

Exercise 2: Create a building scene layer in ArcGIS Pro

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

A building scene layer allows you to share 3D BIM data across the ArcGIS system. Building scene layers, which are a unique type of scene layer, are created from ArcGIS Pro building layers and BIM data. A scene layer is a type of layer that is optimized for displaying large amounts of 3D data in a scene. A building scene layer allows you to work with Revit or IFC model data in ArcGIS Pro and when converted to a scene layer package to ArcGIS Online or ArcGIS Enterprise.

BIM information captured in the building scene layer is useful for visualizing, querying, and filtering different aspects of a model, such as a building, bridge, rail, tunnel, or any other infrastructure element. You can view building scene layers together with other GIS and BIM content. Integrating building scene layers into your AEC projects and workflows allows you and your project stakeholders to view, explore, and analyze a model and integrate that model into a scene, providing more real-world context with the natural environment.

Previously, you had an opportunity to interact with a building scene layer in the Building E story. Now you will learn how to create one for your project.

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

Scenario

In the previous exercise, you used individual BIM feature classes or individual discipline datasets to make georeferencing the BIM file easier.

In this exercise, you will be working with two buildings in Utrecht, Netherlands. Now that you have georeferenced the files to their correct location, you must prepare them to share with the larger team. You will use the entire BIM file workspace by first adding it to your scene view and then using it to create new building scene layers (scene layer packages) from the two Revit files that you worked with in the previous exercise. Your architectural firm also needs a quick inspection of the air conditioning (A/C) units planned for one of the buildings. To accomplish this task, you will define a building filter to isolate these A/C units to make them easier to see and inspect in the building model.

Estimated completion time: 30 minutes

[Expand all steps](#) ▾

[Collapse all steps](#) ▲

- Step 1: Add a BIM file workspace to a scene view

In this step, you will add the BIM file workspace to a scene view.

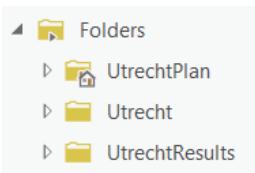
- a If necessary, start ArcGIS Pro and open the UtrechtPlan project.
- b In the Catalog pane, expand Maps, and then right-click Utrecht Scene Layer Package and choose Open Local View.

A scene layer package is a compressed file that contains all your BIM data, which is stored as a cache for sharing. This cached data can be of a building, a multipatch, an integrated mesh, a point, or a point cloud dataset. Upon its creation, a scene layer package can be shared as a web scene layer to ArcGIS Online or ArcGIS Enterprise. You will learn about sharing these files to ArcGIS Online in other sections of this MOOC; however, in this exercise, you will learn how to prepare your data to share with other team members.

For more information on sharing packages to ArcGIS Online or ArcGIS Enterprise, including the different types of packages available to share, go to ArcGIS Pro Help: Introduction to sharing packages.

You will need to make a new folder connection to access this data in ArcGIS Pro. This new folder connection contains the same two Revit files that you worked with in the previous exercise. The two BIM files, however, are already georeferenced. You will use these two BIM files to create your new scene layer packages.

- c In the Catalog pane, from the Project tab, right-click Folders and choose Add Folder Connection 
- d In the Add Folder Connection dialog box, browse to **C:\EsriMOOC\Data**, click the UtrechtResults folder to select it, and click OK.
- e In the Catalog pane, expand Folders to see the new folder connection.

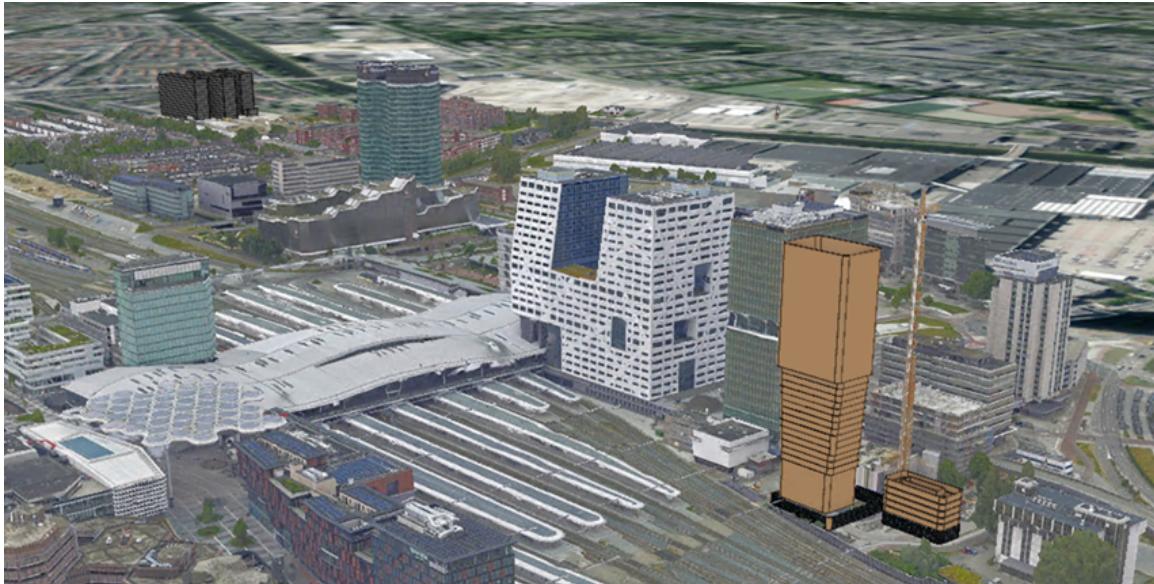


*Step 1e***: Add a BIM file workspace to a scene view.*

- f Right-click the UtrechtResults folder and choose Add To New Projects.

