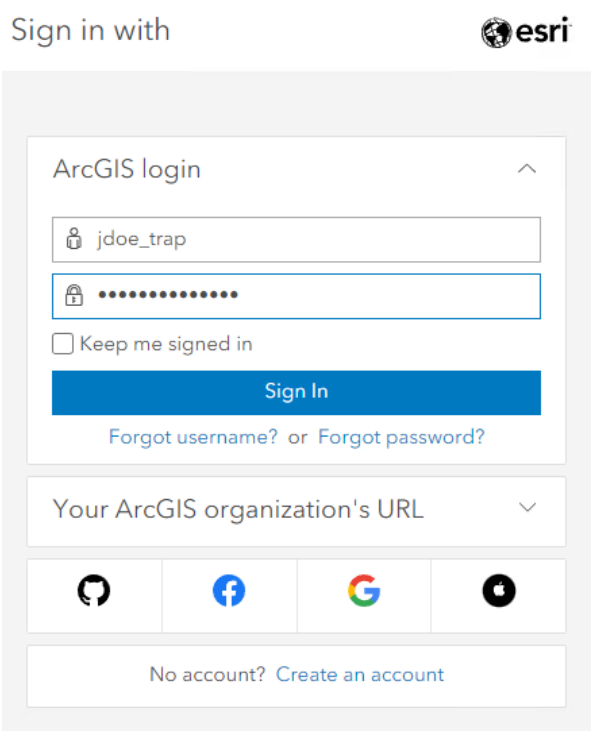
Note: To learn how to enable private browsing, go to the article How to Enable Private Browsing on Any Web Browser (https://links.esri.com/HowToBrowse | https://www.howtogeek.com/269265/how-to-enable-private-browsing-on-any-web-browser).

d In the address bar, type **www.arcgis.com** and press Enter.

*Step 1d***: Access your MOOC credentials.*

e Click Sign In.

f Under ArcGIS Login, enter your course ArcGIS username and password.



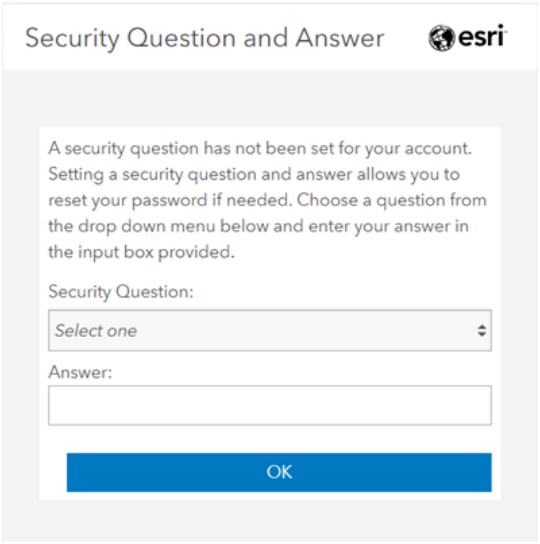
*Step 1f***: Access your MOOC credentials.*

g Click Sign In.

For the first time that you sign in, you may be asked to change your password and set a security question.

h If necessary, follow the on-screen instructions to change your password.

i Follow the on-screen instructions to set your security question.



*Step 1i***: Access your MOOC credentials.*

Note: An automated email will be sent to the email address associated with the account, telling you that your account was recently modified; no action is required.

After you set your security question, you will see the home page of the MOOC organization. You now have your MOOC account information and access to the MOOC organization.

j If you would like, bookmark the MOOC organization home page.

Next, you will download the exercise data.

- Step 2: Download the exercise data files

In this step, you will create the file structure that you will use throughout the rest of the MOOC to store exercise data. Then, you will download the exercise data files for Section 2.

a From your Windows taskbar, open File Explorer, and then browse to and select your C: drive.

b Click the Home tab, if necessary, and then click New Folder to create a new folder.

Note: You can also right-click in the white space, point to New, and choose Folder.

c For the folder name, type **EsriMOOC** and press Enter.

This folder will be used to store the exercise data and any projects that you start in ArcGIS Pro and ArcGIS Drone2Map throughout the course. When you create the folder, do not include any spaces or special characters.

d Open a new web browser tab or window.

e Go to https://links.esri.com/EsriMOOC and download the EsriMOOC data ZIP file.

Note: The complete URL to the exercise data file is https://www.arcgis.com/home/item.html?id=df75693ce3214cadb87a272f8e753c21.

f Extract the files to the **EsriMOOC** folder on your local computer.

g Verify that the EsriMOOC folder contains a Data folder and a Projects folder.

h Close File Explorer.

- Step 3: Confirm that your computer can run ArcGIS Pro

In this step, you will run a test to confirm that your computer can support ArcGIS Pro. Even if you already have ArcGIS Pro installed, you should confirm that it can support ArcGIS Pro 3.1.

Note: This test uses a third-party executable file. If you prefer, for security reasons, not to run this test, you can review the Common Questions or go to ArcGIS Pro Help: ArcGIS Pro 3.1 system requirements.

a In a web browser, go to the Can You Run It? test (https://links.esri.com/CanYouRunIt) link.

b Click Run Tech Check.

c Follow the steps to open and run the test.

The site generates a report that lists the minimum requirements and identifies whether your machine meets these requirements.

d If your computer does not meet the requirements, check the Common Questions to find links to complete the recommended updates, and then run the test again.

Note: If your computer does not meet the requirements, you may need to use a different computer or update your graphics card. For more information, go to ArcGIS Pro Help: Graphics adapter resources.

e If your computer meets the requirements, save the report.

The MOOC team may ask you to share the report if you need help in later ArcGIS Pro exercises.

- Step 4: Install Microsoft .NET Desktop Runtime 6.0.5

ArcGIS Pro 3.1 is built on .NET 6.0, Microsoft's latest edition of .NET for Long-Term Support. Moving to this version of .NET positions Esri and other ArcGIS Pro developers well for future development and enhancements. Additionally, with certain third-party components only updating controls to .NET 6 moving forward, it is important and necessary that you stay at the forefront of the software development community.

Before you can install ArcGIS Pro 3.1 to use in the MOOC exercises, you must update your version of .NET. In this step, you will update .NET on your machine.

a In a web browser, go to ArcGIS Pro Help: Software requirements.

b For Microsoft .NET, click the link under Minimum Requirement and follow the instructions.

When you have successfully installed and updated .NET, you are now ready to download and install ArcGIS Pro 3.1.

- Step 5: Install ArcGIS Pro

This MOOC uses ArcGIS Pro 3.1. You will install ArcGIS Pro 3.1 from ArcGIS Online.

a In a web browser, go to the MOOC organization home page and, if necessary, sign in.

