
# Building a 3D Thematic Cityscape

learn.arcgis.com/

380 New York Street
Redlands, California 92373 – 8100 USA

# Building a 3D Thematic Cityscape

## Time: 2 hours

## Overview

3D scenes can represent an object, event, or phenomenon based on their state or condition, and are categorized into a theme. For example, hurricane intensity at time intervals, road asphalt conditions at specific segments, property value by parcel, or solar radiation potential of the roof of a building. These layers are listed in the 3D Layers category of the Contents pane, much like realistic vector content. However, they can be modified to show more than just representation of the real.

Thematic 3D vector symbology may use real-world units, such as meters or feet, or use the traditional cartographic unit of points representing size on screen. This depends on the scale at which the data is intended to be viewed. Sparsely scattered phenomenon across the globe (Olympic competitions, for example) may be represented in a fixed-point scale to remain visible when zoomed out at a global view or zoomed in to a specific city. Densely spaced data (traffic conditions on streets), meant to be viewed at a local scale (city down to block), often uses a simple variation of one aspect of the phenomena's visual representation, such as size, color, or orientation that represents the condition. In some cases, altering multiple aspects of the phenomena's visual representation can provide a more powerful understanding of its condition. For instance, using both extrusion height and color variation, to indicate population density for census blocks. You may also choose to alter multiple aspects of a phenomena's visual representation to represent different states or conditions simultaneously. For instance, using extrusion height to indicate a census block's population density, and color variation to indicate its diversity.

Much like realistic features, thematic features can obtain their base elevations from a surface, stored shape z-values, feature attributes, or from a constant value. However, the base elevation of a thematic feature is another visual representation that can be altered to represent a state or condition.

In this exercise, you will be working with simple GIS data for a city–building multipatches, parcel footprints, water main lines, city-managed tree points, and regular spaced wind sample points–to create a thematic representation of different aspects of the city. You will also consider how the scene might be consumed by others.

In this lesson, you will learn to do the following:

- Use color to represent a theme of a 3D object

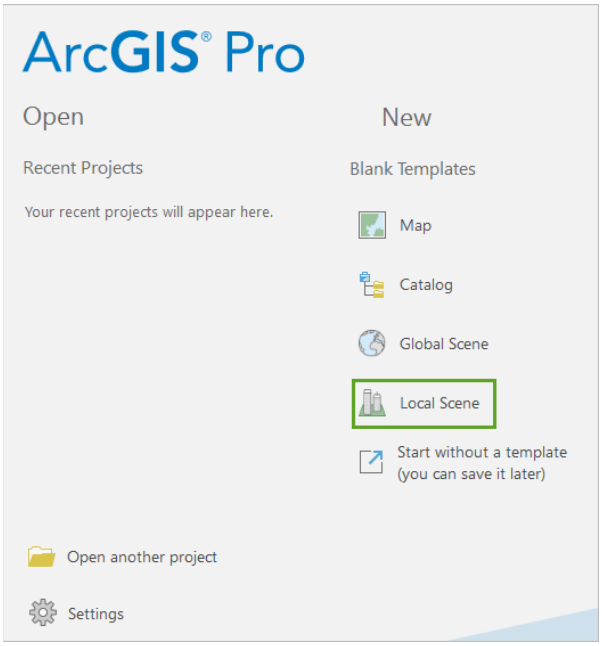
- Match thematic representation across multiple layers
- Use thematic extrusion, size, shape, and orientation on layers

## Getting started

First, download the data.

1. Download the **ThematicCityscape.zip** compressed folder.
2. Locate the downloaded file on your computer and extract it to a location you can easily find, such as your Documents folder.
3. Open the **ThematicCityscape** folder. Notice that the folder contains several layer package files you will be using in the lesson steps.

   The data used in this exercise has been contributed by PLW Modelworks, LLC, created using Pictometry images. The data represents an area in San Diego, California, and comprises 3D geometry and texture maps, along with points, 2D polygons, 3D polygons, elevation data, and other data delivered in various formats. The approximate coverage of the 3D model is 19.5 square kilometers.
4. Start ArcGIS Pro and create an ArcGIS project based on the Local Scene project template.



***Hint**: From the main ArcGIS Pro window, in the Create a New Project area, click **Local_Scene** or from within ArcGIS Pro, click the **Project** tab, and then click **Local_Scene** to create a project based on the Local Scene project template.*

Note: If you don't have ArcGIS Pro or an ArcGIS account, you can sign up for an ArcGIS free trial.

5. Save the project as **ThematicCityscapeProject** in the default Projects folder.

## Apply symbology on layers

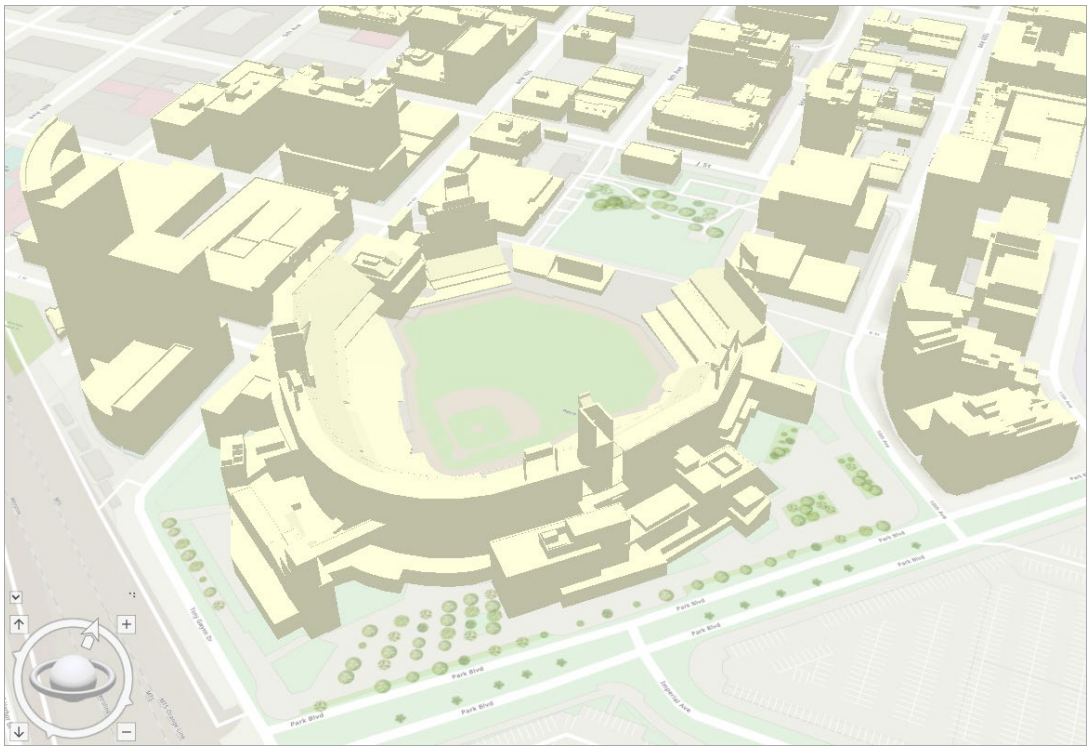
One of the simpler methods for doing thematic representation of a 3D object is varying its color. This is very similar to choropleth mapping in 2D. You can vary the color of a feature based on unique categories or ranges of values. In this case, you have a set of buildings for an area of interest that you want to represent based on the number of floors in each building.

Before you can apply symbology, you need to add the layer to your new blank scene. Please note that any layer with the term Completed in its name already has the steps in this lesson applied and should be used for reference after completing the work.

1. In the **Catalog** pane, create a folder connection to the uncompressed **ThematicCityscape** folder containing the layer packages (lpkx files).
2. From the folder connection, drag the **Untextured Buildings – Source.lpkx** layer package and drop it onto your 3D scene.

   The layer appears on the **3D Layers** section of the **Contents** pane. Multipatch layers always appear here by default, since they are inherently z-enabled.
3. Right-click on the **Untextured Buildings (AOI)** layer and select zoom to layer.

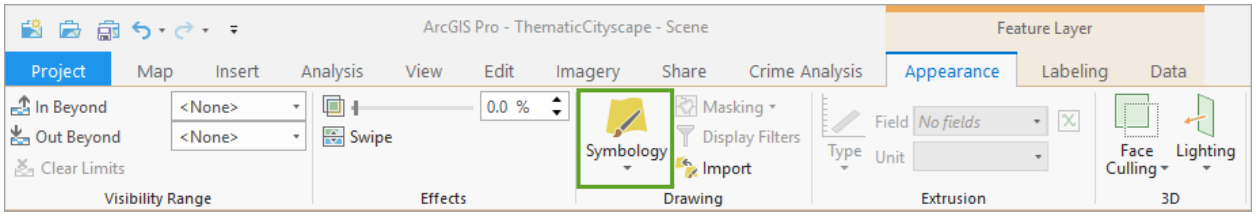
4. Zoom close to the buildings with the mouse's wheel button to get a closer look.



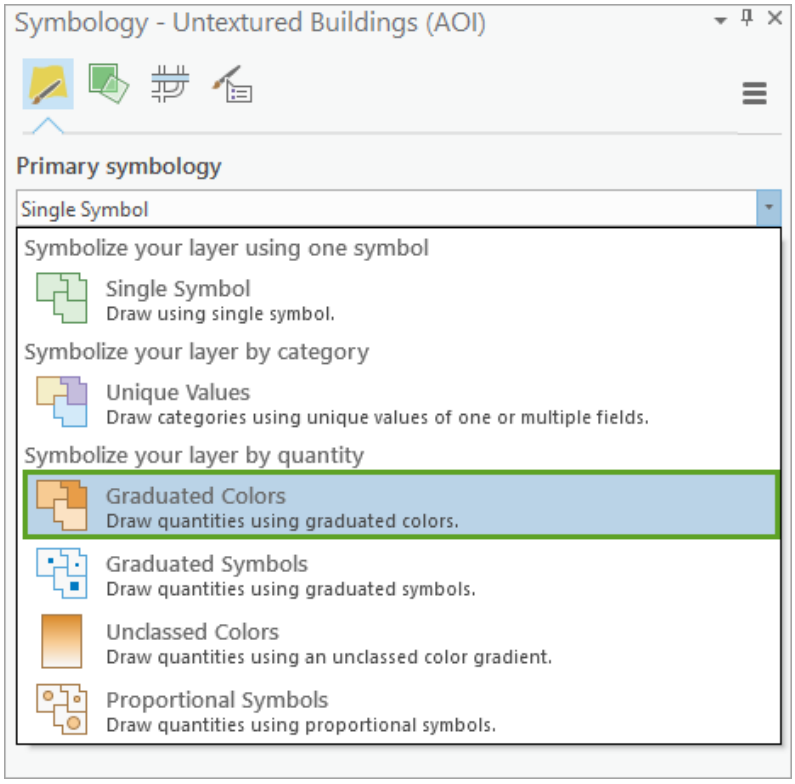
The default color applied here makes the buildings hard to see against the default basemap. Feel free to change the basemap to get a better look if you wish, though you'll solve that problem shortly.

5. If necessary, select the **Untextured Buildings (AOI)** layer in the **Contents** pane.

6. On the **Appearance tab > Drawing** group, click **Symbology**.




7. In the **Symbology** pane, change the **Primary** symbology to **Graduated Colors**.



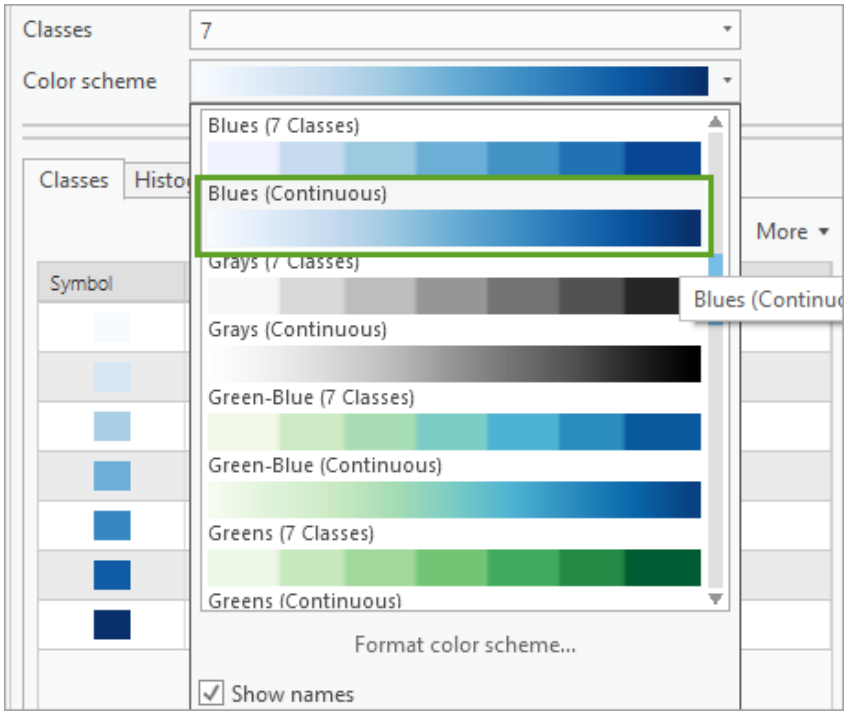

By default, the **Graduated Colors** renderer finds the first field in your data that could be meaningful for **a Graduated Colors** renderer, in this case **FloorCount**. It then applies some default settings to the method of graduation, number of classes, and picks a random color scheme. Let's customize that now.

8. In the **Symbology** pane, change the number of **Classes** to **7.**

The number of classes you use is up to you. A classic rule of thumb is everyone can distinguish between five classes of color, however people with some map interpretation experience can distinguish between seven. Once you go beyond this threshold, creating color schemes that can effectively show more

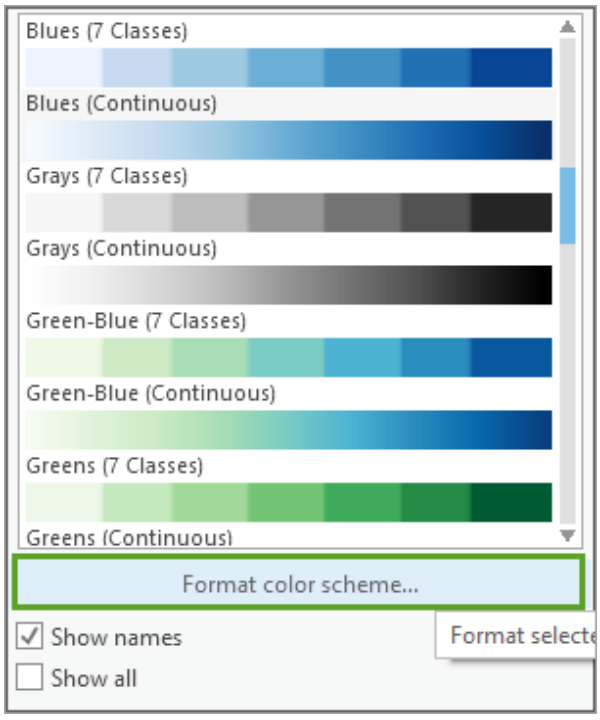
classes becomes challenging. Always consider your audience when choosing how many classes you are going to use.

