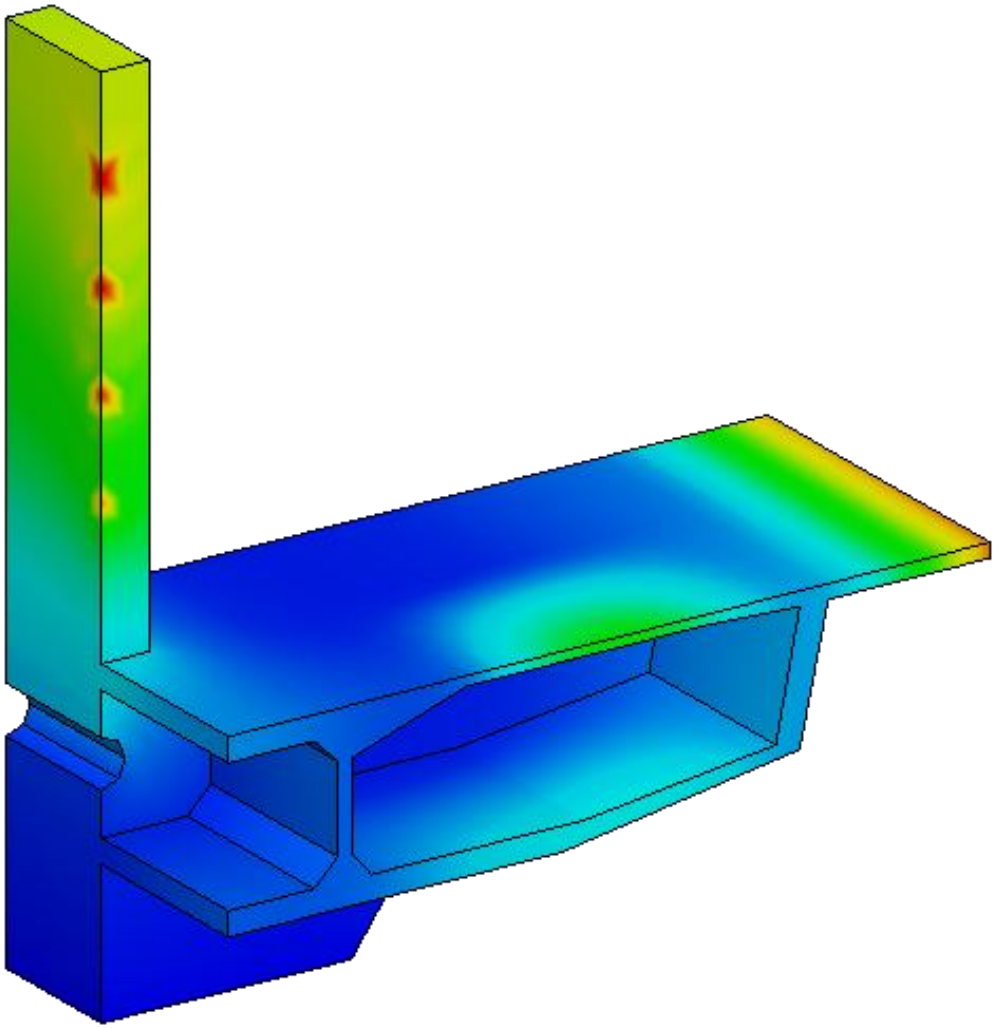
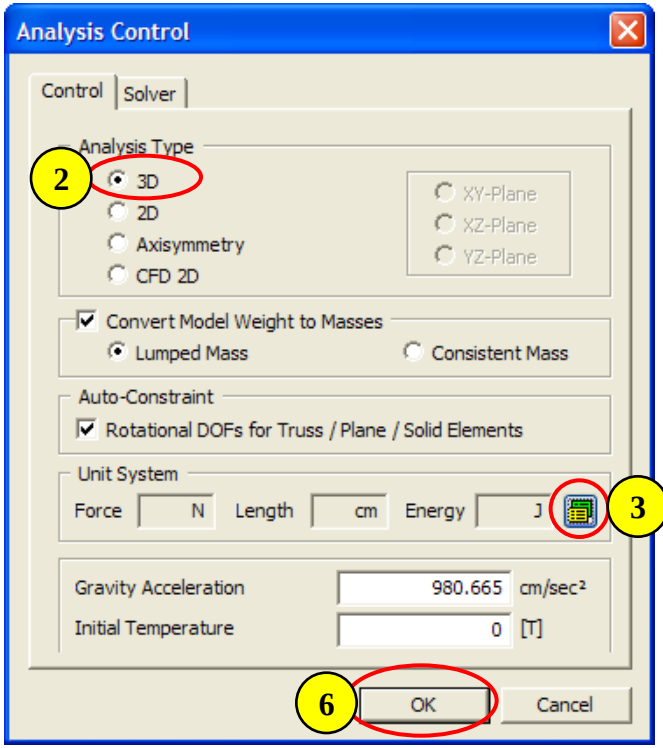
LS-7. Pier table

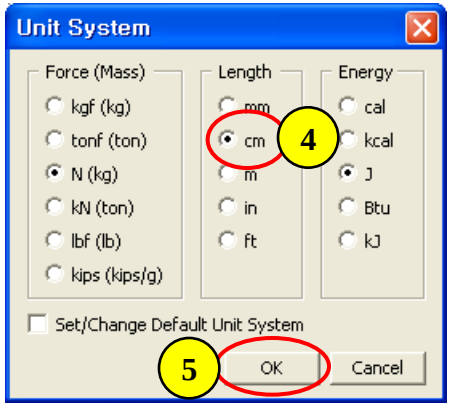


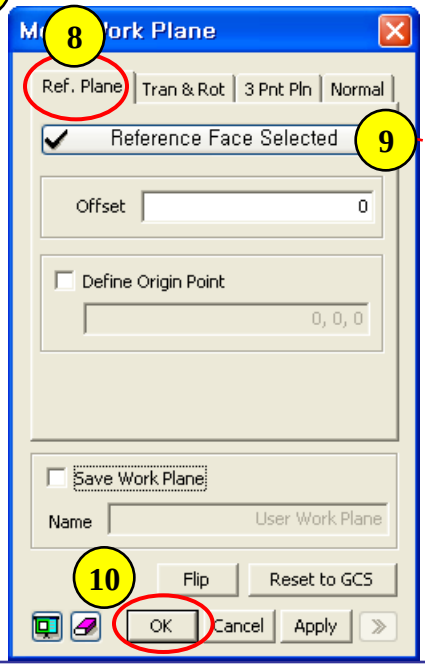
Overview

- 3-D Linear Static Analysis
- Model
  - *Unit : N, cm*
  - *Isotropic Elastic Material*
  - *Solid Element*
- Load & Boundary Condition
  - *Body Force*
  - *Force*
  - *Element Temperature*
  - *Constraint*
- Result Evaluation
  - *Presenting various features of Post-Processing options*

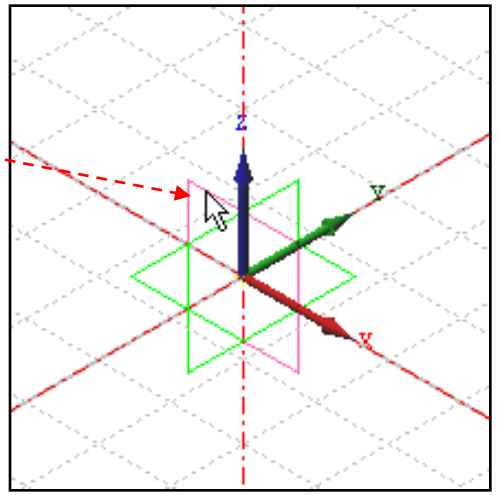
Step 1.







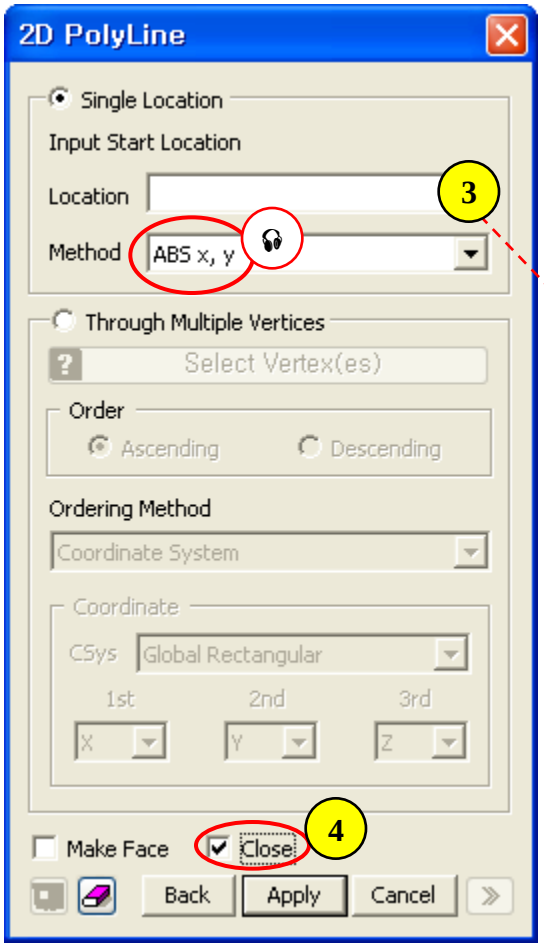
1. *Analysis > Analysis Control – "Control" tab*
2. *Analysis Type : 3D*
3. *Click*  *Button (Unit System)*
4. *Length : cm*
5. *Click* **[OK]** *Button*
6. *Click* **[OK]** *Button*
7. *Geometry > Work Plane > Move …*
8. *Select "Ref. Plane" tab*
9. *Select "XZ-Plane"*
10. *Click* **[OK]** *Button*

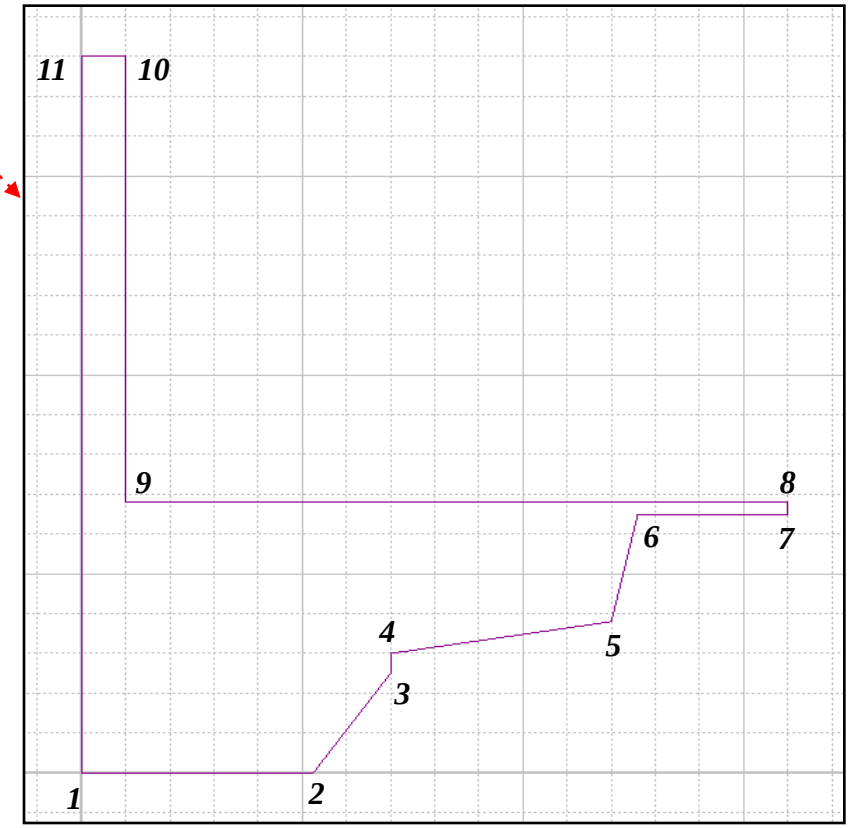


Select "XZ-Plane" in Work Window or Pre-Works Tree

Step 2.

1. Click “Normal”
2. Geometry > Curve > Create on WP > Polyline (Wire)…
3. Location : (0) , <525> , <175, 250> , <0, 50> , <500, 80> , <60, 270> , <340> , <0, 30> , <-1500> , <0, 1120> , <-100>
4. Check on “Close”
5. Click Right Mouse Button in Work Window (to Stop Polyline Drawing)
6. Click “Zoom All”

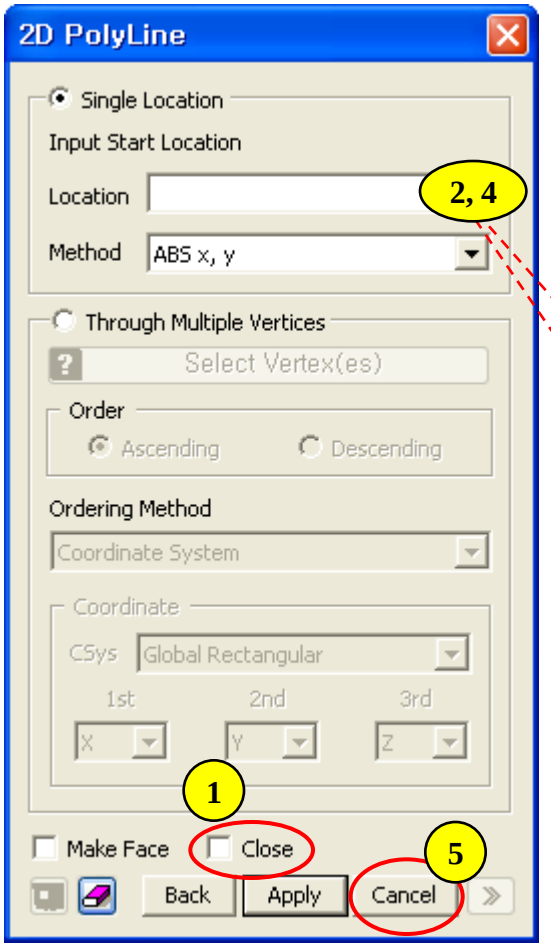


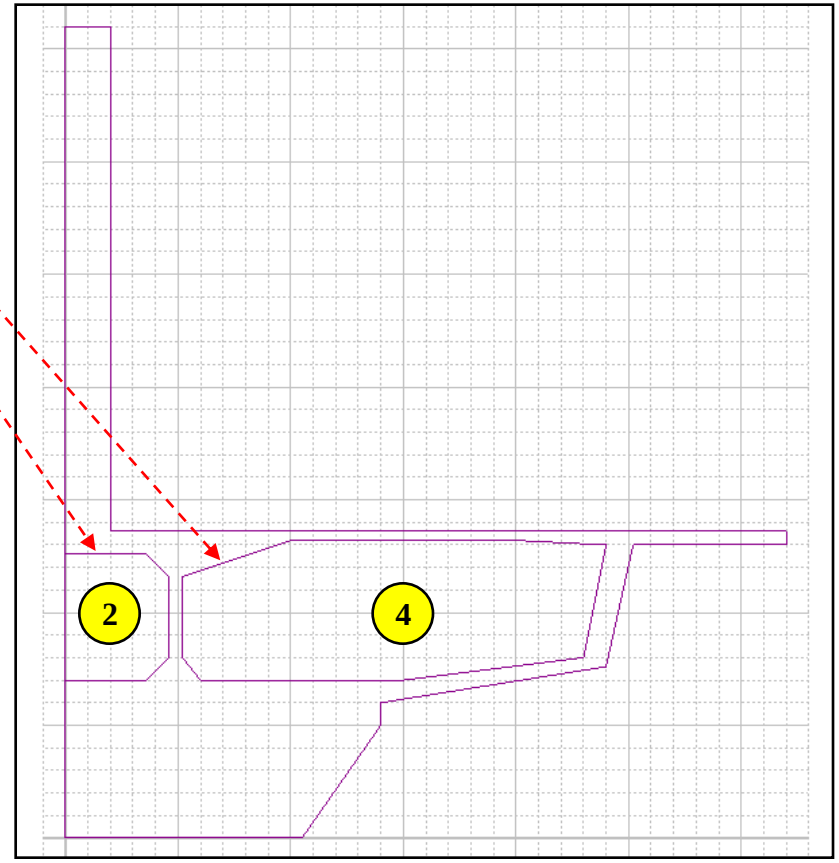


“(): ABS x, y”, <>: “REL dx, dy”
<525> same as <525, 0>

Step 3.