- Hint

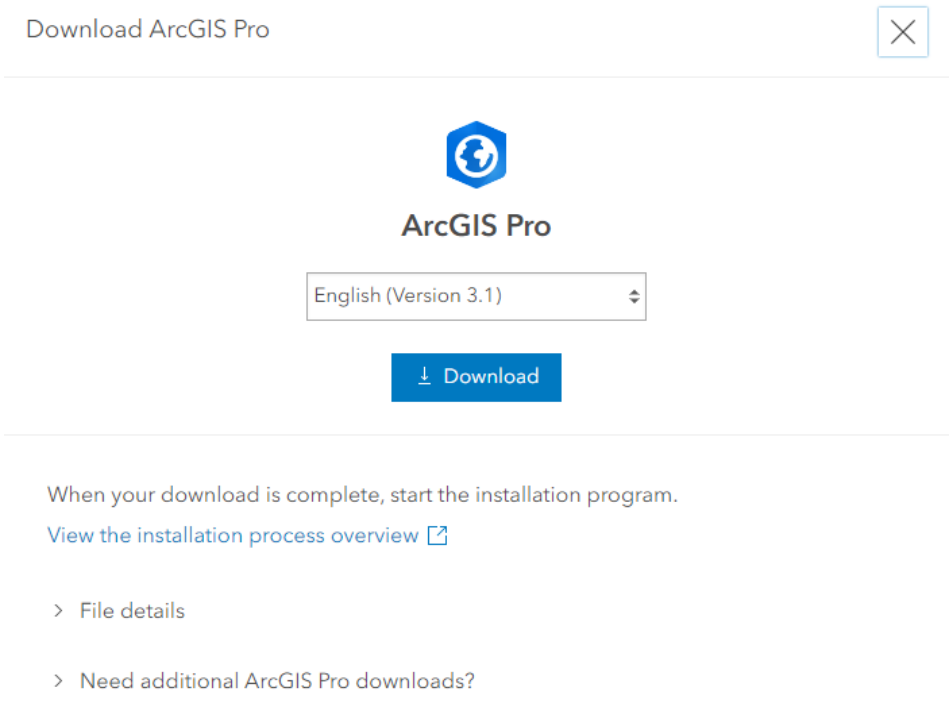
Use the bookmark that you created in the first step, or go to **www.arcgis.com** and use your MOOC credentials to sign in and access the MOOC organization home page.

b In the upper-right corner, click your account, and then click My Settings.

c On the left side of the page, under My Settings, click the Licenses tab.

d Under Licensed Products, locate ArcGIS Pro.

e To the right of the software name, click Download ArcGIS Pro.



*Step 5e***: Install ArcGIS Pro.*

The Download window opens.

Note: You can run ArcGIS Pro in a different language by clicking the down arrow next to English (Version 3.1) and choosing a different supported language. Keep in mind that this course is taught in English, which means all screenshots and exercises will use the English version of ArcGIS Pro.

f Click Download.

If the default download location does not have enough space, you can change the location by following the steps in this How to Change the File Download Location in Your Browser article (https://links.esri.com/ChangeDownloadLocation).

g After the download completes, double-click the .exe file.

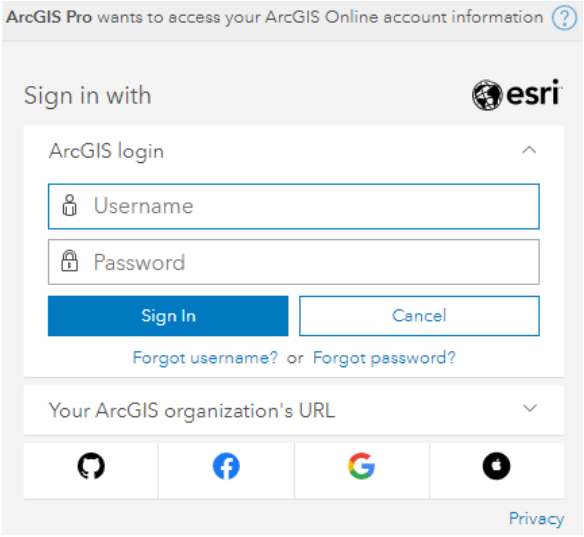
h Follow the installation instructions, accepting all defaults.

i When you are finished installing ArcGIS Pro, close your web browser.

- Step 6: Sign in to ArcGIS Pro

In this step, you will use your course ArcGIS account username and password to sign in to ArcGIS Pro. You will need to use your course ArcGIS account to license ArcGIS Pro and to access other software applications that are used throughout the MOOC exercises.

a If necessary, start ArcGIS Pro.



*Step 6a***: Sign in to ArcGIS Pro.*

Note: If you are already signed in to ArcGIS Pro with a different account, in the top-right corner, click Sign Out, and then click Sign In.

b Sign in with the provided course ArcGIS account username that ends in _trap.

Note: The course ArcGIS account username and password are listed on the MOOC home page under Lessons. The username for this account ends with _trap (for example, jdoe_trap).

c Click Sign In.

- Step 7: Open an ArcGIS Pro project

Now that you have installed the software for the course, you will open an ArcGIS Pro project for where you will georeference BIM files in the city of Utrecht, Netherlands.

a On the ArcGIS Pro Start page, near Recent Projects, click Open Another Project .

Note: If you have configured ArcGIS Pro to start without a project template or with a default project, you will not see the Start page. On the Project tab, click Open, and then click Open Another Project.

b In the Open Project dialog box, browse to **C:\EsriMOOC\Projects\UtrechtPlan**, which is the folder that you saved on your computer.

c Click UtrechtPlan.aprx to select it, and then click OK.

*Step 7c***: Open an ArcGIS Pro project.*

Your ArcGIS Pro project opens to a topographic reference map, called a basemap.

At the top of the map is the ArcGIS Pro ribbon. ArcGIS Pro uses this horizontal ribbon to display and organize functionality into a series of tabs. On the Map tab is the Navigate group, which provides the tools that you need to navigate the map. The default tool is the Explore tool, which you can use to pan and zoom in and out of maps. To explore different areas of the world on this basemap, pan the map by clicking your mouse and holding down the button while you move the map. When you pan a map with the mouse, the pointer becomes a hand. Zoom in or out of the map using the mouse wheel or by using the Fixed Zoom In button and Fixed Zoom Out button in the Navigate group.

To the left of the map is the Contents pane, which lists the layers that have been added to the map. To the right of the map is the Catalog pane, which lists the items associated with this ArcGIS Pro package: Maps, Toolboxes, Notebooks, Databases, Styles, Folders, and Locations.

If you do not see the Contents or Catalog panes, from the View tab, in the Windows group, either click Contents or Catalog Pane.

To learn more about the ArcGIS Pro interface, go to ArcGIS Pro Help: ArcGIS Pro user interface, and to learn more about ArcGIS Pro projects, go to ArcGIS Pro Help: Projects in ArcGIS Pro.

- Step 8: Create a folder connection

In this step, you will create a folder connection in ArcGIS Pro. The folder connection will allow you to access data for the exercise.

a. In the Catalog pane, from the Project tab, right-click Folders and choose Add Folder Connection.

b. In the Add Folder Connection dialog box, browse to **..\EsriMOOC\Data**, click the Utrecht folder to select it, and click OK.

c. In the Catalog pane, expand Folders to see the new folder connection.

d. Right-click the Utrecht folder and choose Add To New Projects.

This option will make the folder connection persist between different projects.

- Step 9: Explore the local scene

A scene in ArcGIS Pro is very similar to a web scene in ArcGIS Online. A scene allows you to visualize your data and analyze geographic information in an intuitive and interactive 3D environment. Local scenes are best used for displaying or analyzing data at the local or city scale that have a fixed extent in which you work.

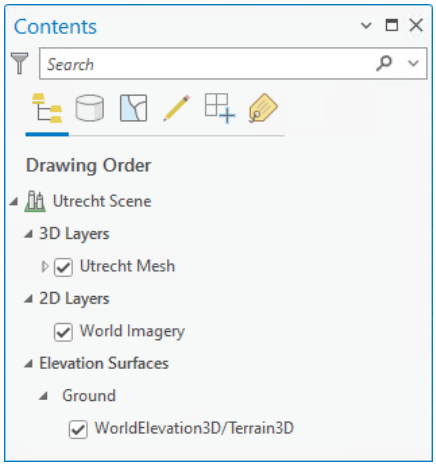
In this step, you will open a local scene of Utrecht, Netherlands. This scene contains a highly detailed 3D mesh layer of the city center.

a In the Catalog pane, expand Maps, and then right-click Utrecht Scene and choose Open Local View.

