



# Practice Workbook

This workbook is designed for use in Live instructor-led training and for OnDemand selfstudy. The explanations and demonstrations are provided by the instructor in the classroom, or in the OnDemand eLectures of this course available on the Bentley LEARN Server ([learn.bentley.com](http://learn.bentley.com)).

This practice workbook is formatted for on-screen viewing using a PDF reader. It is also available as a PDF document in the dataset for this course.

## Getting Started with 3D in MicroStation CONNECT Edition



TRNC02001-1/0001

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## Description and Objectives

Learning 3 Dimensional (3D) drawing with MicroStation CONNECT Edition is an extension of your knowledge of 2 Dimensional (2D) drawing. If you can draw in 2D, then all that is needed is to learn how to manipulate the AccuDraw compass in 3D space.

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## Course Description

This workbook contains exercises that will provide the basic skills required to:

## Skills Taught

- Begin a transition from 2D drafting to 3D Designing
- Provide an understanding of the 3D Workspace
- Show how to use 3D standard, rotated, and Saved views
- Isolate parts of a design using Clip Volumes
- Create Auxiliary Coordinate Systems for any 3D plane
- Design using AccuDraw in 3D space
- Create and place 3D Cells

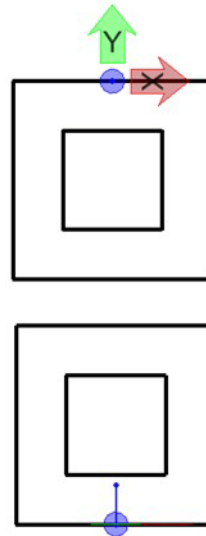
## Transitioning from 2D Drafting to 3D Designing

In this section, we will open the MicroStation design file:

- **01-Transitioning from 2D to 3D.dgn**

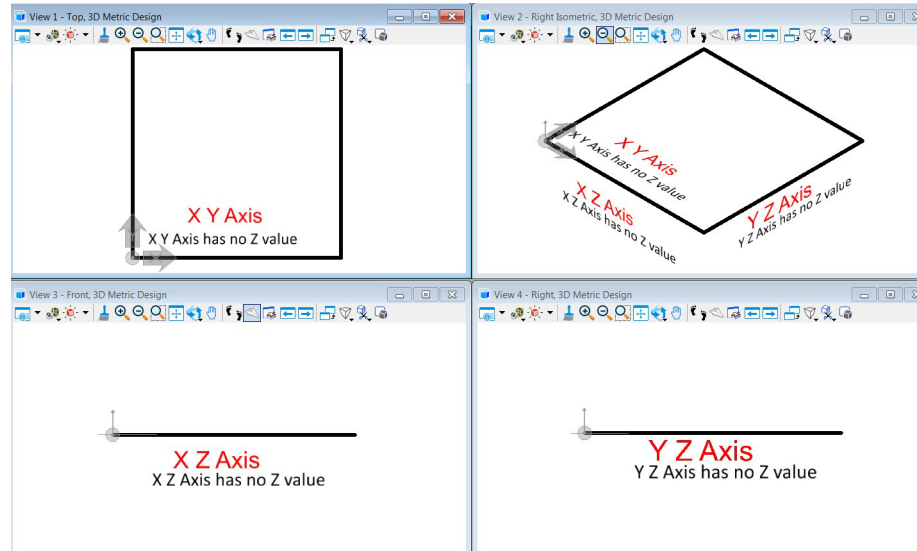
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1. View 1 is a top View of a 3D object. View 3 is the front view, When you think you have a mental image of the right side then open View 4 and compare your results.



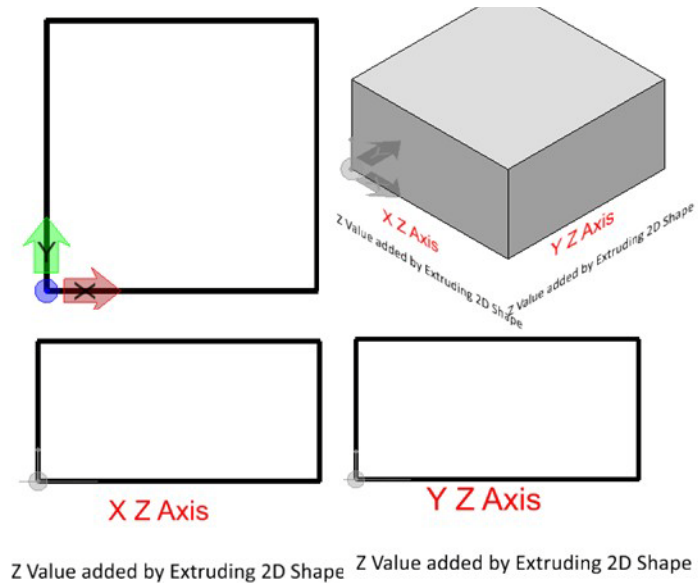
2. Now open View 4 to see the 3D object in a Right Isometric orientation.  
There is another possible solution to these orthographic views.
3. Open View 6 to see another solution.

4. Let's take a look at a 2D shape created in a 3D DGN file by opening **02-2D Shapes in 3D Space.dgn**.

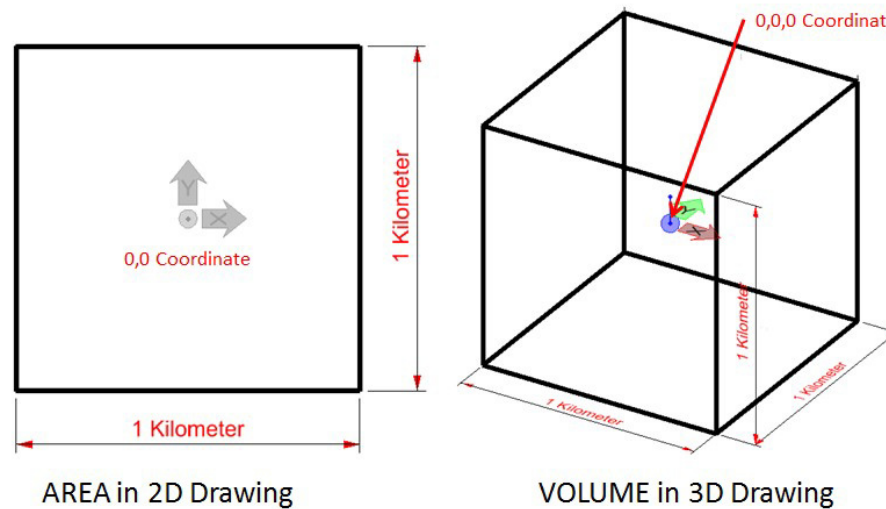


This 3D design has only a 2D block created in the Top view. The height of this 2D Shape or closed profile has no Z value. The front, View3 and right side, View 4 appear as a line with no height in Z axis.

5. If we add a Z value the 2D shape is now a 3D object. Open [03-2D Shape extruded.dgn](#). The technique for adding the height will be covered in another course.



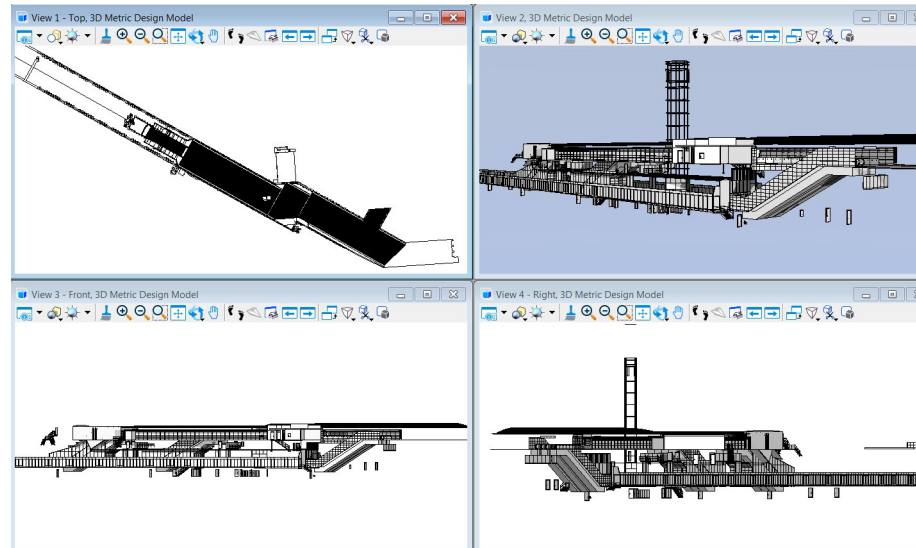
As you may have noticed a 2D view only displays an area in the XY or top view. A 3D view displays a volume; in other words the geometry has a value in the Z axis. The 2D and 3D drawings also have a Global origin, the (0,0) coordinate for 2D and the (0,0,0) coordinate for 3D. Both 2D and 3D have default drawing extents. These sizes are controlled by the [File > Settings > Design File Settings dialog > Working Units](#). The typical 2D default extents are 1 kilometer in X and Y axis. The 3D default settings are 1 kilometer in X, Y and Z axis..



