

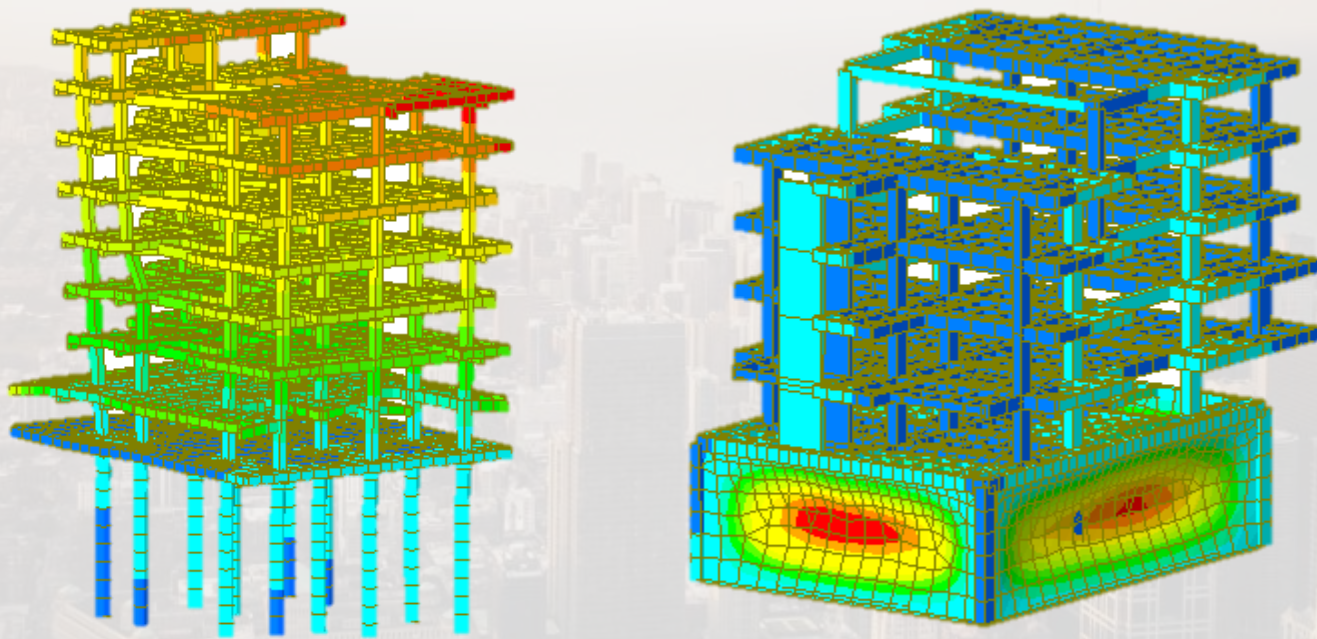
# MIDAS Structure Training Series

## SUBSTRUCTURE ANALYSIS

An aerial photograph of a city skyline, likely Chicago, during sunset. The sky is a mix of orange, yellow, and blue. The city is densely packed with skyscrapers and buildings. The water is visible in the background.

**MIDAS**

# SUBSTRUCTURE ANALYSIS



ANGEL F. MARTINEZ  
CIVIL ENGINEER  
MIDASOFT



An aerial photograph of a dense urban skyline, likely New York City, featuring numerous skyscrapers and buildings. The image is partially obscured by a semi-transparent white rectangular overlay that contains the text. The lighting suggests a sunset or sunrise, with a warm orange glow on the left side.

# **CONTENTS**

**1. FOOTING DESIGN**

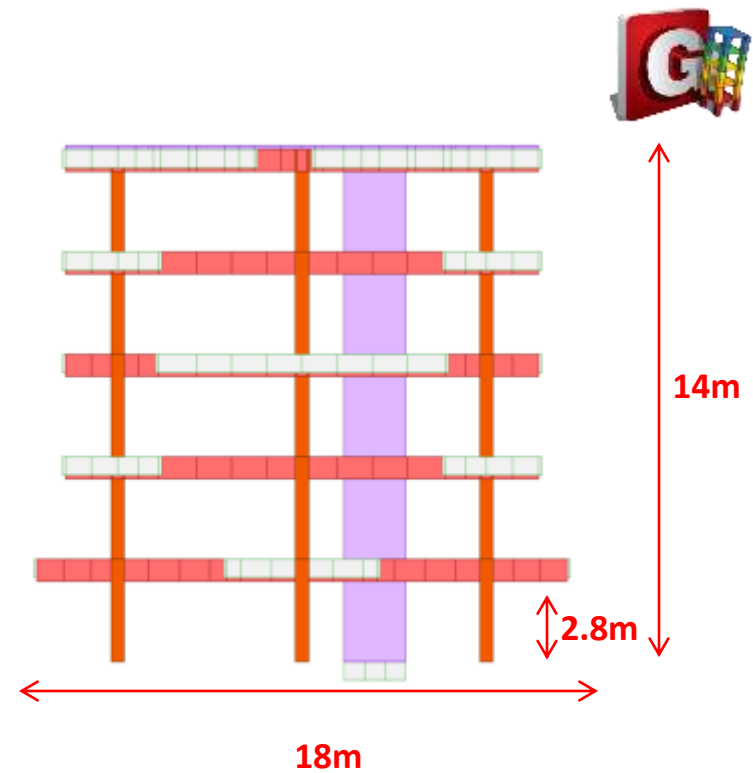
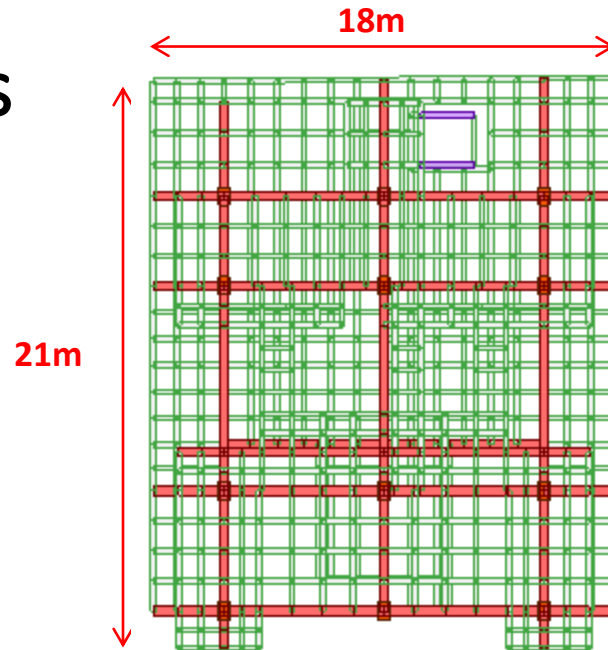
**2. PILE RAFT ANALYSIS & DESIGN**

**3. BASEMENT WALL ANALYSIS & DESIGN**

An aerial photograph of a dense urban skyline, likely New York City, featuring numerous skyscrapers and a hilly area in the background. A semi-transparent white rectangular overlay covers the upper portion of the image, serving as a background for the title text.

# **FOOTING DESIGN**

# Dimensions



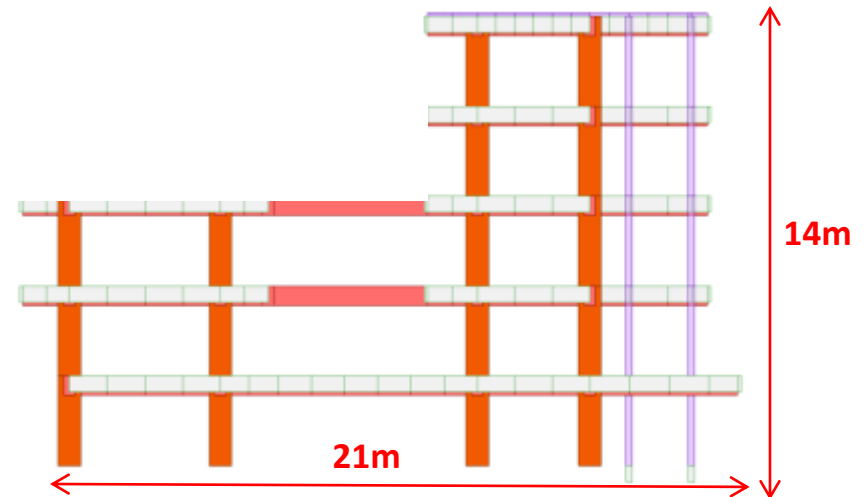
## Unit System

### Length

- ☒ m
- ☐ cm
- ☐ mm
- ☐ ft
- ☐ in

### Force (Mass)

- ☐ N (kg)
- ☒ kN (ton)
- ☐ kgf (kg)
- ☐ tonf (ton)
- ☐ lbf (lb)
- ☐ kips (kips/g)

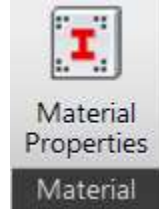




# Inspect Properties

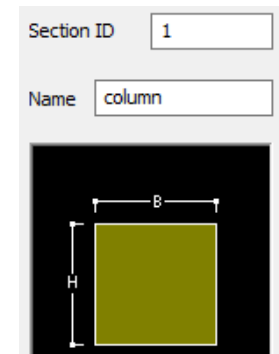


Properties				
Material   Section   Thickness				
ID	Name	Type	Stan...	DB
2	Grad...	Concrete	ASTM...	Grade C4000



- Material  
-Concrete ASTM C4000

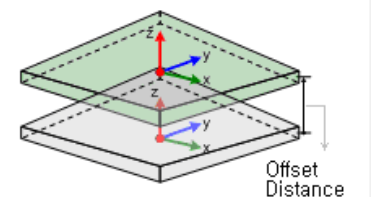
Properties			
Material   Section   Thickness			
ID	Name	Type	Shape
2	beam	User	SB
3	girder	User	SB
8	column	User	SB



- 3 rectangle Sections

	H	B
Column	0.45 m	0.6 m
Beam	0.4 m	0.35 m
Girder	0.3 m	0.2 m

Properties			
Material   Section   Thickness			
ID	Type	Thickness(m)	Offset
1	Value	0.200000	No

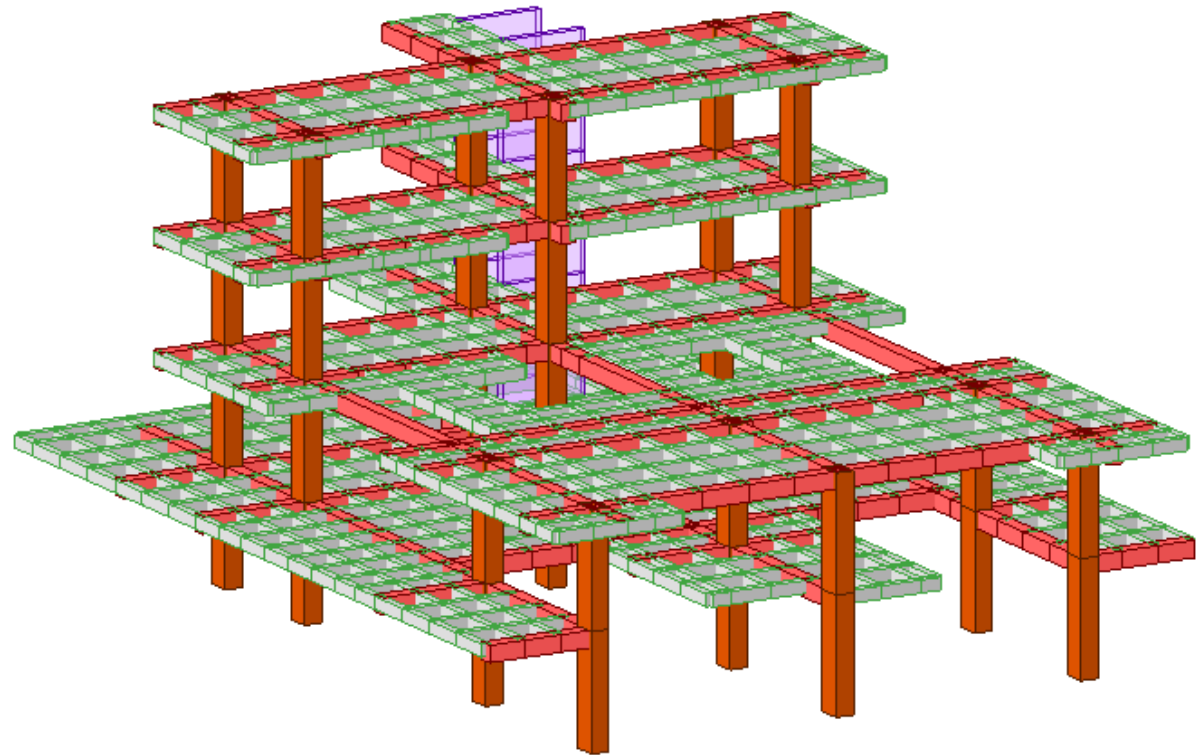
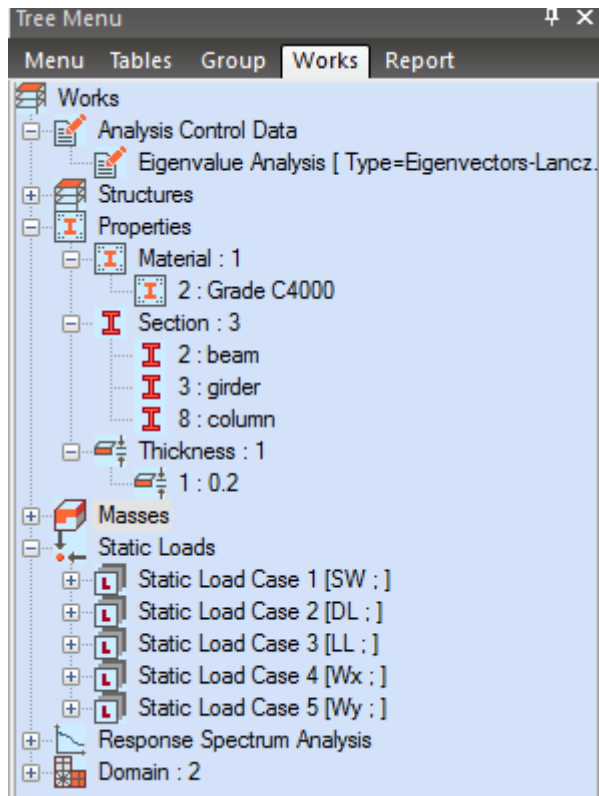


- 1 thickness

	Thickness
Wall	0.2 m



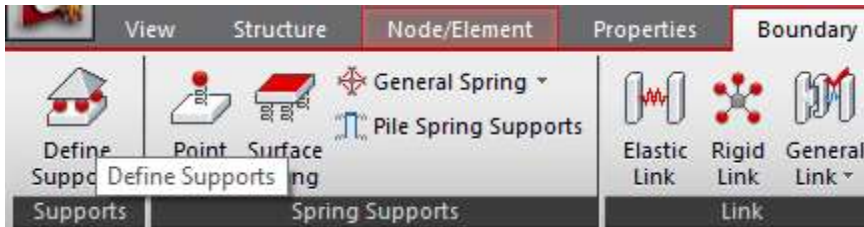
# Start file



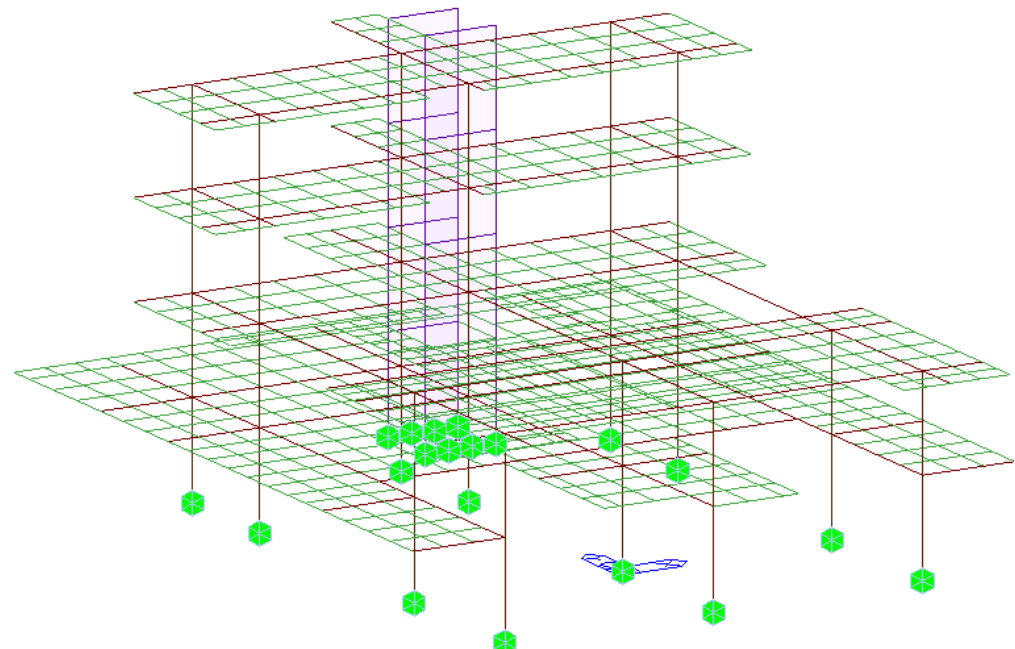
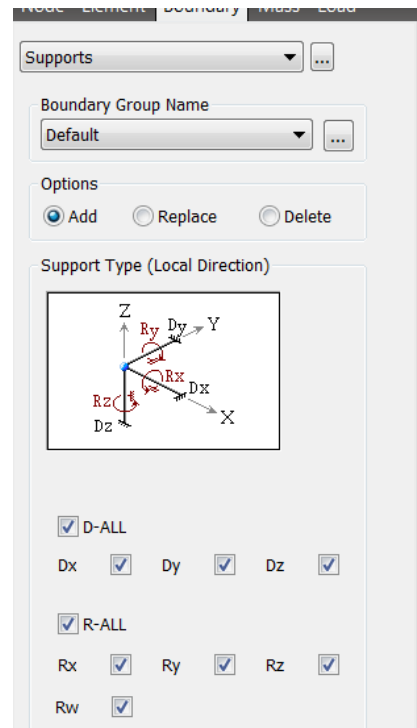




# Boundary Conditions



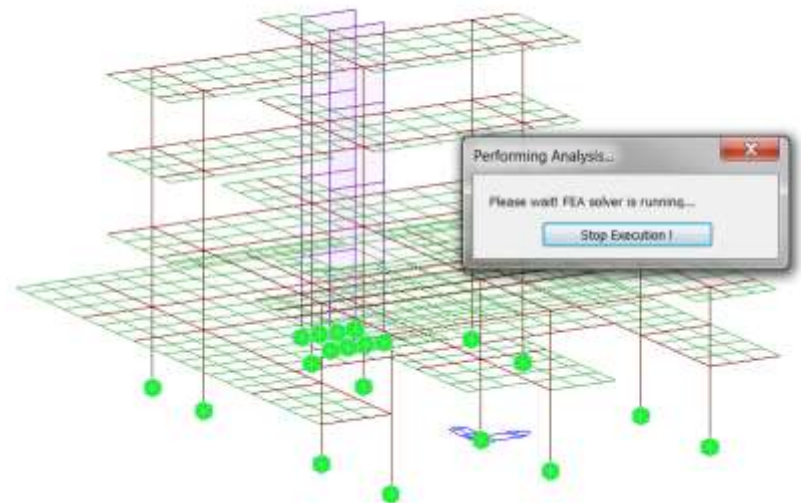
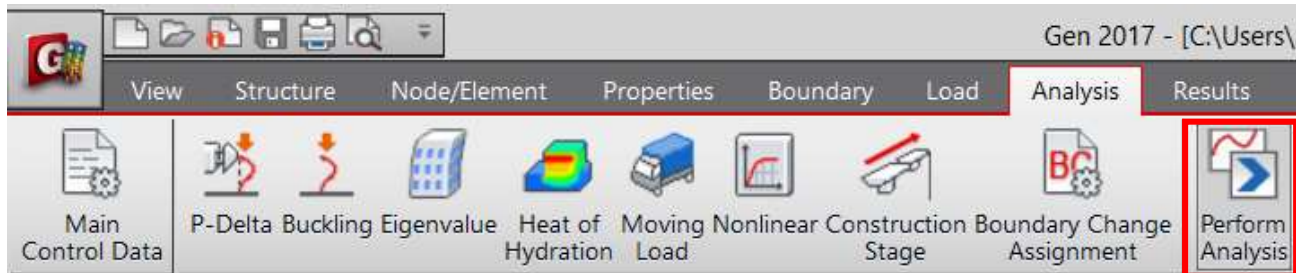
- Assign fixed all **SUPPORTS** to bottom nodes (footing)







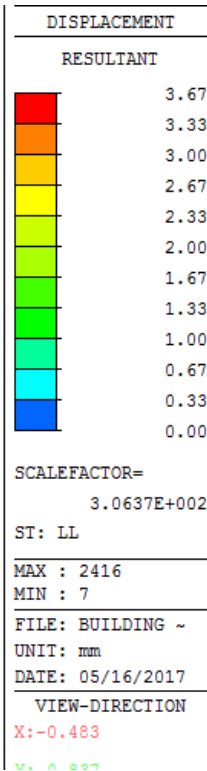
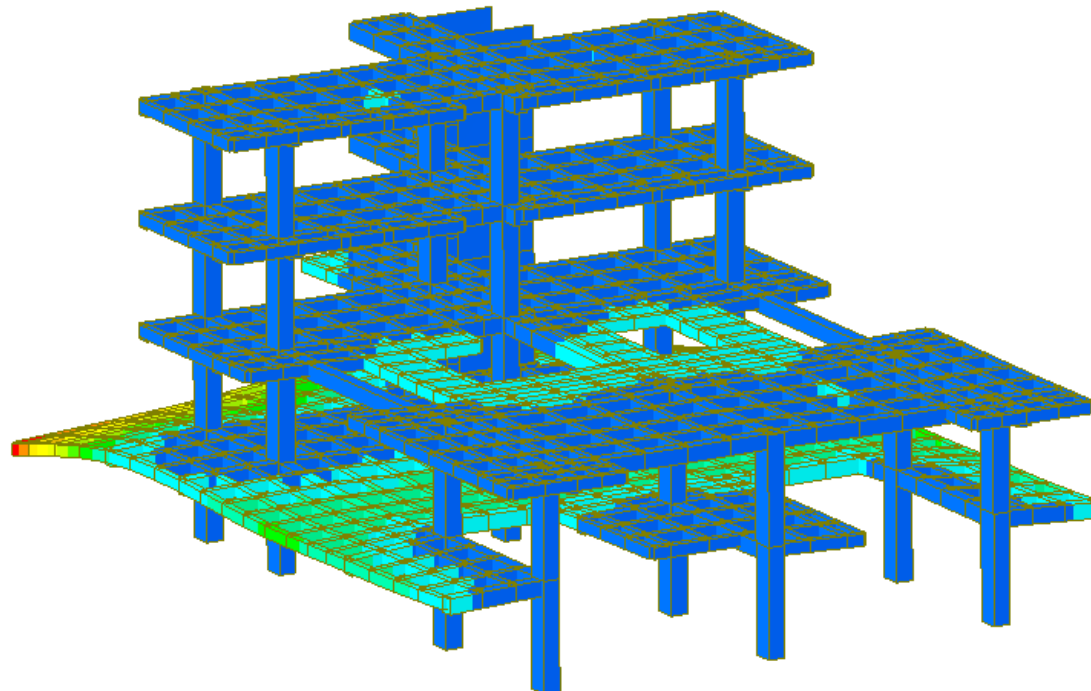
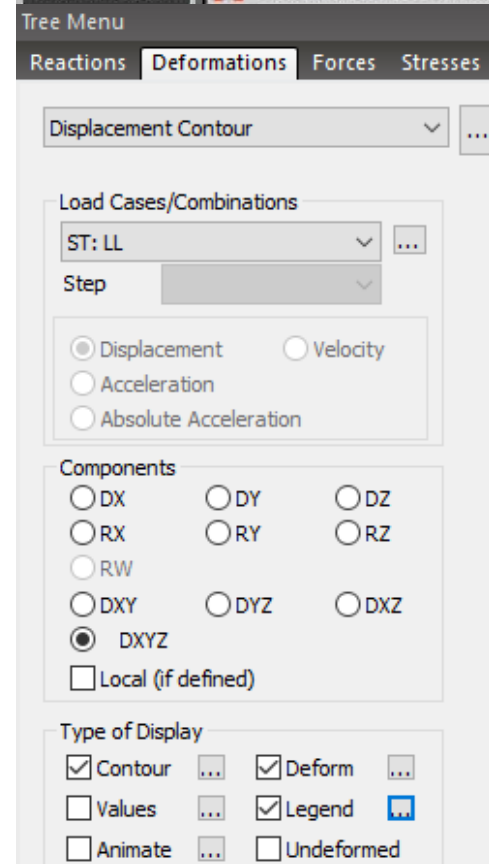
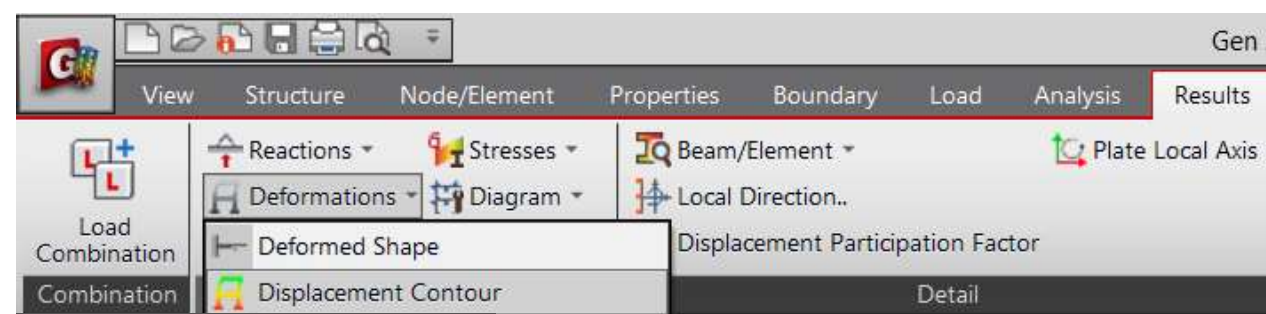
# Perform Analysis



