# Sectioning Workflows

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The following is an overview of the tools and workflows that help create dynamic views and drawings of sections and elevations. In addition, show a workflow to slice a model to prepare for laser cutting.

Clipping-Plane Properties

The **ClippingPlane** command creates a clipping plane object that is used to clip visibility of objects behind the clipping-plane and render the intersection with specified section styles.

Exercise 1: Clipping-plane properties
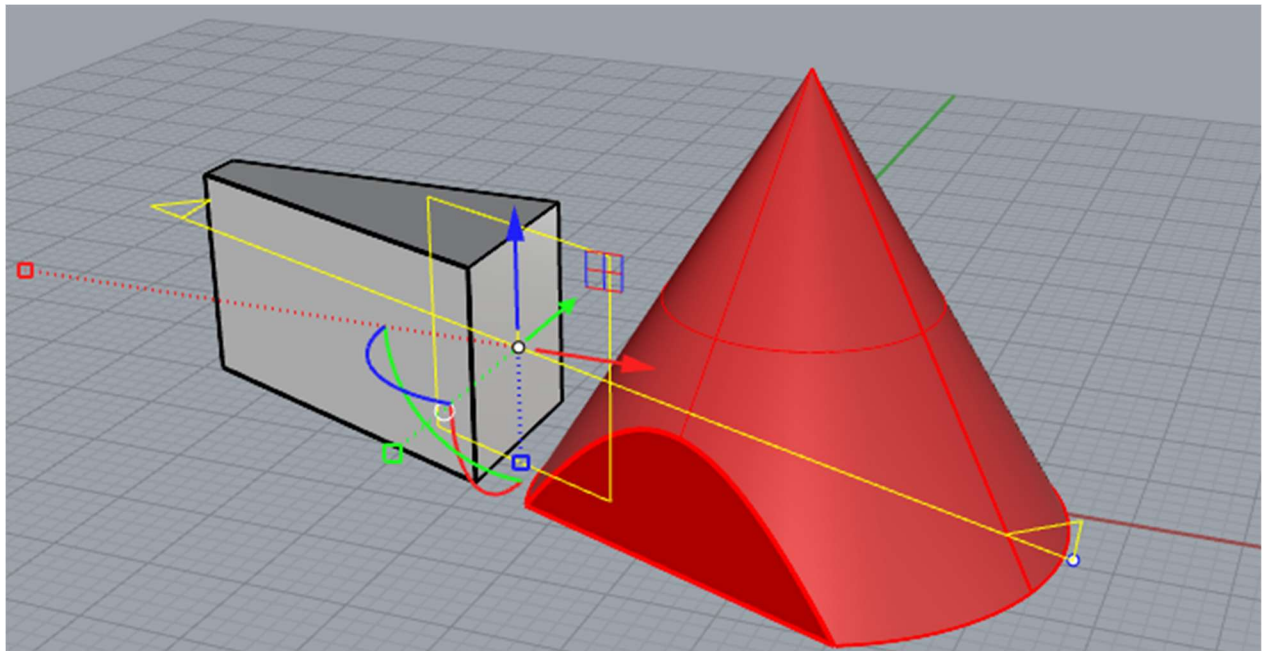
1. Open a new session of *Rhino®* .
2. Create a **Box** in the *Default* layer (black).
3. Create a **Cone** in *Layer 1* (red).
4. Create a **ClippingPlane** so that it cuts through both objects. Use default command options.
5. Select the clipping plane. In the object **Property** panel, set the following options:
   a. Set the *Name* field.
   b. Set the *Label* to various values (none, dot, text) and observe how it appears in the viewport.
   c. Unchecked *Custom Depth* property indicates that the clipping depth is infinite. Check *Custom Depth* and set the *Depth* to a specific value. Observe the effect in the viewport.

Change the depth value and observe the effect in the clipped viewport.
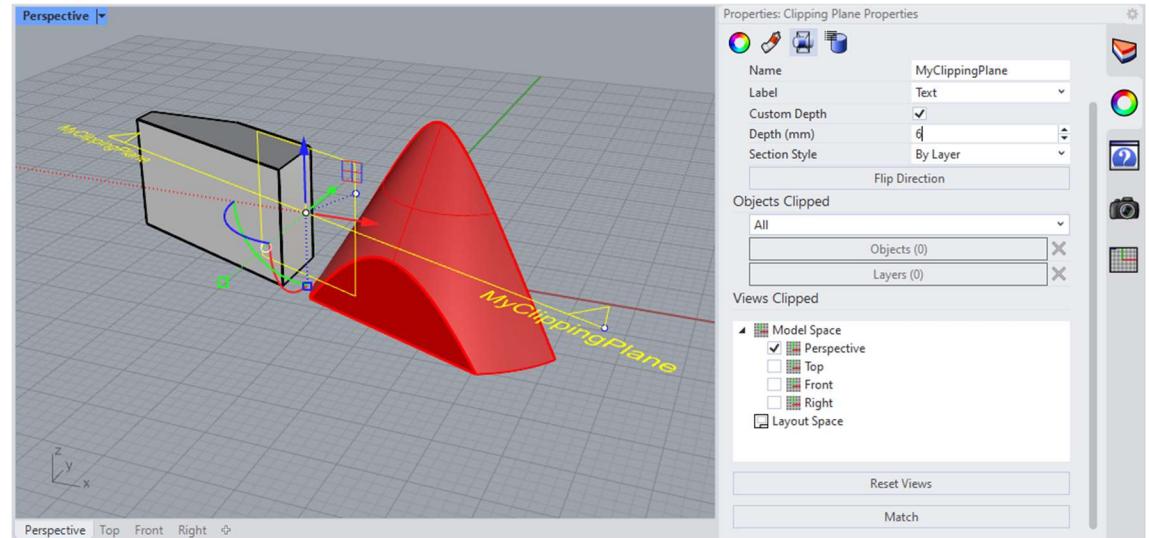
d. The *section style* is set to *By Layer* by default. This option will be discussed in detail later.
e. *Objects Clipped* is set to *All* by default with the possibility to clip specified layers or objects. This functionality will be reviewed later.
f. Under *Views ClippedI* check various *Model Space* views to clip and observe the effect in the 3D viewports.