Now you will add the entire BIM file workspace to your scene. These are the full BIM design files and can be read directly as native ArcGIS feature data in ArcGIS Pro. When a BIM file workspace is added to an ArcGIS Pro scene, it is added as a special building layer and a group layer.

- g Expand the UtrechtResults folder and expand the BIM folder.
h Click Blg_3.rvt, press and hold the Shift key, and click Tower_ft.rvt.
i Right-click either of the Revit files and choose Add To Current Map.



*Step 1j***: Add a BIM file workspace to a scene view.*

Note: It may take a moment for the scene to update. The refresh indicator in the lower-right corner of the scene provides a progress metric on the loading of your data, as indicated in the following graphic.



BIM design files are interpreted by ArcGIS Pro as a single ArcGIS workspace that contains multiple datasets of feature data expressed as feature classes. These datasets, or group layers, contain feature layers that are named after common industry construction disciplines. BIM software organizes its categories of elements into these construction views by convention. ArcGIS Pro has adopted these construction discipline names as feature dataset names for the BIM file workspace. The element categories in BIM files are used as feature class definitions, like the ones that you examined and used in the previous exercise, that are in turn organized within the discipline datasets according to the same construction discipline conventions. When you add an entire BIM file workspace to your scene, the feature classes are expressed as individual feature layers like other GIS data sources but now as a special ArcGIS Pro building layer.

Adding the entire BIM file workspace representing the Revit or IFC file to an ArcGIS Pro scene creates an ArcGIS Pro building layer and a group layer. The feature classes in a BIM file workspace from Revit files have a one-to-one correlation with Revit categories. All the feature classes included in the BIM file workspace are standard, read-only feature classes.

By default, the ExteriorShell feature layer, which represents the entire structure as a single multipatch feature, is visible when you add the entire BIM file workspace to your scene. The building discipline layers that contain the individual BIM building element categories as feature layers are hidden by default. The ExteriorShell feature class is created by ArcGIS Pro from a collection of BIM elements most likely to depict the outside shell of the structure modeled in the BIM file. This collection of elements or categories varies depending on the individual structure type and contents of the design. Additionally, the representation of the ExteriorShell can vary based on the individual standards used during the initial BIM creation. As such, the ExteriorShell is often not the best way to represent the model in a scene.

- j In the Contents pane, click the arrow to the left of the Tower_ft layer to expand it.

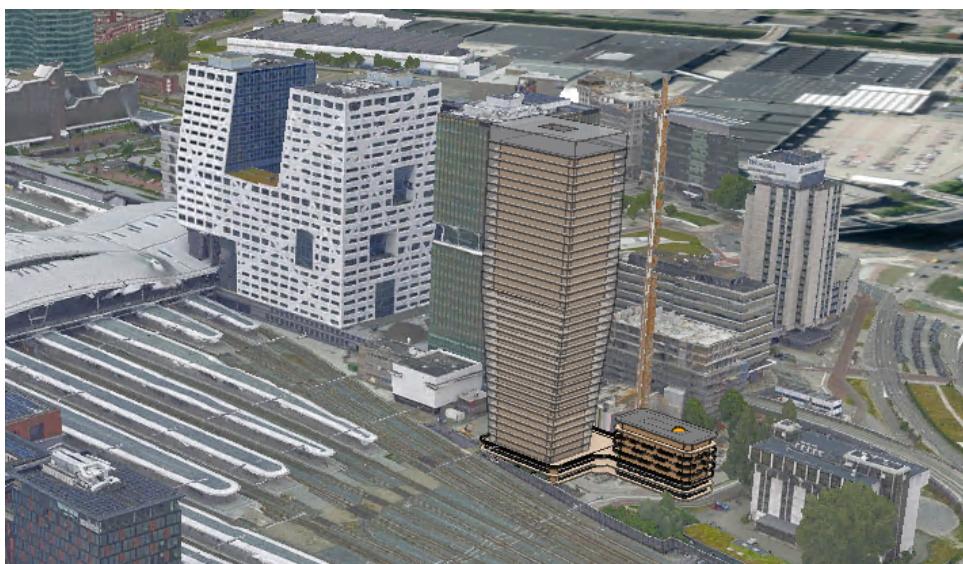
▲ 3D Layers

- ▷ Tower_ft_Floorplan
- ◀ Tower_ft
 - ◀ ExteriorShell
 -
 - ▷ Architectural
 - ▷ Structural
 - ▷ Electrical
 - ▷ Mechanical
 - ▷ Piping
 - ▷ Infrastructure

*Step 1j***: Add a BIM file workspace to a scene view.*

You will now turn off the Floorplan dataset and turn on the Architectural feature class to see the tower like you did in the previous exercise.

- k Uncheck the box for the ExteriorShell feature class to turn it off, and then check the box for the Architectural feature class to turn it on.



