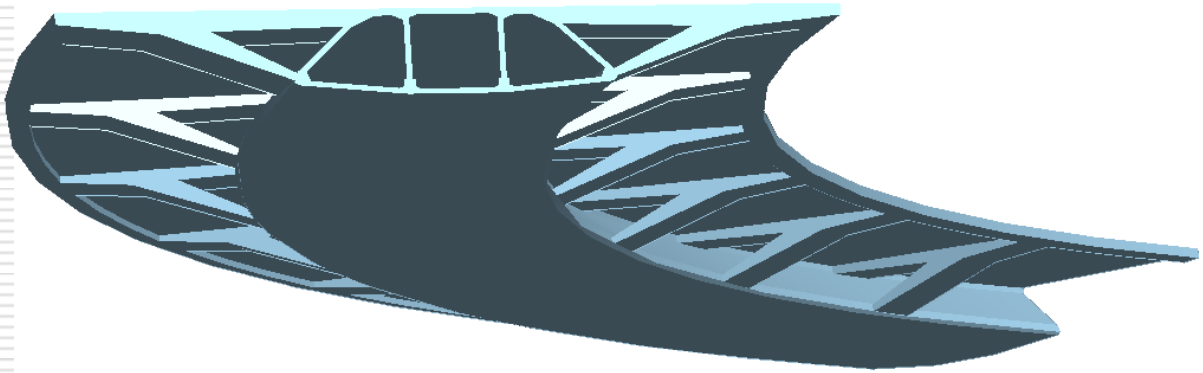
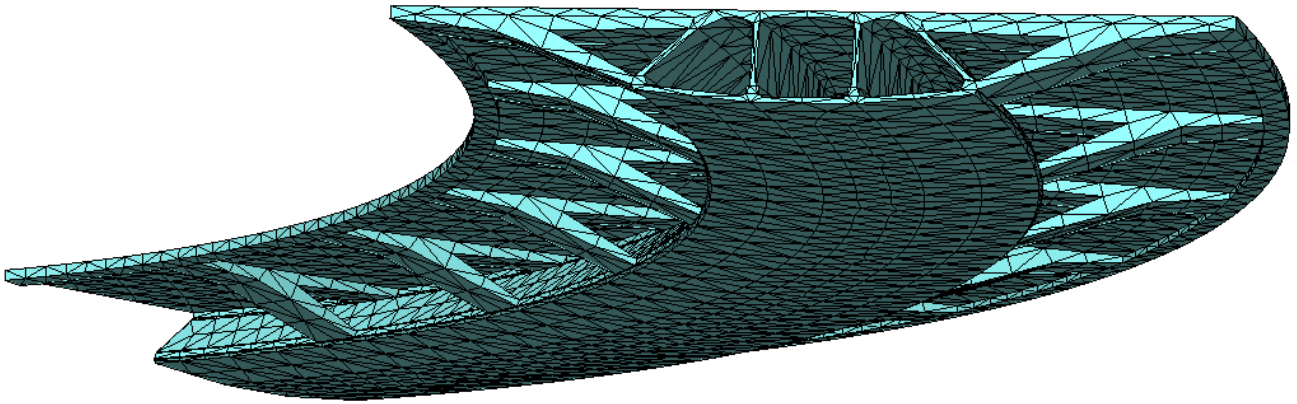
TP-3. Curved concrete box girder with compressive struts



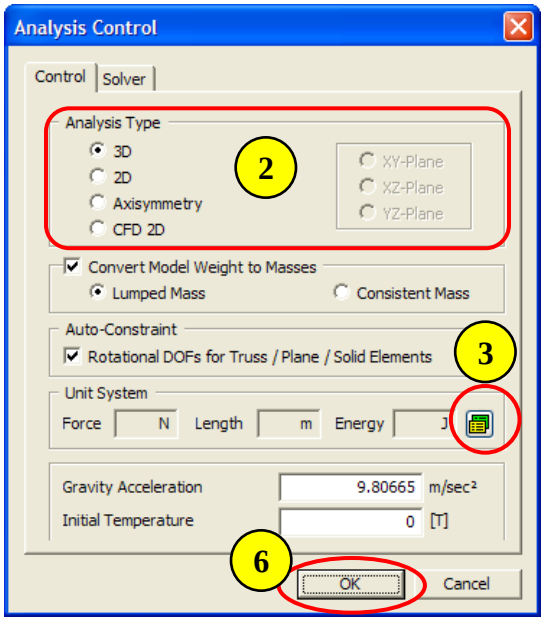
Overview

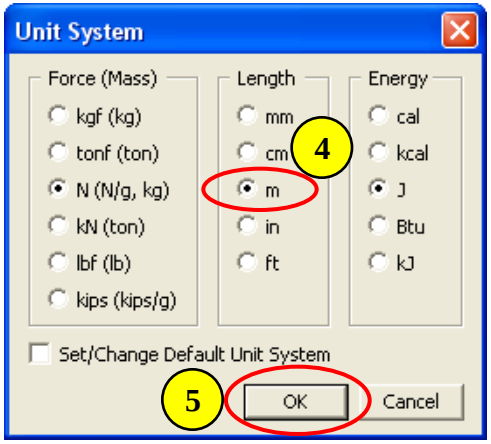
- Modeling a curved concrete box girder with compressive struts
- Geometry
  - *Mirror*
  - *Fuse*
  - *Revolve*
  - *Rotate*
  - *Cut*
- Mesh
  - *Auto Mesh*



Step 1.

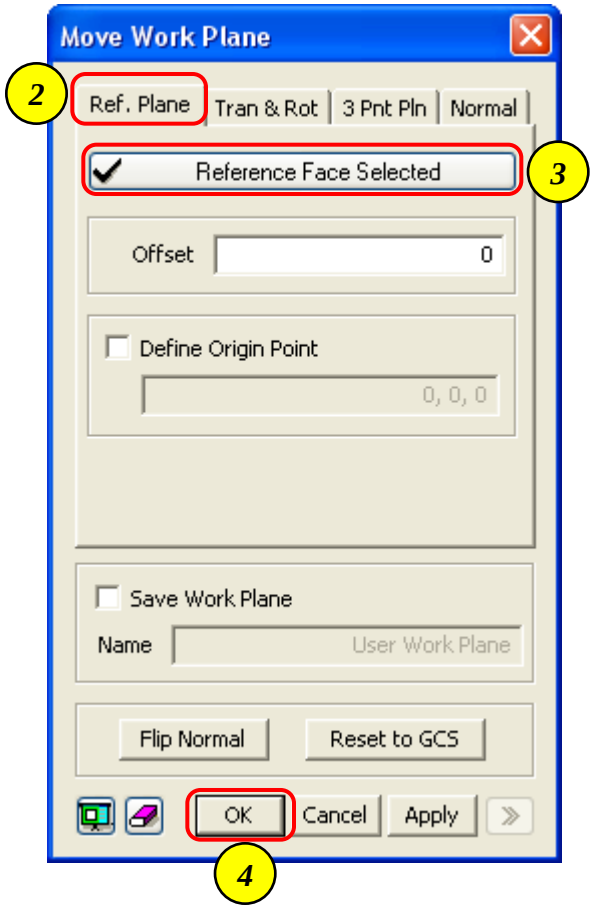
1. *Analysis > Analysis Control – Control tab*
2. *Analysis Type : 3D*
3. *Click*  *Button (Unit System)*
4. *Length : m*
5. *Click on* **[OK]** *Button*
6. *Click on* **[OK]** *Button*

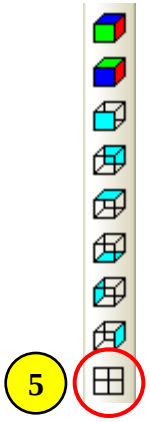


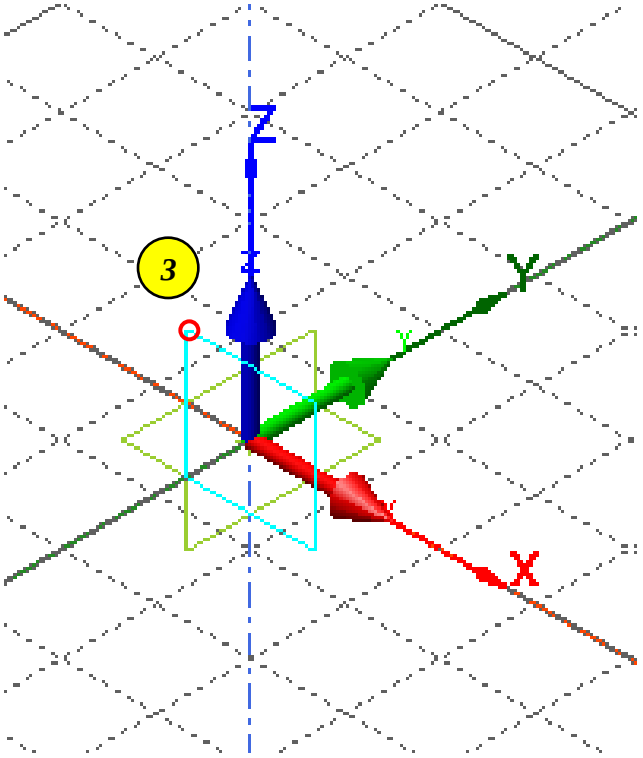


Step 2.