9. In the **Symbology** pane, using the **Color scheme** drop-down menu, check the **Show names** check box and change the **Color scheme to Blues (Continuous)**.

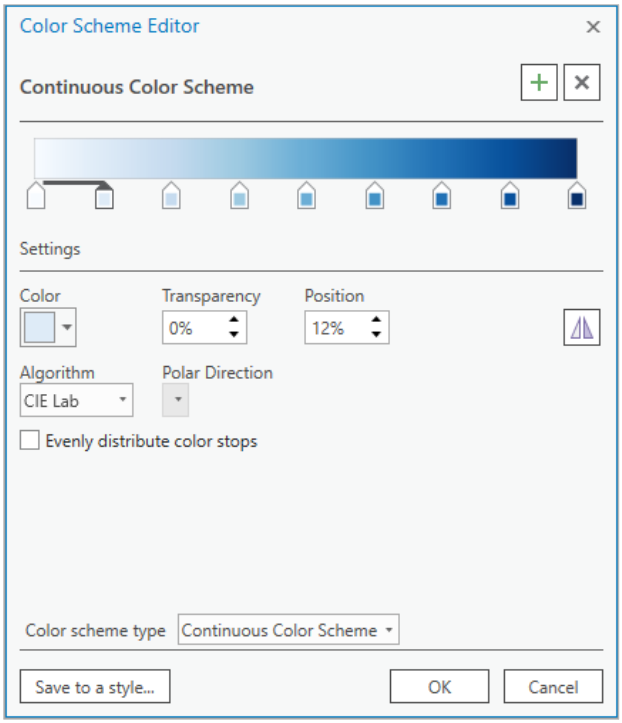



The scene updates to display buildings with a graduated white to blue color representing floor count. Taller buildings with more floors are darker and lower buildings are lighter.

10. From the **Color scheme** drop-down menu, select **Format color scheme**.



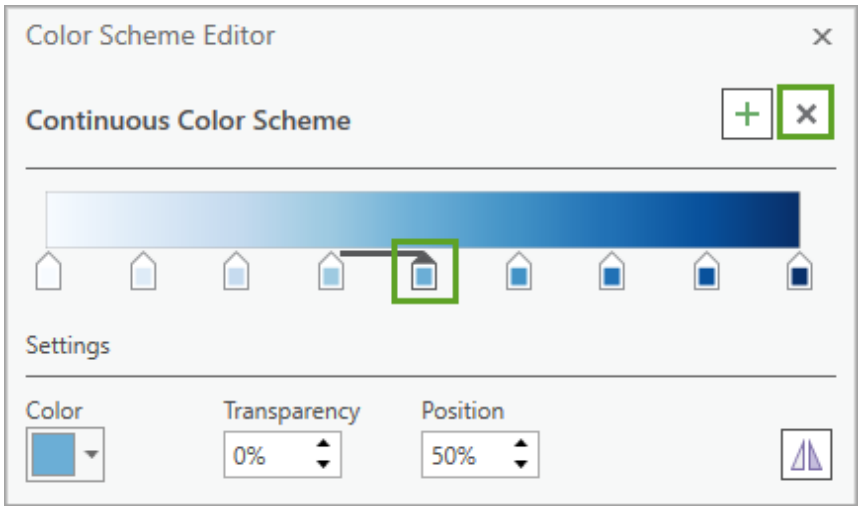

This opens the **Color Scheme Editor**, which allows you to define different color ramps for application as graduated symbols. You can add or remove colors to influence the appearance of the ramp, and even alter transparency at different intervals along the color ramp.



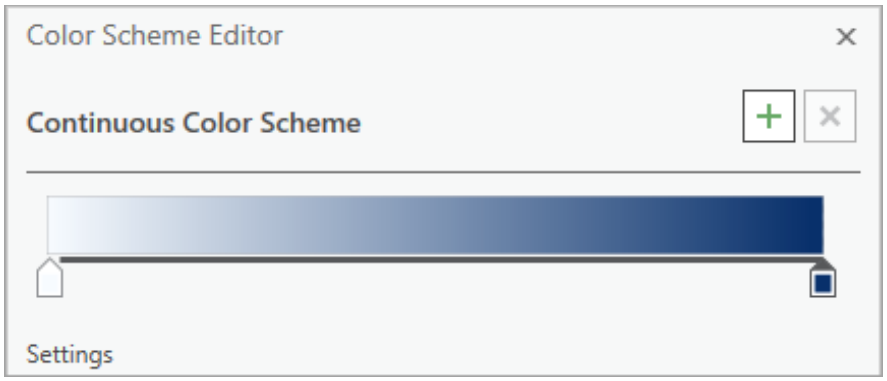

Let's modify this color ramp to show buildings from beige to brown, beige being a building with fewer floors and brown with more floors. Let's also make shorter buildings more transparent than taller ones.

11. Select one of the colors in the middle of the color scheme.

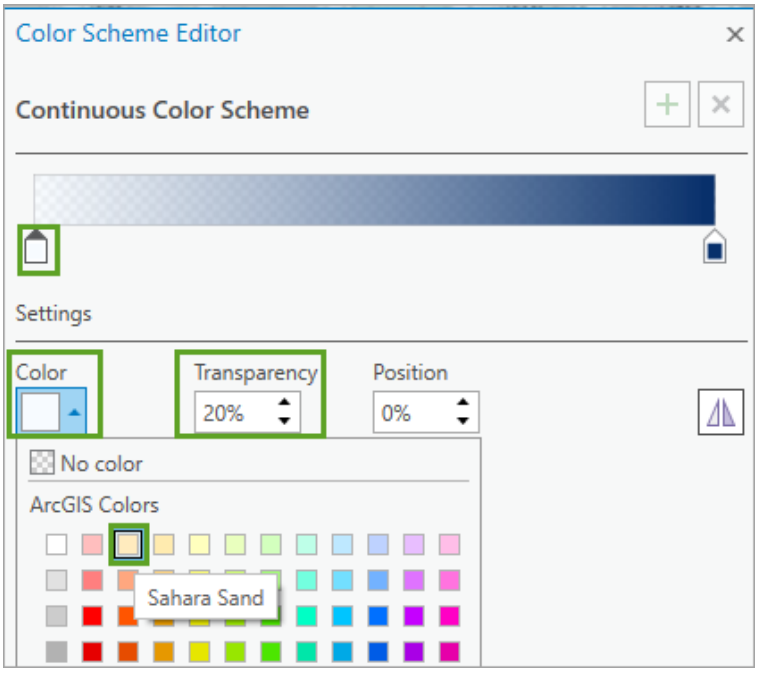
12. Click the delete button at the top right to remove it.



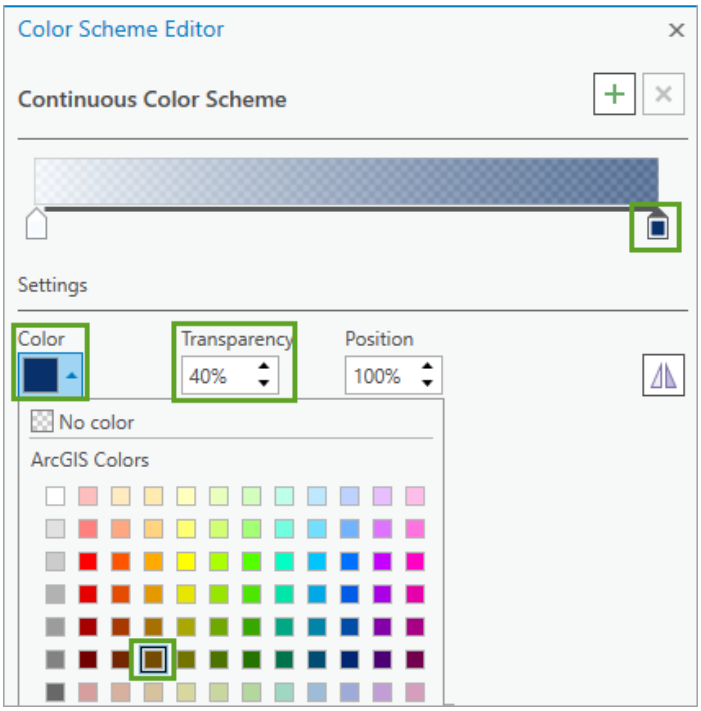

13. Repeat this until you only have one color on the left, and one on the right.




14. For the color on the left, set it to **Sahara Sand (#FFEBBE)**, with a transparency of **20%**.

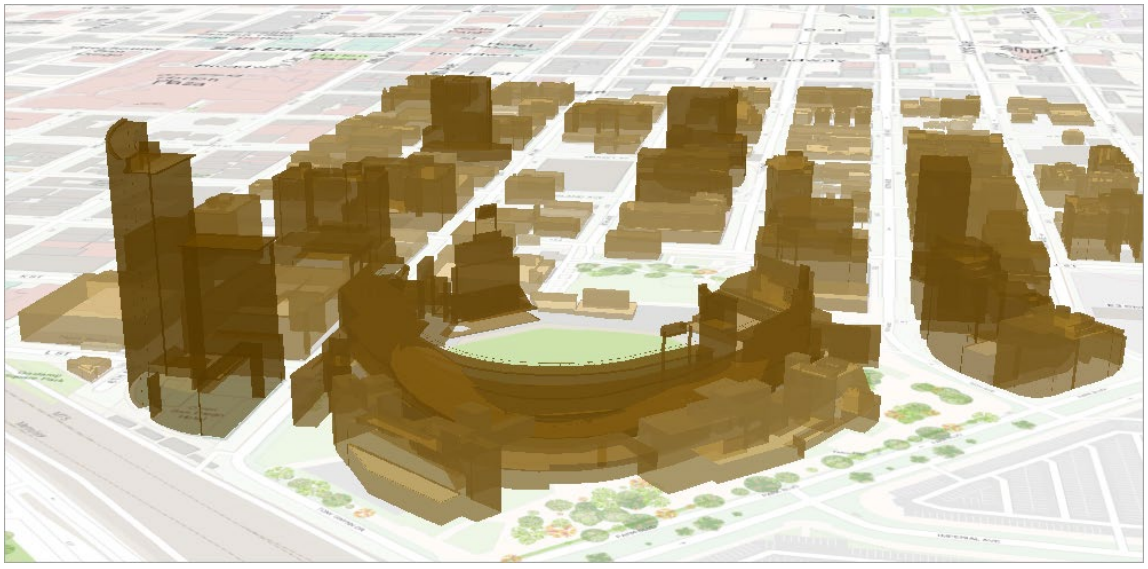



15. For the color on the right, set it to **Burnt Umber(#734C00)**, with a transparency of **40%**.




16. Click **OK**.

    The scene updates to display the new transparent buildings in hues of brown.



17. Save your project.

    You now have a set of buildings, displayed thematically by the numbers of floors from beige to brown. Note, you ramped from a light color to a dark color going from a small number of floors to large number of floors but inverted that for transparency, making darker colors more transparent and lighter

colors less transparent. This reduces how stark dark colors appear in the scene. Excessive transparency on lighter colored features tends to make them fade drastically from visual prominence.

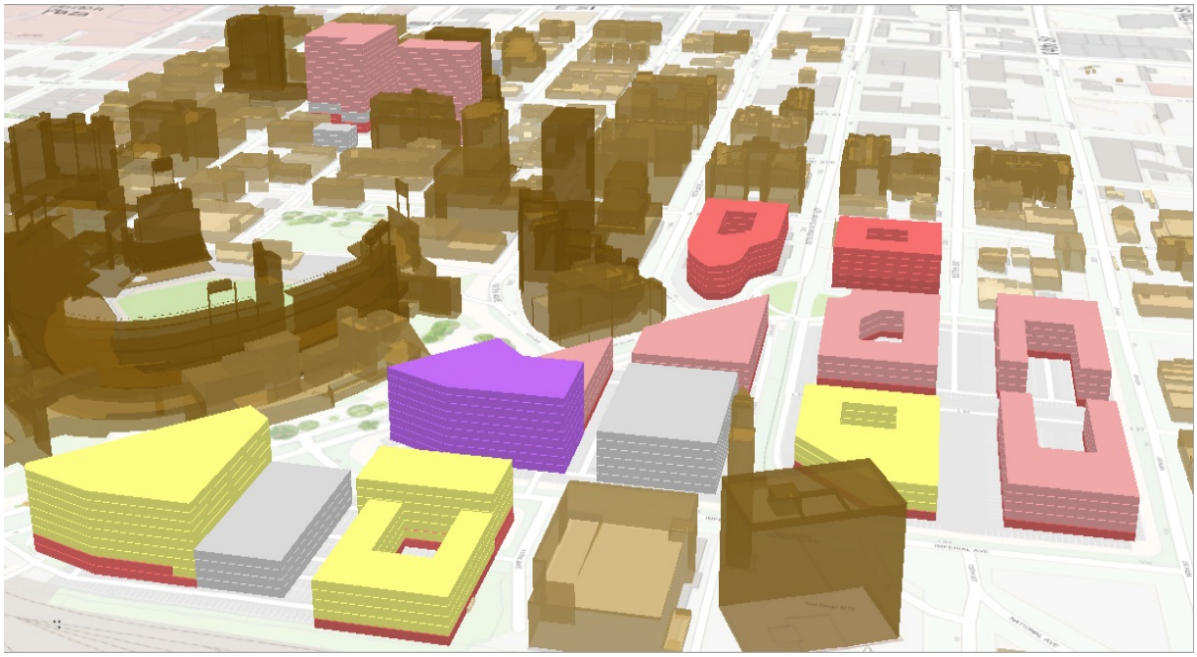
## Match 2D and 3D themes

Sometimes you want to match thematic representation across multiple layers, where some of those layers may be 2D and others 3D.

You have a set of proposed buildings for this city, created using Esri CityEngine. You want to understand their impact on solar radiation in the urban environment, but you want to understand the impact both on the surface of the earth, as well as on the roof tops of the existing buildings. You want to display solar radiation on the ground and on the buildings using similar symbology so that the two layers blend into a seamless visual representation.

Let's start by adding some additional data to your scene.

