Advanced Application 2

Seismic Design for Reinforced Concrete Building

Seismic Design for Reinforced Concrete Building

Overview

This example problem is meant to demonstrate the design of a Reinforced Concrete building structure subjected to floor loads, wind loads and seismic loads.

Description

Seismic Design Data

- Dual system (special reinforced concrete structural walls with special moment frame) in the transverse direction
- Special moment frame in the longitudinal direction
- Assigned to a high seismic zone

Methodology

- Response spectrum analysis
- P-Delta analysis

Model

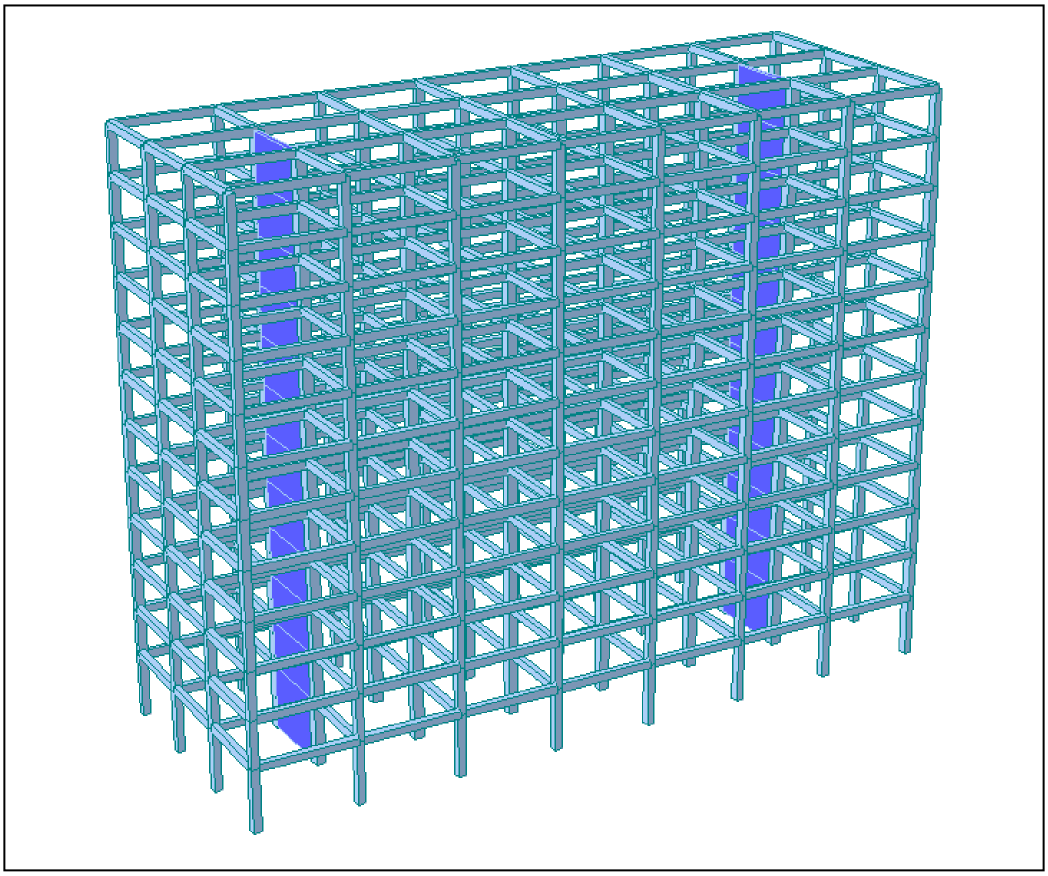


Figure 1 : Reinforced Concrete Building Model

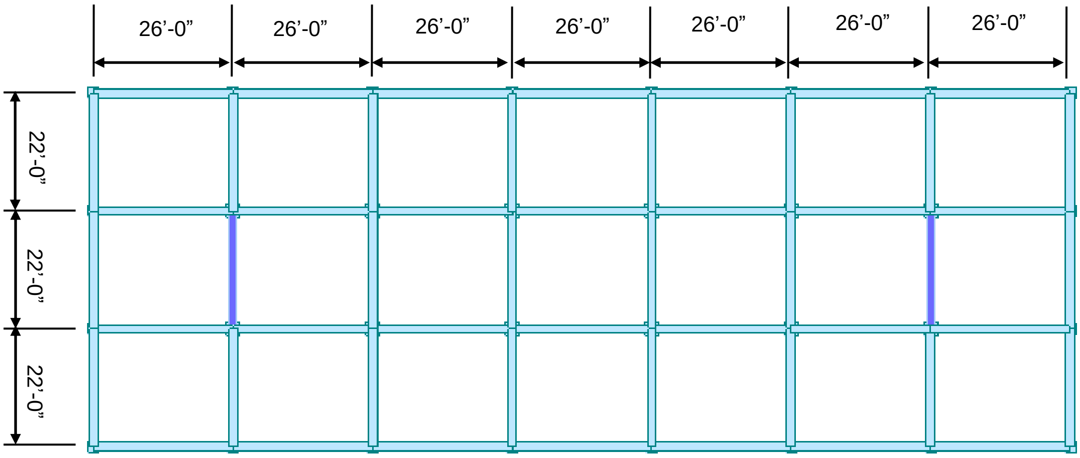


Figure 2 : Typical Floor Plan

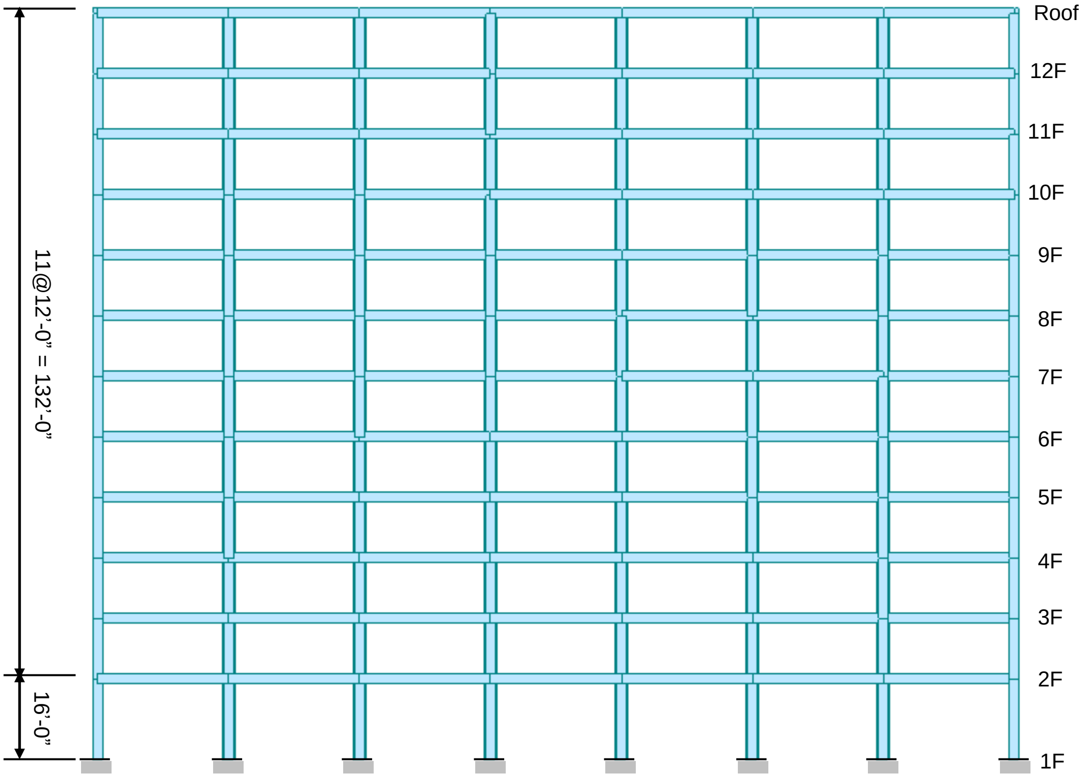


Figure 3 : Longitudinal Section

Design Procedure

1. Material & Section Properties Input

Material

- Concrete fc' = 4,000 psi
- Reinforcement fy = 60,000 psi

Section

- Edge columns 24×24 in.
- Interior columns 30×30 in.
- Beams 20×24 in.
- Walls 18 in. (In-plane & Out-of-plane)

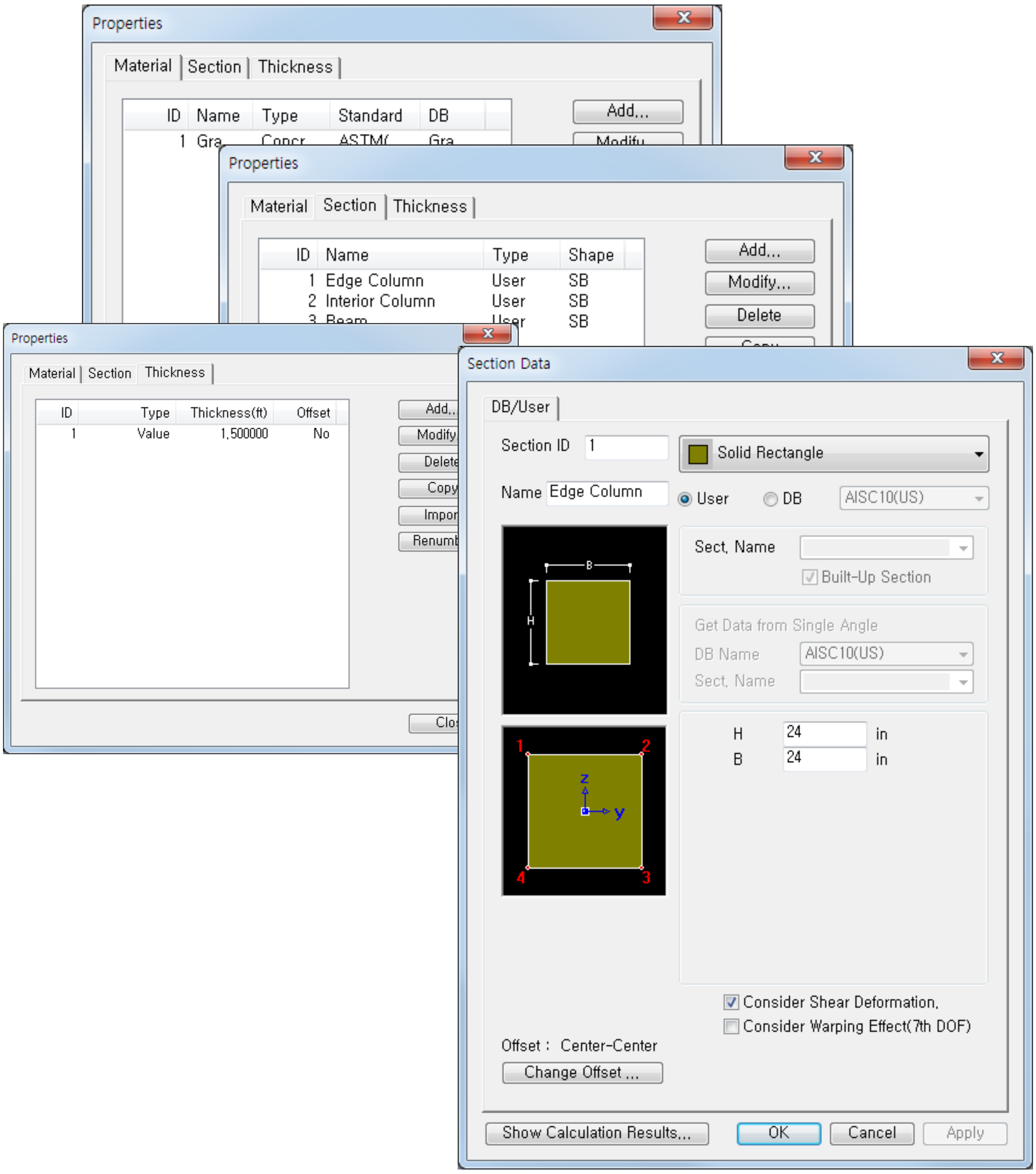


Figure 4 : Material & Section Properties Input

2. Create Model

Units : Length > ft

Set UCS to X-Y Plane

Origin : 0, 0, 16

Change View Direction > (on)

OK

Set Line Grid Add

Grid Name = 2F

X-Grid Lines Add

Relative > (on)

'7@26' OK

Y-Grid Lines Add

Relative > (on)

'3@22' OK

Add/Modify Grid Lines OK

Define Grids OK

Line Grid, Line Grid Snap (toggle on)

