NEMETSCHEK Vectorworks

Getting Started Guide

Vectorworks Fundamentals

2015

Vectorworks Fundamentals Getting Started Guide

Created using: Vectorworks Fundamentals 2015

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Getting Started with Vectorworks Fundamentals

Initial Setup

To ensure consistency when doing these exercises, please take a moment to set up your Workspace and Vectorworks Preferences. This way, we can start with the same base line.

1. Go to **Tools** > **Workspaces** > **Fundamentals**.

2. Go to **tools** > **Options** > **Vectorworks Preferences** and click the **Reset** button. Accept the "Are you sure…?" dialogue box.

3. Now we'll adjust the constraints categories. Go to **Tools** > **SmartCursor Settings**.

4. Dismiss the "Did you know…?" dialogue box, and click the **Reset** button. Accept the "Are you sure…?" dialogue box, and select General in the **Category** list on the left.

5. Uncheck **Snap to Combined Page Area**.

6. Click **OK** to close the SmartCursor setting dialogue box.

Document Setup

1. First, open a new blank document by going to **File** > **New**.

2. Choose Create Blank Document and click **OK**.

3. Next, go to **File** > **Page Setup**, uncheck the option Show Page Boundary, and click **OK** to close the Page Setup dialogue box .

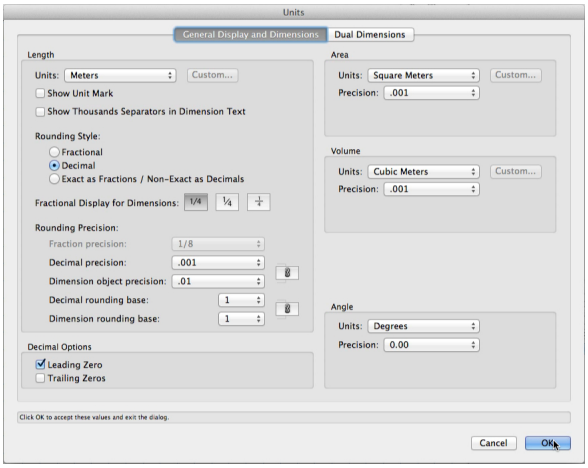
4. Go to **File** > **Document Settings** > **Units**.

5. Choose Meters from the **Units** pop up menu under Length.

6. Under Rounding Precision, set the **Decimal Precision** to .001.

7. Now under Area, choose Square Meters from the **Units** pop up menu.

8. Finally, set the **Volume Units** to Cubic Meters and click **OK**.



9. To change the design layer scale, right-click (Windows) or Ctrl-click (Macintosh), in a blank area of the drawing area.

10. Choose **Active Layer Scale** from the menu.

11. Set the Scale to 1:100 and click **OK**.

Concrete base and Bowl

In this guide, will will create a Skatepark. Using various tools and commands available with Vectorworks Fundamentals, we will create the park, stairs, multiple obstacles, and a gazebo. Then we will create viewports and place them on sheet layer to present the model.

Creating the Bowl Shape

Now that the file is set up, we will create the shapes for the concrete base and bowl of the skatepark. We will use the Rectangle and Circle tools to create the Bowl.

1. In the Basic palette, double-click the Rectangle tool. This will

open the Create Object dialogue box.

2. In the Create Object dialog, set the **Width** to 12.5 and the **Height** to 21.65.

3. Make sure **Position at Next Click** is checked and click **OK**.

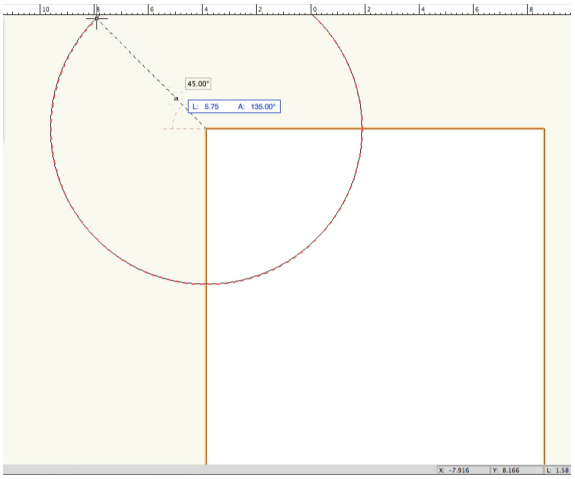
4. Since **Position at Next Click** was checked, you will need to click somewhere near the origin (0,0) to create the rectangle.

5. In the Basic palette, click on the **Circle** tool.

6. Make sure the 1st mode, **Radius** mode is enabled in the tool bar.

7. Place your cursor over the top left corner of the rectangle. When you see the "Top Left" SmartCursor cue, click once and move the cursor up and to the left.

8. Press the Tab key to activate the Floating Data bar. Enter 5.75 for the **Length (L)** field and press Enter or Return twice to place the circle.



9. Now place another circle on the bottom right corner. The **Circle** tool should still be active, so move your cursor over the bottom right corner of the rectangle. When the "Bottom Right" SmartCursor cue is displayed, click once, then move your cursor down and to the right.

10. Press the Tab key to activate the Floating Data bar, enter 7.375 for the **Length (L)** field, and press Enter or Return twice to place the circle.

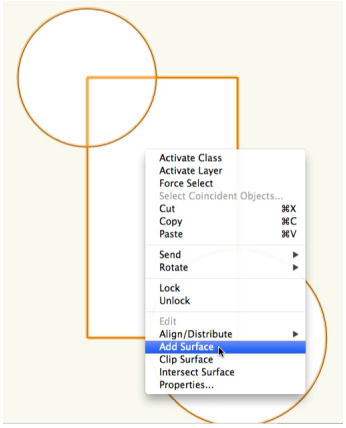
Next, using the Add Surface command we will combine these objects into one polyline.

11. Press the X key once to activate the **Selection** tool in the Basic palette.

12. Select the rectangle and the two circles by holding the Shift key and clicking once on each object.

Note: If the last Circle you created is already selected, you do not need to click on it again.

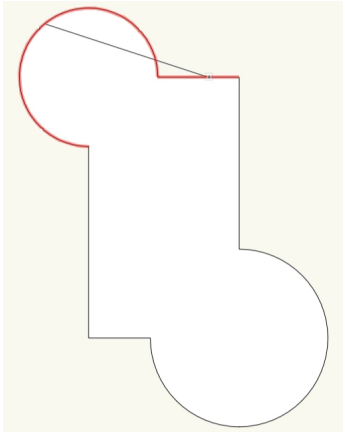
13. With all three objects select Right-click (Windows) or Ctrl-click (Macintosh) on the selected objects and choose **Add Surface**. The three objects will be combined into a single polyline object.



Now, we will fillet the corners of the bowl. The Fillet tool will allow us to reshape this polyline and change the corner vertices to curves.

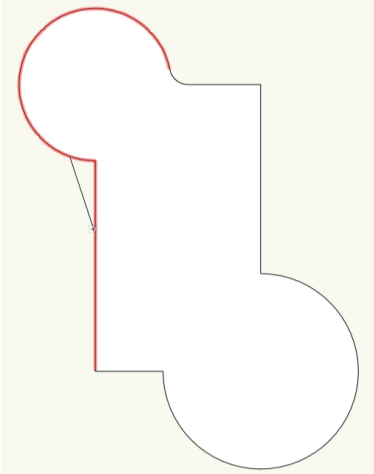
14. In the Basic palette, activate the **Fillet** tool, in the Tool bar, switch to the 3rd mode, **Trim** mode and enter 1.4 for the **Fillet Radius**.

15. Move your cursor over the top left of the polyline. The curved segment of the polyline will highlight in red, click once, and move your cursor over the top horizontal segment of the polyline. This segment will highlight in red as well, click once more to fillet the corner.

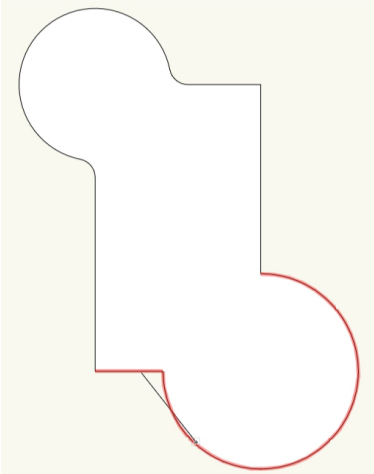


16. Repeat this action for the corner of the top left curved segment and the left vertical segment, by clicking once on the

top left `curved segment and once on the left vertical segment.

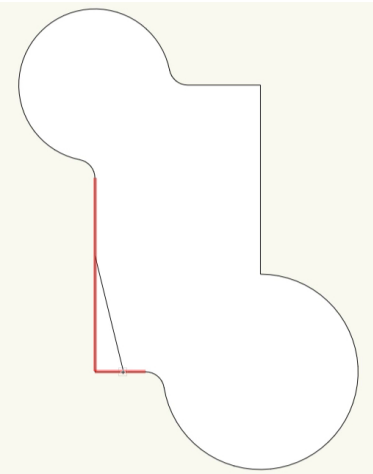


17. Finally, click once on the bottom horizontal segment and then once on the bottom right curved segment, to fillet this corner as well.

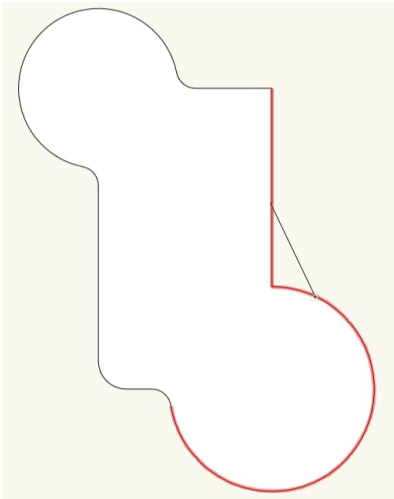


18. Next, in the tool bar, change the **Fillet Radius** to 2.

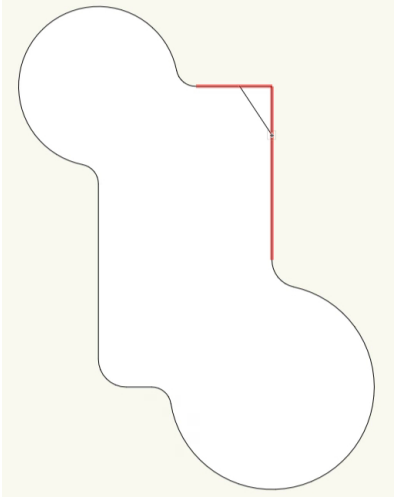
19. Click once on the left vertical segment and once on the bottom horizontal segment to fillet the corner.



20. Now using the same fillet radius, click once on the right vertical segment and then once on the bottom curved segment to fillet this corner.



21. Finally, change the **Fillet Radius** in the tool bar to 2.75, click once on the top horizontal segment and then once on the right vertical segment to fillet the last corner.



Using the Offset tool, we will create a larger offset polyline.

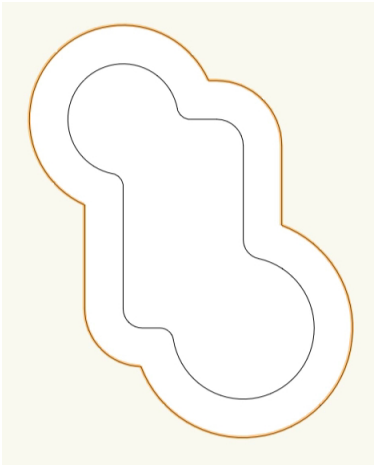
22. In the Basic palette, activate the **Offset** tool.

23. In the tool bar, enable the **Offset by Distance** and **Duplicate and Offset** modes and enter 4 in the **Distance** field.

24. Click once outside of the polyline. A new offset polyline will be created on top of the original polyline.

25. Now, with the new polyline selected, go to **Modify** > **Send** > **Send to Back**. The original polyline will now be visible above

the new offset polyline.

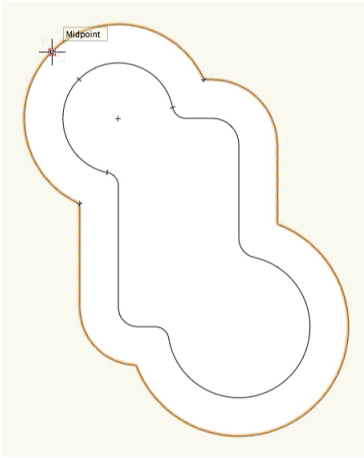


Next, we will use the Polygon tool to create more of the concrete base.

26. Activate the **Polygon** tool in the Basic palette.

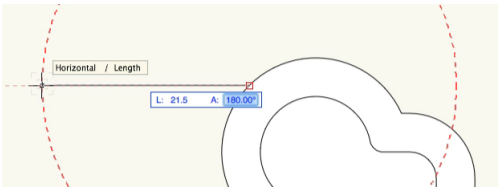
27. In the Tool bar, make sure **Vertex** mode is enabled.

28. Move your cursor over the midpoint of the top left curved segment of the outer polyline and click once the “Midpoint” SmartCursor Cue is displayed, to start the polygon.



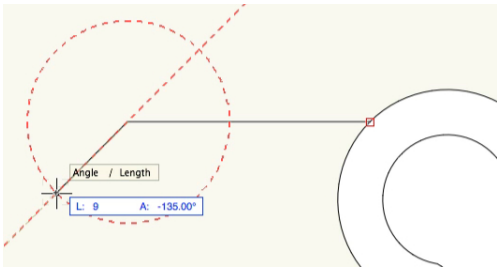
29. Move your cursor to the left horizontally and press the Tab key to activate the Floating Data bar.

30. Enter 21.5 for the **Length (L)** and press Tab to lock the Length field. Move your cursor to the left until the “Horizontal / Length” SmartCursor Cue is displayed. Click once to start the next segment.



31. Move the cursor down and to the left. Press the Tab key to enter the Floating Data bar, enter 9 for the **Length (L)**, press Tab again, enter -135º for the **Angle (A)**, and press Tab once more to lock the Angle field.

32. When the SmartCursor Cue “Angle / Length “is displayed, click once to start the next segment.



33. Press Tab again to activate the Floating Data bar, enter 10.5 for the **Length (L)** field, press Tab, enter 135º for the **Angle (A)** field, and press Tab again to lock the Angle field.

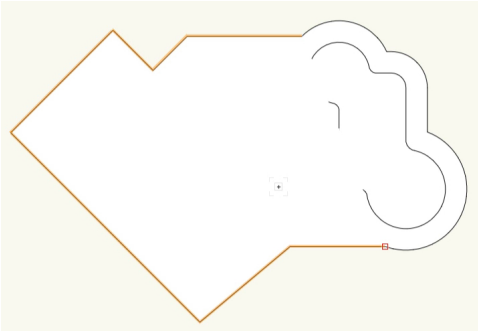
34. When the SmartCursor Cue “Angle / Length” is displayed, click once to start the next segment.

35. Repeat the same process above for the next segment. For this segment enter 27 for the **Length (L)** field and -135º for the **Angle (A)** field.

36. Repeat the process again, this time enter 50 for the Length and -45º for the Angle.

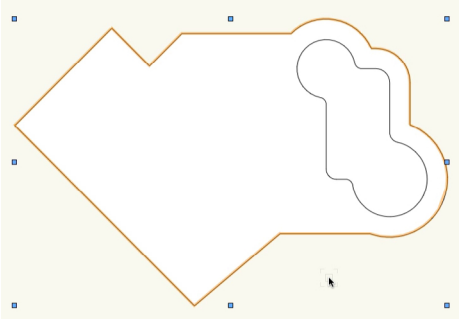
37. For the next segment, enter 22 for the Length and 40º for the Angle.

38. Finally to complete the polygon, move the cursor to the right horizontally until it intersects the outer polyline. Double-click to to complete the polygon when the SmartCursor Cue, “Object / Horizontal” is displayed.



39. Select both the new polygon object and the outer polyline object by holding the Shift key and clicking on both objects.

Right-click (Windows) or Ctrl-click (Macintosh) on the objects and choose **Add Surface** to combine the objects into one polyline.



Fillet Corners of Concrete base

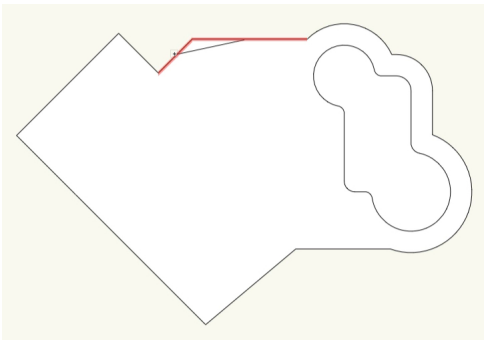
Using the same procedure as shown previously, use the Fillet tool to adjust the corner vertices of the concrete base polyline.

1. Activate the **Fillet** tool in the Basic palette.

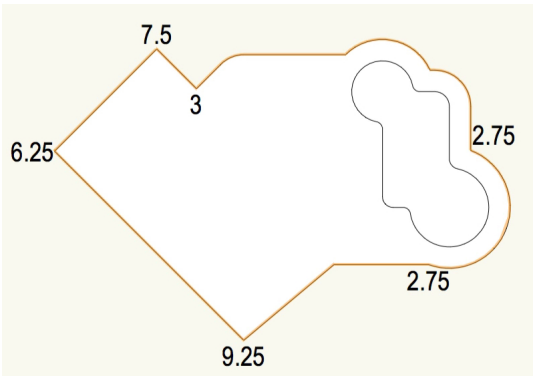
2. Enable the 3rd mode, **Trim** mode and set the **Fillet Radius** to 6.25.

3. Move your cursor over the top horizontal segment of the polyline. When the segment highlights in red, click once.

4. Move the cursor over the left adjacent segment and click once more to fillet the corner.



5. Using the image below use the Fillet tool with shown Radius settings to fillet 6 more corners.



Extruding the Concrete base

Using the Push/Pull tool, we will extrude the concrete base polygon and then use the Sub Face mode of the Push/Pull tool with the Line and Polyline tools, to create stepped surfaces.

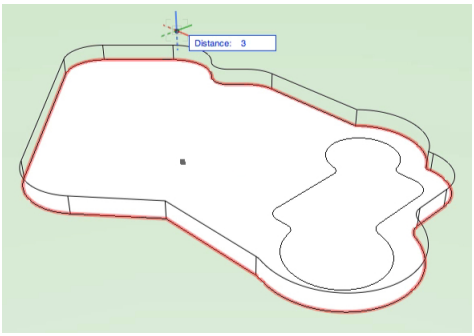
1. In the View bar, go to the Standard views menu and choose **Right Isometric**

2. Open the 3D modeling tool set and activate the **Push/Pull** tool.

3. Enable the 1st mode, **Extrude Face** mode in the tool bar.

4. Move your cursor inside the larger outer polyline. The face will highlight in red. Click once and move the cursor vertically.

5. Press the Tab key to activate the Floating Data bar, enter 3 in the **Distance** field, and press Enter or Return twice.

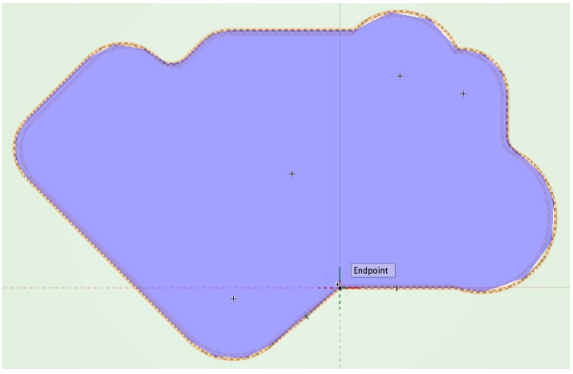


6. Open the Standard views menu in the View bar and switch to Top view.

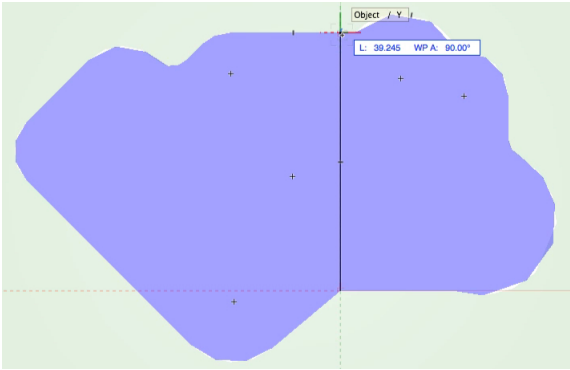
7. Activate the **Polyline** tool in the Basic palette and enable the 1st mode, **Corner Vertex** mode.

8. Make sure **Automatic** is set in the Plane menu in the View bar.

9. Move the cursor on top of the extrude. The top surface will highlight in blue. Click once on the left corner of the bottom horizontal segment to start the polyline.



10. Move the cursor across the top of the extrude until it intersects the opposite side. When the SmartCursor Cue “Object / Y” is displayed, double-click to create the polyline.



11. Switch to a **Left Isometric** view, through the Standard views menu in the View bar. You will see the polyline was drawn on the top surface of the extrude.

12. Activate the **Push/Pull** tool in the 3D modeling tool set. Enable the 3rd mode, **Sub-Face** mode.

13. Place the cursor over the polyline you just drew, it will highlight in red. Click once.

14. Move the cursor over the extrude, it will also highlight in red. Click again.

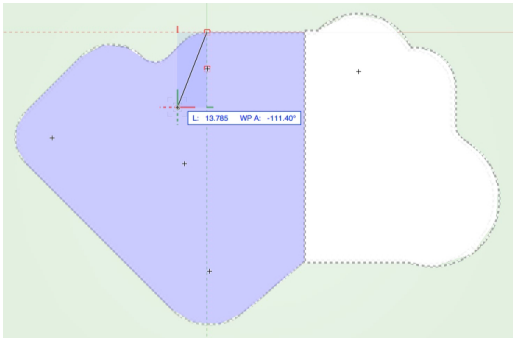
15. Move the cursor over the left side of the extrude, the left side will highlight in red. Click once more and move the cursor down.

16. Press the Tab key to activate the Floating Data bar and enter -1.5 in the **Distance** field. Press Enter or Return twice to move the face. The object is now a generic solid.

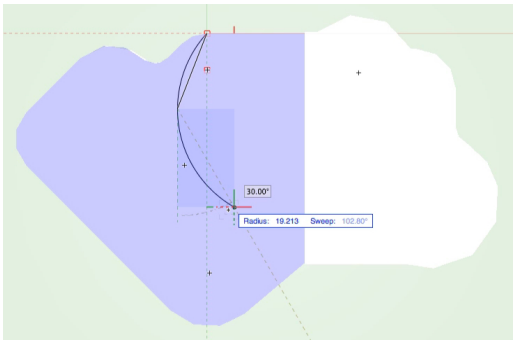
17. Switch back to a **Top** view using the Standard views menu in the View bar.

18. Activate the **Polyline** tool in the Basic palette and switch to the **Point on Arc** mode in the Tool bar.

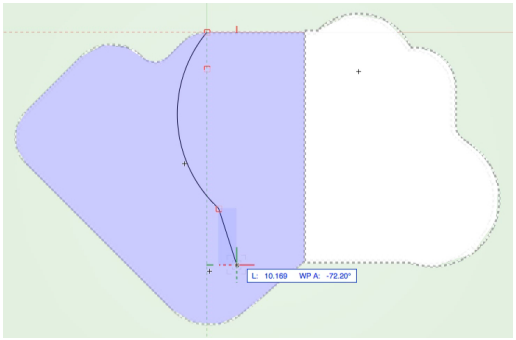
19. Draw a curved polyline to the left of the vertical line we drew previously. Click once at the top of the concrete base. Move the cursor down and slightly to the left, about a one third the way across the concrete case. Click once.



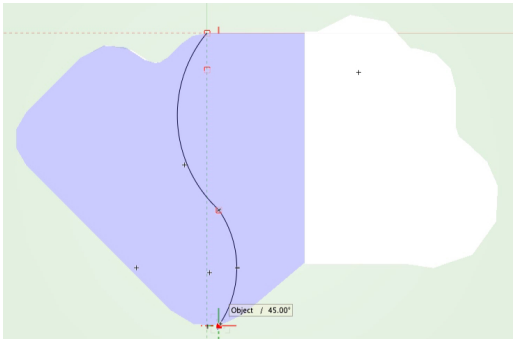
20. Move the cursor about two thirds the way across the concrete base and slightly to the right. Click once more.



21. Move the cursor down about half to the bottom edge of the concrete base and little more to the right. Click again.



22. Finally, move the cursor down and to the left, until you intersect the bottom edge of the concrete base. Then double-click to complete the polyline. Your polyline should appear similar the image below.



23. Switch back to the Left Isometric view and activate the **Push/Pull** tool, with the **Sub-Face** mode active.

24. Click once on the curved polyline. Move your cursor to the left and click once on the concrete base, and then click on the bottom left face of the concrete base.

25. Finally, move the cursor down, press Tab, enter -1.2 in the **Distance** field, and press Enter or Return twice to move the face of the concrete base.

Creating Skatepark Levels

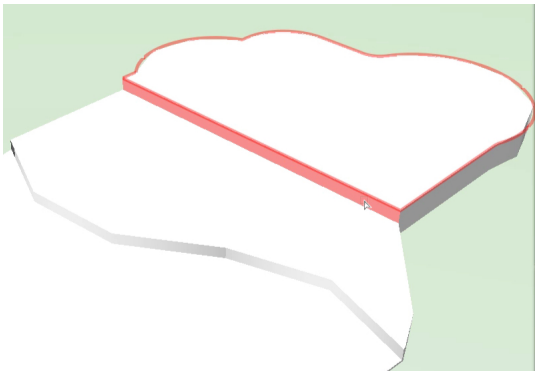
We will now use the Taper Face and Fillet Edge tools from the 3D Modeling tool set, to create sloped and curved surfaces.

1. In the 3D Modeling tool set activate the **Taper Face** tool.

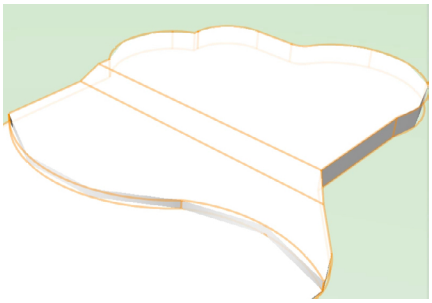
First, we need to set the reference plane, this plane will be used to determine the pivot point for the Taper operation.

2. With the 1st mode, **Tangent Faces** mode enabled in the Tool bar, move your cursor over the upper most surface of the generic solid, the surface will highlight in red. Click once.

3. Now, let's select the face to taper, move the cursor over the adjacent vertical surface, the surface will highlight in red. Click again.



4. Finally, move the cursor out to set the angle of the taper. The **Taper Angle** should be about -66°. Click once more to complete the action.



5. Activate the **Fillet Edge** tool in the 3D modeling tool set. In the Tool bar click on the **Fillet Edge Tool Preferences** button.

6. In the Fillet Edge Preferences dialog, check **Select Tangent Entities**, enable **Constant Radius** mode, and set the **Radius** to 4. Click **OK**.

7. Select the edge that intersects the bottom most face with the adjacent vertical face, it will highlight in red. Hold the Shift key to select both segments. Click the green check mark button in the Tool bar to complete the action. The generic solid is now a fillet object.

Adjusting Rendering Settings

You may notice that the curved portions of the generic solid appear segmented. This is because, by default the detail level for the OpenGL render mode is set to low. Next, we will adjust these settings.

1. Go to the Render modes menu in the View bar. Make sure OpenGL is active and select **OpenGL Options** at the bottom.

2. In the OpenGL Options dialog, set the Detail to Very High.

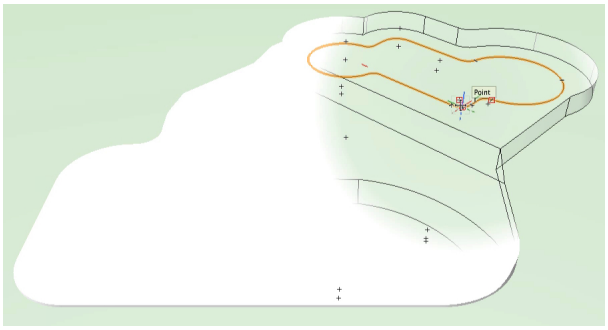
3. Click **OK** and Vectorworks will re-render the object. The curved portions are no longer segmented.

Subtracting the Bowl from the Concrete base

Next, we will use the Extrude and Subtract Solids command to carve out the bowl from the concrete base. Then, we will use the Fillet Edge tool to curve the inside face. First, we will use the original polyline we drew to create an extrude to subtract from the concrete base (fillet object).

1. To select the polyline, activate the **Selection** tool in the Basic palette.

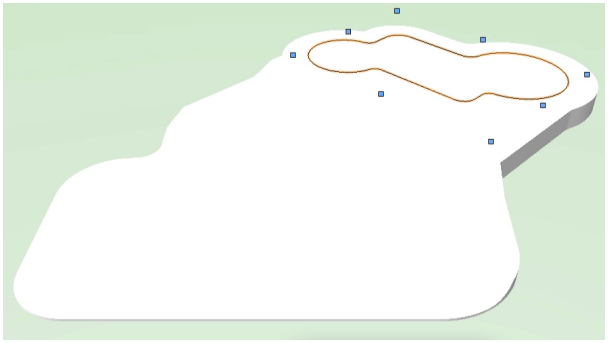
2. Press and hold the B key on your keyboard to activate the **X-Ray Select** mode. This mode allows you to see through and select object beneath other objects.



3. Move your cursor over the polyline and select it.

4. With the polyline selected, go to **Modify** > **Move** > **Move 3D**.

5. Set the **Z Offset** to 3 and click **OK**. The polyline is now on the surface of the concrete base.

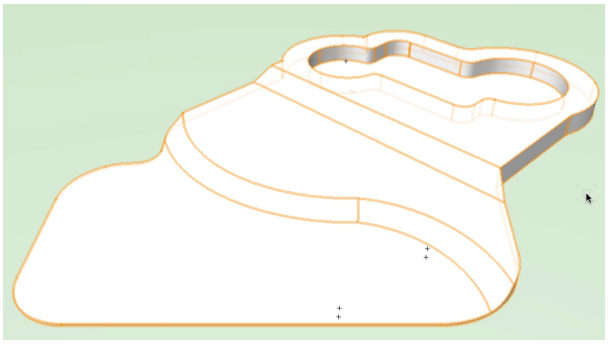


6. With the polyline still selected, go to **Model** > **Extrude**.

7. Set the **Extrusion** to -2.5 and click **OK**.

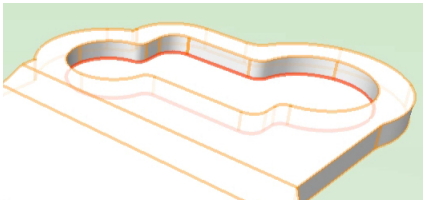
8. Holding the Shift key, select both the extrude and concrete base, go to **Model** > **Subtract Solids**. In the Select Object dialog, use the Back and Front toggle buttons to highlight the concrete base (fillet object) and click **OK**.

The extrude is removed from the concrete base. We now has a solid subtraction object.



9. Activate the **Fillet Edge** tool in the 3D Modeling tool set.

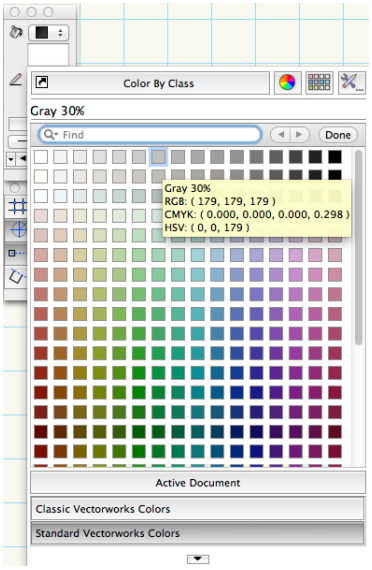
10. Click on the bottom edge of the subtracted area, it will highlight in red. Set the **Constant Radius** to 2.5 in the Tool bar and click the green check mark button to complete the action.



Applying Attributes

With the concrete base geometry complete, we will now give it a fill color using the Attributes palette. Then, we will place it in a new class.

1. With the concrete base (fillet object) selected, set the Fill Color to Gray 30% from the Standard Vectorworks Colors in the Attributes palette.

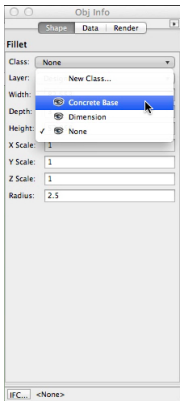


2. Next, click on the **Classes** button in the View bar. In the

Organization dialog, click **New** to create a new class.

3. Name the class Concrete base, uncheck **Edit Properties After Creation**, and click **OK**.

4. Finally, with the concrete base selected, go to the Object Info palette, and change the Class drop down menu to **Concrete base**.



Stairs

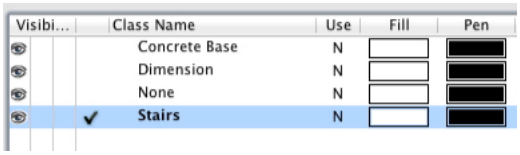
In this section, we will create a simple stair object and place it between the upper and middle levels of the concrete base. First, we will create a new class for the stairs.

1. Click on the Classes button in the View bar.

2. In the Organization dialog, click **New**.

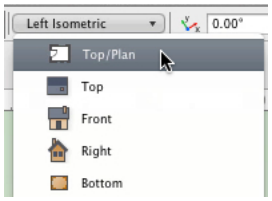
3. Name the class Stairs and click **OK**.

4. Make the Stairs class the active class, by clicking in the Active Class column, to the left of the Class name in the Organization dialog. A check mark will appear.



