Advanced Application 1

Steel Structure

Steel Structure

Summary

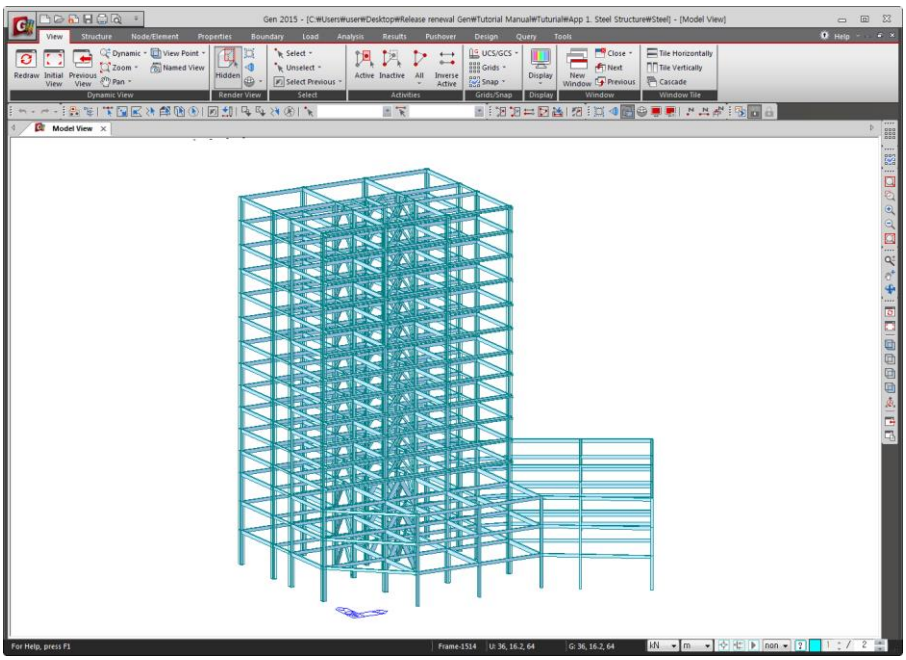
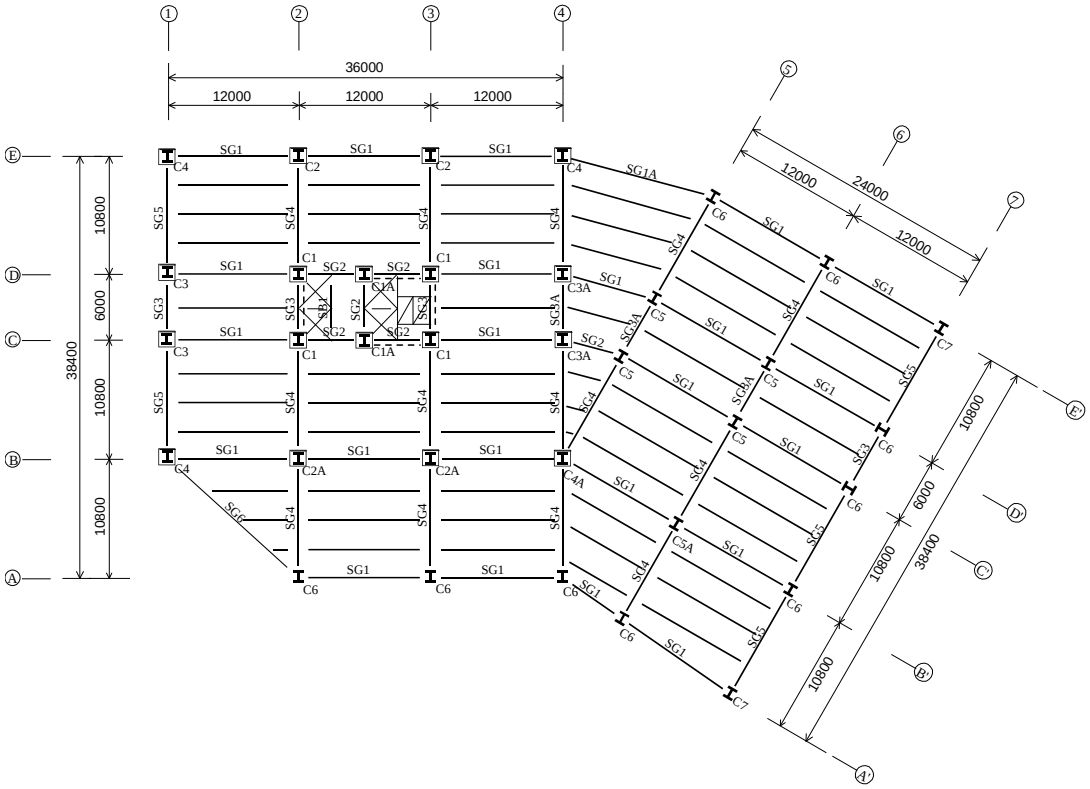


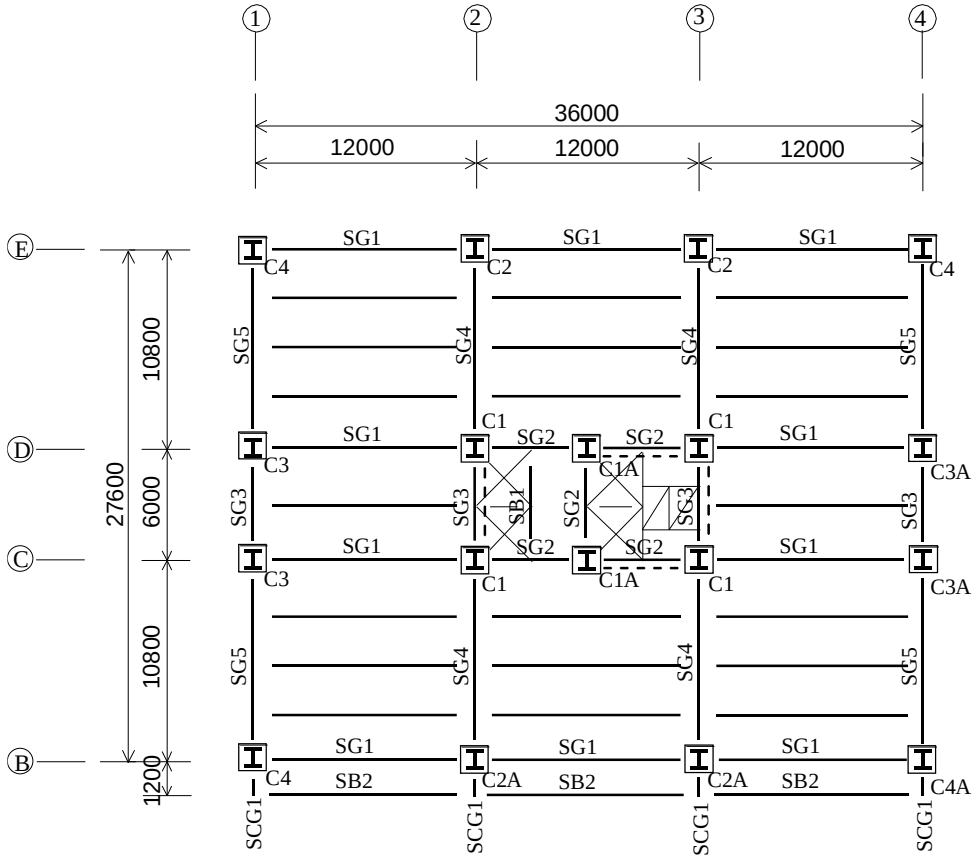
Figure 1.1 Steel Building

Structural Plans & Section



Element Name	Section ID	DB	Section Size
SG1	221	AISC	W24x76
SG2	222	AISC	W18x55
SG3	223	AISC	W18x55
SG4	224	AISC	W12x136
SG5	225	AISC	W24x103
SG6	226	AISC	W18x86
SB1	231	AISC	W12x26
SG1A	241	AISC	W12x53
SG3A	243	AISC	W24x76

Figure 1.2 Structural Plan of the lower part (2~4F)



Element Name	Section ID	DB	Section Size
SG1	521	AISC	W24x76
SG2	522	AISC	W21x62
SG3	523	AISC	W14x48
SG4	524	AISC	W27x129
SG5	525	AISC	W24x103
SB1	531	AISC	W12x26
SB2	532	AISC	W8x31
SCG1	571	AISC	W14x34

Figure 1.3 Structural Plan of the upper part (5~Roof)

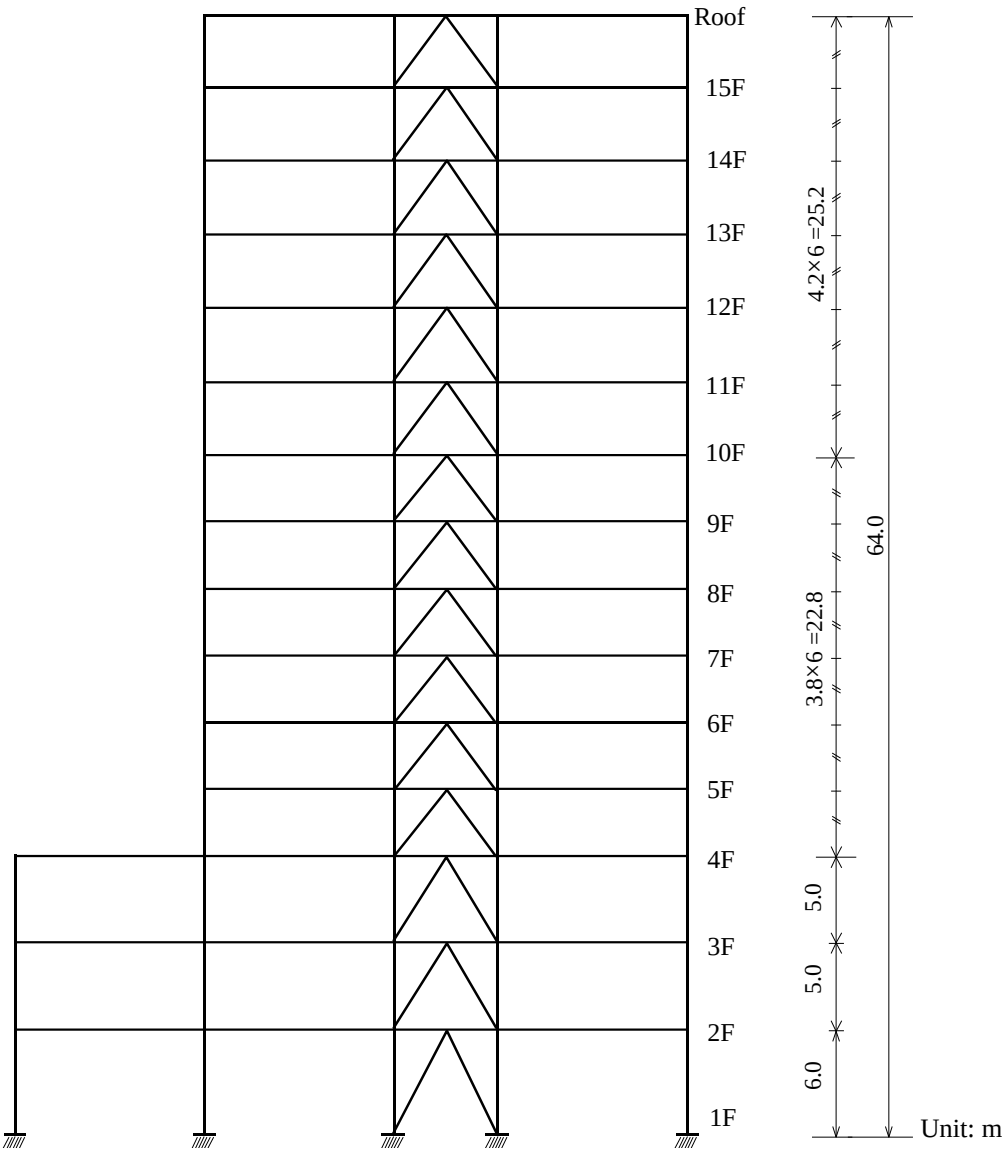


Figure 1.4 The cross section (Section–②)

Applied Codes

- Applied Load / UBC(1997)
- Steel Design Code / AISC(14th)-LRFD10
- SRC Design Code / SSRC79

Used Materials

- Beam, Brace: A36

- Column: A572-50
  Concrete Grade C4000

Applied Loads

- **Gravity loads**

unit: kN/m^2

Use	Shop	Office	Roof
Floor	2~3	4~15	4, Roof
Dead Load	3.6	4.2	5.1
Live Load	3.9	2.5	2.0

- **Wind loads**

  - Basic Wind Speed: 80 mph
  - Exposure Category: C
  - Importance Factor: 1.0
  - Pressure Coefficient: 1.3

➢ **Seismic Load**

- Seismic Zone Factor: Z = 1 (0.075)
- Importance Factor: 1.0
- Soil Coefficient: Sc
- Height of the building: Hn = 64 m
- Width of the building: Bx = 70.58 m, By = 48.95 m
- Response Modification Coefficient
  Rx: 4.2 (Steel with steel OMRF)
  Ry: 4.2 (Steel with steel OMRF)

➢ **Unit Load Cases**

Load Case Number		Name	Applied loads
Static Load Cases	1	Self	Self weight
	2	DL	Dead Load
	3	LL	Live Load
	4	WX	Wind Load (X-direction in the global coordinates)
	5	WY	Wind Load (Y-direction in the global coordinates)
Dynamic Load Cases		RX	Response Spectrum Seismic Load (X-direction in the global coordinates)
		RY	Response Spectrum Seismic Load (Y-direction in the global coordinates)

Structural Modeling

Initial Window & Unit System Setting

File >  ***New Project***

File >  ***Save (Steel)***

Tools > Setting > ***Unit System*** or ***Status Bar***

Length > **m** ; Force > **N**

 ***Point Grid*** (off),  ***Point Grid Snap*** (off),  ***Line Grid Snap*** (off)

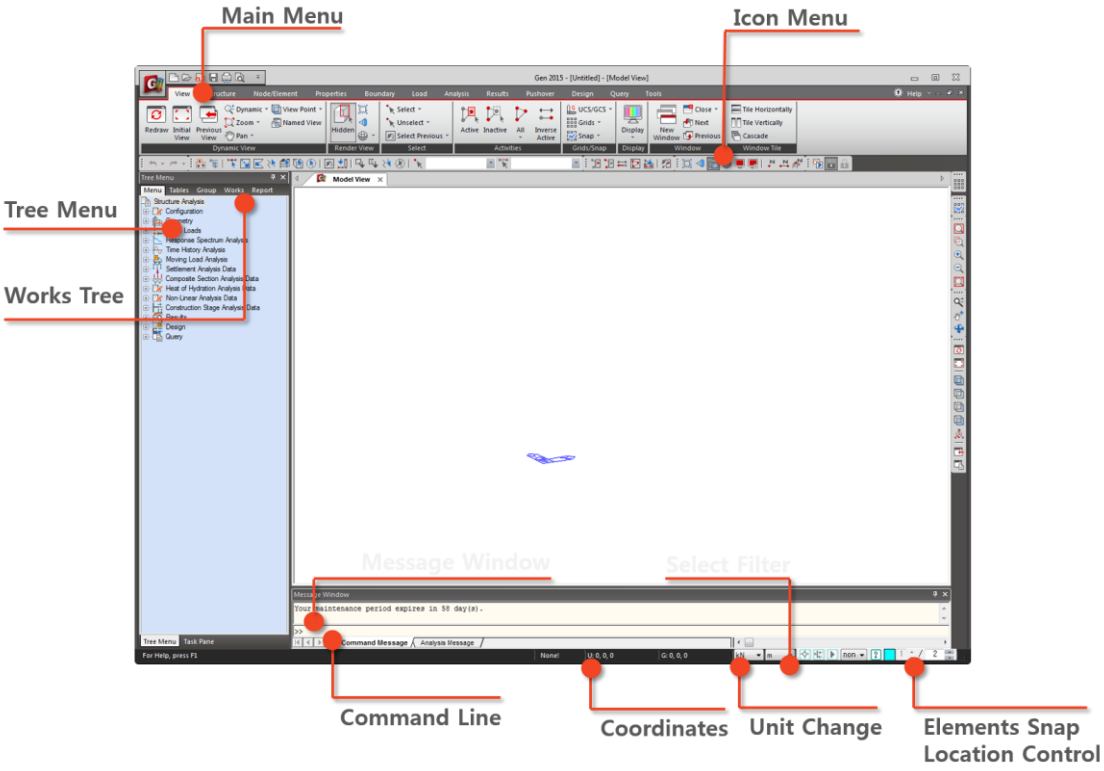


Figure 1.5 Initial Window Setting

Input Material Property & Section Data

Property Number	Name	Type	Property Type
1	Girder	Steel	A36
2	Steel Column	Steel	A53
3	SRC Column	SRC	A53 + Grade 3500
4	Brace	Steel	A36

Table 1.1 Used material properties

Properties > Material >  ***Material Properties***

Name > **Girder** ; Type > **Steel**

Standard > **ASTM(S)** ; DB > **A36**

Name > **Steel Column** ; Type > **Steel**

Standard > **ASTM(S)** ; DB > **A572-50**

Name > **SRC Column** ; Type > **SRC**

Steel Standard > **ASTM(S)** ; DB > **A572-50**

Concrete Standard > **ASTM(RC)** ; DB > **Grade C4000**

Name > **Brace** ; Type > Steel

Standard > **ASTM(S)** ; DB > **A36** .↵

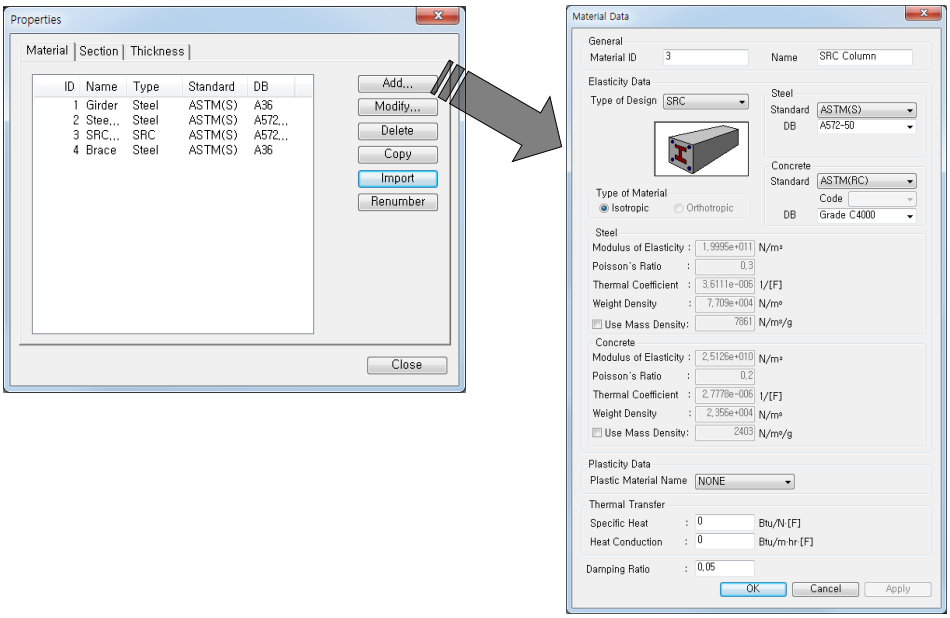
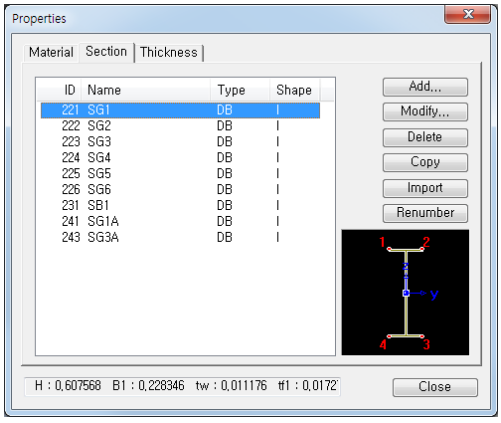


Figure 1.6 Input material properties

Figure 1.7 Input the section data of the lower part girders



(refer Figure 1.2 for section sizes)

Input the 2nd floor Elements

Hidden (on), ***Node Number*** (on), ***Element Number*** (on)

Structure > Wizard > Base Structure > ***Frame***

Input tab

X Coord. / Distance > **12** ; Repeat > **3**

Add X-Coord.

Z Coord./ Distance > **10.8** ; Repeat > **2**

Add Z-Coord.

Z Coord./ Distance > **6** ; Repeat > **1**

Add Z-Coord.

Z Coord./ Distance > **10.8** ; Repeat > **1**

Add Z-Coord.

Edit tab

Beta Angle > **90 Deg**.

Material > **1** ; Section > **221**

Click Generate Frame.

Insert tab

Insert Point > **0, 0, 6**

Rotations / Alpha > **-90** .

Click OK.

Zoom Fit

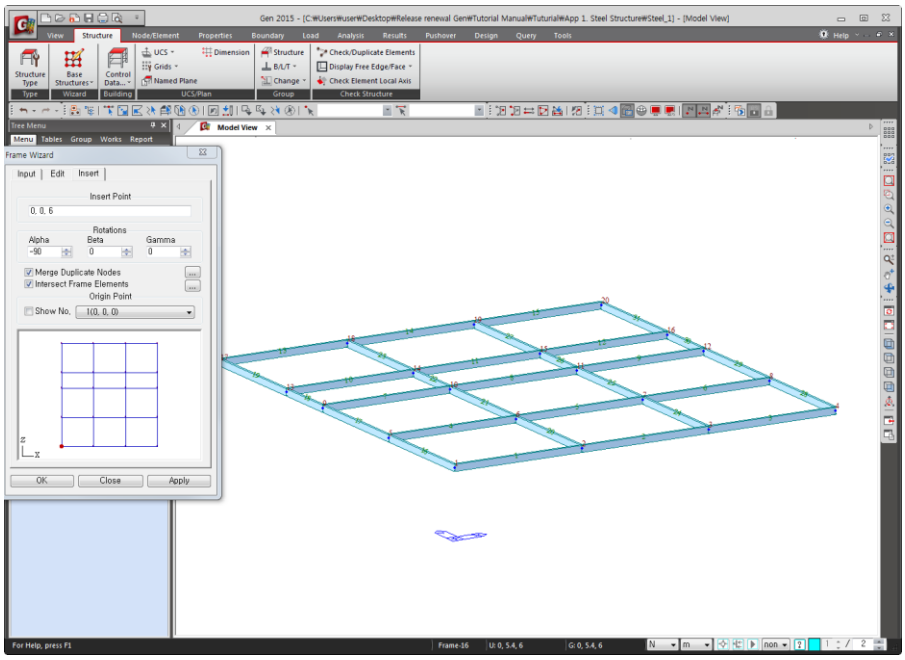


Figure 1.8 Create the 2nd floor elements using Frame Wizard

Node/Element > Elements > ***Create Element***

Material Name> **1:Girder**

Section Name > **226:SG6**

Nodal Connectivity > **2, 5**

Material Name> **1:Girder**

Section Name > **222:SG2**

Nodal Connectivity > Element **33** (Refer to Figure 1.9)

Material Name> **1:Girder**

Section Name > **231:SB1**

Nodal Connectivity > Element **36** (Refer to Figure 1.9)

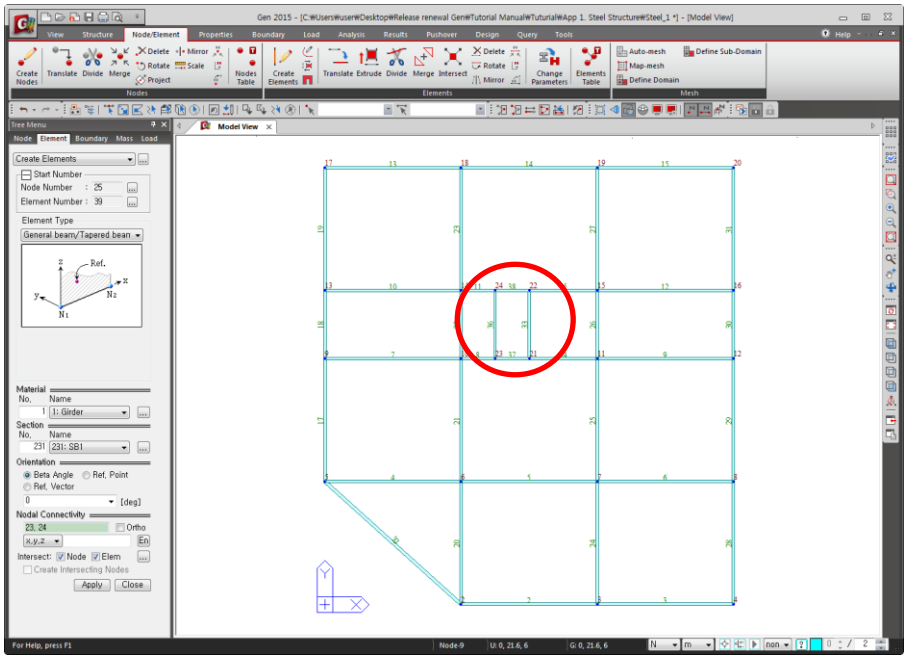


Figure 1.9 Modify the 2nd floor elements

Top View

Select Window (Node 1)

Select Element **1, 16**

Click **Delete** key

Display > Node > **Node Number** (off)

