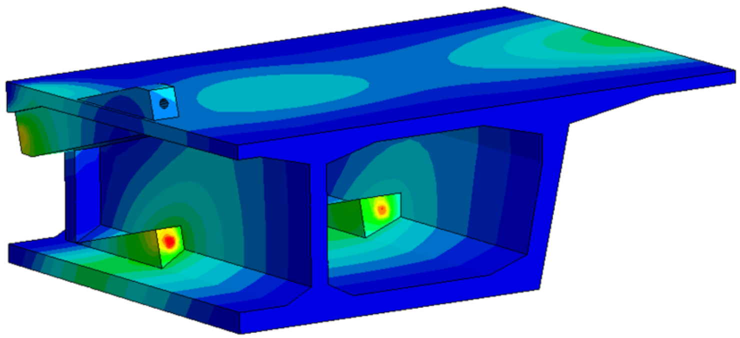
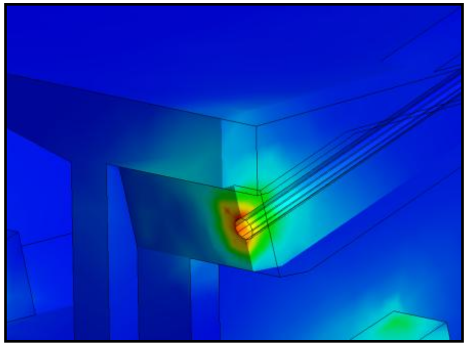
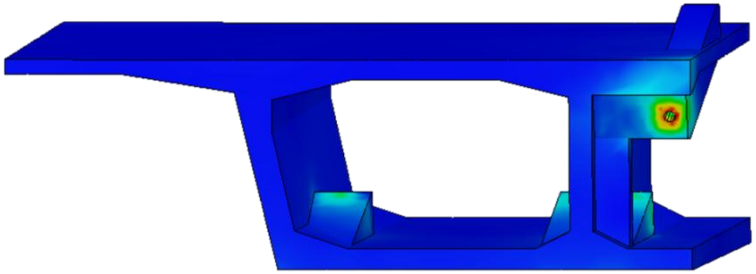
LS-18. PSC Anchorage

Overview

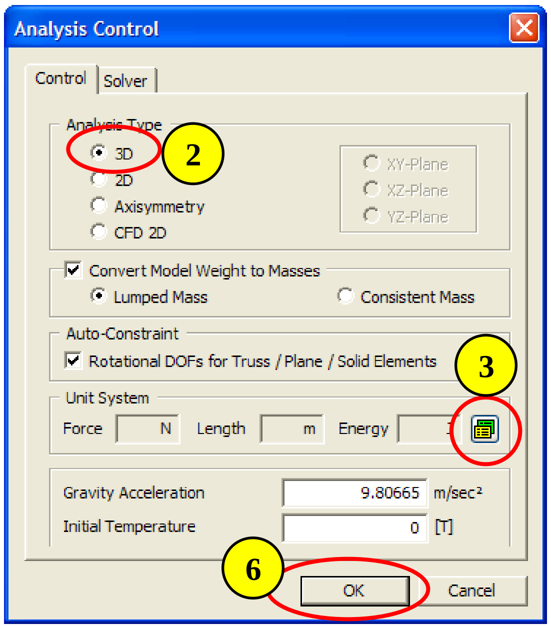
- **3-D Linear Static Analysis**
- **Model**
  - *- Symmetric Model*
  - *- Unit : N, m*
  - *- Isotropic Elastic Material*
  - *- Solid Elements*
- **Load & Boundary Condition**
  - *- Self weight*
  - *- Pressure*
  - *- Symmetric Constraint*
- **Result Evaluation**
  - *- Stress*
  - *- Clipping mode*

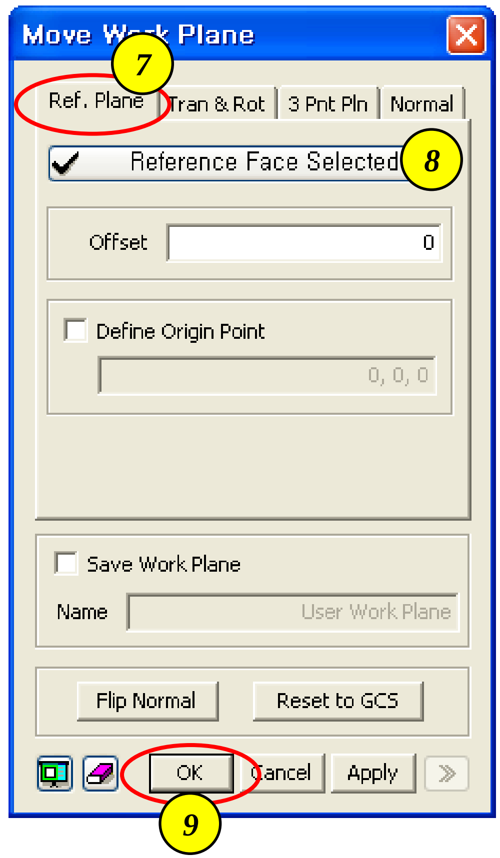




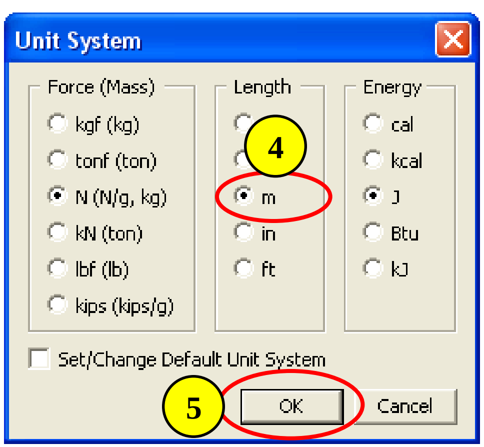


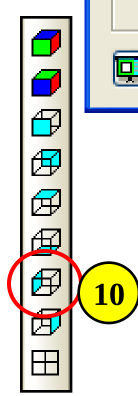
Step 1.

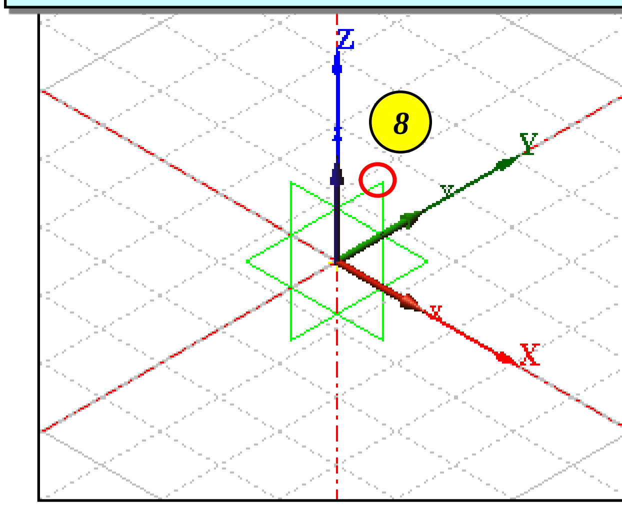




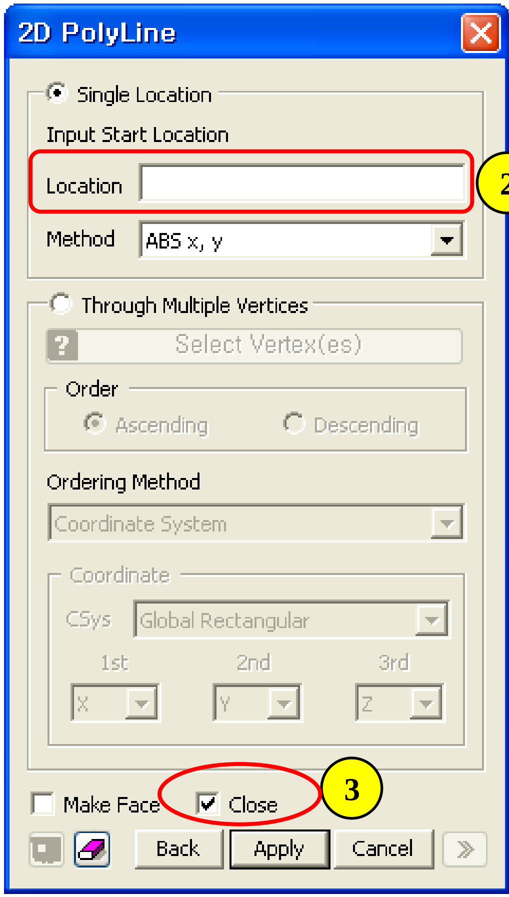
1. Analysis > Analysis Control – Control tab
2. Analysis Type : 3D
3. Click Button (Unit System)
4. Length : m
5. Click [OK] Button
6. Click [OK] Button
7. Geometry > Work Plane > Move – "Ref. Plane" tab
8. Select "YZ Plane"
9. Click [OK] Button
10. Click on "Left View"







Step 2.

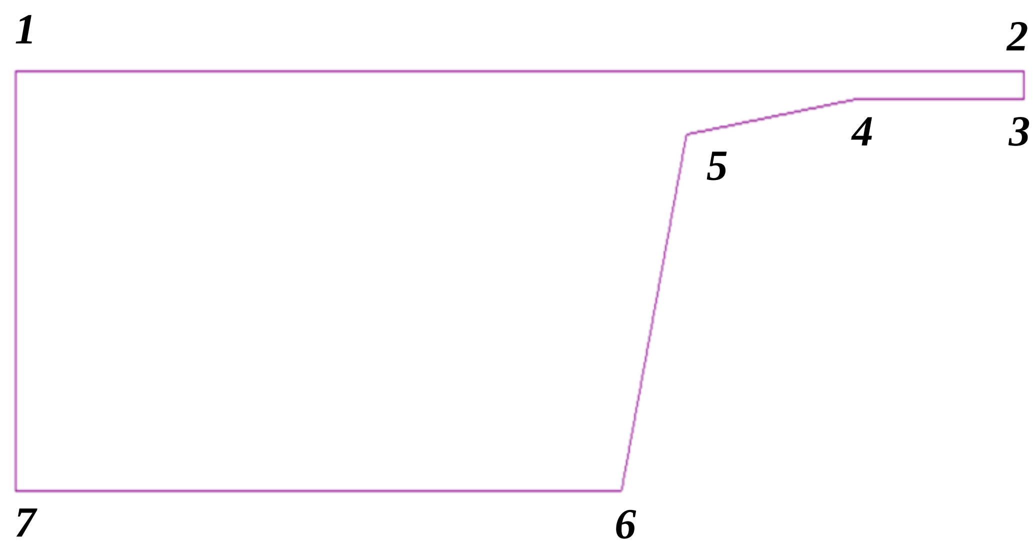


1. Geometry > Curve > Create on WP > Polyline (Wire)…

2. Location : (0) , <-11.95> , <0,-0.25>, <2.0> , <2.0,-0.32> , <0.77,-3.234> , <7.180> ☊

3. Check on "Close"

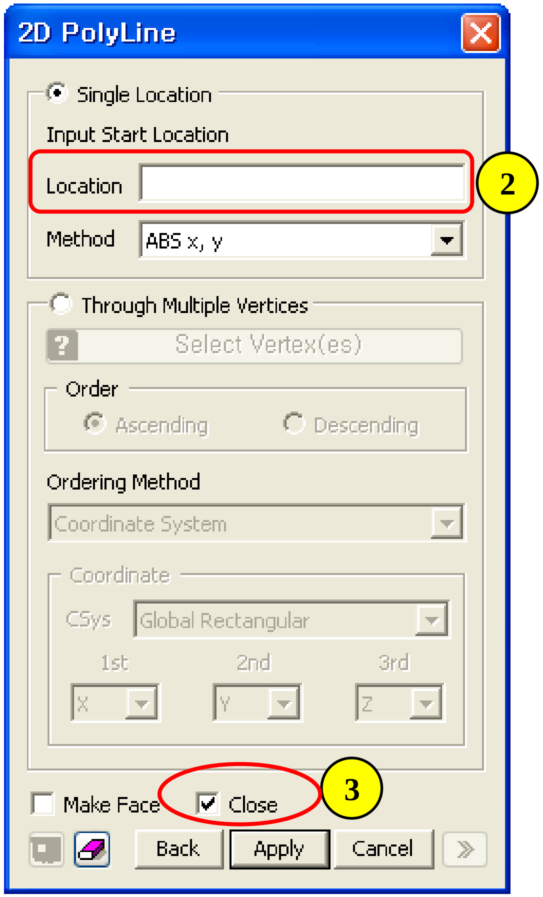
4. Click Right Mouse Button in Work Window (to close the Polyline)



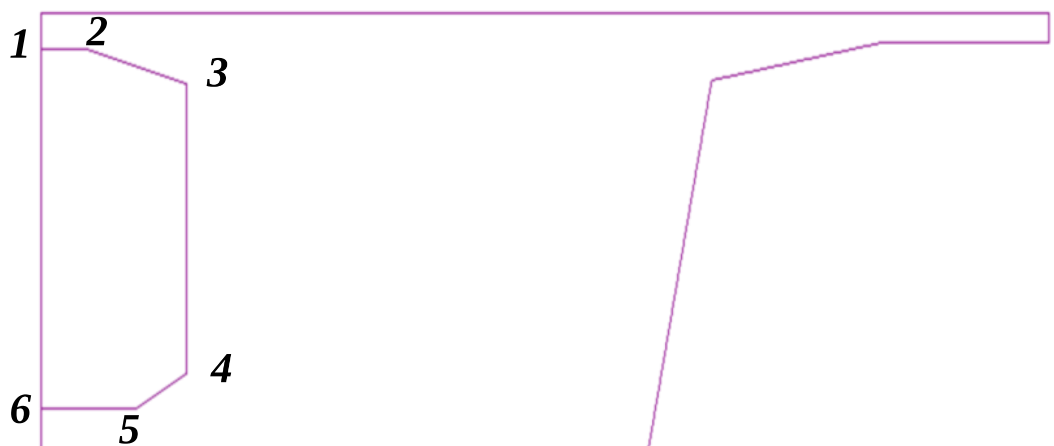
☊ *(): "ABS x, y", <>: "REL dx, dy"*

(0) same as (0, 0)

Step 3.

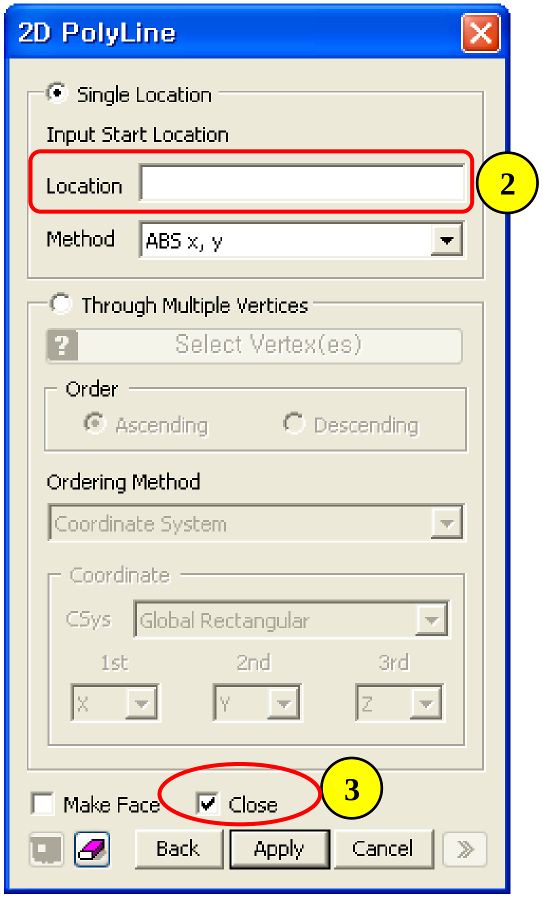


1. *Geometry > Curve > Create on WP > Polyline (Wire)…*
2. *Location : (0, -0.3) , <-0.525> , <-1.2, -0.3> , <0, -2.471> , <0.6, -0.3>, <1.125, 0>*
3. *Check on "Close"*
4. *Click Right Mouse Button in Work Window (to close the Polyline)*



(): "ABS x, y", <>: "REL dx, dy"
(0) same as (0, 0)

Step 4.



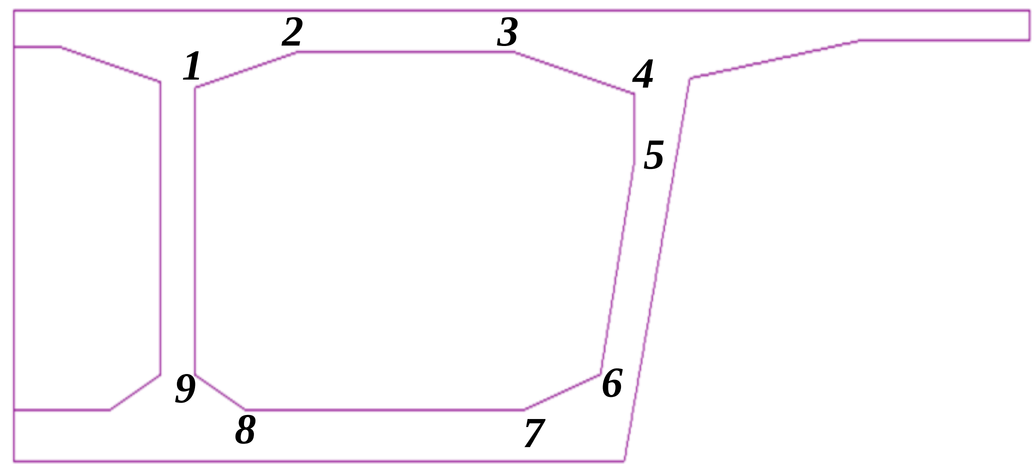
1. Geometry > Curve > Create on WP > Polyline (Wire)…

2. Location : (-2.125, -0.65), <-1.2, 0.3>, <-2.575>, <-1.4, -0.35>, <0, -0.562>, <0.4, -1.809>, <0.9, -0.3>,<3.275>, <0.6, 0.3>

3. Check on "Close"

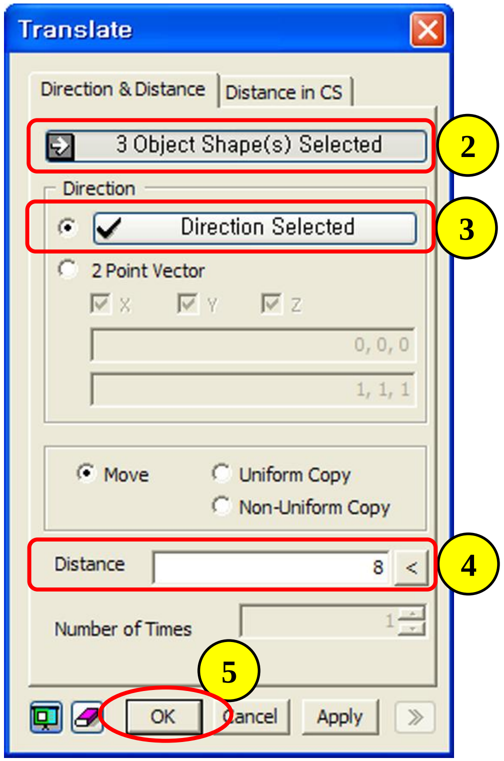
4. Click Right Mouse Button in Work Window (to close the Polyline)

5. Click [Cancel] *Button*

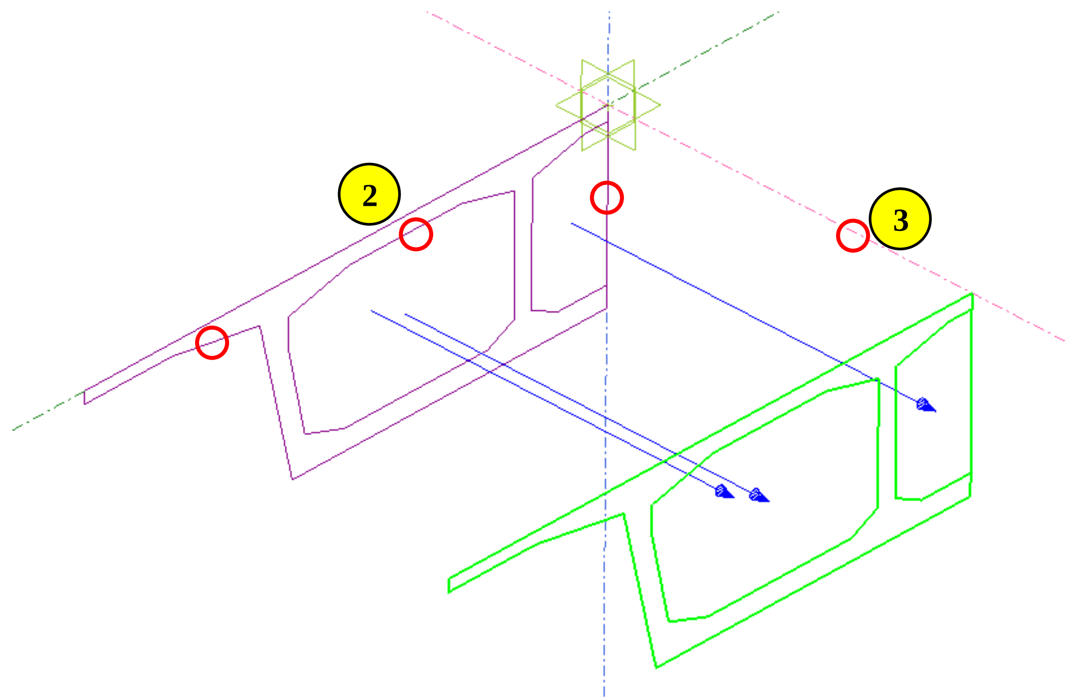


- *(): "ABS x, y", <>: "REL dx, dy"*
  (0) same as (0, 0)
- [Esc] *as shortcut for* [Cancel].

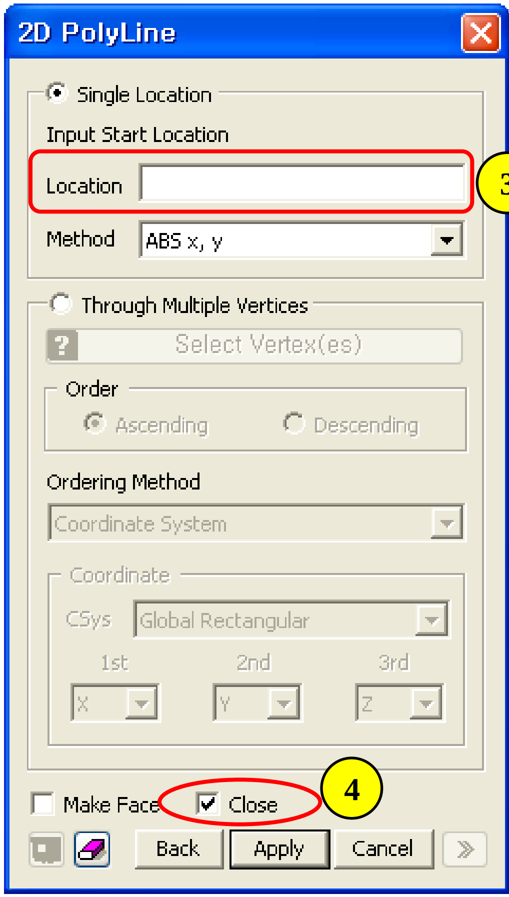
Step 5.



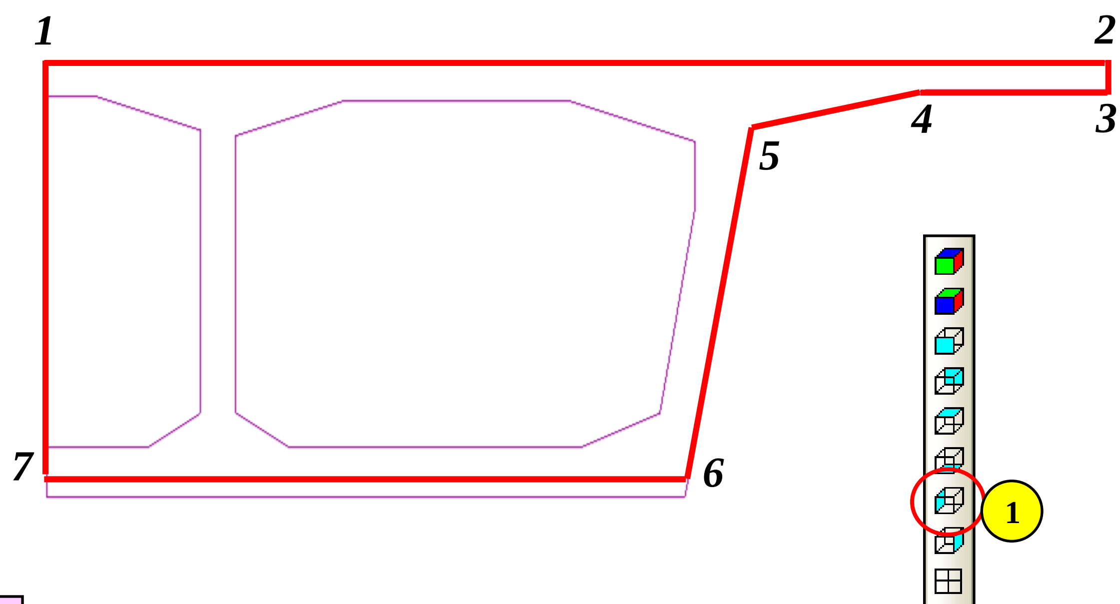
1. *Geometry > Transform > Translate…*
2. *Select three highlighted polylines (See Figure)*
3. *Click* [Select Direction] *Button and Select* [X-Axis]
4. *Distance: 8*
5. *Click* [OK] *Button*



Step 6.



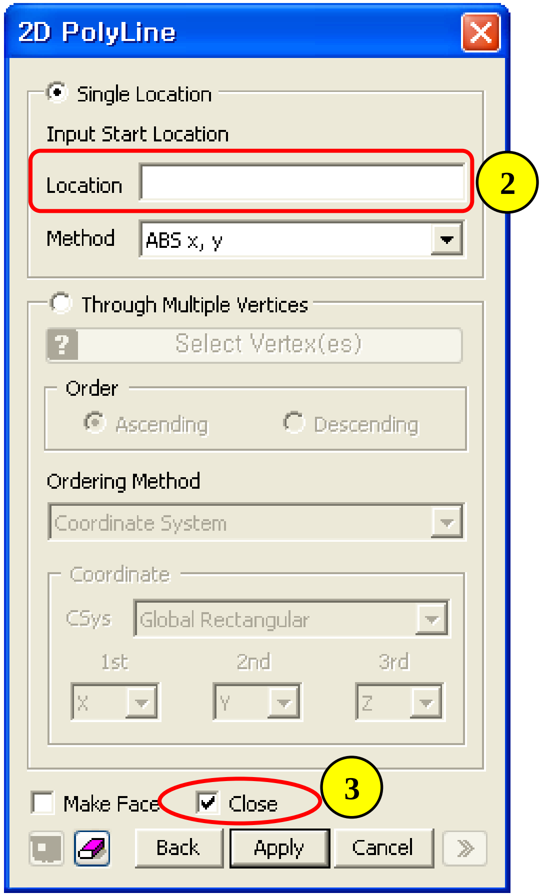
1. *Click on "Left View"*
2. *Geometry > Curve > Create on WP > Polyline (Wire)…*
3. *Location : (0) , <-11.95> , <0, -0.25> , <2.0> , <2.0, -0.32> , <0.73, -3.065> , <7.22>* ☊
4. *Check on "Close"*
5. *Click Right Mouse Button in Work Window (to close the Polyline)*



☊ *(): "ABS x, y", <>: "REL dx, dy"*

(0) same as (0, 0)

Step 7.

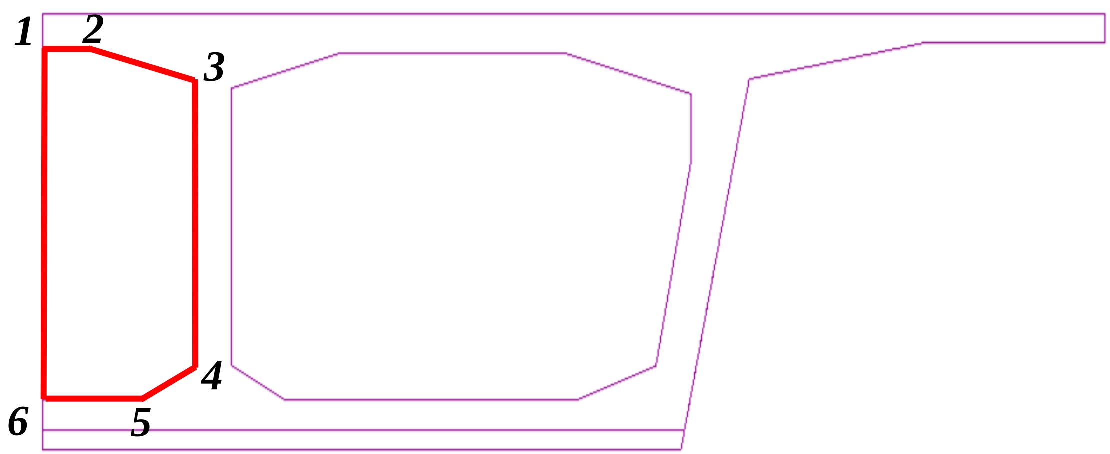


1. Geometry > Curve > Create on WP > Polyline (Wire)…

2. Location : (0, -0.3) , <-0.525> , <-1.2, -0.3> , <0, -2.366> , <0.6, -0.3>, <1.125, 0>, <0, 2.966>

3. Check on "Close"

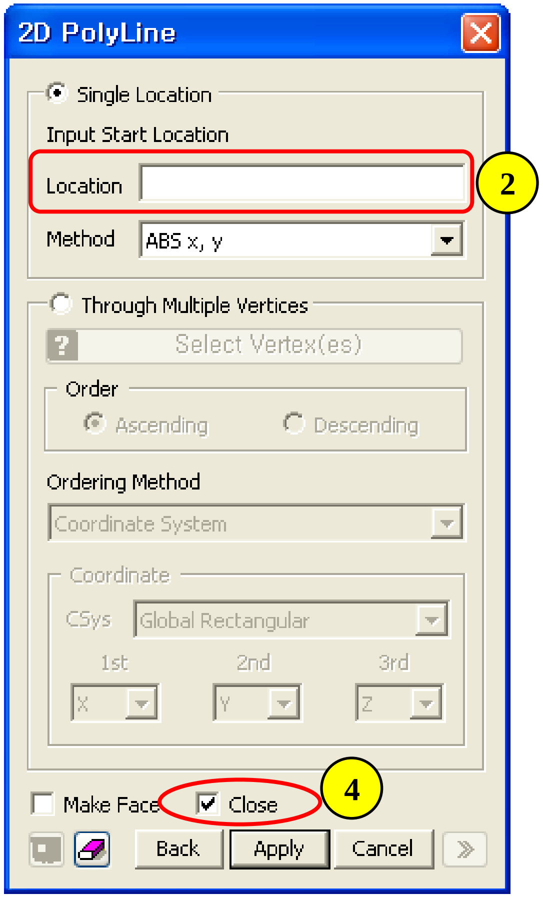
4. Click Right Mouse Button in Work Window (to close the Polyline)



(): "ABS x, y", <>: "REL dx, dy"

(0) same as (0, 0)

Step 8.