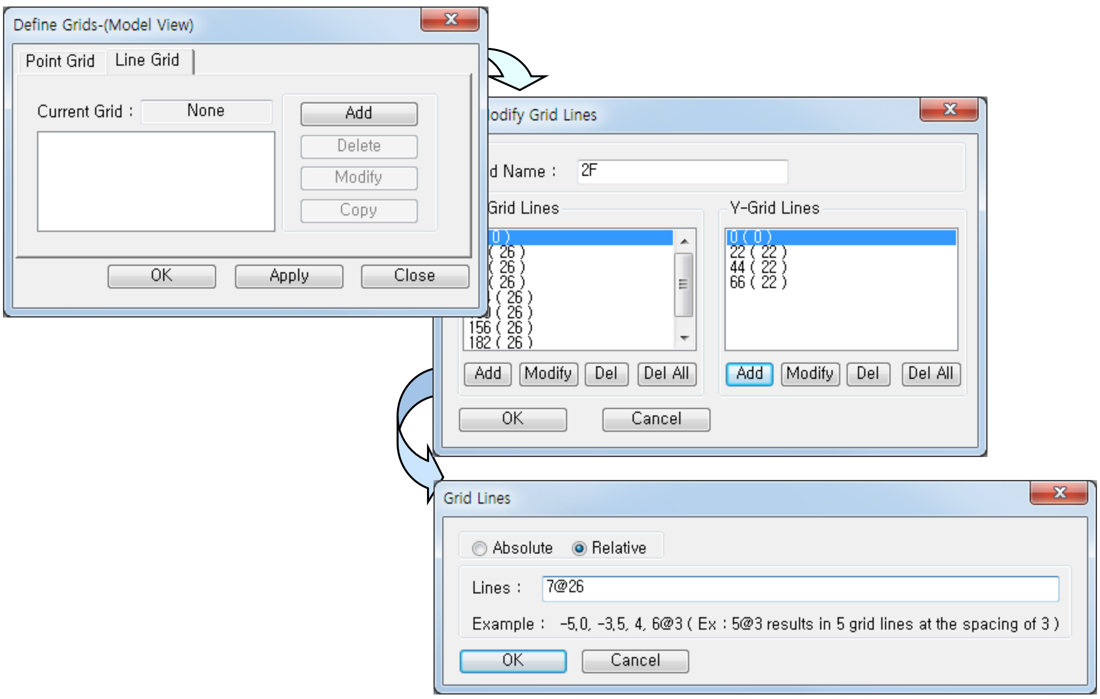


Figure 5 : Create Grid Lines

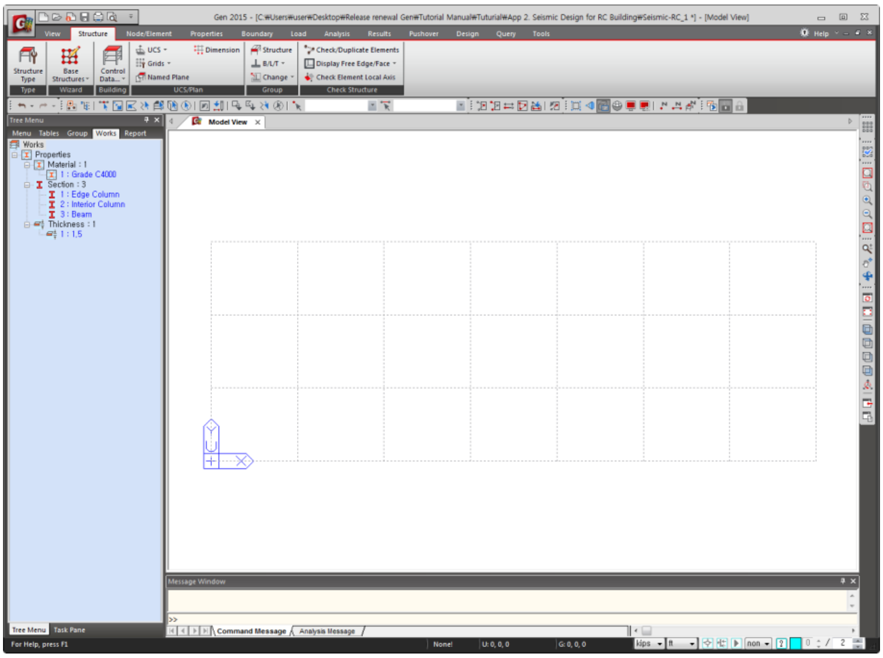


Figure 5 : Grid Lines in X-Y Plane

Generate Floor Plan

Hidden, Node Number, Element Number (toggle on)

Create Elements

Element Type = General Beam / Tapered Beam

Section Name = 3 : Beam

Draw Elements as shown (Refer Figure 6)

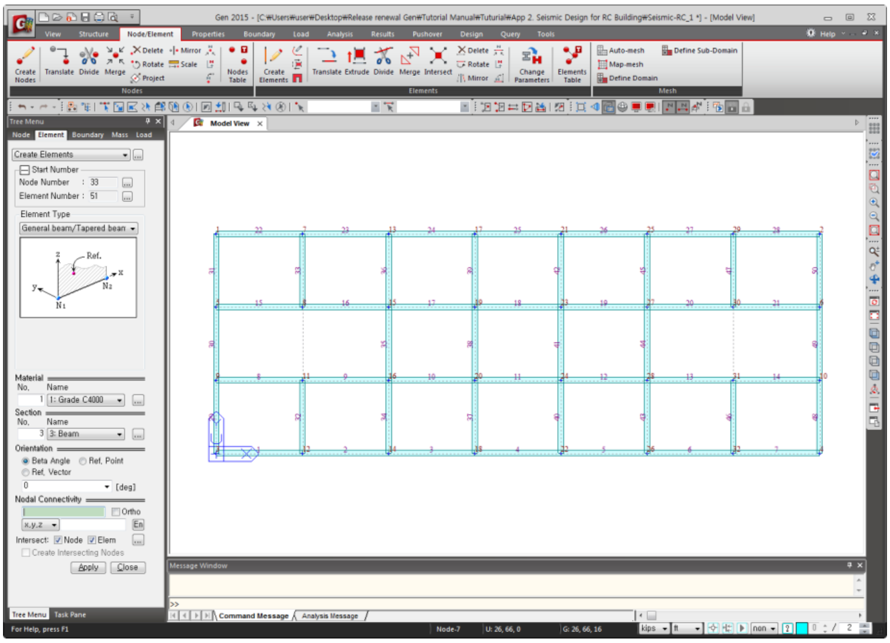


Figure 6 : Floor Plan

Generate Columns

Change to GCS

Select All

Extrude Element

Node → Line Element

Reverse I-J > (on)

Element Type = Beam

Material = 1 : Grade C4000

Section = 1 : Edge column

d_x, d_y, d_z = 0, 0, -16

Apply

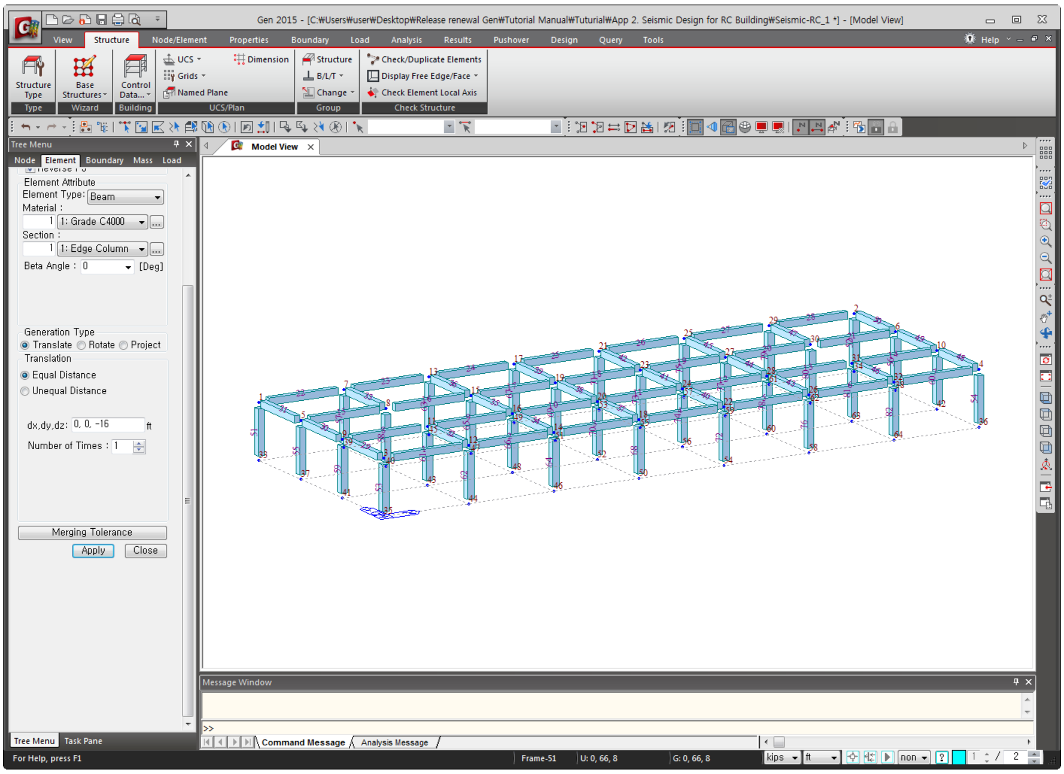


Figure 7 : Generate Columns

Change Properties of Interior Columns

Work > Properties > Section : 1 : Edge column = Active

Display > Property > Property Name > (on)

OK

Isometric View (Refer Figure 8)

Top View > Select Window > Select Interior Columns

Work > Properties > Section = 2 : Interior column

Drag & Drop (Refer Figure 9)

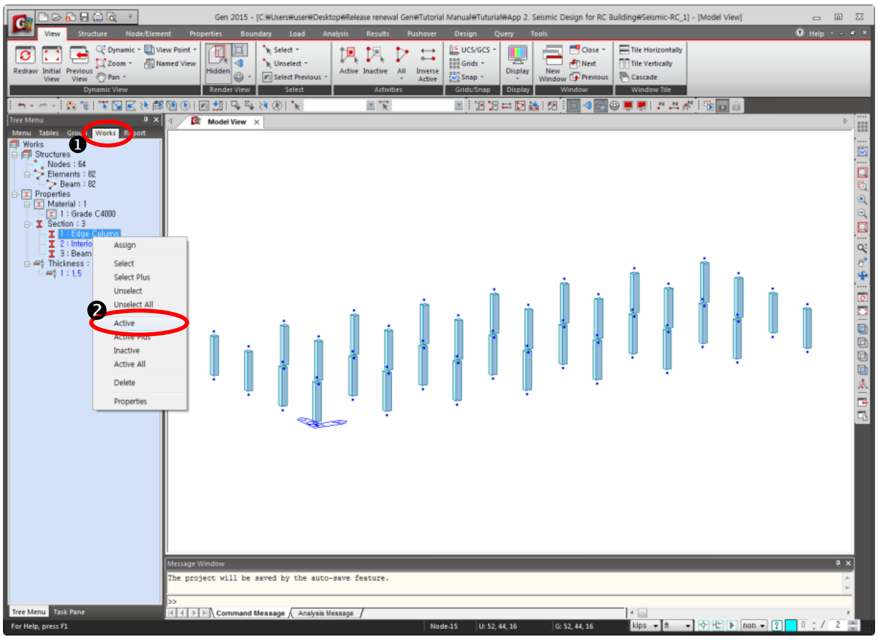


Figure 8 : Inactivate Beams

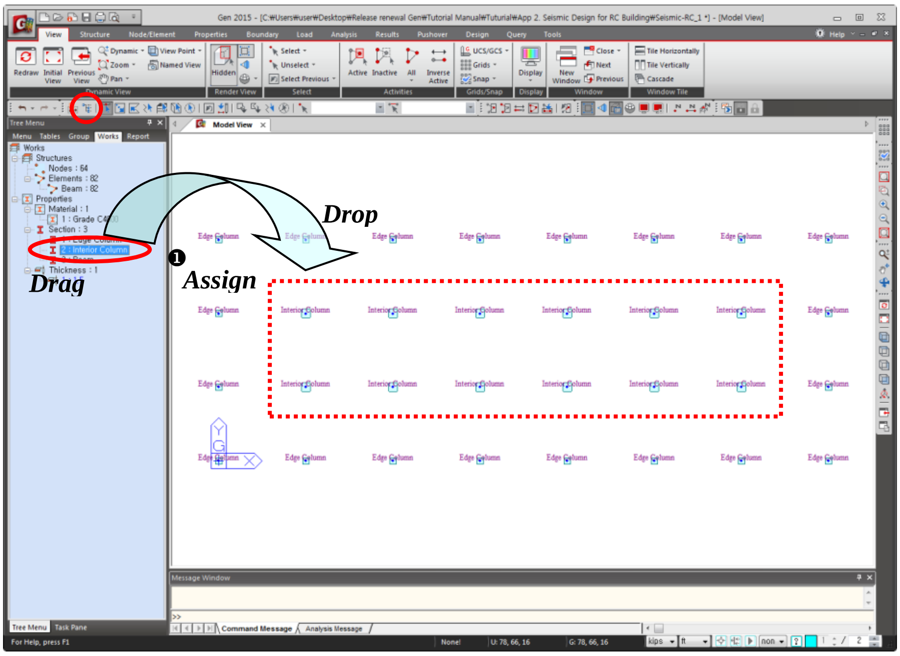


Figure 9 : "Drag & Drop" Interior Column Properties

Generate Walls

Hidden (toggle off) ; Node Number (toggle on)

Display > Property > Property Name > (off)

Select Window (Refer Figure 10)

Active

Create Elements

Element Type : Wall

Membrane > (on)

Wall ID > Auto Inc. > 1

Material Name > 1:Grade C4000

Thickness > 1:1.5000

Intersect Node > (on)

Nodal Connectivity > 50, 42, 10, 18 (Refer ❶ on Figure 11)