Tree Menu > **Works tab**

Select Single **(8, 11, 34, 35, 37, 38)**

Display > Property > **Property Name** (on)

Properties > Section > **222:SG2** (Drag & Drop)

Similarly change properties of **SG1 to SG3A, SG4 & SG5** by Drag & Drop

(Refer to Figure 1.2)

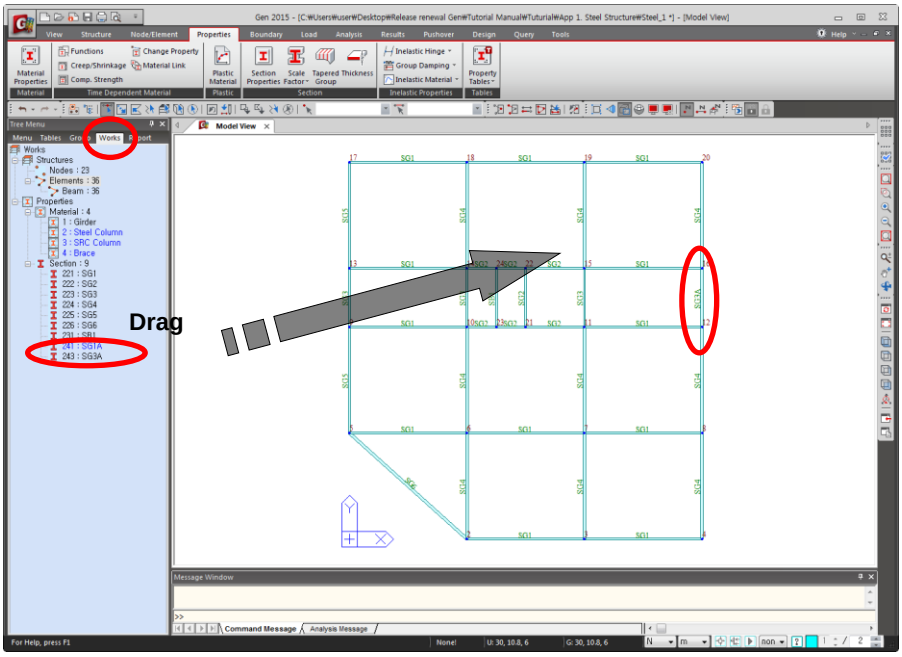


Figure 1.10 Change the section numbers using Drag & Drop

UCS & Line Grid Setting

Node Number (on)

Display > Property > **Property Name** (off)

X-Y

Coordinates Origin > **36, 10.8, 6** (**Node 8**)

Angle > **-30** ↵

Define Line Grid

Grid Name > **Skew Plane**

X-Grid Lines [Add]

Line > **2@12** . ↵

Y-Grid Lines [Add]

Levels > **-10.8, 2@10.8, 6, 10.8** ↵

Add/Modify Grid Lines ↵ ↵

Zoom Fit (on), ***Line Grid Snap*** (on)

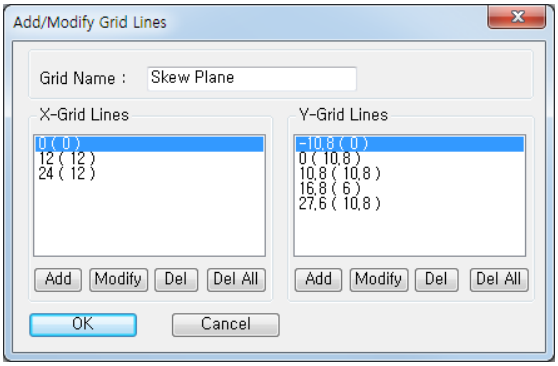


Figure 1.12 Define the grid lines

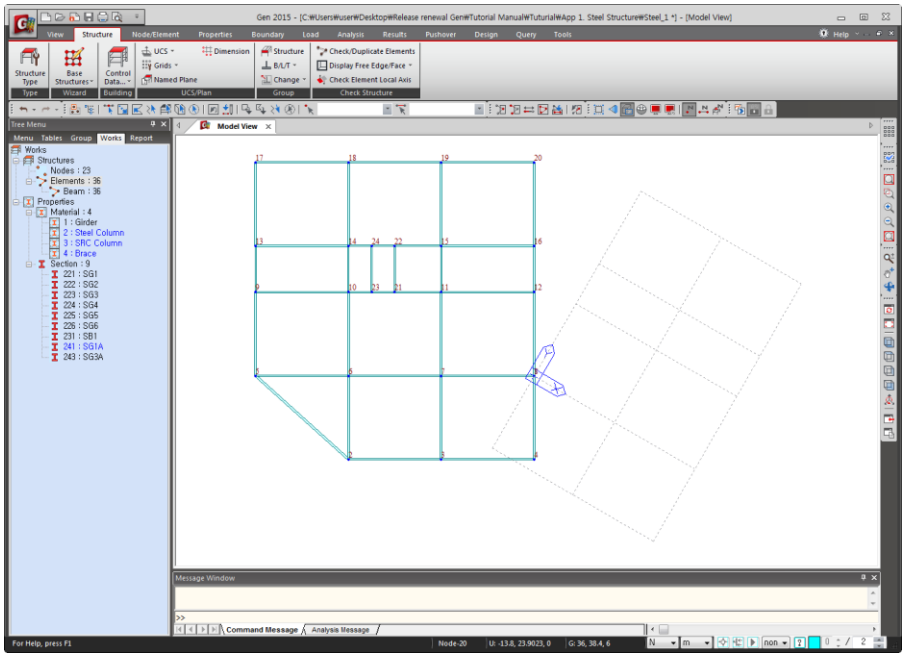


Figure 1.13 UCS & Line Grid setting

Create Elements of the Skewed Part

Node/Elements > Elements >  ***Create Elements***

Section Name > **221:SG1**

Nodal Connectivity > **Node 4 & corner of Line Grid**

(Refer to ❶ of Figure 1.14)

Create the Remainders (Refer to Figure 1.15)

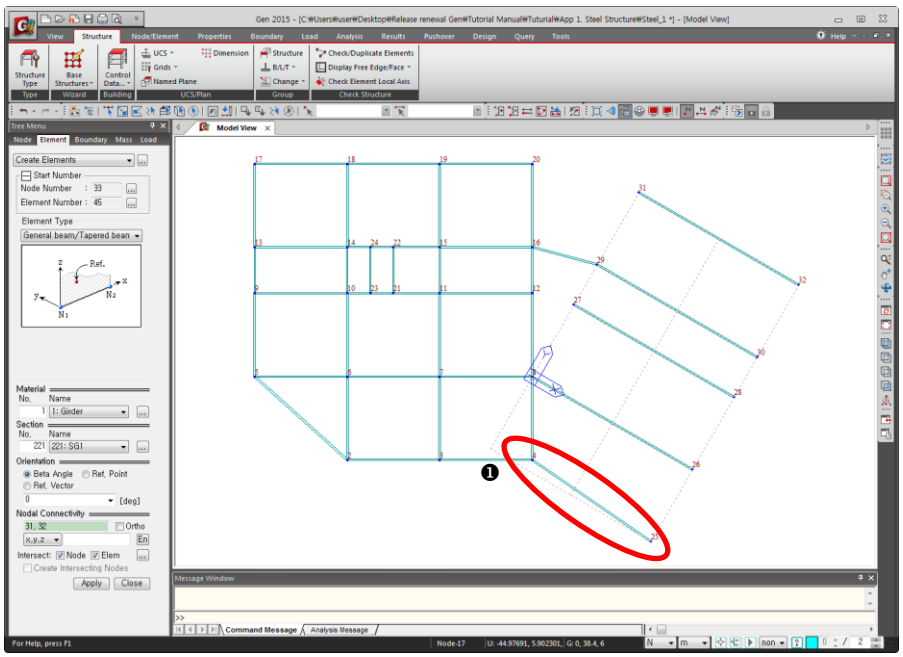


Figure 1.14 Input SG1 of the 2nd floor of the skewed part

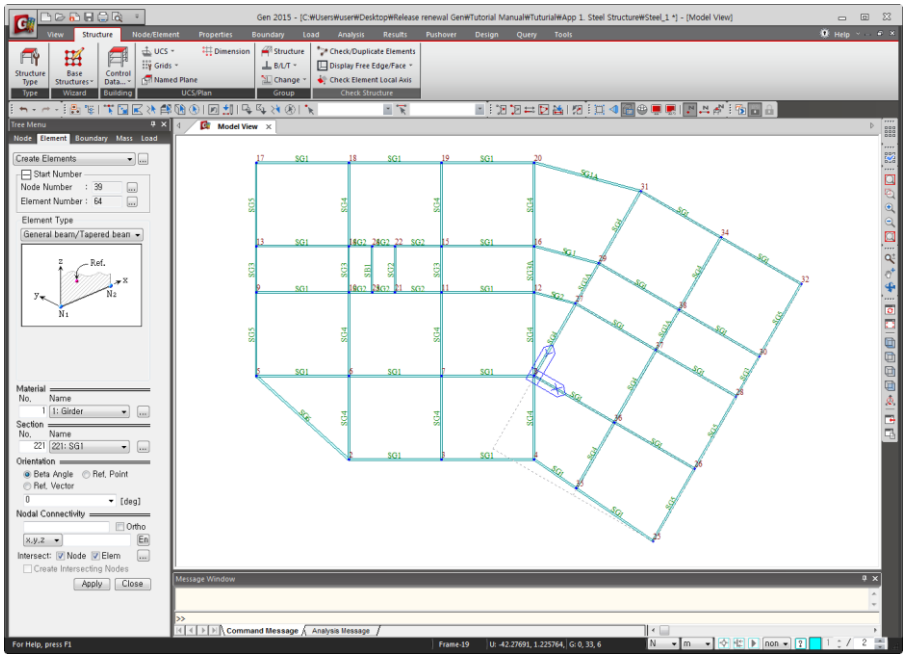


Figure 1.15 Input the beam element of the 2nd floor of the skewed part

Select Single (**unnecessary node & element**; ❶ of Figure 1.15)

Delete ↵

Display Reset All ↵

GCS (on), *Line Grid* (off), *Line Grid Snap* (off)

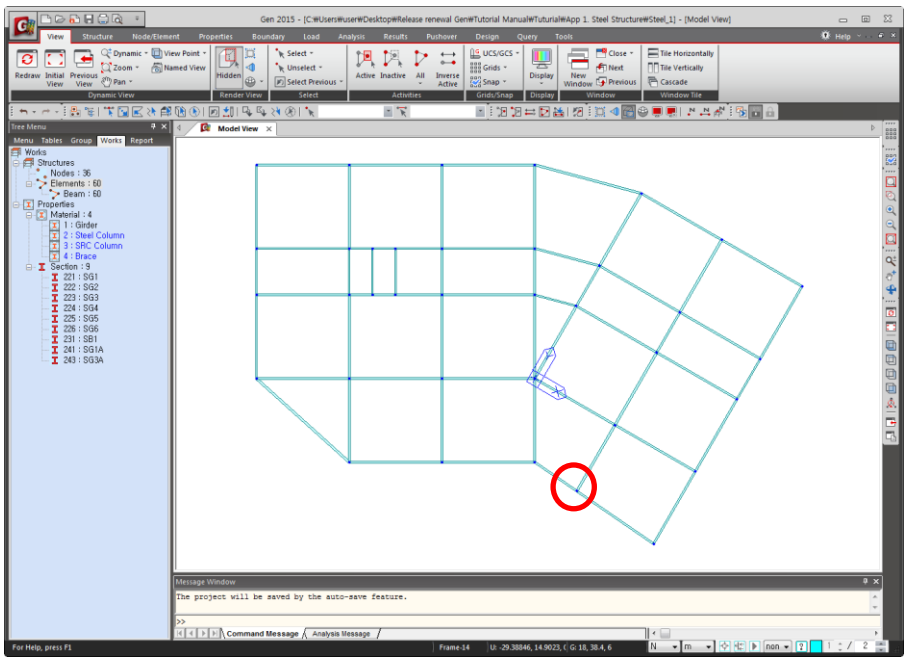


Figure 1.16 Delete the unnecessary node and element

Input the Beam End Release Conditions

Display > Property > **Property Name** (on) ↵

Select Single (**SB1-element 36**)

Boundary > Release/Offset >

Beam End Release (Refer to ❶ of Figure 1.17)

Pinned-Pinned ↵

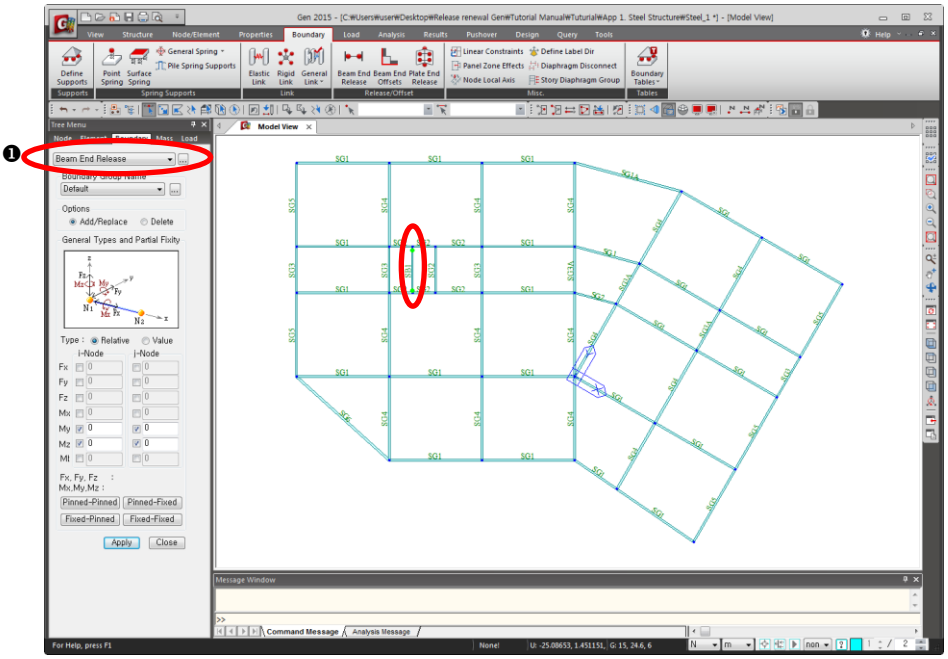


Figure 1.17 Input the Beam End Release condition

The following column section data have been inputted in the file Steel(import).mgb

		C1			C1A		
Unit	Story	Section Number	Steel	RC	Section Number	Steel	RC
6	14~15	106	W 14 × 176	700 × 700	156	W 10 × 54	600 × 600
5	11~13	105	W 14 × 145	700 × 700	155	W 10 × 54	600 × 600
4	8~10	104	W 14 × 176	700 × 700	154	W 10 × 54	600 × 600
3	5~7	103	W 14 × 211	700 × 700	153	W 12 × 72	600 × 600
2	3~4	102	W 18 × 258	700 × 700	152	W 12 × 72	600 × 600
1	1~2	101	W 18 × 258	700 × 700	151	W 12 × 136	600 × 600

		C2			C2A		
Unit	Story	Section Number	Steel	RC	Section Number	Steel	RC
6	14~15	206	W 14 × 109	700 × 700	256	W 12×96	700 × 700
5	11~13	205	W 14 × 109	700 × 700	255	W 12×65	700 × 700
4	8~10	204	W14 × 120	700 × 700	254	W 14×109	700 × 700
3	5~7	203	W 14 × 159	700 × 700	253	W 14×176	700 × 700
2	3~4	202	W 18 × 175	700 × 700	252	W 14×193	700 × 700
1	1~2	201	W 18 × 211	700 × 700	251	W 14×283	700 × 700

Table 1.2 Column Section Data (1)

		C3			C3A		
Unit	Story	Section Number	Steel	RC	Section Number	Steel	RC
6	14~15	306	W 12 × 72	700×700	356	W 12×96	700×700
5	11~13	305	W 12 × 65	700×700	355	W 12×65	700×700
4	8~10	304	W 12 × 65	700×700	354	W 12×65	700×700
3	5~7	303	W 12 × 96	700×700	353	W 12×96	700×700
2	3~4	302	W 12 × 120	700×700	352	W 14×145	700×700
1	1~2	301	W 12 × 152	700×700	351	W 14×193	700×700

		C4			C4A		
Unit	Story	Section Number	Steel	RC	Section Number	Steel	RC
6	14~15	406	W12 × 96	700×700	456	W 12×96	700×700
5	11~13	405	W 12 × 65	700×700	455	W 12×65	700×700
4	8~10	404	W 12 × 65	700×700	454	W 12×65	700×700
3	5~7	403	W 12 × 65	700×700	453	W 14×99	700×700
2	3~4	402	W 14 × 120	700×700	452	W 14×99	700×700
1	1~2	401	W 14 × 159	700×700	451	W 14×176	700×700

		C5			C5A		
Unit	Story	Section Number	DB	Steel	Section Number	DB	Steel
2	3	502	AISC	W 14×99	552	AISC	W 12×65
1	1~2	501	AISC	W 14×132	551	AISC	W 14×132

		C6			C7		
Unit	Story	Section Number	DB	Steel	Section Number	DB	Steel
2	3	602	AISC	W 14×176	702	AISC	W 14×176
1	1~2	601	AISC	W 14×176	701	AISC	W 14×176

Table 1.2 Column Section Data (2)

Typical method for inputting SRC sections:

Properties > Section > ***Section Properties***

Add> **SRC tab**

Section ID > **101** ; Name > **C1**

Shape > **Rect-IBeam**

Concrete Data

HC > **0.7** ; BC > **0.7**

Steel Data / DB > **AISC**

Steel Name > **W 18×258**

Material > Select Material from DB...

Concrete Material>DB>**ASTM(RC)**

Concrete Material / Name > **Grade C4000**

Steel Material>DB>**ASTM(S)**

Steel Material / Name > **A572-50** ↵

Replace steel **(on) ;** Shear Deformation **(on)** ↵

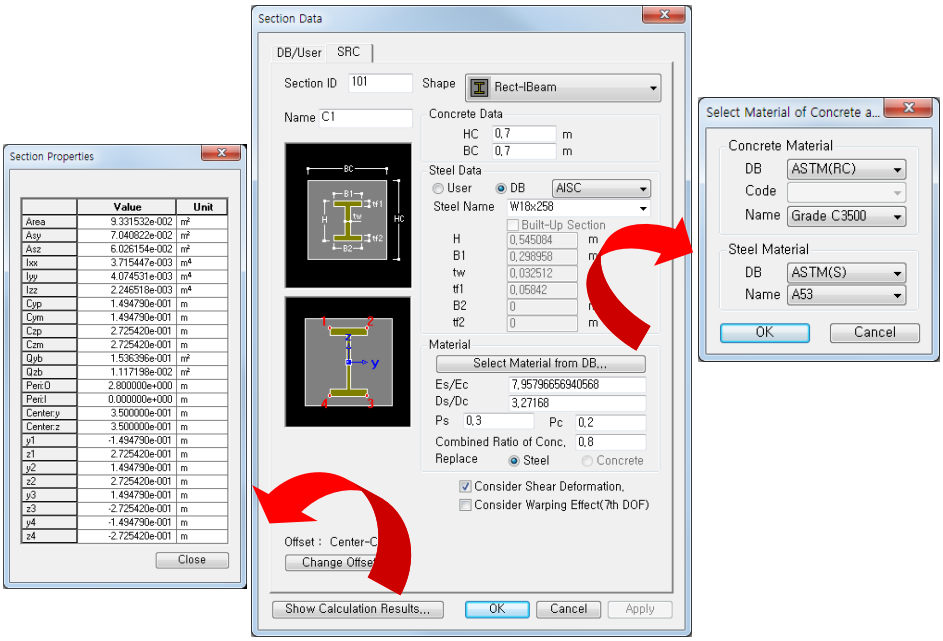


Figure 1.18 Input SRC Sections

Properties > Section >  ***Section Properties*** > Import (❶ of Figure 1.19)

Application folder > **Steel(import).mgb** Open

Import the column section data > None

Close

(Refer to Figure 1.20)

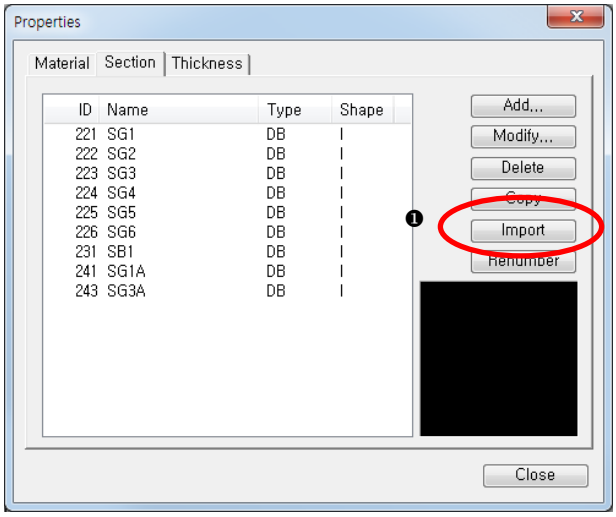


Figure 1.19 Section data before Import

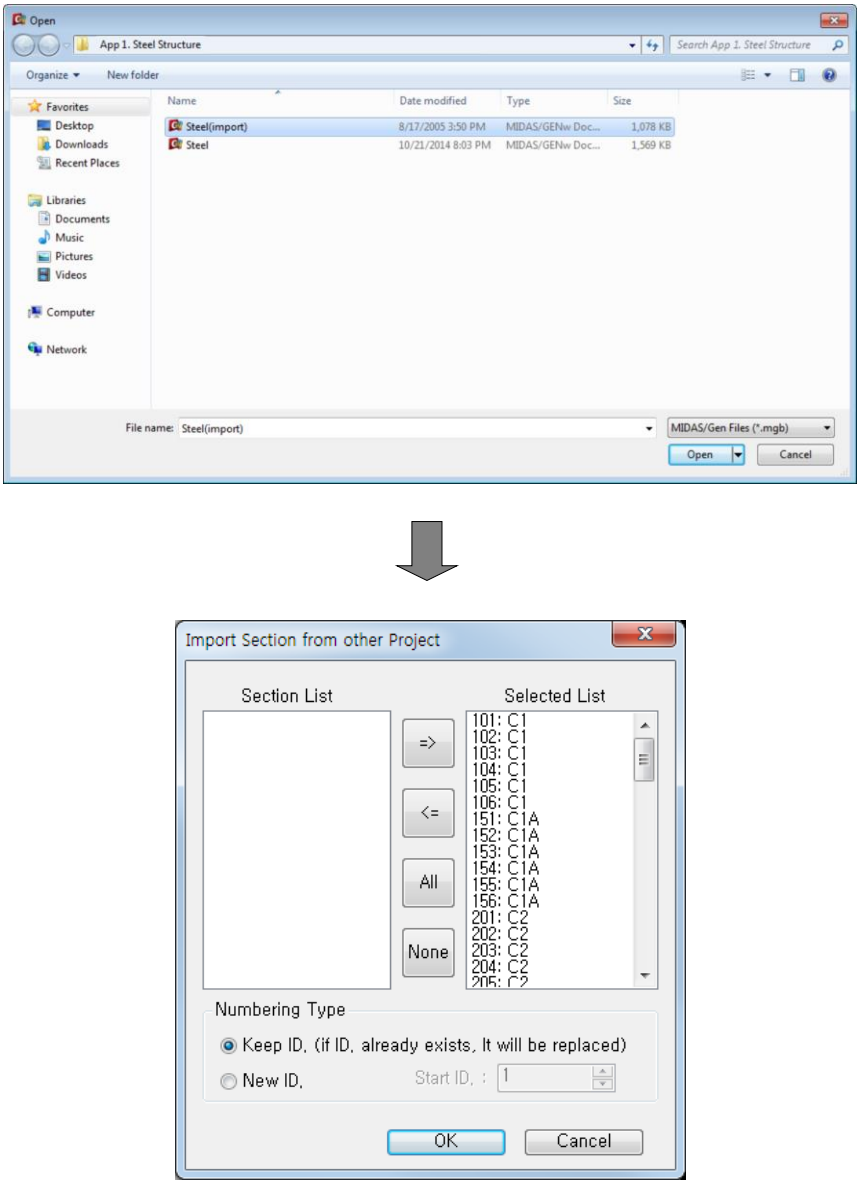


Figure 1.20 Input the section data using import function

Input Columns

Redraw

Node Number (on)

Display > Property > **Property Name** (off) ↵

Iso View, *Rotate Dynamic* *Zoom Fit* (Refer to Figure 1.21)

Select All

Unselect Window (**Node 23, 24**)

