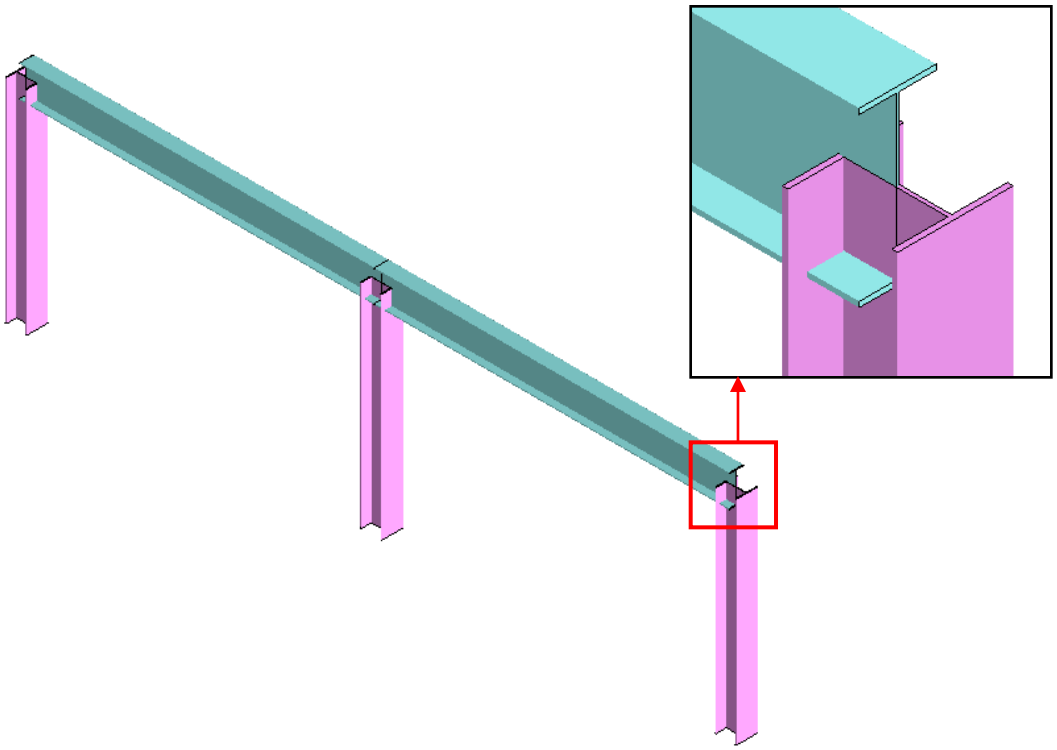
LS-2. Plane Frame

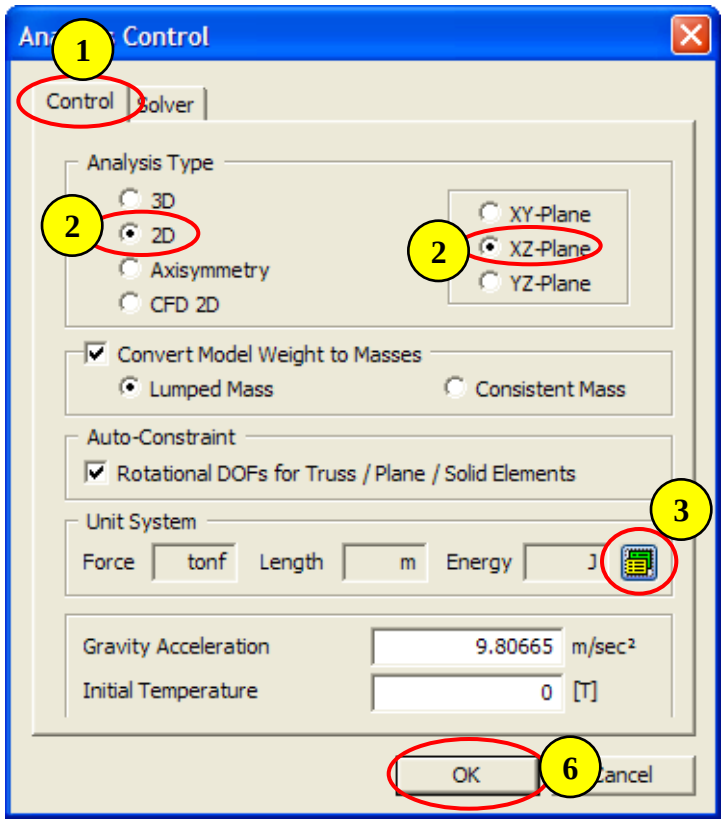


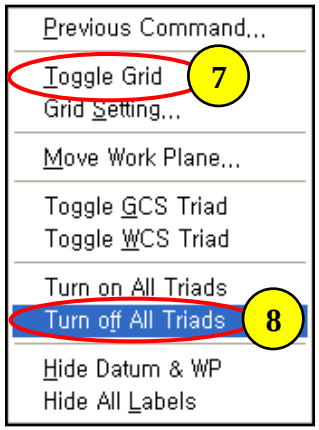
Overview

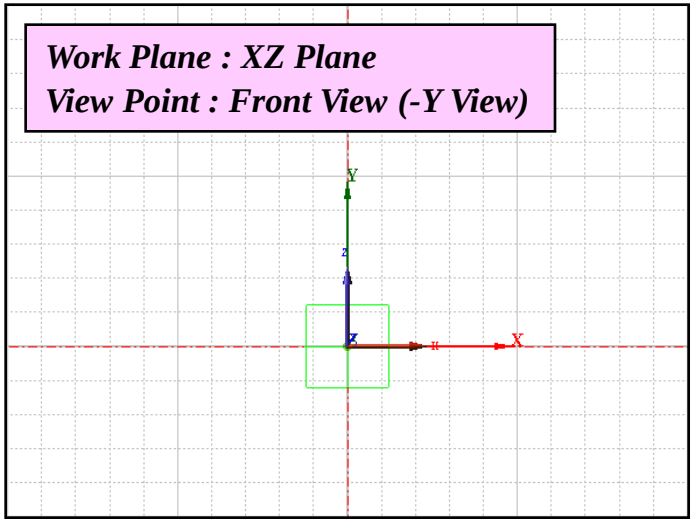
- 2-D Linear Static Analysis
- Model
  - *Unit : tonf, m*
  - *Isotropic Elastic Material*
  - *Beam Elements*
- Load & Boundary Condition
  - *Beam Load*
  - *Nodal Force*
  - *Constraint*
  - *Beam End Release*
- Result Evaluation
  - *Deformation*
  - *Result Combination*
  - *Moment Diagram*

Step 1.

1. *Analysis > Analysis Control - Control tab*
2. *Analysis Type : 2D, XZ-Plane*
3. *Click Button (Unit System)*
4. *Force (Mass) : tonf (ton)*
5. *Click* [OK] *Button*
6. *Click* [OK] *Button*
7. *Click Right Mouse Button in Work Window and Select "Toggle Grid"*
8. *Click Right Mouse Button in Work Window and Select "Turn off All Triads"*

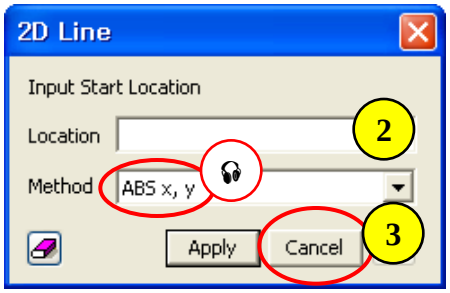


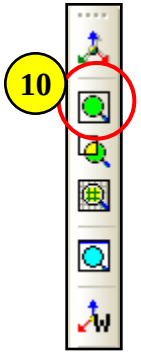


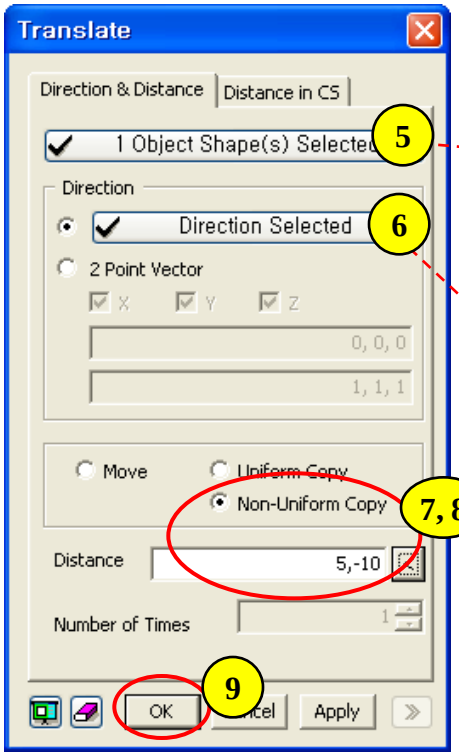


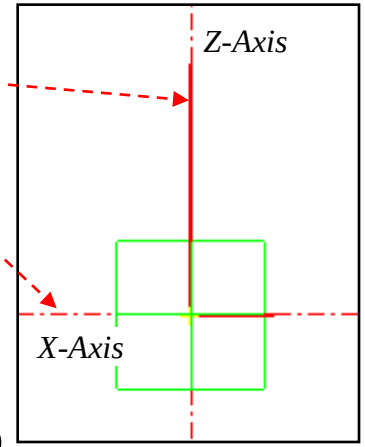
Work Plane and View Point are automatically changed.

Step 2.