## Message Window

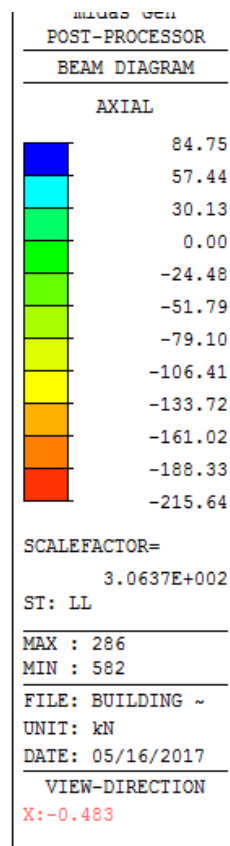
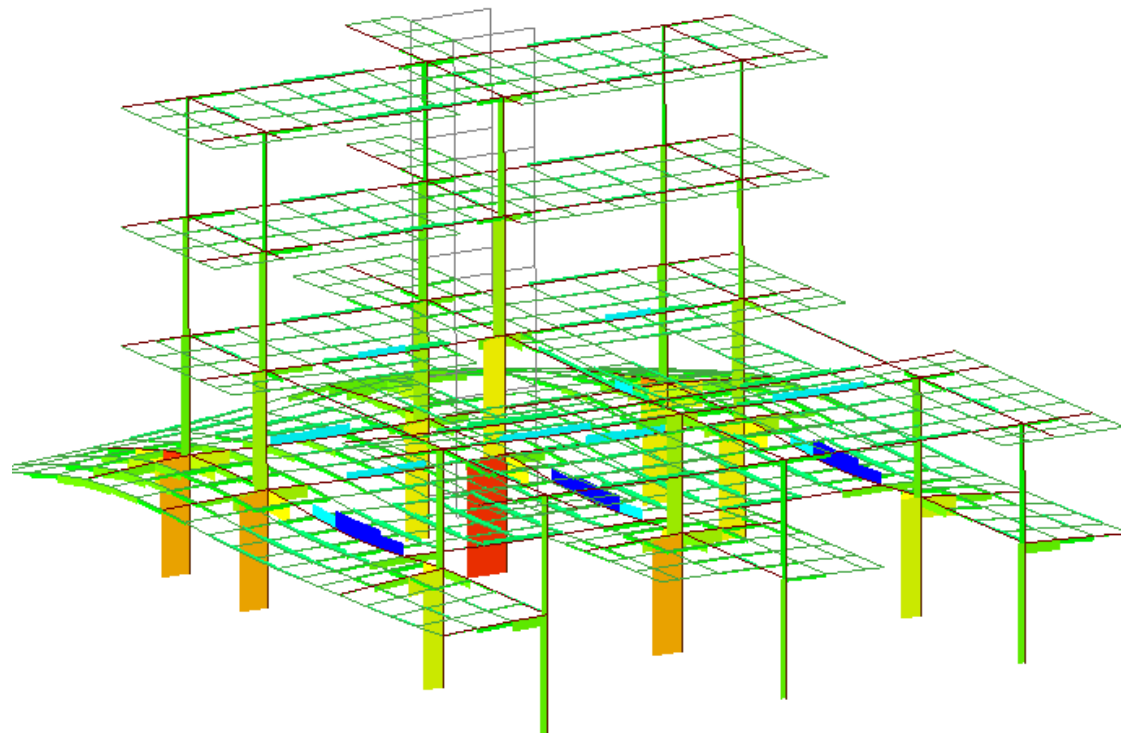
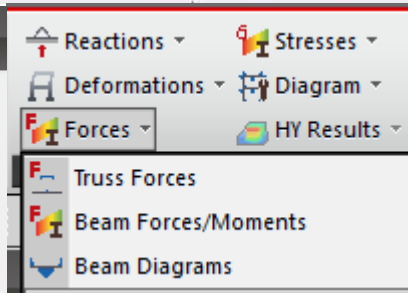
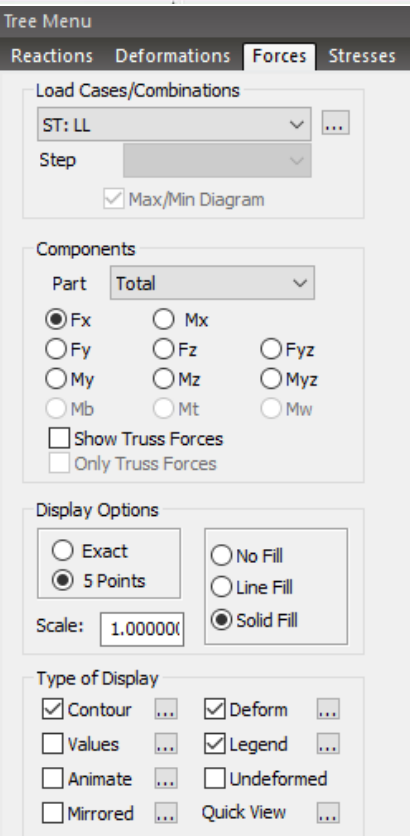
-----SOLUTION TERMINATED  
YOUR MIDAS JOB IS SUCCESSFULLY COMPLETED.....C:\Users\A.martinez\Desktop\substructs\Edificio+Zapatas  
TOTAL SOLUTION TIME...: 19.07 [SEC]  
-----

# Results: Displacements





# Results: Axial Forces





# Results: Moments Y

**Tree Menu**

Reactions Deformations **Forces** Stresses

Load Cases/Combinations  
ST: LL  
Step  
☒ Max/Min Diagram

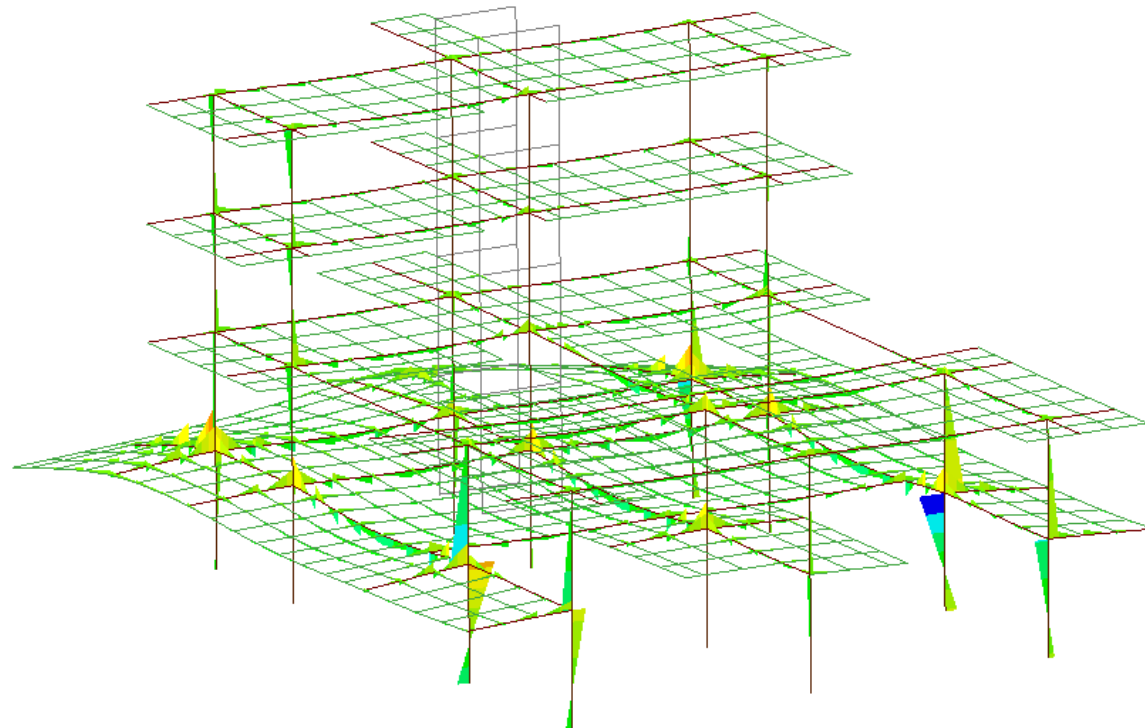
Components  
Part: Total  
☐ Fx ☐ Mx  
☐ Fy ☐ Fz ☐ Fyz  
☒ My ☐ Mz ☐ Myz  
☐ Mb ☐ Mt ☐ Mw  
☐ Show Truss Forces  
☐ Only Truss Forces

Display Options  
☐ Exact ☐ No Fill  
☒ 5 Points ☐ Line Fill  
Scale: 1.000000 ☒ Solid Fill

Type of Display  
☒ Contour ☐ Deform  
☐ Values ☒ Legend  
☐ Animate ☐ Undeformed  
☐ Mirrored ☐ Quick View

Reactions  
Deformations  
**Forces**  
Truss Forces  
Beam Forces/Moments  
Beam Diagrams

Stresses  
Diagram  
HY Results



midas Gen	
POST-PROCESSOR	
BEAM DIAGRAM	
MOMENT-y	
	21.80
	16.53
	11.25
	5.97
	0.00
	-4.58
	-9.85
	-15.13
	-20.40
	-25.68
	-30.96
	-36.23
SCALEFACTOR=	
3.0637E+002	
ST: LL	
MAX : 60	
MIN : 582	
FILE: BUILDING ~	
UNIT: kN*m	
DATE: 05/16/2017	
VIEW-DIRECTION	
X:-0.483	
Y:-0.837	
Z: 0.259	





# Results: Reactions

Gen 2

View Structure Node/Element Properties Boundary Load Analysis Results

Tree Menu

Reactions Deformations Forces Stresses

Reaction Forces/Moments

Load Cases/Combinations

CB: gLCB1

Step

Components

☐ FX ☐ FY ☐ FZ ☒ FXYZ

☐ MX ☐ MY ☐ MZ ☐ MXYZ

☐ Mb

☐ Local (if defined)

Type of Display

☐ Values ☒ Legend

Arrow Scale Factor: 1.000000

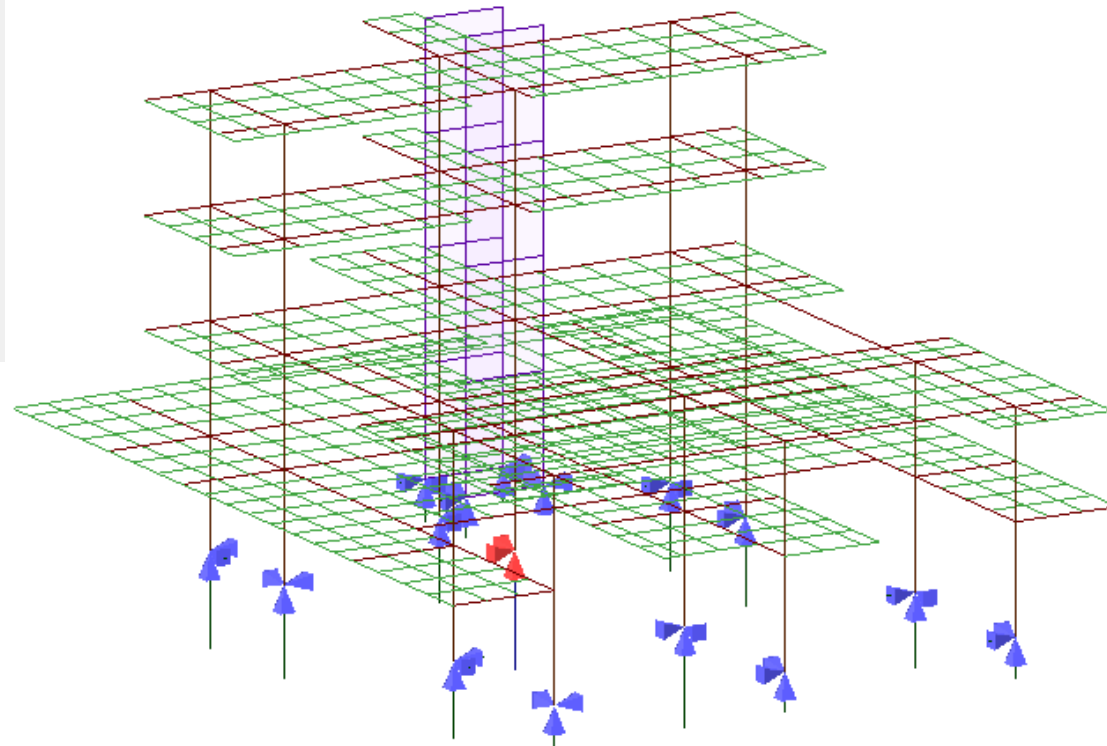
Reactions

Reaction Forces/Moments

Search Reaction Forces/Moments

Soil Pressure

Beam/Elem



midas Gen
POST-PROCESSOR
REACTION FORCE
FORCE-XYZ
MIN. REACTION
NODE=2714
FX: -2.47
FY: -0.00
FZ: 3.18
FXYZ: 4.02
MAX. REACTION
NODE=20
FX: 0.81
FY: -11.37
FZ: 196.28
FXYZ: 196.61
ST: LL
MAX : 20
MIN : 2714
FILE: BUILDING ~
UNIT: kN
DATE: 05/16/2017



# Load combination

Automatic Generation of Load Combinations

Option  
☒ Add ☐ Replace

Code Selection  
☐ Steel ☒ Concrete ☐ SRC  
☐ Cold Formed Steel ☐ Footing

Design Code : ACI318-14

☐ Scale Up of Response Spectrum Load Cases  
Scale Up Factor : 1  
Factor Load Case Add Modify Delete

Wind Load Factor  
☒ Strength-level ☐ Service-level

☐ Consider Lateral Soil Pressure Factor  
Load Factor : 0.9

Manipulation of Construction Stage Load Case  
ST : Static Load Case  
CS : Construction Stage Load Case  
☒ ST Only ☐ CS Only ☐ ST+CS

☐ Consider Orthogonal Effect  
Set Load Cases for Orthogonal Effect...  
☒ 100 : 30 Rule  
☐ SRSS(Square-Root-of-Sum-of-Squares)

☐ Generate Additional Load Combinations  
☐ for Special Seismic Load  
☐ for Vertical Seismic Forces  
Factors for Seismic Design...

☐ Will Execute Construction Stage Analysis  
☐ Consider Losses for Prestress Load Cases  
Transfer Stage : 1 Define Factors  
Service Load Stage : 1

OK Cancel

## Generate Load Combo

Results > Combinations > Concrete Design > Auto Generation

Select Concrete Design and Footing Design

Auto Generation

Design Code: ACI318-14 for both

Load Combinations

General | Steel Design | Concrete Design | SRC Design | Cold Formed Steel Design | Footing Design

Load Combination List

No	Name	Active	Type	Description
1	cLCB1	Stren	Add	1.4(D)
2	cLCB2	Stren	Add	1.2(D) + 1.5(L)
3	cLCB3	Stren	Add	1.2(D) + 1.0wind x + 1.0(L)
4	cLCB4	Stren	Add	1.2(D) + 1.0wind y + 1.0(L)
5	cLCB5	Stren	Add	1.2(D) - 1.0wind x + 1.0(L)
6	cLCB6	Stren	Add	1.2(D) - 1.0wind y + 1.0(L)
7	cLCB7	Stren	Add	1.2(D) + 1.0(1.0(RX)(RS)+RX)E
8	cLCB8	Stren	Add	1.2(D) + 1.0(1.0(RX)(RS)-RX)ES
9	cLCB9	Stren	Add	1.2(D) + 1.0(1.0(RY)(RS)+RY)E
10	cLCB10	Stren	Add	1.2(D) + 1.0(1.0(RY)(RS)-RY)ES
11	cLCB11	Stren	Add	1.2(D) - 1.0(1.0(RX)(RS)+RX)ES
12	cLCB12	Stren	Add	1.2(D) - 1.0(1.0(RX)(RS)-RX)ES
13	cLCB13	Stren	Add	1.2(D) - 1.0(1.0(RY)(RS)+RY)ES
14	cLCB14	Stren	Add	1.2(D) - 1.0(1.0(RY)(RS)-RY)ES
15	cLCB15	Stren	Add	0.9D + 1.0wind x
16	cLCB16	Stren	Add	0.9D + 1.0wind y
17	cLCB17	Stren	Add	0.9D - 1.0wind x
18	cLCB18	Stren	Add	0.9D - 1.0wind y
19	cLCB19	Stren	Add	0.9(D) + 1.0(1.0(RX)(RS)+RX)E
20	cLCB20	Stren	Add	0.9(D) + 1.0(1.0(RX)(RS)-RX)ES
21	cLCB21	Stren	Add	0.9(D) + 1.0(1.0(RY)(RS)+RY)E

Load Cases and Factors

LoadCase	Factor
dead(ST)	1.4000

Copy Import... Auto Generation... Spread Sheet Form

File Name: C:\Users\j.martinez\Desktop\Slab and Wall Tutorial\p... Browse Make Load Combination Sheet Close



# Footing Design: CODE CHECK

Gen 2017 - [C:\Users\A.Martin]

View Structure Node/Element Properties Boundary Load Analysis Results Pushover Design

ACI318-14 SSRC79

RC Design SRC Design

Design Code  
Strength Reduction Factors  
Modify Concrete Material  
Limiting Maximum Rebar Ratio  
Limiting Minimum Section Size  
Design Criteria for Rebar  
Design Criteria for Rebars by Member  
Same Beam Rebar at Joints...  
Moment Redistribution Factor  
Torsion Reduction Factor  
Serviceability Parameters  
Uncertainty Load Combination Factor  
Modify Beam Rebar Data  
Modify Column Rebar Data  
Modify Brace Rebar Data  
Modify Wall Rebar Data  
Modify Wall Mark Data  
Boundary element Method by Wall ID  
Concrete Design Tables  
Concrete Code Design  
Concrete Code Check  
RC Strong Column-Weak Beam  
Footing Design Ctrl+9

### Select Node 20

- Enter size 1.5X1.5X.35m
- Enter allowable soil pressure : 300 kN/m<sup>2</sup>
- Rebar size #4 in X and Y
- Surcharge Load 50 kN/m<sup>2</sup>
- CODE CHECK

Footing Design

Name: F Node No: 20

Footing Size  
Lx: 1.5 m  
Ly: 1.5 m  
Depth (D): 0.35 m  
CoverThk (dc): 0.08 m

Material Strength: kN/m<sup>2</sup>  
Concrete (Fc): 20593.965  
Re-bar (fy): 392266

Re-bar size  
X Direction: #4  
Y Direction: #4

Isolated FDI

Allowable Soil Pressure (Qe): 300 kN/m<sup>2</sup>

Misc. Load:  
Surcharge Load (Ws): 50 kN/m<sup>2</sup>  
Soil Height (H): 0 m  
Soil Density (Ya): 17.65197 kN/m<sup>3</sup>

Major Axis  
X Axis: ☒  
Y Axis: ☐

Select Load Combinations  
Change Column Size  
Reaction Force View  
Option

Code Check

Close



# Footing Design: CODE CHECK

Gen 2017 - [C:\Users\A.Martin]

View Structure Node/Element Properties Boundary Load Analysis Results Pushover Design

ACI318-14 SSRC79

RC Design SRC Design

- Design Code
- Strength Reduction Factors
- Modify Concrete Material
- Limiting Maximum Rebar Ratio
- Limiting Minimum Section Size
- Design Criteria for Rebar
- Design Criteria for Rebars by Member
- Same Beam Rebar at Joints...
- Moment Redistribution Factor
- Torsion Reduction Factor
- Serviceability Parameters
- Uncertainty Load Combination Factor
- Modify Beam Rebar Data
- Modify Column Rebar Data
- Modify Brace Rebar Data
- Modify Wall Rebar Data
- Modify Wall Mark Data
- Boundary element Method by Wall ID
- Concrete Design Tables
- Concrete Code Design
- Concrete Code Check
- RC Strong Column-Weak Beam
- Footing Design Ctrl+9

- CODE CHECK

**1.5mX1.5mX0.35m**

### 1. Geometry and Materials

Material :  $f'_c = 20594$ ,  $f_y = 392266 \text{ kN/m}^2$   
 Dim. :  $1.5 \times 1.5 \times 0.35 \text{ m}$  ( $D_c = 0.08 \text{ m}$ )  
 Allow. Soil  $Q_e = 300 \text{ kN/m}^2$   
 Surcharge  $W_s = 50 \text{ kN/m}^2$

### 2. Design Condition

Design Code : ACI318-02  
 Selected Node No : 20  
 Design Node No : 20 (Column Size:  $0.45 \times 0.6 \text{ m}$ )  
 Design Load Combination  
 Service : 100  $[1.0B100 : (D) + 0.75L + 0.75(0.7(1.0)(EQY(RS) - EQY(ES)))]$   
 Factored : 10  $[1.0B10 : 1.2D + 1.0(1.0)(EQY(RS) - EQY(ES)) + 1.0L]$   
 Applied Loads  
 $P_s = 946.001$ ,  $P_u = 1110.98 \text{ kN}$   
 $M_{sx} = 92.5400$ ,  $M_{ux} = 144.552 \text{ kN-m}$   
 $M_{sy} = 6.78761$ ,  $M_{uy} = 10.2571 \text{ kN-m}$

### 3. Soil Bearing Pressure Check

Actual Pressure  
 $Q_s(\text{max}) = 655.265 \text{ kN/m}^2 > Q_e = 300.000 \text{ kN/m}^2$  ..... N.G  
 $Q_s(\text{min}) = 302.100 \text{ kN/m}^2 > 0.00 \text{ kN/m}^2$  ..... O.K  
 Design Pressure  
 $Q_u(\text{max}) = 768.986 \text{ kN/m}^2$   
 $Q_u(\text{min}) = 218.553 \text{ kN/m}^2$

### 4. Shear Check ( $\phi = 0.75$ )

One Way Shear  
 $V_{uy} = 194.377 \text{ kN} < \phi V_{ny} = 228.912 \text{ kN}$  ..... O.K  
 $V_{ux} = 204.289 \text{ kN} < \phi V_{nx} = 218.145 \text{ kN}$  ..... O.K  
 Punching Shear  
 $V_u = 806.199 \text{ kN} < \phi V_n = 940.198 \text{ kN}$  ..... O.K





# Footing Design: AUTO DESIGN

Gen 2017 - [C:\Users\A.Martin]

View Structure Node/Element Properties Boundary Load Analysis Results Pushover Design

ACI318-14 SSRC79

RC Design SRC Design

- Design Code
- Strength Reduction Factors
- Modify Concrete Material
- Limiting Maximum Rebar Ratio
- Limiting Minimum Section Size
- Design Criteria for Rebar
- Design Criteria for Rebars by Member
- Same Beam Rebar at Joints...
- Moment Redistribution Factor
- Torsion Reduction Factor
- Serviceability Parameters
- Uncertainty Load Combination Factor
- Modify Beam Rebar Data
- Modify Column Rebar Data
- Modify Brace Rebar Data
- Modify Wall Rebar Data
- Modify Wall Mark Data
- Boundary element Method by Wall ID
- Concrete Design Tables
- Concrete Code Design
- Concrete Code Check
- RC Strong Column-Weak Beam
- Footing Design** Ctrl+9

## Select Node 20

- AUTODESIGN

### Footing Design

Name: F Node No: 20

Footing Size

Lx: 1.5 m

Ly: 1.5 m

Depth (D): 0.35 m

CoverThk (dc): 0.08 m

Material Strength:  $\text{kN/m}^2$

Concrete ( $f_c$ ): 20593.96

Re-bar ( $f_y$ ): 392266

Re-bar Size

X Direction: #4

Y Direction: #4

Isolated FDN

Allowable Soil Pressure ( $Q_e$ ): 300  $\text{kN/m}^2$

Misc. Load

Surcharge Load ( $W_s$ ): 50  $\text{kN/m}^2$

Soil Height (H): 0 m

Soil Density ( $\gamma_q$ ): 17.65197  $\text{kN/m}^3$

Major Axis

X Axis: ☒

Y Axis: ☐

Diagram:

Select Load Combinations

Change Column Size

Reaction Force View

Option

**Auto Design**

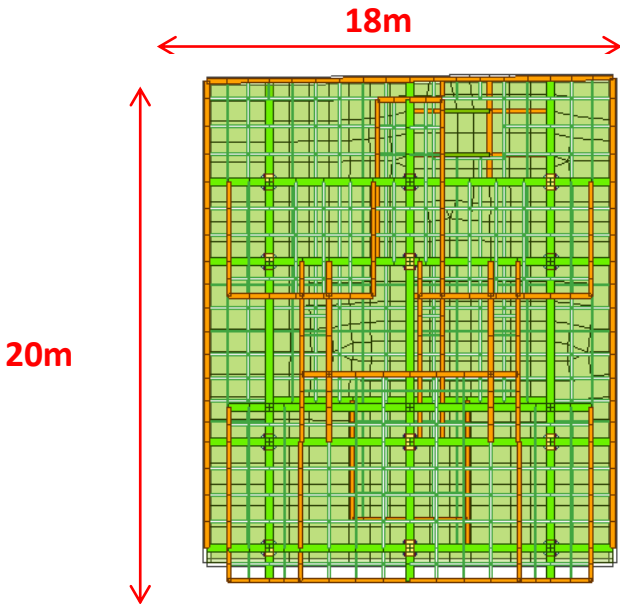


An aerial photograph of a dense urban skyline, likely New York City, featuring numerous skyscrapers and buildings. The image is partially obscured by a semi-transparent white rectangular overlay that covers the upper and central portions of the frame. The text "PILE RAFT ANALYSIS & DESIGN" is centered within this white area.