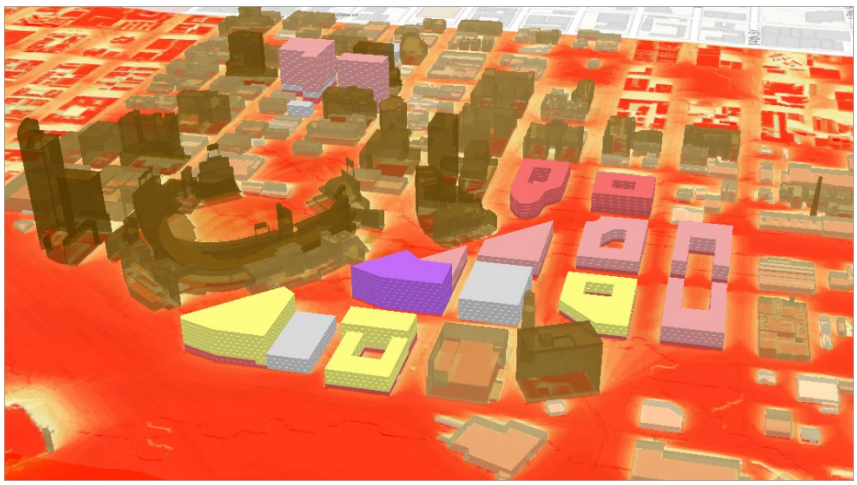
1. In the **Catalog** pane, drag the **Proposed Buildings.lpkx** layer package onto your 3D scene.



These are procedurally generated proposed buildings for the city. Note, that they are thematically colored based on their use type per floor. However, this appearance is not based on a renderer. This is because these colors are "baked" into the multipatches like textures, so they cannot be changed or modified.

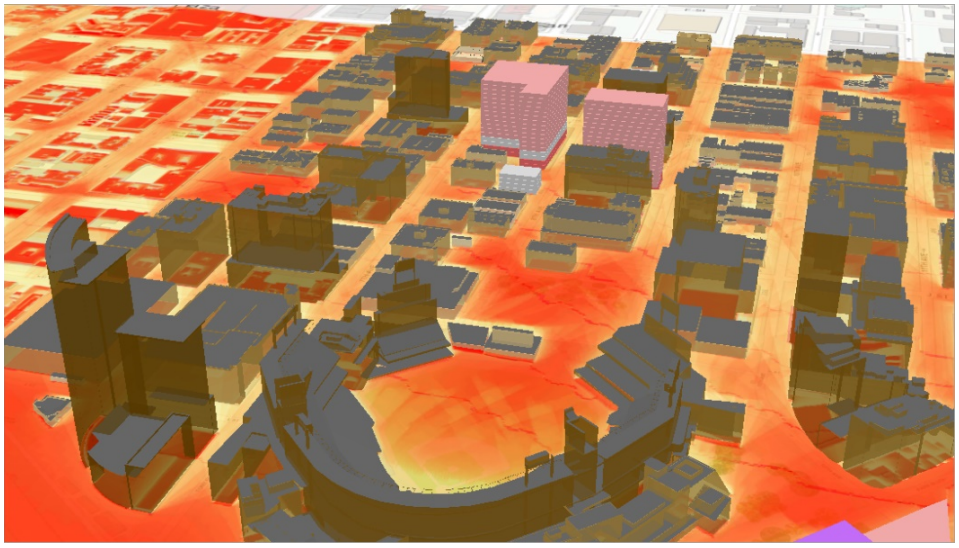
2. Drag the **Solar Radiation (AFTER).lpkx** layer package into your 3D scene.

3. Check and select the **Solar Radiation (AFTER)** layer in the **Content** pane.



This layer represents kilowatt hours of solar exposure. It was created by combining the building forms with an elevation surface and running a geoprocessing tool to assess solar radiation. This is the color scheme you want to mimic with your vector data. Because you don't want to show the building's color through the roof panels, you'll avoid adding a similar transparency that is used in the raster.

4. Drag the **Building Solar Potential - Source.lpkx** layer package into your 3D scene.



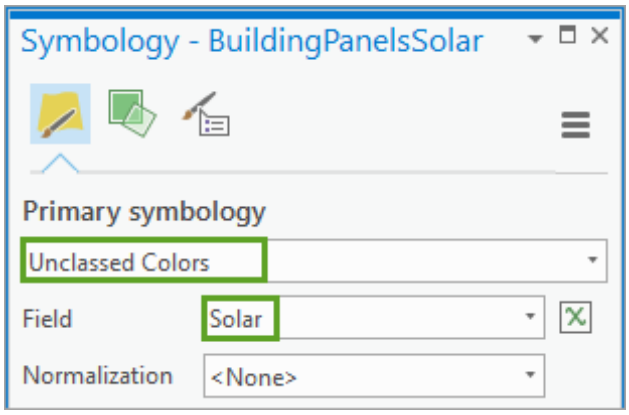
Here, procedural technology was used to pull out the roofs of all the buildings in the area of interest. Roofs were split into panels, so each part of the roof could carry a different value. Then a spatial join was used to attach solar radiation values from the raster to each of the roof panels.

5. If necessary, select the **BuildingPanelsSolar** layer and open the **Symbology** pane if it is not already open.

6. In the **Symbology** pane, for **Primary symbology**, choose **Unclassed Colors**.

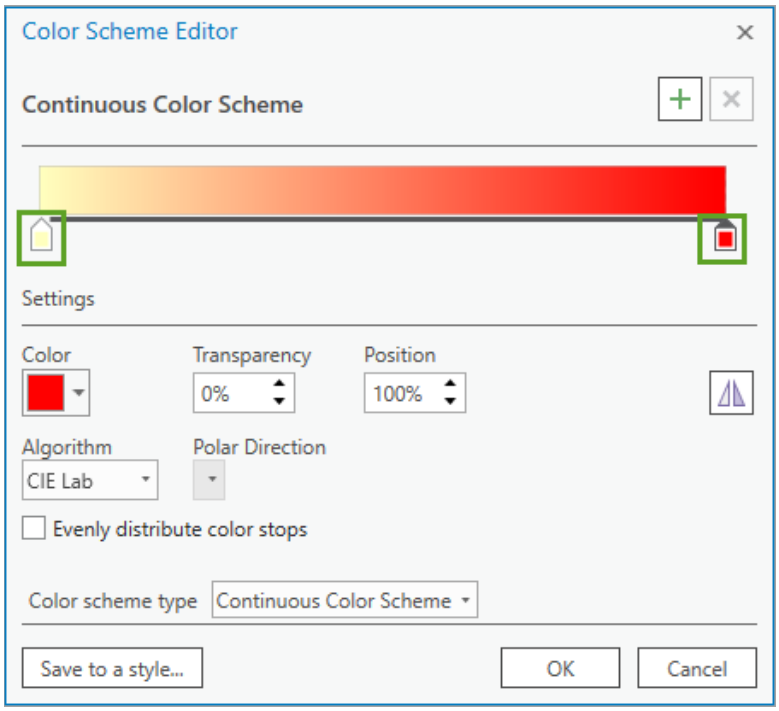
   Note that if a histogram has been used to manipulate the display of the color ramp on the raster so that it's not a simple linear representation, you may need to match that in your vector data. In this case, both are simple linear representations.

7. Set the **Field** to **Solar**.

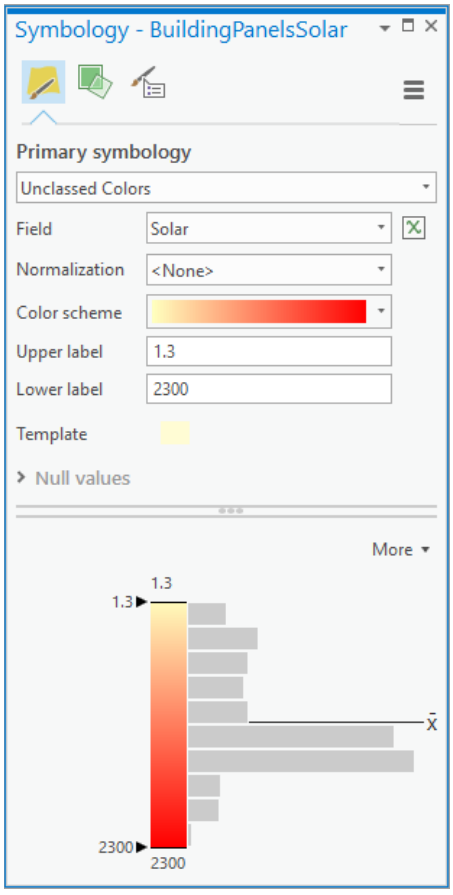



8. For **Color Scheme**, open the drop down and select **Format Color Scheme.** Apply the following:

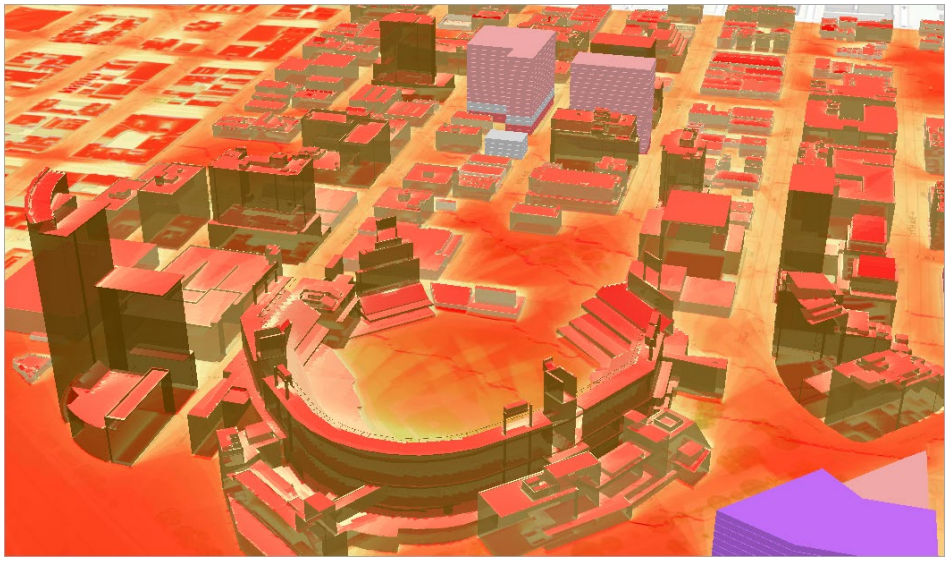
   - Removing all intermediate stops
   - Keep only the **first** and **last** stops.
   - Set the low value stop color to **Yucca Yellow(#FFFFBE)**.
   - Set the high value stop color to **Mars Red(#FF0000)**.


Color Scheme Editor
Continuous Color Scheme
Settings
Color
Transparency
0%
Position
100%
Algorithm
CIE Lab
Polar Direction
Evenly distribute color stops
Color scheme type
Continuous Color Scheme
Save to a style...
OK
Cancel

9. Click **OK**.

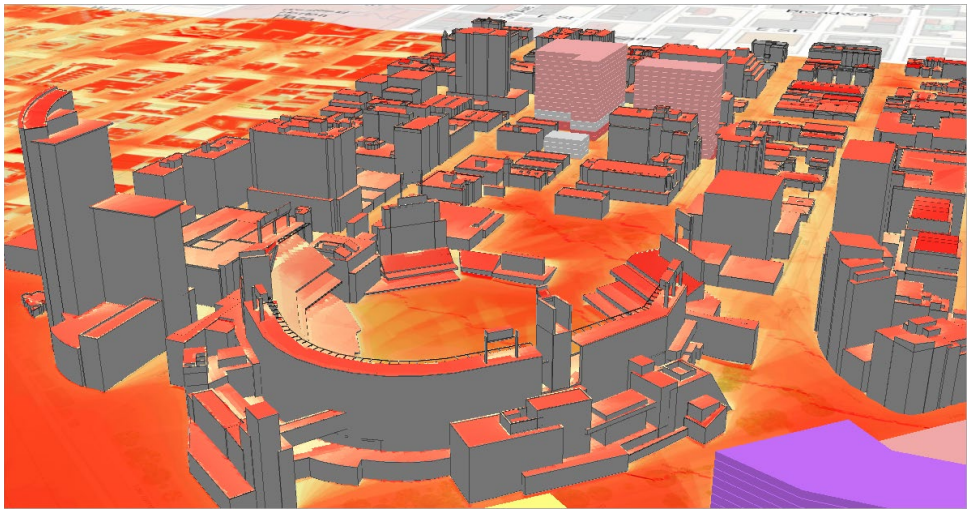

Symbology - BuildingPanelsSolar
Primary symbology
Unclassed Colors
Field
Solar
Normalization
<None>
Color scheme
Upper label
1.3
Lower label
2300
Template
Null values
More
1.3
1.3
2300
2300

The **BuildingPanelsSolar** layer updates to display roofs symbolized by the **Solar** value assigned to each roof panel.



Displaying multiple thematic layers simultaneously can be confusing visually because of color conflict.

10. In the **Contents** pane, copy and paste your **Untextured Buildings (AOI)** layer in the scene to make a duplicate.
11. Change the symbology of the copy so it uses a **Single Symbol** with a medium gray color.
12. In the **Contents** pane, uncheck your classified **Untextured Buildings (AOI)** and check your gray one.
13. Save your project.



This is a common technique for displaying analytics across multiple layers. For instance, you may want to do walk time analysis from a bus stop, or light rail station, to indicate the area served by public transportation. But doing it purely as a 2D raster, the results get lost or obscured by realistic 3D features already in the scene, such as buildings. By thematically representing the same data on the buildings, based on the walk time to their entrance, you can blend the 2D analytic results with your 3D data.