*Step 9a***: Explore the local scene.*

This scene will serve as the backdrop for your new buildings and provide context for how these newly planned buildings will fit into the existing built-up environment.

b In the Contents pane, notice the different layers that are available in your scene.

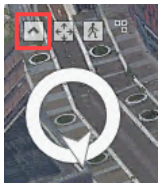


*Step 9b***: Explore the local scene.*

Similar to the basemap in a map, the scene also contains a basemap. The basemap in this scene is the World Imagery layer in the 2D Layers group. Other layers in the scene include an elevation surface layer (WorldElevation3D/Terrain3D) and a 3D mesh layer of Utrecht. You will learn more about mesh layers later in the MOOC.

You will use the navigation controls to familiarize yourself with the area.

c In the scene, above the Navigator wheel, click the Show Full Control button, as indicated in the following graphic.



d Notice how the Navigator wheel expands to include 3D navigation functionality.

*Step 9d***: Explore the local scene.*

e Move your cursor to the middle Navigator wheel to activate the tilt and rotate navigation controls, as shown in the following graphic.

The active axis of the Navigator wheel will change color as you move your cursor over each component of the wheel.

f Use the middle Navigator wheel to tilt and rotate the scene.

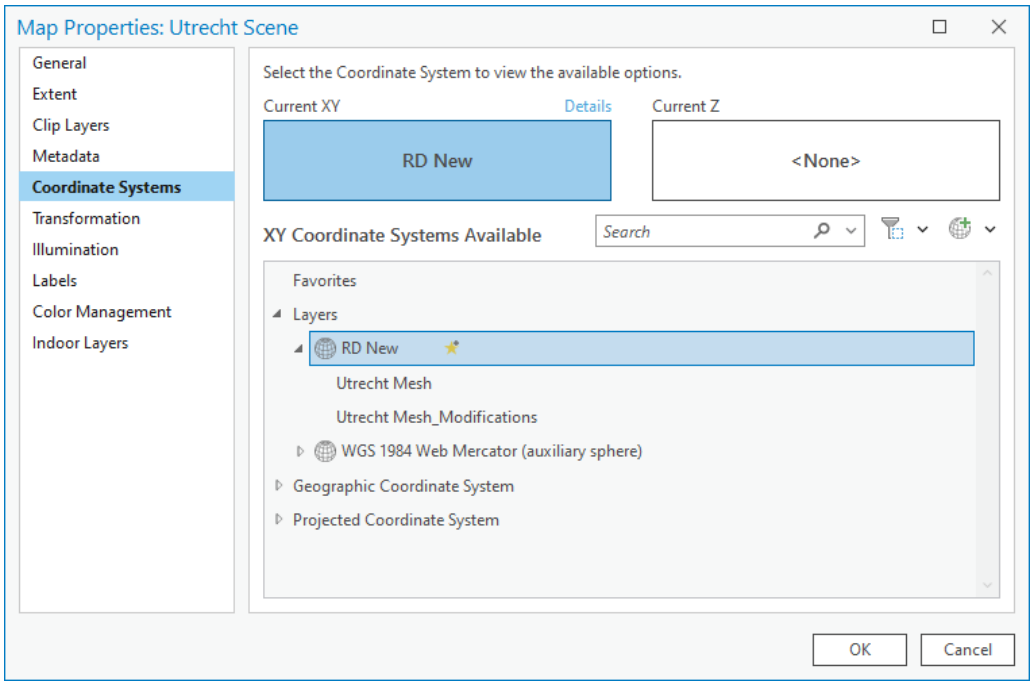
Note: You can also use the mouse buttons and wheel navigate in the scene. To learn more about the options available for 3D navigation in ArcGIS Pro, go to ArcGIS Pro Help: Navigation in 3D.

g Using your new navigation skills, zoom in and out and move through the scene to evaluate the built environment of Utrecht.

Because you will be georeferencing BIM files to the scene, you must determine which spatial reference system, that is a coordinate system, is being used for this scene.

h In the Contents pane, right-click Utrecht Scene and choose Properties.

i In the Map Properties dialog box, on the left side, click the Coordinate Systems tab.



*Step 9i***: Explore the local scene.*

? What is the Current XY coordinate system in use?

- Answer
The current coordinate system for this scene is RD New.

Note: This coordinate system is used in the Netherlands for both onshore, including Waddenzee and Dutch Wadden Islands, and also the 12-mile offshore coastal zone. It is commonly used as a national system for engineering, surveying, and topographic mapping. For more information on the RD New coordinate system, go to the Netherlands Cooperation Geodetic Infrastructure (NSGI) website.

You will use the RD New coordinate system to geolocate your building models.

j Click Cancel to close the Map Properties dialog box without making any changes.

Now that you have explored the city of Utrecht, you will reset your view to an existing bookmark. You will orient the scene to the location where you will add a building model for a new tower and georeference it to its planned location.

k From the Map tab, in the Navigate group, click Bookmarks and select New Building Location.

*Step 9k***: Explore the local scene.*

Your scene will return to the same view that you saw when you first opened the Utrecht scene. In this view, you can see a tower crane on the far side of the railway station tracks and the beginnings of construction. The planned location for the first new building is between the crane and the rail yard.

- Step 10: Inspect the building model

Building information modeling (BIM) data is a common source for GIS content and can be used natively by ArcGIS Pro. However, before it can be added to a map view or a scene view, the data must have an assigned coordinate system.

Before you add the building model to your scene, it is recommended to inspect the BIM properties to determine whether there is any existing coordinate information. If none exists, you must then assign a new coordinate system to place it in the correct geographic location. In this step, you will review BIM data and determine whether any existing coordinate information exists for the data.

a In the Catalog pane, expand Folders, if necessary, and then expand the Utrecht folder.

b Within the Utrecht folder, right-click the BIM folder and choose Show In File Explorer.

Note: Alternatively, you can open File Explorer from your desktop and browse to **..\EsriMOOC\Data\Utrecht\BIM**.

? What files are in this folder?

- Answer

There are five files located in this folder; there are two Revit files (Blg_3.rvt and Tower_ft.rvt), a single 3D World File (Blg_3.wld3) associated with the Blg_3 Revit file, and XML metadata files (TRAP_Blg_3.rvt.xml and TRAP_Tower_ft.rvt.xml) associated with the two Revit files.

ArcGIS Pro supports BIM design files from Industry Foundation Classes (IFC) formatted files and Autodesk Revit (RVT) as ArcGIS BIM file workspaces. BIM data can be georeferenced using a feature layer of a BIM file workspace in an ArcGIS Pro scene to accurately position BIM data without changing the original source data.

These BIM files are required to have a valid Esri coordinate system definition file—stored as a PRJ file—and may require an optional coordinate transformation or offset definition file known as a 3D world file—stored as a WLD or WLD3 file—to identify how the coordinates in the BIM data should be positioned on the earth's surface. PRJ and WLD3 files will have the same name as the BIM design file with which they are associated.

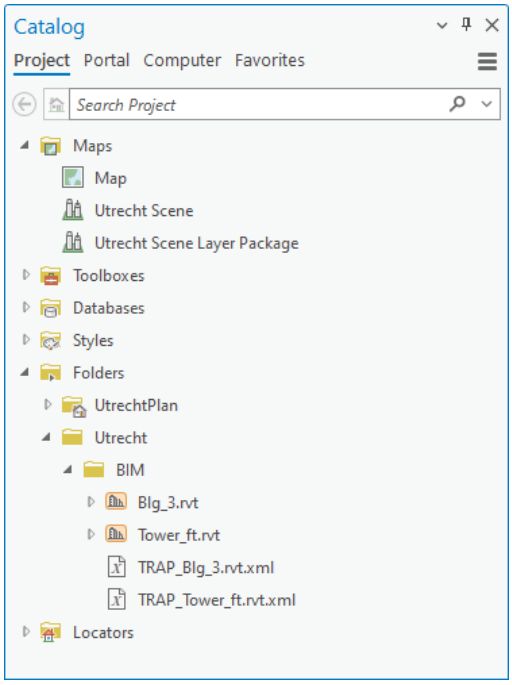
? Based on the files present in this folder, what conclusions can you make?