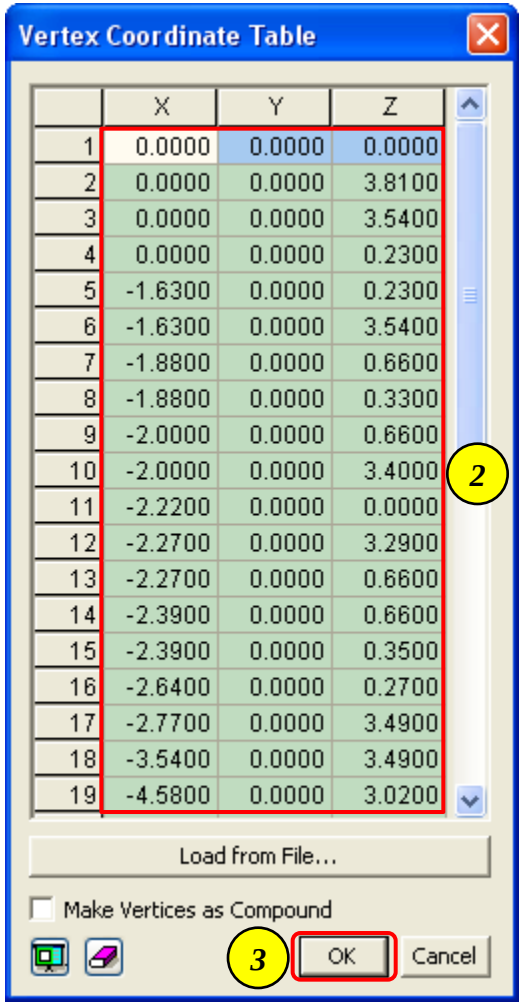
1. Geometry > Work Plane > Move…
2. Select the “Ref. Plane” tab
3. Select “XZ” plane as reference face
4. Click on [OK] Button
5. Toggle on “Normal” view







Step 3.

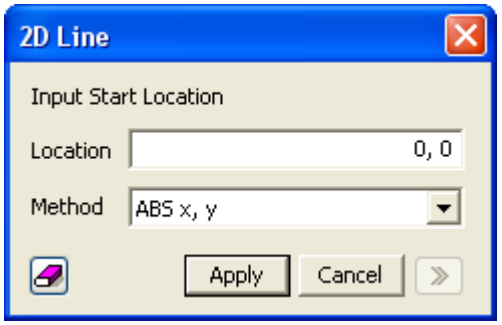


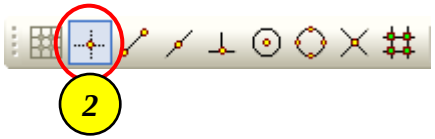
X	Y	Z
0.00	0.00	0.00
0.00	0.00	3.81
0.00	0.00	3.54
0.00	0.00	0.23
-1.63	0.00	0.23
-1.63	0.00	3.54
-1.88	0.00	0.66
-1.88	0.00	0.33
-2.00	0.00	0.66
-2.00	0.00	3.40
-2.22	0.00	0.00
-2.27	0.00	3.29
-2.27	0.00	0.66
-2.39	0.00	0.66
-2.39	0.00	0.35
-2.64	0.00	0.27
-2.77	0.00	3.49
-3.54	0.00	3.49
-4.58	0.00	3.02
-4.79	0.00	3.48
-4.79	0.00	3.18
-4.95	0.00	3.03
-6.58	0.00	0.64
-6.77	0.00	1.05
-7.16	0.00	0.46
-7.16	0.00	1.04
-7.18	0.00	1.00
-7.29	0.00	0.67
-7.32	0.00	0.61
-10.95	0.00	2.87
-13.21	0.00	2.80
-16.73	0.00	3.16
-16.73	0.00	3.48
-17.82	0.00	3.81
-17.82	0.00	3.28

1. *Geometry > Vertex > Tabular Input...*
2. *Copy the highlighted tabulated coordinates into the dialog box.*
3. *Click on [OK] Button*
4. *Toggle off "Toggle Grid"*
5. *Hide Datum & WP*

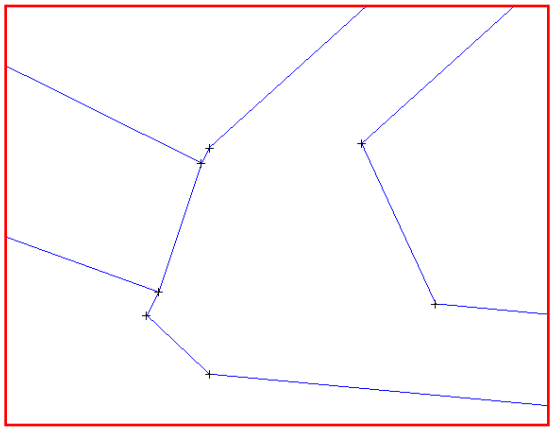
2

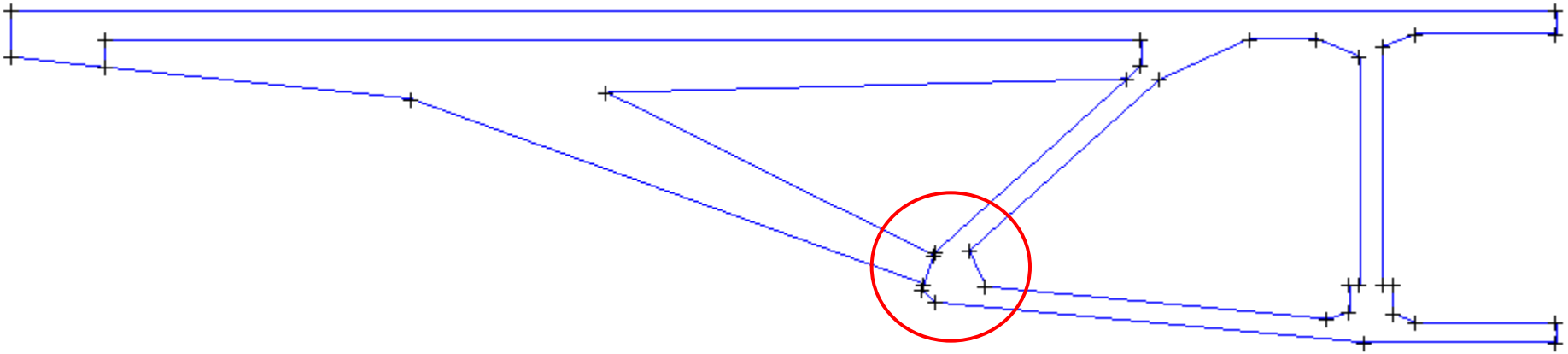
Step 4.





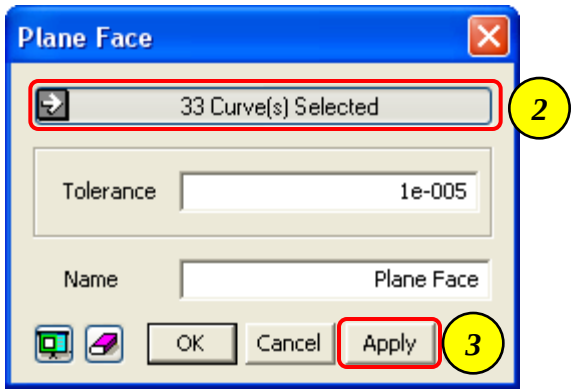
1. *Geometry > Curve > Create on WP > line...*
2. *Toggle on "Vertex Snap"*
3. *Connect the nodes as shown in the picture*
4. *Click on [Cancel] Button*

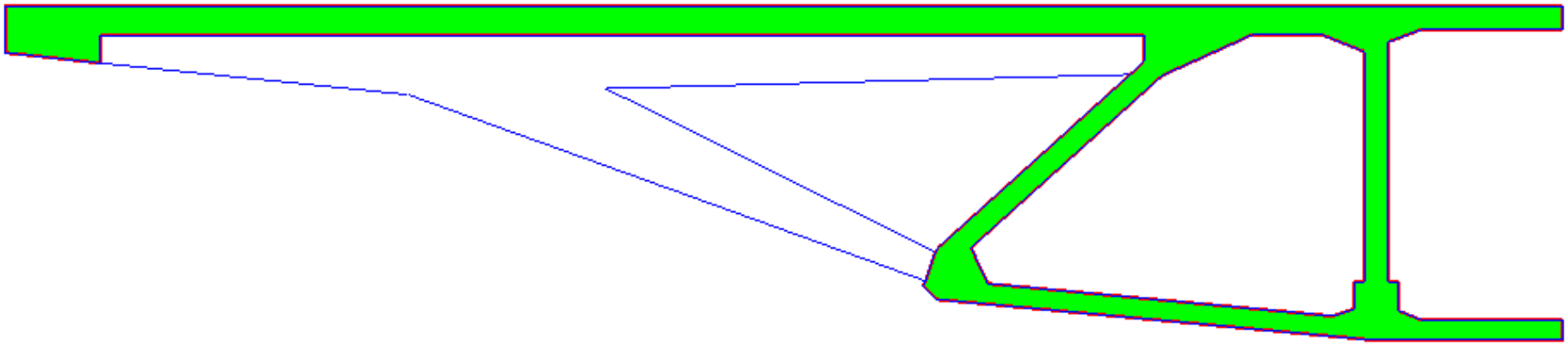




Step 5.

