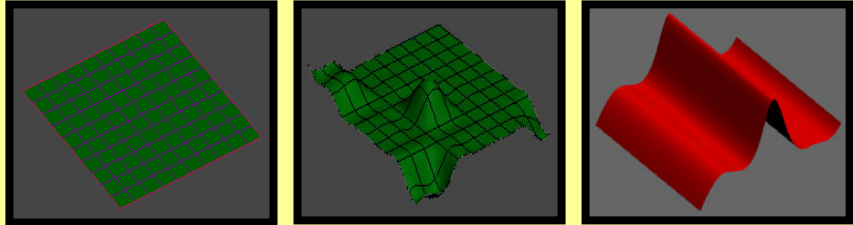# Power Plane Tool

In this tutorial, you will learn how to create a Power Plane and be shown how to:
- **Edit Control Points and Handles.**
- **Edit Spline Cage Settings.**
    - Smooth Bezier Curves, C1 Bezier Curves, Y-Axis Symmetry, Edge Rounding

Tool Used In This Tutorial

This tutorial will be accomplished with the following tool:

 Power Plane tool **(Pwr_Plane).**
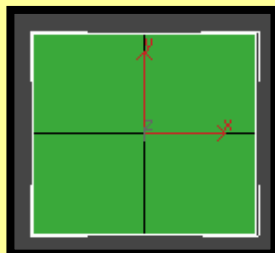
Creating Power Planes

In this section we will discuss:
- A) Smooth Bezier Curves for the Power Plane
- B) C1 Bezier Curves for the Power Plane

Procedure – Power Plane Tool

The Power Plane tool provides a convenient way to create a spline cage that consist of a one Rail Sweep surface. The initial shape is a rectangle. The shape of the rectangle can be modified by editing the points and curves of the associated spline cage sketch or using the Sub-Object Point or Sub-Object Curve editing on the Power Rectangle object itself.

1) Start off by accessing the Power Plane tool .
2) In the top view port click and drag a Power Plane shape.

3) While the shape is still selected, go into the modify mode. Under the Power Plane Parameters roll out, you can change the Length and Width segments of your shape by adjusting the spinners. Change the Length and Width segments to 6 for this example. By Increasing the number of segments in your shape will allow for more detail.
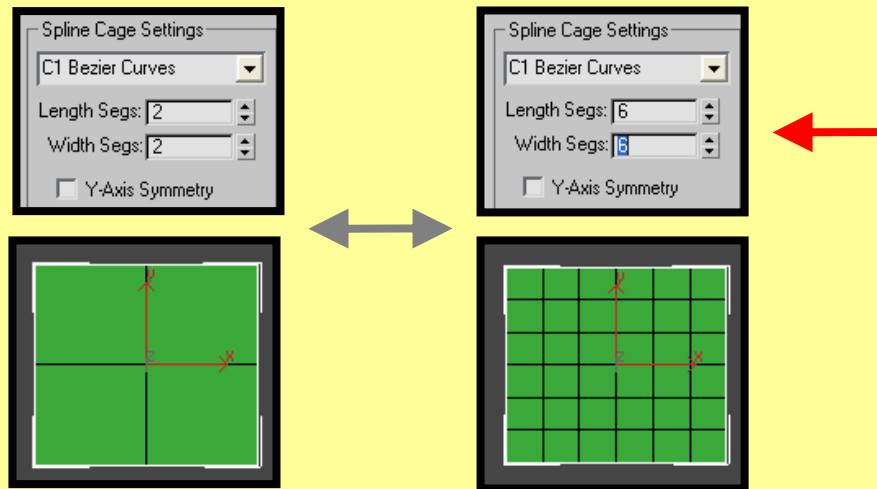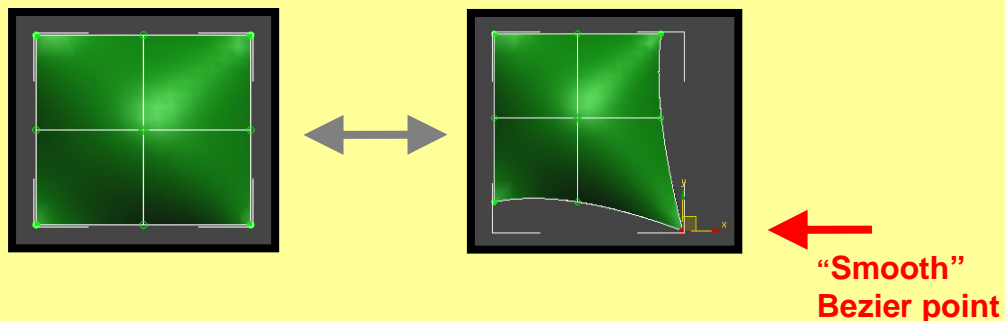