## Perform thematic extrusion

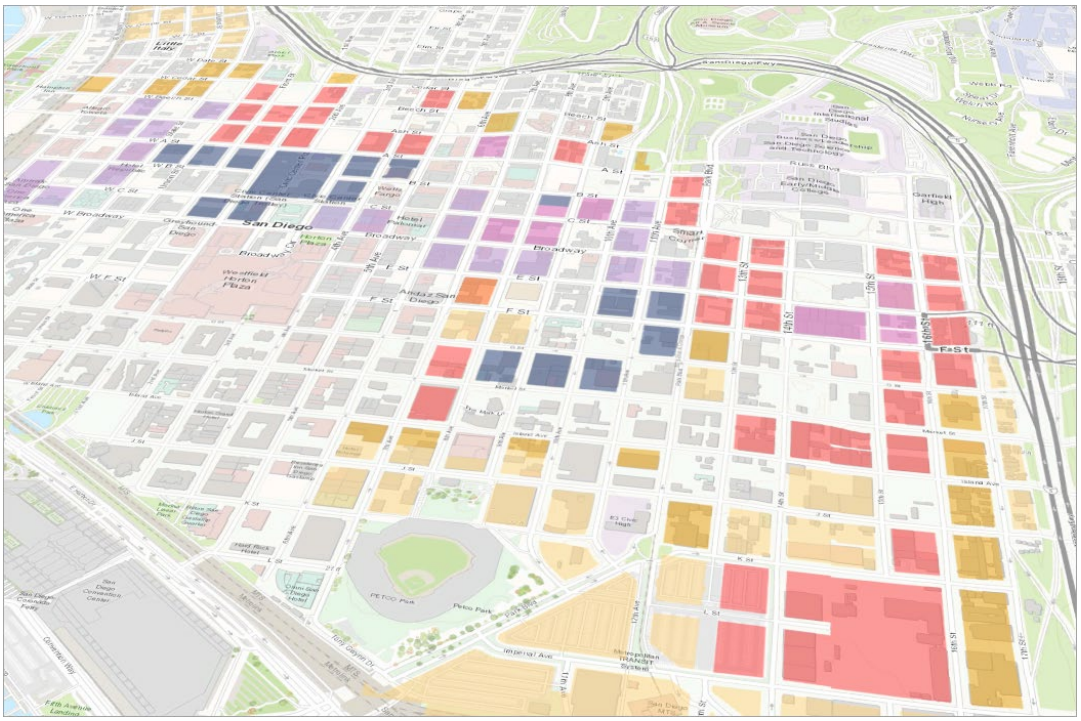
Extrusion is another way to represent a condition, status, or intensity of a feature. It can be an abstract representation, such as driving extrusion height based on a ratio to the financial value of a parcel normalized by its area. Or it can be concrete, relating the extrusion height to regulatory limit on the maximum height in a zoning district. In both cases, the data represented is thematic, meaning it does not exist in the physical world as an object, but has meaning in 3D space.

Let's explore an example of thematic extrusion. The city has identified a subset of its parcels that are ideal for redevelopment. They parallel a proposed bus rapid transit route through the city. They are thinking of altering the floor area ratio, a measure of density, allowed for parcels along this route to increase urban density. They are also considering increasing the maximum height allowed for buildings along the route. They have developed a layer representing this development potential and want to show it in 3D.

1. Check off all 3D and 2D layers in your scene, except your basemap.

   Note: Do not remove the layers, as you'll use them later to show visual conflict between multiple thematic layers.

2. In the **Catalog** pane, from the **Folder** connection, drag the **Development Potential - Source.lpkx** layer package onto your 3D scene.



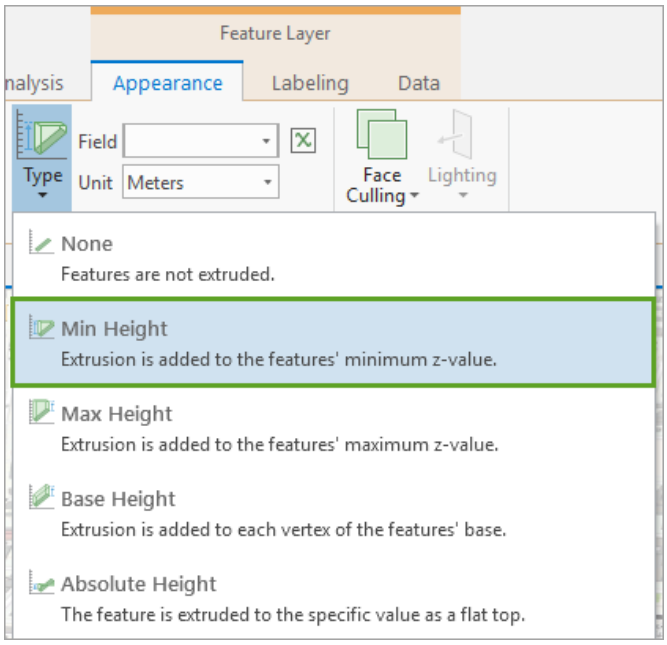

The layer displays as a set of 2D polygons draped to the ground. It already has thematic representation for its floor area ratio (FAR) applied as a part of its symbology. However, you need to represent the maximum building height as well.

3. In the **Contents** pane, click-and-drag the **Development Potential** layer into the **3D Layers** category.

The layer looks like it is fragmented and bumpy because the vertices of each polygon are being placed on the uneven surface, and their interiors are being calculated unevenly across it. This won't matter once you extrude the feature and apply a cartographic offset.

4. If necessary, in the **Contents** pane, click the **Development Potential** layer to select it.

5. From the **Appearance tab > Extrusion** group, click the **Type** drop-down arrow and choose **Min Height**.

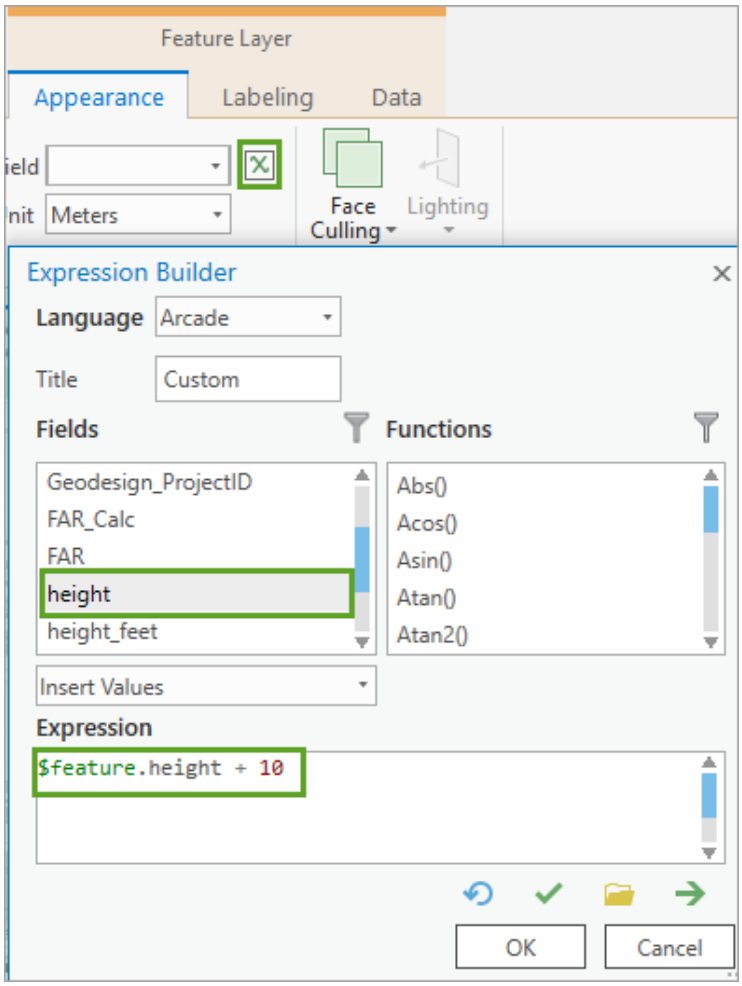



6. In the **Extrusion** group, click the **Extrusion Expression** button  .

7. In the **Expression Builder**, create an expression that will extrude each polygon by adding 10 to its current height value.

   - In the **Fields** list, double-click **height** to add it to the expression.
   - Next type "+".
   - Type "10".

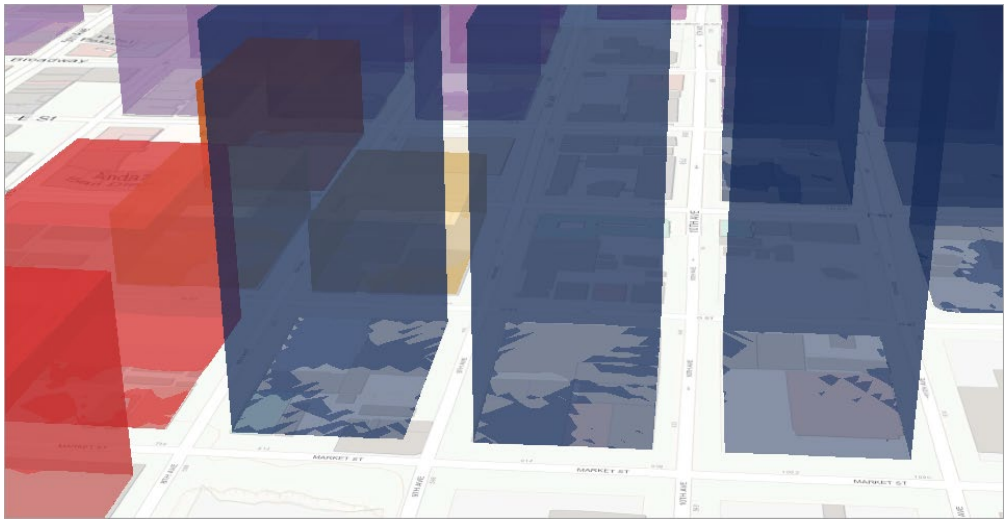
   Your expression should read as follows: $feature.height + 10.




8. Click **OK** to apply the expression.

The **Development Potential** layer updates to displaying buildings where extrusion height is derived from the values in the height field plus 10; in addition, the type of extrusion is set to add to the feature's minimum z-value.

9. Zoom in close to one of the buildings and notice the symbology effect at the base of the polygon.

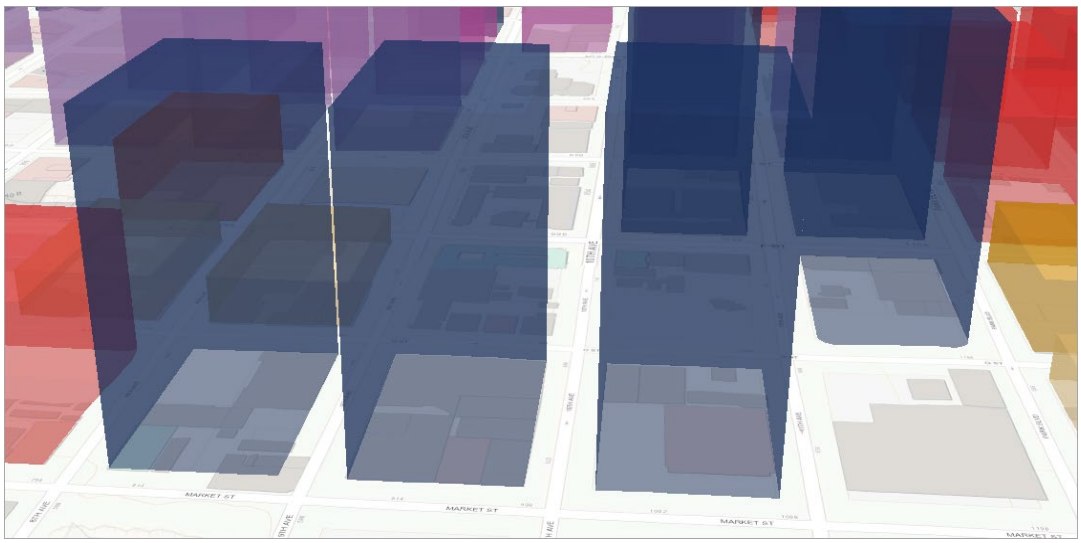



10. In the **Contents** pane, right-click the **Development Potential** layer and select **Properties**.

11. In the **Layer Properties** window, click the **Elevation** tab.

12. Set the **Cartographic** offset to be **-10** and, if necessary, set the **Elevation** units **to Meters**.

13. Click **OK**.



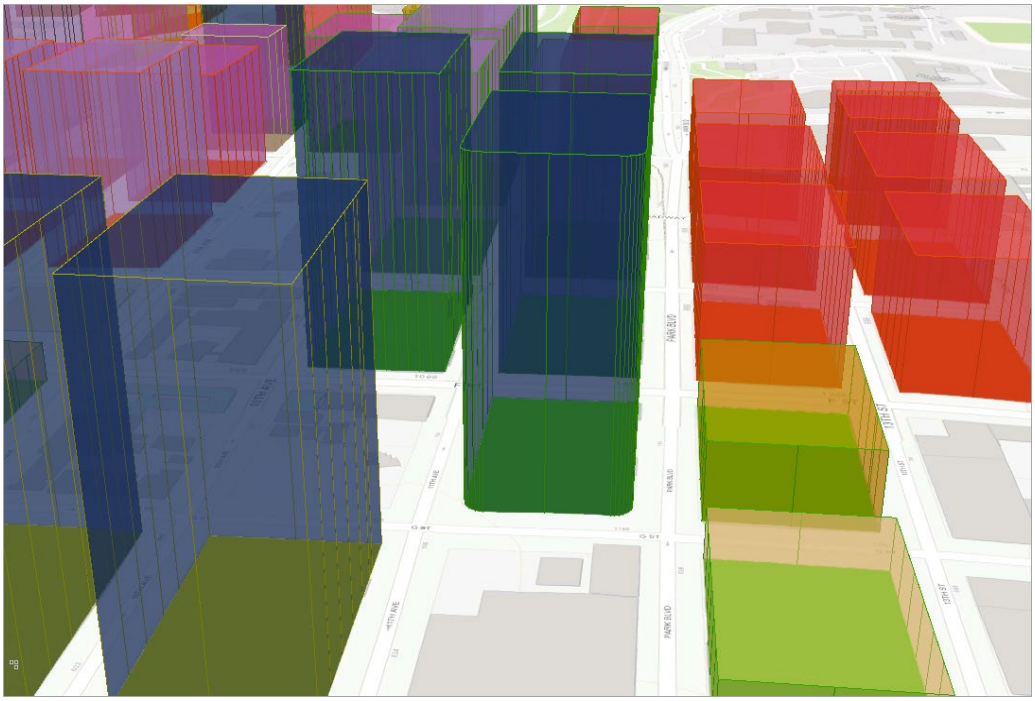
You extruded by the minimum height limit plus 10 meters. Then you used a cartographic offset to slide the base of each parcel below the surface by 10 meters. This removed any visual conflict with the surface and gave us nice, clean edges around the development polygons. You also used the minimum elevation value for each polygon to extrude from, thereby representing the worst-case development constraints.

14. Save your project.

    Note that the fill color is not the only thing you can change on an extruded polygon. You can also apply thematic mapping on the edges of the extruded forms (along with polygons and multipatches).

