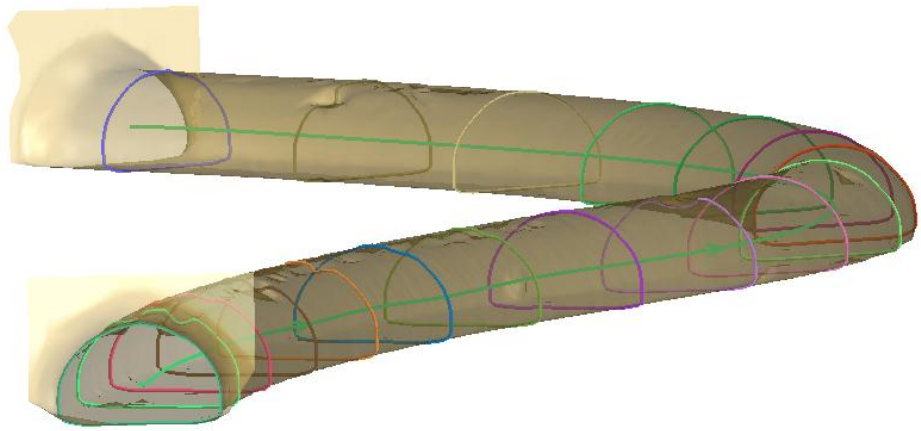
Exercise 8: Making sections of a tunnel

Reshaper V7



In 3DReshaper, you can make cross sections with different strategies:

- Planar sections of meshes and (or) point clouds
- Radial sections.
- Freehand sections.
- Section along curves.

This exercise shows how to compute sections along a curve. Besides, you will also see how to create a theoretical tunnel model from an extruded shape according to a specific direction. 3D comparison can be realized between two sections as well (but it will not be presented in this exercise).

➢ Open the file: 3DReshaper-Practise/Section/Tunnel.rsh

In this exercise, we will see how to reconstruct the neutral axis of a tunnel to make section along this curve. The following method is necessary in the previous versions 6 and in the current 7.0. In the 7.1 version, scheduled for September 2012, you will have the ability to automatically compute the neutral axis, starting from an approximate line.

➢ Set the top view and enter a polyline which follows the tunnel

- Click in the 3D scene and press the Z key to set the top view.
- Launch the command **“Create -> Polyline”** or **“Polyline -> Create Polylines”** and insure that the XYZ option is activated to authorize the free input of points from the mouse click.
- Click a polyline like on the right picture.

This polyline will be used to give the “rough” direction of the tunnel.

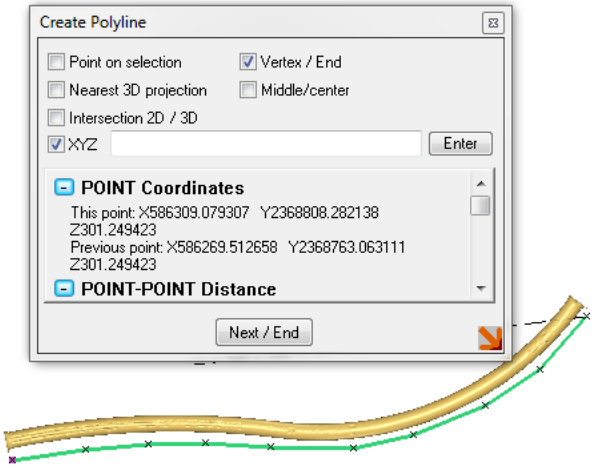


Figure 1: Create manually a polyline to approximate the tunnel direction.

➢ Make sections along the rough polyline

We will use the rough polyline to make section and calculate the neutral axis of the tunnel.

- Select both the tunnel and the polyline.
- Launch the command “**Polyline -> Section along curve**” and complete the dialog box as on the right picture.
- Press “Preview” and “OK”.
- Select the polyline and delete it.

Note: as you can see on the interface, the planes which correspond to the sections to be calculated are displayed at each change of values or options. This tool enables you to see the position and the extent of the future sections.