**Exercise 2: The clipping-plane widget**
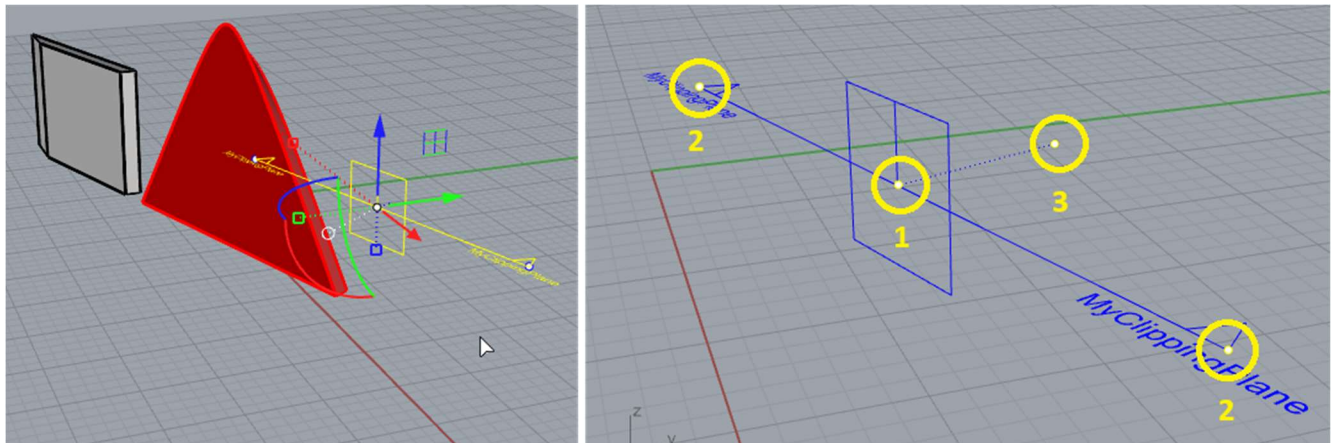
1. Select the clipping-plane widget and make sure the **Gumball** is turned on.
2. Manipulate the clipping-plane in the viewport directly using the *Gumball* (rotate and move) and observe the effect of clipping objects.
3. Use the clipping-plane grip point at the center (1, in the figure above) to move it, and the grip points at the end of the line (2) to scale. Notice how the clipping-plane continues to clip the objects even if the widget does not intersect the objects directly. This is because the clipping-plane represents an infinite plane.
4. Identify the depth grip point (3) and change its location. Observe the change of the value in the clipping-plane *Depth* property.

Create Sections

Clipping planes can be used to set up sections and elevations. Rhino 8 added a new set of tools to create and manage sectioning. The following exercise shows how to use the **ClippingSections** command to create clipping-planes and set options all in one step.

Exercise 3: Create clipping sections
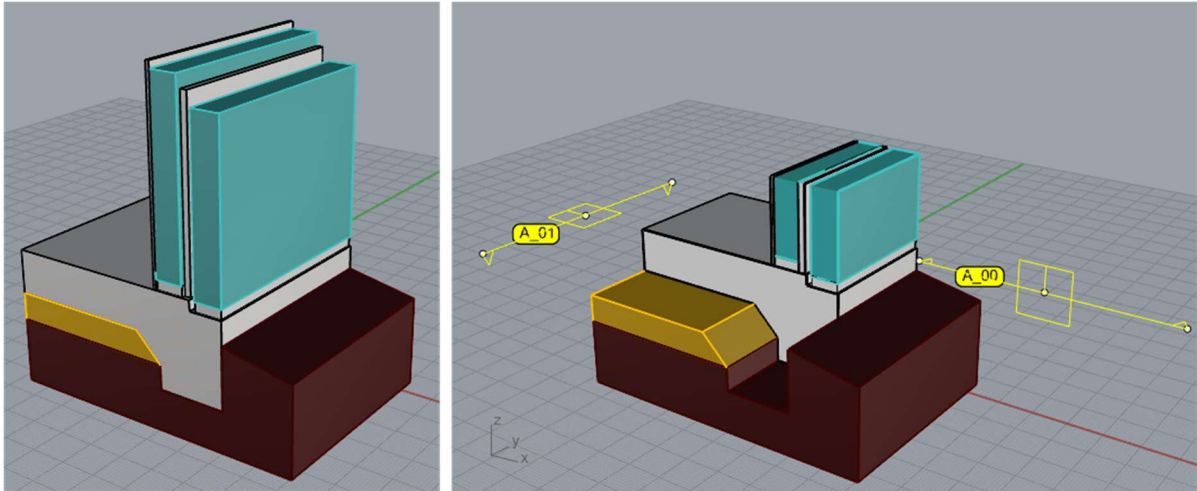
1. Open **Sectioning-Exercise3-ClippingSections.3dm** file in **Rhino**
2. Run the **ClippingSections** command, then select all objects except the ones in **Sand** and **Earth** layers.
3. Set the following options:
    a. *Dir* = **X**
    b. *CustomDepth* = **No**
    c. *Clip* = **Yes**
    d. *Name* = **A**
    e. *LabelMode* = **Dot**
    f. *SaveToNamedViews* = **Yes**
    g. *Flip* = **No**
4. Place the first section (will automatically be named A_00).
5. Change the *Dir* option from **X** to **CPlane**.
6. Place the second section (A_01), and press *Enter* to end.
7. Notice how only selected objects were clipped and the **Earth** and **Sand** did not.
8. Move the clipping-plane to show the effect of selective clipping.
9. Select the clipping-plane and reset *Objects Clipped* in the property panel to have different layers or objects.