15. Drag the **Development Potential - Overlay.lpkx** layer package onto your 3D scene.

16. Drag the **Development Potential - Underlay.lpkx** layer package onto your 3D scene.



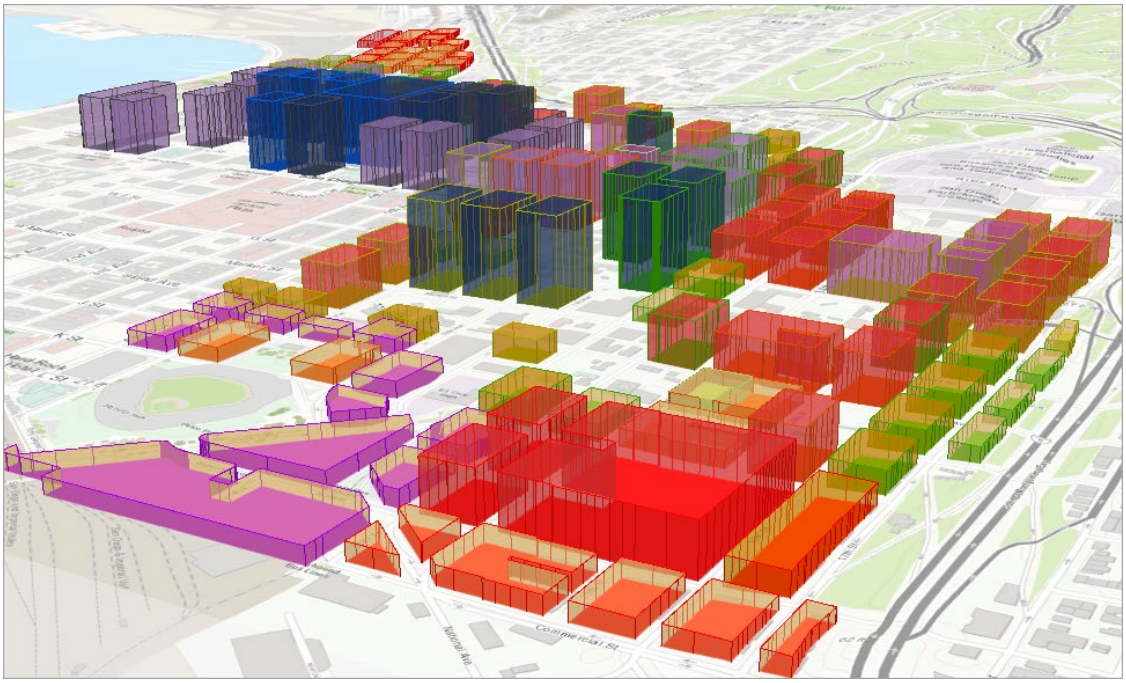
You've added two new layers that show the land use category for each of these proposed redevelopment parcels. The overlay color codes the edges of each extruded polygon based on the land use. The underlay colors the parcel as draped to the ground by the land use category.

17. In the **Contents** pane > **3D** layers, open the **Development Potential** layer showing the edge effects.

    ***Hint**: There are now three layers in the contents pane named Development Potential. Two are listed under **3D Layers,** one that shows edge effects and one that shows the building shapes as translucent, 3D*

*shapes. and shows the edge effects in 3D space. To keep track of the layers, you can rename the layer showing the edge effects as "Development Potential Overlay" by clicking on the layer title, then clicking again to activate the textbox. The underlay layer is listed under **2D Layers** because it has no elevation information associated with the features. You can rename this layer as "Development Potential Underlay."*

You can apply frame coloring around polygons here. Note, not all display modes (dashes, for example) will work on polygon edges. In the current scene, you are displaying a combination of three thematic variables, FAR, maximum buildable height, and land use category.



However, you have created visual information overload. You need to be careful how much information you combine into a scene or set of layers. There are times, though, when combining color, size, and orientation are appropriate, but this may not be one of them.

18. Turn off the **Development Potential** layer and look only at the **Underlay** and **Overlay**.

    Even without the conflicting **Development Potential** colors, using edge color to display thematic data can make the scene appear busy, especially if the data involved is complex with many vertices. However, edge rendering can be very helpful in editing workflows for extruded lines, extruded polygons, and multipatches, as it helps highlight the geometry driving the shape of the feature.

19. Save your project.

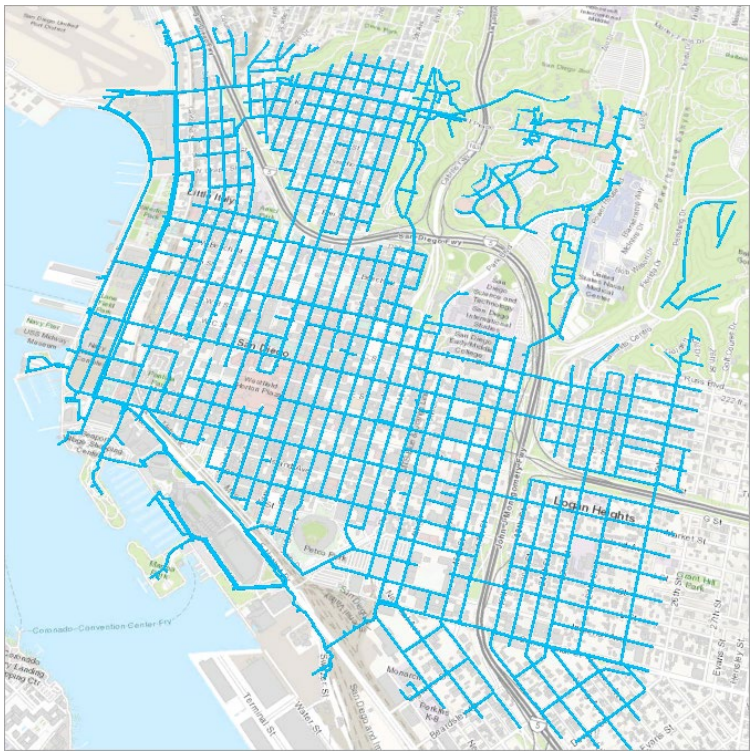
## Apply size for thematic representation

Representing multipatches and polygons differs significantly from how you represent lines and points. For multipatches and polygons, shape is explicitly defined by the geometry (though you can vary the size of edges, which are treated as lines, on both). For lines, however, you can vary the shape, called a profile, of the geometry that is swept along the length of the line. For points, you can use any number of prebuilt 3D models to create your symbol, or even import your own models. Varying the size of the swept profile along a line, or the size of a 3D model on a point, can be used to highlight thematic differences in data.

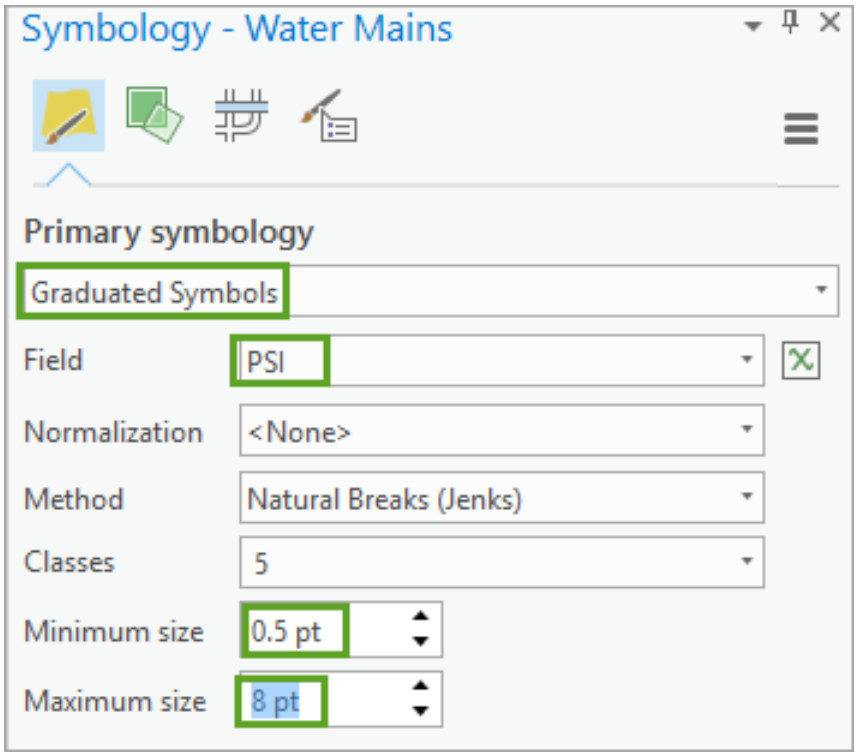
For instance, you could represent the storm water load of a storm water culvert system based on the size (width, height, radius, and so on) of the profile used to represent it. Or you could vary the size of cylinders representing subsurface earthquake epicenters to represent magnitude.

Let's play with size as a visual variable. The city Public Works department has a dataset that shows its water mains across the city. Public Works employees recently began collecting water pressure values at locations along these mains to get a sense of where they might have insufficient pressure to support development needs. They'd like to visualize the PSI values in 3D, as pipes of varying size.

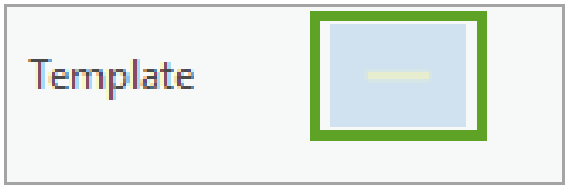
1. In the **Contents** pane, uncheck all the current displayed layers in your scene except your basemap.
2. Drag the **Water Mains - Source.lpkx** layer package from Windows Explorer onto your 3D scene.
3. In the **Contents** pane, check the **Water Mains** layer check box.
4. Right-click the **Water Mains** layer and zoom to the layer.




5. Open the **Symbology** of the **Water Mains** layer by clicking on the layer in the **Contents** pane, then clicking **Symbology** on the **Appearance** tab..
6. In the **Symbology** pane, select **Graduated Symbols** from the **Primary symbology** drop-down menu.
7. Select the **PSI** field from the **Field** drop-down menu.
8. Set the **Minimum size** to **0.5 pt.** and the **Maximum size** to **8 pt**.