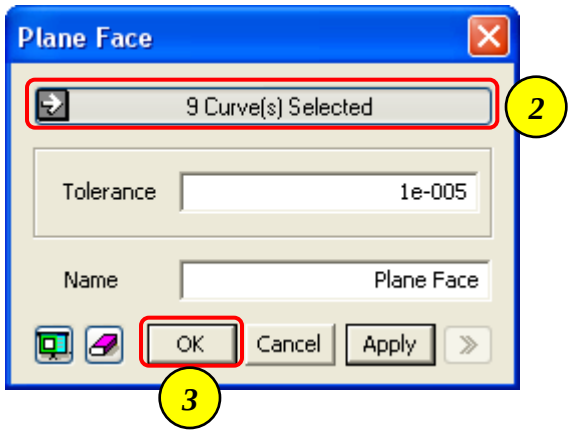
1. Geometry > Surface > Create > Plane Face ...
2. Select the highlighted edges
3. Click on [Apply] Button

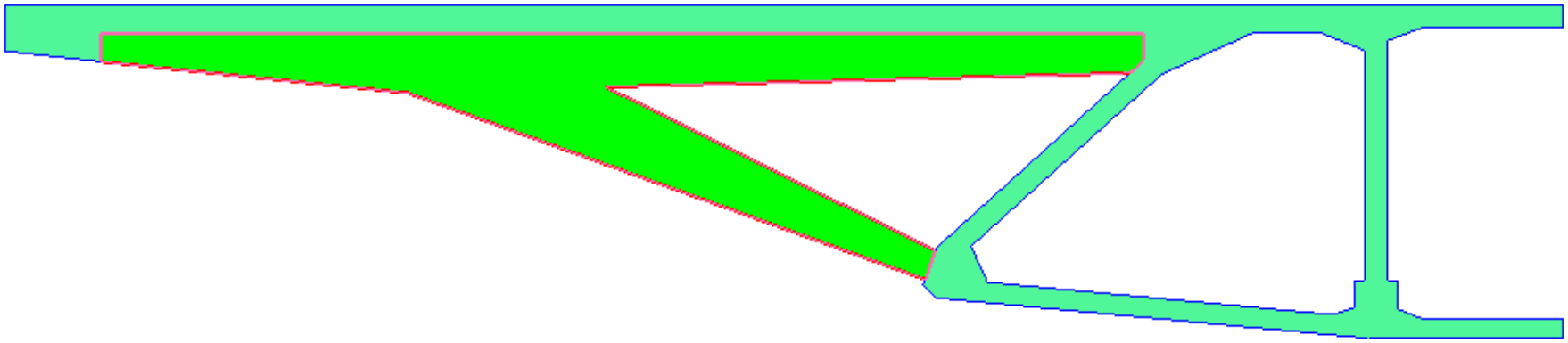




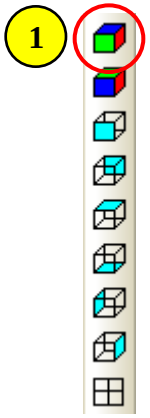
Step 6.

1. Geometry > Surface > Create > Plane Face ...
2. Select the highlighted edges
3. Click on [OK] Button

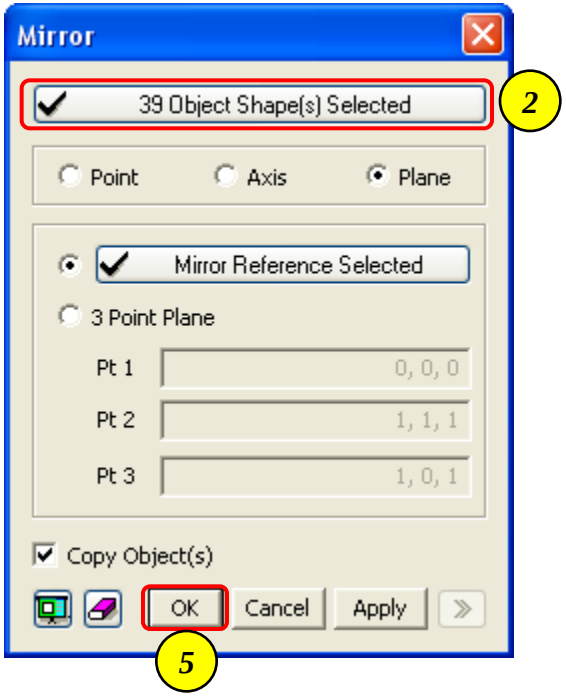


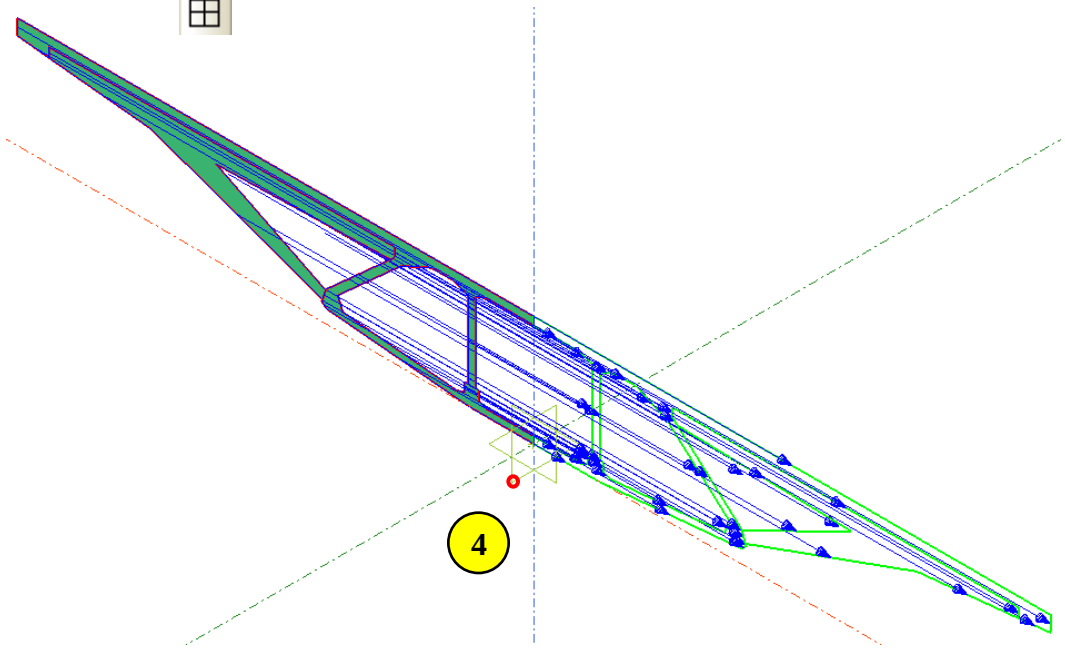


Step 7.

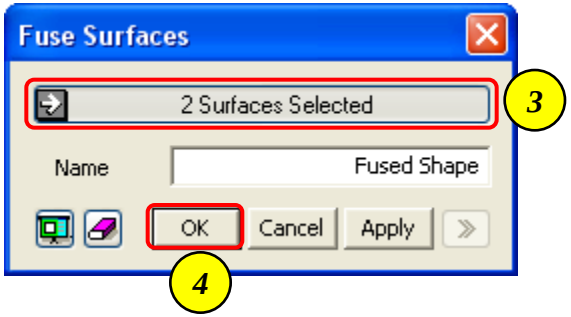


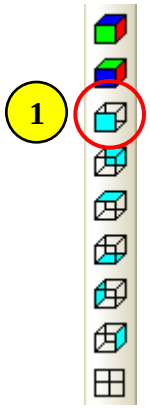
1. *Toggle on "Isometric 1" view*
2. *Geometry > Transform > Mirror ...*
3. *Select all*
4. *Select the highlighted plane*
5. *Click on [OK] Button*