Node/Element > Elements > *Extrude Elements*

Extrude Type > **Node → Line Element**

Reverse I-J (on) ; Element Type > **Beam**

Material > **3 : SRC Column** ; Section > **101 : C1**

Generation Type > **Translate** ; Translate > **Equal Distance**

Beta angle > **0** ; Number of Times > **1**

dx, dy, dz > **0, 0, -6** ↵

Display > Element > **Local Direction** (on) ↵

Display > Element > **Local Direction** (off) ↵

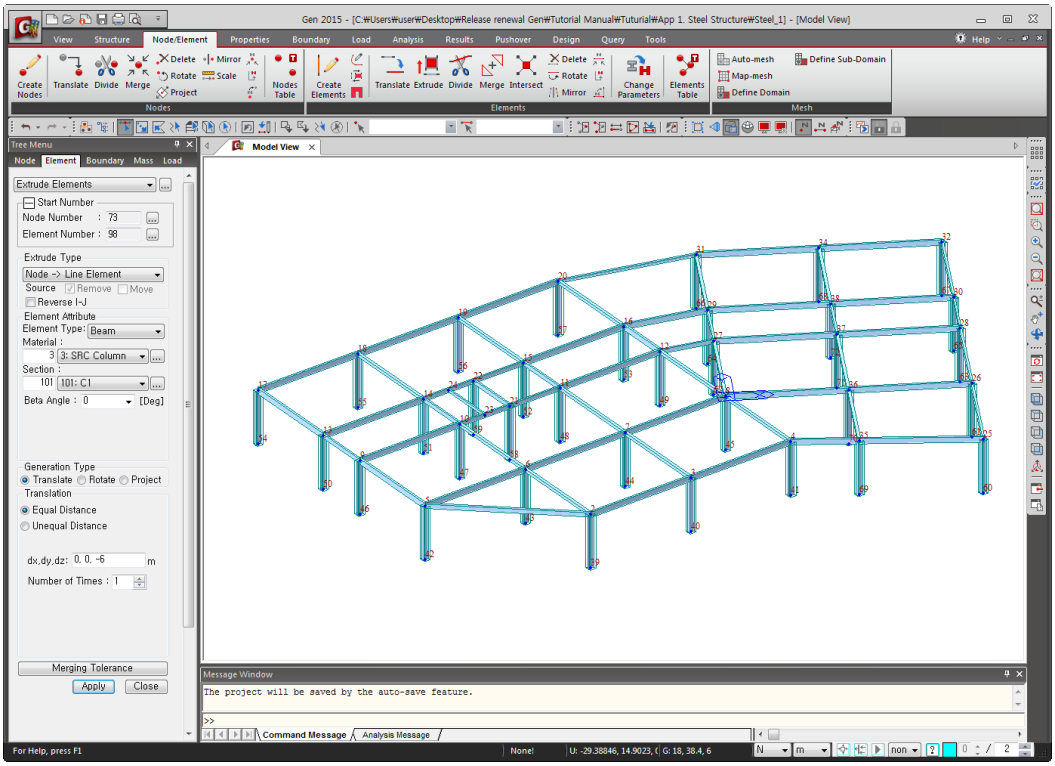


Figure 1.21 Create the columns of the 1st floor

Select Recent Entities **(Columns)**

Node/Element > Elements > ***Change Element Parameters***

Parameter Type > Element Local Axis

Mode > Assign > Beta Angle > **90** ↵

Select Previous

Unselect Polygon (Columns with Beta Angle = 90°)

Beta Angle > **60** ↵

Select Single (Refer to ❶ of Figure 1.22)

Assign > Beta Angle > **-30** ↵

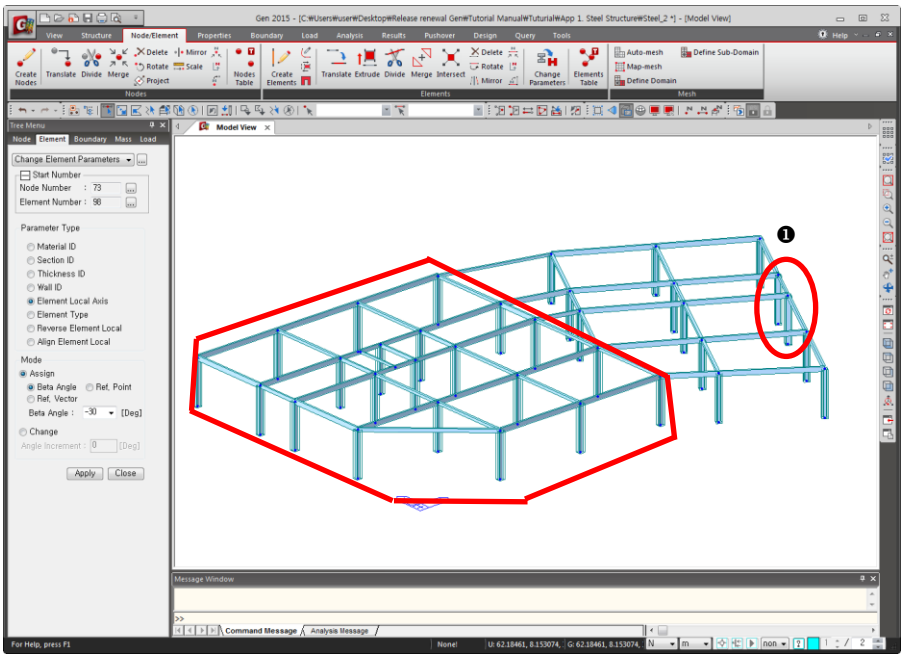


Figure 1.22 Unselect Polygon

Status bar > Filter > **z (Columns)**

Select All

Unselect Polygon (**Columns**) (Refer to Figure 1.23)

Tree Menu > **Works tab**

Properties > Material > **2 : Steel Column** (Drag & Drop)

Select All, ***Active***, ***Node Number*** (off)

Display > Property > **Property Name** (on) ↵

Select Single (**Elements 83, 84**) (Refer to Figure 1.24)

Properties > Section > **151 : C1A** (Drag & Drop)

Modify the others in the same way (Refer to Figure 1.2)

Active All

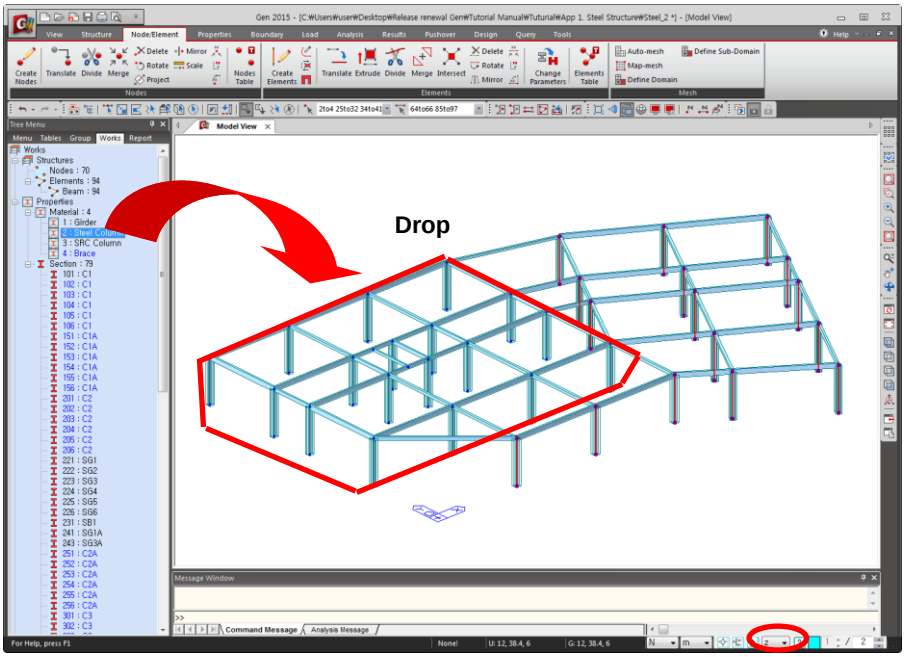


Figure 1.23 Modify beta angles and material properties

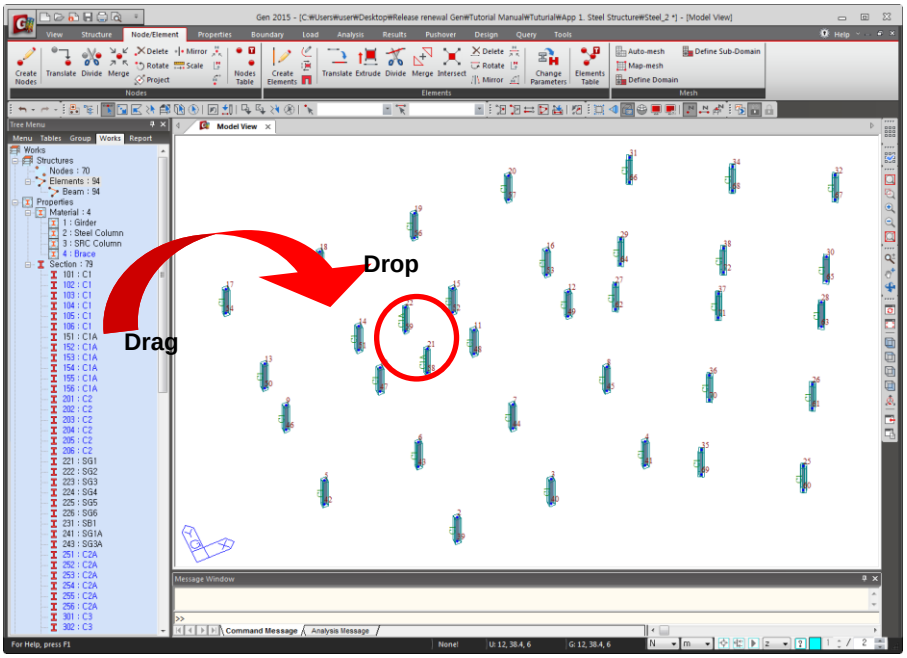


Figure 1.24 Modify the column number using Drag & Drop

Input the Diagonal Elements

Story	X-direction		Y-direction	
	Section Number	Section size	Section Number	Section size
4~15	1002	W 12 × 40	2002	W 14 × 68
1~3	1001	W 10 × 60	2001	W 14 × 68

Table 1.3 Section list of the diagonal elements

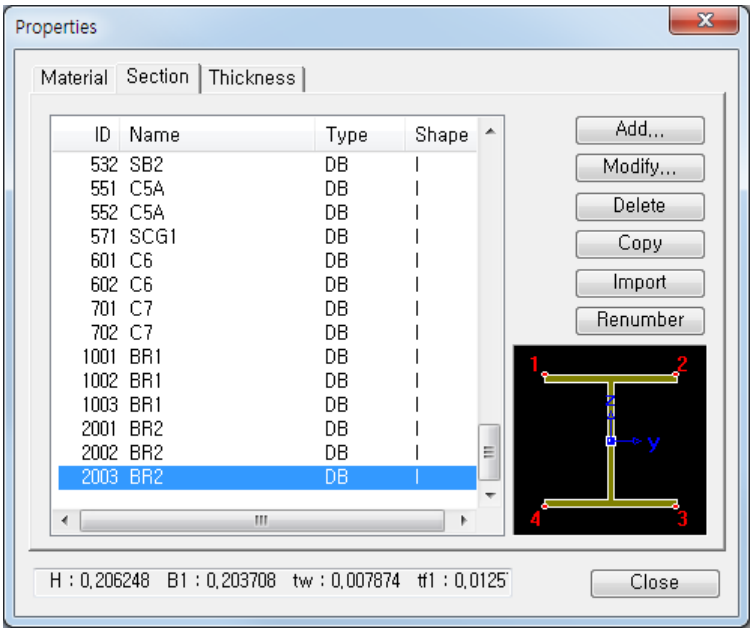


Figure 1.25 Input the Brace section data

Shrink (off)

Zoom Window (**core part**)

Node Number (on) , ***Element Number*** (on)

Node/Element > Elements > ***Create Elements***

Element Type > **Truss**

Material Name > **4 : Brace**

Section Name > **1001 : BR1**

Nodal Connectivity > **X-directional Braces** (Refer to Figure 1.26)

Section No. > **2001:BR2**

Nodal Connectivity > **Y-directional Braces** (Refer to Figure 1.26)

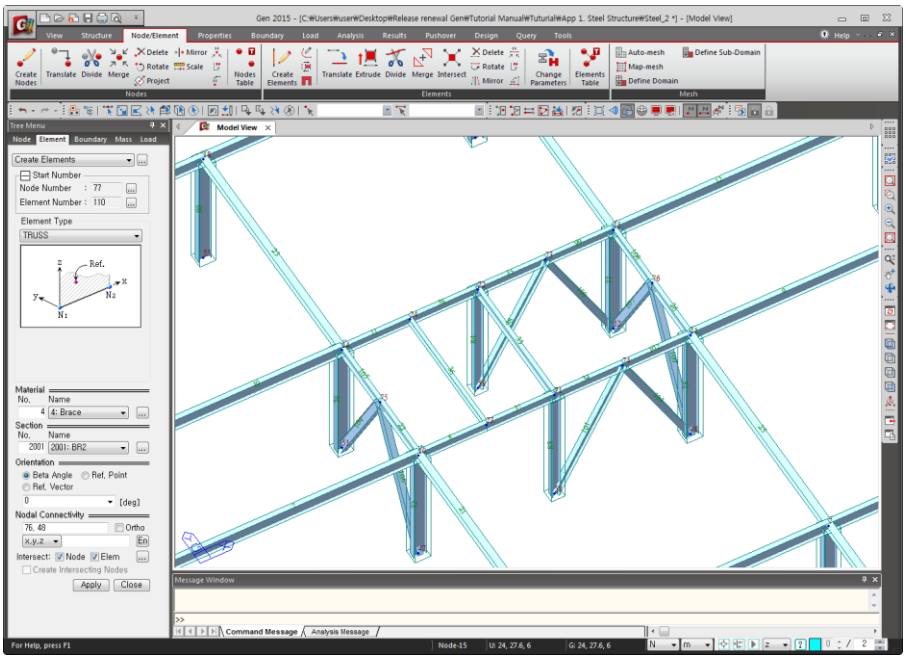


Figure 1.26 Input the Braces

Building Generation

Auto Fitting (on)

Node Number (off), ***Elements Number*** (off)

Status bar > Filter > **none**

Select All

Structure > Building > Control Data > ***Building Generation***

Building Generation > Number of Copies > **2**

Distance(Global Z) > **5** ; Operations > Add

Building Generation > Number of Copies > **6**

Distance(Global Z) > **3.8** ; Operations > Add

Building Generation > Number of Copies > **6**

Distance(Global Z) > **4.2** ; Operations > Add

Building Generation Table>

Insert the increment of the section numbers (Refer to Figure 1.27)

Copy Element Attributes (on) > ...

Boundaries > **Beam Release** (on) ↵ ↵

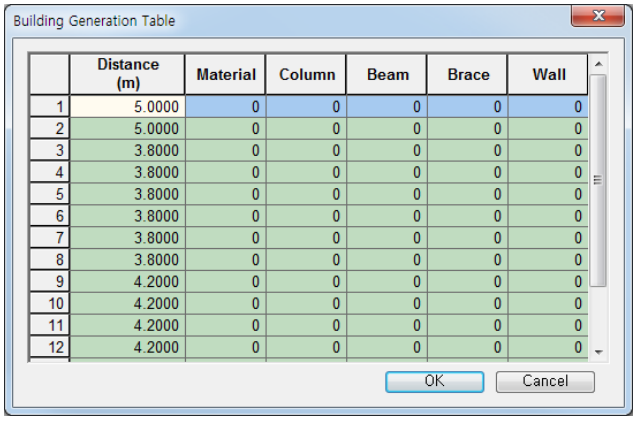


Figure 1.27 Building Generation Table

Select Plane

XY Plane > Z Position > **64** ↵

Active

Display > Boundary > **Beam End release Symbol** (on) ↵

Display > Boundary > **Beam End release Symbol** (off) ↵

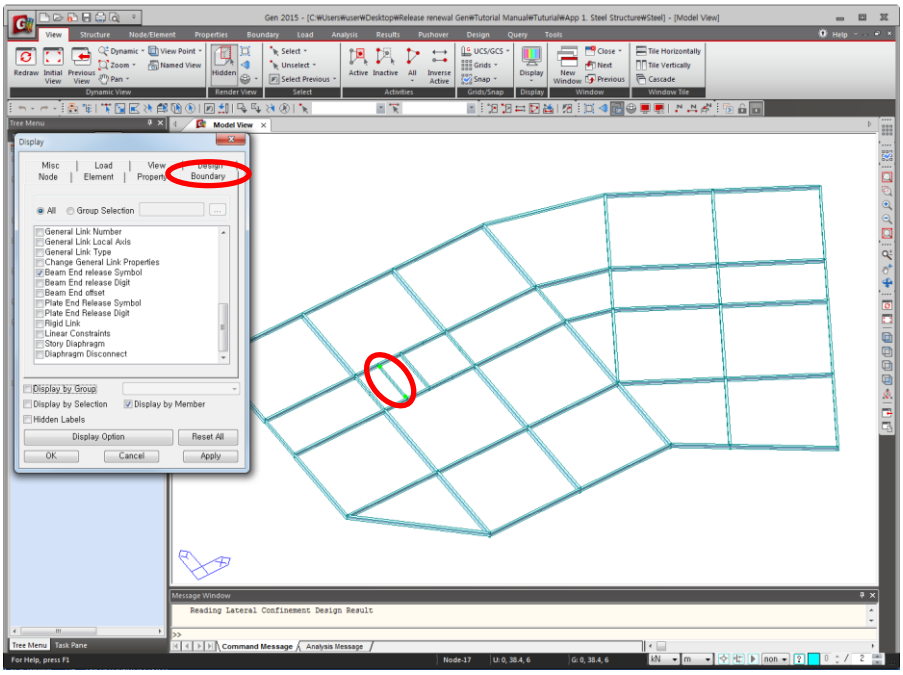


Figure 1.28 Building Generation

Modify the upper part of the model

Element Name	Section Number	Section Size
SG1	521	W 24 × 76
SG2	522	W 21 × 62
SG3	523	W 14 × 48
SG4	524	W 27 × 129
SG5	525	W 24 × 103
SB1	531	W 12 × 26
SB2	532	W 8 × 31
SCG1	571	W 14 × 34

Table 1.4 Sections of the upper part beams/girders

 ***Active All,***  ***Top View***

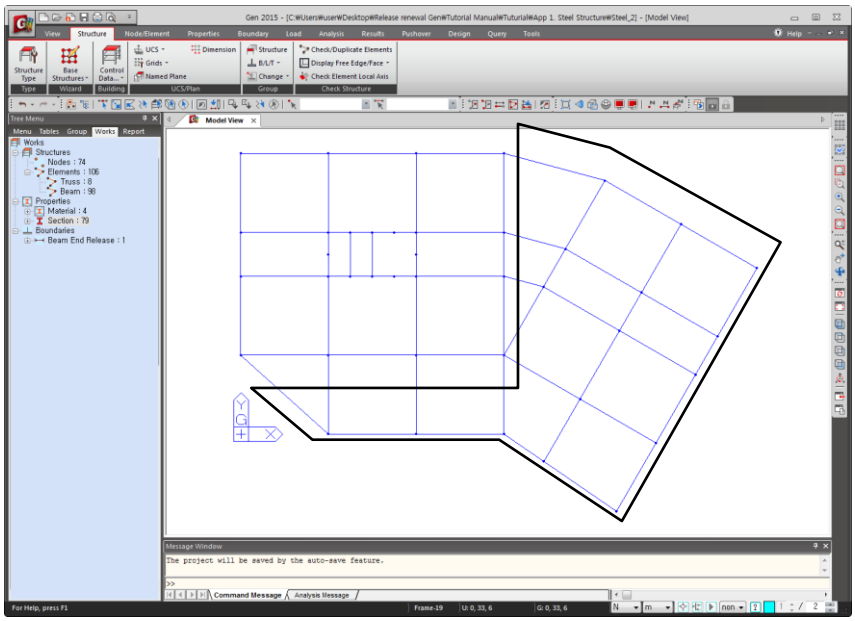
 ***Select Polygon*** + **Ctrl key** in Keyboard (**Top View of Figure 1.29**)

 ***Front View***

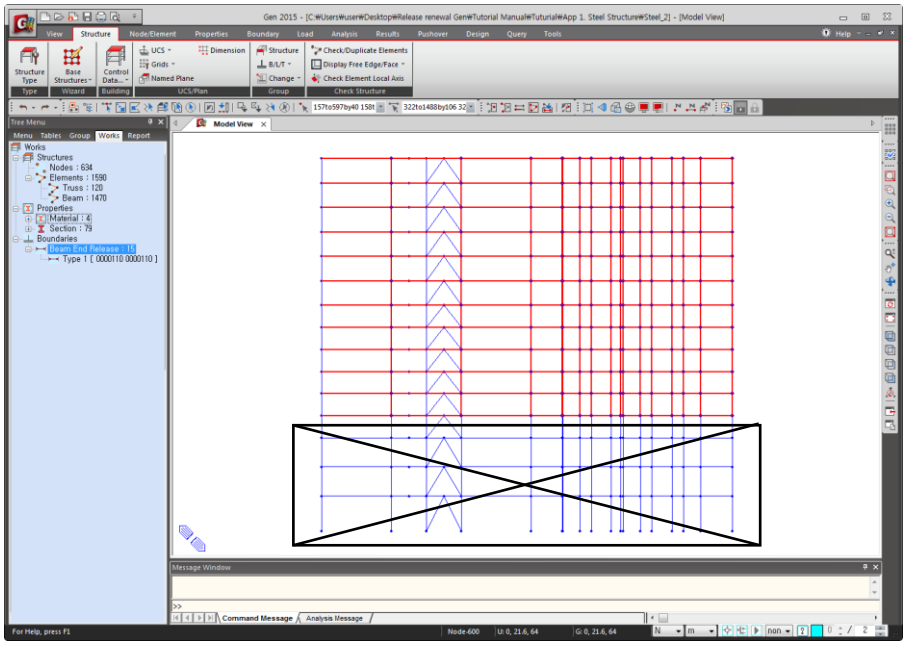
 ***Unselect Window*** (**Front View of Figure 1.29**)

 ***Iso View***

Delete Key in Keyboard (**Selected Nodes & Elements**)



Top view



Front view

Figure 1.29 Select the non-existent elements

Select-Identity Element

Select Type > **Section**

List > **243** Add, Close

Right View

Unselect Window (Refer to Figure 1.31)

Iso View

Tree Menu > **Works tab**

Properties>Section > **523:SG3** (Drag & Drop)

Select-Identity Element

Select Type > **Section**

List > **224 : SG4**

Add, Close

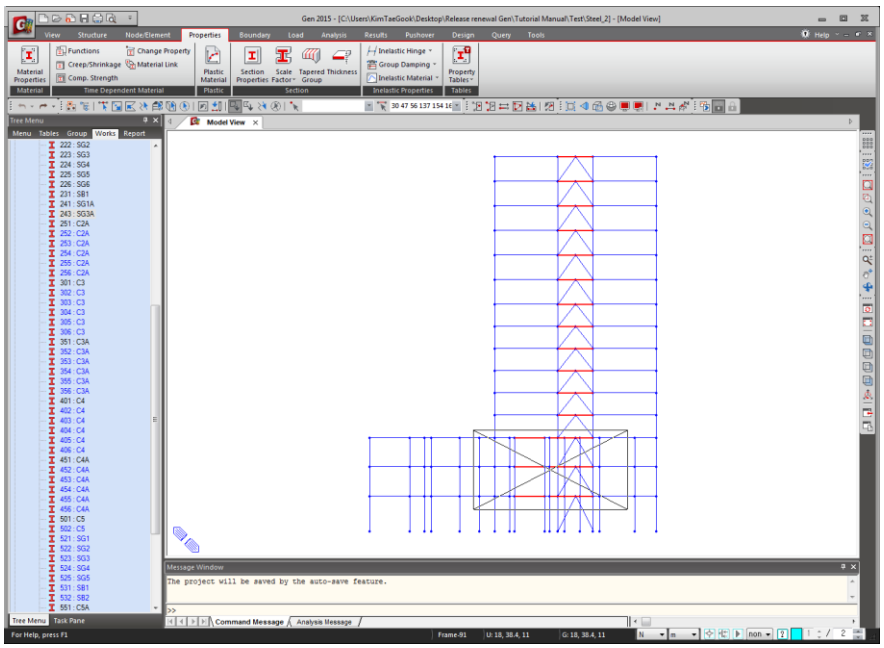
Top View

Unselect Window (Refer to Figure 1.31)

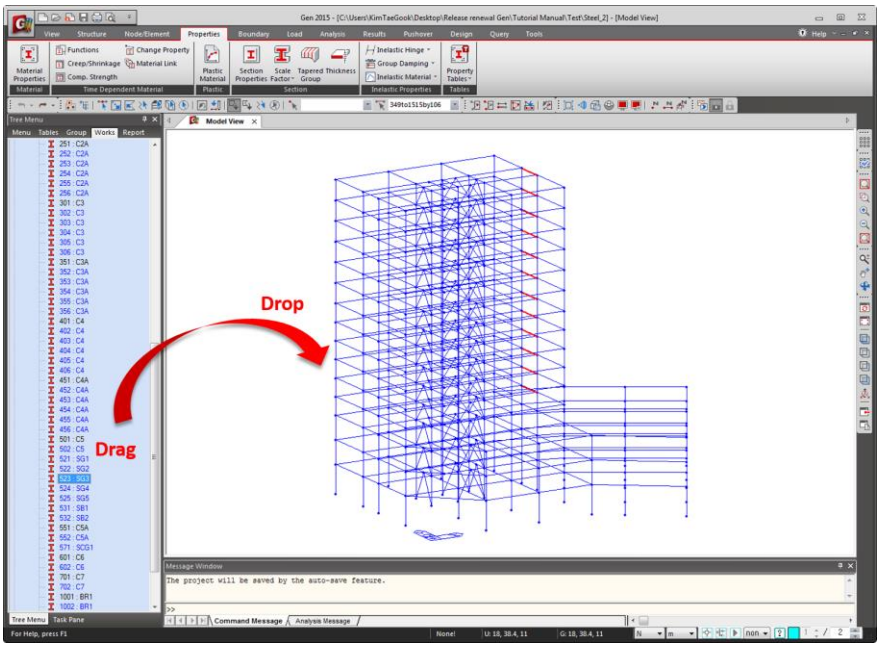
Tree Menu/ **Works tab**

Properties > Section > **525:SG5** (Drag & Drop)