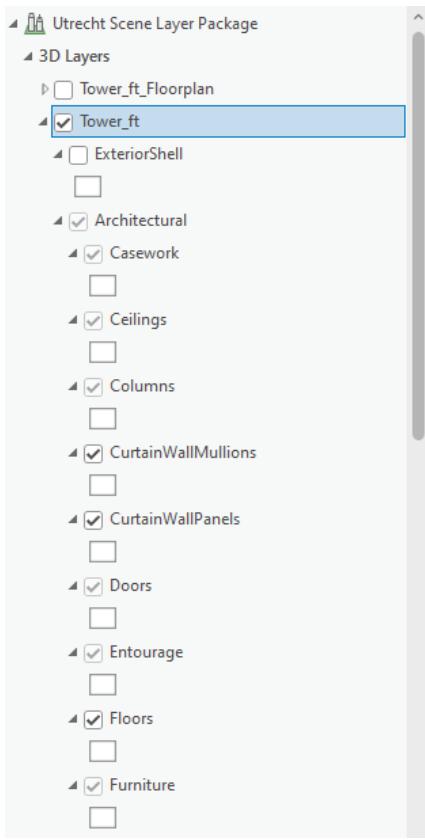
*Step 1k***: Add a BIM file workspace to a scene view.*

Your BIM now looks similar to what you observed in the previous exercise. It is already georeferenced based on the same workflow that you performed in the previous exercise and is represented in the correct location.

- Step 2: Examine the BIM file workspace

Before you create a new building scene layer, you will examine the feature dataset contents of the Tower_ft BIM file workspace.

- a In the Contents pane, in the Tower_ft BIM file layer, expand the Architectural discipline layer.



*Step 2a***: Examine the BIM file workspace.*

Note: The Architectural discipline layer is the same as the Architectural feature dataset. These common industry construction disciplines are represented and expressed in ArcGIS Pro as feature datasets.

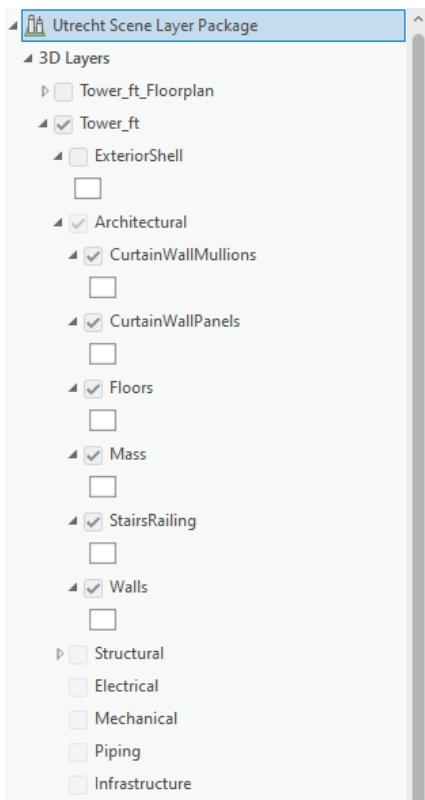
What do you observe about the structure and feature classes inside the group layer?

- Answer

The Architectural group layer contains many individual feature layers. Further, many of these feature layers, such as Casework, Ceilings, Doors, or Furniture, are marked with a disabled check.

You can access the context menu of BIM feature layers to perform various actions on those layers or inspect their layer properties. Layers with no data in them appear in the Contents pane with disabled checks. You can clean up the Contents pane and remove empty layers to help with organizational efficiency. For example, you can remove individual feature layers from a building feature dataset using the Remove command by right-clicking a BIM feature layer one at a time. You can also remove all empty layers from the entire BIM file workspace.

- b In the Contents pane, right-click the Tower_ft BIM file layer and choose Remove Empty Layers.



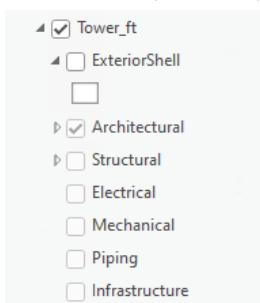
*Step 2b***: Examine the BIM file workspace.*

What do you observe about the structure and feature classes inside the feature dataset after you removed the empty layers?

- Answer

In the Architectural group layer, there are only a few feature layers remaining: CurtainWallMullions, CurtainWallPanels, Floors, Mass, StairsRailing, Walls.

- c In the Contents pane, collapse the Architectural feature class.



*Step 2c***: Examine the BIM file workspace.*

What do you observe about the structure of the feature datasets after you removed the empty layers?

- Answer

Only the Architectural and Structural feature datasets contain feature layers, which is evident because they are expandable feature datasets with an arrow. The Electrical, Mechanical, Piping, and Infrastructure feature datasets all contained empty layers, so they were removed.

This step is not required to create a building scene layer and is included to provide data familiarization. When you create a building scene layer, if construction discipline datasets or feature layers are empty, they are automatically dropped during the conversion. You have only removed empty layers from the Tower_ft BIM layer, and at this point, you have not removed any empty layers from the Blg_3 BIM layer.

- d On your own, expand the Blg_3 BIM file workspace and examine its contents but do not remove any layers.

To make it easier to see and review the new building scene layers that you will create, you will now turn off the BIM layers in your scene view.

e In the Contents pane, collapse the Tower_ft BIM layer and the Blg_3 BIM layer.

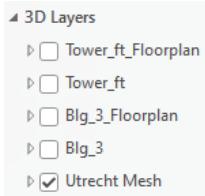
f If necessary, collapse the Utrecht Mesh layer.