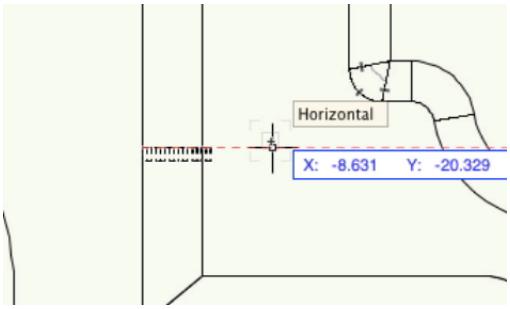
5. Click **OK** to save the changes and exit the Organization dialog.

6. In the Standard Views menu in the View bar, select **Top/Plan.**



7. Switch to the Walls tool set and activate the Simple Stair tool.

8. Move your cursor over the concrete base, you will see a preview of the simple stair object. Move your cursor to left edge of the tapered face between the upper and mid level of the concrete base. Click once towards the bottom of the concrete base, then move your cursor to the right, and click once more to set the rotation.

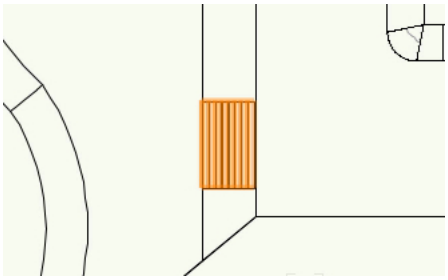


9. In the Object Properties dialog, set the following values. Leave all other values default.

- **Style**: Masonry
- **Width**: 6
- **Flr-Flr Height**: 1.5
- **Max Riser**: 0.2
- **Tread Depth**: 0.45

10. Check **Draw Top Tread**

11. Click **OK** to place the simple stair object.

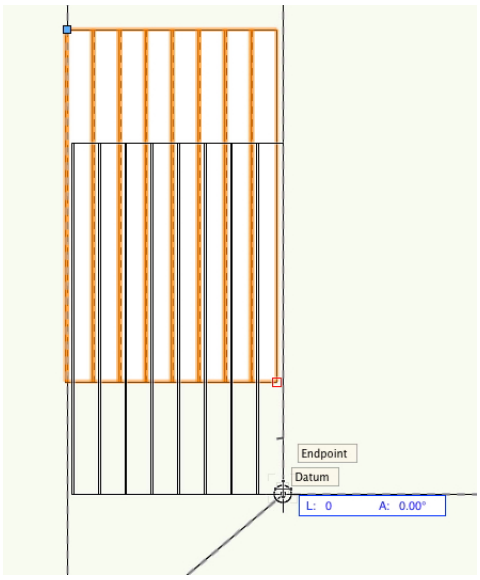


Next, we will use a floating datum to position the simple stair object. Then adjust its elevation.

12. Click and hold on the bottom right corner of the simple stair object. Drag the object to the intersection of the right edge of the tapered face and the bottom of the concrete base.

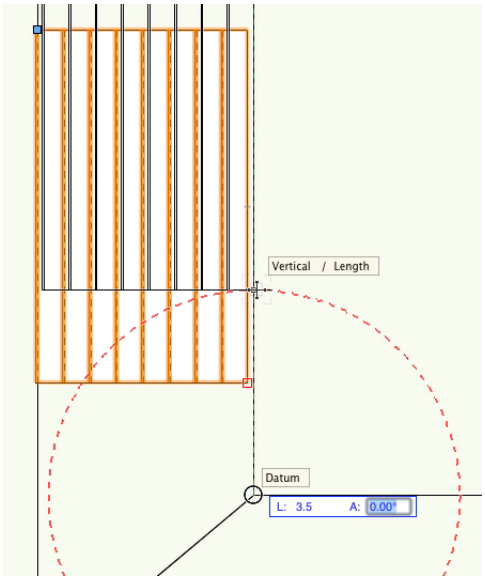
13. Continue to hold down left mouse button, when the

SmartCursor Cue “Endpoint” is displayed, press the G key on the keyboard to place a floating datum.



14. Press the Tab key to activate the Floating Data bar. You can now release the mouse button. Enter 3.5 in the **Length (L)** field.

15. Press Tab once to set the length and then move the cursor up vertically until you intersect the length constraint represented by the dashed red circle. When the SmartCursor Cue “Vertical / Length” is displayed, click once to move the stairs.



16. Now switch to a **Left Isometric view**, by using the Standard views menu in the View bar. You will see the stairs are below the surface of the concrete base.

17. With the simple stair still selected, in the Object Info palette, change the **Z** to 1.5. The Stairs will now be partially above the surface of the concrete base.

Finally, lets adjust the angle of the tapered face so that it matches the angle of the stairs.

18. In the 3D modeling tool set, activate the **Taper Face** tool.

19. Click on the upper surface of the concrete base to set the reference plane, then click on the tapered face to adjust the taper angle.

20. Snap the cursor to the bottom edge of the stairs and click once to adjust the angle of the face. (Screenshot Needed)

Duplicating the Stairs

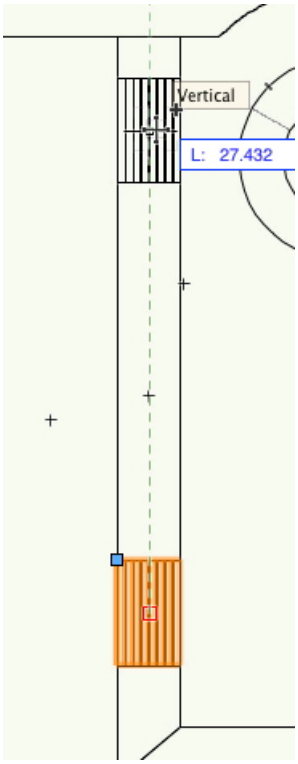
Now that these stairs are complete, let’s duplicate and modify the stairs for the other side of the concrete base.

1. Switch back to a Top/Plan view

2. Press the X key to activate the **Selection** tool and select the stairs.

3. Click and drag the stairs vertically to the other side of the concrete base.

4. While still holding the left mouse button down, press and hold the Ctrl key (Windows) or Option key (Macintosh) on your keyboard. A small plus sign will be displayed next to your cursor.

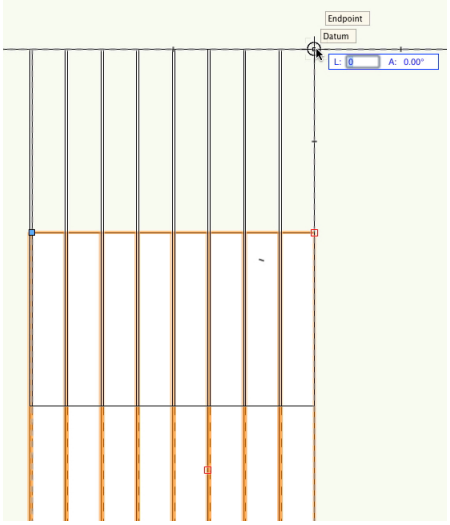


5. Keep the Ctrl (Windows) or Option (Macintosh) key pressed and release the mouse button to duplicate the stairs.

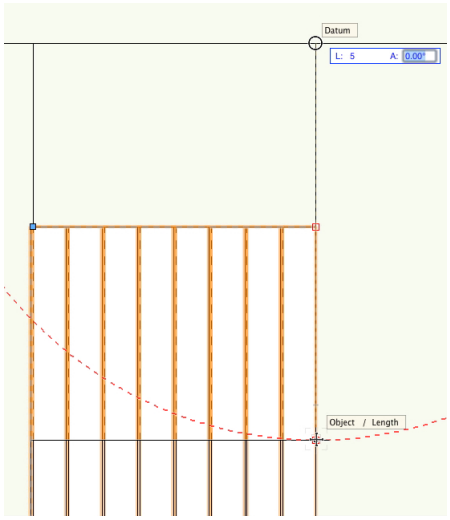
6. With the duplicated simple stair object selected, change the **Width** to 4.5 in the Object Info palette.

7. Next, click and drag the top right corner of the stairs until the cursor intersects the right edge of the tapered face and the top of the concrete base.

8. While still holding down the left mouse button, press the G key to place a floating datum. Then press Tab to activate the Floating Data bar. You can now release the mouse button.



9. Enter 5 for the **Length (L)** field, press Tab, and then move the down vertically, until you intersect the length constraint represented by the dashed red circle. When the SmartCursor Cue “Object / Length” is displayed, click once to move the stairs.



10. Switch to a left isometric view to confirm the placement of the stairs.

We will now added the two stair objects to the concrete base object, using the Add Solids command.

11. Select both of the simple stair objects and the concrete base (generic solid) by holding the Shift key and clicking on each object.

12. Go to **Model** > **Add Solids**. The stairs and the concrete base are now one solid addition object.

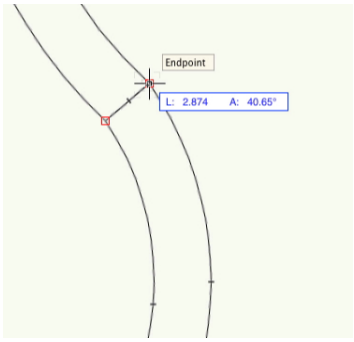
Creating Curved Stairs

Next, we will create a set of curved stairs, between the middle and lower faces of the concrete base.

1. Switch to a Top/Plan view.

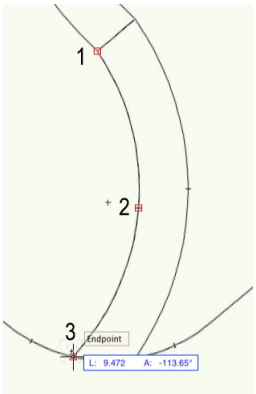
2. Activate the **Line** tool in the Basic palette.

3. Now trace the segment line of the curved face. Click once at the intersection of the segment line and the left edge. Then click once more at the intersection of the segment and the right edge.

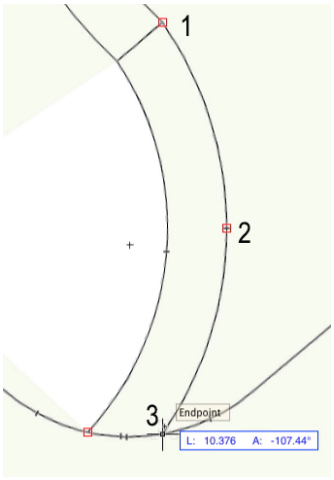


4. Switch to the **Arc** tool in the Basic palette. Enable the 2nd mode, **Three Points** mode.

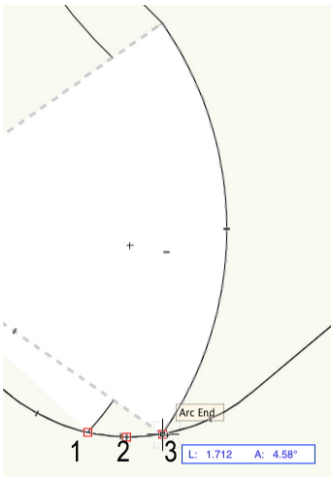
5. Click once on the start point the line we just drew. Then, move the cursor down along the curve. When the SmartCursor Cue “Midpoint” is displayed, click again. Continue to move down along the curve, and click a final time at the end of the curve.



6. Repeat this process for the curve on the right.



7. Using the same technique, draw one more arc connecting the bottom of the two arcs we just drew.



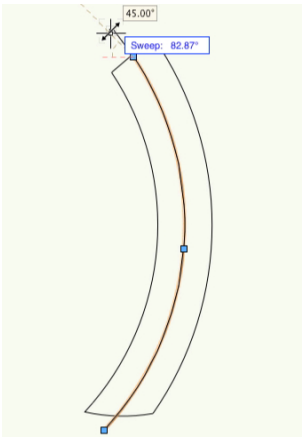
8. Select the three arcs and in the Attributes palette, set the Fill to **None**. You may need to use the B key to select the arc on the left.

9. Now, to make these objects easier to work with, click on the **Classes** button in the View bar and set the Concrete Base class to invisible and click **OK**.

10. Select the arc on the left, activate the **Offset** tool in the Basic palette, enable the **Offset by Distance** and **Duplicate and Offset** modes, and set the **Distance** to 1.43.

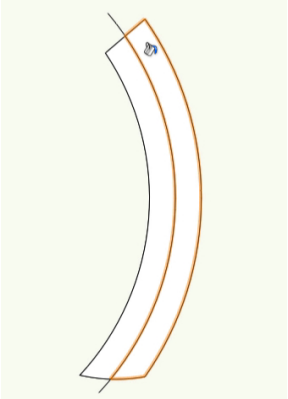
11. Click once to the right of the arc on the left, to create an offset duplicate.

12. If the offset arc does not extend past the top line and bottom arc, switch the **Selection** tool, select the arc, click and drag the top and bottom arc end blue control handles to increase the sweep of the arc.



13. Next, activate the **Polygon** tool in the Basic palette. Enable the **Inner Boundary** mode in the Tool bar.

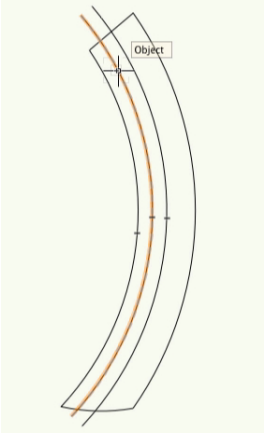
14. Click once in between the arc on the left and the offset arc. Then click once in between the offset arc and the arc on the right.



15. Select both of the polylines, we just created, go to **Edit** > **Cut**. This will remove the polylines temporarily.

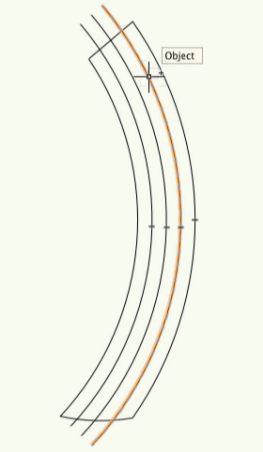
16. Activate the **Offset** tool again and set the **Distance** to 0.715. Hold down the Alt key (Windows) or command key (Macintosh) and click the arc in the center.

17. Click once to the left of the selected arc.



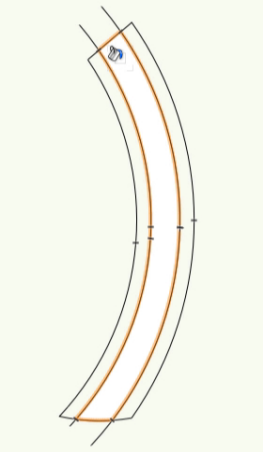
18. Hold down the Alt key (Windows) or command key (Macintosh) again to select the arc in the center again.

19. Click once to the right of the selected arc.



20. Now, switch to the **Selection** tool, select the arc in the center and press the Delete key to remove it.

21. Activate the **Polygon** tool in the Basic palette, with the I**nner Boundary** mode still enabled, click once in between the arcs we just created.

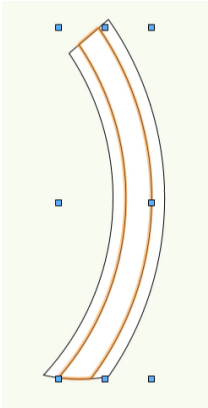


22. With only the newly created filled polyline selected, go to **Edit** > **Invert Selection**. This will select all other visible objects. Press the Delete key to removed these objects. Only the filled polyline should be be left.

23. Next, go to **Edit** > **Paste in Place**. This will paste the two filled polylines we used the Cut command to remove earlier. They will be placed the same location they were previously.

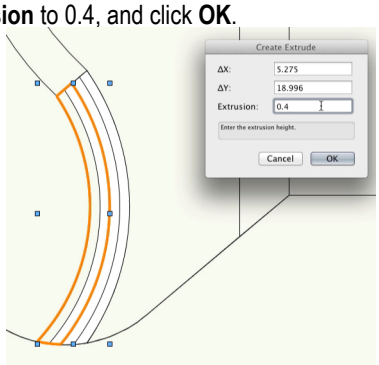
24. Press and hold the B key to activate the **X-Ray Select** mode. Select the polyline that is underneath the two polylines we just placed.

25. Go to **Modify** > **Send** > **Send to Front.**



26. Set the Concrete base class to visible, by going to the **Classes** button in the View bar, switching the Concrete base class to **Visible** in the Visibility column, and clicking **OK**.

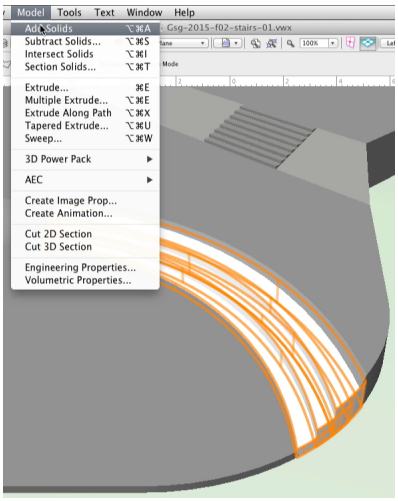
27. Now, select only the left polyline, go to **Model** > **Extrude**, set the **Extrusion** to 0.4, and click **OK**.



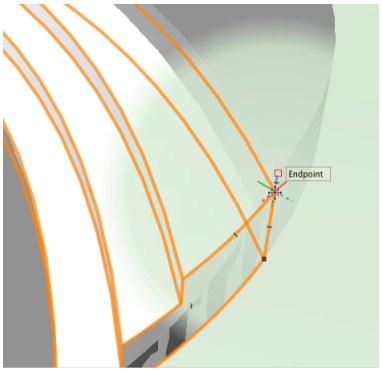
28. Select the middle polyline, go to **Model** > **Extrude**, set the **Extrusion** to 0.8, and Click **OK**.

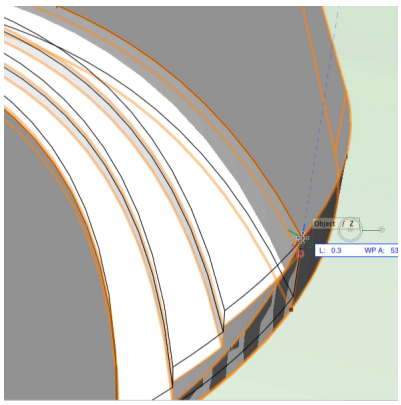
29. Finally, select the right polyline, go to **Model** > **Extrude**, set the **Extrusion** to 1.2, and Click **OK**.

30. Switch to a Left Isometric view, select all three extrudes, and go to **Model** > **Add Solids**.



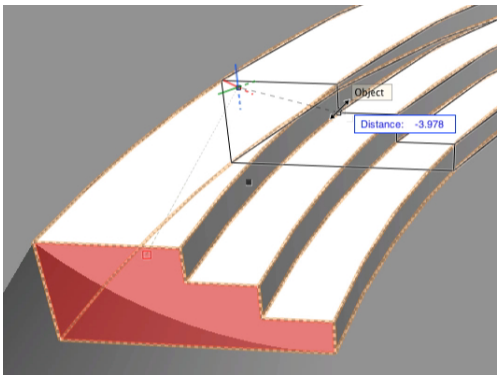
31. Press and hold the B key to activate the **X-Ray Select** mode. Click and drag the top right corner of the stairs so that it intersects with the top edge of the curved face, the SmartCursor Cue “Object / Z” will be displayed.





32. Switch to a Left Rear Isometric view, activate the **Push/Pull** tool in the 3D Modeling tool set, and enable the 2nd mode, **Move Face** mode.

33. Move your cursor over the left face of the stairs, the face will highlight in red. Click once and move the face inward. When the Floating Data bar shows approximately -4, click once to complete the action.



34. With the stairs still selected, in the Object Info palette, set the Class drop down menu to **Stairs**.

35. Finally, set the Fill Color to the same Gray 30% as the concrete base in the Attributes palette.

Rails

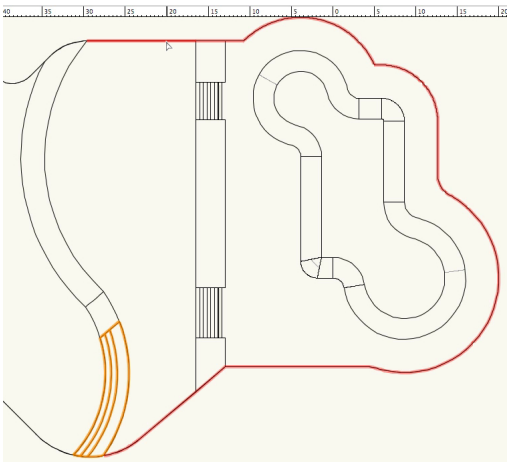
Creating a Concrete Rail

In this section we will use the Extract tool to create a 3D path for a concrete rail. Then, we will create a profile object and use the Extrude Along Path command to create the rail.

1. Let’s start by creating a rails class. Click on the **Classes** button in the View bar and create a new class named Rails. Make the new Rails class the active class and click **OK**.

2. Switch to a Top/Plan view and activate the **Extract Surface** tool in the 3D Modeling tool set.

3. Enable the **Extract Curve** mode, and select each edge while holding the Shift key as seen in the image below. Once all edges are selected, click the green check mark button in the Tool bar to extract the NURBS curves.



4. The NURBS curves are grouped together. Go to **Modify** > **Ungroup** to ungroup the NURBS curves.

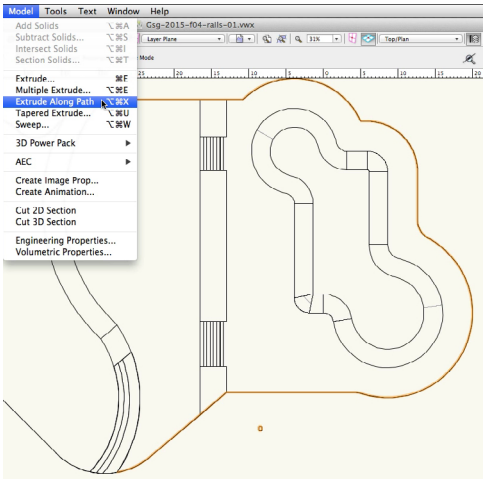
5. With all of the NURBS curves selected, go to **Modify** > **Compose**.

6. Double-click on the **Rectangle** tool in the Basic palette.

7. Set the **Width** to 0.4 and the **Height** to 0.6. Make sure **Position at Next Click** is checked, and click **OK**.

8. Click in a blank area to place the rectangle.

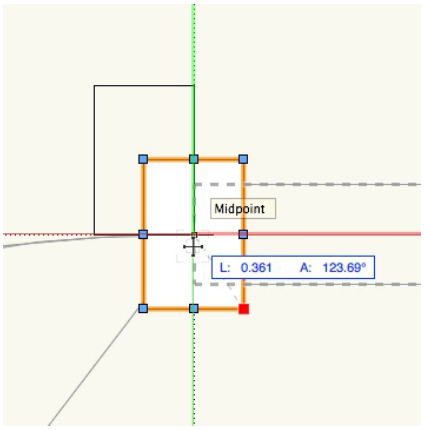
9. Select both the rectangle and the NURBS curve, go to **Model > Extrude Along Path**.



10. Use the arrows to set the NURBS curve as the path object, check the **Lock Profile Plane** option and click **OK**.

11. Double-click on the concrete rail (extrude along path) object, select to edit the Profile and click **OK**.

12. Move the rectangle so that the bottom right corner is at X and Y equal 0. Click **Profile Exit** in the top right corner of the screen.

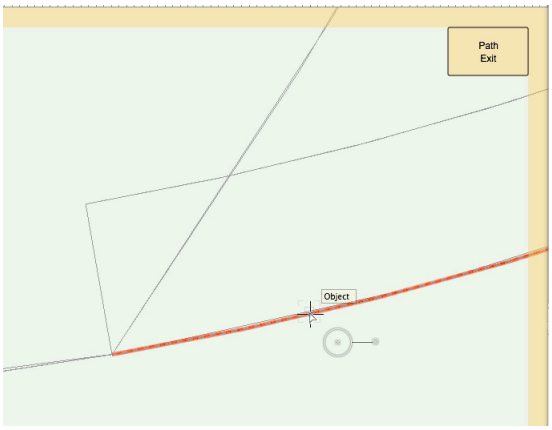


Note: Depending on the curve you created, you may find that the extrude along path object, hangs over the edge of the slope. If this is the case, follow the steps below to adjust the length of the path.

13. Double-click on the extrude along path object, select to edit the Path and click **OK**.

14. Activate the **Trim** tool in the Basic palette and enable the 1st mode, **Point Split** mode.

15. Click along the path to split the NURBS curve.



16. Switch to the **Selection** tool, select only the end segment and press delete.

17. Click **Path Exit**.

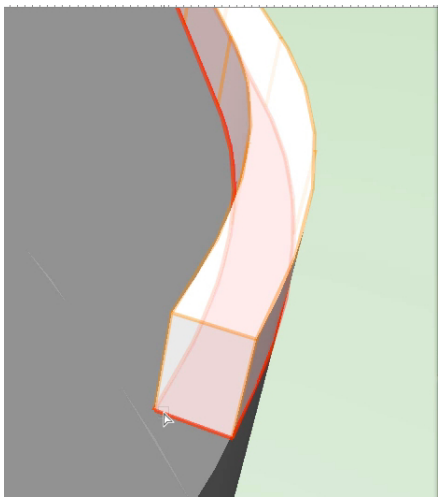
Now, let's use the Taper Face tool to reshape the ends of the rail. The ends of the concrete rail come to an abrupt end, we will taper the ends for a better look.

18. Switch to a Left Isometric view and zoom in on the right end of the extrude along path.

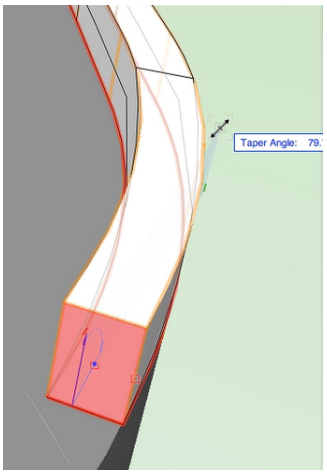
19. Activate the **Taper Face** tool in the 3D Modeling tool set and enable the 1st mode, **Tangent Face** mode.

We need to use the bottom face of the concrete rail (extrude along path) object, as the reference face for the taper.

20. Position the cursor over the end of the concrete rail (extrude along path) object. To select the sub face, hold the Alt key (Windows) or Option key (Macinstosh). When the bottom surface of the concrete rail highlights in red, click once to set the reference plane.



21. Now set the taper face to the end face of the concrete rail. Move the to the right and set the **Taper Angle** to about 80º.



22. Repeat this action for the other end of the concrete rail.

Creating Handrails

We will create 3D handrails for the steps and slopes of the skatepark. Using the plane options in Vectorworks we will create base 2D objects and then use the Extrude Along Path and Extrude commands to convert these objects to 3D.

1. First, we need to change the projection setting. We are going to create 2D objects in a 3D view. This can be easier in an orthogonal projection. Go to **View** > **Projection** > **Orthogonal**.

2. Before we draw the path for the rail, we need to change the plane setting. In the View bar, select **Screen** from the Plane menu. This will draw 2D objects flat on the screen no matter what view is set.

3. Now, switch to a Font view.

4. Set the Rails class to Invisible and make the None class the active class.

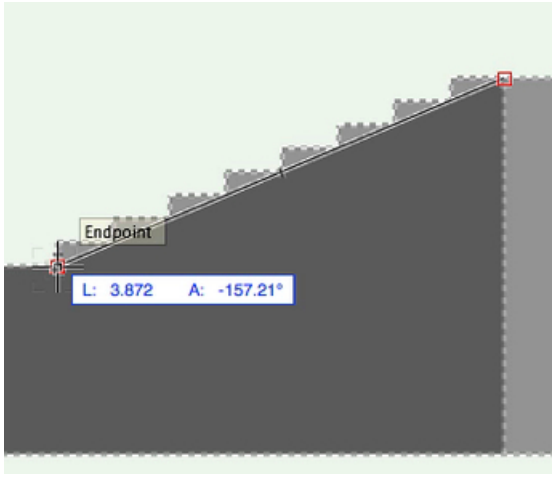
5. Zoom in on the stairs on the tapered face.

6. Next, let's draw the path for the rail. Activate the **Line** tool in the Basic palette. Enable the **Unconstrained** and **Vertex** modes in the Tool bar.

We are going to trace the tapered face below the stairs. Place the cursor at the top step, where the top tread intersects with the upper level of the concrete base.

7. Click once to start the polygon. Move the cursor down and to the left along the tapered face.

8. Click once more at the intersection of the bottom step and the concrete base, to complete the line.

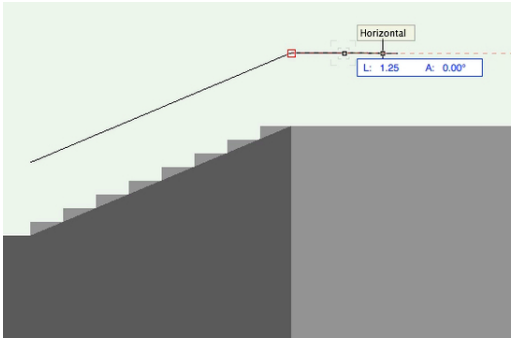


9. Now we need to move the line up. With the object selected, in the **Y** field in the Object Info palette, simply type + 1 to the right of the current value and press Enter or Return.

In most numerical fields, you can perform arithmetic. Vectorworks will calculate the values automatically.

10. Next, let's extend the rail at top of the stairs. With the **Line** tool still active, click once at the top endpoint of the line we just moved.

11. Move the cursor to the right, press the Tab key to enter the Floating Data bar, set the **Length (L)** to 1.25 and press Enter or Return twice to complete the operation.



12. Select both line objects and go to **Modify** > **Compose**.You now have your path (polygon) object.

13. Let's use the **Rectangle** tool in the Basic palette to create a profile object for the railing. Double-click on the **Rectangle** tool and set the **Width** and **Height** to 0.1 and click **OK**.

14. Click once below the path object to place the profile (rectangle).

Before using the Extrude Along Path command to create the 3D rail, we need to change the plane of the path (polygon) object.

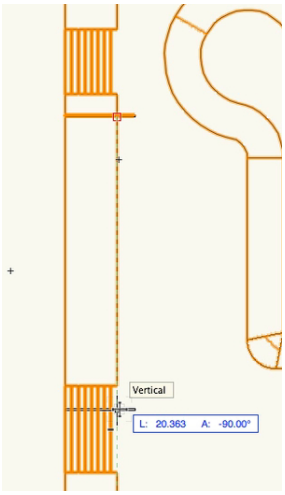
15. In the Object Info palette, change the Plane to **Layer**. This will project the object onto a 3D plane that is aligned with our current Front view.

16. Select the both the path object and the profile object and go to **Model** > **Extrude Along Path**.

17. Use the **Next** and **Previous** buttons to make sure the path object is highlighted in red. Make sure both **Lock Profile Plane** and **Fix Profile** are unchecked, and click **OK**.

18. Now, switch to a Top/Plan view. You will see the rail (extrude along path) object is not in the correct position.

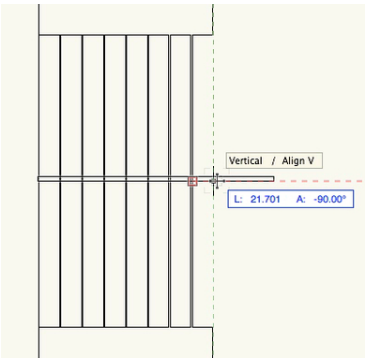
19. Click and drag the rail down over the stairs. As you move the rail down, you will see a dotted green extension line appear and the "Vertical" SmartCursor cue will be visible. Use this line to maintain the X coordinate of the rail.



20. Move the cursor over the midpoint of the top step. After a few seconds a red box will appear indicating that a smart point has been set.

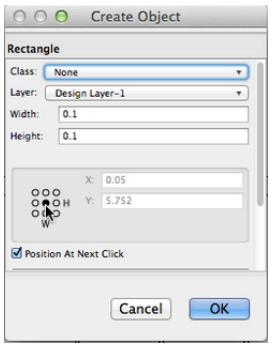
21. Move the cursor to right along the horizontal dotted red extension line until you intersect the vertical dotted green extension line. When SmartCursor Cue "Vertical / Align V" is displayed, release the mouse button to place the rail.

Note: The Smart Point used to align the rail in the section is controlled by the Smart Points Snap option. This and all other Snapping options are controlled through the Snapping palette. If this Snap option is disabled, you will not be able to set a Smart Point. Also, if you do not see the extension lines mentioned in the steps above, go to tools > SmartCursor Settings and ensure that both Horizontal/Vertical Extensions and extension lines are enabled for the Smart Points.



22. Now we will create posts for the rail. Using the Extrude command and snapping functions, we will create and place the posts along the rail.

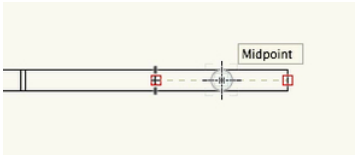
23. First, we will the base shape for the posts. Double-click on the **Rectangle** tool. In the Object Settings dialog, set the control point mode to the center point and click **OK**.



24. Place the cursor over the midpoint of the right end of the rail. After a few seconds a red box will appear, indicating that a Smart Point has been set.

25. Move the cursor to the left, a marker will appear indicating the center of the upper segment of the rail. The SmartCursor Cue "Center" will display. After a few seconds a second Smart Point will appear.

26. Move the cursor back to the right, a marker indicating the midpoint between the two Smart Points will appear. Place the cursor over this point, when the SmartCursor Cue "Midpoint" is displayed, click once to place the rectangle.