Select Single > Wall Element 1

Translate Element > Copy

Equal Distance (d_x, d_y, d_z) > 130, 0, 0 Apply

Wall ID Increment = 1 OK

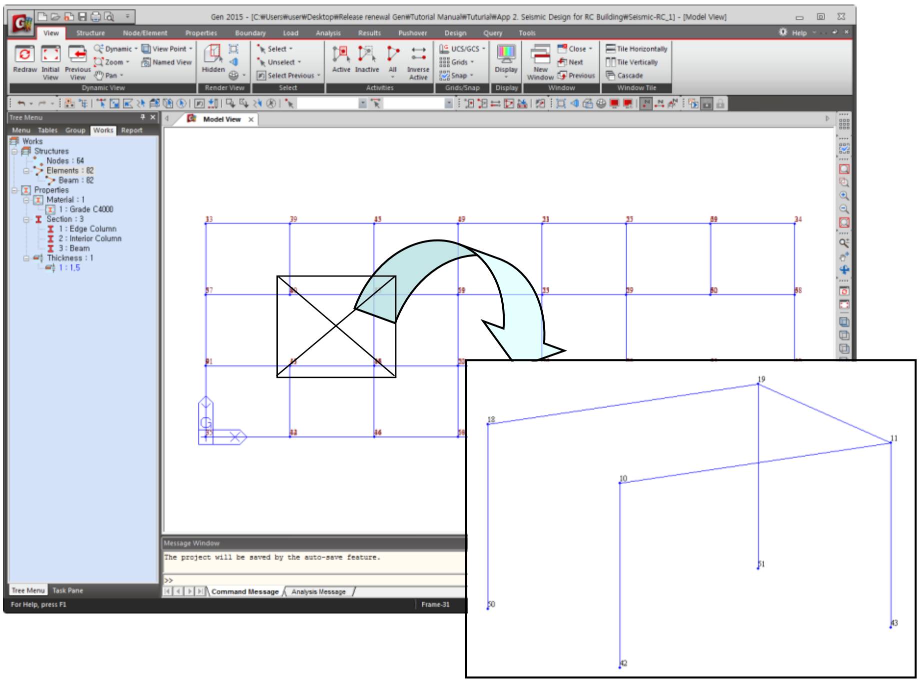


Figure 10 : Location of Wall Element

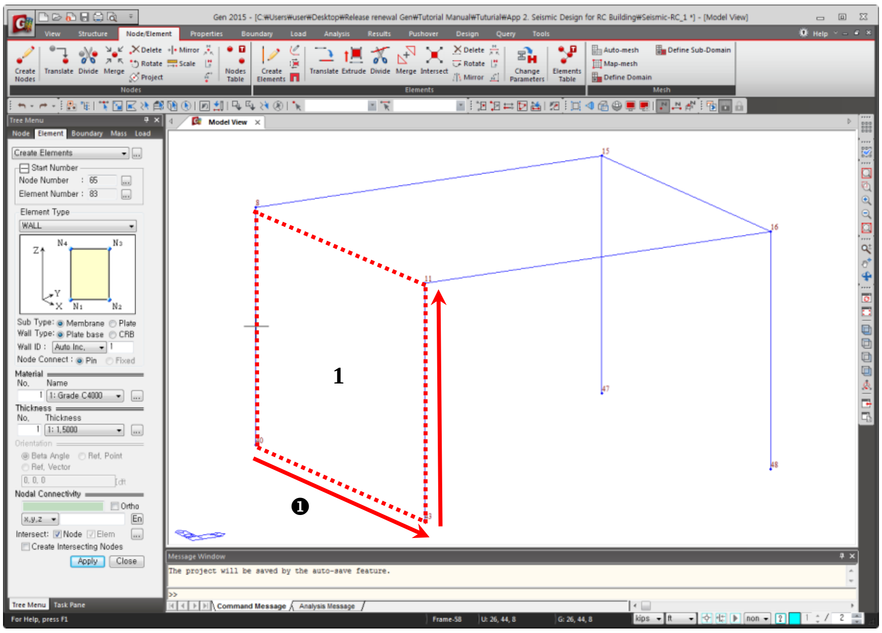


Figure 11 : Nodal Connectivity of Wall Element

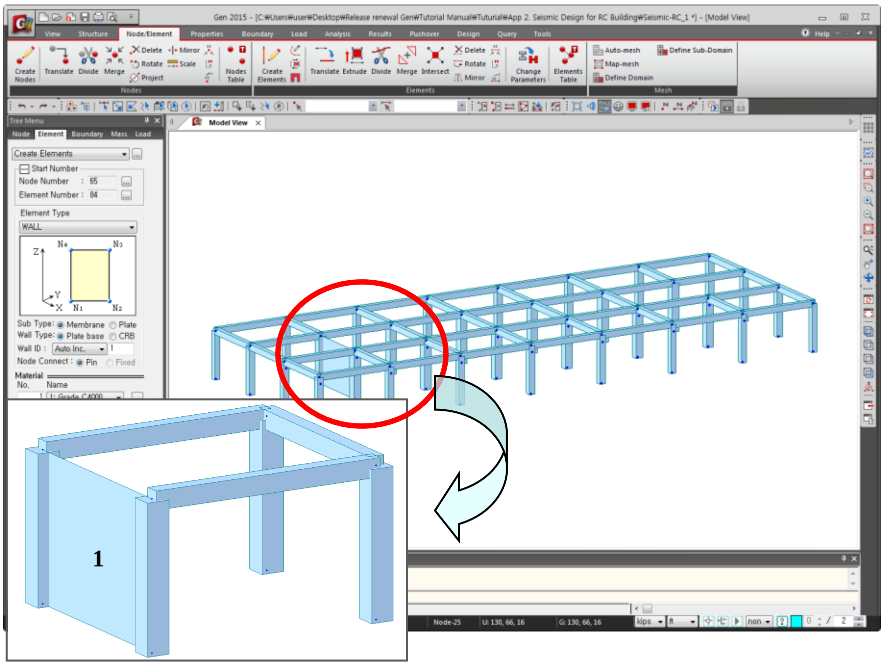


Figure 12 : Generation of Wall Element

Building Generation

Select All

Structure > Building > Control Data > Building Generation

Number of Copies = 11

Distance(Global Z) = 12 Add Apply

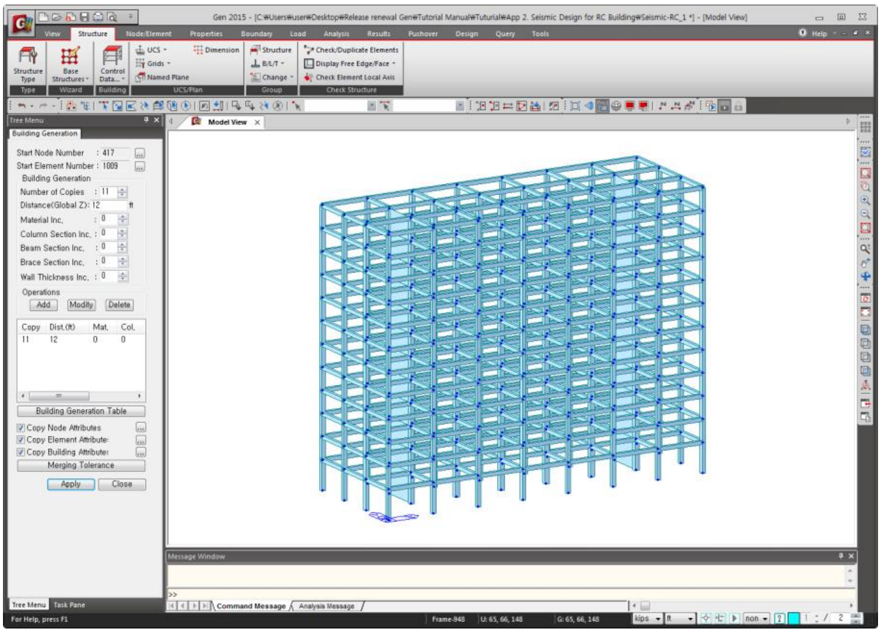


Figure 13 : Building Generation

Generate Story Data

Structure > Building > Control Data > Story

[Auto Generate Story Data...]

[OK]

[Close]

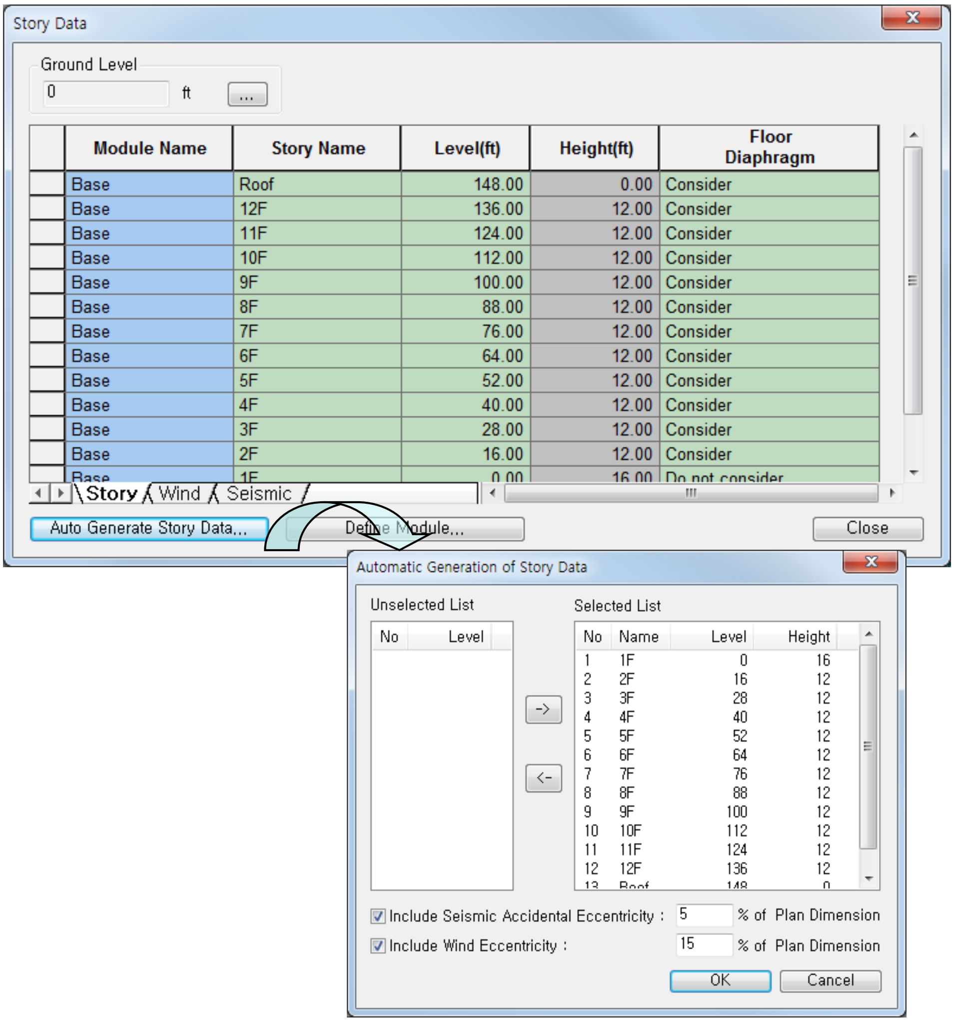


Figure 14 : Generation of Story Data

3. Boundary Conditions Input

The lower ends of the columns are assumed fixed.

Boundary > Supports > Define Supports
D – All > (on)
R – All > (on)
 Select Window
Apply

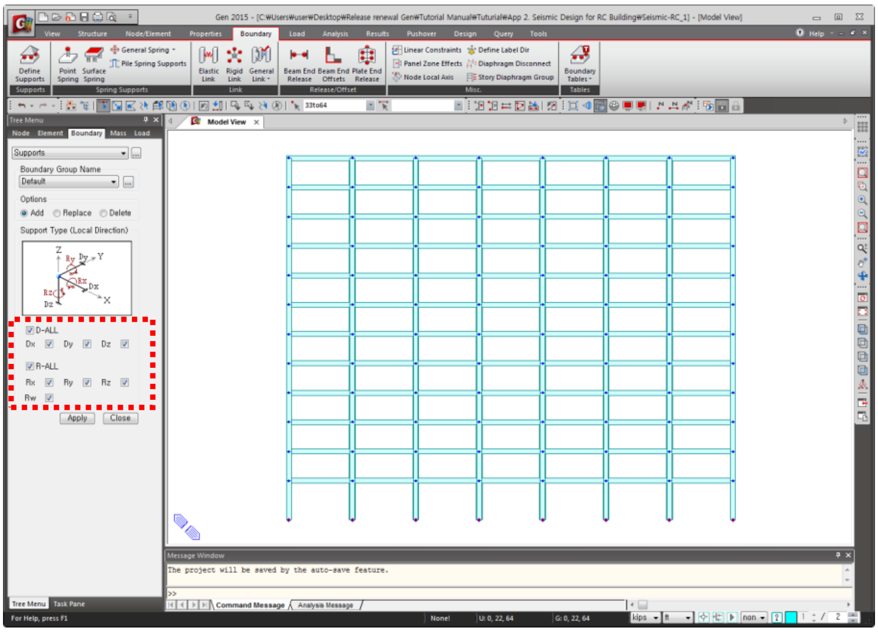


Figure 15 : Boundary Supports

4. Loading Data Input

Load > Static Load > Create Load Cases > Static Load Cases

- Dead Load
- Live Load
- Wind Load (X-direction)
- Wind Load (Y-direction)
- Earthquake Load (X-direction, Eccentricity direction-Positive)
- Earthquake Load (X-direction, Eccentricity direction-Negative)
- Earthquake Load (Y-direction, Eccentricity direction-Positive)
- Earthquake Load (Y-direction, Eccentricity direction-Negative)