*Step 2f***: Examine the BIM*

file workspace.

g Turn off the Tower_ft BIM layer and the Blg_3 BIM layer.



*Step 2g***: Examine the
BIM file workspace.*

The only visible layer in your scene view is the Utrecht Mesh layer. Both the BIM layers disappear from your scene view, but because they are both listed in the Contents pane, you can still interact with them as needed.

Next, you will use a geoprocessing tool to create a building scene layer for both of the BIM files in your scene.

- Step 3: Create a building scene layer

You will use the Create Building Scene Layer Content geoprocessing tool to generate a scene layer package on disk (.slpk) based on the building layers in the ArcGIS Pro scene. The building scene layers can be shared to ArcGIS Online using the Share Package geoprocessing tool as a web scene layer for your other team members to access and view. First, you will create the building scene layer for the Tower_ft layer.

a In the Contents pane, click the Tower_ft BIM file layer to ensure that it is selected.

b From the BIM Data tab, in the Conversion group, click Create Building Scene Layer .

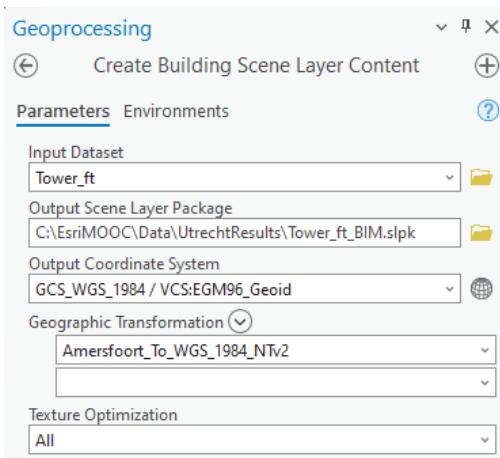
The Create Building Scene Layer Content tool opens in the Geoprocessing pane.

c In the Create Building Scene Layer Content tool, for Input Dataset, click the down arrow and choose Tower_ft, if necessary.

d For Output Scene Layer Package, click the Browse button .

e In the Output Scene Layer Package dialog box, browse to ..\EsriMOOC\Data\UtrechtResults, and then for Name, type **Tower_ft_BIM** and click Save.

f For Texture Optimization, click the down arrow and choose All.



*Step 3f***: Create a building scene layer.*

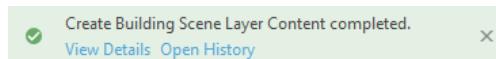
Note: By choosing All, you have optimized the view for both desktop and mobile devices.

Additionally, you will notice that the Output Coordinate System and Geographic Transformation parameters are automatically set for you.

The Target Cloud Connection field is listed when you open the geoprocessing tool. If you have a cloud connection available, which is already connected, you can select and update the Target Cloud Connection field. If no connection is available, the field will disappear after you provide an output scene layer package name.

- g Click Run.

When the geoprocessing tool is finished, you will see following message at the bottom of the Geoprocessing pane.



The building scene layer will not automatically be added to your map; you will need to add it to your map so you can verify its contents.

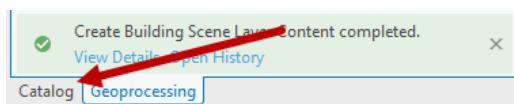
- h If necessary, in the Catalog pane, right-click the UtrechtResults folder and choose Refresh



*Step 3h***: Create a building scene layer.*

- Hint

Click the Catalog tab to return to the Catalog pane, as indicated in the following graphic.



Now that the new building scene layer is visible in the Catalog pane as a scene layer package, you will add it to your scene view.

- i In the Catalog pane, right-click Tower_ft_BIM.slpk and choose Add To Current Map.

The new building scene layer has been added to your local scene view as a new layer.

- j If necessary, in the Contents pane, under the expanded Tower_ft building scene layer, select Full Model to turn on the Architectural layer.

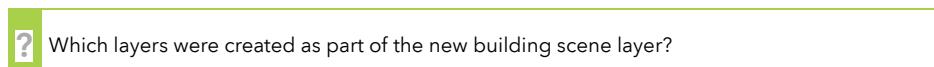


*Step 3j***: Create a building scene layer.*

Unlike the BIM file workspace, which has the same layer name in the Contents pane, when the Tower_ft building scene layer is expanded, it is represented by only an Overview layer and a Full Model layer. The Overview layer is derived from the Exterior Shell layer; the Full Model layer organizes only the layers of the original BIM feature datasets that contained data.

For more information on the layers represented in a building scene layer, go to ArcGIS Pro Help: Structure of a building scene layer.

- k In the Contents pane, under the Tower_ft building scene layer, expand Full Model.



- Answer

The two layers with data, Architectural and Structural, were exported. The remaining layers that were empty—Electrical, Mechanical, Piping, and Infrastructure—were not included as part of the creation process.

Now that you have created a scene layer package for one of your BIM files, you will repeat the process to create another scene layer package for the Blg_3 BIM file.