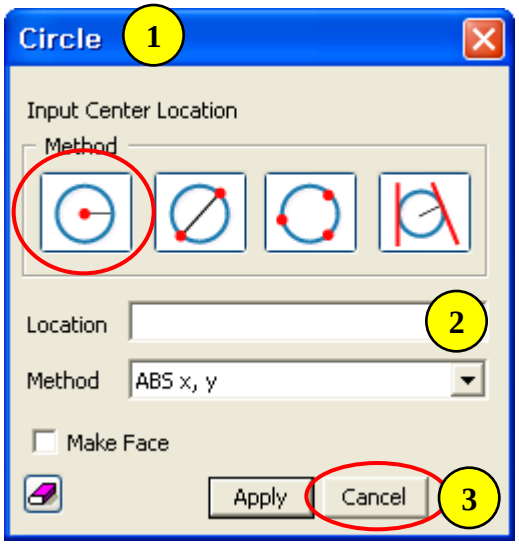
1. *Check off "Close"*
2. *Location : (0, 350) , <180> , <50, 50> , <0, 180> , <-50, 50> , <-180>*
3. *Click Right Mouse Button in Work Window (to Stop Polyline Drawing)*
4. *Location : (300, 350) , <450> , <400, 50> , <50, 250> , <-200, 10> , <-500> , <-240, -80> , <0, -180> , <40, -50>*
5. *Click* **[Cancel]** *Button*

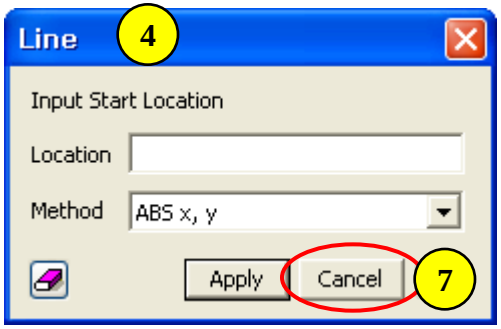




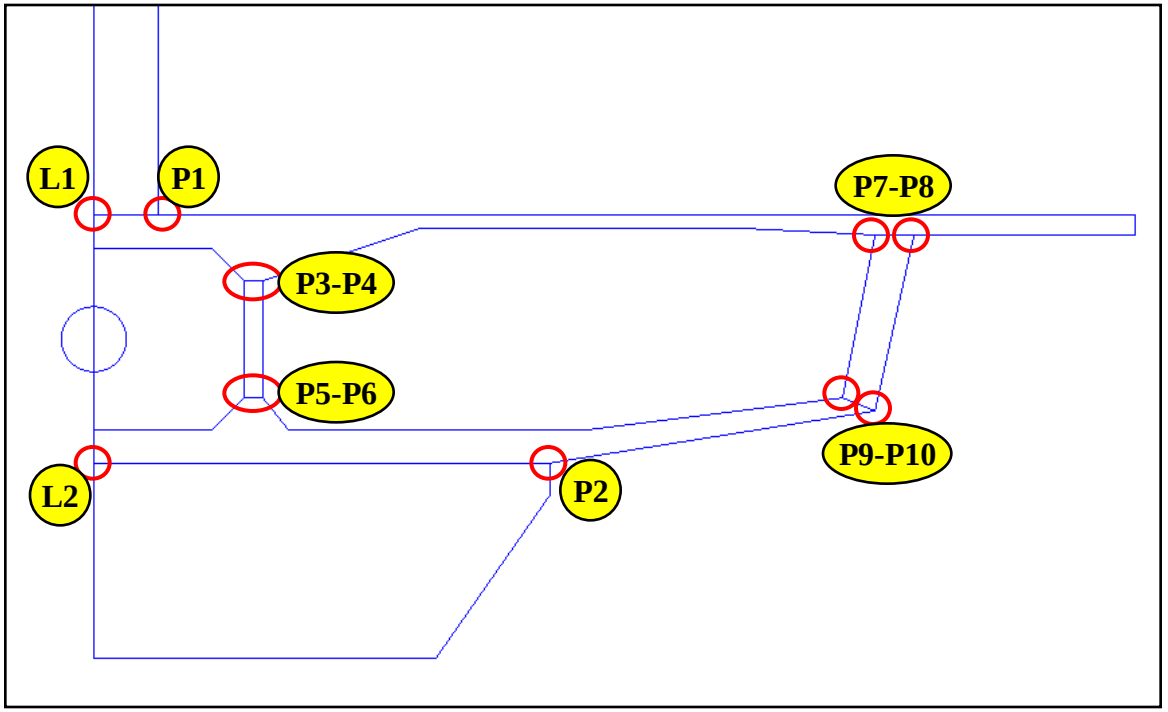
[Esc] *as shortcut for* **[Cancel]**.

Step 4.



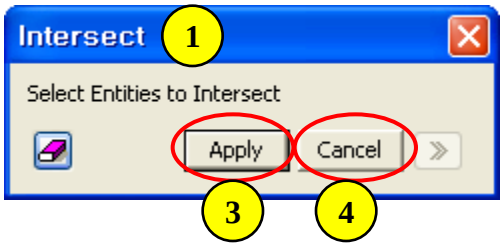


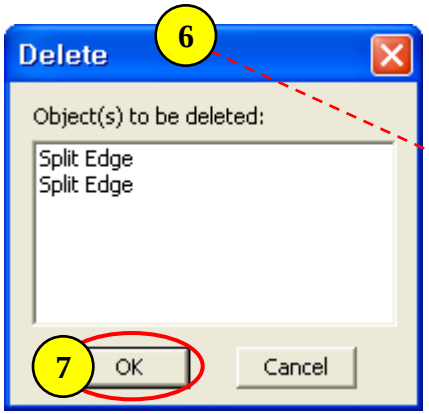
1. *Geometry > Curve > Create on WP > Circle…*
2. *Center : (0, 490) , Radius : 50*
3. *Click* **[Cancel]** *Button*
4. *Geometry > Curve > Create on WP > Line…*
5. *Toggle on "Vertex Snap" & "Perpendicular Snap"*
6. *Select (P1, L1) , (P2, L2) , (P3, P4) , (P5, P6) , (P7, P8) , (P9, P10)*
7. *Click* **[Cancel]** *Button*

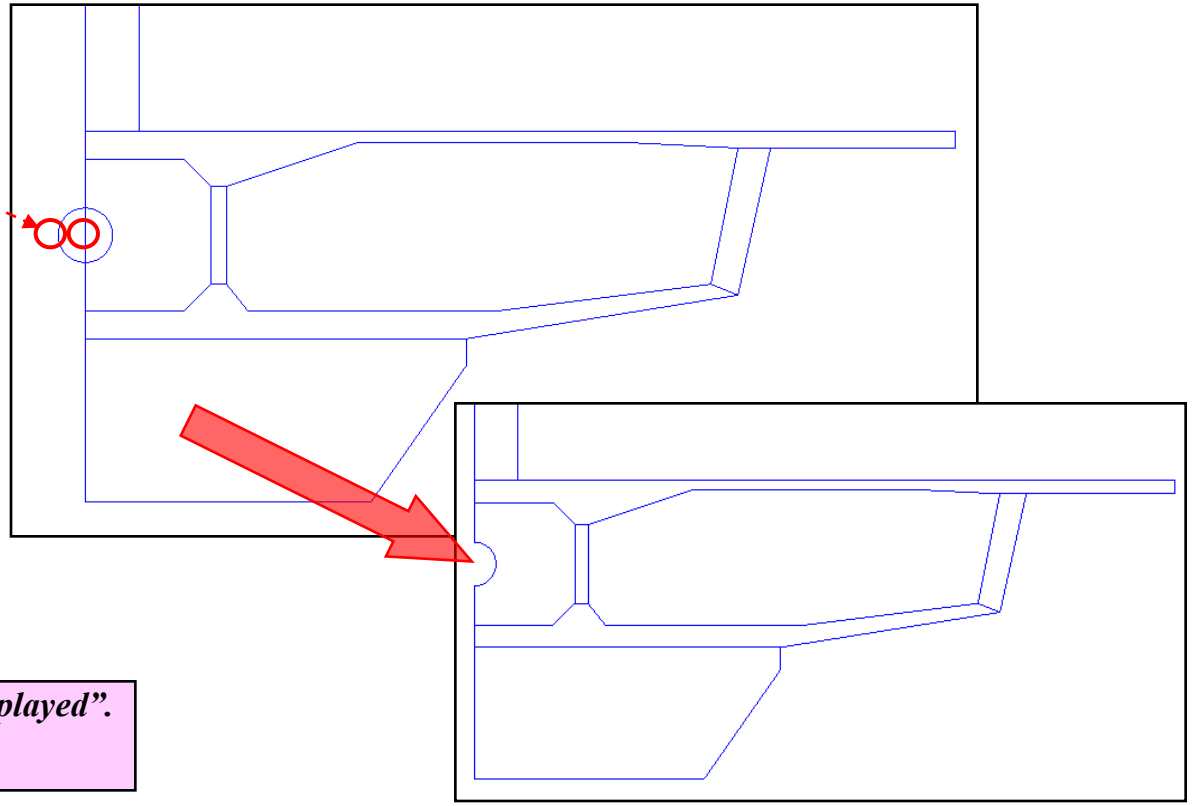


Step 5.

1. *Geometry > Curve > Intersect …*
2. *Select* *"Displayed"*
3. *Click* **[Apply]** *Button*
4. *Click* **[Cancel]** *Button*
5. *Select 2 Edges marked by "O" (See Figure)*
6. *Press "Delete" Key*
7. *Click* **[OK]** *Button*

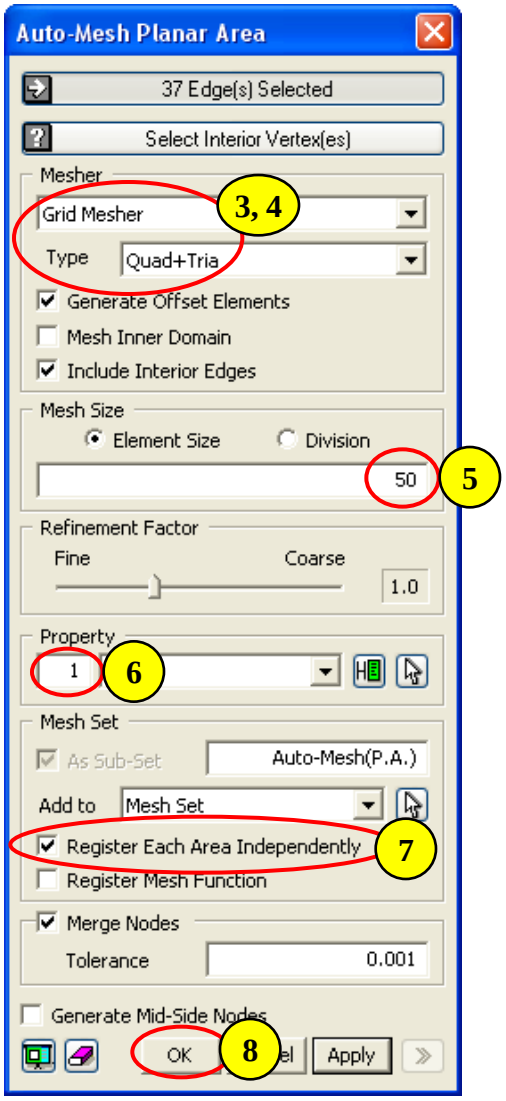




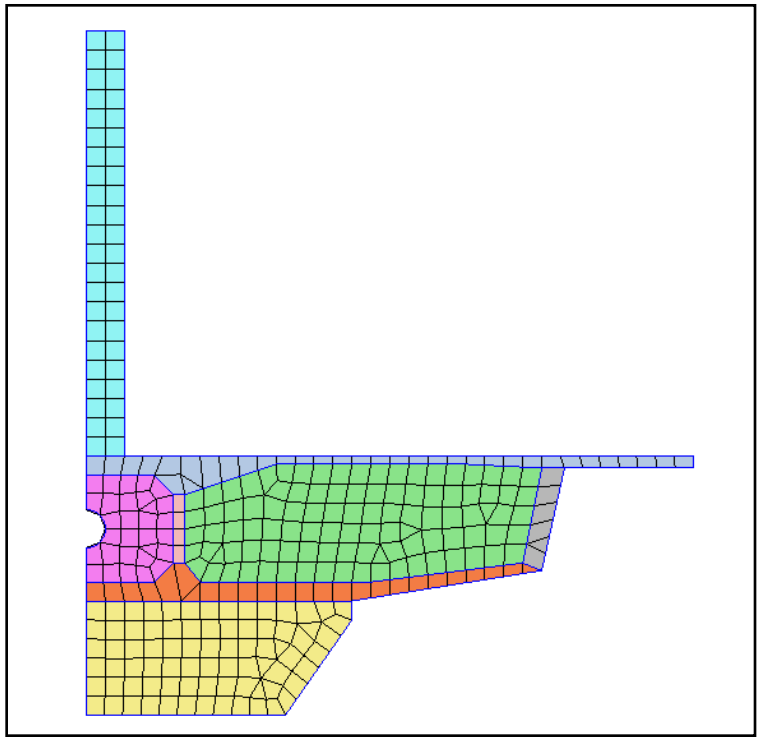


- *"Ctrl+A" as shortcut for "Select Displayed".*
- **[Enter]** *as shortcut for* **[Apply].**

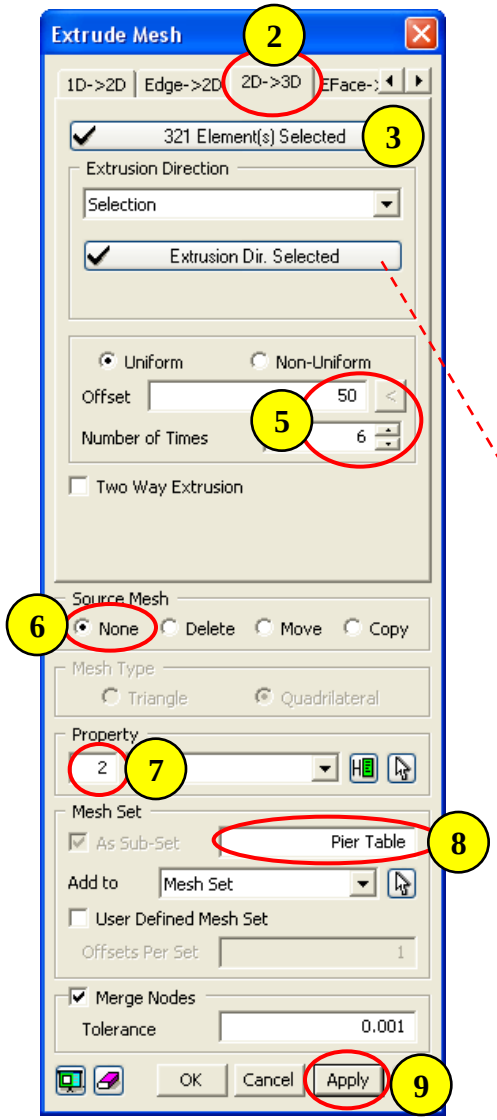
Step 6.