10. Open the *Named Views Panel* and drag-and-drop the section view into the 3D viewports.
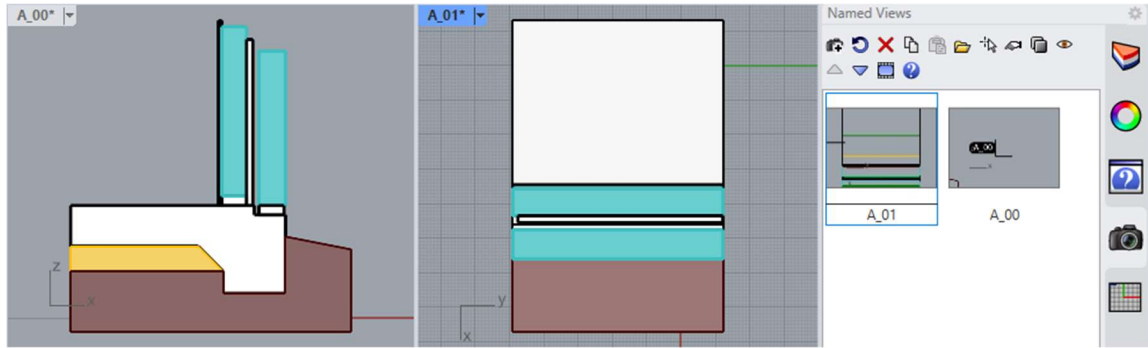
11. Select the clipping-plane, and in the object property panel, change the name of the clipping-plane and observe how the name changes in the *Named Views* panel.

12. Rotate the clipping-plane, the saved clipping-plane view is updated in the *Named Views* panel, but not in the 3D viewport that uses that saved view.
    Drag-and-drop the section in the *Named View* panel to refresh the orientation of the section in the 3D viewport.

Sections Styles

Section styles for objects can be set *ByLayers*, *ByObject* or *ByClipping Plane*. When the model is clipped, section styles are used to determine various sectioning properties such as the cut hatch pattern. Note The following:

- Section styles for new objects are set to *By Layer* by default.
- Rhino 8 does not support named section styles. In other words, it does not support saving and loading custom section styles.
- You can load additional hatch patterns to use in section styles and Hatch command. For more details, check the following wiki article.

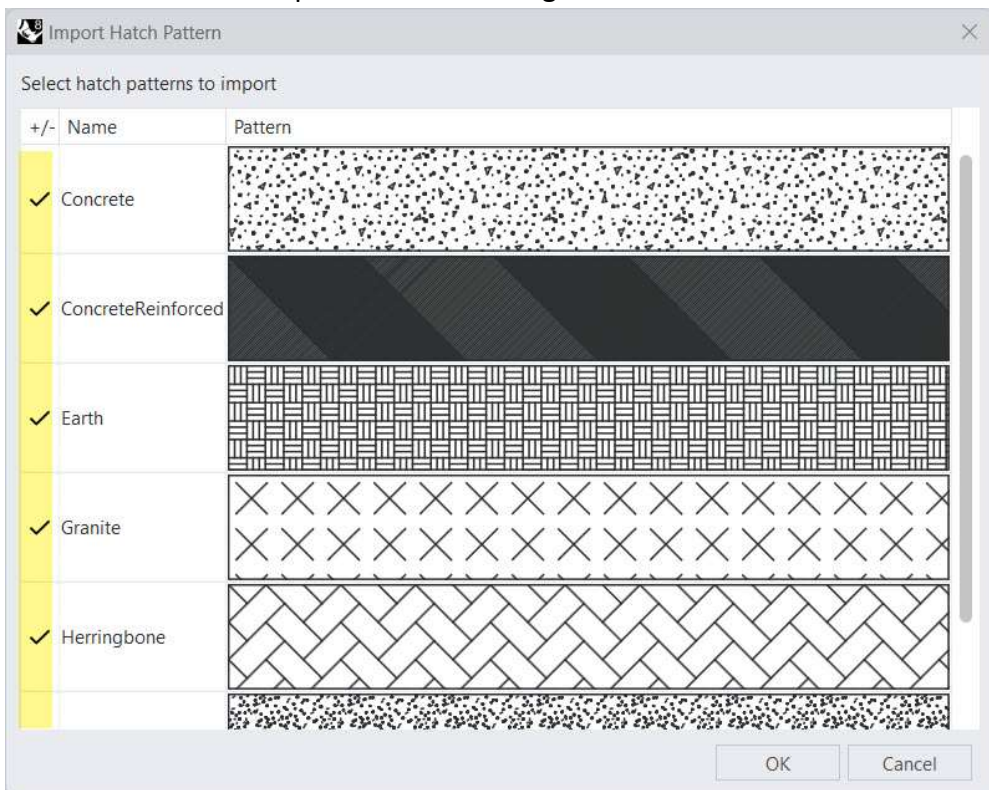**Exercise 4: Set section styles ByLayer, ByObject and ByClippingPlane**

4-1: Load additional hatch patterns:

1. Open your **Sectioning-HatchPatterns.pat** file in Rhino.
2. On **Windows**, type the Options command or on **Mac** go to **File** and click **Settings**.
3. Click the **Hatch** page.