- Step 4: Create a building scene layer and verify its contents

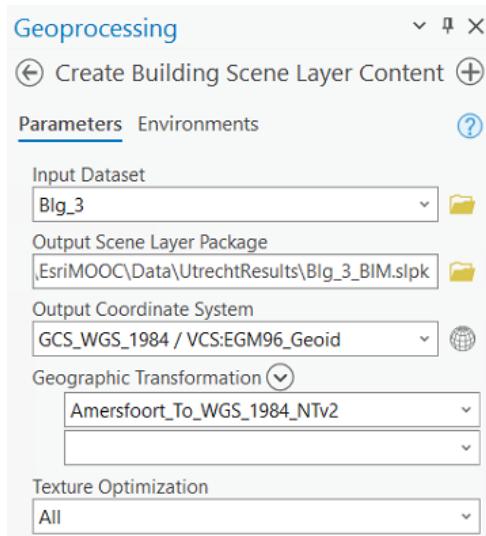
If you recall, you did not remove any empty layers from the Blg_3 BIM file workspace when you examined the individual construction discipline datasets and feature layers. In this step, you will create a new building scene layer from this BIM file and then verify its content and renewal of empty layers during the creation process using the same workflow that you learned in the previous step.

- Near the bottom of the Catalog pane, click the Geoprocessing tab to return to the Geoprocessing pane.

The Create Building Scene Layer Content pane will still be active and contain the parameters from the previous creation process in the various fields. You will update the information in these fields using the Blg_3 BIM file and new output parameters.

- In the Create Building Scene Layer Content tool, specify the following parameters:

- Input Dataset: Blg_3
- Output Scene Layer Package: ..\EsriMOOC\Data\UtrechtResults\Blg_3_BIM
- Texture Optimization: All



*Step 4b***: Create a building scene layer and verify its contents.*

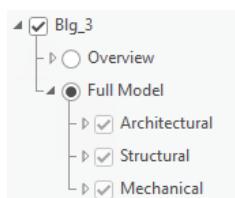
Note: You will see a Warning icon next to the Output Scene Layer Package field. After you update the name, the warning will disappear. This icon appears when a file with the same name appears in the same folder location.

- Click Run.

When the geoprocessing tool is finished, you will see following message at the bottom of the Geoprocessing pane.



- Using previously learned skills, add Blg_3_BIM.slpk to your scene view and ensure that Full Model is selected.
- In the Contents pane, under the Blg_3 building scene layer, expand Full Model and turn on the Architectural, Structural, and Mechanical layers, if necessary.



*Step 4e***: Create a building*

scene layer and verify its

contents.

Looking in the Contents pane, what do you notice about the Full Model of the Blg_3 building scene layer? Why is this the case?

- Answer

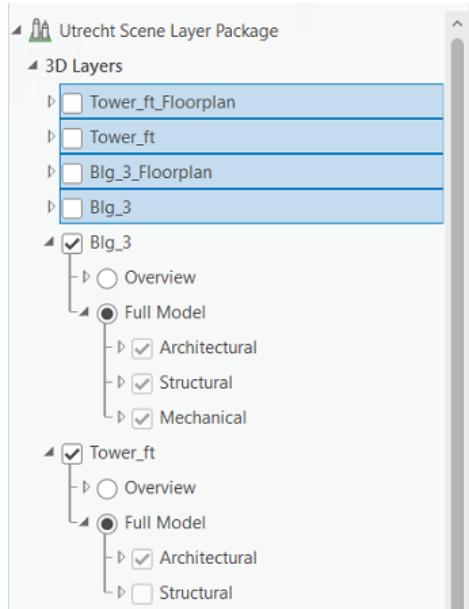
There are only three construction disciplines available in the new building scene layer: Architectural, Structural, and Mechanical. These were the only BIM feature datasets that contained any data. The empty layers and disciplines were automatically removed during the creation process.

One of the benefits of a building scene layer is the ability to filter different aspects of a building. Next, to assist your architectural firm with an inspection of the air conditioning units planned for this building, you will define a building filter to isolate one of the Mechanical feature classes of this new building scene layer.

- Step 5: Explore the new building scene layer

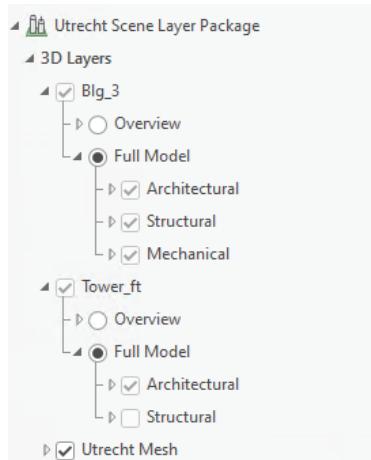
Before you create and apply a building filter, you will need to simplify some of your scene contents. By removing the BIM file workspaces, the Contents pane becomes easier to read and more efficient to manage. In this step, you will clean up the scene.

- a In the Contents pane, under 3D Layers, click the Tower_ft_Floorplan layer, press and hold the Shift key, and click the Blg_3 BIM layer.



*Step 5a***: Explore the new building scene layer.*

- b Right-click any of the selected layers and choose Remove.



*Step 5b***: Explore the new building scene layer.*

The building scene layers for Blg_3 and Tower_ft and the Utrecht Mesh layer are now the only layers showing in the Contents pane within the 3D Layers group.

Now you will explore the new Blg_3 building scene layer.

- c In the Contents pane, right-click the Blg_3 building scene layer and choose Zoom To Layer.



*Step 5c***: Explore the new building scene layer.*

Note: You can right-click and choose Zoom To Layer for either the Blg_3 scene layer package or Full Model to zoom to the BIM.