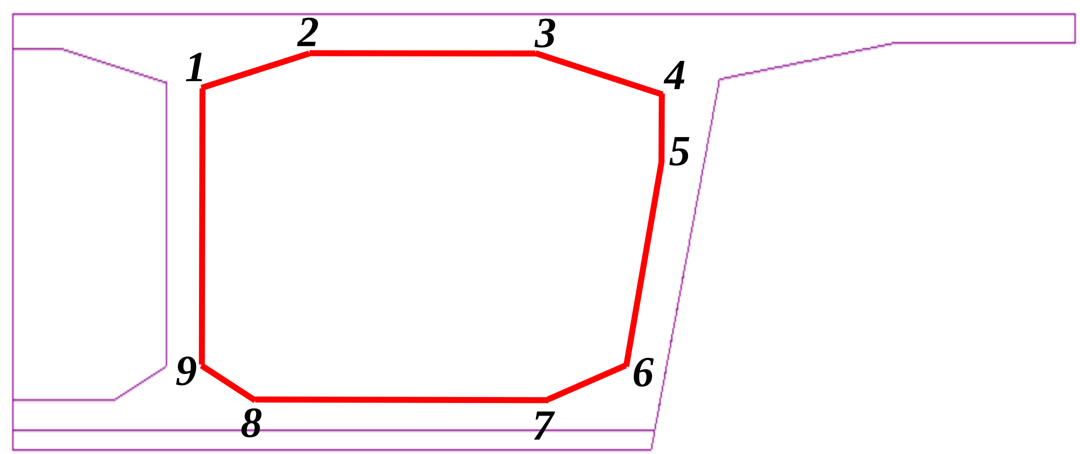


1. Geometry > Curve > Create on WP > Polyline (Wire)…

2. Location : (-2.125, -0.65), <-1.2, 0.3>, <-2.575> , <-1.4, -0.35>, <0, -0.562>, <0.378, -1.704>, <0.9, -0.3>,<3.297>, <0.6, 0.3>

3. Check on "Close"

4. Click Right Mouse Button in Work Window (to close the Polyline)

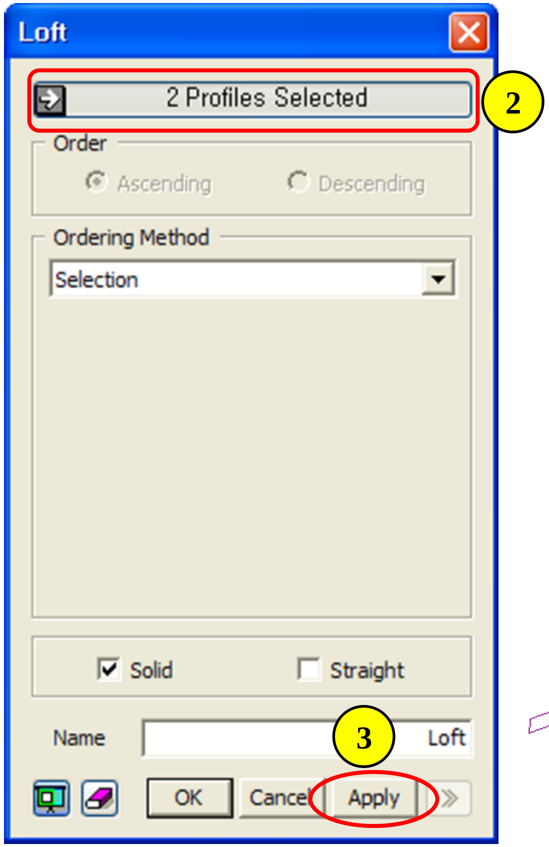


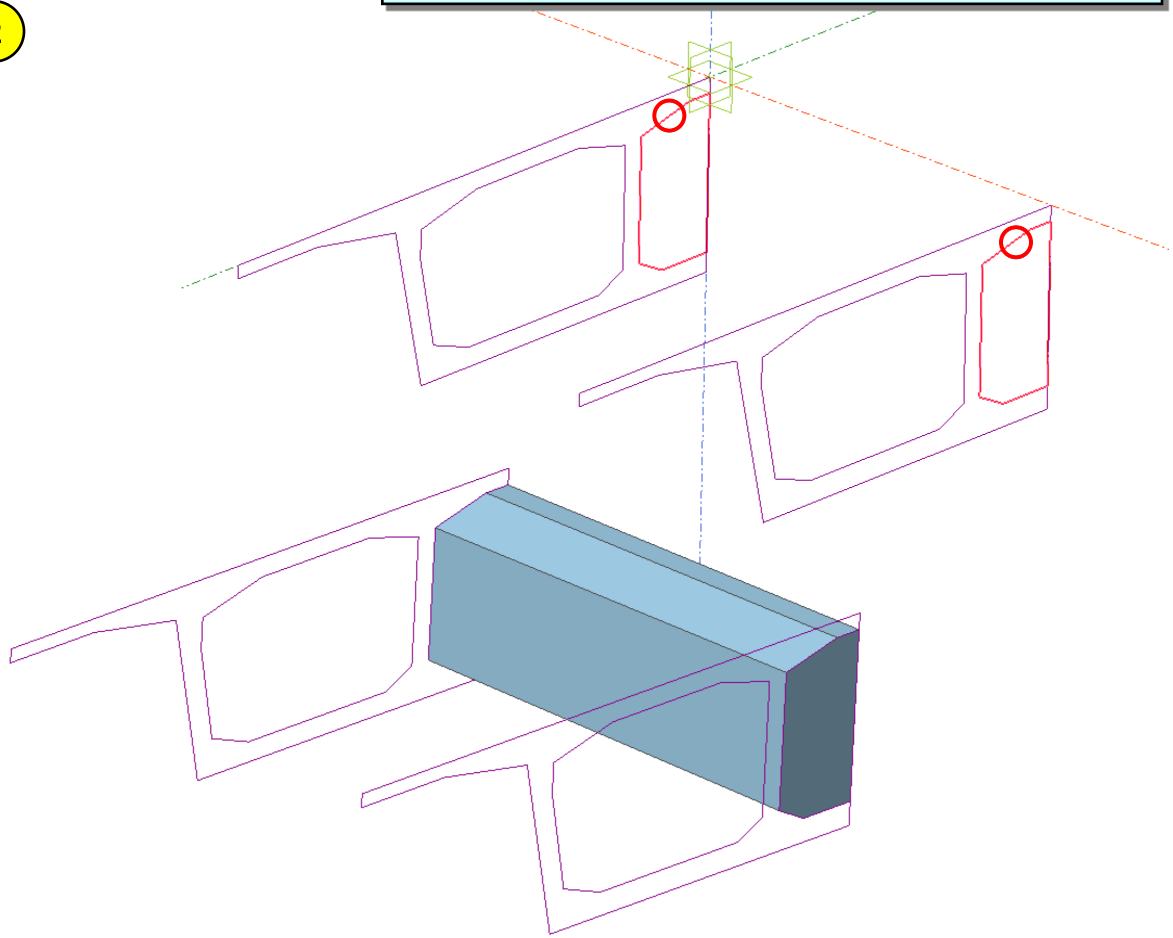
(): "ABS x, y", <>: "REL dx, dy"

(0) same as (0, 0)

Step 9.

1. Geometry > Generator > Feature > loft …
2. Select two Wires as shown in the picture
3. Check on "Apply"



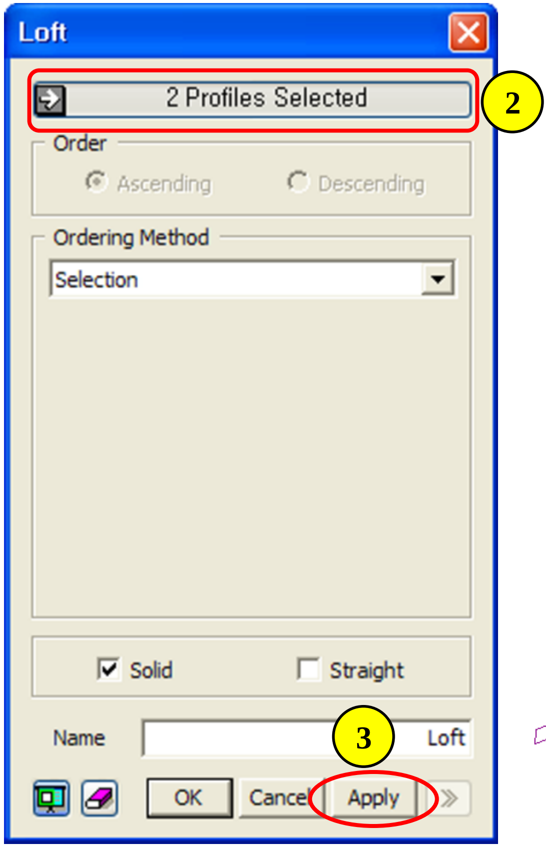


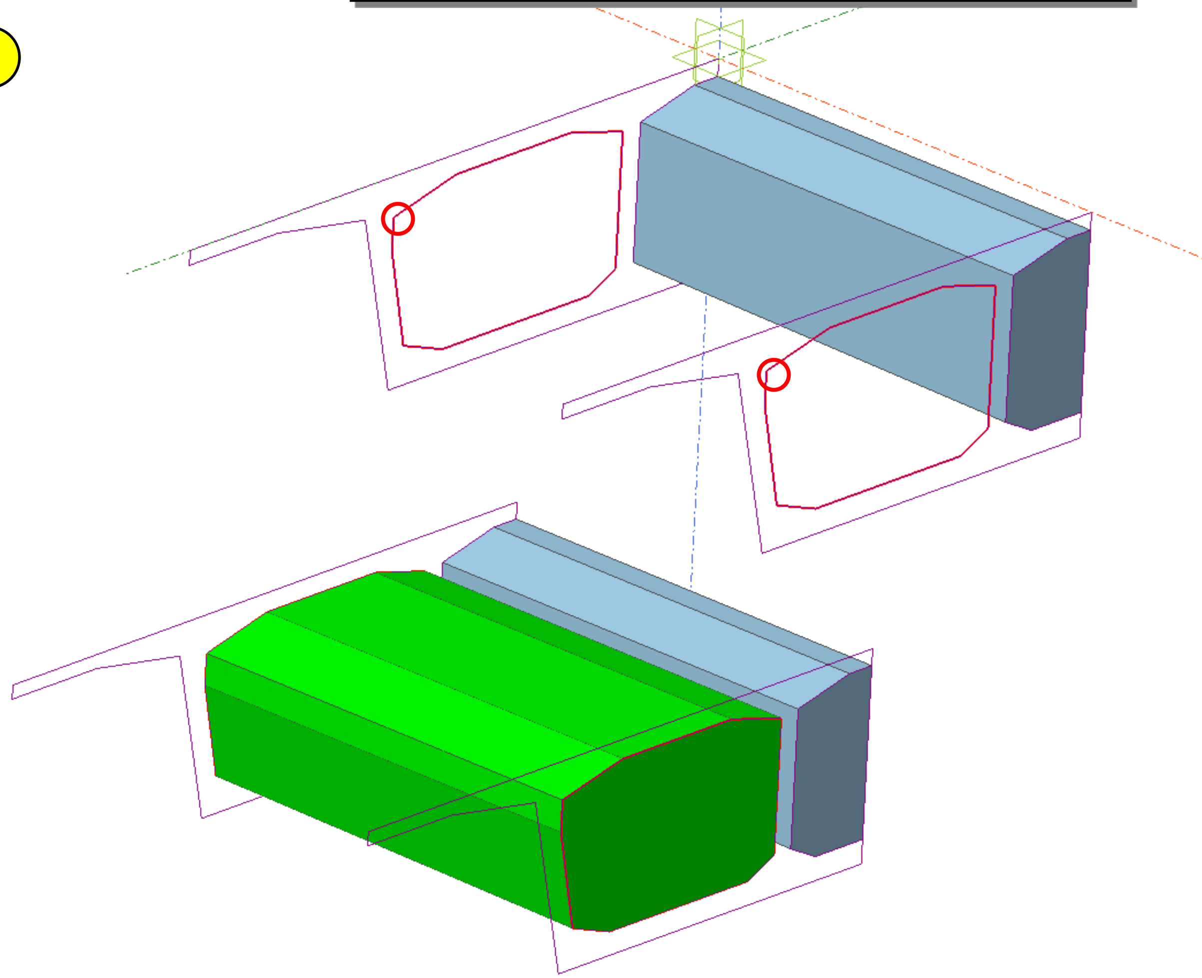
Step 10.

1. Geometry > Generator > Feature > loft …

2. Select two Wires as shown in the picture

3. Check on "Apply"



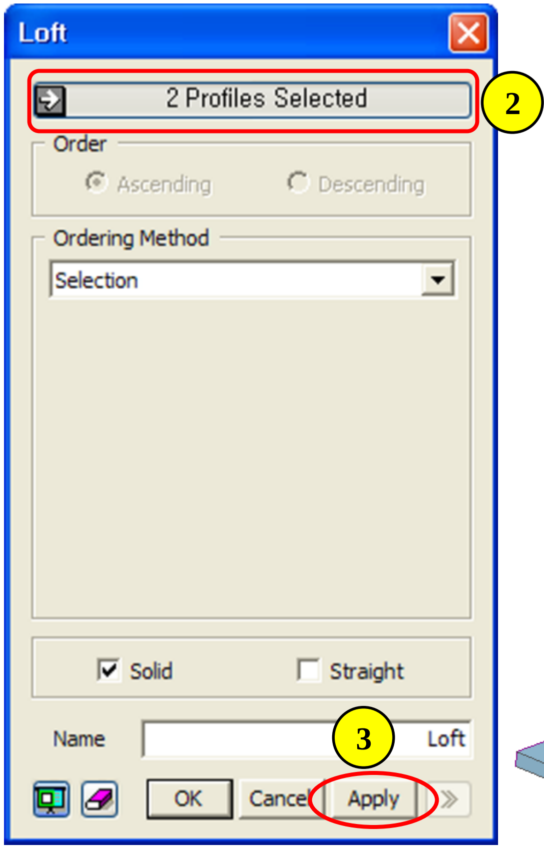


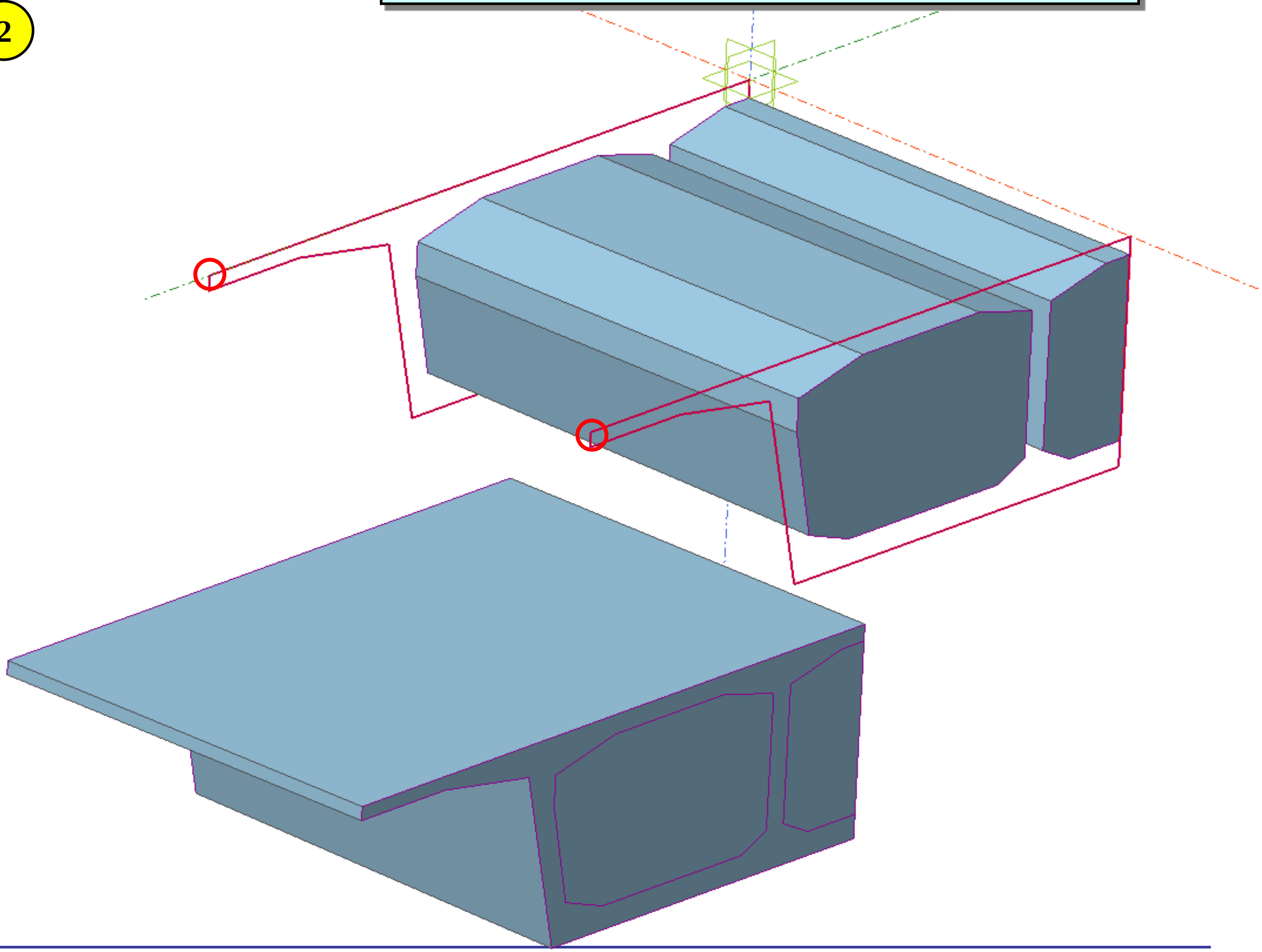
Step 11.

1. Geometry > Generator > Feature > loft …

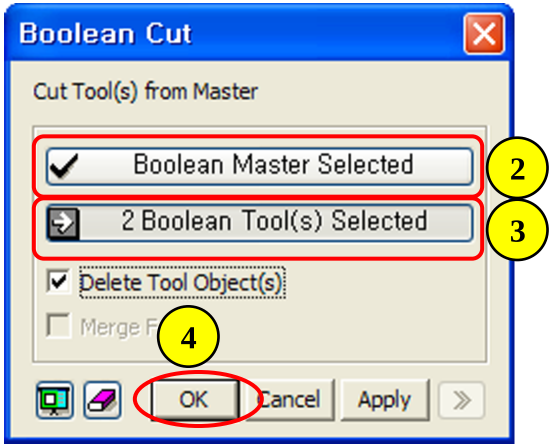
2. Select two Wires as shown in the picture

3. Check on "Apply"

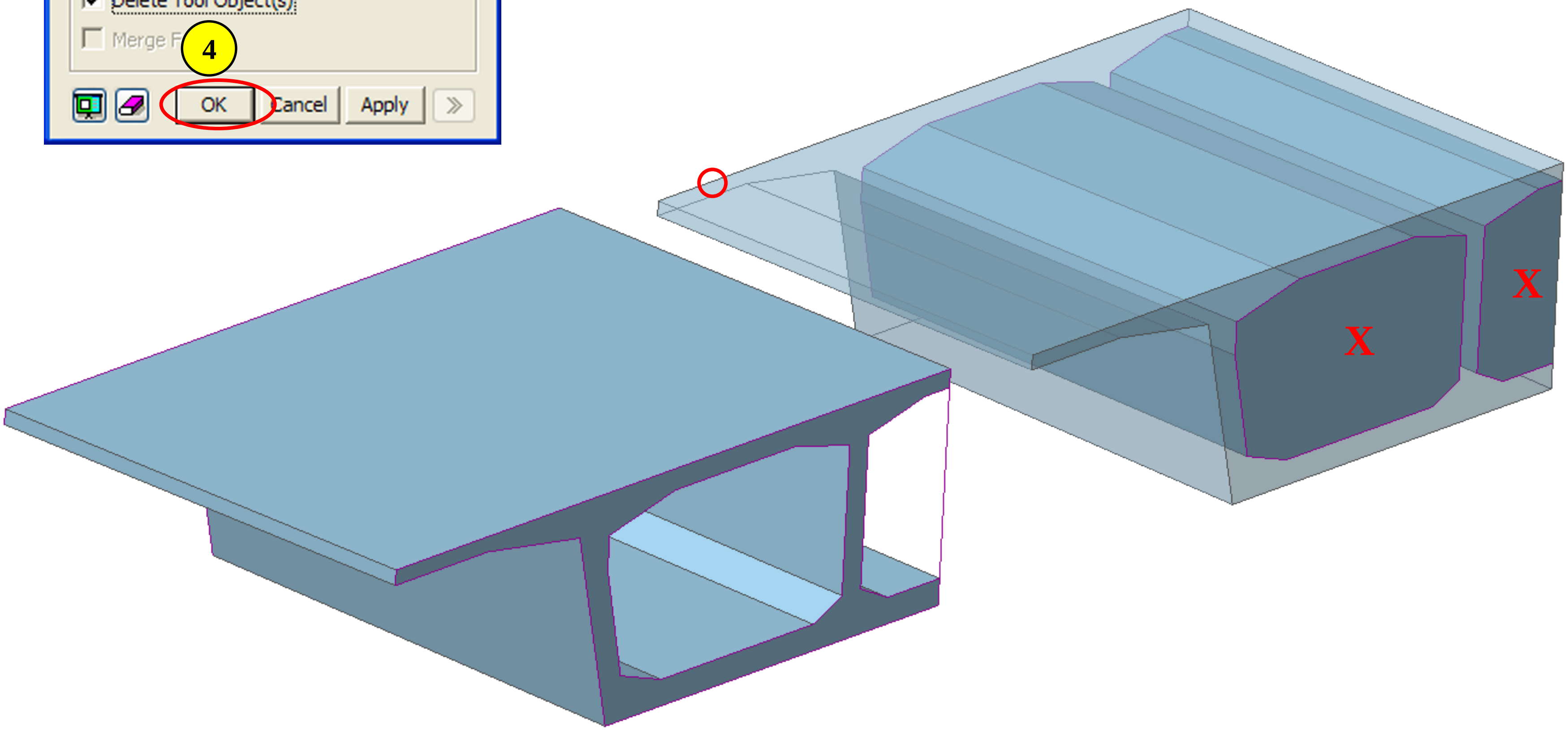




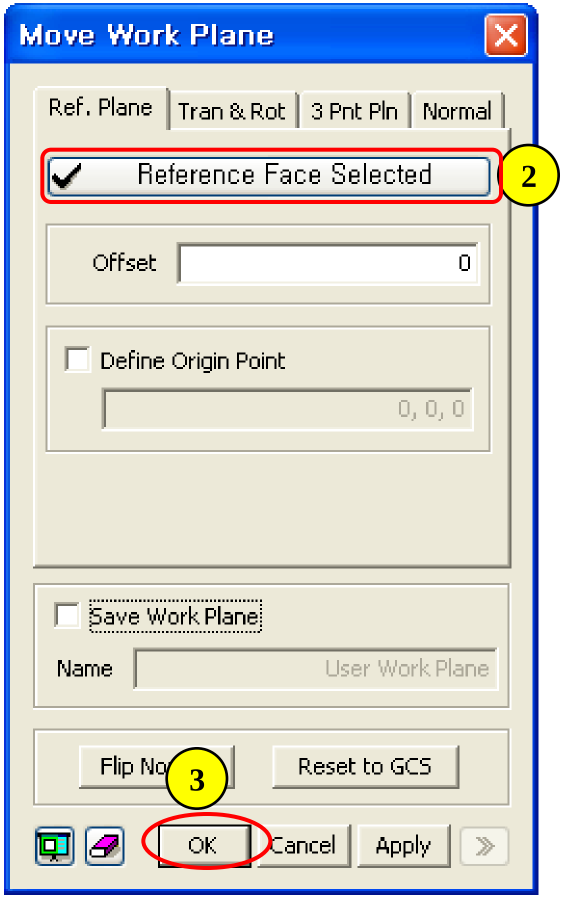
Step 12.



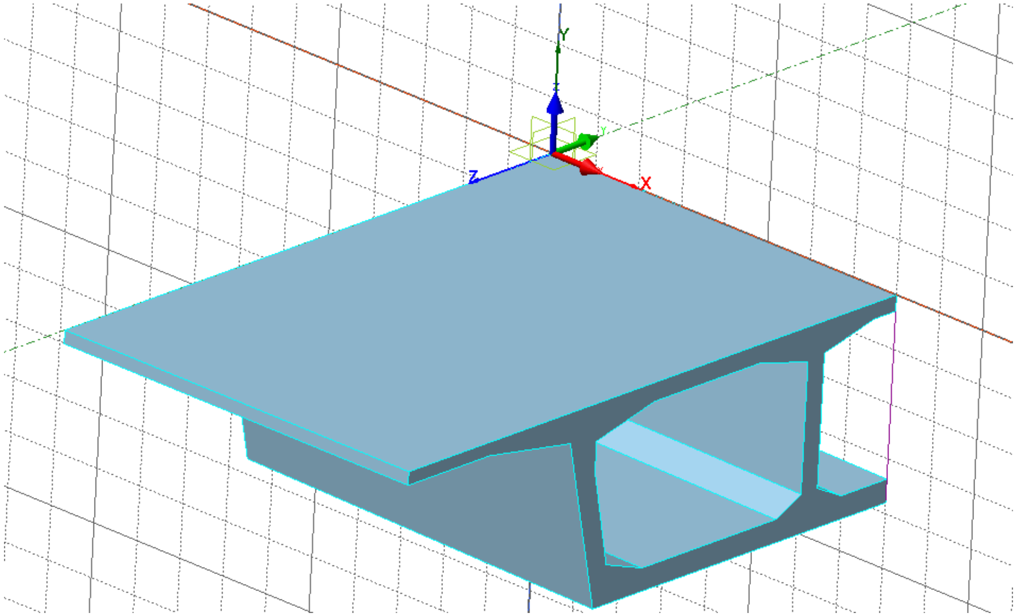
1. Geometry > Boolean Operation > Cut…
2. Select [Boolean Master Shape](Solid) marked by [O] (See Figure)
3. Select [Boolean Tool Shapes](Solid) marked by [X] (See Figure)
4. Check on "OK"



Step 13.