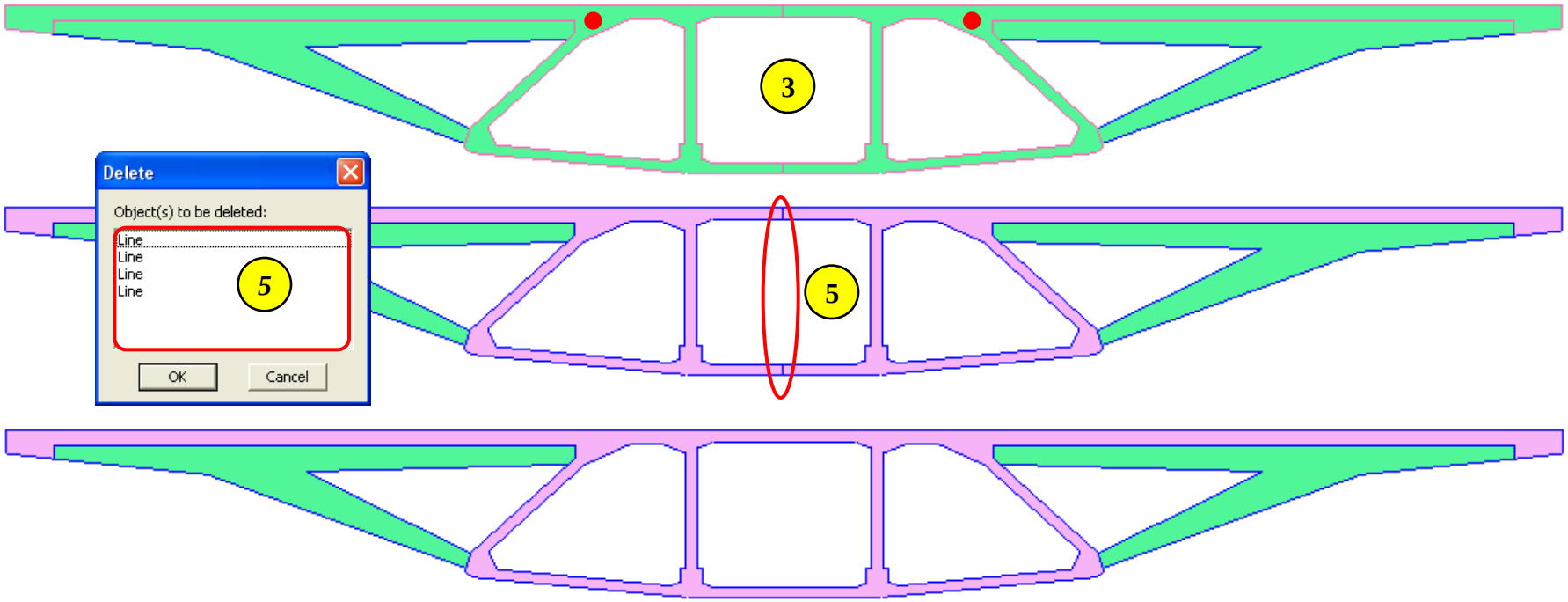


Step 8.

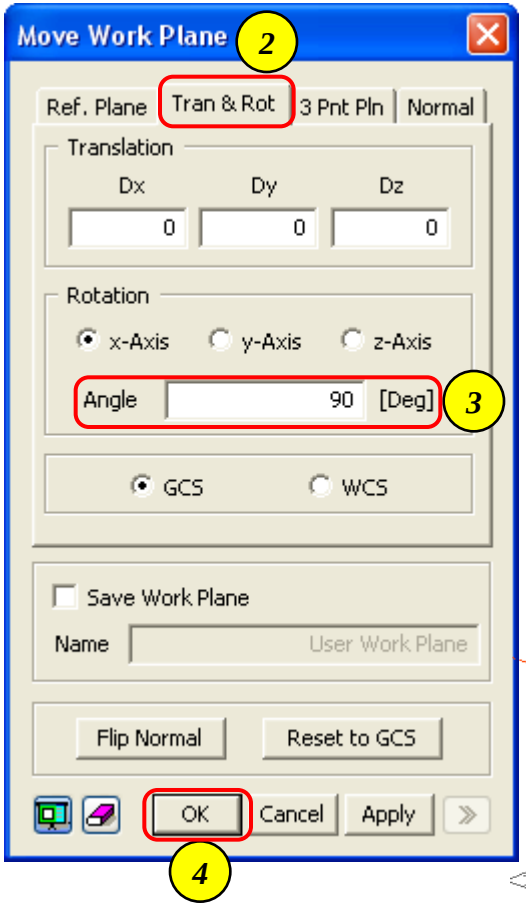


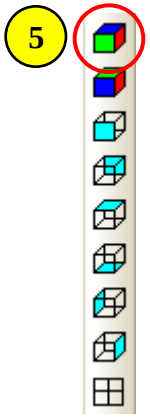


1. *Toggle on "Front" view*
2. *Geometry > Surface > Fuse ...*
3. *Select two highlighted faces*
4. *Click on [OK] Button*
5. *Select the highlighted lines and delete them*

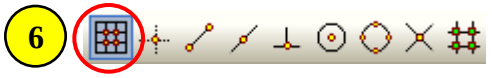


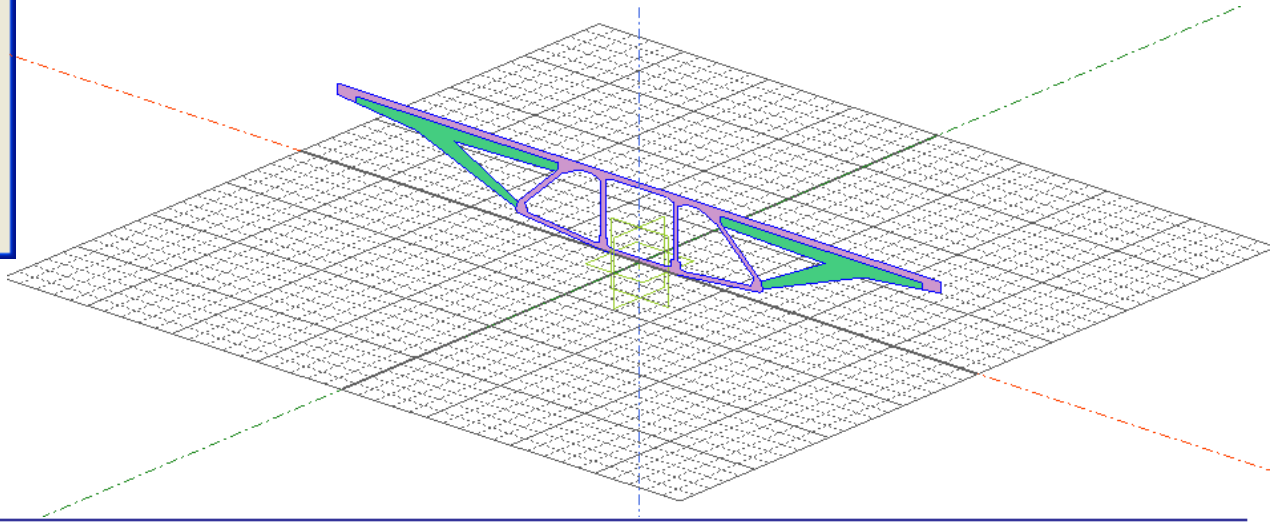
Step 9.





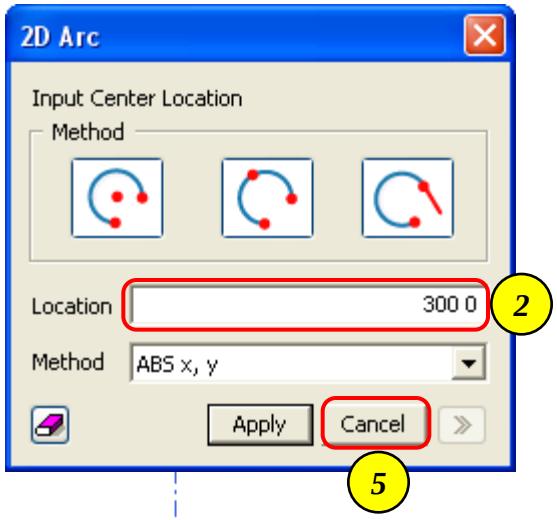
1. *Geometry > Work Plane > Move…*
2. *Select the "Tran & Rot" tab*
3. *Angle: 90 [Deg]*
4. *Click on [OK] Button*
5. *Toggle on "Isometric 1" view*
6. *Toggle on "Grid Snap"*