4. At the bottom of the *Hatch* page, pick the Import button.
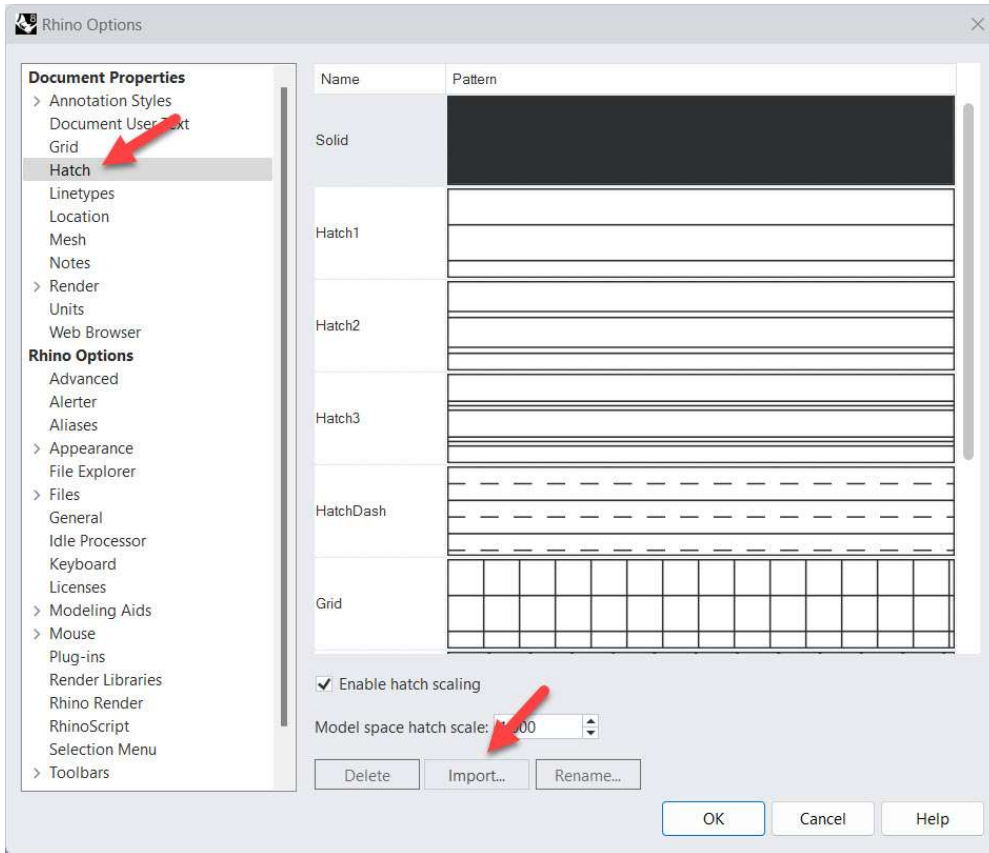
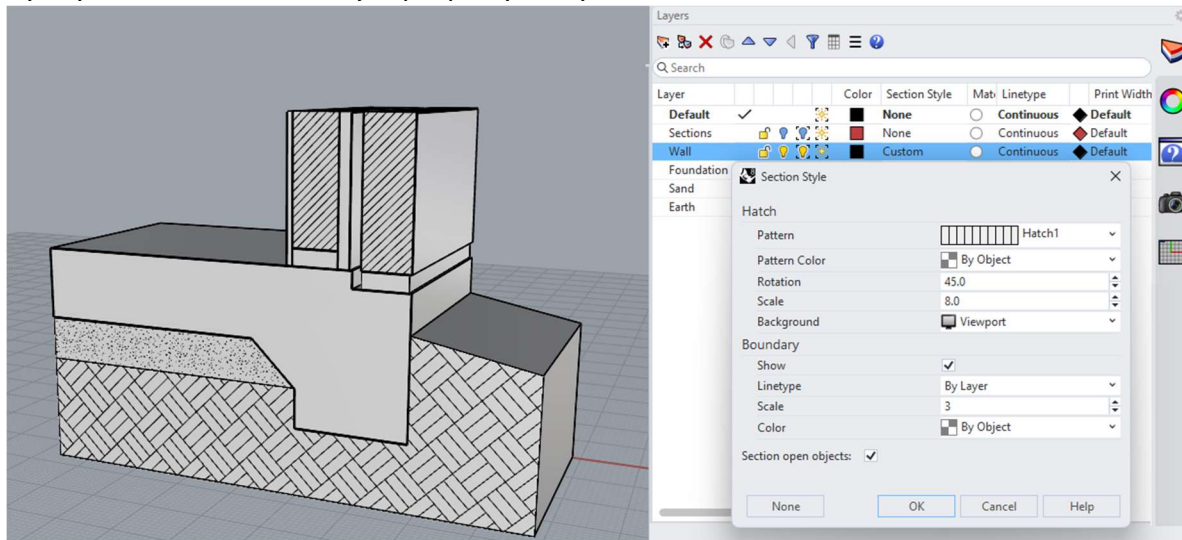5. Pick the *Hatches* to import from the dialog.


6. Pick **OK**

4-2: Set section styles:

By Layer: Set the *Section Style* property in layers.

1. Open **Sectioning-Exercise4-SectionStyles.3dm**
2. Go to the *Layers* panel.
3. The *Section Style* is set to **None** to all layers.
4. Unser *Section Style* in **Walls** layer, click on **None** to open the custom style dialog.
5. Set a new hatch style and click **OK**.
6. Do the same to Layers **Sand** and **Earth**.
7. Notice how clipped sections update in the viewport to reflect the new style.