# **PILE RAFT ANALYSIS & DESIGN**



# Dimensions



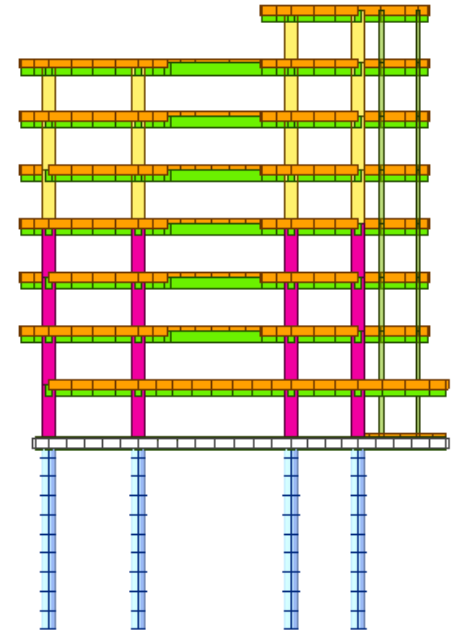
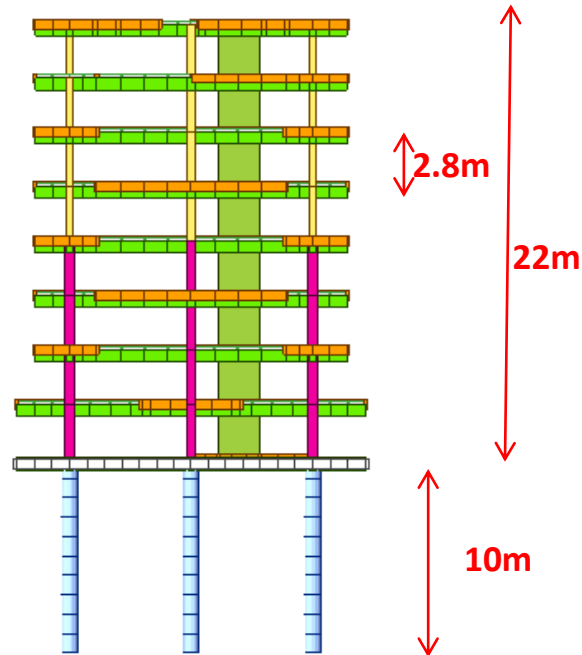
Unit System

Length

- ☒ m
- ☐ cm
- ☐ mm
- ☐ ft
- ☐ in

Force (Mass)

- ☐ N (kg)
- ☒ kN (ton)
- ☐ kgf (kg)
- ☐ tonf (ton)
- ☐ lbf (lb)
- ☐ kips (kips/g)







# Inspect Properties



Properties				
Material   Section   Thickness				
ID	Name	Type	Stan...	DB
2	Grad...	Concrete	ASTM...	Grade C4000



Material Properties

Material

- Material  
-Concrete ASTM C4000

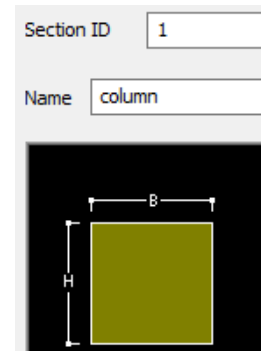


Section Properties

- 6 rectangle Sections

	H	B
C30X70	0.3 m	0.7 m
V35X50	0.35 m	0.5 m
B20X50	0.2 m	0.5 m
N10X25	0.1 m	0.25 m
Pile	D = 0.5 m	
C45X70	0.45 m	0.7 m

Properties			
Material   Section   Thickness			
ID	Name	Type	Shape
1	C30X70	User	SB
2	V35X50	User	SB
3	B20X50	User	SB
4	N10X25	User	SB
7	Pile D=80cm	User	SR
8	C45x70	User	SB



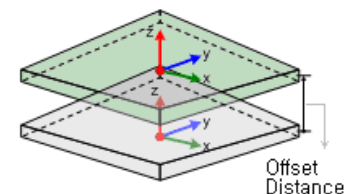
- 2 thickness



Thickness

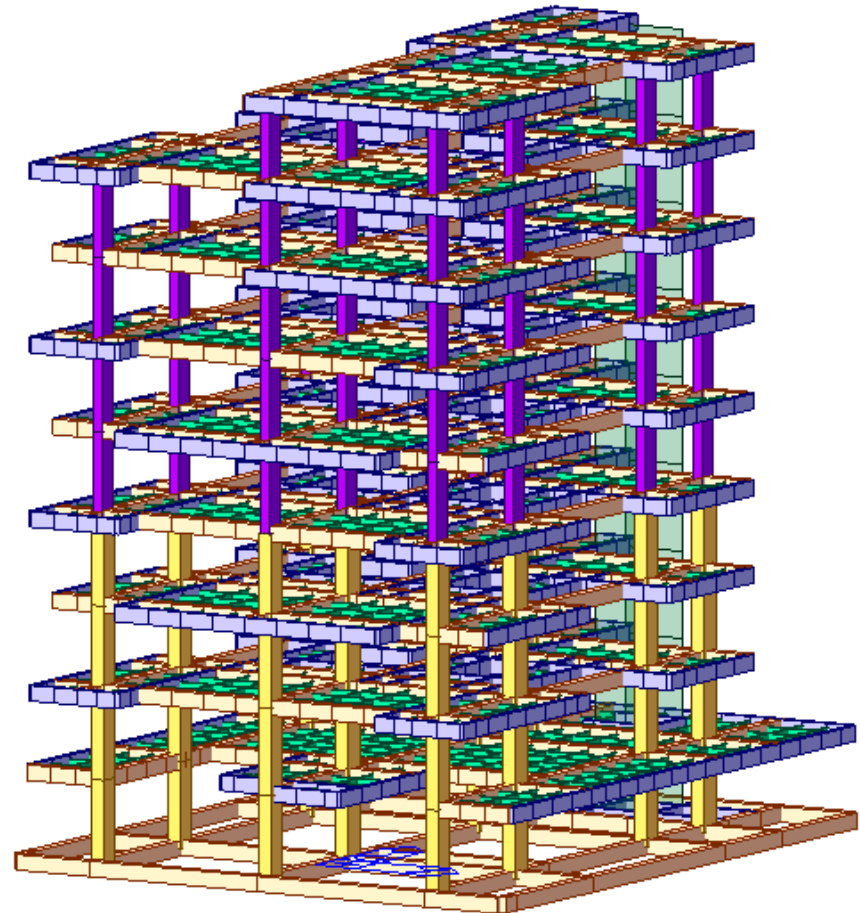
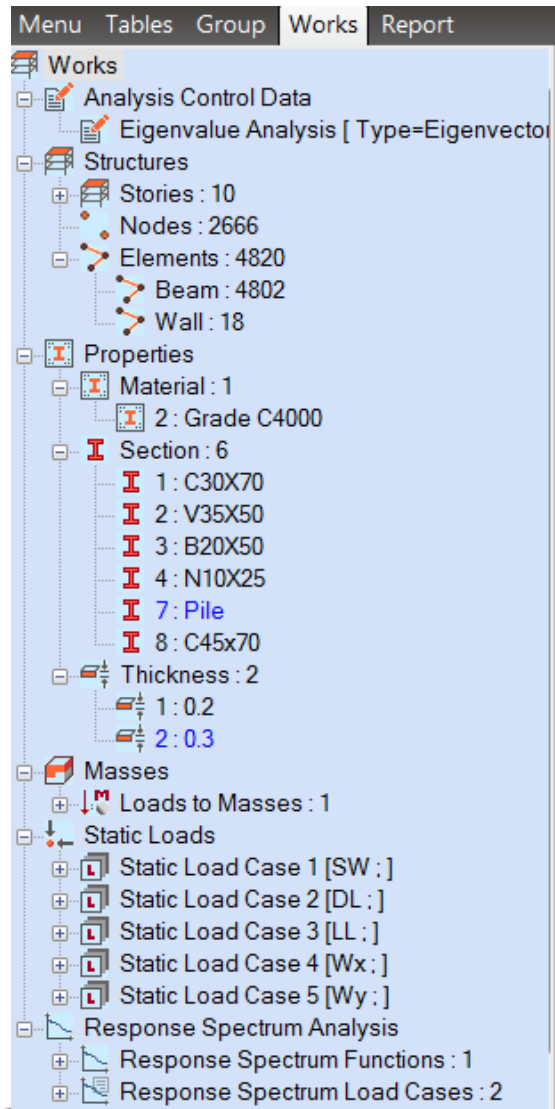
	Thickness
Wall	0.2 m
Raft	0.3 m

Properties			
Material   Section   Thickness			
ID	Type	Thickness(m)	Offset
1	Value	0.200000	No
2	Value	0.300000	No



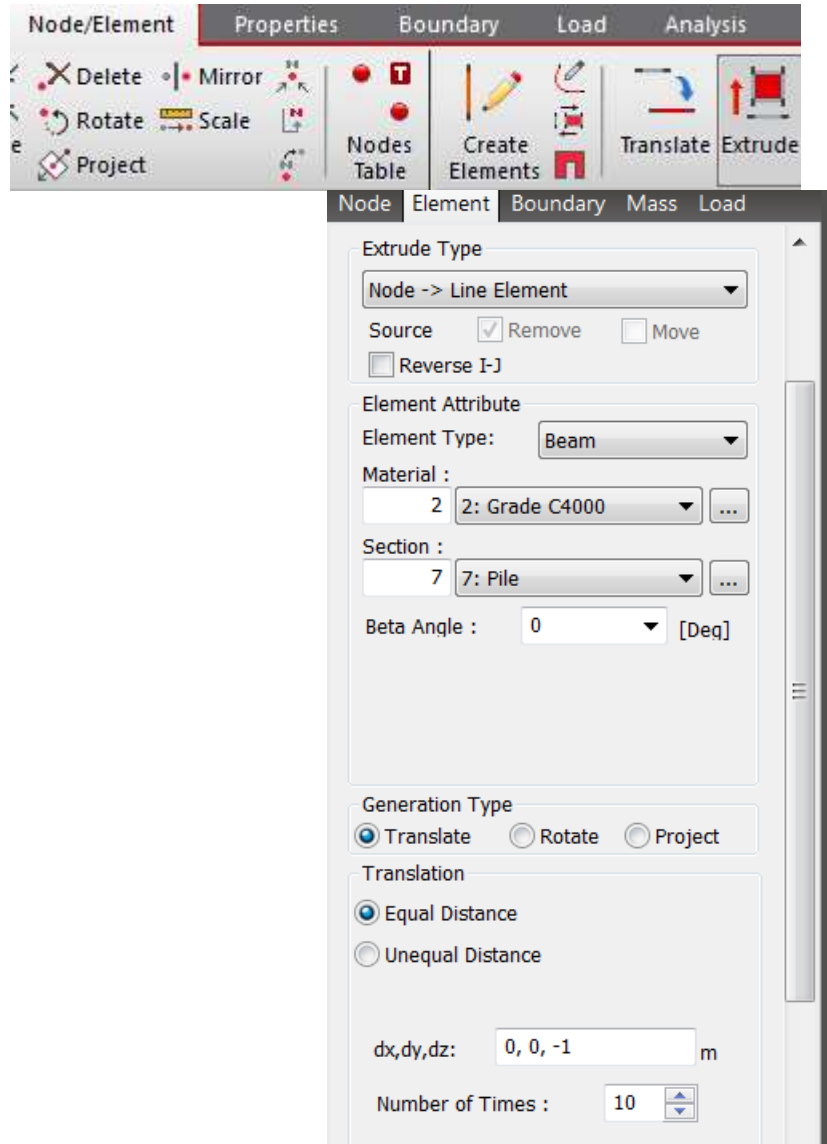


# Start file

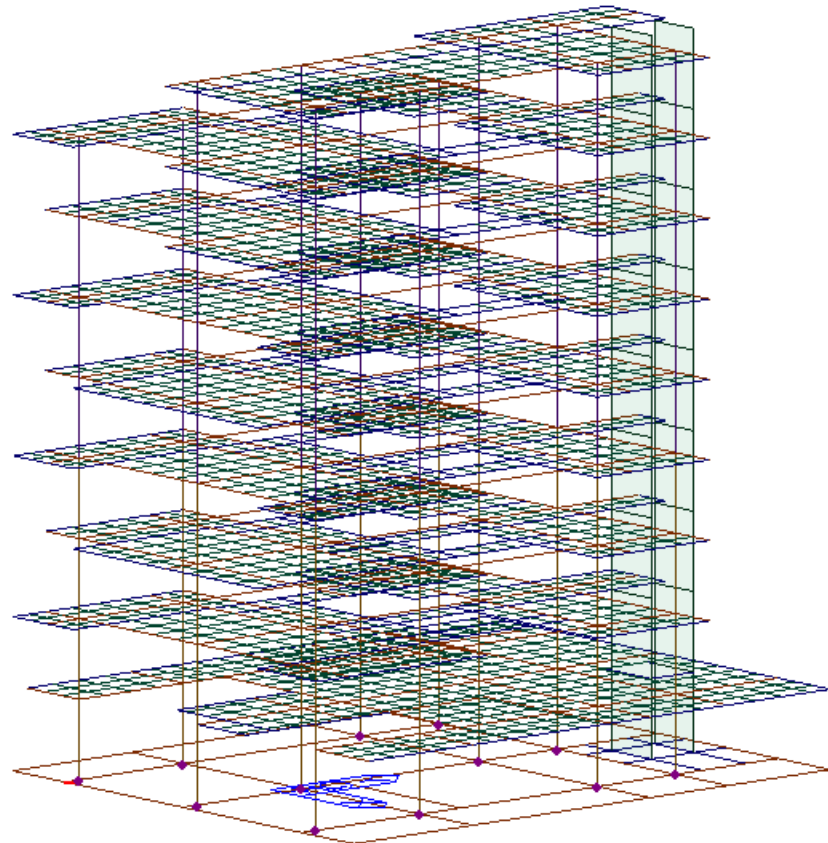




# Extrude Piles

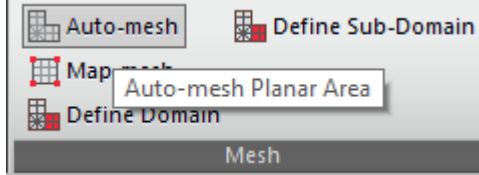


Select column nodes to extrude piles  
Select pile Section  
Extrude -1m in dz 10 times





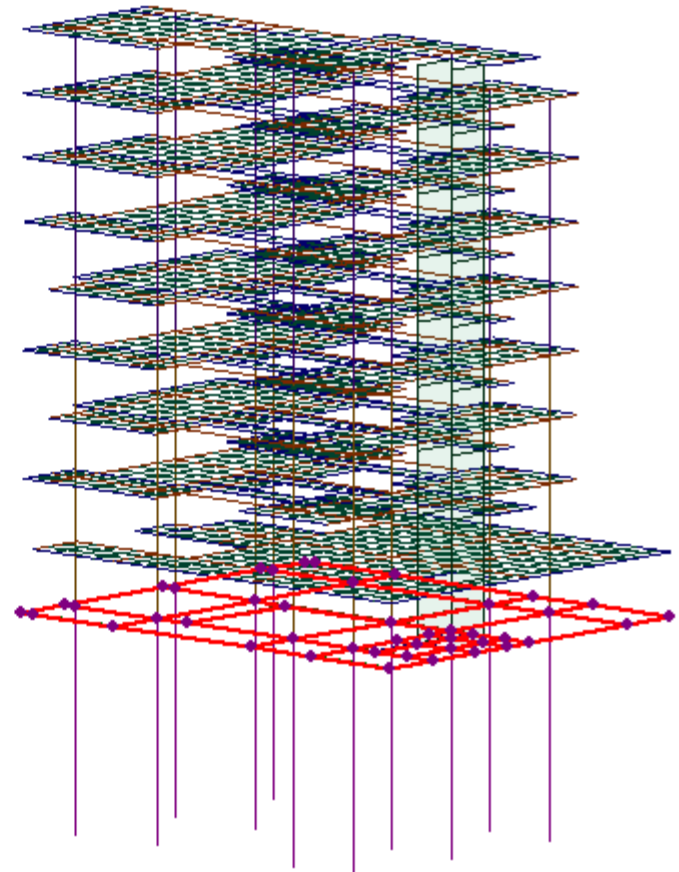
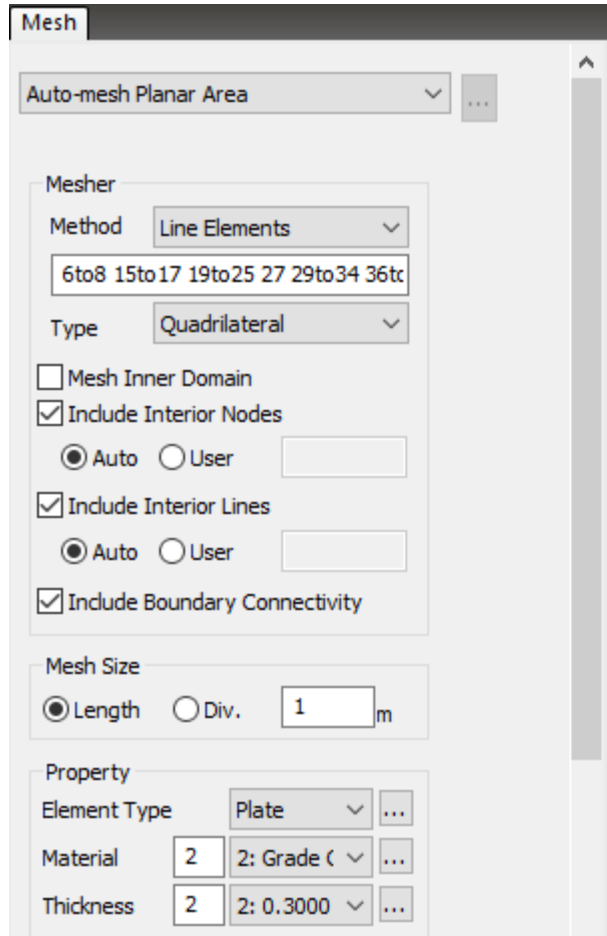
# Auto-Mesh Slab



Select beams on the base by line elements

Mesh size 1m

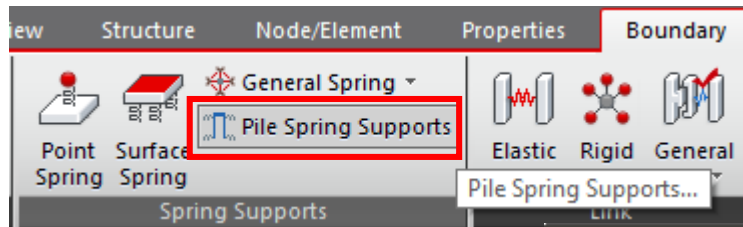
Thickness 0.3 m





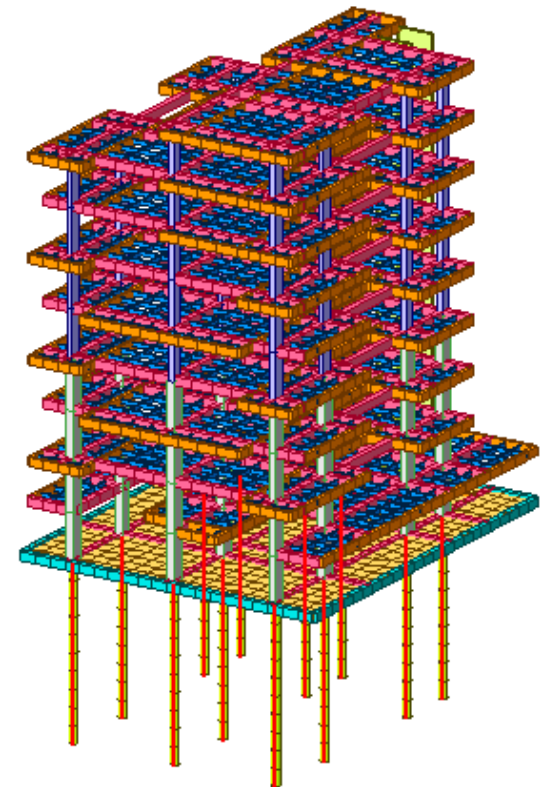
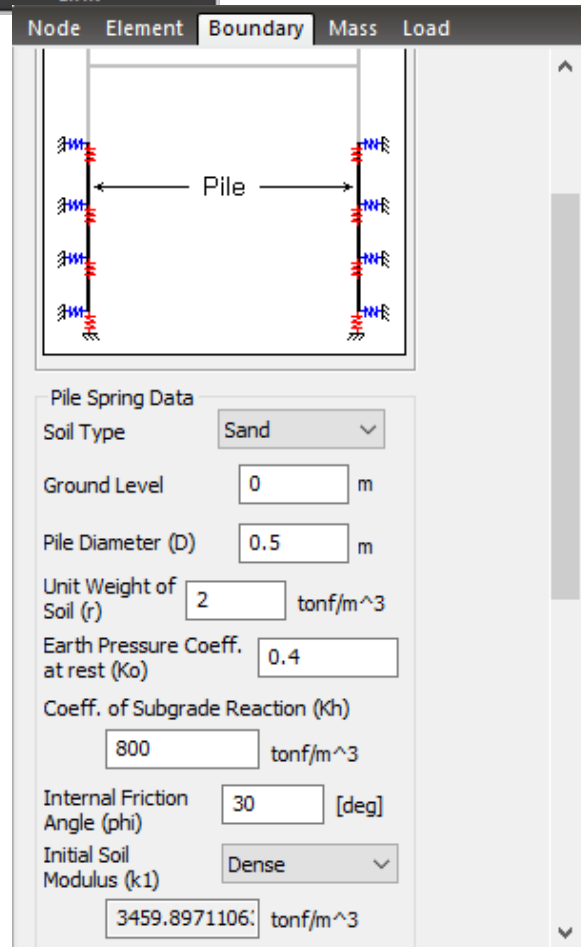


# Boundary Conditions



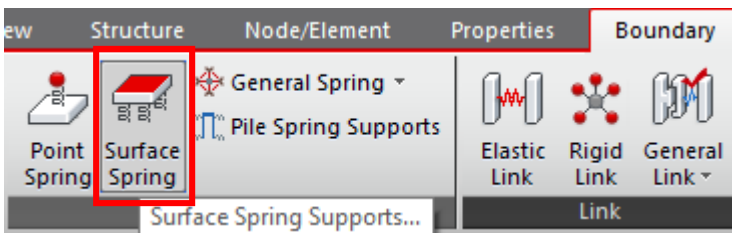
- Select Pile Spring Supports and apply to piles

Soil Type: Sand  
Ground Level: 0m  
Unit weight: 2 tonf/m<sup>3</sup>  
Ko: 0.4  
Kh: 800 tonf/m<sup>3</sup>  
Friction Angle: 30 deg  
K1: Dense