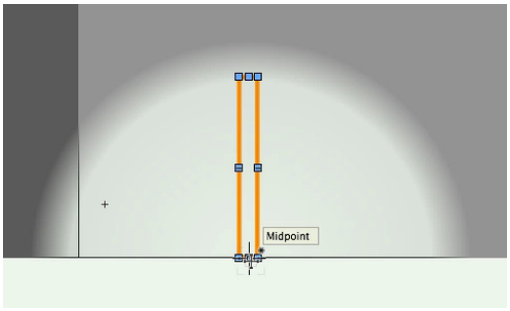


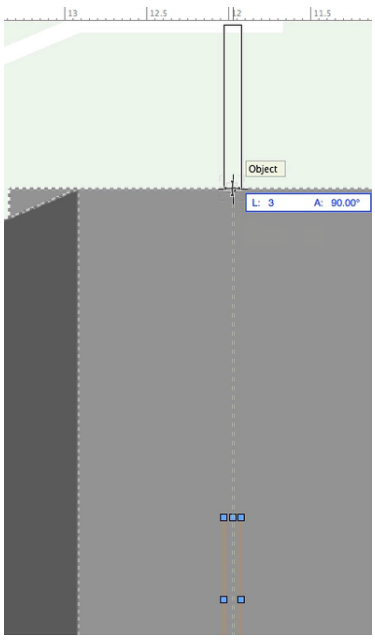
27. Now let's extrude the rectangle. With the rectangle selected, go to **Model** > **Extrude**.

28. Set the **Extrusion** to 1 and click **OK**.

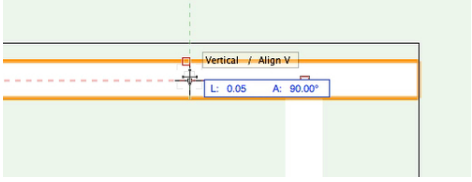
29. Switch to a Front view. You will see the extrude is below the surface of the concrete base.

30. Press the B key to activate the **X-Ray Select** mode. Click and drag the bottom of the extrude and snap it to the top of the concrete base.

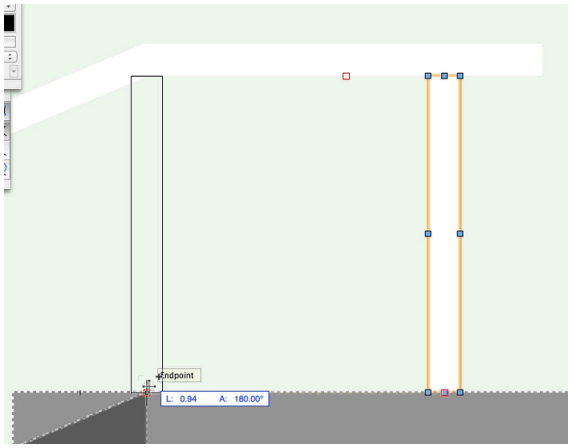




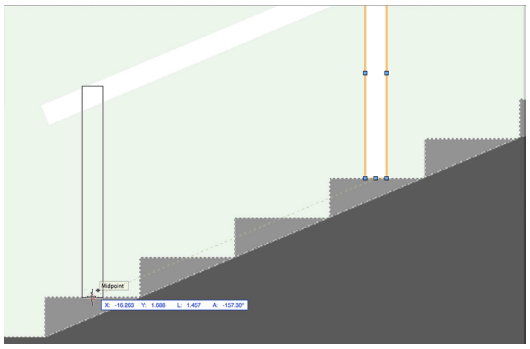
31. The post (extrude) extends slightly inside the rail. Click and drag the rail upward and snap the bottom of the rail to the top of the post.



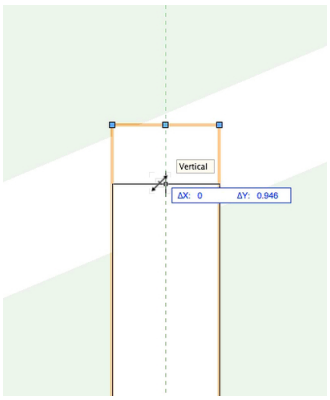
32. Move and duplicate the post, so that the midpoint of the base of the duplicated post intersects the start of the first step. Hold down the Alt key (Windows) or Option key (Macintosh) to duplicate the post while moving it.



33. Place two more duplicates on the fourth step down and the last step. Snap the base of the posts to the midpoint of the top of the steps.



34. We need to shorten the two posts on the stairs. Select one of the posts on the stairs. Place the cursor over the top middle blue control handle, and click once and move the cursor down vertically until the top of the post is completely within the rail. Click once more to move the control point and adjust the height of the post.



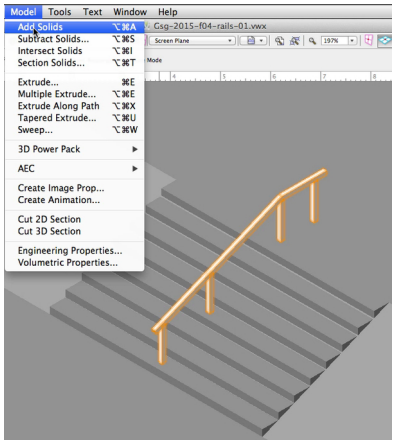
35. Repeat this action for the other post on the stairs.

Next, we will use the Add Solids command to combine the rail and the posts into a single object and then apply a fill color through the Attributes palette.

36. First, switch to a Left Isometric view.

37. Select the four posts and the rail.

38. Go to **Model** > **Add Solids.**



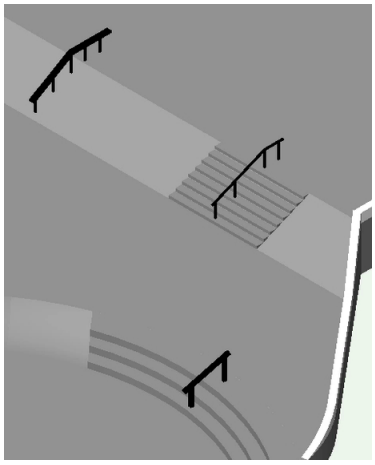
39. With the rail (solid addition) selected, in the Attributes palette, set the Fill Color to black.

40. Now, let's place the completed rail in the Rails class. With the rail selected, in the Object Info palette, click on the Class menu, and choose **Rails**.

You will notice that the rail disappeared. This is because the rails class is currently set to Invisible.

41. Click on the **Classes** button in the View bar, set the Rails class to Visible, and click **OK**.

Note: You can use the same workflow to create other rails in the file. If you would like to, use the techniques described above to create two more rails. One in the center of the tapered face and the other on the curved stairs.



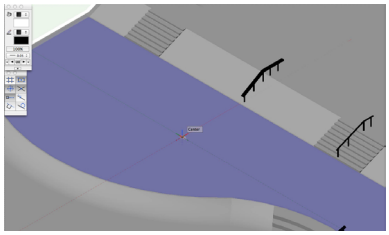
Creating a Long Rail

We will create a long rail using the Extrude command and the Push/Pull tool. Also, we will use the Automatic Working Plane feature to quickly draw the objects in a 3D view.

1. Make sure you are in a Left Isometric view. Then, activate the **Rectangle** tool in the Basic palette and enable the1st mode, **Corner to Corner** mode.

2. Switch the plane mode back to **Automatic** in the Plane menu in the View bar. This will allow us to draw directly on the plane of the concrete base.

3. Click in the center of the middle level of the concrete base, to start the rectangle.



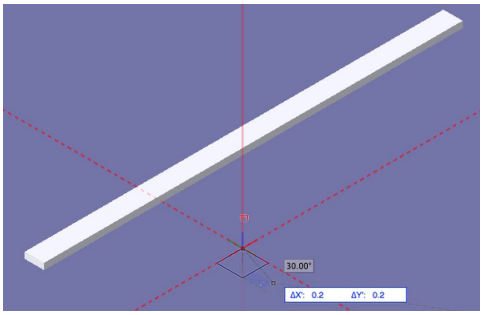
4. Tab into the Floating Data bar, set the **Delta X (ΔX)** to 3.25 and the **Delta Y (ΔY)** to 0.15, press Enter or Return twice to place the rectangle.

5. With the rectangle selected, go to Model > Extrude, set the **Extrusion** to 0.05, and click **OK**.

6. In the Object Info palette, set the **Bot Z** to 2. This extrude will be the top of the long rail.

Using the Automatic Working Plane feature, along with the Subtract Solids command, we will create a base for the long rail.

7. Activate the **Rectangle** tool again and click middle level of the concrete base to start drawing another rectangle. In the Floating Data bar enter 0.2 for the **Delta X (ΔX)** and the **Delta Y (ΔY)**. Press Enter or Return twice to place the rectangle.



8. With the rectangle selected, go to **Model** > **Extrude**, set the **Extrusion** to 0.05, and press **OK**. This extrude will become the base for the rail posts.

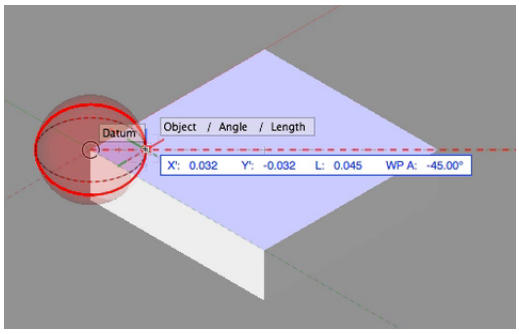
Next, we will use the Circle tool and the Subtract Solids command to create bolt holes in the base.

9. Activate the **Circle** tool in the Basic palette and enable the 1st mode, **Radius** mode.

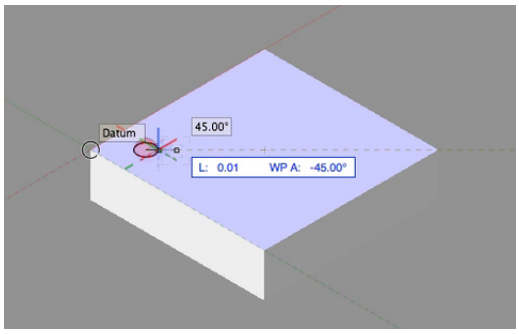
10. Place the cursor on the left corner of the base (extrude), make sure the top surface of the base is highlighted in blue, and press the G key to place a datum

11. Tab into the Floating Data bar. Set the **Length (L)** to 0.045 and the **Working Plane Angle (WP A)** to -45º. Press Enter or Return and move the cursor to the right.

12. When the SmartCursor Cue "Object / Angle / Length" is displayed, click once to start the circle.

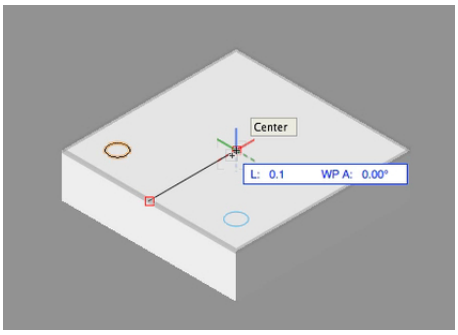


13. Tab into the Floating Data bar, set the **Length (L)** to 0.01 and press Enter or Return twice to place the circle.

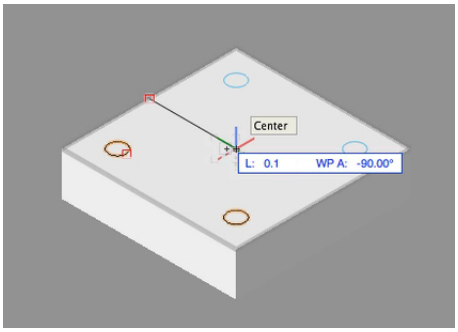


14. With the circle selected, activate the **Mirror** tool in the Basic palette. Enable the 2nd mode, **Duplicate** mode.

15. We need to draw a mirror Line across the base. Click once at the midpoint of the bottom left edge of the base. Move the cursor across the base object, a preview of the duplicate circle will appear. Make sure the **Working Plane Angle (WP A)** shows 0.00 and click once more to mirror and duplicate the circle.



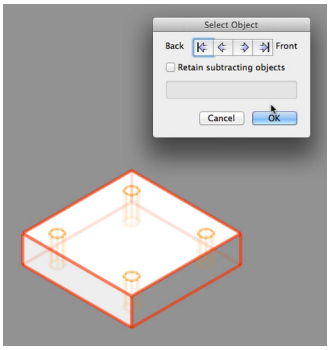
16. Select both circles and repeat the mirror process, by clicking once at the midpoint of the top left edge and moving the mouse across the base. The **Working Plane Angle (WP A)** will show -90º.



17. Now we will use these circles subtract holes from the base. Select all of the circles, go to **Modify** > **Extrude**, and set the **Extrusion** to -0.05.

18. Now we will use these circles to subtract holes from the base. Select all of the circles, go to **Model** > **Extrude**, and set the **Extrusion** to -0.05.

19. Hold Shift and select the base to add it to the selection. The four circular extrudes and the base should be selected. Go to **Model** > **Subtract Solids**.

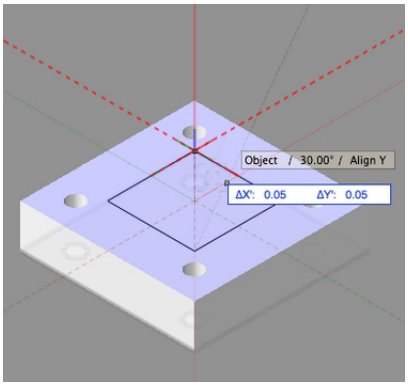


Next, we will continue to use the Automatic Working Plane and

use the Automatic Push/Pull feature to create an extrude for the post.

20. Activate the **Rectangle** tool in the Basic palette, enable the 2nd mode, **Center to Corner** mode, click once on the top center of the base.

21. Tab into the Floating Data bar, set the **Delta X (ΔX)** and the **Delta Y (ΔY)** to 0.05. Press Enter or Return twice to place the rectangle.



22. Without clicking, move the cursor over the rectangle, it will highlight in red. The Red highlight indicates that the Automatic Push/Pull mode is activate.

23. Click once and move the cursor up. Tab into the Floating Data bar and enter 0.45 for the **Distance**. Press Enter or Return twice to extrude the rectangle.

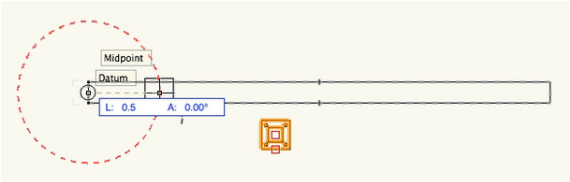
24. Zoom out to see the whole object.

25. Select both the base and the post (extrude), go to **Model** > **Add Solids**.

26. Switch to a Top/Plan view.

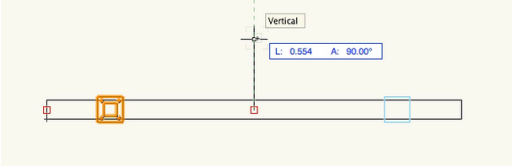
27. Click and drag the center of the post to the midpoint of the left side of the rail. While still holding the mouse button, press the G key to place a datum.

28. Press Tab to enter the Floating Data bar. You can now release the mouse button. Enter 0.5 for the **Length (L)**. Press Enter or Return twice to place the post.

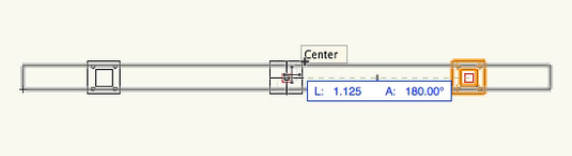


29. Now let's place two duplicates of the post. With the post still selected, activate the **Mirror** tool in the Basic palette and make sure **Duplicate** mode is enabled.

30. Move your cursor to the center of the rail. When the SmartCursor Cue "Center" is displayed, click once and move the cursor up vertically. Click once to mirror and duplicate the post.



31. Click and drag the center point of the new post to the center of the rail. Press and hold the Alt key (Windows) or Option key (Macintosh), then release the mouse button to place a duplicate post.



Creating a Symbol

For the long rail, we need to apply a separate fill color to the rail and the posts. So we will not combine the objects into a single object using the Add Solid command. Instead we will use the Create Symbol command to group the objects in a symbol resource.

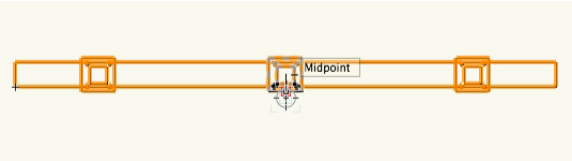
1. First, select rail and set the Fill Color to Black in the Attributes palette.

2. Now, select the rail and the three posts.

3. Go to **Modify** > **Create Symbol**

4. In the Create Symbol dialog, name the symbol Long Rail, choose **Next Mouse Click** under **Insertion Point**, and click **OK**.

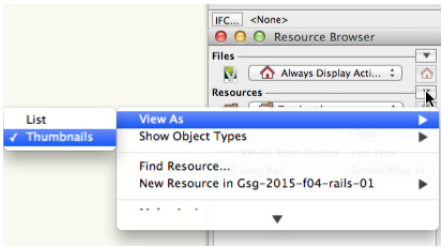
5. Click on the bottom midpoint of the center post to set the insertion point. The insertion point controls how the geometry will appear in relation to the mouse click.



6. In the Create Symbol dialog, click **OK** to save the symbol in this file.

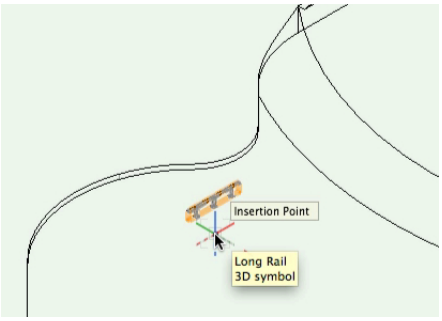
Note: The long rail is now saved as symbol resource. It can be accessed through the Resource Browser and placed multiple times.

7. In the Resource Browser, click the Home icon once to confirm you are looking at resources in the active document. Open the Resources menu under the Home icon and set the **View As** option to **Thumbnails**.



8. Scroll down in the Resource Display window and locate the Long Rail symbol, in the Symbols/Plug-In Objects section.

9. Place another instance of this symbol on the left side of the lower level of the skatepark.



10. Finally, select both of the long rail symbols and change their class to Rails, in the Object Info palette.

Creating a Curved rail

In this section, we will use the Extrude Along Path command to quickly create another rail. Then we will use the Deform tool, to reshape the object to create an S shaped curved rail.

1. Switch to a Font view.

2. Activate the **Circle** tool in the Basic palette.

3. Click once in the drawing area to start the circle and move the cursor to the right.

4. Tab into the Floating Databar, enter 0.1 for the **Length (L)**, and press Enter or Return twice to create the circle.

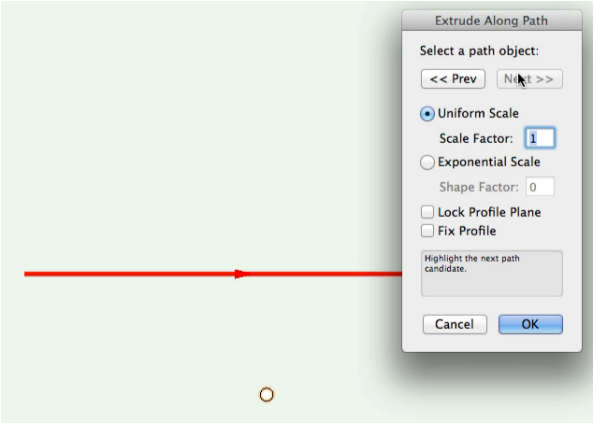
5. Next, switch to **Screen Plane** in the Plane menu in the View bar.

6. Activate the **Line** tool in the Basic palette.

7. Click once in the drawing area to start the line and move the cursor to the right.

8. Tab into the Floating Data bar, enter 6.5 for the **Length (L)**. When the SmartCursor cue "Horizontal" is displayed press Enter or Return twice to complete the Line.

9. Select both the circle and the line, go to **Model** > **Extrude Along Path**, using the **Previous** and **Next** buttons, make sure the Line is highlighted in red, and click **OK**.



Note: The rail (extrude along path) object will be place on the default Layer Plane. This is because the path object was created on screen plane.

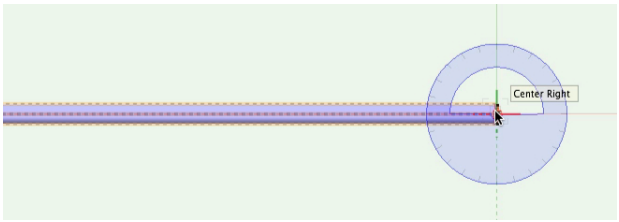
10. Using the **Selection** tool, click and drag the rail so that it is positioned above the concrete base of the skatepark.

11. Activate the **Deform** tool in the 3D Modeling tool set.

12. We want to bend a portion of this rail, so we need to enable the **Bend Solid** and **Finite Length** modes in the Tool bar. This will allow us to set the length of the bend spine.

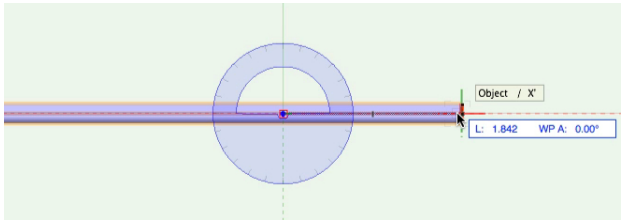
13. Move the cursor over the rail, the ends will highlight in red. Click once to select the object.

14. Move the cursor over the midpoint of the right end of the rail. Wait a few seconds to acquire a Smart Point.

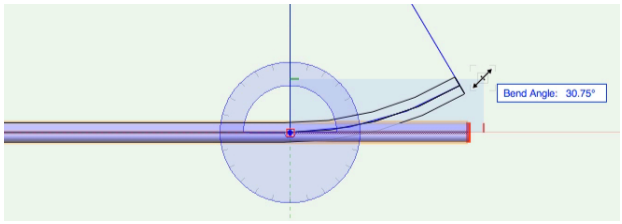


15. Move the cursor to the left along the horizontal extension line about a quarter of the way across the rail. Click Once.

16. Then move the cursor back to the right end of the rail. Click one more time to set the length of the bend spine.

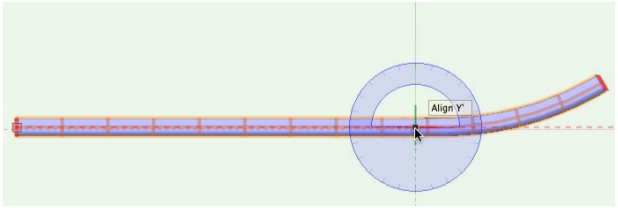


17. Move the cursor up. You will see a preview of the bend. When the **Bend Angle** is about 30º, click one more time to complete the operation.

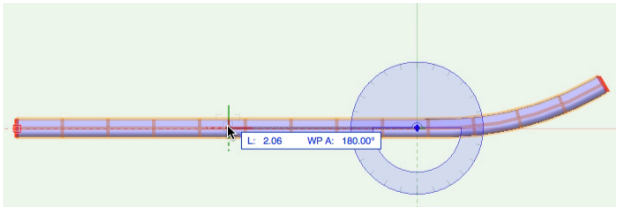


18. Now, with the **Deform** tool still active, click on the rail, and then acquire a Smart Point at the midpoint of the left end of the rail.

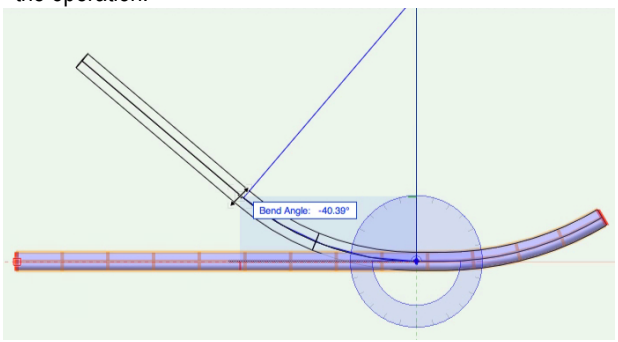
19. Move the cursor to the right along the horizontal extension line until it is slightly to the left of the start of the first bend.



20. Click once and move the cursor to the left about halfway to the left end.

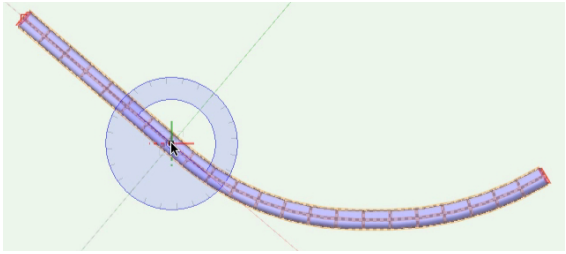


21. Click again to set the Bend Spine Length, move the cursor up until the **Bend Angle** is about -40º, and click once to complete the operation.

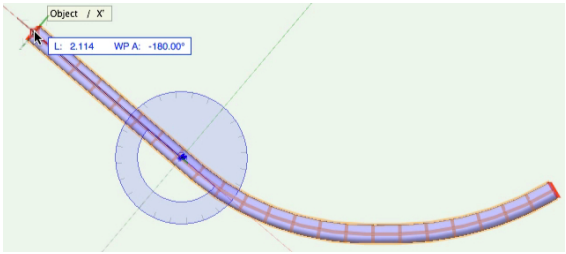


22. Finally, let's bend the left end of the rail down. With the Deform tool still active, click once on the rail.

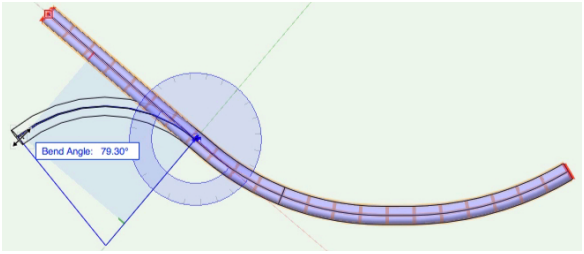
23. Move the cursor about three quarters across the remaining straight segment of the rail, click once.



24. Move the cursor back to the left and click on the midpoint of the left end of the rail to set the bend spine.



25. Now, move the cursor down until the the **Bend Angle** is about 80º and click once more to complete the operation.



Next, we will now use the Extrude command and the Move By Points tool to create three posts for this rail. Then, we will adjust the height of the posts and combine the objects using the Add Solids command.

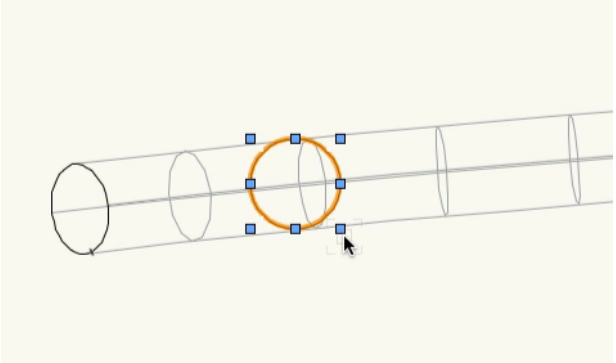
26. Switch to a Top/Plan view.

27. If needed, move the rail overtop of the lower level of the skatepark.

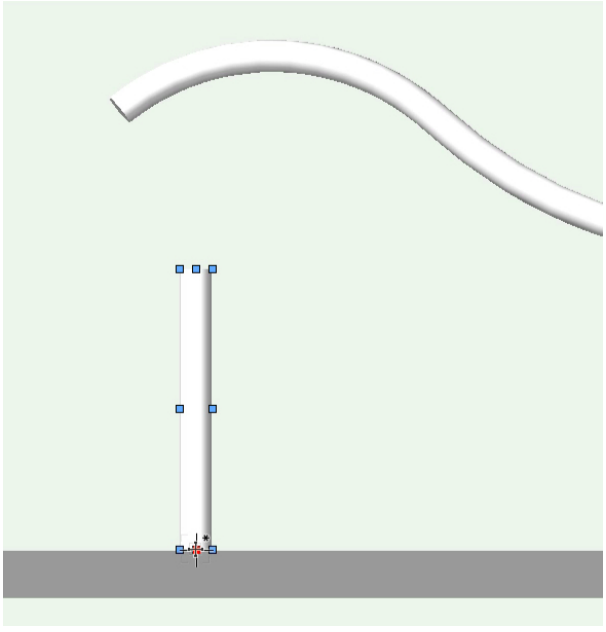
28. Activate the **Circle** tool and draw a circle with a **Length (L)** of 0.1.

29. With the circle selected, extrude the circle by going to **Model** > **Extrude**.

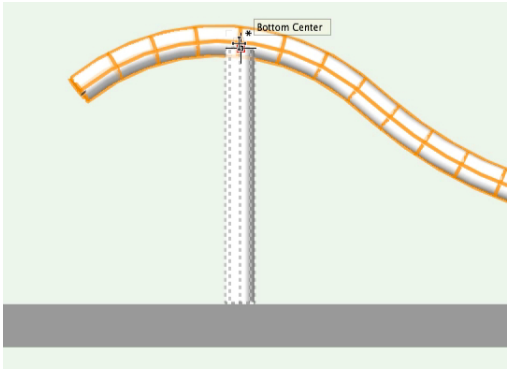
30. Set the **Extrusion** to 1.75 and center the extrude under the rail.



31. Switch to a Front view and move the post (extrude) up so that the bottom of the post is snapped to the concrete base of the skatepark and is below the left curve of the rail.



32. Now drag the rail down by the highest part of the curve and snap to the top of the post. Switch to a Top/Plan view to confirm the post is still under the rail and then switch back to a Front view.



33. With the post still selected, move the middle top, blue control point up, so that the top of the post is inside the rail.

34. Then activate the **Move By Points** tool in the Basic palette.

35. Enable the **Distribute** and **Object Retention** modes in the Tool bar and set the **Number of Duplicates** to 2.

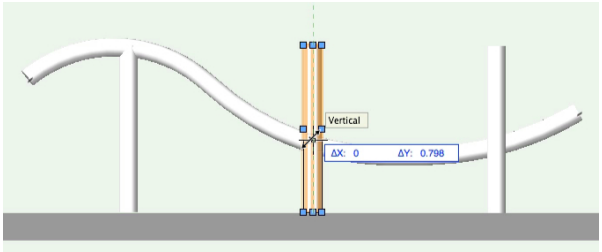
36. Make sure the post is still selected and click once on the center of the base of the post.

37. Move the cursor to the right, until the **Length** field in the Floating Data bar is about 4 and click once to place the duplicates.

38. Now, let's adjust the height of the other posts. Select the middle post.

39. Click the top middle, blue control point of the post and move the cursor down.

40. Once the top of the post is within the rail, click again to adjust the height.



41. Repeat the action for the other post.

42. Switch to a Top/Plan view and confirm that all posts are under the rail. Adjust the position of the posts if needed.

43. Select the rail and the three posts, go to **Model** > **Add Solids**

to combine the objects into one solid addition.

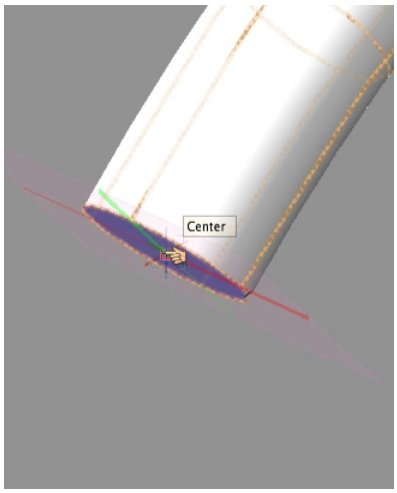
Finally, using the Set Working Plane tool and the Hemisphere tool, we will add rounded ends to the rail.

44. Switch to a Left Isometric view and zoom in on the left end of the rail.

45. Activate the **Set Working Plane** tool in the 3D Modeling tool set.

46. Enable the 2nd mode, **Planar Face** mode.

47. Move the cursor over the end of the rail, it will highlight in blue and the working plane preview will align with that plane.

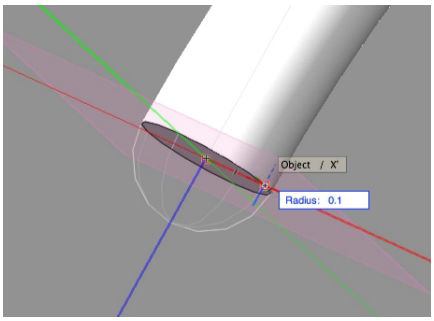


48. Click once to set the working plane.

49. Now, activate the **Hemisphere** tool in the 3D Modeling tool set.

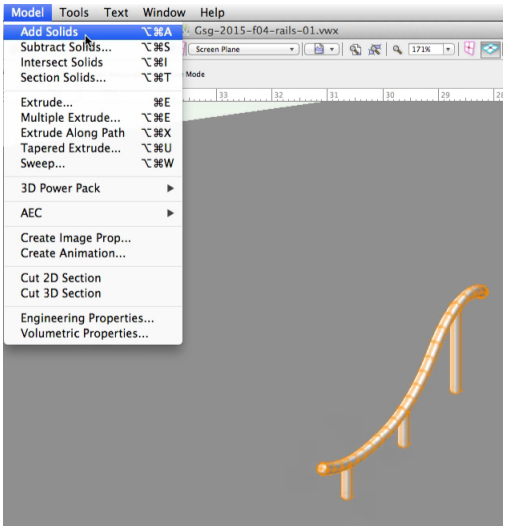
50. Enable the 2nd mode, **Diameter mode**.

51. Click once on the left edge of the rail and then once on the right edge.



52. Repeat this process for the other end of the rail.

53. Next, select the rail and the two Hemispheres and go to **Model** > **Add Solids**.



54. Finally, give the completed rail a Cool Gray 50% fill color from from the Standard Vectorworks color palette through the Attributes palette and change its class to Rails in the Object Info palette.

Planters

Rectangular planters

Using the Rectangle and Offset tools with the Extrude command we will create planter and place them next to the stairs.

1. First, let's create a new class for the planters. Click on the Active Class menu in the View bar and choose **New Class**.

2. Name the class Planters and click **OK**.

3. Make the new planters class the active class by selecting it through the Active Class menu in the View bar.

4. Switch to a Top/Plan view and double-click on the **Rectangle** tool in the Basic palette.

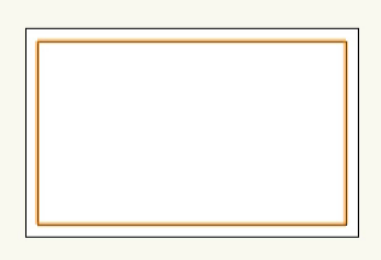
5. Set the **Width** 4 and the **Height** to 2.5. Make sure **Position at Next Click** is checked and click **OK**.