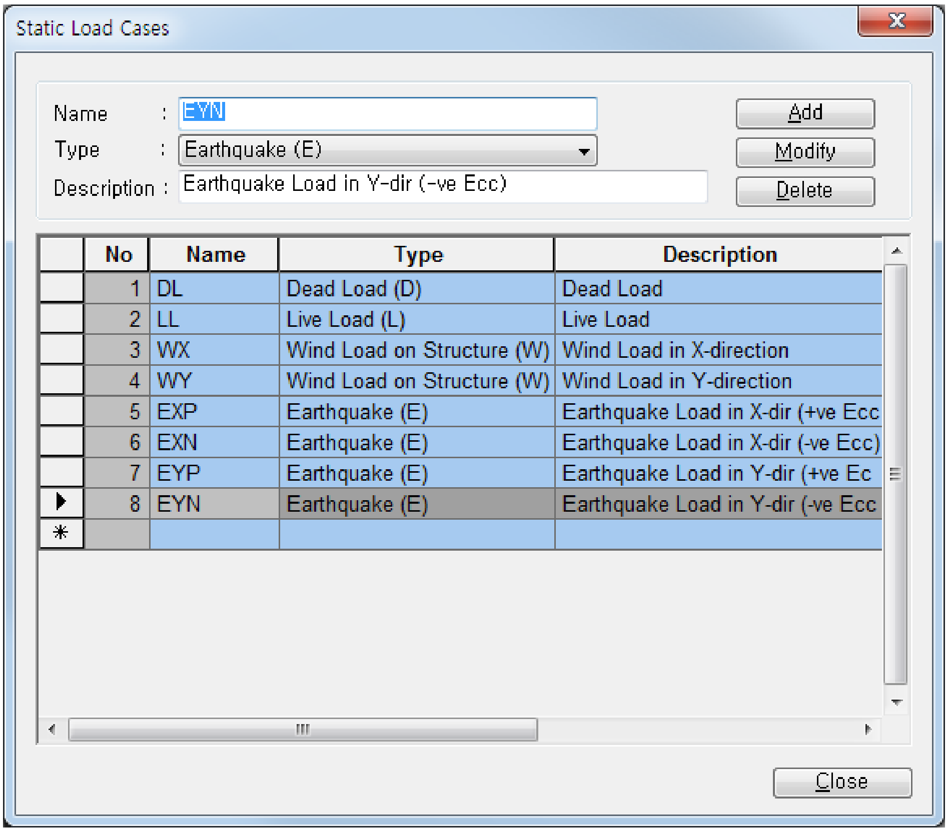


Figure 16 : Loading Data Input

Self Weight

Load > Static Loads > Structure Loads/Masses > Self Weight

Z = -1 Add

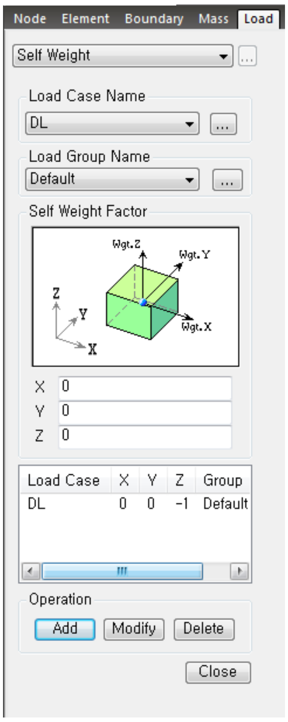


Figure 17 : Self Weight Load

Floor Load

Load > Initial Forces/Misc. > Assign Floor Loads > Define Floor Load Type

- Name > Typical Floor : DL = -30 psf, LL = -75 psf 

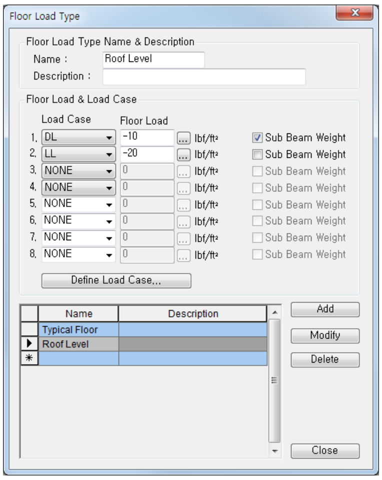
- Name > Roof Level : DL = -10 psf, LL = -20 psf 

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

- Load Type > Typical Floor
- Two Way Distribution
- Copy Floor Load > (on)
- Axis > z (on)
- Distance > 10@12
- Assign Nodes Defining Loading Area > (1, 8, 32, 25)

Similarly, assign floor load at roof level :

- Load Type > Roof Level
- Copy Floor Load > (off)
- Assign Nodes Defining Loading Area > (386, 387, 417, 410)



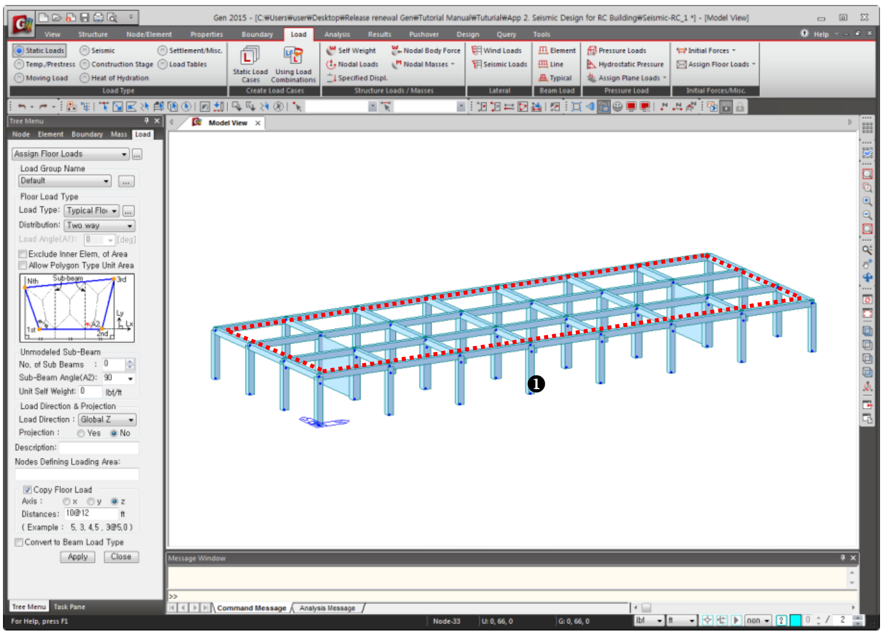


Figure 18 : Assign Floor Loads

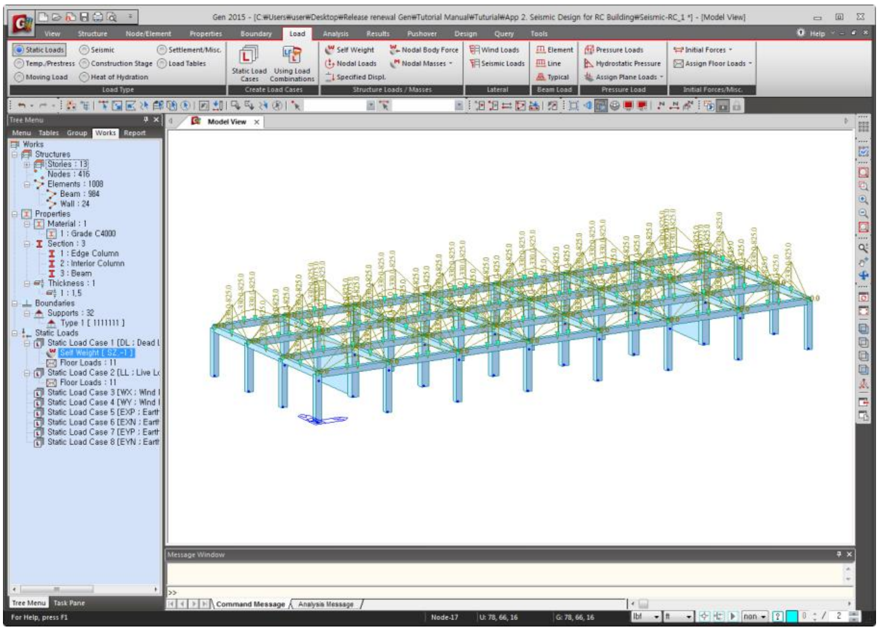


Figure 19 : Floor Load Distribution

Wind Loads

Load > Static Loads > Lateral > Wind Loads

Add

- Load Case Name > WX
- Wind Load Code > IBC2012 (ASCE7-10)
- Alternate Method > (on)
- Basic Wind Speed > 85 mile/h
- Exposure Category > B
- Scale Factor in Global X > 1
- Scale Factor in Global Y > 0

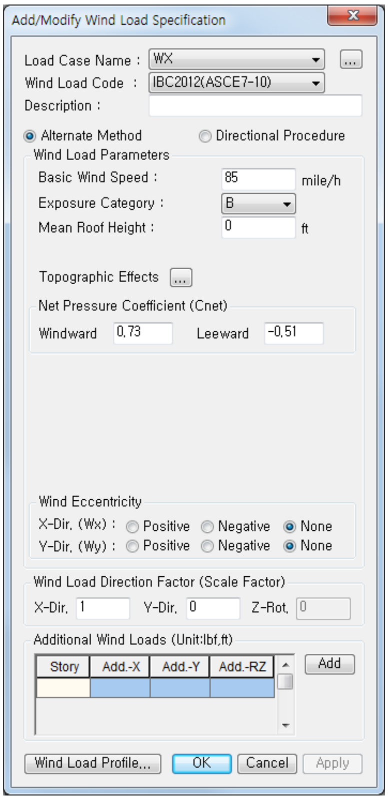
Apply

- Load Case Name > WY
- Scale Factor in Global X > 0
- Scale Factor in Global Y > 1

Apply

OK

Close



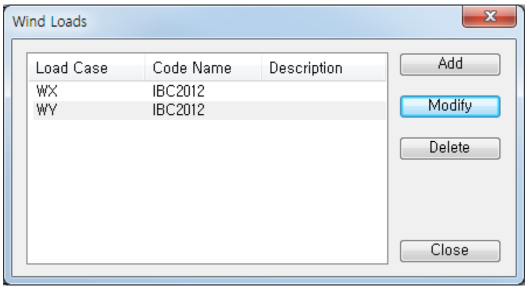


Figure 20 : Input Wind Loads

Convert Model Weight & Loads to Masses

Structure > Type > Structure Type
- Structure Type > 3-D (on)
- Convert Self-weight into Masses (on)
- Convert to X, Y (on)
- Gravity Acceleration > 32.1719 (ft/sec^2)
-

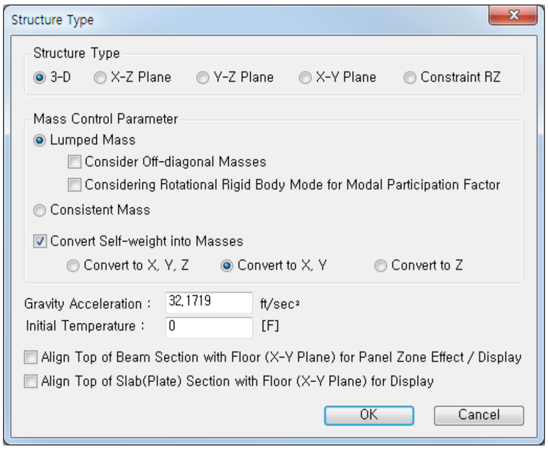


Figure 21 : Convert Model Weight to Masses

Load > Static Loads > Structure Loads/Masses > Nodal Masses > Loads to Masses
- Mass Direction > X, Y (on)
- Load Type for Converting > *All* (on)
- Gravity > 32.1719 (ft/sec^2)
- Load Case > DL
- Scale Factor > 1

- Load Case > LL
- Scale Factor > 0.25

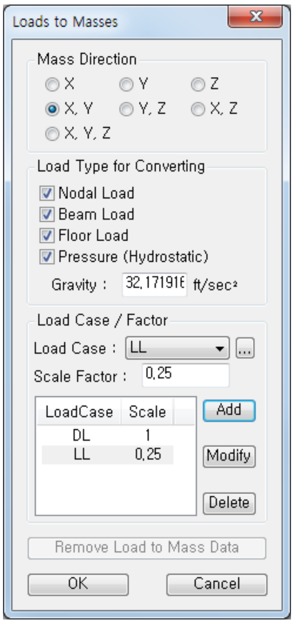


Figure 22 : Covert Model Loads to Masses

Static Seismic Loads

Load > Static Loads > Lateral > Seismic Loads

Add

- Load Case Name > EXP
- Seismic Load Code > IBC2012 (ASCE7-10)
- Seismic Design Category > E
- Site Class > C
- Ss = 1.0
- S1 = 0.3
- Importance Factor (I) = 1
- Period (Code) > X-Dir. = 1.2 ; Y-Dir. = 0
- Response Modification Coef. (R) > X-Dir. = 8 (Special moment frame),
  Y-Dir. = 8 (Dual system: special reinforced concrete structural walls with special moment frame)
- Scale Factor in Global X = 1
- Scale Factor in Global Y = 0
- Accidental Eccentricity in X-direction > Positive (on)
- Accidental Eccentricity in Y-direction > Positive (on)