Iso View



Right View



Iso View

Figure 1.30 Modify the model using Unselect Window and Works Tree

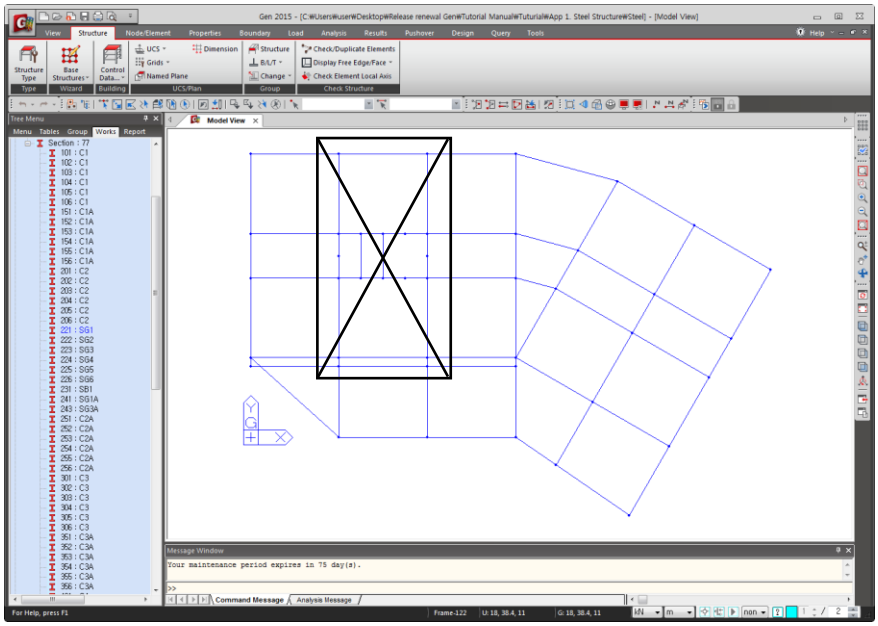


Figure 1.31 Modify the model using Unselect Window

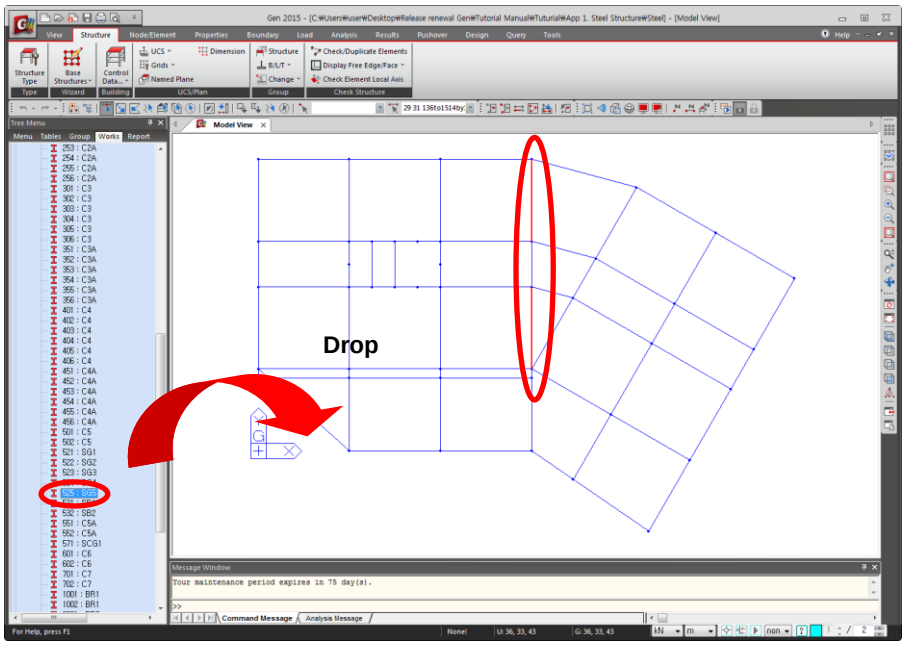


Figure 1.32 Modify the upper part of the model

Input Story Data

Structure > Building > Control Data > ***Story***

Auto Generate Story Data...

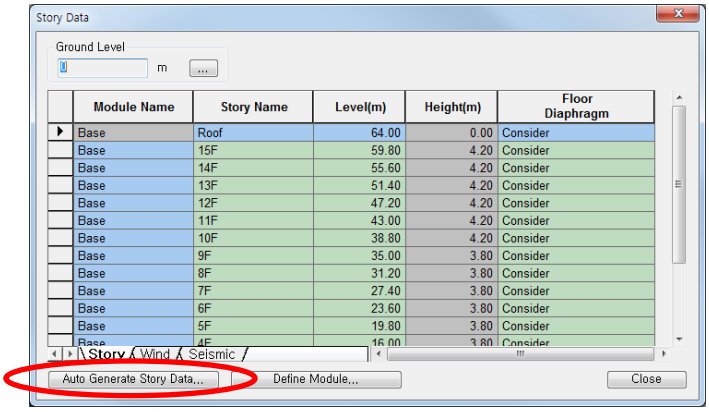


Figure 1.33 Story Data

Input the Cantilever Beams

Structure > UCS/Plan > ***Named Plane***

Plane Name > **B**

Plane Type > **X-Z Plane**

Y Position > **10.8**

Add

Select All

Active Identity > Named Plane > **B**

Active, Close

Display > Node > **Story Name** (on)

Display > Boundary > **Beam End release Symbol** (on) ↵

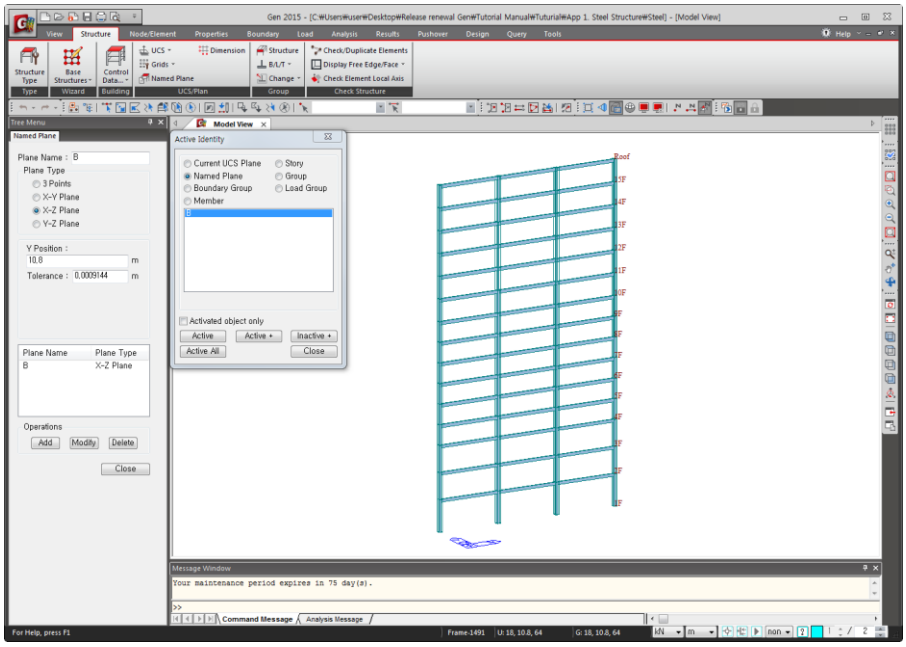


Figure 1.34 Activate the Named Plane

Node/Element > Elements > ***Extrude Elements***

Extrude Type > **Node →Line Element > Reverse I-J** (on)

Element Type > **Beam ;** Material > **1:Girder**

Section > **571:SCG1**

Equal Distance > dx, dy, dz > **0, -1.2, 0**

Number of Times > **1**

Select Polygon (**Nodes over the 5th Floor**) ↵

Node/Element > Elements > ***Create Elements***

Element Type > **General beam/Tapered beam**

Material > **1:Girder** ; Section No. > **532:SB2**

Zoom Window (**the grid of the 5th Floor**)

Nodal Connectivity > **637**

Zoom Fit

Zoom Window (**the grid of the 5th Floor**)

Zoom Window (off)

Nodal Connectivity > **637, 640**

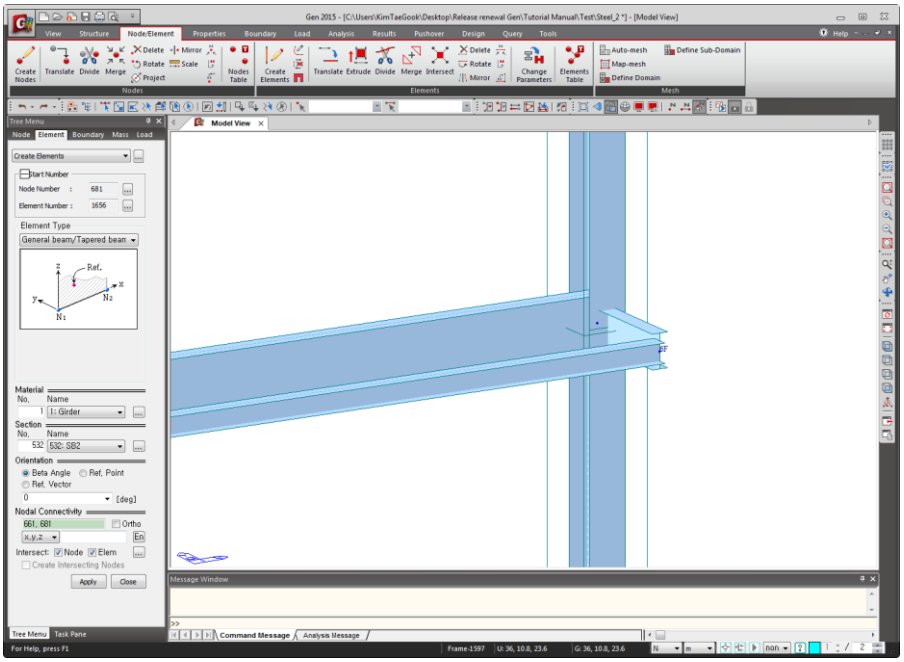


Figure 1.35 Input the Cantilever Beam

Zoom Fit

Select Recent Entities

Boundary > Release/Offset > **Beam End Release**

Pinned-Pinned

Select Previous

Node/Element > Elements > ***Translate Elements***

Translation > **Unequal Distance**

Axis > **Z**

Distances > **5@3.8, 6@4.2**

Copy Node Attributes (on)

Copy Element Attributes (on) ↵

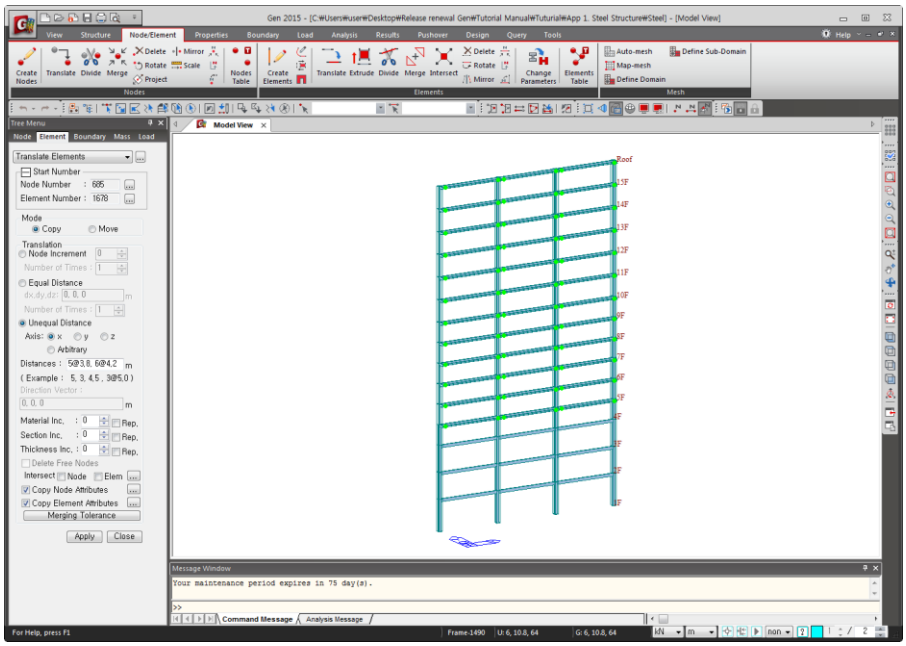


Figure 1.36 Copy the outer Cantilever Beam

Input the Boundary Conditions

Active All

Display > Node > **Story Name** (on) ↵

Select Plane

XY Plane > Z Position > **0**

Boundary > Supports > **Define Supports**

D-All (on) ; **R-All** (on) ↵

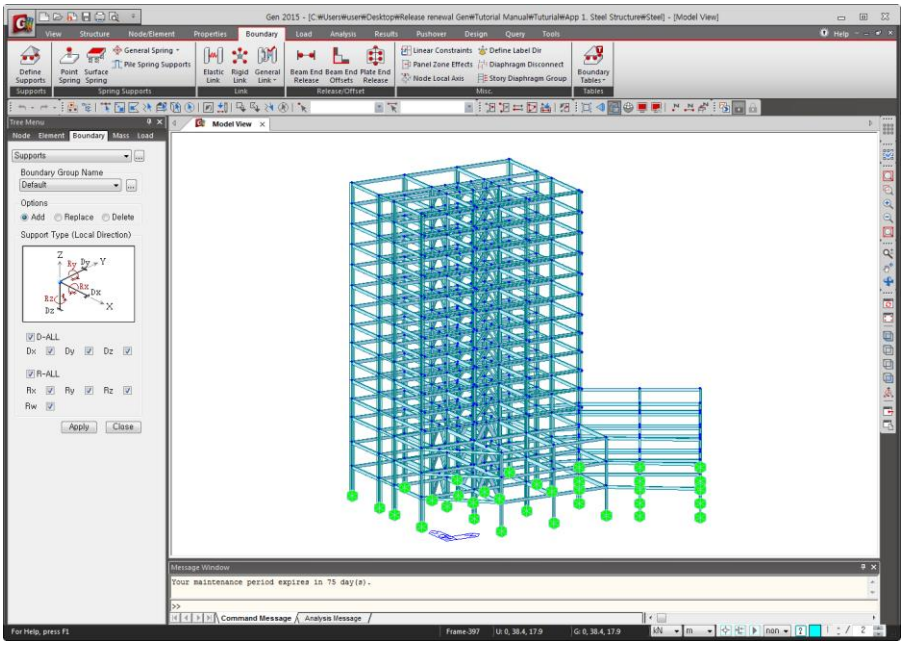


Figure 1.37 Input the Support Condition of the structure

Input Loads

Load Cases Setting

Load > ***Static Load Cases***

Input as Figure 1.38

Close

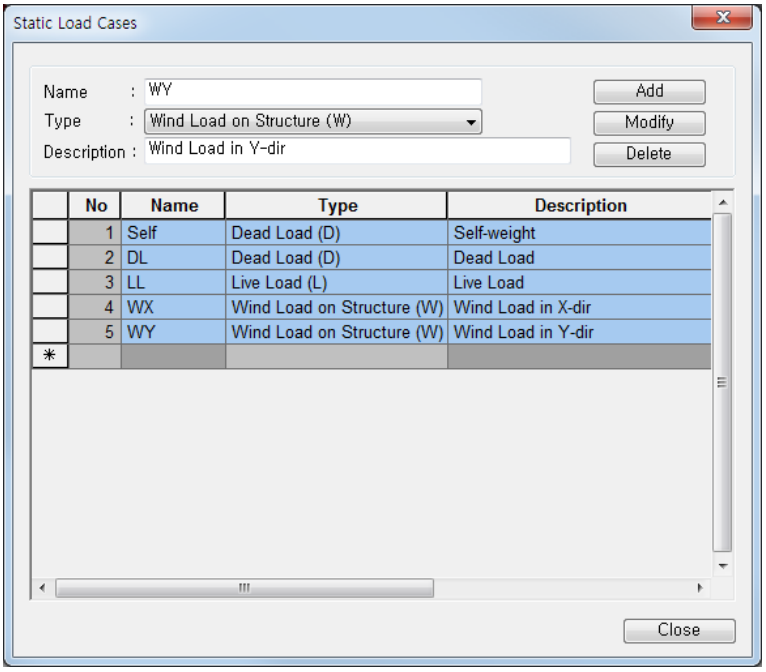


Figure 1.38 Static unit load case setting

Input Self-weight

Refer to other “Tutorials”.

Input the Floor Loads

Load > Static Loads > Initial Forces/Misc. > **Assign Floor Loads**

Load Type > [...]

Define Floor Load Type (Refer to Figure 1.39)

Refer to "**Applied Loads**" on page 5.

Close

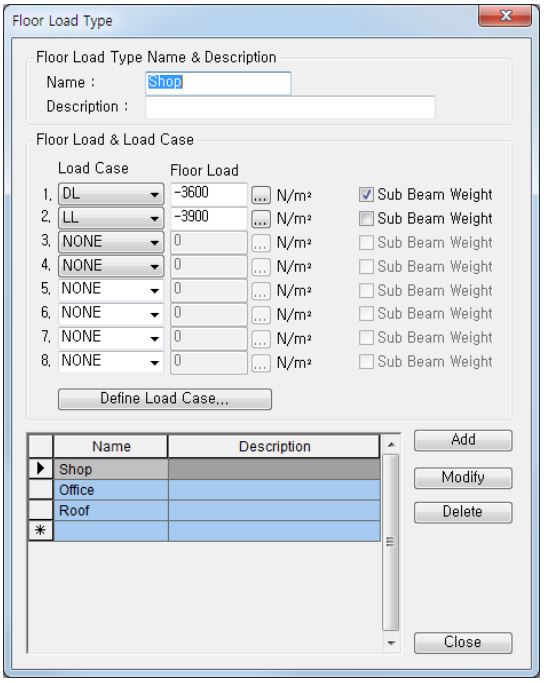


Figure 1.39 Define Floor Load Type

Active Identity

Story > **2F** **+Below** (on)

Active , Close

Node Number (on)

Hidden (off)

Angle View

Horizontal > **50** ; Vertical > **60** ↵

Load > Static Loads > Initial Forces/Misc. > **Assign Floor Loads**

Load Type > **Shop**

Distribution Type > **One Way** ; Load Angle (A1) > **0**

No. of Sub Beams > **3 ;** Sub Beam Angle (A2) > **90**

Unit Self Weight > **883 N/m** ; **Copy Floor Load** (on)

Load Direction > **Global Z ;** Projection > **Yes**

Axis > **Z** ; Distances > **5**

Nodes Defining Loading Area > **4,12, 9, 5, 2, 4**

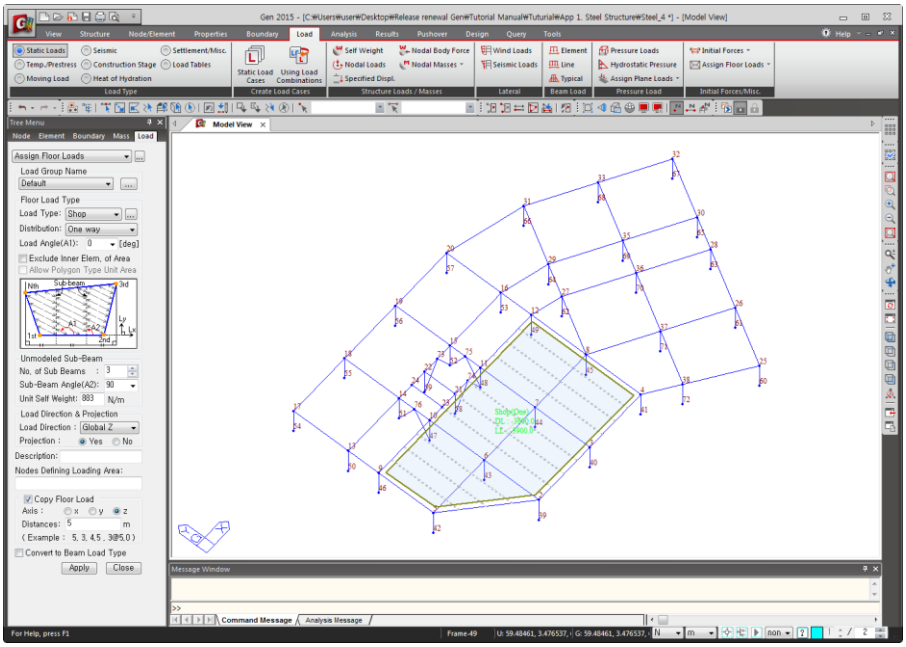


Figure 1.40 Input the Floor Loads

Nodes Defining Loading Area > **17, 13, 16, 20, 17**

Nodes Defining Loading Area > **25, 28, 27, 8, 4, 25**

Nodes Defining Loading Area > **30, 32, 31, 29, 30**

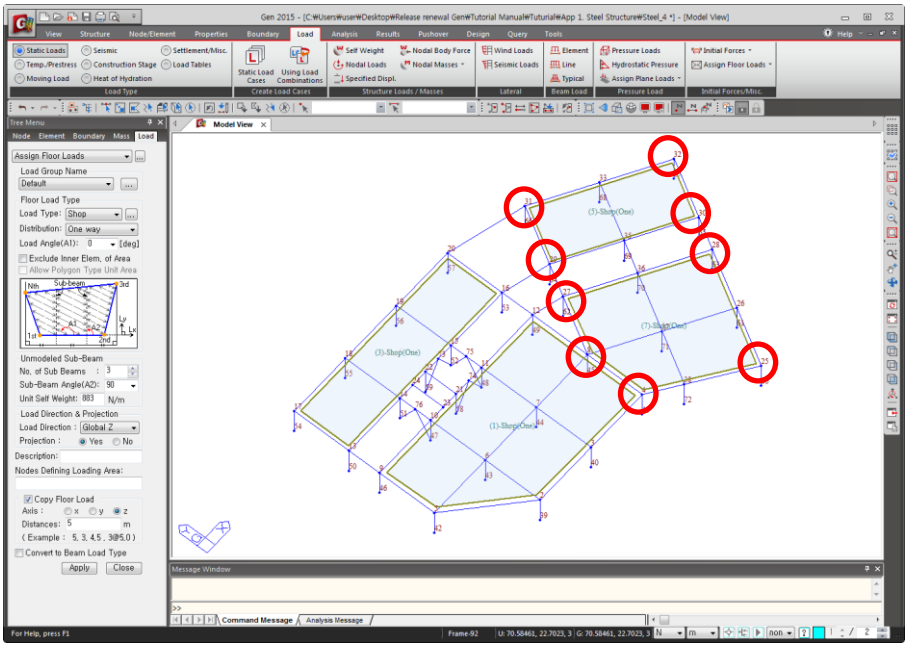


Figure 1.41 Input the Floor Loads of the skewed part

Load Angle(A_1) > **90**

Sub-Beam Angle(A_2) > **0**

Nodes Defining Loading Area > **12, 27, 8, 12**

Nodes Defining Loading Area > **20, 31, 29, 16, 20**

Display > Load > **Floor Load Name** (on) ↵

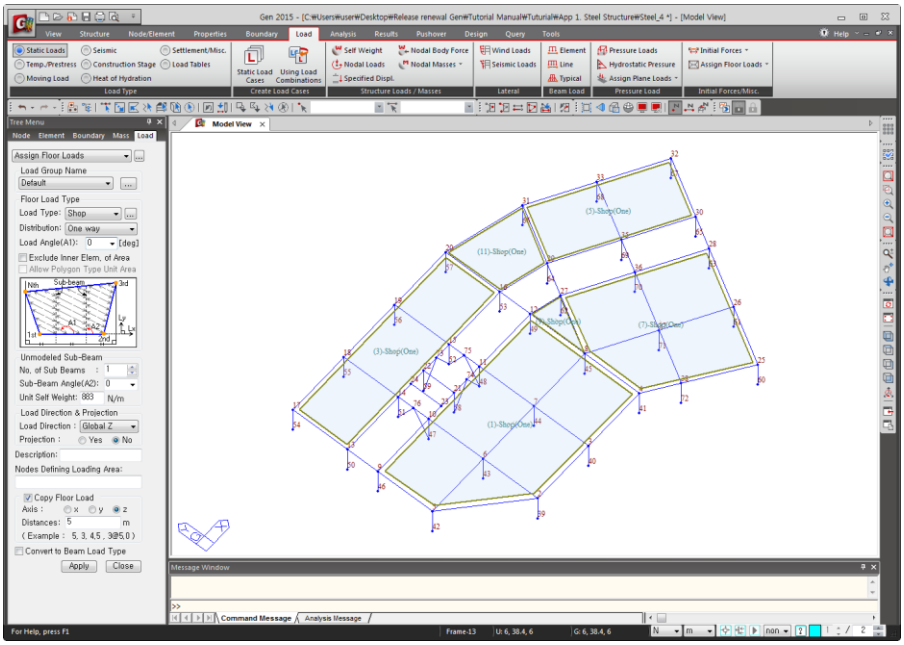


Figure 1.42 Confirm the inputted floor loads by Floor Load Name

No. of Sub Beams > **1**

Nodes Defining Loading Area > **16, 29, 27, 12, 16**

Nodes Defining Loading Area > **13, 14,10, 9, 13**

Nodes Defining Loading Area > **15, 16, 12, 11, 15**

Nodes Defining Loading Area > **29, 30, 28, 27, 29**

No. of Sub Beams > **0**

Nodes Defining Loading Area > **22, 21, 23, 24, 22**

Active All

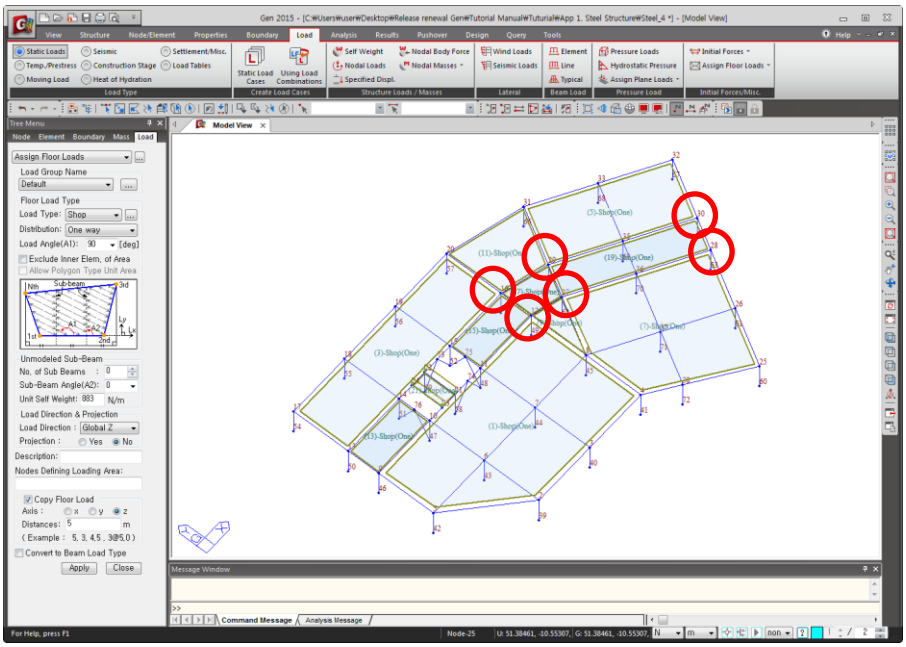


Figure 1.43 Confirm the inputted floor loads by Floor Load Name

Active Identity

Story > **4F** **+Below** (on)