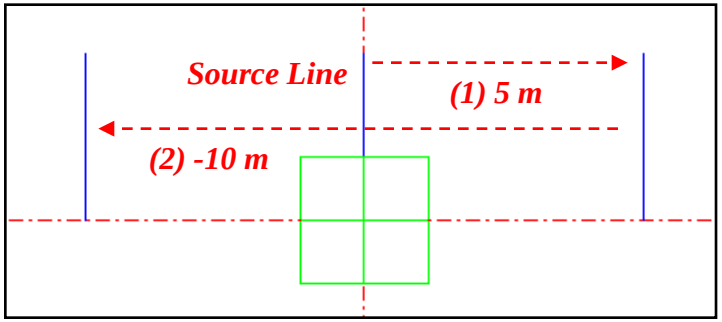






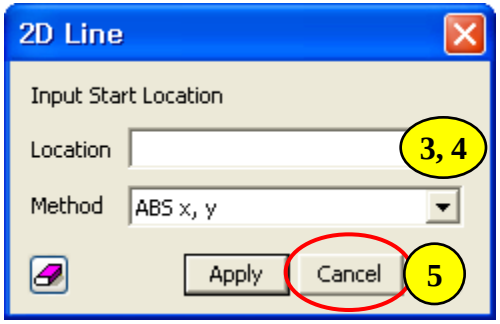


1. *Geometry > Curve > Create on WP > Line…*
2. *SL(0) , EL<0, 3>*
3. *Click* **[Cancel]** *Button*
4. *Geometry > Transform > Translate…*
5. *Select "Line" in Work Window*
6. *Direction : X-Axis*
7. *Option : Non-Uniform Copy*
8. *Distance : 5, -10*
9. *Click* **[OK]** *Button*
10. *Click "Zoom All"*
11. *Click Right Mouse Button in Work Window and Select "Hide Datum & WP"*

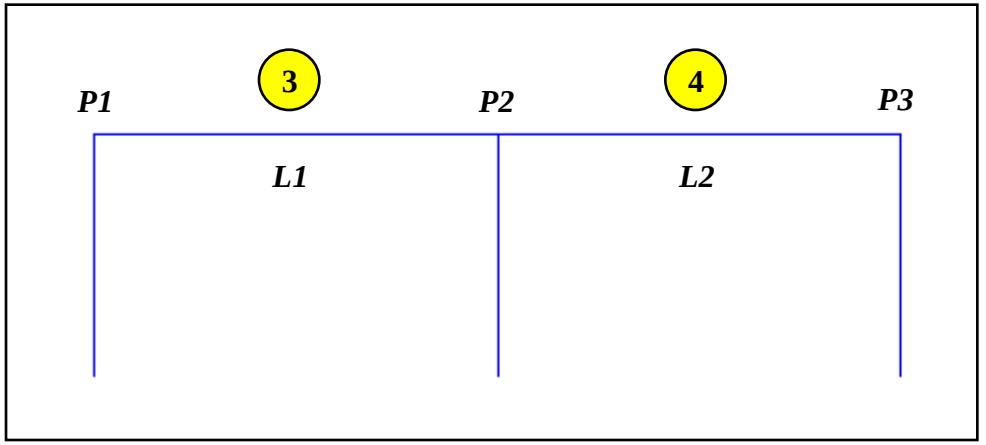


- *(): "ABS x, y", <>: "REL dx, dy"*
  (0) same as (0, 0)
- **[Esc]** *as shortcut for* **[Cancel]**.

Step 3.

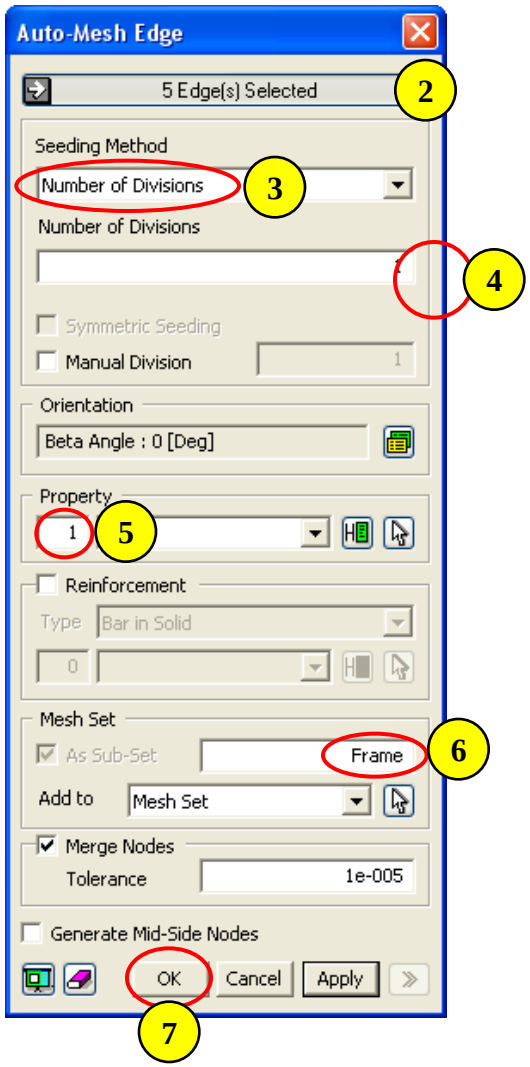


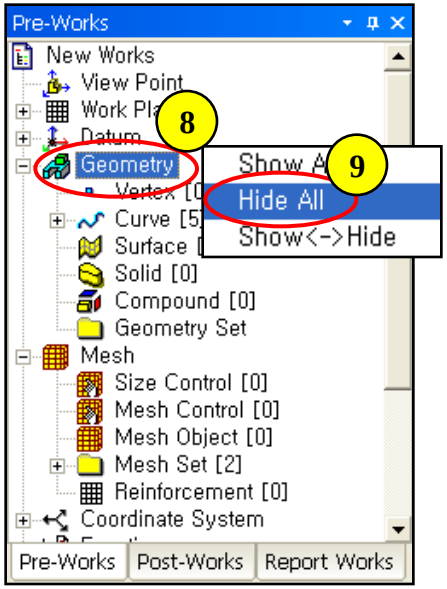
1. *Geometry > Curve > Create on WP > Line…*
2. *Toggle on "Vertex" Snap*
3. *Draw Line L1 by Clicking P1 & P2*
4. *Draw Line L2 by Clicking P2 & P3*
5. *Click* **[Cancel]** *Button*

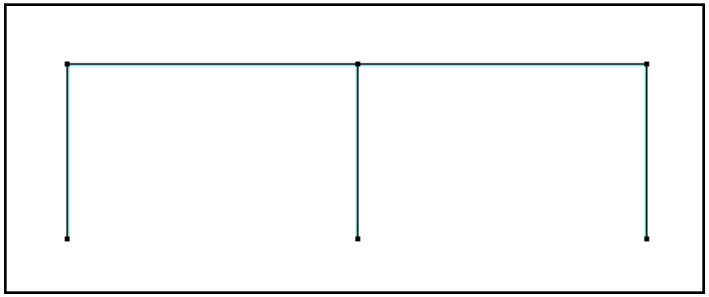


Step 4.

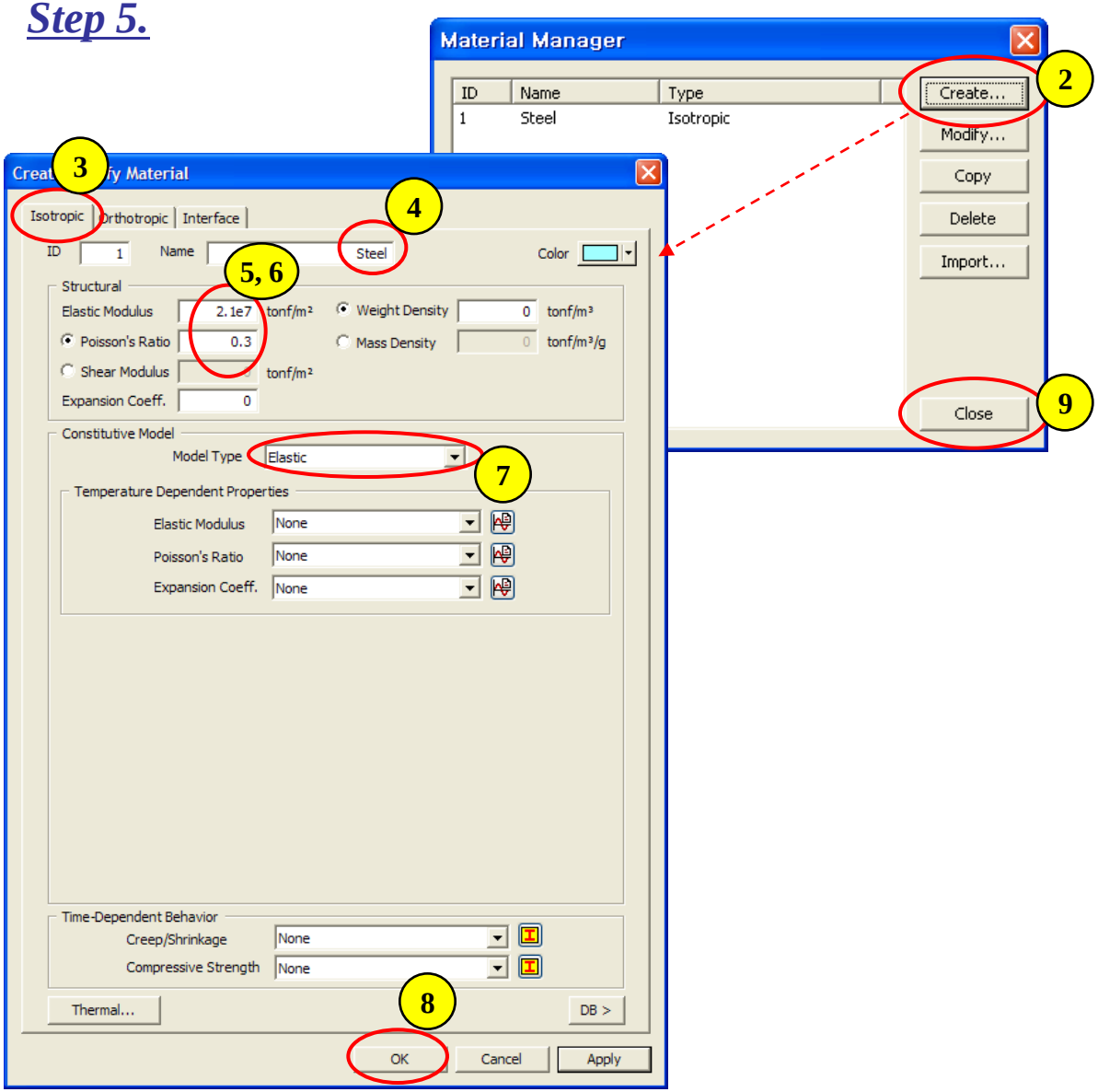
1. *Mesh > Auto Mesh > Edge…*
2. *Select*  *"Displayed"*
3. *Seeding Method : Number of Divisions*
4. *Number of Divisions : 1*
5. *Property : 1*
6. *Mesh Set : Frame*
7. *Click* **[OK]** *Button*
8. *Pre-Works Tree : Geometry ...*
9. *Click Right Mouse Button and Select "Hide All"*