Apply

- Load Case Name > EXN
- Period (Code) > X-Dir. = 1.2 ; Y-Dir. = 0
- Scale Factor in Global X = 1
- Scale Factor in Global Y = 0
- Accidental Eccentricity in X-direction > Negative (on)
- Accidental Eccentricity in Y-direction > Negative (on)

Apply

- Load Case Name > EYP
- Period (Code) > X-Dir. = 0 ; Y-Dir. = 1.2
- Scale Factor in Global X = 0
- Scale Factor in Global Y = 1
- Accidental Eccentricity in X-direction > Positive (on)
- Accidental Eccentricity in Y-direction > Positive (on)

Apply

- Load Case Name > EYN
- Period (Code) > X-Dir. = 0 ; Y-Dir. = 1.2
- Scale Factor in Global X = 0
- Scale Factor in Global Y = 1
- Accidental Eccentricity in X-direction > Negative (on)
- Accidental Eccentricity in Y-direction > Negative (on)

OK

Close

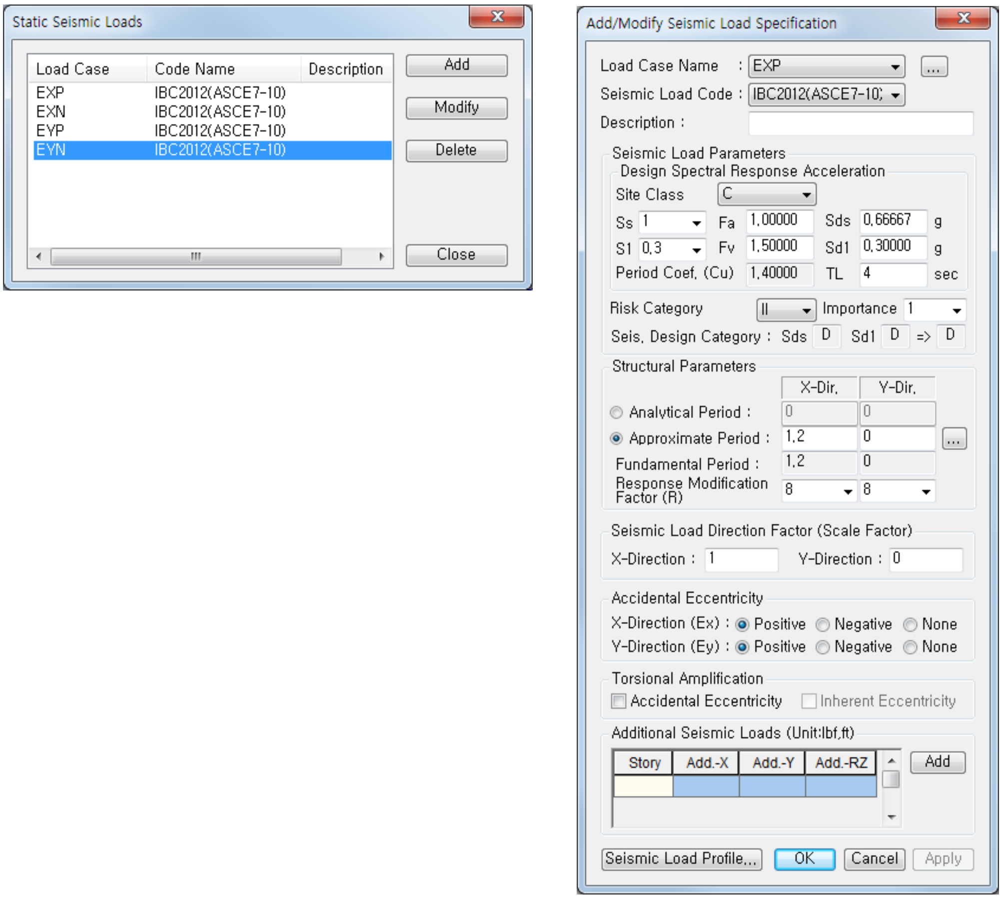


Figure 23 : Input Static Seismic Loads

Response Spectrum Load

Load > Seismic > Response Spectrum Data > Response Spectrum Functions
Add

Design Spectrum
- Design Spectrum > IBC2012 (ASCE7-10)
- Site Class > C
- Ss = 1.0
- S1 = 0.3

OK

OK

Close

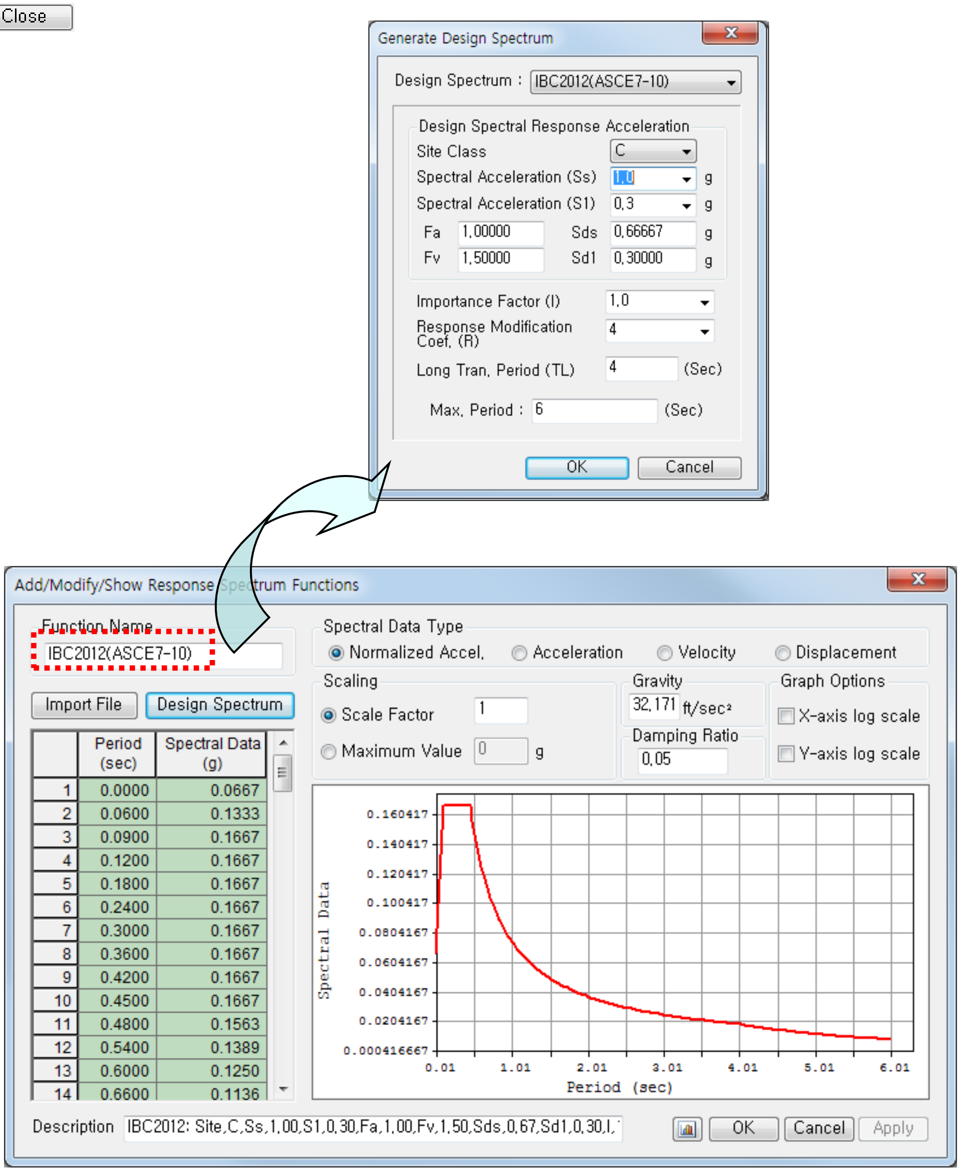


Figure 24 : Response Spectrum Loads

Load > Response Spectrum Analysis Data > Response Spectrum Load Cases

- Load Case Name > RX
- Direction > X-Y
- Excitation Angle = 0 (deg.)
- Scale Factor (I/R) > 1/8 = 0.125
- Period Modification Factor = 1
- Function Name (Damping Ratio) > IBC2012(ASCE7-10) (0.05) > (on)
- Interpolation of Spectral Data > Linear (on)
- Accidental Eccentricity > (on)
- Modal Combination Type > SRSS

- Load Case Name > RY
- Excitation Angle = 90 (deg.)
- Modal Combination Type > SRSS

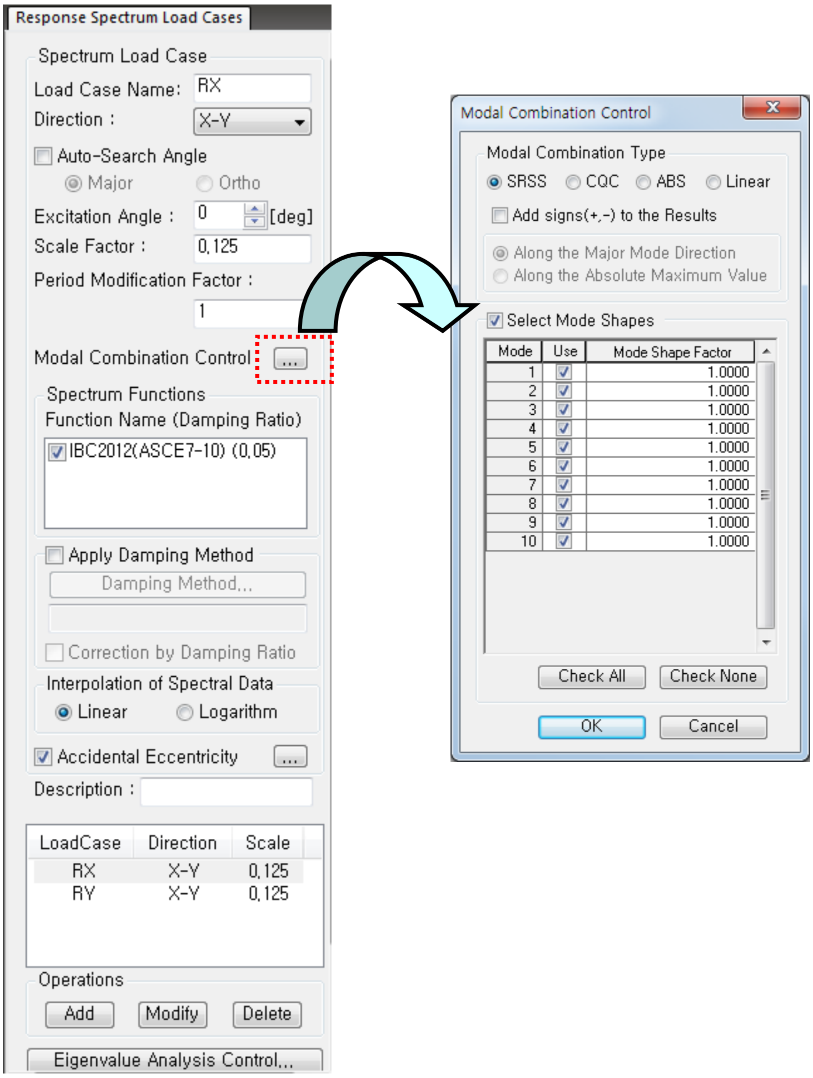


Figure 25 : Response Spectrum Analysis

5. Analysis

Analysis > P-Delta Analysis Control
- Number of Iterations = 5
- Convergence Tolerance = 1e-005
- P-Delta Combination > Load Case > DL ; Scale Factor > 1

Add

- P-Delta Combination > Load Case > LL ; Scale Factor = 0.25

Add

OK

Analysis > Eigenvalue Analysis Control
- Type of Analysis > Eigen Vectors (on) > Subspace Iteration (on)
- Number of Frequencies = 10
- Number of Iterations = 20
- Subspace Dimension = 0
- Convergence Tolerance = 1e-010

OK

Perform Analysis

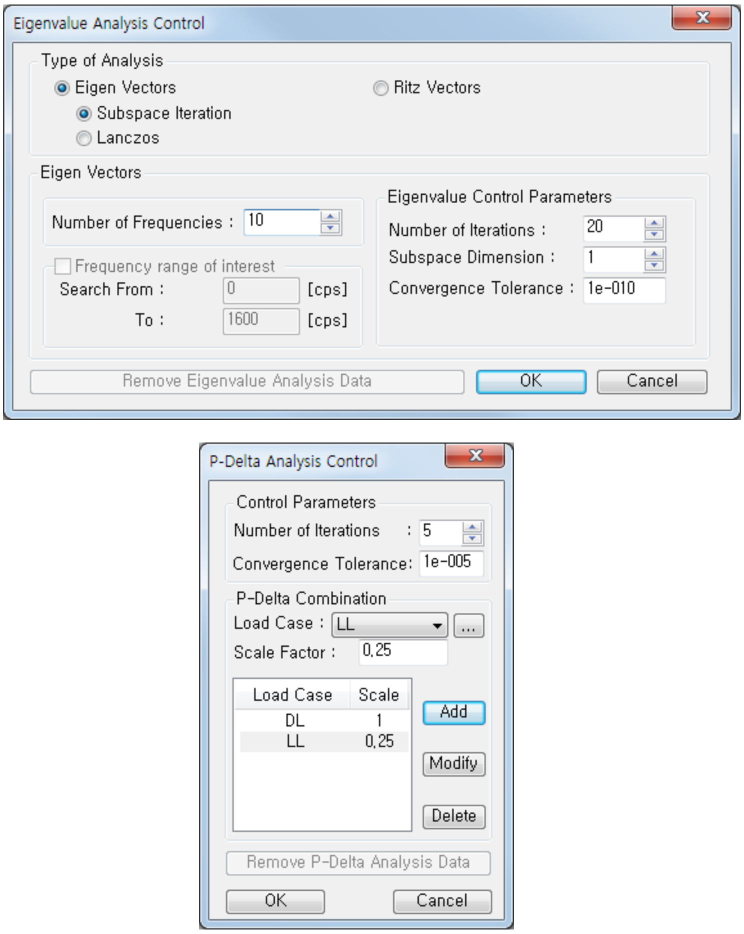


Figure 27 : P-Delta and Eigenvalue Analysis Control

6. Design Input

Results > Combinations

Concrete Design > Auto Generation

- Option > Add (on)
- Design Code > ACI318-11
- Scale Up Factor = 1.48 ; RX [Add]
- Scale Up Factor = 1 ; RY [Add]

[OK]

Bi-directional combination needs to be investigated, but omitted in this tutorial.