## Viewing 3D Geometry

When working with 3D geometry it is very important to be able to rotate the geometry around any axis. It is also necessary to change to any standard orthographic view.

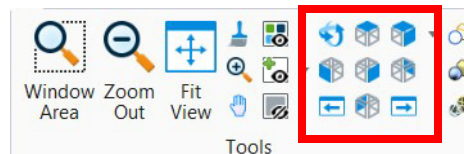
1. Begin by opening the **04-Architectural.dgn** file.



This file displays the Top, Front, Right side and Right Isometric views of a train station.

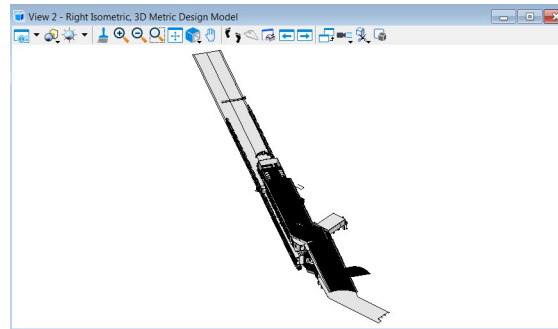
What you want to accomplish in this topic is to be able to change to a standard orthographic view and rotate to any desired view.

2. First we need to locate the Rotate and standard views tools. These tools are located in the **View** tab of the Drawing, Modeling, and Visualization Workflows. They are also located in the **View** popup menu. The popup menu is accessed via Shift+Right mouse button...

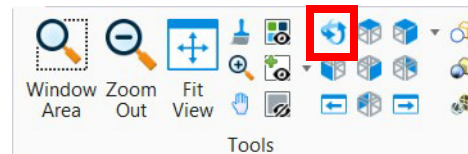


**Note:** The View Popup menu is placed wherever you place your cursor then hold down the shift key and press right mouse button.

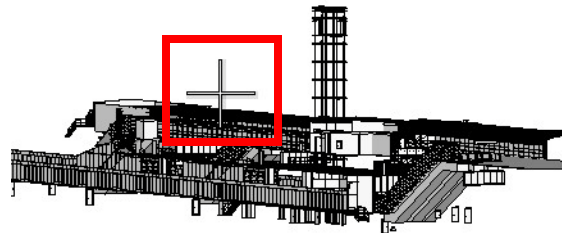
- Let's work with one view. Close Views 1,3 and 4.and Fit View in View 2.
- Using the **Right Isometric** tool, set View 2 to Right Isometric.



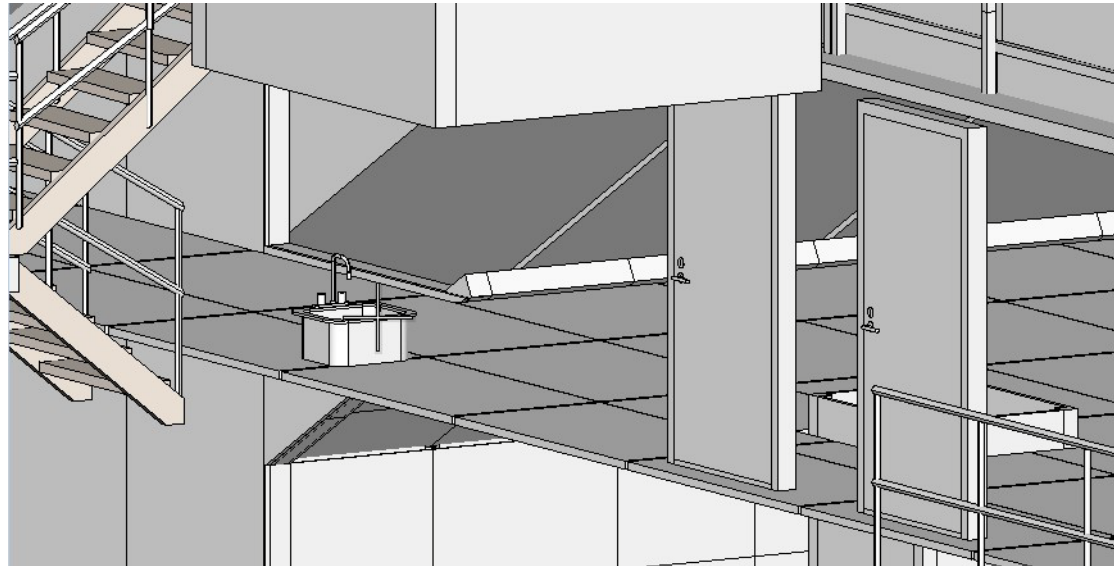
- Use the **Standard View** tools to change View 2 to Top, Front and Right Isometric Views. With only one view open you have more room for designing.
- To create a custom view you will use the **Rotate** tool.



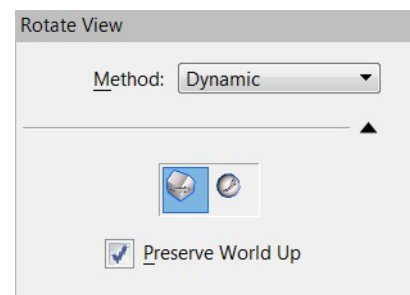
- After you select the **Rotate** tool you will notice the Tool Settings *Method* is set to **Dynamic**, and you will see a plus sign in View 2. This plus sign is the center of rotation. Hold down the left mouse button and move your cursor left, right, up or down. The geometry in the view will rotate. Remember the geometry is not rotating, just you the observer. You are looking at the geometry from different angles.



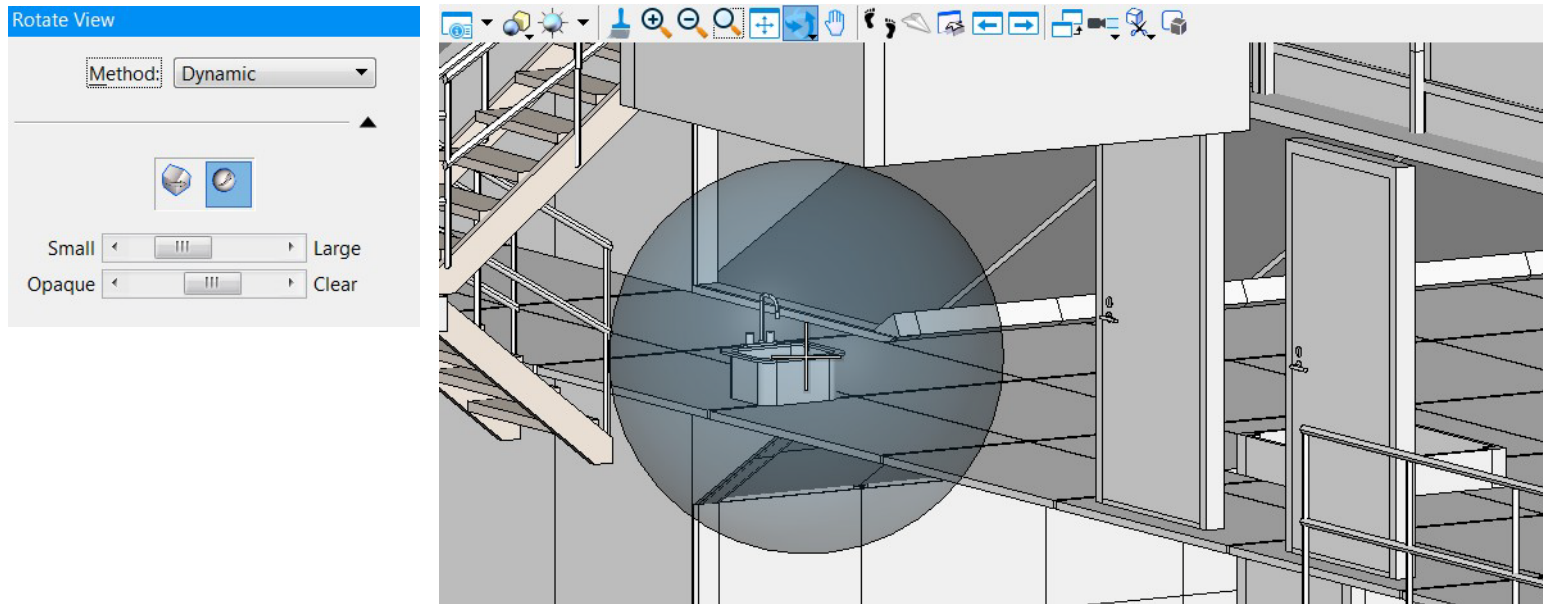
8. Move the plus sign by moving your cursor over the plus sign, then pressing the left mouse button and dragging the plus sign to any point on the geometry. This will now become the new center of rotation. You can also move your scroll wheel forward and backward to zoom into the geometry.
9. To pan the view hold down the mouse wheel as a button and drag by moving your cursor. Try setting the view as pictured below.