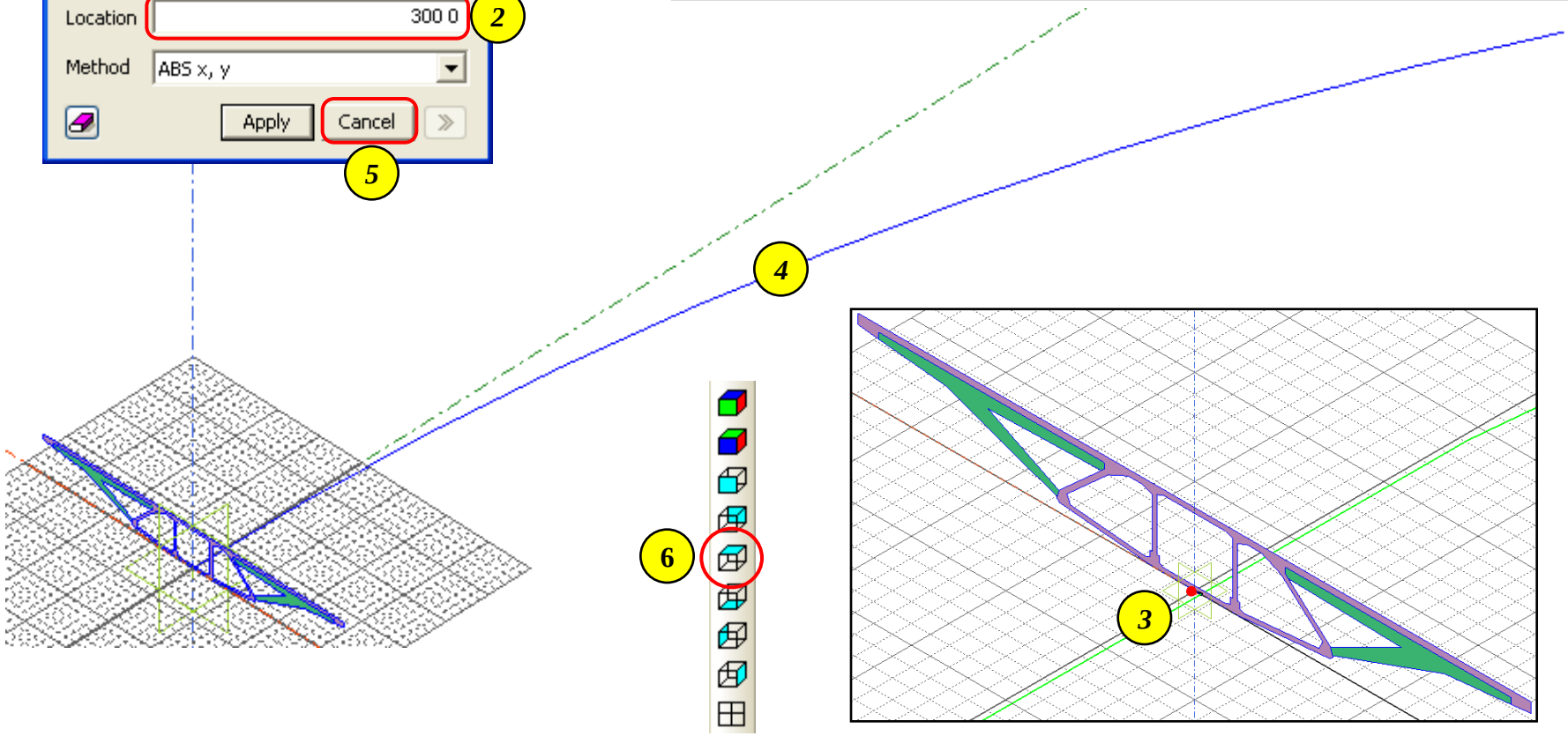




Step 10.

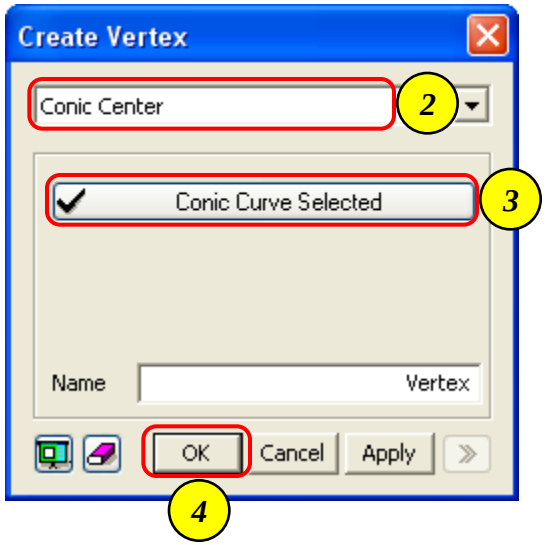
1. Geometry > Curve > Create on WP > Curve …
2. Location: (300,0)
3. Select the starting point of the curve as shown in the picture
4. Draw the "Guide Curve" as shown in the picture (arbitrary length)
5. Click on [Cancel] Button
6. Toggle on "Top" view

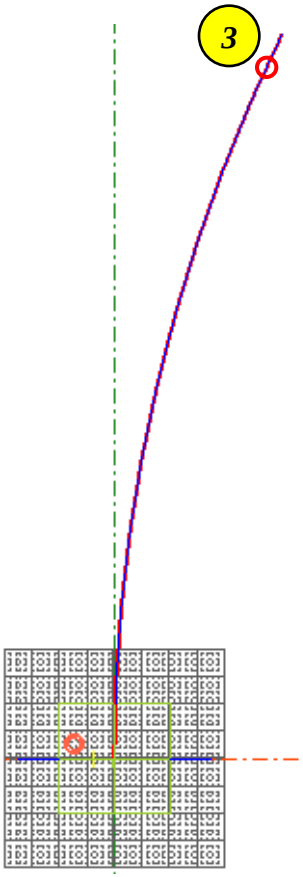


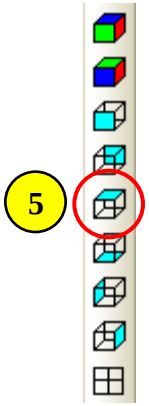


Step 11.

1. Geometry > Vertex > Create ...
2. Type: Conic Center
3. Select the curve as shown in the picture
4. Click on [OK] Button
5. Toggle on “Isometric 1” view

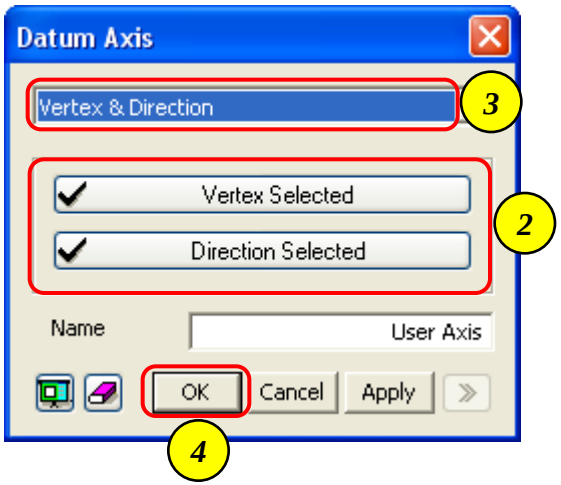


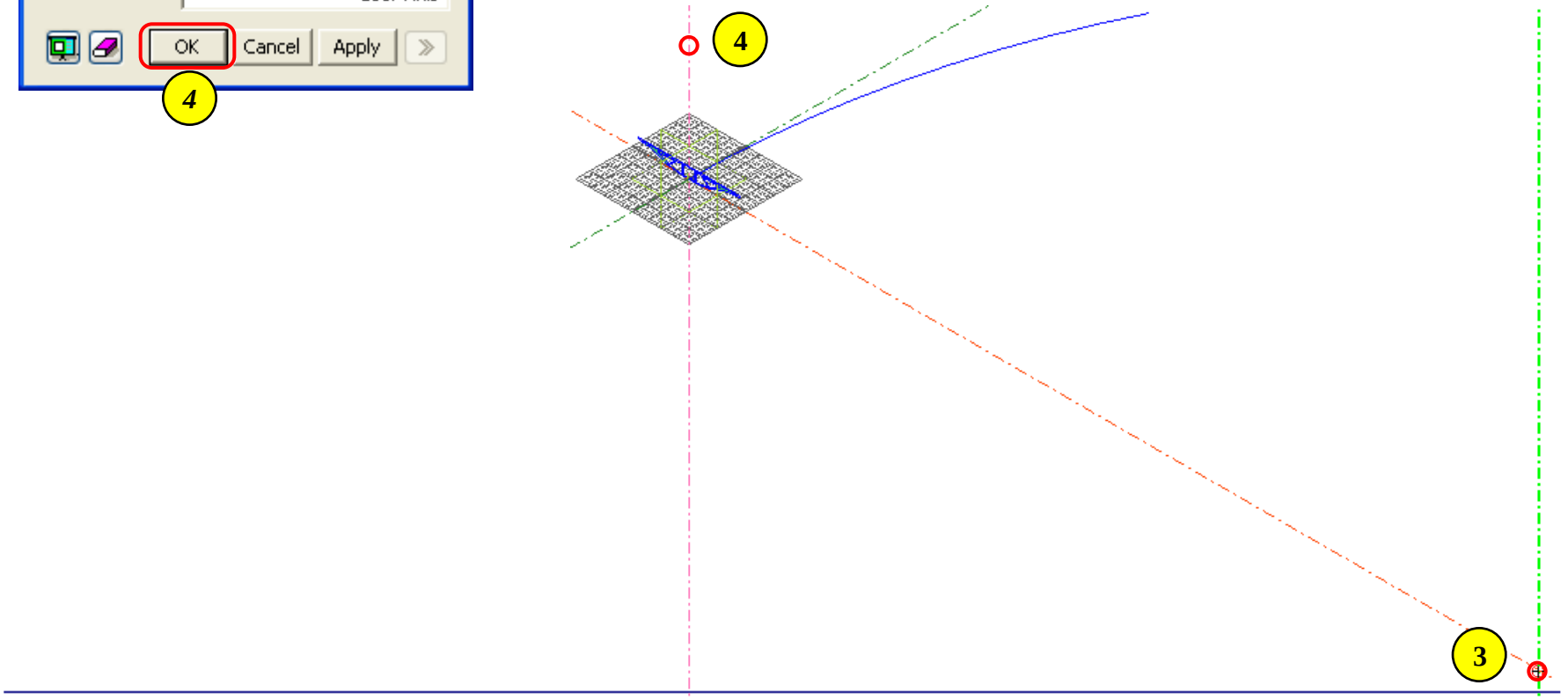




Step 12.