- Answer

Because you have two BIM design files stored as Revit files and a single coordinate transformation file associated with only one of them, you may not have enough information available to easily add these BIM files to your scene. Additionally, without a PRJ file for either of the two Revit files, there is no valid coordinate system present.

c Close File Explorer.

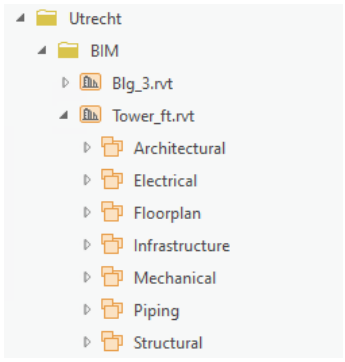
d In the Catalog pane, expand the BIM folder to view the two Revit files.



*Step 10d***: Inspect the building model.*

ArcGIS Pro reads BIM files as an ArcGIS workspace of feature classes called a BIM file workspace. The BIM file workspace is organized into feature datasets named after conventional construction disciplines. These disciplines include architectural, structural, electrical, mechanical, piping, and so on. The entire BIM file workspace, or individual feature classes, can be added to an ArcGIS Pro map or scene. These feature classes are then expressed as individual feature layers like any other GIS data source.

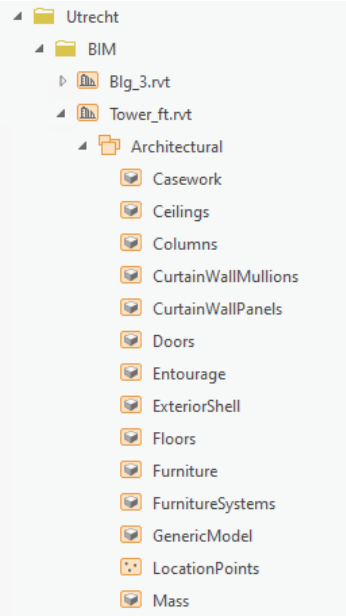
e Expand Tower_ft.rvt.



*Step 10e***: Inspect the building model.*

The Revit file is organized into several feature datasets by construction discipline.

f Expand the Architectural feature dataset and explore its contents.



*Step 10f***: Inspect the building model.*

Each discipline is composed of categories; for instance, the Architectural discipline contains categories such as Ceilings, Doors, Roofs, and Walls.

g After you have completed your explorations, collapse the Architectural feature dataset and Tower_ft.rvt.

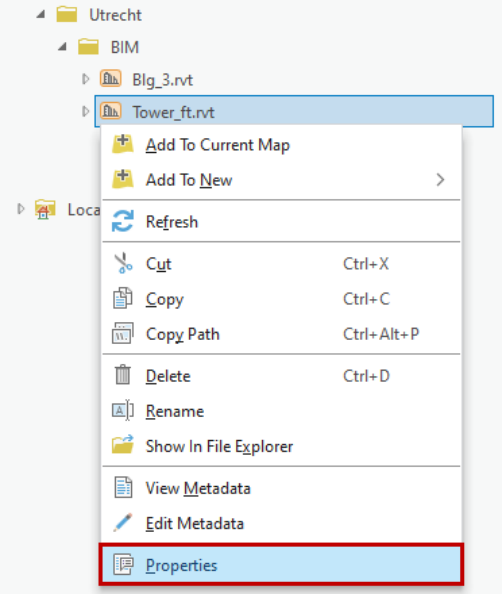
- Hint

  To collapse the feature dataset and Revit file, click the arrow next to the name.

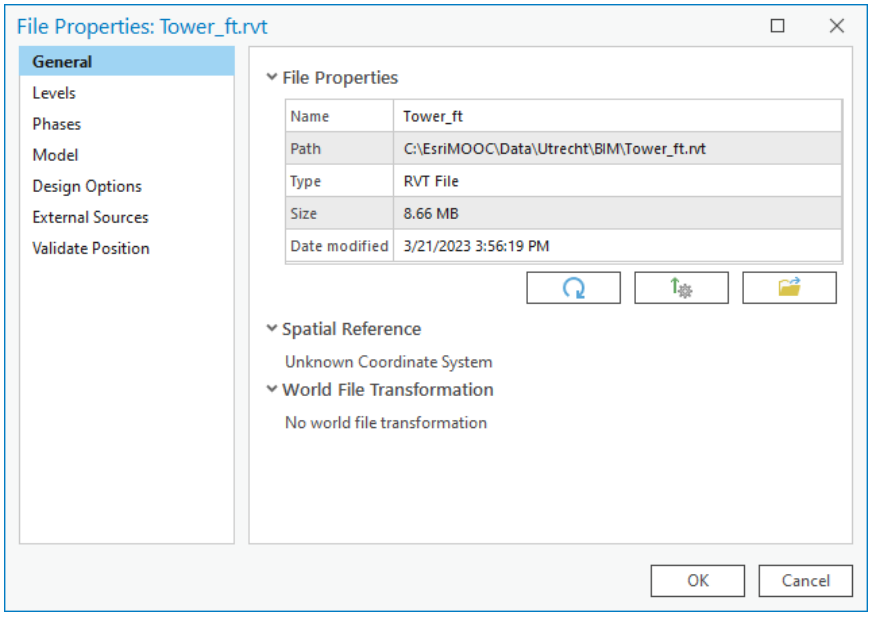
To learn more about BIM files and their structure, go to ArcGIS Pro Help: What is BIM data, and to learn more about how ArcGIS Pro incorporates BIM data as map or scene layers, go to ArcGIS Pro Help: BIM data as ArcGIS Pro layers.

Now you will examine the BIM file properties to verify that the file has no spatial reference system or world transformation file associated with the data. When it is validated, it is from the properties that you will assign a coordinate system, suggest a location and extent, and finally apply a transformation.

h Right-click Tower_ft.rvt and choose Properties, as shown in the following graphic.



i In the File Properties dialog box, on the General tab, expand the Spatial Reference and World File Transformation sections.



*Step 10i***: Inspect the building model.*

To be geolocated, the building model needs coordinate system information and coordinate transformation information.

Based on the information on the General tab in the File Properties dialog box, can Tower_ft.rvt be geolocated?

- Answer

No; the Spatial Reference has an unknown coordinate system, and there is no World File Transformation, so it cannot currently be geolocated.

In Revit files, there is a parameter called Geospatial Location. Despite its name, this information is insufficient to establish the geospatial position of the BIM model in ArcGIS Pro. However, this geospatial location information can be inspected from the BIM File Properties and is useful in helping you establish a BIM model's general location.

You found that Spatial Reference is set to Unknown Coordinate System. Although you can create BIM data where the x,y coordinates correspond to a defined geospatial coordinate system, the data must include the Esri coordinate system definition in the form of a PRJ file for the data to be positioned correctly in ArcGIS Pro; that information is currently not present.

You also found that World File Transformation is set to No World File Transformation. Both of these values verify that location information is not currently present for, or associated with, this data. The tower model does not currently have any of the necessary information needed to be geolocated.

To learn more about these and other properties of digital models, go to ArcGIS Pro Help: BIM data file properties.