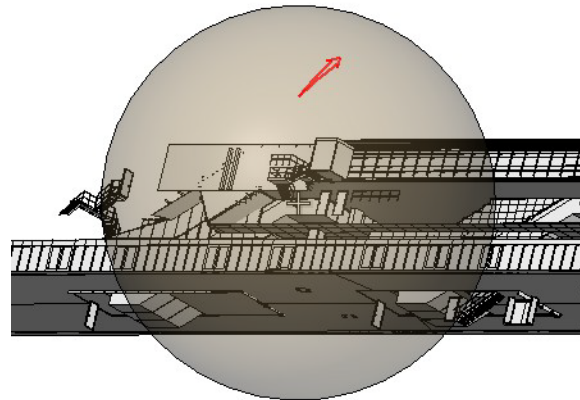
10. All of the rotation so far used the Cube rotation with the option **Preserve World Up** enabled in the *Rotate* tool settings. **Preserve World Up** means the Z axis is always pointing straight up from Active Auxiliary Plane. Auxiliary Coordinate Systems will be in a later topic.



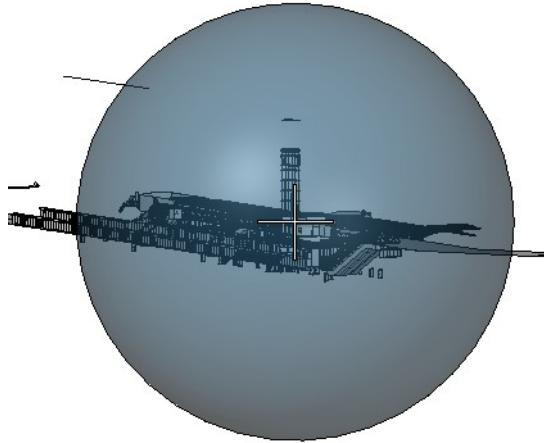
11. Select the **Sphere** in the Tool Settings options and notice a Sphere appears in the view window.



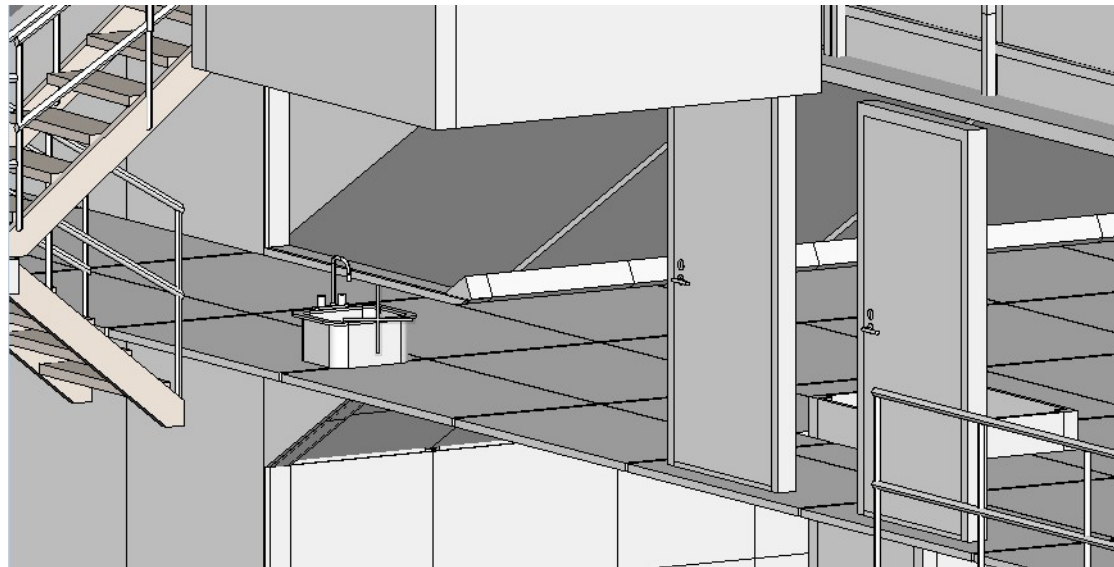
12. When you hold down your left mouse button and drag your cursor you will notice a red arrow indicating the direction of the rotation. The **Preserve World Up** option is not on, and thus you can rotate about any axis.



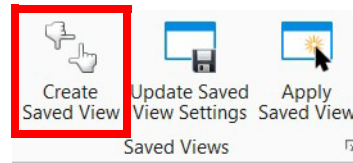
**Hint:** You can use the Slide bars to change the size of the sphere or change its opacity with the **Opaque** slider.



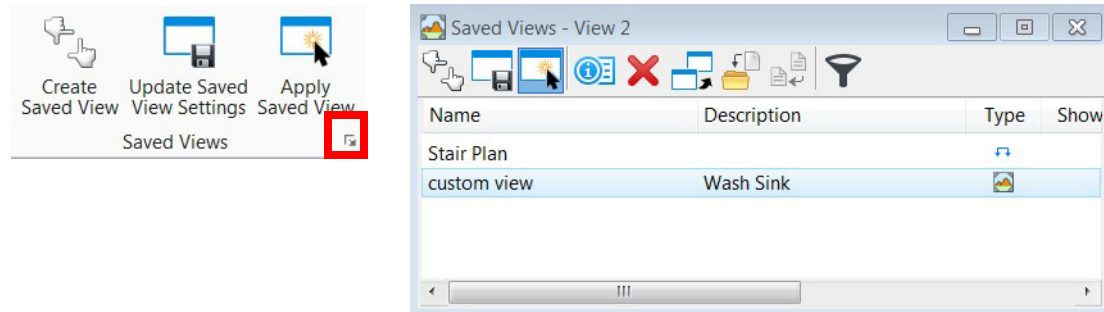
13. After rotating to a custom view you may want to save the view for later use for viewing or a drawing detail to clarify a design in your deliverables. We will go back to our Cube rotate with **Preserve World Up** enabled, then rotate to a custom view.



14. Navigate to the **Saved View** tool located in **View > Saved Views > Create Saved View**.



15. In the Tool Settings type a name for this view and a good Description so you can find this view for use at a later date. Click in View 2 to select the Source View. Navigate to the **Saved View** dialog by clicking on the button in lower right corner of the Saved Views tools.



## Clip Volumes

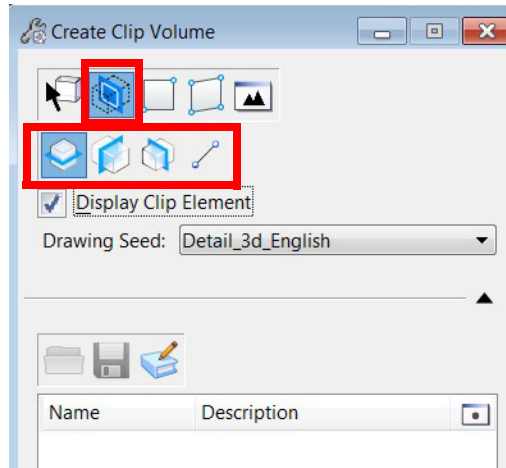
A Clip Volume is a method to limit the amount of geometry displayed within a view. Only the elements within the Clip Volume will display and can be snapped to. Each View can have a different Clip Volume applied to that view.

In this section open the design file 05-Fountain.dgn.

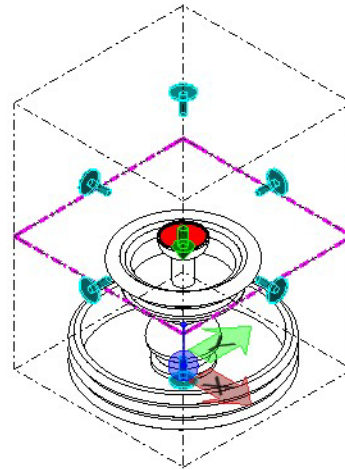
1. Let's navigate to the *Clip Volume* tools located at **View > Clip > Clip Volume**.



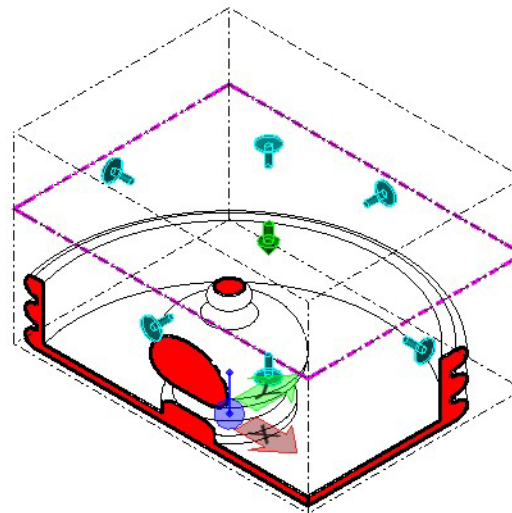
2. After selecting the *Clip Volume* tool you have a variety of Clip Elements to select. In this workbook we will focus on the Section Clip tools. These tools provide sectional cuts parallel to Top, Front or Side Plane.



3. Fit All geometry in View 2 then select the fitted section parallel to the Top Plane. Enable **Display Clip Element** then click anywhere in View 2.



4. The blue handles control the amount of the clip to be displayed and the green arrow indicates the cutting plane. These can be modified by selecting and moving them.