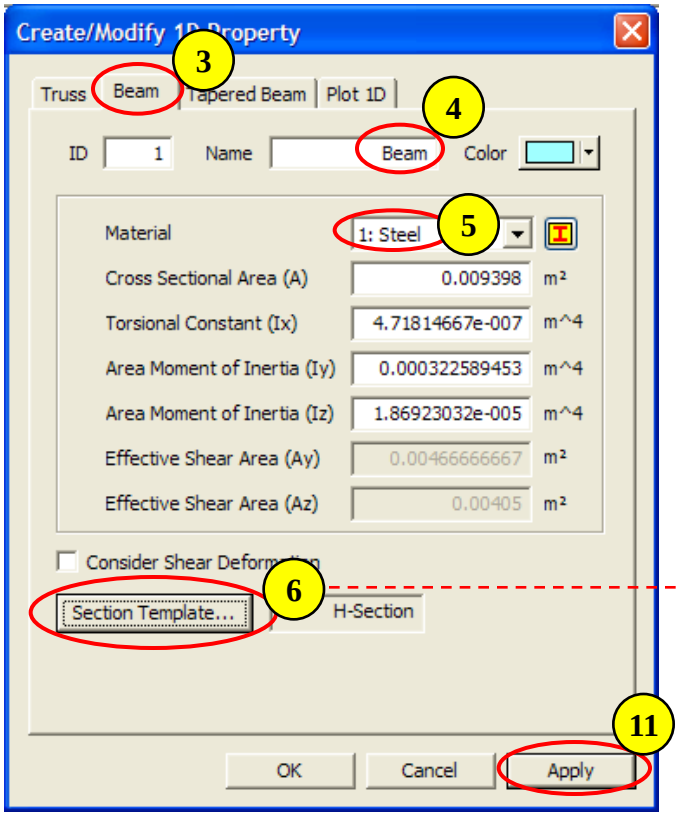


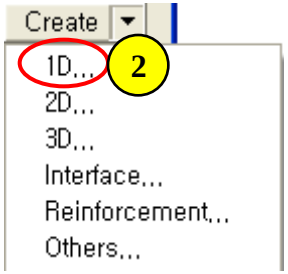
Step 5.

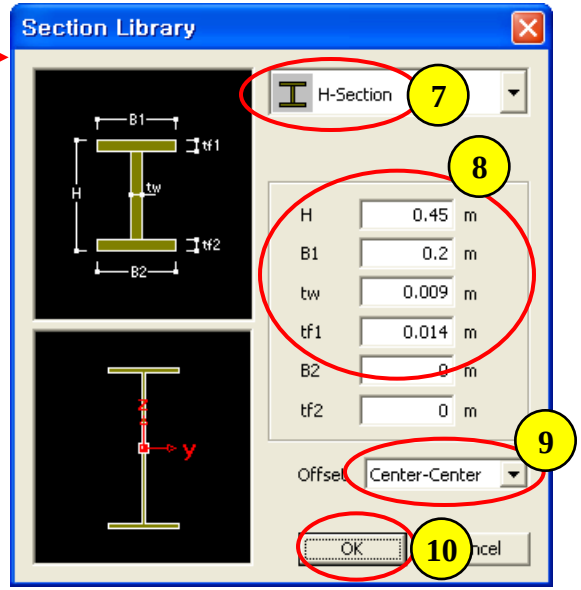


1. *Analysis > Material …*
2. *Click* **[Create]** *Button*
3. *Select "Isotropic" tab*
4. *ID : 1 , Name : Steel*
5. *Elastic Modulus : 2.1e7 tonf/m²*
6. *Poisson's Ratio : 0.3*
7. *Model Type : Elastic*
8. *Click* **[OK]** *Button*
9. *Click* **[Close]** *Button*

Step 6.