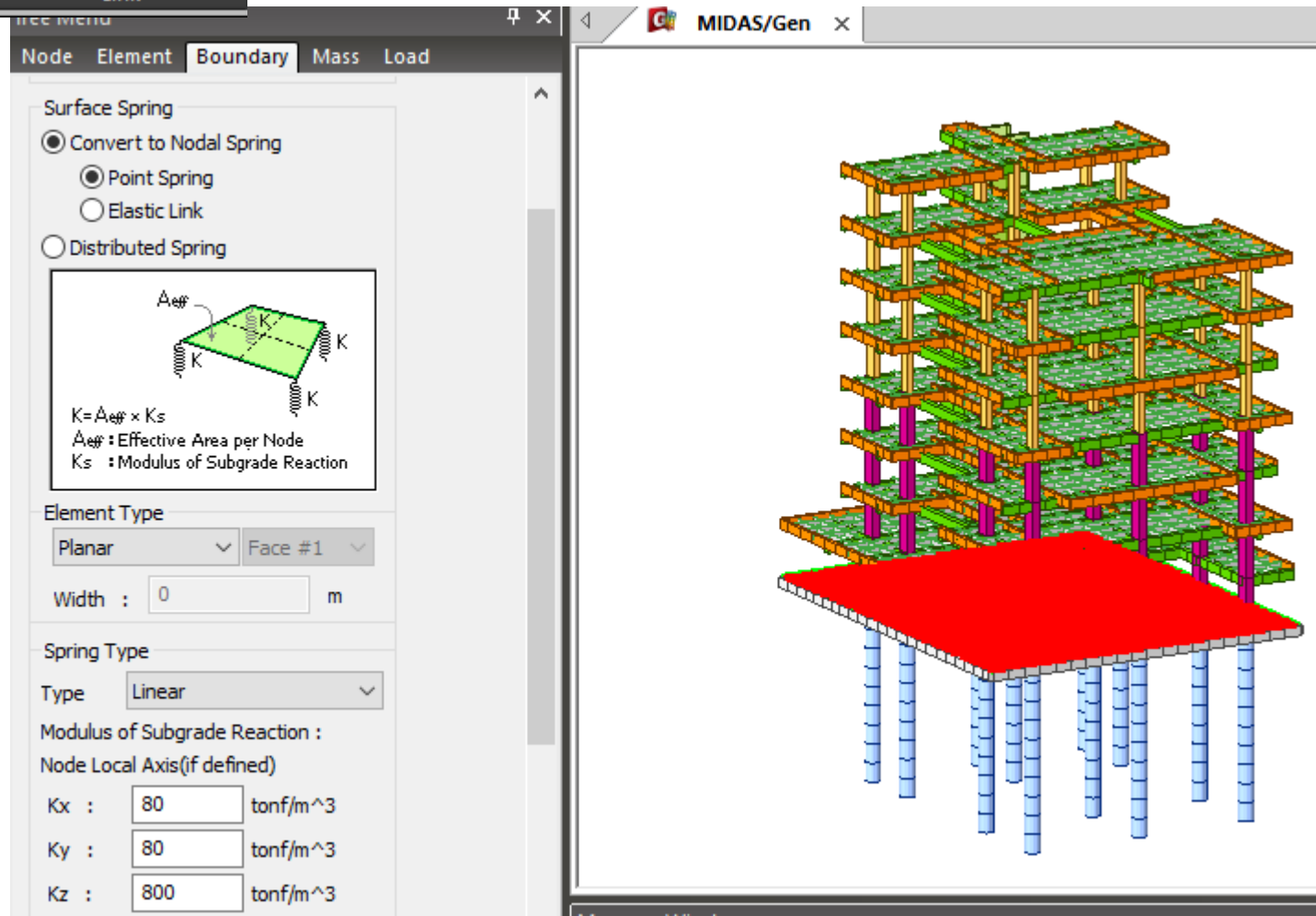


# Boundary Conditions

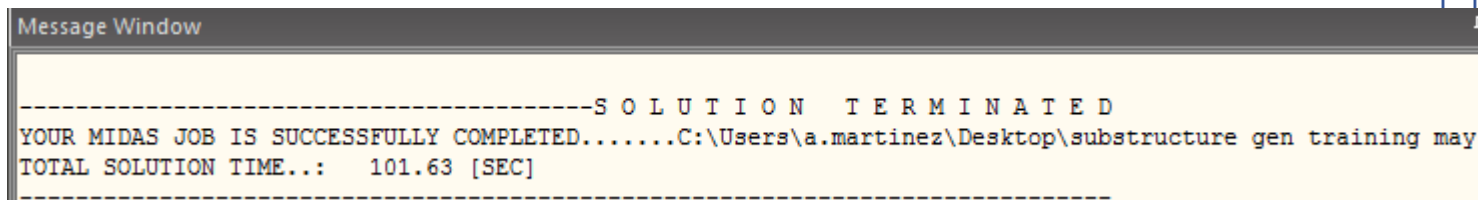
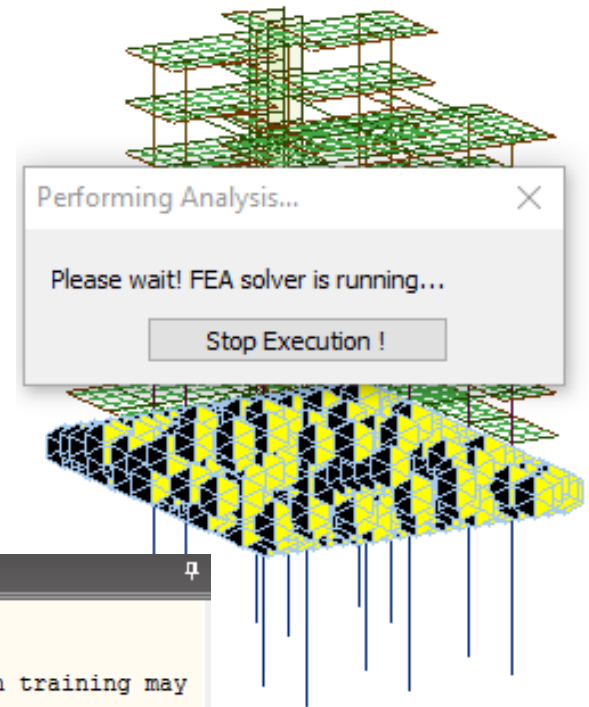
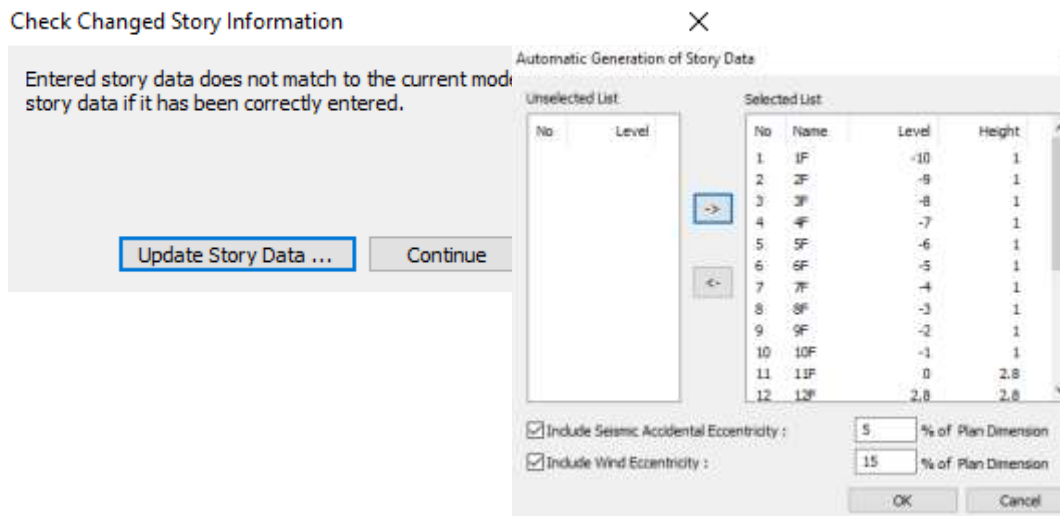
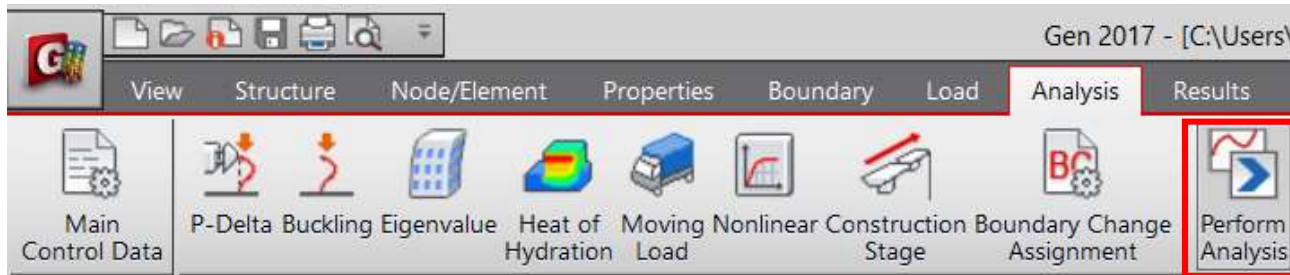


- Select Surface Springs and apply to raft

Point Spring  
Kx: 80 tons/m<sup>3</sup>  
Ky: 80 tons/m<sup>3</sup>  
Kz: 800 tons/m<sup>3</sup>



# Perform Analysis



# Results: Displacements



Gen 2

View Structure Node/Element Properties Boundary Load Analysis Results

Reactions Stresses Beam/Element Plate Local Axis  
Deformations Diagram Local Direction..  
Deformed Shape Displacement Participation Factor  
Displacement Contour Detail

Load Combination  
Combination

Reactions Deformations Forces Stresses

Displacement Contour

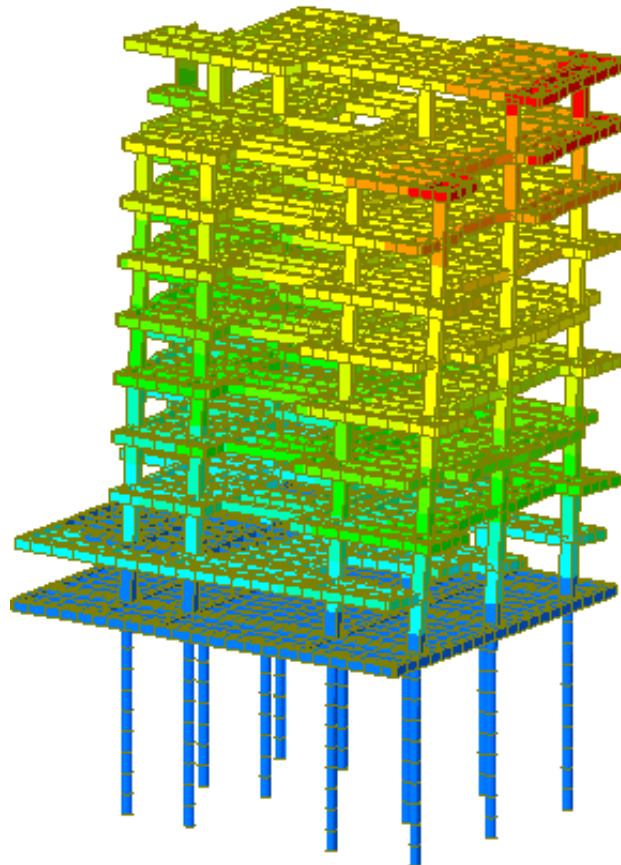
Load Cases/Combinations  
RS: EQX

Step

☒ Displacement ☐ Velocity  
☐ Acceleration  
☐ Absolute Acceleration

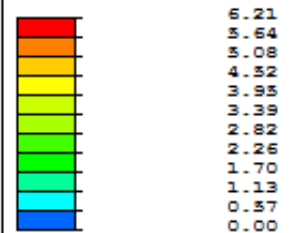
Components  
☐ DX ☐ DY ☐ DZ  
☐ RX ☐ RY ☐ RZ  
☐ RW  
☐ DXY ☐ DYZ ☐ DXZ  
☒ DXYZ  
☐ Local (if defined)

Type of Display  
☒ Contour ☒ Deform  
☐ Values ☒ Legend



midas Gen  
POST-PROCESSOR  
DISPLACEMENT

RESULTANT



SCALEFACTOR=

2.8554E+001  
RS: EQX

MAX : 2257

MIN : 2838

FILE: BUILDING PIL~

UNIT: cm

DATE: 04/26/2017

VIEW-DIRECTION

X: -0.796

Y: -0.547

Z: 0.259





# Results: Axial Forces

midas Gen 2017

View Structure Node/Element Properties Boundary Load Analysis Results

Reactions Deformations Forces Stresses

Beam Diagrams

Load Cases/Combinations

RS: EQX

Step

☒ Max/Min Diagram

Components

Part Total

☒ Fx ☐ Mx ☐ Fy ☐ Fz ☐ Fyz ☐ My ☐ Mz ☐ Myz ☐ Mb ☐ Mt ☐ Mw

☐ Show Truss Forces

☐ Only Truss Forces

Display Options

☐ Exact ☐ No Fill ☒ 5 Points ☐ Line Fill ☒ Solid Fill

Scale: 1.00000

Type of Display

☒ Contour ☒ Deform ☐ Values ☒ Legend

Reactions

Stresses

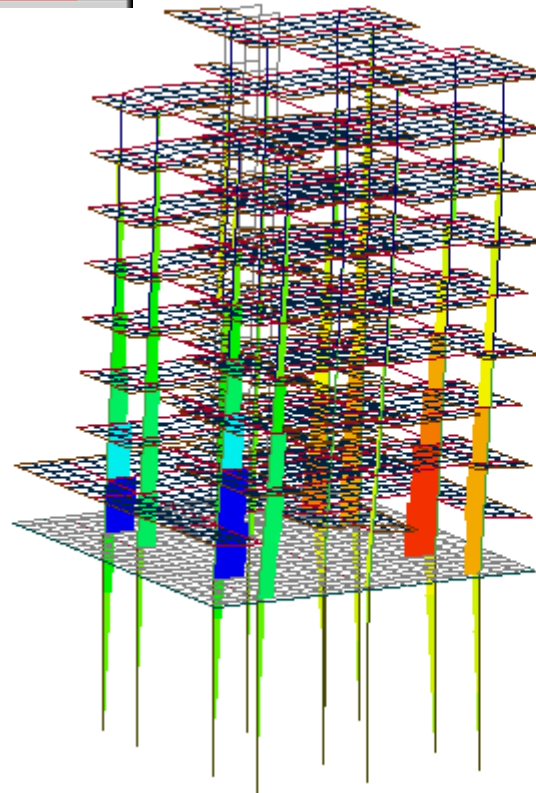
Diagram

HY Results

Truss Forces

Beam Forces/Moments

Beam Diagrams



midas Gen  
POST-PROCESSOR  
BEAM DIAGRAM

AXIAL

	32.93
	26.90
	20.88
	14.86
	8.83
	0.00
	-3.22
	-9.24
	-15.26
	-21.29
	-27.31
	-33.34

SCALEFACTOR=

2.8554E+001

RS: EQX

MAX : 58

MIN : 60

FILE: BUILDING PIL~

UNIT: tonf

DATE: 04/26/2017

VIEW-DIRECTION

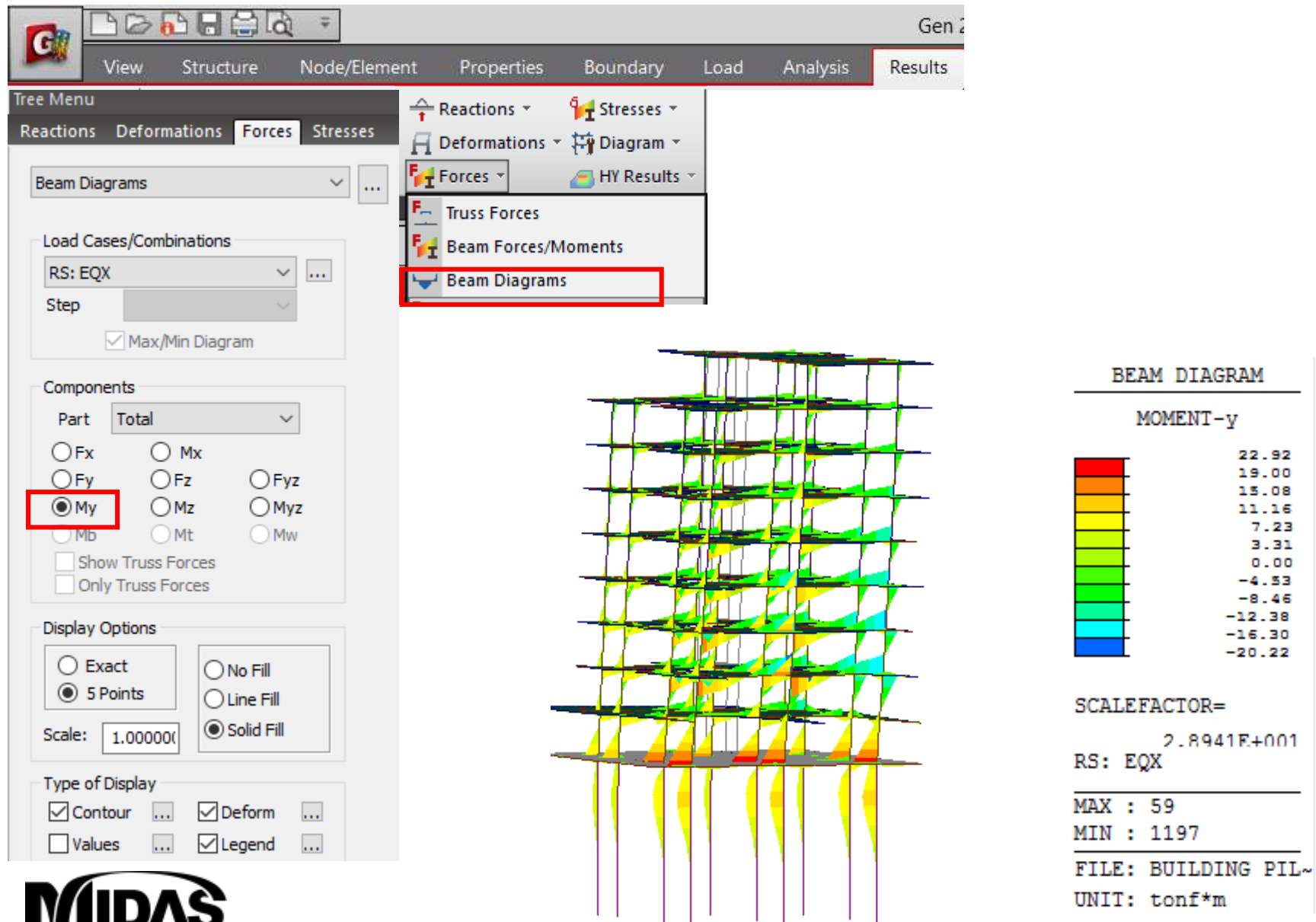
X: -0.796

Y: -0.547

Z: 0.259



# Results: Moments Y





# Load combination

Automatic Generation of Load Combinations

Option  
☒ Add ☐ Replace

Code Selection  
☐ Steel ☒ Concrete ☐ SRC  
☐ Cold Formed Steel ☐ Footing

Design Code : ACI318-14

☐ Scale Up of Response Spectrum Load Cases  
Scale Up Factor : 1

Factor	Load Case

Add  
Modify  
Delete

Wind Load Factor  
☒ Strength-level ☐ Service-level

☐ Consider Lateral Soil Pressure Factor  
Load Factor : 0.9

Manipulation of Construction Stage Load Case  
ST : Static Load Case  
CS : Construction Stage Load Case  
☒ ST Only ☐ CS Only ☐ ST+CS

☐ Consider Orthogonal Effect  
Set Load Cases for Orthogonal Effect...

☐ 100 : 30 Rule  
☐ SRSS(Square-Root-of-Sum-of-Squares)

☐ Generate Additional Load Combinations  
☐ for Special Seismic Load  
☐ for Vertical Seismic Forces  
Factors for Seismic Design...

☐ Will Execute Construction Stage Analysis  
☐ Consider Losses for Prestress Load Cases

Transfer Stage : 1  
Service Load Stage : 1

Define Factors

OK Cancel

## Generate Load Combo

Results > Combinations > Concrete Design > Auto Generation

Select Concrete Design Auto Generation

Design Code: ACI318-14

Load Combinations

General | Steel Design | Concrete Design | SRC Design | Cold Formed Steel Design | Footing Design

Load Combination List

No	Name	Active	Type	Description
1	cLCB1	Stren	Add	1.4(D)
2	cLCB2	Stren	Add	1.2(D) + 1.5(L)
3	cLCB3	Stren	Add	1.2(D) + 1.0wind x + 1.0(L)
4	cLCB4	Stren	Add	1.2(D) + 1.0wind y + 1.0(L)
5	cLCB5	Stren	Add	1.2(D) - 1.0wind x + 1.0(L)
6	cLCB6	Stren	Add	1.2(D) - 1.0wind y + 1.0(L)
7	cLCB7	Stren	Add	1.2(D) + 1.0(1.0(RX)(RS)+RX(E
8	cLCB8	Stren	Add	1.2(D) + 1.0(1.0(RX)(RS)-RX(E
9	cLCB9	Stren	Add	1.2(D) + 1.0(1.0(RY)(RS)+RY(E
10	cLCB10	Stren	Add	1.2(D) + 1.0(1.0(RY)(RS)-RY(E
11	cLCB11	Stren	Add	1.2(D) - 1.0(1.0(RX)(RS)+RX(E
12	cLCB12	Stren	Add	1.2(D) - 1.0(1.0(RX)(RS)-RX(E
13	cLCB13	Stren	Add	1.2(D) - 1.0(1.0(RY)(RS)+RY(E
14	cLCB14	Stren	Add	1.2(D) - 1.0(1.0(RY)(RS)-RY(E
15	cLCB15	Stren	Add	0.9D + 1.0wind x
16	cLCB16	Stren	Add	0.9D + 1.0wind y
17	cLCB17	Stren	Add	0.9D - 1.0wind x
18	cLCB18	Stren	Add	0.9D - 1.0wind y
19	cLCB19	Stren	Add	0.9(D) + 1.0(1.0(RX)(RS)+RX(E
20	cLCB20	Stren	Add	0.9(D) + 1.0(1.0(RX)(RS)-RX(E
21	cLCB21	Stren	Add	0.9(D) + 1.0(1.0(RY)(RS)+RY(E

Load Cases and Factors

LoadCase	Factor
dead(ST)	1.4000

Copy Import... Auto Generation... Spread Sheet Form

File Name: C:\Users\j.martinez\Desktop\Slab and Wall Tutorial\p... Browse Make Load Combination Sheet Close



# File: Rebar Data

## Select Piles

- RC Design > Modify Column Rebar
- Main #4
- Ties/Spirals #3 @100

Add / Replace

Gen 2017 - [C:\Users\A.Martin]

View Structure Node/Element Properties Boundary Load Analysis Results Pushover **Design**

ACI318-08 SSRC79

RC Design SRC Design

**Design Code**

Strength Reduction Factors

Modify Concrete Material

Limiting Maximum Rebar Ratio

Limiting Minimum Section Size

Design Criteria for Rebar

Design Criteria for Rebars by Member

Same Beam Rebar at Joints...

Moment Redistribution Factor

Torsion Reduction Factor

Serviceability Parameters

Uncertainly Load Combination Factor

Modify Beam Rebar Data

**Modify Column Rebar Data**

Modify Column Rebar Data

☐ Create Sub Section

Element List : 5059to5178

Rebar		Data			
Main	Numbers	6	#4		
	Rows	3			
	Corner	<input type="checkbox"/>			
Ties/ Spirals	End(I & J)	y	2	#3	@ 100
		z	2		
	Center(M)	y	2	#3	@ 100
		z	2		

Concrete Face to Center of Rebar(do) : 0.0635 m

Type of Hoop Rebar : ☒ Ties ☐ Spirals


☐ Detail Figure

End(I & J) Center(M)



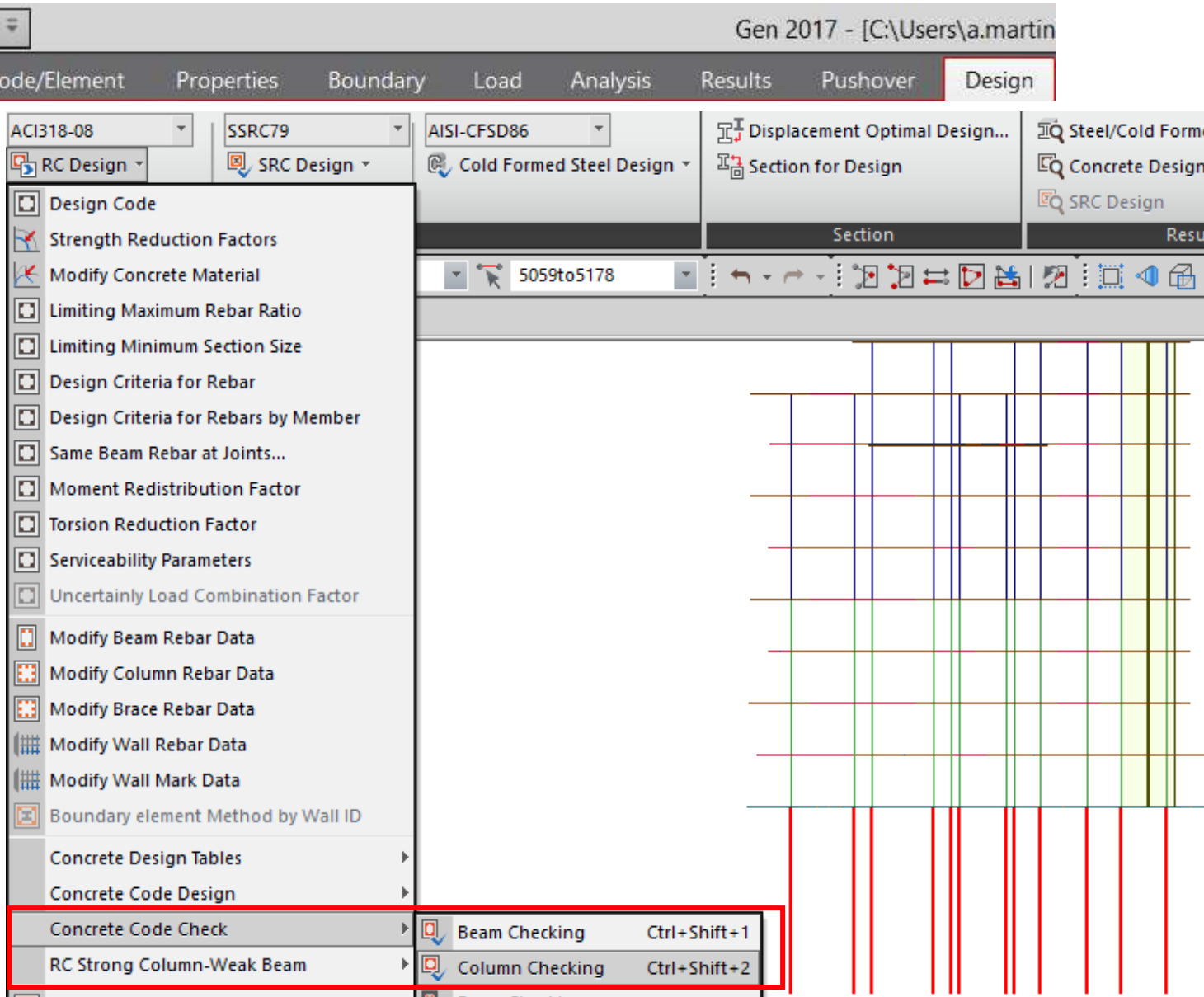


# File: Code Check



**Select All Piles**

- RC Design
- Concrete Code Check
- Column Check



Gen 2017 - [C:\Users\a.martin]

View Structure Node/Element Properties Boundary Load Analysis Results Pushover **Design**

ACI318-08 SSRC79 AISI-CFSD86

RC Design SRC Design Cold Formed Steel Design

Displacement Optimal Design... Section for Design Steel/Cold Form Concrete Design SRC Design

Section

5059to5178

Design Code

Strength Reduction Factors

Modify Concrete Material

Limiting Maximum Rebar Ratio

Limiting Minimum Section Size

Design Criteria for Rebar

Design Criteria for Rebars by Member

Same Beam Rebar at Joints...