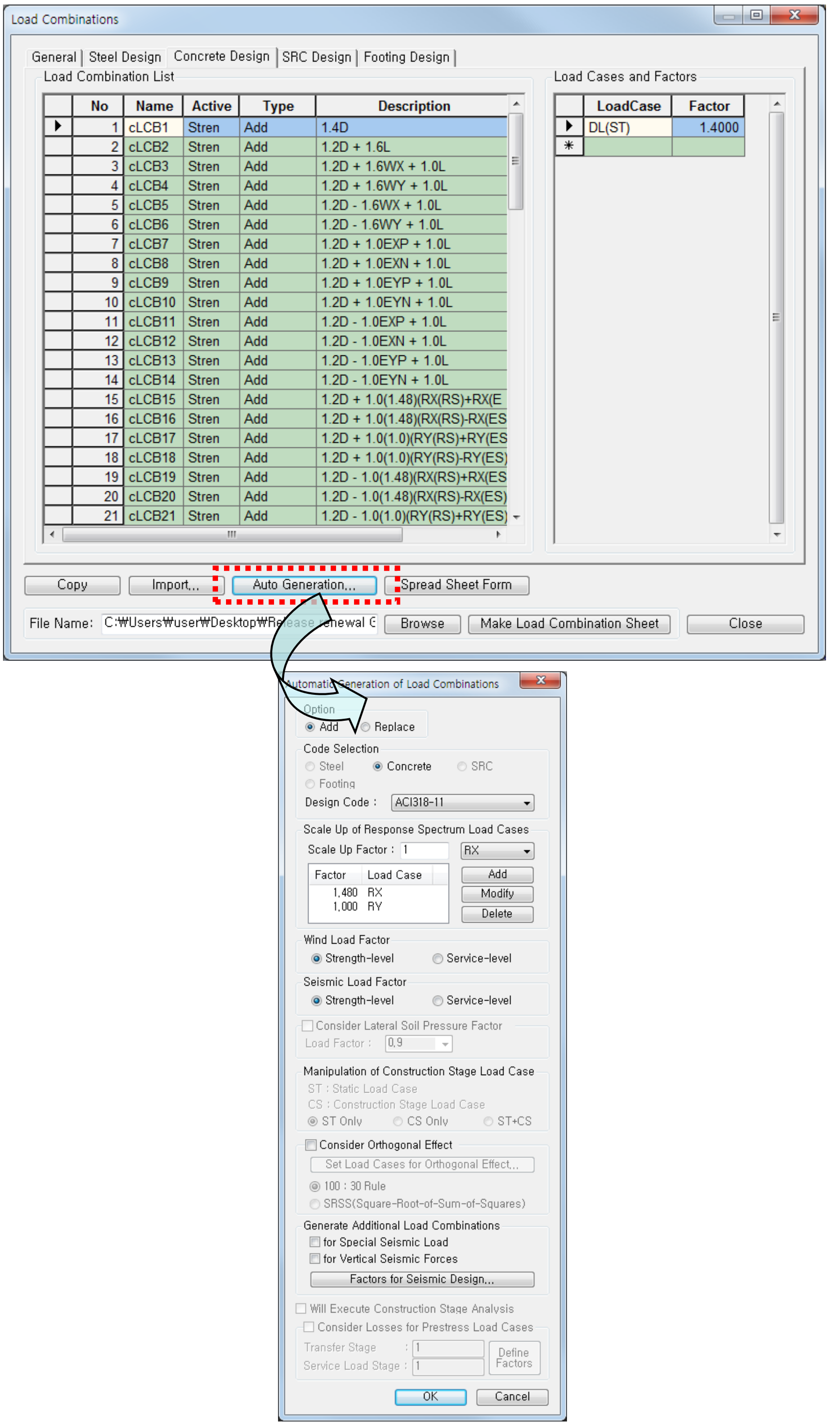


Figure 28 : Generation of Load Combinations for Concrete Design

Compare RX (RY) with EX (EY)

RX (RY):
Results > Tables > Result Tables > Story > Story Shear (Response Spectrum Analysis)
- Spectrum Load Cases > RX(RS) (on) & RY(RS) (on) OK
- Shear Force (Without Spring)

Story	Level (ft)	Spectrum	Inertia Force X (lbf)	Inertia Force Y (lbf)	Shear Force – Spring Reactions X (lbf)	Shear Force – Spring Reactions Y (lbf)	Shear Force – Without Spring X (lbf)	Shear Force – Without Spring Y (lbf)	Shear Force – With Spring X (lbf)	Shear Force – With Spring Y (lbf)	Eccentricity (ft)	Story Force (lbf)	Eccentric Moment (ft·lbf)
Roof	148.0000	RX(RS)	5.1709e+004	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	3.3000e+000	5.1709e+004	1.7064e+005
12F	136.0000	RX(RS)	6.6489e+004	0.0000e+000	0.0000e+000	0.0000e+000	5.1709e+004	0.0000e+000	5.1709e+004	0.0000e+000	3.3000e+000	6.6489e+004	2.1941e+005
11F	124.0000	RX(RS)	5.7482e+004	0.0000e+000	0.0000e+000	0.0000e+000	1.1593e+005	0.0000e+000	1.1593e+005	0.0000e+000	3.3000e+000	5.7482e+004	1.8969e+005
10F	112.0000	RX(RS)	5.3392e+004	0.0000e+000	0.0000e+000	0.0000e+000	1.6341e+005	0.0000e+000	1.6341e+005	0.0000e+000	3.3000e+000	5.3392e+004	1.7619e+005
9F	100.0000	RX(RS)	5.3730e+004	0.0000e+000	0.0000e+000	0.0000e+000	1.9933e+005	0.0000e+000	1.9933e+005	0.0000e+000	3.3000e+000	5.3730e+004	1.7731e+005
8F	88.0000	RX(RS)	5.4505e+004	0.0000e+000	0.0000e+000	0.0000e+000	2.2738e+005	0.0000e+000	2.2738e+005	0.0000e+000	3.3000e+000	5.4505e+004	1.7987e+005
7F	76.0000	RX(RS)	5.6120e+004	0.0000e+000	0.0000e+000	0.0000e+000	2.5096e+005	0.0000e+000	2.5096e+005	0.0000e+000	3.3000e+000	5.6120e+004	1.8520e+005
6F	64.0000	RX(RS)	5.7092e+004	0.0000e+000	0.0000e+000	0.0000e+000	2.7204e+005	0.0000e+000	2.7204e+005	0.0000e+000	3.3000e+000	5.7092e+004	1.8840e+005
5F	52.0000	RX(RS)	5.8322e+004	0.0000e+000	0.0000e+000	0.0000e+000	2.9230e+005	0.0000e+000	2.9230e+005	0.0000e+000	3.3000e+000	5.8322e+004	1.9246e+005
4F	40.0000	RX(RS)	5.7401e+004	0.0000e+000	0.0000e+000	0.0000e+000	3.1255e+005	0.0000e+000	3.1255e+005	0.0000e+000	3.3000e+000	5.7401e+004	1.8942e+005
3F	28.0000	RX(RS)	5.3145e+004	0.0000e+000	0.0000e+000	0.0000e+000	3.3314e+005	0.0000e+000	3.3314e+005	0.0000e+000	3.3000e+000	5.3145e+004	1.7538e+005
2F	16.0000	RX(RS)	3.9772e+004	0.0000e+000	0.0000e+000	0.0000e+000	3.5229e+005	0.0000e+000	3.5229e+005	0.0000e+000	3.3000e+000	3.9772e+004	1.3125e+005
1F	0.0000	RX(RS)	3.6652e+005	0.0000e+000	0.0000e+000	0.0000e+000	3.6652e+005	0.0000e+000	3.6652e+005	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000
Roof	148.0000	RY(RS)	0.0000e+000	8.2332e+004	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	9.1000e+000	8.2332e+004	7.4922e+005
12F	136.0000	RY(RS)	0.0000e+000	1.0413e+005	0.0000e+000	0.0000e+000	0.0000e+000	8.2332e+004	0.0000e+000	8.2332e+004	9.1000e+000	1.0413e+005	9.4760e+005
11F	124.0000	RY(RS)	0.0000e+000	7.9195e+004	0.0000e+000	0.0000e+000	0.0000e+000	1.8585e+005	0.0000e+000	1.8585e+005	9.1000e+000	7.9195e+004	7.2068e+005
10F	112.0000	RY(RS)	0.0000e+000	6.5364e+004	0.0000e+000	0.0000e+000	0.0000e+000	2.6141e+005	0.0000e+000	2.6141e+005	9.1000e+000	6.5364e+004	5.9482e+005
9F	100.0000	RY(RS)	0.0000e+000	6.6553e+004	0.0000e+000	0.0000e+000	0.0000e+000	3.1390e+005	0.0000e+000	3.1390e+005	9.1000e+000	6.6553e+004	6.0563e+005
8F	88.0000	RY(RS)	0.0000e+000	7.5427e+004	0.0000e+000	0.0000e+000	0.0000e+000	3.5154e+005	0.0000e+000	3.5154e+005	9.1000e+000	7.5427e+004	6.8639e+005
7F	76.0000	RY(RS)	0.0000e+000	8.2318e+004	0.0000e+000	0.0000e+000	0.0000e+000	3.8405e+005	0.0000e+000	3.8405e+005	9.1000e+000	8.2318e+004	7.4909e+005
6F	64.0000	RY(RS)	0.0000e+000	8.2208e+004	0.0000e+000	0.0000e+000	0.0000e+000	4.1896e+005	0.0000e+000	4.1896e+005	9.1000e+000	8.2208e+004	7.4809e+005
5F	52.0000	RY(RS)	0.0000e+000	7.3775e+004	0.0000e+000	0.0000e+000	0.0000e+000	4.5817e+005	0.0000e+000	4.5817e+005	9.1000e+000	7.3775e+004	6.7135e+005
4F	40.0000	RY(RS)	0.0000e+000	5.8127e+004	0.0000e+000	0.0000e+000	0.0000e+000	4.9799e+005	0.0000e+000	4.9799e+005	9.1000e+000	5.8127e+004	5.2895e+005
3F	28.0000	RY(RS)	0.0000e+000	3.8144e+004	0.0000e+000	0.0000e+000	0.0000e+000	5.3220e+005	0.0000e+000	5.3220e+005	9.1000e+000	3.8144e+004	3.4711e+005
2F	16.0000	RY(RS)	0.0000e+000	1.8738e+004	0.0000e+000	0.0000e+000	0.0000e+000	5.5569e+005	0.0000e+000	5.5569e+005	9.1000e+000	1.8738e+004	1.7051e+005
1F	0.0000	RY(RS)	0.0000e+000	5.6733e+005	0.0000e+000	0.0000e+000	0.0000e+000	5.6733e+005	0.0000e+000	5.6733e+005	0.0000e+000	0.0000e+000	0.0000e+000

Figure 29 : Story Shear (Response Spectrum Analysis)

EX (EY):
Load > Static Loads > Lateral > Seismic Loads
Load Case > EXP > Modify > Seismic Load Profile
- Story Shear (on)