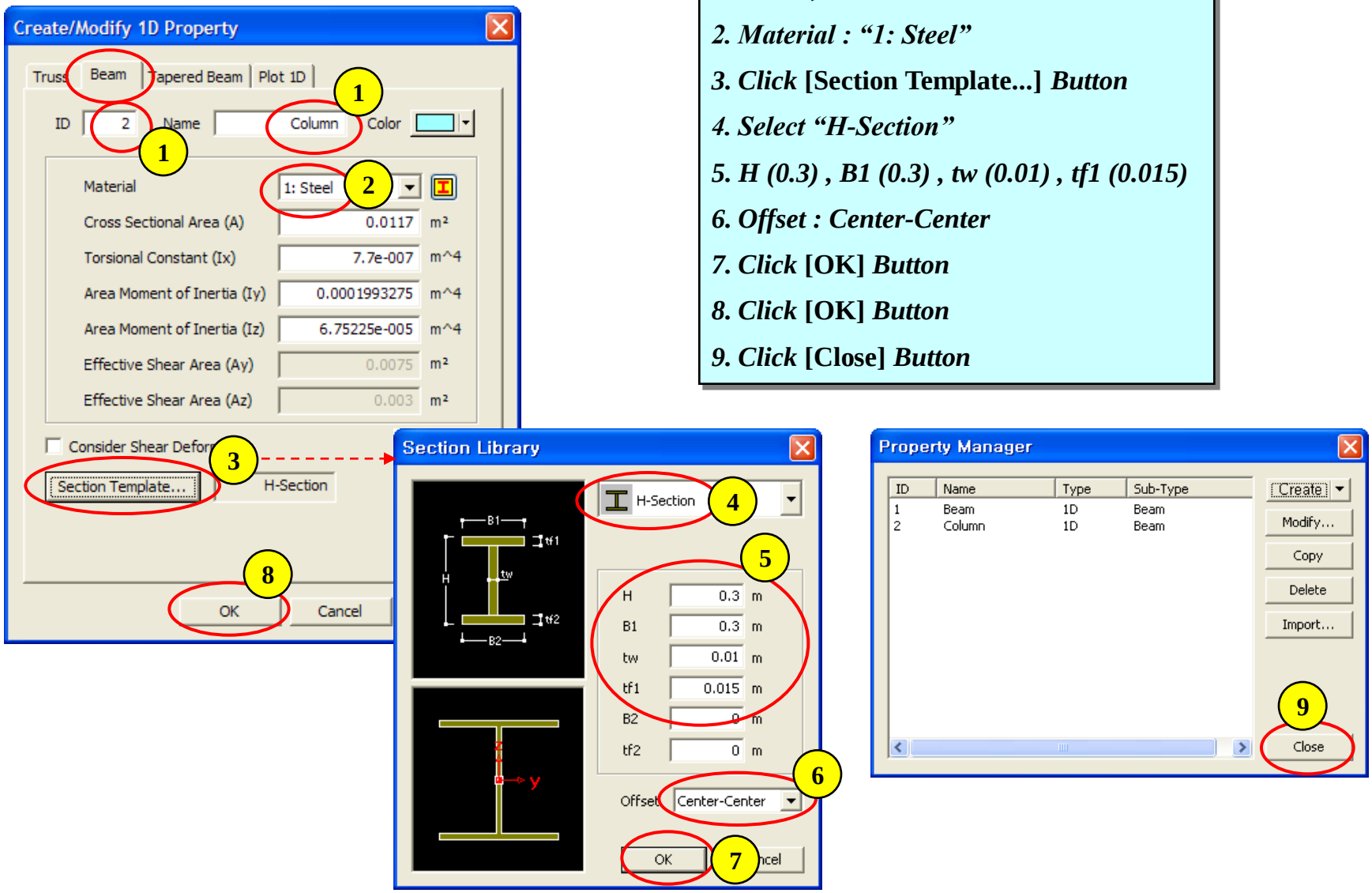




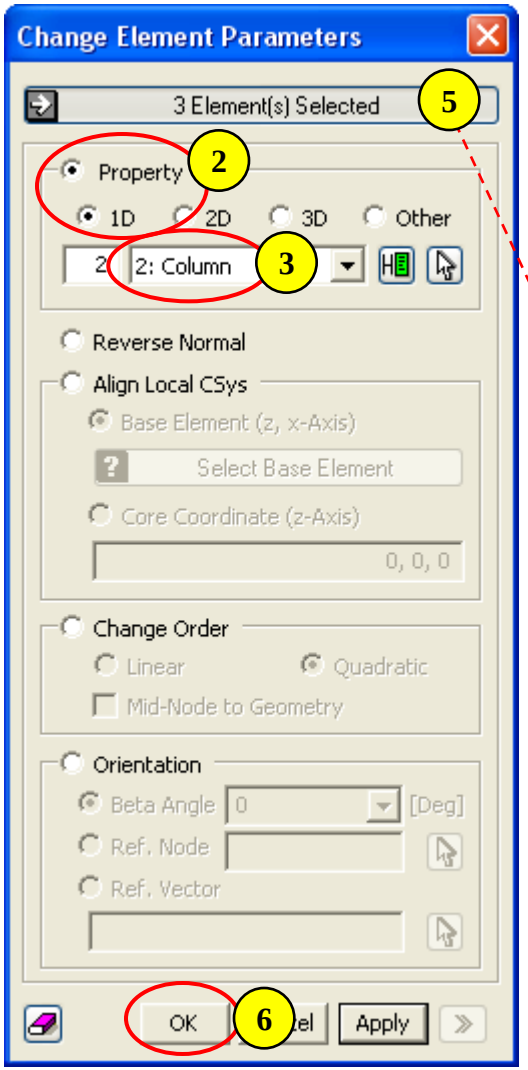
1. *Analysis > Property …*
2. *Create 1D…*
3. *Select “Beam” tab*
4. *ID : 1 , Name : Beam*
5. *Material : “1: Steel”*
6. *Click* **[Section Template...] Button**
7. *Select “H-Section”*
8. *H (0.45) , B1 (0.2) , tw (0.009) , tf1 (0.014)*
9. *Offset : Center-Center*
10. *Click* **[OK]** *Button*
11. *Click* **[Apply]** *Button*

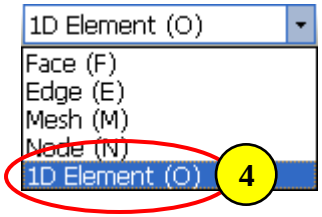
Step 7.

1. ID : 2 , Name : Column
2. Material : "1: Steel"
3. Click [Section Template...] Button
4. Select "H-Section"
5. H (0.3) , B1 (0.3) , tw (0.01) , tf1 (0.015)
6. Offset : Center-Center
7. Click [OK] Button
8. Click [OK] Button
9. Click [Close] Button

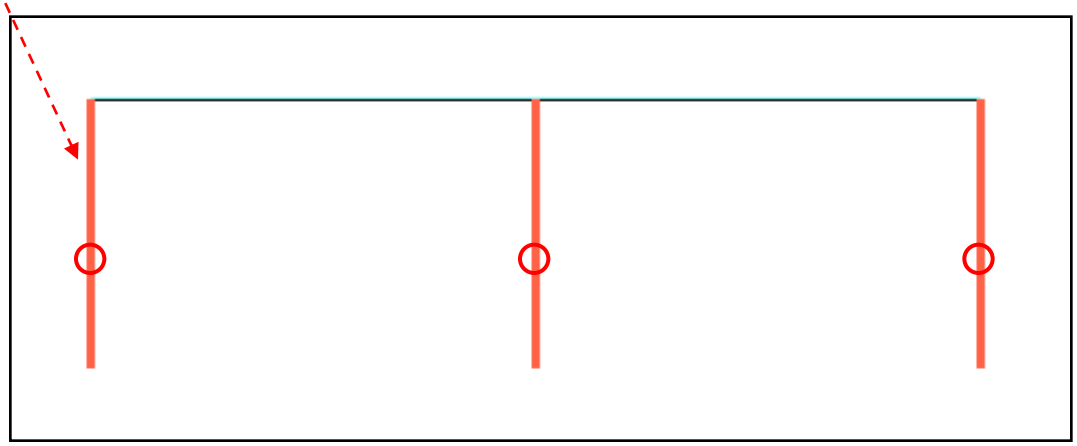


Step 8.

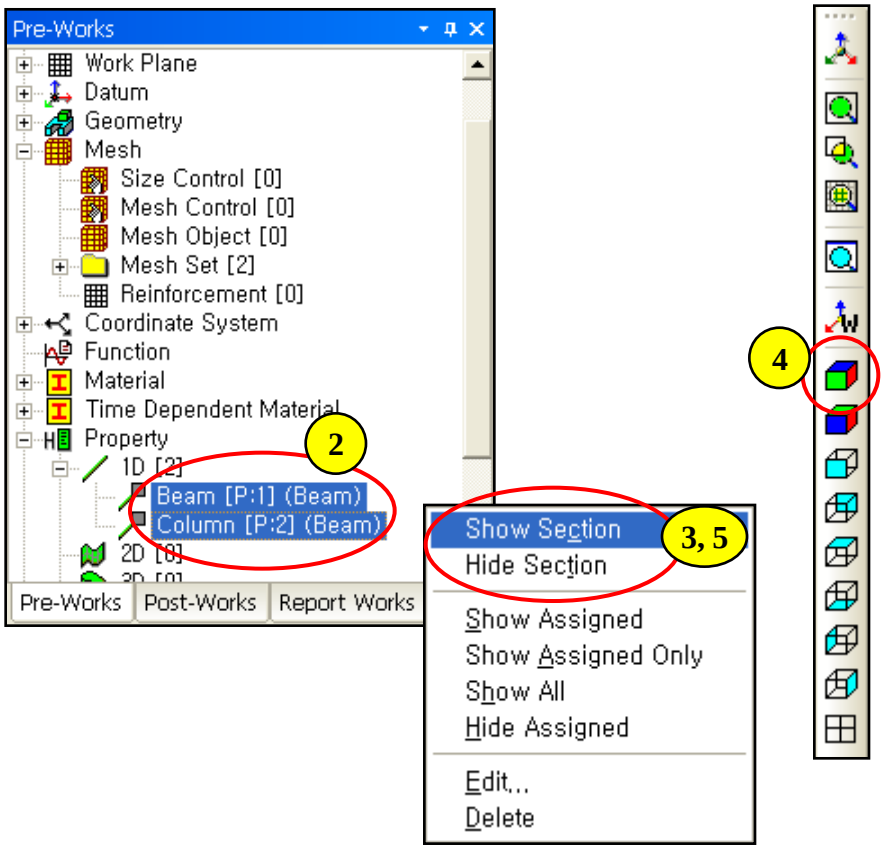




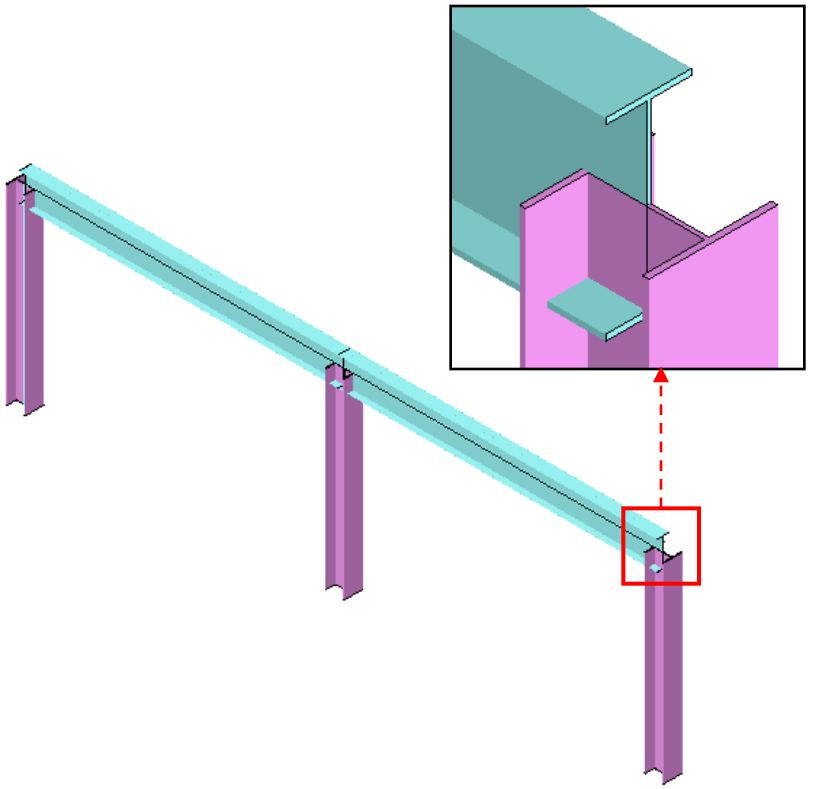
1. *Mesh > Element > Change Parameter…*
2. *Select "Property" - "1D"*
3. *Property : "2: Column"*
4. *Change Selection Filter to "1D Element (O)"*
5. *Select 3 Vertical Elements Marked by "O" (See Figure)*
6. *Click* **[OK]** *Button*



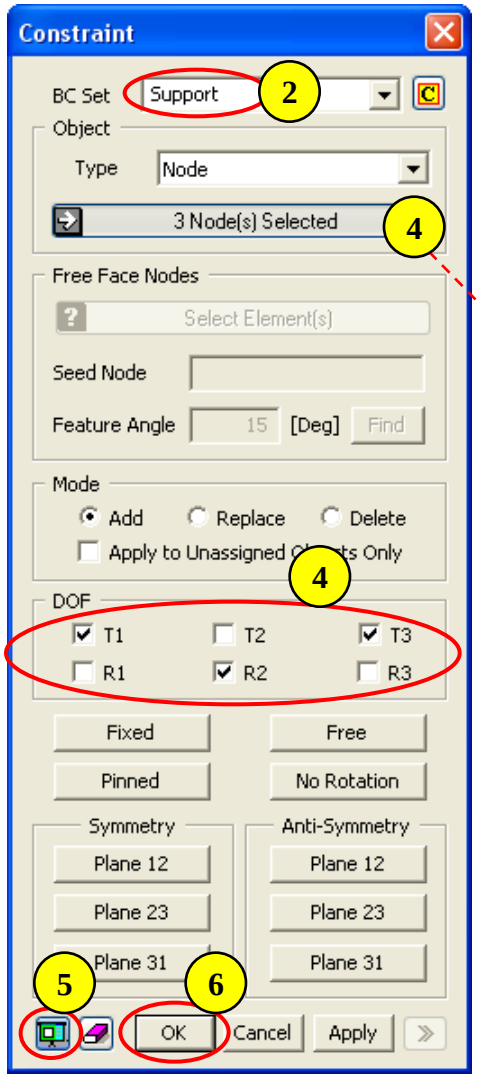
Step 9.