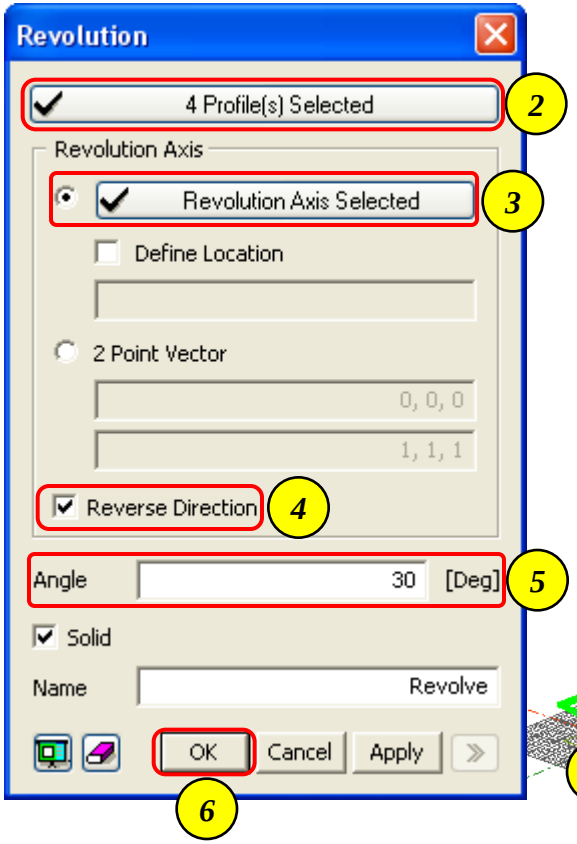
1. Geometry > Datum > Axis ...
2. Type: Vertex and Direction
3. Select the conic center for vertex
4. Select Z-Axis as reference direction
5. Click on [OK] Button

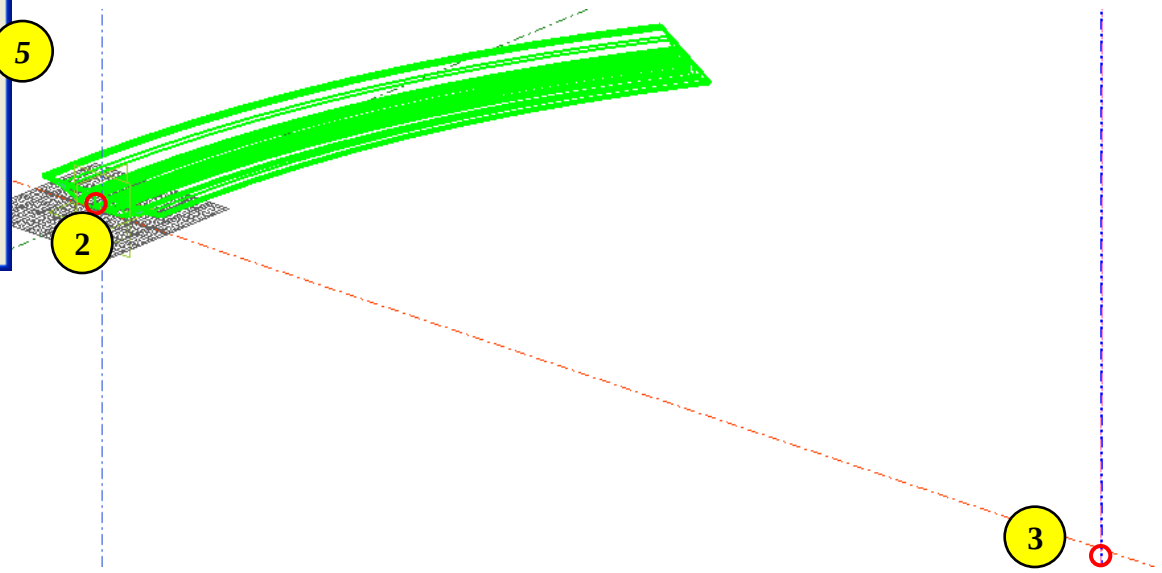




Step 13.

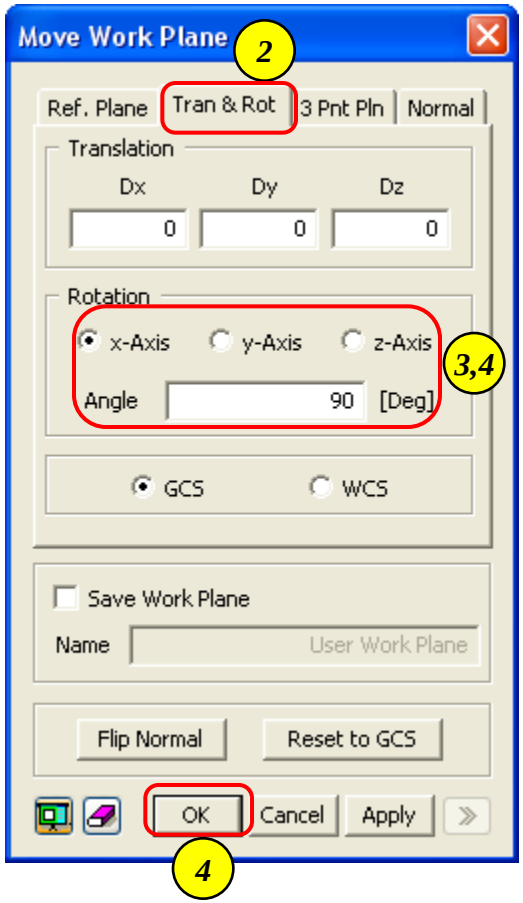
1. *Geometry > Generate Features > Revolve …*
2. *Select all the faces*
3. *Select the new generated axis as reference axis*
4. *Tick on “Reverse Direction”*
5. *Angle: 30 [Deg]*
6. *Click on [OK] Button*

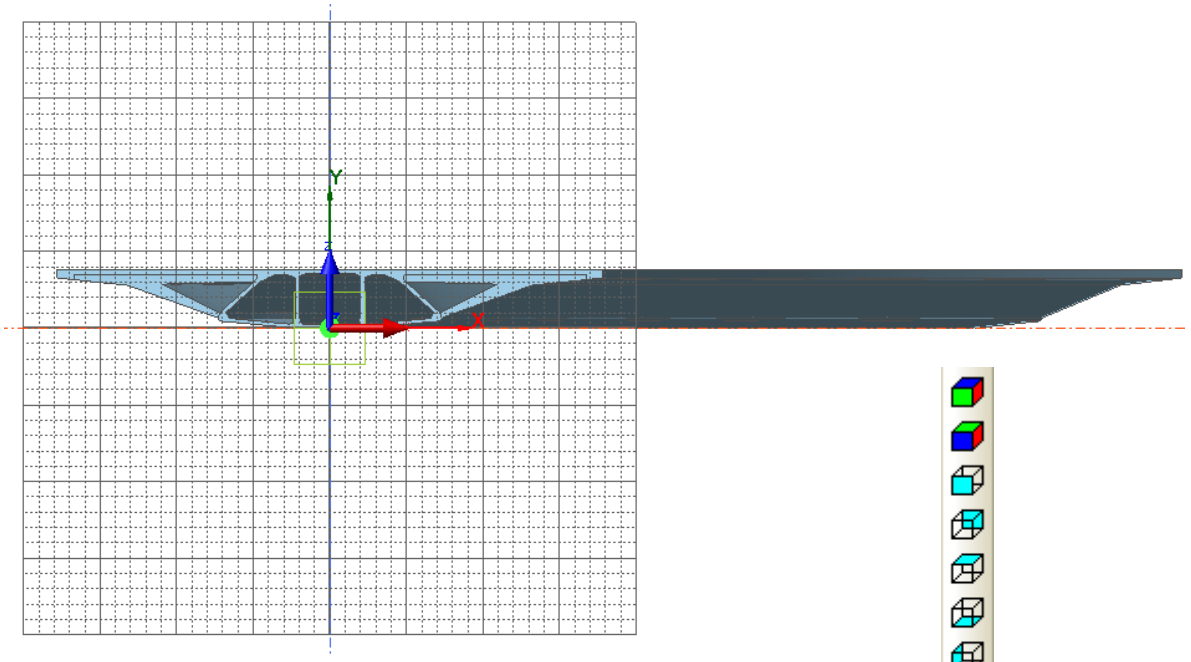




Step 14.

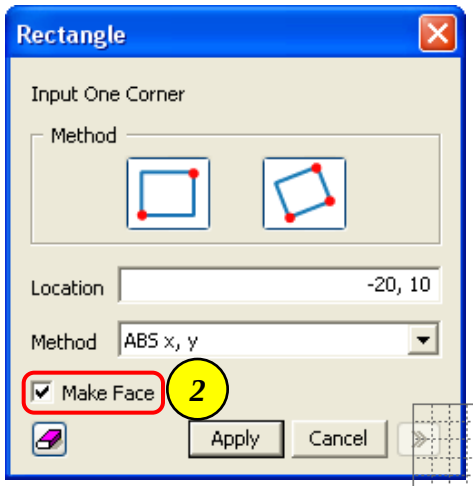
1. Geometry > Work Plane > Move…
2. Select the "Tran & Rot" tab
3. Rotation: x-Axis
4. Angle: 90 [Deg]
5. Click on [OK] Button
6. Toggle on "Normal" view





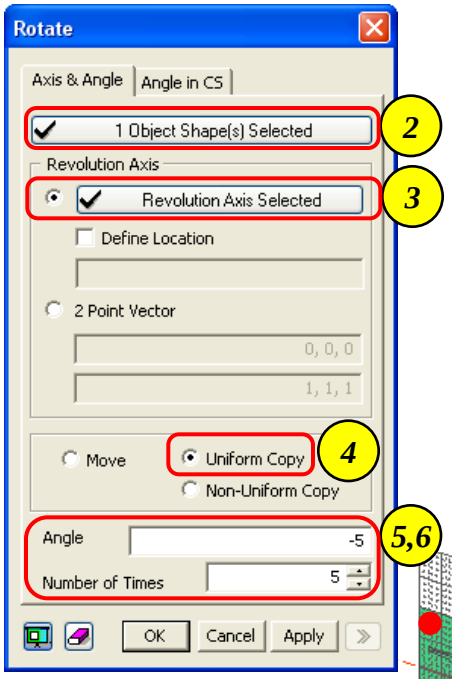
Step 15.