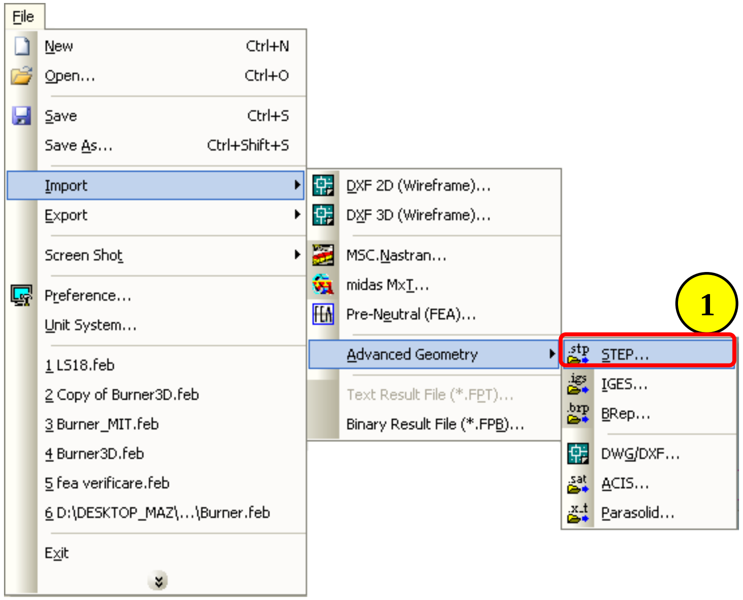


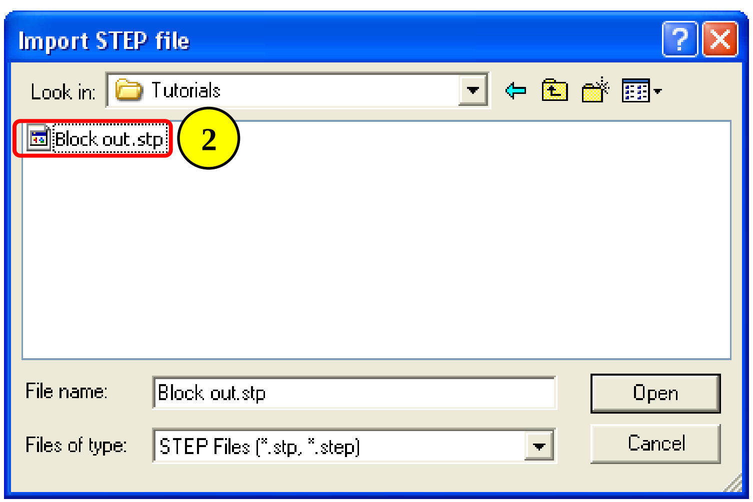
1. Geometry > Work Plane > Move "Ref. Plane" tab
2. Select "XZ Plane"
3. Click [OK] Button

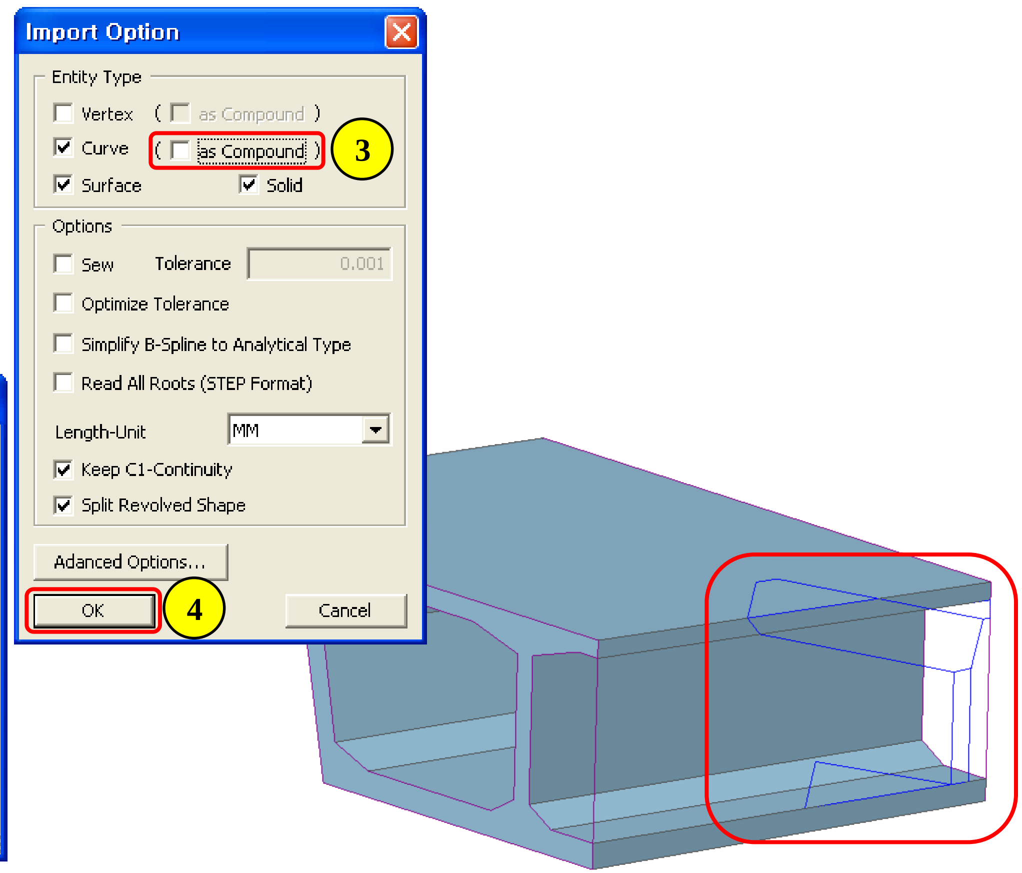


Step 14.

1. *File > Import > Advanced Geometry > STEP…> Block out.stp*
2. *Select "Block out.stp"*
3. *Check off "as Compound"*
3. *Click [OK] Button*

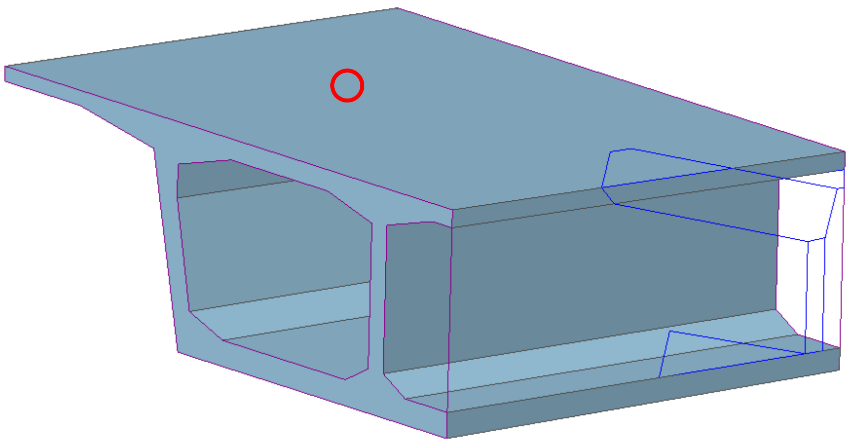


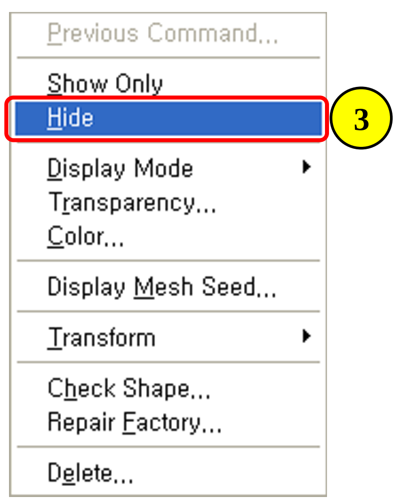


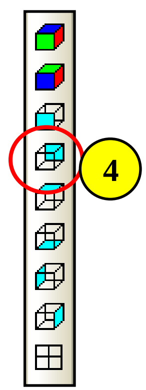


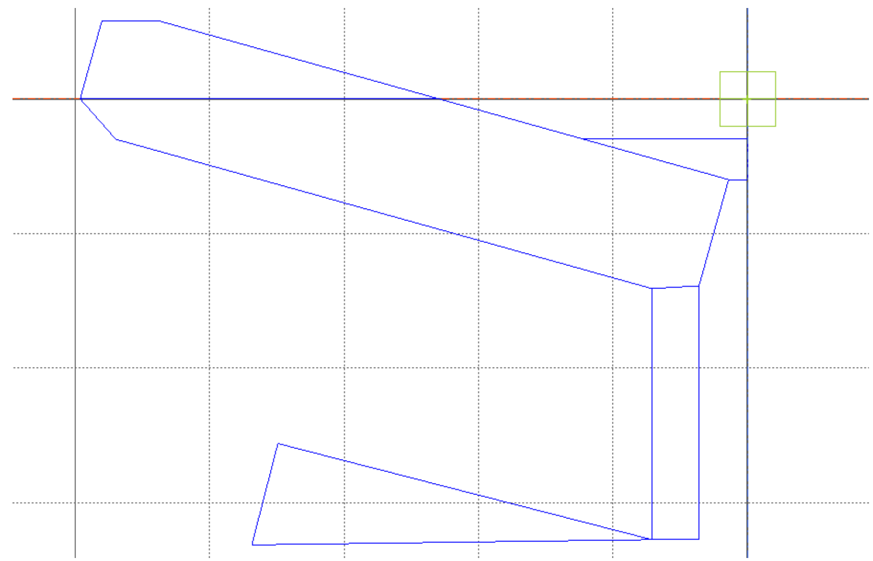
Step 15.

1. Select (Shape - Solid) marked by [O] (See Figure)
2. Click Right Mouse Button on the [Work Plane]
3. Click [Hide] on the Context Menu
4. Click on "Rear View"

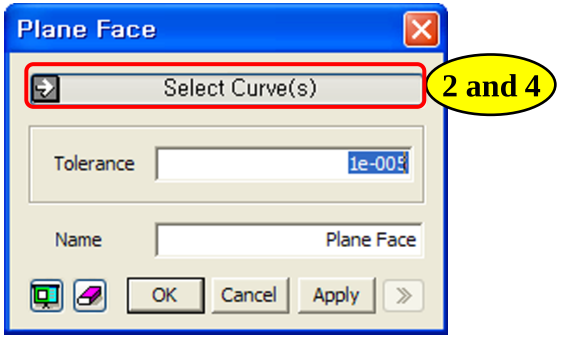




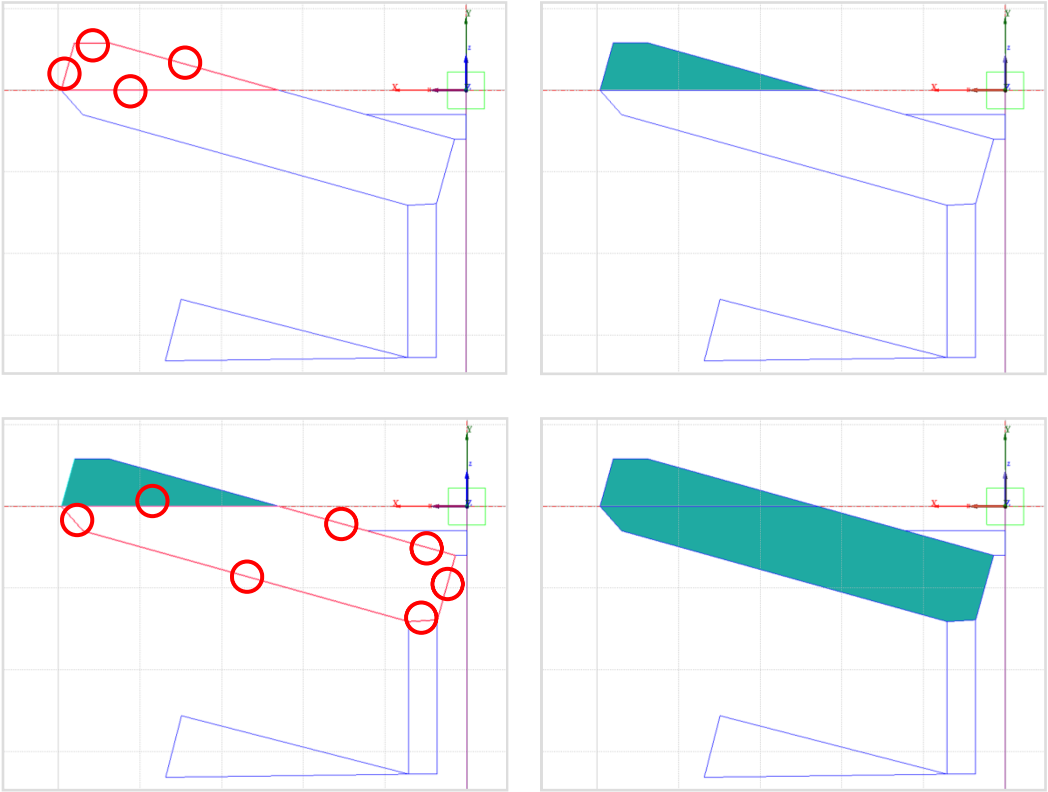




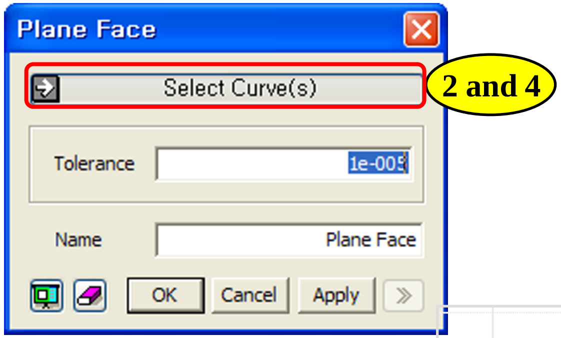
Step 16.



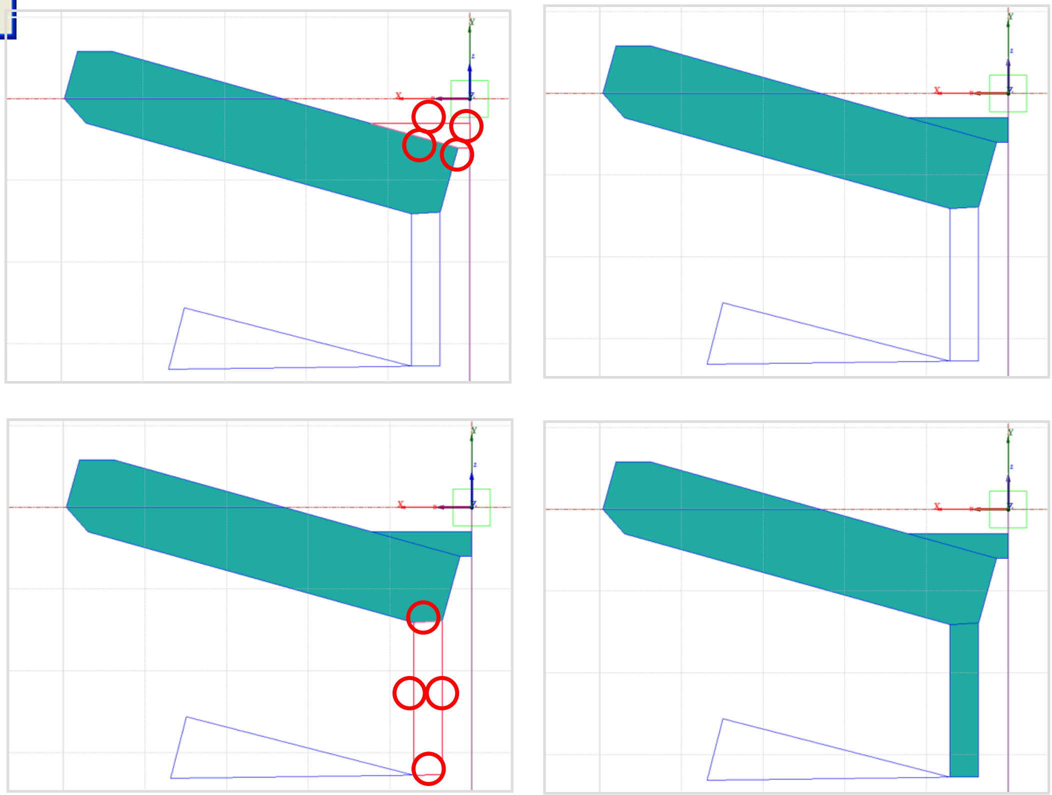
1. Geometry > Surface > Create > Plane Surface…
2. Select [4 Edges] marked by [O] (See Figure)
3. Click [Apply] Button
4. Select [7 Edges] marked by [O] (See Figure)
5. Click [Apply] Button



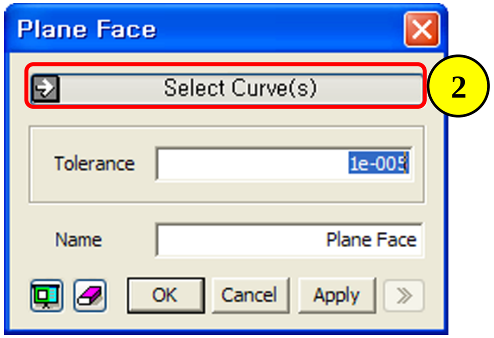
Step 17.



1. Geometry > Surface > Create > Plane Surface…
2. Select [4 Edges] marked by [O] (See Figure)
3. Click [Apply] Button
4. Select [4 Edges] marked by [O] (See Figure)
5. Click [Apply] Button



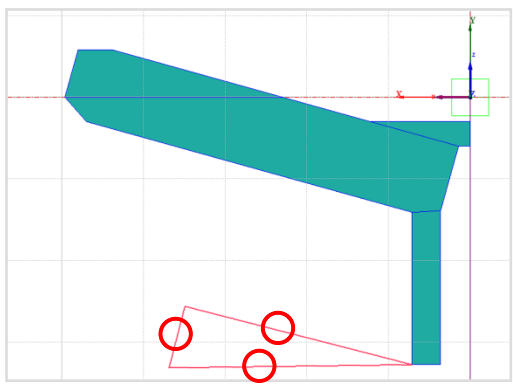
Step 18.

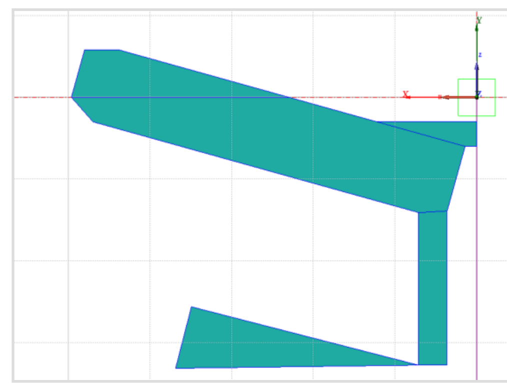


1. Geometry > Surface > Create > Plane Surface…

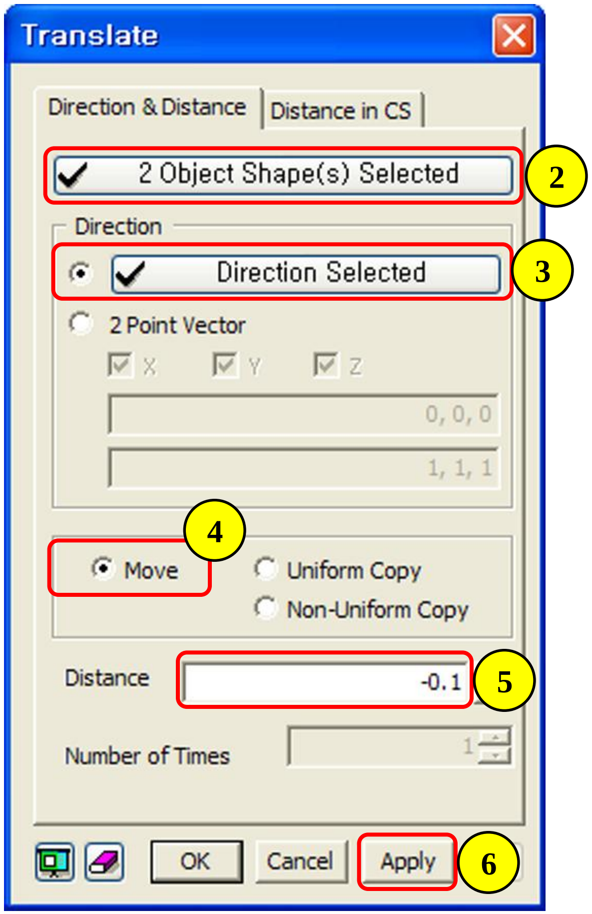
2. Select [3 Edges] marked by [O] (See Figure)

3. Click [OK] Button

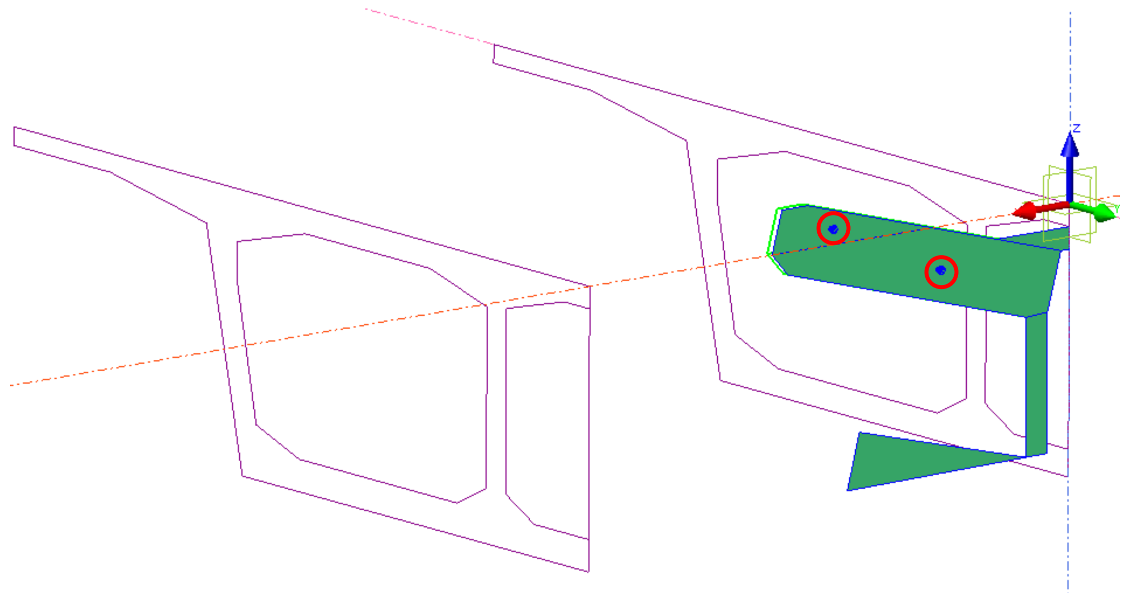




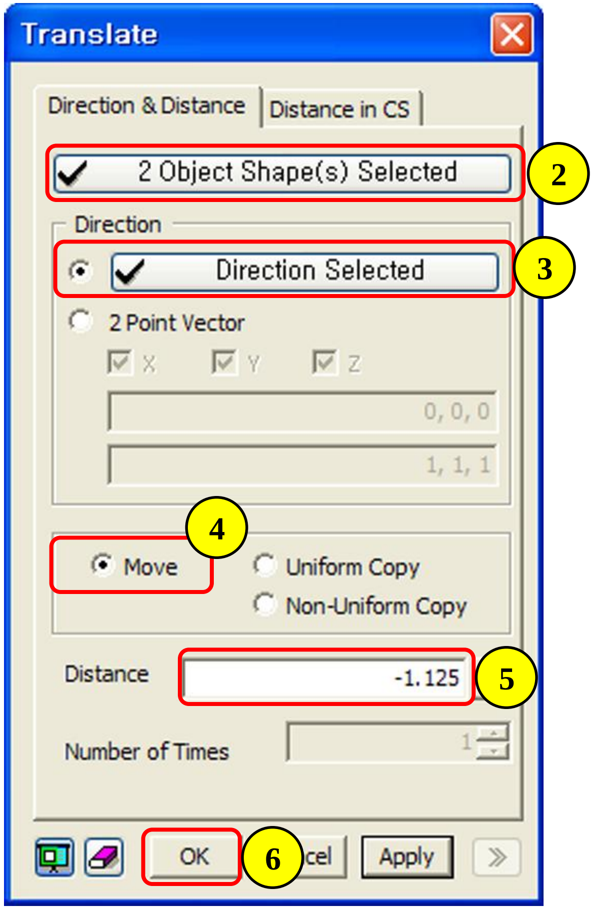
Step 19.



1. Geometry > Transform > Translate…
2. Select [2 Object Shapes] (Face) marked by [O] (See Figure)
3. Click [Select Direction] Button and Select [Y-Axis]
4. Check on [Move]
5. Distance : “-0.1”
6. Click [Apply] Button



Step 20.



1. Geometry > Transform > Translate…

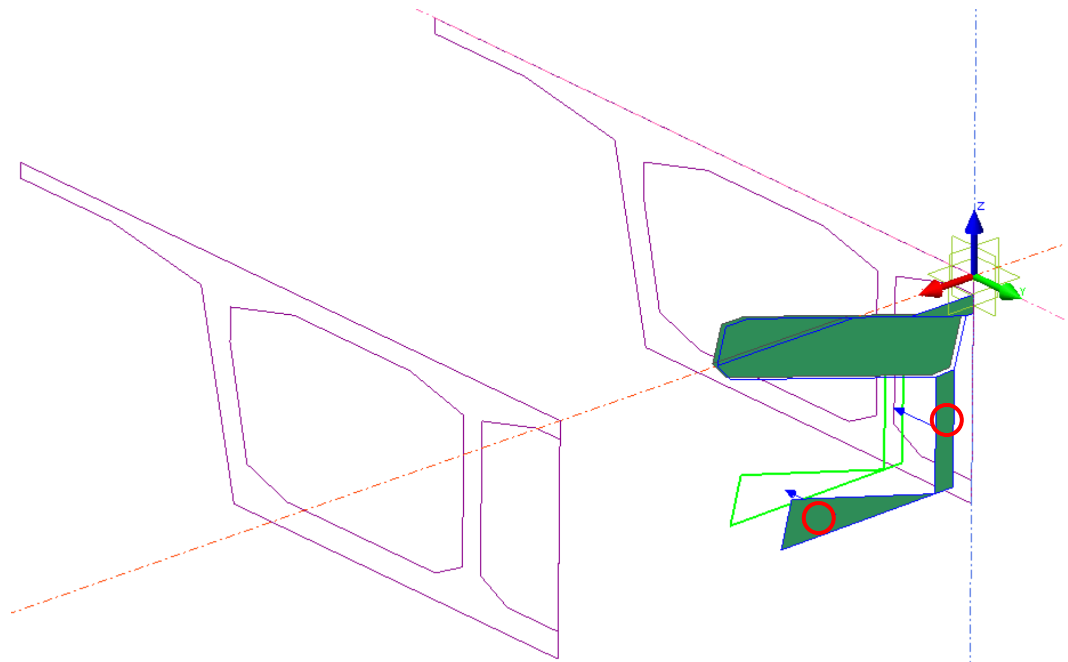
2. Select [2 Object Shapes] (Face) marked by [O] (See Figure)

3. Click [Select Direction] Button and Select [Y-Axis]

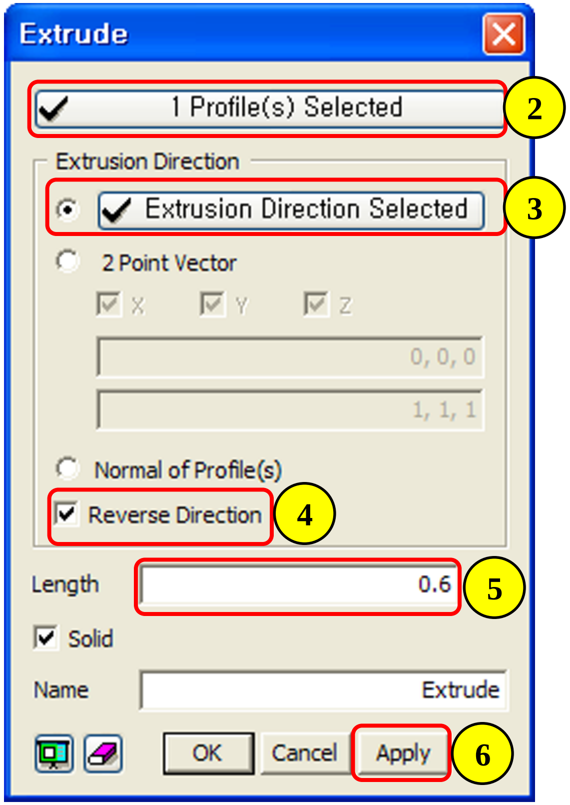
4. Check on [Move]

5. Distance : "-1.125"

6. Click [OK] Button



Step 21.