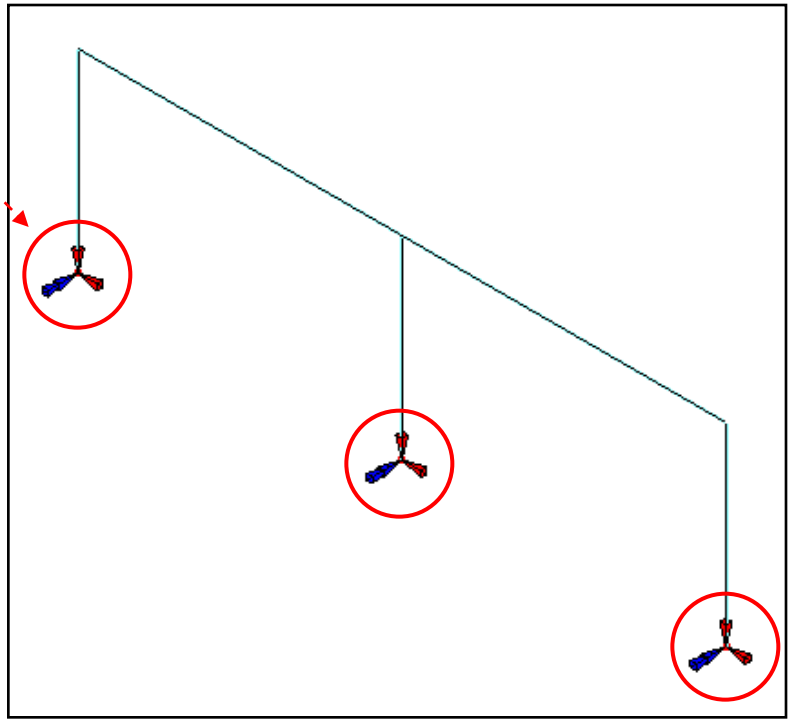
1. *Pre-Works Tree : Property - 1D…*
2. *Select "Beam" & "Column"*
3. *Click Right Mouse Button and Select "Show Section"*
4. *Click "Isometric 1"*
5. *Select "Hide Section"*



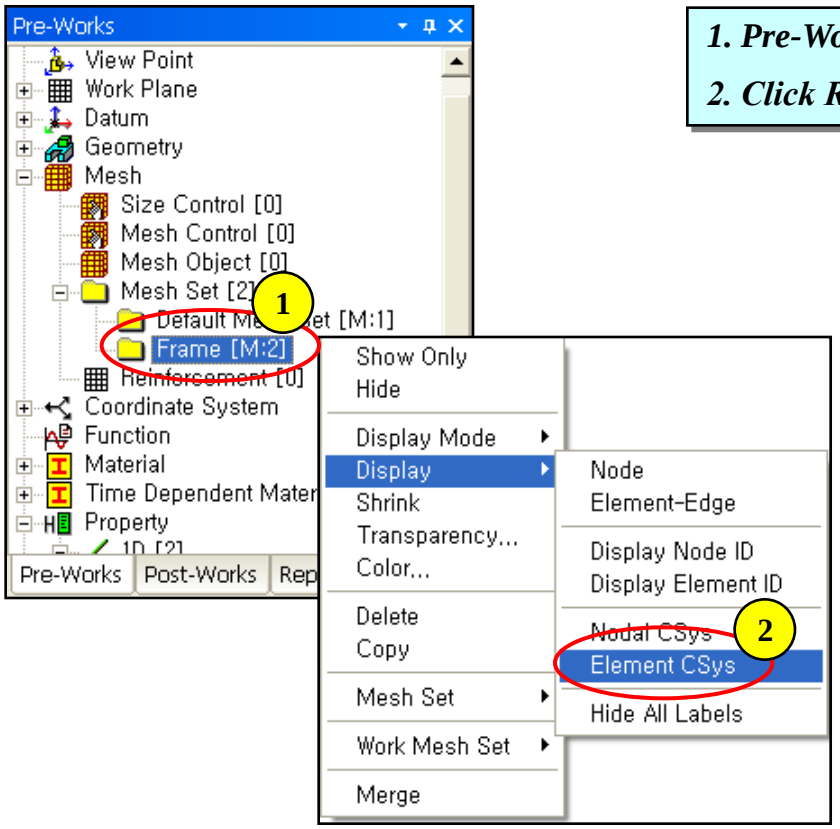
Step 10.



1. *Analysis > BC > Constraint…*
2. *BC Set : Support*
3. *Select 3 Nodes Marked by "O" (See Figure)*
4. *Check on "T1", "T3" & "R2"*
5. *Click "Preview" Button*
6. *Click* **[OK]** *Button*

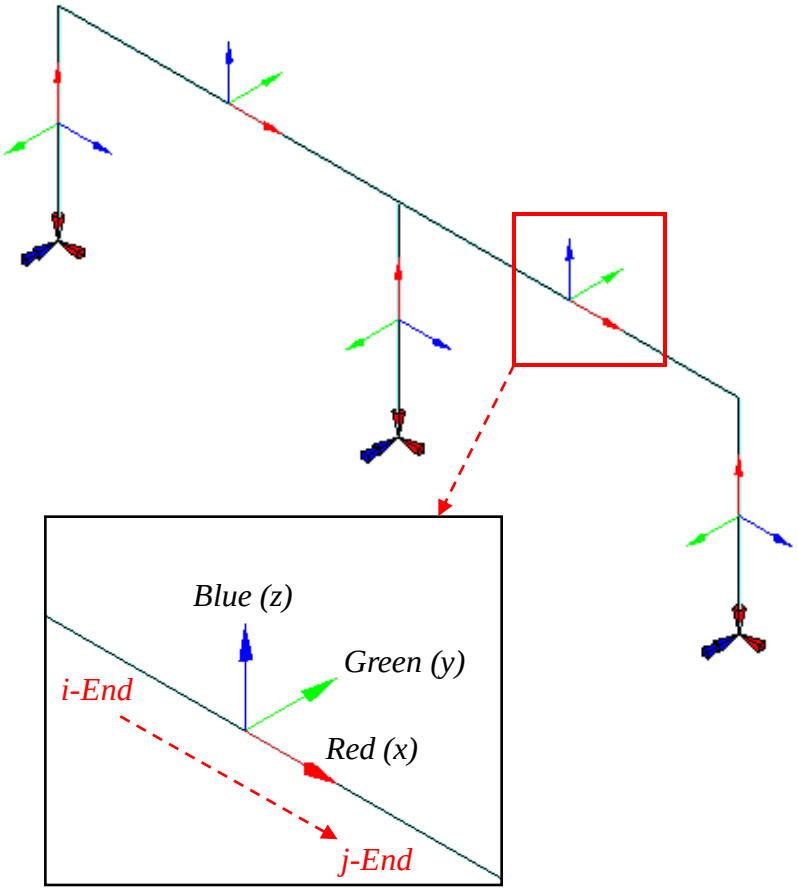


Step 11.