A) Smooth Bezier Curves for the Power Plane

1) While in the modify mode, change the Length and Width segments spinner value back to "2" and change the Spline Cage Type to "Smooth Bezier Curves", if not already done. Select the center "Sub Object Point" on your shape and drag upwards along the local Z-axis. This will create a dome effect for your Plane.
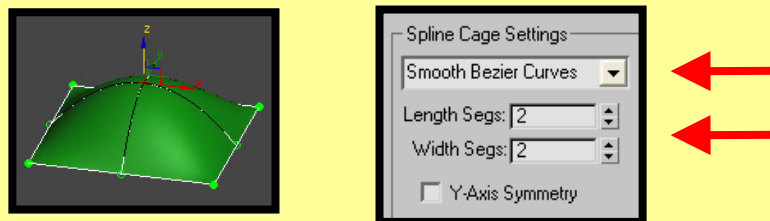

2) When working in the "Smooth Bezier Curves" mode, the Smooth Bezier Curves will consist of "Smooth" Bezier points. Drag the bottom right "Sub Object Point" of your shape to create a skewed effect to your object.


"Smooth" Bezier point

You can also use the "Ctrl" key to select multiple points at a time. (For more clarity in this example, I used the "C1 Bezier curves" spline cage type). I selected four random points within the plane and dragged up along the z-axis.
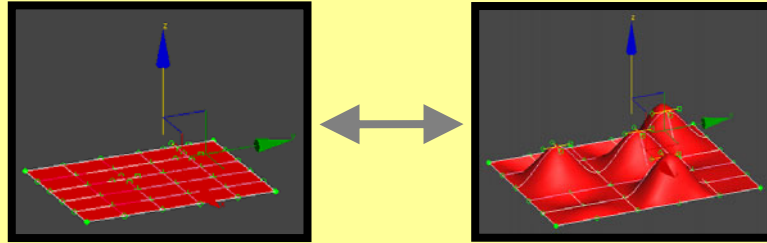
3) The "Sub Object Curve" sub-object allows you to grab a complete curve on your object.

Save a copy of your dome shape and hide. Turn off the <u>Power Box</u> and edit the <u>spline cage</u> directly. Go into the "Edge" sub-object mode and select the two outer curves and select one of the curves across the middle of your shape. Drag along the local z-axis to create a horse saddle effect.
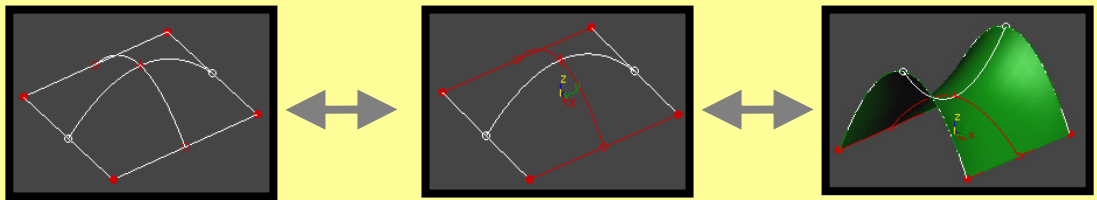

4) Now unhide your original dome shape. Click the "Y-Axis Symmetry" option. This option specifies that a symmetry will be applied at the local Y-Axis along the minimum X points of the rectangle.


Local Y-Axis

Minimum X Points

Spline Cage Settings
Smooth Bezier Curves
Length Segs: 2
Width Segs: 2
☐ Y-Axis Symmetry

5) Let's increase the "Length" and "Width" segments of the object to a value of 7. Select a Sub Object point and drag up along the local z-axis". Any changes you make to the original shape's sub-d will be reflected on the mirrored shape.
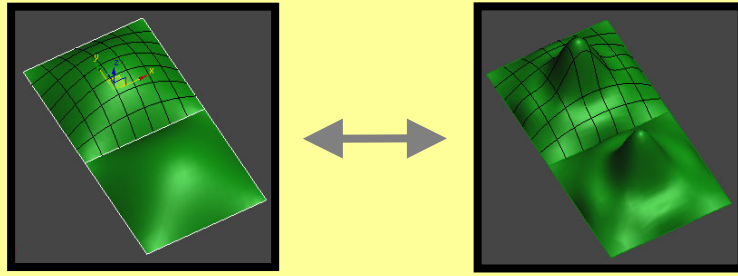
6) Examining the Edge Rounding options. Edge Rounding is useful for smoothing between two surfaces when Symmetry is turned on. It also works in cases where tangency has been broken in the spline cage and the resulting plane has creases.