5. To delete a Clip Volume for a specific view, click on the **Clear Clip Volume** icon.

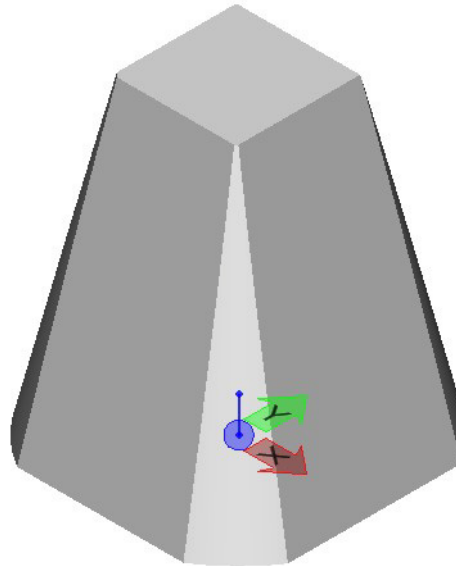


## Auxiliary Coordinate Systems (ACS)

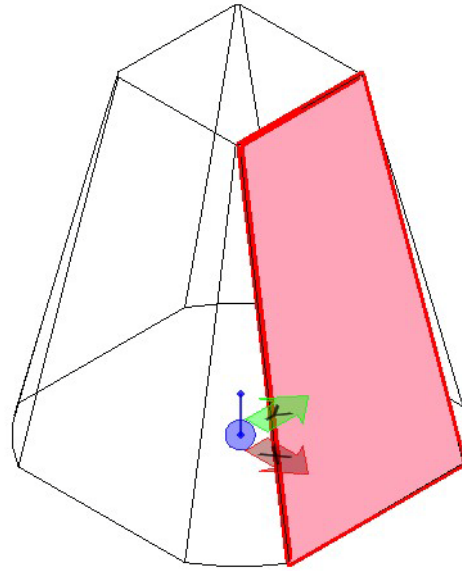
An ACS is useful in placing elements on planes that have a different depth or orientation. In this section you will create a new ACS and draw 2D elements on the plane.

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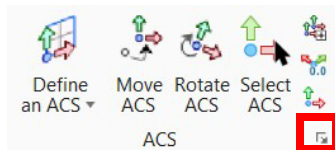
1. Open the design file [06-ACS Planes.dgn](#).



The objective is to create an ACS on the indicated plane.

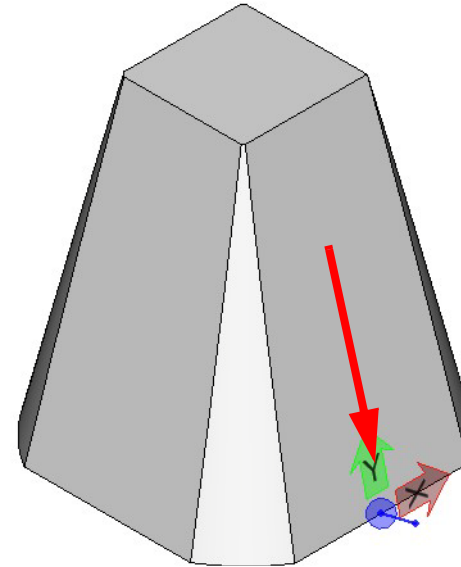


2. Open the *Manage ACS* dialog by navigating to the lower right corner of Drawing Aids > ACS.



Name	Origin X	Origin Y	Origin Z	Type	Description
View 2 : Top	0.000	0.000	0.000	Rectangular	Default Origin at 0,0,0
Front	0.000	0.000	0.000	Rectangular	
Side	0.000	0.000	0.000	Rectangular	
Top	0.000	0.000	0.000	Rectangular	Default Origin at 0,0,0

- Some ACS have been created by default and these will be discussed in the section on AccuDraw in 3D. To create this new plane select the **Define ACS (Aligned with Element)** tool and click on the midpoint of the bottom edge of indicated plane above.

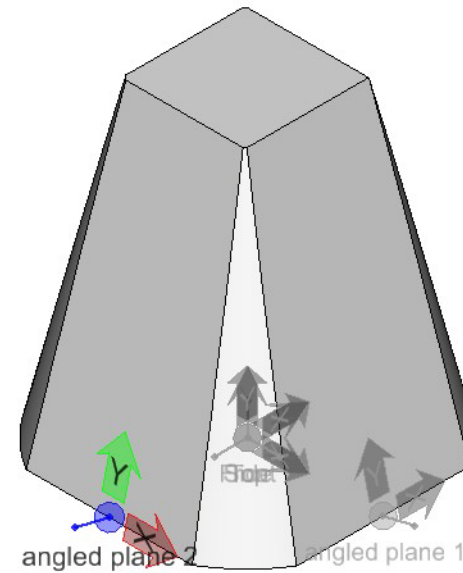


- The next step is to create a name for the ACS. In the *Manage ACS* dialog select the **Create a New ACS** tool and name the ACS **angled plane 1**.

Name	Origin X	Origin Y	Origin Z	Type
View 2 : Unnamed	6.047	0.000	-0.000	Rectangular
<b>angled plane 1</b>	6.047	0.000	-0.000	Rectangular
Front	0.000	0.000	0.000	Rectangular
Side	0.000	0.000	0.000	Rectangular
Top	0.000	0.000	0.000	Rectangular

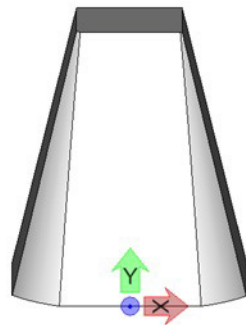
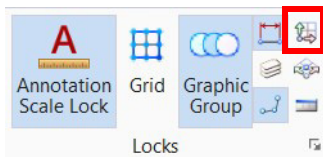
- Create another ACS named **angled plane 2** then select the **Select ACS** tool in the *Manage ACS* dialog. All available ACS are displayed. Click on any ACS to make it the Active ACS.

Name	Origin X	Origin Y	Origin Z	Type
View 2 : Unnamed	-0.000	-6.148	-0.000	Rectangular
angled plane 1	6.047	0.000	-0.000	Rectangular
angled plane 2	-0.000	-6.148	-0.000	Rectangular
Front	0.000	0.000	0.000	Rectangular
Side	0.000	0.000	0.000	Rectangular
Top	0.000	0.000	0.000	Rectangular

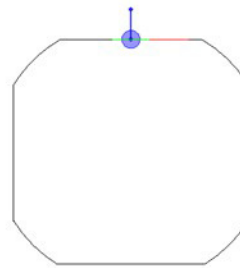


You can also Lock the ACS plane. This will force all X, Y and Z coordinates to be relative to the Active ACS, such as angled plane 2 above.

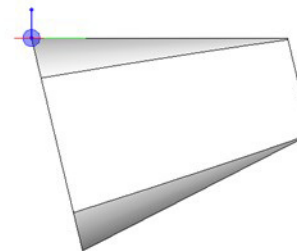
6. Navigate to **Drawing Aids > Locks > Select ACS Plane Lock**. The standard views are placed relative to the active ACS.