Active, Close

Display > Load > **Floor Load Name** (off) ↵

Load Type > **Office**

Distribution Type > **One Way**

Load Angle (A1) > **90**

No. of Sub Beams > **3**

Sub-Beam Angle (A2) > **0**

Unit Self Weight > **883 N/m**

Copy Floor Load (on) ; Axis > **z**

Distances > **6@3.8, 5@4.2**

Nodes Defining Loading Area > **124, 127, 123, 120, 124**

Input the others in the same way (Refer to Figure 1.44)

Node Number (off)

Active All, ***Front View***

Tree Menu > **Works tab**

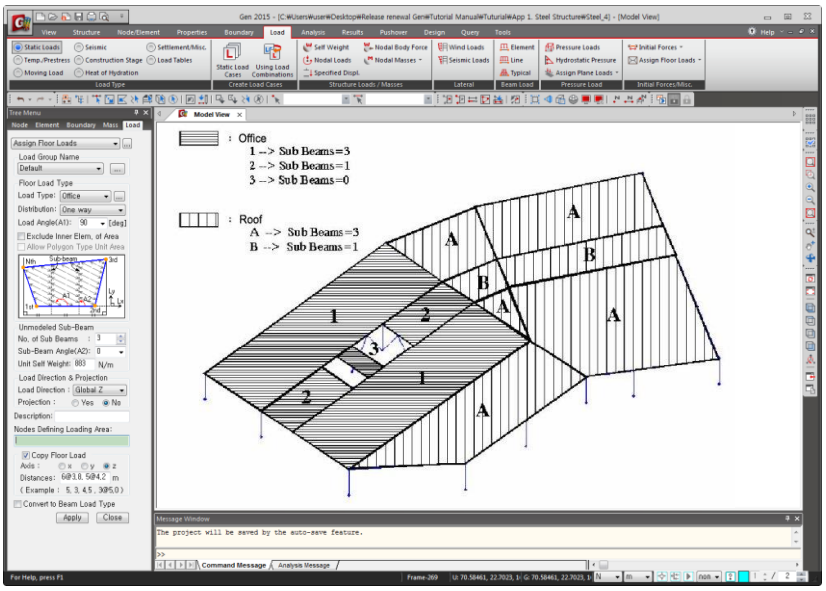


Figure 1.44 Loading Plan of the upper part over the 4th floor

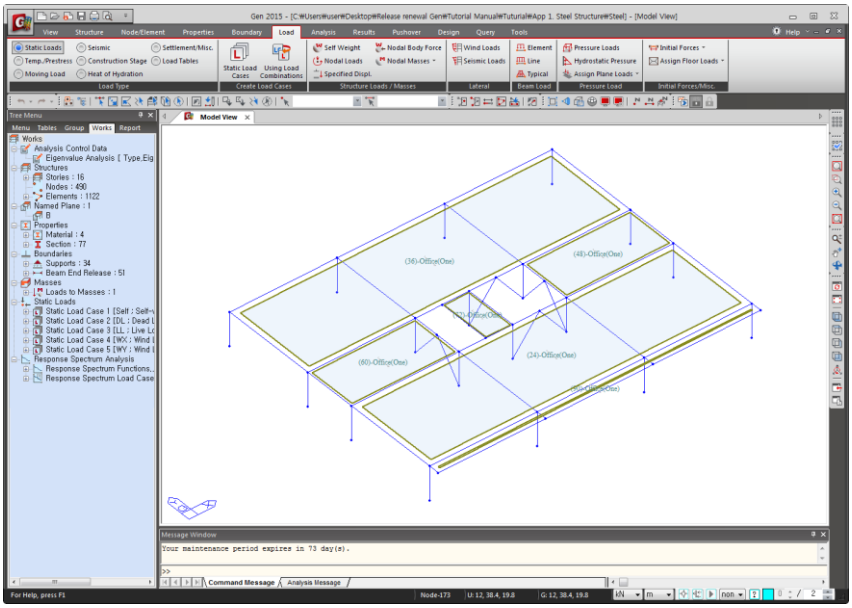


Figure 1.45 Confirm the inputted floor loads on the upper Office

Active Identity

Story > **4F** ; **+Below** (on)

Active , Close

Angle View

Horizontal > **50** ; Vertical > **60** ↵

Zoom Fit

Load Type > **roof** ; Description > **4F roof**

Copy Floor Load (off)

Nodes Defining Loading Area > **Roof Loads**

** Notice: Load Angle, Sub-Beam Angle, Number of Sub Beams*

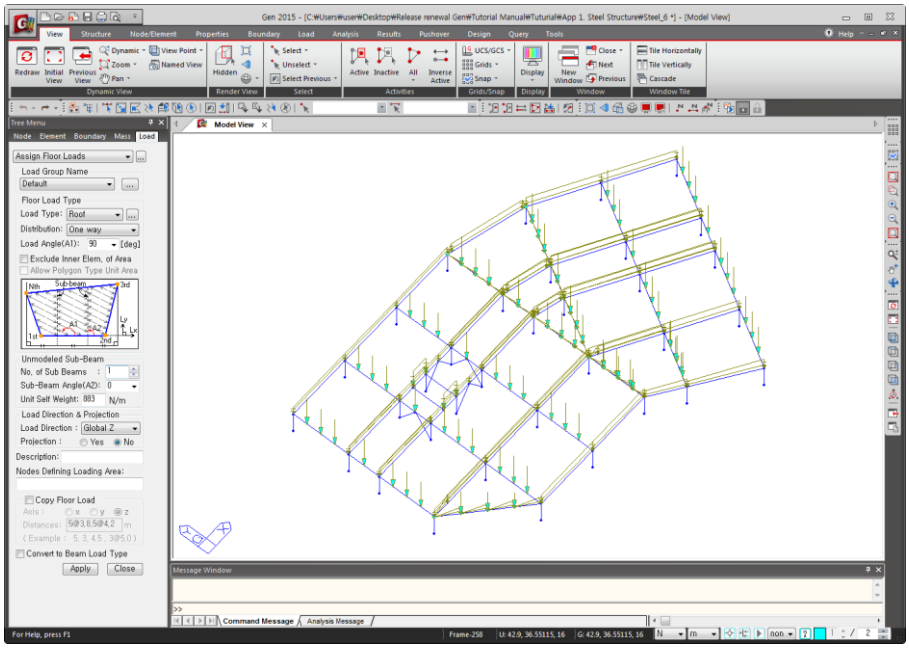


Figure 1.46 Input the 4th floor loads

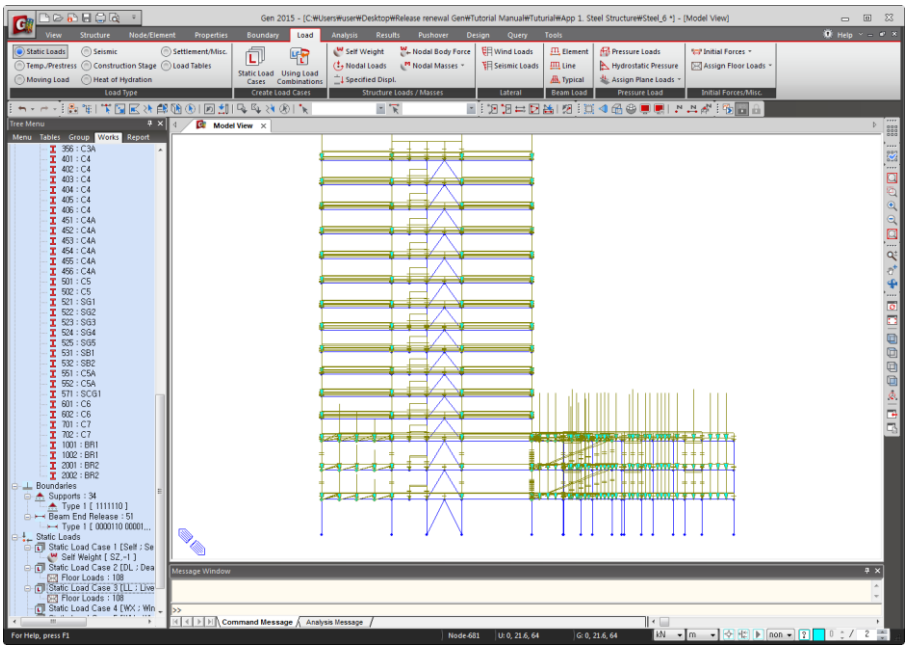


Figure 1.47 Confirm the inputted loads by Works Tree

Active Identity

Story > **5F** ; **+Below** (on)

Active, Close

Load Type > **Office**

Distribution Type > **One Way**

No. of Sub Beams > **0**

Description > *Delete*

Copy Floor Load (on)

Z Axis Distances > **5@3.8, 5@4.2**

Nodes Defining Loading Area > **Cantilever**

**Consider Load Angle (A1)*

Active Identity

Story > **15F** ; **+Below** (on)

Active

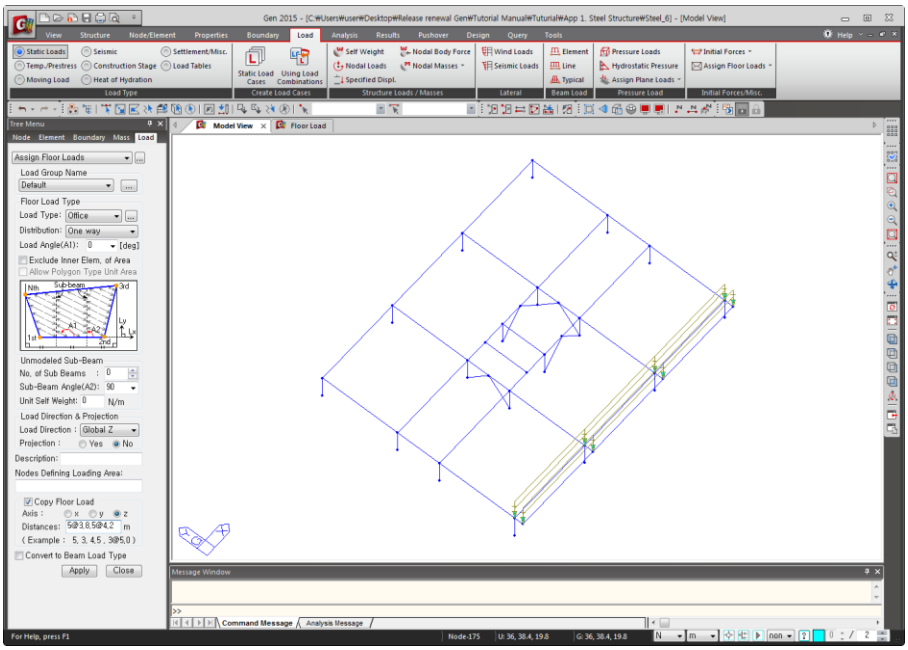


Figure 1.48 Input the Floor Loads of the upper part cantilever

Active Identity

Story > **Roof** ; **+Below** (on)

Active, Close

Load Type > **roof**

No. of Sub Beams > **3**

Copy Floor Load (off)

Nodes Defining Loading Area > **Roof Floor**

Cantilever portion:

No. of Sub Beams > **0**

Active All

Assign Floor Loads >

Floor Load Table > (Refer to Figure 1.50)

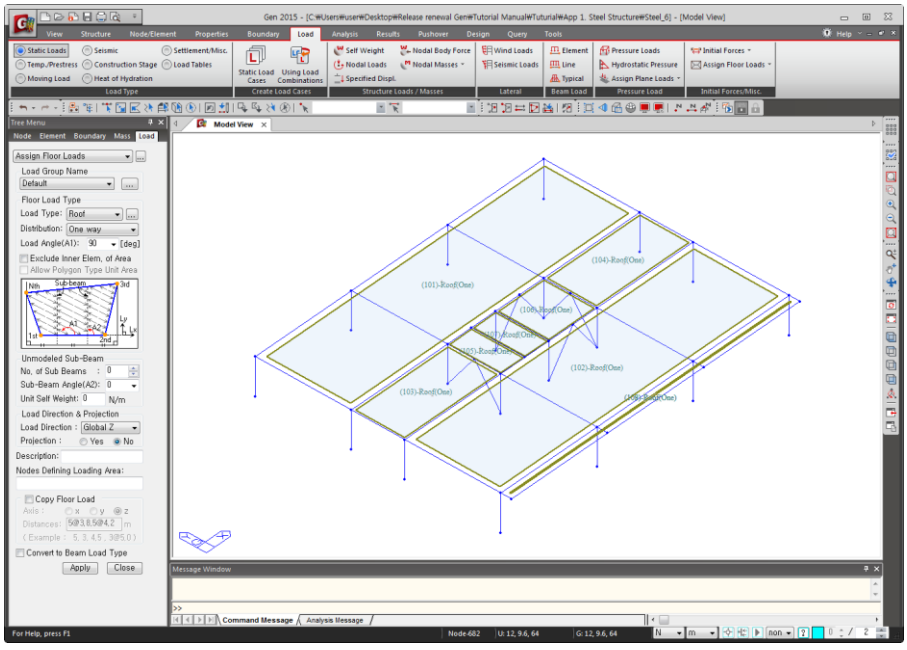


Figure 1.49 Input the floor loads of the roof

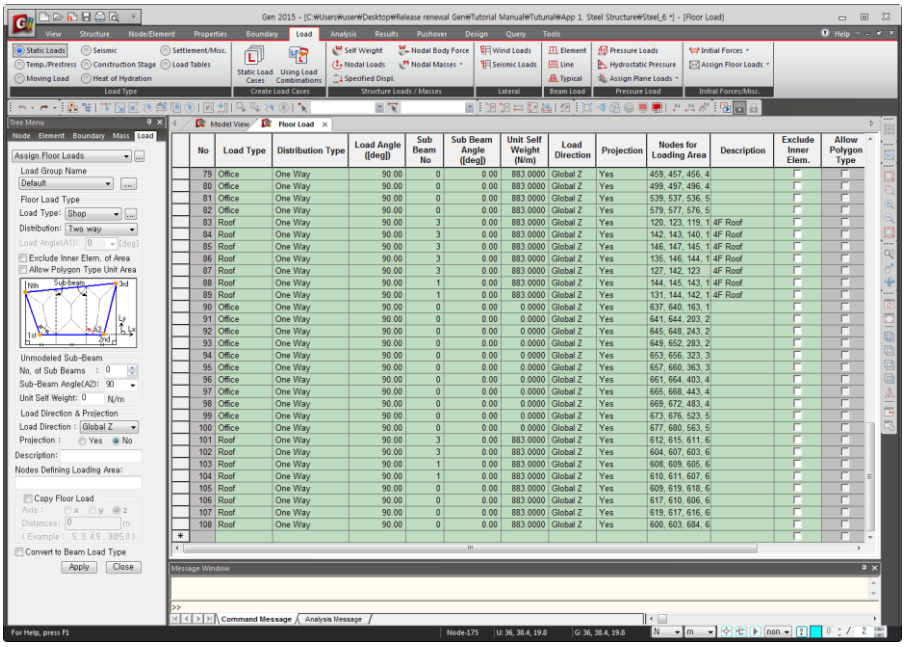


Figure 1.50 Floor Load Table

Input the Wind Loads

Structure > Building > Control Data > ***Story***

Wind tab (❶ of Figure 1.51)

Auto Generate Story Data... ↵

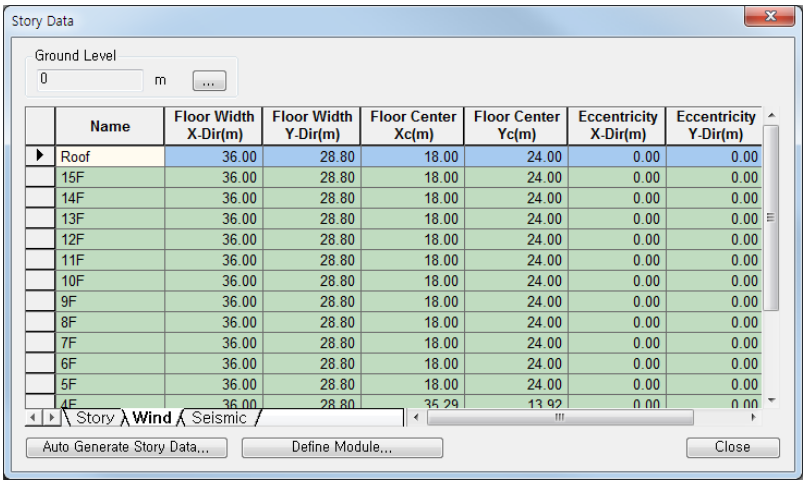


Figure 1.51 Story Data

Load > Lateral Loads > ***Wind Loads***

Add

Load Case Name > **WX** Wind Load Code > **UBC(1997)**

Projected Area Method > **(on)** ;

Exposure Category > **C** ; Basic Wind Speed > **80**

Importance Factor > **1** ; Pressure Coefficient > **1.3**

Scale Factor in Global Y > **1** ; Scale Factor in Global Y > **0**

Wind Load Profile...

Story Shear (GL) > **3241920.0 N** Close ↵

Add

Load Case Name > **WY** Wind Load Code > **UBC(1997)**

Projected Area Method > **(on)** ;

Exposure Category > **C** ; Basic Wind Speed > **80**

Importance Factor > **1** ; Pressure Coefficient > **1.3**

Scale Factor in Global X > **0** ; Scale Factor in Global Y > **1**

Wind Load Profile...

Story Shear (GL) > **4212477.0 N** Close ↵

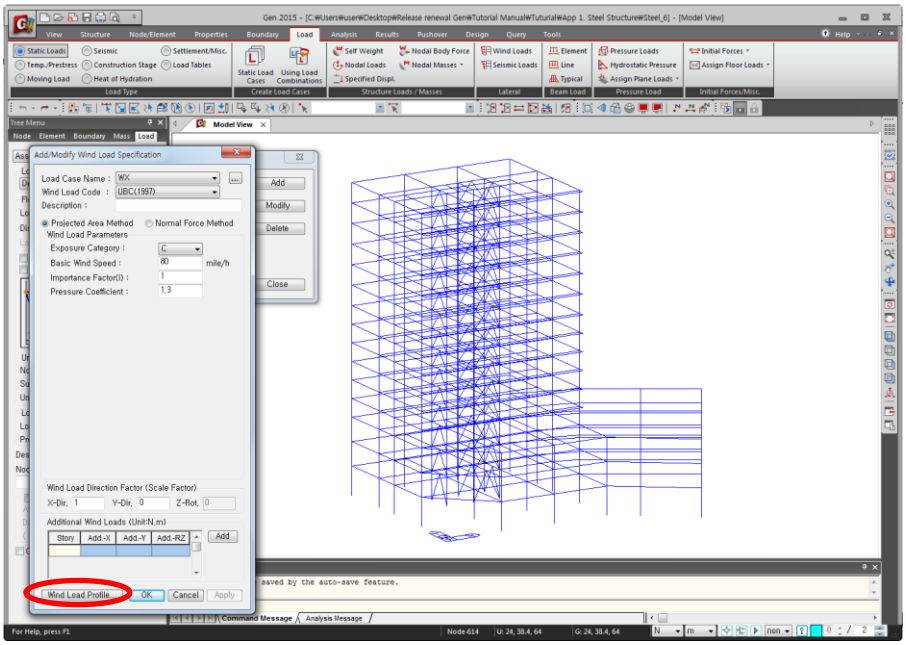


Figure 1.52 Dialog box to input the wind load

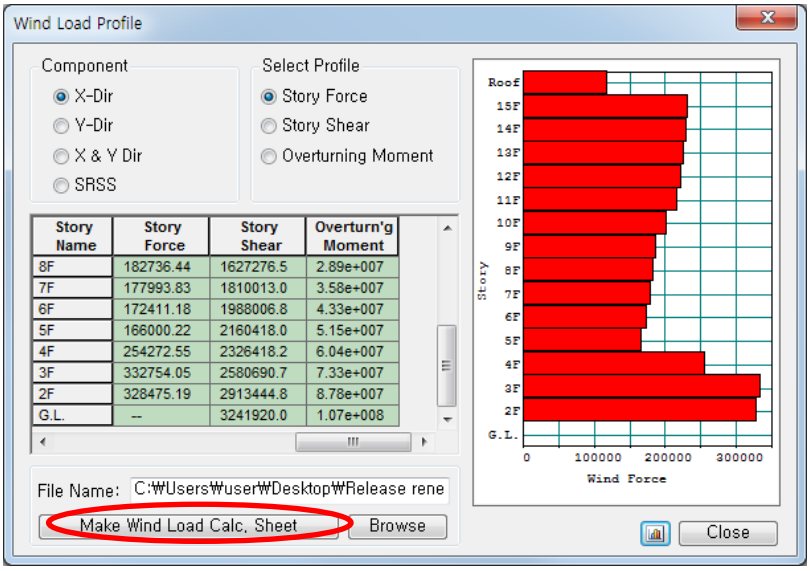


Figure 1.53 Wind Load Profile

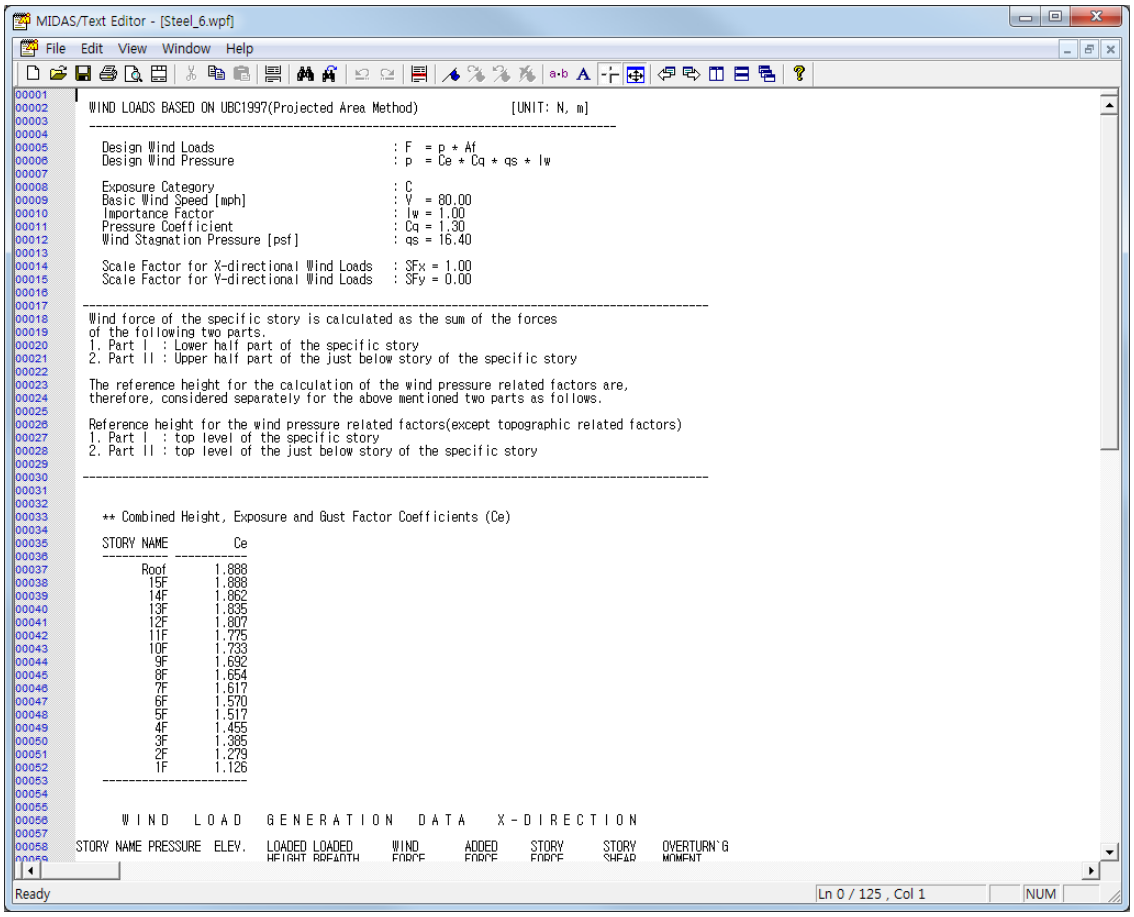


Figure 1.54 Wind loads calculation

Input the Response Spectrum Analysis Conditions

Structure > Type > ***Structure Type***

Converting Type of Model weight to Masses > **Convert to X, Y**

Gravity Acceleration > **9.806**

Align Top of Beam Section to Floor(X-Y Plane) for Panel Zone Effect/Display (on) ↵