By Object: Set the *Section Style* property in the object properties.
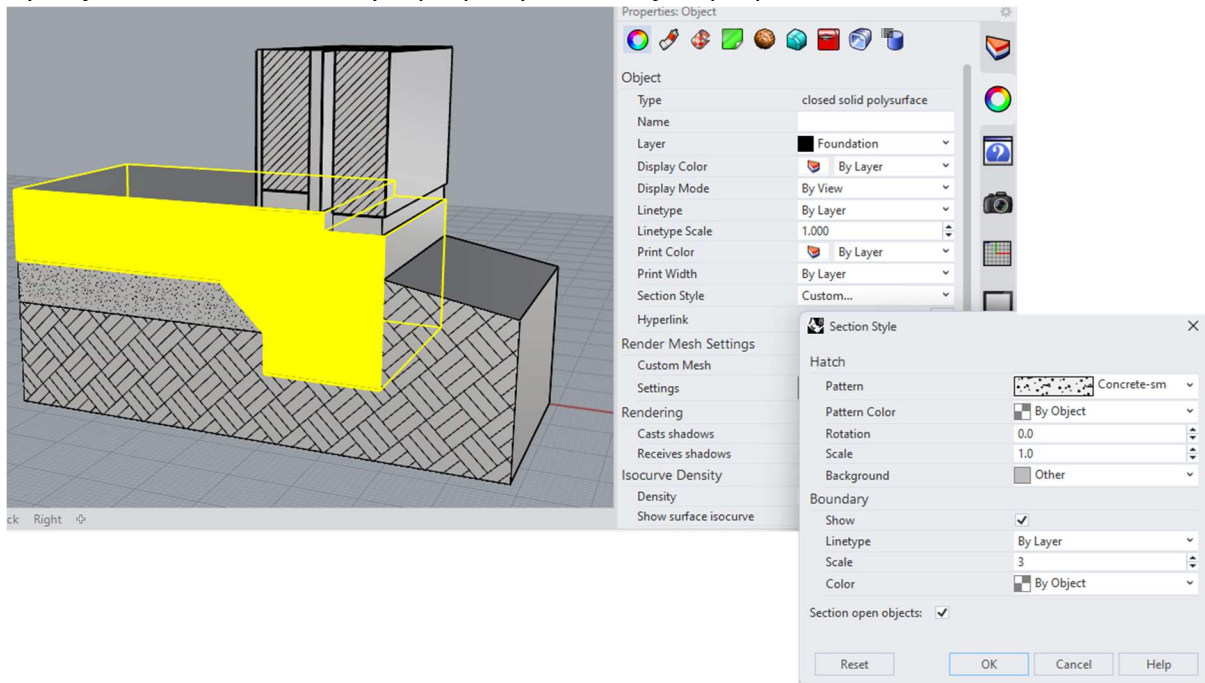

8. Select the foundation geometry in the Foundation layer
9. Open the property panel for that object.

10. The *Section Style* is set to *By Layer* by default.
11. Click on the drop-down box and select *Custom…* and set a new style.
12. Notice how clipped sections update in the viewport to reflect the new style.

Objects section style can be set *By Clipping Plane*. This option is used only when the user wants to apply one section style to all the objects cut by that plane. There are 2 places that need to be set to apply the clipping-plane section style:

13. Select the rest of the objects in the **Foundation** layer
14. Open the property panel.
15. Under *Section Style*, set *By Clipping Plane*.
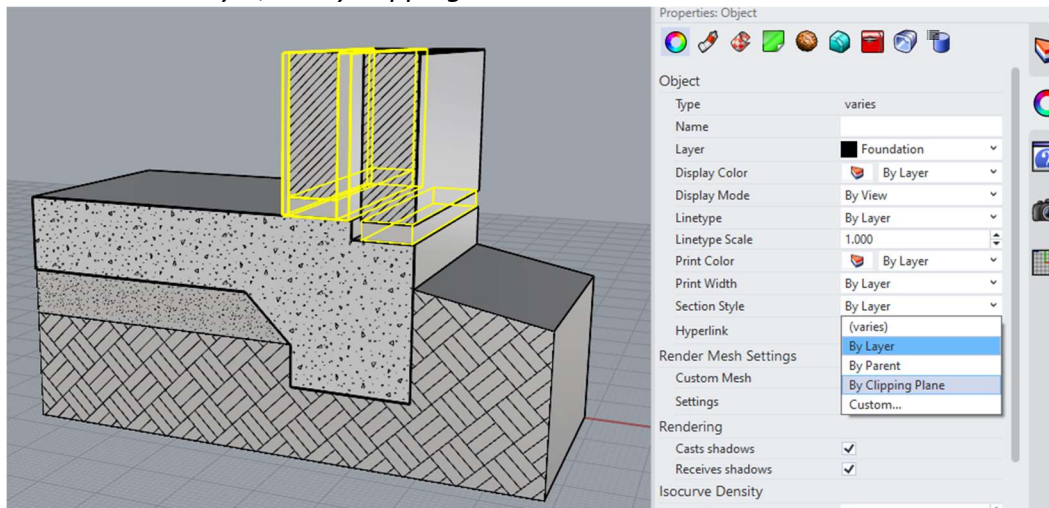
16. Select **A_00** clipping-plane.
17. Change the clipping-plane *Section Style* from *By Layer* to *Custom…* and fill with a new hatch pattern and notice how the clipped section updates in the viewport to reflect the new style.
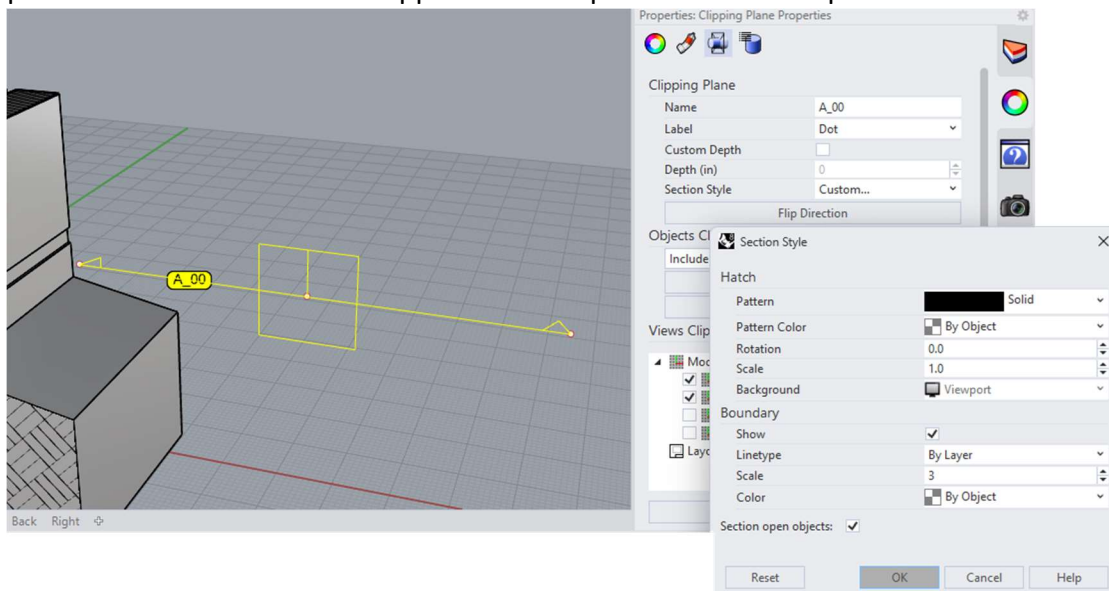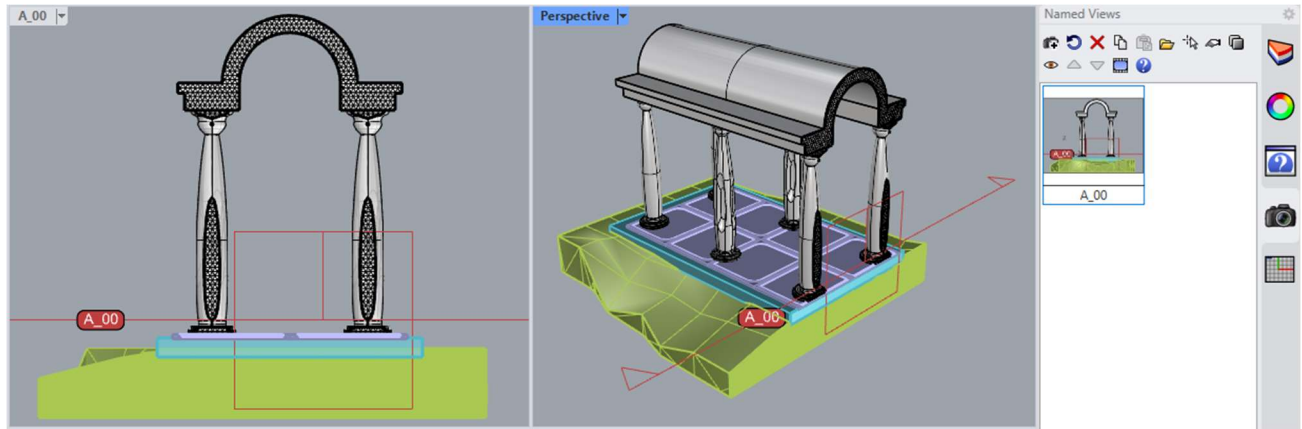

Sections' Views in 3D Viewports and 2D Details

Clipping-plane view can be saved to *Named Views* and retrieved in 3D viewport or 2D detail.

Exercise 5: Set section views in 3D viewports and 2D layouts
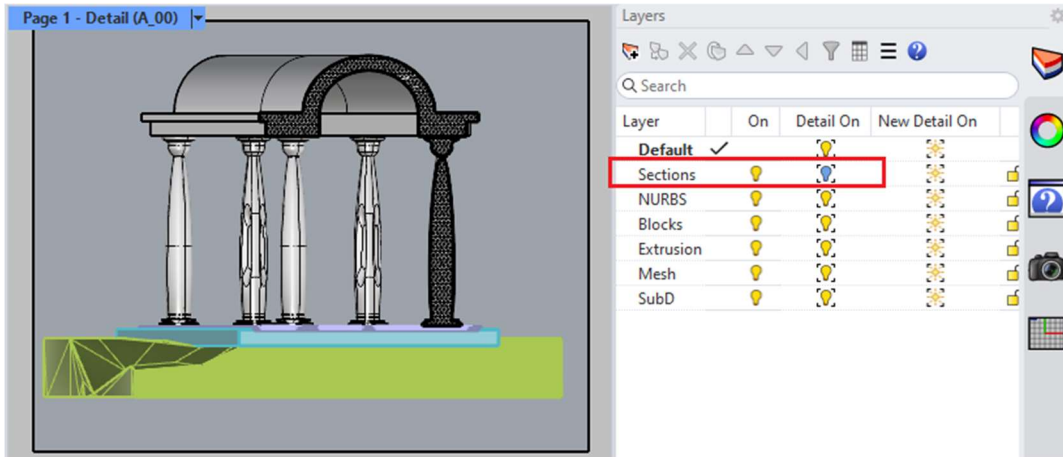
5-1: Set section views in 3D viewports

1. Open **Sectioning-Exercise5-SectionsViews.3dm** file.
2. Run **ClippingSections** command, press *Enter* to cut through all objects.
3. Set the *Dir*=**Y** and *SaveToNamedViews=**Yes***, then place the section to go through the center of the front columns.
4. Note that the **ClippingPlane** command does not have an option to save to *Named Views*. In this case, you can use the **SaveClippingSectionViews** command.
5. To load the clipping-plane view into the 3D viewport, drag and drop from the saved Named Views panel into an active viewport. Alternatively, use the active viewport drop-down menu (located at the top left of the viewport), then select the *Set View* sub menu, and the section named view is listed to select.
6. When transforming the clipping-plane, you will need to reload the clipping view into the viewport to align properly.