1. Geometry > Generate Feature > Extrude…

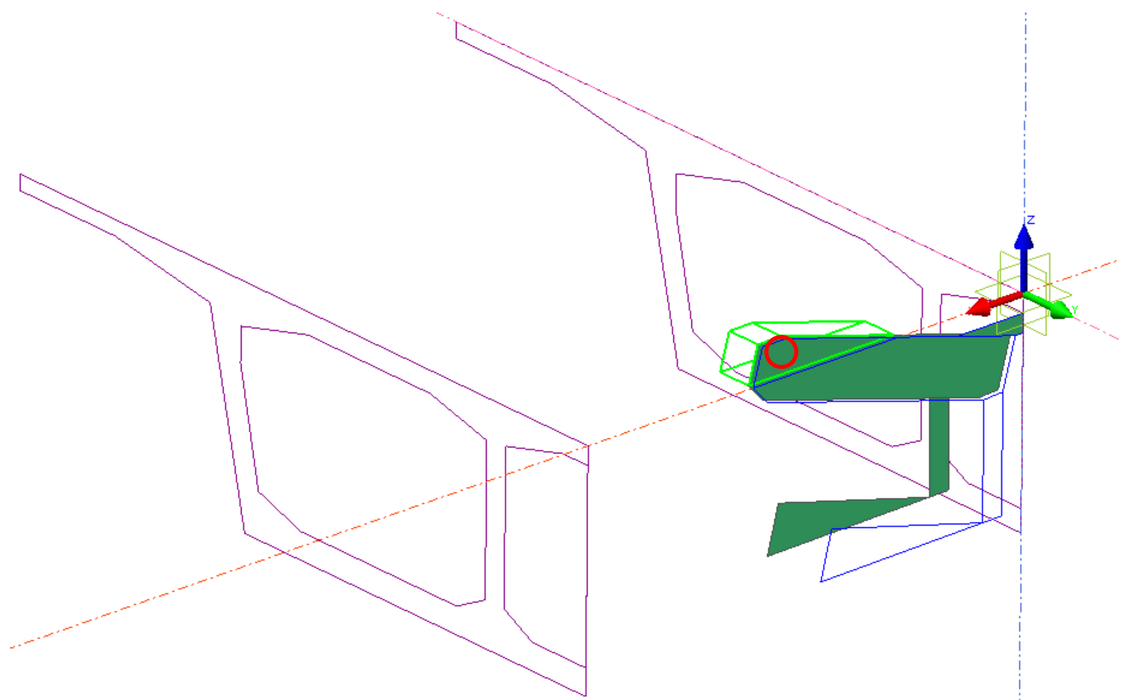
2. Select [1 Profile (Face)] marked by [O] (See Figure)

3. Click [Select Direction] Button and Select [Y-Axis]

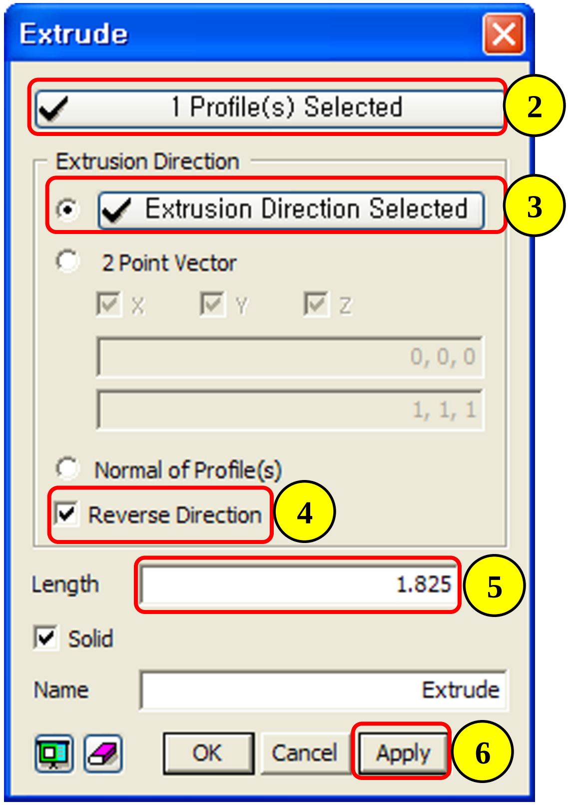
4. Check on [Reverse Direction]

5. Length : "0.6"

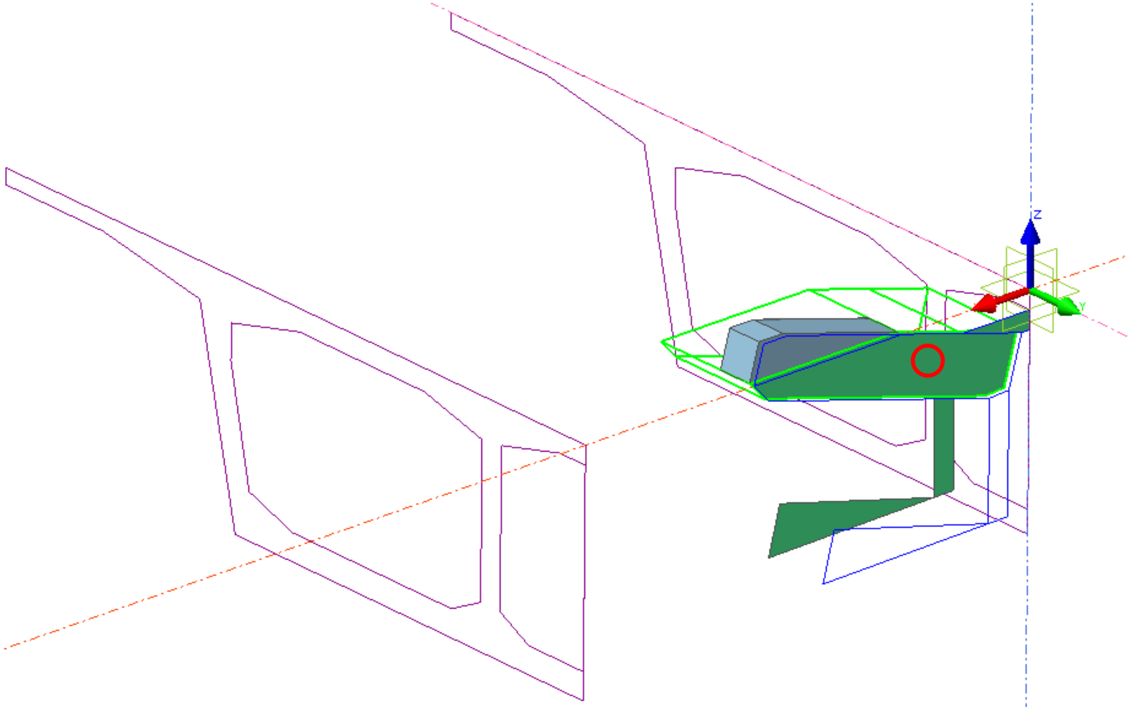
6. Click [Apply] Button



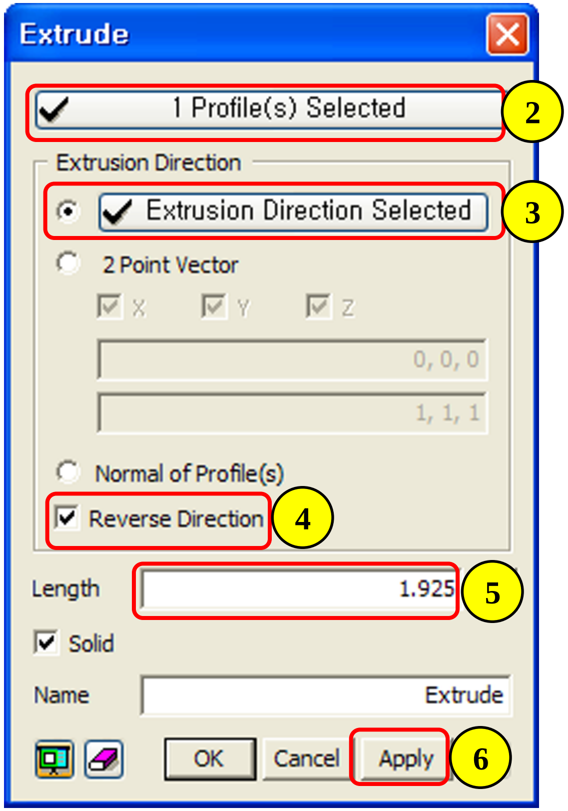
Step 22.



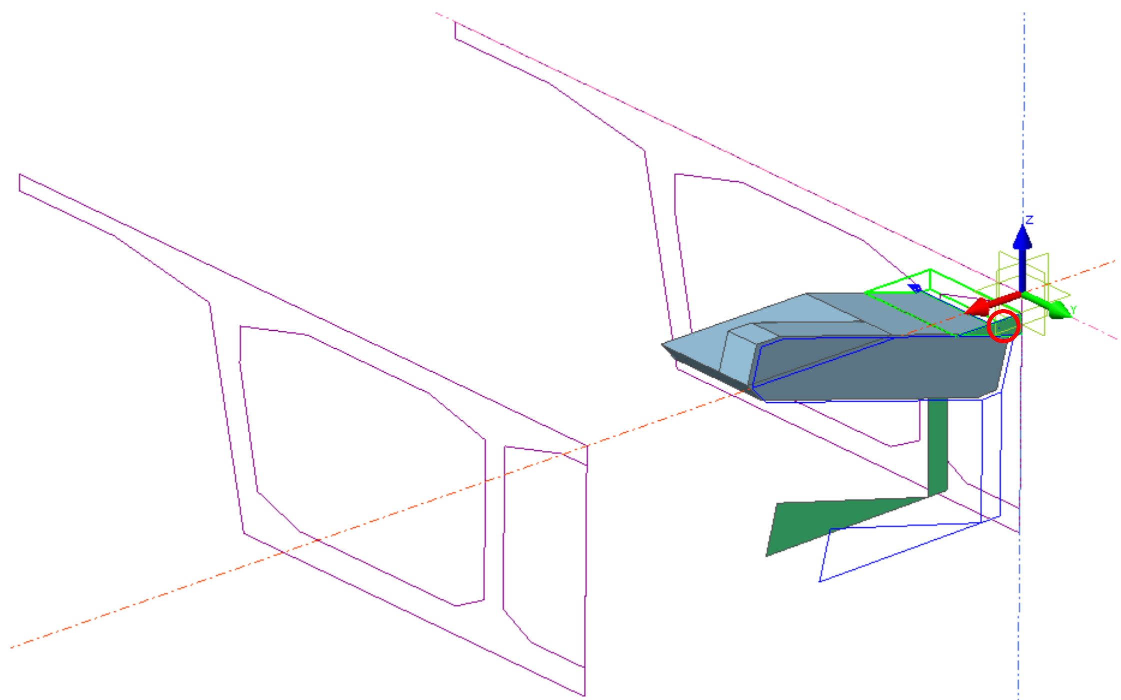
1. Geometry > Generate Feature > Extrude…
2. Select [1 Profile (Face)] marked by [O] (See Figure)
3. Click [Select Direction] Button and Select [Y-Axis]
4. Check on [Reverse Direction]
5. Length : “1.825”
6. Click [Apply] Button



Step 23.

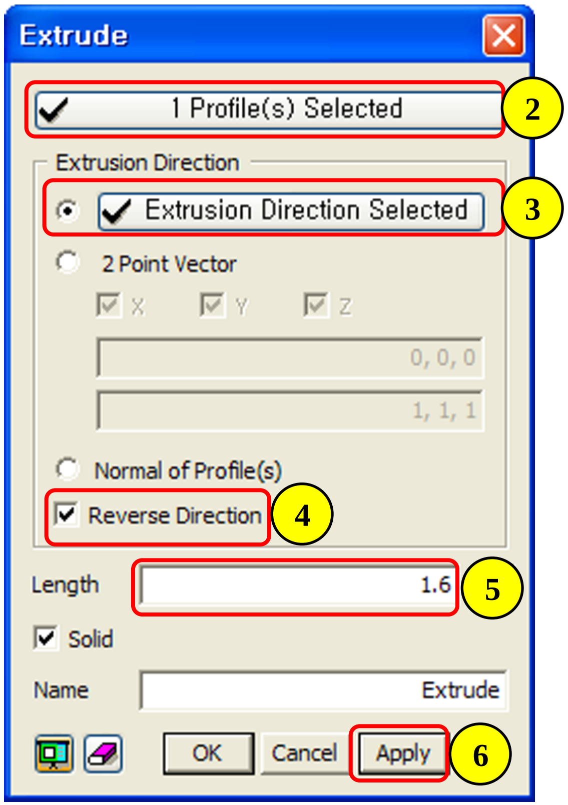


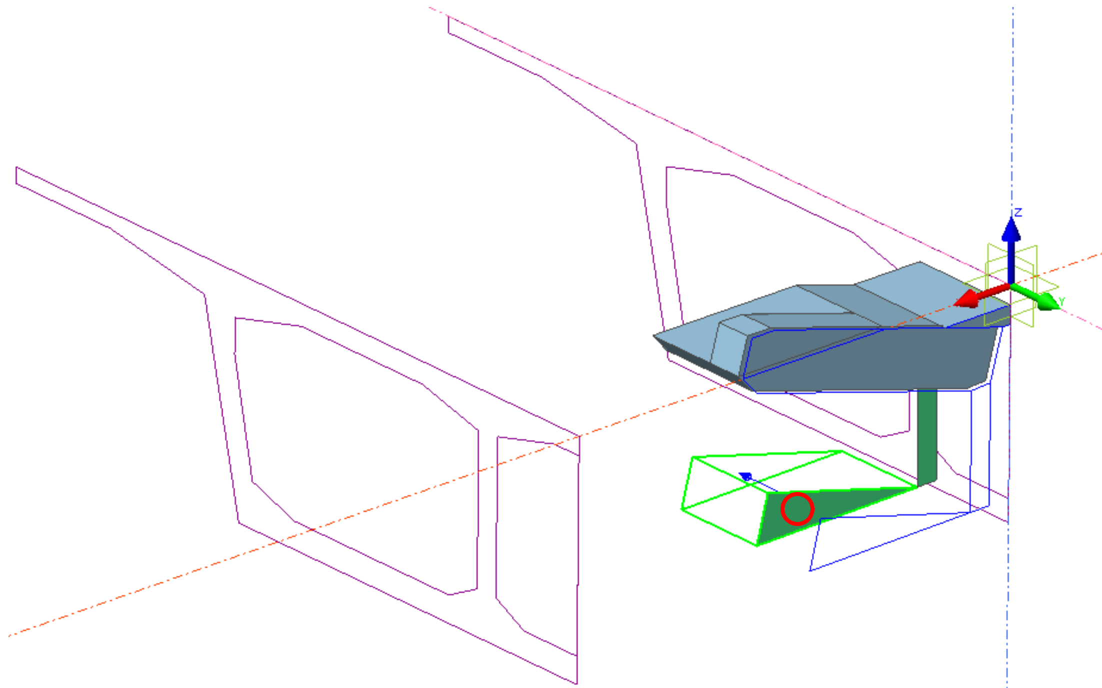
1. *Geometry > Generate Feature > Extrude…*
2. *Select [1 Profile (Face)] marked by [O] (See Figure)*
3. *Click [Select Direction] Button and Select [Y-Axis]*
4. *Check on [Reverse Direction]*
5. *Length : "1.925"*
6. *Click [Apply] Button*



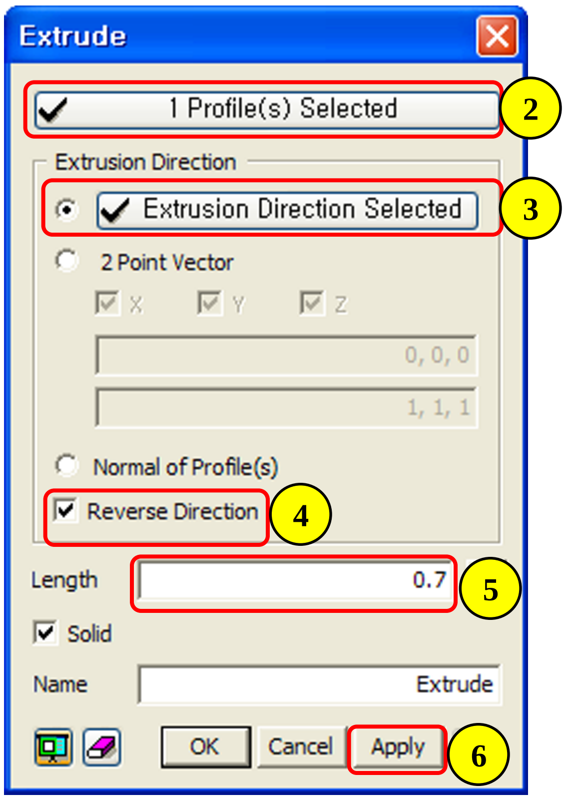
Step 24.

1. Geometry > Generate Feature > Extrude…
2. Select [1 Profile (Face)] marked by [O] (See Figure)
3. Click [Select Direction] Button and Select [Y-Axis]
4. Check on [Reverse Direction]
5. Length : "1.6"
6. Click [Apply] Button





Step 25.



1. Geometry > Generate Feature > Extrude…

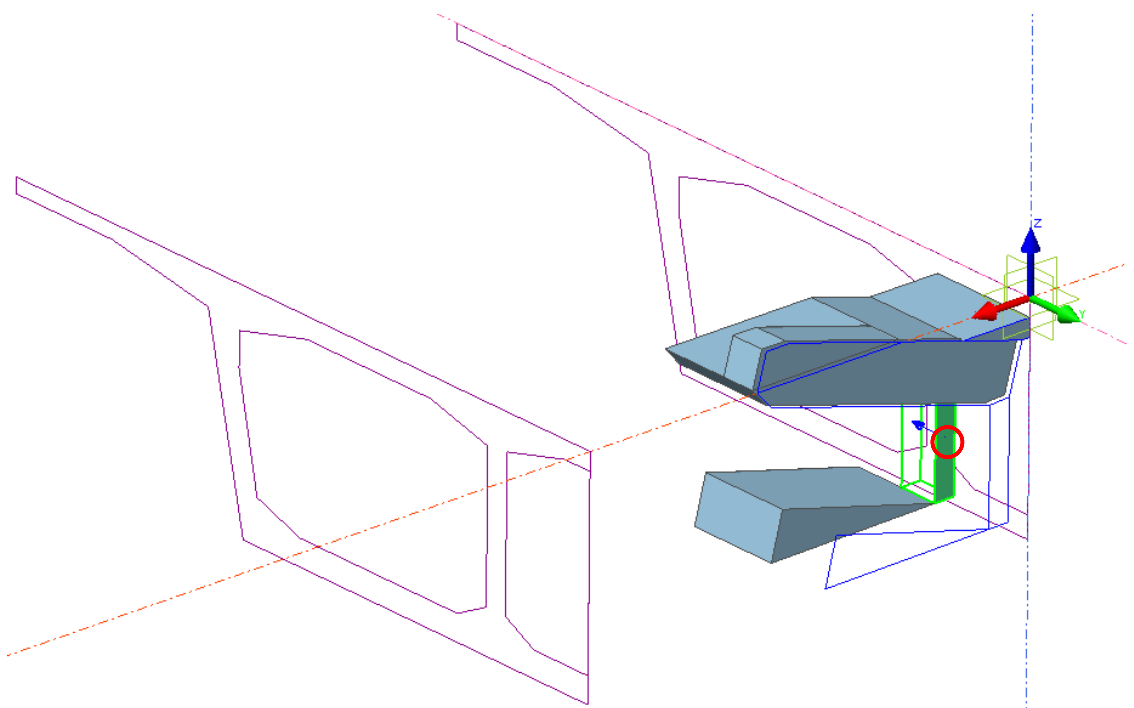
2. Select [1 Profile (Face)] marked by [O] (See Figure)

3. Click [Select Direction] Button and Select [Y-Axis]

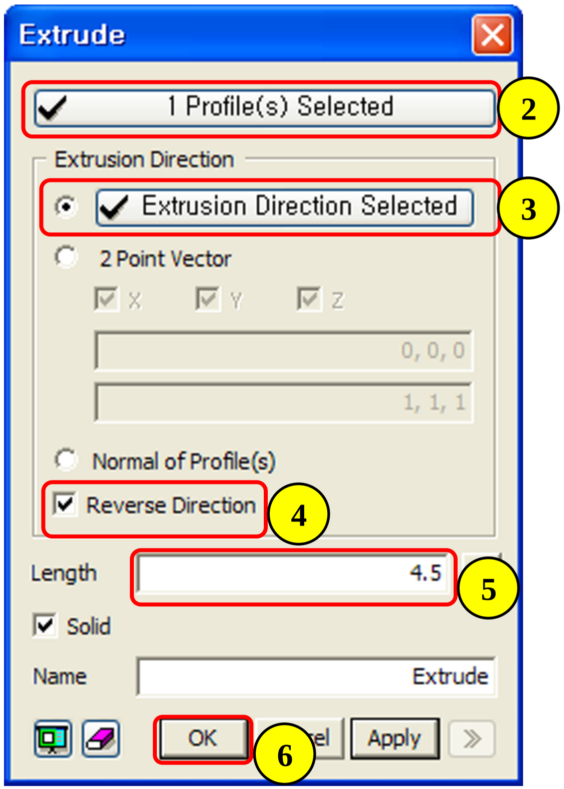
4. Check on [Reverse Direction]

5. Length : "0.7"

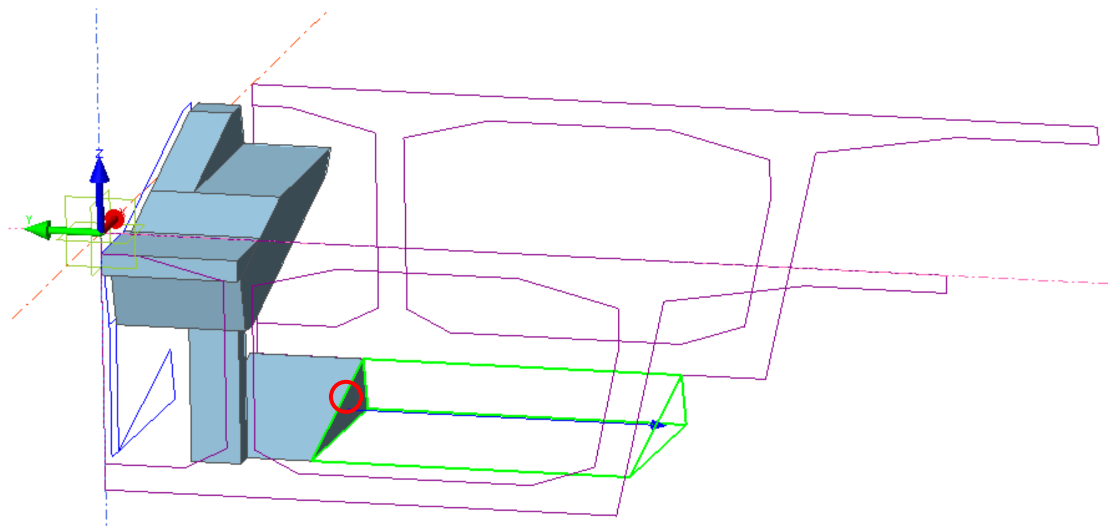
6. Click [Apply] Button



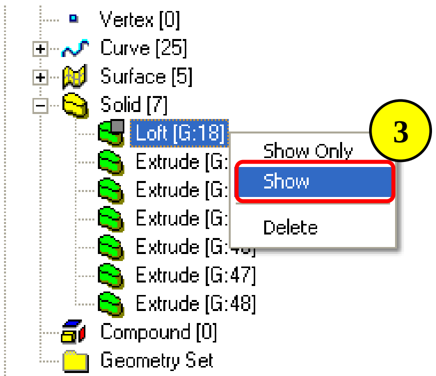
Step 26.

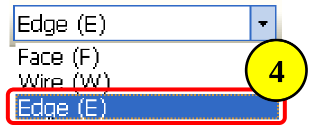


1. Geometry > Generate Feature > Extrude…
2. Select [1 Profile (Face)] marked by [O] (See Figure)
3. Click [Select Direction] Button and Select [Y-Axis]
4. Check on [Reverse Direction]
5. Length : "4.5"
6. Click [OK] Button

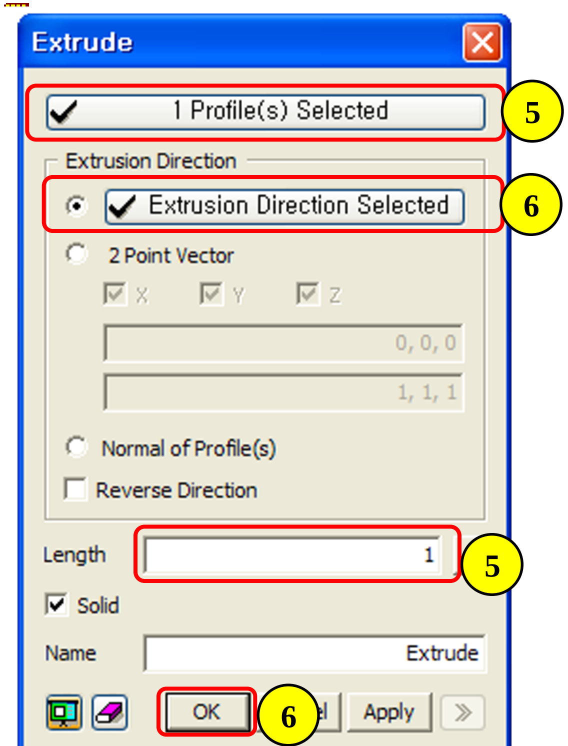


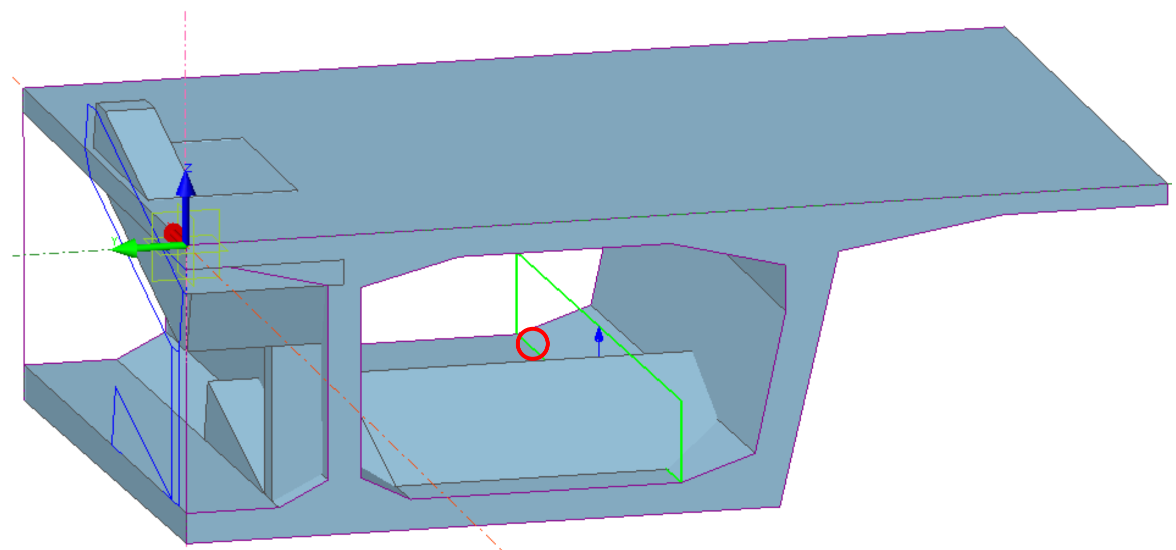
Step 27.



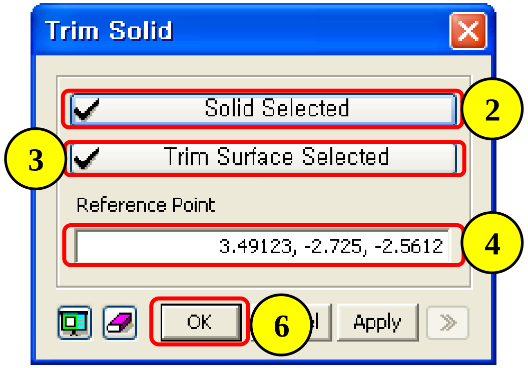


1. *Geometry > Generate Feature > Extrude…*
2. *Select Solid [Loft] on Tree Menu*
3. *Click Right Mouse Button and Select [Show]*
4. *Select [Edge] in Selection Filter*
5. *Select [1 Profile (Edge)] marked by [O] (See Figure)*
6. *Click [Select Direction] Button and Select [Z-Axis]*
7. *Length : "1"*
8. *Click [OK] Button*





Step 28.



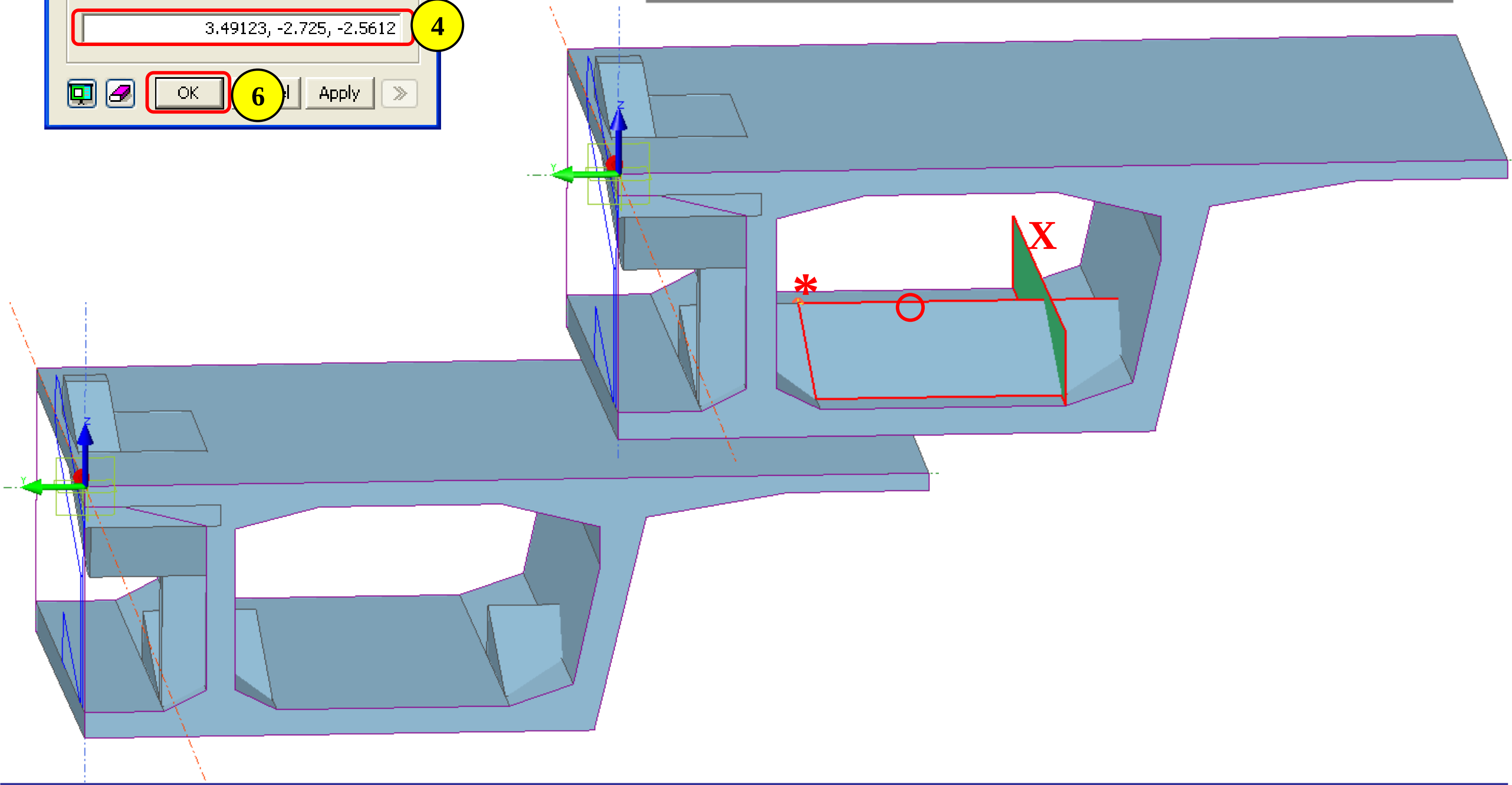
1. Geometry > Solid > Trim…

2. Select [1 Solid] marked by [O] (See Figure)

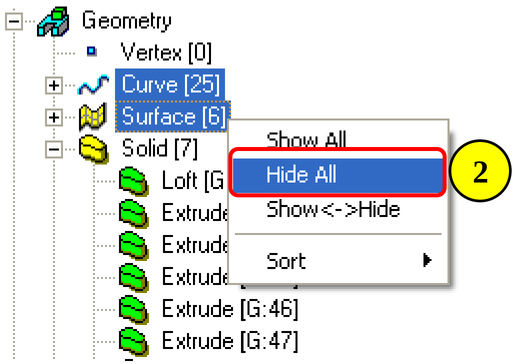
3. Select [1 Surface (Face)] marked by [X] (See Figure)

*4. Select 1 Point marked by [*] (See Figure)*

5. Click [OK] Button



Step 29.