1. *Mesh > Auto Mesh > Planar Area …*
2. *Select “Displayed”*
3. *Mesher : Grid Mesher*
4. *Type : Quad + Tria*
5. *Mesh Size - Element Size : 50*
6. *Property : 1*
7. *Check on “Register Each Area Independently”*
8. *Click* **[OK]** *Button*

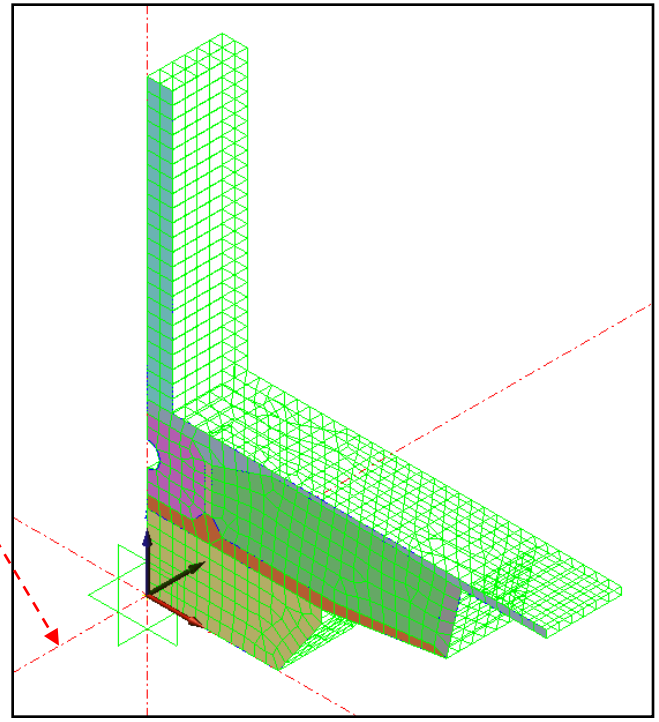


Step 7.



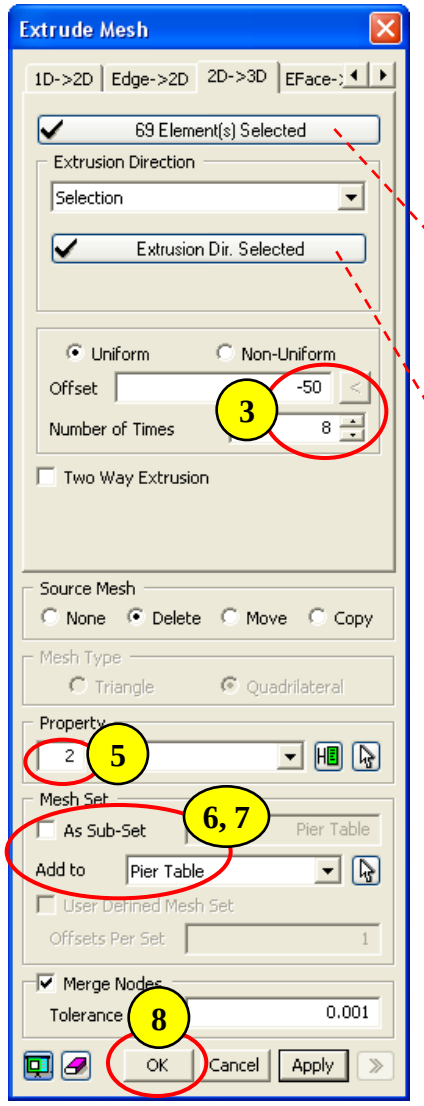
4

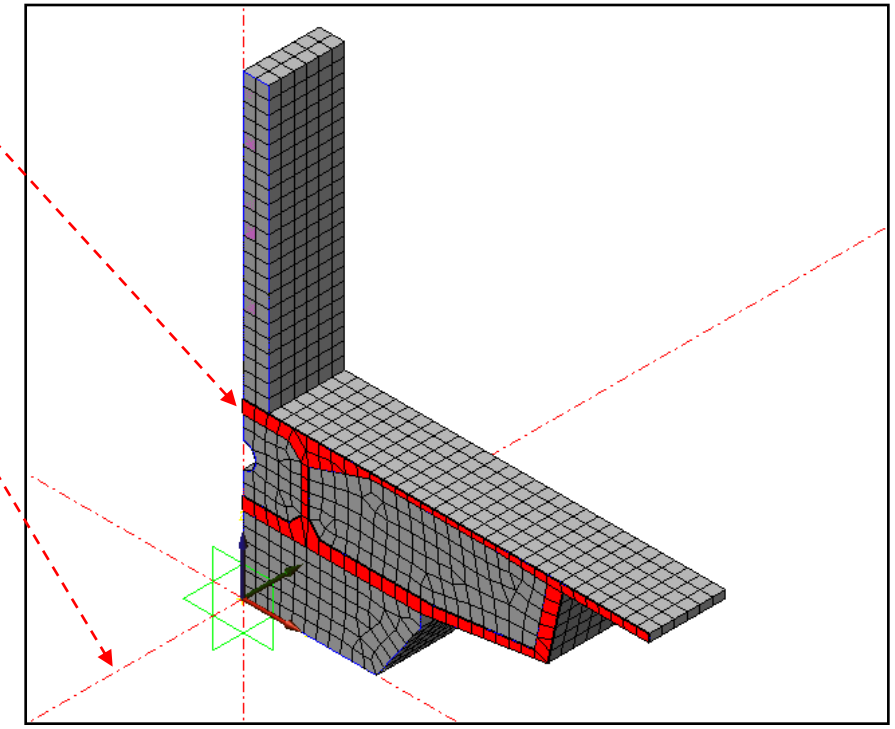
1. *Mesh > Protrude Mesh > Extrude …*
2. *Select "2D->3D" tab*
3. *Select "Displayed"*
4. *Extrusion Direction : Y-Axis*
5. *Offset : 50 , Number of Times : 6*
6. *Source Mesh : None*
7. *Property : 2*
8. *Mesh Set : Pier Table*
9. *Click* **[Apply]** *Button*



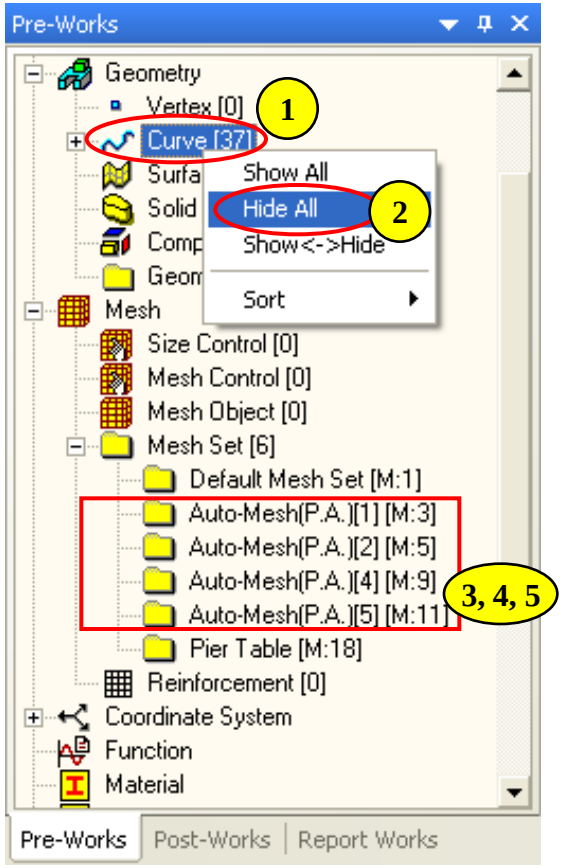
Step 8.

1. Select 4 Meshes (Red in Figure)
2. Extrusion Direction : Y-Axis
3. Offset : -50 , Number of Times : 8
4. Source Mesh : Delete
5. Property : 2
6. Mesh Set - Add to “Pier Table”
7. Check off “As Sub-Set”
8. Click [OK] Button

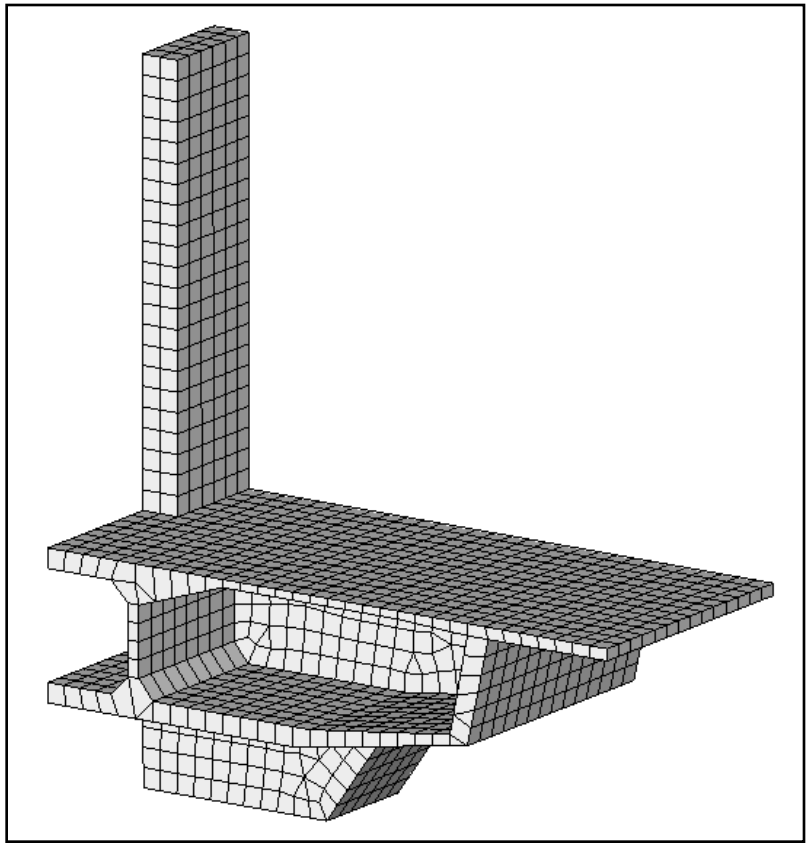




Step 9.

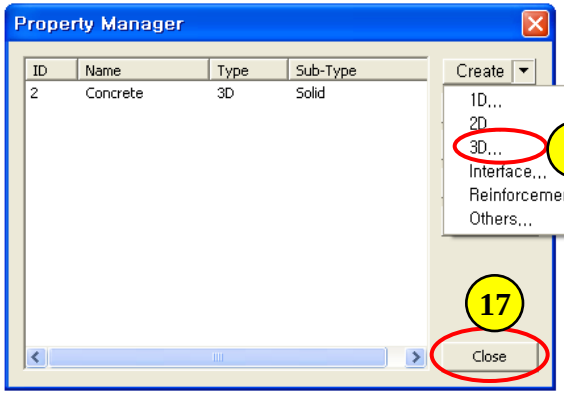


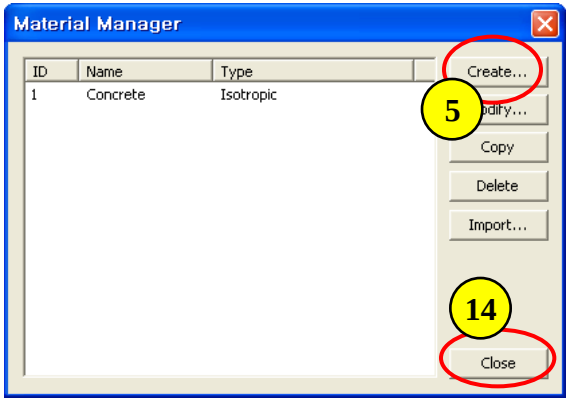
1. *Pre-Works Tree : Geometry > Curve …*
2. *Click Right Mouse Button and Select "Hide All"*
3. *Pre-Works Tree : Mesh > Mesh Set …*
4. *Select All Mesh Sets except "Default Mesh Set" & "Pier Table"*
5. *Press* **[Delete]** *Key*

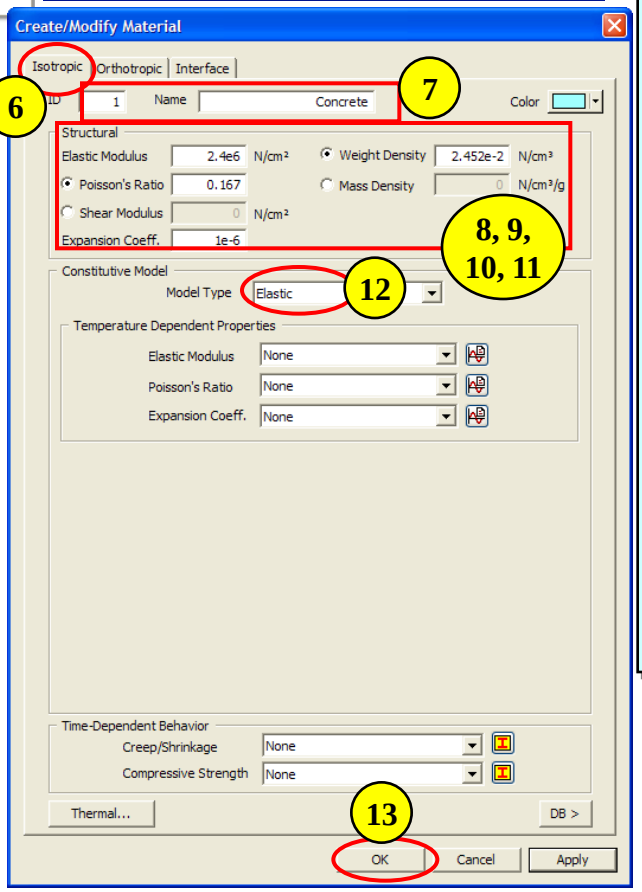


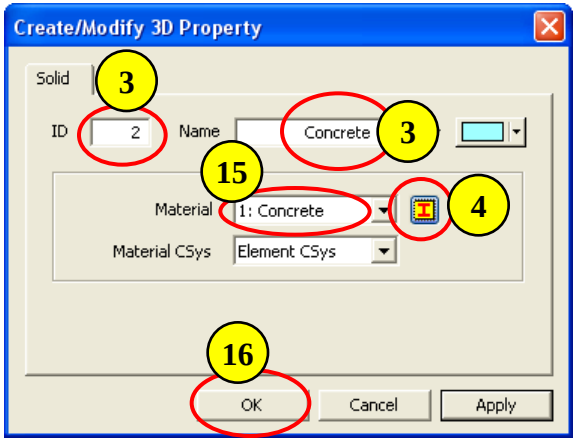
Multiple Selection: "Shift" / "Ctrl" + Click

Step 10.