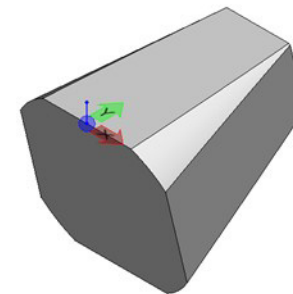
TOP View



FRONT View

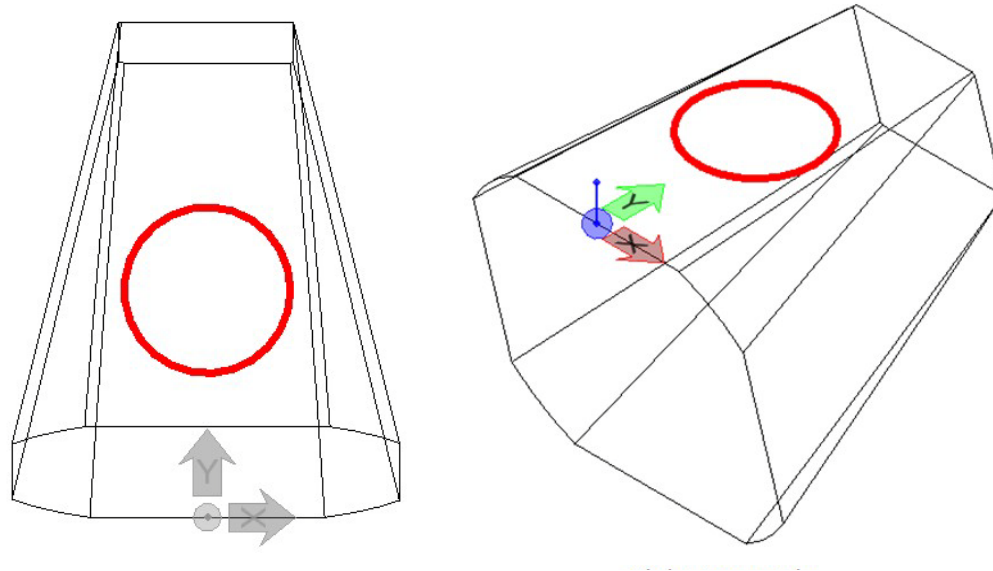


SIDE View



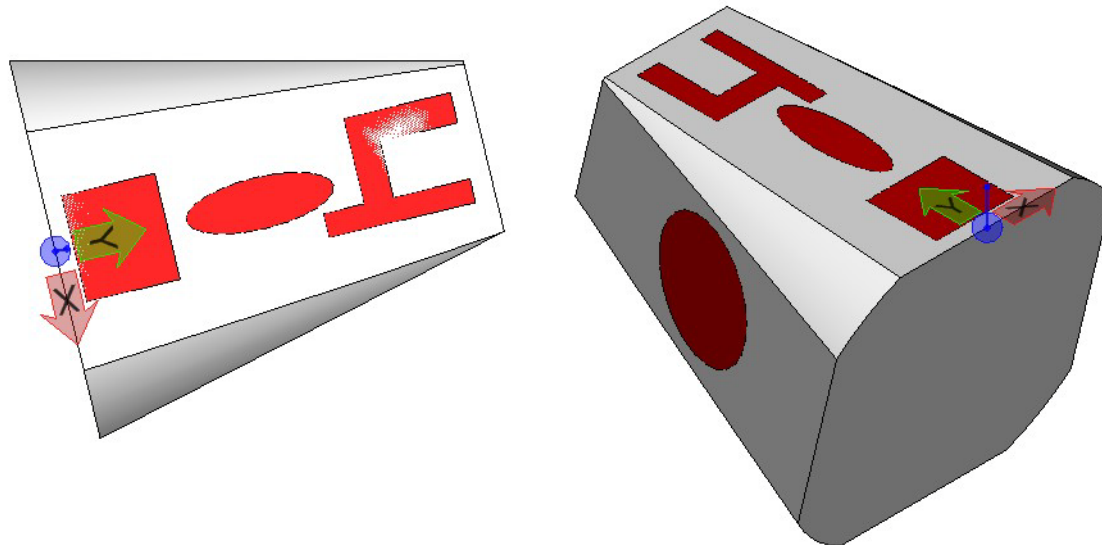
Right Isometric View

7. You can draw a Circle Element on the Plane in the Top View.



Try creating other shapes such as a Block, Ellipse, orthogonal shape, on angled plane 1.

**Hint:** Another method for making an ACS active is to double click the name in the *Manage ACS* dialog.

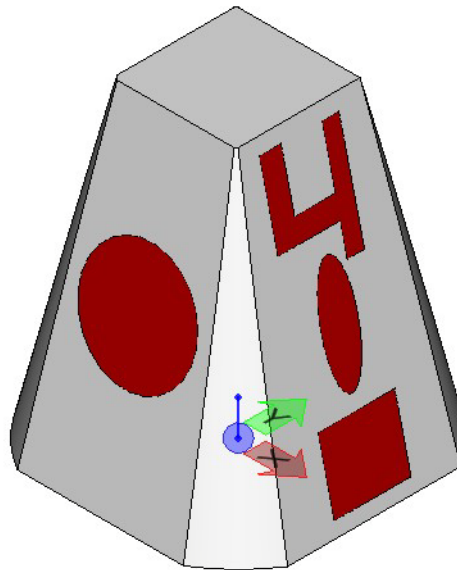


## AccuDraw with 3D Geometry.

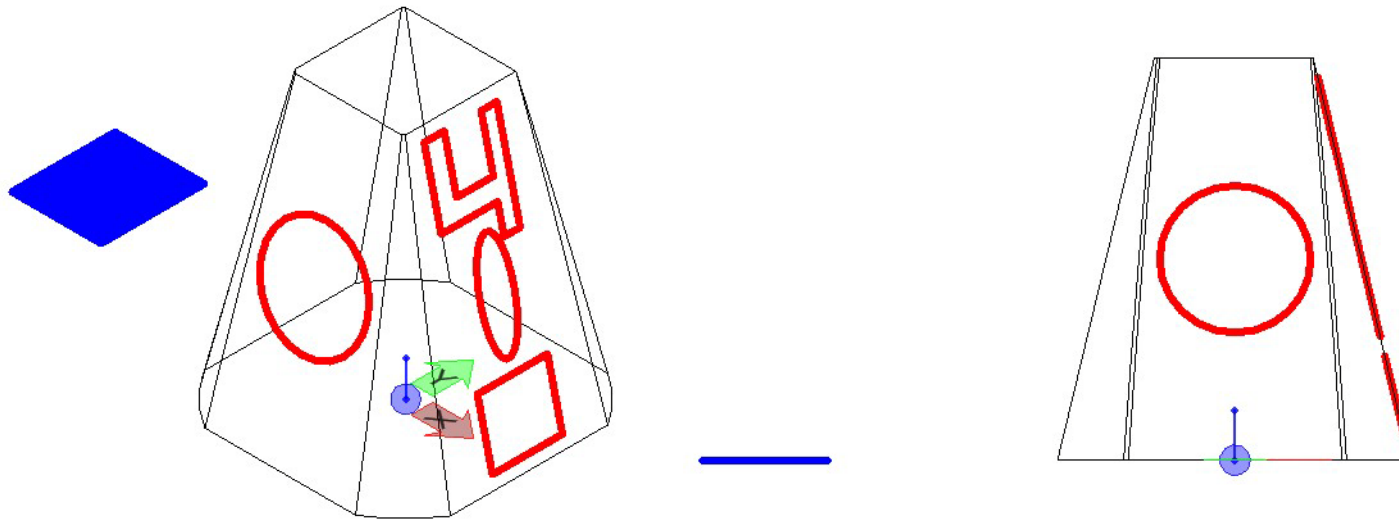
AccuDraw is a drawing aid composed of an input window, compass, and shortcuts used to orient the compass to the top, front or side views of an Active ACS plane.

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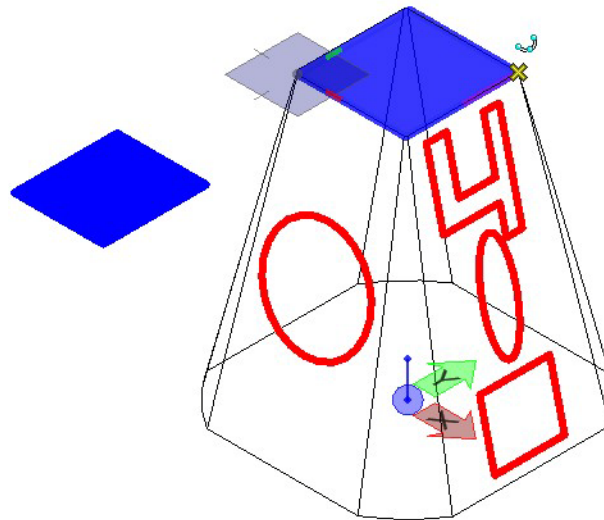
1. Continuing with the **06-ACS Planes.dgn**, let's create a new Global origin ACS.
2. Use the **Create a New ACS** tool and name the new ACS **Global Origin**.
3. Right click on *Global Origin name*, click on **Reset To Global** then double click the name to make it the Active ACS.
4. Change view to Right Isometric.



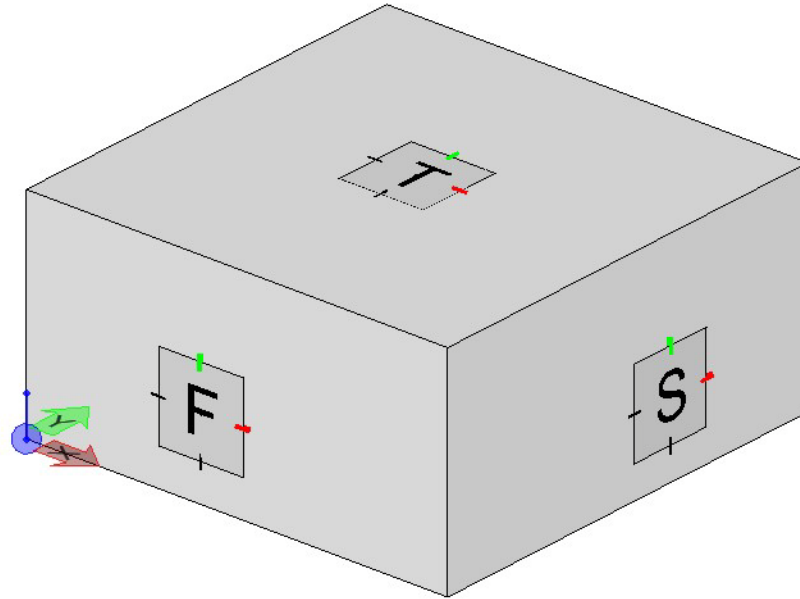
5. You will draw a Block on the top of the 3D geometry. Remember the ACS lock is on, so elements will be drawn relative to the Global Origin ACS. If you were to create the Block away from the 3D object, the Block will be drawn on the Global Origin ACS. In the Front View notice the Block is drawn on the Global Origin ACS plane.