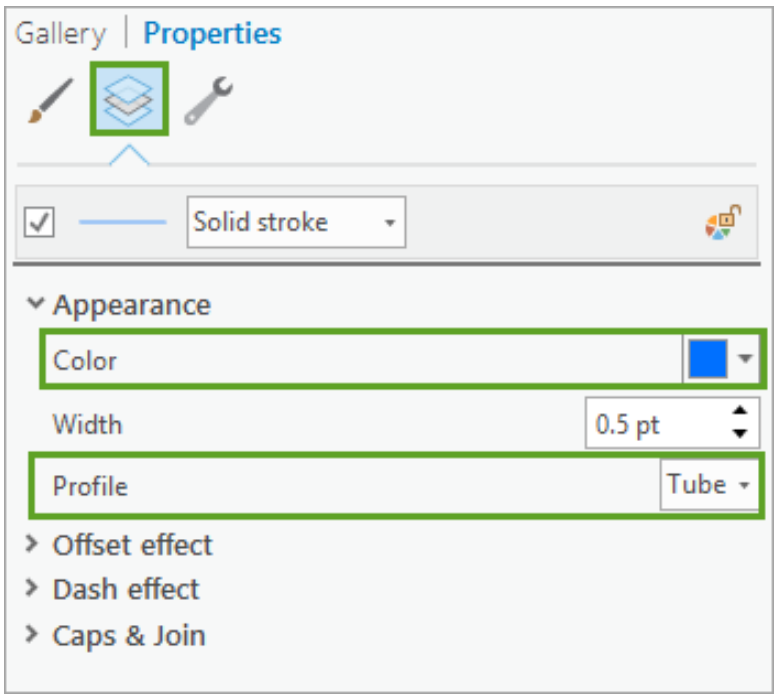



9. Select the **Template** symbol.

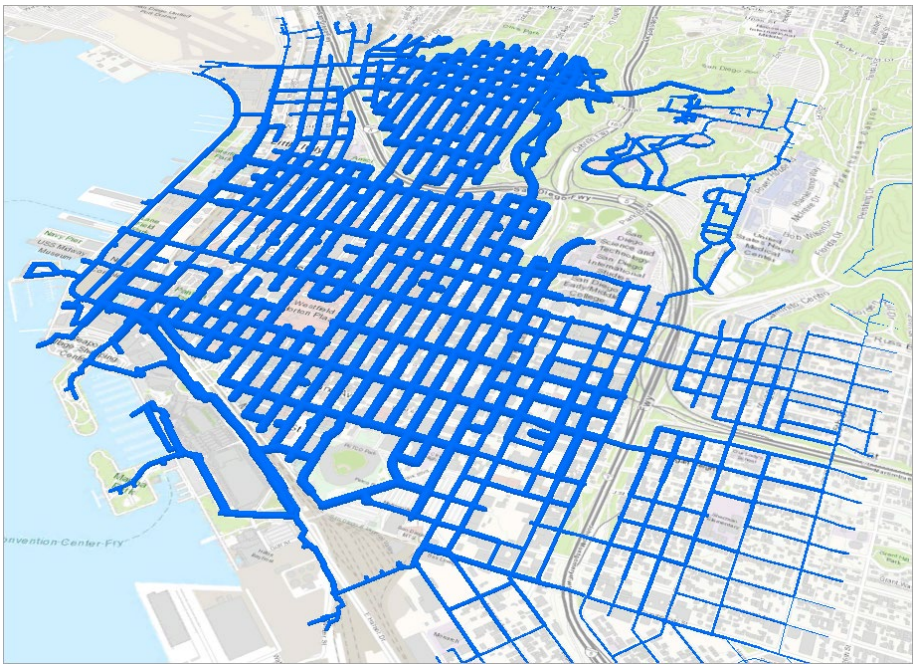



10. In the **Properties** tab > **Layers** tab, change the color to **Cretan Blue(#0070FF)**.

11. Change the **Profile** to **Tube**.




12. Apply the symbol changes and go back to the **Primary symbology** pane.

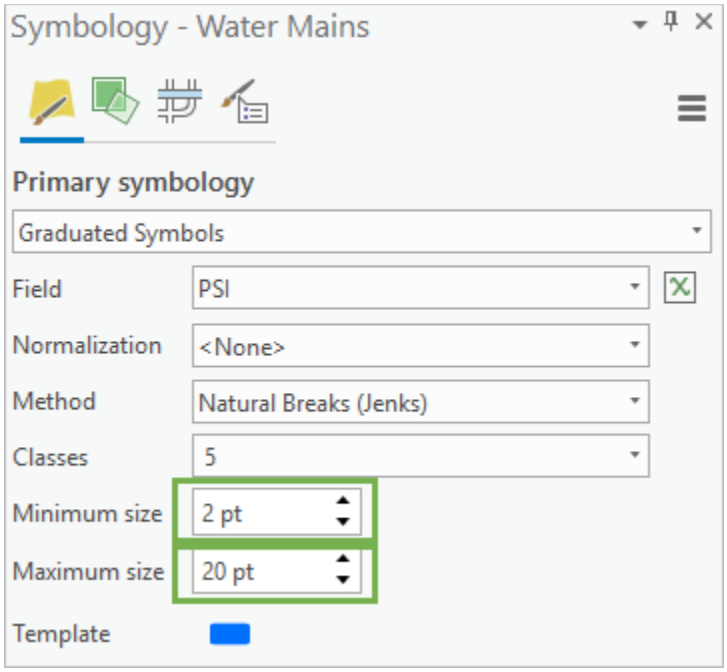


13. Zoom in and out and notice how the size of the pipes stays consistent with the screen.\

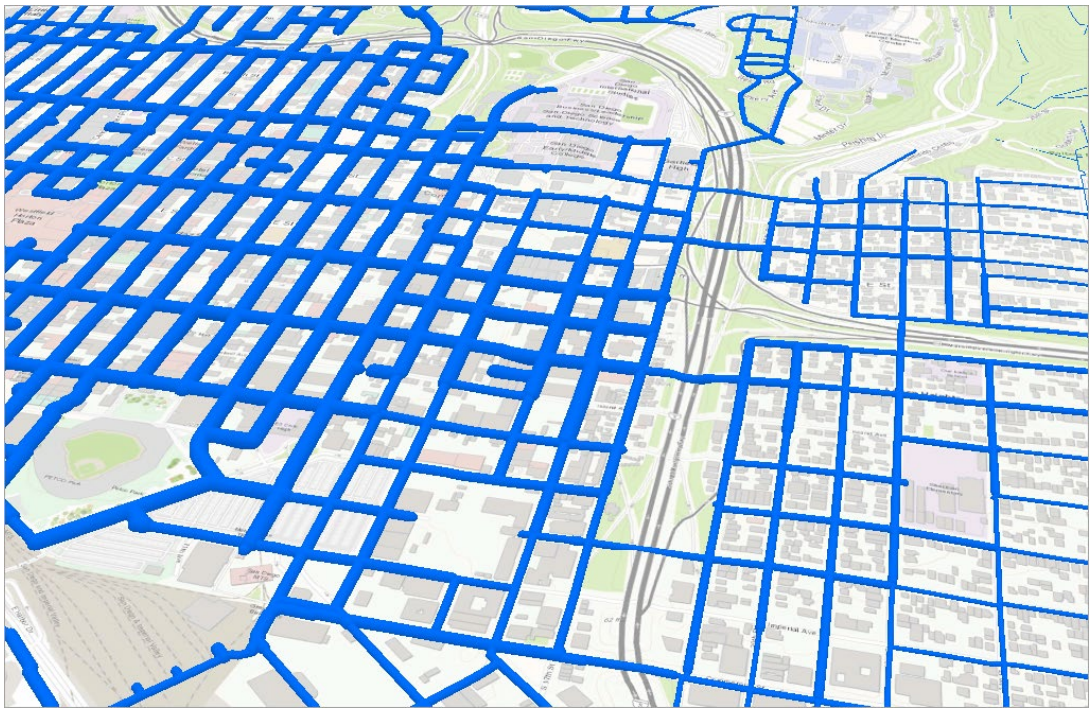
    The size of the symbols is scaling based on the screen point size. That means even when you zoom in, each pipe will always take up the same amount of screen space. This is useful if you want to guarantee

that a feature will always be visible regardless of scale. However, at certain scales, symbols will merge and look muddled.

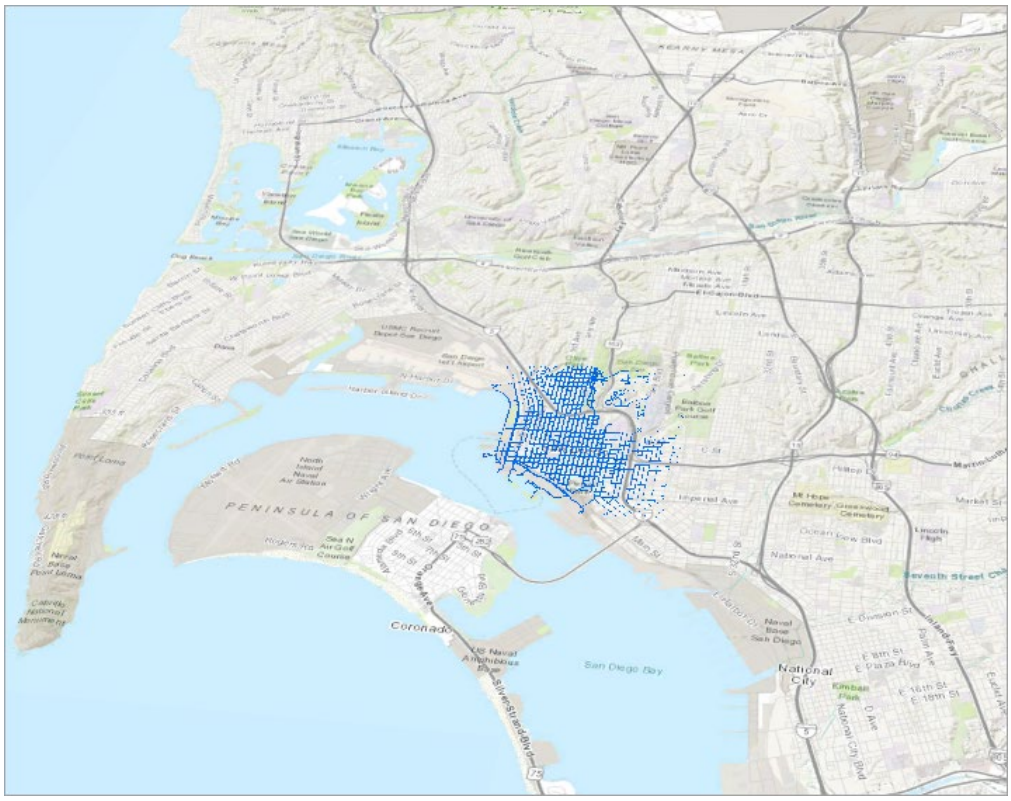
14. Right-click the **Water Mains** layer and select **Zoom to Layer**.
15. In the **Contents** pane, right-click the **Water Mains** layer and select **Properties**.
16. In the **Layer Properties** window, click the **Display** tab.
17. Check **Display 3D Symbols in real-world units** and click **OK**.
18. In the **Symbology** pane, set the **Minimum size** to **2 pt**, and set the **Maximum size** to **20 pt**.




19. Zoom in and out and notice how the size of the pipes stays the same absolute size.



20. Zoom out to the city, to Southern California, to the state level, to global view, and notice how the symbols shrink, become indistinct, and then disappear.



The symbols are now represented by real-world units. Which means they won't get larger and lump together as you zoom away from them, but they will get smaller, then pixelated, and fade to the point where they no longer appear.

Varying the size of the symbols in this case is the only way you could represent PSI. Let's apply extrusion as a method from the previous step.

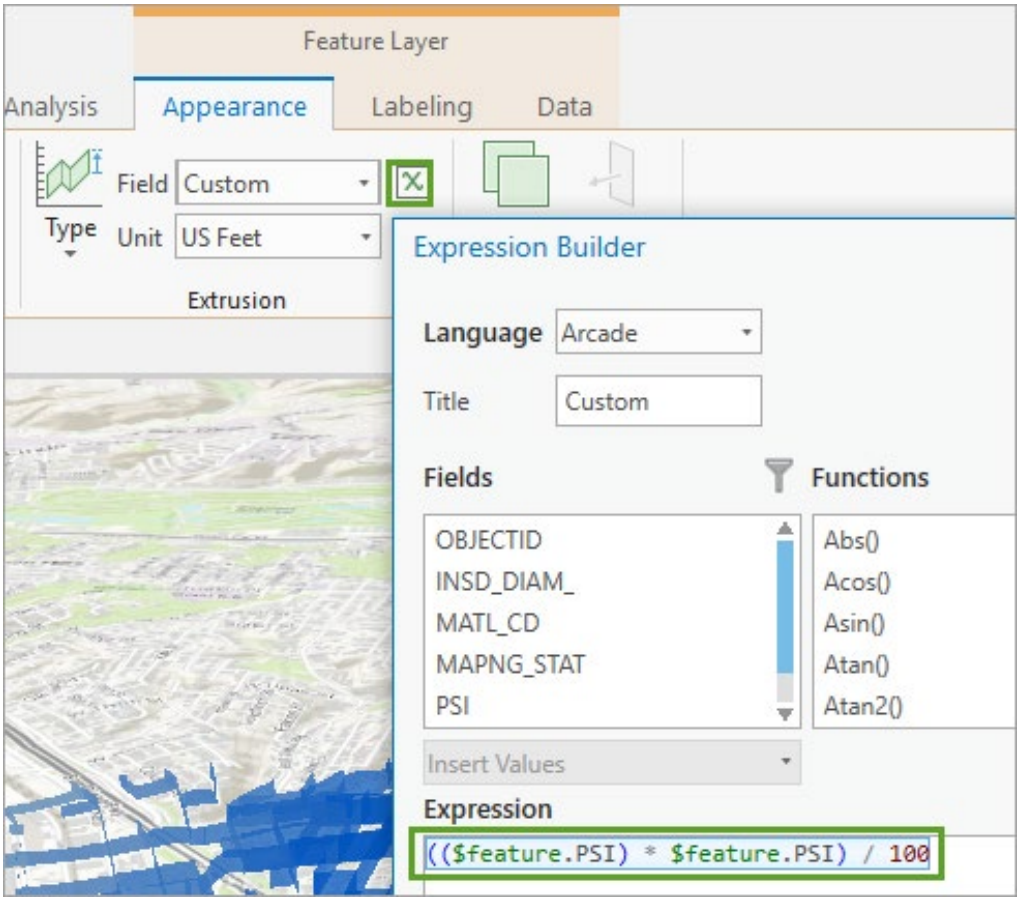
21. Uncheck the **Water Mains** layer.
22. In the **Catalog** pane, drag the **Water Mains - Extruded.lpkx** layer package onto your 3D scene.

    Here you have used PSI in a formula to vary extrusion height for each segment of the water main system.

    Much like the graduate symbols, where relative size indicated how much PSI was available, the extrusion height provides the same visual differentiation here.

23. On the **Appearance** tab > **Extrusion** group, click the **Expression Builder** button  and review the expression used to provide the extrusion height:

    - (($feature.PSI) * $feature.PSI) / 100




24. Click **Cancel**.

25. Save the project.

## Apply shape for thematic representation

Points can be represented by different kinds of 3D models, markers, and symbols. One way to indicate thematic difference is to vary their shape. Some forms of markers and symbols can be billboarded, so that they always face the viewer. Others can be billboarded, so they rotate around a z-axis to face the viewer.

The city Public Works department has been keeping track of the tree conditions around the baseball park, as they represent a critical asset and have high visibility. Some of the surveyed trees have been found to be dead, diseased, or stressed. Public Works department employees want to visualize these in a way that calls out clearly which trees must be replaced quickly.

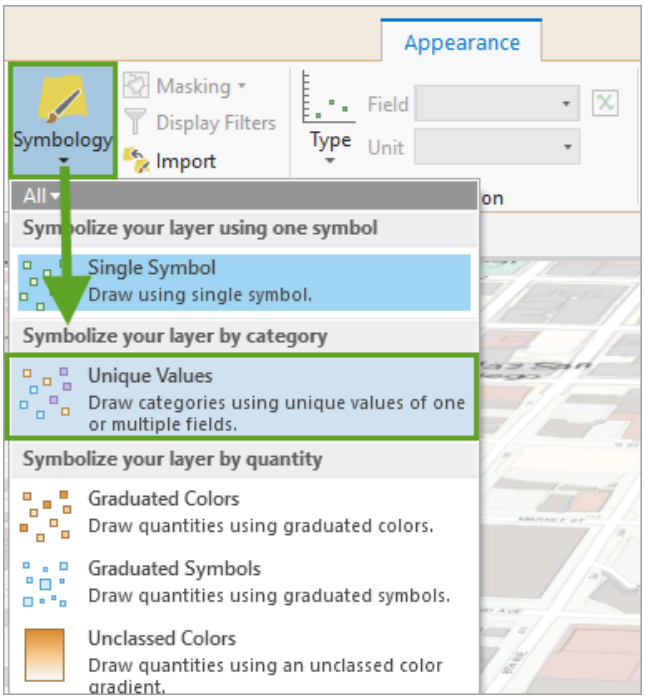
1. Turn off all the current displayed layers in your scene except your basemap.

2. Drag the **Trees - Source.lpkx** layer package from the **Catalog** pane onto your 3D scene.

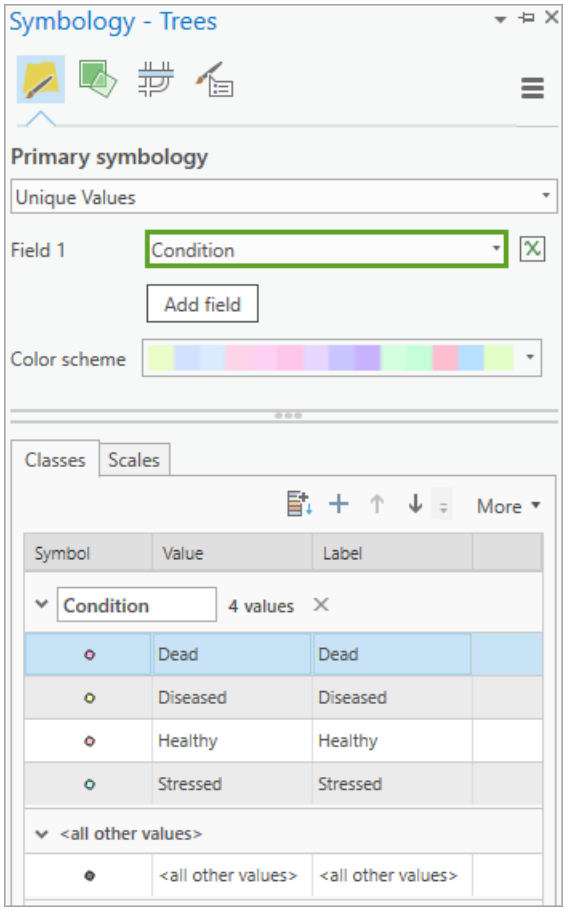
3. Zoom to the layer. Your symbology may differ from the screenshot below.


The trees are displayed as single points. You'll change them into 3D trees.

4. On the **Appearance** tab > **Drawing** group, click the **Symbology** drop-down menu and select **Unique Values**.




5. From the **Symbology** pane, on the **Field 1** drop-down menu, select the **Condition** field.

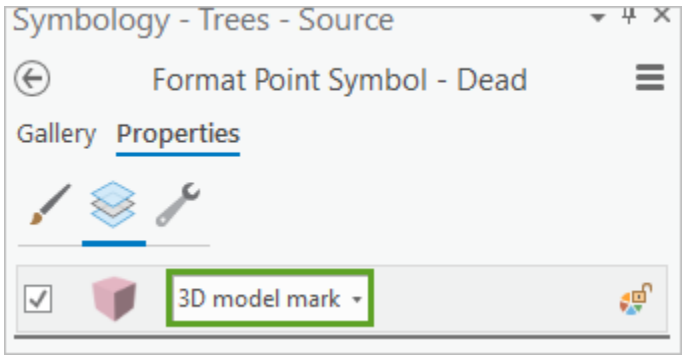


A unique symbol is applied to each **Condition** type in the display field.