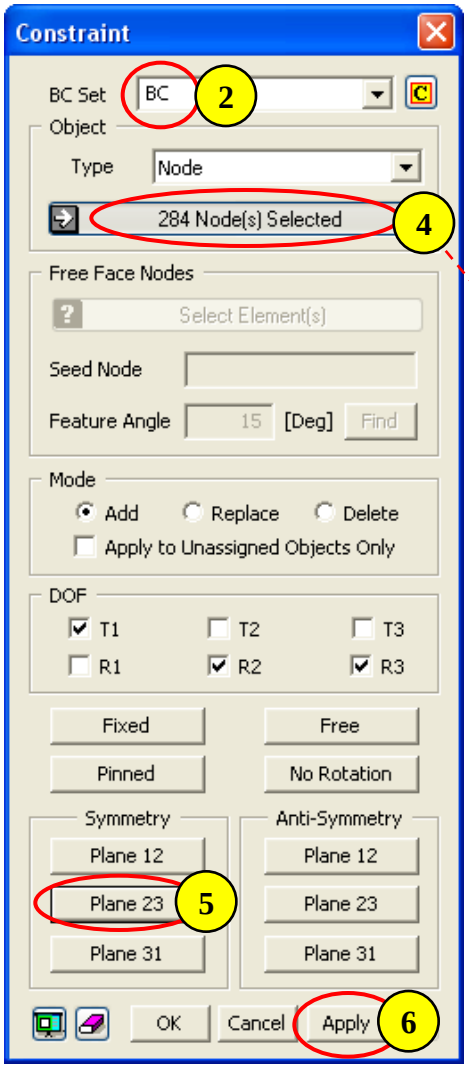


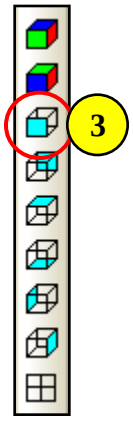




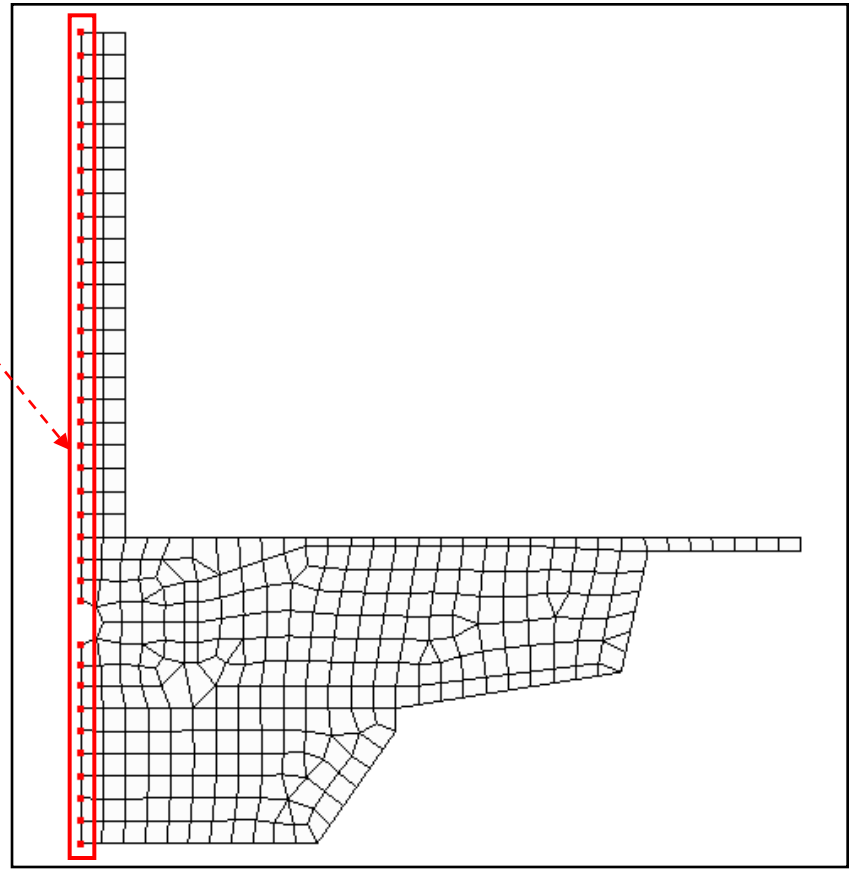
1. *Analysis > Property …*
2. *Create 3D …*
3. *ID : 2 , Name : Concrete*
4. *Click* [I] *Button*
5. *Click* **[Create...]** *Button*
6. *Select "Isotropic" tab*
7. *ID : 1 , Name : Concrete*
8. *Elastic Modulus : 2.4e6 N/cm²*
9. *Poisson's Ratio : 0.167*
10. *Expansion Coeff. : 1e-6*
11. *Weight Density : 2.452e-2 N/cm³*
12. *Model Type : Elastic*
13. *Click* **[OK]** *Button*
14. *Click* **[Close]** *Button*
15. *Select "1: Concrete" for Material*
16. *Click* **[OK]** *Button*
17. *Click* **[Close]** *Button*

Step 11.

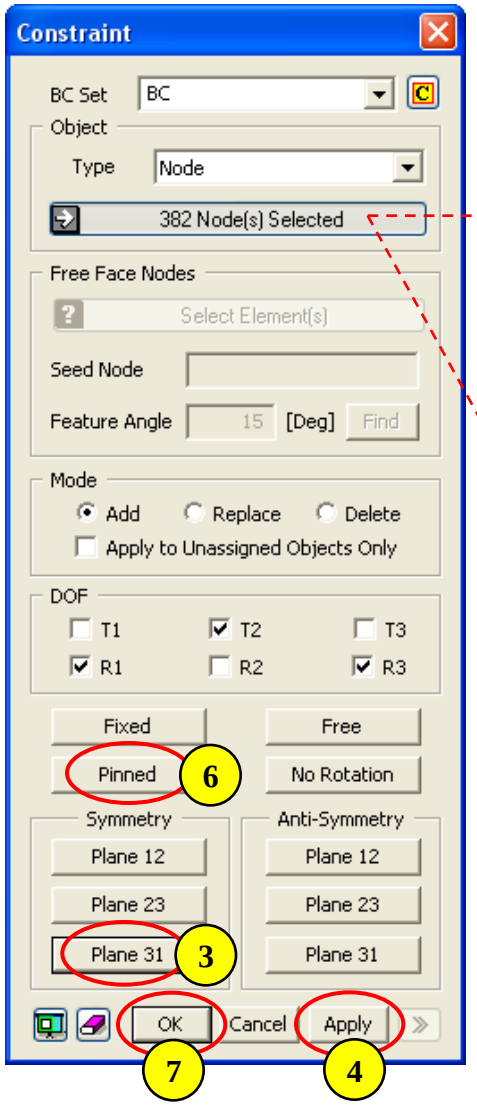


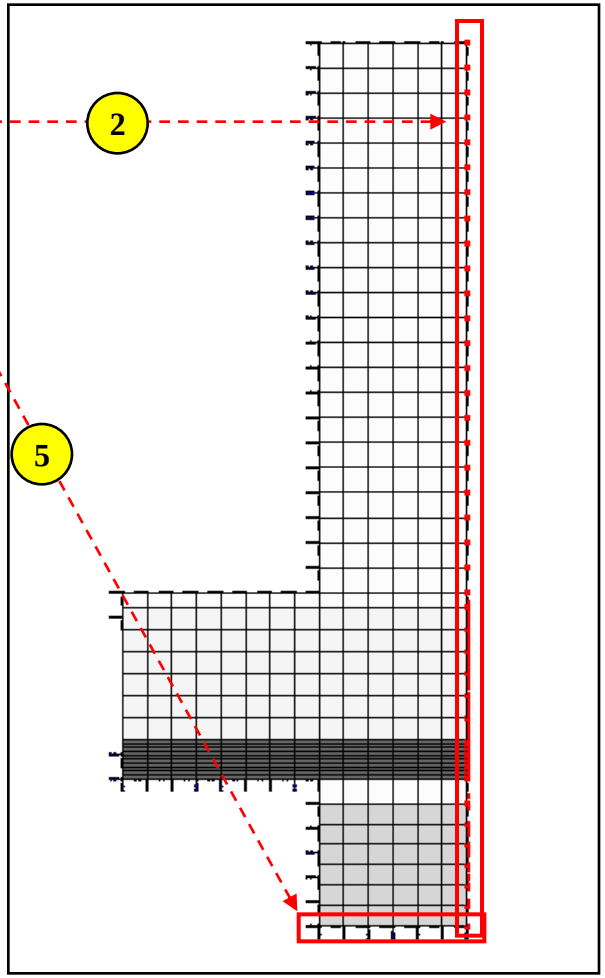


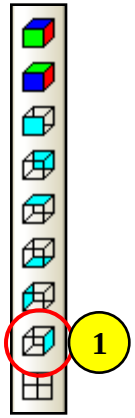
1. *Analysis > BC > Constraint …*
2. *BC Set : BC*
3. *Click "Front View"*
4. *Select Left Nodes (See Figure)*
5. *Click "Symmetry"* – **[Plane 23]** *Button*
6. *Click* **[Apply]** *Button*



Step 12.

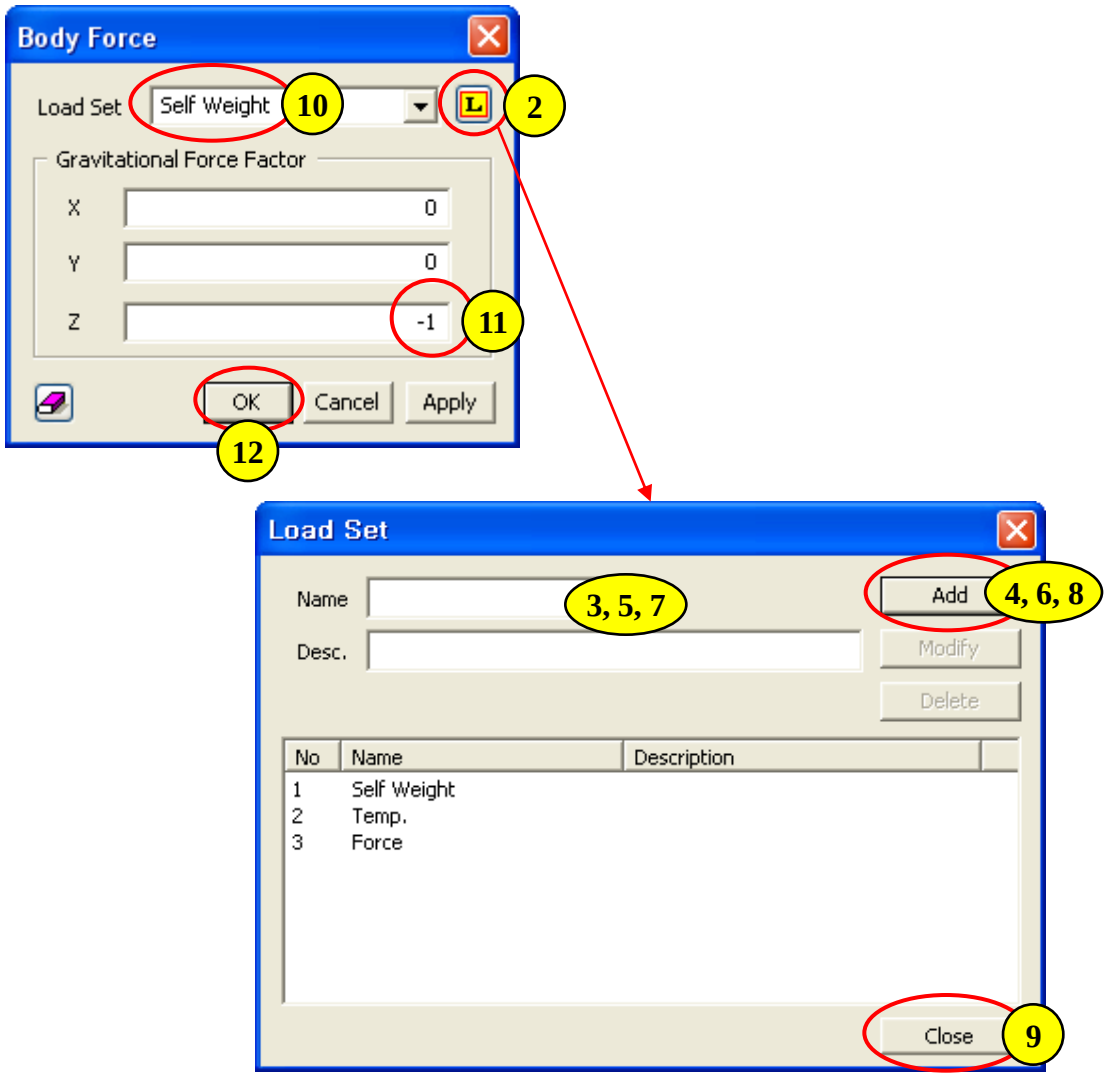






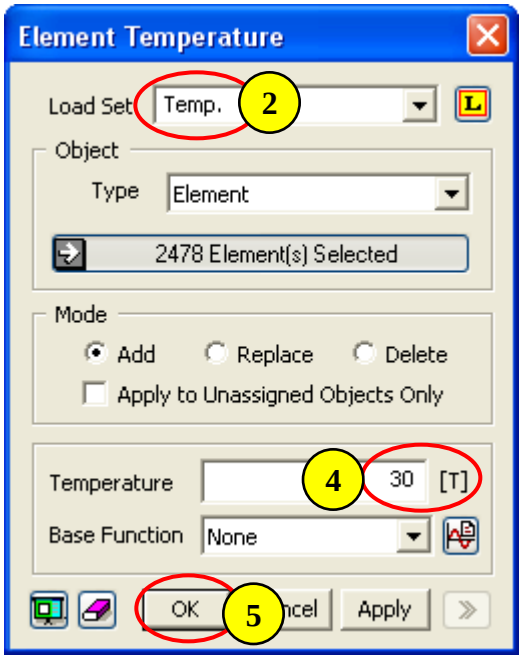
1. *Click "Right View"*
2. *Select Right Nodes (See Figure)*
3. *Click "Symmetry"* – **[Plane 31]** *Button*
4. *Click* **[Apply]** *Button*
5. *Select Bottom Nodes (See Figure)*
6. *Click* **[Pinned]** *Button*
7. *Click* **[OK]** *Button*

Step 13.