Now that you verified that there is no spatial information associated with this BIM file, you will apply location information to start the georeferencing process.

- Step 11: Apply location information to the building model

In this step, you will assign location information to the BIM file in the form of a spatial reference system and then add general location information so that you can georeference it to its final location.

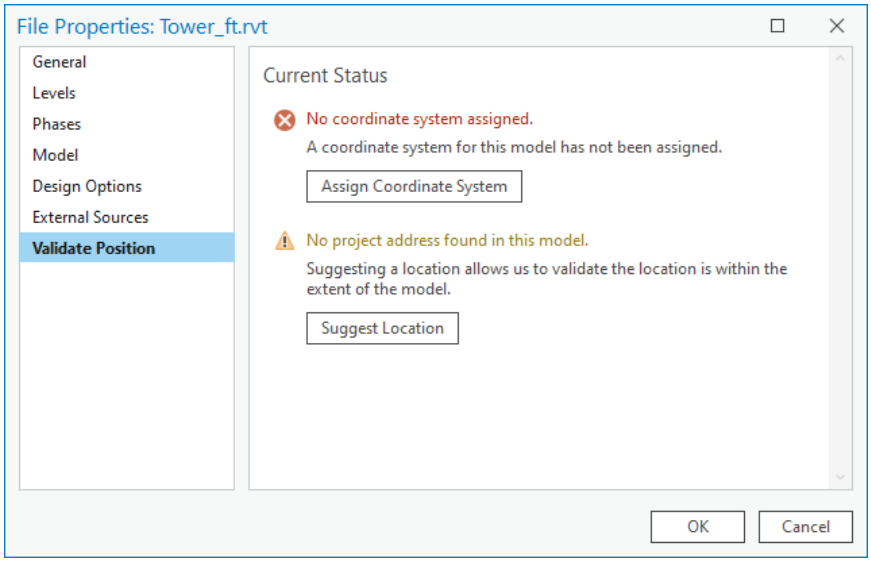
When you georeference BIM data, you define its location in ArcGIS Pro by assigning the proper required Esri coordinate system definition as a spatial reference (PRJ) file. After you define this coordinate system, ArcGIS Pro will be able to correctly interpret its general location on the globe.

To more accurately position the building model within the assigned coordinate system correctly in ArcGIS Pro, you can optionally define a transformation. When you define this transformation, it gets stored as a coordinate transformation file (either with a WLD or WLD3 extension). In addition to refining a BIM file's location, this transformation information is used to determine how the position of the building model should be moved and rotated within the assigned coordinate system.

When the spatial reference is included and any optional offsets are defined, the BIM coordinates in the design file are transformed on the fly in memory in ArcGIS Pro while the source BIM data remains unchanged.

Next, you will assign a coordinate system.

a In the File Properties dialog box, click the Validate Position tab.



*Step 11a***: Apply location information to the building model.*

Here, again, as you observed previously, you can verify that there is no coordinate system assigned. This scene uses the National Dutch coordinate system RD New, so you will assign the same coordinate system to the tower model.

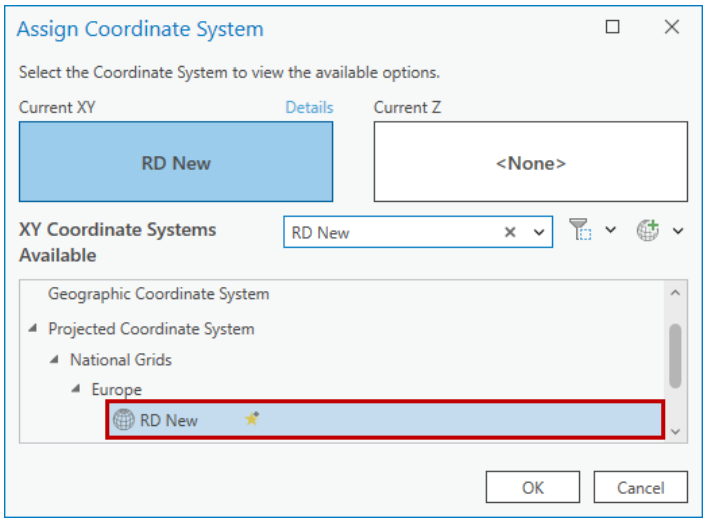
Tip: The 3D scene and the digital model should always be in the same coordinate system to avoid having to reproject the data on the fly, which would slow down the scene display. When working with your own data, you need to select a coordinate system commonly used in your region. Because you want to enable precise measurement, you should choose a projected coordinate system that preserves distances. To learn more about projections, go to ArcGIS Pro Help: Choose the right projection.

b In the File Properties dialog box, under No Coordinate System Assigned, click Assign Coordinate System.

c In the Assign Coordinate System dialog box, in the Search field, type **RD New** and press Enter.

d In the XY Coordinate Systems Available section, expand Projected Coordinate System, and then expand National Grids and Europe.

e Select RD New, as shown in the following graphic.

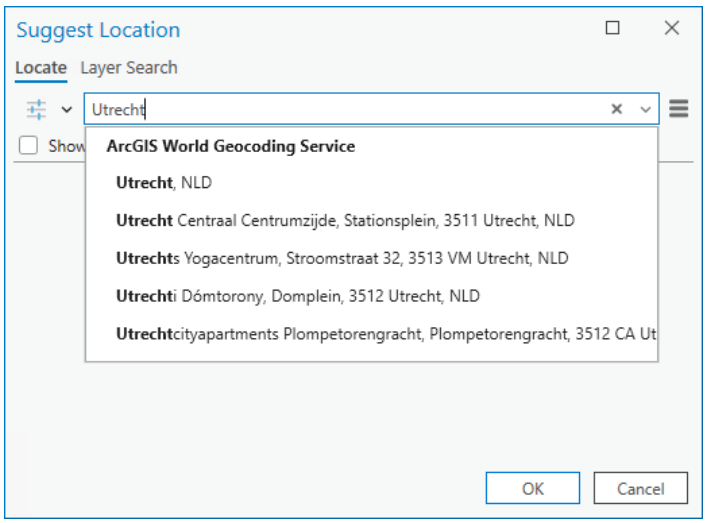


f Click OK.

You have now assigned a coordinate system to your Revit file, but it may not be enough information for ArcGIS Pro to accurately place the model in its correct location. You can provide a street address or another location such as a city that allows you to position the model approximately near its final location.

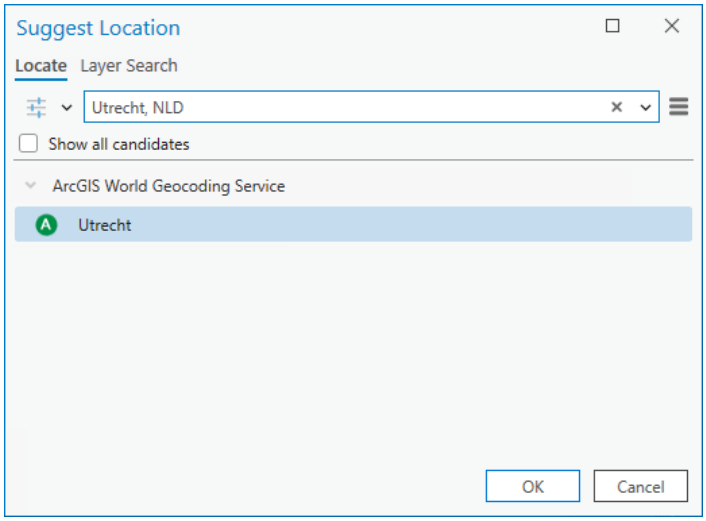
g In the File Properties dialog box, under The Extent Of The Model Is Not Within The Coordinate System's Area Of Use, click Suggest Location.

h In the Suggest Location dialog box, in the Search field, type **Utrecht**, and then in the drop-down list, locate the Utrecht, NLD option.