Moment Redistribution Factor

Torsion Reduction Factor

Serviceability Parameters

Uncertainly Load Combination Factor

Modify Beam Rebar Data

Modify Column Rebar Data

Modify Brace Rebar Data

Modify Wall Rebar Data

Modify Wall Mark Data

Boundary element Method by Wall ID

Concrete Design Tables

Concrete Code Design

Concrete Code Check

RC Strong Column-Weak Beam

Beam Checking Ctrl+Shift+1

Column Checking Ctrl+Shift+2



# File: Code Check

ACI318-08 RC-Column Checking Result Dialog

Code : ACI318-08 Unit : tonf , m Primary Sorting Option  
Sorted by ☒ Member ☐ Property

MEMB	SECT	Section		fc	fy	CHK	LC B	V-Rebar	phiPn-max	Pu	D_nsy	Mcy	McZ	LC B	Vu.end	Rat-V.end
		Bc	Hc	Height	fys					Rat-P	D_nsz	Rat-My	Rat-Mz		Vu.mid	Rat-V.mid
5070	<input checked="" type="checkbox"/>	Pile		2812.28	42184.2	PM*	10	6-3-#4	260.088	97.4394	1.000	16.3994	10.7566	10	22.6432	0.629
7	<input checked="" type="checkbox"/>	0.000	0.500	1.0000	42184.2					1.044	1.000	1.031	1.035		10	22.6432

**1 member is NG: NOT GOOD**  
**Click GRAPHIC to see PM Curve and details**

**1. Design Condition**  
Design Code : ACI318-08 UNIT SYSTEM : tonf, m  
Member Number : 5065  
Material Data : fc = 2812.28, fy = 42184.2, fys = 42184.2 tonf/m<sup>2</sup>  
Column Height : 1 m  
Section Property : Pile D=600mm (Phi = 7)  
Rebar Pattern : 6-3-#4  
Axial = 0.000774+92 m<sup>2</sup>E (Stress = 3.002 + Stresse = 9.010)

**2. Applied Loads**  
Load Combination : 1 AT (1 Point)  
Pu = 30.3008 tonf Mu = -0.5462 tonf-m Mx = -30.4477 tonf-m  
Mc = 0.000000 tonf-m Mcz = 0.000000 tonf-m

**3. Axial Forces and Moments Capacity Check**  
Concrete Max. Axial Load : phiPn-max = 848.834 tonf  
Axial Load Ratio : Pu/phiPn = 35.8338 / 848.834 = 1.188 > 1.000 ... NG  
Mu/phiMu = 30.4315 / 28.1713 = 1.184 > 1.000 ... NG  
Mx/phiMx = -0.5462 / 0.40731 = -1.173 > 1.000 ... NG  
Mzc/phiMzc = -30.4477 / 28.1671 = -1.104 > 1.000 ... NG

**4. P-M Interaction Diagram**  
phiPn(tonf) phiMu(tonf-m)  
801.04 0.00  
735.52 21.83  
562.18 44.71  
244.81 80.14  
456.57 67.66  
280.19 69.51  
347.28 89.04  
353.07 71.47  
298.21 74.83  
283.98 73.47  
140.88 33.21  
41.10 24.37  
-29.39 0.00  
Theta=88.88Deg  
PNA=90.88Deg

**5. Shear Force Capacity Check ( End )**  
Applied Shear Strength Vu = 34.5424 tonf (Load Combination : )  
Design Shear Strength phiVn = 38.1183 + 28.7398 + 88.8881 tonf (Aa=H\_Less = 0.00142 m/2m; 3#3 @100)  
Shear Ratio Vu/phiVn = 0.911 < 1.000 ... OK

☒ Connect Model View  
Select All Unselect All Re-calculation  
**Graphic...** Detail... Summary... <<  
Draw PM Curve... Close  
Result View Option  
☐ All ☐ OK ☒ NG  
Copy Table



# Pile: Code Design

ACI318-08 RC-Column Design Result Dialog

Code : ACI318-08      Unit : tonf , m      Primary Sorting Option  
Sorted by ☒ Member      ☐ SECT      ☒ MEMB

MEMB	SECT	Section		fc	fy	LC B	Pu	Mc	Ast	V-Rebar	LC B	Vu.end	Rat-V.end	As-H.end	H-Rebar.end
		Bc	Hc	Height	fys		Rat-P	Rat-M				Vu.mid	Rat-V.mid	As-H.mid	H-Rebar.mid
5070	<input checked="" type="checkbox"/>	Pile		2812.28	42184.2	10	97.4394	19.6124	0.0008	6-3-#4	10	22.6432	0.629	0.0014	2-#3 @100
7		0.000	0.500	1.0000	42184.2		1.044	1.032				22.6432	0.629	0.0014	2-#3 @100

Run Pile/Column Design

ACI318-08      SSR79      AISI-CFSD86  
☒ RC Design      ☒ SRC Design      ☒ Cold Formed Steel Design

- ☒ Design Code
- ☒ Strength Reduction Factors
- ☒ Modify Concrete Material
- ☒ Limiting Maximum Rebar Ratio
- ☒ Limiting Minimum Section Size
- ☒ Design Criteria for Rebar
- ☒ Design Criteria for Rebars by Member
- ☒ Same Beam Rebar at Joints...
- ☒ Moment Redistribution Factor
- ☒ Torsion Reduction Factor
- ☒ Serviceability Parameters
- ☒ Uncertainly Load Combination Factor
- ☒ Modify Beam Rebar Data
- ☒ Modify Column Rebar Data
- ☒ Modify Brace Rebar Data
- ☒ Modify Wall Rebar Data
- ☒ Modify Wall Mark Data
- ☒ Boundary element Method by Wall ID
- Concrete Design Tables
- Concrete Code Design
- Concrete Code Check

Result View Option  
☒ All      ☐ OK      ☐ NG

Connect Model View  
Select All      Unselect All      Re-calculation  
Graphic...      Detail...      Summary...      <<  
Draw PM Curve...      Update Rebar      Close      Copy Table

5070

Beam Design Ctrl+1  
Column Design Ctrl+2



# Pile: Code Design

ACI318-08 RC-Column Design Result Dialog

Code : ACI318-08 Unit : tonf , m Primary Sorting Option

Sorted by ☐ Member ☒ Property

☐ SECT ☒ MEMB

MEM	SE	Section	fc	fy	LC	Pu	Mc	Ast	V-Rebar	LC	Vu.end	Rat-V.en	As-H.en	H-Rebar.e
SEC	L	Bc Hc	Height	fys	B	Rat-P	Rat-M			B	Vu.mid	Rat-V.mi	As-H.mi	H-Rebar.m
0	<input type="checkbox"/>	Pile	2812.2	42184.	61	97.439	19.612	0.0020	10-0-#5	54	17.6691	0.465	0.0004	2-#3 @88
7	<input type="checkbox"/>	0.00 0.50	1.0000	42184.		0.821	0.816			54	17.6691	0.465	0.0004	2-#3 @88

☐ 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

1. Click Re-Calculation

Pile rebar was redesigned based on code

2. Click Update Rebar to see new rebar data created for pile

Modify Column Rebar Data

☐ Create Sub Section

SECT	Name	Bar
1	C30X70	-
7	Pile	In
8	C45x70	-

Element List : 5059to5178

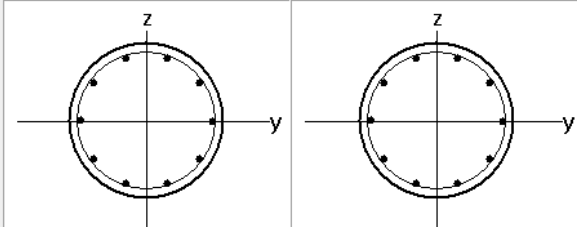
Rebar			Data			
Main	Numbers	10	#5			
	Rows	0				
	Corner	<input type="checkbox"/>				
Ties/ Spirals	End(I & J)	y	2	#3	@ 88.9	
		z	2			
	Center(M)	y	2	#3	@ 88.9	
		z	2			

Concrete Face to Center of Rebar(do) : 0.04 m

Type of Hoop Rebar : ☒ Ties ☐ Spirals

☐ Detail Figure

End(I & J) Center(M)



An aerial photograph of a dense urban skyline, likely New York City, featuring numerous skyscrapers and buildings. The image is overlaid with a semi-transparent white rectangle that serves as a background for the title text. The lighting suggests a sunset or sunrise, with a warm orange glow on the left side.

# **BASEMENT WALL ANALYSIS & DESIGN**





# Dimensions

## Unit System

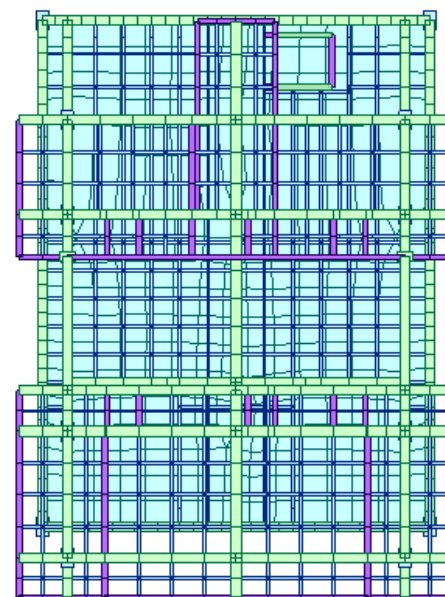
### Length

- ☒ m
- ☐ cm
- ☐ mm
- ☐ ft
- ☐ in

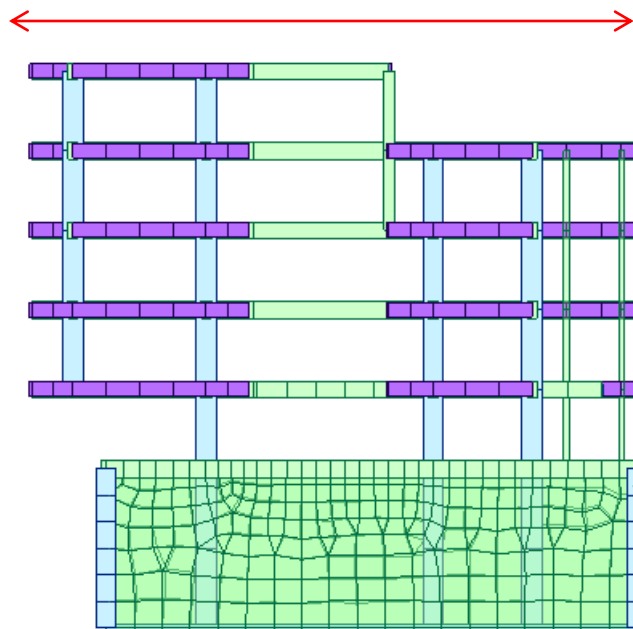
### Force (Mass)

- ☐ N (kg)
- ☒ kN (ton)
- ☐ kgf (kg)
- ☐ tonf (ton)
- ☐ lbf (lb)
- ☐ kips (kips/g)

20m

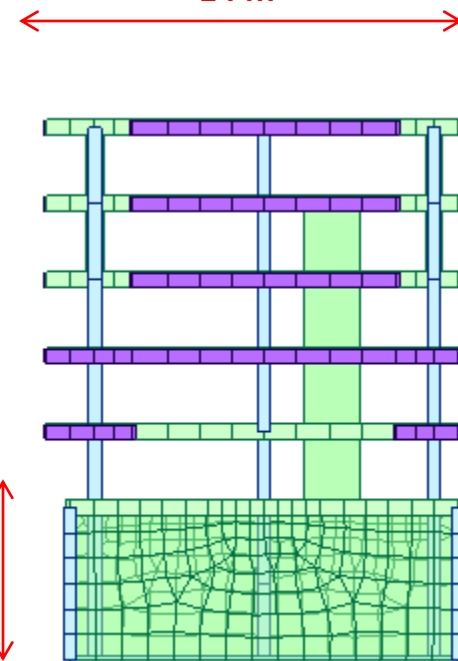


20m



19.6 m

14 m



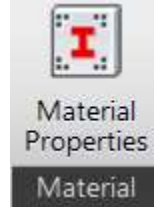
5.6m



# Inspect Properties



Properties				
Material   Section   Thickness				
ID	Name	Type	Stan...	DB
2	Grad...	Concrete	ASTM...	Grade C4000



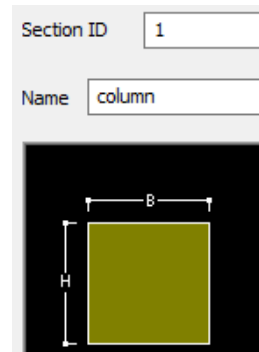
- Material  
-Concrete ASTM C4000
- 4 rectangle Sections



	H	B
V35X50	0.35 m	0.5 m
B20X50	0.2 m	0.5 m
N10X25	0.1 m	0.25 m
C45X70	0.45 m	0.7 m

Properties				
Material   Section   Thickness				
ID	Name	Type	Shape	
2	V35X50	User	SB	
3	B20X50	User	SB	
4	N10X25	User	SB	
8	C45x70	User	SB	

Buttons: Add..., Modify..., Delete, Copy, Import, Renumber

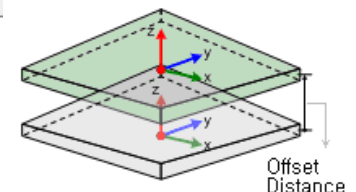


- 2 thickness



	Thickness
Slab and Wall	0.2 m
Basement Wall	0.3 m

Properties				
Material   Section   Thickness				
ID	Type	Thickness(m)	Offset	
1	Value	0.200000	No	
2	Value	0.300000	No	

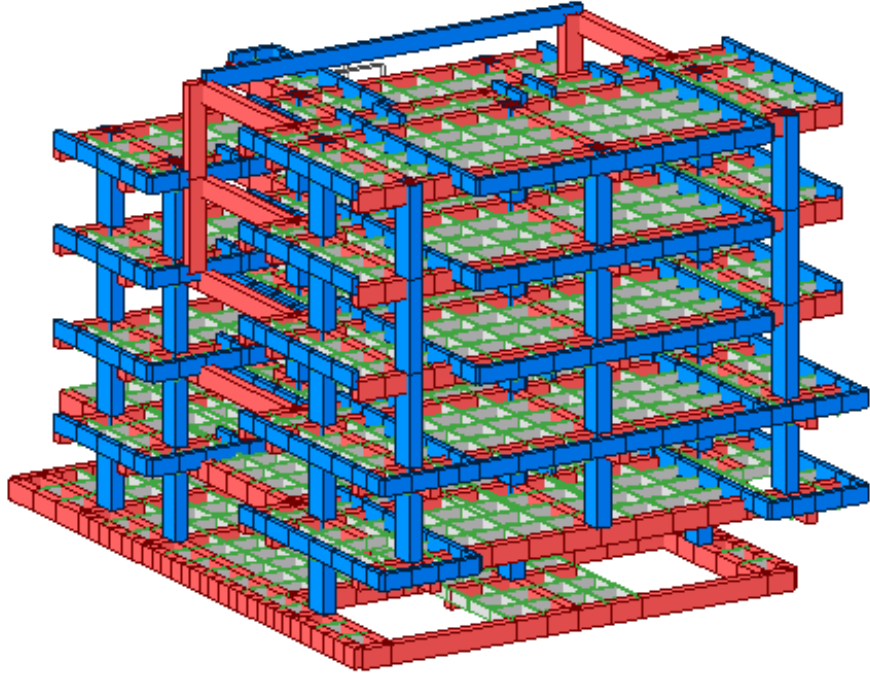




# Start file

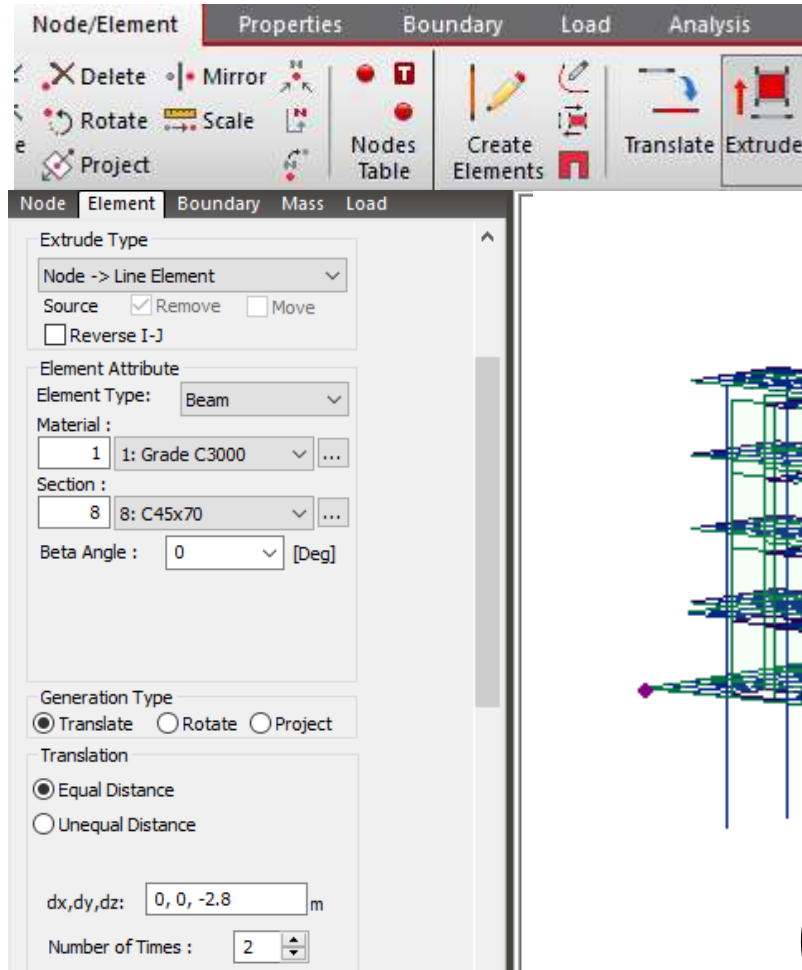
Menu Tables Group Works Report

- Analysis Control Data
- Structures
- Properties
  - Material : 1
    - 2 : Grade C4000
  - Section : 4
    - 2 : V35X50
    - 3 : B20X50
    - 4 : N10X25
    - 8 : C45x70
  - Thickness : 2
    - 1 : 0.2
    - 2 : 0.3
- Masses
  - Loads to Masses : 1
- Static Loads
  - Static Load Case 1 [SW ;]
    - Self Weight [ SZ=-1 ]
  - Static Load Case 2 [DL ;]
    - Element Beam Loads : 26
  - Static Load Case 3 [LL ;]
    - Element Beam Loads : 26
  - Static Load Case 4 [Wx ;]
    - Wind Loads [IBC2012(ASCE7-10)]
  - Static Load Case 5 [Wy ;]
    - Wind Loads [IBC2012(ASCE7-10)]
  - Static Load Case 6 [water Pressure load ;]
  - Static Load Case 7 [earth pressure ;]

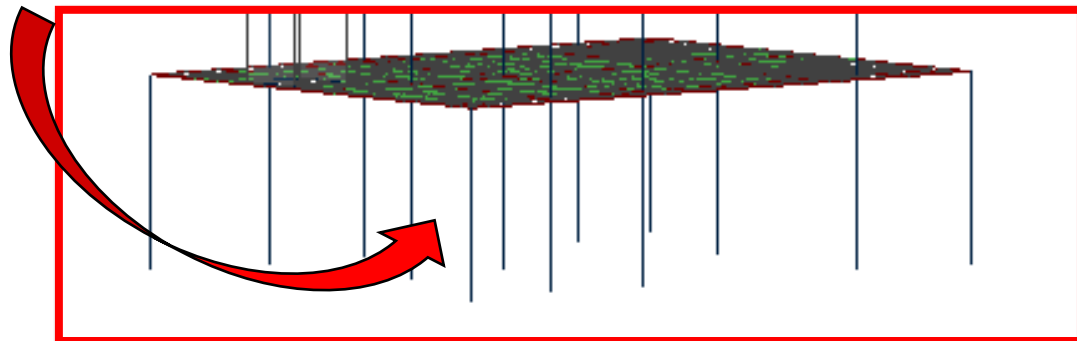
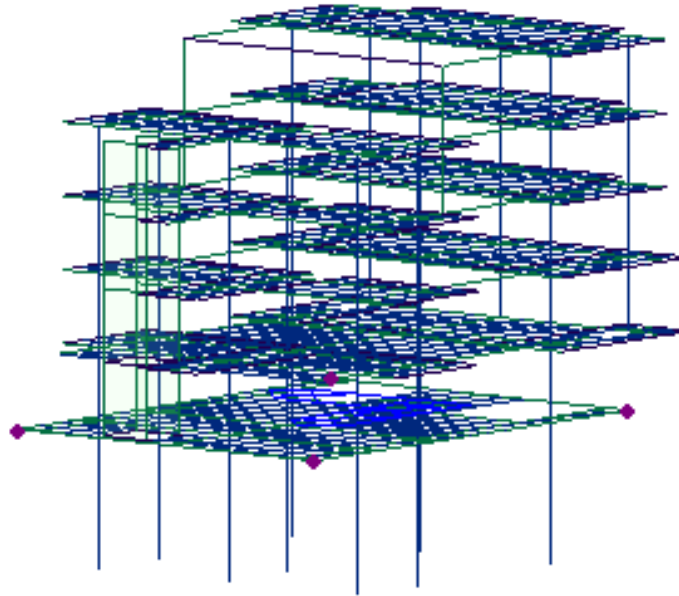




# Extrude Piles

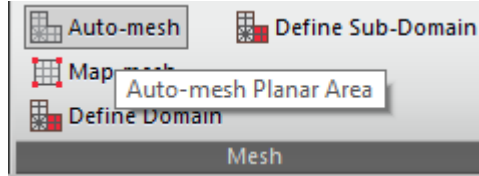


Select column and slab corner nodes to extrude  
Select C45x70 Section  
Extrude -2.8m in dz 2 times