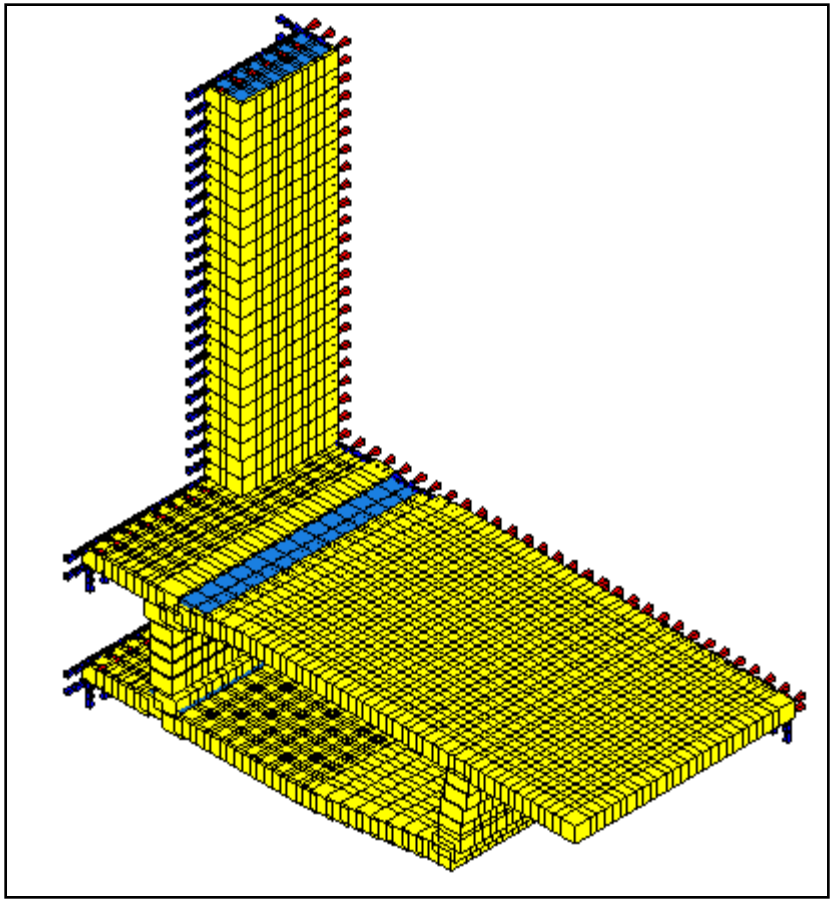


1. *Analysis > Load > Body Force …*
2. *Click* [L] *Button*
3. *Name : Self Weight*
4. *Click* **[Add]** *Button*
5. *Name : Temp.*
6. *Click* **[Add]** *Button*
7. *Name : Force*
8. *Click* **[Add]** *Button*
9. *Click* **[Close]** *Button*
10. *Load Set : Self Weight*
11. *Z : -1*
12. *Click* **[OK]** *Button*

Step 14.

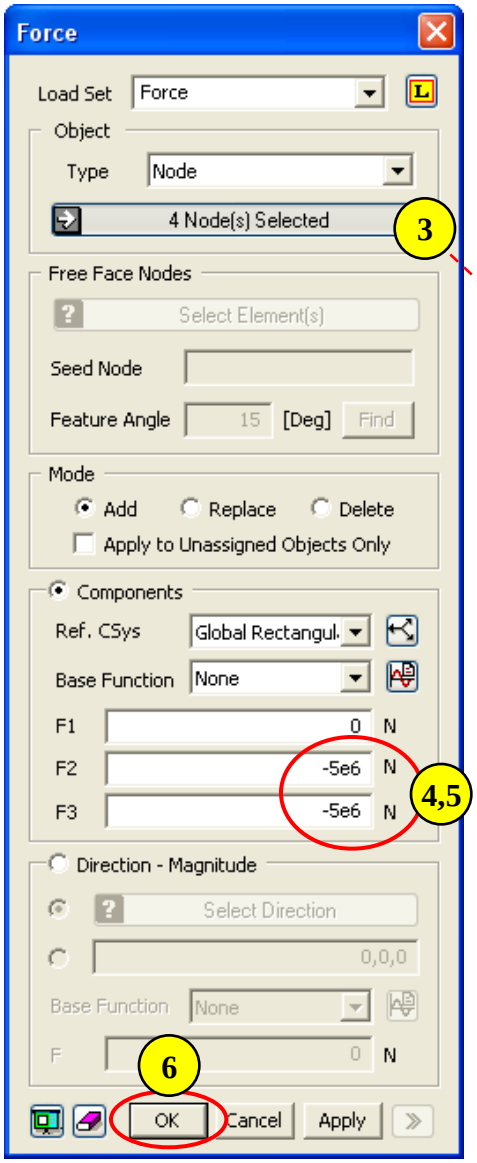


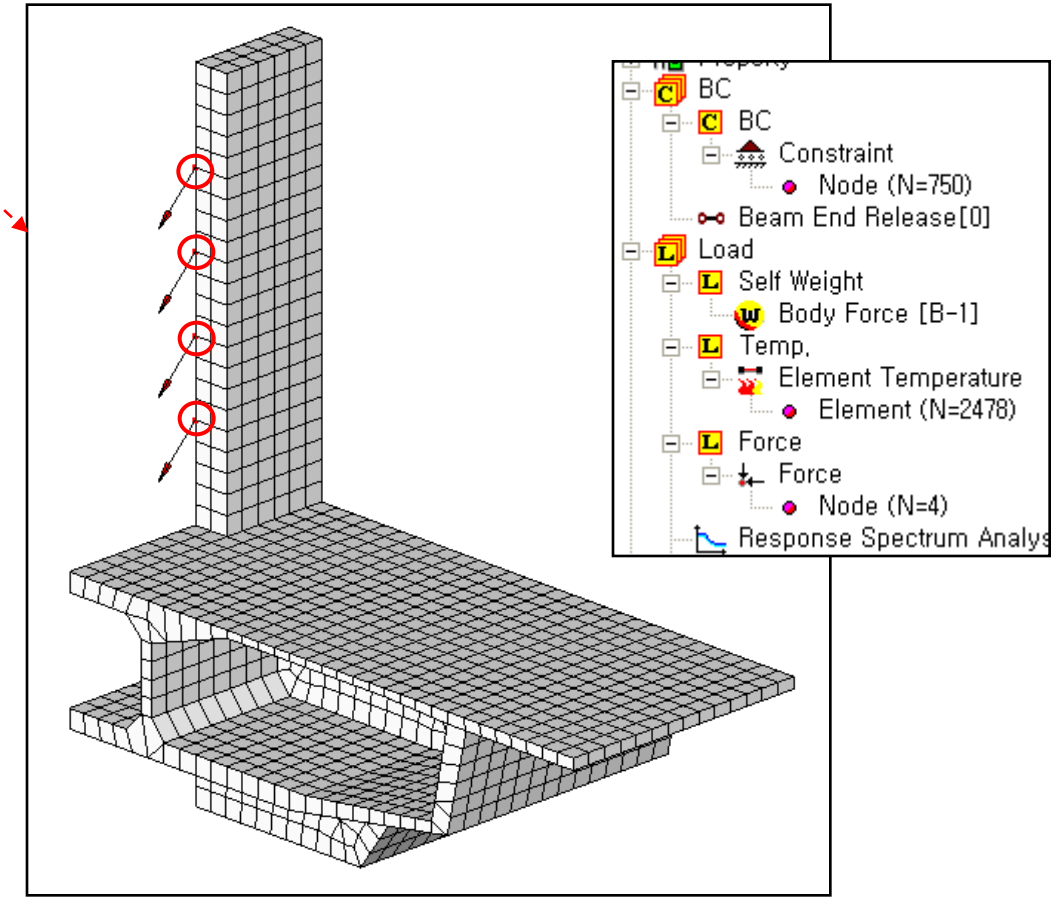
1. *Analysis > Load > Element Temperature …*
2. *Load Set : Temp.*
3. *Select* *"Displayed"*
4. *Temperature : 30*
5. *Click* **[OK]** *Button*



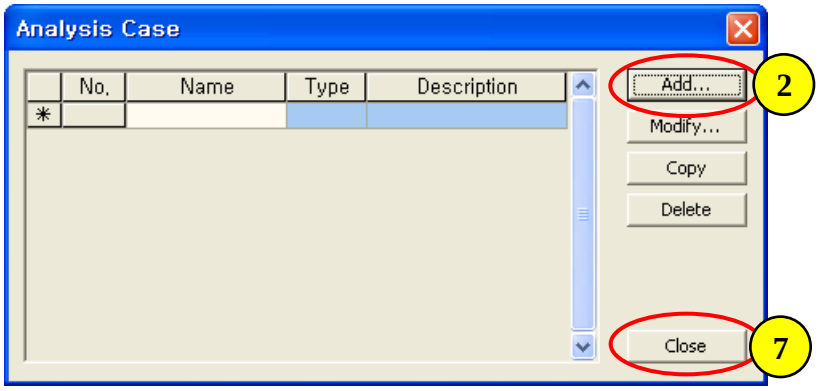
Step 15.

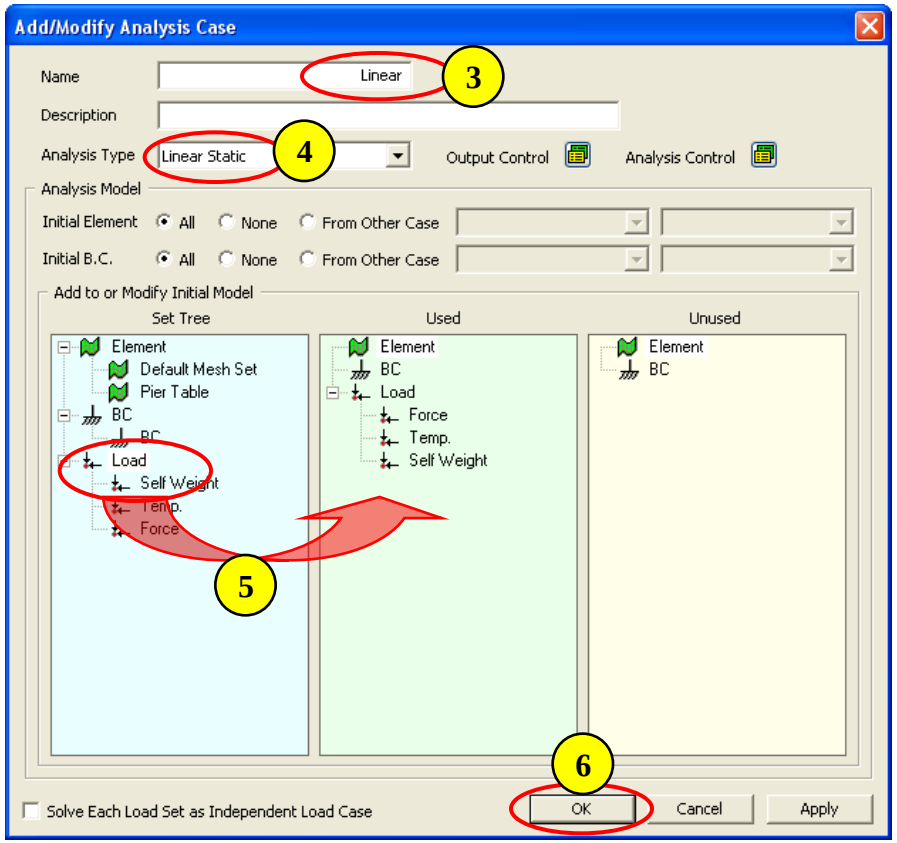
1. *Analysis > Load > Force …*
2. *Load Set : Force*
3. *Select 4 Nodes marked by "O" (See Figure)*
4. *F2 : -5e6 N*
5. *F3 : -5e6 N*
6. *Click* **[OK]** *Button*



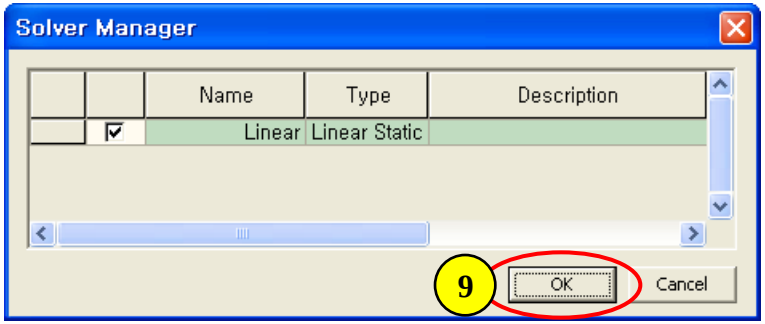


Step 16.