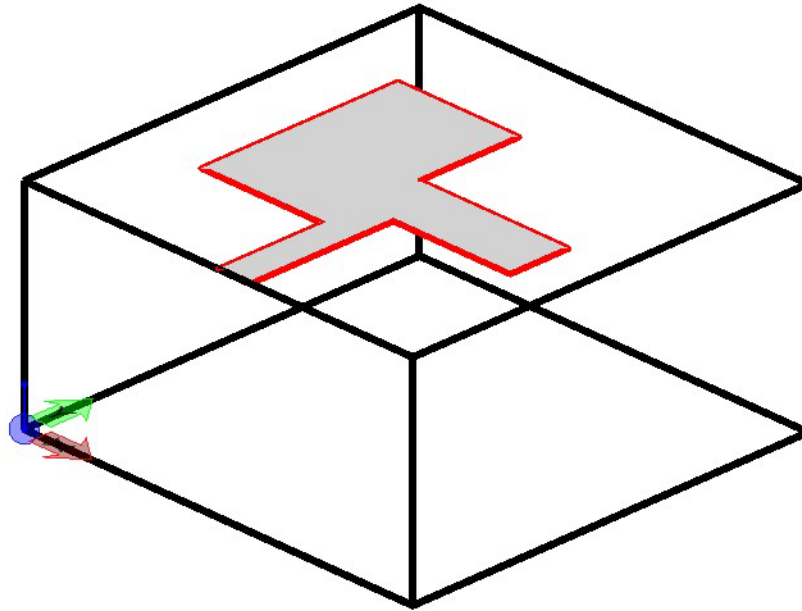
6. Draw the Block again but snap to the top of the 3D geometry. This will set the depth in the 3D View volume.



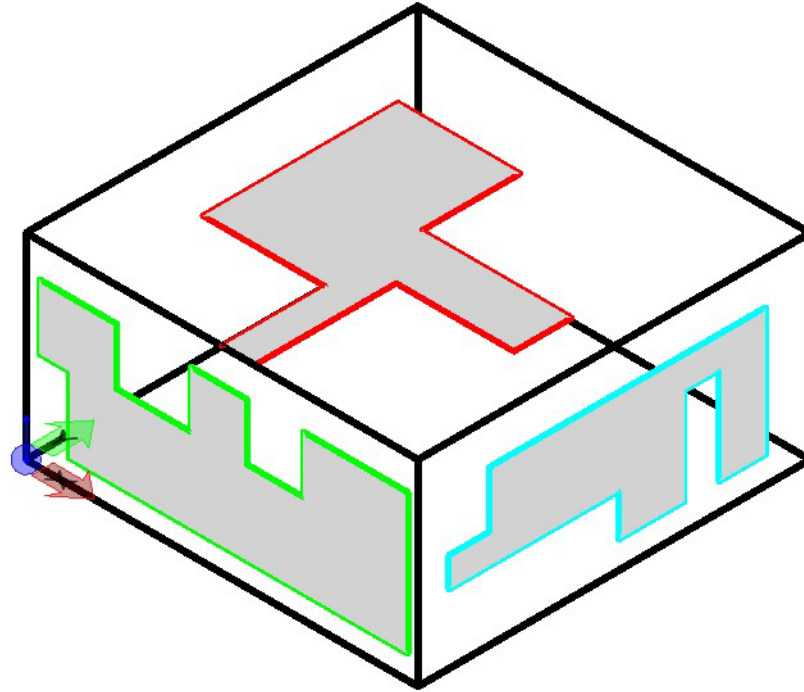
7. Open Design file **AccuDraw compass orientation**.
8. There are 3 basic compass orientations, the Top (T), Front (F), and Side (S) shortcuts. Remember from 2D training, Function Key (F11) places focus in AccuDraw, then type Shift+? to display the AccuDraw Shortcuts. Here are the 3 Compass orientation shortcuts in a Right Isometric View.



9. Open the *Manage ACS* dialog and you will see all the ACS planes. Some ACS planes have been created for top, front and side. By making one of these planes the Active plane then using the AccuSnap tools, you can set the depth to the top plane and draw elements on the top plane.

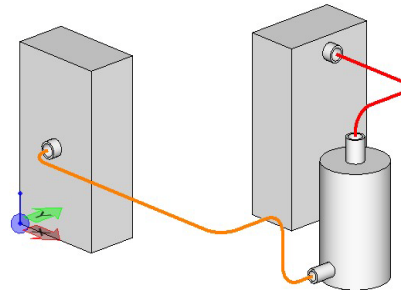


10. Do this for other ACS planes or just use AccuDraw shortcuts T, F or S and create the following geometry. Do not worry about size or dimensions; just fit your drawings on the various planes.



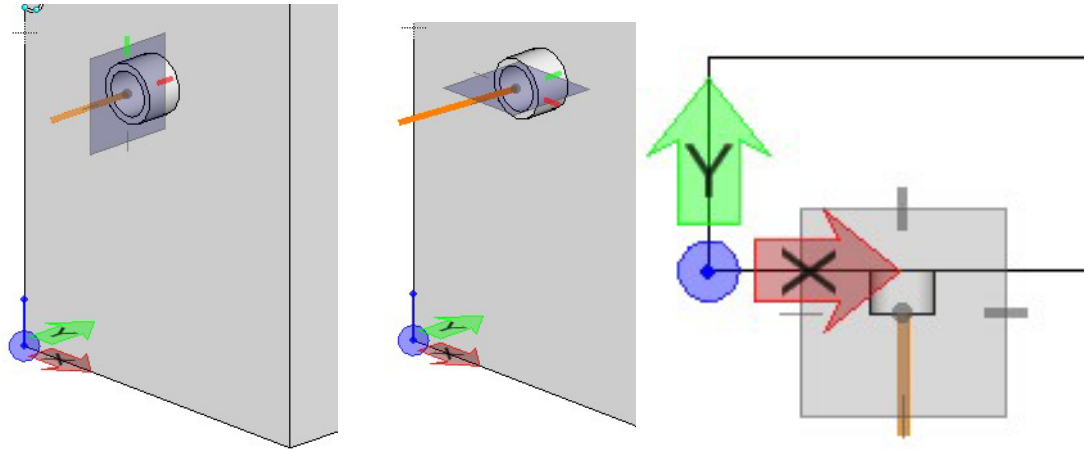
Review: So far we have drawn shapes onto various Active ACS planes and have also used the AccuDraw shortcuts to draw on planes with only the Global Origin set as the Active Plane. Now let's see how you can draw lines in 3D space.

11. Open the Model **Lines in 3D space** in the **06-ACS Planes.dgn** file. The objective of this exercise is to route SmartLines between the pipe attachments on each object.

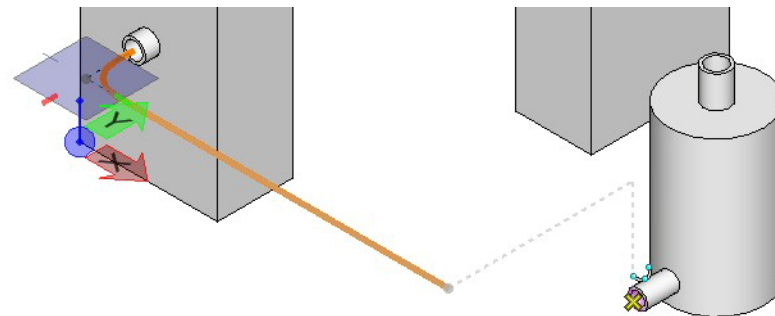


12. Use a SmartLine with a *Rounded Vertex* of **0.200 Meters**, and select the Center of the pipe attachment. Orient your compass to the (S), side or (T) top orientation, and move along the -X axis for 0.3 meters.