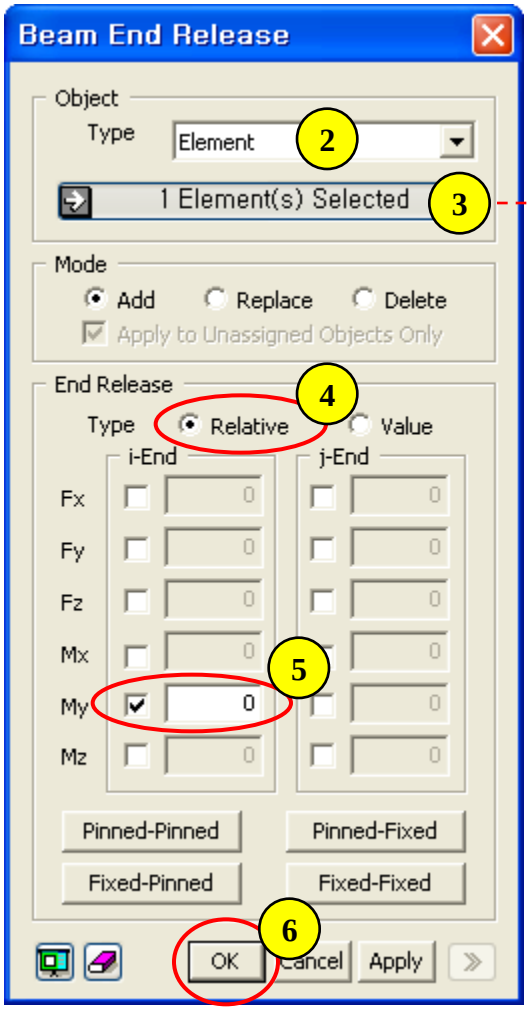
1. Pre-Works : Mesh - Mesh Set - Frame

2. Click Right Mouse Button and Select "Display > Element CSys"

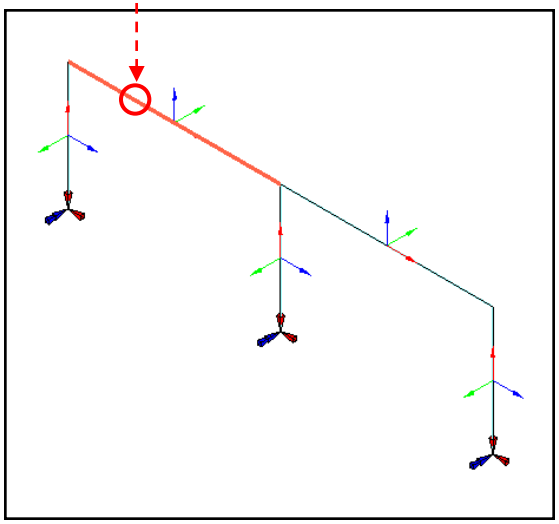


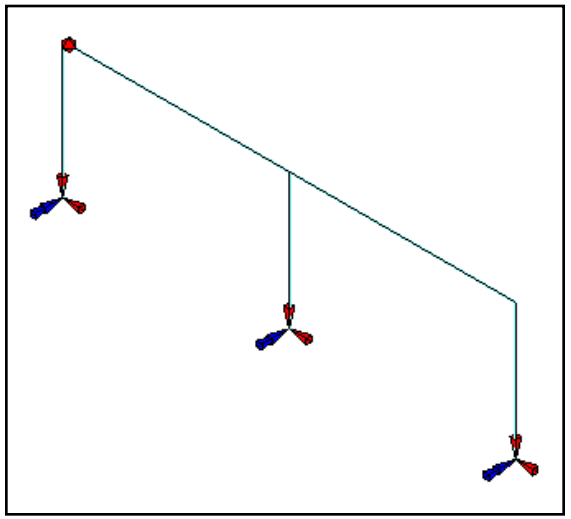
Symbol size can be changed at "Display Option" - "LBC" - "Mesh" - "Element CSys".

Step 12.

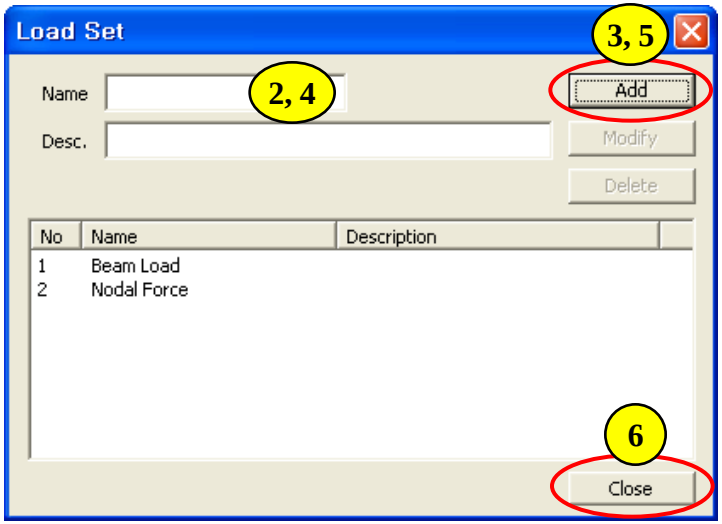


1. *Analysis > BC > Beam End Release…*
2. *Type : Element*
3. *Select 1 Element Marked by "O"*
4. *Type : Relative*
5. *i-End – My (0) (Turn off Other Flags)*
6. *Click* **[OK]** *Button*

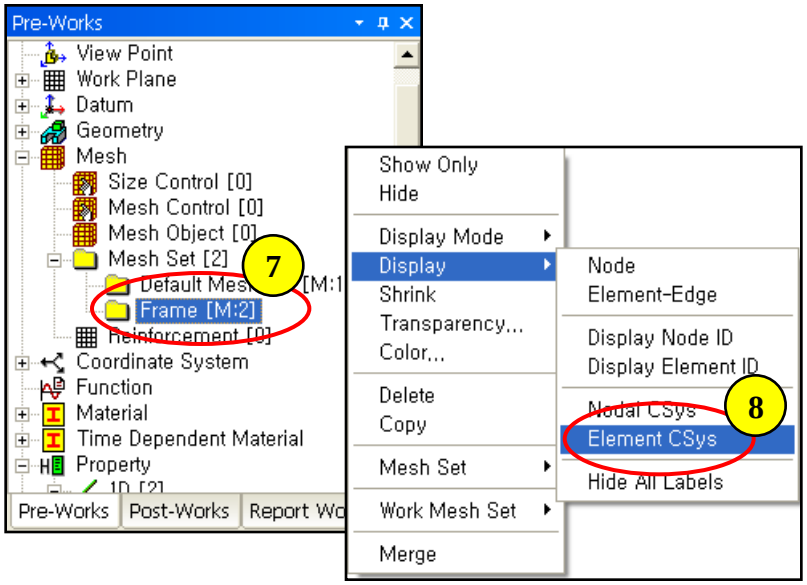




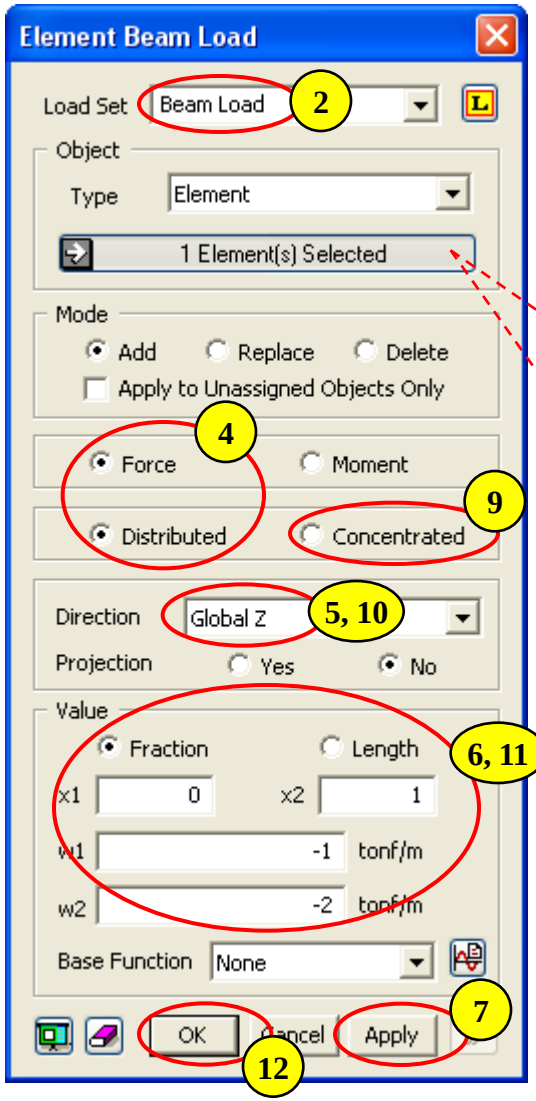
Step 13.

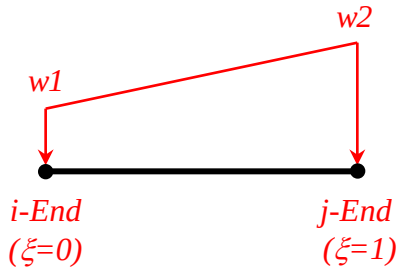


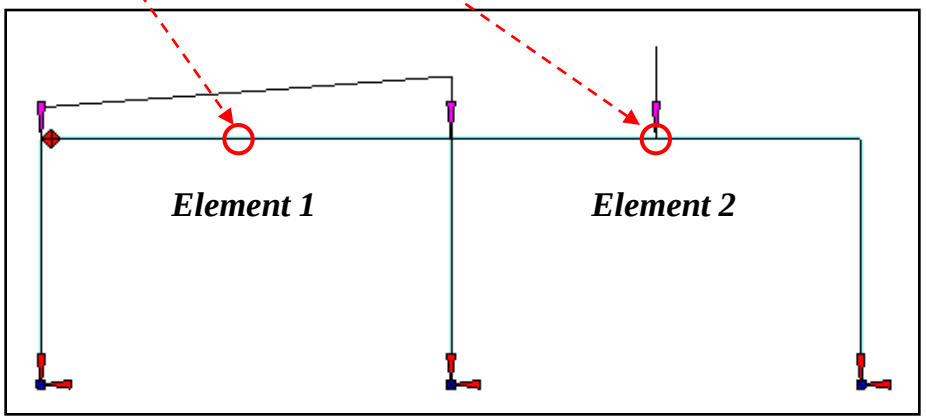
1. *Analysis > Load > Set…*
2. *Name : Beam Load*
3. *Click* **[Add]** *Button*
4. *Name : Nodal Force*
5. *Click* **[Add]** *Button*
6. *Click* **[Close]** *Button*
7. *Pre-Works : Mesh – Mesh Set – Frame*
8. *Click Right Mouse Button and Select "Display > Element CSys"*



Step 14.