- d On your own, use previously learned skills to navigate in the scene view and explore the BIM and its surroundings.
- e After you have finished investigating the BIM, orient your view to one similar to the following graphic.



- Hint

The Navigation wheel is open and exposed to help with orientation.



Do you notice any difference or increase in performance? Why or why not?

- Answer

There is an increase in performance in the 3D environment. Because the building scene layer is now using a scene layer package that contains cached elements, the computer

can use fewer hardware resources by drawing fewer individual components. Processing is faster and more efficient, including display renderings.

Now that you have explored and examined the Blg_3 building scene layer and its surroundings, you are ready to define a building filter to isolate some of the mechanical components.

- Step 6: Define and apply building filters

Building scene layers can be visually complex. For the purposes of this exercise, the building scene layers used are fairly basic, but they can be as intricate as required by your design project. Because of the complexity, it is useful to filter elements or parts of a building to see only the relevant or important information that you are looking for. A building filter allows you to make elements of a building visible as either a solid or a wireframe representation. When defining filters, you can achieve different scenarios, or design views, by applying a different building filter to a building scene layer. Each building scene layer can have multiple filters defined, but you can choose to display only one active filter at a time.

When sharing a building scene layer with filters applied, the building scene layer will include these filters.

In this step, you will define a filter to examine the Heating, Ventilation, and Air Conditioning (HVAC) unit on the roof of the Blg_3 model.

- a In the Contents pane, ensure that the Blg_3 building scene layer is selected.
- b From the Building Scene Layer tab, in the Filter group, click Building Filter and choose New Filter.
- c In the Building Filter - Blg_3 pane, for Name, type **HVAC Roof Units**.
- d For Description, type **This filter will show the planned HVAC system location on the roof of Building 3**.
- e Near the top of the Building Filter - Blg_3 pane, click the Settings tab.

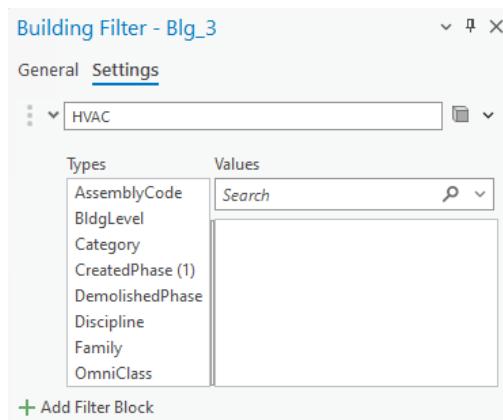


*Step 6e***: Define and apply building filters.*

- f In the Filter Block field, delete any existing text, if necessary, and type **HVAC**.

Each building filter contains one or many filter blocks. Filter blocks define what is visible in the building scene layer.

- g Next to the HVAC field, click the arrow to expose the Types and Values fields.



*Step 6g***: Define and apply building filters.*

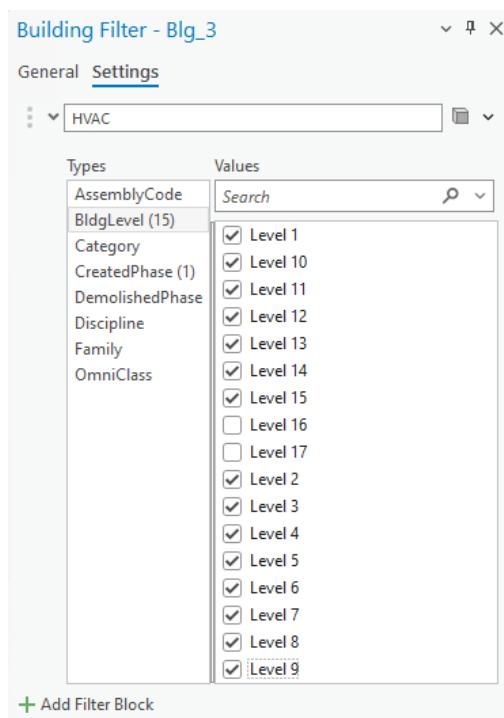
First, you will isolate only the building levels in your model that you want to show.

Building levels are not the same as building floors. Levels represent fixed, horizontal planes that act as a reference for hosted elements within a BIM file. These planes can contain roofs, floors, furniture, and ceilings. Typically, most levels are used for floor and roof elements that correspond to a plan view of a building design, which is why there is sometimes confusion between this terminology. Other uses can include, however, column heights, tops of parapet walls, window sills, head heights, and so on. Importantly, levels are used everywhere that parametric control is needed within a BIM.

Floors, on the other hand, correspond to the lower horizontal surface of any space in a building. As mentioned previously, floors and levels may sometimes correspond but not always. It is important to understand this distinction when working with filters and also when isolating levels in the Building Explorer tool as you did in the Building E story in Section 1.

The HVAC units in this building scene layer are a hosted element in Level 15 of the model. The top two levels of this building scene layer contain information that may block your view of these units.

- h Under Types, click BldgLevel.
- i Under Values, check all levels except Level 16 and Level 17.



*Step 6i***: Define and apply building filters.*

In the scene view, the filters are automatically applied, and the building looks like the following graphic. Levels 16 and 17 are levels that represent other roof features, making it difficult to see the HVAC units.



Now you will remove the remaining roof features to make it easier to see the HVAC units.