5-2: Set section views in 2D layouts

1. Create a new **Layout**.
2. Create a new **Detail**.
3. Double click inside the detail window to activate the viewport, then set the view to the section view. You can either drag-and-drop from the *Name Views* panel, or use the view drop-down menu, then *Set View* submenu and select the section view.

4. Turn off the Sections layer in detail only by clicking on the light bulb under **Detail On**column.

5. Note that clipped views are raster images on screen, but when **Print** your layout, you can set the *Output Type* to *Vector Output*.
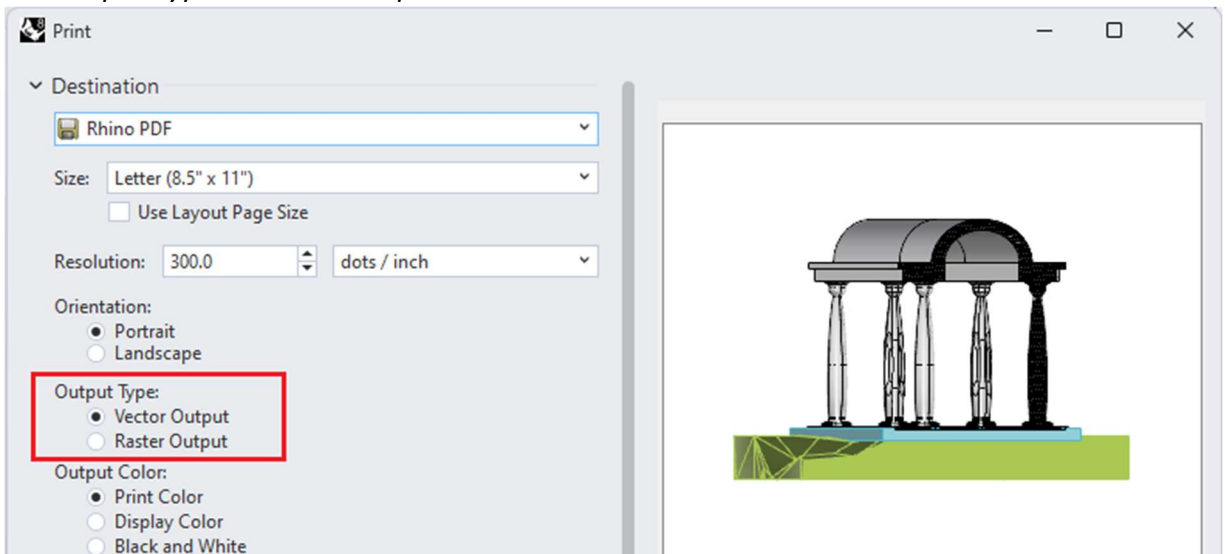

Sections' Vector Drawings in 3D Viewports and 2D Details

Rhino 8 supports creating dynamic vector 2D drawings. Those are similar to Make2D but can update with model changes.

**Exercise 6: Extract dynamic 2D drawings in 3D viewports**

1. Open **Sectioning-Exercise7-SectionsDrawings.3dm** file.
2. Run **ClippingDrawings** command, select the **Section_00** clipping-plane, set AddBackground=No, and place it on the xy-plane.