*Step 11h***: Apply location information to the building model.*

i Click Utrecht, NLD, and then ensure that the A option, Utrecht, is selected.



*Step 11i***: Apply location information to the building model.*

j Click OK.

The city of Utrecht is now listed as the suggested location for the building model.

k In the File Properties dialog box, scroll down, if necessary, and under Suggested Location Is Utrecht, click Transform To Suggested Location.

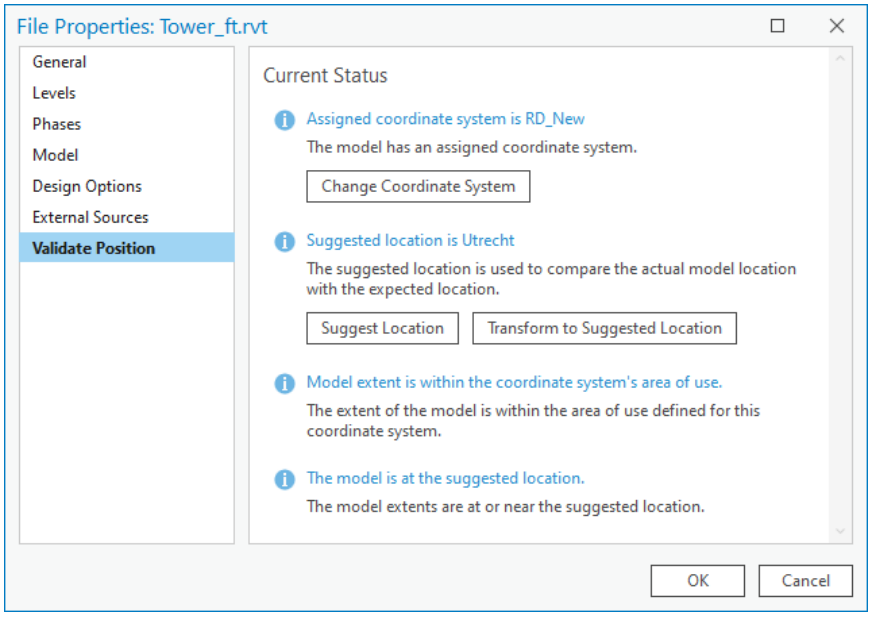
Note: There are two options for you to click Transform To Suggested Location. You can click either one; both will perform the same action and apply the appropriate transformation to your data.

The building's coordinates are automatically moved and rotated to be positioned at the suggested location. This transformation information is generated as a result of this process and then stored in a new 3D world file (.wld3).

After a few moments, the Validate Position tab updates, informing you that now the model extent is within the coordinate system's area of use and that the model is at the suggested location.

For more information on these world files and their use in the georeferencing workflow, go to ArcGIS Pro Help: World files for CAD and BIM data and ArcGIS Pro Help: Spatial transformation world file (WLD3).

l Verify that your File Properties dialog box matches the following graphic.



m Click OK to close the File Properties dialog box.

n Return to File Explorer and browse to **..\EsriMOOC\Data\Utrecht\BIM**, if necessary.

Note: Alternatively, in the Catalog pane, right-click the BIM folder and choose Show In File Explorer.

? What are the files located in this folder?

- Answer

There are now seven files located in this folder. There are two original Revit files (Blg_3.rvt and Tower_ft.rvt), the original single 3D World File (Blg_3.wld3) associated with the Blg_3 Revit file, and the two original XML metadata files (TRAP_Blg_3.rvt.xml and TRAP_Tower_ft.rvt.xml). However, now that you have assigned a coordinate system and location to the Tower_ft Revit file, you have two additional files. There is a projection file (Tower_ft.prj) and a 3D World File (Tower_ft.wld3) file. These files were created when you applied the location information to the model.

For more information on validating the position of BIM data, go to ArcGIS Pro Help: Validation of CAD and BIM data positioning.

o Close File Explorer.

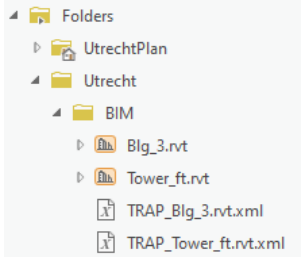
In this step, you assigned a coordinate system to the model, and you added coarse location information to it. Now you are ready to display the building within the scene.

- Step 12: Add the building model to the scene

You will now add the model to the scene and begin to refine its geolocation. Geolocating a BIM is a series of refinements. In the previous step, you provided information on its coordinate system and generalized location within that coordinate system to a point—in this case Utrecht, Netherlands. In this step, you will add the BIM to your scene and evaluate its default location.

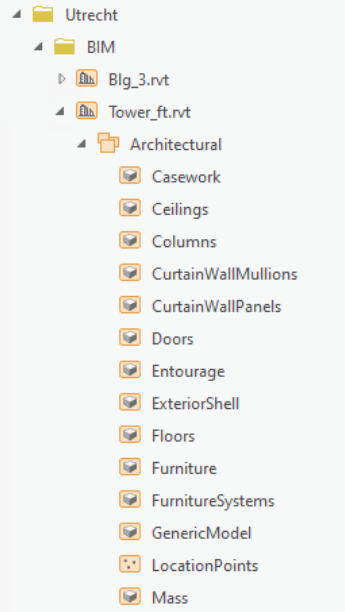
However, instead of adding the complete model, with its many disciplines and categories, you will only add one single category for easier manipulation. You will choose the Floors category, which outlines the floors of the tower, as it is easy to interpret.

a In the Catalog pane, expand Folders, and then expand the Utrecht and BIM folders, if necessary.



*Step 12a***: Add the building model to the scene.*

b In the BIM folder, expand Tower_ft.rvt, and then expand the Architectural feature dataset.



*Step 12b***: Add the building model to the scene.*

c Right-click the Floors multipatch feature class and choose Add To Current Map.

The Floors multipatch feature class appears in the scene, but it may be difficult to locate.

d In the Contents pane, right-click Floors and choose Zoom To Layer.

*Step 12d***: Add the building model to the scene.*

Note: It may take a moment for the Utrecht Mesh layer to refresh.

e Use the Navigator wheel to orient the scene to get a better view and evaluate the location of the tower in relation to the city of Utrecht.

? Where in Utrecht is the building located?

- Answer

As expected, the building is located in Utrecht, which is its temporary coarse location. However, the building is placed at a centralized location between the old city center

and the train station.

If you become disoriented or lose your place using the Navigation wheel, a bookmark has been saved to help you locate the building in Utrecht.

f If necessary, from the Map tab, in the Navigate group, click Bookmarks and select the Tower In Utrecht bookmark.

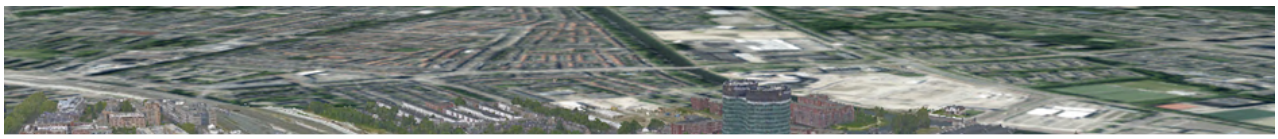
*Step 12f***: Add the building model to the scene.*

In this step, you displayed the building floors and determined the rough location of the model in relation to the city of Utrecht. You are now ready to geolocate the building precisely.

- Step 13: Geolocate the new building in the scene

In this step, you will move the building model to its planned location.

a From the Map tab, in the Navigate group, click Bookmarks and select the Geolocate Tower bookmark.