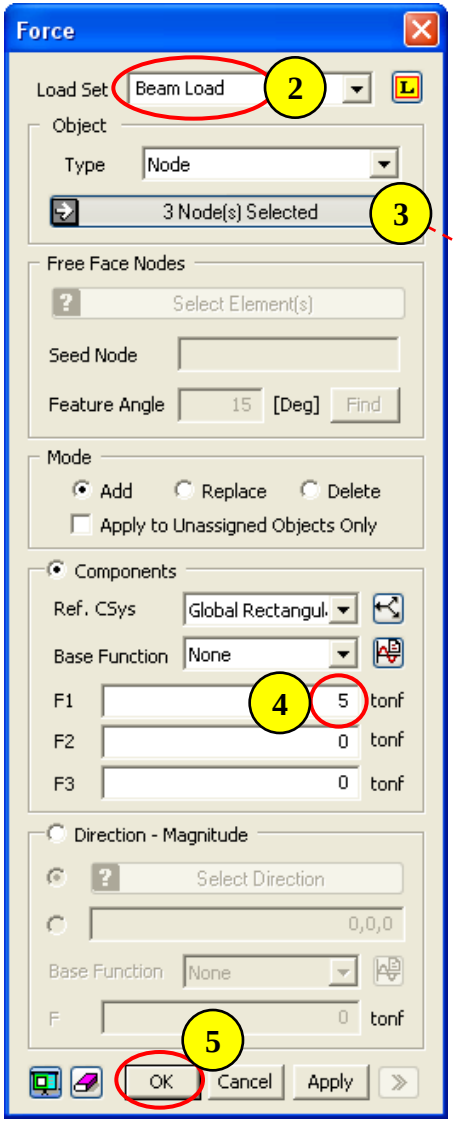




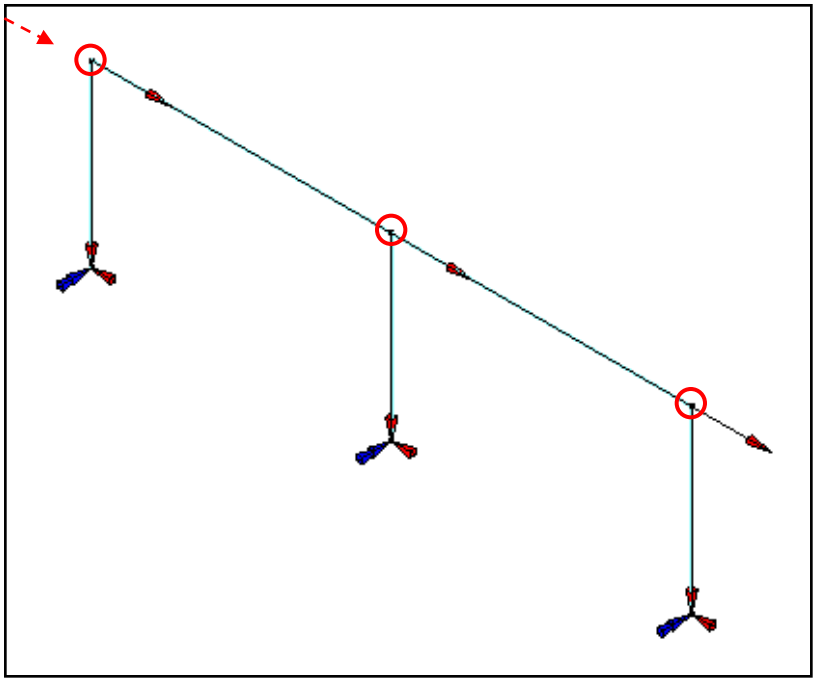


1. *Analysis > Load > Element Beam Load…*
2. *Load Set : Beam Load*
3. *Select Element-1 Marked by "O"*
4. *Type : Force – Distributed*
5. *Direction : Global Z*
6. *Value : Fraction*
   x1(0), w1(-1), x2(1), w2(-2)
7. *Click* **[Apply]** *Button*
8. *Select Element-2 Marked by "O"*
9. *Type : Force – Concentrated*
10. *Direction : Global Z*
11. *Value : Fraction*
    x1(0.5), w1(-10)
12. *Click* **[OK]** *Button*

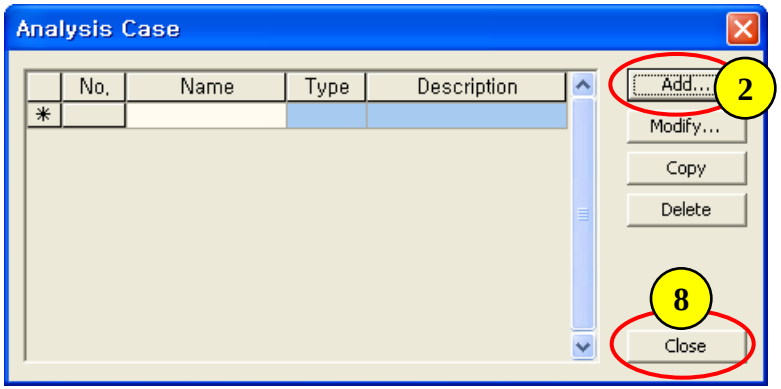
Step 15.

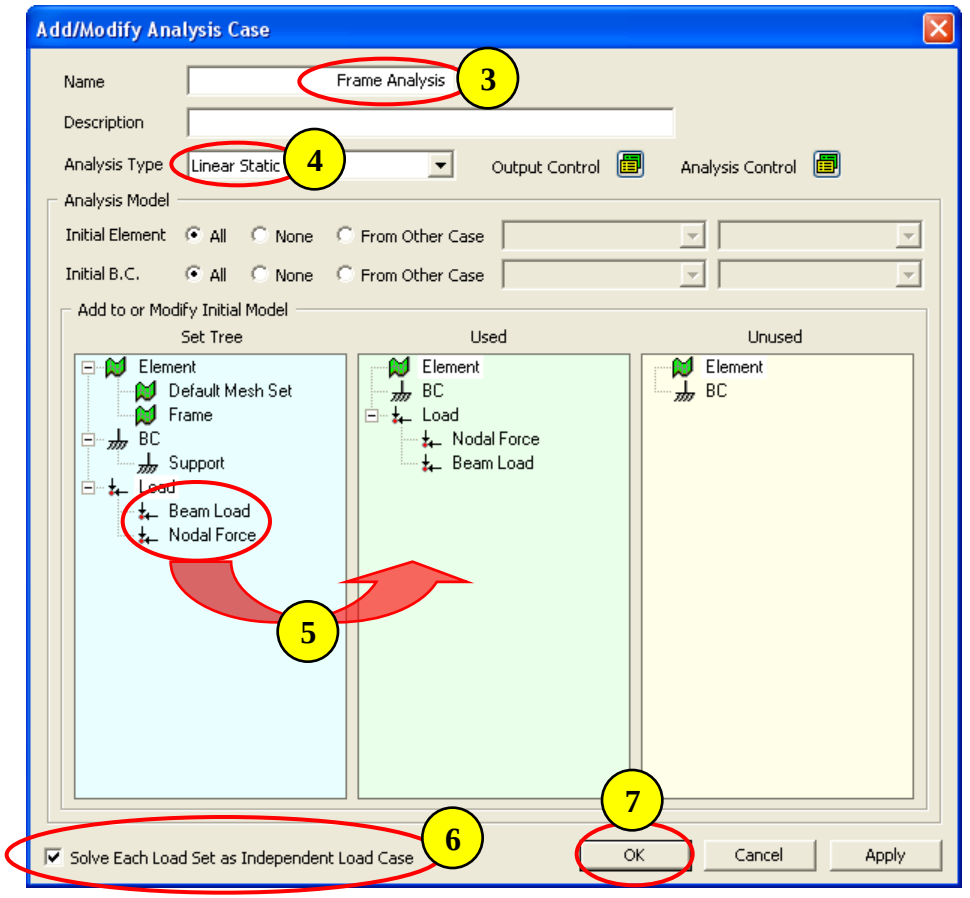


1. *Analysis > Load > Force…*
2. *Load Set : Nodal Force*
3. *Select 3 Nodes Marked by "O" (See Figure)*
4. *F1 : 5*
5. *Click* **[OK]** *Button*



Step 16.