6. Click once in a blank area above the skatepark, to place the rectangle.

7. Activate the **Offset** tool in the Basic palette.

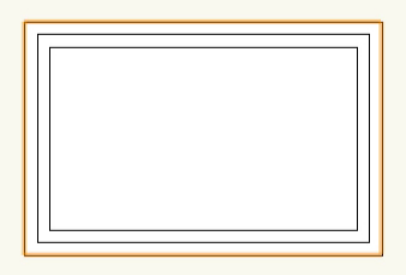
8. In the Tool bar enable the **Offset By Distance** and **Offset and Duplicate** modes, and set the **Distance** to 0.15.

9. Click once on the inside of the rectangle to create an offset duplicate of the rectangle.

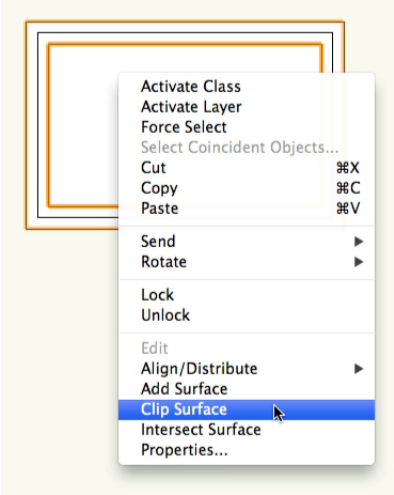


10. With the new rectangle selected, change the **Distance** field to 0.3 in the Tool bar and click on the outside of both rectangles.

11. Go to **Modify** > **Send** > **Send to Back** to move the new rectangle behind the other two.



12. Select the inner and outer rectangles, right click on the inner rectangle, and choose **Clip Surface**. We now have a clipped polyline.



13. The inner rectangle used to clip the outer rectangle will remain selected. We no longer need this rectangle, press the Delete key to remove the inner rectangle.

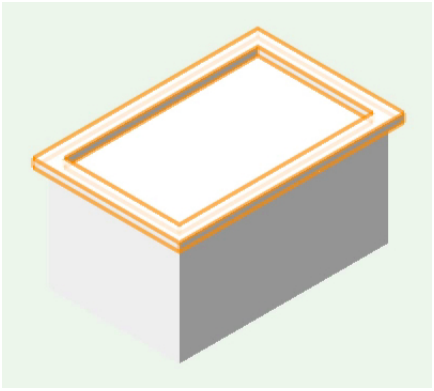
14. Now select the remaining inner rectangle, go to **Model** > **Extrude**, and set the **Extrusion** to 2.

15. With the extrude selected, set the **Bot Z** to 0.15 in the Object Info palette.

16. Now, select the outer clipped polyline. Go to **Model** > **Extrude** and set the **Extrusion** to 0.15.

17. In the Object Info palette, set the **Bot Z** to 3.5.

18. Switch to a Left Isometric view, the planter should look like the image below.

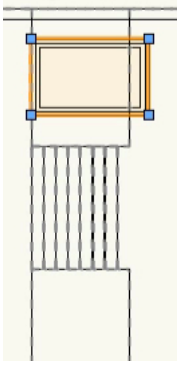


19. Switch back to a Left Isometric view, select the two extrudes, go to **Modify** > **Create Symbol**.

20. Name the symbol Planter Box-1, set the Insertion Point to **Plan Projection Center**, and click **OK**.

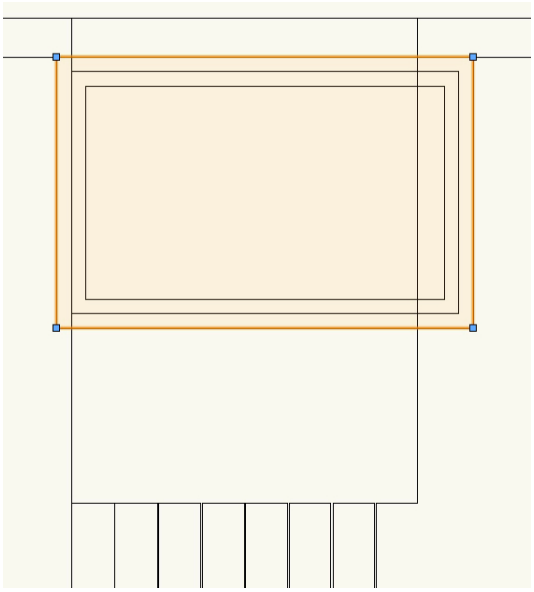
21. Click **OK** again, to accept the destination folder. The symbol will be saved in the active file.

22. Move the Planter Box-1 symbol so that the base aligns with the bottom edge of the tapered face of the concrete base and the top of the planter box aligns with the concrete rail.



Note: In a Top/Plan view the planter Box is represented by three offset rectangles. This middle rectangle is the edge of the

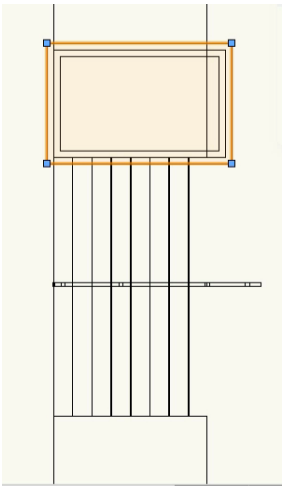
planter's base and the outer rectangle is the edge of the planter's top. When moving the planter Box, use these Snap Points to help align the planter.



23. Now let's place another instance of the Planter Box-1 symbol, on the left side of the stairs on the tapered face.

24. Locate the Planter Box-1 symbol in the Resource Browser. Drag and drop a new instance of the symbol.

25. Using the bottom left corner of the planter's base, move the planter box so that the bottom left corner of the base aligns with the bottom edge of the tapered face and the base of the stairs.



26. Switch to a Left Isometric view to confirm the placement of the planter Box.

Custom planter Box

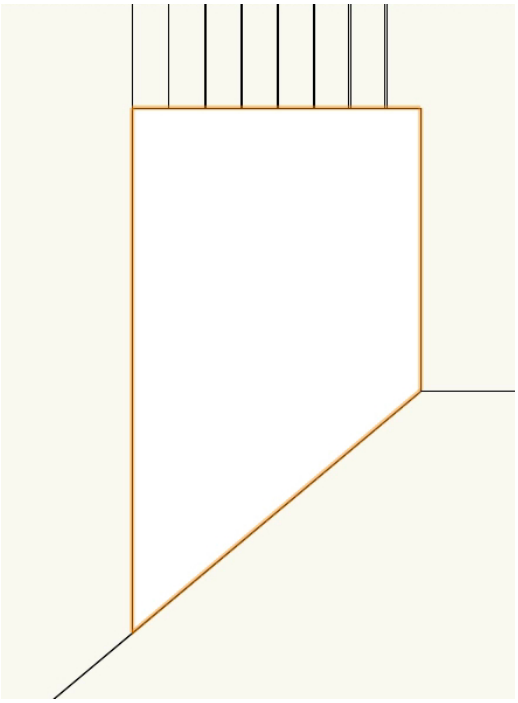
Next, we will create another planter box that matches the edge of the concrete base on the other side of the stairs. We will use the edge of stairs and the concrete base to trace the shape of the custom planter using the Polygon tool.

1. First, switch to a Top/Plan view, set the Rails class to invisible by clicking on the **Classes** button in the View bar, and selecting **Invisible** for the Rails class.

Setting the Rails class to invisible will make it easier to trace the edge of the concrete base.

2. Activate the **Polygon** tool in the Basic palette.

3. With the **Vertex** mode enabled, trace the shape of the custom planter as seen in the image below.



4. Now, set the Rails class back to Visible.

5. With the polygon selected, activate the **Reshape** tool in the Basic palette.

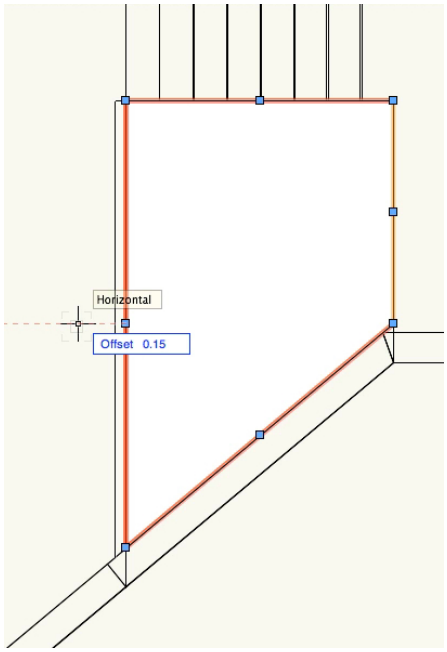
6. Enable the **Move Edges Parallel** mode, in the Tool bar.

7. Click on the middle blue control point of the angled edge.

8. Move up and snap to the inner edge of the concrete rail. Click

once to move the edge.

9. Next, select the middle blue control point of the left edge, move the cursor to the left, tab into the Floating Data bar, and offset the edge by 0.15.



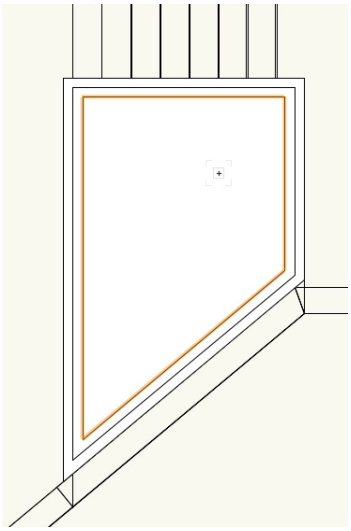
10. Repeat this action for the top edge as well.

11. Activate the **Offset** tool in the Basic palette.

12. In the Tool bar enable the **Offset By Distance** and **Offset and Duplicate** modes, and set the **Distance** to 0.15.

13. Click once on the inside of the polygon to create an offset duplicate of the polygon.

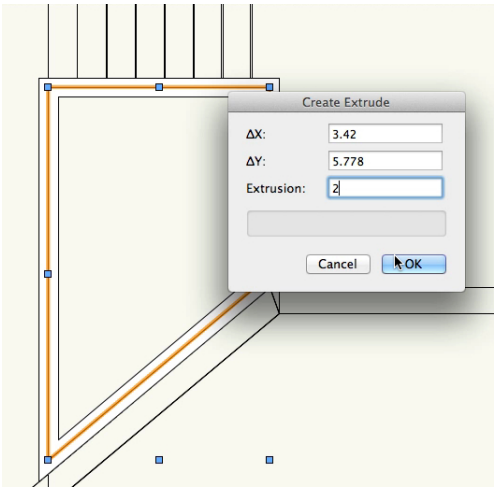
14. Click once again on the inside of the new polygon, to make one more offset duplicate.



15. Select the inner and outer polygons, right click on the inner polygon, and choose **Clip Surface**. We now have a clipped polyline.

16. The inner polygon used to clip the outer polygon will remain selected. We no longer need this object, press the Delete key to remove the inner polygon.

17. Select the remaining polygon object, go to **Model** > **Extrude**, and set the **Extrusion** to 2.

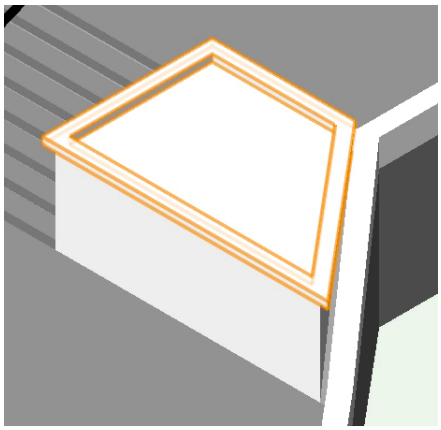


18. In the Object Info palette, set the **Bot Z** to 1.5.

19. Now, select the clipped polyline, go to **Model** > **Extrude**, and set the **Extrusion** to 0.15.

20. Then, set the **Bot Z** to 3.5 in the Object Info palette.

21. Switch to a Left Isometric view to check the shape and position of the custom planter. Then, switch back to a Top/Plan view.



22. Select both of the extrudes and go to the **Modify** > **Create Symbol**.

23. Name the symbol, Planter Box-2, click **OK**, and then **OK** again.

Tapered Planter Box

Now let us create one more planter cox. We will use the Deform tool to give this planter tapered sides.

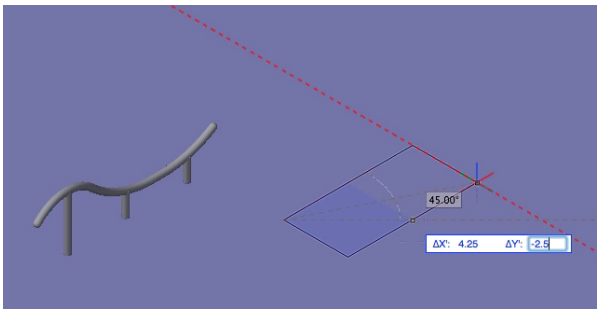
1. Switch to a Left Isometric view.

2. Center the view over the lower level of the skatepark.

3. Activate the **Rectangle** tool and enable the **Corner to Corner** mode.

4. In the View bar, choose **Automatic** from the Plane menu.

5. To the right of the curved rail, draw a rectangle on the top surface of the concrete base. Set the **Delta X (ΔX)** to 4.25 and the **Delta Y (ΔY)** to -2.5.

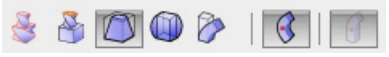


6. Without clicking, move the cursor over the rectangle. The rectangle with highlight in red, indicating the Automatic Push/Pull mode is active.

7. Click once and move your cursor up. Tab into the Floating Data bar and set the **Distance** to 1. Press Enter or Return twice to extrude the rectangle.

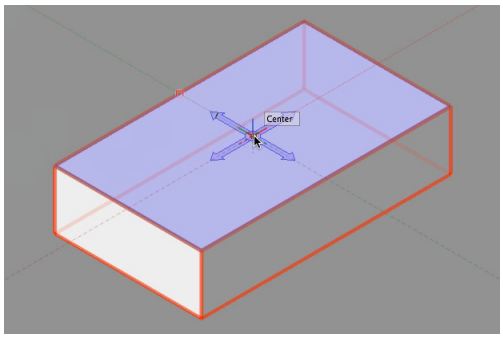
8. Activate the **Deform** tool in the 3D Modeling tool set.

9. Enable the **Taper Solid** and **Symmetric** modes.

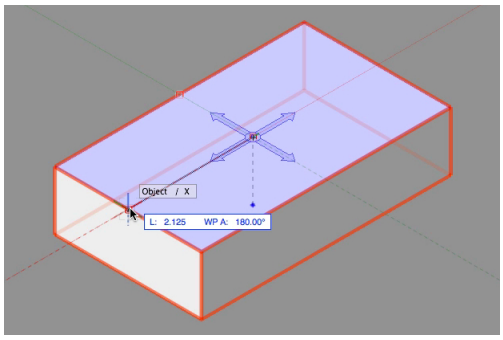


10. Move your cursor over the planter (extrude), it will highlight in red. Click once to select the Extrude.

11. A four-way arrow graphic will be displayed move the arrow to the center of the top surface of the planter. Click once to set the center of the taper.



12. Move the cursor along the red extension line to the edge of the planter. When the SmartCursor Cue “Object / X” is displayed, click once more to set the taper axis.



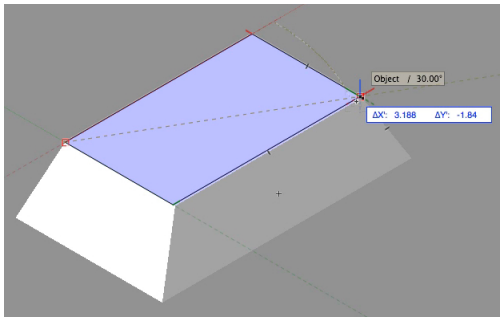
13. Move the cursor back in towards the center of the planter. Tab into the Floating Data bar and set the **Taper Ratio** to 0.75.

14. Press Enter or Return twice the taper the planter.

15. Next, activate the **Rectangle** tool and make sure the **Corner to Corner** mode is enabled.

16. Move the cursor over the top of the planter. When the top of the planter highlights in blue, click once on the top left corner of the planter.

17. Move the cursor to the bottom right corner and click again to place the rectangle.



18. Activate the **Offset** tool, enable the **Offset by Distance** and

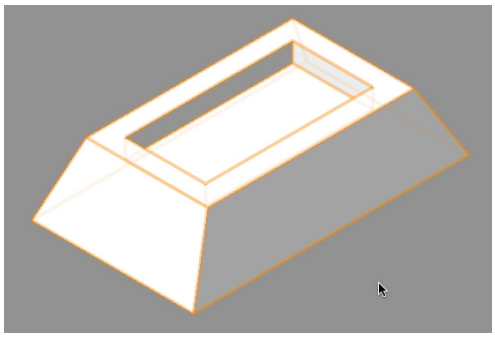
Offset Original Object modes, and set the **Distance** to 0.3.

19. Click once, inside the rectangle we just created, to offset the rectangle.

20. Now, let's use the **Push/Pull** tool in the 3D Modeling tool set to subtract a portion of the Planter. Make sure the 3rd mode, **Sub-Face** mode is enabled.

21. First, click once on the rectangle. Next click on the planter. Now move the cursor over the rectangle, it will highlight in red. Click again to select the face to move.

22. Move your cursor down, Tab into the Floating Data bar, set the **Distance** to -0.3, and press Enter or Return twice to move the face.



Ledge Obstacle

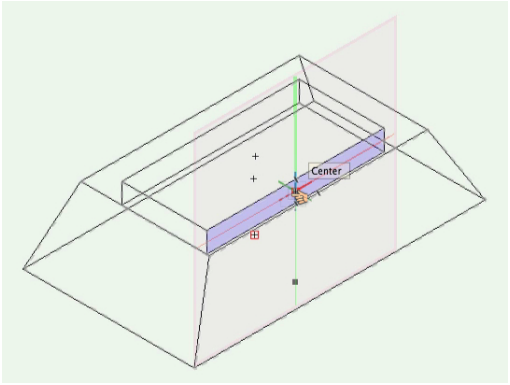
Now we will add a ledge to the tapered planter box, to create a new obstacle. Using the Working Plane tool, we will set a working plane that is perpendicular to the top of the planter. Then we will cut a hole in the planter and place ledge in it.

1. In the View bar, click on the Render menu and choose **Wireframe**. This will allow us to set a working plane on the inner face of the planter.

2. Activate the **Working Plane** tool in the 3D Modeling tool set. Make sure the 2nd mode, Planar Face mode is enabled.

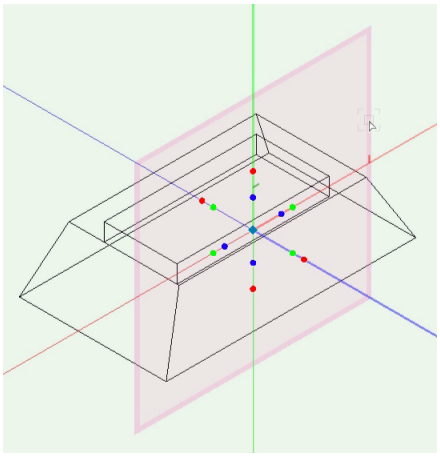
3. Move the cursor over the bottom vertical face of the cut out of the planter.

4. When the face highlights in blue, click once to set the working plane.

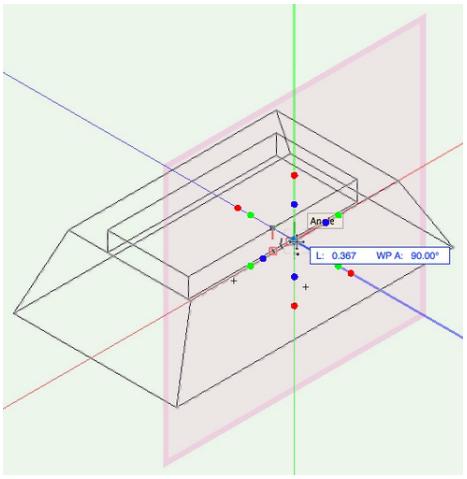


5. Press the X key to activate the **Selection** tool.

6. Click on the outer border of the pink working plane indicator to activate the working plane grips.



7. Click the center grip of the working plane. Move it out until it snaps to the edge of the top face of the planter. Click once to move the working plane. The working plane should now be perpendicular to the edge of the top face of the planter.

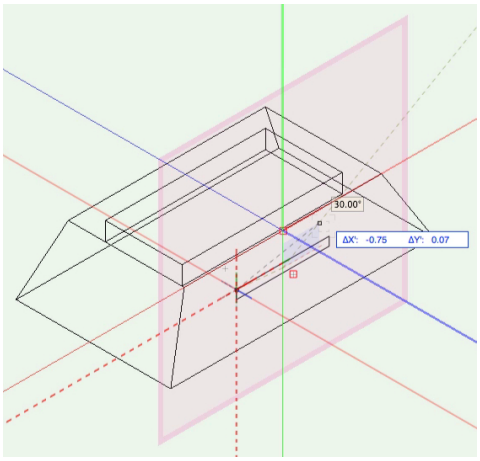


8. Activate the **Rectangle** tool and enable the **Center to Corner**

mode.

9. Move the cursor over on the set working plane. Snap to the center of the tapered face. When the SmartCursor Cue “Center “is displayed, click once to start the rectangle.

10. Tab into the Floating Data bar, set the **Delta X (ΔX)** to -0.75 and the **Delta Y (ΔY)** to 0.07, and press Enter or Return twice to place the rectangle.



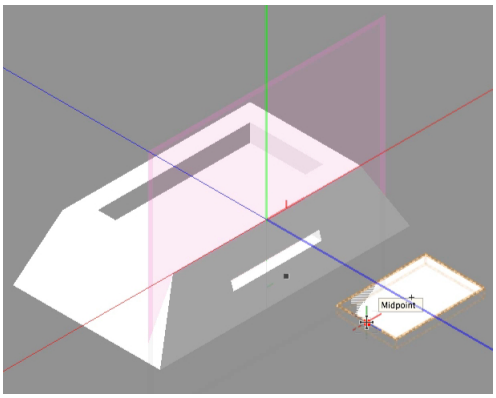
11. Without clicking, move the cursor over the rectangle. The **Automatic Push/Pull** mode will activate and the rectangle with highlight in red.

12. Click once and move the cursor out. Tab into the Floating Data bar, set the **Distance** to 1, and press Enter or Return twice to extrude the rectangle.

13. Render in OpenGL, by going to the Render menu in the View bar and choosing **OpenGL**.

14. Select both the ledge and the planter and go to **Model** > **Subtract Solids**. Use the Back and Front buttons to highlight the planter and check the **Retain Subtracting Objects** option.

This will cut a hole in the planter for the ledge and leave the ledge object in place.



15. If you drag the ledge object out, you will see a hole has been cut in the planter. Go to **Edit** > **Undo** to undo the move and place the ledge back in place.

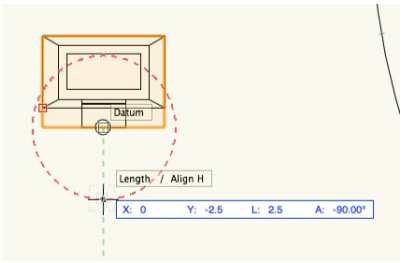
16. Let’s save this planter as a symbol. Select both the planter and the ledge, go to **Modify** > **Create Symbol**, name the symbol Planter Box-3 and click **OK** twice.

17. Finally, lets use the **Mirror** tool to mirror and duplicate the planter. Switch to a Top/Plan view, activate the **Mirror** tool, and enable the **Duplicate** mode.

18. Place the cursor over the center of the bottom edge of the ledge. Press the G key to place a datum.

19. Tab into the Floating Data bar and set the **Length (L)** to 2.5.

20. Move the cursor down until the SmartCursor Cue “Length / Align H” is displayed. Click once and move the cursor to the right.



21. Click once more to mirror and duplicate the planter.

22. Now, select both the planters and go to **Modify** > **Group**. These objects will no move together as a group.

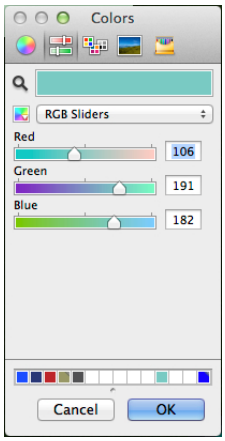
Editing a Symbol

Symbol resources not only allow you to save objects for later use, they also allow you to quickly edit and make changes to all instances of the symbol. We will edit the planter symbols and adjust the fill color of all of the instances, by just editing the symbol definition.

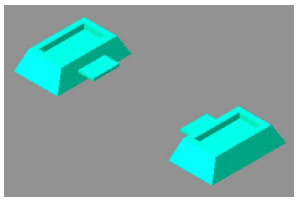
1. In the Resource Browser, locate the Planter Box-3 Symbol.

2. Right-click on the symbol and choose **Edit 3D Component**. The Symbol Edit window will open, indicated by the colored border around the drawing window and the 3D symbol geometry will be displayed.

3. With all of the objects selected, set a turquoise fill color in the Attributes palette using the RGB values shown below.



4. Click the **Exit Symbol** button in the top right corner of the drawing window. To exit the Symbol Edit window and save the changes. You will see both instances of the Planter Box-3 Symbol now show the new fill color.



5. Repeat this process for the Planter Box-1 and Planter Box-2 Symbols. Give the geometry of both these symbols a Cool Gray 50% fill color.

Note: You can also edit the symbol definition, by double-clicking on an instance of the symbol in the drawing. Editing a symbol in this way will update the symbol definition in the same way as editing the symbol through the Resource Browser. Any changes will be applied to all instances of the symbol.

Ramps and Ledges

Curved ramp

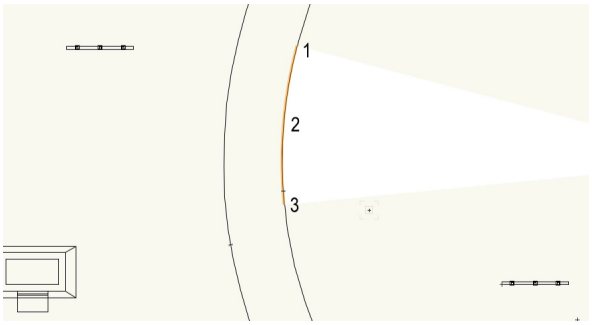
First, we will create a curved ramp on the curved face between the lower and mid level of the skatepark. Using the Arc tool, we will match the curve of the edge. We will also use the Push/Pull tool, Loft Surface tool, and Stitch and Trim command, to create the slope of the ramp.

1. Let's start by creating a new class for the ramps. Name the class Ramps and make it the active class.

2. Switch to a Top/Plan view and center the drawing over the curved face.

3. Activate the **Arc** tool and enable the **Three Points** mode.

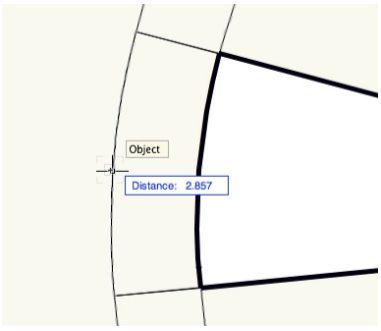
4. Click once on the upper edge of the curved face to start the arc. Move along the edge and click a second time further down the edge to set a point for the arc to pass through. Click one last time further down along the edge to end the arc.



5. Now, activate the **Offset** tool and click on the **Offset Tool Preferences** button in the tool bar.

6. Set the Method to **Offset by Point**, the Duplication to **Duplicate and Offset**, check the **Close Open Curves** option and Click **OK**.

7. Click once to the left of the arc, move the cursor until you intersect the lower edge of the curved face. Click once move to complete the operation.

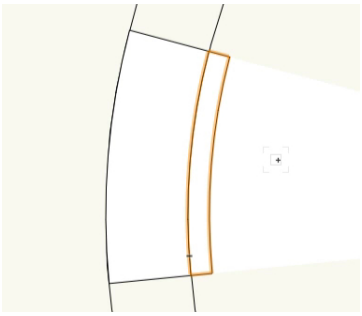


8. Press the X key twice to deselect the closed polyline. Select the original arc again.

9. Switch back to the **Offset** tool and click to the right of the arc.

10. Move your cursor to the right, tab into the Floating Data bar,

set the **Distance** to -0.75, and press Enter or Return twice to create the polyline.



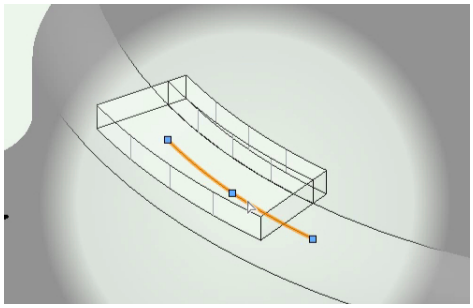
11. With the polyline on the right still selected, go to **Model** > **Extrude**, and set the **Extrusion** to 1.

12. In the Object Info palette, set the **Bot Z** to 1.5.

13. Repeat this process for the polygon on the left.

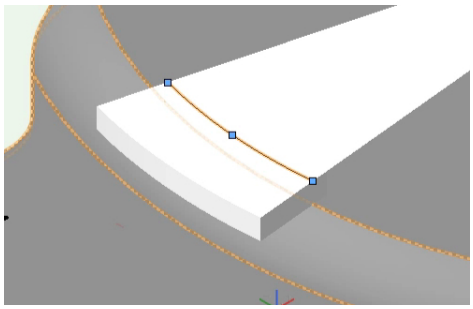
14. Switch to a Left Isometric view.

15. Press the B key to activate the **X-Ray Select** mode, and select the original arc we created.



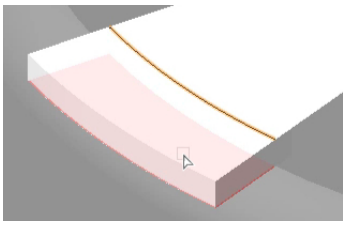
16. With the arc selected, go to **Modify** > **Move** > **Move 3D**.

17. Set the **Z Offset** to 2.5 and click **OK**. The Arc is now on the top surface of the Extrudes.

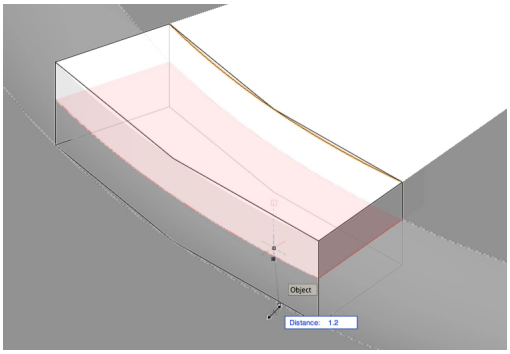


18. Activate the **Push/Pull** tool, enable the **Move Face** mode.

19. Move your cursor over the large extrude, press the Alt key (Windows) or Option key (Macintosh) to select the bottom face of the extrude. When the bottom face highlights in red, click once.



20. Move the cursor down and snap to the bottom edge of the curved face. Click once to extend the face of the extrude.

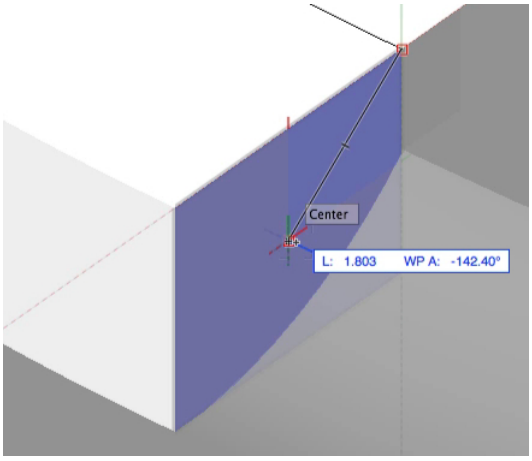


21. Activate the **Arc** tool and enable the **Tangent to Line** mode.

22. Select **Automatic** from the Plane menu in the View bar.

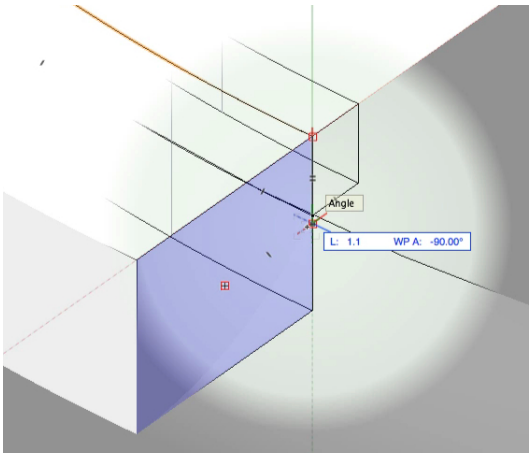
23. Move your cursor over the right side face of the larger extrude, it will highlight in blue.

24. Click once on the top right corner of the face to start the arc, move your cursor to the center of the face and acquire a Smart Point.