3. Observe the new layers created with the name of the clipping-plane
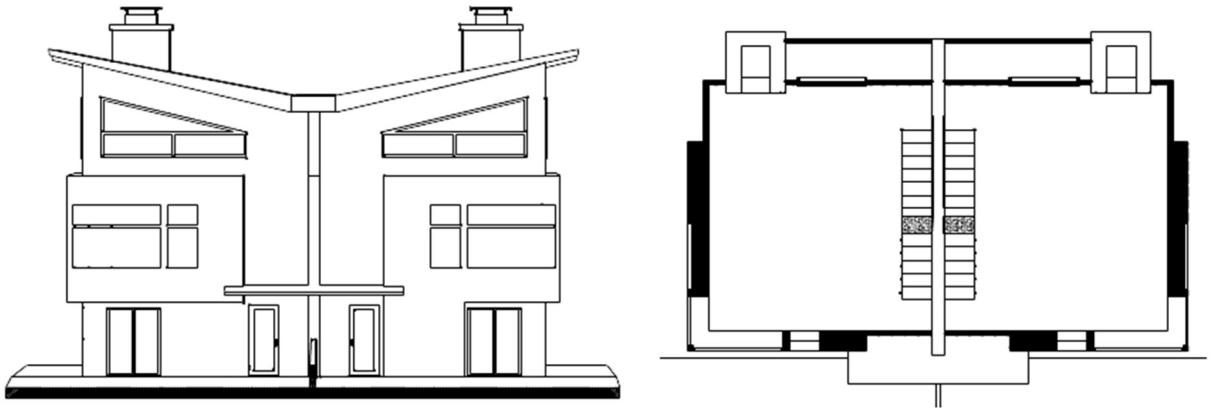
4. Change clipping-plane location.
5. Observe how the drawing change dynamically
6. Add more objects to the model, then run **UpdateClippingDrawings** to update.
7. Run **EditClippingDrawings** command and set *AddBackground* = "Yes" and Projection=Parallel. Observe how the model updates with background layers and geometry added.
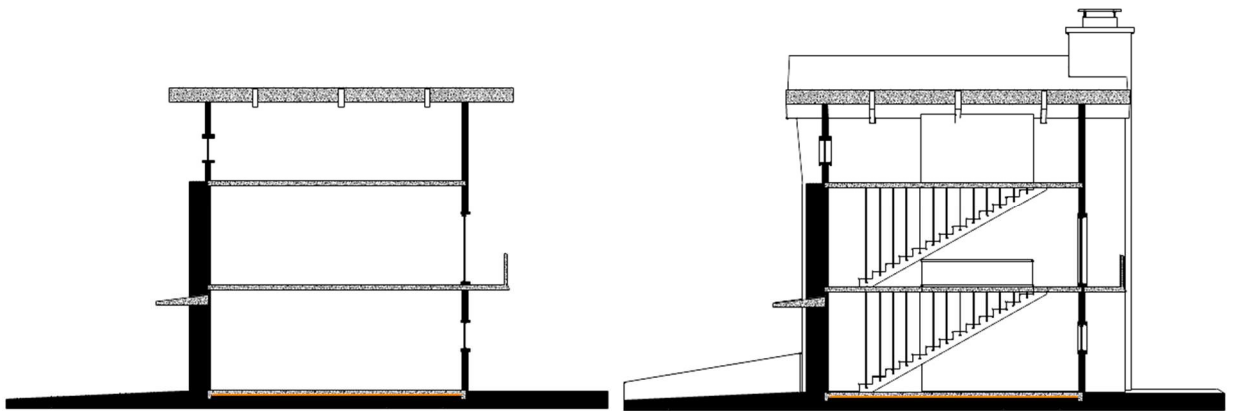
8. Open a detail and set to **Top** viewport then zoom to the section drawing.
9. Rotate the clipping plane, and observe how the section update in detail

Sectioning for Fabrication

The sectioning tool set in Rhino allows slicing through a model and extract cuts then layout on the xy-plane with unique tags based on the name of the clipping planes. This functionality supports workflows such as laser cutting.

Exercise 7: Slicing a model for laser cutting

1. Download and open **Sectioning-Exercise7-NestedSections.3dm** model.

2. In the **Front** view, select the *clipping plane* tagged with the name **C_00**. It's important to note that this clipping plane was created with the **ClippingSections** command with option **Name=C**.

3. Run **Array** command in the Front view. Set the **YNumber** to **24** and **YSpacing=0.565**. Rhino creates 23 new clipping planes and serializes their names so that each clipping plane has a unique new number (C_00 to C_23).

4. Switch to the **Top** viewport, and run the **NestedClippingDrawing** command. Select all your clipping planes and
set **Spacing=0.1**, **Width=10**, **Label=On**, **LabelTag=Text** and **LabelLocation=Inside**. Place your output anywhere on the XY-plane.

5. Note that you can post-process to remove additional curves and change label size.
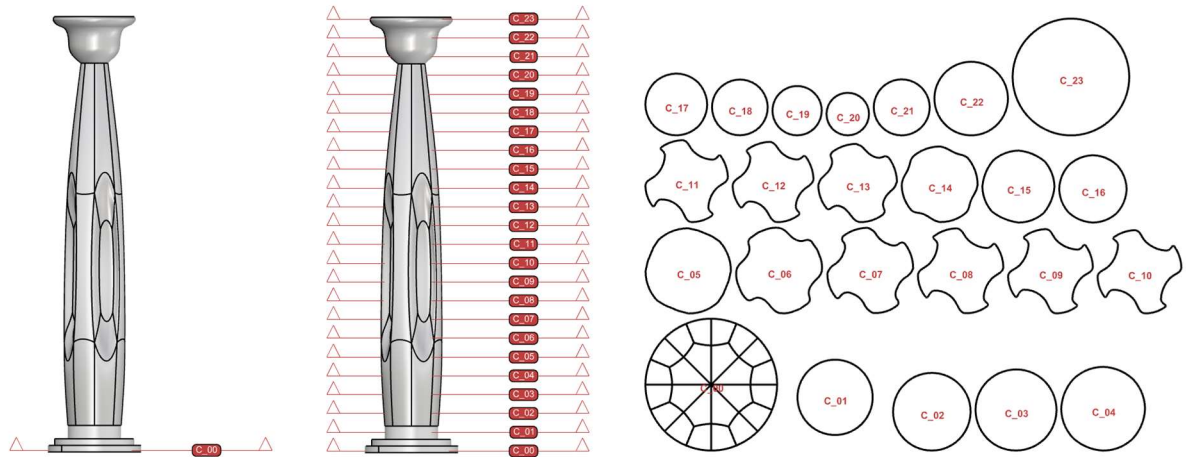
Reference Material

1. More Rhino Hatch Patterns: https://wiki.mcneel.com/rhino/hatch
2. SectionTools Integrated (*McNeel Discourse*): https://www.rhino3d.com/stories/sectiontools-integrated/
3. Section Styles (*McNeel Discourse*): https://www.rhino3d.com/features/clipping/section-styles/
4. Selective Clipping (*McNeel Discourse*): https://www.rhino3d.com/features/clipping/selective-clipping/
5. Clipped Views (*McNeel Discourse*): https://www.rhino3d.com/stories/documentation/clipped-views/
6. Dynamic Vector Drawings (*McNeel Discourse*):
https://www.rhino3d.com/stories/documentation/dynamic-vector-drawings/
7. Sectioning for Fabrication (*McNeel Discourse*): https://www.rhino3d.com/stories/fabrication/sectioning-for-fabrication/