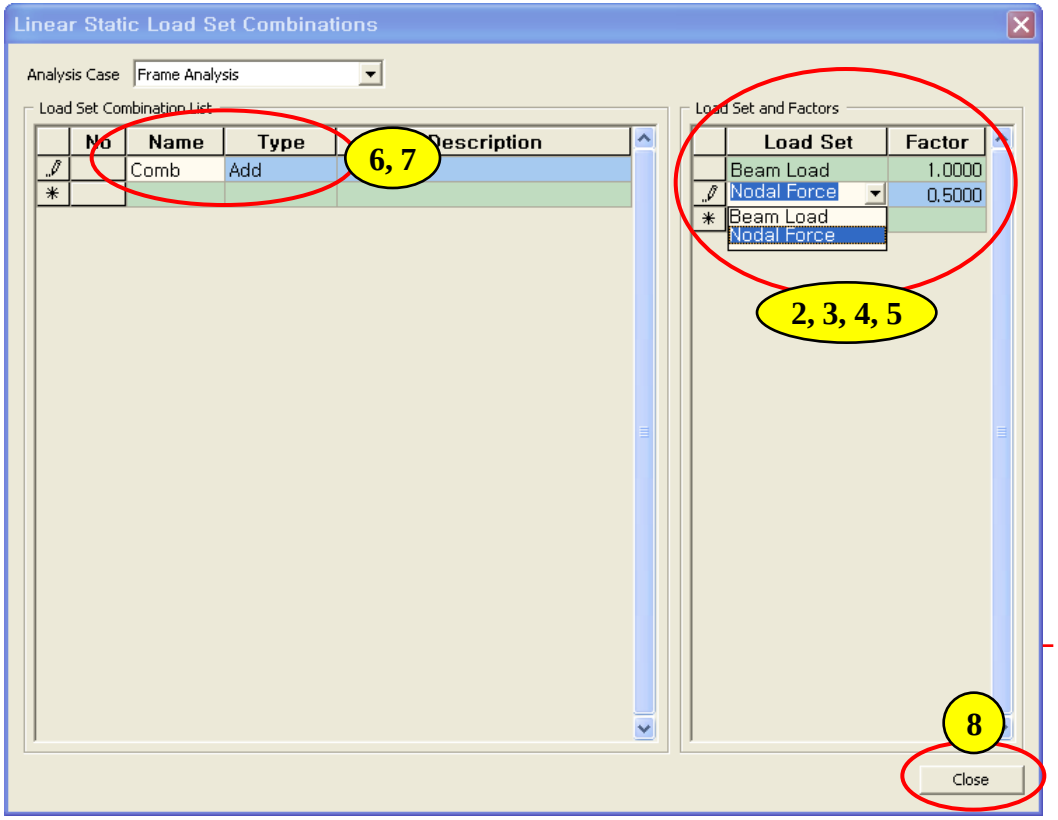


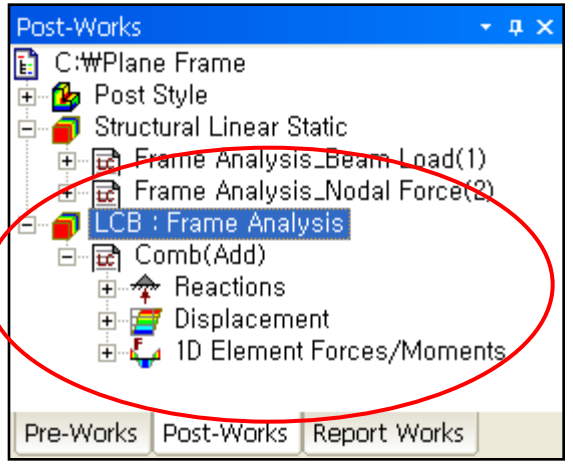


1. *Analysis > Analysis Case …*
2. *Click* **[Add]** *Button*
3. *Name : Frame Analysis*
4. *Analysis Type : Linear Static*
5. *Drag & Drop "Load" to "Used" Window*
6. *Check on "Solve Each Load as Independent Load Case"*
7. *Click* **[OK]** *Button*
8. *Click* **[Close]** *Button*
9. *File > Save… (Plane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

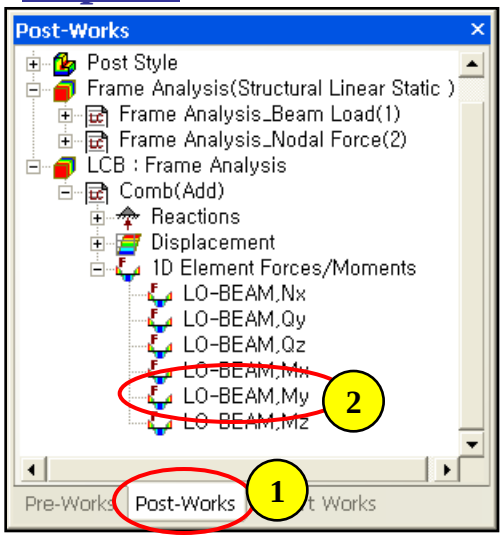
Step 17.

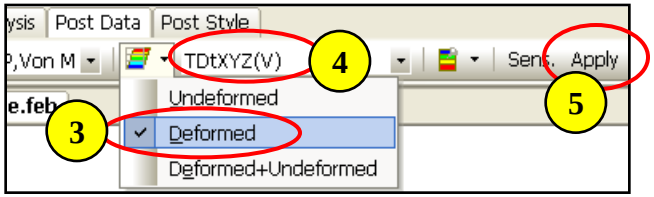
1. *Post > Linear Static Result Combinations…*
2. *Load Set : Beam Load*
3. *Factor : 1.0*
4. *Load Set : Nodal Force*
5. *Factor : 0.5*
6. *Name : Comb*
7. *Type : Add*
8. *Click* **[Close]** *Button*

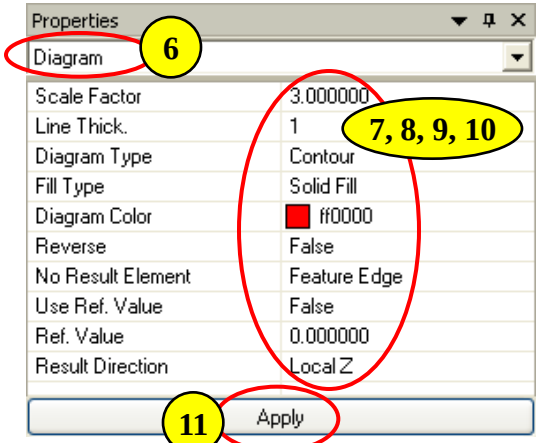




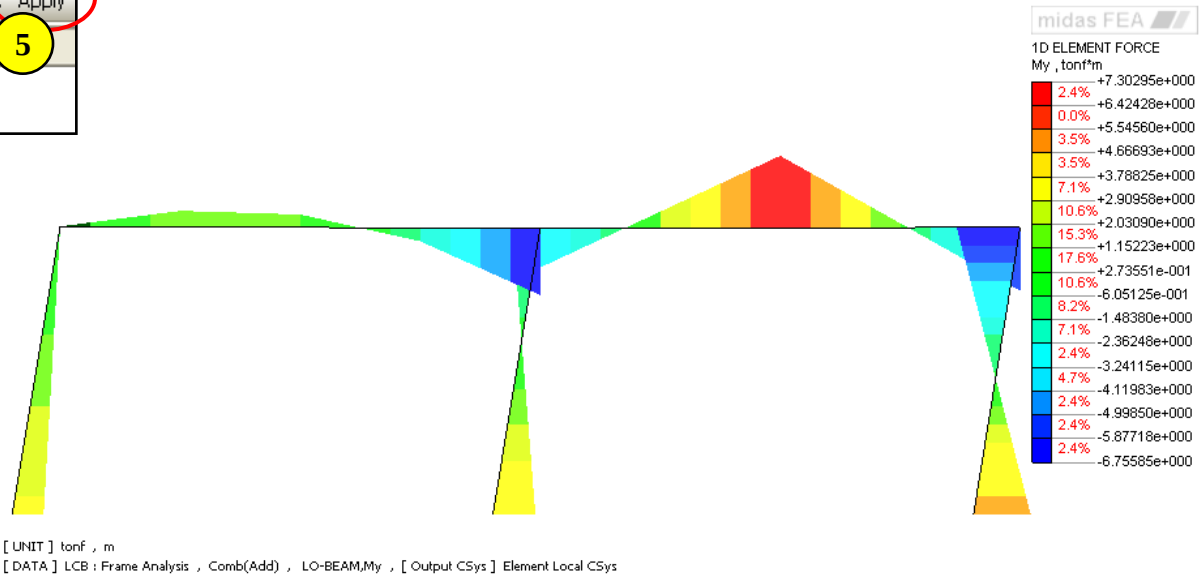
Step 18.



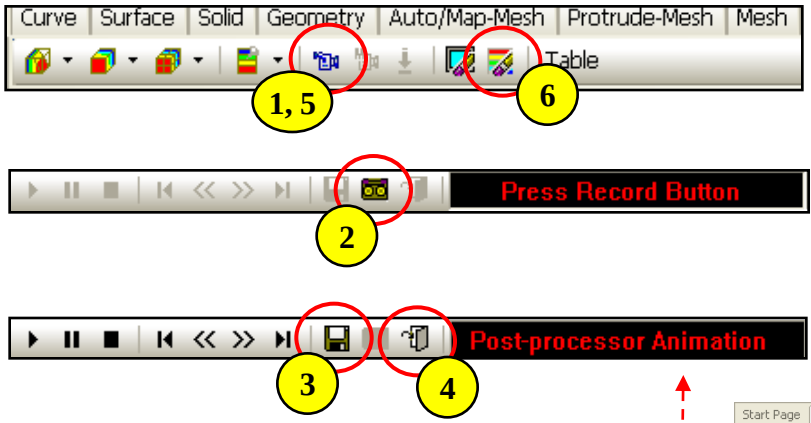




1. *Post-Works Tree : LCB : Frame Analysis > Comb(Add) > 1D Element Forces/Moments*
2. *Double Click "LO-BEAM,My"*
3. *Select "Deformed" for Mesh Shape at "Post Data" Toolbar*
4. *Select "TDtXYZ(V)" for Deformation Data*
5. *Click* **[Apply]** *Button*
6. *Property Window : Diagram*
7. *Scale Factor : 3*
8. *Diagram Type : Contour*
9. *Fill Type : Solid Fill*
10. *Result Direction : Local Z*
11. *Click* **[Apply]** *Button*



Step 19.



1. Click "Animation Recording" Button at "Post Style" Toolbar
2. Click "Record" Button
3. Click "Save File" and Save Animation as "AVI" format file
4. Click "Finish" Button
5. Click "Animation Recording" Button at "Post Style" Toolbar
6. Click "Initial Post Style" Button at "Post Style" Toolbar