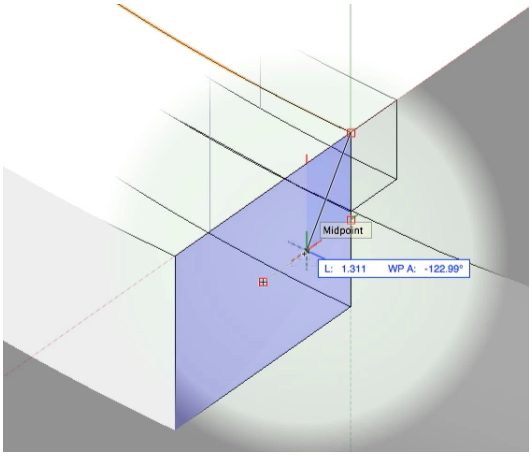


25. Press and hold the B key to activate the **X-Ray Select** mode. Move the cursor to the right along the red extension line until you intersect the right edge of the extrude. After a few seconds

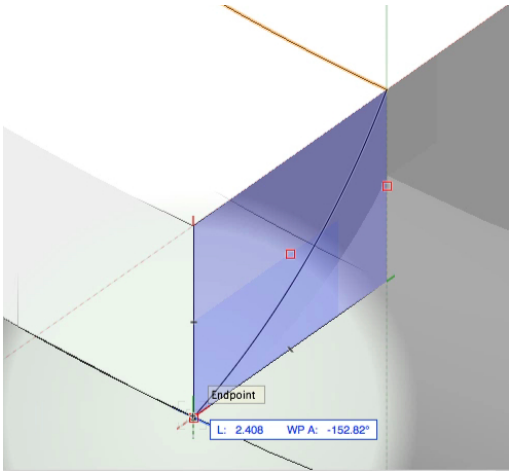
a second Smart Point will appear.



26. Move the cursor to the midpoint indicator between these two smart points. Click once to set the tangent line.

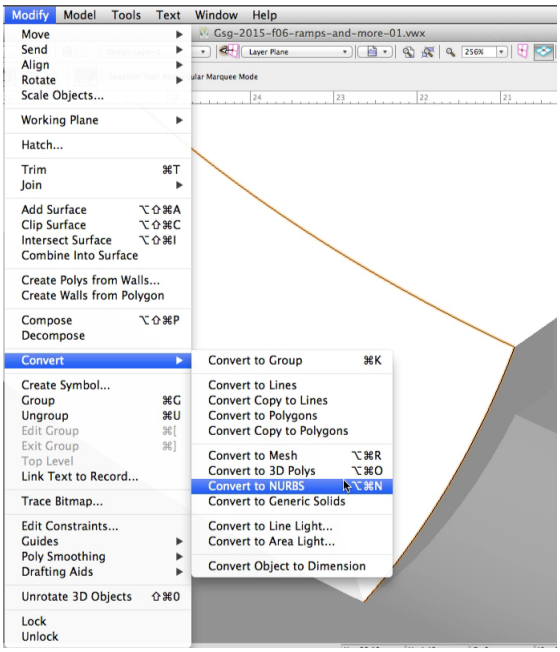


27. Move the cursor to the bottom left corner of the face and click once more to create the arc.



Now we need to convert these arcs to NURBS curves, so we can use the Loft Surface tool to create a curved NURBS Surface.

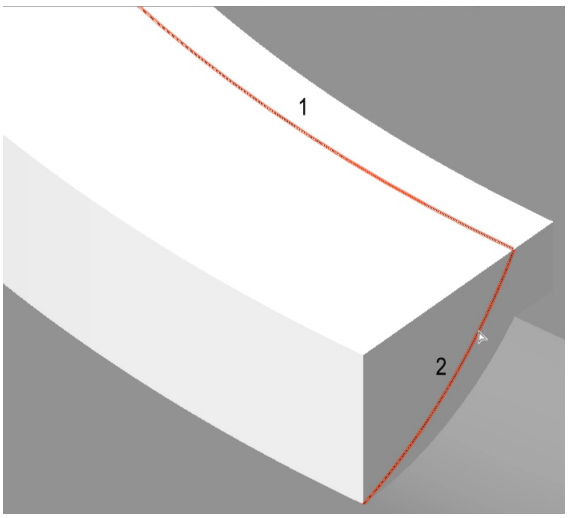
28. Select this arc and the original arc we created. Go to **Modify > Convert > Convert to NURBS**.



29. The NURBS curves are placed in a group, go to **Modify > Ungroup** to ungroup the Curves.

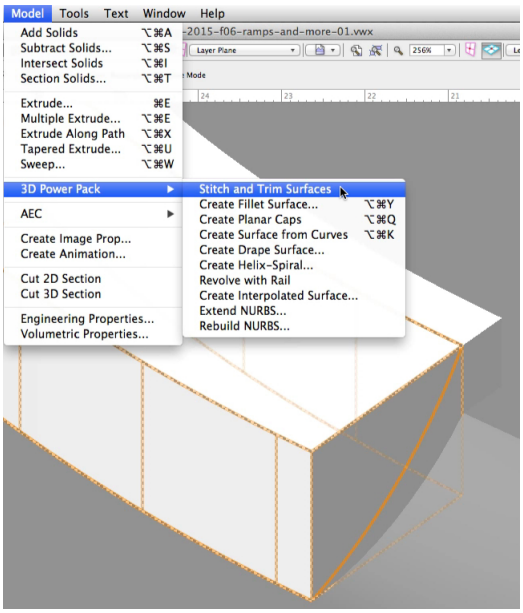
30. Activate the **Loft Surface** tool in the 3D Modeling tool set and enable the 2nd mode, **One Rail** mode. This mode allows you to select a single rail and profile(s).

31. Move the cursor over the upper NURBS curve, click once to set it as the rail. Now move the cursor over the other NURBS curve and click once to set it as the profile.



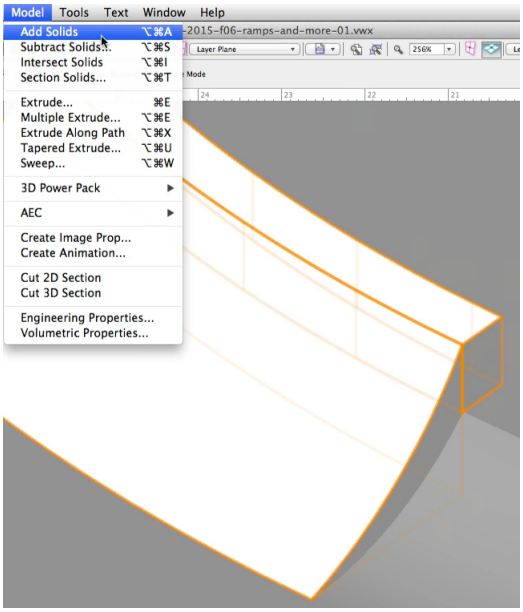
32. Click the green check mark button, the Loft Creation dialog will be displayed. Click **OK** to accept the defaults and create the NURBS surface.

33. Select both the large extrude and the NURBS surface, go to **Model** > **3D Power Pack** > **Stitch and Trim Surfaces**.



34. The Stitch and Trim Surfaces command created two generic solids from the extrude. Using the NURBS Surface to separate the two objects. Double tap the X key to switch to the **Selection** tool. Select the upper generic solid and press Delete to remove it. We now have a curved face for the ramp.

35. Select the curved generic solid and the remaining extrude, go to **Model** > **Add Solids** to combine the objects and complete the Ramp.



36. Finally, let's give the Ramp a Cool Gary %50 fill color.

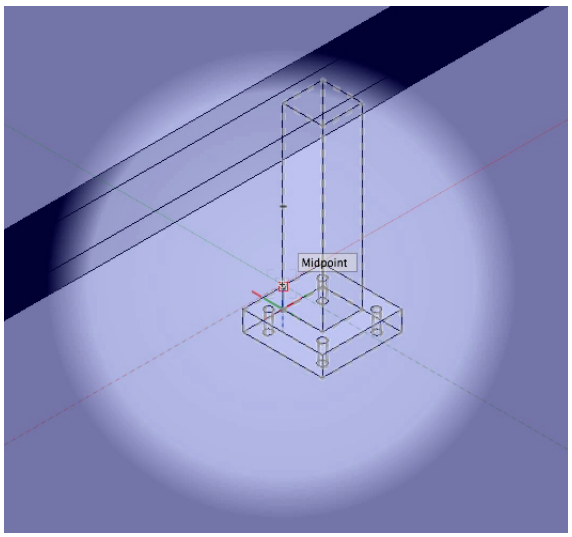
Elevated Obstacle

Using the same techniques covered earlier we will now create an elevated obstacle. We will use the Rectangle, Automatic Working Plane, Extract, Offset, and Push/Pull tools to create this obstacle.

1. Center the view to the left of the long rail on the middle level of the satepark.

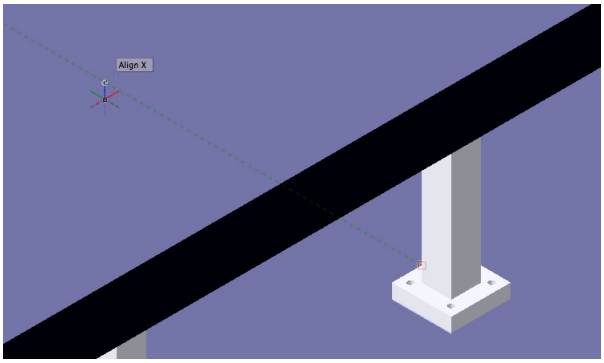
2. Activate the **Rectangle** tool and enable the **Center to Corner** mode.

3. We want to center the obstacle across from the long rail. Move the cursor over base of the middle post of the long rail. Use the **X-Ray Select** mode (B Key), to acquire a Smart Point at the center of the base.



Note: If you accidentally set a Smart Point in the wrong location, pressing the Escape key once will remove all Smart Points.

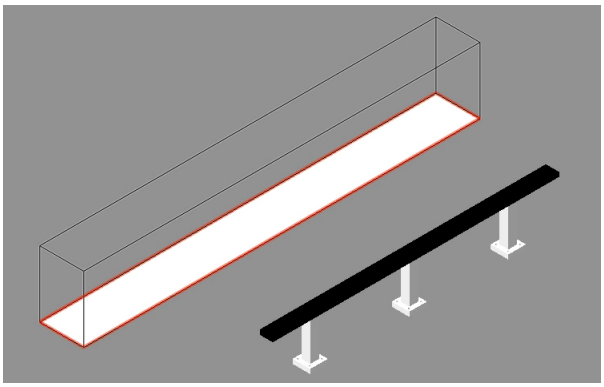
4. Move the cursor to the left along the extension line from the Smart Point.



5. Click once to start the rectangle. Move the cursor out, tab into the Floating Dat Bar, set the **Delta X (ΔX)** to 2.25 and the **Delta Y (ΔY)** to 0.25, and press Enter or Return twice to place

the rectangle.

6. Without clicking, move the cursor over the rectangle and use the **Automatic Push Pull** mode to extrude the rectangle. Set the **Distance** to 0.75. We now have a base (extrude) for our obstacle.



7. Next, we will use the **Extract** tool in the 3D Modeling tool set, to extract a 2D planar object from the top face of the base. This will be the top platform of the obstacle. Activate the **Extract** tool.

8. In the Tool bar, enable the **Extract Surface** mode and click on the **Extract Tool Preferences** button.

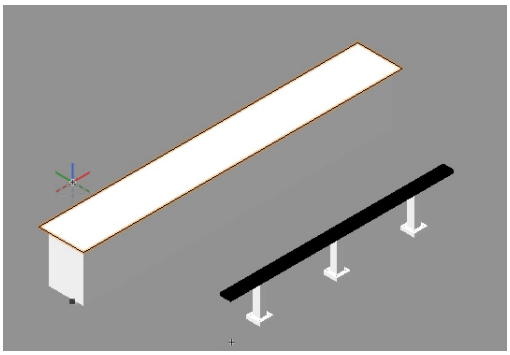
9. Check the option for **Create Planar Objects**. This setting will create a 2D polygon, instead of a NURBS surface. Make sure all other options are unchecked, and Click **OK**.

10. Move the cursor over the top of the base, when it highlights in red, click once to select the surface.

11. Click the green check mark button to extract a polygon from the surface.

12. Now, activate the **Offset** tool, enable the **Offset by Distance** and **Offset Original Object** modes, and set the **Distance** to 0.075.

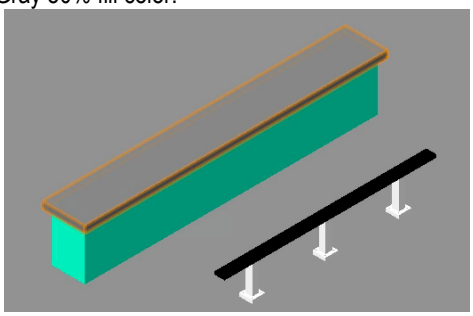
13. Click outside of the extracted polygon to offset it.



14. Now activate the **Push/Pull** tool and enable the 1st mode, **Extrude Face** mode.

15. Move the cursor over the offset polygon, click once to select the face. Tab into the Floating Data bar, set the **Distance** to 0.1, and press Enter or Return twice to extrude the polygon.

16. Finally, using the Attributes palette, give the base the same turquoise fill color as used previoulsy and the top platform a Cool Gray 50% fill color.



Straight Ramp

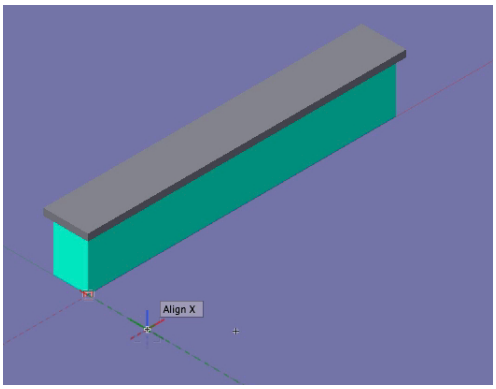
In this section, we will create a simple straight ramp. Will utilizes the Rectangle tool and Automatic Push/Pull mode to quickly recreate the ramp. Then, we will use the Rotate tool, to pivot the ramp up. Finally, using the Project tool, we will create supports for the Ramp.

1. To make it easier to create the ramp, set the Rails class to invisible.

2. Activate the **Rectangle** tool and enable the **Corner to Corner** mode.

3. Move the Cursor over the bottom right corner of the left side of the elevated obstacle and acquire a Smart Point.

4. Move the cursor to the right, along the extension line. Click once to start the rectangle.



5. Move the cursor out, tab into the Floating Dat Bar, set the **Delta X (ΔX)** to 2.75 and the **Delta Y (ΔY)** to -1.25, and press Enter or Return twice to place the rectangle.

6. Without clicking, move the cursor over the rectangle and use the **Automatic Push Pull** mode to extrude the rectangle. Set the **Distance** to 0.15.

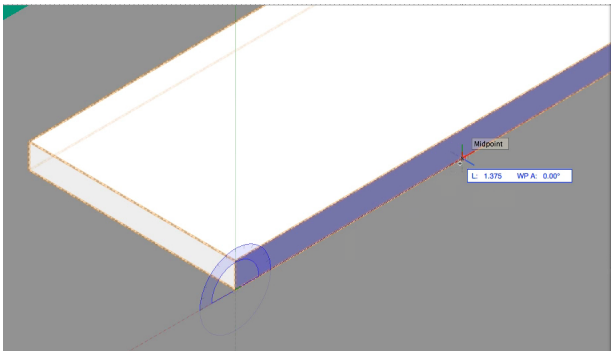
7. With the ramp face (extrude) selected, activate the **Rotate** tool in the Basic palette.

8. Enable the 1st mode, **Standard** mode and the **Standard Rotation** mode in the Tool bar.

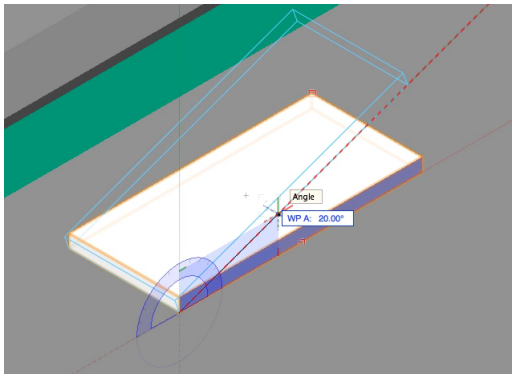
9. Move the cursor over the ramp face. A protractor feedback graphic displays around the cursor. Align the protractor on the bottom right, vertical face of the ramp face.

10. Click once on the bottom left corner of the vertical face to set the center point of rotation.

11. Move cursor along the bottom edge of the vertical face and click once to define the axis of rotation.

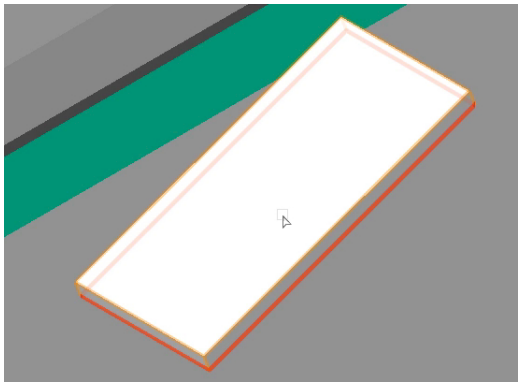


12. Move the cursor up. You will see a preview of the rotated object. Tab into the Floating Data bar and set the **Working Plane Angle (WP A)** to 20º. Press Enter or Return twice to rotate the ramp face.

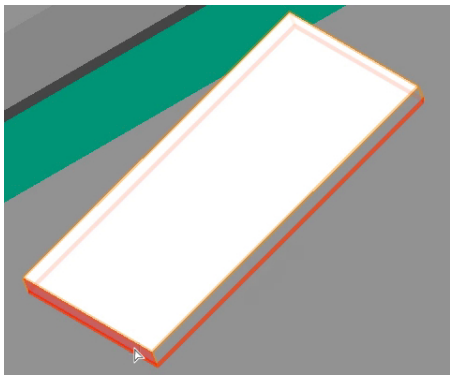


13. Now let's taper the bottom of the ramp. Activate the **Taper** tool in the 3D Modeling tool set and enable the 2nd mode, **Picked Face** mode.

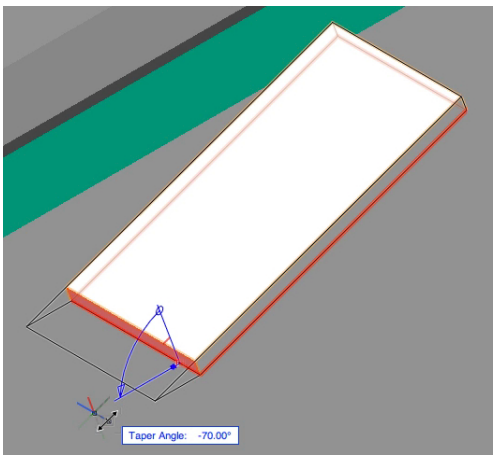
14. Move the cursor over the ramp, hold the Alt key (Windows) or Option key (Macintosh) to highlight the bottom face of the ramp. Click once to select to set the reference plane for the taper.



15. Move the cursor over the side face that intersects the concrete base. When it highlights in red click once more to select the face to taper.

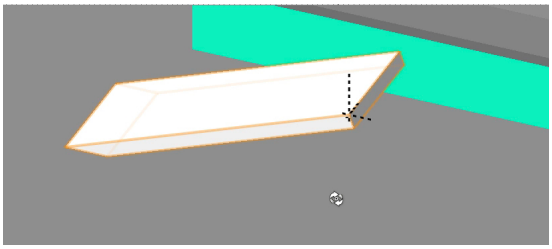


16. Finally, move your cursor out until it snaps to the concrete base. Click one more time to set the taper angle.

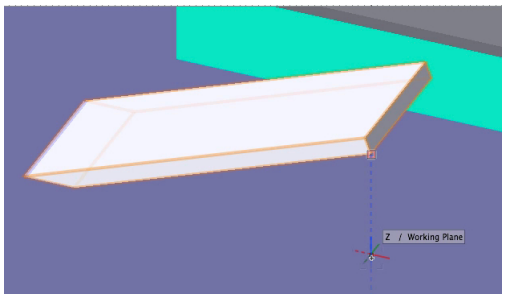


Next, we will create supports for the ramp.

17. Use the Flyover tool to rotate the view slightly.



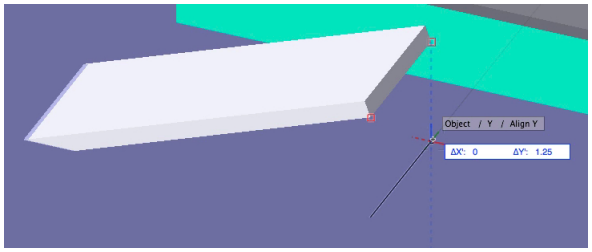
18. Move the cursor over the bottom left corner of the elevated face. Wait a few seconds until a Smart Point is displayed. Move the cursor down along the extension line until you intersect the concrete base.

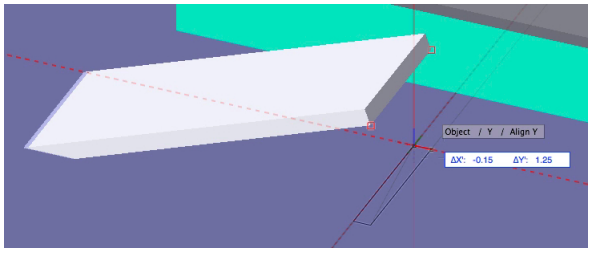


19. When the SmartCursor Cue "Z/Working Plane" is displayed, click once to start the rectangle.

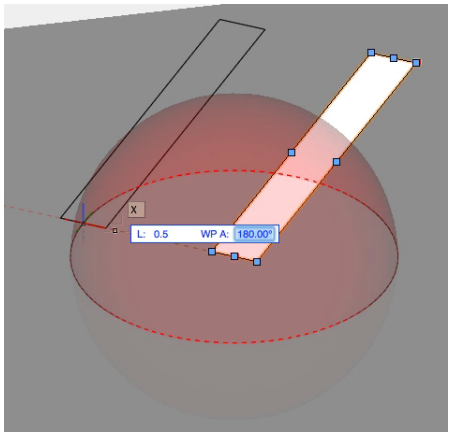
20. Acquire a second Smart Point on the bottom right corner of the elevated face. Move the cursor down along the extension line until you intersect the concrete base.

21. When the SmartCursor Cue "Object / Y / Align Y" is displayed, tab into the Floating Data bar and set the **Delta X (ΔX)** to -0.15. Make sure the **Delta Y (ΔY)** is 1.25, and press Enter or Return twice to place the rectangle.

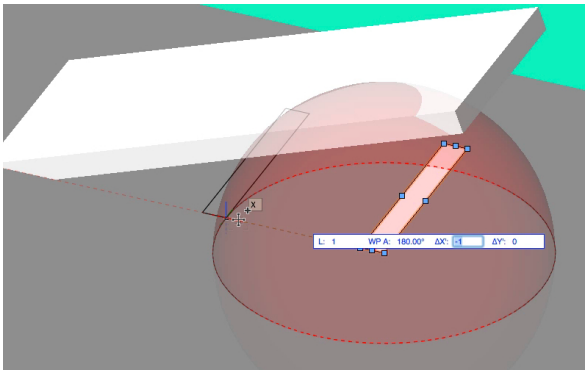




22. Click and drag the bottom midpoint of the rectangle to the left. Tab into the Floating Data bar, set the **Length (L)** to 0.5 and the **Working Plane Angle (WP A)** to 180°, and press Enter or Return twice to move the rectangle.



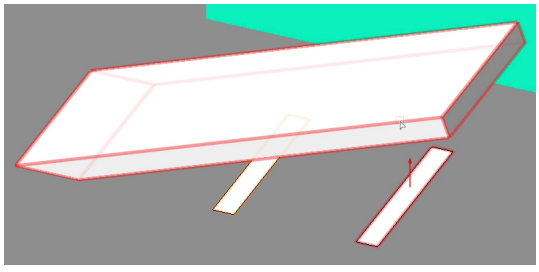
23. Now, let's duplicate the rectangle. Click and drag the bottom right control point to the left. Tab into the Floating Data bar and set the **Length (L)** to 1 and the **Working Plane Angle (WP A)** to 180°. Press and hold the Ctrl key (Windows) or Option key (Macintosh) on your keyboard and press Enter or Return twice to duplicate and move the rectangle.



Next, let's use the Project tool from the 3D Modeling tool set to create supports for the Ramp.

24. Activate the **Project** tool and enable the **Add** and **Add Downward** modes in the Tool bar.

25. Click once on the 1st rectangle, then click a 2nd time on the ramp. The rectangle is projected to the bottom of the ramp.



26. Repeat this action for the other rectangle.

27. Now, select the ramp and two supports, go to **Model** > **Add Solids**.

28. Finally, give the ramp a Cool Gray 50% fill color in the Attributes palette.

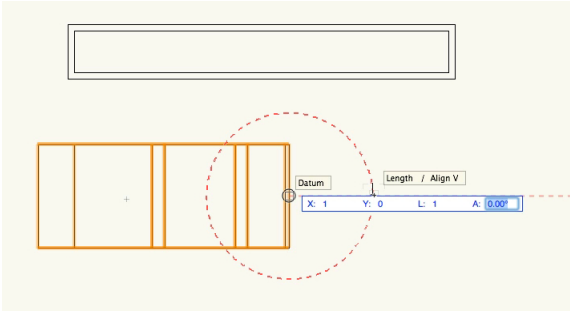
Now let's mirror the ramp to create a jump and organize the nearby obstacles.

29. With the ramp selected, activate the **Mirror** tool in the Basic palette and enable **Duplicate** mode.

30. Switch to a Top/Plan view.

31. Move the cursor over the midpoint of the right side of the Ramp. Press the G key to set a floating datum

32. Tab into the Floating Data bar, set the **Length (L)** to 1, press Tab once to set the length. Click once to start the mirror axis line when the SmartCursor cue "Lenght/ Align V" is displayed.

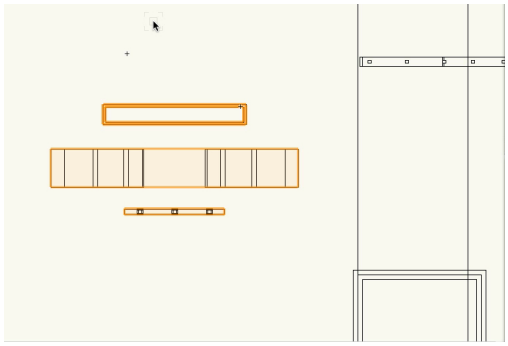


33. Move the cursor up vertically, when the SmartCursor Cue "Vertical" is visible, click once to set the mirror axis and complete the operation.

34. Now, select both ramps and go to **Modify** > **Group**.

35. Next, let's turn the Rails class back on. Click on the **Classes** button in the View bar and set the Rails class to Visible.

36. Finally, using Smart Points, arrange the objects so that the center of the elevated obstacle, ramps, and long rail align.



Stair ledges

In this sections we will use the Extrude Along Path command to quickly create ledges on the sides of the left Stairs.

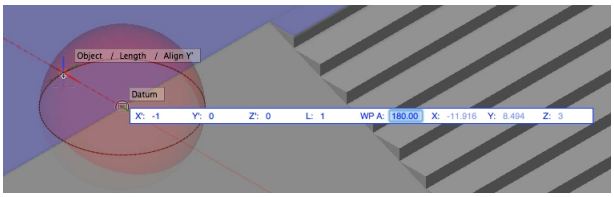
1. Switch to a Left Rear Isometric view and center the view to the left of the stairs.

2. Set the Planters and Rails class to Invisible.

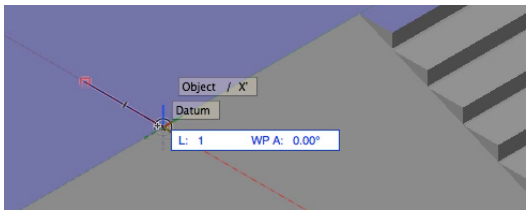
3. Activate the **3D Polygon** tool in the 3d Modeling tool set.

4. Move the cursor over the midpoint between the stairs and the edge of the concrete base.

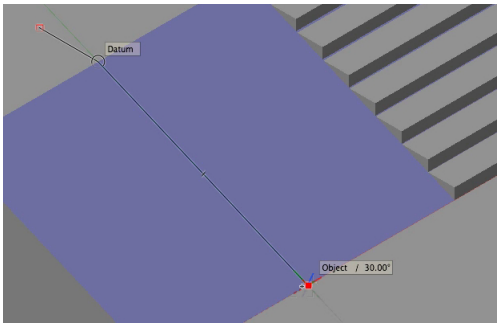
5. Press the G key to set a datum. Tab into the Floating Data bar, set **Length (L)** to 1, and press Tab again to set the length value.Move the cursor back and click once to start the 3D polygon.



6. Click again at the datum point.

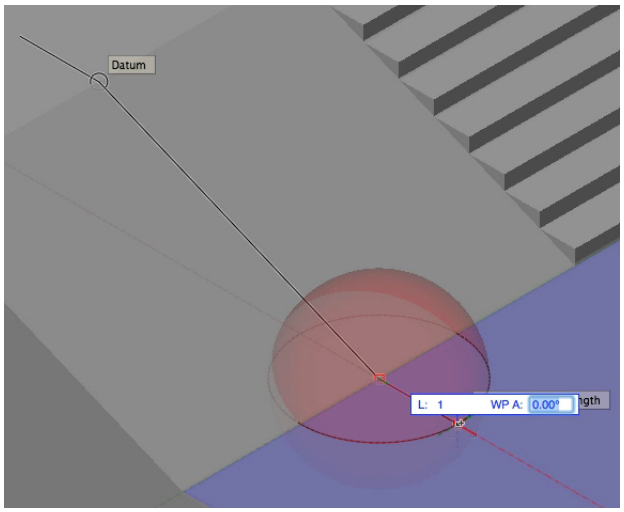


7. Then move the cursor down the tapered face and click once at the base of the face.



8. Finally, Tab into the Floating Data bar, set the **Length (L)** to 1, press Tab again to set the length, and double-click to complete

the 3D polygon.

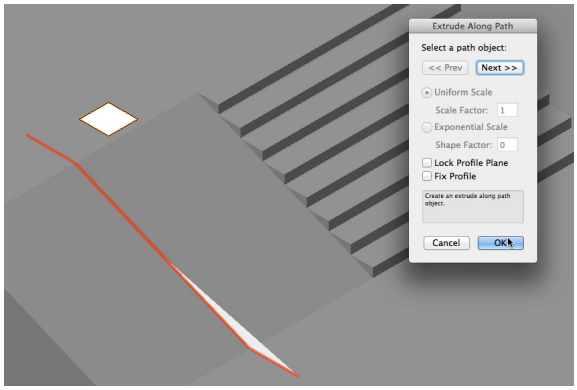


Now that we have a path that conforms to the tapered surface, let's create a profile and use the Extrude Along Path command.

9. Double-click on the **Rectangle** tool. Set the **Width** and **Height** to 0.6 and click **OK**.

10. Click once to the upper level of the skatepark to place the rectangle.

11. Select both the profile (rectangle) and path (3D polygon), go to **Model** > **Extrude Along Path**, use the **Prev** and **Next** buttons to highlight the path object, make sure **Lock Profile Plane** and **Fix Profile** are unchecked, and click **OK**.



We now have the base for our ledge. However, it is sitting below the surface of the concrete base. This is because when you create an extrude along path object, the profile is centered on the path, which was on the top surface of the concrete base. So, half of the extrude is below the surface. Let's edit the elevation of the path to move the base of the ledge up, so it is no longer below the surface of the concrete base.

12. Double-click on the ledge base (extrude along path) and choose to **Edit the Path**.

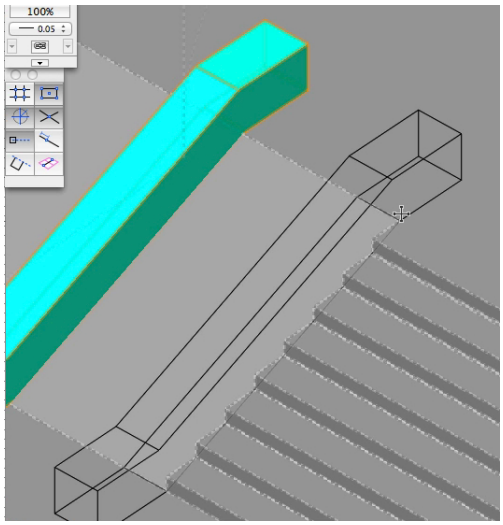
13. Switch to a Back view.

14. With the path objects selected, set the **Z** to 0.3 in the Object Info palette. This is half the height of the Profile and will move the ledge base on top of the concrete base.

15. Click the **Path Exit** button in the top right corner of the drawing area to exit the Edit window and save the changes.

16. Next, give the ledge base a turquoise fill color.

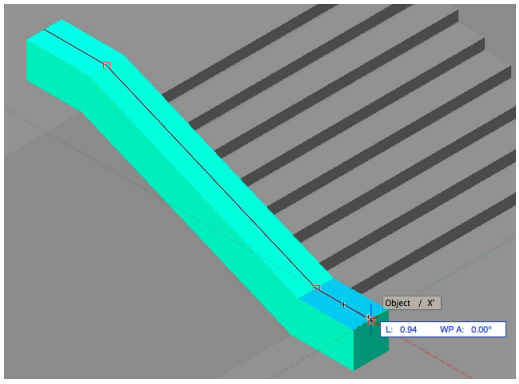
17. Now, move the ledge base so that the right side intersects the start edge of the stairs. You will need to use the **Flyover** tool to rotate the view and the ledge as shown in the image below.



Next, we will use the same procedure to create a top for the ledge.

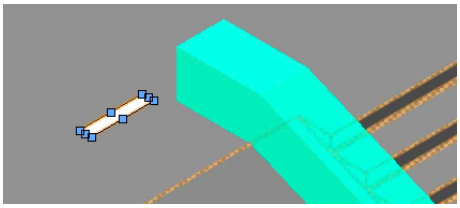
18. Switch back to a Left Rear Isometric view.