6. Click the symbol for the **Dead** trees.

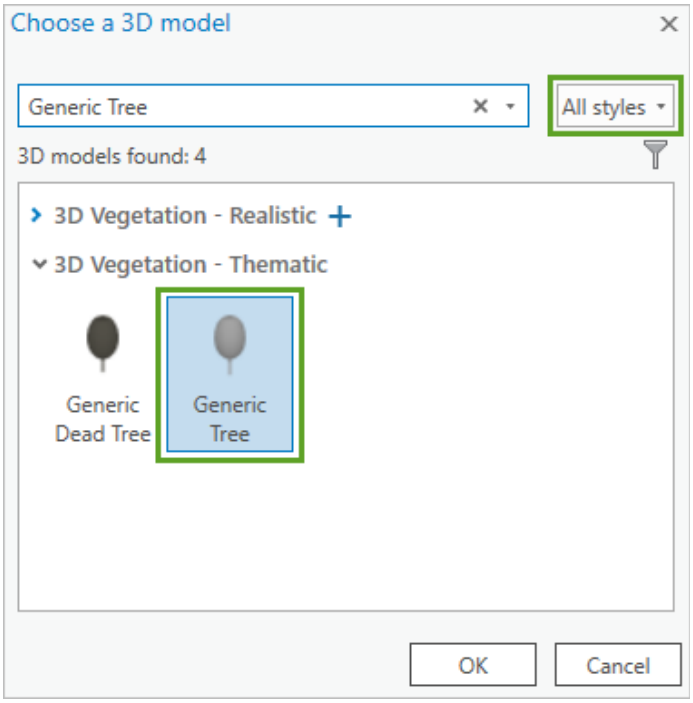
   The **Symbology** pane changes to **Layer properties**.

7. Next to the symbol, change **Shape marker** to **3D Model Marker**.




8. In the **Layer properties** pane, click the **Style** button.

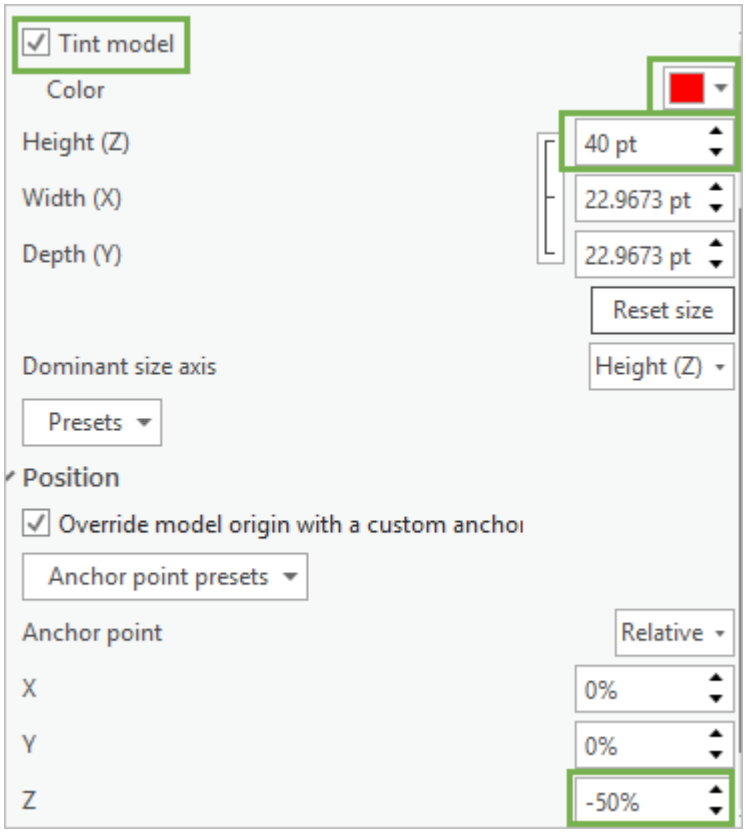
9. In the **Choose a 3D model** pane, ensure the search is set to All Styles, and search for and select 'Generic Tree'. Click **OK.**




   The Generic Tree model is designed to cartographically represent any kind of tree and is shaded to allow for further styling.

10. In the **Symbology** pane:

- Check **Tint Model**.
- Change the tint color to red
- Set the **Height** to **40 pt**. The **Width** and **Depth** boxes will automatically populate with proportionate values.
- Expand the **Position** group and set **Z** to -50%.




10. Click **Apply**.

11. Click the back button and select the **Diseased Trees** symbol.

12. Change the symbol from **Shape marker** to **3D model marker**.

13. Click **Style** and search for and select the **3D Generic Tree** symbol.

14. In the Symbology pane, change the following:

- Check **Tint Model**.
- Change the tint color to orange
- Set the **Height** to **25 pt**. Leave the **Width** and **Depth** values as they are.
- In the **Position** group, set **Z** to **-50%.**

14. Click **Apply**.

    Follow the previous steps again to change the Healthy and Stressed tree symbols to the following:

16. Healthy Trees:

- Change to **3D Model Marker**
- Style: **Generic Tree**.
- Check **Tint model** and change color to **green**.
- Set **Height** to **13**.
- Set **Z** to **-50%.**

16. Stressed Trees:

- Change to **3D Model Marker**
- Style: **Generic Tree**.
- Check **Tint model** and change color to **yellow**.
- Set **Height** to **18**.
- Set **Z** to **-50%.**

You can further explore changing the 3D models to represent this condition. For example, you can explore other 3D models and select the appropriate tree species.


11. Save your project.

In this section you symbolized point symbols into 3D tree models that are styled based on their condition. By styling tree condition with color and size, you have created a visual hierarchy of trees that require further care.

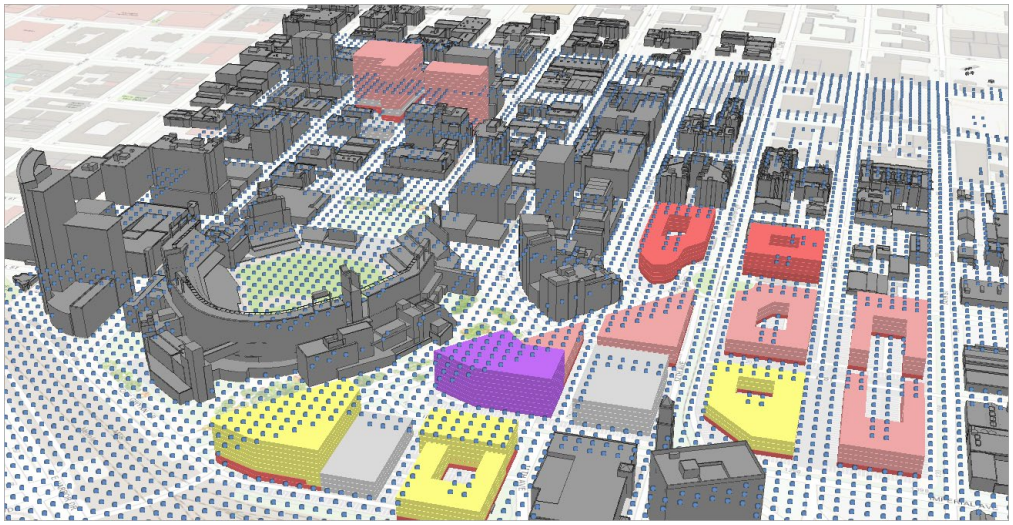
## Apply orientation for thematic representation

Points also can be rotated around their axes. This orientation can represent a variable as well. For instance, you could have a point over each county in the United States that points to the left or to the right depending on which party the residents voted for, and by what percentage.

The city has been trying to understand the impact of its proposed development on heat islands in the downtown area. The city has conducted solar radiation analysis previously, and recently has done same additional airflow analysis to show where areas of still air might overlap areas of high solar radiation exposure. The city wants to display these air flow points, color and sized to their intensity, and oriented toward their flow direction, combining three methods of thematic visualization into a single layer.

1. Turn off and collapse all the current displayed layers in your scene except your basemap, the gray **Untextured Buildings (AOI)**, and your **Proposed Buildings**.

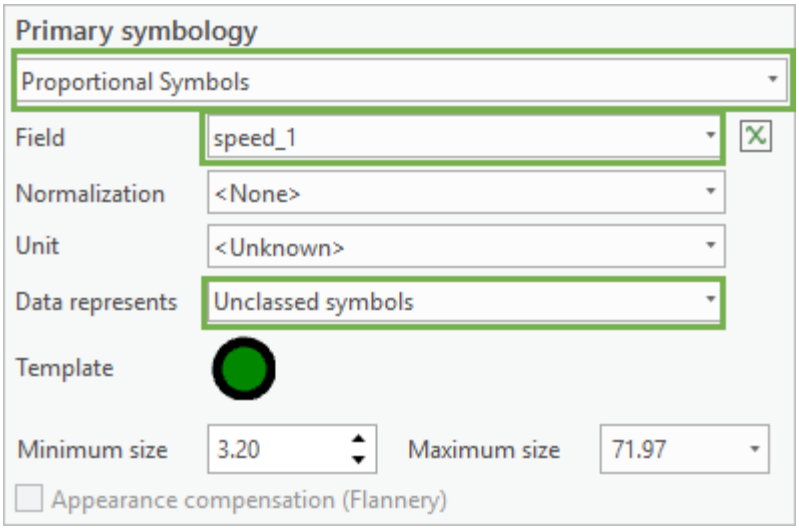
2. From the **Catalog** pane, drag the **Wind (AFTER) - Source.lpkx** layer package onto your 3D scene.



3. From the **Appearance** tab > **Drawing** group, click the **Symbology** drop-down menu and select **Proportional Symbols.**

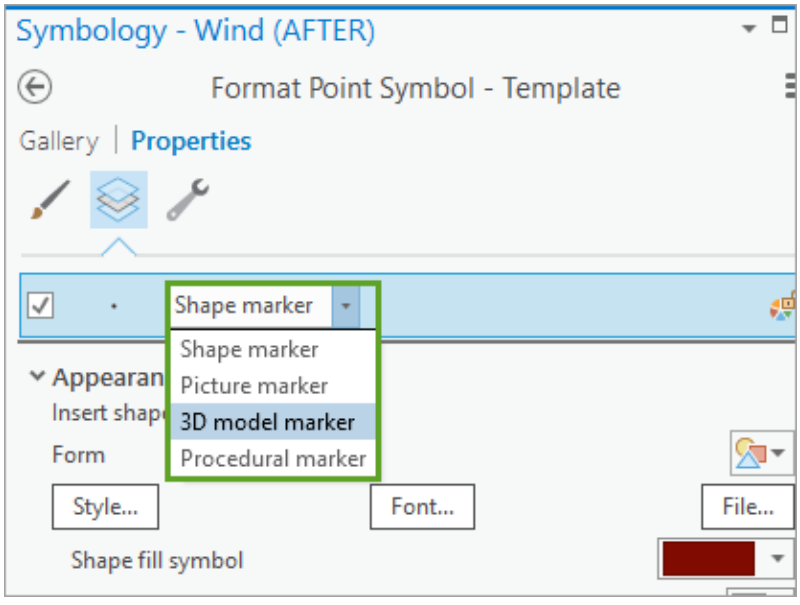
4. From the **Symbology** pane, on the **Field** drop-down menu, select the **speed_1** field.