- j Under Types, click Family.
- k Under Values, check the boxes for the following values:
 - Basic Wall
 - Floor
 - HVACAir Conditioning_LG_VRF_MV_5_106-135kW_Dual_Frame_EU_v1.2

Building Filter - Blg_3

General Settings

HVAC

Types	Values
AssemblyCode	<input checked="" type="checkbox"/> Basic Wall
BldgLevel (15)	<input checked="" type="checkbox"/> Floor
Category	<input checked="" type="checkbox"/> HVACAir Conditioning_LG_VRF_MV.
CreatedPhase (1)	<input type="checkbox"/> Rails
DemolishedPhase	<input type="checkbox"/> Rectangular Mullion
Discipline	<input type="checkbox"/> RoofMass
Family (3)	<input type="checkbox"/> System Panel
OmniClass	<input type="checkbox"/> W Shapes
	<input type="checkbox"/> W Shapes-Column

+ Add Filter Block

*Step 6k***: Define and apply building filters.*

In the scene view, the filters are automatically applied. The building now looks like the following graphic, and you can clearly see the rooftop HVAC units.



- | Close the Building Filter - Blg_3 pane.
- m In the scene view, navigate to explore and examine the rooftop HVAC units.



*Step 6m***: Define and apply building filters.*

Note: Depending on where you navigate to near the Blg_3 model, your view may look slightly different from the preceding graphic.

- n From the Map tab, in the Navigate group, ensure that the Explore tool is active.
- o In the scene view, click one of the HVAC units to see more information about that unit in a pop-up.

Pop-up

▲ MechanicalEquipment (1)
Blg_3

MechanicalEquipment - Blg_3	
OBJECTID_1	
BaseCategory	MechanicalEquipment
Discipline	Mechanical
AssemblyCode	
AssemblyDesc	
BldgLevel	Level 15
Category	Mechanical Equipment
CreatedPhase	New Construction
DemolishedPhase	<Null>
ElementType	FamilyInstance
Family	HVAC_Air Conditioning_LG_VRF_MV_5_106 135kW_Dual_Frame_EU_v1.2
Function	<Null>
Mark	14
Objectld	384386
OmniClass	
OmniClassDescription	
Typ_Mark	
Type	
DocName	Blg_3
DocPath	C:\EsriMQOC\Data\UtrechtResults\BIM\Blg
DocType	RVT
DocumentDate	5/10/2021 10:05:20 PM

◀ 1 of 1 ▶

*Step 6o***: Define and apply building filters.*

Note: Depending on which unit that you clicked, the attributes may be different from the preceding graphic.

p Scroll through the pop-up to answer the following questions.

What Building Level (BldgLevel) are the HVAC units in?

- Answer
Level 15

Who is the manufacturer of these planned HVAC units?

- Answer
LG Electronics

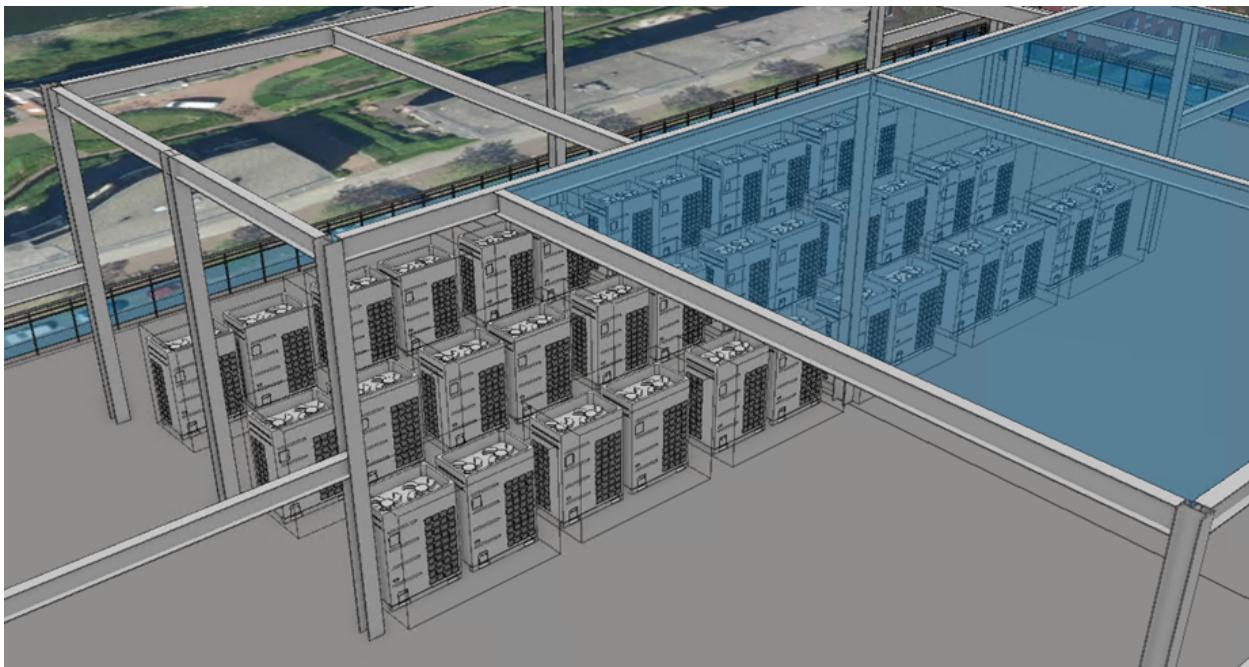
What is the main and secondary material used in the units?