19. Use the **3D Polygon** tool to create a path along the top of the ledge base.



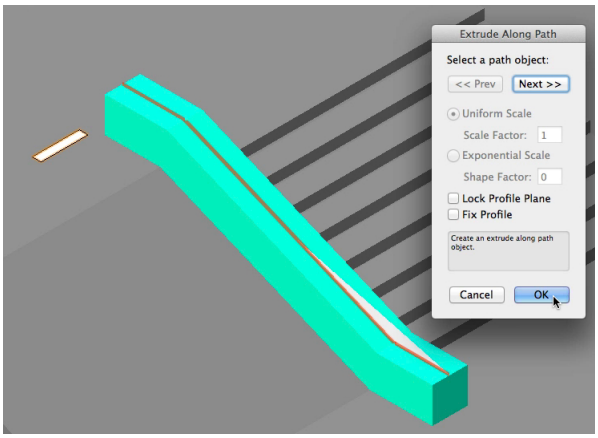
20. Then, use the **Rectangle** tool to draw a profile that is 0.8 in width and 0.15 in height.

Make sure the rectangle is parallel with the edge of stairs.



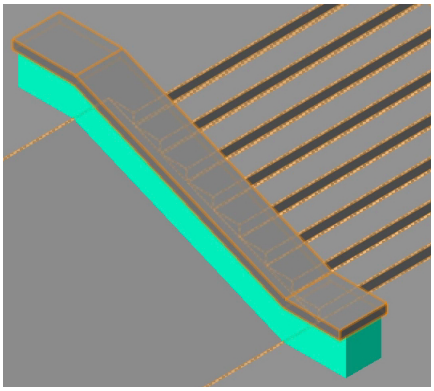
21. If the rectangle is not parallel, adjust the **Rotation** field to 90° in the Object Info palette.

22. Now, use the **Extrude Along Path** command to extrude the profile along the path.



23. Next, edit the extrude along path object and adjust the height of the path, so the ledge top is not below the surface of the ledge base. You will need to set the **Z** of the path to half the height of the profile, 0.075.

24. Finally, give the ledge top a Cool Gray %50 fill color.



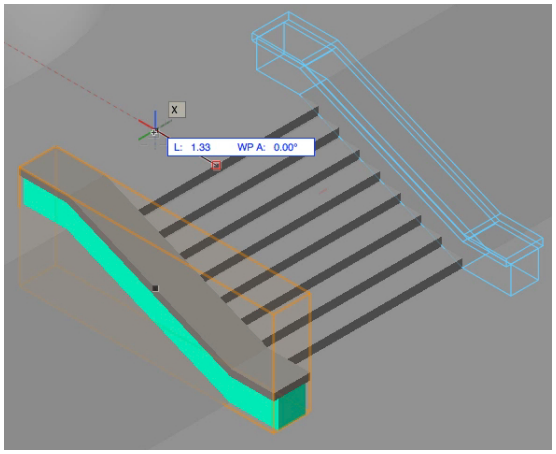
Finally, let's group the ledge base and top together and mirror the ledge to the other side of the Stairs.

25. Select both the top and base of the ledge and go to **Modify** > **Group**.

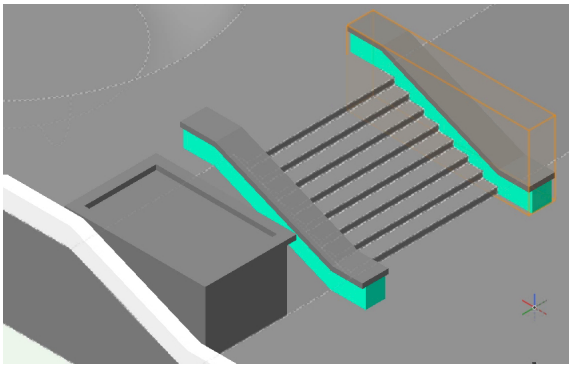
26. With the ledge (group) selected, activate the **Mirror** tool in the Basic palette, and enable the **Duplicate** mode.

27. Find the midpoint of the top stair, when the SmartCursor Cue "Midpoint" is displayed, click once.

28. Now move the cursor up and to the left. When the mirror preview is displayed in correct location on the other side of the stairs and the SmartCursor Cue "X" is displayed, click once to set the axis line.



29. Now, set all classes to visible and review the placement of the ledges.



Curved ledge

Next, we will create a curved ledge on the lower level of the skatepark. Using the Arc and Offset tools, we will create a polyline that matches the curve of the concrete base. Then we will extrude the polyline to create a base. Finally, using the Extract tool we will create the top of the ledge.

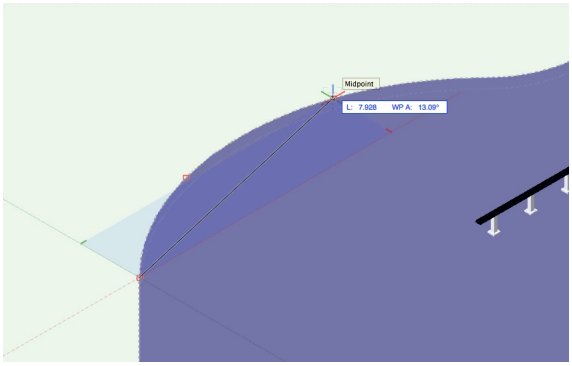
1. Switch to a Left Isometric view and center the drawing area

over lower level of the skatepark.

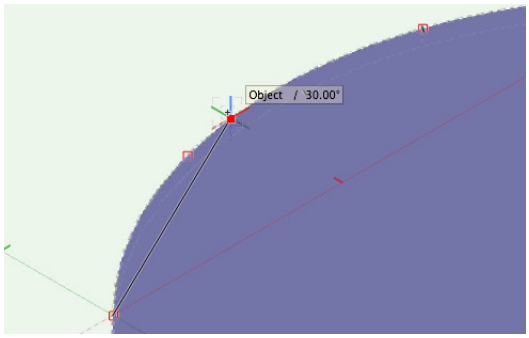
2. Use the **Arc** tool with the 2nd mode, **Three Points** mode, to trace the curve of the upper edge of the concrete base.

3. Move the cursor along the straight edge of the concrete base. When the SmartCursor Cue “Endpoint” is displayed, click once to start the arc.

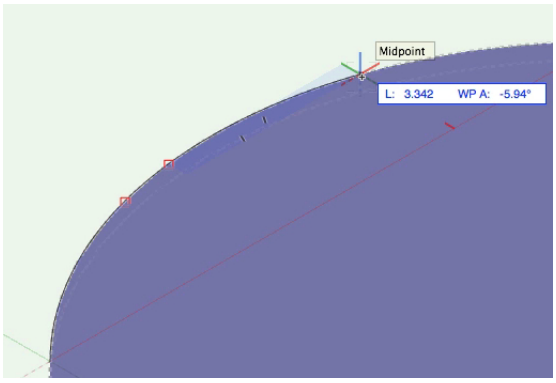
4. Move along the curve until the SmartCursor Cue “Midpoint” is displayed.



5. Move the cursor back along the curve about halfway between the start and midpoint. Click a second time to set a point for the arc to pass through.



6. Move the cursor back the midpoint and click once more to complete the arc.

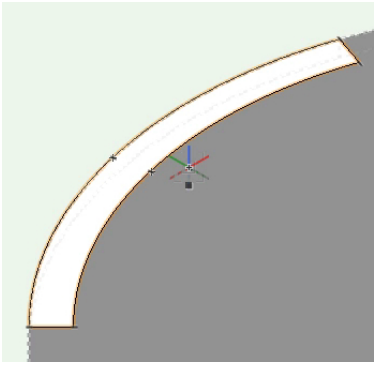


Next, use the Offset tool to create a closed polyline and then Extrude the polyline to create the ledge base.

7. Activate the **Offset** tool, enable the **Offset by Distance** and **Duplicate Offset** modes, and click on the **Offset Preferences** button.

8. Set the **Offset Distance** to 0.6, check the **Close Open Curves** option, and click **OK**.

9. Click once on the inside of the arc. We now have a closed polyline.



10. Activate the **Push/Pull** tool, enable the 1st mode, **Extrude Face** mode, and select the face of the polyline.

11. Tab into the Floating Data bar and set the **Distance** to 0.6. Press Enter or Return twice to extrude the polyline.

Now let’s create the top of the curved ledge.

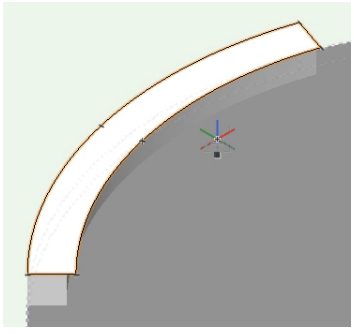
12. Activate the **Extract** tool, enable the 2nd mode, **Extract Curve** mode, click on the **Extract Preferences** button and check the **Create Planar Objects** option.

13. Move the cursor over the upper, outer edge of the base, when the edge highlights in red, click once to select it.

14. Click the green check mark button in the tool bar to extract the edge and create an arc.

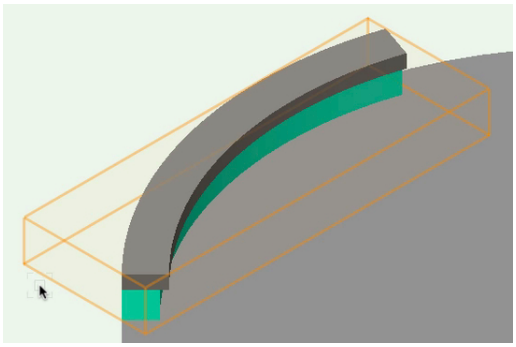
15. Next, activate the **Offset** tool and change the **Distance** to 0.75 in the Tool bar.

16. Click once on the inside of the arc to create a closed polyline.



17. Activate the **Push/Pull** tool and extrude the polyline to a **Distance** of 0.3.

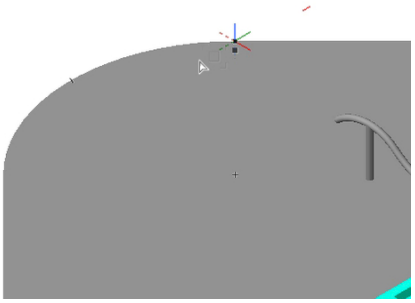
18. Finally, give the base a turquoise fill color, the top a Cool Gray %50 fill color, and place the two objects in a group.



Curved Bank

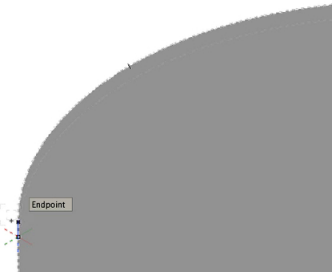
Using the Inner Boundary mode of the Polygon tool, we will create a curved bank on the other side of the lower level of the skatepark.

1. Switch to a Right Isometric view and center the drawing area other curved corner of the lower level.

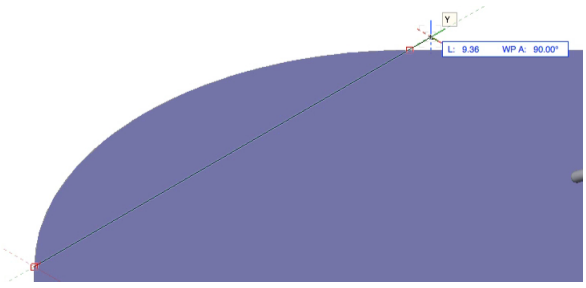


2. Activate the **Line** tool and make sure **Automatic** is set in the Plane menu in the View bar.

3. Move the cursor along the straight edge of the concrete base. When the SmartCursor Cue “Endpoint” is displayed, click once the start the Line.

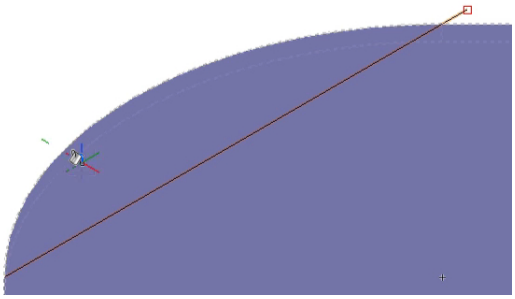


4. Move the cursor to the right along the green extension line. Move past the edge of the concrete base and click once more to complete the line.



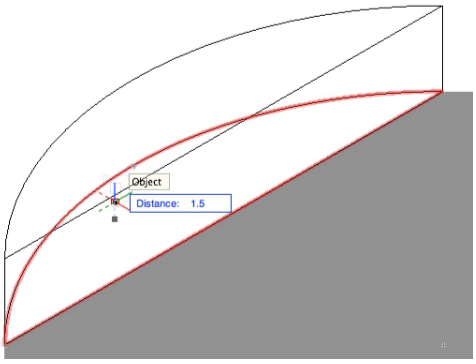
5. Activate the **Polygon** tool and enable the 2nd mode, **Inner Boundary** mode.

6. Click once between the line and the edge of the concrete base to create a closed polyline.

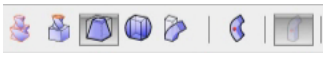


7. Select the line and delete it, as it is no longer needed.

8. Activate the **Push/Pull** tool and extrude the polyline to a distance of 1.5.

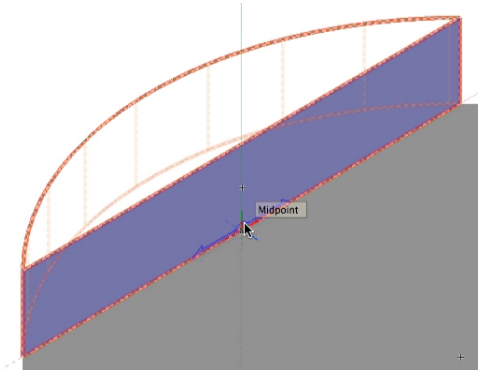


9. Now, activate the **Deform** tool and enable the **Taper Solid** mode. Make sure the **Symmetric** mode is not enabled.

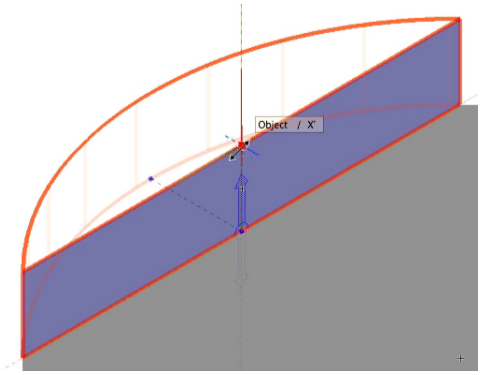


10. Click once on the extrude to select it. Then, click once at bottom midpoint, of the vertical face. Make sure the vertical

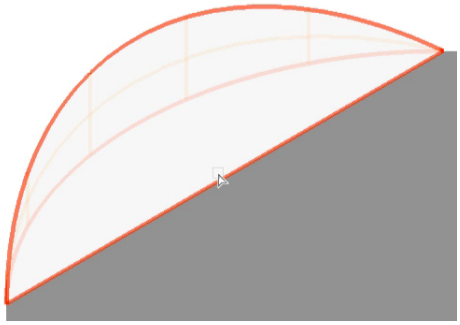
face is highlighted in blue.



11. Now move the cursor up to the center of the face, click once.



12. Move the cursor down to the bottom midpoint and click once more to taper the face.



13. Finally, give the curved bank a turquoise fill color.

Tapered Bank

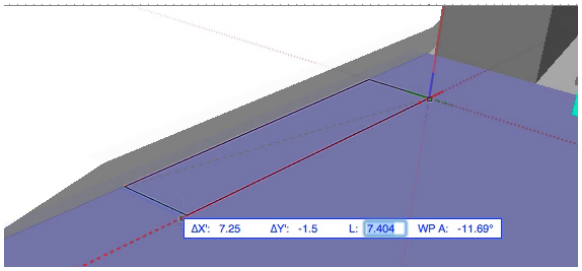
Let's create another bank with multiple tapered sides. We will start with a simple rectangle and then use the Push/Pull and Taper Face tools to create the tapered bank.

1. Switch to a Left Isometric view and center the drawing area over the middle level of the skatepark.

2. Activate the **Rectangle** tool, enable the **Corner to Corner** mode, and make sure **Automatic** is set in the Plane menu.

3. Move the cursor along the inner, bottom edge of the concrete rail. About a quarter of the way along the concrete rail, click once to start the rectangle.

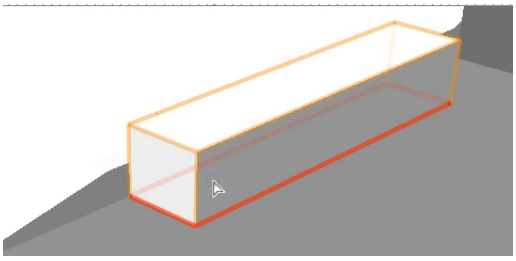
4. Move the cursor down and to the right. Tab into the Floating Data bar, set the **Delta X (ΔX)** to 7.25. Make sure the **Delta Y (ΔY)** is -1.5, and press Enter or Return twice to place the rectangle.



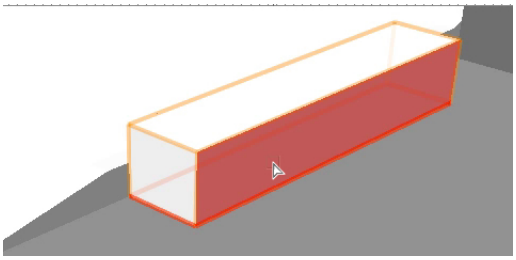
5. Without clicking, move the cursor over the rectangle. The rectangle will highlight in red indicating the **Automatic Push/Pull** mode is active. Click once and set the **Distance** to 1.25.

6. Now, activate the **Taper Face** tool and enable the **Picked Face** mode.

7. Move the cursor over the extrude, press the Alt key (Windows) or the Option key (Macintosh) and when the bottom face of the extrude highlights in red, click once to select it.



8. Then, move the cursor over the long vertical face. When it highlights in red, click once to select the face.



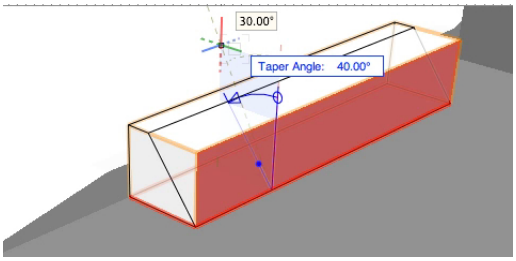
9. Move the cursor towards the back of the extrude. When the **Taper Angle** is about 40° click one last time to taper the face.

Note: The are multiple snap points in this area. You may find it difficult to set an angle of 40º. However, if you hold the Back Quote key (`), you can temporarily suspend snapping. This will make it easier to set the angle to 40º.

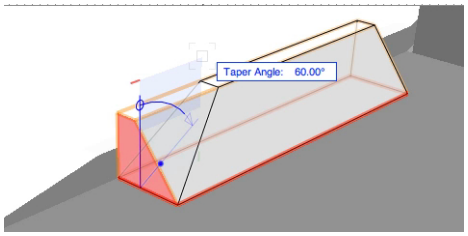
10. Next, let's taper the left side of the bank. With the **Taper Face** tool still active, select the bottom face of the base, by holding the Alt key (Windows) or the Option key (Macintosh).

11. Then, select the left side face.

12. Move the cursor in, tab into the Floating Data bar and set the **Taper Angle** to 60º, and press Enter or Return twice to taper the face.



13. Repeat this process for the right side of the bank.



Note: You can use the Alt (Windows) or Option (Macintosh) key to select both the bottom and right side face. This will allow you to Taper the other side without adjusting your view.

14. Finally, give the tapered bank a turquoise fill color.

Tapered Ramp with a Ledge

Next, we will create a tapered ramp on the lower level of the skatepark. Then using the Push/Pull tool, we will create a tapered ledge on the ramp.

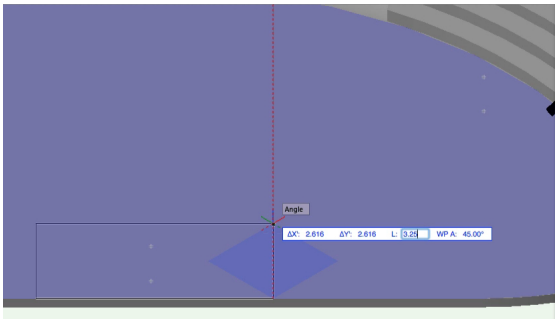
1. Center the drawing area over the lower level of the skatepark, near the curved stairs.

2. Activate the **Rectangle** tool and enable the 4th mode, **Three Point Rotated** mode.

3. Click once on the top edge of the concrete base between the stairs and tapered planter box.

4. Move the cursor along the edge towards the stairs. Tab into the Floating Data bar and set the **Length (L)** to 6.75. Press Enter or Return twice to set the second point of the rectangle.

5. Now, move the cursor up and use the Floating Data bar again to set a **Length (L)** of 3.25.

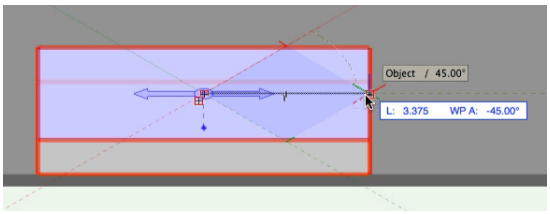


6. Move the cursor over the rectangle and use **Automatic Push/Pull** mode to extrude the rectangle to a distance of 0.85.

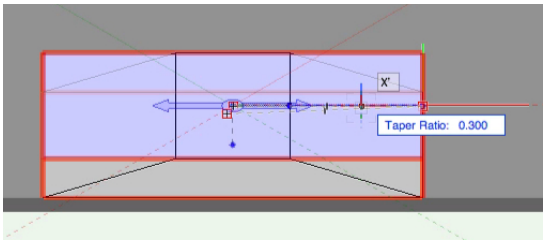
7. Activate the **Deform** tool and enable the **Taper Solid** mode. Make sure the **Symmetric** mode is not enabled.

8. Click once on the extrude to select it, then click once on the top center of the extrude to set the taper center.

9. Move the cursor to the right, horizontally across the extrude. Click once more, to set the direction of the taper.



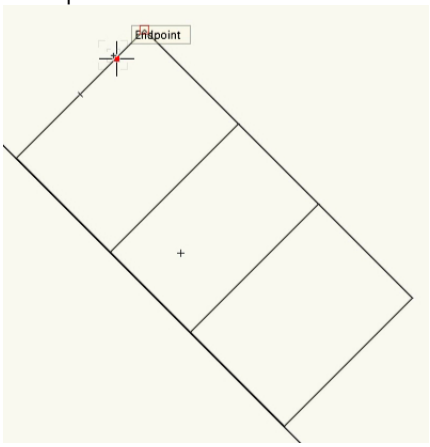
10. Move the cursor in, tab into the Floating Data bar, and set the **Taper Ratio** to 0.3.



Now, let's create the ledge.

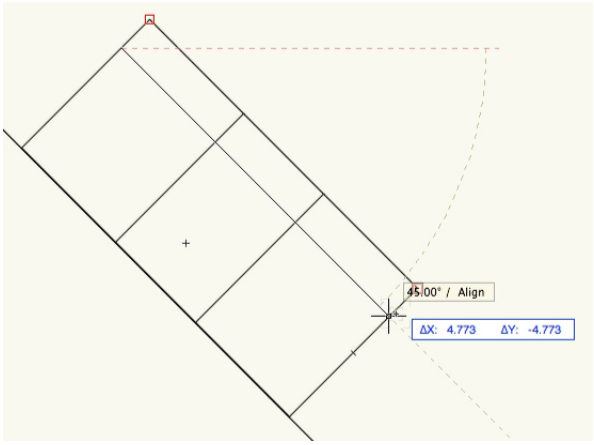
11. Switch to a Top/Plan view and activate the **Rectangle** tool.

12. With the **Three Point Rotated** mode still enabled, click once at the base of the left side of the ramp, about a quarter the way across the ramp.

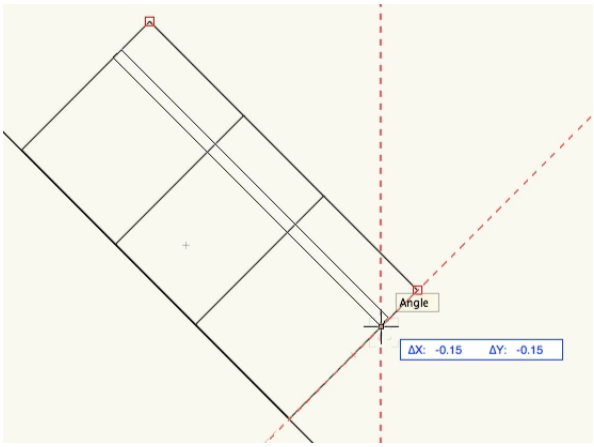


13. Move the cursor across the ramp, acquire a Smart Point on the bottom right corner of the ramp. Follow the extension line down and to the left.

14. When the SmartCursor Cue “45º / Align” is displayed, click once to set the second point of the rectangle.



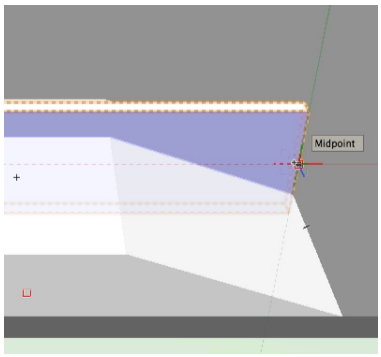
15. Move down and to the left, tab into the Floating Data bar, set the **Delta X (ΔX)** to -0.15, and press Enter or Return twice to complete the rectangle.



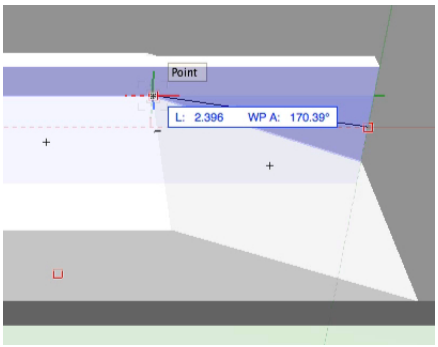
16. Go to **Model** > **Extrude** and set the **Extrusion** to 1.5.

17. Switch to a Left Isometric view and activate the **Line** tool.

18. Move the cursor over the right side of the ledge (extrude). When the SmartCursor Cue “Midpoint” is displayed, click once to start the line.

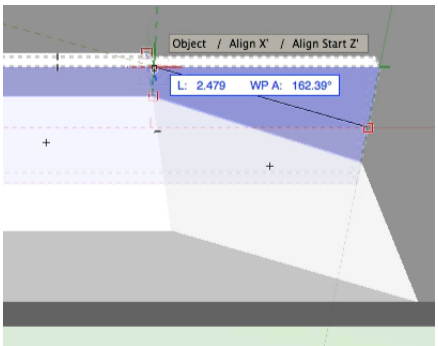


19. Move the cursor to the left and acquire a Smart Point at the intersection of the ledge and the top edge of the tapered face.



Note: You may need to press the T key to set the Smart Point at the top edge of the Tapered

20. Move the cursor up along the extension line and click once at the top of the ledge to complete the Line.

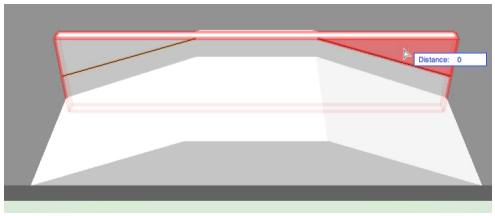


21. Repeat this process on the other side of the ledge.

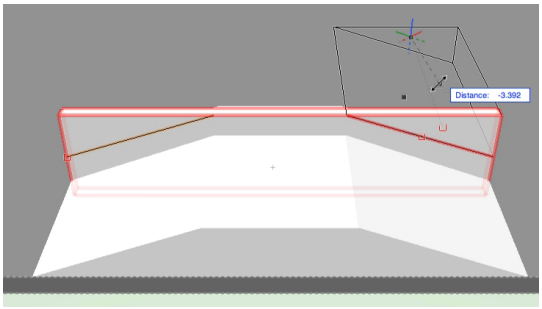
22. Next, activate the **Push/Pull** tool and enable the **Sub-Face**

mode.

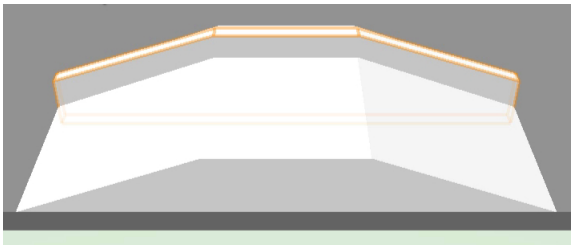
23. Click the line on the right, next click the ledge, then click the face between the line and the upper right corner of the ledge.



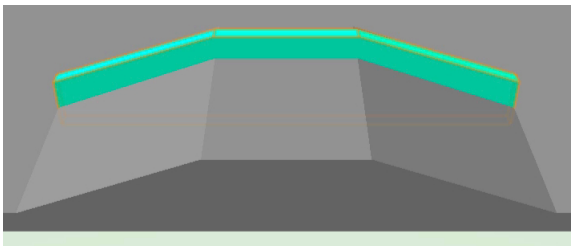
24. Now, move the cursor up until the preview is past the edge of the ledge and click one more time to remove the section of the ledge.



25. Repeat this procedure for the other side.



26. Finally, give the ramp a Cool Gray %50 fill color, the ledge a turquoise Fill Color, and place them in a group.



Bowl Fill Color

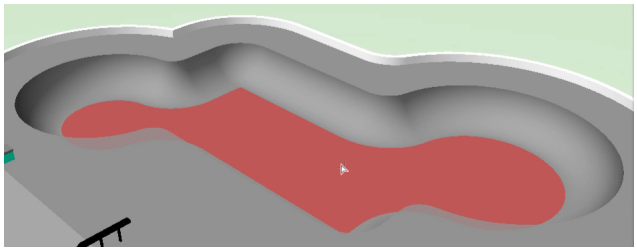
To complete the obstacles of the skatepark, let's extract the bottom of the bowl to give it a different fill color.

1. Center the drawing area over the Bowl on the upper level of the Skatepark.

2. Activate the **Extract** tool, enable the **Extract Surface** mode, and click on the **Extract Tool Preferences** button.

3. Check the option for **Select Faces** and make sure all other options are unchecked.

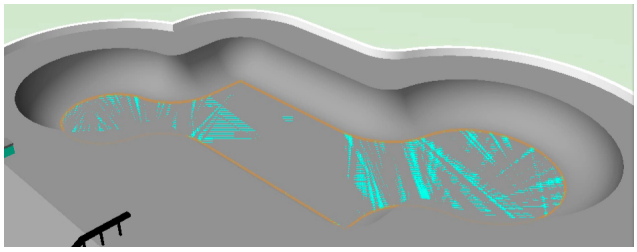
4. Move the cursor over the bottom of the bowl, it will highlight in red. Click once to select the face.



5. Click the green check mark button in the tool bar to extract the face and create a NURBS surface.

6. With the NURBS surface selected, give it a turquoise fill color in the Attributes palette.

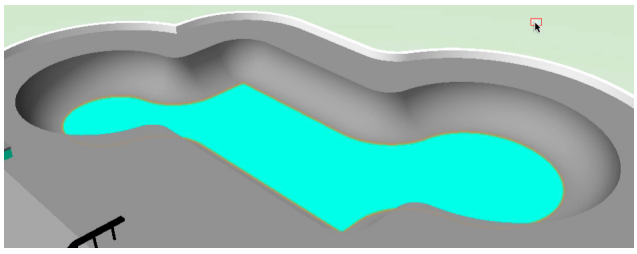
You will notice that the fill color does not appear correctly. This is because the NURBS surface intersects the top surface of the concrete base. To see the fill color of the NURBS surface above the concrete surface, we need to move the object up slightly.



7. With the NURBS surface still selected, switch to a Front view.

8. Hold the Shift key and press the Up Arrow key on your keyboard. This will activate the **Nudge** command and move the NURBS surface up slightly.

9. Finally, switch back to a Left Isometric view. You will see the fill color of the NURBS surface is now fully visible above the concrete base.



Gazebo

Extend the Concrete base

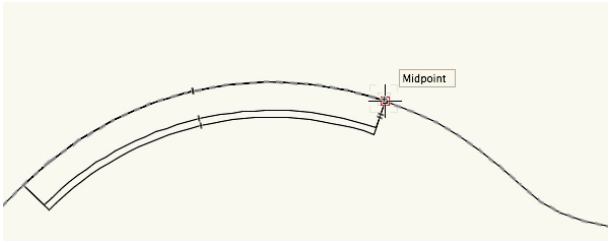
We will start by creating an extension to the concrete base on the lower level of the skatepark. Using the Arc, Rectangle, and Split tools, we will create the base shape of the extension. Then we will use the Push/Pull and Project tools to complete the extension.

1. Let's start by making the Concrete Base class the active class.

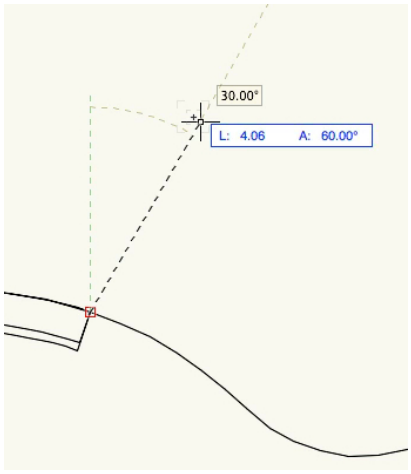
2. Switch to a Top/Plan view and center the drawing over the lower level of the skatepark.

3. Activate the **Arc** tool and enable the **Tangent to Line** mode.

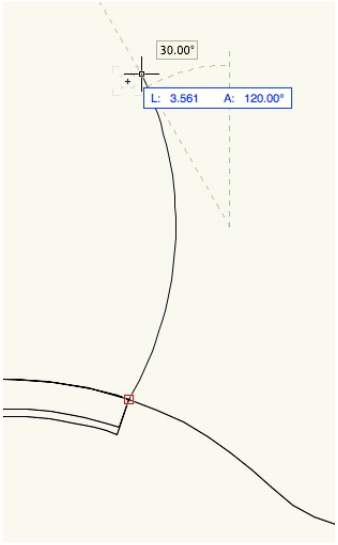
4. Start the arc by clicking on the right end of the curved bank, where it intersects the edge of the concrete base.