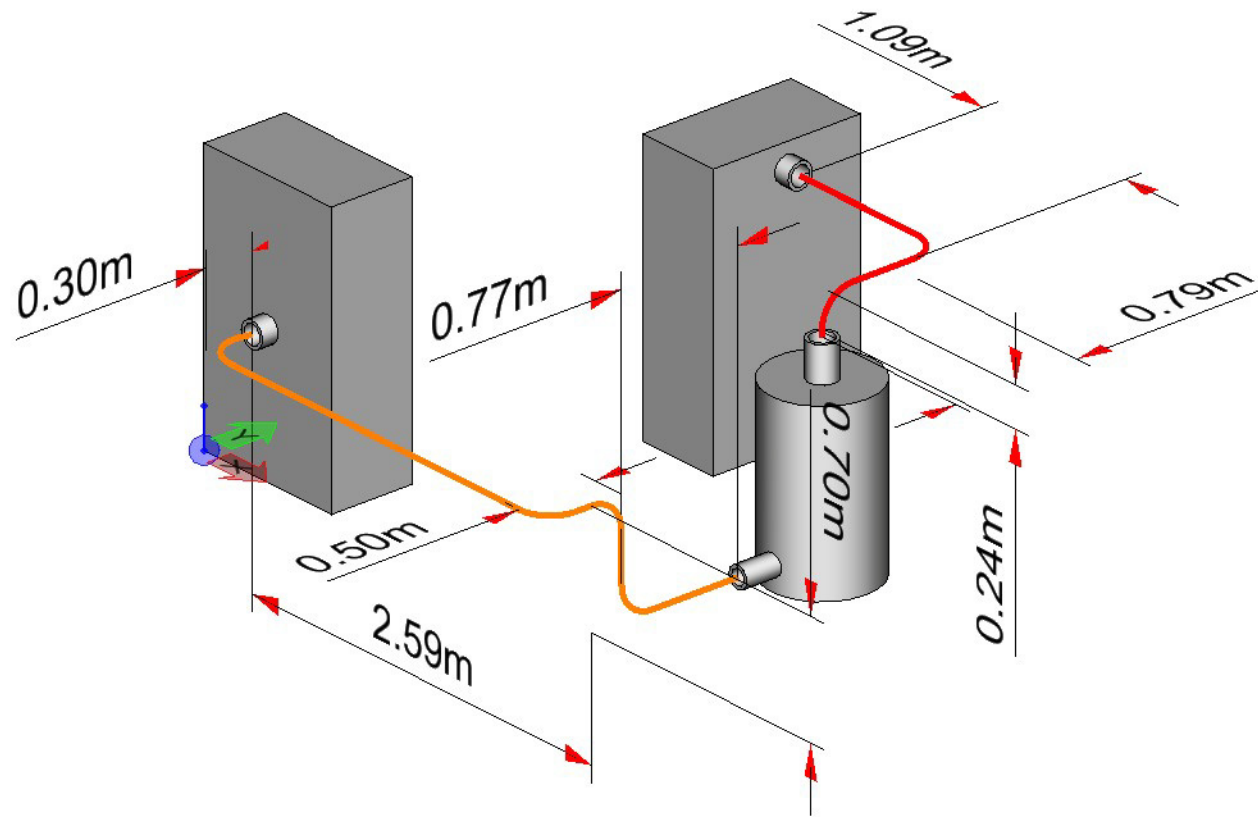
**Note:** You can change to Top standard view. With only one view window being used you can change to any standard view anytime.



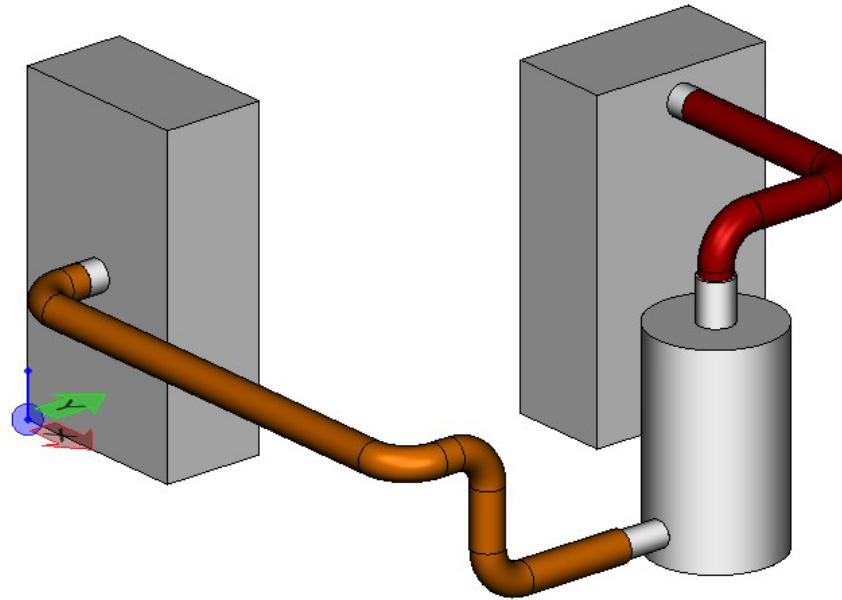
13. Lock the axis in the positive Y axis by pressing Enter. This is the shortcut called Smart Lock. This allows you to move your cursor along the Y axis and align to the pipe attachment on the cylindrical object by moving the cursor to the pipe attachment point. Then press the left mouse button to add a data point.



14. To complete the routing of all the lines, use the following image as a guide



15. Simply draw a circle at the start point of each line, then use the **Modeling > Solids > Extrude Along** tool and create pipes as you see below.



## Placing 3D Cells

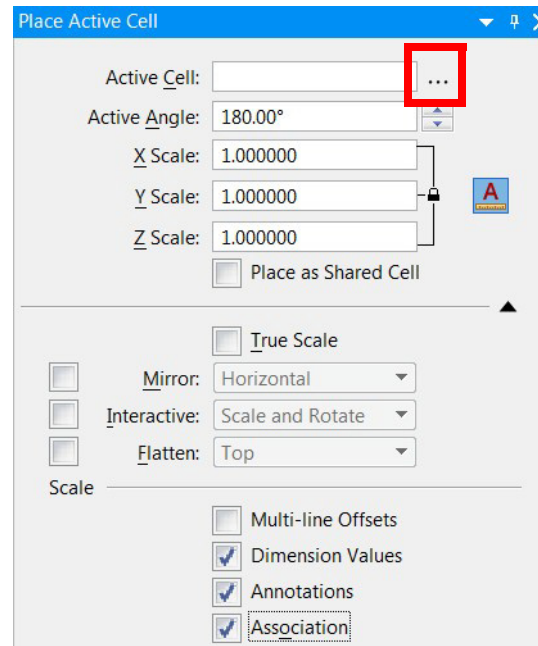
In this section, we will open the Model **Placing 3D cell** in the MicroStation design file **07-3D Cells.dgn**.

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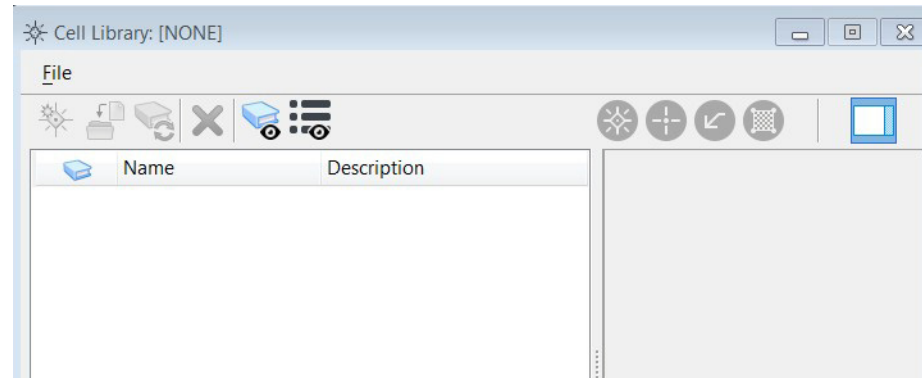
1. First navigate to the **Drawing > Annotate > Cells > Place Active Cell** tool.



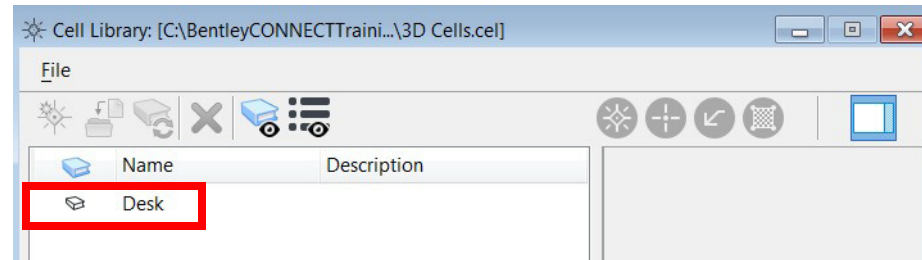
2. Select the browse button (three dots) to the right of the Active Cell



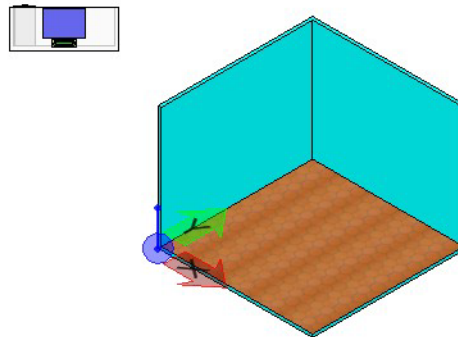
The *Cell Library* dialog opens.



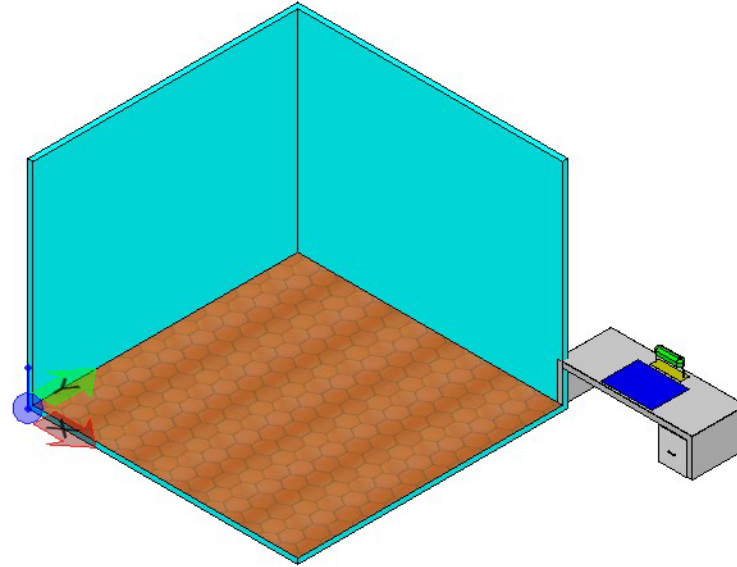
3. Select **File > Attach File**, then navigate to **BentleyCONNECTTraining > WorkSets > Introduction To 3D > Cell Library > 3D Cells.cel**.