1. Select [Curve] and [Surface] on Tree Menu

2. Click Right Mouse Button and Select [Hide All]

3. Geometry > Boolean Operation > Fuse…

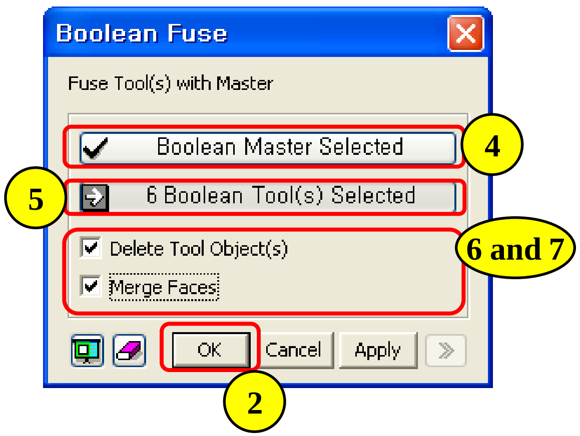
4. Select [1 Boolean Master Solid] marked by [O] (See Figure)

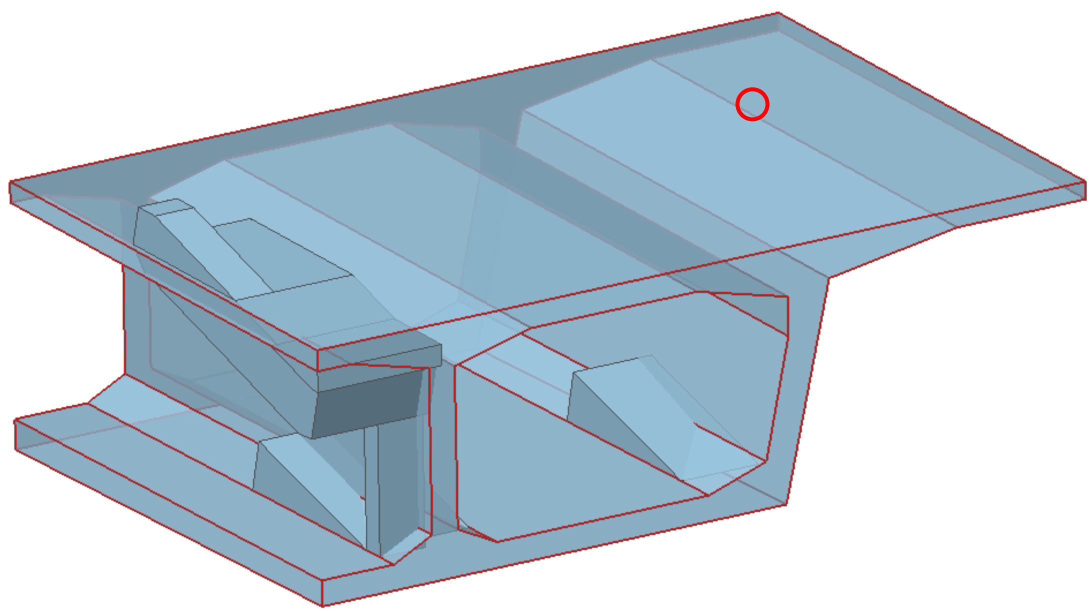
5. Select[ ] Displayed All

6. Check on [Delete Tool Object(s)]

7. Check on [Merge Faces]

8. Click [OK] Button





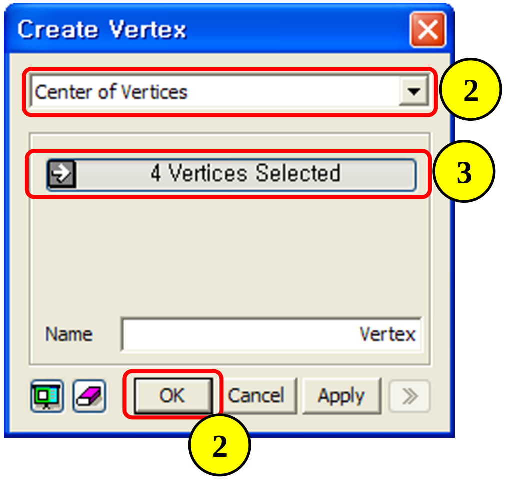
Step 30.

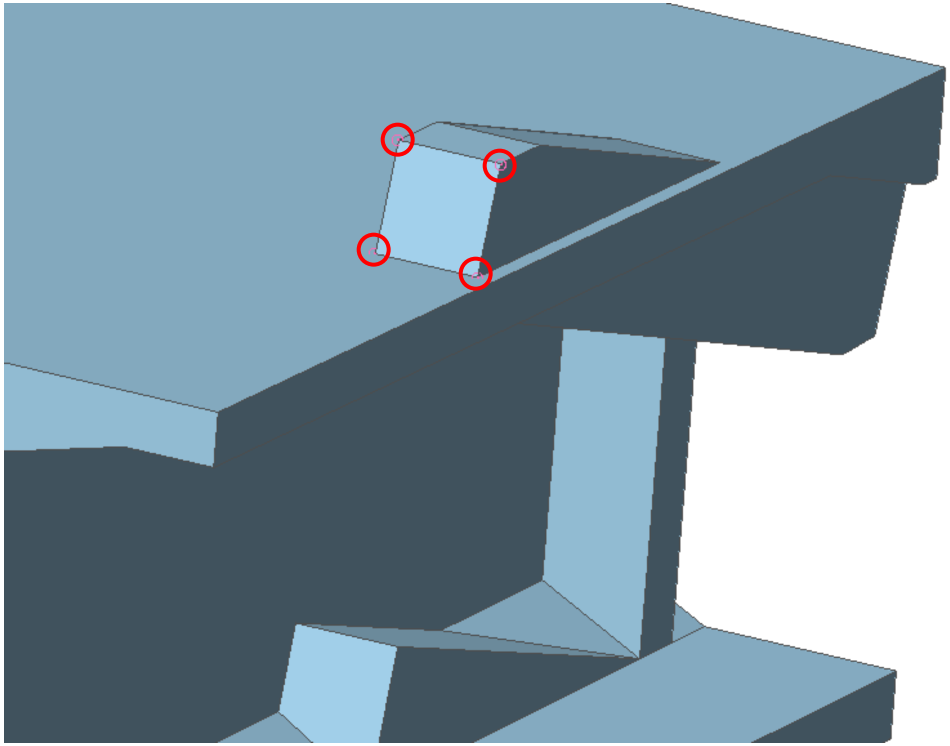
1. Geometry > Vertex > Create…

2. Select [Center of Vertices]

3. Select [4 Vertices] marked by [O] (See Figure)

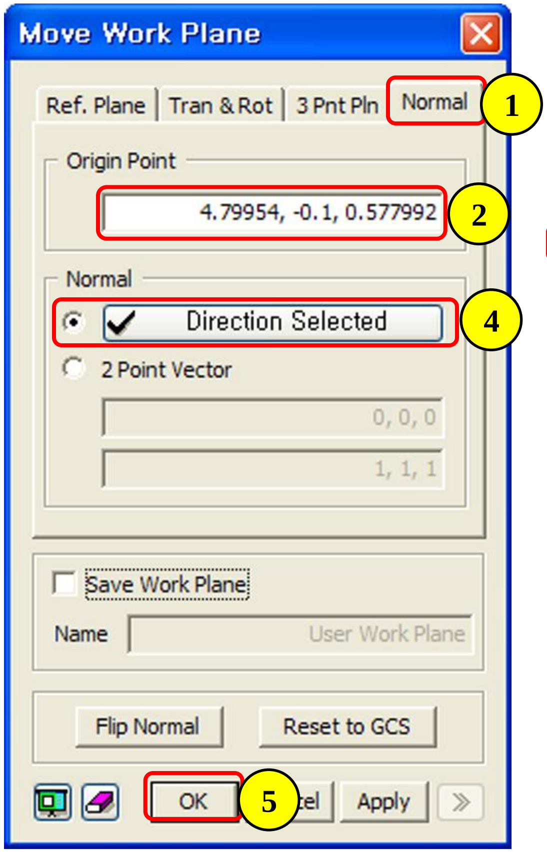
4. Click [OK] Button

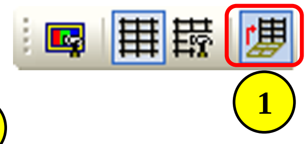


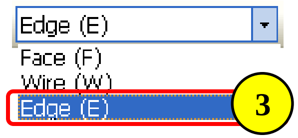


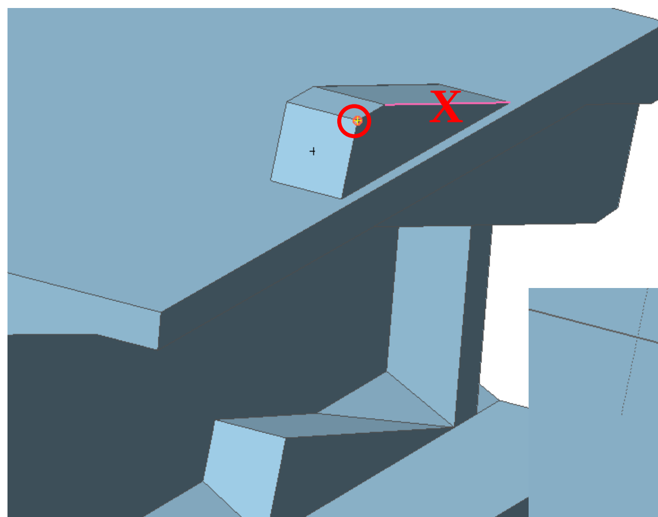
Step 31.

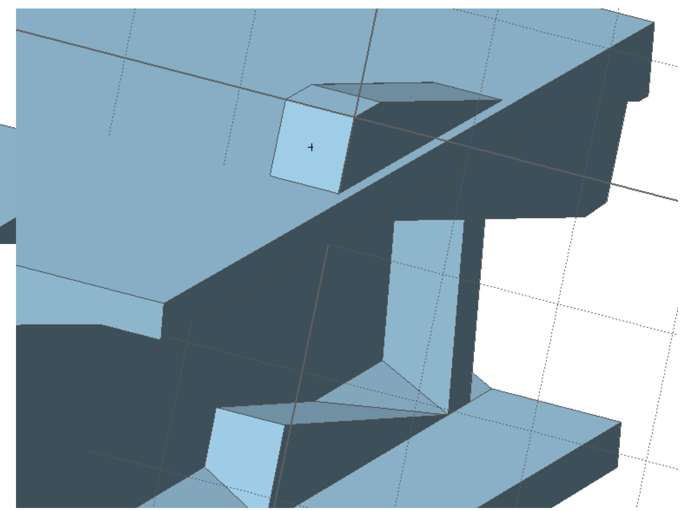
1. *Geometry > Work Plane > Move – Normal*
2. *Select [Origin Point] marked by [O] (See Figure)*
3. *Select [Edge] in Selection Filter*
4. *Select Edge marked by [X] (See Figure)*
5. *Click [OK] Button*
6. *Toggle on [Grid]*

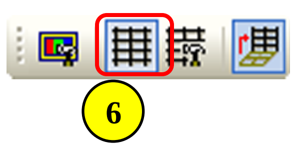




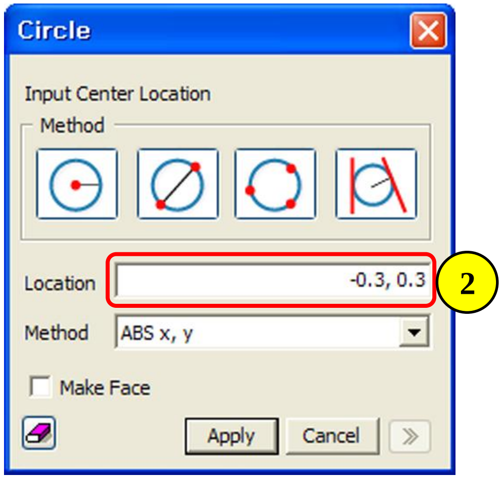


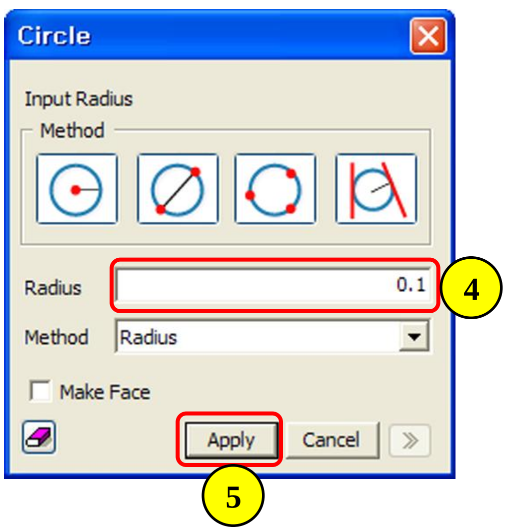




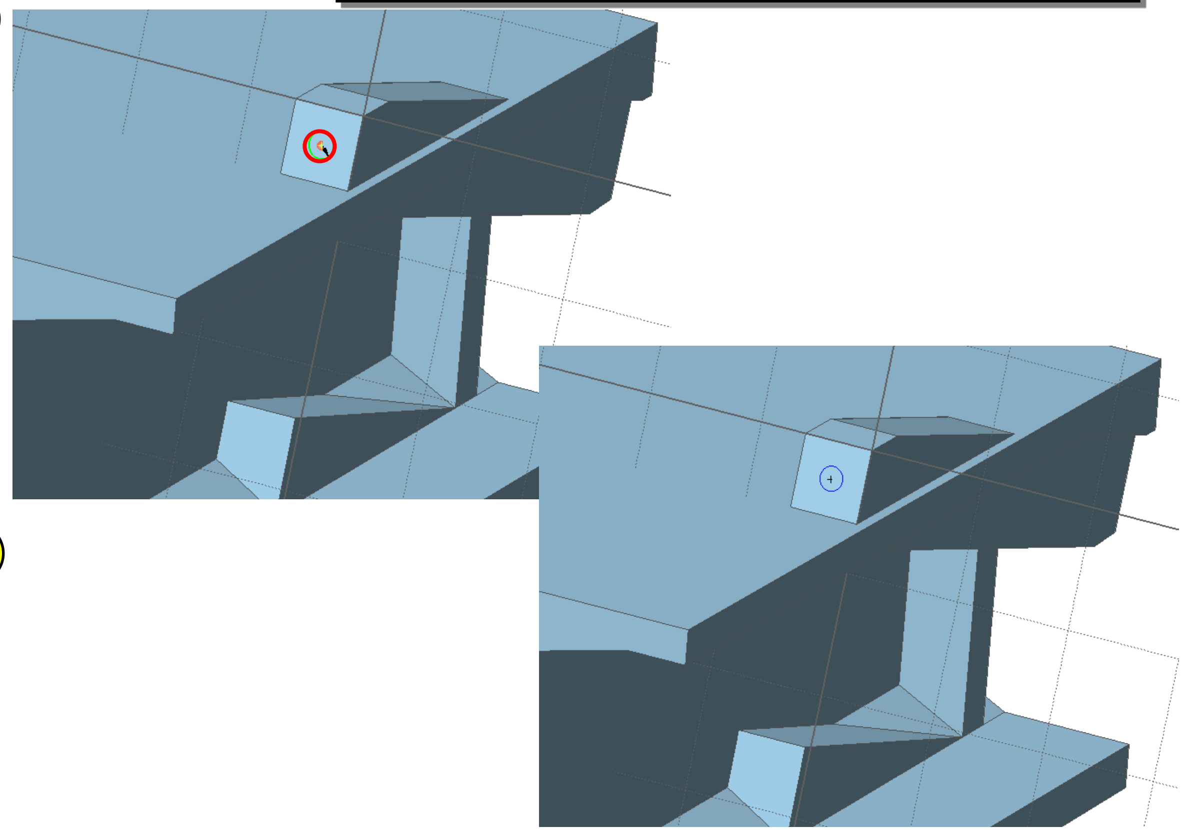


Step 32.



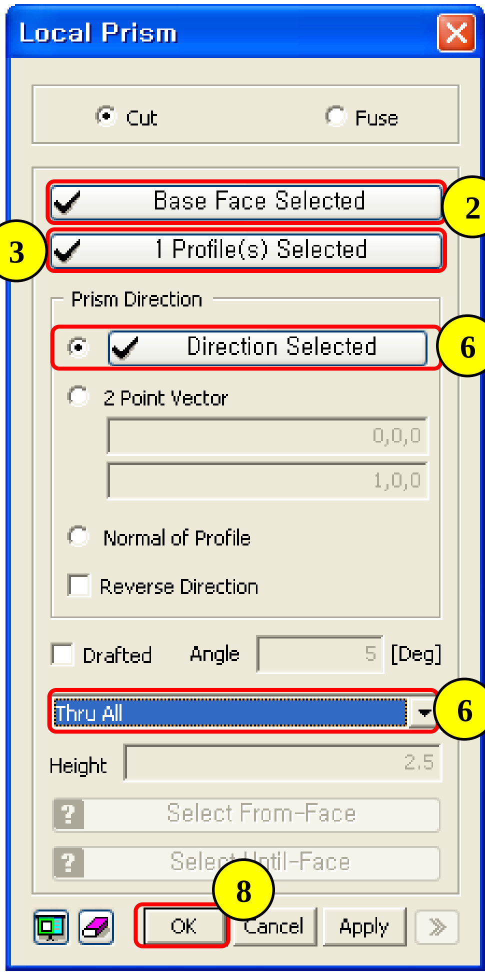


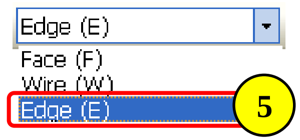
1. *Geometry > Curve > Create on WP > Circle…*
2. *Click [Input Center Location]*
3. *Select Vertex marked by [O] (See Figure)*
4. *Input Radius "0.1"*
5. *Click [Apply] Button*
6. *Click [Cancel] Button*

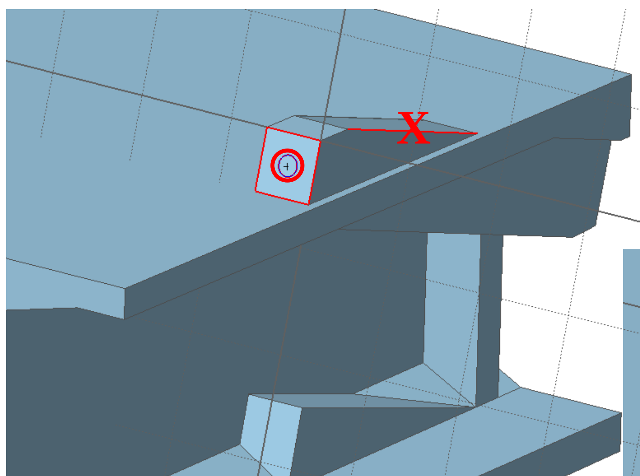


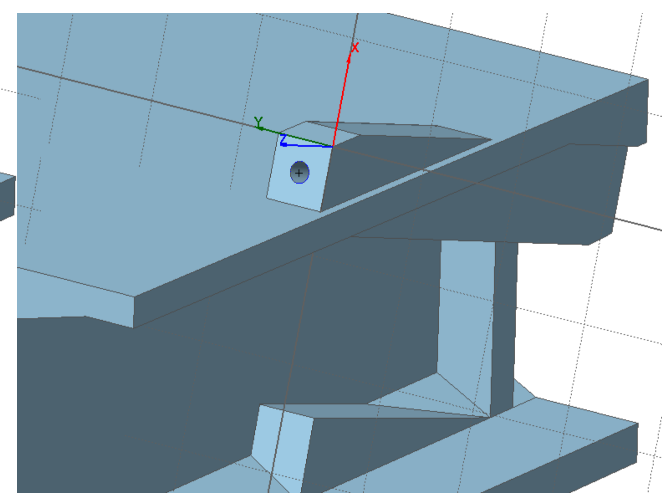
Step 33.

1. *Geometry > Modifier Feature > Local Prism…*
2. *Select [1 Base Face] (See Figure)*
3. *Select [1 Profile] marked by [O] (See Figure)*
4. *Click [Select Direction] Button*
5. *Select [Edge] in Selection Filter*
6. *Select [Edge] marked by [X] (See Figure)*
7. *Select [Thru All]*
8. *Click [OK] Button*



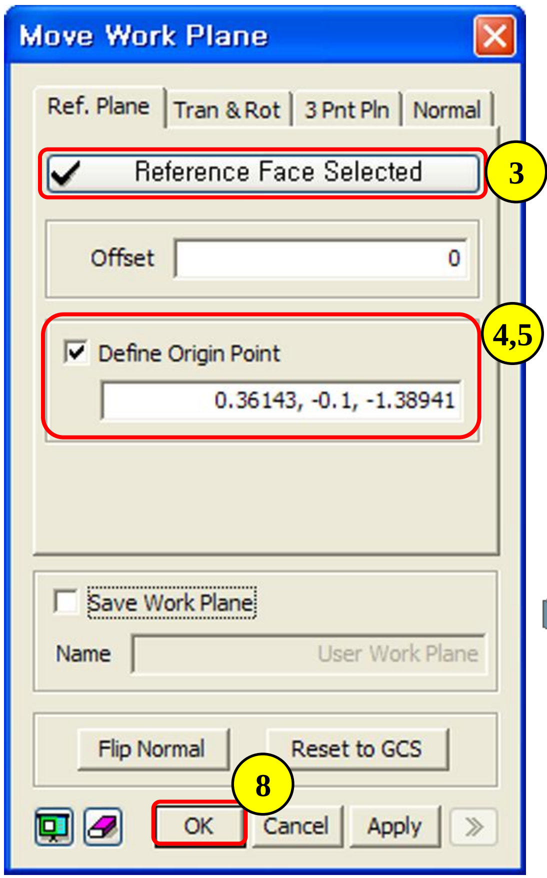


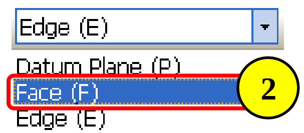


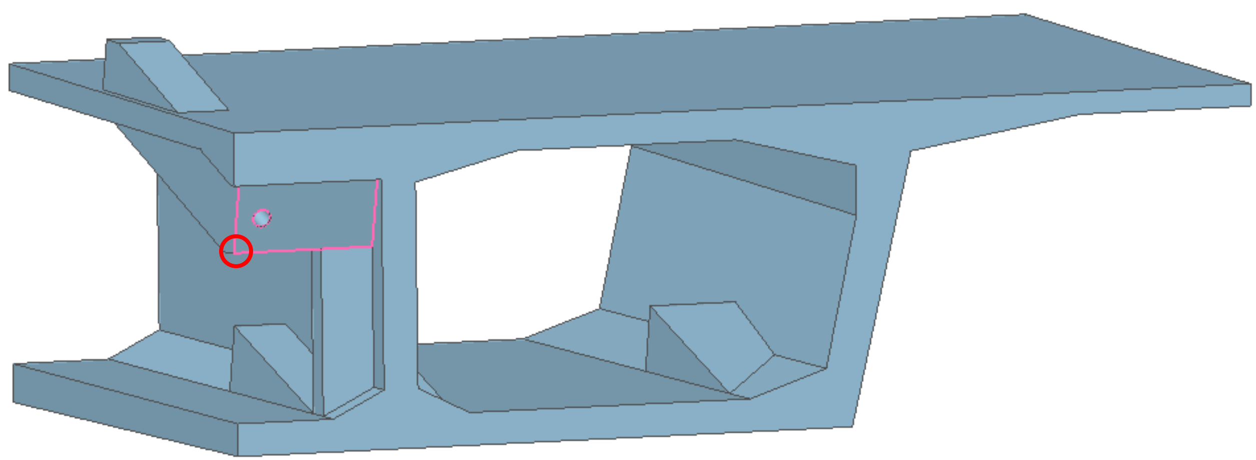


Step 34.

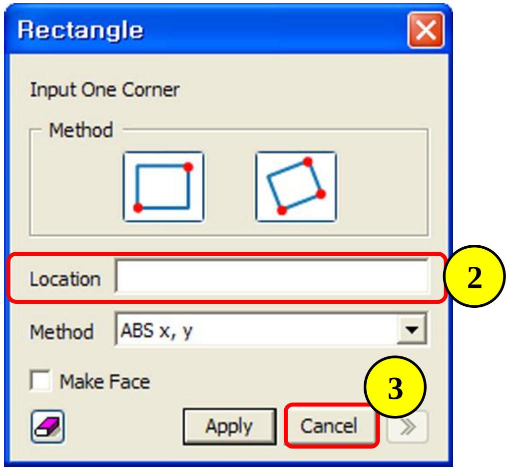
1. *Geometry > Work Plane > Move – Ref. Plane*
2. *Select [Face] in Selection Filter*
3. *Select Reference Face (See Figure)*
4. *Click on Define Origin Point*
5. *Select Vertex marked by [O] (See Figure)*
6. *Click [OK] Button*
7. *Toggle on [Grid]*







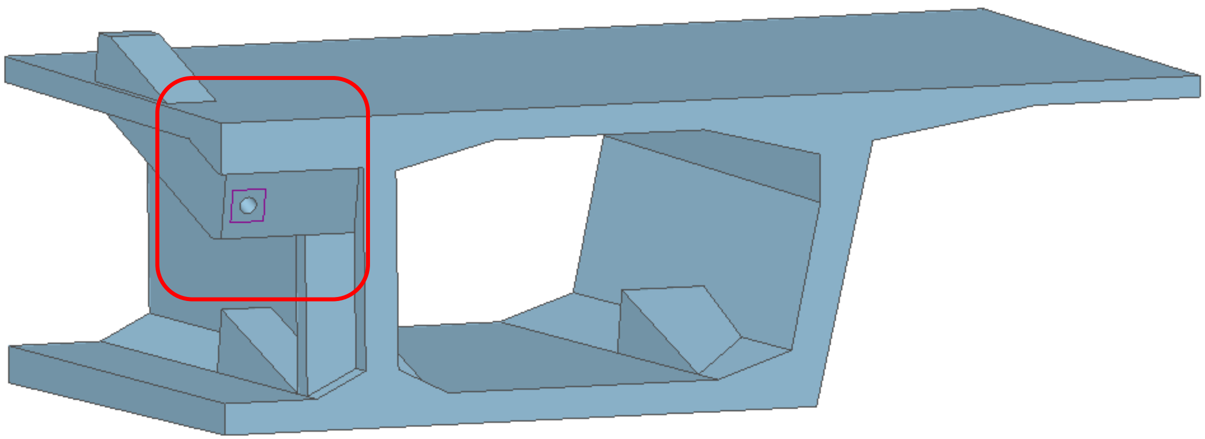
Step 35.



1. Geometry > Curve > Create on WP > Rectangle (Wire)…

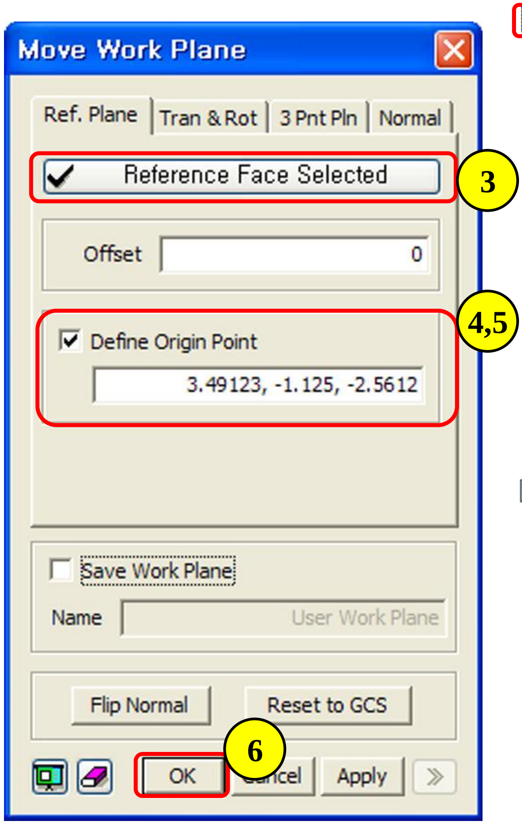
2. Location : (0.2, -0.1) , <0.4, -0.4>

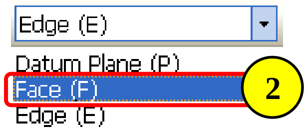
3. Click [Cancel] Button



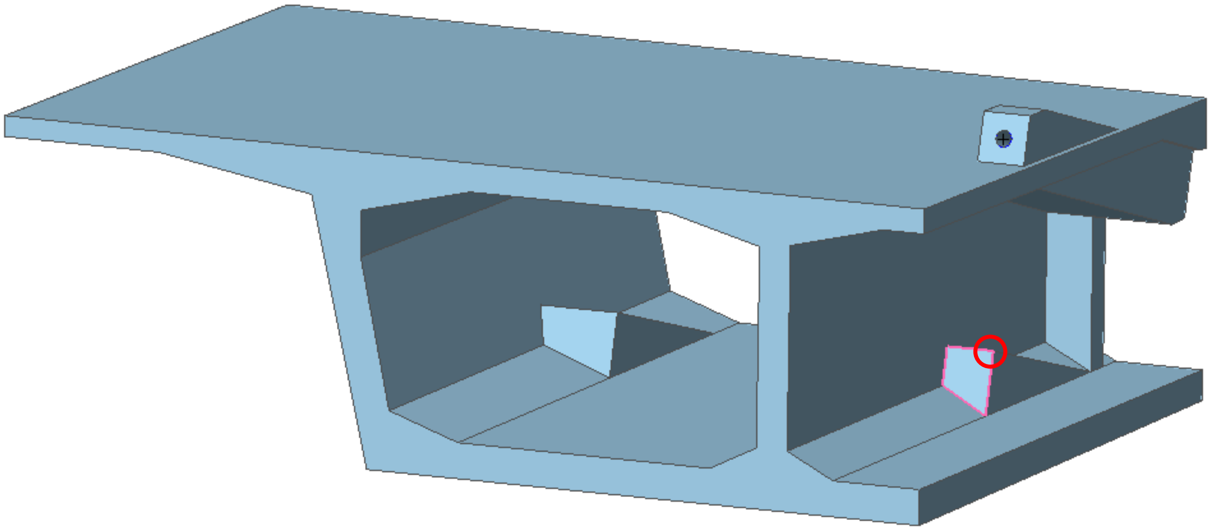
(): "ABS x, y", <>: "REL dx, dy"

Step 36.