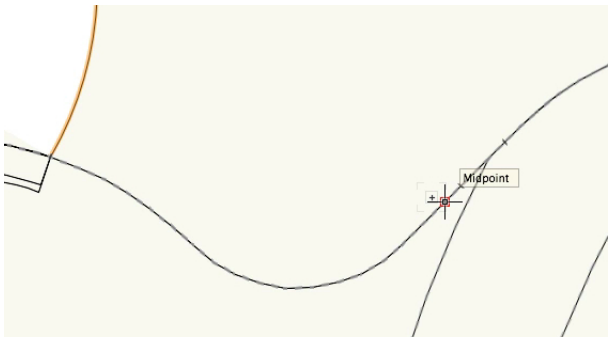
5. Move the cursor up at a 30° until the **Length (L)** field in the Floating Data bar is about 4 and click a second time.



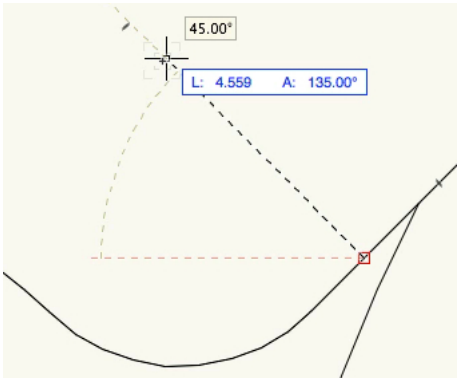
6. Move the cursor up and to the left, at a 30° angle until **Length (L)** is about 3.5, click one more time to complete the Arc.



7. Next, place the cursor on the edge of the concrete base, at the location shown in the image below. Click once to start another arc.

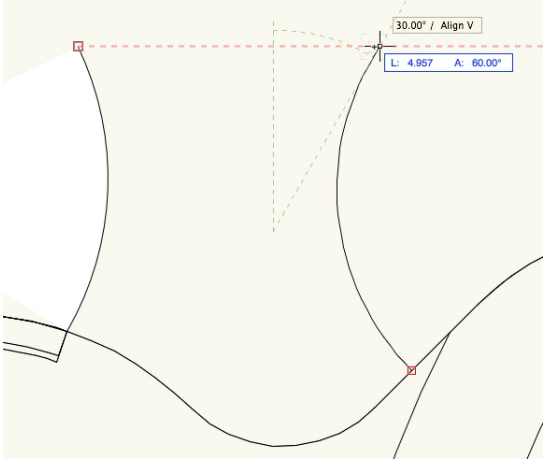


8. Move the cursor up and to the left, at a 45° angle. When the the **Length (L)** is about 4.5, click again.



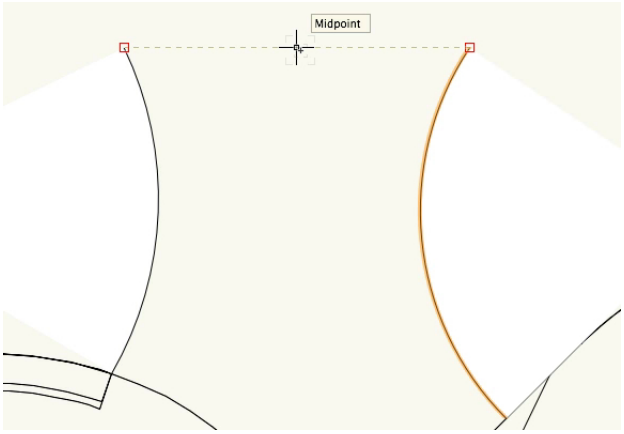
9. Acquire a Smart Point at the end of the first arc. Move the cursor to the right along the extension line. When the SmartCursor Cue "30° / Align V" is visible, click once more to

complete the arc.



10. Activate the **Rectangle** tool and enable the **Center to Corner** mode.

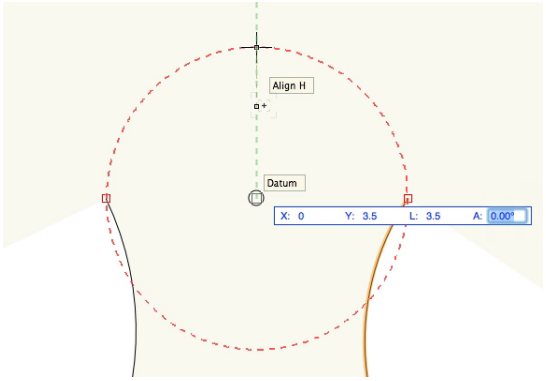
11. Acquire Smart Points at the end of each arc. Find the midpoint between the two Smart Points.



12. Press the G key to set a floating datum.

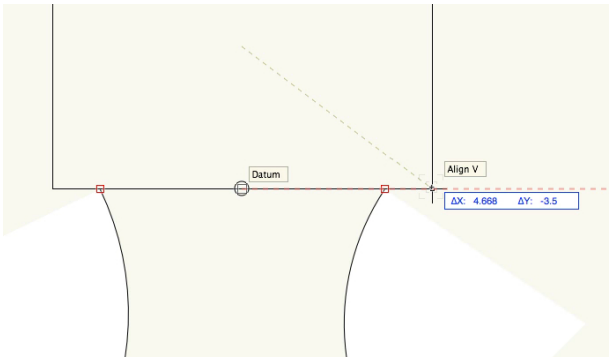
13. Tab into the Floating Data bar, set the **Length (L)** to 3.5, and press Tab to set the length.

14. Move the cursor upward and when the SmartCursor cue "Align H"" is displayed click once to start the rectangle.



15. Move the cursor down and to the right. Acquire a Smart Point at the end of the arc on the right.

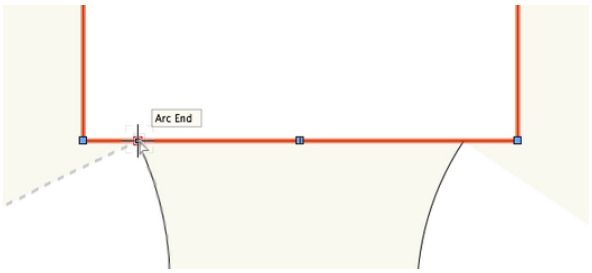
16. Move your cursor to the right along the extension line, until it is slightly wider than the two arcs. Click once more to complete the rectangle.



Now, let's use the Split tool to split the rectangle into two polygons.

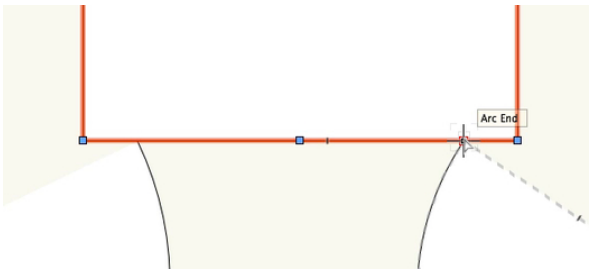
17. Activate the **Split** tool in the Basic palette. Enable the **Point Split** mode.

18. Place your cursor over the end of the left arc, when the SmartCursor Cue "Arc End" is displayed, click once.



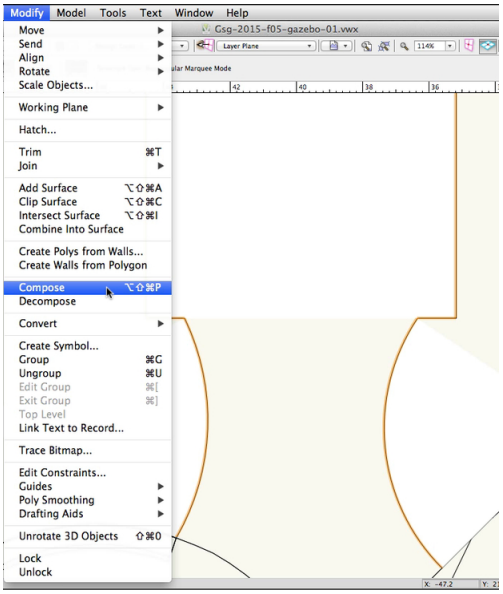
19. Make sure the rectangle is highlighted in red, use the Prev and Next buttons if needed, and click **OK**.

20. Repeat this action for the intersection of the rectangle and the right arc end, to create a separate segment the arc ends.

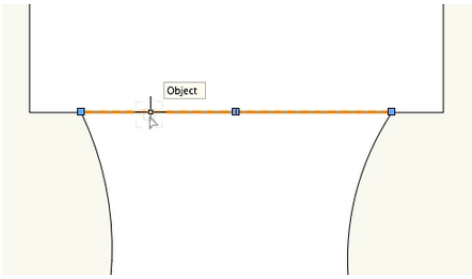


21. Select all the two arcs outer polygon segment and go to

Modify > **Compose**.



22. Select the middle trimmed segment and delete it.



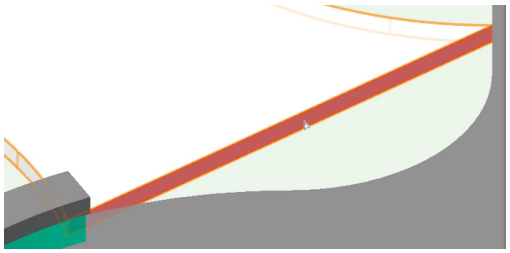
Next, we will extrude the polyline and use the Project tool to connect it with the concrete base.

23. Switch to a Left Isometric view.

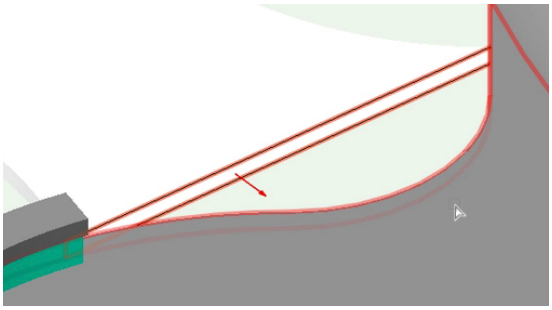
24. Select the polyline and check the **Closed** option in the Object Info palette. This will draw the final segment to create a closed polyline.

25. Using the **Push/Pull** tool, extrude the face of the polygon to a distance of 0.3.

26. Activate the **Extract** tool, then using the **Extract Surface** mode and **Create Planar Objects** option in the Extract Tool Preferences, extract the vertical face of the extruded polygon, that faces the concrete base.



27. Now, activate the **Project** tool, then using the **Add** and **Add Upwards** modes. Project the extracted face to the concrete base by clicking the polygon we just extracted and then the concrete base.



28. Select the extrude and projected generic solid, and go to **Model** > **Add Solids**.

29. Finally, give the extension the same Gray %30 fill color as the concrete base.

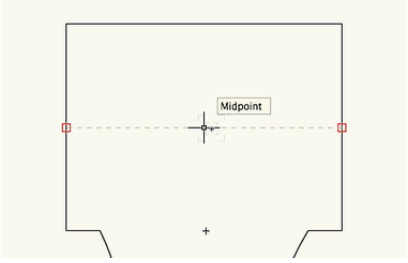
Creating the Gazebo Roof

We will now use the Create Roof command to create a roof for the gazebo.

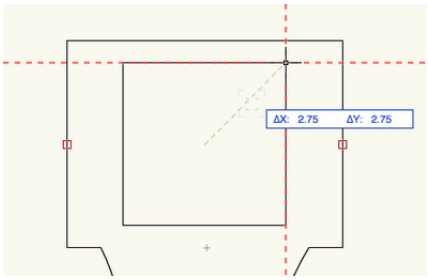
1. First, create a new class named Gazebo and make it the active class.

2. Switch to a Top/Plan view.

3. Activate the **Rectangle** tool, using the **Center to Corner** mode. Find the center of the rectangular gazebo area using Smart Points.



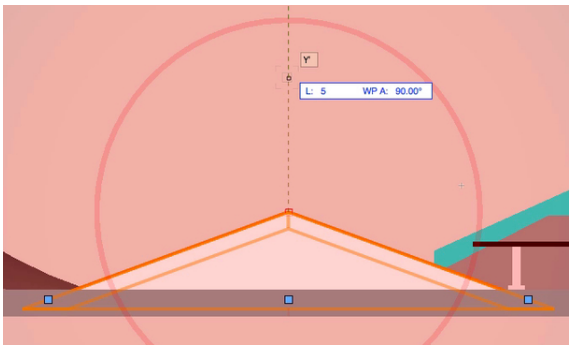
4. Then create a rectangle with a **Delta X (ΔX)** and **Delta Y (ΔY)** of 2.75.



5. With the rectangle selected, go to **Model** > **AEC** > **Create Roof**.

6. In the Create Roof dialog, set the **Thickness** to 0.18, the **Roof Pitch** to 20º, uncheck **Retain Original Objects**, and then click **OK**.

7. Now, switch to a Back view. You will see the roof is laying on the ground. Click on the peak of the Roof and drag it up. Tab into the Floating Data bar, set the **Length (L)** to 5, and press Enter or Return twice.



8. Switch to a Left Rear Isometric view and give the roof a Cool Gray %50 fill color.

9. In the Object Info palette, check the **Insert Soffit** option and then click on the **Soffit Settings** button.

10. In the Edit Soffit Settings dialog, set **Trim Depth** to 0.65, and click **OK**.

Next, we will insert a facia. In order to insert a fascia, we need to first adjust the eave setting.

11. In the Object Info palette, choose **Square Cut Miter** from the Eaves menu.

12. Now, check the option for **Insert Fascia** and click the **Fascia Settings** button.

13. In the Edit Fascia Settings dialog, set the **Fascia Width** to 0.15, the **Fascia Height** to 0.1, and then click **OK**.

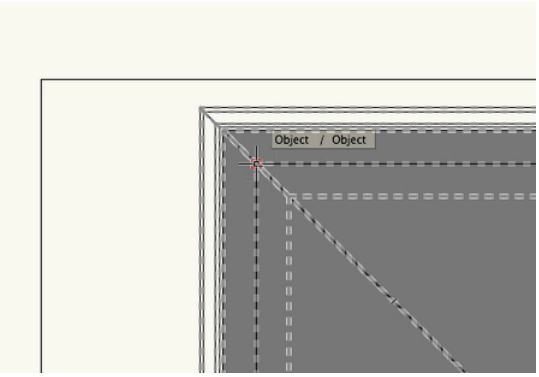
Creating Gazebo posts

We will use the Extrude command, Project tool, and the Duplicate Array command to quickly create four posts for the Gazebo.

1. First, let's create a base for the post. Switch to a Top/Plan view.

2. Activate the **Rectangle** tool and enable the **Corner to Corner** mode.

3. Click once on the inner top left corner of the gazebo roof.

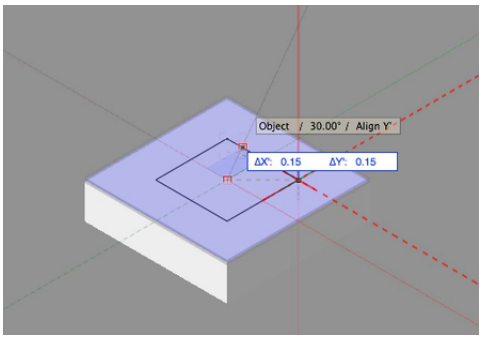


4. Tab into the Floating Data bar, set the **Delta X (ΔX)** to 0.6. Make sure the **Delta Y (ΔY)** is -0.6, and press Enter or Return twice to place the rectangle.

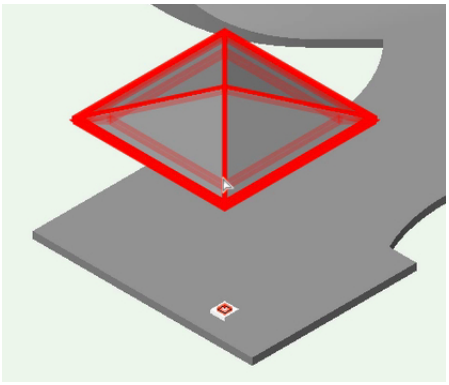
5. With the rectangle selected, go to **Model** > **Extrude** and set the Extrusion to 0.15.

6. Switch to a Left Rear Isometric view and in the Object Info palette, set the **Z** of the extrude to 0.3.

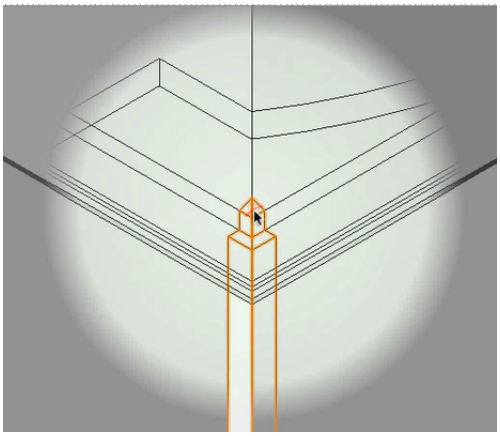
7. Draw a rectangle on top of the extrude, using the **Center to Corner** mode and with **Automatic Working Plane** active. Tab into the Floating Data bar, set the **Delta X (ΔX)** to 0.15. Make sure the **Delta Y (ΔY)** is 0.15, and press Enter or Return twice to place the rectangle.



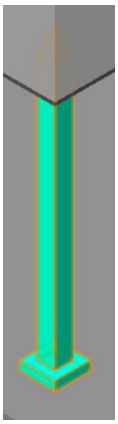
8. Using the **Project** tool, with **Add** and **Add Downwards** modes enabled, click the rectangle first then the roof object to project the rectangle.



Note: If you press the B key to activate the X-Ray Select mode, you will see the top of the Post conforms to the shape of the inside of the Gazebo Roof.



9. Select the post and the base, go to the **Model** > **Add Solids**, and give the combined object a turquoise fill color.



10. Switch to a Top/Plan view.

11. With the post selected, go to **Edit** > **Duplicate Array**.

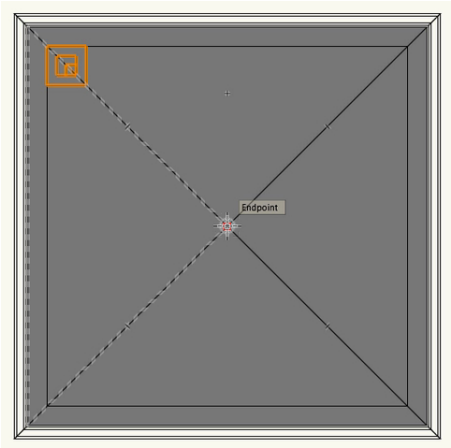
12. In the Duplicate Array dialog, set the Shape menu to **Circular Array**.

13. Then the **Number of Duplicates** to 3 and the **Angle Between Duplicates** to 90º.

14. Choose **Next Mouse Click** for Circle Center Point, check the **Rotate Duplicates** option, and enable **Use Duplication Angle**.

15. Finally, make sure **Retain** is checked under Original Object and click **OK**.

16. Click once in the center of the roof to duplicate the posts around the gazebo roof.



Adding Benches and Light Posts

Resource Browser

In this section we will use the Resource Browser to import symbol resources from another file.

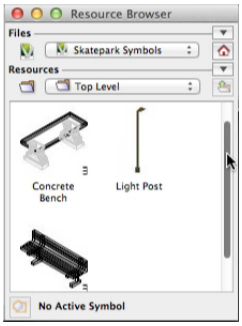
1. In the Resource Browser, click on the Files menu button above the Home button.

2. In the Files menu, choose **Browse a Document**. This will allow you to view resources from other Vectorworks files.

3. Download the Skatepark Symbols.vwx file. This file can be found in the Exercise Files section. Navigate to the Skatepark Symbols.vwx file and click Open.

4. This file contains three symbols, a Concrete Bench, Light Post,

and Wooden Bench. If you scroll through the Resource Display window, you will see these resources.



These symbols are currently saved in the Skatepark Symbols file. To import the symbols into our document, you can either drag and drop a symbol into the file or use the Import option to move the resource into the active document.

5. Select all three symbols in the Resource Browser.

6. Right-click on the first symbol and choose **Import** from the menu.

7. In the Import Symbols dialog, leave **Preserve Folder Hierarchy** enabled and Click **OK**.

8. Now, click the Home icon in the top right corner of the Resource Browser. This will switch the view of the Resource Browser back the active document.

9. If you scroll through the Resource Display window, you will see the three symbols now show with the other symbols we have created in this file.

Adding Benches

Next, we will use the Symbol Insertion tool to add bench symbols around the skatepark. The Symbol Insertion tool allows you to place a symbol and set it's rotation.

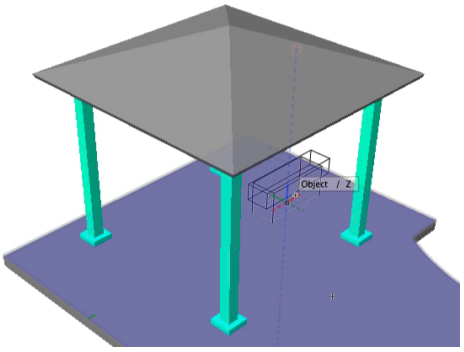
1. Let's start by creating a new class for the benches. Name the class Benches and make it the active class.

2. Switch to a Left Isometric view.

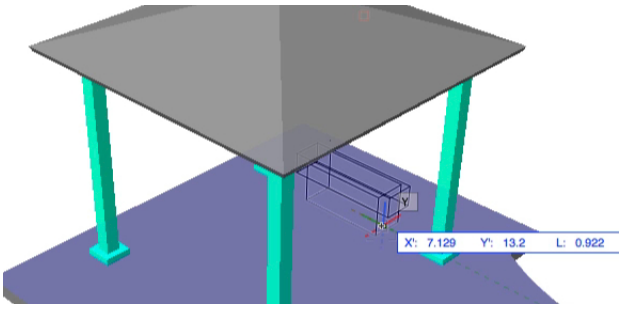
3. Now, let's place some wooden benches under the gazebo. In the Resource Browser, double-click on the Wooden Bench symbol. This will make the Wooden Bench the active symbol and activate the **Symbol Insertion** tool in the Basic palette.

4. When you move the cursor into the drawing area, you will see a preview of the Wooden Bench symbol. Move the cursor over the right side of the gazebo.

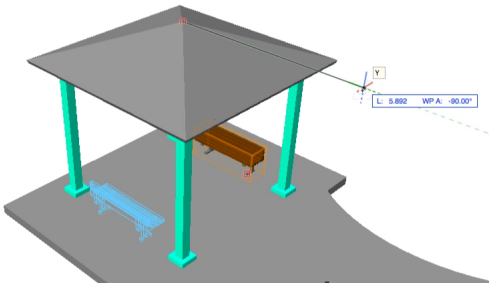
5. Using Smart Points and the **X-Ray Selec**t mode, align the insertion point of the bench with the center of the right side of the gazebo area. Click once to place the bench under the gazebo roof.



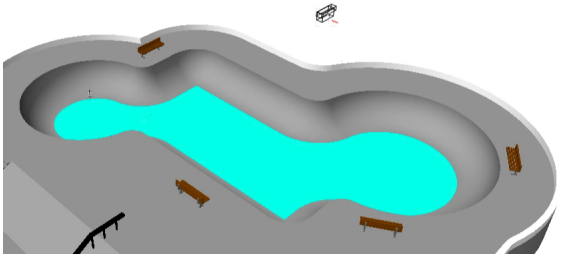
6. Move the cursor down and to the right along the Y extension line. Click once to center the rotation and place the bench.



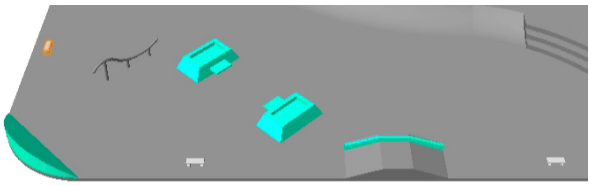
7. Then, using the **Mirror** tool, create a duplicate of the bench on the other side of the gazebo.



8. Using the same technique, place four more wooden benches around the bowl on the upper level of the skatepark.



9. Double-click on the Concrete Bench symbol in the Resource Browser and place three instances of this symbol around the lower level of the skatepark.



Adding Light posts

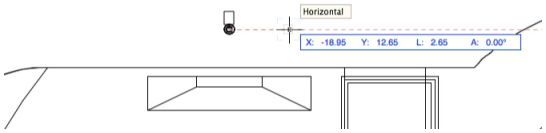
In this section, we will add a single light post symbol to the Skatepark. Then, using the Extract tool, Offset tool, and Duplicate Along Path command, we will create 12 light posts around the skatepark.

1. First, create a new class named Light Posts and make it the active class. Also set Rails class to invisble.

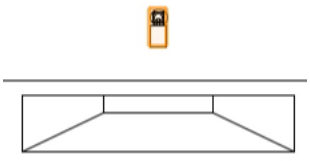
2. Switch to a Top/Plan view and center the drawing area to the right of the gazebo.

3. Double-click on the Light Post symbol in the Resource Browser.

4. Click once outside of the skatepark, to the right of the gazebo to set the insertion point for the light post.



5. Move the cursor to the left horizontally. Click once to set the rotation.



Next, we will need to extract the edge of the concrete base to create the path to duplicate the light posts around.

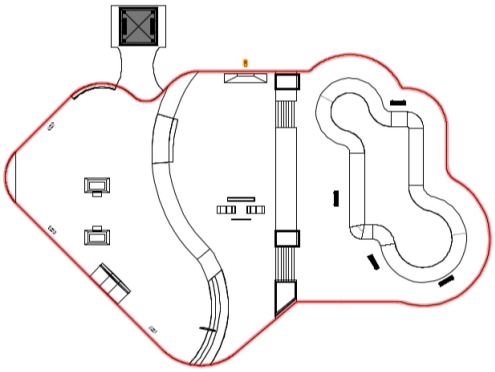
6. To make it easier to extract the edge, set the Rails class to invisible.

7. Activate the **Extract** tool, enable the **Extract Curve** mode, and click on the **Extract Tool Preferences** button.

8. Check the S**elect Tangent Entities** option and uncheck all other options.

9. Move the cursor over the edge of the concrete base, a portion will highlight in red. Click once to select it.

10. While holding the Shift key, move the cursor around the concrete base until the all edges are selected. Do not select the edges of the gazebo extension.



11. Click the green check mark button in the tool bar to extract the curves.

12. The curves will be created in a group, go to **Modify** > **Ungroup**, to ungroup the curves.

13. With all of the NURBS curves selected, go to **Modify** > **Compose**, to create one object.

We need to Offset the path, you cannot use the Offset tool on NURBS curve objects, so we need convert the NURBS curve to a polygon.

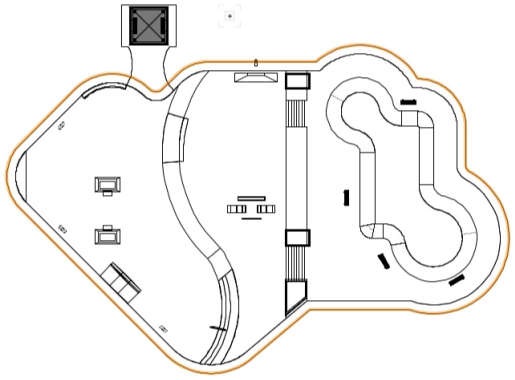
14. Go to **Modify** > **Convert** > **Convert to Polygons**.

15. In the Convert to Polygons dialog, choose **Wireframe Rendering** and click **OK**.

16. Ungroup the converted polygons and go to **Modify** > **Compose** to combine the polygons into one object.

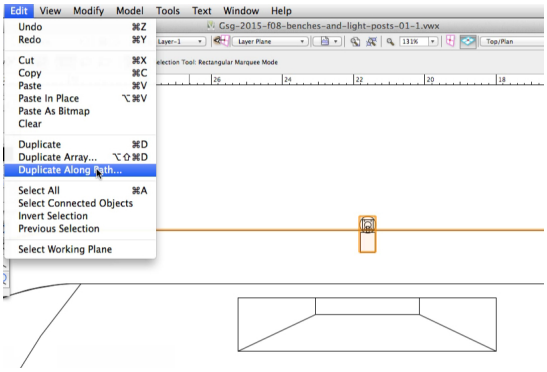
17. Activate the **Offset** tool, enable the **Offset by Distance** and **Offset Original Object** modes, and set the **Distance** to 1.5.

18. Click once on the outside of the polygon.



19. Select the path (polygon) and the light post.

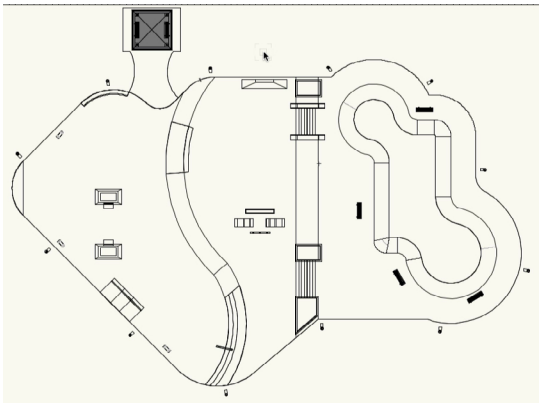
20. Go to **Edit** > **Duplicate Along Path**.



21. In the Duplicate Along Path dialog, set the **Number of Duplicates** to 12 and check the options for **Center Object on Path**, **Tangent to Path**, and make sure **Keep Original Orientation** is unchecked.

22. Now Click **OK**.

23. Delete the path object, as it is no longer needed.



24. Switch to a Left Isometric view, to see the placement of the light posts.

You will see that the bases of the light posts are lower than the surface of the Skatepark.

25. To better visualized the position of the light posts, click on the **Classes** button in the View bar and set the Site Class to visible. This will turn on a preconfigured site. (**Screenshot**)

This object was made using the same techniques we used to create the concrete base. Let's adjust the height of the light posts.

26. First, if any light posts are on the tapered or filleted slopes, move them off the slopes.

27. Select all of the light posts around the upper level of the skatepark.

28. To adjust the height of these light posts, simply set the **Z** to 2.75 in the Object Info palette.

29. Now, select any light posts on the middle level and set the **Z** to 1.25.

30. Finally, repeat this operation for the light posts on the lower level. Setting the **Z** to 0.15.

Creating Viewports

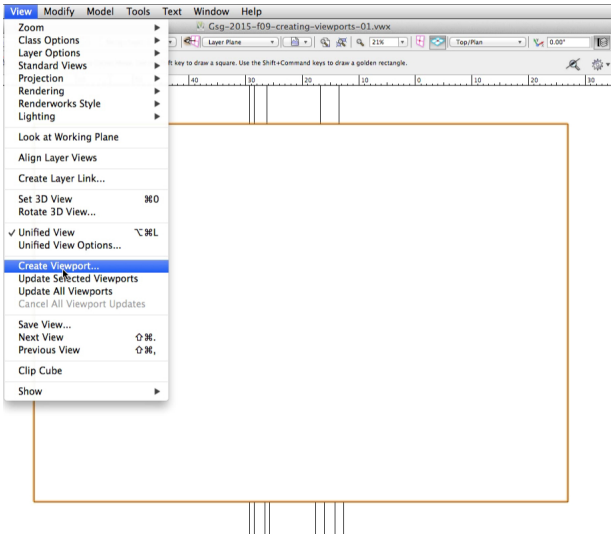
Cropped viewport

We now have a complete skatepark. Next, we will create a cropped viewport and place it on sheet layer. Then, we will adjust the sheet layer page setup, set the scale, position, and visibility settings of the viewport.

1. Switch to a Top/Plan view.

2. To create the crop, you can use any 2D shape. For this viewport, draw a rectangle over the skatepark.

3. With the rectangle selected, go to **View** > **Create Viewport**.



4. A prompt will appear, asking if you want to use the selected object as the crop. Click **Yes**.

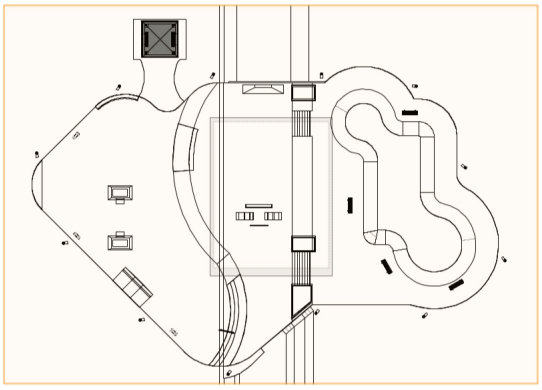
5. In the Create Viewport dialog, choose **New Sheet Layer** in the Create on Layer menu.

6. In the New Sheet Layer dialog, keep the default settings and click **OK**.

7. Set the Scale to **1:100**.

8. Do not adjust any other settings in the Create Viewport dialog at this time. All of these settings can be adjusted after the viewport is created. Click **OK**.

The viewport is created and placed on the new sheet layer. Next, let's edit the sheet layer page setup.



9. Now let's edit the page setup of the new Sheet Layer. Go to **Tools** > **Organization**.

10. Switch to the Sheet Layers tab and click the **Edit** button.

11. In the Edit Sheet Layers dialog, click **Page Setup**.

12. Uncheck the **Show Page Breaks** option under Pages.

13. Under Printable Area, check the **Choose size unavailable in printer setup** option.

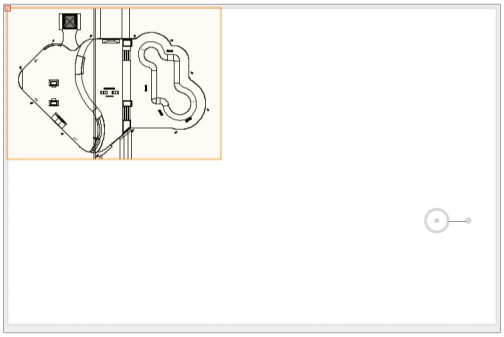
14. Then, select **ASME D** from the Size menu.

15. Click **OK** to save the changes, then click **OK** two more times to exit the Edit Sheet Layers and Organization dialogs.

The viewport is still too large to fit on our page. Let's adjust the scale of the viewport and position it on the page.