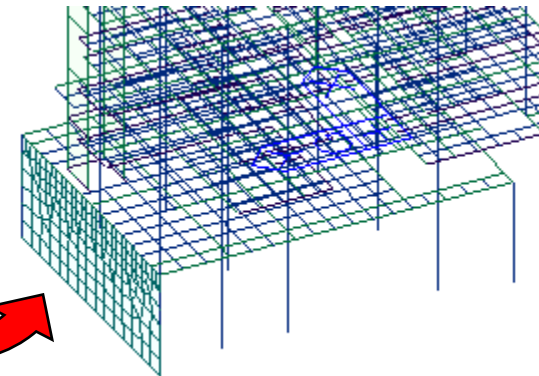
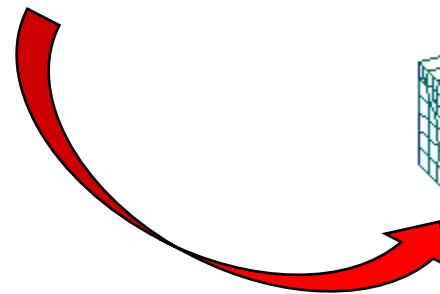
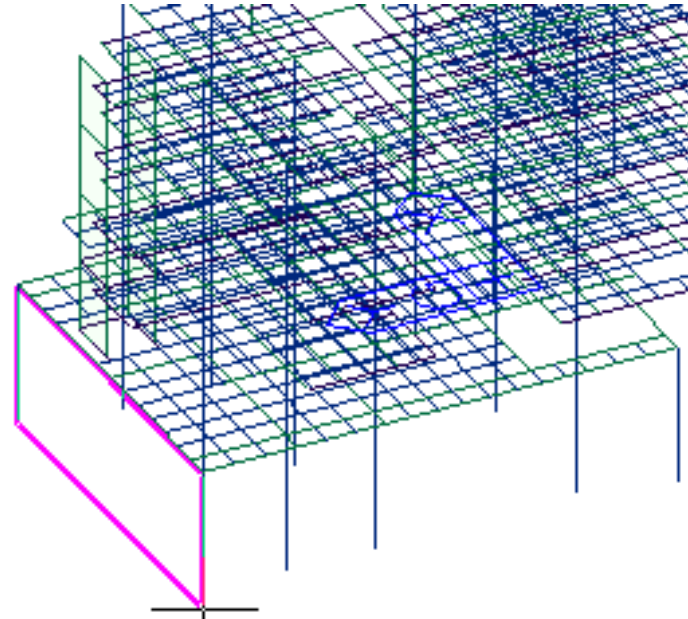
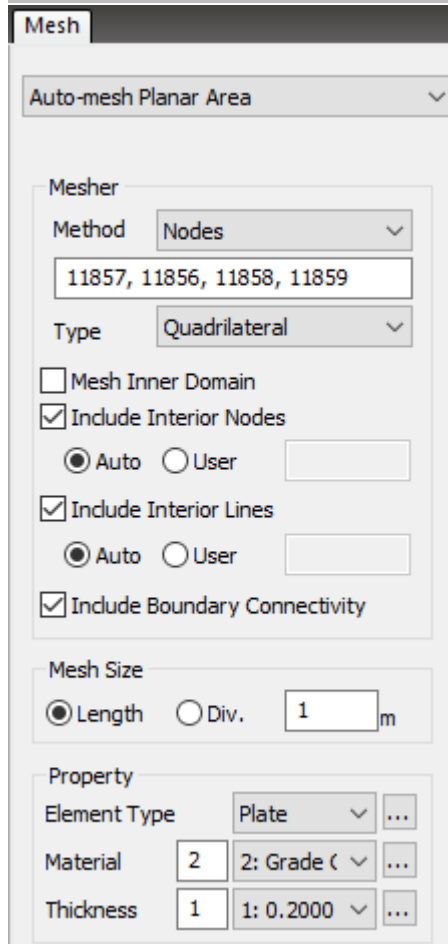




# Auto-Mesh Basement Walls



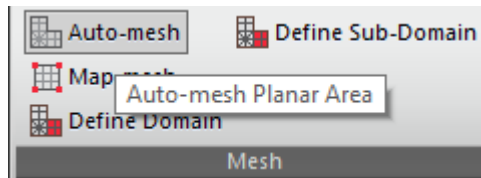
Select node method: Draw rectangle by clicking 4 corners of side CCW  
Mesh size 1m  
Thickness 0.2 m







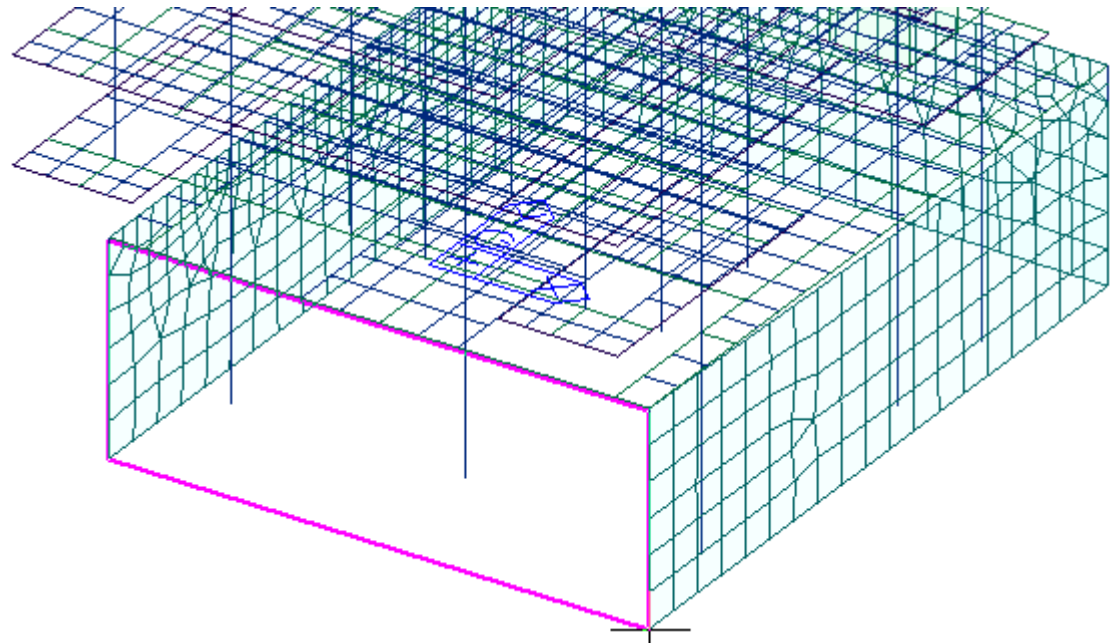
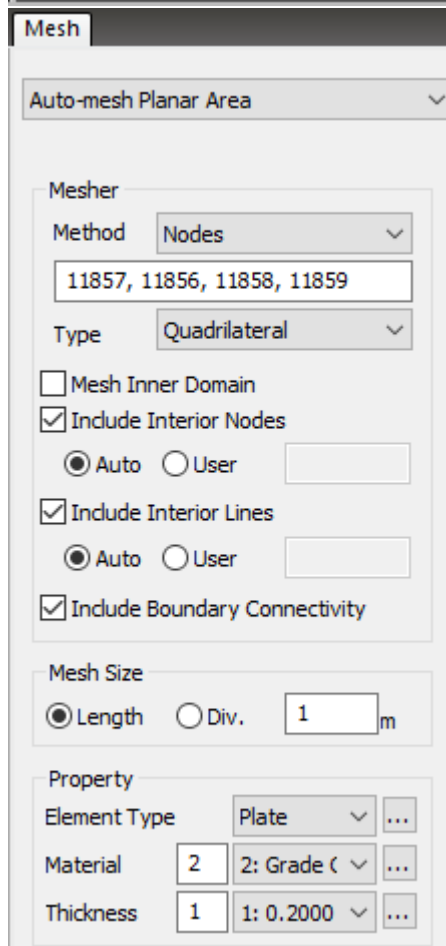
# Auto-Mesh Basement Walls



Draw rectangle by clicking 4 corners of remainnig sides

Mesh size 1m

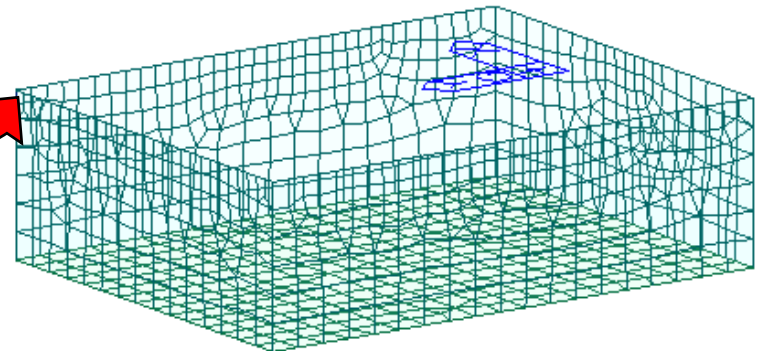
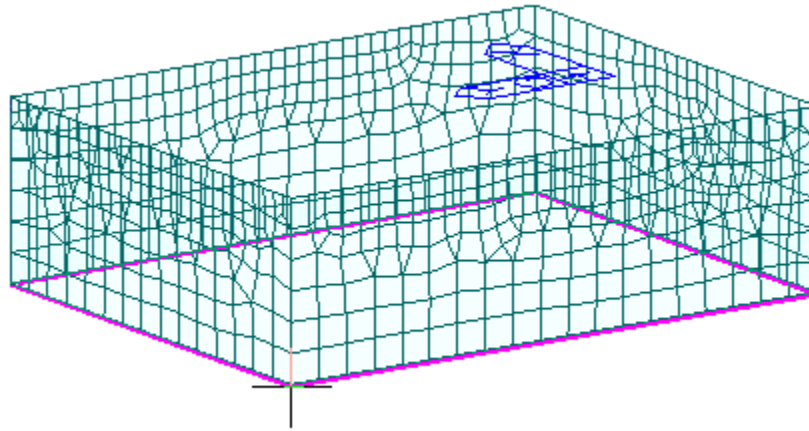
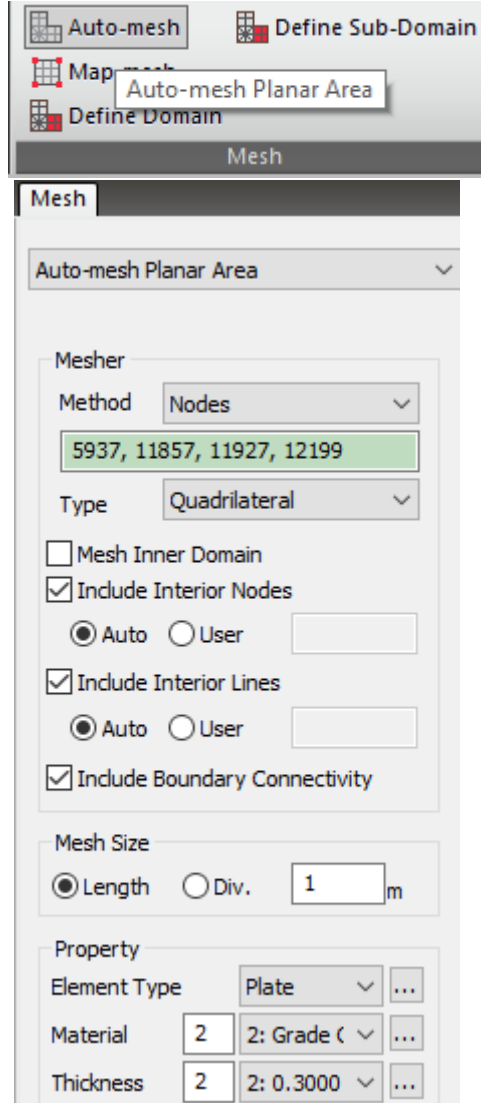
Thickness 0.2 m





# Auto-Mesh Slab

Select 4 corner nodes of base as shown  
Mesh size 1m  
Thickness 0.3 m





# Boundary Condition

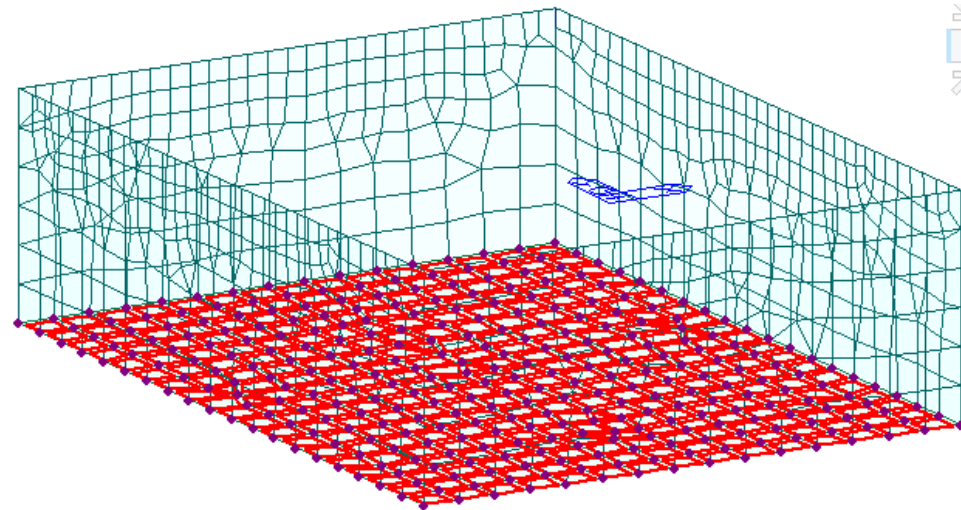
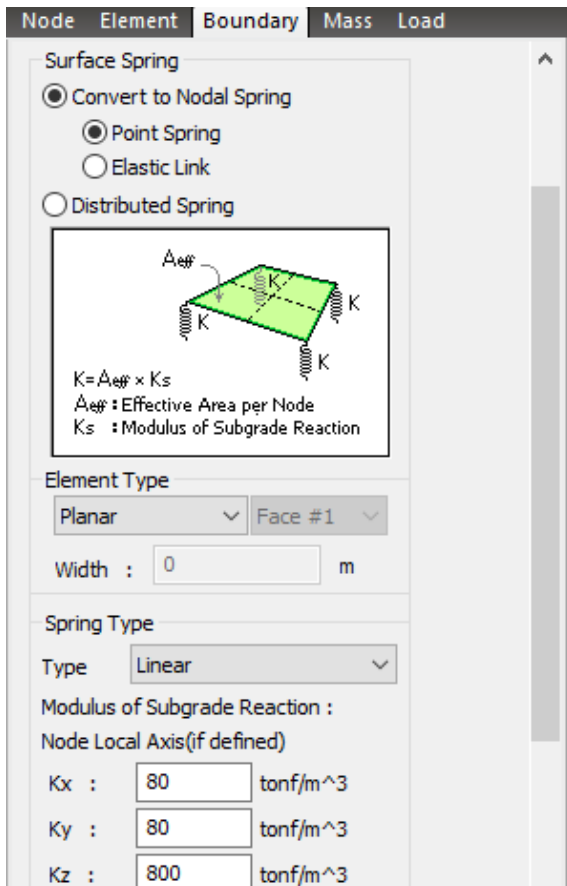
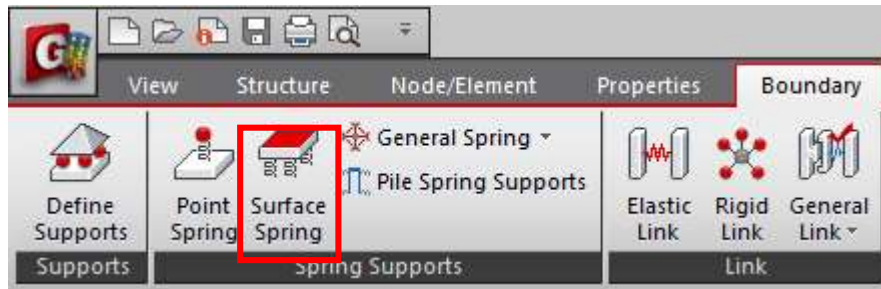
## Add Spring Supports

Element Type: Planar

Spring Type: Linear

$K_x = K_y = 80$   $K_z = 800$  tonf/m<sup>3</sup>

Select bottom raft





# Boundary Condition

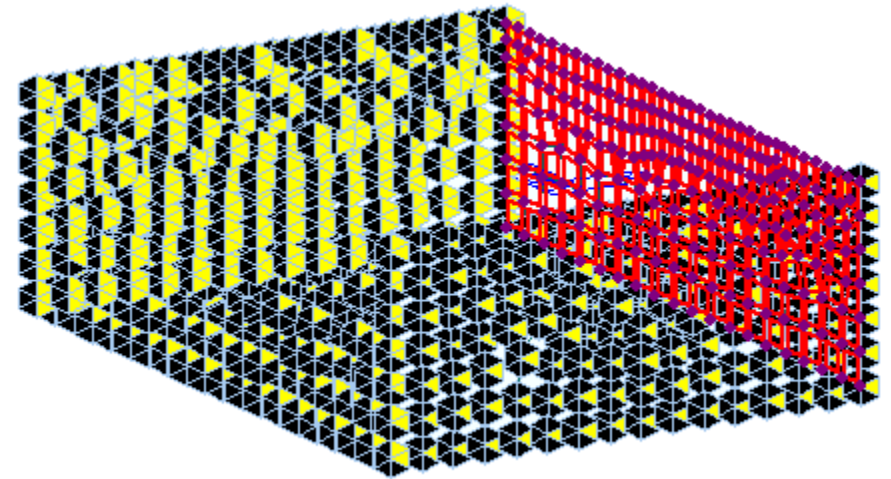
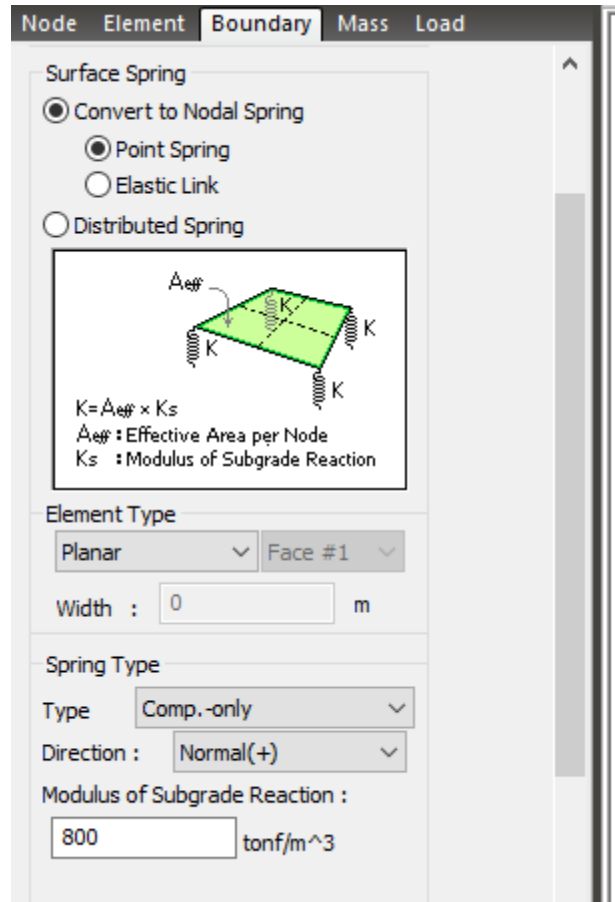
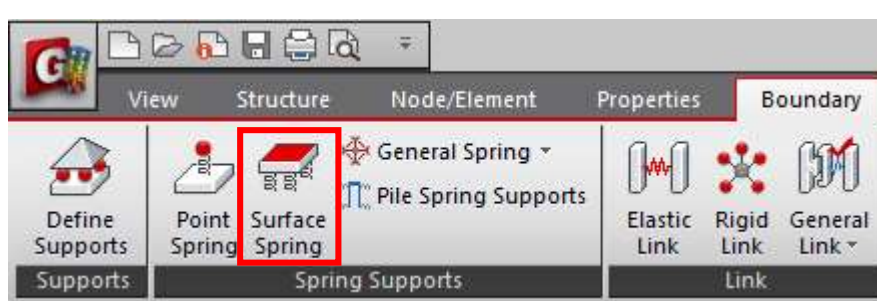
Element Type: Planar

Spring Type: Compression Only

Direction: Normal +

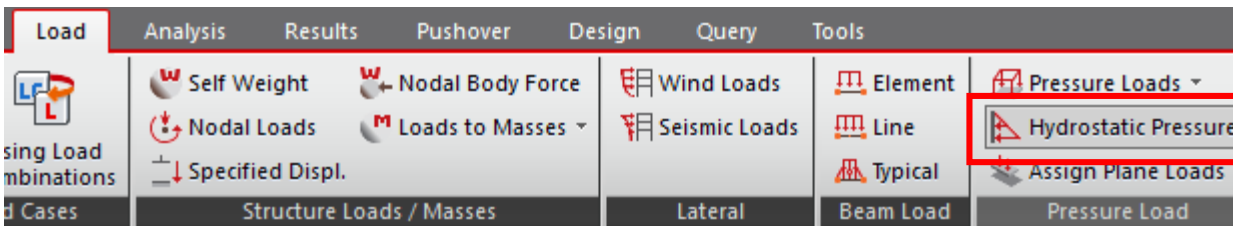
$K = 800 \text{ ton/m}^3$

Select basement walls in sequence

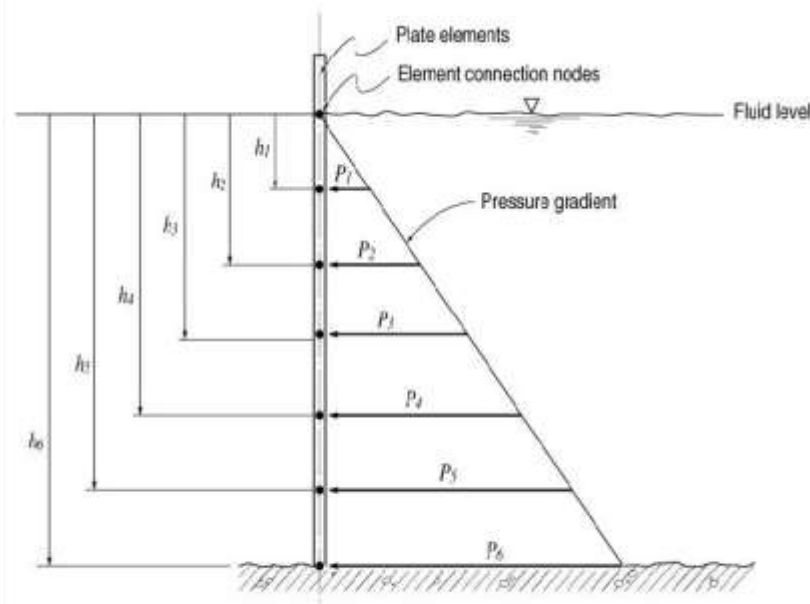




# Basement Loads



## ✓ Loads



Pressure loads due to the fluid potential at the connection nodes of plate elements

The application conditions for **hydrostatic** pressure loads are as follows:

$$\text{Hydrostatic Pressure} = P_0 + g(H - h)$$

Where,  $H > h$  (position of the element connection nodes)

**Gradient Direction:** Assign the gradient direction of the hydraulic potential - increasing direction from the fluid surface

Global ( -X )

Global ( -Y )

Global ( -Z )

**Reference Level(H):** Reference level for the pressure due to the hydraulic potential of fluids (enter with the mouse or keyboard)

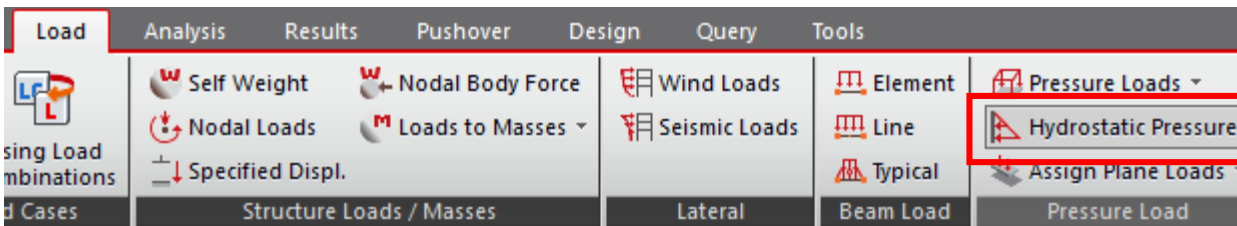
**Constant Intensity( $P_0$ ):** Pressure acting on the fluid surface

**Gradient Intensity(g):** Specific weight of fluid

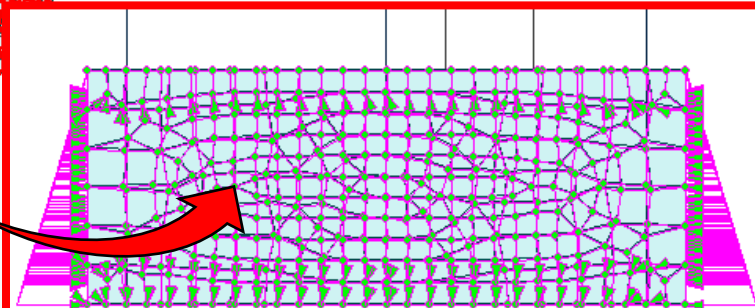
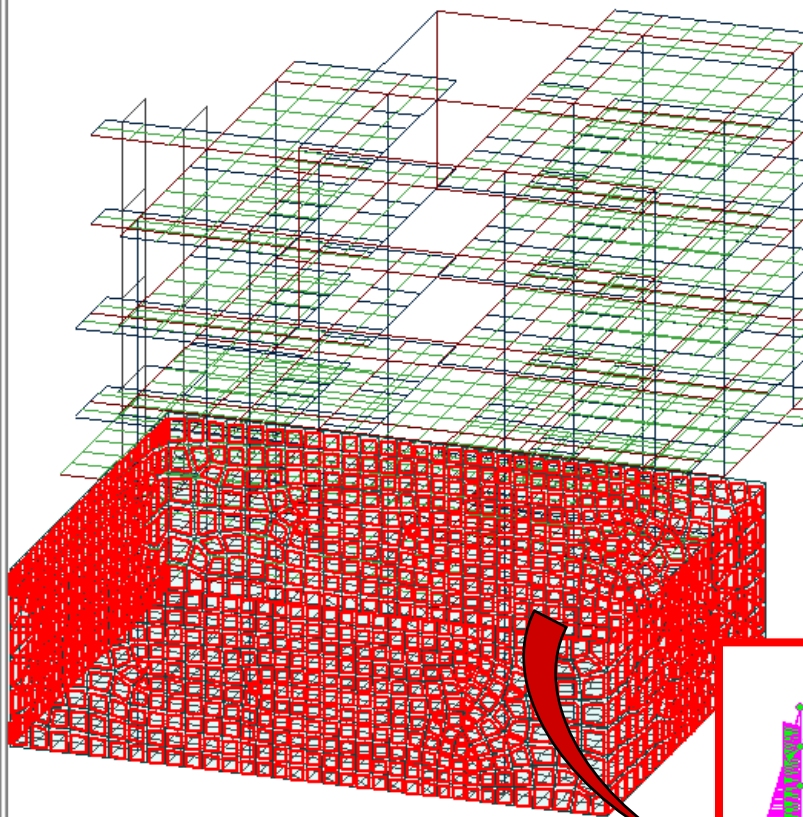
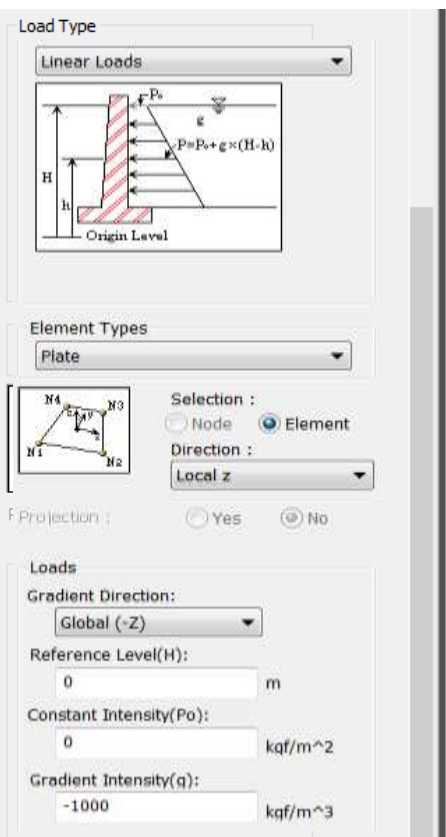


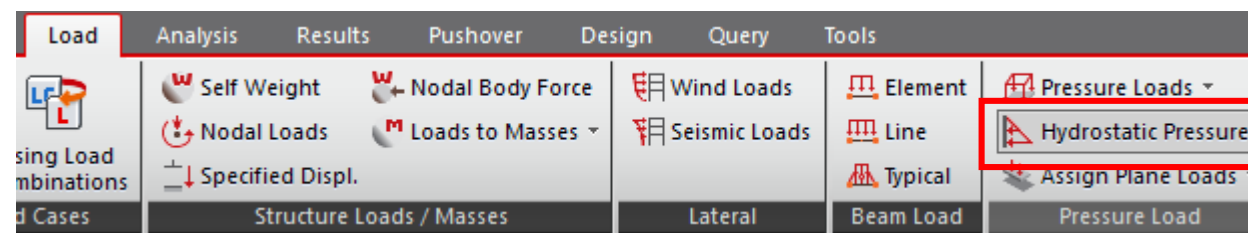


# Basement Loads



Apply Hydrostatic Pressure  
Load Case: Water pressure load  
Select Basement walls  
 $-1000\text{kgf/m}^3$





Lateral soil pressure with or without ground water pressure can be applied using this functionality.