Load > Structure Loads/Masses > Nodal Masses > ***Loads to Masses***

Mass Direction > **X, Y**

Load Type for Converting > *all* (on)

Load Case > **DL** ; Scale Factor > **1** Add ↵

Query > ***Story Mass Table***

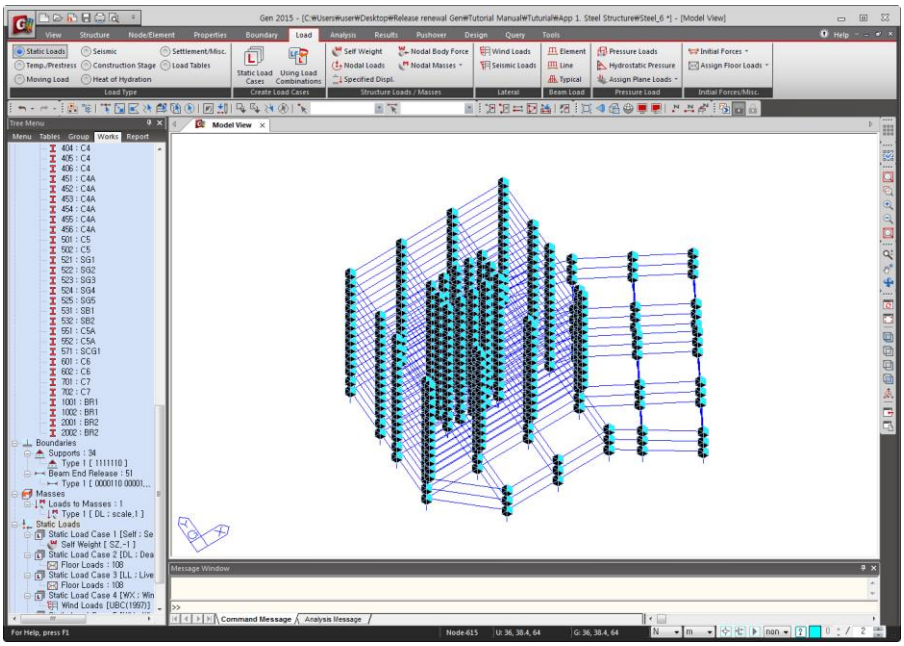


Figure 1.55 Create the mass data automatically

Model View | Story Mass

Story	Level (m)	Translational Mass X-Dir (N/g)	Translational Mass Y-Dir (N/g)	Rotational Mass (N/g·m²)	Center of Mass X-Coord (m)	Center of Mass Y-Coord (m)
Use Ground Level : OFF						
Consider Mass under Ground Level : ON						
Roof	64.0000	645283.2862201	645283.2862201	141283870.7222	18.0054	24.0556
15F	59.8000	576240.3312567	576240.3312567	132417276.1453	17.9933	24.0908
14F	55.6000	575403.8652721	575403.8652721	132183411.5263	17.9900	24.0933
13F	51.4000	574567.3992874	574567.3992874	131949527.1881	17.9866	24.0958
12F	47.2000	574567.3992874	574567.3992874	131949527.1881	17.9866	24.0958
11F	43.0000	575075.9272789	575075.9272789	132013997.4102	17.9867	24.0928
10F	38.8000	570986.0483796	570986.0483796	130942673.2916	17.9863	24.0857
9F	35.0000	566387.6414888	566387.6414888	129805857.5742	17.9859	24.0814
8F	31.2000	567460.3194981	567460.3194981	130026546.7558	17.9881	24.0780
7F	27.4000	568532.9975075	568532.9975075	130247217.7493	17.9902	24.0746
6F	23.6000	568532.9975075	568532.9975075	130247217.7493	17.9902	24.0746
5F	19.8000	569644.7371027	569644.7371027	130558006.1166	17.9900	24.0781
4F	16.0000	1367162.443169	1367162.443169	676260934.9352	32.5828	17.8105
3F	11.0000	1115589.873984	1115589.873984	552075939.7212	31.2398	18.3457
2F	6.0000	1132763.073632	1132763.073632	560134031.9527	31.1096	18.4065
1F	0.0000	0.00000000	0.00000000	0.0000	0.0000	0.0000
	Total	10548198.34087	10548198.34087			

ADDITIONAL MASSES FOR THE CALCULATION OF EQUIVALENT SEISMIC FORCE

Story	Level (m)	Translational Mass X-Dir	Translational Mass Y-Dir
Roof	64.0000	0.00000000	0.00000000
15F	59.8000	0.00000000	0.00000000
14F	55.6000	0.00000000	0.00000000
13F	51.4000	0.00000000	0.00000000
12F	47.2000	0.00000000	0.00000000
11F	43.0000	0.00000000	0.00000000
10F	38.8000	0.00000000	0.00000000
9F	35.0000	0.00000000	0.00000000
8F	31.2000	0.00000000	0.00000000
7F	27.4000	0.00000000	0.00000000
6F	23.6000	0.00000000	0.00000000
5F	19.8000	0.00000000	0.00000000
4F	16.0000	0.00000000	0.00000000
3F	11.0000	0.00000000	0.00000000
2F	6.0000	0.00000000	0.00000000

Story Mass | X-Dir | Y-Dir | Z-Dir

Figure 1.56 Story Mass Table

Load > Seismic > Response Spectrum Data > ***Response Spectrum Load Case***

Eigenvalue Analysis Control...

Number of Frequencies > **15** ↵

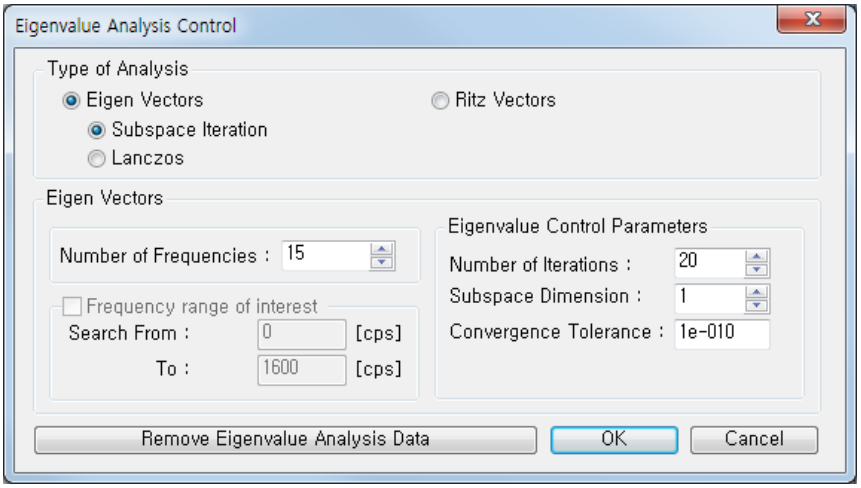


Figure 1.57 Eigenvalue analysis conditions setting

Modal Combination Control > ...

Modal Combination Type > **SRSS** ↵

Response Spectrum Functions...

Add

Design Spectrum

Design Spectrum > **UBC(1997)**

Seismic Coefficients Calculation Option > **Automatic** (on)

Soil Profile Type (S) > **Sc**

Seismic Zone Factor (Z) > **1 (0.075)**

Seismic Coefficient (Ca) > **0.09**

Seismic Coefficient (Cv) > **0.13**

Max. Period > **10** (sec) ↵

Scale Factor (I_E/R) > **0.238** (Refer to Figure 1.59) ↵

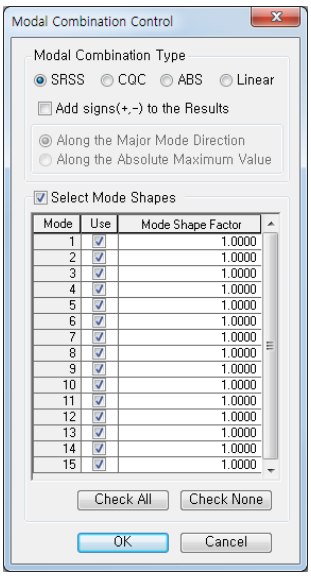


Figure 1.58 Assign the method of the mode combination

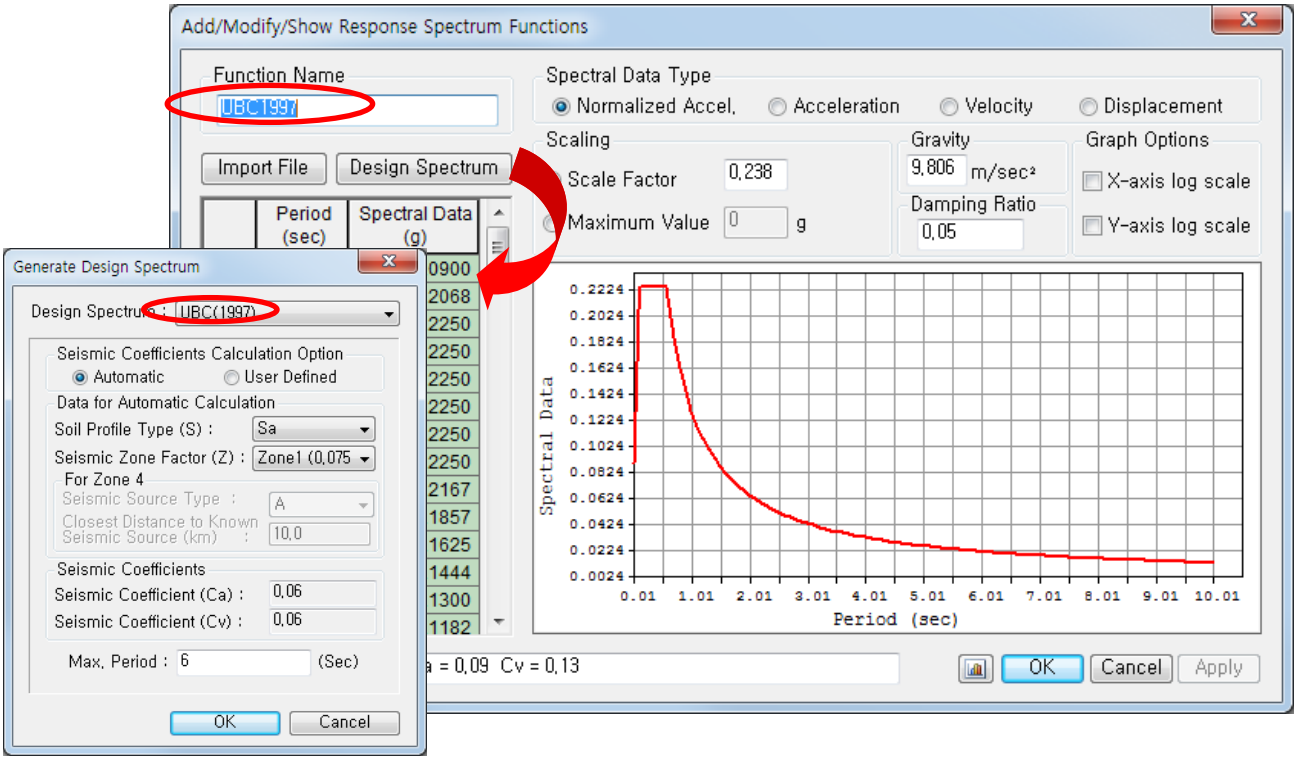


Figure 1.59 Dialog box to create the Design Spectrum automatically

Load > Seismic > Response Spectrum Data > ***Response Spectrum Load Case***

Load Case Name > **RX**

Direction > **X-Y**

Excitation Angle > **0**

Scale Factor > **1**

Period Modification Factor > **1**

Function Name > **UBC1997** (on)

Operations > Add

Load Case Name > **RY**

Excitation Angle > **90**

Operations > Add

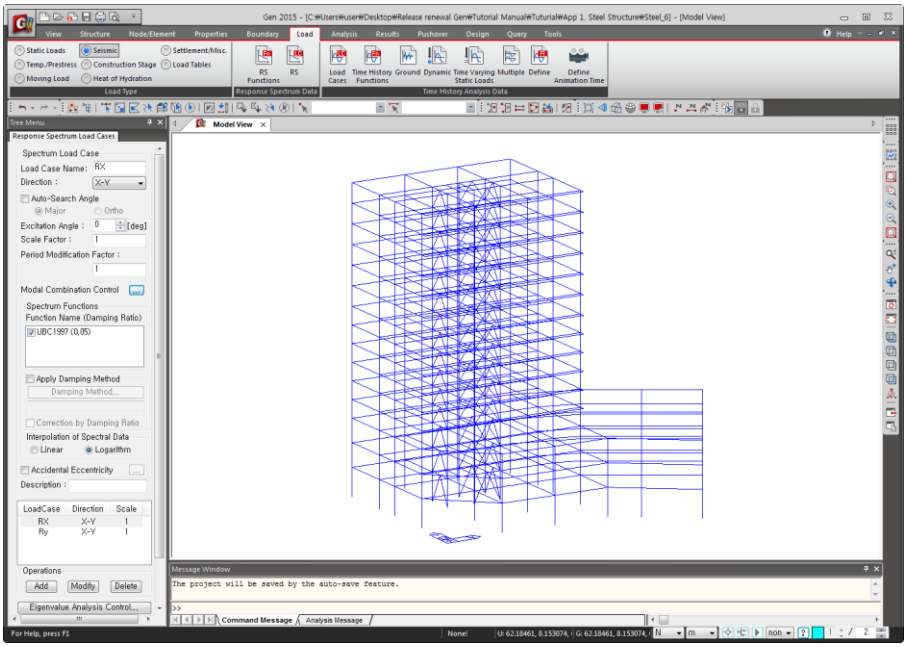


Figure 1.60 Input the response spectrum load cases

Perform the Structural Analysis/Window Setting

Analysis > ***Perform Analysis***

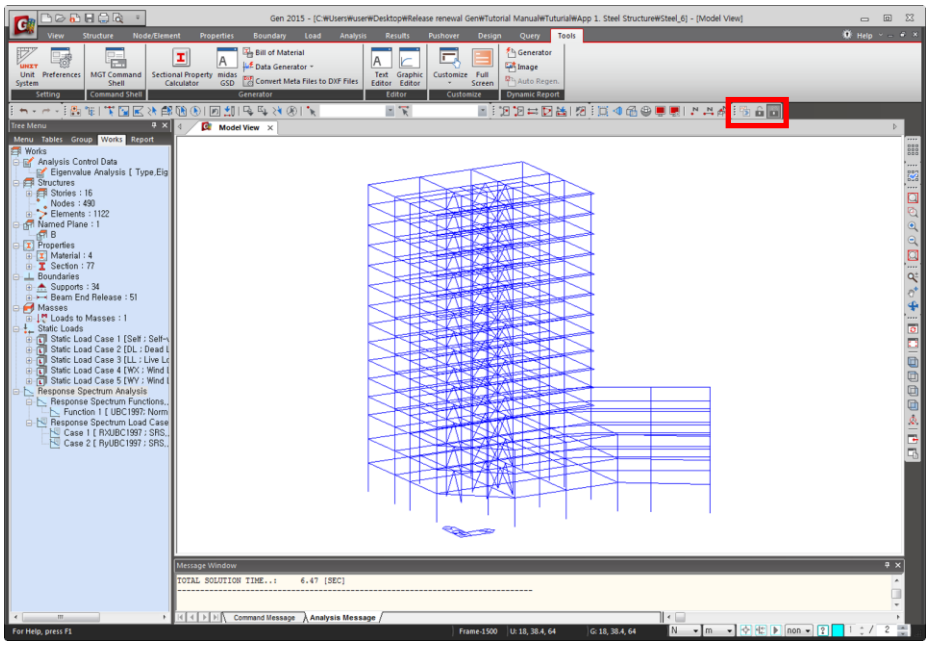


Figure 1.61 Toolbar setting to confirm the results

Confirm the Analysis Results

Examine Reactions

Tools > Setting > ***Unit System***

Force > **kN**

Active Identity

Story > **2F** ; **+Below** (on)

Active, Close

Results > Results > Reactions > ***Reaction Forces/Moments***

Load Case/Combinations > **ST : DL**

Components > **FZ**

Type of Display > **Values** (on)**, Legend** (on)

Values > ...

Decimal Points > **2** ↵

Results > Tables > Result Tables > ***Reaction***

Load Combination > **Self(ST)** (on), **DL(ST)** (on), **LL(ST)** (on) ↵

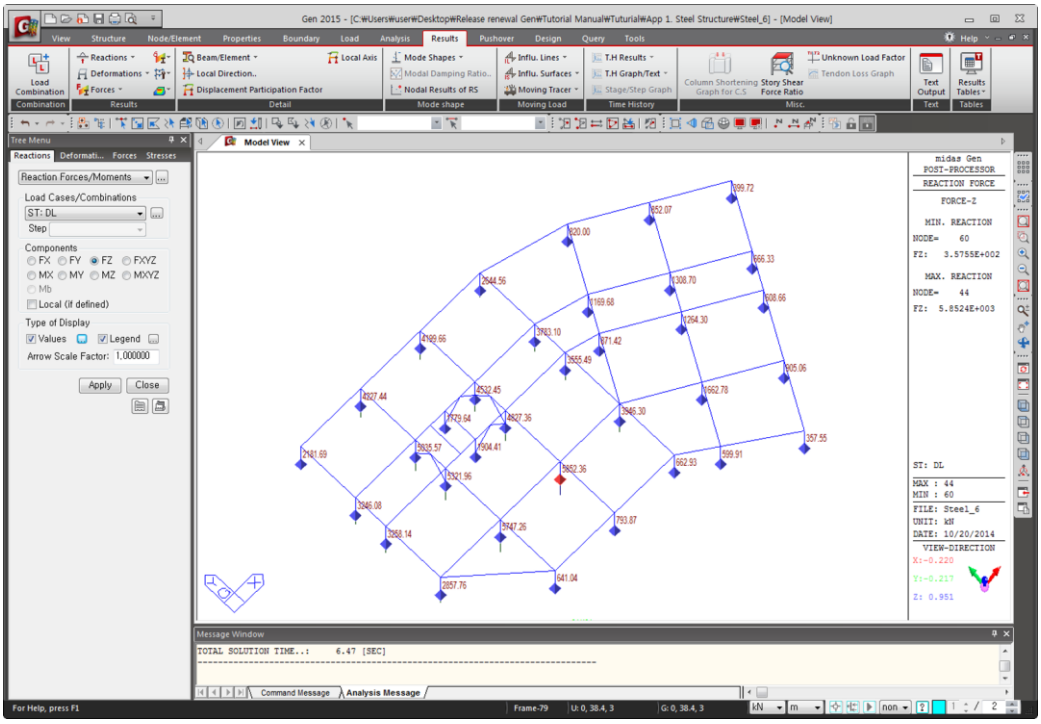


Figure 1.62 Confirm the reactions in the gravity direction

Model View | Result-[Reaction]

	Node	Load	Fx (kN)	Fy (kN)	Fz (kN)	Mx (kN·m)	My (kN·m)	Mz (kN·m)
	43	LL	0.689900	5.245529	3549.330497	-13.125182	0.781628	0.034968
	44	LL	0.762338	-2.584876	3631.809610	1.767165	0.924447	0.034968
	45	LL	10.621871	3.144687	2554.012450	-9.053264	20.390970	0.034674
	46	LL	6.879727	-11.575065	1974.272455	20.788972	12.868230	0.034672
	47	LL	-2.533018	-4.167934	3219.688298	65.334332	-5.749904	0.037736
	48	LL	-6.804844	-3.754875	2937.679547	63.715997	16.251496	0.037736
	49	LL	-5.564936	-12.838587	2194.917723	22.029405	-11.703359	0.034706
	50	LL	6.857837	12.719437	1967.656601	-26.748256	12.717720	0.034672
	51	LL	-2.554230	22.895517	3023.622346	-77.514383	-5.910388	0.037736
	52	LL	-7.144140	24.892577	2734.370237	-77.672838	15.847274	0.037736
	53	LL	-5.311330	26.482825	2375.031522	-54.694194	-11.320769	0.034706
	54	LL	6.678308	-18.581468	1306.676055	34.293404	12.109760	0.034649
	55	LL	0.861328	-36.660223	2537.292698	68.100925	0.635981	0.037569
	56	LL	0.923293	-36.486299	2522.043062	67.378935	0.758114	0.037569
	57	LL	-4.586413	-35.991015	1653.794935	67.478043	-10.065304	0.034649
	58	LL	2.214885	0.141490	1122.469666	-1.652329	-8.639702	0.018732
	59	LL	1.129603	0.142426	1046.590484	-1.654169	-8.418205	0.018732
	60	LL	3.400784	12.140046	271.144050	-23.726603	6.409888	0.000017
	61	LL	-8.404915	4.546120	674.447178	-9.979180	-16.450152	0.000112
	62	LL	-1.511684	-9.032492	668.575100	16.821741	-2.574074	0.000052
	63	LL	-8.305523	-3.088132	470.444952	5.671655	-16.575089	0.000112
	64	LL	10.730115	13.400707	897.583744	-26.045177	20.749820	0.000052
	65	LL	-0.236074	10.923307	507.668886	-22.181905	-0.586369	0.000112
	66	LL	-11.801844	-28.974882	629.135438	54.568020	-22.120292	0.000112
	67	LL	-9.941673	-10.078727	301.084840	18.656040	-19.141377	0.000017
	68	LL	-15.028248	-26.689803	641.081379	49.973374	-28.496628	0.000112
	69	LL	8.164882	14.733640	998.055419	-28.761845	15.689108	0.000052
	70	LL	-7.373421	-12.131348	970.155106	22.542665	-13.972908	0.000052
	71	LL	3.278618	4.114361	1239.928496	-8.424944	6.461010	0.000052
	72	LL	12.808422	15.099899	452.027397	-29.460092	24.865014	0.000112
	SUMMATION OF REACTION FORCES PRINTOUT							
		Load	Fx (kN)	Fy (kN)	Fz (kN)			
		Self	-0.000000	-0.000000	21816.498301			
		DL	0.000000	-0.000000	82485.258416			
		LL	0.000000	-0.000000	52395.745545			

Reaction(Global) | Reaction(Local) | Reaction(Local-Surface Spring)

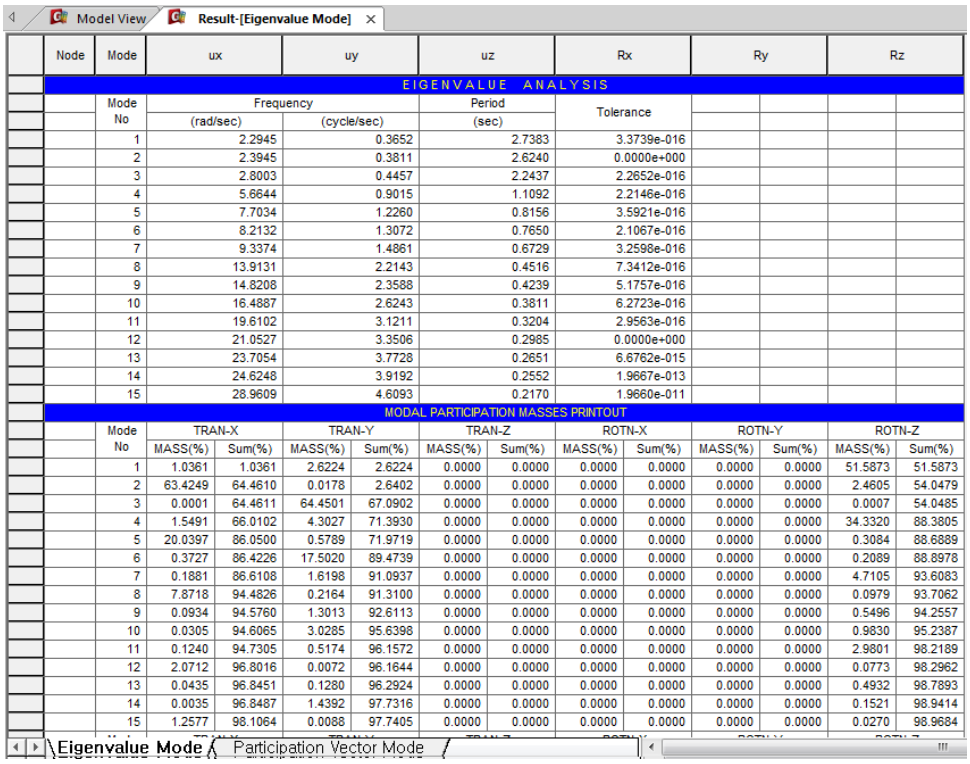
Figure 1.63 Reaction Table

Examine the Eigenvalue Analysis Results

Results > Tables > Result Tables > ***Vibration Mode Shape***

Active Dialog > Cancel

Node No.	Governing Direction	Participation Masses (%)	Period(sec)
1	ROTN-Z	52.80	2.807
2	TRAN-X	67.57	2.744
3	TRAN-Y	68.52	2.363