16. With the viewport selected, in the Object Info palette set a **Custom Scale** to 1:250.

17. Now move the viewport to the upper left corner of the page.

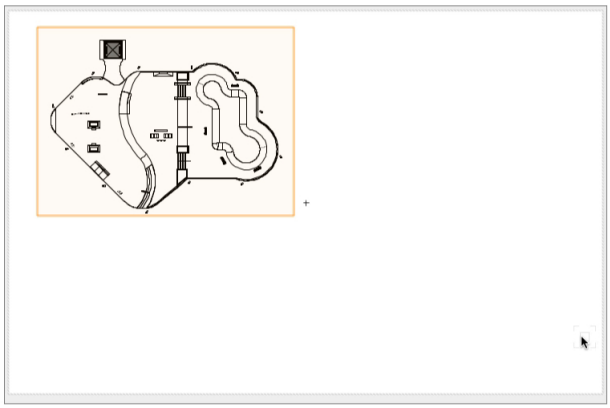


Viewports have independant class and layer visibility settings. You can choose which Class or Layers you wish to display per viewport. Let's turn off the Site Class for this viewport.

18. In the Object Info palette, click on the **Classes** button to edit the class settings for this viewport.

19. Set the Site class to Invisible

20. Click **OK**.



21. The Site is no longer visible in the viewport. However, if you click on the **Classes** button in the View bar, you will see the Site class is still set to visible in the file.

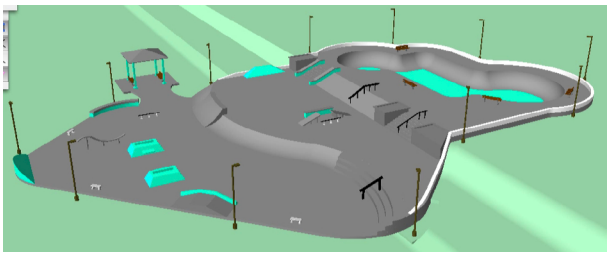
Custom 3D viewport

Now let's create a custom 3D viewport. We will setup a custom view on the design layer, then create a viewport and apply a render mode.

1. In the View bar, click on the Layers menu and choose **Design Layer-1**.

2. Switch to a Left Isometric view.

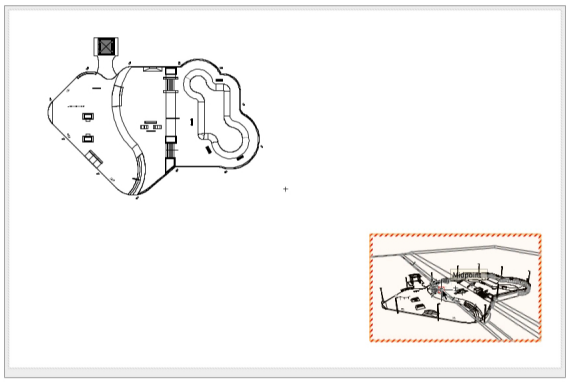
3. Using the **Flyover**, **Pan**, and **Zoom** tools, adjust the view until the skatepark appears similar to the image below.



4. Now, go to **View** > **Create Viewport**.

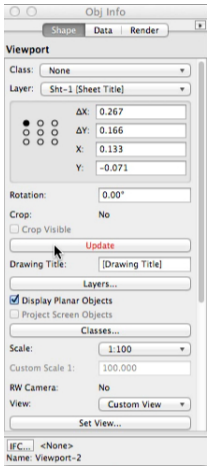
5. Keep the default settings and click **OK**.

6. The viewport is placed on the center of the sheet layer. Move it to the bottom right corner of the page area.



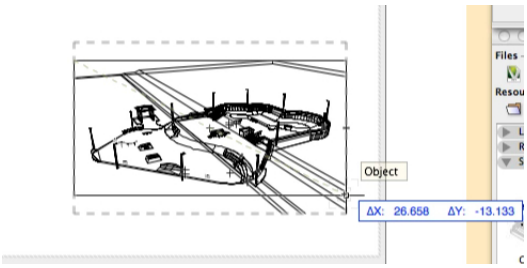
You will notice, the viewport is in Wireframe has a red and white border. This is the viewport out-of-date border. It indicates that the viewport needs to be updated. We created this viewport in an OpenGL Render mode. Viewports with render mode settings need to be updated any time you make changes in the file.

7. With the viewport selected, go to the Object Info palette. You will see the **Update** button is red. This indicates the viewport is out of date. Click **Update** to render the viewport.



8. Now, let's add a crop to this viewport, double-click on the viewport, select **Crop**, and click **OK**.

9. In the Edit Crop window, draw a rectangle around the skatepark.



10. Click the **Exit Viewport Crop** button in the top right corner of the drawing area.

11. Click **Update** in the Object Info palette to render the viewport.

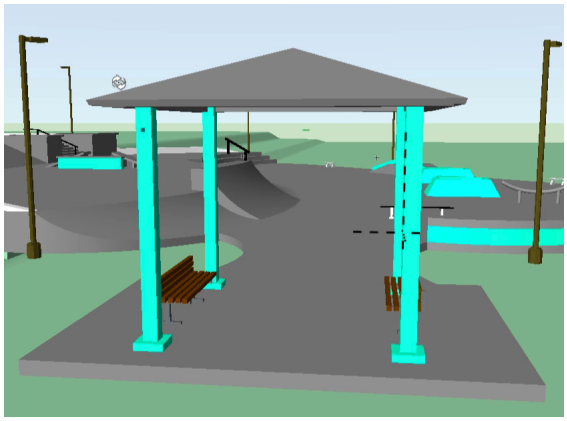
Viewport of the Gazebo

Next, let's create a viewport focused on the gazebo. Then, we will add a Foreground Render option to give the viewport a different style.

1. Using the Layer menu in the View bar, switch back to **Design Layer-1**.

2. Switch to a left Right Isometric view and use the **Flyover**, **Pan**, and **Zoom** tools to adjust the view until the gazebo appears

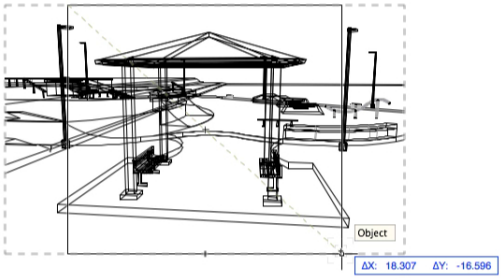
similar the image below.



3. Go to **View** > Create **Viewport** and Click **OK**.

4. Move the viewport to the upper right corner of the page area.

5. Add a crop around the gazebo.



6. Now, in the Object Info palette, selected **Hidden Line** from the Foreground Render menu.

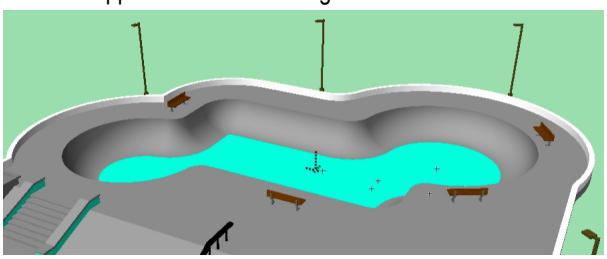
7. Click the **Update** button to render the viewport.

Viewport of the Bowl

Finally, we will create one more viewport centered on the bowl. Then, we will add Foreground Hidden Line Render option and adjust the settings.

1. Switch back to Design Layer-1.

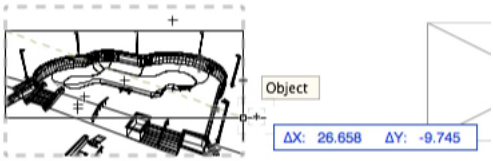
2. Use the **Flyover**, **Pan**, and **Zoom** tools to adjust the view until the bowl appears similar the image below.



3. Go to **View** > **Create Viewport** and Click **OK**.

4. Move the viewport to the lower left corner of the page area.

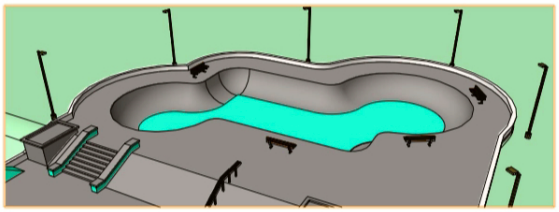
5. Add a crop around the bowl.



6. Now, in the Object Info palette, selected **Hidden Line** from the Foreground Render menu.

7. Click the **Update** button to Render the viewport.

You will notice there are a unwanted lines on the sides of the Bowl. We can remove these lines, by adjusting the Smoothing Angle for the Hidden Line Render mode.



8. In the Object Info palette, click the **Foreground Render Settings** button.

9. Set the **Smoothing Angle** to 15º and click **OK**.

10. Click the **Update** button in the Object Info palette, to Render the viewport and see the changes.

Enhanced with Renderworks

Applying and Editing Textures

In the section we will import a texture and apply it to the concrete base. We will then use the Attribute Mapping tool, to adjust the scale of the texture. Finally, we will duplicate the texture, edit it's settings and apply it to some of the obstacles in the skatepark.

1. Switch to Design Layer-1.

2. Change the View to Left Isometric.

3. Center the skatepark in the Drawing Area.

4. In the Resource Browser, click on the **Files** list and select **Vectorworks Libraries**.

5. Navigate to the Textures folder, select Textures_Exterior Finishes.vwx, and click **Open**.

6. In the resource display window, locate the Conc Stained Smooth Clear texture.

7. Right-click on the texture and choose **Import**.

8. Click on the **Classes** button in the View bar, select the Concrete Base class, and click **Edit**.

9. In the Edit Class dialog, switch to the Other tab, check the **Texture / Surface Hatch** option and choose the Conc Stained Smooth Clear texture.

10. Click **OK** twice to save the changes and exit the Edit Class and Organization dialog.

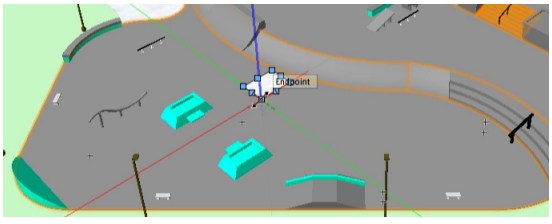
All of the objects in the Concrete Base class, will now render using the Conc Stained Smooth Clear Texture. You will notice the texture pattern appears small. Next, we will use the Attribute Mapping tool, to adjust the texture mapping.

11. Select the concrete base.

12. Activate the **Attribute Mapping** tool in the Basic palette.

13. Choose **Plane** under New Map Type and click **Yes**.

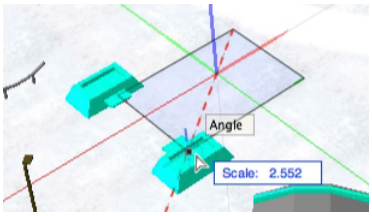
14. Click once on the lower level of the skatepark.



15. Enable the **Original Repeat** mode in the Tool bar.

16. Click and drag the bottom left, blue handle to adjust the scale of the texture.

17. When the Scale field is about 2.5, click once to set the scale.



18. Press X once, to switch to the **Selection** tool.

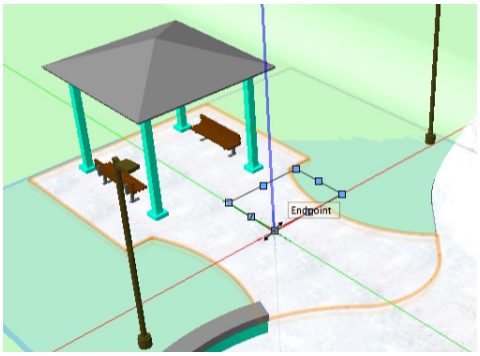
19. In the Object Info palette, switch to the Render tab and check the option for **Use World Z For Origin**.

20. Now, select the gazebo extension to the concrete base.

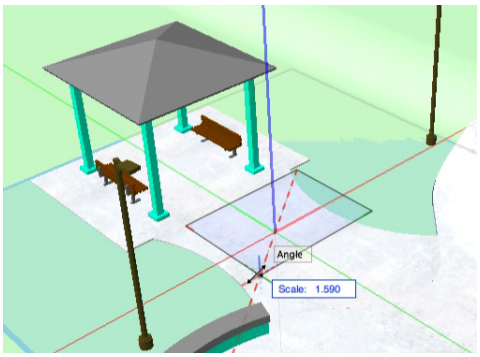
21. Activate the **Attribute Mapping** tool.

22. Choose **Plane** under New Map Type and click **Yes**.

23. Click once on the gazebo extension.



24. Adjust the scale of the texture until it is about, 1.5.



25. Switch to the Selection tool and check the **Use World Z For Origin** option in the Object Info palette.

26. Click the Home button in the Resource browser, to view the

resources from the current active document.

27. Next, right-click on the Conc Stained Smooth Clear Texture in the Resource Browser.

28. Choose **Duplicate**.

29. Name the Texture, Conc Stained Smooth Clear-Object Color and click OK.

30. Right click on the new Texture in the Resource Browser and choose **Edit**.

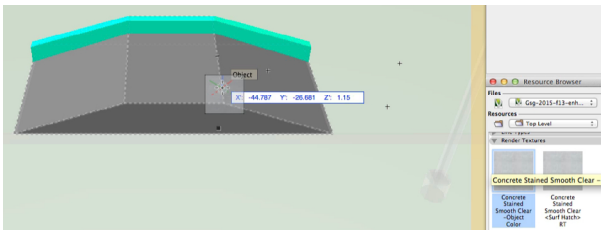
31. Under Color, click the **Edit** button.

32. Under Filter Color, choose **Use Object Fill**, and click **OK**

33. Click **OK** again, to exit the Edit Texture dialog and save the changes.

34. Double-click on the ramp group at the bottom of the skate park to edit the group.

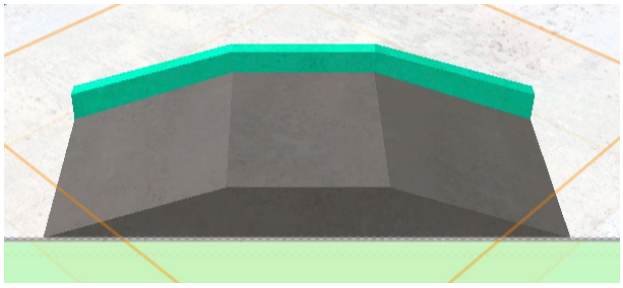
35. Click and drag the Conc Stained Smooth Clear-Object Color from the resource browser to the main body of the ramp.



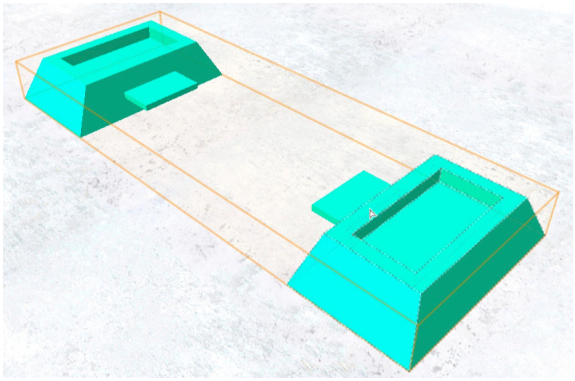
36. Now, select the ledge and double-click the Conc Stained Smooth Clear-Object Color texture from the Resource Browser. This is simply an alternate method of applying a texture to a selected object.

37. Exit the group.

You will notice the texture appears darker on the tapered ramp. This is because the texture is using this object's current fill color with the texture.



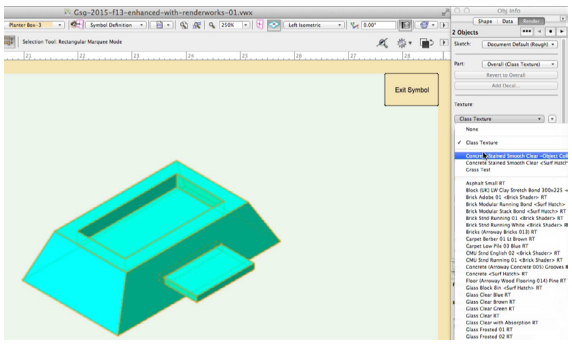
38. Double-click on the group of tapered ramp symbols on the bottom level of the skatepark.



39. Then, double-click on one of the symbols within the group. Choose to edit the **3D Component** of the symbol, and click **OK**.

40. Render in OpenGL if your rendering mode has reverted to wireframe.

41. Apply the Conc Stained Smooth Clear-Object Color to all objects within this symbol by selecting the texture from the Render tab in the Object Info palette.

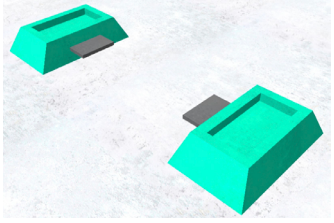


42. Deselect the objects, then select the small ledge.

43. In the Attributes Palette, set its fill color to Cool Gray 50%. You can see that the texture still remains, but takes on the objects new fill color automatically.

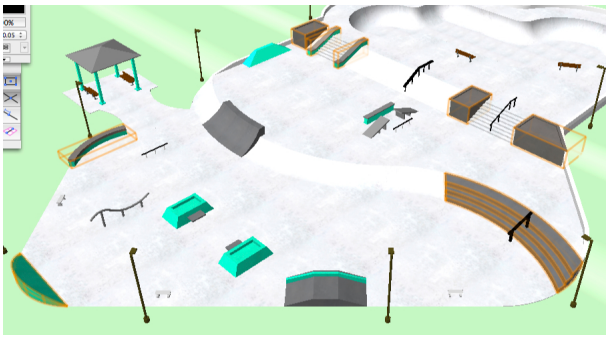
44. Exit the symbol.

Notice that the mirrored duplicate of this symbol has changed as well. This is because any changes made to a symbol, will be pushed to all instances of that symbol within a document.



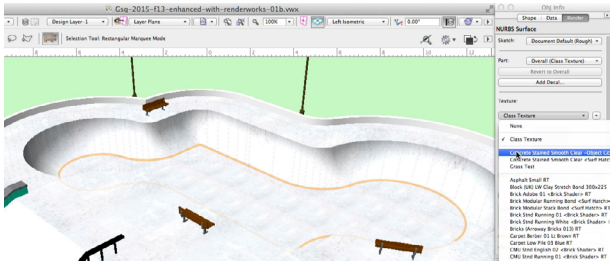
45. Select the curved ramp between the lower and middle levels, and apply the Conc Stained Smooth Clear-Object Color texture to is as well.

46. Repeat these steps on the following objects hightlight below using the same methods just demonstrated.



You may have noticed the color on the bottom surface of the bowl has changed, This occurred when we changes the texture of all objects in the Concrete Base class.

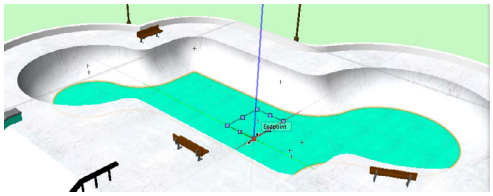
47. To correct this, simply change the texture of the bottom surface to the new Conc Stained Smooth Clear-Object Color texture from the Texture menu in the Render tab of the Object Info palette. The colored fill will now show through again.



48. To adjust the textures size, as we did before, select the **Attribute Mapping** tool.

49. Select **Plane**, then click **OK**.

50. Click on the surface of the bottom of the bowl.



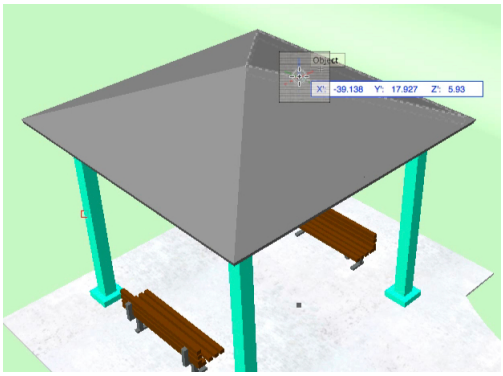
51. Scale this texture to around 1.9, then click and switch back to the **Selection** tool.

52. Now let's apply a new texture to the gazebo roof. Go to the Resource Browser and in the File List, choose **Vectorworks Libraries**.

53. Navigate to the Textures folder, select Textures_Exterior Finishes.vwx, and click **Open**.

54. In the Resource Display window, locate the Shingles White Texture.

55. Click and drag the texture onto the roof of the gazebo. This will import the texture and apply it to the gazebo roof.



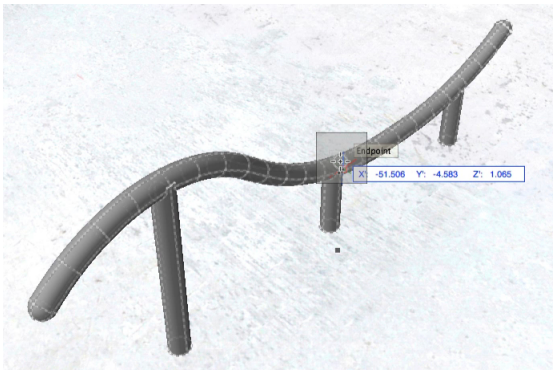
56. Click on the Home icon in the Resource Browser, locate the Shingles White Texture, right-click, and choose **Edit**.

57. Under Color, click the **Edit** button.

58. Under Filter Color, choose **Use Object Fill**, and click **OK**

59. Name the texture, Shingles-Object Color.

60. Click **OK** again, to exit the Edit Texture dialog and save the changes.



The Roof now shows the Gray fill color with the texture.

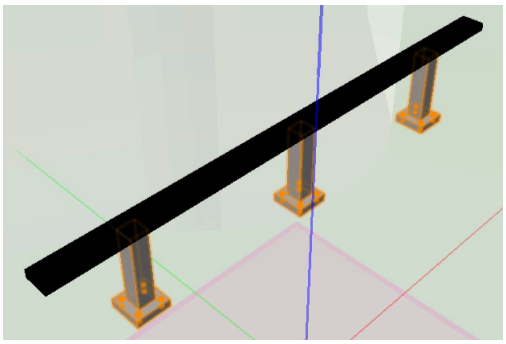
61. Through the Resource Browser, access the Vectorworks Libraries and open the Textures_Metals Plastics and Glass.vwx file in the textures folder.

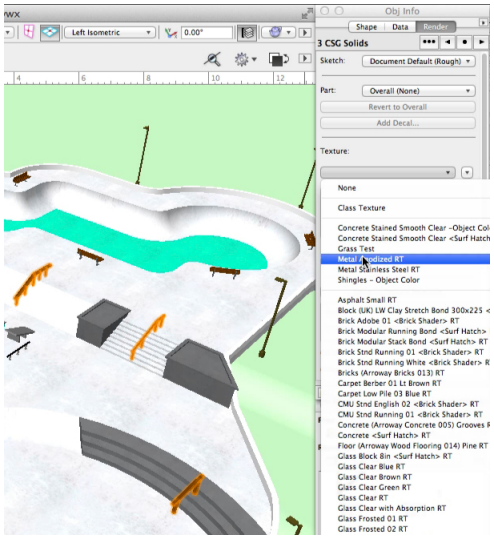
62. Locate the Metal Stainless Steel texture.

63. Apply this texture to the S-shaped rail on the bottom level of the skatepark.

64. Double-click one of the Long Rail symbols. Choose to edit the **3D Component** and click **Edit**.

65. Select the three posts and double-click on the Metal Stainless Steel texture to apply it to the posts.





66. Now, select the rail, locate and double-click on the Metal Anodized Texture in the Resource Browser to apply it to the rail.

67. Click the **Exit Symbol** button to exit the symbol editing window and save the changes.

68. Apply the Metal Anodized texture to the rails on the stairs and the tapered surface as shown below.

Creating Textures

Now we will create a new texture resource. Will use a grass image for our texture. Then we will adjust the shaders and add a displacement mapping.

1. In the Resources Browser, click on the Resources menu and choose **New Renderworks Texture in…**

Note: If you do not see the **New Renderworks Texture in…** option, choose **New Resource in…** and select **Renderworks Texture** from the menu.

2. In the Edit Texture dialog, name the texture Grass.

3. Under Color, choose **Image**.

4. Download the Skatepark Grass.jpg image from the Exercise Files section and navigate to the file.

5. Click **OK** in the Edit Image Color dialog.

6. Set the Reflectivity to **Plastic**.

7. Under Preview Options, set the **Obj Size** to 3.

8. Under Size, click the **Set By Image** button, click and drag the sizing marker across the top of the preview image.

9. Also enter 1.5 for the **Feature Size**.

10. Under Bump, choose **Noise** and click **Edit**.

11. For the Pattern, choose **FBM**.

12. Adjust the **Strength** to 100%.

13. Under Scale, set the **Global Percent** to 5.

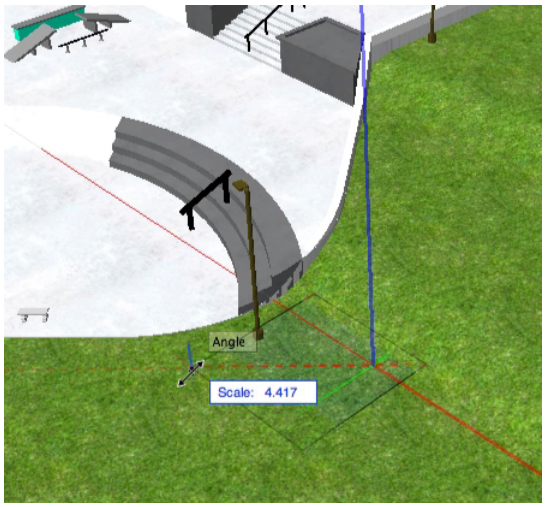
14. Under Options, set **Detail** to 8.

15. Finally, under Displacement Mapping, set the **Height** to .025 and the **Detail** to High.

16. Click **OK** and then **OK** again to create the texture.

17. Now, apply the texture to the site object, by dragging the texture from the Resource Browser onto the site.

18. Then adjust the scale using the **Attribute Mapping** tool. Set the scale to about 4.4.



Adding Light Objects

Next, we will add a light object to the Light Post symbol.

1. Double-click the Light Post symbol near the curved stairs in the drawing and choose to Edit the **3D Component**.

2. Switch to an Orthogonal Projection, by going to **View** > **Projection** > **Orthogonal**.

3. Switch to a Left view and render in Wireframe.

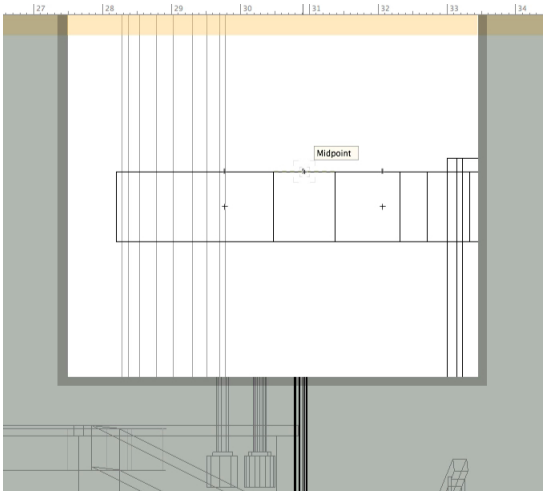
4. In the **Visualization** tool set, activate the **Light** tool.

5. Enable the third mode, **Spot Light** mode.

6. Move your cursor over the top of the light post.

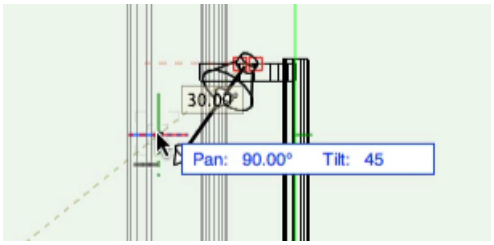
7. Press the Z key to activate the **Snap Loupe** mode.

8. Click once in the center of the top of the light post.



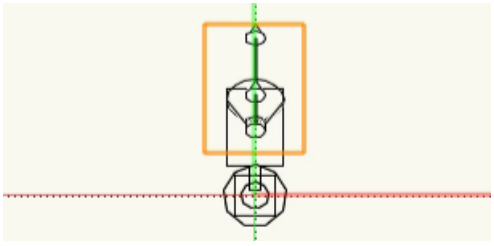
9. In the Light Preferences dialog, check the **Soft Shadows** option and click **OK**.

10. Adjust the angle of the spot light, until the **Pan** is 90° and the **Tilt** is 45°.



11. Switch to a Top/Plan view.

12. Make sure the Spot Light is pointing in the correct direction.

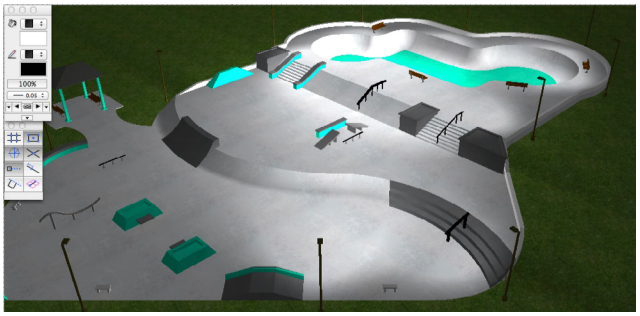


13. In the Object Info Palette, set the **Spread** to 100°, the **Beam** to 50°, the **Z** to 7.15, and adjust the **Tilt** to about 37°.

14. Click the **Exit Symbol** button to exit the symbol and save the changes.

You will see the light object was added to each instance of the Light Post Symbol. In this rendered view, you can also still see the Wireframe representation of the light objects.

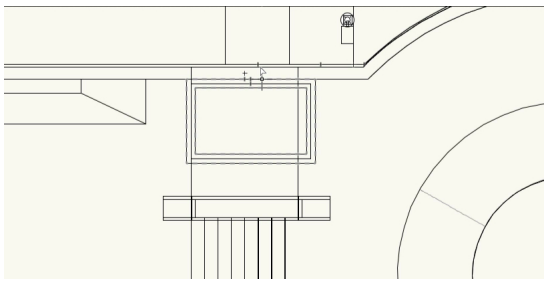
To disable this, go to **Tools** > **Settings** > **Vectorworks Preferences**. In the Display Tab, set Display Light Objects to **Only in Wireframe**. Click OK to return to the drawing. The light objects should no longer be visible.



Using Image Props

We will place several image prop objects to represent the plants for our planter boxes. Image props are a quick way to represent 3D objects without having to modeling them.

1. Switch to a Top view and zoom in on the upper planter box.



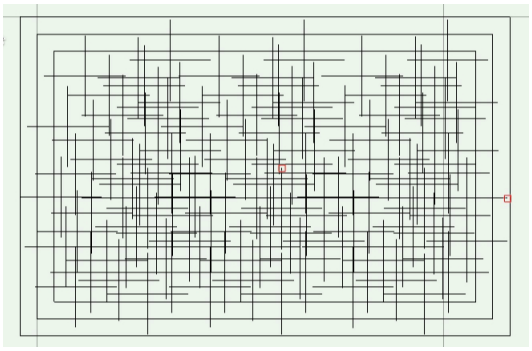
2. Double-click on the Planter Box symbol and choose to edit the **3D Component**.

3. In the Resource Browser, navigate to the Flower Image Prop, in the Symbols/Plugin Objects section.

Note: This is a predefined Image Prop object. For more information on creating Image Prop objects, please see the Further Exploration section.

4. Double click on the Flower Image Prop object.

5. Move your cursor within the planter. Place multiple instances on this symbol within the planter. Hold the Back Quote (`) key to disable snapping to make it easier to randomly place the instances.



6. Select all of the Image Props and set the Z to 3.5 in the Object Info Palette.

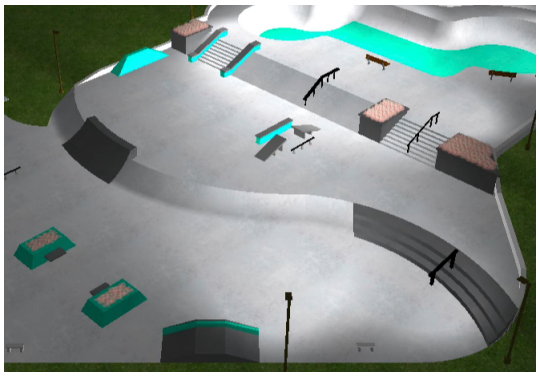
7. Click the **Exit Symbol** button.

8. Switch to a Left Isometric view.

9. Zoom out, so you can see both instances of this Planter Box symbol.

10. Now, go to **View** > **Rendering** > **Fast Renderworks**.

Fast Renderworks, will render the scene with more detail than OpenGL. You will also see shadows. Switch back to an OpenGL render mode and repeat this process for the other planters.



Placing Renderworks Cameras

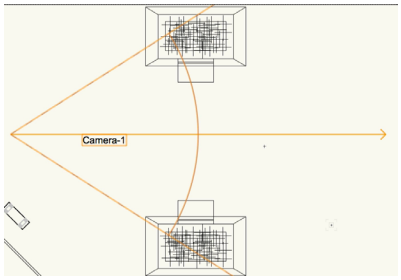
Finally, we will place a Renderworks Camera to quickly define a custom view. Then we will render using a Renderworks Style.

1. Switch to a Top/Plan view and center your view over the lower level of the Skatepark.

2. Activate the **Renderworks Camera** tool in the Visualization tool set.

3. Click once in between and to the left of the planter boxes on the lower level set the location of the Renderworks Camera.

4. Move the cursor to the right until the **Length (L)** is about 16. click once more to set the direction of the camera.



5. Accept the defaults in the Object Properties dialog and click **OK**.

6. In the Object Info palette, click **Display Camera View**. The view will change to show the view of the Camera.

7. Click the **Fine Tune Camera View** button in the Object Info Palette.

8. Set the **Camera Height** to 4.25 and click OK.

9. Finally, go to **View** > **Renderworks Styles** > **Realistic Exterior Night Final**.

This will render the view using a pre-defined Renderworks Style. There are several Renderworks Styles included with Renderworks. You can also create your own custom styles for your needs. You have now completed the skatepark project.