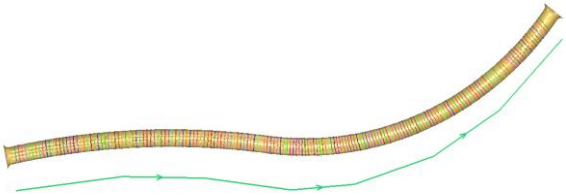
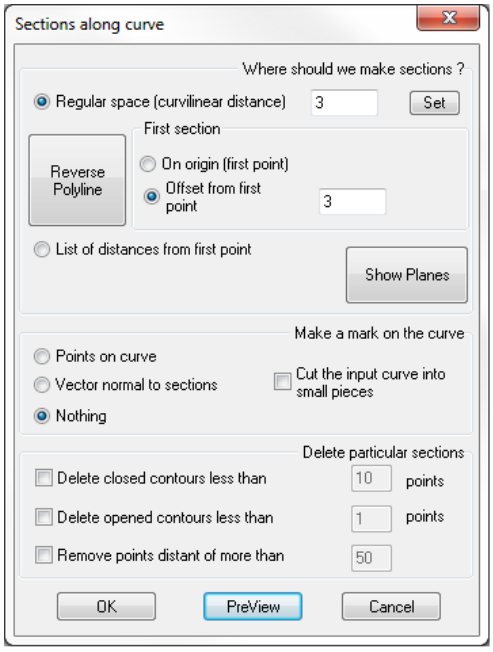


Figure 2: Making sections along the rough



➢ Computing the neutral axis

- Develop the “Contour group” in the object explorer.
- Select all the sections: click the first section, press the shift key while you click the last section.
- Launch the command “**Measure -> Best shape**” and select the circle tab.
- Select the option one best shape per selected entity.
- Click “Preview” then “OK”.
- In the object explorer, select all the “Best circles” in the Geometrical.
- Launch the command: “**Polyline -> Chain group polyline**” and select the options “**Create polyline from particular points**”.

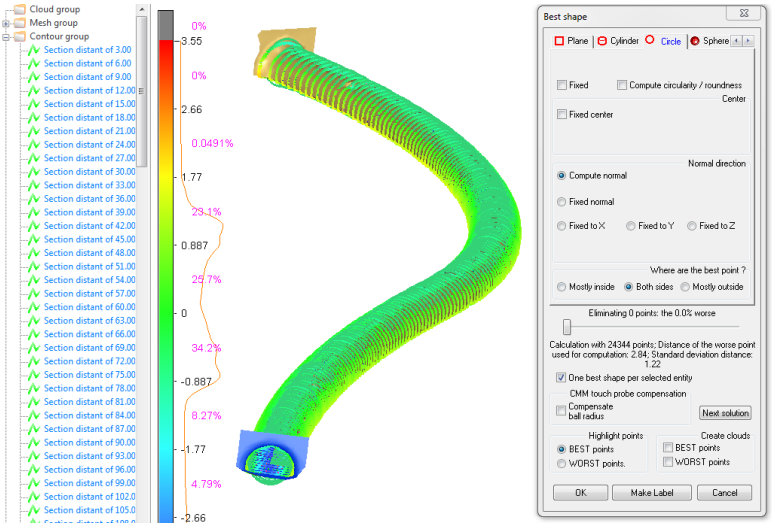


Figure 3: Computing sections along a curve to approximate the neutral axis.

- Click “OK”.
- In the object explorer you can select all the sections and the best circles to delete them.
- Select now the tunnel and launch the command “**Edit -> Color and aspects**” or use the **contextual menu** (Right click on the model).
- Adjust the transparency slider so that you can see the polyline inside the tunnel.
- Select the polyline and launch the command “**CAD -> Bspline**”.
- As the first and the last point of the polyline are not “better” than the other points, you should disable the options “**passing by first extremity**” and “**passing by second extremity**”.
- You can play with the construction method and see the corresponding smoothing error.
- The best compromise for this Bspline is when you have about 13 control points.
- Click “OK” to validate.
- As here we need a polyline you need to select the Bspline and launch “**CAD -> explode**”.

