

# BEZIER AND SPLINE CURVES:

## *bezierspline.rb v1.2* - QUICKCARD

### 1. Installation

- **Unzip 'bezierspline.zip' in Plugins directory of Sketchup:** it should install the following files:
  - **bezierspline.rb** (main macro)
  - **LibTraductor.rb** (utility to support language translation)
  - **A BZ\_DIR\_12 subfolder**, which contains extensions, icon files for the toolbar as well as the documentation
- **Language:** by default, language of operating system, if supported, otherwise English
- **Menus:** all Bezier family curves have their menu item in menu '**Draw**' (submenu '*BezierSpline curves*').
- **Contextual menus:** When a curve is selected, the Edit menu is in the contextual menu



- **Icon toolbar:**

**IMPORTANT:** Before launching, delete all *BZ\_\*\*\*.rb* files in the Plugins folder.

### 2. Creation Mode

- **Drawing mode** for entering the control points (default depends on curve type):
  - **Start / End:** click on start point, then on End point, then intermediate points



- **Open-Ended:** click on points in sequential order



**Double-Shift** allows toggling between modes (before entering 2 points!)

- **Maximum number of control points:** type new number in **VCB** → ex: "43"
- **Finishing creation mode:** **Double-click** on last point to enter will switch to Edition mode. Termination options are also available in contextual menu
- **Undo:** **Esc** will remove last point entered. **Double-Esc** to cancel all and create a new curve. Note that Sketchup Undo (Ctrl-Z) will cancel all entries

### 3. Edition Mode

All actions will be immediately reflected in the drawing

- **Entering Edition mode:** Select curve, and **Right-click** to show contextual menu
- **Exiting Edition mode:** **Double-click** anywhere outside the polygon (or options in contextual menu)
- **Moving control points:** **Click and drag** a point or a segment between 2 points
- **Adding control points:** **Double-Click on a segment** to create a new control point
- **Deleting control points:** **Double-Click on a point** to delete it.
- **Undo:** **Esc** to undo last change. **Double-Esc** to cancel all changes. Note that Sketchup Undo / Redo (Ctrl-Z) is supported, but can go back beyond initial state.

#### 4. Common to Creation and Edition modes

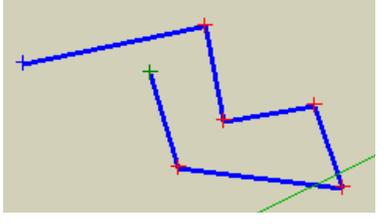
- **Plane Lock toggle Ctrl key** (filled square mark) for curve plane - press **Axis Arrows** to force perpendicular plane to selected axis
- **Axis Lock (Edition mode only)**: without Plane lock set, **toggle Axis Arrows** to force move along selected axis – Down Arrow to deactivate.
- **Precision (if applicable)**: type new number followed by 's' in **VCB** → ex: "35s"
- **Extra parameters**: press **TAB** to call the dialog box for additional parameters
- **Loop toggle**: **F8** to close curve by a segment, **F9** to close by a 'nice' curve, **F7** to cancel loop. F8 and F9 are toggle keys. Number of segments of the closure can be changed in the VCB: type new number followed by 'c' in **VCB** → ex: "14c"
- **Show curve vertices**: **F5** toggles display of vertices on the curve
- **Extra Parameters**: **TAB**, when applicable (for instance for Uniform B-Splines)

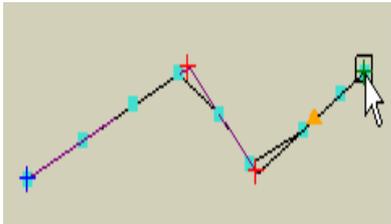
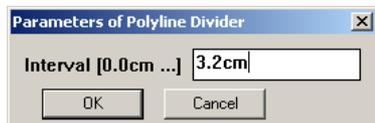
#### 5. Curve conversion

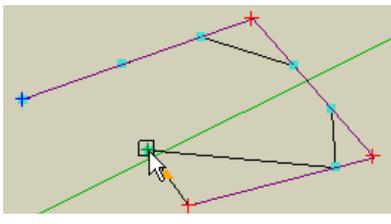
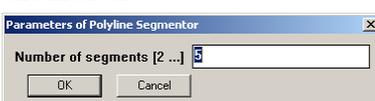
- Option in **contextual menu of a selected curve**, but depends on type of curve
- Any Sketchup curve can be converted into a Polyline
- Polyline can then be converted into Spline curves

## 6. Supported Curves

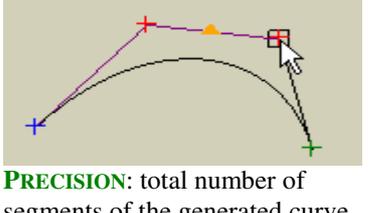
### 6.1. Curves based on Polylines

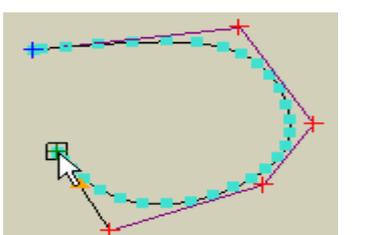
<p><b>POLYLINE</b> </p>	 <p><b>No PRECISION Parameter</b></p>
<p>The curve generated is the same as the sequence of control points. Even if this may seem very simple, the interest is that you get a Polyline that can be edited by moving, adding or deleting vertices. Note also that:</p> <ul style="list-style-type: none"> <li>- Any Sketchup curve (or suite of segments assembled with Weld) can be converted into a Polyline</li> <li>- A Polyline can be converted into any BezierSpline curve</li> </ul>	