*Step 13a***: Geolocate the new building in the scene.*

You can now see both the tower and its planned located near the train station. You will now move the building model to the construction site where the crane is located.

Note: Depending on the view extent of your scene, you may need to zoom out to see both locations.

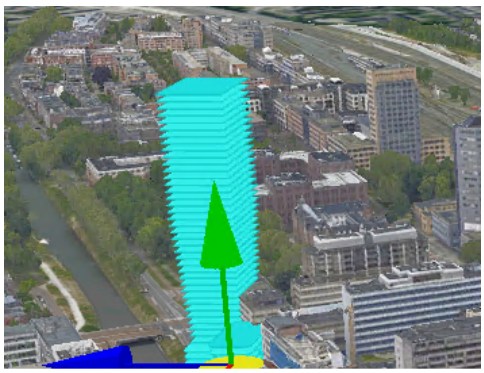
b In the Contents pane, ensure that the Floors layer is selected.

c From the BIM Data tab, in the Alignment group, click Georeference.

This action opens the Georeference tab.

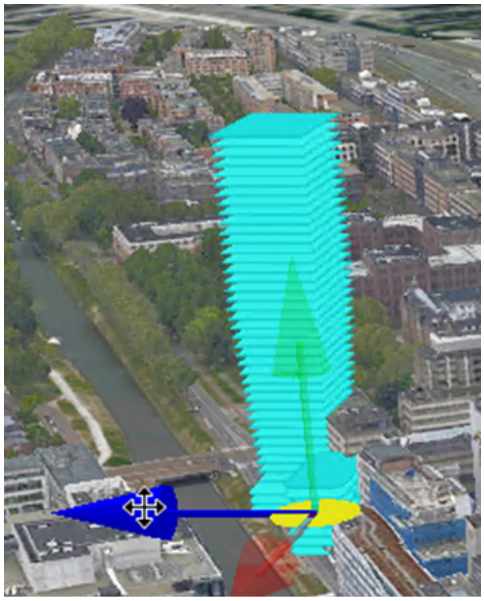
d From the Georeference tab, in the Prepare group, click Move.

e In the scene, zoom and pan to the selected building.



In the scene, the building activates in Move mode. The building becomes cyan, and multi-axis direction arrows appear. The blue and red arrows operate in an x, y (planar) direction along the surface of the scene. The green arrow operates in the y (vertical) direction relative to the surface of the scene.

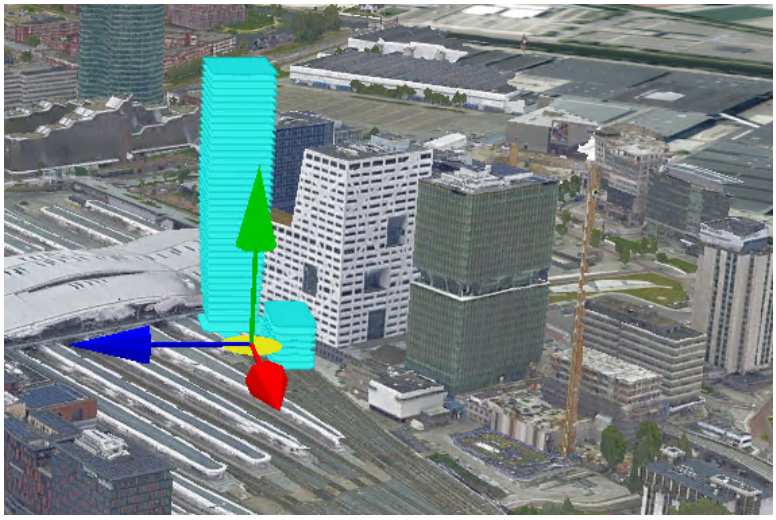
f Point to the blue arrow and notice how your cursor changes shape.



The arrows allow you to move the model in one direction at a time. When you move your cursor over one of the arrows, the cursor changes shape, and the non-active arrows become transparent.

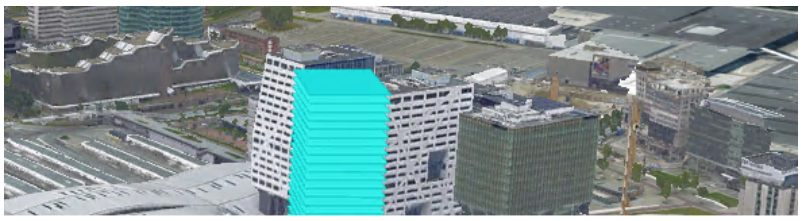
Because you can only move the building along one axis at a time, you will have to perform several moves to position the building correctly and place the building near its planned location, as indicated in the following graphic.

g Point to the blue arrow, and then click and drag the building model towards the planned location.



*Step 13g***: Geolocate the new building in the scene.*

h Point to the red arrow, and then click and drag the building model closer to the planned location.



*Step 13h***: Geolocate the new building in the scene.*

i On your own, alternate between the blue and red arrows to move the model into the approximate planned location.

When you click to enlarge, an animation displays demonstrating the Move tool.

- Hint

  Use the Navigation wheel to adjust your view and look angle if it helps to fine-tune your adjustments.

j From the Georeference tab, in the Save group, click Save.

k In the window asking to overwrite the existing 3D World File, click Yes.

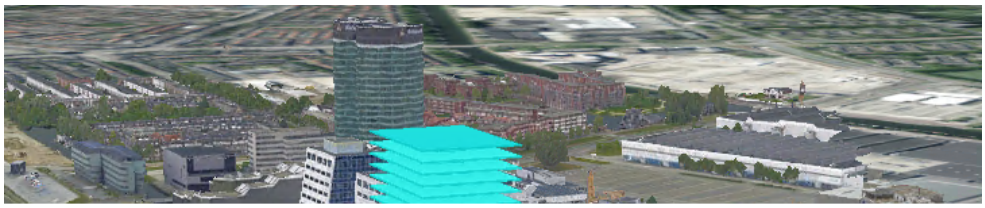
Now you will rotate the building model to align with the planned location.

l From the Georeference tab, in the Prepare group, click Rotate .

*Step 13l***: Geolocate the new building in the scene.*

In the scene, the building now activates in Rotate mode. At the base of the building, a rotation wheel in green appears and allows you to rotate the model around the model's central axis in yellow. When you move your cursor into the rotation wheel, the cursor changes shape, indicating that you can now control the building's rotation.

m In the scene, point to the green rotation wheel, and then click and drag to rotate the building model into the proper alignment on the site.



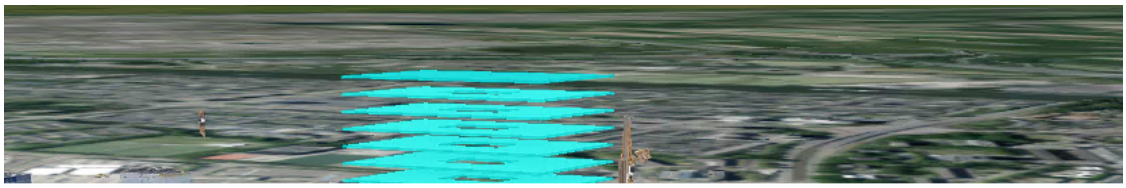
When you click to enlarge, an animation displays demonstrating the Rotate tool.

Tip: If it is challenging or disorienting to rotate the building model from a certain viewing angle, use the Navigation wheel to view the model from directly overhead in the scene, as shown in the following graphic.

Finally, you will scale the model to the proper height and width dimensions. You know the new building, as planned, will not be higher than the tower crane, so you must rescale the model to reflect this height.

n From the Map tab, in the Navigate group, click Bookmarks and select the Building Rescale bookmark.

o From the Georeference tab, in the Prepare group, click Scale .