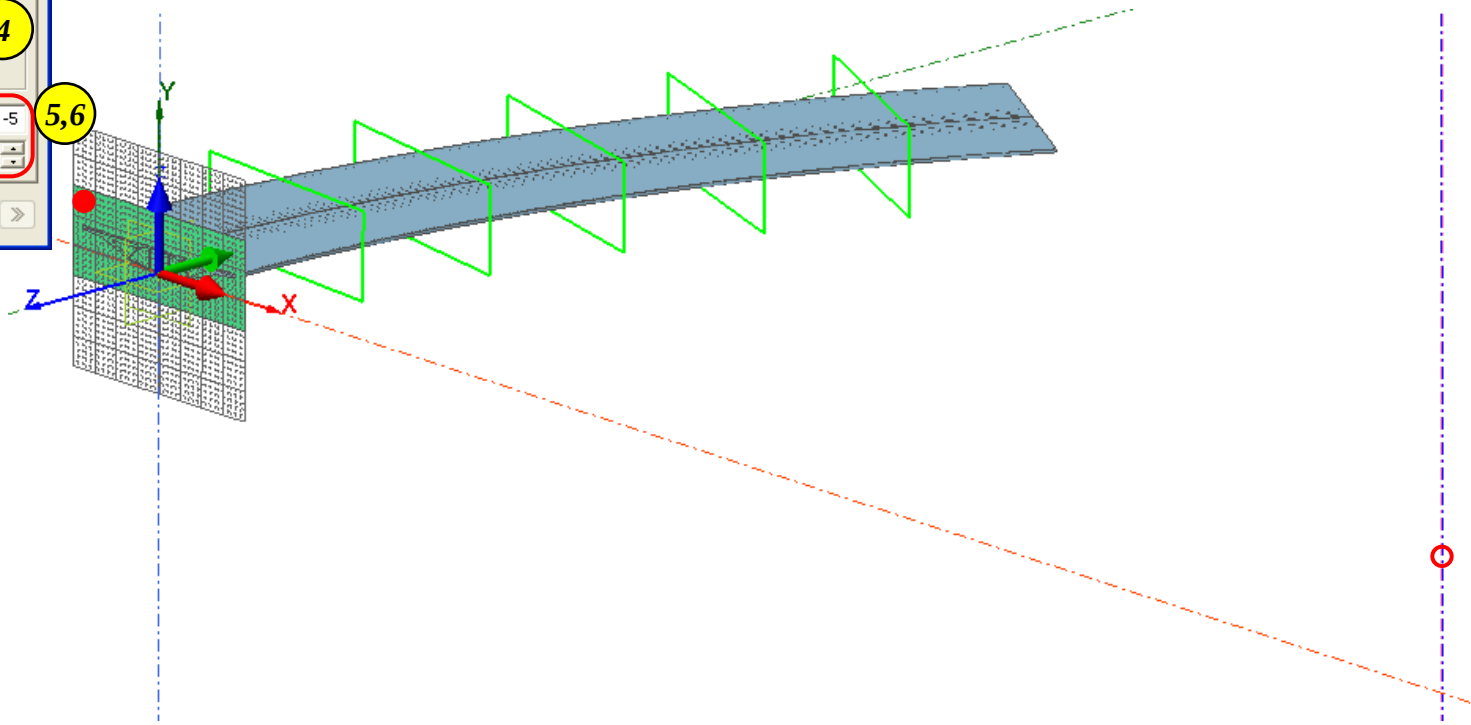
1. Geometry > Curve > Create on WP > Rectangle (Wire)…
2. Tick on “Make Face”
3. Toggle on “Grid Snap” view
4. Draw an arbitrary face as shown in the picture
5. Click on [Apply] Button
6. Click on [Cancel] Button



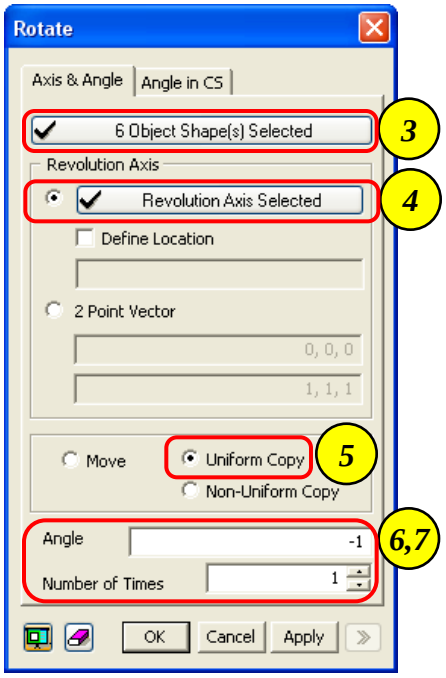
Step 16.

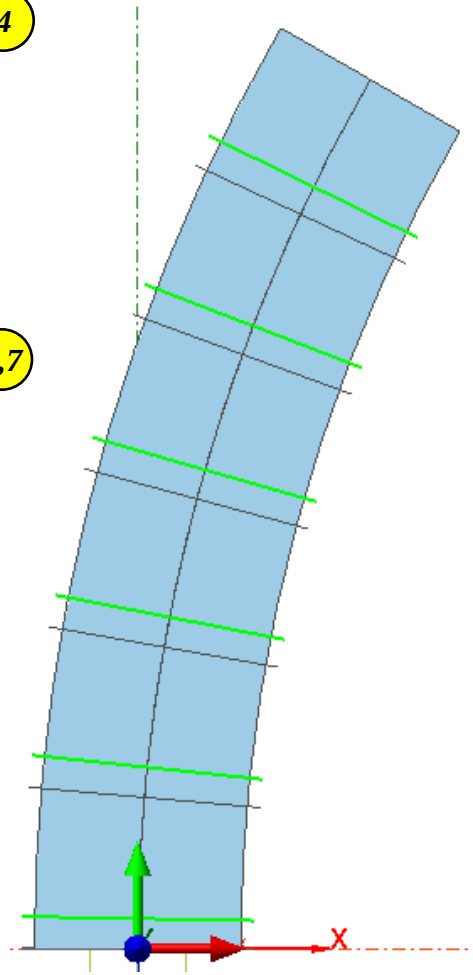
1. *Geometry > Transform > Rotate …*
2. *Select the highlighted face*
3. *Select the new generated axis as reference axis*
4. *Select “Uniform Copy”*
5. *Angle: -5 [Deg]*
6. *Number of Times: 5*
7. *Click on [OK] Button*



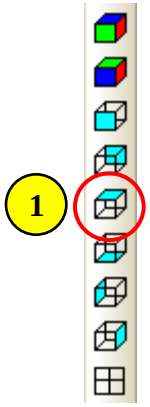


Step 17.

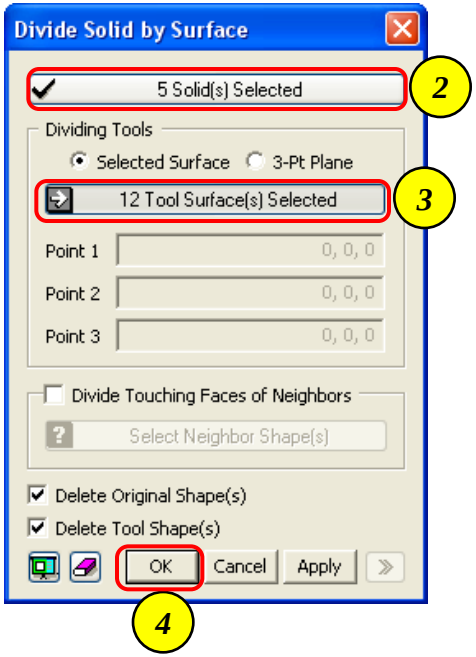




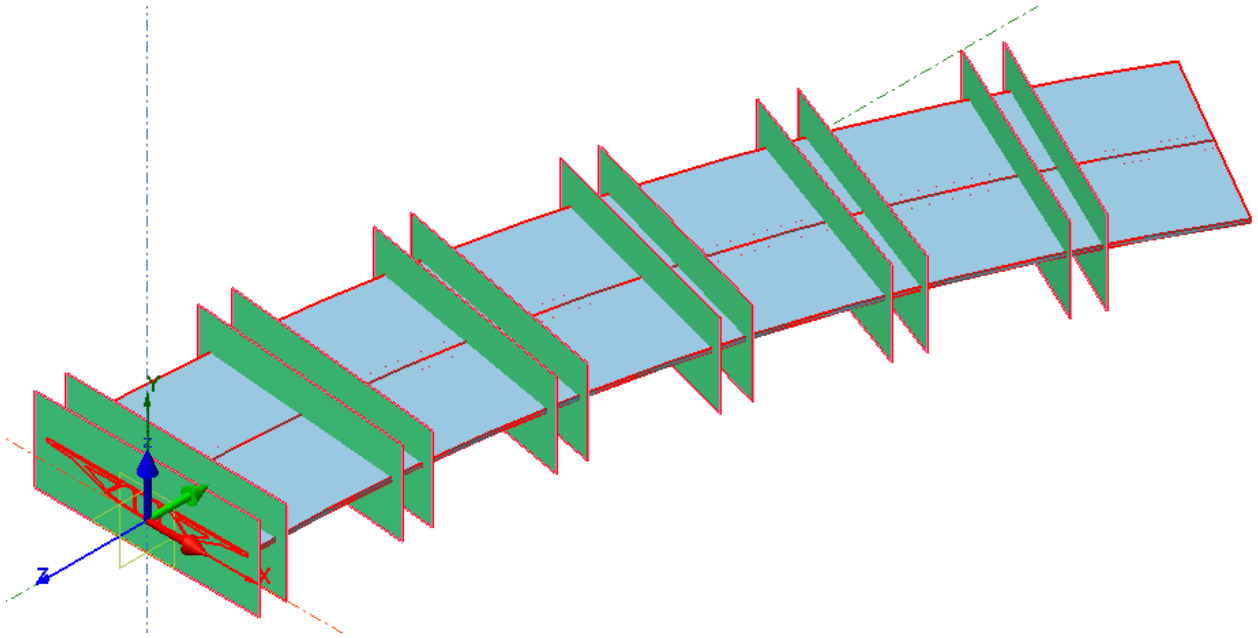
1. *Toggle on "Top" view*
2. *Geometry > Transform > Rotate …*
3. *Select 6 faces*
4. *Select the new generated axis as reference axis*
5. *Select "Uniform Copy"*
6. *Angle: -1 [Deg]*
7. *Number of Times: 1*
8. *Click on [OK] Button*



Step 18.