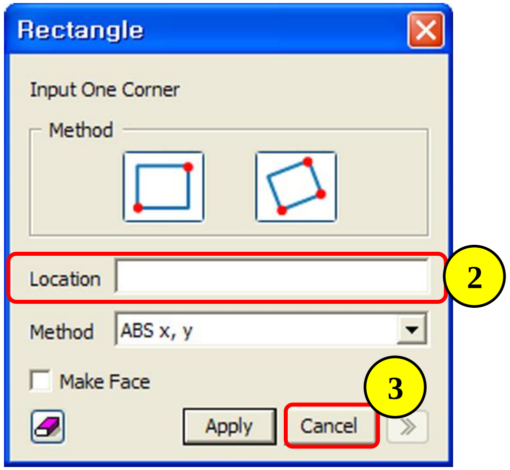




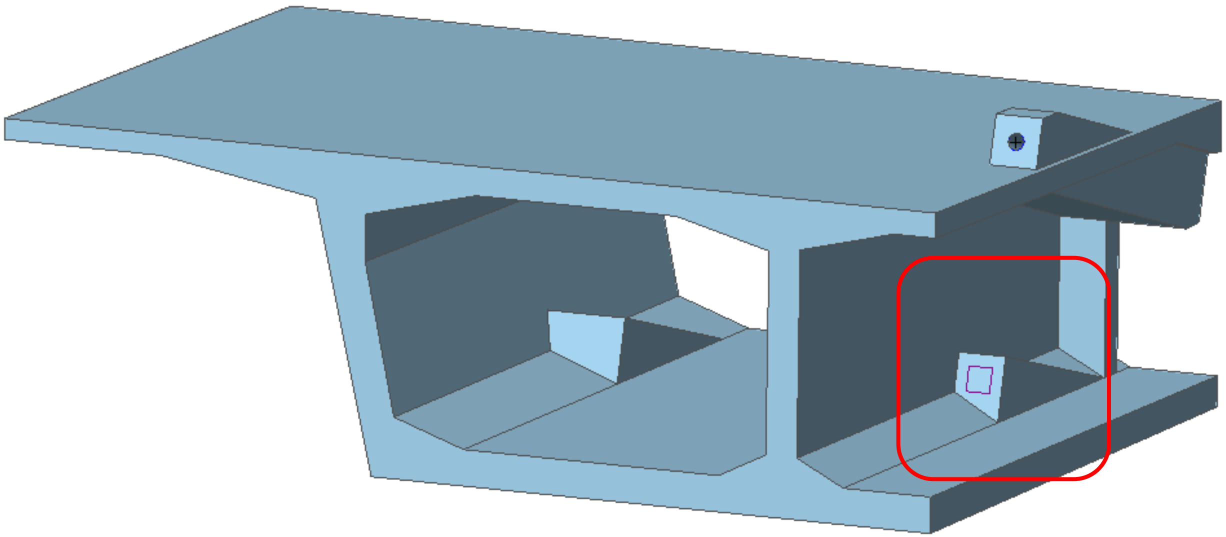
1. Geometry > Work Plane > Move – Ref. Plane
2. Select [Face] in Selection Filter
3. Select Reference Face (See Figure)
4. Click on Define Origin Point
5. Select Vertex marked by [O] (See Figure)
6. Click [OK] Button



Step 37.

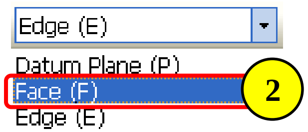


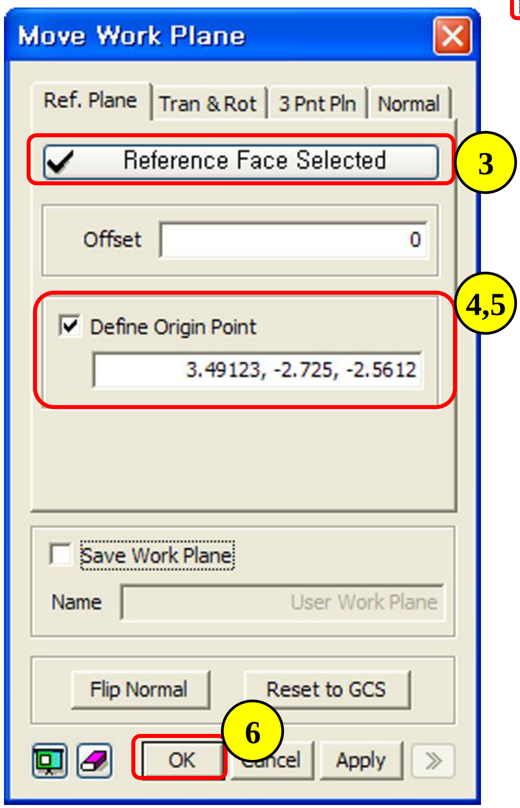
1. Geometry > Curve > Create on WP > Rectangle (Wire)…
2. Location : (0.15, -0.15) , <0.3, -0.3>
3. Click [Cancel] Button



(): "ABS x, y", <>: "REL dx, dy"

Step 38.





1. Geometry > Work Plane > Move – Ref. Plane

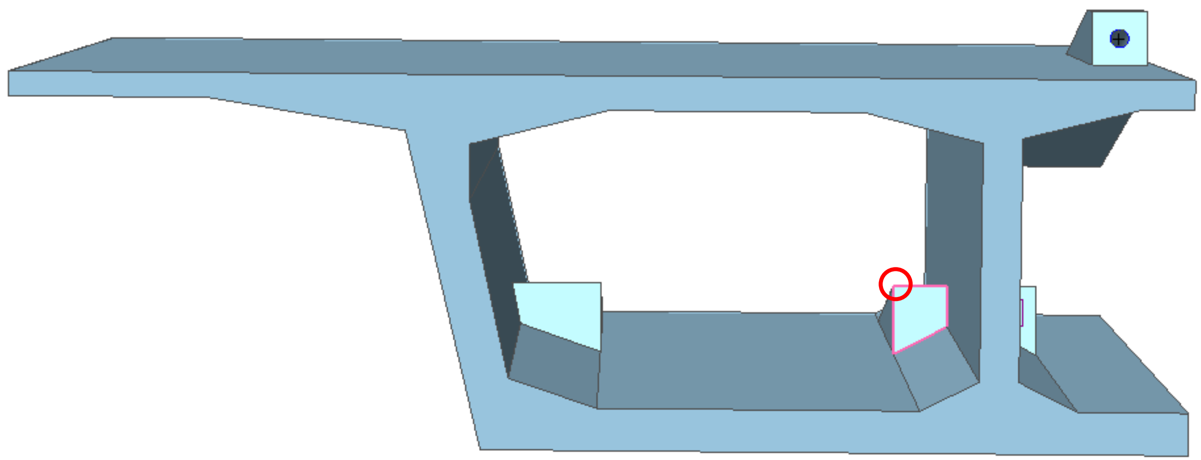
2. Select [Face] in Selection Filter

3. Select Reference Face (See Figure)

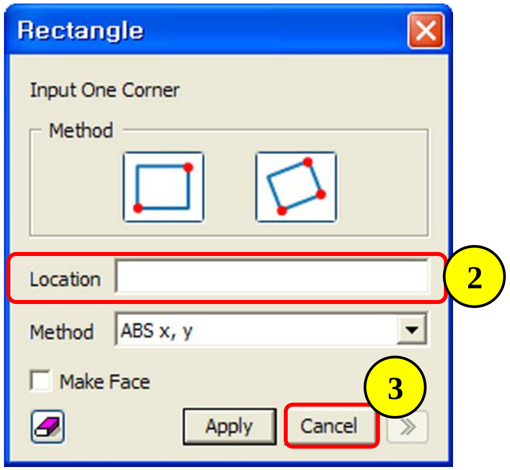
4. Click on Define Origin Point

5. Select Vertex marked by [O] (See Figure)

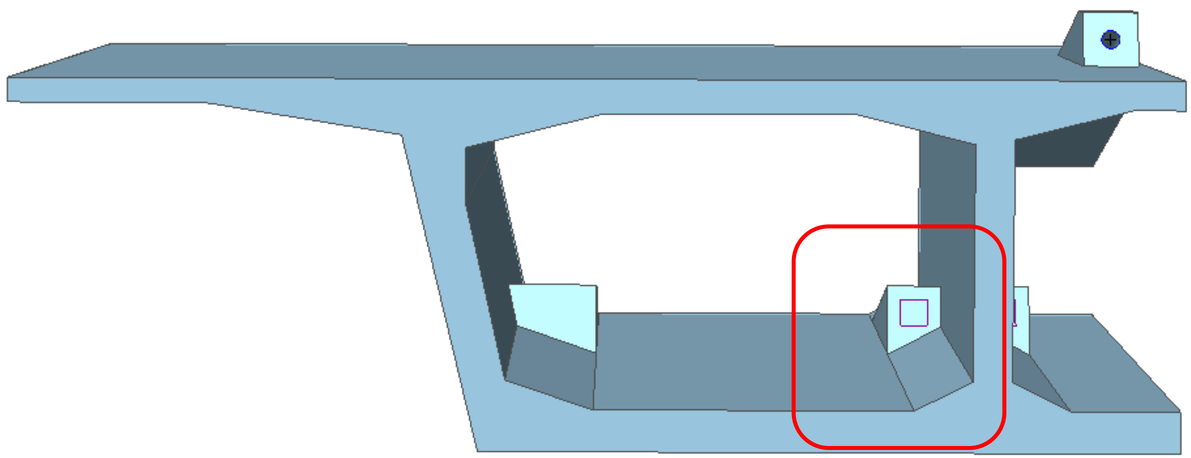
6. Click [OK] Button



Step 39.



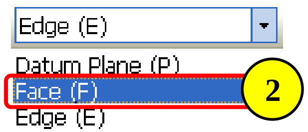
1. *Geometry > Curve > Create on WP > Rectangle (Wire)…*
2. *Location : (0.15, 0.15) , <0.3, 0.3>*
3. *Click [Cancel] Button*

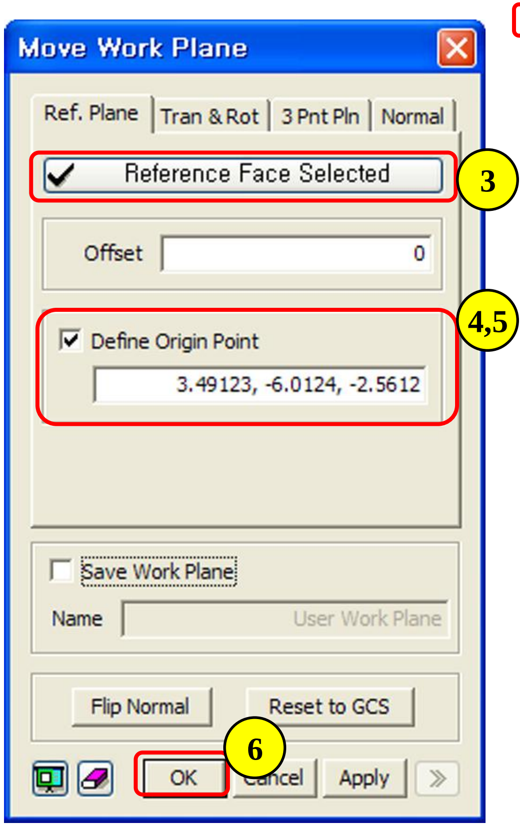


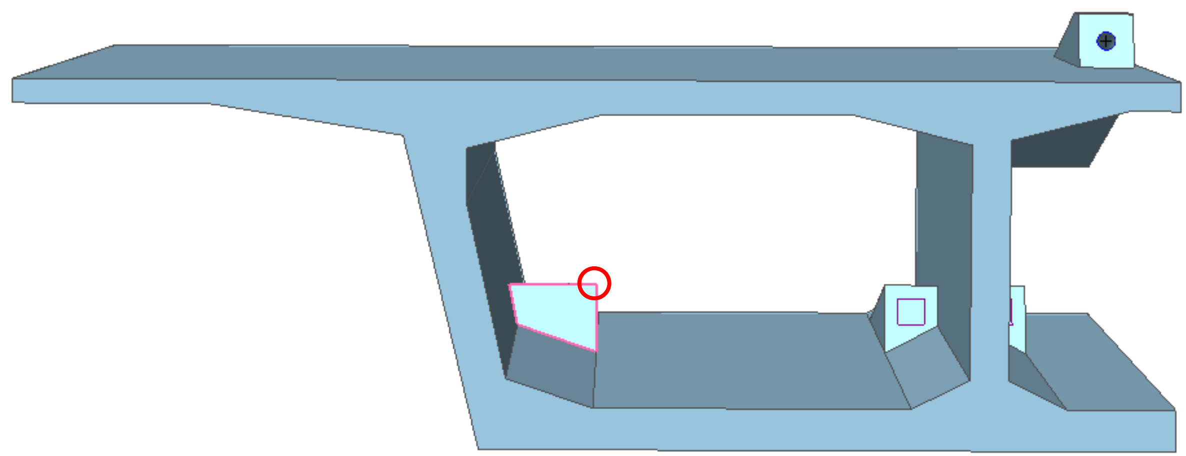
(): "ABS x, y", <>: "REL dx, dy"

Step 40.

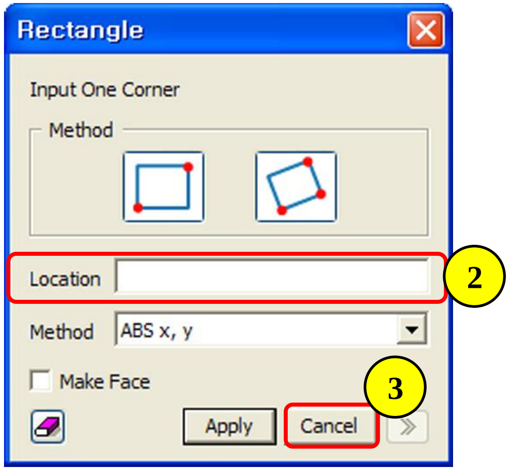
1. *Geometry > Work Plane > Move – Ref. Plane*
2. *Select [Face] in Selection Filter*
3. *Select Reference Face (See Figure)*
4. *Click on Define Origin Point*
5. *Select Vertex marked by [O] (See Figure)*
6. *Click [OK] Button*



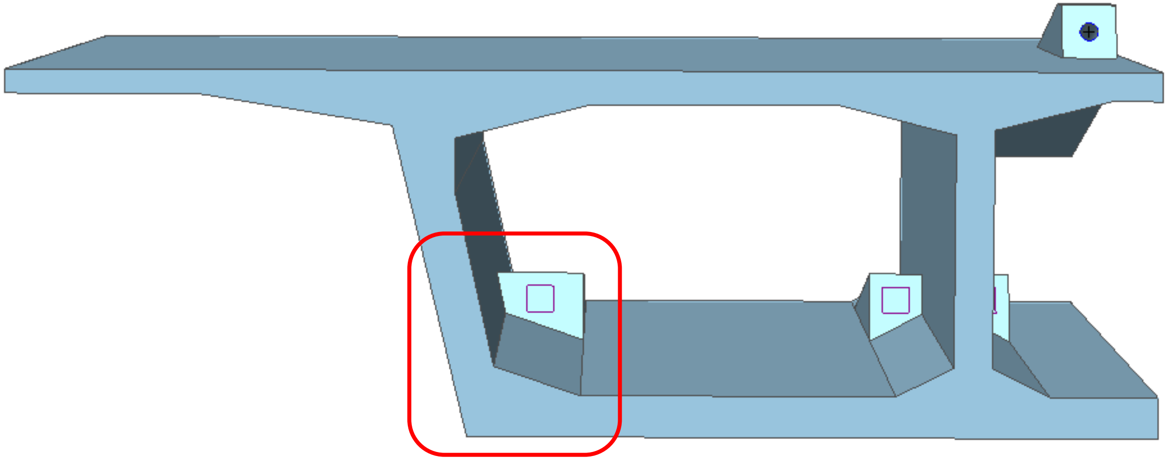




Step 41.

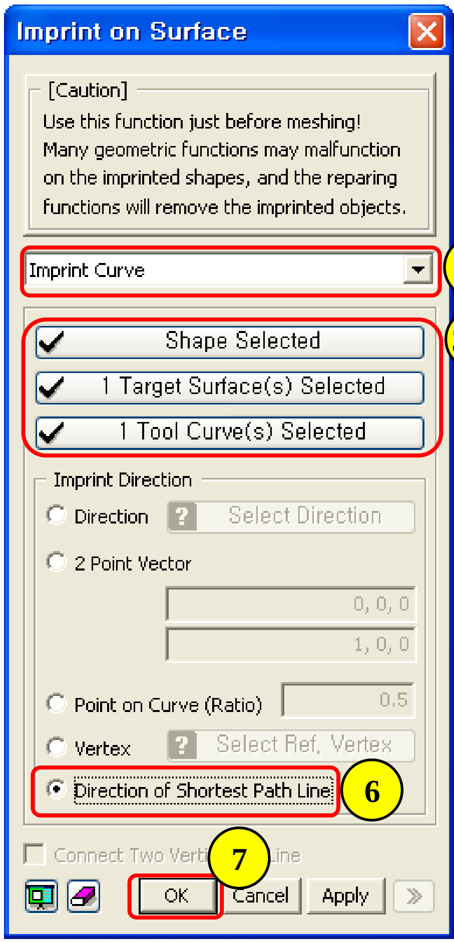


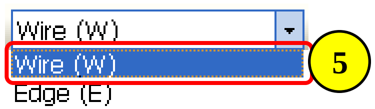
1. *Geometry > Curve > Create on WP > Rectangle (Wire)…*
2. *Location : (0.15, -0.35), <0.3, -0.3>*
3. *Click [Cancel] Button*



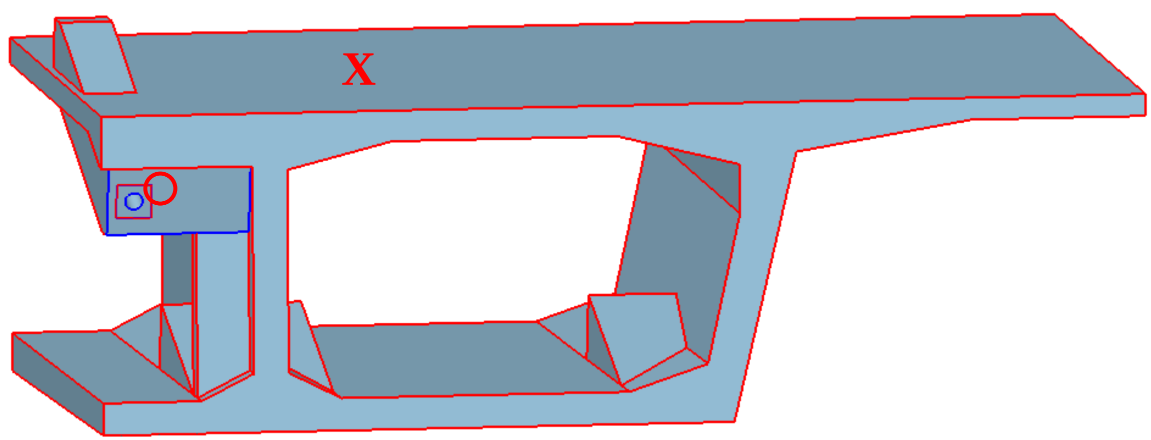
(): "ABS x, y", <>: "REL dx, dy"

Step 42.

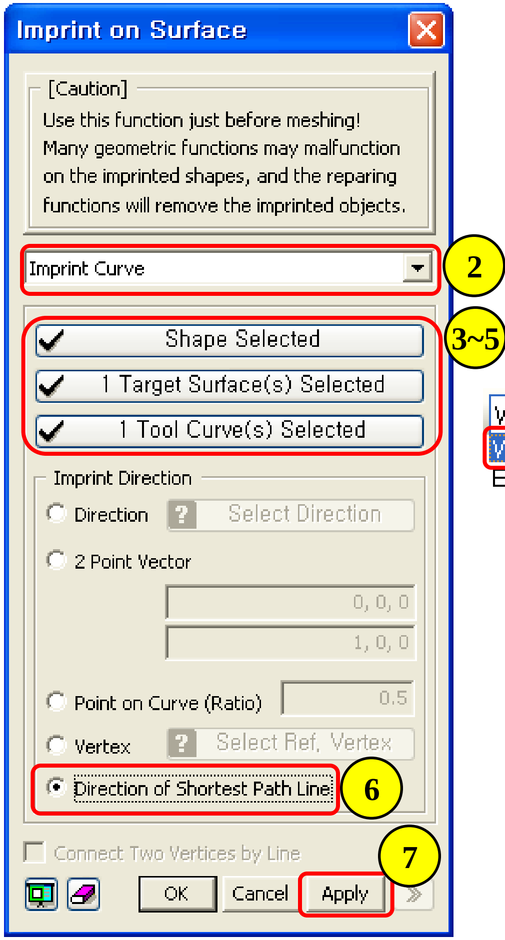


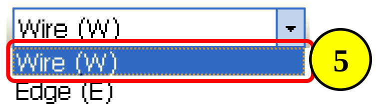


1. *Geometry > Surface > Imprint…*
2. *Select [Imprint Curve]*
3. *Select [1 Solid] marked by [X] (See Figure)*
4. *Select [1 Face] marked in Blue (See Figure)*
5. *Select [Wire] in Selection Filter and Select [1 Wire] marked by [O] (See Figure)*
6. *Check on [Direction of Shortest Path Line]*
7. *Click [OK] Button*

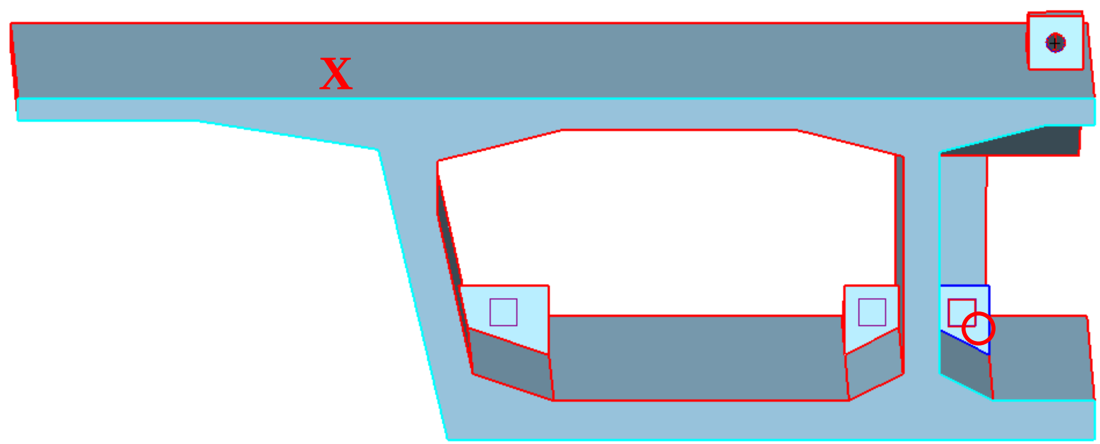


Step 43.

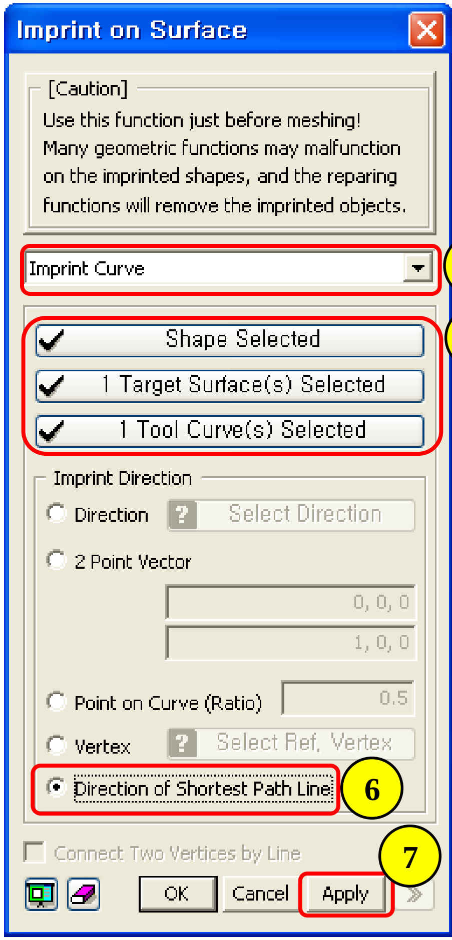


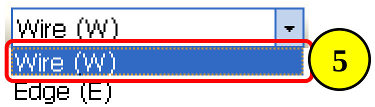


1. *Geometry > Surface > Imprint…*
2. *Select [Imprint Curve]*
3. *Select [1 Solid] marked by [X] (See Figure)*
4. *Select [1 Face] marked in Blue (See Figure)*
5. *Select [Wire] in Selection Filter and Select [1 Wire] marked by [O] (See Figure)*
6. *Check on [Direction of Shortest Path Line]*
7. *Click [Apply] Button*

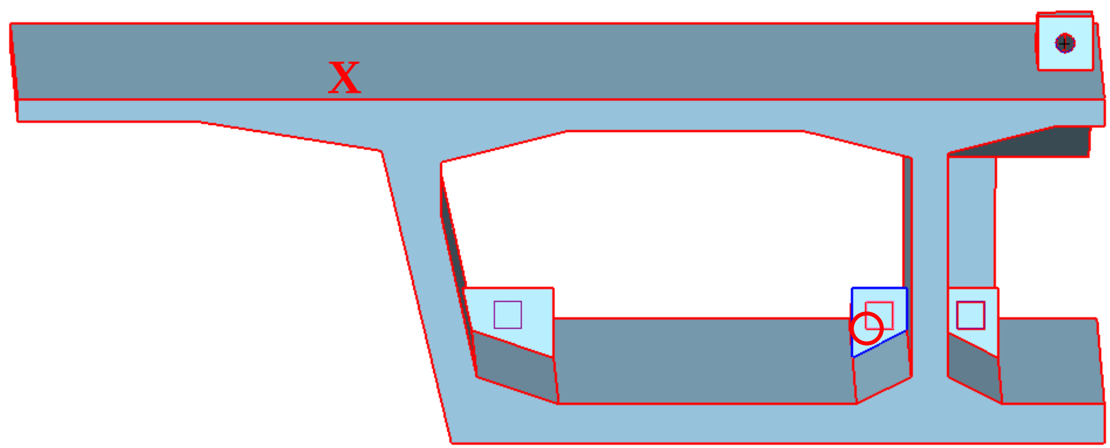


Step 44.

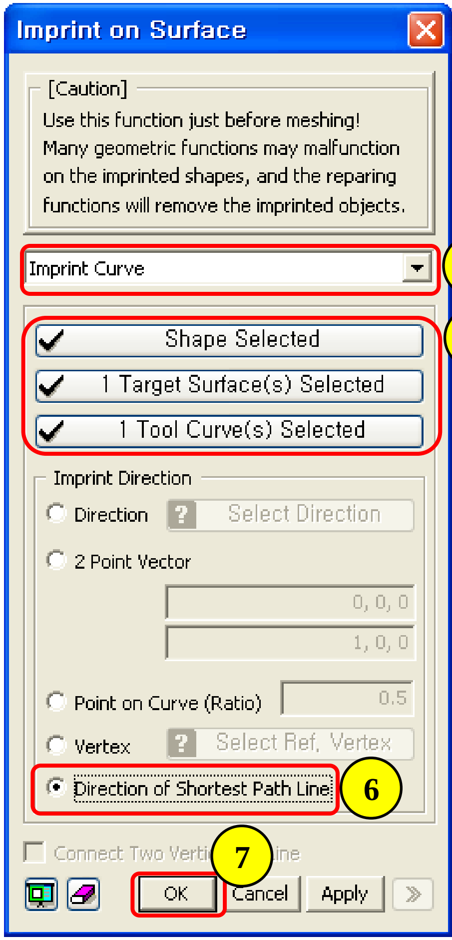


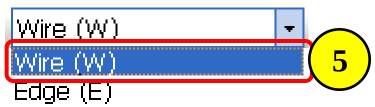


1. Geometry > Surface > Imprint…
2. Select [Imprint Curve]
3. Select [1 Solid] marked by [X] (See Figure)
4. Select [1 Face] marked in Blue (See Figure)
5. Select [Wire] in Selection Filter and Select [1 Wire] marked by [O] (See Figure)
6. Check on [Direction of Shortest Path Line]
7. Click [Apply] Button

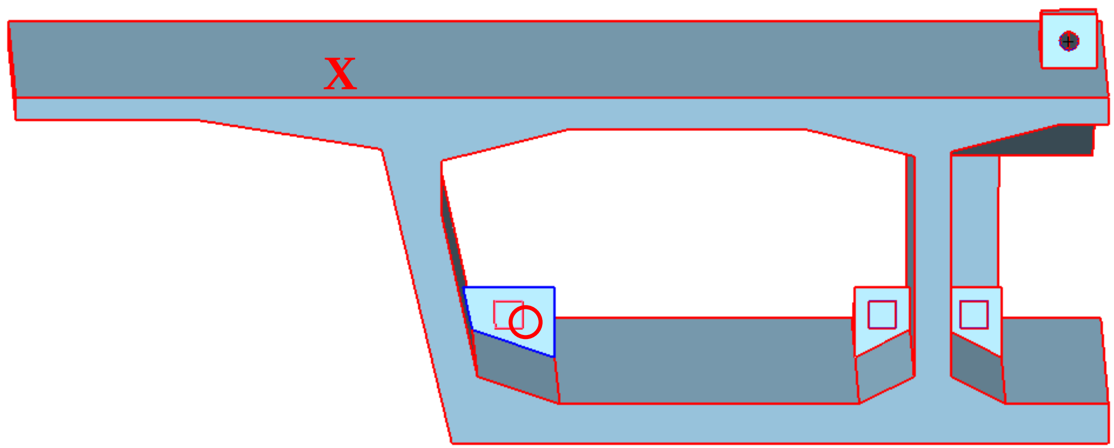


Step 45.