1. *Analysis > Analysis Case …*
2. *Click* [Add] *Button*
3. *Name : Linear*
4. *Analysis Type : Linear Static*
5. *Drag & Drop "Load" to "Used" Window*
6. *Click* [OK] *Button*
7. *Click* [Close] *Button*
8. *File > Save… (Pier Table.feb)*
9. *Analysis > Solve ...*
10. *Click* [OK] *Button*



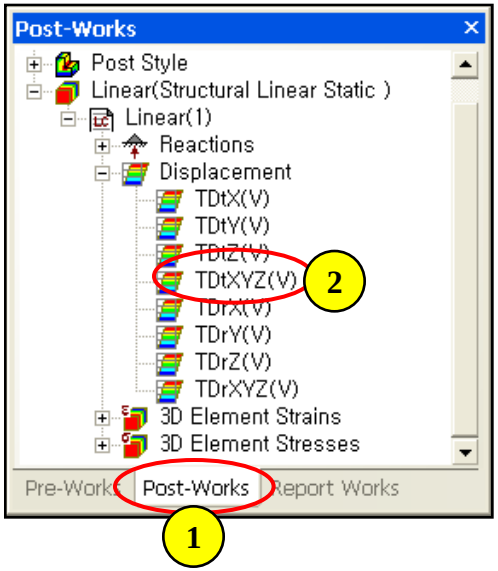
Post-Processing

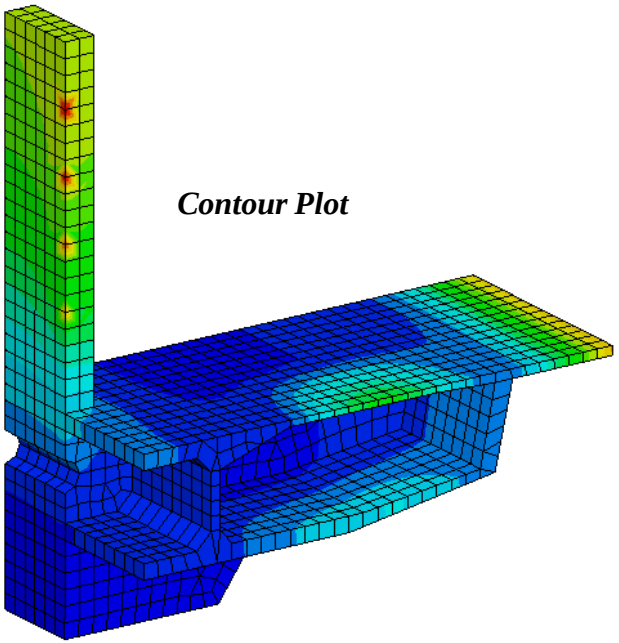
Complete Support for Visualization and Interpretation

- *Works Tree, toolbar and Property Window-based operation and manipulation*
- *Flexible User-control on Legends, Colors, Fonts, Magnification, etc.*
- *Multiple Plots, Graphs and Tables in Multiple Windows*
- *Deformed Shape Combined with Undeformed Shape (including Mode Shape)*
- *Local Plots defined by Geometrical Topology or User-selection*
- *Contour Plots and Animations (AVI)*
- *Iso-value Lines (2D) and Surfaces (3D)*
- *Clipping Planes and Slice Lines/Planes*
- *Partitioned Plots*
- *History Plots in Various Graphs and Animations (AVI)*
- *Result Values in MS-Excel compatible Tables*
- *Result Probe and Extraction*
- *Result Extraction for Construction Stage Analysis and Transient Analysis*
- *Screen-shots in WMF, BMP, PNG Picture Formats*
- *State-of-the-art Reports Generated by XML and HTML*

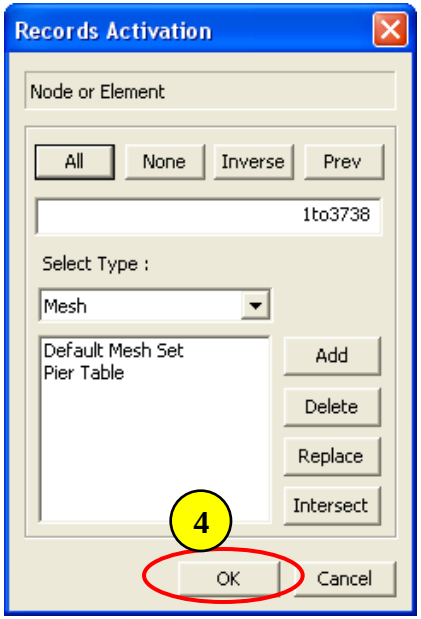
Post-Processing

1. *Post-Works Tree : Linear(Structural Linear Static) > Linear(1) > Displacement*
2. *Double Click "TDtXYZ(V)"*
3. *Right Click "TDtXYZ(V)" and Select Table*
4. *Click* **[OK]** *Button*





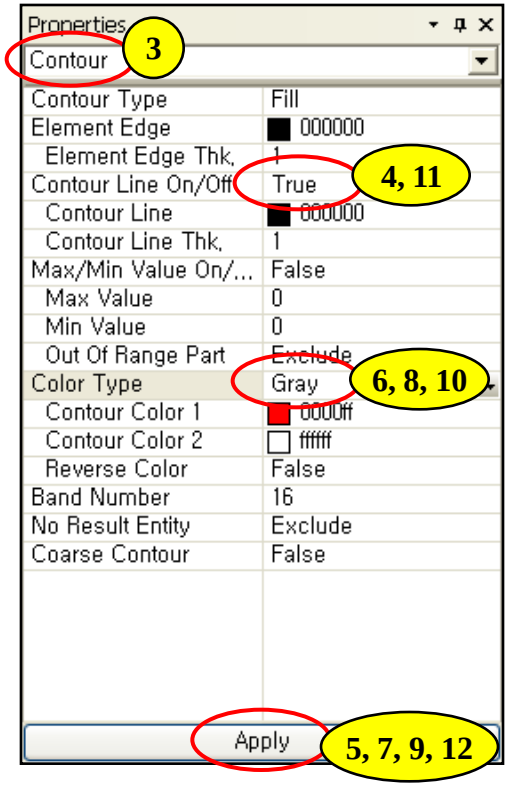
Contour Plot

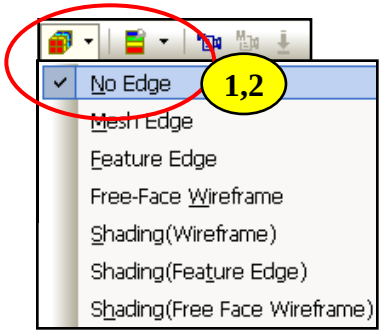


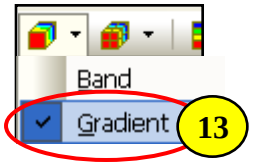
	No	TDtX(V) (cm)	TDtY(V) (cm)	TDtZ(V) (cm)
	1	1.299e-002	-1.264e-002	-1.698e-002
	2	1.352e-002	-1.182e-002	-1.391e-002
	3	5.156e-002	-1.113e-002	-4.141e-002
	4	5.253e-002	-1.139e-002	-4.784e-002
	5	7.006e-003	-1.427e-002	-2.559e-002
	6	8.109e-002	-1.159e-002	-3.417e-001
	7	7.950e-002	-1.150e-002	-2.867e-001

Result Table

Contour Plot Type

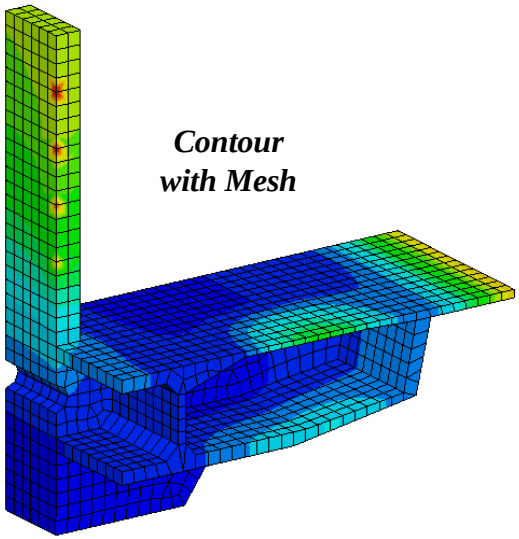


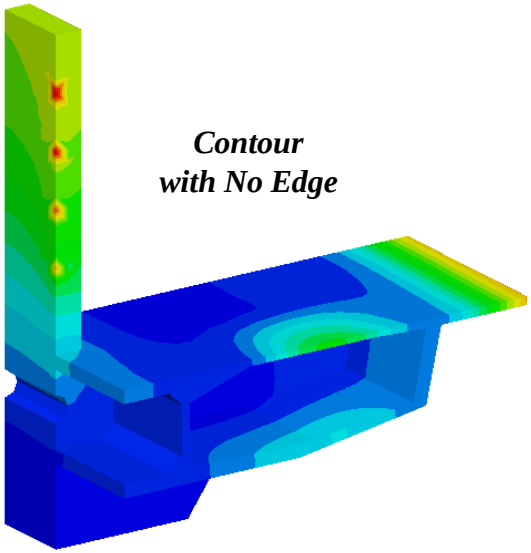


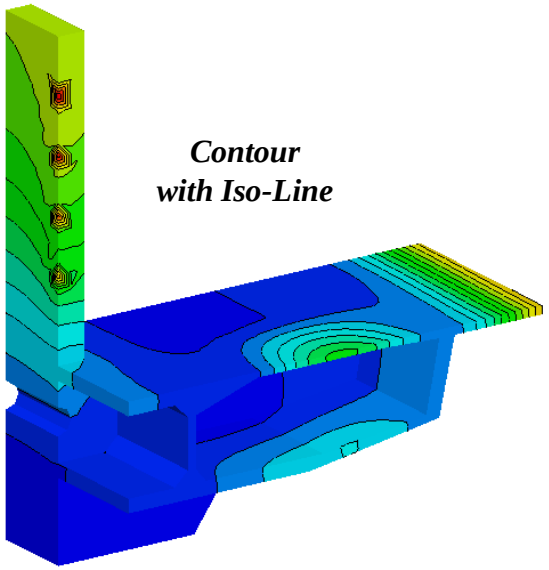


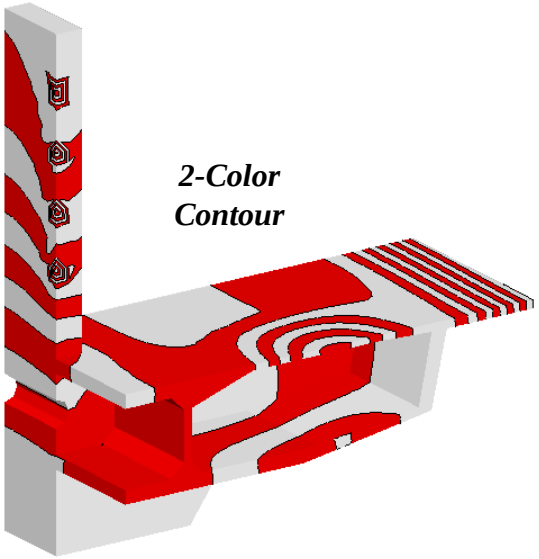
1. *Click “Post Style” Toolbar*
2. *Select “No Edge” for Edge Type*
3. *Property Window : Contour*
4. *Select “True” for Contour Line On/Off*
5. *Click* **[Apply]** *Button*
6. *Select “Repeat Two Colors” for Color Type*
7. *Click* **[Apply]** *Button*
8. *Select “Gray” for Color Type*
9. *Click* **[Apply]** *Button*
10. *Select “ RGB” for Color Type*
11. *Select “False” for Contour Line On/Off*
12. *Click* **[Apply]** *Button*
13. *Select “Gradient” for Contour Type*

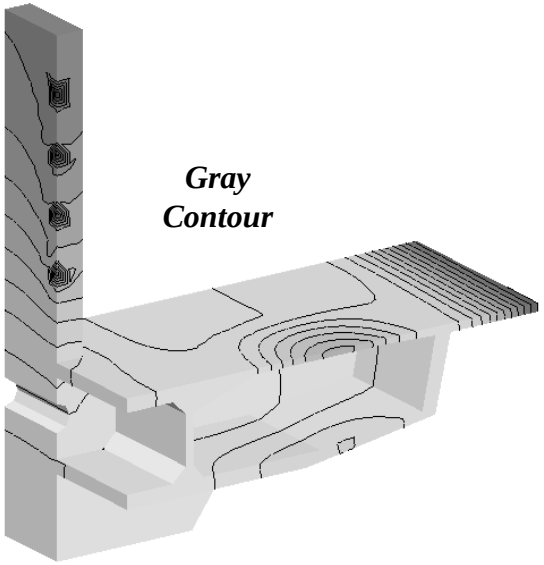
Contour Plot Type

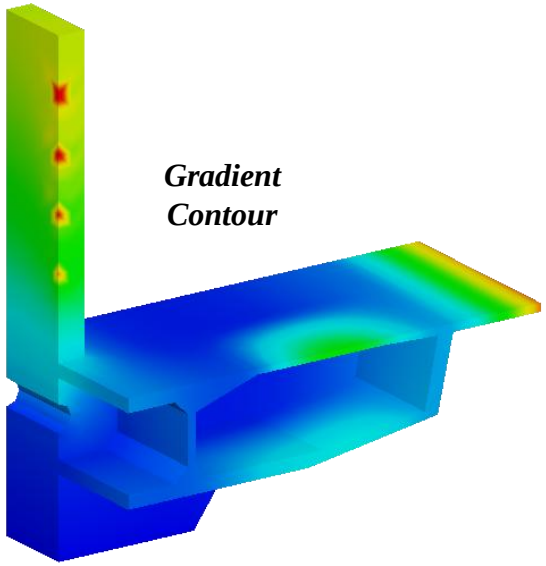






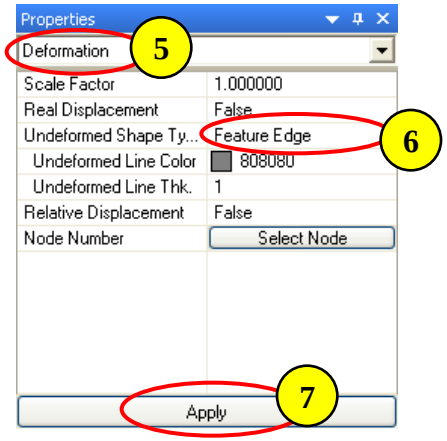


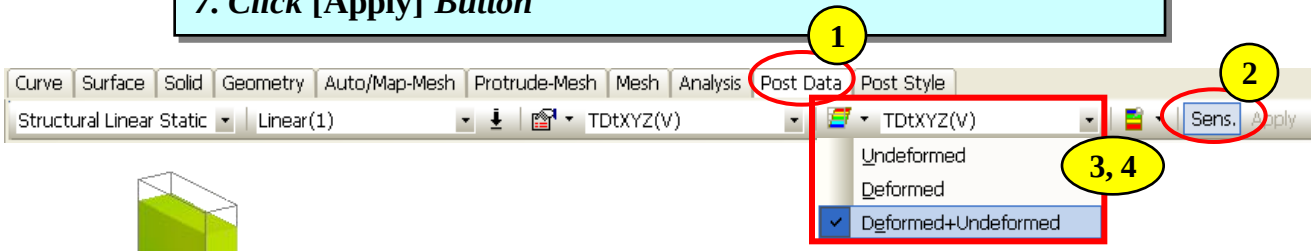


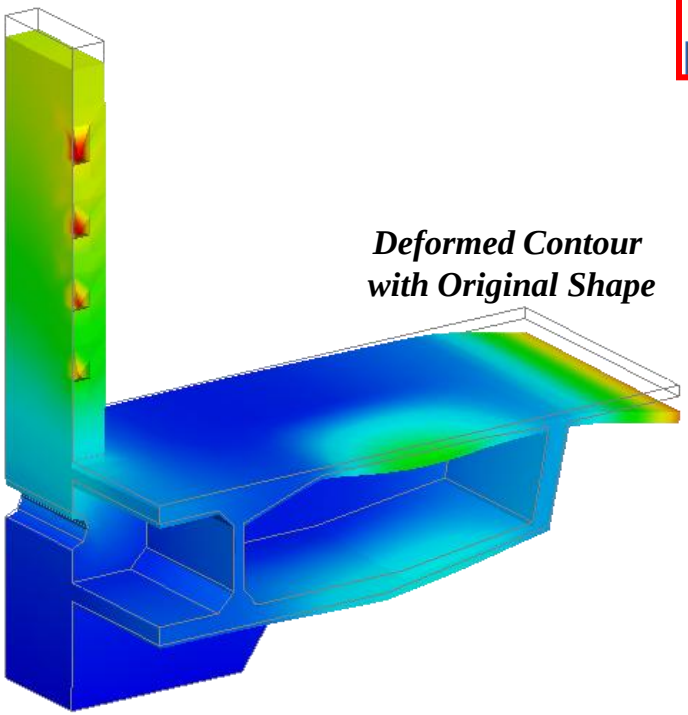


Deformed Shape

1. Click “Post Style” Toolbar
2. Click “Sens.” Button
3. Select “Deformed+Undeformed” for Mesh Shape (See Figure)
4. Select “TDtXYZ(V)” for Deformation Data
5. Property Window : Deformation
6. Undeformed Shape Type : Feature Edge
7. Click [Apply] Button