Similarly, select Load Cases EXN, EYP & EYN

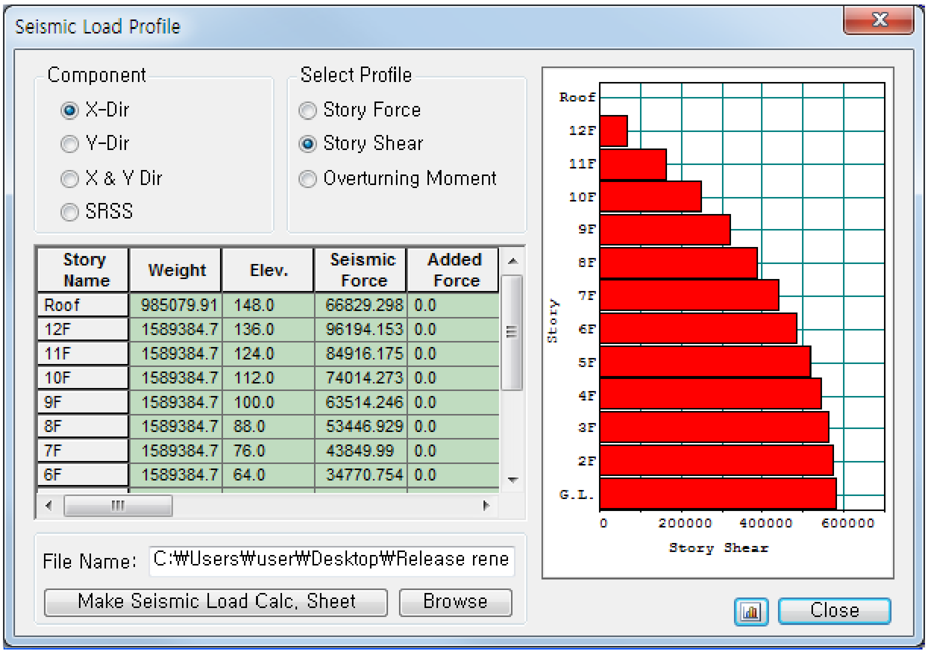


Figure 30 : Story Shear (Static Seismic Loads)

Design > General > General Design Parameter >Definition of Frame
- X-direction > Unbraced | Sway (on)
- Y-direction > Braced | Non-Sway (on)
- Design Type > 3-D
- Auto Calculate Effective Length Factors > (on)

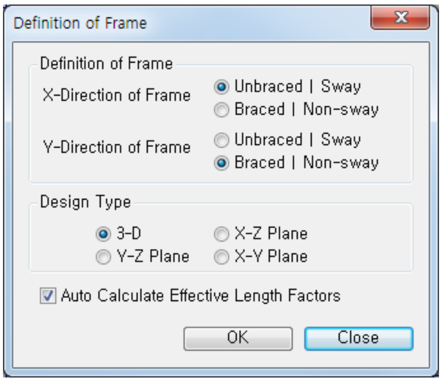


Figure 31 : Definition of Frame

Design > General > General Design Parameter > Modify Live Load Reduction Factor
General Tab

- Option > Add/Replace (on)
- Applied Components > Axial Force (on)
- Top View > Select Window 

- Interior columns: Reduction Factor = 0.56

- Edge column: Reduction Factor = 0.69

- Corner column: Reduction Factor = 0.88

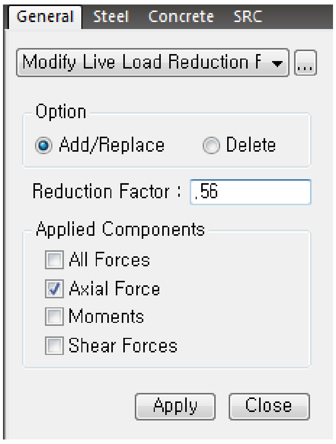


Figure 32 : Modify Live Load Reduction Factor

- Unbraced Length (L, Lb)
- Option > Add/Replace (on)
- Unbraced Length > Ly=0 ; Lx=0
- Laterally Unbraced Length > Do not consider (on)
- Select All

Apply

- Equivalent Moment Correction Factor (Cm)
- Option > Add/Replace (on)
- Moment Factor > Calculate by Program (on)
- Select All

Apply

Close

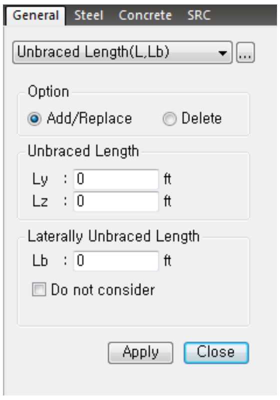


Figure 33 : Unbraced Length

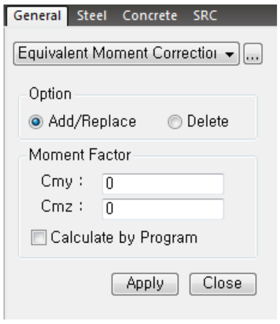


Figure 34 : Equivalent Moment Correction Factor

Design > Design > RC Design > Design Code
- Design Code > ACI318-11
- Apply Special Provisions for Seismic Design > (on)
- Select Frame Type > Special Moment Frames (on)

OK

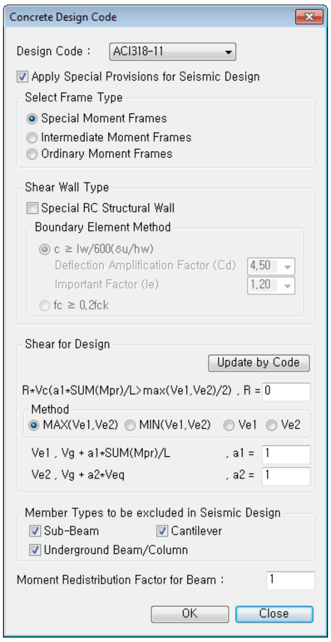


Figure 35 : Concrete Design Code

Design > Design > RC Design > Strength Reduction Factors
Update By Code

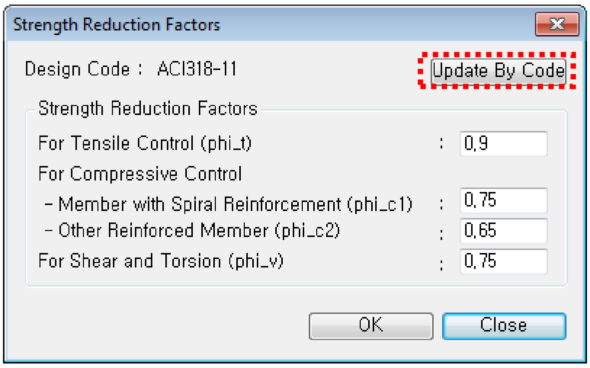



Figure 36 : Strength Reduction Factors

Design > Design > RC Design > Design Criteria for Rebars (Refer Figure 37)

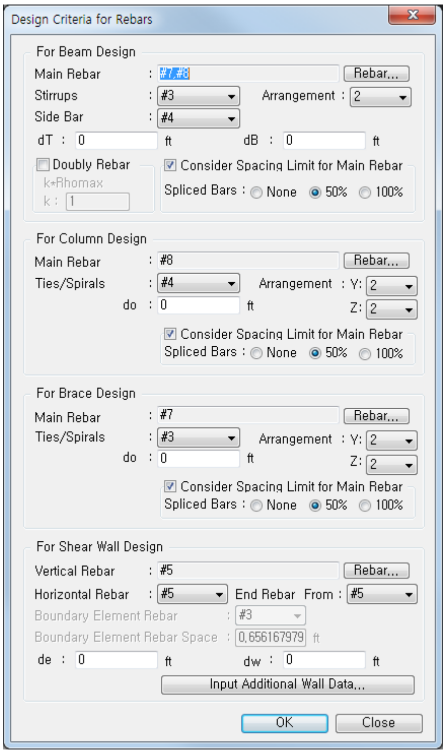


Figure 37 : Design Criteria for Rebars

Design > Design > RC Design > Modify Concrete Materials

Select material ID #1
Rebar Selection
- Code > ASTM (RC)
- Grade of Main Rebar > Grade 60
- Grade of Sub-Rebar > Grade 40

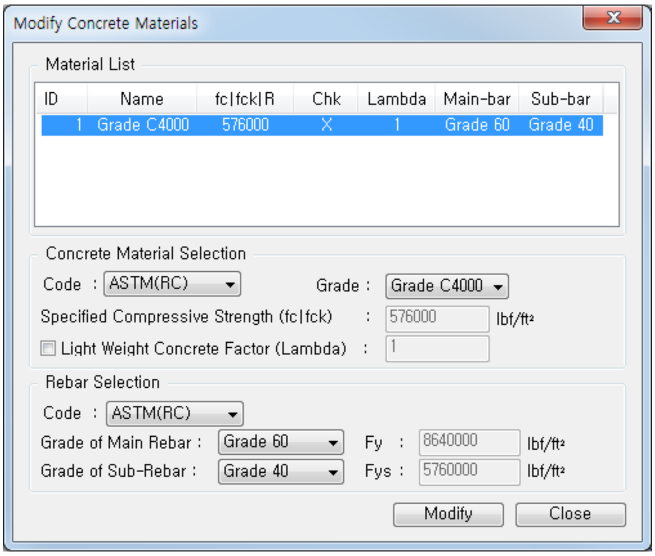
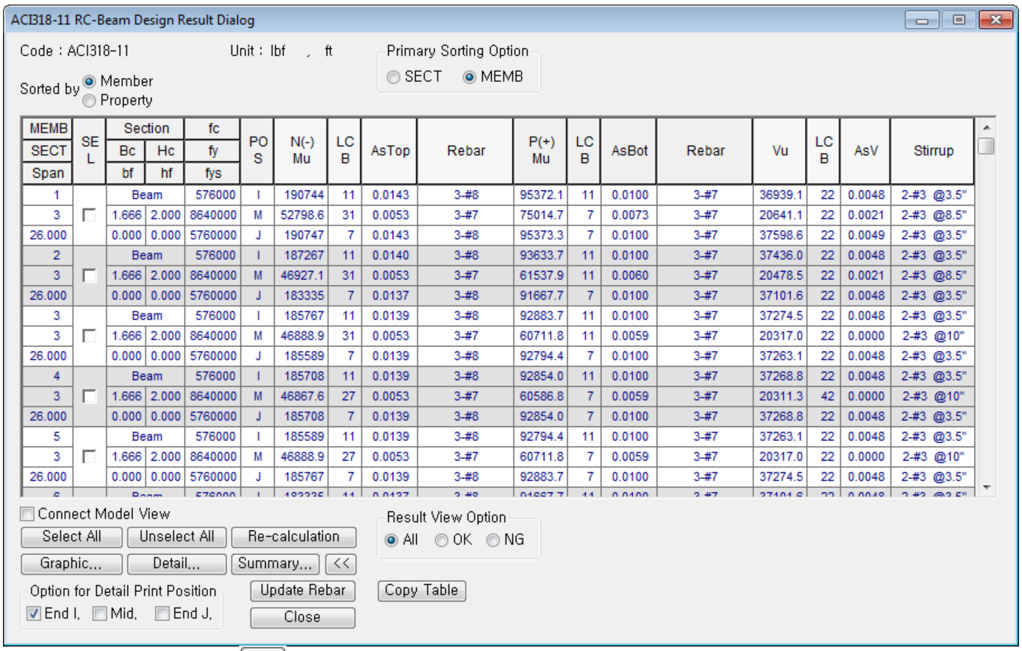


Figure 38 : Modify Concrete Materials

7. Design Output

Design > Design > RC Design > Concrete Code Design > Beam Design



ACI318-11 RC-Beam Design Result Dialog

Code : ACI318-11 Unit : lbf , ft

Sorted by ◉ Member ○ Property

Primary Sorting Option ○ SECT ◉ MEMB

MEMB / SECT / Span	SEL	Section: Bc / bf	Section: Hc / hf	fc / fy / fys	POS	N(-) Mu	LCB	AsTop	Rebar	P(+) Mu	LCB	AsBot	Rebar	Vu	LCB	AsV	Stirrup
1		Beam		576000	I	190744	11	0.0143	3-#8	95372.1	11	0.0100	3-#7	36939.1	22	0.0048	2-#3 @3.5"
3	☐	1.666	2.000	8640000	M	52798.6	31	0.0053	3-#7	75014.7	7	0.0073	3-#7	20641.1	22	0.0021	2-#3 @8.5"
26.000		0.000	0.000	5760000	J	190747	7	0.0143	3-#8	95373.3	7	0.0100	3-#7	37598.6	22	0.0049	2-#3 @3.5"
2		Beam		576000	I	187267	11	0.0140	3-#8	93633.7	11	0.0100	3-#7	37436.0	22	0.0048	2-#3 @3.5"
3	☐	1.666	2.000	8640000	M	46927.1	31	0.0053	3-#7	61537.9	11	0.0060	3-#7	20478.5	22	0.0021	2-#3 @8.5"
26.000		0.000	0.000	5760000	J	183335	7	0.0137	3-#8	91667.7	7	0.0100	3-#7	37101.6	22	0.0048	2-#3 @3.5"
3		Beam		576000	I	185767	11	0.0139	3-#8	92883.7	11	0.0100	3-#7	37274.5	22	0.0048	2-#3 @3.5"
3	☐	1.666	2.000	8640000	M	46888.9	31	0.0053	3-#7	60711.8	11	0.0059	3-#7	20317.0	22	0.0000	2-#3 @10"
26.000		0.000	0.000	5760000	J	185589	7	0.0139	3-#8	92794.4	7	0.0100	3-#7	37263.1	22	0.0048	2-#3 @3.5"
4		Beam		576000	I	185708	11	0.0139	3-#8	92854.0	11	0.0100	3-#7	37268.8	22	0.0048	2-#3 @3.5"
3	☐	1.666	2.000	8640000	M	46867.6	27	0.0053	3-#7	60586.8	7	0.0059	3-#7	20311.3	42	0.0000	2-#3 @10"
26.000		0.000	0.000	5760000	J	185708	7	0.0139	3-#8	92854.0	7	0.0100	3-#7	37268.8	22	0.0048	2-#3 @3.5"
5		Beam		576000	I	185589	11	0.0139	3-#8	92794.4	11	0.0100	3-#7	37263.1	22	0.0048	2-#3 @3.5"
3	☐	1.666	2.000	8640000	M	46888.9	27	0.0053	3-#7	60711.8	7	0.0059	3-#7	20317.0	22	0.0000	2-#3 @10"
26.000		0.000	0.000	5760000	J	185767	7	0.0139	3-#8	92883.7	7	0.0100	3-#7	37274.5	22	0.0048	2-#3 @3.5"