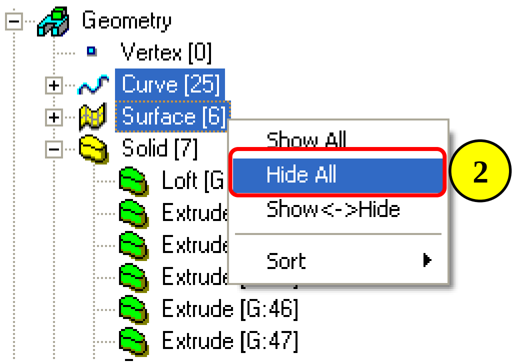




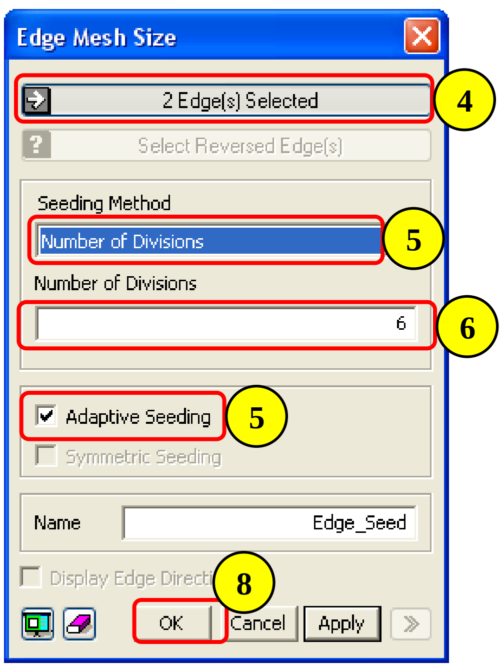
1. *Geometry > Surface > Imprint…*
2. *Select [Imprint Curve]*
3. *Select [1 Solid] marked by [X] (See Figure)*
4. *Select [1 Face] marked in Blue (See Figure)*
5. *Select [Wire] in Selection Filter and Select [1 Wire] marked by [O] (See Figure)*
6. *Check on [Direction of Shortest Path Line]*
7. *Click [OK] Button*

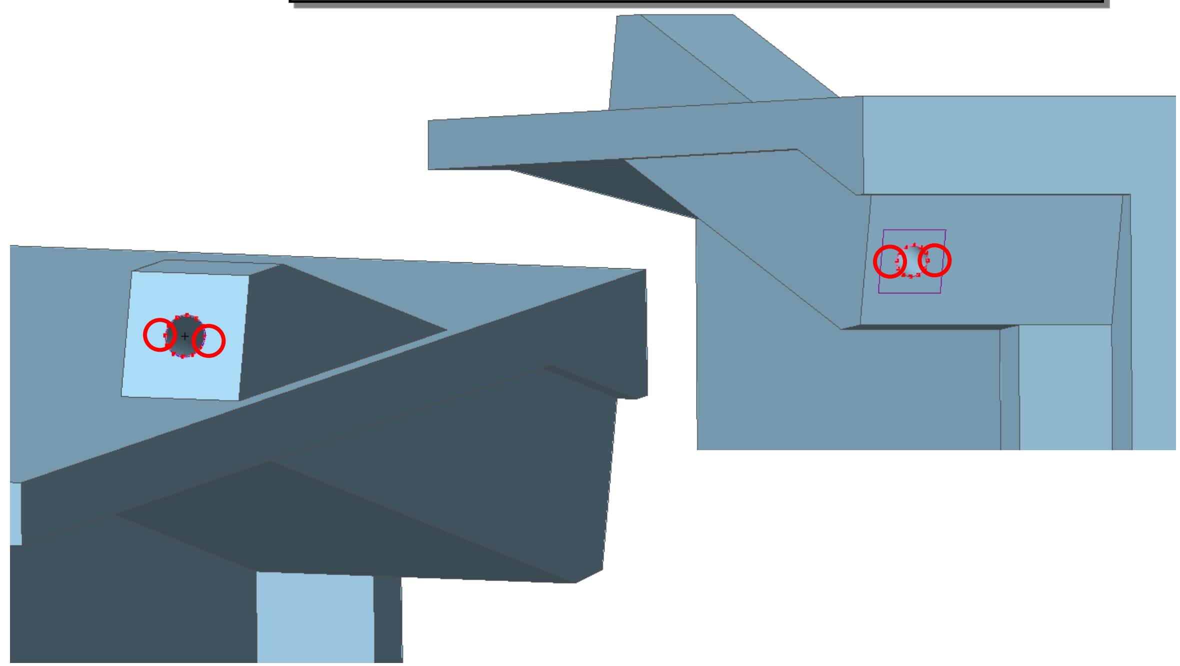


Step 46.

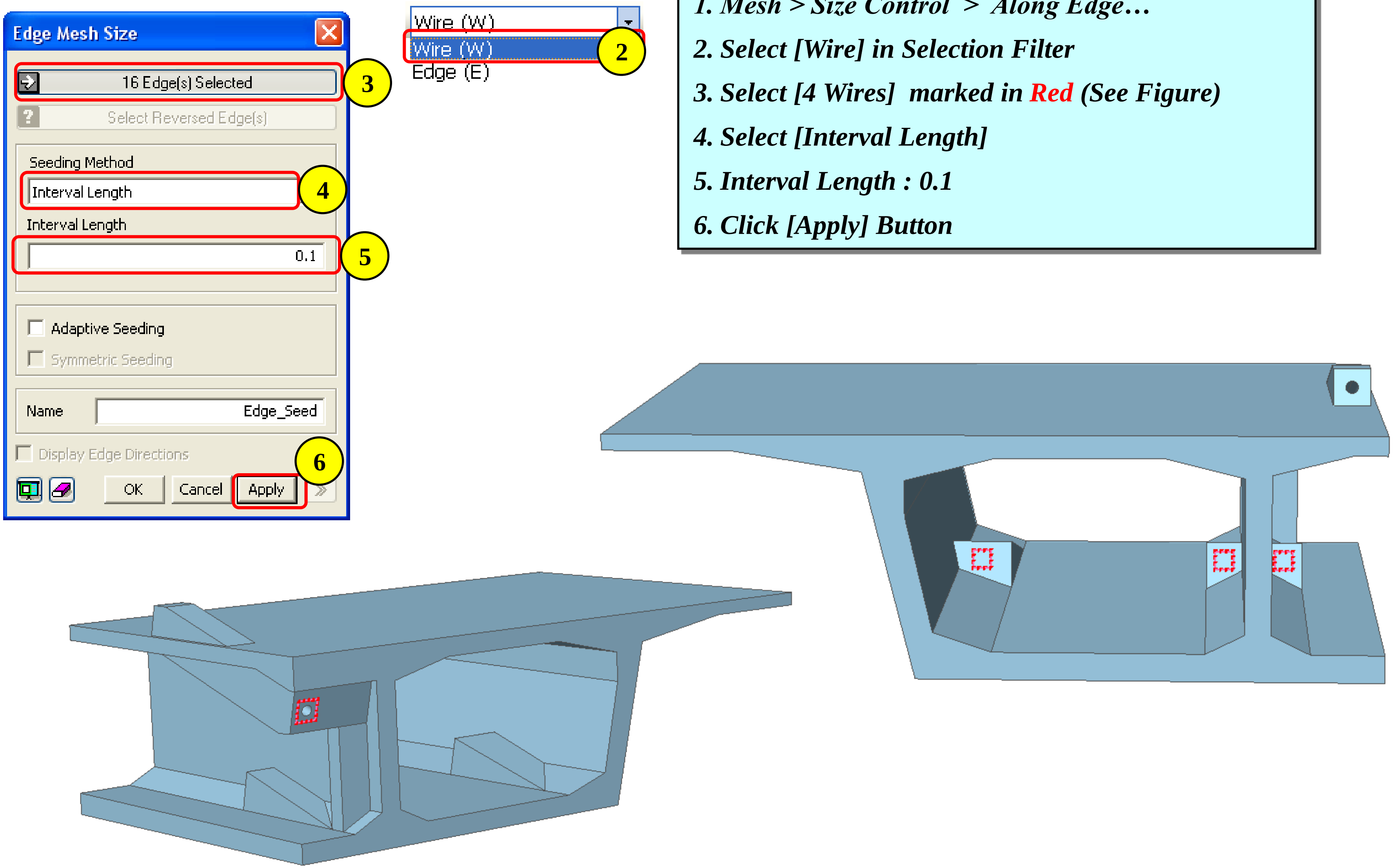


1. Select [Curve] and [Surface] on Tree Menu
2. Click Right Mouse Button and Select [Hide All]
3. Mesh > Size Control > Along Edge…
4. Select [4 Edges] marked by [O] (See Figure)
5. Select [Number of Divisions]
6. Number of Divisions : 6
7. Check on Adaptive Seeding
8. Click [OK] Button



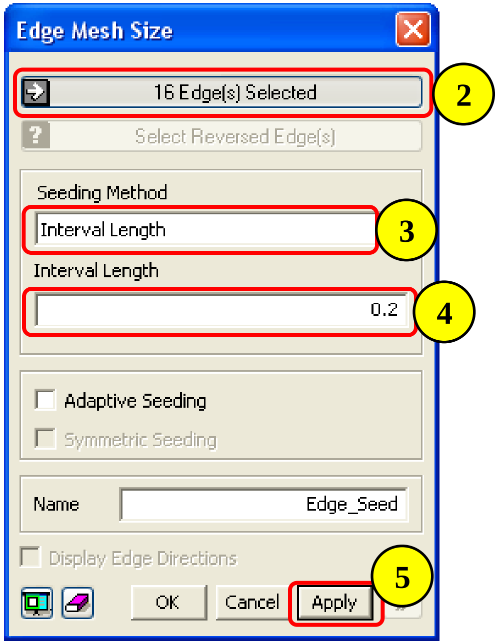


Step 47.

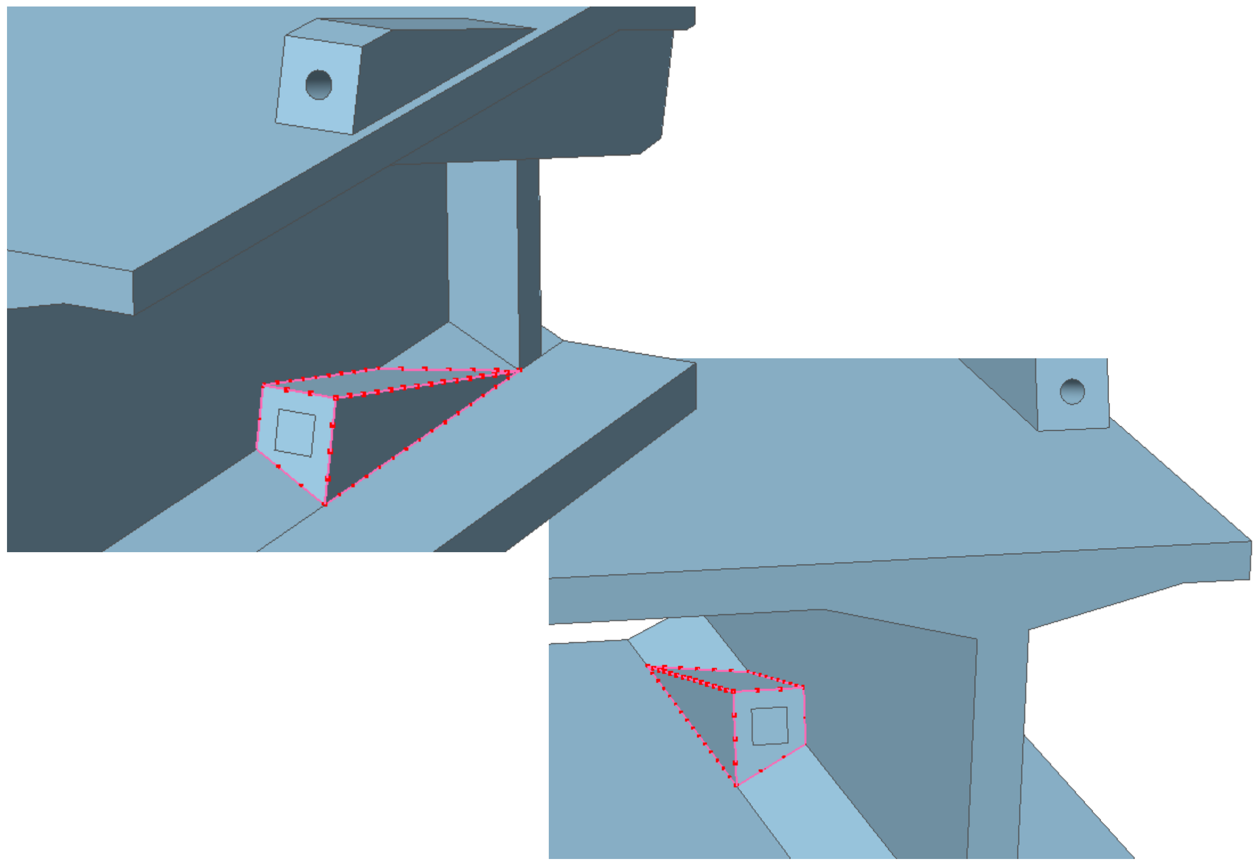


1. *Mesh > Size Control > Along Edge…*
2. *Select [Wire] in Selection Filter*
3. *Select [4 Wires] marked in Red (See Figure)*
4. *Select [Interval Length]*
5. *Interval Length : 0.1*
6. *Click [Apply] Button*

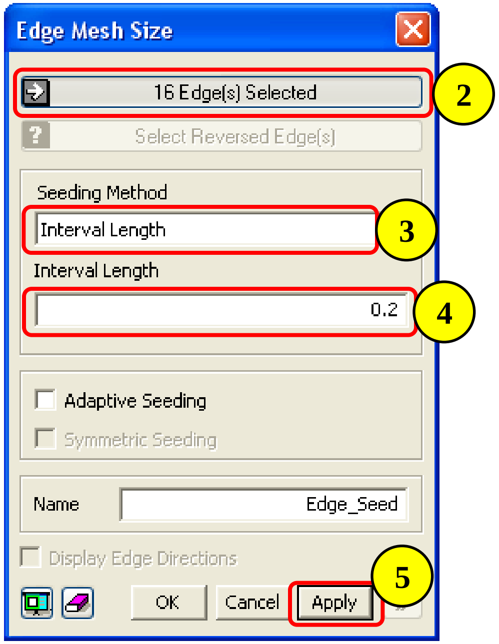
Step 48.



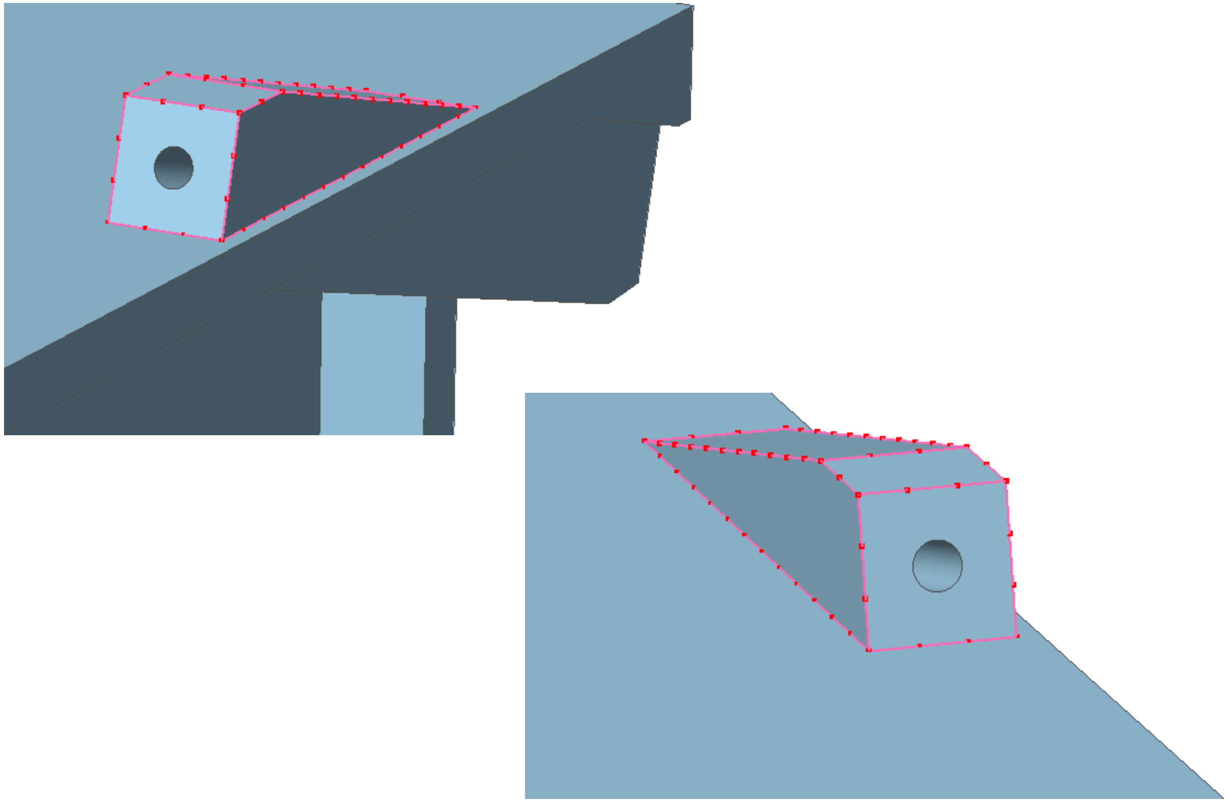
1. *Mesh > Size Control > Along Edge…*
2. *Select [16 Edges] marked in Red (See Figure)*
3. *Select [Interval Length]*
4. *Interval Length : 0.2*
5. *Click [Apply] Button*



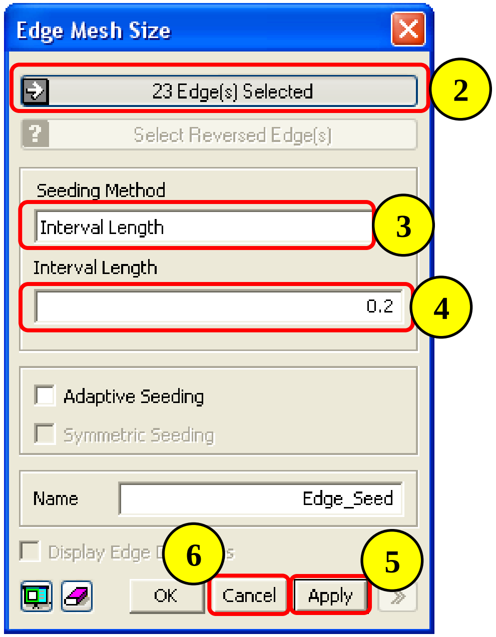
Step 49.



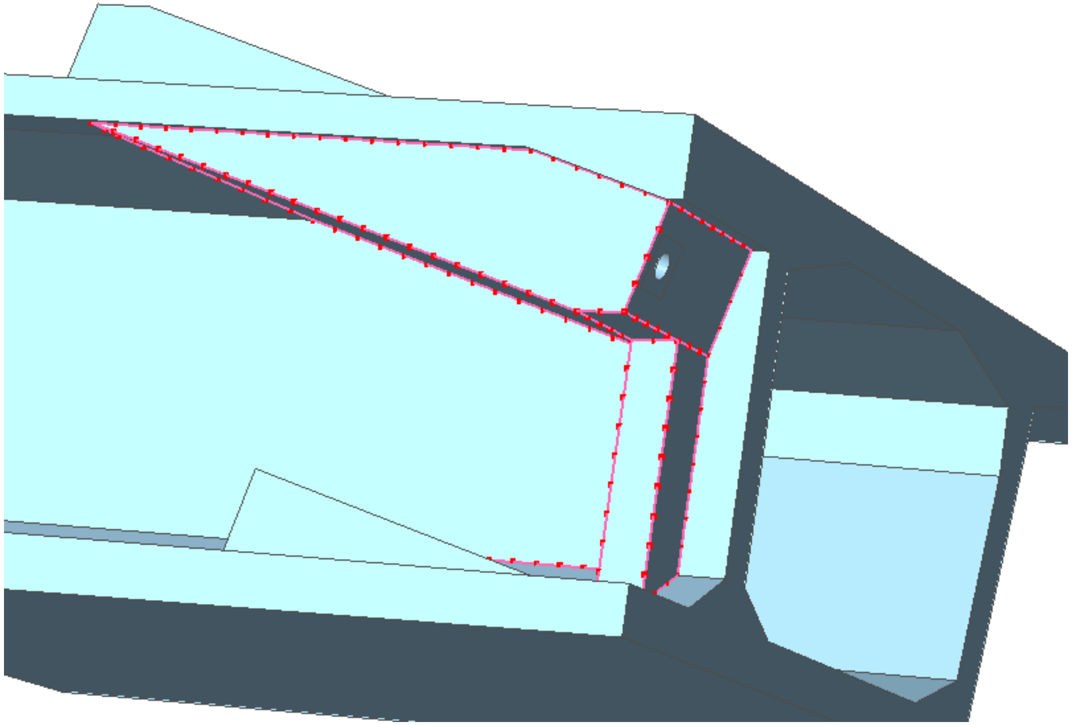
1. Mesh > Size Control > Along Edge…
2. Select [16 Edges] marked in Red (See Figure)
3. Select [Interval Length]
4. Interval Length : 0.2
5. Click [Apply] Button



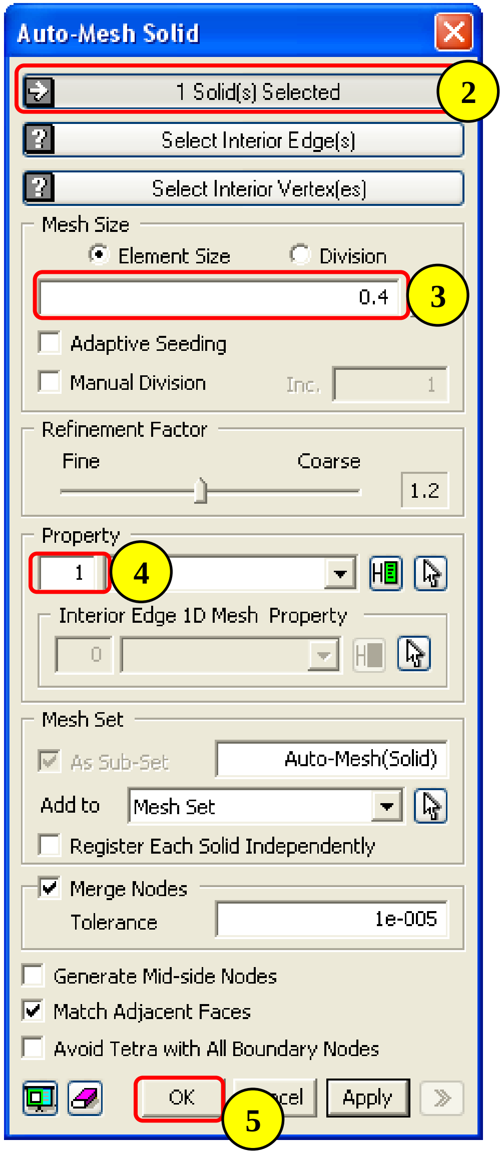
Step 50.



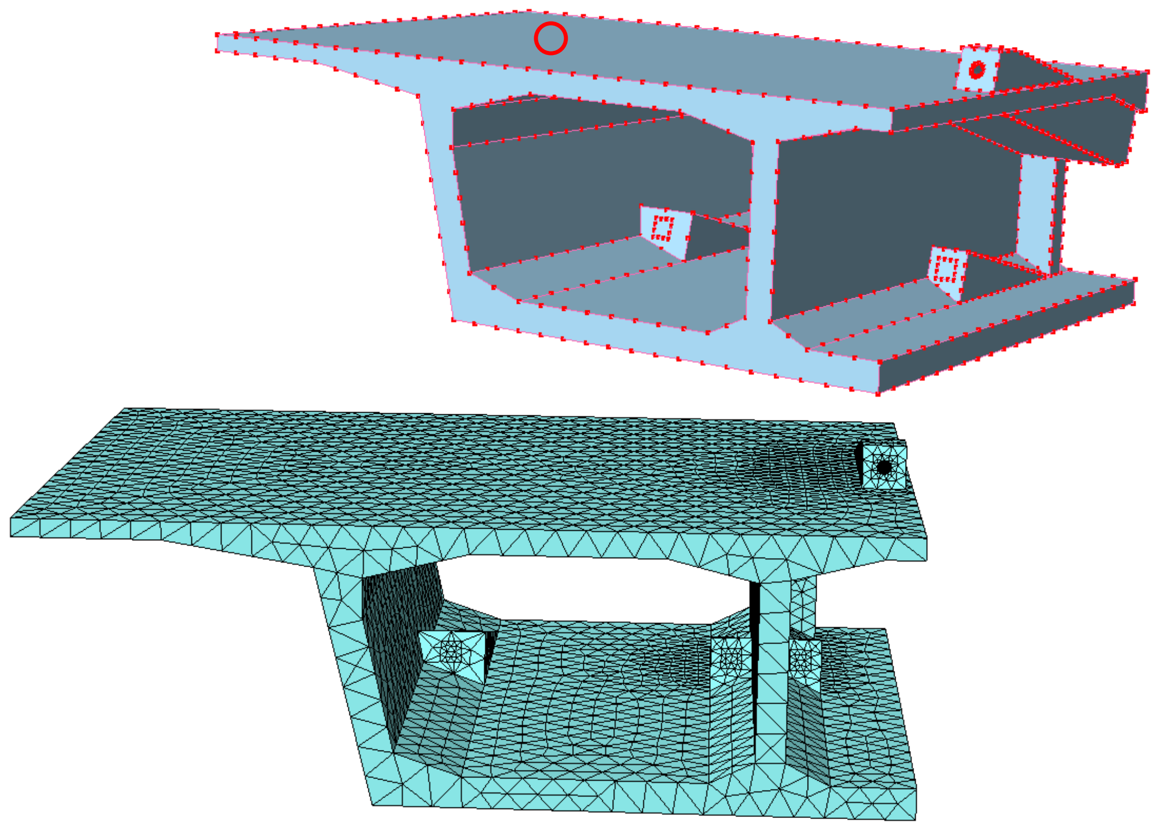
1. *Mesh > Size Control > Along Edge…*
2. *Select [23 Edges] marked in Red (See Figure)*
3. *Select [Interval Length]*
4. *Interval Length : 0.2*
5. *Click [Apply] Button*
6. *Click [Cancel] Button*



Step 51.



1. *Mesh > Auto Mesh > Solid…*
2. *Select [1 Solid] marked by [O] (See Figure)*
3. *Element Size : 0.4*
4. *Property ID : 1*
5. *Click [OK] Button*



Step 52.