*Step 13o***: Geolocate the new building in the scene.*

Similar to the move arrows and the rotation wheel, there are block graphics to help with scaling of the building model. To scale the graphic, either the blue or the red block can be used. When scaling the building model, the aspect ratio is maintained.

p In the scene, point to either scaling block, and then click and drag to scale the building model down.

When you click to enlarge, an animation displays demonstrating the Scale tool.

q From the Georeference tab, in the Save group, click Save.

r In the window asking to overwrite the existing 3D World File, click Yes.

Note: Every time that you save in the georeferencing process, you are updating the transformation file (WLD3) associated with the building model. In other words, each time that you perform a move, rotate, or scale from the Georeference tab and then save your results, you are overwriting the four points that describe the coordinate transformation.

s From the Georeference tab, in the Close group, click Close Georeference.

t If prompted with a warning message, click OK.

*Step 13t***: Geolocate the new building in the scene.*

Now that you have updated the geolocation information for your BIM, you will add the architectural feature dataset tier map to see a more accurate representation of the building model than just the floors layer. Because the coordinate reference system file (PRJ) and the 3D world file (WLD3) are associated with the entire BIM file and not a single layer, when adding any element of the Revit file, whether a single BIM feature dataset or the entire Revit file, the building model will be geolocated in the correct space.

u In the Catalog pane, expand Tower_ft.rvt, if necessary, and then right-click the Architectural file dataset and choose Add To Current Map.

v In the Contents pane, under 3D Layers, uncheck the box for LocationPoints.

w If necessary, orient the scene to examine the tower building model in its newly planned location.

*Step 13w***: Geolocate the new building in the scene.*

- Hint

  You can use either the Navigation wheel or a bookmark to navigate to the Tower_ft.rvt planned location.

Now that the building model is aligned to its planned location and scaled correctly, you will create a universal projection file that can be used for another building model that you will add to the Utrecht scene.

- Step 14: Create a new projection file

In this step, you will apply the projection information of the scene to a second building model in the same folder by creating a universal projection file.

A universal projection file defines the coordinate system for all BIM files that are stored in the same folder and do not have a PRJ file of their own that matches the associated BIM file name. Using a universal projection file is a convenient way of defining a coordinate system or all BIM files whose coordinates use the same coordinate system definition and are located in the same folder.

a In the Catalog pane, expand Folders, and then expand the Utrecht and BIM folders, if necessary.

b In the BIM folder, right-click Blg_3.rvt and choose Properties.

? Does this Revit model have a spatial reference system?

- Answer
  No; this model does not have any spatial reference system. However, it does contain information related to its transformation information. This world transformation information is contained in the Blg_3.wld3 file.

- Hint

  In the File Properties dialog box, click the General tab, and then expand the Spatial Reference and World File Transformation sections.

? Would you be able to add this Revit model to your scene?

- Answer
  While you would be able to add it to your scene, you would receive a notification that the file lacks a coordinate system.

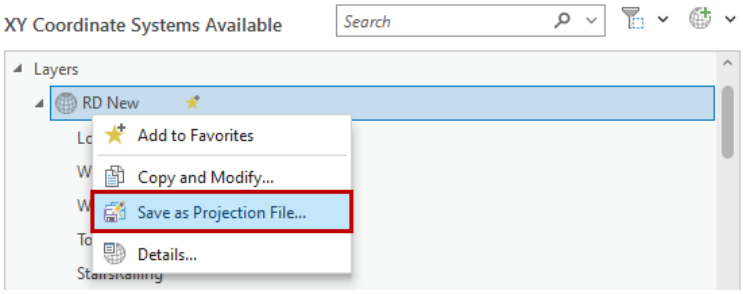
In ArcGIS Pro, all maps and scenes contain coordinate information like GIS and BIM layers. Using the information from the map properties, you can create a projection file.

c Click Cancel to close the File Properties dialog box.

d In the Contents pane, right-click Utrecht Scene and choose Properties.

e In the Map Properties dialog box, click the Coordinate Systems tab, if necessary.

f In the XY Coordinate Systems Available section, under Layers, right-click RD New and choose Save As Projection File, as shown in the following graphic.



g In the Save Coordinate System As PRJ File dialog box, browse to **..\EsriMOOC\Data\Utrecht\BIM**.

h For Name, type **esri_cad.prj** and click Save.

Tip: For a projection file to be recognized as a universal projection file, it must be named esri_cad.prj and must exist in the same folder as other accompanying CAD or BIM files. If you have multiple BIM or CAD files of the same geographical area and stored in the same folder structure, it is often more convenient to have the coordinate system information as a single universal projection file rather than as multiple, individual coordinate system definition files for each CAD or BIM file.

i In the Map Properties dialog box, click OK.

Your scene will take a moment to refresh.

j In the Catalog pane, expand Folders, and then expand the Utrecht and BIM folders, if necessary.

k In the BIM folder, right-click Blg_3.rvt and choose Properties.

l In the File Properties dialog box, from the General tab, under File Properties, click the Reload The File Into ArcGIS Pro button to update the Revit file information.

? Does this Revit model have a spatial reference system now?

- Answer

Yes; this model now has the same spatial reference system as the scene. It would then place the model beyond the extent of your scene.

m Click OK to close the File Properties dialog box.

n In the Catalog pane, expand Blg_3.rvt, right-click the Architectural file dataset, and choose Add To Current Map.

The LocationPoints layer is the survey point or project for the BIM. This layer, while important, is not necessary for this view and can potentially distract from the aesthetics. Like other layers in ArcGIS Pro, you can control the visibility of individual layers in the Contents pane.

o In the Contents pane, under 3D Layers, uncheck the box for the new LocationPoints layer.

p From the Map tab, in the Navigate group, click Bookmarks and select the Building 3 Planned Location bookmark.

*Step 14p***: Create a new projection file.*

q Use the Navigation wheel to examine this new building model in the scene.

The two new planned buildings are relatively close to each other. You can modify your view and navigate to a location in the scene where you can see both simultaneously.

r Navigate to the planned location of the tower building model.

*Step 14r***: Create a new projection file.*

- Hint

  You can use either the Navigation wheel or a bookmark to navigate to the Tower_ft.rvt planned location.

s Near the upper-left corner, on the Quick Access Toolbar, click the Save Project button to save your project.

t Leave ArcGIS Pro open for the next exercise.

In this exercise, you validated the coordinate reference system of a BIM file and then used that information to help in georeferencing. Additionally, you used existing spatial reference information to create a universal projection file for use with all BIM in a folder.

- Step 15: Stretch goal (Optional)

Throughout this course, you will have the opportunity to complete stretch goals. These goals allow you to continue or enhance the work that you completed during the exercise.

Stretch goals are community-supported (meaning that your fellow MOOC participants can assist you with the steps to complete the stretch goal using the Lesson Forum), and they are a great opportunity to work together to learn.

1. Using previously learned skills—and your best judgment—refine the location of both the Tower_ft and the Blg_3 building models within their respective construction footprints.
2. From the Georeference tab, use Elevate To Ground to align either the Tower_ft or Blg_3 to the surface elevation of the scene.
    - Did you find that refining the building models' locations easier or harder with additional practice?
    - Did you encounter any challenges when aligning the model to the surface elevation?

- Hint

    Remember that it is easier to manipulate a single layer instead of a full BIM feature dataset.

Use the Lesson Forum to post your questions, observations, and screenshot examples showing the buildings' updated locations and orientations that best represent the answers. Be sure to include the **#stretch** hashtag in the posting title.