## Note

When lateral soil pressure is entered as Hydrostatic Pressure Loads, Element Type must be Plate, and the structure must be divided into a reasonable number of elements to properly reflect its flexural behavior.

Direction represents the direction of acting force. Gradient Direction is generally selected in the direction of gravity (Global-Z).

Constant Intensity ( $P_o$ ) represents surcharge (soil overburden), which is subject to soil pressure coefficient. Gradient Intensity ( $g$ ) is also obtained by applying the soil pressure coefficient. Depending on the presence of ground water, the following is entered:

1) Only soil is present without ground water

Soil:  $g = \text{soil pressure coefficient} * \text{unit density of soil}$

2) To consider ground water (separately enter values for soil and water)

**Soil:  $g = \text{soil pressure coefficient} * \text{unit density of soil under water}$**

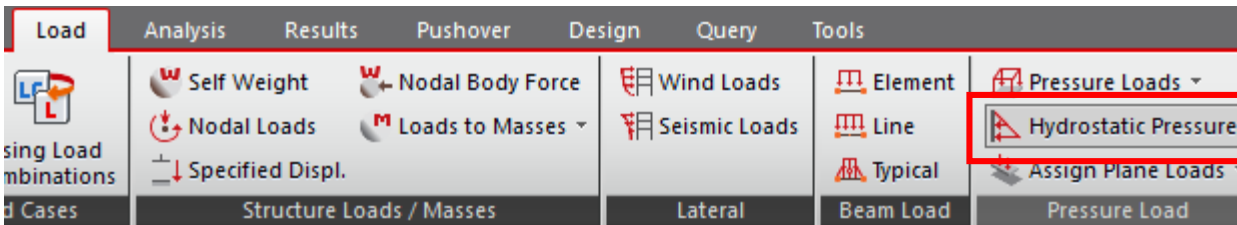
Water:  $g = \text{unit density of water}$

(In case of water, Reference level (H) locates the level of ground water.)

Sand with gravel, dry	1650 ( $kg/m^3$ )
Sand with gravel, wet	2020 ( $kg/m^3$ )
Earth Pressure Coefficient	1
Surcharge $P_o$	600 ( $kg/m^3$ )



# Basement Loads



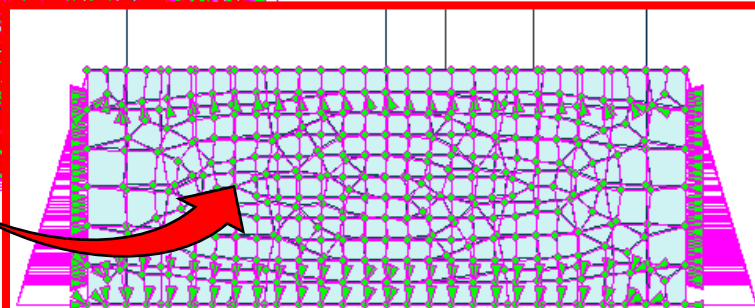
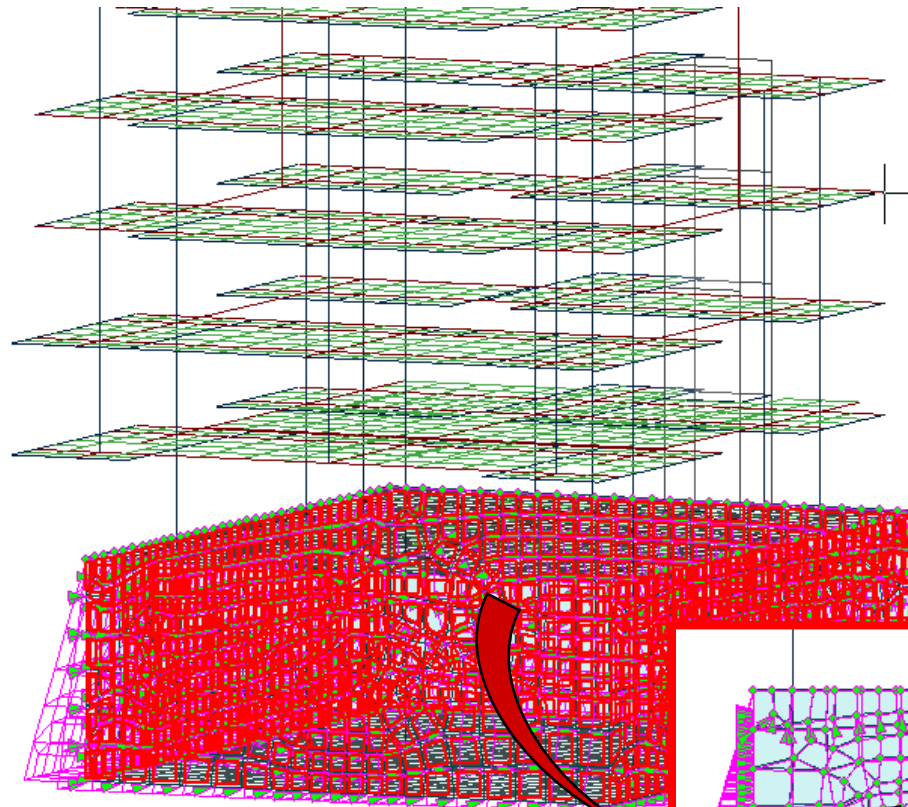
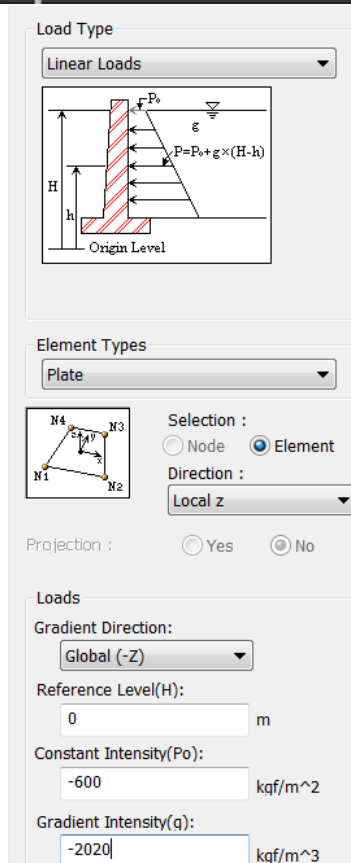
Apply Hydrostatic Pressure

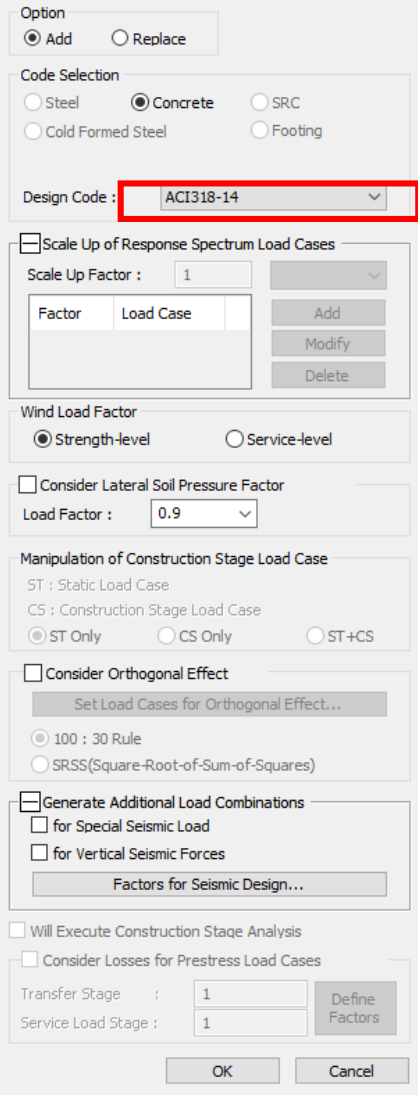
Load Case: earth pressure

Select Basement walls

-600 kgf/m<sup>2</sup> constant intensity

-2020 kgf/m<sup>3</sup> gradient intensity





## Select Concrete and Design

## Auto Generation

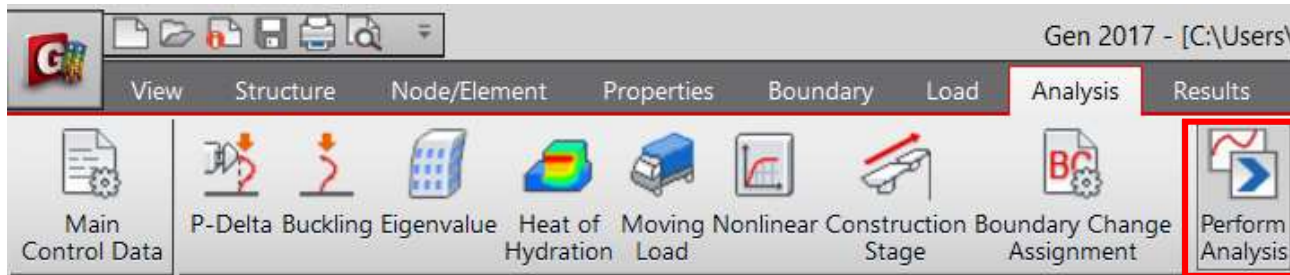
Design Code: ACI318-14







# Perform Analysis



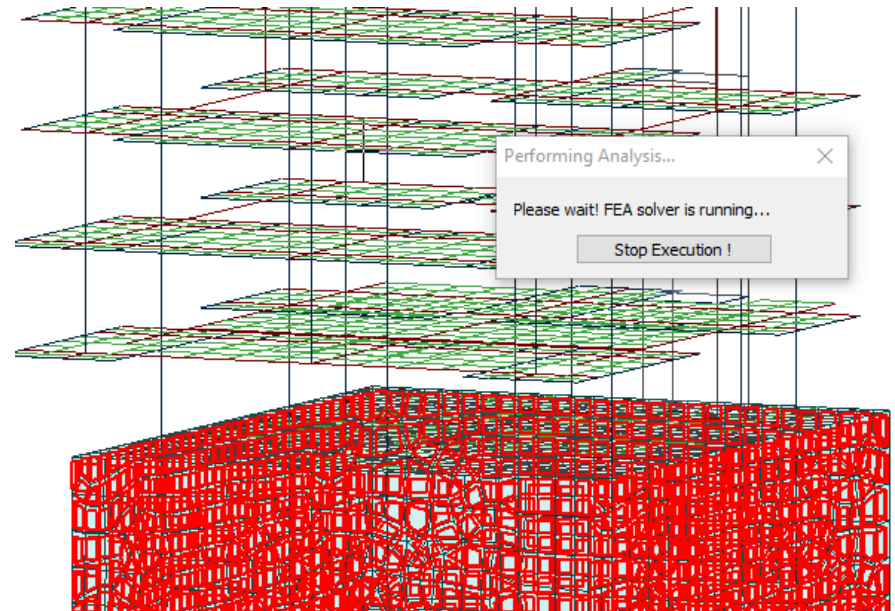
## Check Changed Story Information

Entered story data does not match to the current model. Please check the story data if it has been correctly entered.

Update Story Data ...

Continue

Cancel

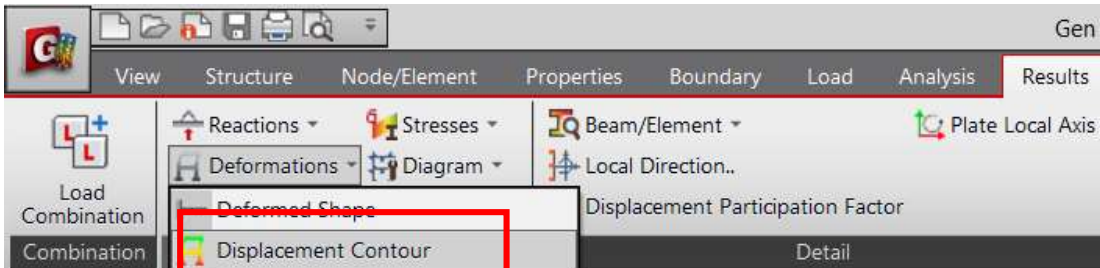


## Message Window

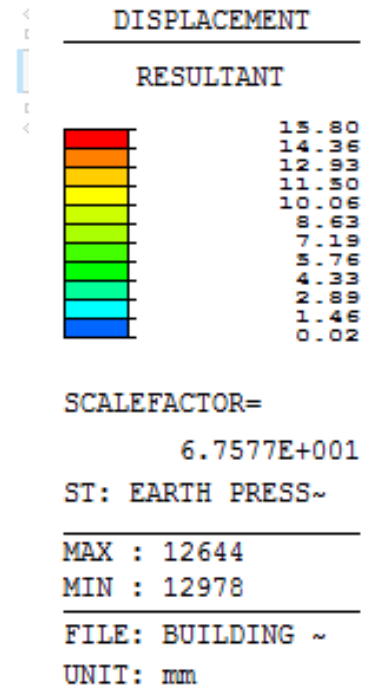
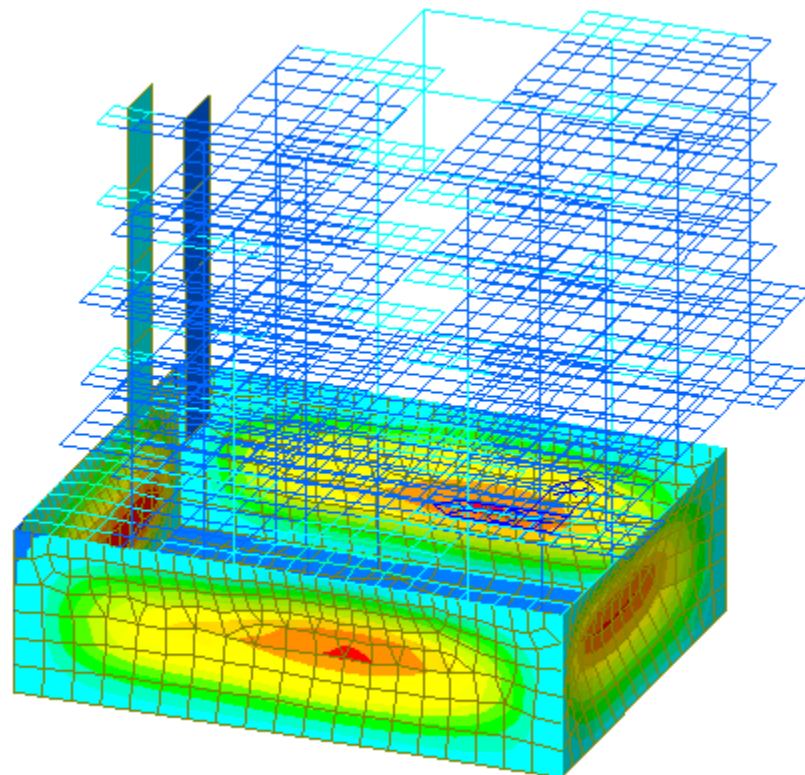
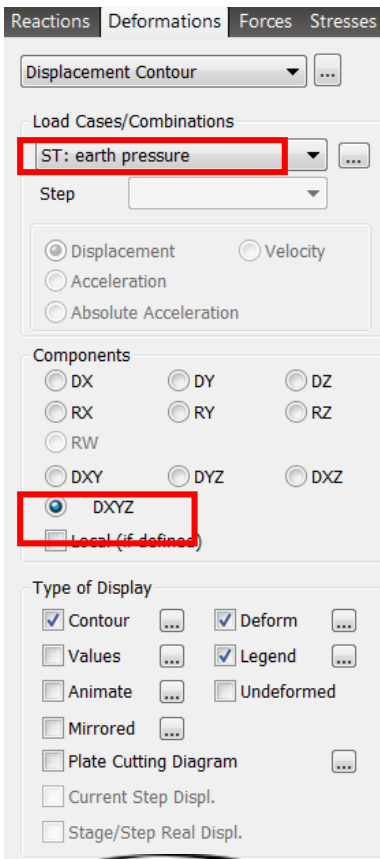
```
-----SOLUTION TERMINATED
YOUR MIDAS JOB IS SUCCESSFULLY COMPLETED.....C:\Users\A.Martinez\Desktop\substructure gen training may 17\Building with basement wall
TOTAL SOLUTION TIME...: 119.91 [SEC]
```



# Results: Deformations



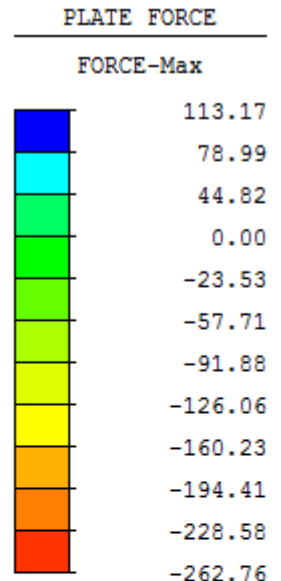
## Check Deformations





# Results: Axial Plate Forces

## Check Axial Forces

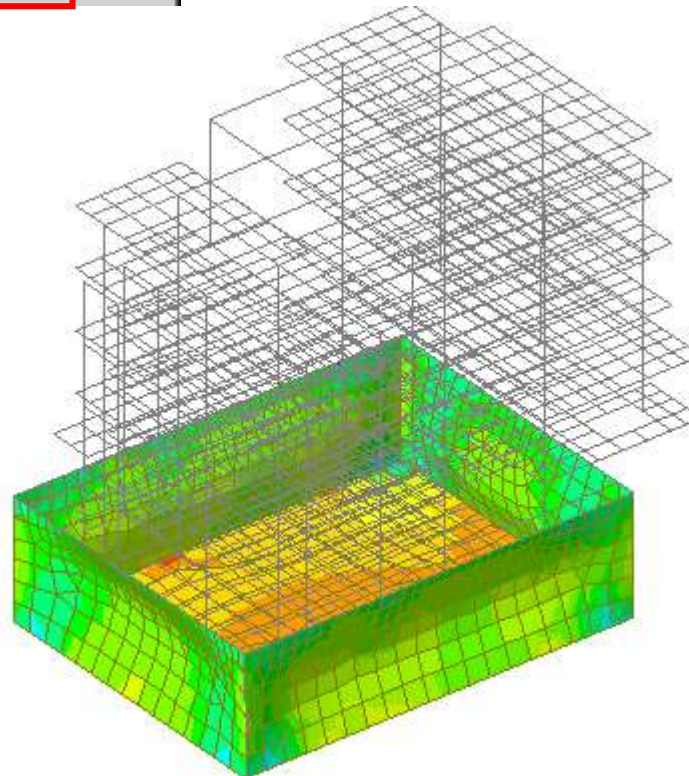


SCALEFACTOR=  
5.1788E+001

ST: EARTH PRESS~  
ELEMENT

MAX : 14725  
MIN : 15457

FILE: BUILDING ~  
UNIT: kN/m



Gen 2

View Structure Node/Element Properties Boundary Load Analysis Results

Reactions Deformations Forces Stresses

Plate Forces/Moments

Load Cases/Combinations

ST: earth pressure

Step

Plate Force Options

Local

UCS Current UCS

Print UCS Axis

Element Avg. Nodal

Avg. Nodal Active Only

Components

Fxx Fyy Fxy

Fmax Fmin FMax

Mxx Myy Mxy

Mmax Mmin MMax

Vxx Vyy VMax

Wood Armer Moment

Reactions

Stresses

Deformations

Diagram

Forces

HY Results

Truss Forces

Beam Forces/Moments

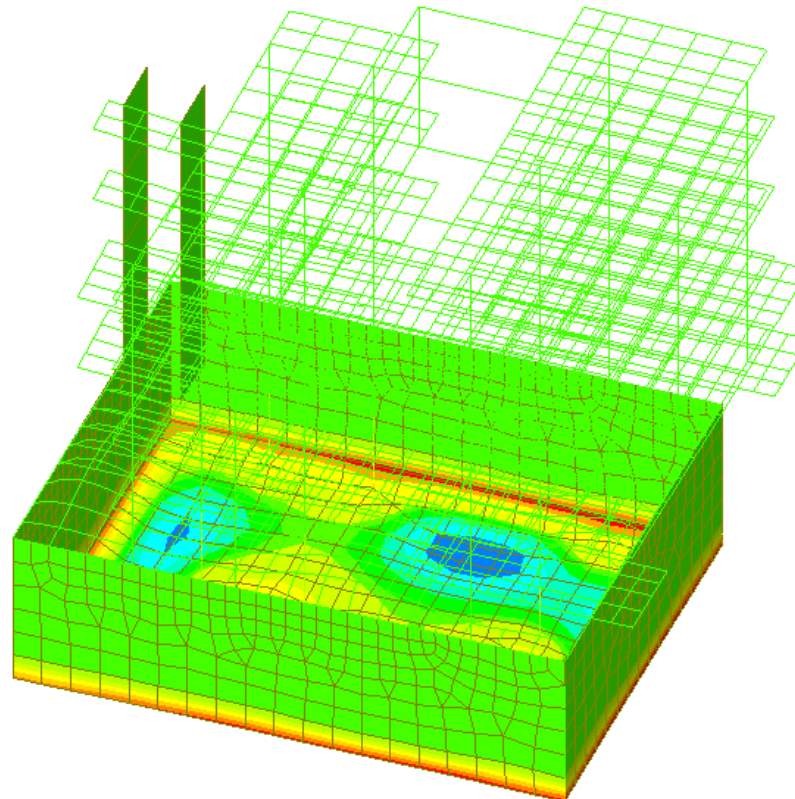
Beam Diagrams

Plate Forces/Moments



# Results: Soil Pressure

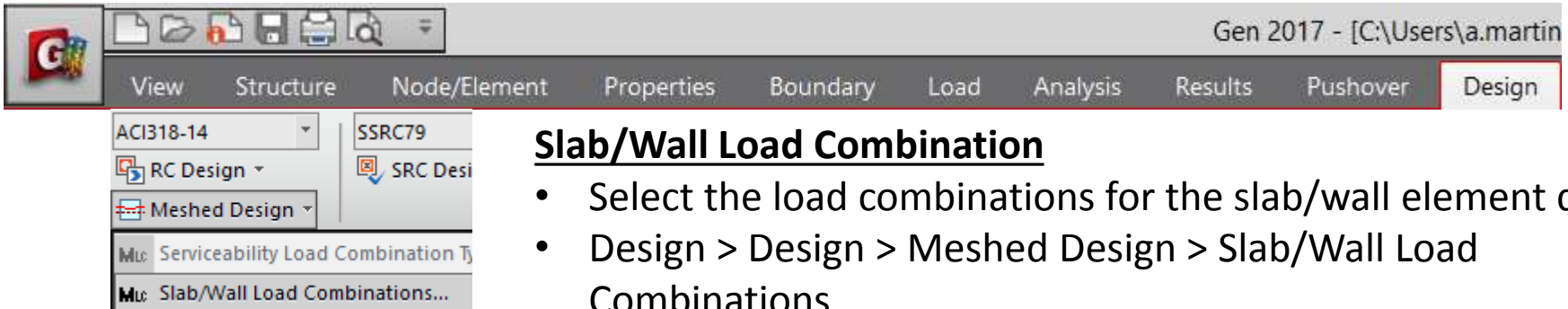
## Check Vertical Soil Pressure



midas Gen POST-PROCESSOR SOIL PRESSURE	
PZ	
	14.75
	12.48
	10.21
	7.94
	5.66
	3.39
	0.00
	-1.15
	-3.43
	-5.70
	-7.97
	-10.24
SCALEFACTOR= 2.4602E+002	
ST: EARTH PRESS~	
MAX : 12166	
MIN : 12824	
FILE: BUILDING ~	
UNIT: kN/m^2	
DATE: 05/17/2017	
VIEW-DIRECTION	
X: -0.658	Z^X
Y: -0.259	
Z: 0.707	