1. Analysis > Material…

2. Click [Create] Button

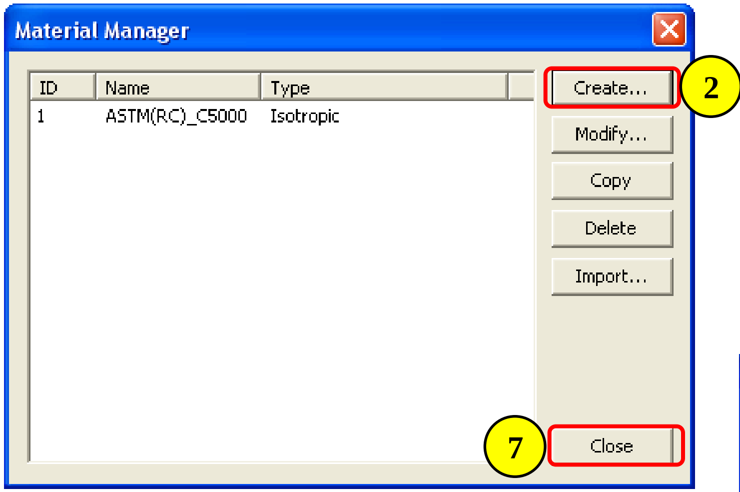
3. Click [DB >] Button

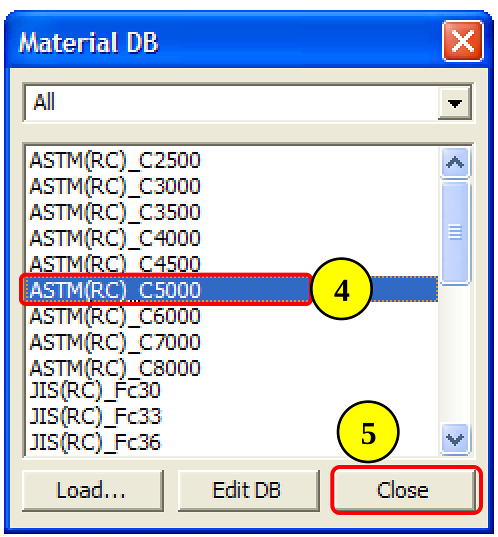
4. Select [ASTM(RC)_C5000]

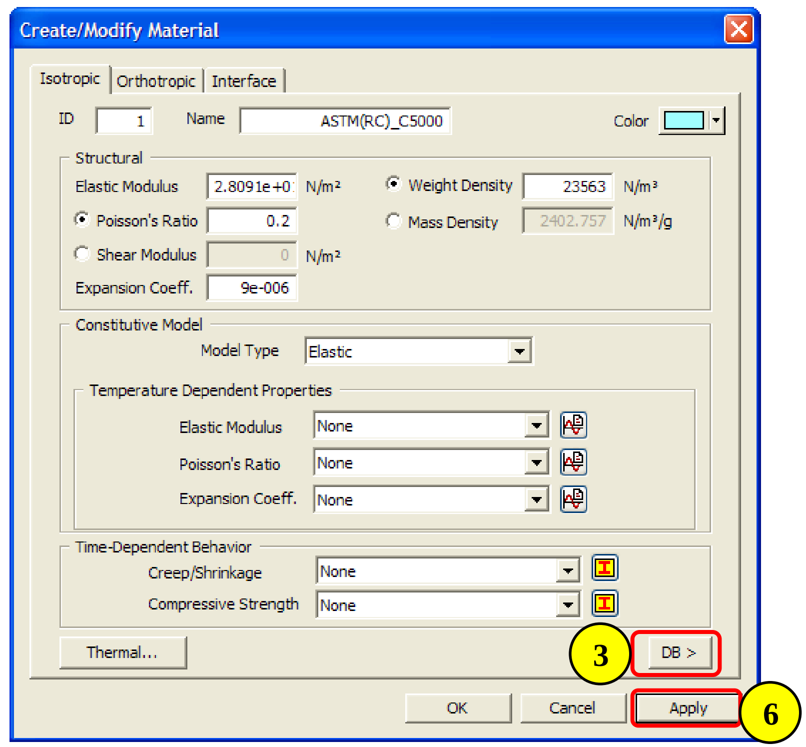
5. Click [Close] Button

6. Click [Apply] Button

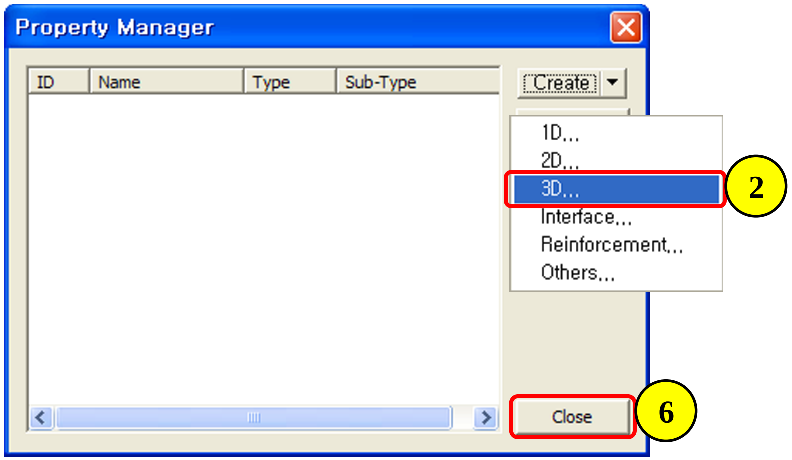
7. Click [Close] Button



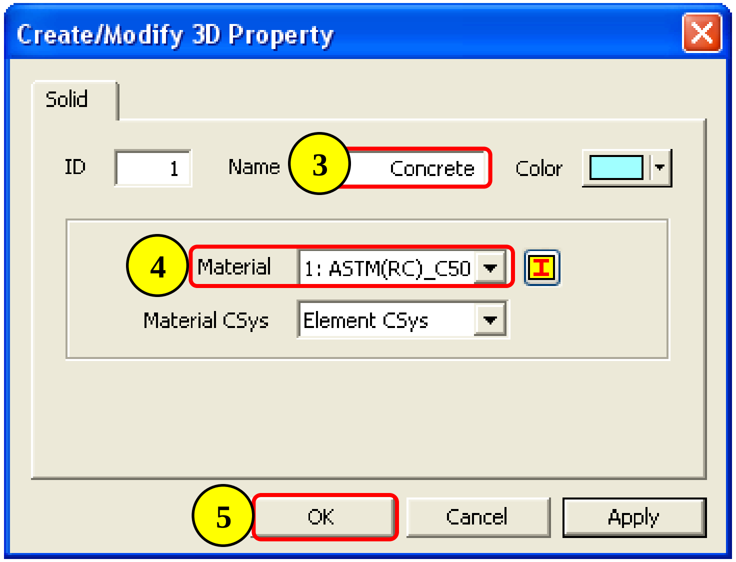




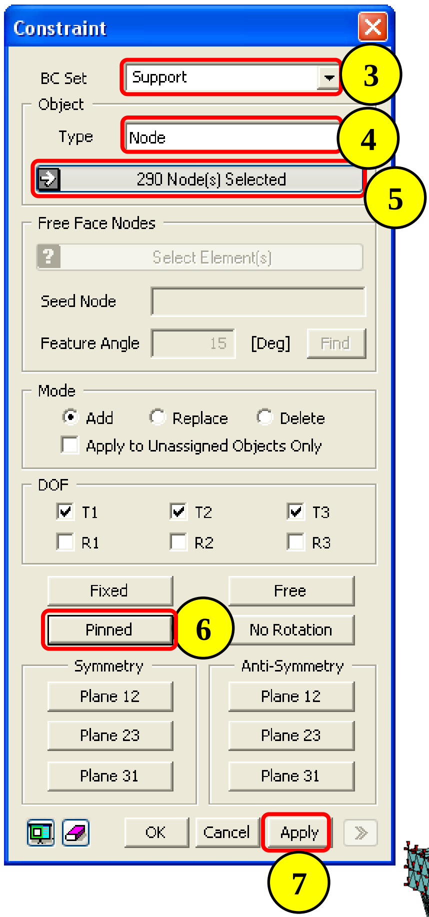
Step 53.

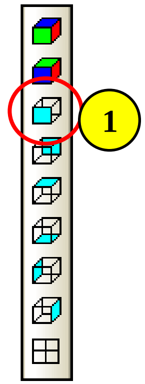


1. *Analysis > Property…*
2. *Click [Create ▾] Button and Select [3D…]*
3. *Name : Concrete*
4. *Material [ASTM(RC)_C5000]*
5. *Click [OK] Button*
6. *Click [Close] Button*

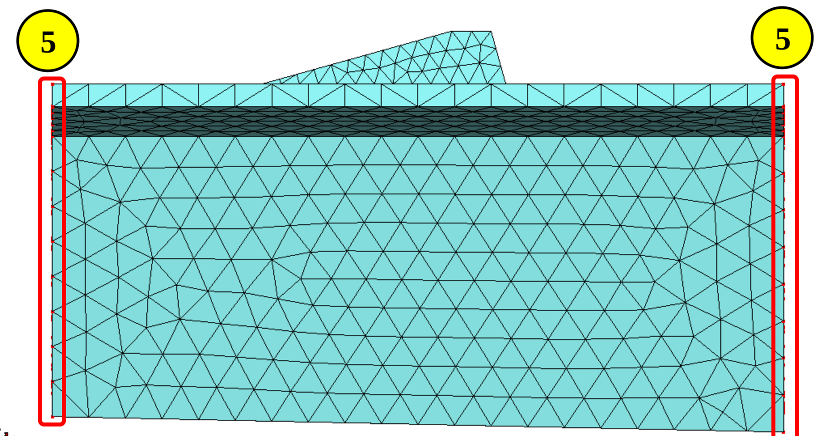


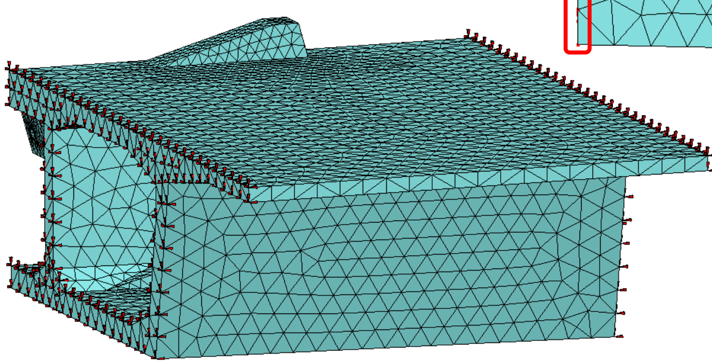
Step 54.



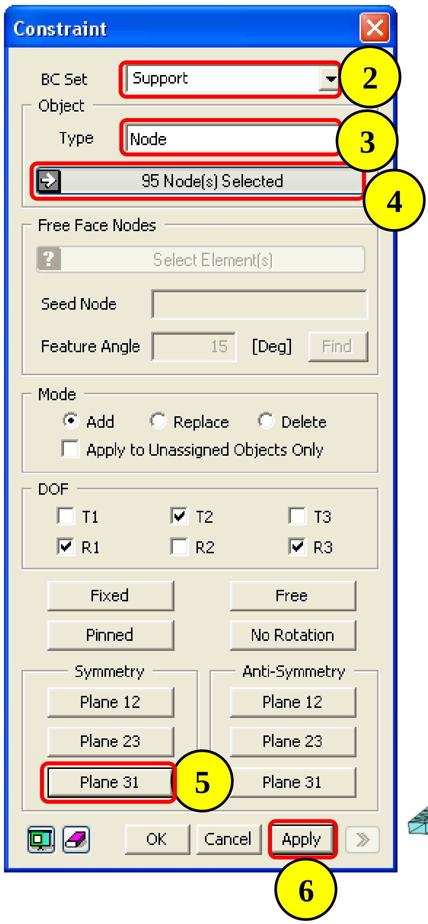


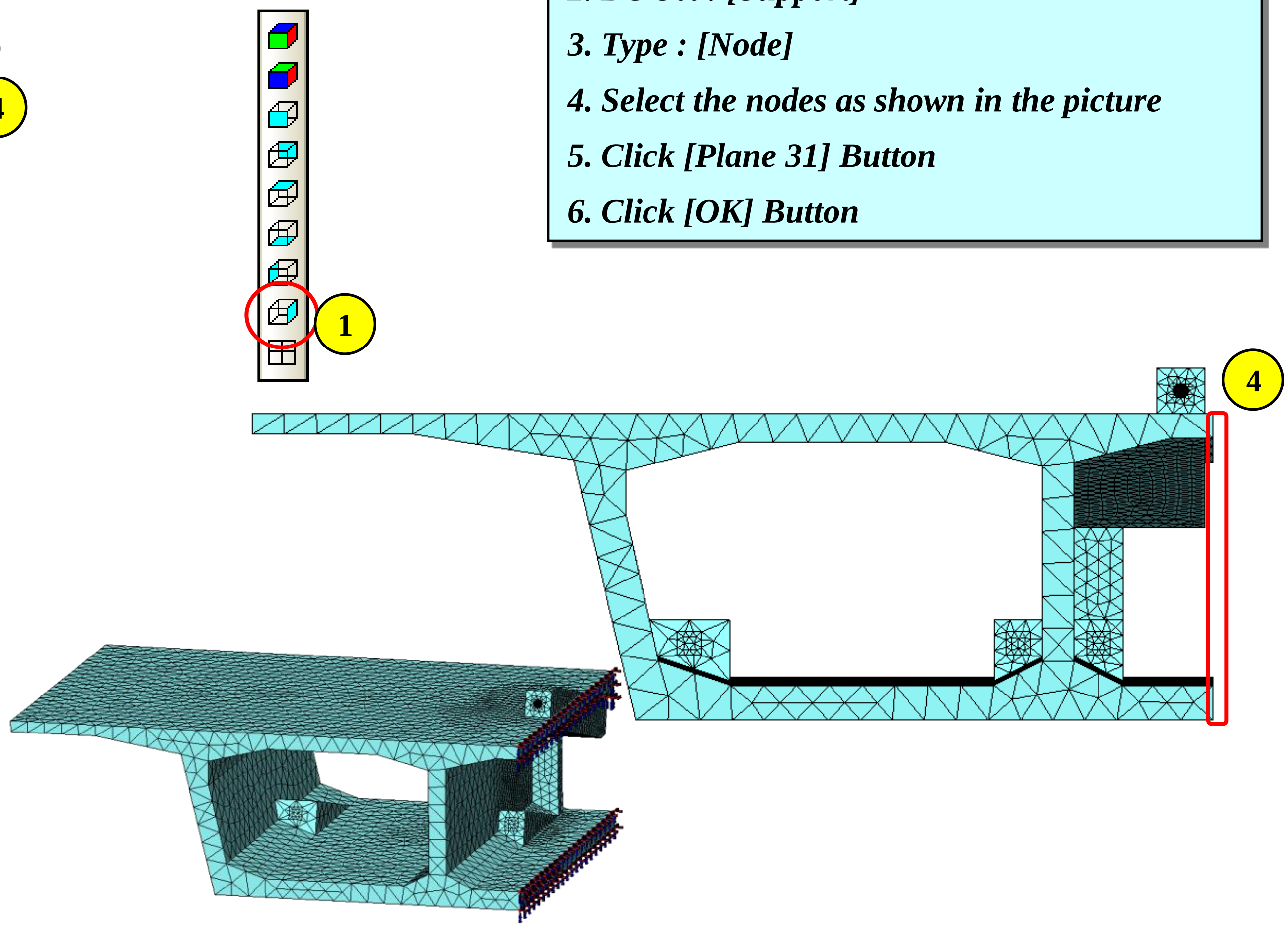
1. Click on "Front View"
2. Analysis > Analysis > BC > Constraint…
3. BC Set : [Support]
4. Type : [Node]
5. Select the nodes as shown in the picture
6. Click [Pinned] Button
7. Click [Apply] Button





Step 55.





1. Click on "Right View"

2. BC Set : [Support]

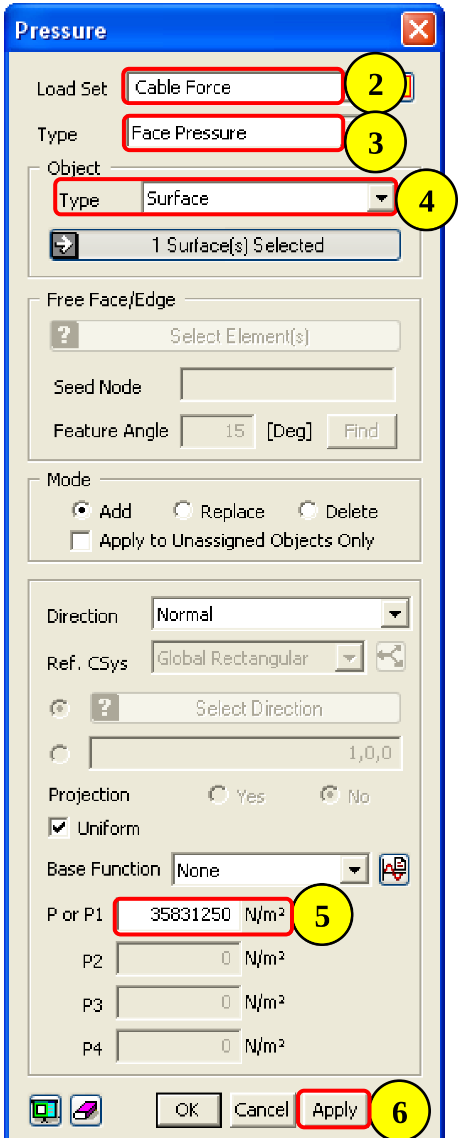
3. Type : [Node]

4. Select the nodes as shown in the picture

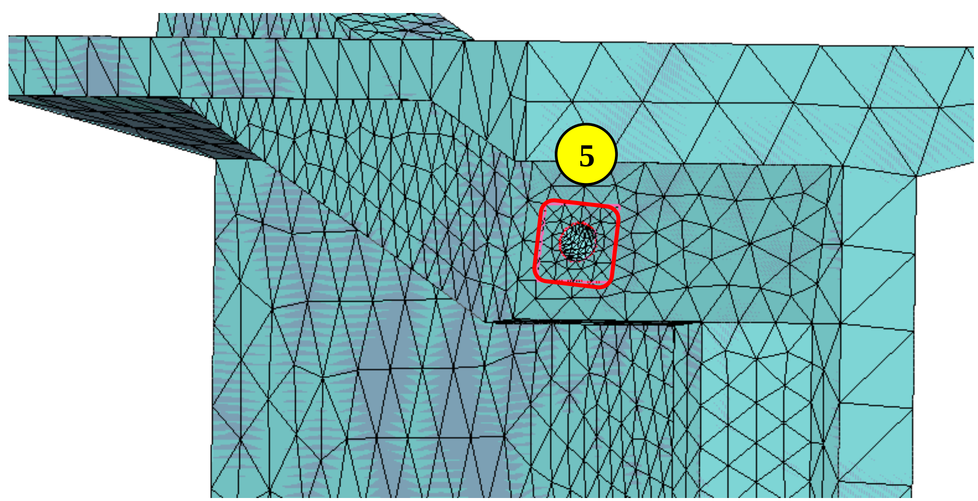
5. Click [Plane 31] Button

6. Click [OK] Button

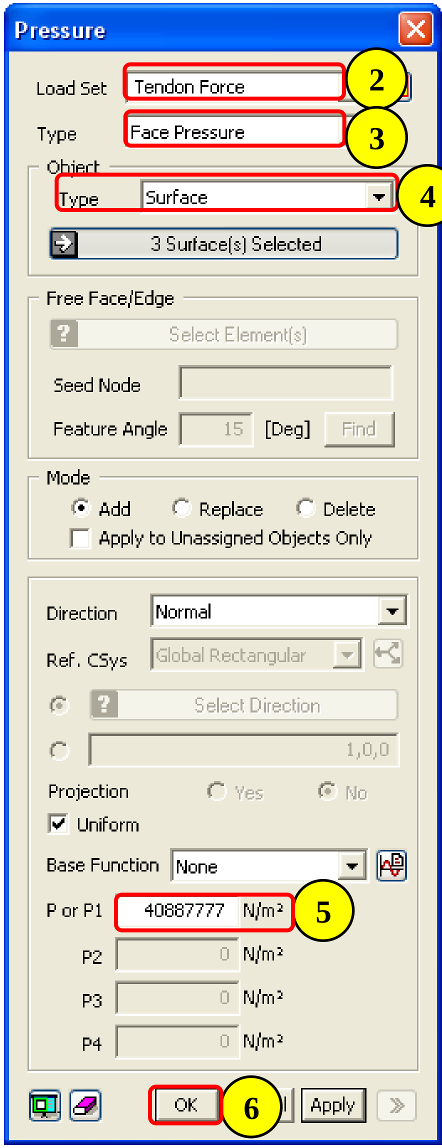
Step 56.



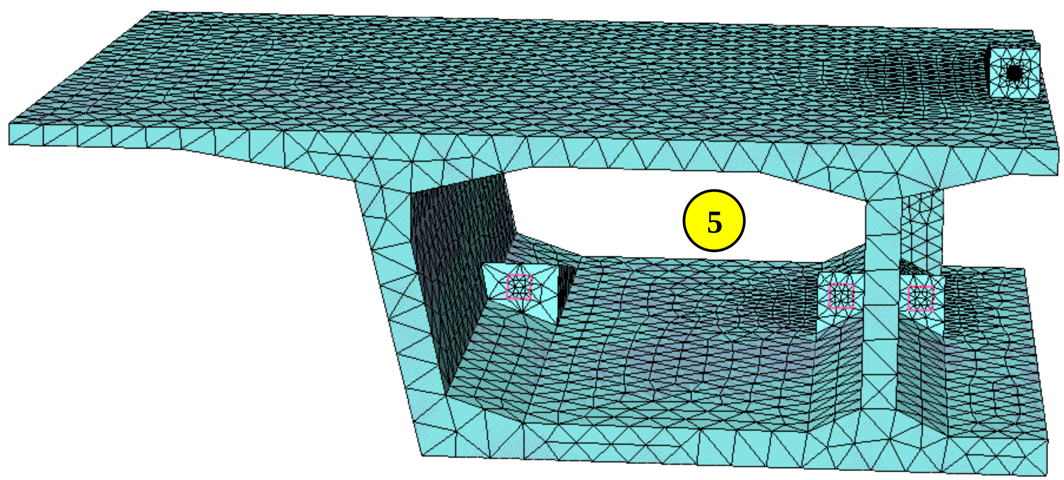
1. Analysis > Load > Pressure…
2. Load Set : [Cable Force]
3. Type : [Face Pressure]
4. Object Type : [Surface]
5. Select [1 Surface] as shown in the picture
6. P or P1 : 35831250 N/m²
7. Click [Apply] Button



Step 57.



1. Analysis > Load > Pressure…
2. Load Set : [Tendon Force]
3. Type : [Face Pressure]
4. Object Type : [Surface]
5. Select [3 Surfaces] as shown in the picture
6. P or P1 : 40887777 N/m²
7. Click [OK] Button



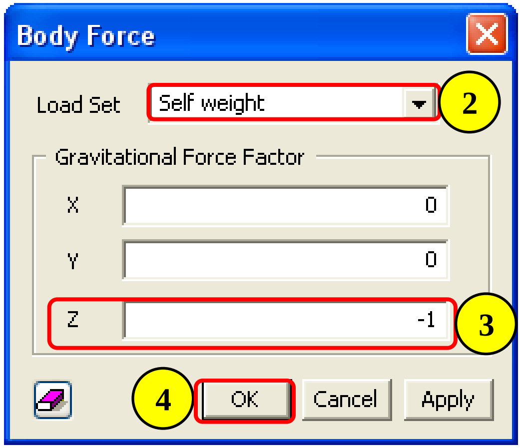
Step 58.

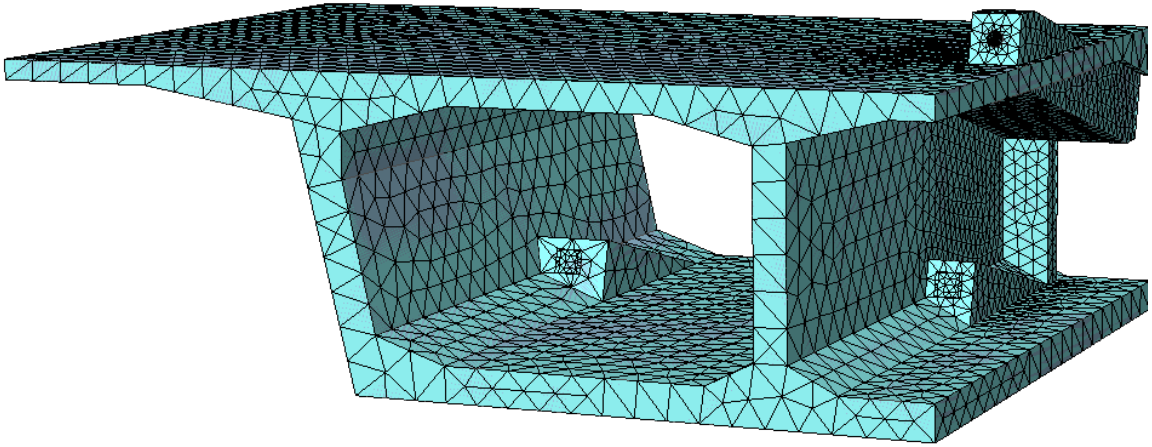
1. Analysis > Load > Body Force…

2. Load Set : [Self weight]

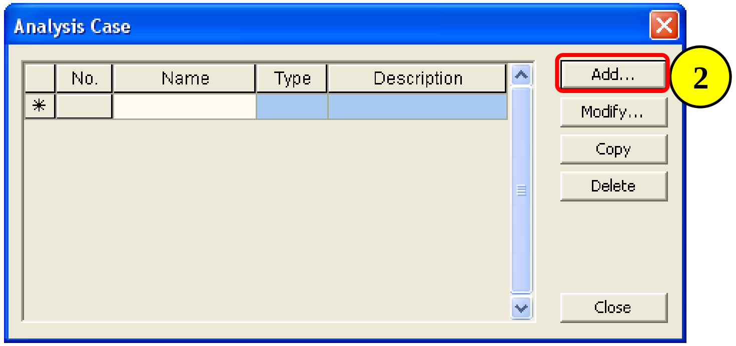
3. Gravitational Force Factor Z : -1

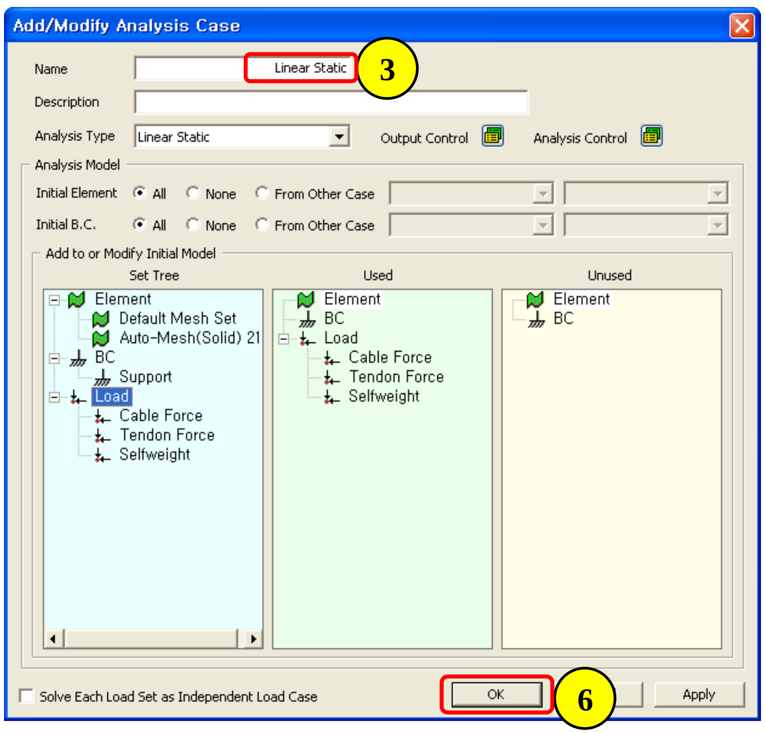
4. Click [OK] Button



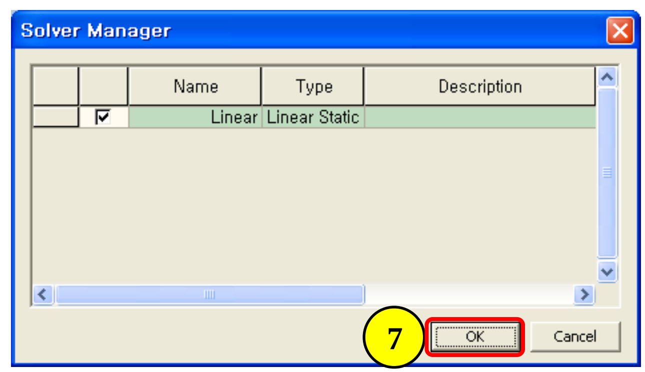


Step 59.



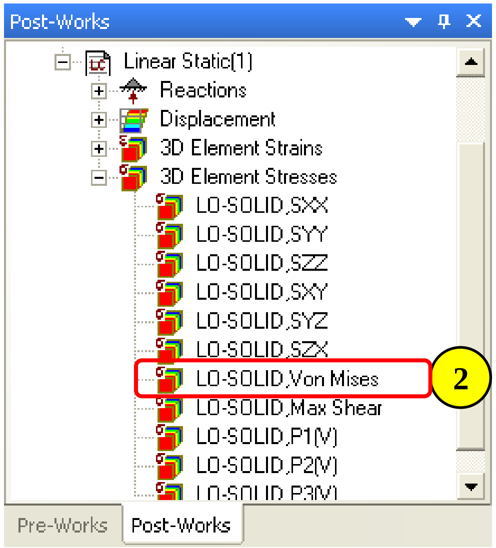


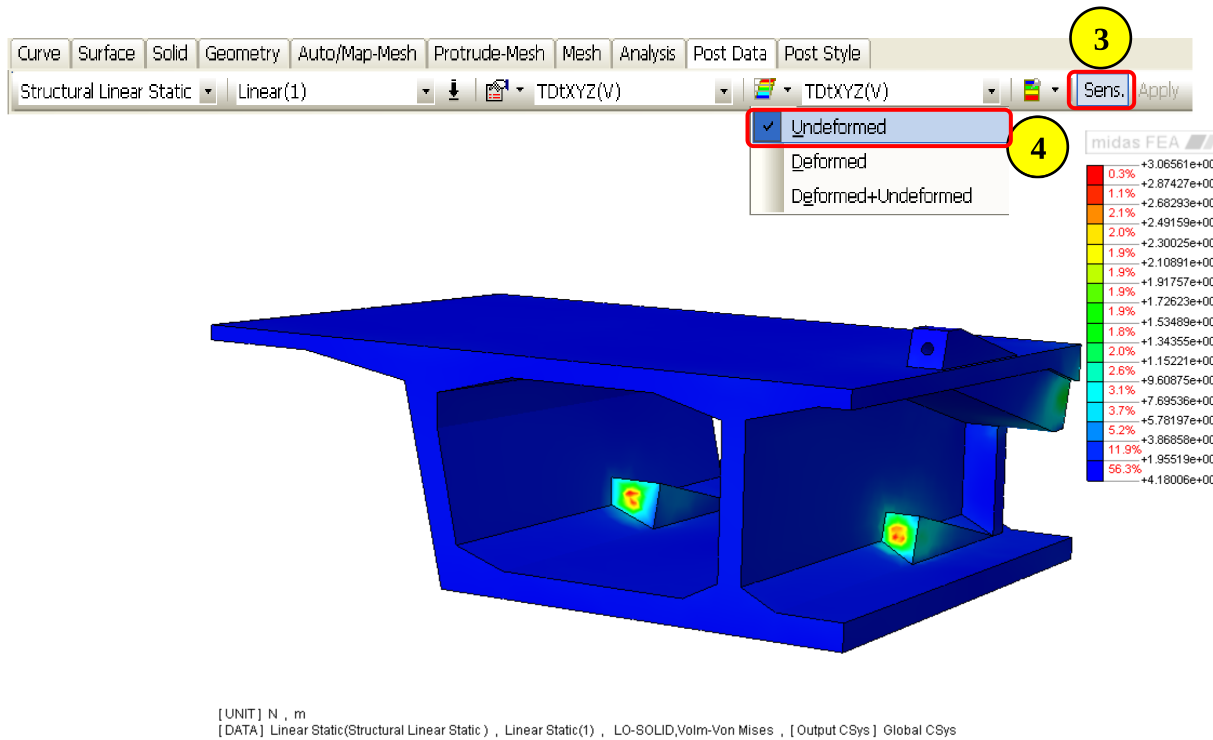
1. *Analysis > Analysis Case…*
2. *Click on [Add]*
3. *Name : Linear Static*
4. *Analysis Type : [Linear Static]*
5. *Drag & Drop [Load] to [Used] Window*
6. *Click [OK] Button*
7. *Click [Close] Button*
8. *Analysis > [Solve]*
9. *Click [OK] Button*

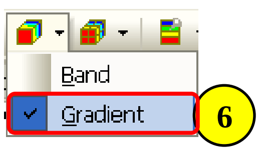


Step 60.

1. ***Post-Works Tree : Linear (Structural Linear Static) > Linear(1) > 3D Element Stresses***
2. ***Double Click on [LO-Solid Von Mises]***
3. ***Click [Sens.] Button***
4. ***Select [Unreformed] for Mesh Shape (See Figure)***
5. ***Click [Post Style] Toolbar***
6. ***Select [Gradient] for Contour Type***
7. ***Select [Feature Edge] for Edge Type***







Step 61.

1. *Select Clipping Plane Mode*
2. *Property Window : [Clipping Plane]*
3. *Click [Define] Button*
4. *Check on [Global Axis]*
5. *Check on [Y- Direction : -0.4]*
6. *Click [Preview Direction Symbol] Button*
7. *Click [Plot] Button*