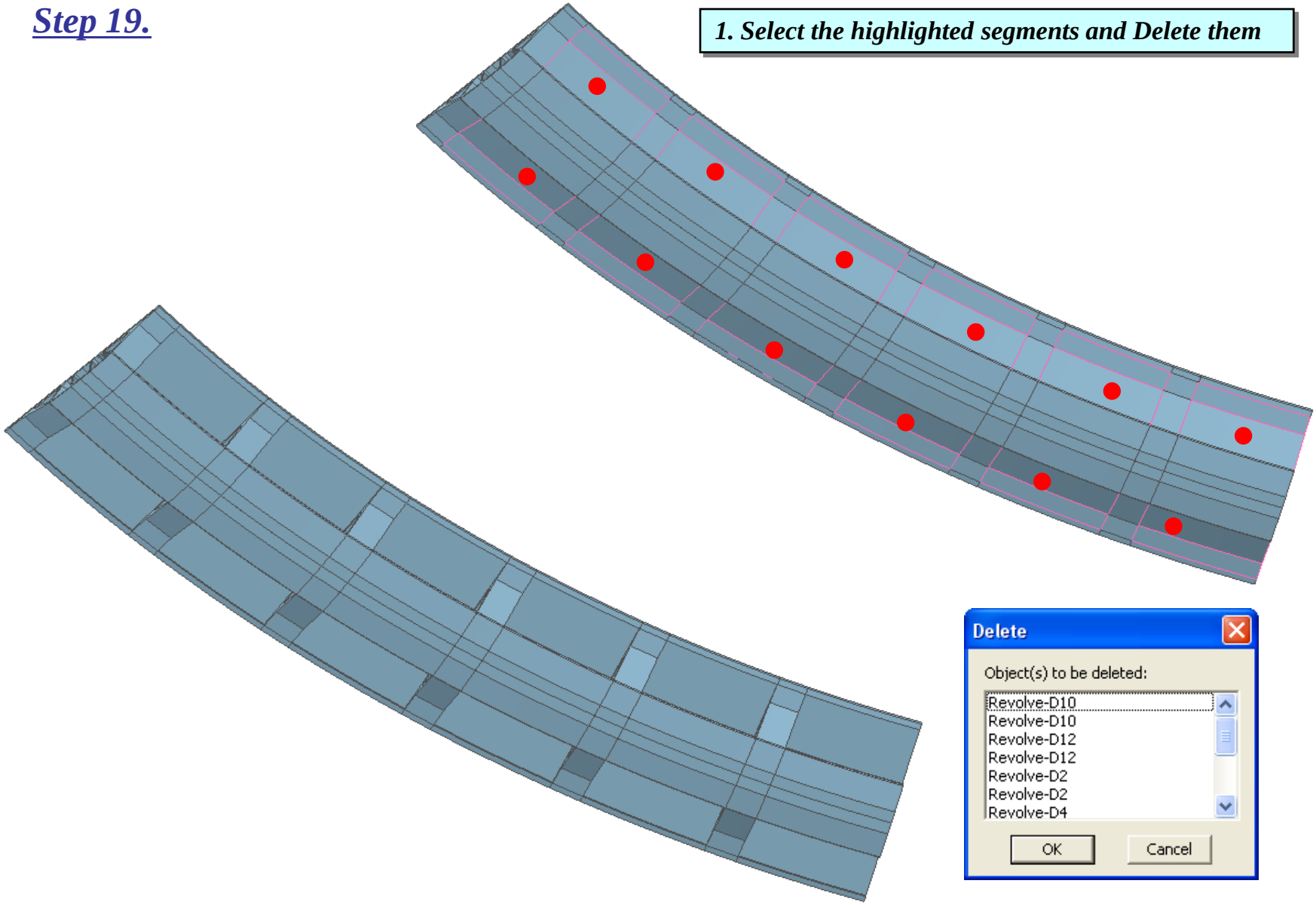


1. *Geometry > Solid > Divide…*
2. *Select all the solid elements*
3. *Select 12 faces for "Tool Surface(s)"*
4. *Click on [OK] Button*

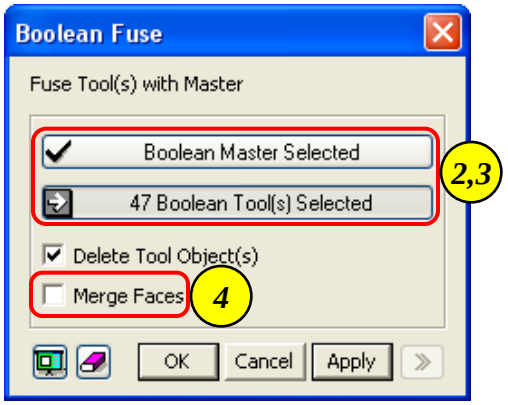


Step 19.

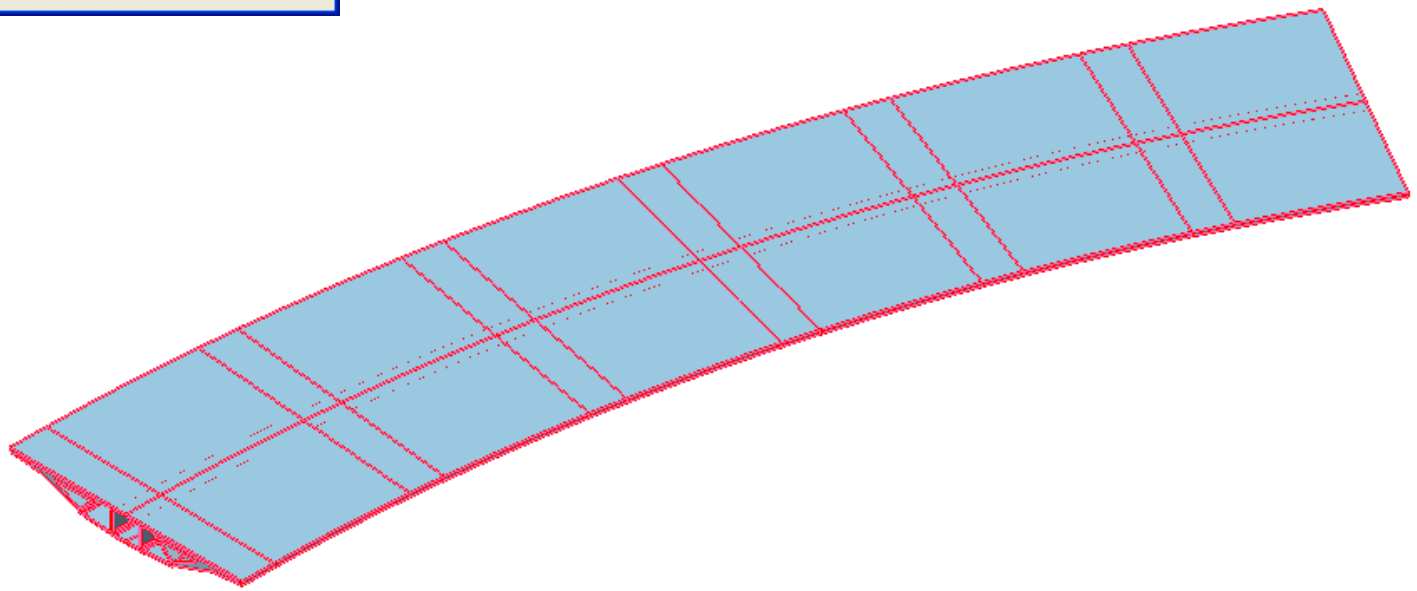
1. Select the highlighted segments and Delete them



Step 20.



1. *Geometry > Boolean Operation > Fuse…*
2. *Select one segment as Boolean Master*
3. *Select other segments as Boolean Tool(s)*
4. *Check off Merge Faces*
5. *Click on [OK] Button*



Step 21.

1. *Mesh > Auto Mesh > Solid…*
2. *Select the solid model*
3. *Element size: 2*
4. *Property: 1*
5. *Click on [OK] Button*