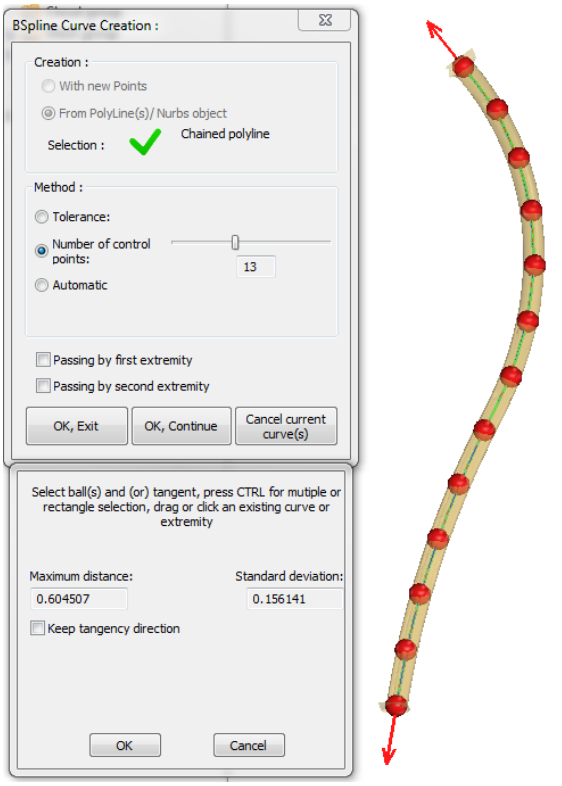


Figure 4: Making a Bspline curve for the neutral axis

Note that if you do not have the CAD license and corresponding authorization code you can also make the smoothing operation with the command “**Polyline -> Smooth contour**”. However, this command is less powerful because this command will pass by the first and the last point and you won’t be able to see the resulting smoothing error.

➢ Create the final set of sections

- Select both the tunnel and the polyline.
- Launch the command "**Polyline -> Section along curve**" and complete the dialog box like on the right picture.
- Press "Preview" and "OK".

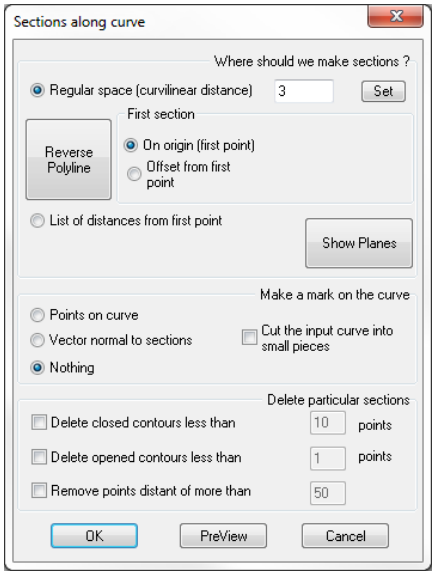
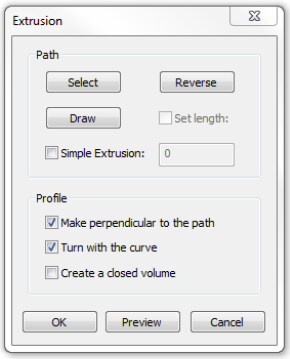


Figure 5: Computing the final set of sections.

➢ Create a theoretical tunnel from an extruded shape

- Display only both the polyline (neutral axis) and one section (the first one for instance). You can try to modify its shape by smoothing if you want (Polyline menu).
- Select the section and launch the command "**Mesh -> Extrusion**". Select the polyline as the path and complete the dialog box like on the right picture.
- Press "Preview" and "OK".



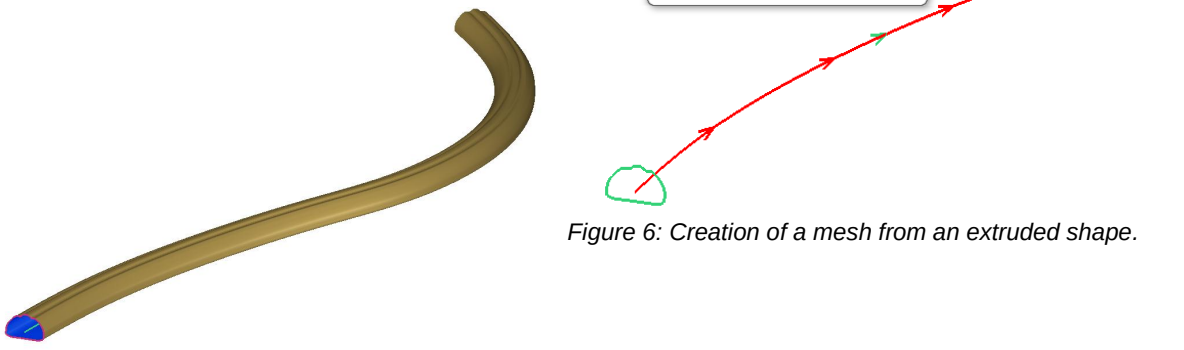


Figure 6: Creation of a mesh from an extruded shape.

Note that you can make a 3D comparison or a deviation analysis between the different sections made on the theoretical and as measured tunnel.

➢ Swap between orthographic and perspective view

- You can change the display mode of the 3D model. Use the icons located at the bottom right part of the graphic scene and the mouse to move inside the tunnel.

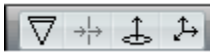


Figure 7: Orthographic view

Figure 8: Perspective view