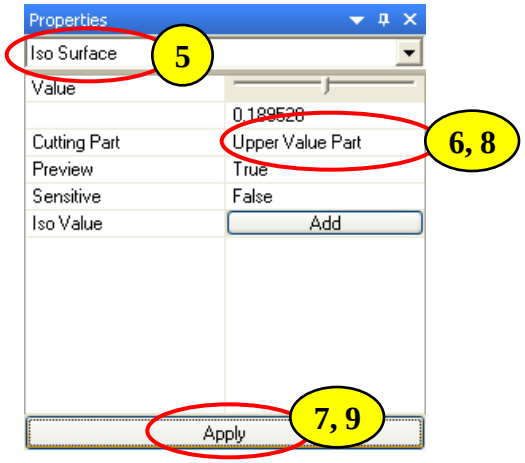


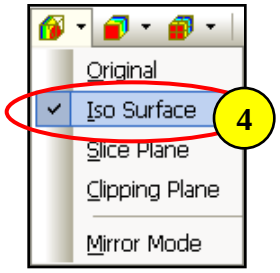


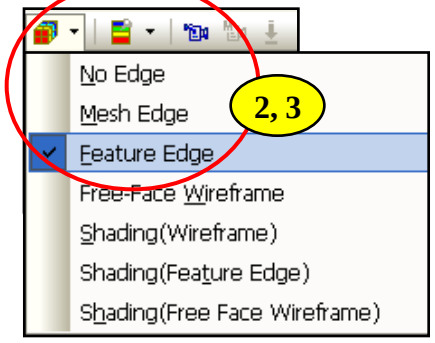


Deformed Contour with Original Shape

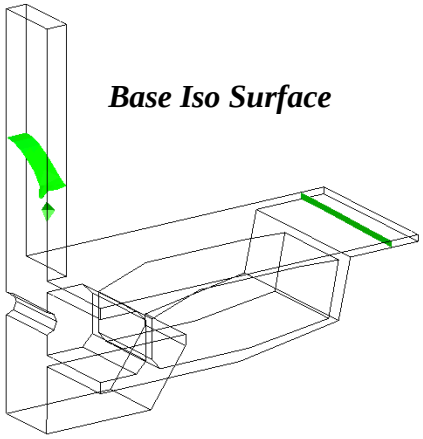
Iso-Surface Plot



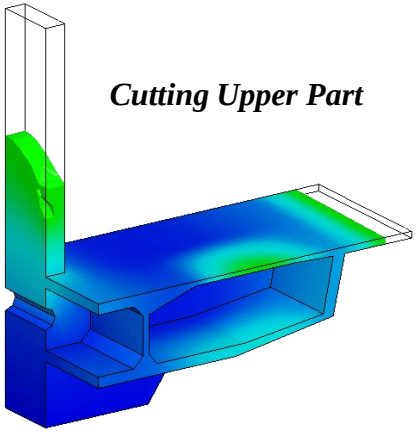




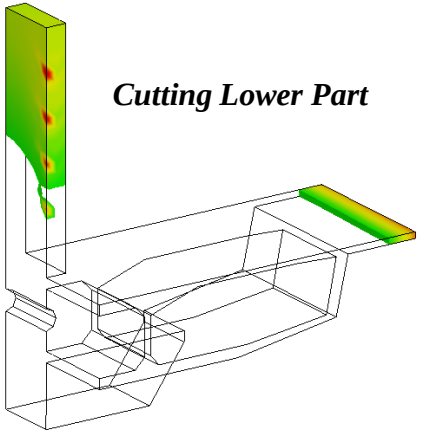
1. *Select "Undeformed" for Mesh Shape*
2. *Click "Post Style" Toolbar*
3. *Select "Feature Edge" for Edge Type*
4. *Select "Iso Surface" for Visualization*
5. *Property Window : Iso Surface*
6. *Select "Upper Value Part" for Cutting Part*
7. *Click* **[Apply]** *Button*
8. *Select "Lower Value Part" for Cutting Part*
9. *Click* **[Apply]** *Button*



Base Iso Surface

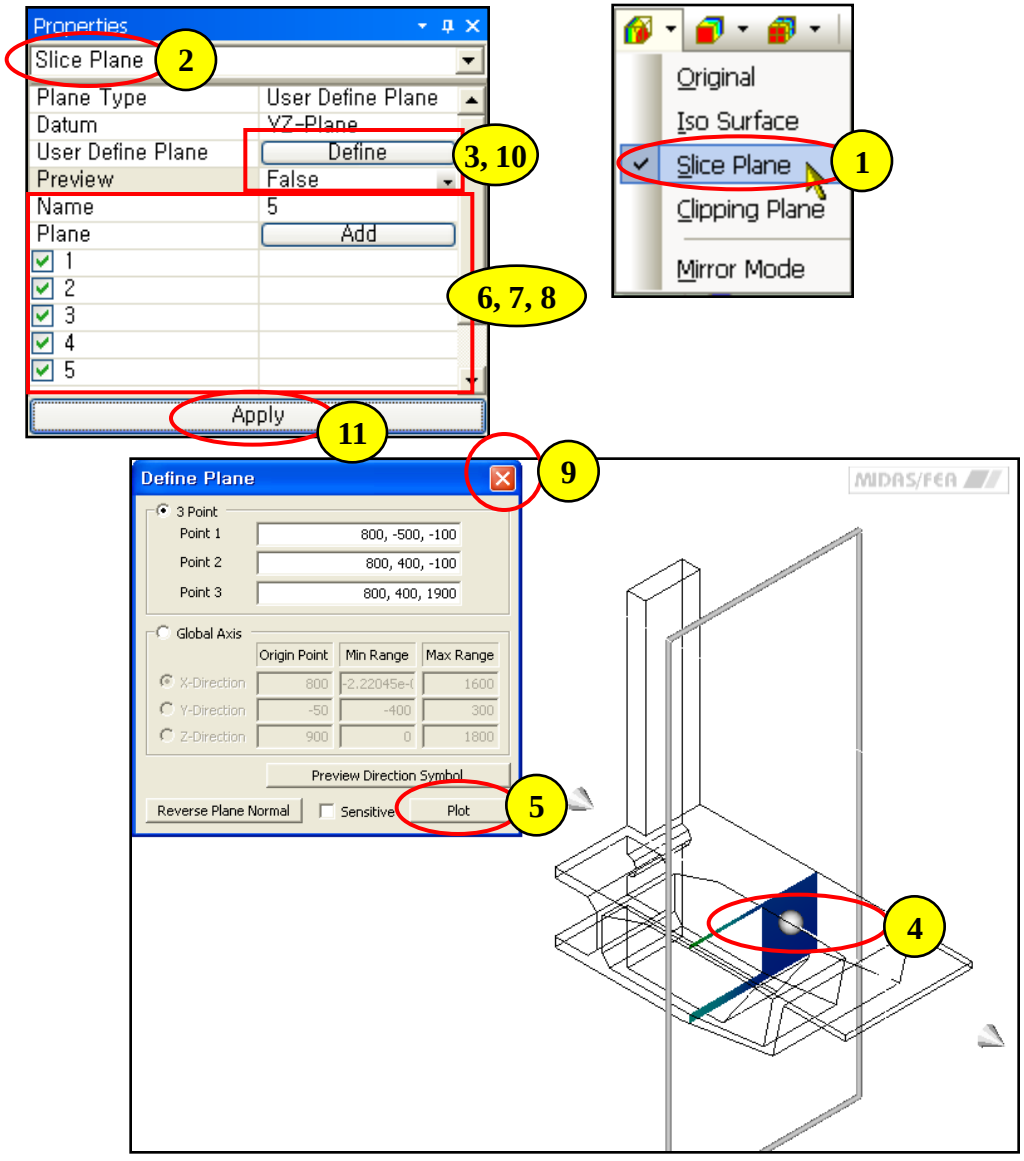


Cutting Upper Part

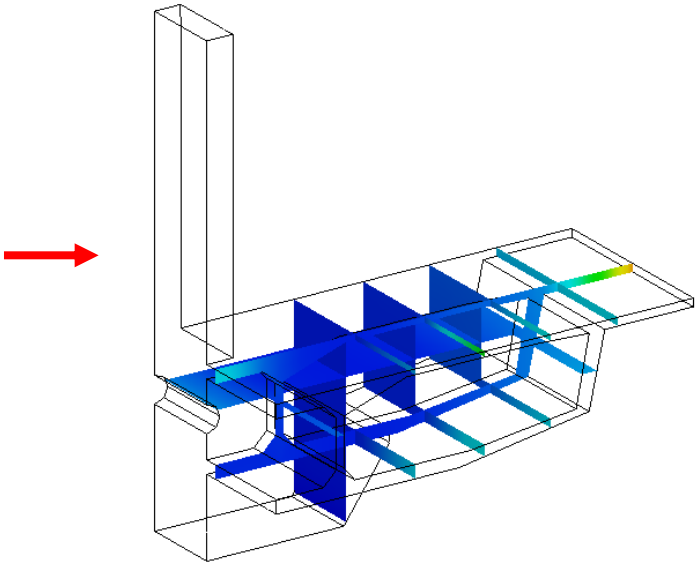


Cutting Lower Part

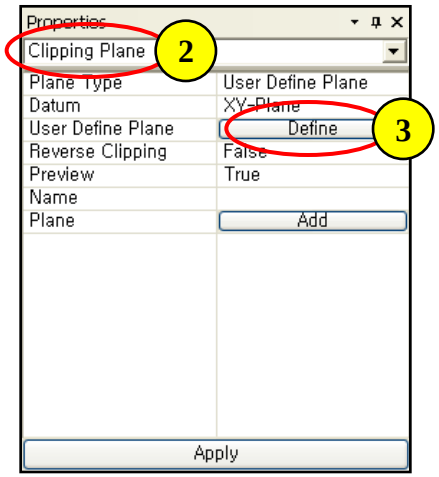
Slice Plot

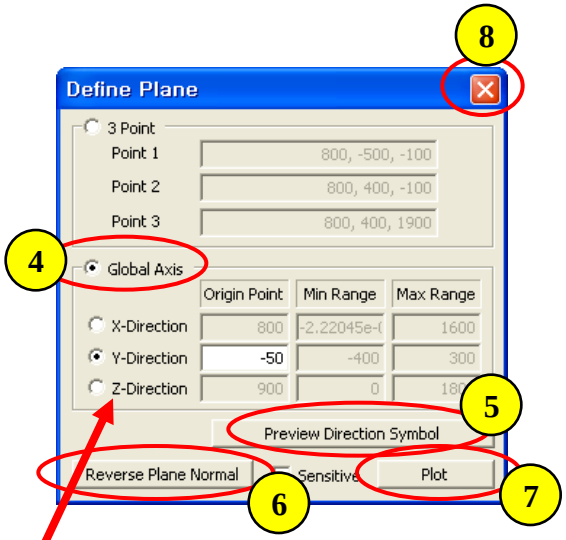


1. *Select "Slice Plane" for Visualization*
2. *Property Window : Slice Plane*
3. *Click* **[Define]** *Button*
4. *Move Slice Plane by Mouse Dragging*
5. *Click* **[Plot]** *Button*
6. *Input "Name"*
7. *Click* **[Add]** *Button*
8. *Repeat Step 4~7*
9. *Click* **[X]** *Button*
10. *Select "False" for Preview*
11. *Click* **[Apply]** *Button*