5. On the **Data represents** drop-down menu, select **Unclassed symbols**.

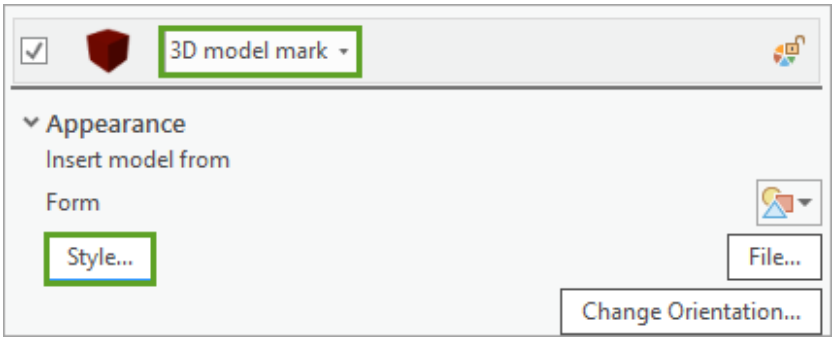



6. Click the symbol next to **Template**.

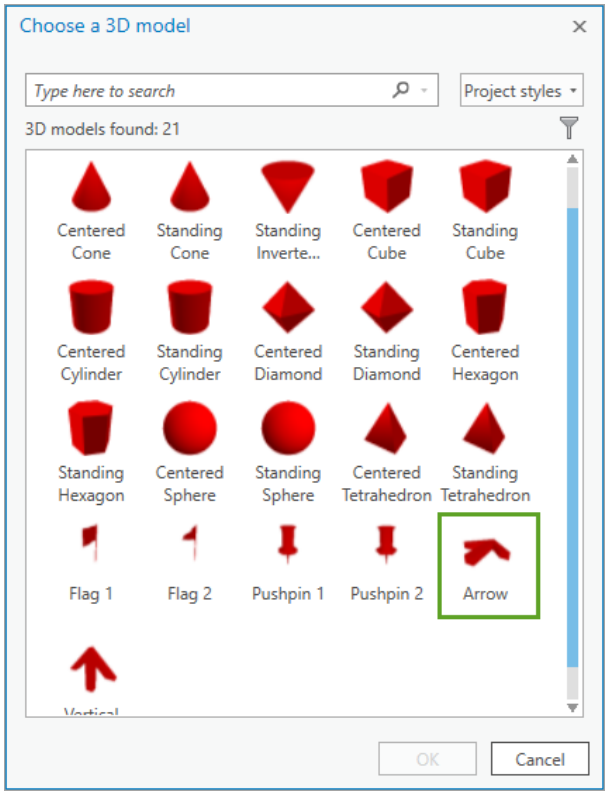

7. In the **Layer Properties** pane, select **3D model marker** from the symbol marker type.




8. Under the **Layer Properties Appearance** category, for **Form**, click the **Style** button.




9. In the ArcGIS 3D Symbol Set, select the **Arrow** symbol.

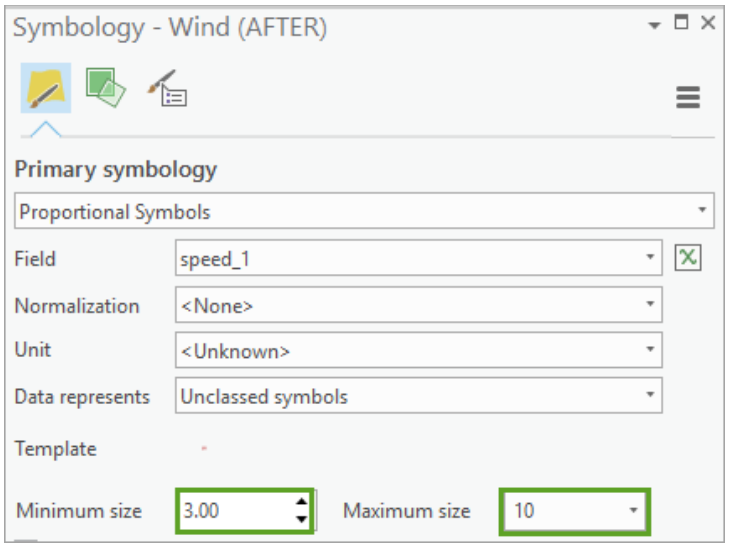



10. Click **OK**.

11. On the **Symbology** pane, click **Apply**.

12. Click the back button to return to the **Symbology** pane.

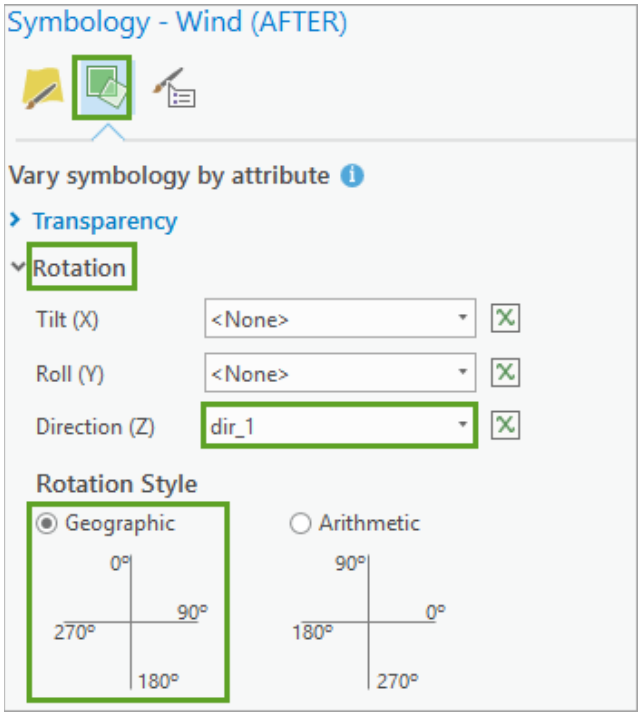
13. Change the **Minimum size** to **3**, and the **Maximum size** to **10**.




14. Click the **Classes** tab on the bottom half of the **Symbology** pane and change the **Legend** count to **9.**

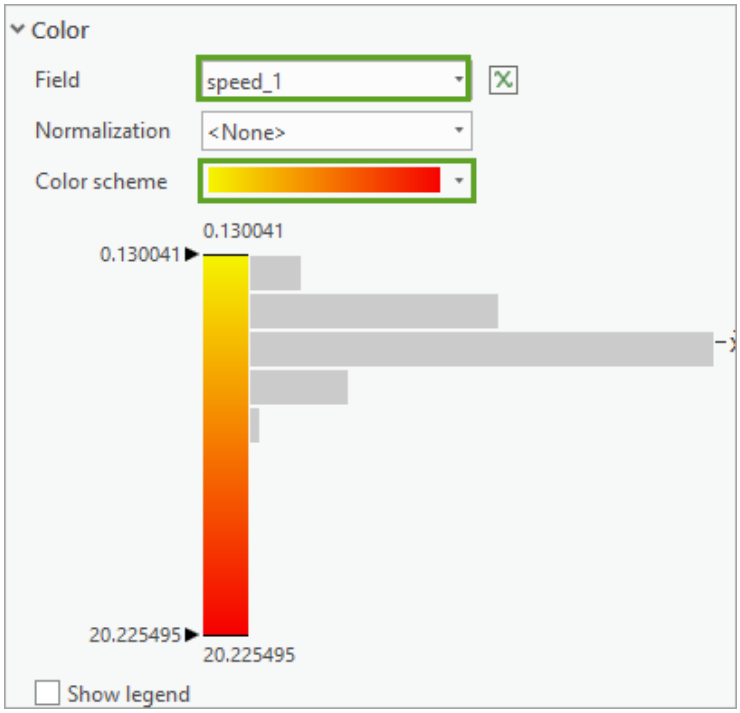
15. On the **Symbology** pane, select the **Vary symbology by attribute** tab  .

16. Expand **Rotation** and set **Direction (Z)** to the **dir_1** field, and **Rotation Style** to **Geographic**.



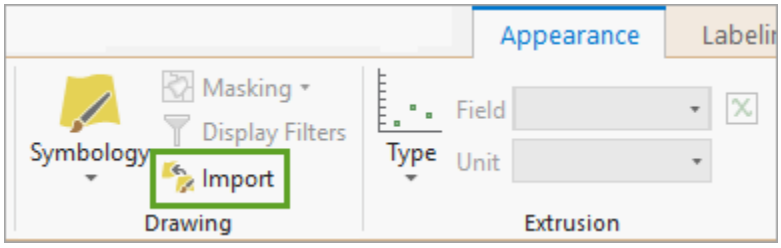

17. Expand **Color** and set the Field to **speed_1**.

18. Set the **Color scheme** to **Yellow-Orange-Red**.

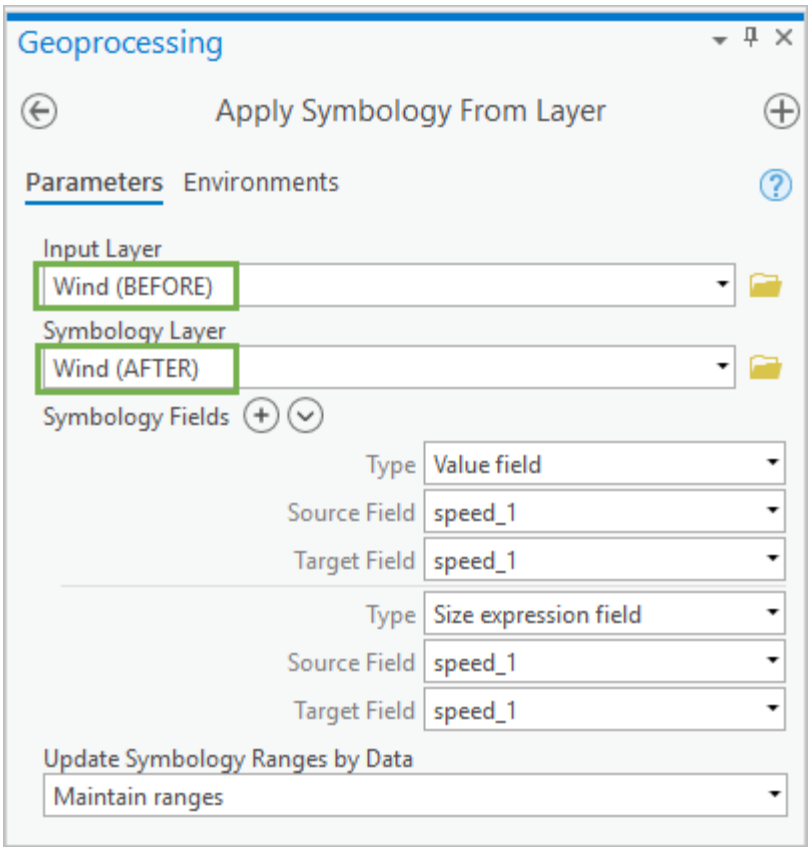



19. From the **Catalog** pane, drag the **Wind (BEFORE) - Source.lpkx** layer package onto your 3D scene.

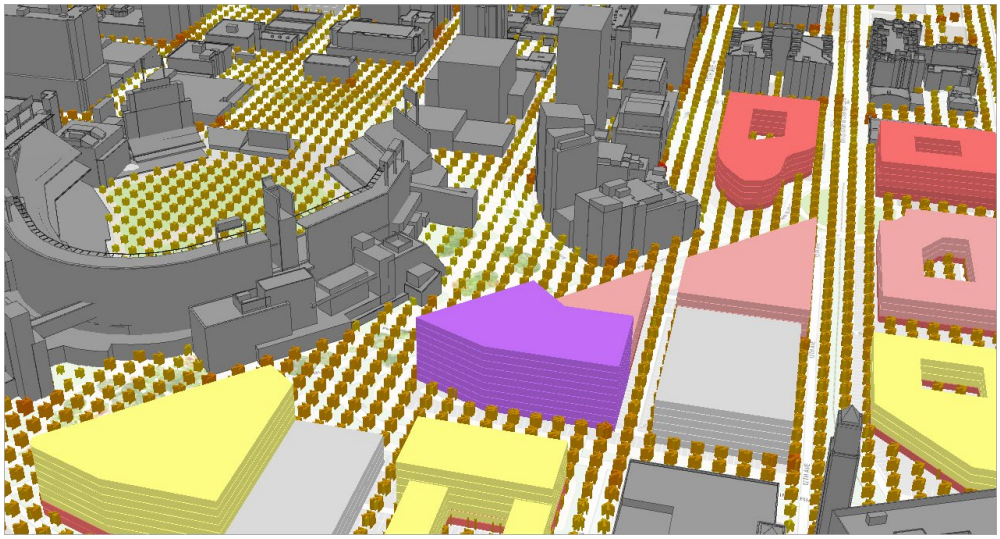
20. From the **Appearance** tab > **Drawing** group, click the **Import** button.




21. In the **Apply Symbology From Layer** tool, apply the **Wind (AFTER)** symbology to **Wind (BEFORE)** and click **Run**.

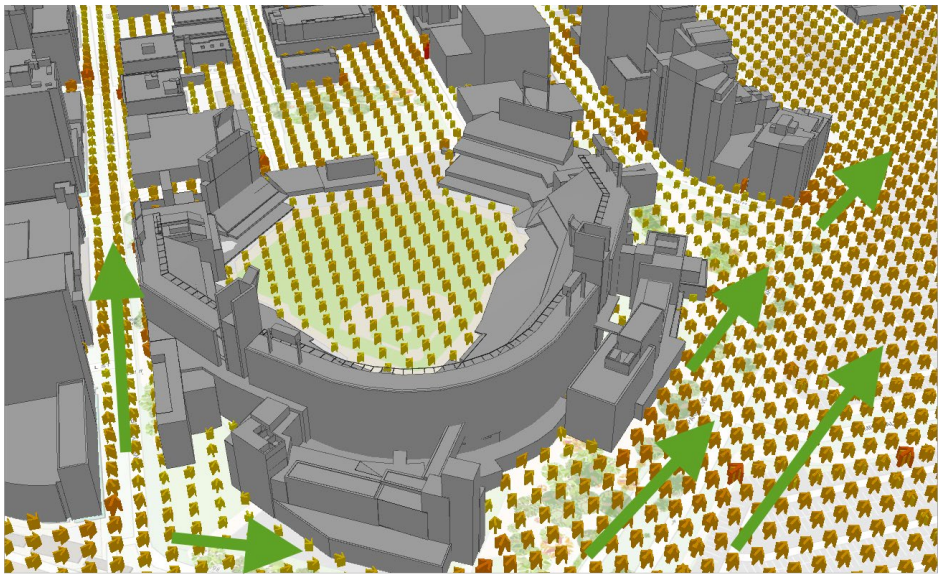



The **Wind (BEFORE)** layer is updated and now displays the same symbology as the **Wind (AFTER)** layer.

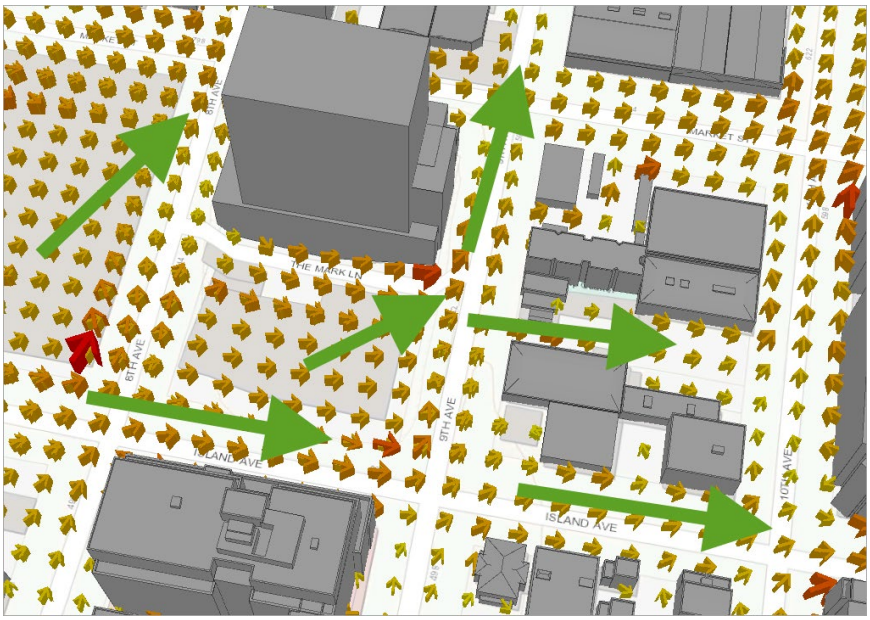


22. Zoom in to the area around the baseball field.

    Notice how the size and shape of the building deflects and channels the wind around the structure. Using 3D symbology, this effect can easily be observed and understood. The green arrows in the picture below show the general trend in wind movement.



An urban canyon effect can also be observed between 8th Avenue and Island Avenue as the wind is funneled between high-rise buildings and the alleyways between buildings.




23. Save your project.

Flip back and forth between **BEFORE** and **AFTER** to see the impact of the proposed design. You may want to turn off your proposed buildings, as the impact of the change will be more visible. Note how adding in these new buildings slows air down at the surface level. Try turning on your **Solar Radiation** layer to find areas that have both high solar exposure, and slow air flow. These might be hot spots that need additional trees and vegetation to help mitigate heat.

How might you modify your wind symbology, and your solar radiation symbology to show areas of overlapping slow air and high radiation visually?

## Summary

In this lesson, you've learned multiple ways of representing thematic data in 3D. You've varied data by color according to unique values, by graduated symbols, unclassed colors, and attributes. You've varied size by graduated size, proportional symbology, and using extrusion. You've represented categories as types of 3D models, with varied colors and sizes. You've even combined size, color, and orientation to represent complex multiple variable thematic data. This is just the beginning, as you've just started to fully explore the impact of 3D on cartographic method. We'd love to hear from you; what methods work best, and what practices should be shared with the community? Please share the work you do with everyone through GeoNet.