Going back to the original dome shape, turn on the "Rounding Turned On" option and adjust the "Round Size %" spinner.
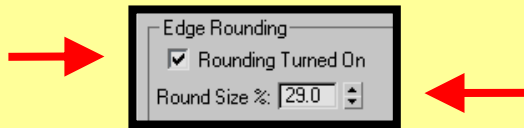

By Adjusting the "Round Size %" spinner, the higher the value the smoother the blend between the two surfaces.
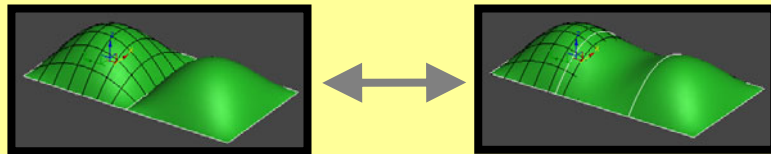
When the "Rounding Turned On" option is selected, this is a short cut for turning on the "Step Back Blending" options in the "Power Surface Parameters" panel. When the "Rounding Turned On" option is selected, this option sets the Blending option to "Blend Corners" and the Cross Section Type option to "G2 Blend Section" in the Step Back Blending dialog.
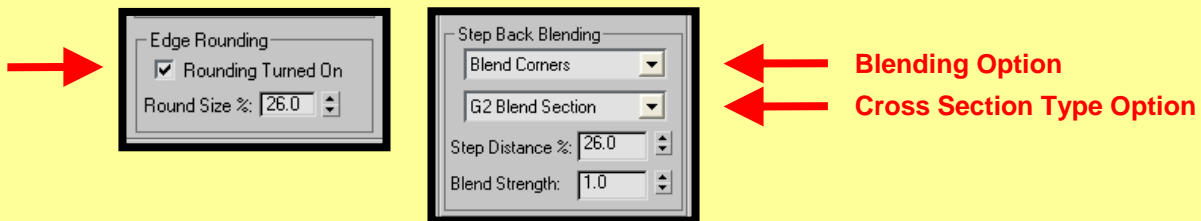
As you adjust the "Round Size %" spinner, the "Step Distance %" spinner within the Step Back Blending dialog adjust simultaneously.
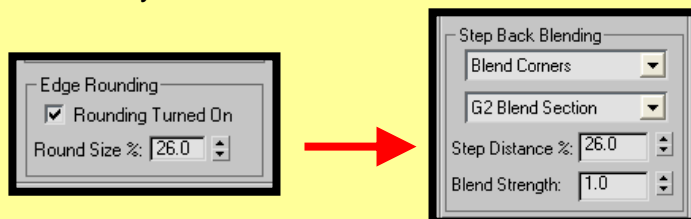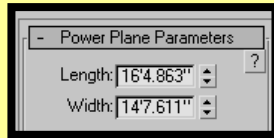
7) While the shape is still selected, you have the option to adjust the "Length" and "Width" settings under the Power Plane Parameters roll out of your shape.

Length: Size of the Box in the X direction of the local coordinate system.
Width: Size of the Box in the Y direction of the local coordinate system.


Note: the modification of the **Length and Width** of your shape will reset the spline cage to the original rectangle shape and loose any edits done on the spline cage. Once you have modified the spline cage, you can change the number of segments without resetting the rectangle shape because the new spline cage is generated using the existing surface.

B) C1 Bezier Curves for the Power Plane

The "C1 Bezier Curves" spline cage type works very similar to the "Smooth Bezier Curves" spline cage type except for the operation of the Bezier curves.