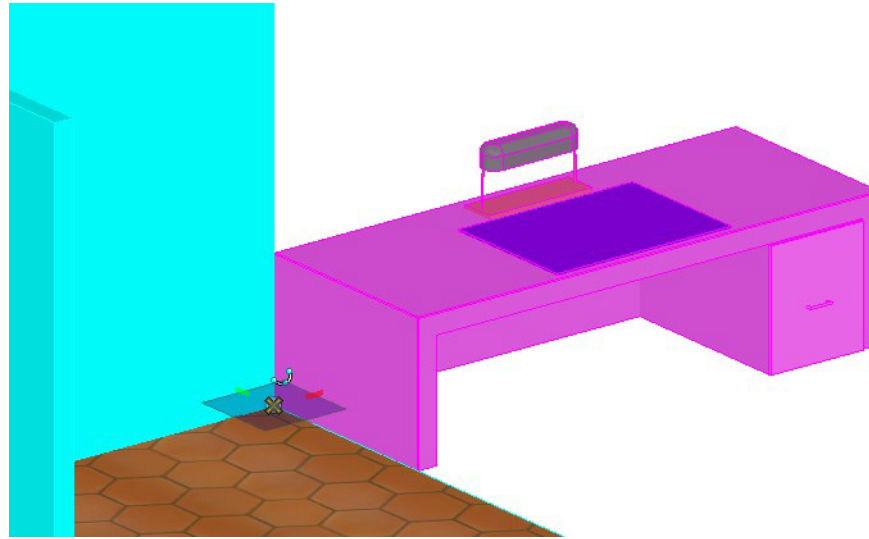
4. Double click the Desk cell. This will make the Desk the Active Cell and it will appear at your cursor in View 2. You can close the *Cell Library* dialog.



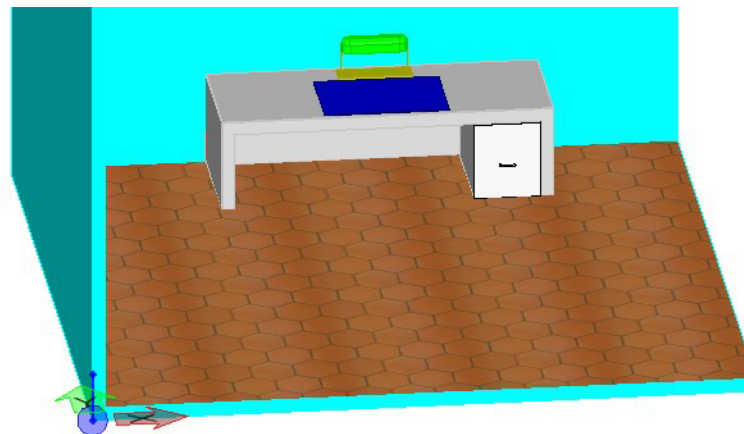
5. The cell is in a top orientation but the view is right isometric. You will use the AccuDraw shortcut, letter O. This shortcut will place a temporary origin at the cursor (X). Remember to hover the cursor over a point until the "X" appears, then press the letter O. The cell will orient to the View 2 right isometric view.



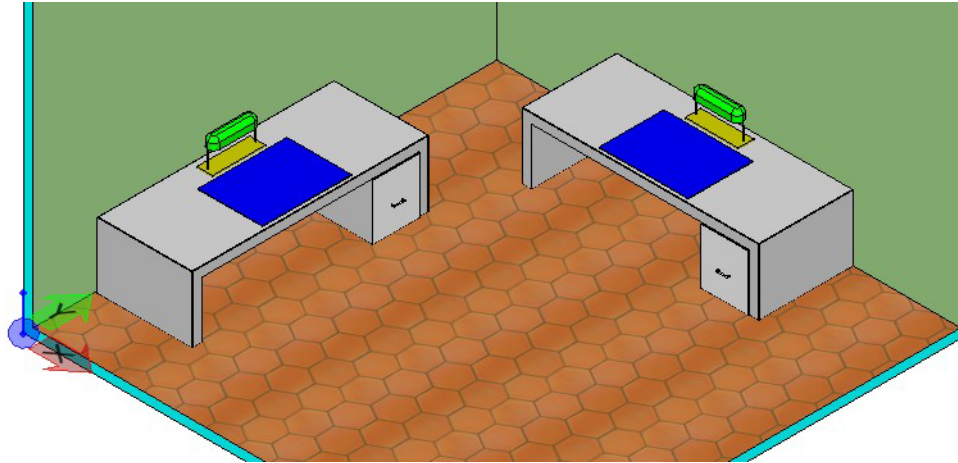
The desk's origin is now placed on the right side at corner between floor and wall. Use the **Move** tool to position the desk on the back wall. You may have to Rotate view if shaded or change to wireframe to see the back of Desk cell.



6. Now move the Desk cell along the negative X axis to position along the back wall.

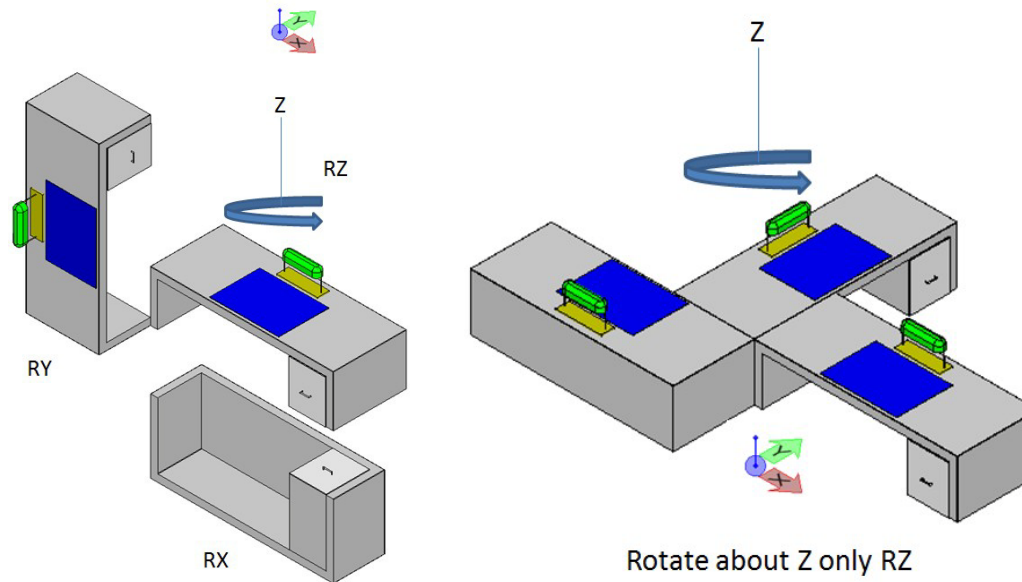


7. Now let's place a Desk cell along the left wall.

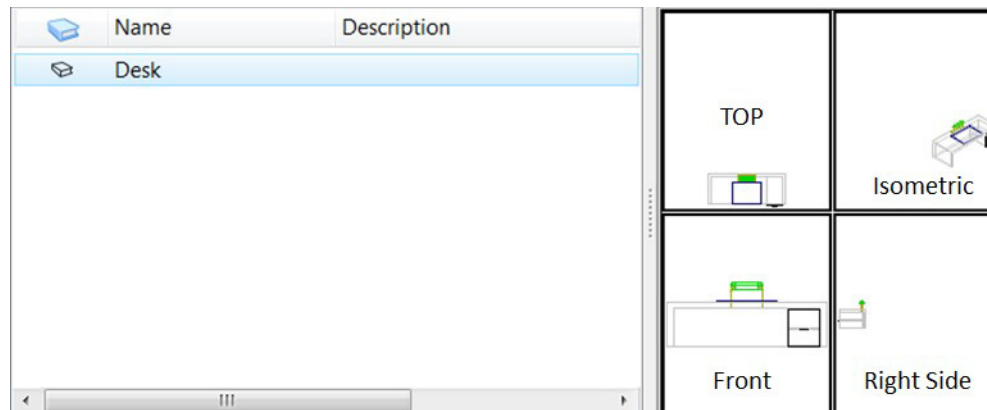


8. Select Place Cell tool. Hover over a point and press F11 then letter "O". Rotate the Desk around the Z axis by typing shortcut RZ, then move to correct position.

The RZ tool rotates about the Z axis, RX about X axis and RY about Y axis. Try these other rotations to see results.



9. The creation of 3D cells is the same process as 2D cell creation.
  - a. Create geometry
  - b. Place all geometry in a Selection Set
  - c. Place a cell Origin
  - d. Change to Top View
  - e. Create a name for 3D cell



This exercise completes the Introduction To 3D course. Completion of this course is a prerequisite for all courses in MicroStation CONNECT Edition 3D.