Model View | Result-[Eigenvalue Mode]

Node	Mode	ux	uy	uz	Rx	Ry	Rz

EIGENVALUE ANALYSIS

Mode No	Frequency (rad/sec)	Frequency (cycle/sec)	Period (sec)	Tolerance
1	2.2945	0.3652	2.7383	3.3739e-016
2	2.3945	0.3811	2.6240	0.0000e+000
3	2.8003	0.4457	2.2437	2.2652e-016
4	5.6644	0.9015	1.1092	2.2146e-016
5	7.7034	1.2260	0.8156	3.5921e-016
6	8.2132	1.3072	0.7650	2.1067e-016
7	9.3374	1.4861	0.6729	3.2598e-016
8	13.9131	2.2143	0.4516	7.3412e-016
9	14.8208	2.3588	0.4239	5.1757e-016
10	16.4887	2.6243	0.3811	6.2723e-016
11	19.6102	3.1211	0.3204	2.9563e-016
12	21.0527	3.3506	0.2985	0.0000e+000
13	23.7054	3.7728	0.2651	6.6762e-015
14	24.6248	3.9192	0.2552	1.9667e-013
15	28.9609	4.6093	0.2170	1.9660e-011

MODAL PARTICIPATION MASSES PRINTOUT

Mode No	TRAN-X MASS(%)	TRAN-X Sum(%)	TRAN-Y MASS(%)	TRAN-Y Sum(%)	TRAN-Z MASS(%)	TRAN-Z Sum(%)	ROTN-X MASS(%)	ROTN-X Sum(%)	ROTN-Y MASS(%)	ROTN-Y Sum(%)	ROTN-Z MASS(%)	ROTN-Z Sum(%)
1	1.0361	1.0361	2.6224	2.6224	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	51.5873	51.5873
2	63.4249	64.4610	0.0178	2.6402	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4605	54.0479
3	0.0001	64.4611	64.4501	67.0902	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	54.0485
4	1.5491	66.0102	4.3027	71.3930	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	34.3320	88.3805
5	20.0397	86.0500	0.5789	71.9719	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3084	88.6889
6	0.3727	86.4226	17.5020	89.4739	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2089	88.8978
7	0.1881	86.6108	1.6198	91.0937	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.7105	93.6083
8	7.8718	94.4826	0.2164	91.3100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0979	93.7062
9	0.0934	94.5760	1.3013	92.6113	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5496	94.2557
10	0.0305	94.6065	3.0285	95.6398	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9830	95.2387
11	0.1240	94.7305	0.5174	96.1572	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.9801	98.2189
12	2.0712	96.8016	0.0072	96.1644	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0773	98.2962
13	0.0435	96.8451	0.1280	96.2924	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4932	98.7893
14	0.0035	96.8487	1.4392	97.7316	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1521	98.9414
15	1.2577	98.1064	0.0088	97.7405	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0270	98.9684

Eigenvalue Mode | Participation Vector Mode

Figure 1.64 Confirm the Eigenvalue analysis results

Model View tab

Iso View, *Active All*, *Initial View*

Results > *Vibration Mode Shapes*

Load Cases (Mode Numbers) > **Mode 1**

Components > **Md-XYZ** (on)

Type of Display > Mode Shape >

Mode Shape Scale Factor > **3.0** ↵

Animate (on) >

Animation Mode > **Repeat Full Cycle** ↵ ↵

Record

Stop

Close

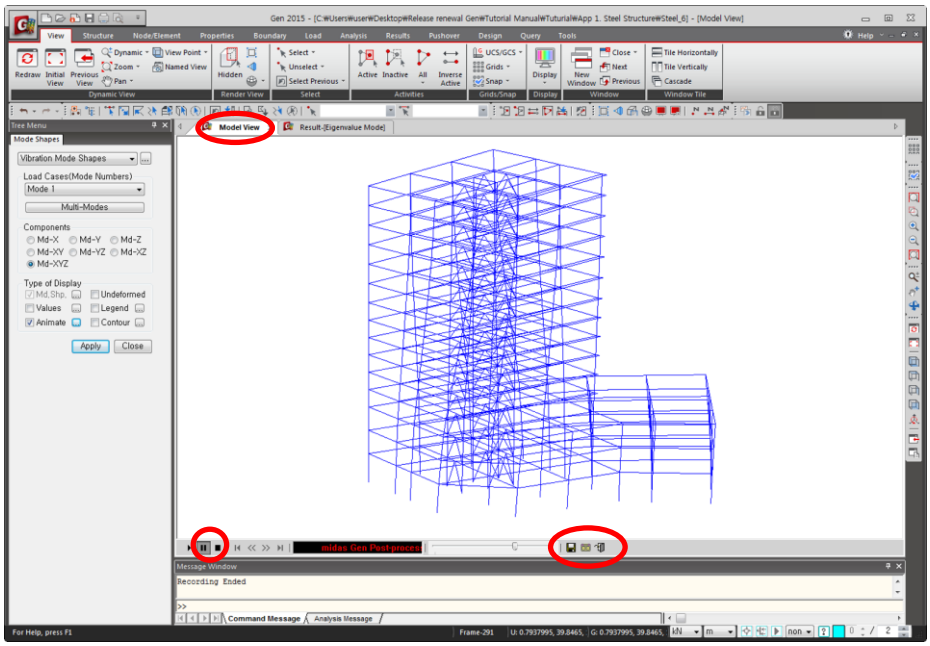


Figure 1.65 Vibration Mode Shapes

Steel Member Design

➢ Applied Design Code: AISC(14th)-LRFD10

Create the Load Combinations

All Windows except **Model View** > ☒

Results > Combinations > Load Combination

Steel Design tab

Auto Generation...

Design Code > **AISC(14th)-LRFD10**

Scale Up Factor > **2.719, RX** Add

Scale Up Factor > **2.504, RY** Add

↵ ↵

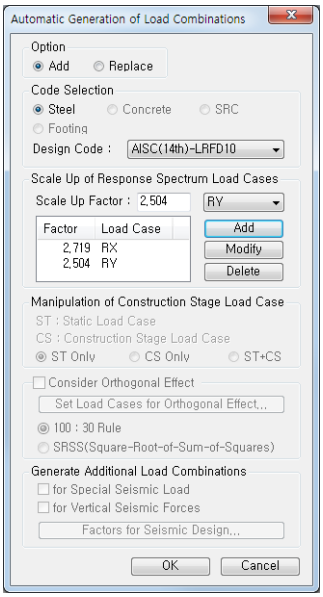


Figure 1.66 Input the Design Code & the Scale Up Factor

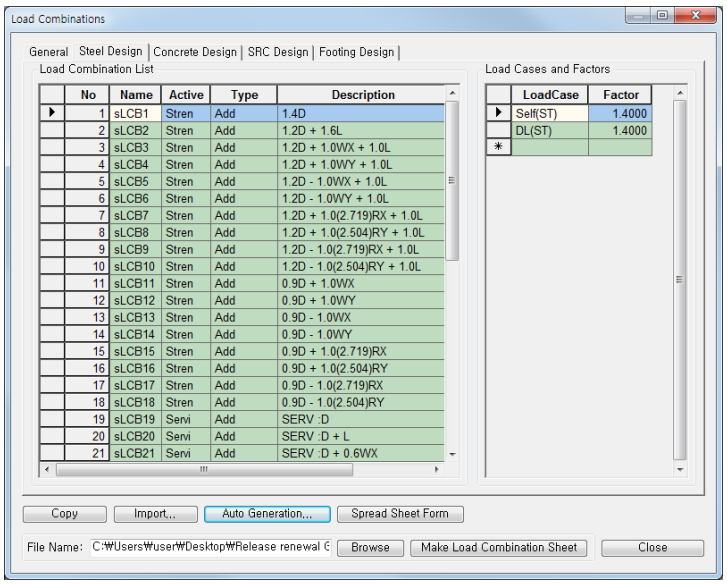


Figure 1.67 Create the load combinations

Input the Design Parameters

Design > General Design Parameter > ***Definition of Frame***

X-Direction Frame > **Braced I Non-sway**

Y-Direction Frame > **Braced I Non-sway**

Design Type > **3-D** (on) ↵

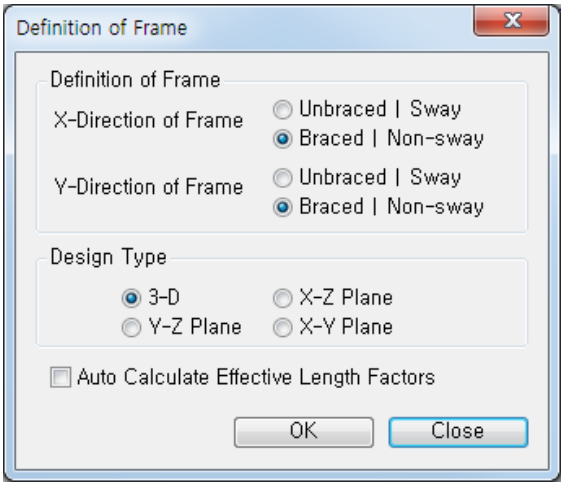


Figure 1.68 Definition of Frame

Initial View

Select Identity-Element

Select Type > **Section**

List > **221 : SG1** Add

List > **226 : SG6** Add

List > **521 : 5SG1** Add

Close

Design > General Design Parameter > ***Unbraced Length (L, Lb)***

Add > Replace > **(on)**

Laterally Unbraced Length Lb > **4** ↵

Input the remainders ; Refer to Table 1.5

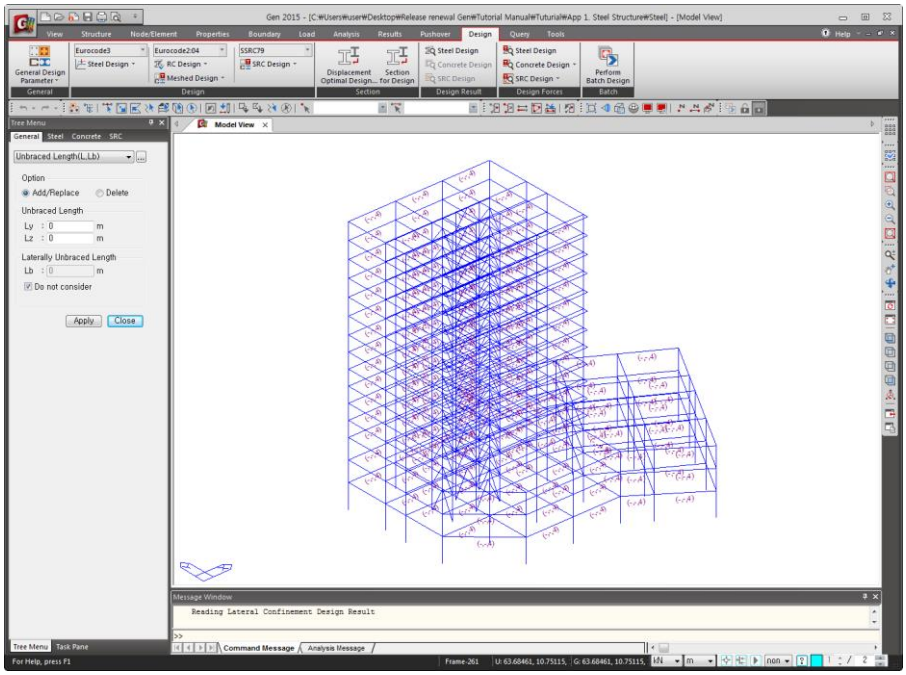


Figure 1.69 Input lateral unbraced lengths

Section Number	Laterally Unbraced Length (m)
241	4.8
221, 226, 521	4.0
224, 225, 524, 525	2.7
222, 223, 243, 522, 523	2.0

Table 1.5 Laterally Unbraced Length of the girders

Design > Design > Steel Design > ***Design Code***

Design Code > **AISC(14th)-LRFD10**

All Beams/Girders are Laterally Braced (on) ↵

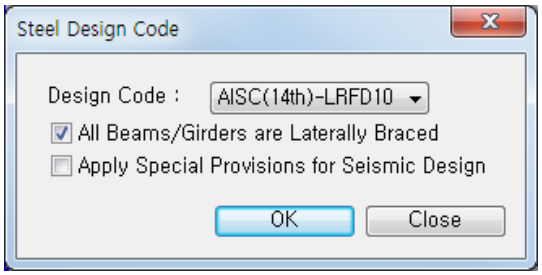


Figure 1.70 Select the design code

Steel Code Check

Redraw

Design > Design > Steel Design > ***Steel Code Check***

>>

Result View Option > **NG**

Select All (Refer to Figure 1.71)

Change...

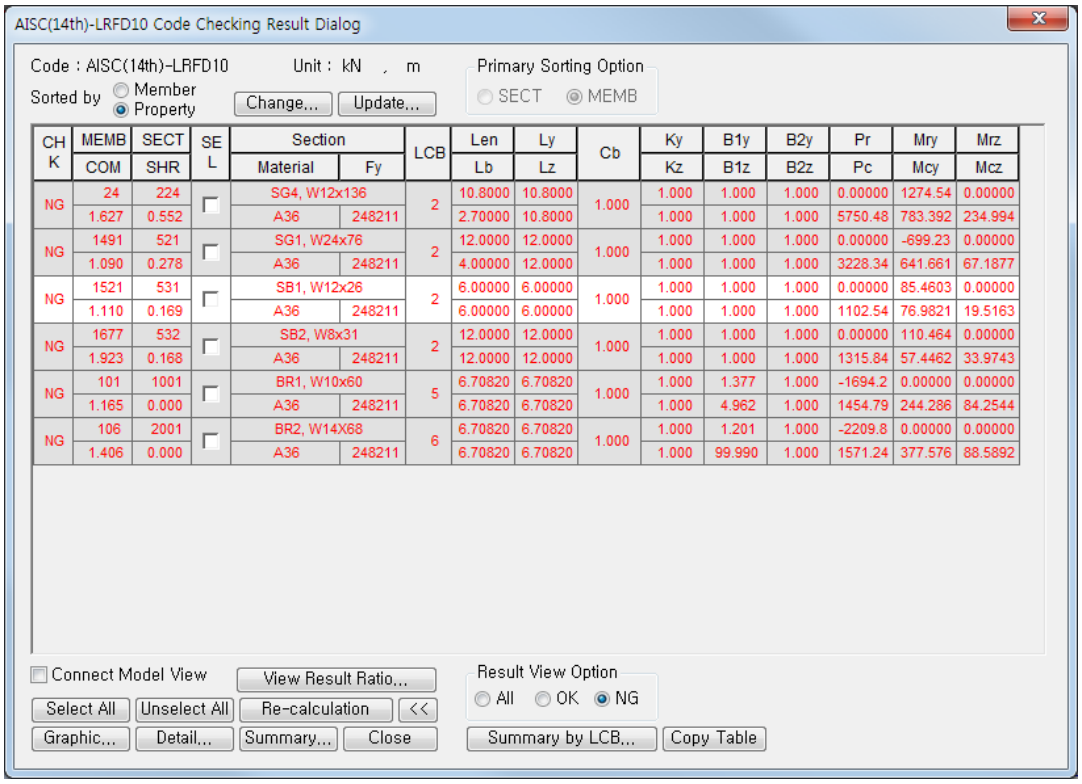
Property No. > **224**

Search Satisfied Section

Select (SEL) **W 30×116** Change & Close (Refer to Figure 1.73)

Select (SEL) > Property No. > **224**

Graphic... (Refer to Figure 1.72)



CHK	MEMB / COM	SECT / SHR	SEL	Section / Material	Fy	LCB	Len / Lb	Ly / Lz	Cb	Ky / Kz	B1y / B1z	B2y / B2z	Pr / Pc	Mry / Mcy	Mrz / Mcz
NG	24	224	☐	SG4, W12x136		2	10.8000	10.8000	1.000	1.000	1.000	1.000	0.00000	1274.54	0.00000
	1.627	0.552		A36	248211		2.70000	10.8000		1.000	1.000	1.000	5750.48	783.392	234.994
NG	1491	521	☐	SG1, W24x76		2	12.0000	12.0000	1.000	1.000	1.000	1.000	0.00000	-699.23	0.00000
	1.090	0.278		A36	248211		4.00000	12.0000		1.000	1.000	1.000	3228.34	641.661	67.1877
NG	1521	531	☐	SB1, W12x26		2	6.00000	6.00000	1.000	1.000	1.000	1.000	0.00000	85.4603	0.00000
	1.110	0.169		A36	248211		6.00000	6.00000		1.000	1.000	1.000	1102.54	76.9821	19.5163
NG	1677	532	☐	SB2, W8x31		2	12.0000	12.0000	1.000	1.000	1.000	1.000	0.00000	110.464	0.00000
	1.923	0.168		A36	248211		12.0000	12.0000		1.000	1.000	1.000	1315.84	57.4462	33.9743
NG	101	1001	☐	BR1, W10x60		5	6.70820	6.70820	1.000	1.000	1.377	1.000	-1694.2	0.00000	0.00000
	1.165	0.000		A36	248211		6.70820	6.70820		1.000	4.962	1.000	1454.79	244.286	84.2544
NG	106	2001	☐	BR2, W14X68		6	6.70820	6.70820	1.000	1.000	1.201	1.000	-2209.8	0.00000	0.00000
	1.406	0.000		A36	248211		6.70820	6.70820		1.000	99.990	1.000	1571.24	377.576	88.5892

Figure 1.71 Automatic Design Result Dialog box

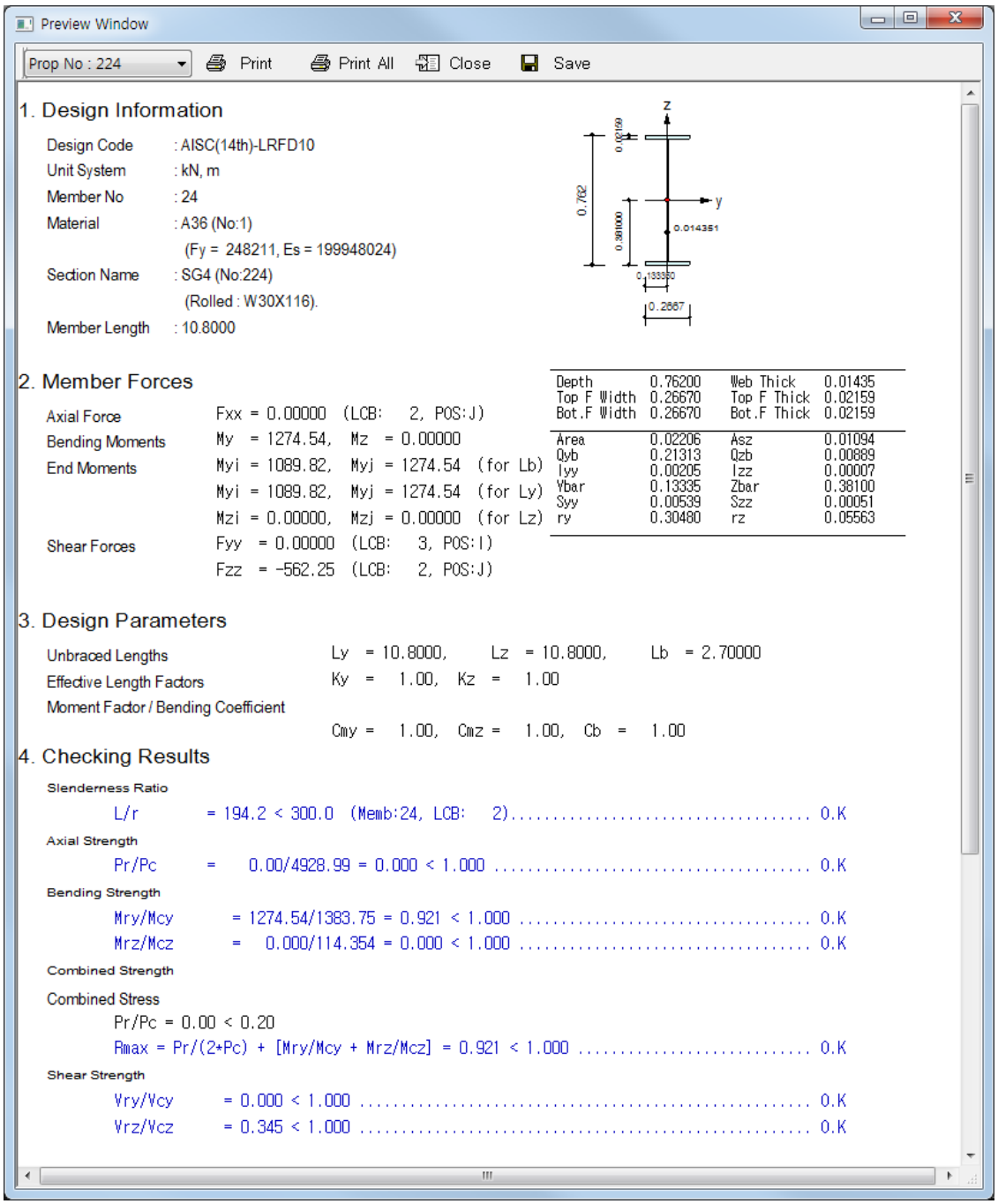


Figure 1.72 Summary of Design Results

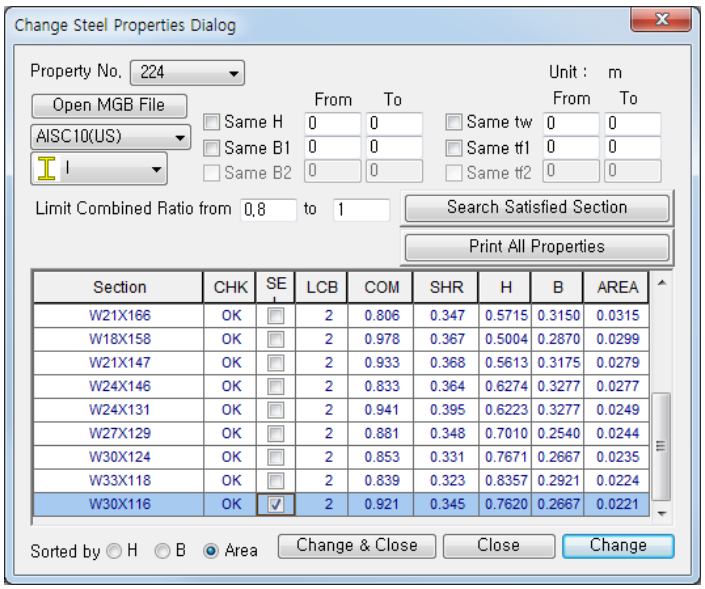


Figure 1.73 Change Steel Properties Dialog box

Design > Section > ***Section for Design*** Modify...

1001 > **W 30×132** ; 1002 > **W 12×50** ; 2001 > **W 14×90** ↵

Select Identity-Element > Select Type > Section

224(on), **1001**(on), **1002**(on), **2001**(on)

Design > Design > Steel > ***Steel Code Check*** Re-calculation

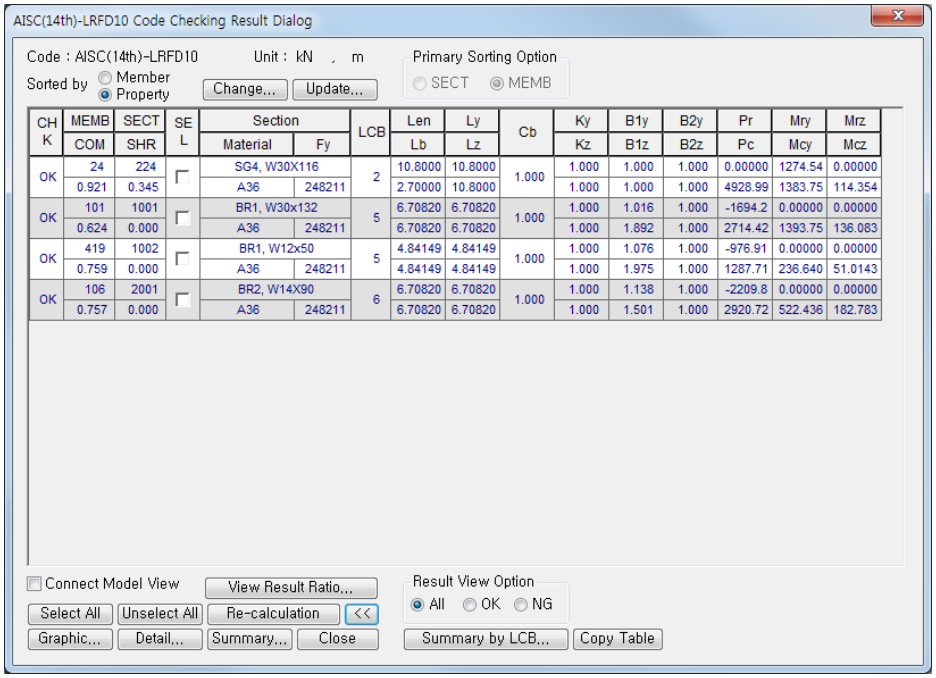


Figure 1.74 Code Checking Result Dialog box after modifying the sections

Unselect All

Design > Design > Steel > ***Steel Code Check***

Result View Option > **All**

<<

View Result Ratio...