1) Let us look at the operation of the "C1 Bezier Curves" points.
 When working in the "C1 Bezier Curves" mode, the C1 Bezier Curves will consist of "C1" Bezier points. The C1 Bezier point contain two sets of Control Handles to assist you in defining your shape.
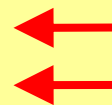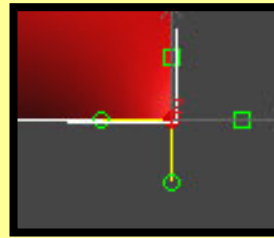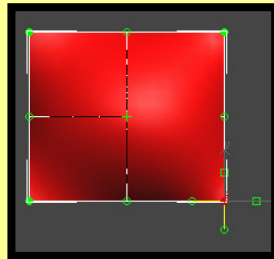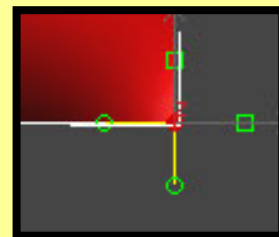

**"C1" Bezier point
with multiple
control handles**

Recap: The "Smooth Bezier Curves" use "Smooth" Bezier points and the "C1 Bezier Curves" use "C1" Bezier points with multiple Control Handles.
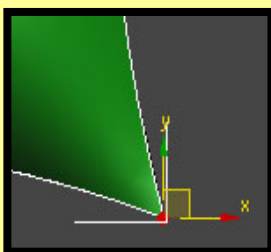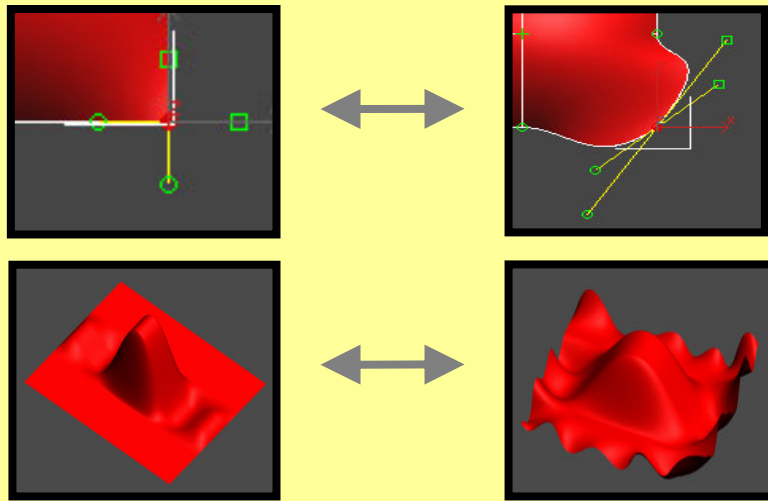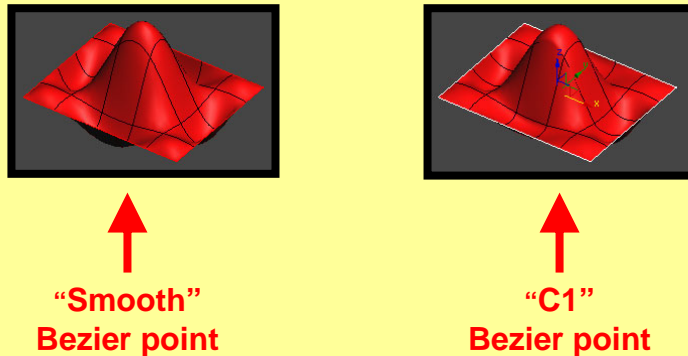

**"Smooth"
Bezier point**

**"C1" Bezier point
with multiple control
handles**

2) By altering the Control handles you can create a variety of forms.

Also, another interesting difference between "C1 Bezier Curves" and "Smooth Bezier Curves". The "C1 Bezier Curves" has less rippling effects on the surface of your shape because of the added vector constraints to the localized edits. Notice the difference in the wavelike motion between the "Smooth" and "C1" bezier curves.

"Smooth"
Bezier point

"C1"
Bezier point

Because the "C1" and "Smooth" bezier curves parameters work very similar, refer back to the "A) Smooth Bezier Curves for the Power Plane" section in regards to:

- "Length" and "Width" Segment settings
- "Y-Axis Symmetry" option
- "Rounding Turned On" option
- "Round Size %" setting
- Rectangle "Length" and "Width" settings

Summary

In this tutorial, you were shown how to create Power Planes using:

- Smooth Bezier Curves spline cage type
- C1 Bezier curve spline cage type

You were also shown how to modify a plane using:

- "Length" and "Width" Segment settings
- "Y-Axis Symmetry" option
- "Rounding Turned On" option
- "Round Size %" setting
- Rectangle "Length" and "Width" settings

 Power Plane tool **(Pwr_Plane).**