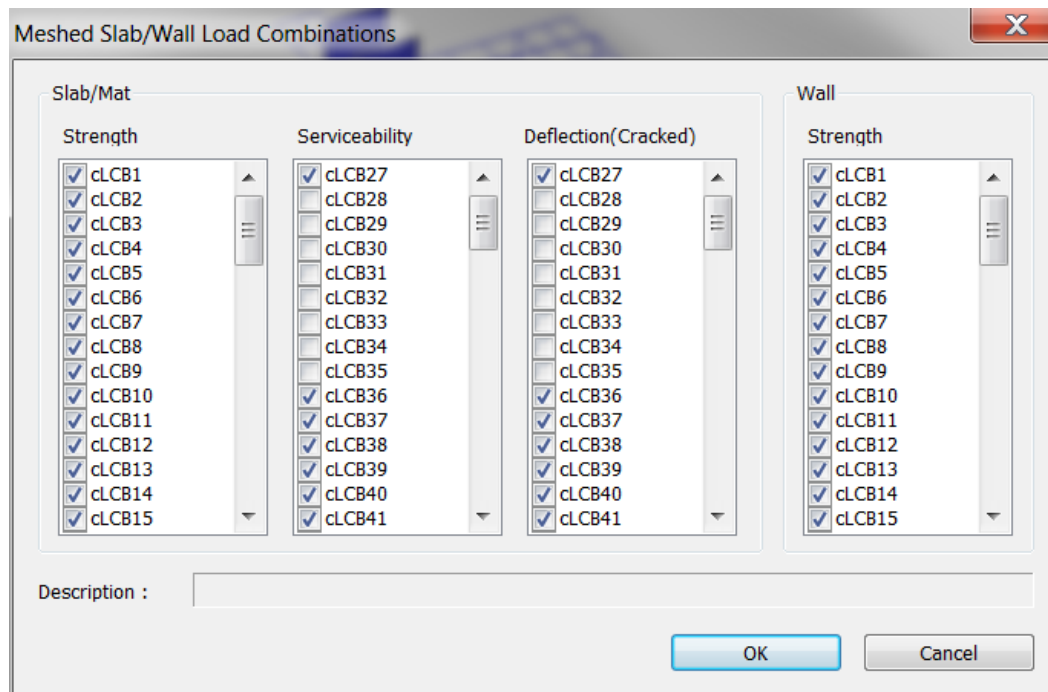


# Slab and wall load combinations



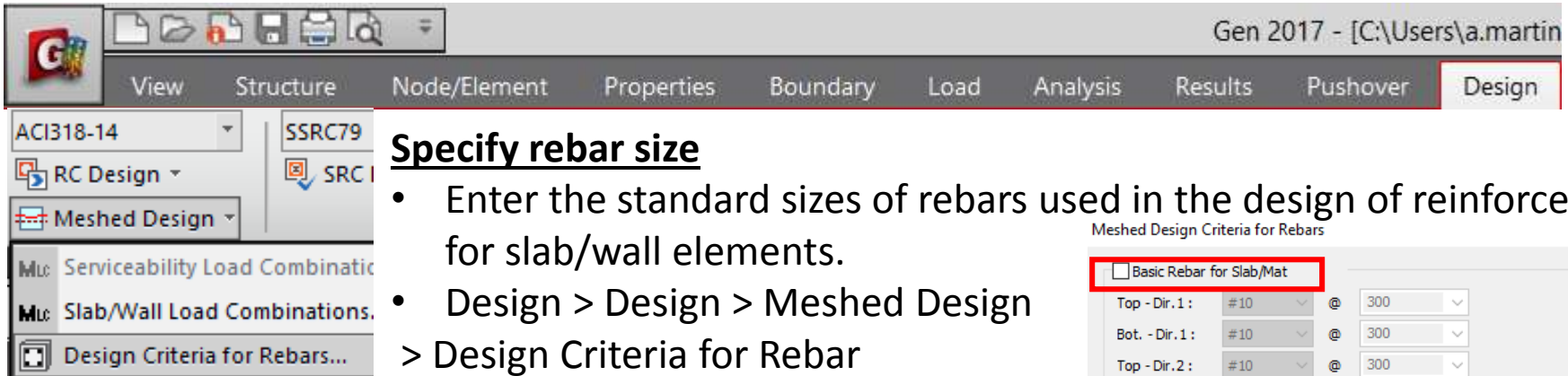
## Slab/Wall Load Combination

- Select the load combinations for the slab/wall element design.
- Design > Design > Meshed Design > Slab/Wall Load Combinations

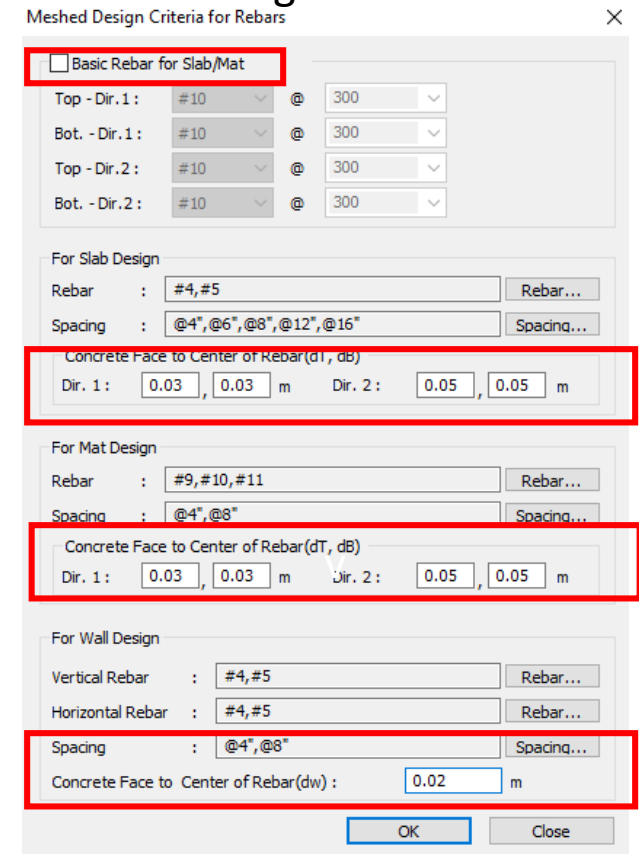
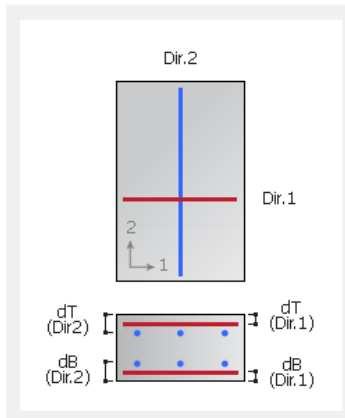




# Define Design Criteria for Rebar



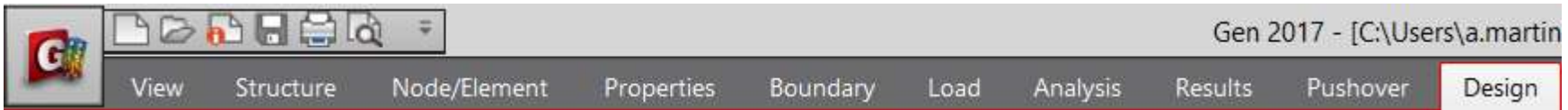
Slab/Mat







# Slab/Wall Rebar Checking Data



## Specify rebar size

- Select all 0.3m slab from tree menu
- Layer Top Dir 1
- Add Rebar 1: #3 @ 100
- Add Rebar 2 #3
- Add/Replace

Slab/Wall Rebars for Checking

Member Type  
☒ Slab/Mat ☐ Wall Type Name : slab

Element List : 15353to15639

Name

Slab/Mat

Layer  
☒ Top-Dir. 1 ☐ Bot.-Dir. 1 ☐ Top-Dir. 2 ☐ Bot.-Dir. 2

Basic Rebar NONE @ 0.000000

Add Rebar 1 #3 @ 100

Add Rebar 2 #3

Cover to Rebar Center : 0.03 m

Wall

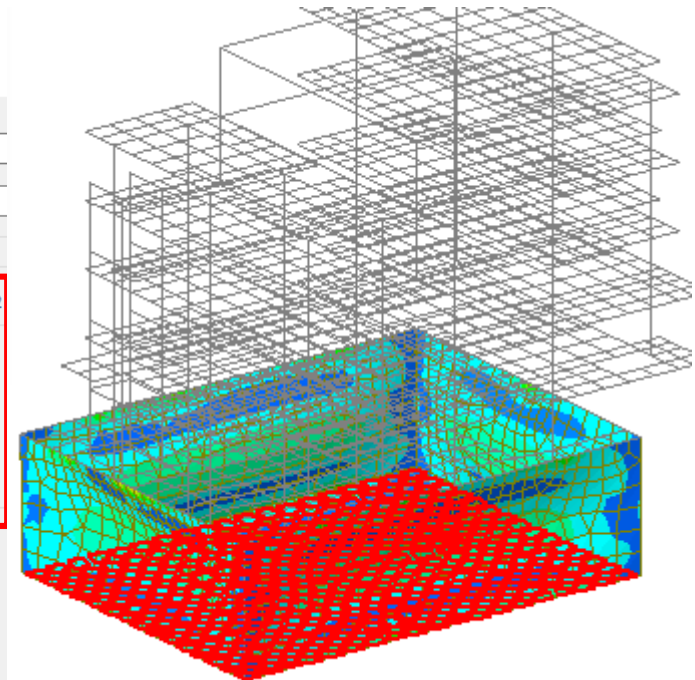
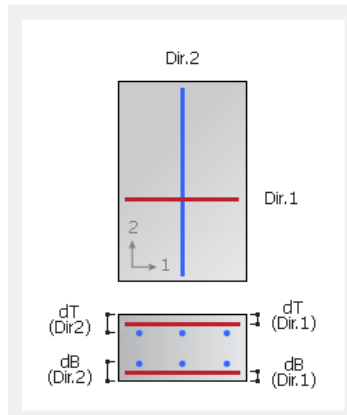
Vertical @

Horizontal @

dw : 0 m

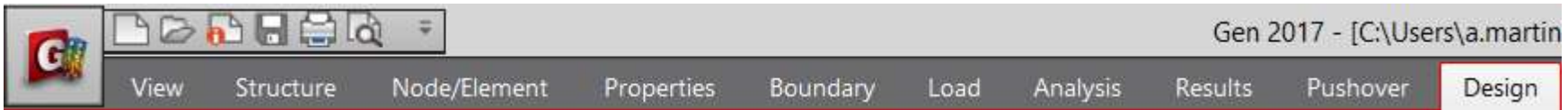
Add/Replace Delete Close

Slab/Mat





# Slab/Wall Rebar Checking Data



## Specify rebar size

- Select all 0.2m walls from tree menu
- Layer Top Dir 1
- Vertical 1: #3 @ 100mm
- Horizontal 2: #3 @ 100mm
- Add/Replace

Slab/Wall Rebars for Checking

Member Type  
☐ Slab/Mat ☒ Wall Type Name : walls

Element List : 3041to3940

Name  
walls

Slab/Mat  
Layer  
☒ Top-Dir.1 ☐ Bot.-Dir.1 ☐ Top-Dir.2 ☐ Bot.-Dir.2

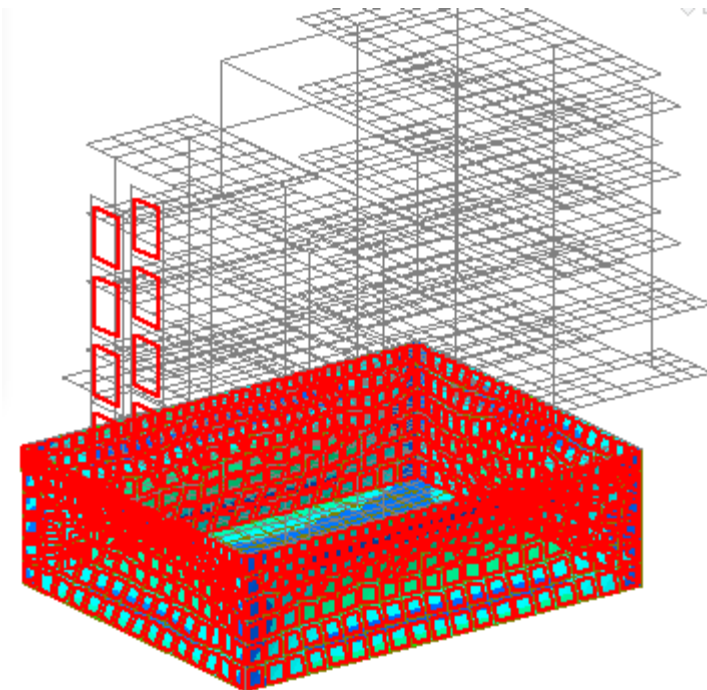
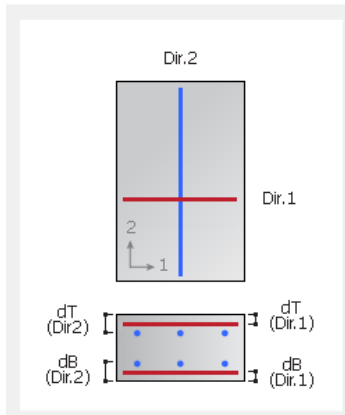
Basic Rebar NONE @ 0.000000  
Add Rebar 1 #4 @ 4.000000  
Add Rebar 2 NONE

Cover to Rebar Center : 0.03 m

Wall  
Vertical #3 @ 100.000000  
Horizontal #3 @ 100.000000  
dw : 0.02 m

Add/Replace Delete Close

Slab/Mat



# Slab Flexural Design

Gen 2017 - [C:\Users\A.Martin]

View Structure Node/Element Properties Boundary Load Analysis Results Pushover **Design**

**Design**

Slab Flexural Design

Load Cases/Combinations  
ALL COMBINATION

☒ Flexural Design

☒ Element ☐ Avg. Nodal

☒ Element ☐ Width 1 m

☐ Top ☐ Bottom ☒ Both

☒ Dir. 1 ☐ Dir. 2

Type of Display  
☒ Contour ☒ Legend  
☐ Values

☐ One-Way Flexural Design  
Element Edge  
☐ Both ☐ Left ☐ Right

☒ Rebar

☒ Rebar

☐ As\_req (m<sup>2</sup>/m)  
☐ Rho\_req  
☐ x/d  
☐ Resistance Ratio  
☐ Wood Armer Moment

Design Result  
Design Force  
**Update Rebar**

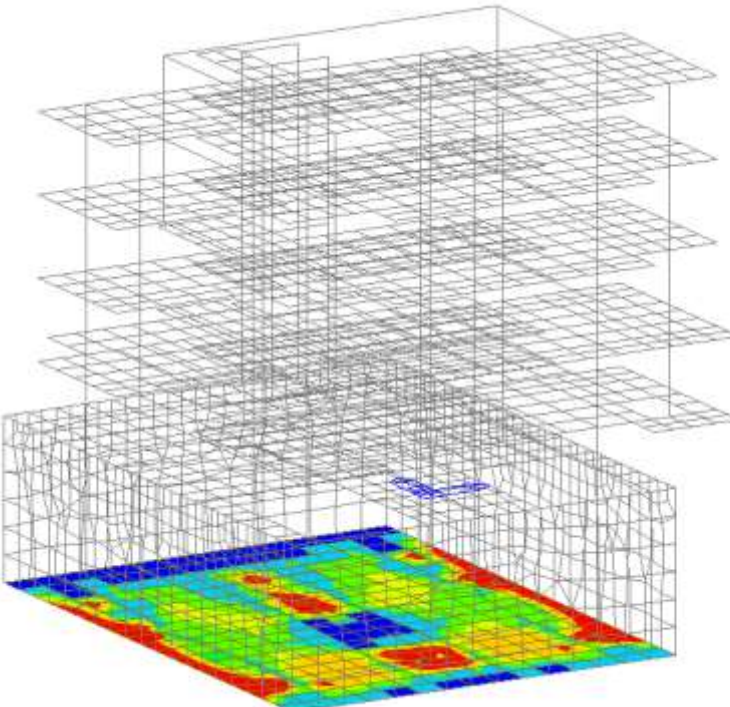
**Run Design**  
Select Avg. Nodal  
Dir. 1  
1. Select Rebar Ratio > Apply  
2. Click: Update rebar

Meshed Design

Serviceability Load Combination Type...  
Slab/Wall Load Combinations...  
Design Criteria for Rebars...  
Slab/Wall Rebars for Checking...  
Serviceability Parameters...  
**Slab Flexural Design...**

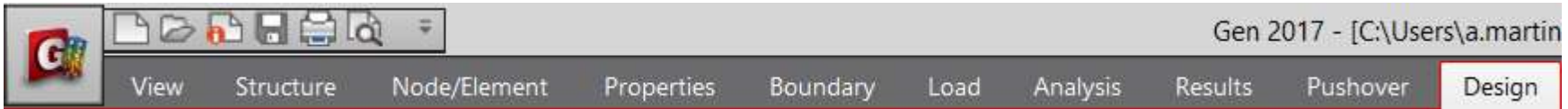
**SLAB DESIGN**

Red	#5@101
Orange	#5@152
Yellow	#4@101
Light Green	#5@203
Green	#4@152
Dark Green	#5@304
Cyan	#4@203
Blue	#5@406
Dark Blue	None



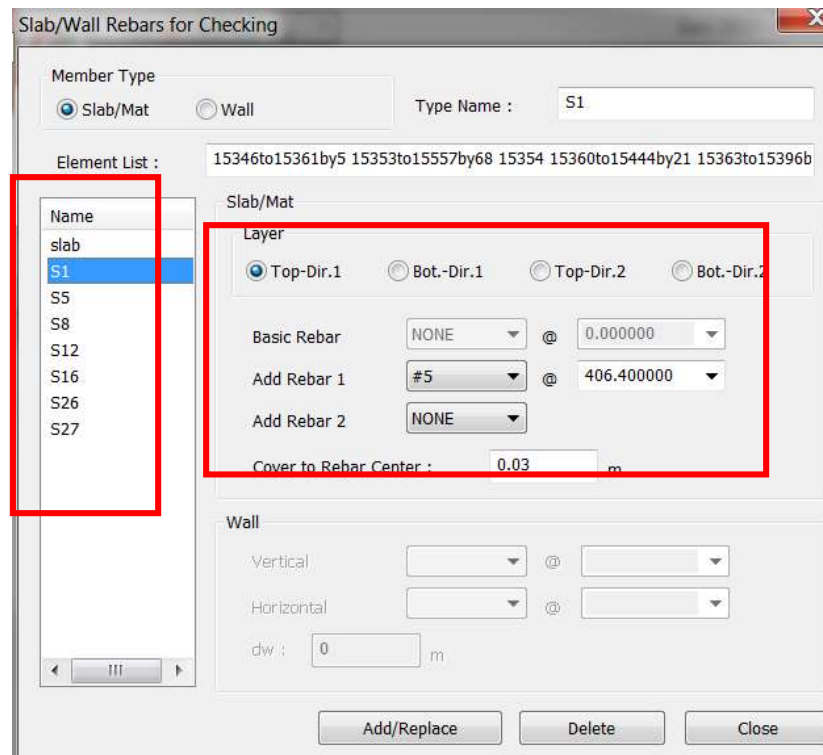
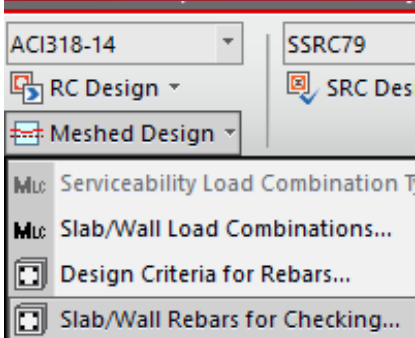


# Slab/Wall Rebar Checking Data

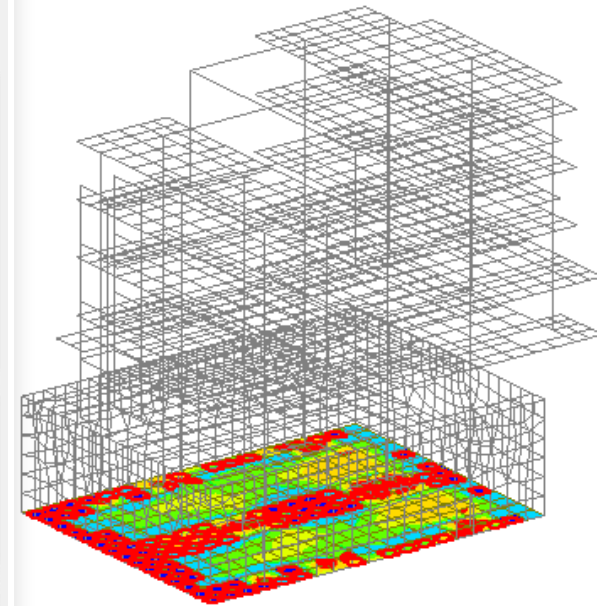
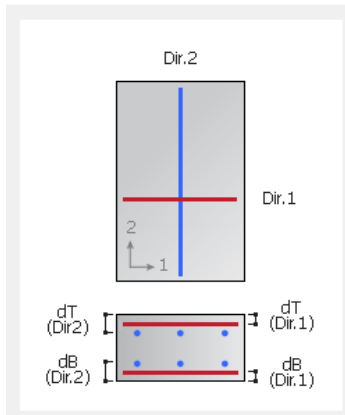


## Rebar Update

New sets of reinforcement were automatically created for parts of slab



Slab/Mat







# Wall Design

Gen 2017 - [C:\Users\A.Martin]

View Structure Node/Element Properties Boundary Load Analysis Results Pushover **Design**

**Design**

Wall Design

Load Combinations  
ALL COMBINATION

☒ Element ☐ Avg. Nodal

☒ Element ☐ Width 1 m

☒ Horizontal ☐ Vertical  
☐ Sig\_cd (concrete)

Type of Display  
☒ Contour ☒ Legend  
☐ Values

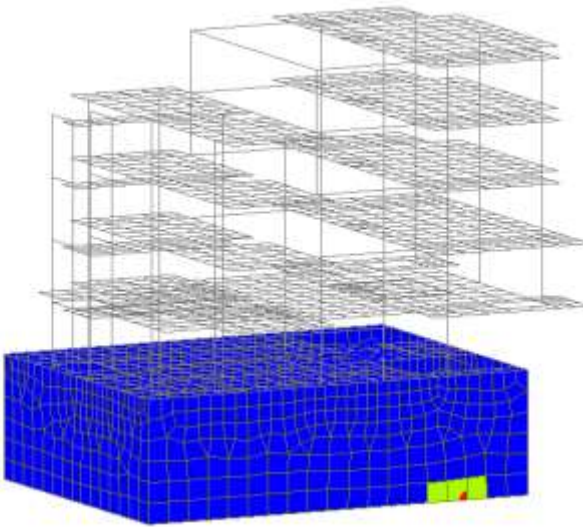
☒ Rebar  
☐ As\_req ( $m^2/m$ )  
☐ Rho\_req  
☐ Resistance Ratio

Design Result  
Design Force  
**Update Rebar**

**Run Design**  
Specify Design Criteria  
1. Select Rebar Ratio > Apply  
2. Click: Update rebar

Meshed Design

- Serviceability Load Combination Type...
- Slab/Wall Load Combinations...
- Design Criteria for Rebars...
- Slab/Wall Rebars for Checking...
- Serviceability Parameters...
- Slab Flexural Design...
- Slab Flexural Checking...
- Slab Shear Checking...
- Slab Serviceability Checking...
- Cracked Section Analysis Control...
- Perform Cracked Section Analysis
- Wall Design...**



WALL DESIGN	
Red	#4 @101
Yellow	#5 @203
Green	#4 @203
Blue	None