☐ Connect Model View

Select All | Unselect All | Re-calculation

Graphic... | Detail... | Summary... | <<

Result View Option ◉ All ○ OK ○ NG

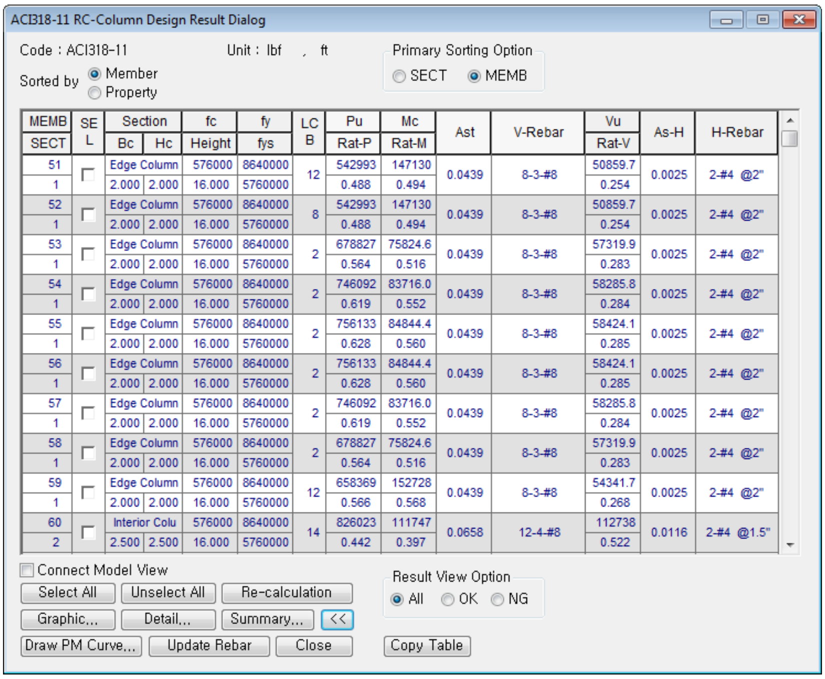
Option for Detail Print Position ☑ End I. ☐ Mid. ☐ End J.

Update Rebar | Copy Table | Close

Sorted by > Member (on) >>

Figure 39 : Concrete Beam Design

Design > Design > RC Design > Concrete Code Design > Column Design
Sorted by > Member (on) >>



ACI318-11 RC-Column Design Result Dialog

Code : ACI318-11 Unit : lbf , ft

Sorted by ◉ Member ○ Property

Primary Sorting Option ○ SECT ◉ MEMB

MEMB / SECT	SEL	Section: Bc	Section: Hc	fc / Height	fy / fys	LCB	Pu / Rat-P	Mc / Rat-M	Ast	V-Rebar	Vu / Rat-V	As-H	H-Rebar
51	☐	Edge Column		576000	8640000	12	542993	147130	0.0439	8-3-#8	50859.7	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.488	0.494			0.254		
52	☐	Edge Column		576000	8640000	8	542993	147130	0.0439	8-3-#8	50859.7	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.488	0.494			0.254		
53	☐	Edge Column		576000	8640000	2	678827	75824.6	0.0439	8-3-#8	57319.9	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.564	0.516			0.283		
54	☐	Edge Column		576000	8640000	2	746092	83716.0	0.0439	8-3-#8	58285.8	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.619	0.552			0.284		
55	☐	Edge Column		576000	8640000	2	756133	84844.4	0.0439	8-3-#8	58424.1	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.628	0.560			0.285		
56	☐	Edge Column		576000	8640000	2	756133	84844.4	0.0439	8-3-#8	58424.1	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.628	0.560			0.285		
57	☐	Edge Column		576000	8640000	2	746092	83716.0	0.0439	8-3-#8	58285.8	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.619	0.552			0.284		
58	☐	Edge Column		576000	8640000	2	678827	75824.6	0.0439	8-3-#8	57319.9	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.564	0.516			0.283		
59	☐	Edge Column		576000	8640000	12	658369	152728	0.0439	8-3-#8	54341.7	0.0025	2-#4 @2"
1		2.000	2.000	16.000	5760000		0.566	0.568			0.268		
60	☐	Interior Colu		576000	8640000	14	826023	111747	0.0658	12-4-#8	112738	0.0116	2-#4 @1.5"
2		2.500	2.500	16.000	5760000		0.442	0.397			0.522		

☐ Connect Model View

Select All | Unselect All | Re-calculation

Graphic... | Detail... | Summary... | <<

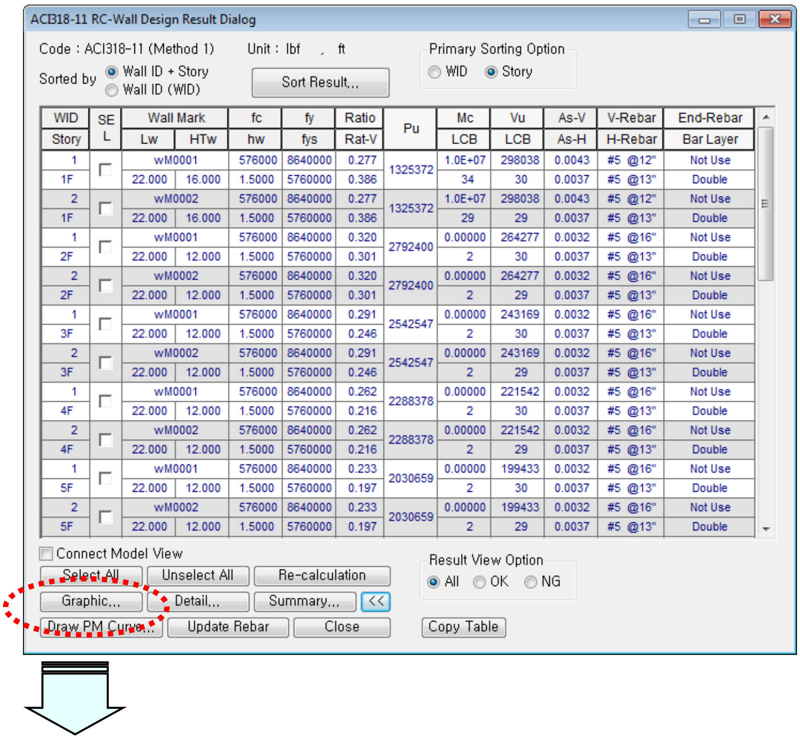
Draw PM Curve... | Update Rebar | Close

Result View Option ◉ All ○ OK ○ NG

Copy Table

Figure 40 : Concrete Column Design

Design > Design > RC Design > Concrete Code Design > Wall Design
Sorted by > Wall ID + Story (on) [>>]
SEL (Select) > WID (Wall ID) = 1 ; Story = 1F
Graphic



WID	SEL	Wall Mark		fc	fy	Ratio	Pu	Mc	Vu	As-V	V-Rebar	End-Rebar
Story		Lw	HTw	hw	fys	Rat-V		LCB	LCB	As-H	H-Rebar	Bar Layer
1		wM0001		576000	8640000	0.277	1325372	1.0E+07	298038	0.0043	#5 @12"	Not Use
1F		22.000	16.000	1.5000	5760000	0.386		34	30	0.0037	#5 @13"	Double
2		wM0002		576000	8640000	0.277	1325372	1.0E+07	298038	0.0043	#5 @12"	Not Use
1F		22.000	16.000	1.5000	5760000	0.386		29	29	0.0037	#5 @13"	Double
1		wM0001		576000	8640000	0.320	2792400	0.00000	264277	0.0032	#5 @16"	Not Use
2F		22.000	12.000	1.5000	5760000	0.301		2	30	0.0037	#5 @13"	Double
2		wM0002		576000	8640000	0.320	2792400	0.00000	264277	0.0032	#5 @16"	Not Use
2F		22.000	12.000	1.5000	5760000	0.301		2	29	0.0037	#5 @13"	Double
1		wM0001		576000	8640000	0.291	2542547	0.00000	243169	0.0032	#5 @16"	Not Use
3F		22.000	12.000	1.5000	5760000	0.246		2	30	0.0037	#5 @13"	Double
2		wM0002		576000	8640000	0.291	2542547	0.00000	243169	0.0032	#5 @16"	Not Use
3F		22.000	12.000	1.5000	5760000	0.246		2	29	0.0037	#5 @13"	Double
1		wM0001		576000	8640000	0.262	2288378	0.00000	221542	0.0032	#5 @16"	Not Use
4F		22.000	12.000	1.5000	5760000	0.216		2	30	0.0037	#5 @13"	Double
2		wM0002		576000	8640000	0.262	2288378	0.00000	221542	0.0032	#5 @16"	Not Use
4F		22.000	12.000	1.5000	5760000	0.216		2	29	0.0037	#5 @13"	Double
1		wM0001		576000	8640000	0.233	2030659	0.00000	199433	0.0032	#5 @16"	Not Use
5F		22.000	12.000	1.5000	5760000	0.197		2	30	0.0037	#5 @13"	Double
2		wM0002		576000	8640000	0.233	2030659	0.00000	199433	0.0032	#5 @16"	Not Use
5F		22.000	12.000	1.5000	5760000	0.197		2	29	0.0037	#5 @13"	Double

Figure 41 : Concrete Wall Design

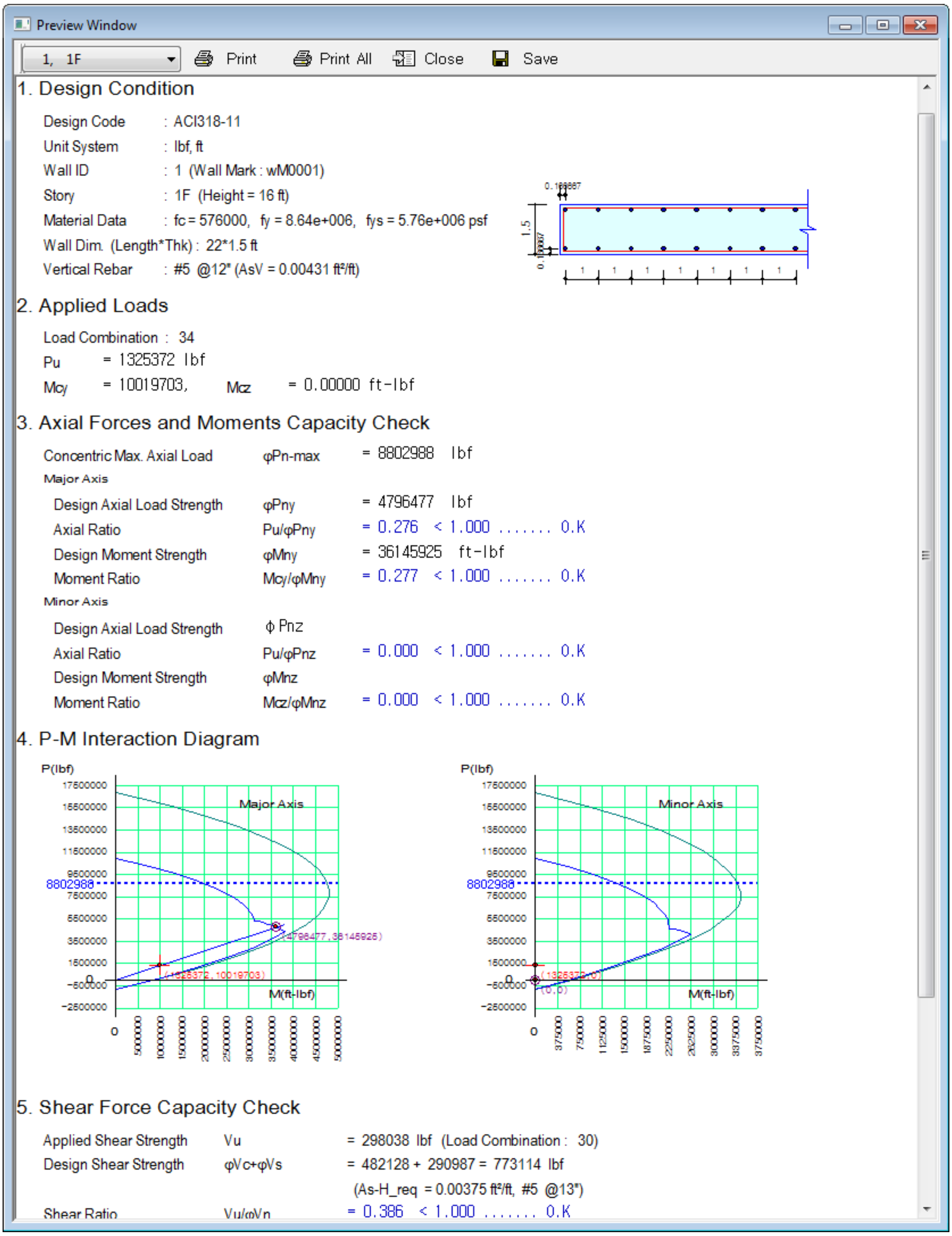


Figure 42 : Typical Output of Concrete Wall Design