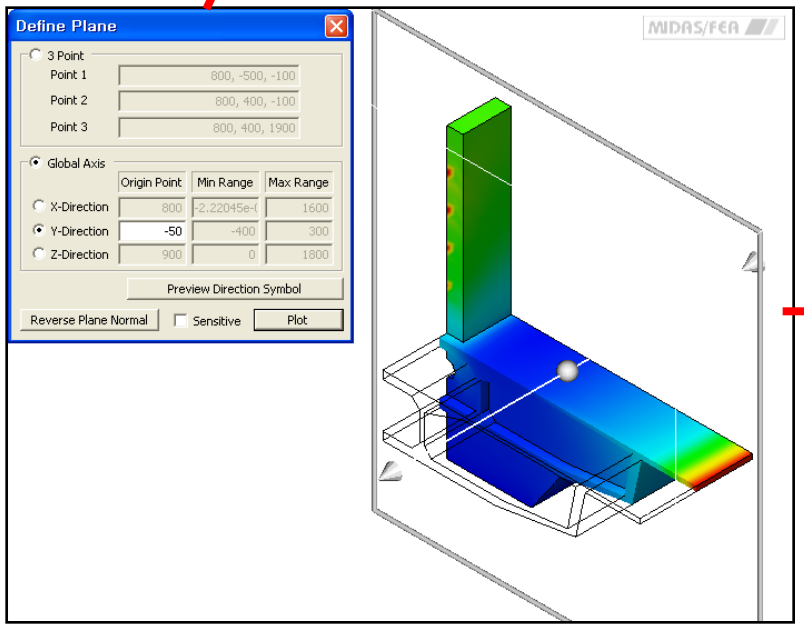


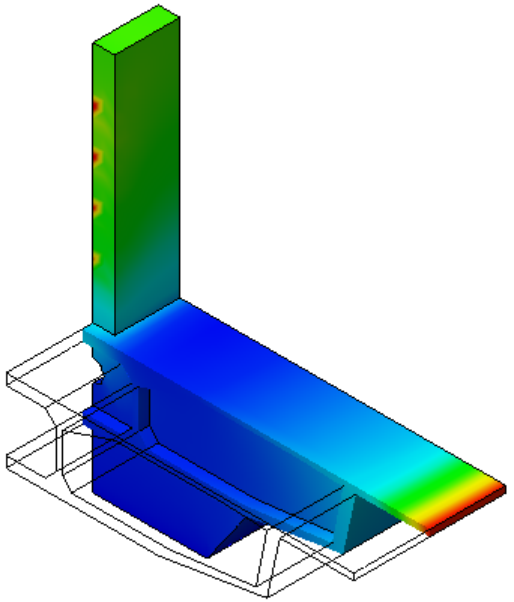
Clipping Plot





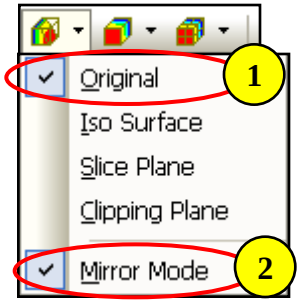
1. *Select "Clipping Plane" for Visualization*
2. *Property Window : Clipping Plane*
3. *Click* **[Define]** *Button*
4. *Check on "Global Axis" - "Y-Direction"*
5. *Click* **[Preview Direction Symbol]** *Button*
6. *Click* **[Reverse Plane Normal]** *Button*
7. *Click* **[Plot]** *Button*
8. *Click* **[X]** *Button*

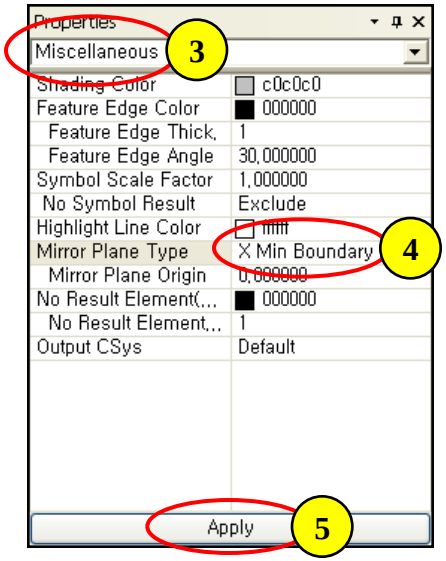


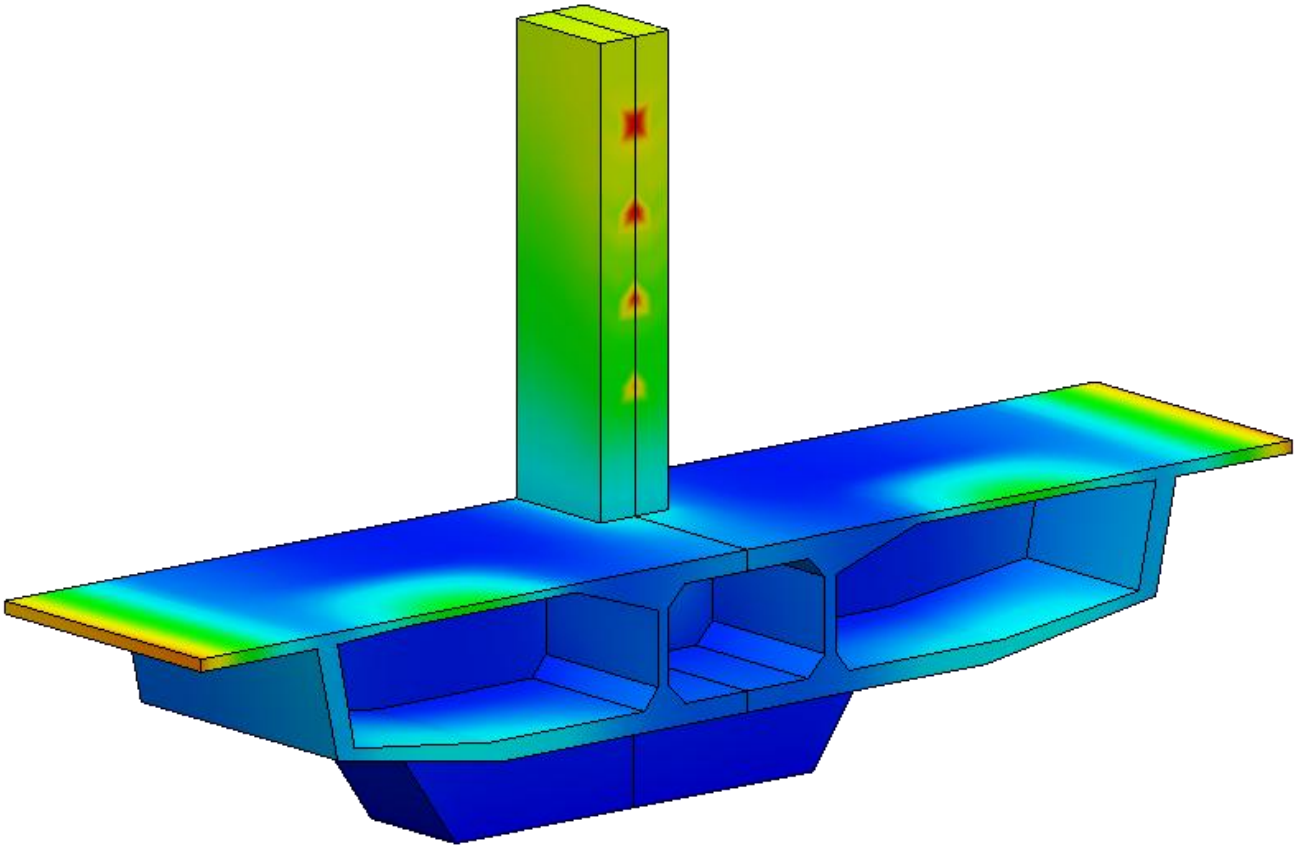


Mirror Mode

1. Select “Original” for Visualization
2. Select “Mirror Mode” for Visualization
3. Property Window : Miscellaneous
4. Select “X Min Boundary” for Mirror Plane Type
5. Click [Apply] Button

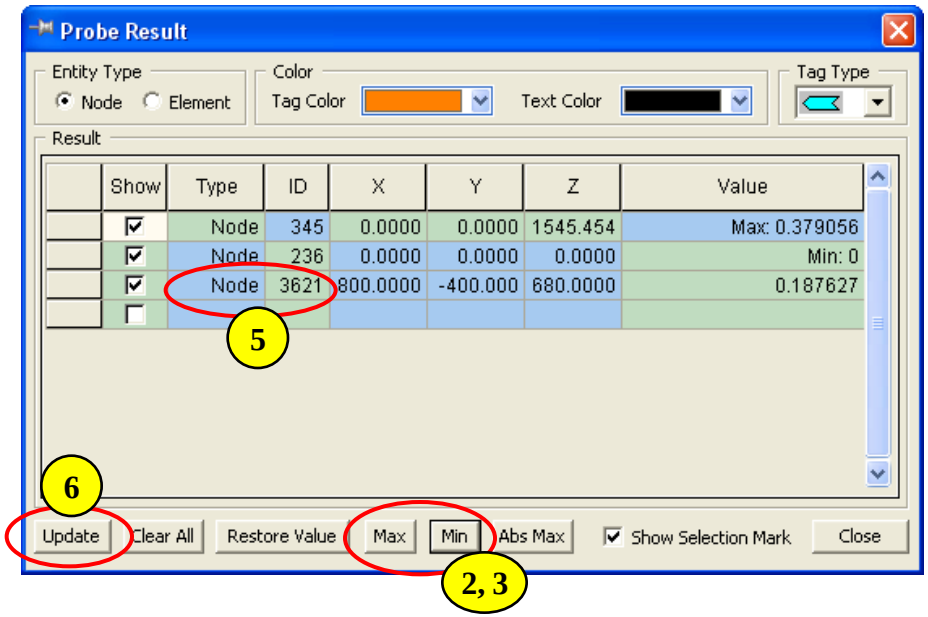


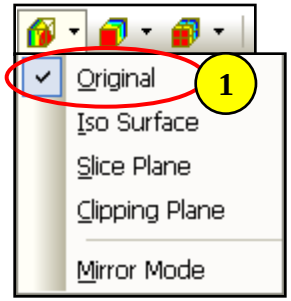


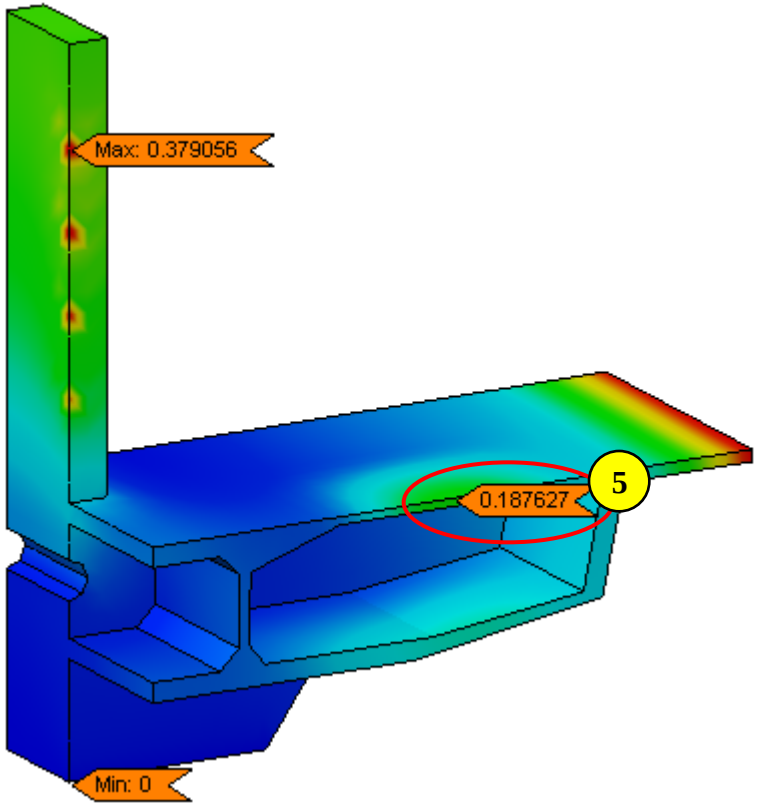


Probe & Result Tag

1. *Select "Mirror Mode" again (to Disable Mirror Mode)*
2. *Post > Probe Result …*
3. *Click "Max" Button*
4. *Click "Min" Button*
5. *Enter Node ID(3621)*
6. *Click* **[Update]** *Button*

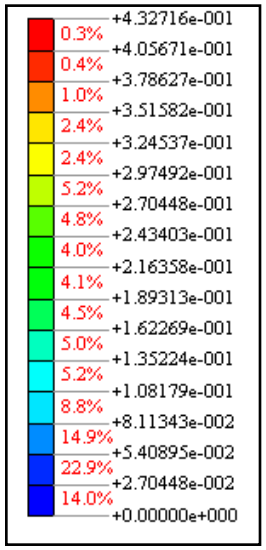


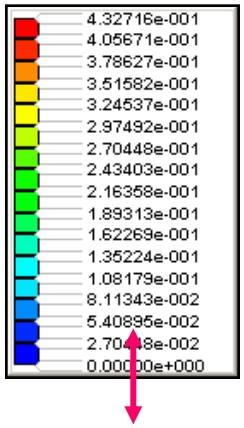




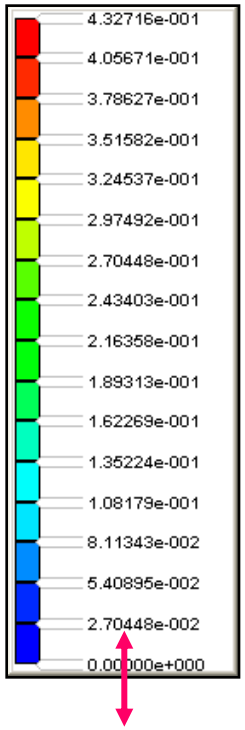
Same as click node on Work Window.

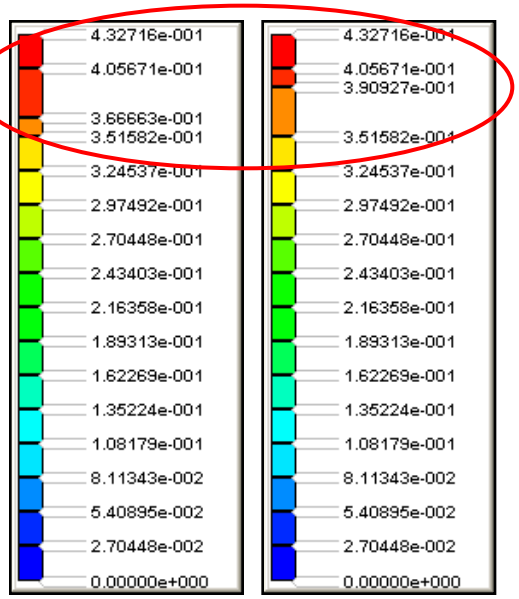
Legend Control



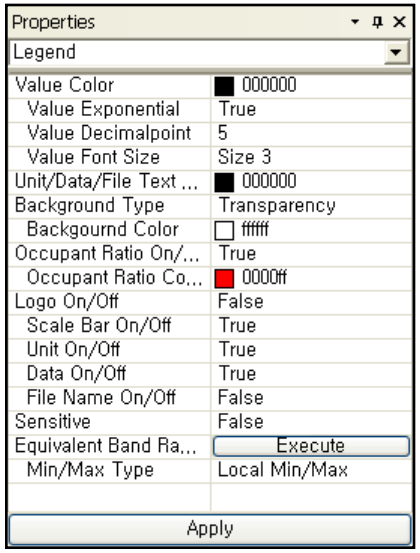


Drag side to resize legend box





Drag scale bar to change range



Property Window (Legend Option)

- ***Legend Option:***
  - ***Color (Value, Ratio, Description)***
  - ***Logo***
  - ***Range (including Min/Max/Zero)***
  - ***Format (Fixed/Scientific, Width)***