Select (SEL) > **221**

Show Graph of Result Ratio

Ratio Limit > From > **0** ; To > **0.75**

Select Elements ↵

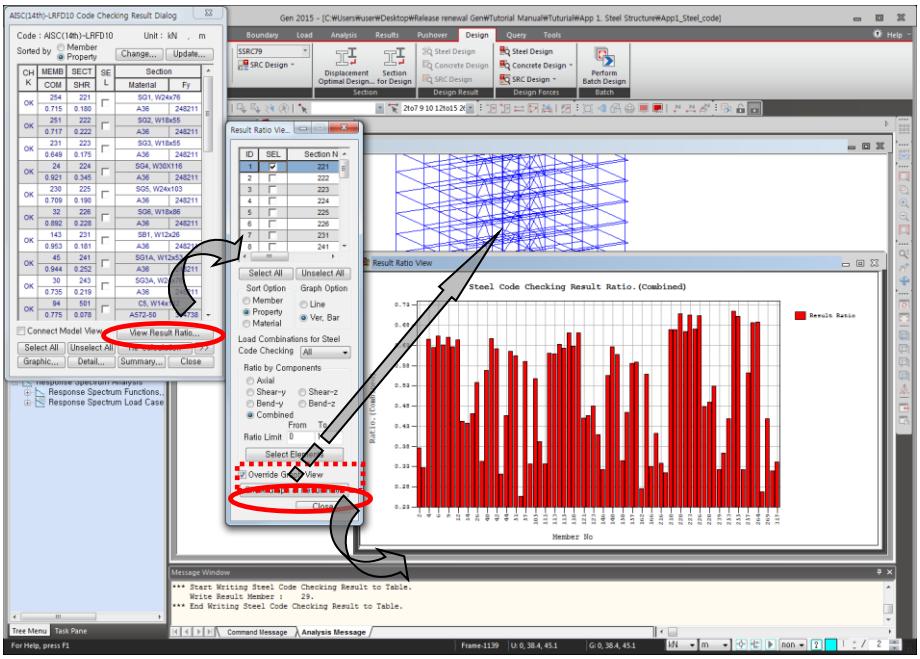


Figure 1.75 Modify section numbers using the design results

Model View tab

The right side of  ***Select Identity-Element*** (Refer to ❶ of Figure 1.76)

[Ctrl]+[**C**] in Keyboard (Copy Command)

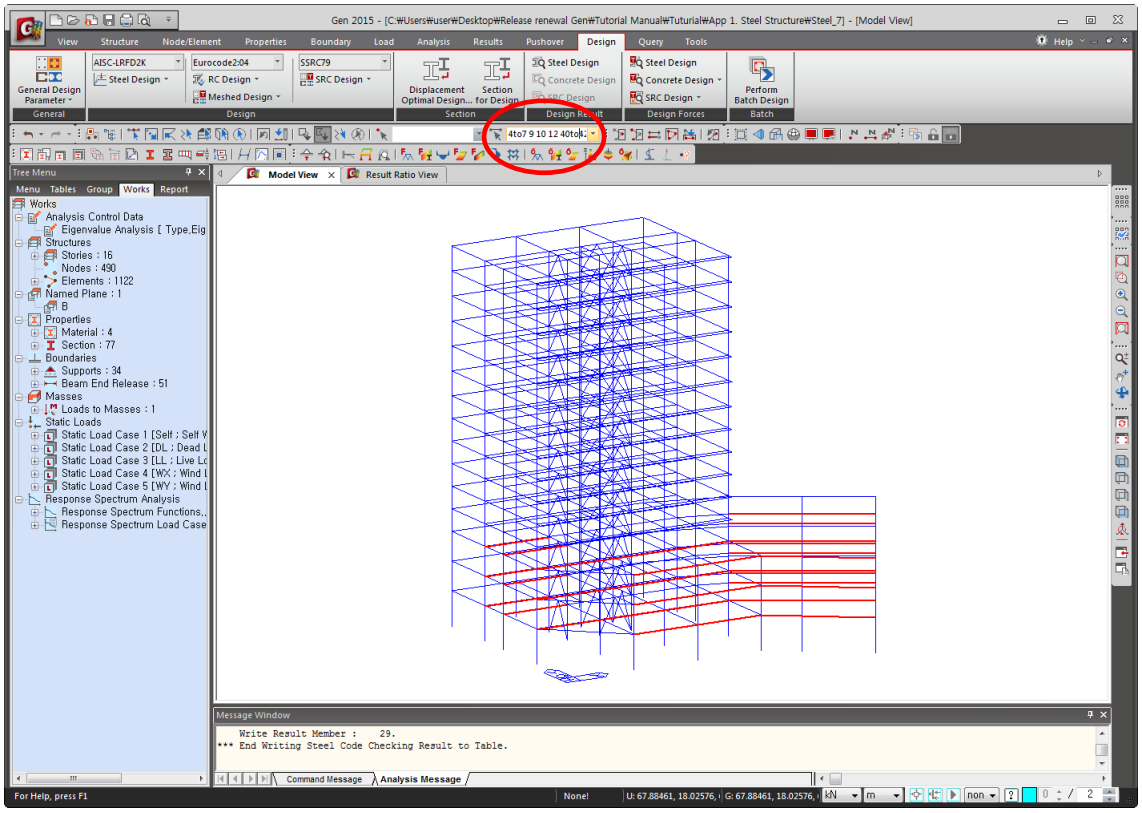


Figure 1.76 Select elements to modify the sections

Re-analyze/Re-design reflecting the Design Results

Code Checking Result Dialog > Update...

Select (SEL) > **224**(on), **1001**(on), **1002**(on), **2001**(on)

<- (Refer to Figure 1.77)

"Analysis / design results will be deleted. Continue?"

Yes

Close

The right side of ***Select Identity-Element*** (Refer to ❶ of Figure 1.76)

[Ctrl]+**[V]** in Keyboard (Paste Command) Enter

Model > Elements > ***Change Element Parameters***

Parameter Type > **Section ID**

Assign No. > **522**

Apply

Analysis > ***Perform Analysis*** **OR** ***Re-analysis*** (Refer to Figure 1.78)

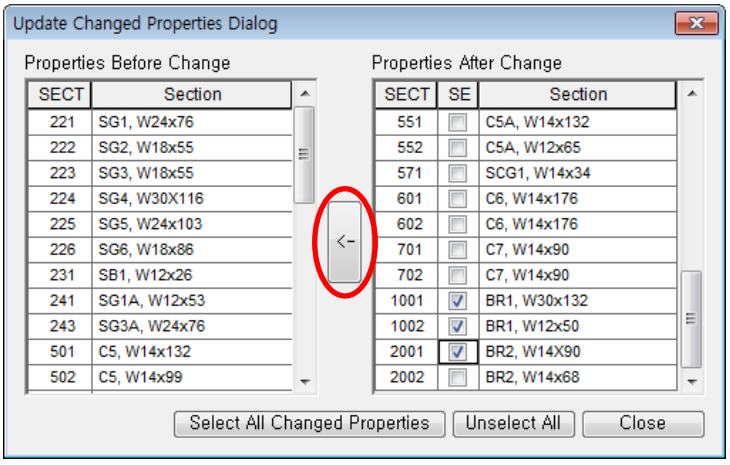


Figure 1.77 Update Changed Properties Dialog

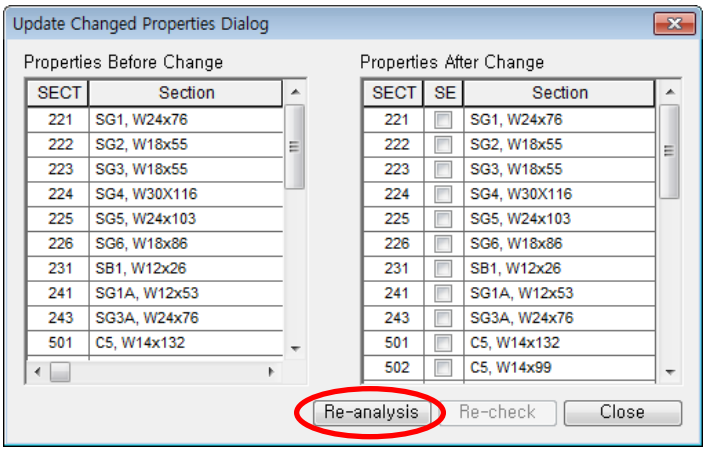


Figure 1.78 Dialog box after updating the selected sections

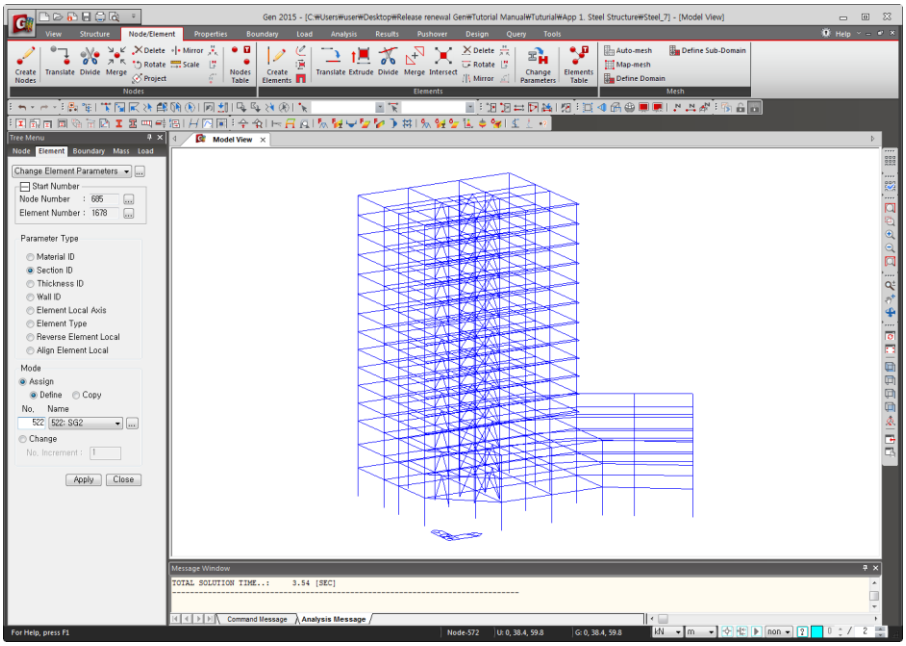


Figure 1.79 Modify sections using the Change Element Parameter

Select Identity-Element

Select Type > **Section**

List > **224:SG4, 522:SG2, 1001:BR1, 1002:BR1, 2001:BR2** Add

Close

Design > ***Steel Code Check***

View Result Ratio... (Refer to Figure 1.80)

Select (SEL) > **224**

Show Graph of Result Ratio (Refer to Figure 1.81)

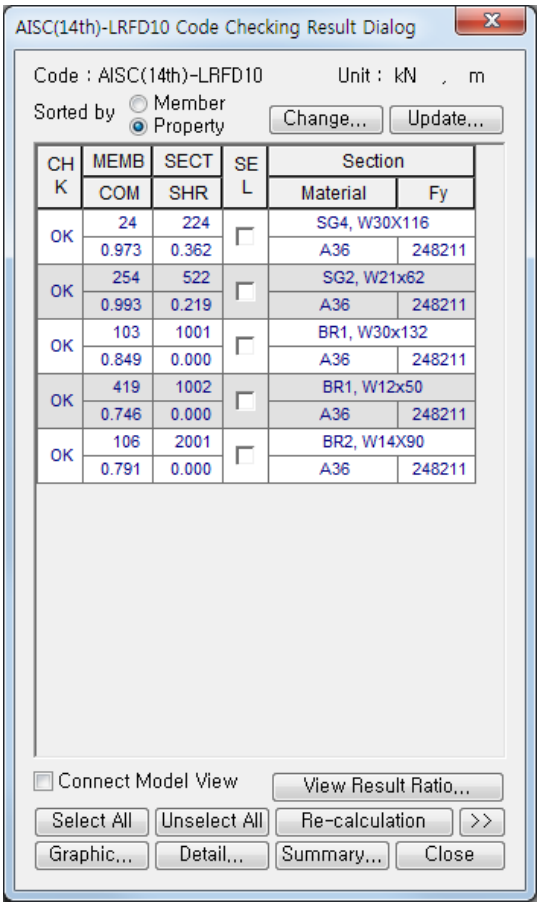


Figure 1.80 Confirm the results of the re-design

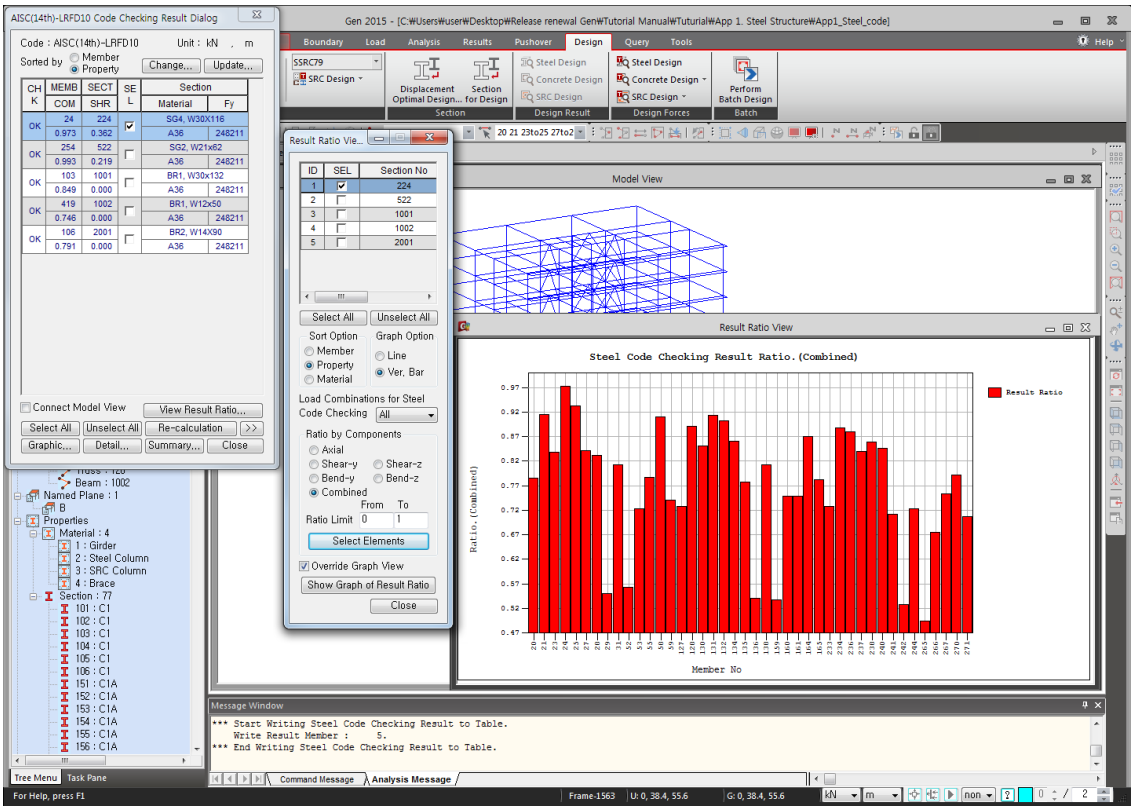


Figure 1.81 Stress ratio graph of 2~4F SG1 (after modifying sections)

SRC Column Design

➢ Applied Design Code: SSRC79

Create the Load Combinations

Unselect All

Result > Combination > ***Load Combination***

SRC Design tab

Auto Generation...

Option **> Add** (on)

Design Code > **SSRC79**

Scale Up Factor > **2.719, RX** Add

Scale Up Factor > **2.504, RY** Add

↵ ↵

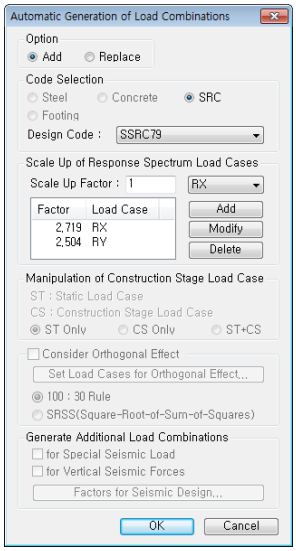


Figure 1.82 Select the SRC Design Code

Input the Design Parameters

Design > Design > SRC Design > ***Design Code***

Design Code > **SSRC79** ↵

Tools > Setting > ***Unit System***

Length > **cm**

Design > Design > SRC Design > ***Modify SRC Column Section Data***

SEL > Section ID > **151 ~ 156**

Reinforcing Main Bar > **Auto Calculate Rebar Space** (on)

Rebar > **12 - #8**

Number of Rows > **4** ↵

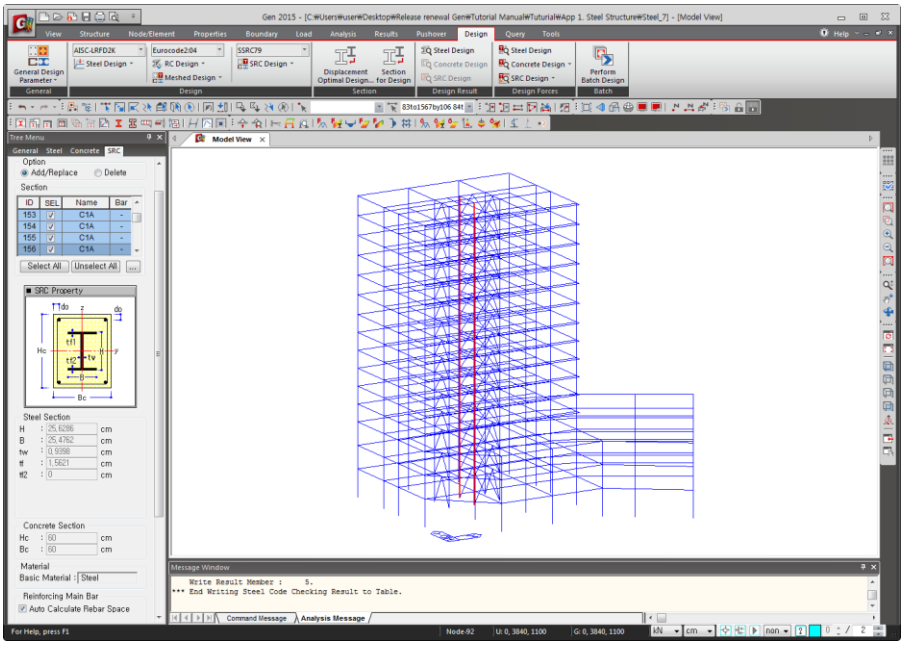
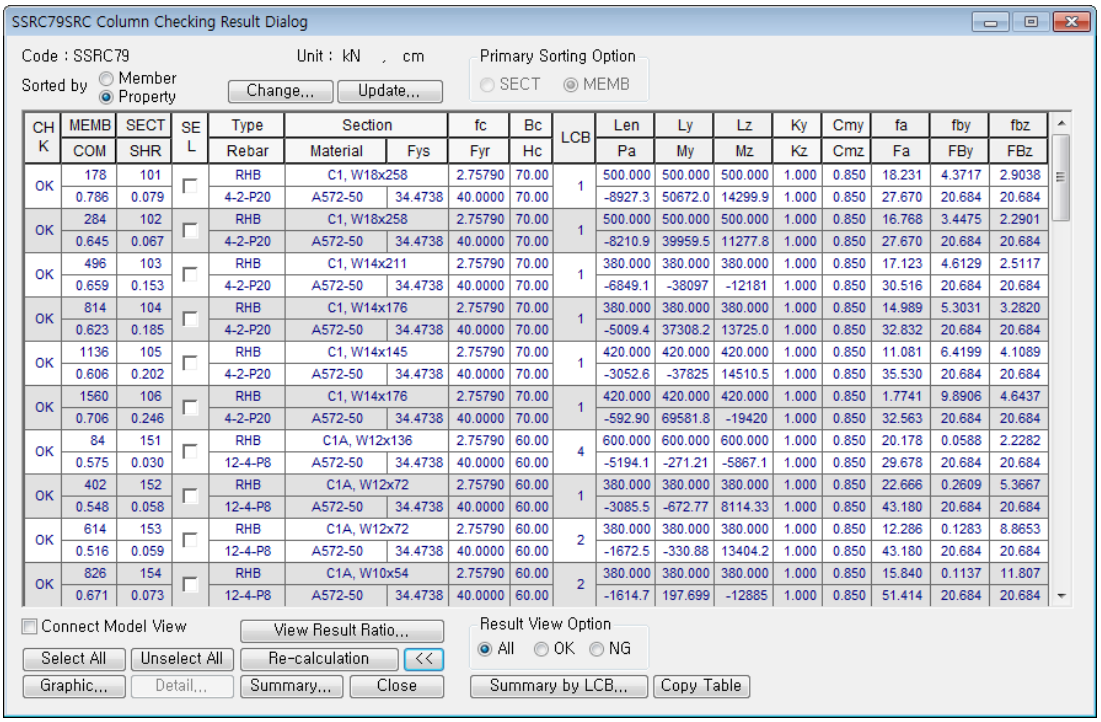


Figure 1.83 Modify SRC Column Section Data

SRC Code Check

Design > Design > SRC Design > SRC Code Check > ***Column Checking***

>>



CHK	MEMB	SECT	SEL	Type	Section		fc	Bc	LCB	Len	Ly	Lz	Ky	Cmy	fa	fby	fbz
	COM	SHR		Rebar	Material	Fys	Fyr	Hc		Pa	My	Mz	Kz	Cmz	Fa	FBy	FBz
OK	178	101		RHB	C1, W18x258		2.75790	70.00	1	500.000	500.000	500.000	1.000	0.850	18.231	4.3717	2.9038
	0.786	0.079		4-2-P20	A572-50	34.4738	40.0000	70.00		-8927.3	50672.0	14299.9	1.000	0.850	27.670	20.684	20.684
OK	284	102		RHB	C1, W18x258		2.75790	70.00	1	500.000	500.000	500.000	1.000	0.850	16.768	3.4475	2.2901
	0.645	0.067		4-2-P20	A572-50	34.4738	40.0000	70.00		-8210.9	39959.5	11277.8	1.000	0.850	27.670	20.684	20.684
OK	496	103		RHB	C1, W14x211		2.75790	70.00	1	380.000	380.000	380.000	1.000	0.850	17.123	4.6129	2.5117
	0.659	0.153		4-2-P20	A572-50	34.4738	40.0000	70.00		-6849.1	-38097	-12181	1.000	0.850	30.516	20.684	20.684
OK	814	104		RHB	C1, W14x176		2.75790	70.00	1	380.000	380.000	380.000	1.000	0.850	14.989	5.3031	3.2820
	0.623	0.185		4-2-P20	A572-50	34.4738	40.0000	70.00		-5009.4	37308.2	13725.0	1.000	0.850	32.832	20.684	20.684
OK	1136	105		RHB	C1, W14x145		2.75790	70.00	1	420.000	420.000	420.000	1.000	0.850	11.081	6.4199	4.1089
	0.606	0.202		4-2-P20	A572-50	34.4738	40.0000	70.00		-3052.6	-37825	14510.5	1.000	0.850	35.530	20.684	20.684
OK	1560	106		RHB	C1, W14x176		2.75790	70.00	1	420.000	420.000	420.000	1.000	0.850	1.7741	9.8906	4.6437
	0.706	0.246		4-2-P20	A572-50	34.4738	40.0000	70.00		-592.90	69581.8	-19420	1.000	0.850	32.563	20.684	20.684
OK	84	151		RHB	C1A, W12x136		2.75790	60.00	4	600.000	600.000	600.000	1.000	0.850	20.178	0.0588	2.2282
	0.575	0.030		12-4-P8	A572-50	34.4738	40.0000	60.00		-5194.1	-271.21	-5867.1	1.000	0.850	29.678	20.684	20.684
OK	402	152		RHB	C1A, W12x72		2.75790	60.00	1	380.000	380.000	380.000	1.000	0.850	22.666	0.2609	5.3667
	0.548	0.058		12-4-P8	A572-50	34.4738	40.0000	60.00		-3085.5	-672.77	8114.33	1.000	0.850	43.180	20.684	20.684
OK	614	153		RHB	C1A, W12x72		2.75790	60.00	2	380.000	380.000	380.000	1.000	0.850	12.286	0.1283	8.8653
	0.516	0.059		12-4-P8	A572-50	34.4738	40.0000	60.00		-1672.5	-330.88	13404.2	1.000	0.850	43.180	20.684	20.684
OK	826	154		RHB	C1A, W10x54		2.75790	60.00	2	380.000	380.000	380.000	1.000	0.850	15.840	0.1137	11.807
	0.671	0.073		12-4-P8	A572-50	34.4738	40.0000	60.00		-1614.7	197.699	-12885	1.000	0.850	51.414	20.684	20.684

Figure 1.84 SRC Code Checking Result Dialog