<p><b>POLYLINE DIVIDER</b> </p>	 <p><b>No PRECISION Parameter</b></p>
<p>Based on the sequence of control points and an Interval value, this extension <b>generates a Polyline where all segments have the same length</b> (except the last one). All points of the curves are on the original polygon of control points. This may be used to simplify curves or balance the space between points.</p> 	

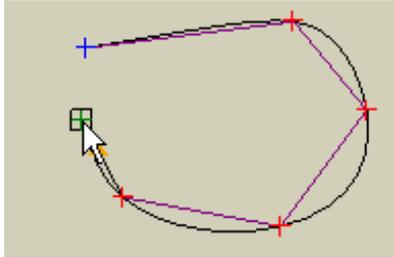
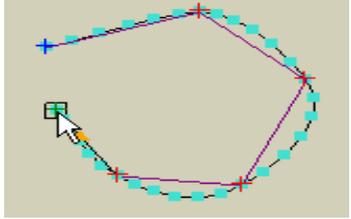
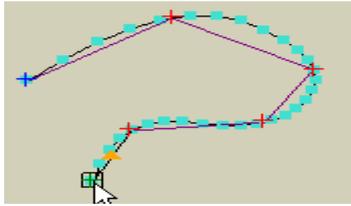
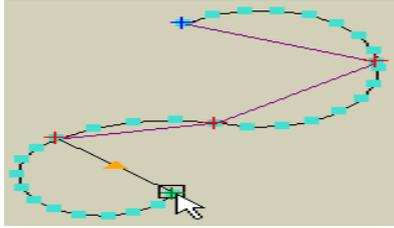
<p><b>POLYLINE SEGMENTOR</b></p>	 <p><b>No PRECISION Parameter</b></p>
<p>Based on the sequence of control points, this extension <b>generates a Polyline with given number of equal segments</b> (except the last one). All points of the curves are on the original polygon of control points. This is the equivalent of Polyline Divider, but you give the number of segments and the Plugin computes the interval.</p> 	

### 6.2. Splines curves not passing through the Control Points

<p><b>BEZIER CLASSIC</b> </p>	 <p><b>PRECISION:</b> total number of segments of the generated curve</p>
<p>By default, Bezier curve are drawn between two extremity points. The curve shape can be quite different from the polygon of control points. Also, moving one control point can affect the shape of the whole curve.</p> <p>Note: you can join 'nicely' 2 coplanar segments by using a Bezier curve where the middle control point is the intersection of the segments</p>	

<p><b>UNIFORM B-SPLINE</b> </p>	 <p><b>PRECISION:</b> total number of segments of the generated curve</p>
<p>Uniform B-Spline curve gives a nice smoothing in general. The Order parameter allows tuning this smoothing (the higher, the smoother). Order 0 means always the higher order.</p> 	

### 6.3. Splines curves passing through the Control Points

<p><b>CUBIC BEZIER</b> </p> <p>Cubic Bezier curve is a particular spline that can be used to draw a contour passing through a suite of given points. The curve is generated by interpolation between the control points.</p> <p>When you move a control point, the change is rather local (unlike Classic Bezier).</p> <p>One drawback is that the Precision is given as the number of segments between control points, which may quickly increase the total number of segments of the curve.</p>	 <p><b>PRECISION:</b> number of segments between 2 control points</p>
<p><b>CATMULL-ROM</b> </p> <p>Catmull-Rom spline is very similar to the Cubic Bezier (though based on a very different algorithm), but a little bit closer to the polygon of control points. So to be used for rounding angles rather than to smooth a complete Polyline.</p> <p>Catmull-Rom spline have also the property to generate closed loops.</p>	 <p><b>PRECISION:</b> number of segments between 2 control points</p>
<p><b>F-SPLINE</b> </p> <p>This is actually a Uniform B-Spline curve of order 3 that is adjusted to pass through the control points. The general shape of the generated curve is much smoother than Cubic Bezier and Catmull-Rom.</p> <p>The other advantage is that the Precision parameter corresponds to the Total number of segments of the generated curve.</p>	 <p><b>PRECISION:</b> total number of segments of the generated curve</p>
<p><b>COURBETTE</b> </p> <p>A Courbette curve is based on arcs of circle joining 3 consecutive points. The main context of usage is when you draw curves that have either a balanced round shape naturally, or that look like spirals (though there are dedicated tools for spiral).</p> <p>The main downside is that you can obtain unexpected results.</p>	 <p><b>PRECISION:</b> Between 2 control points, based on the number of points to draw a full circle.</p>