- Answer
The primary material (Fam_Material_main) is steel, and the secondary material (Fam_Material_secondary) is copper.

q If desired, in the pop-up, scroll to the bottom of the fields and click the Typ_QR_code link to find out more about these particular HVAC units.

r Close the pop-up.

s From the Building Scene Layer tab, in the Filter group, click Building Filter, and then click HVAC Roof Units to turn off the filter.



*Step 6s***: Define and apply building filters.*

If you recall, you are filtering Levels 16 and 17. Level 16 contains information on the steel pylons, and Level 17 contains the glass covering. Including both of these levels can make it difficult to see the HVAC units clearly.

t From the Building Scene Layer tab, in the Filter group, click Building Filter, and then click HVAC Roof Units to turn on the filter.

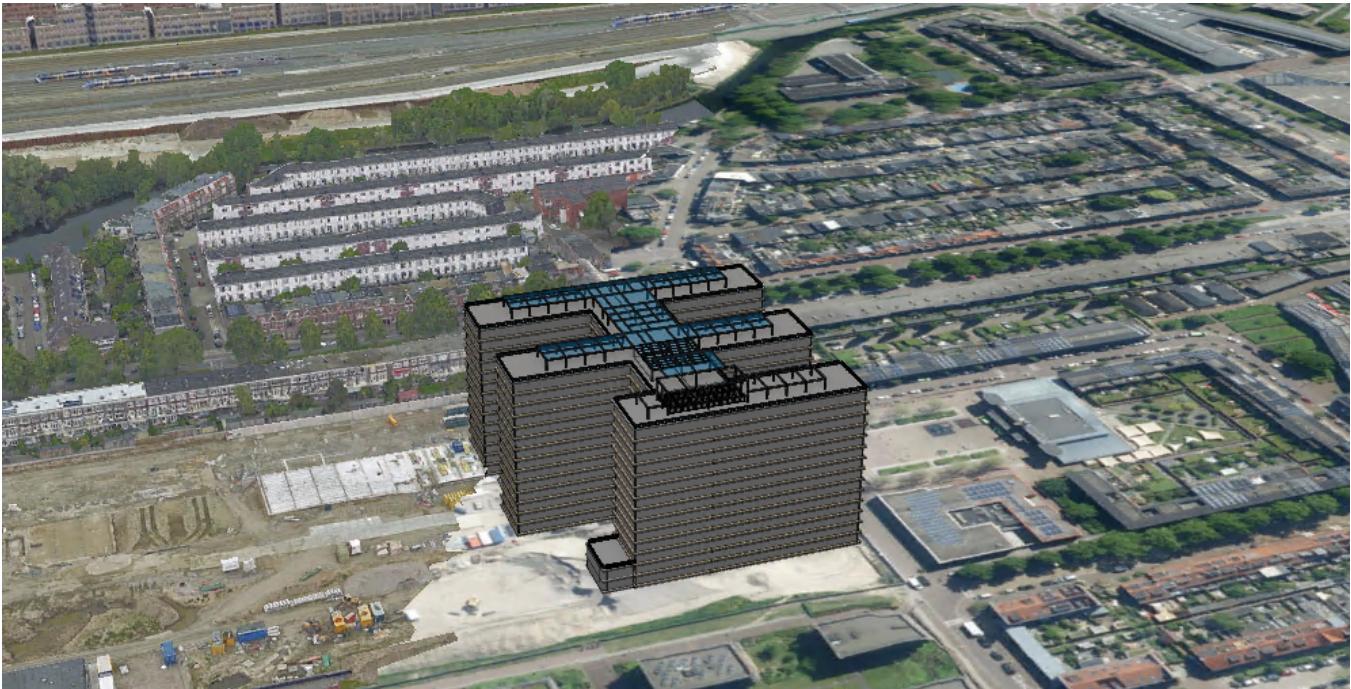
Note: When you turn on the filter, the Building Filter - Blg_3 pane will open.

In this exercise example, there are few obstructions—features, levels, or other building elements—that make it difficult to inspect or view individual features within your building scene layer. With highly complex models, however, defining filters to view particular elements is very important. When called upon in your AEC project to view or isolate different features within your model building, filters give you a powerful tool that you can use to share with project stakeholders across your team.

u On your own, experiment with other filter options and combinations.

v When you are finished experimenting with filters, turn off all building filters.

w From the Map tab, in the Navigate group, click Bookmarks and select the Building 3 Planned Location bookmark to return to the original view of the building.



*Step 6w***: Define and apply building filters.*

- x On the Quick Access Toolbar, click the Save Project button to save your project.
- y Exit ArcGIS Pro.

Scene layer packages and building filters can make it easier and more efficient to work with and examine BIM files, especially when you need to share them with the larger team. In this exercise, you optimized the BIM files for both desktop and mobile devices. If stakeholders—engineers, architects, or even GIS professionals on your team—want to view the data in an office environment or in the field at a construction site, creating a scene layer package with filters enabled will provide them with timely and valid information for your AEC projects.

For more information on building filters, go to ArcGIS Pro Help: Work with building filters and ArcGIS Pro Help: Filter a building scene layer.