CONCRETE PROJECT

BUILDING 18

SUPERVISORS:

DR. MOHAMED NABIL .

DR. AMR ZAHER .

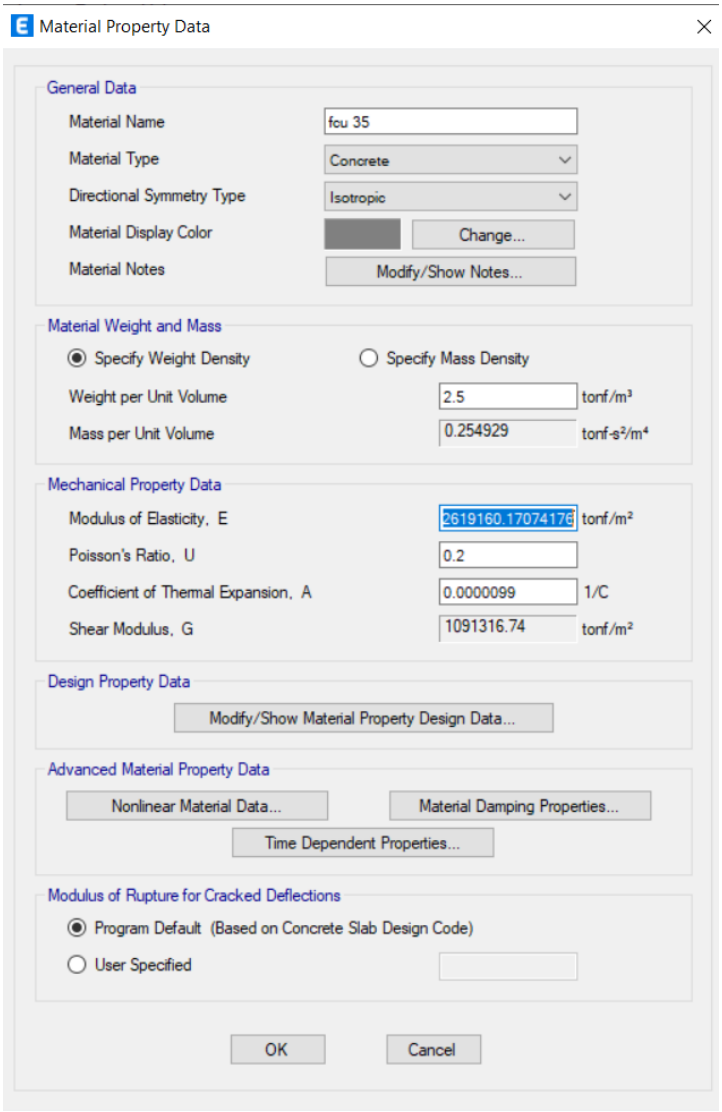
DESIGBNED BY :

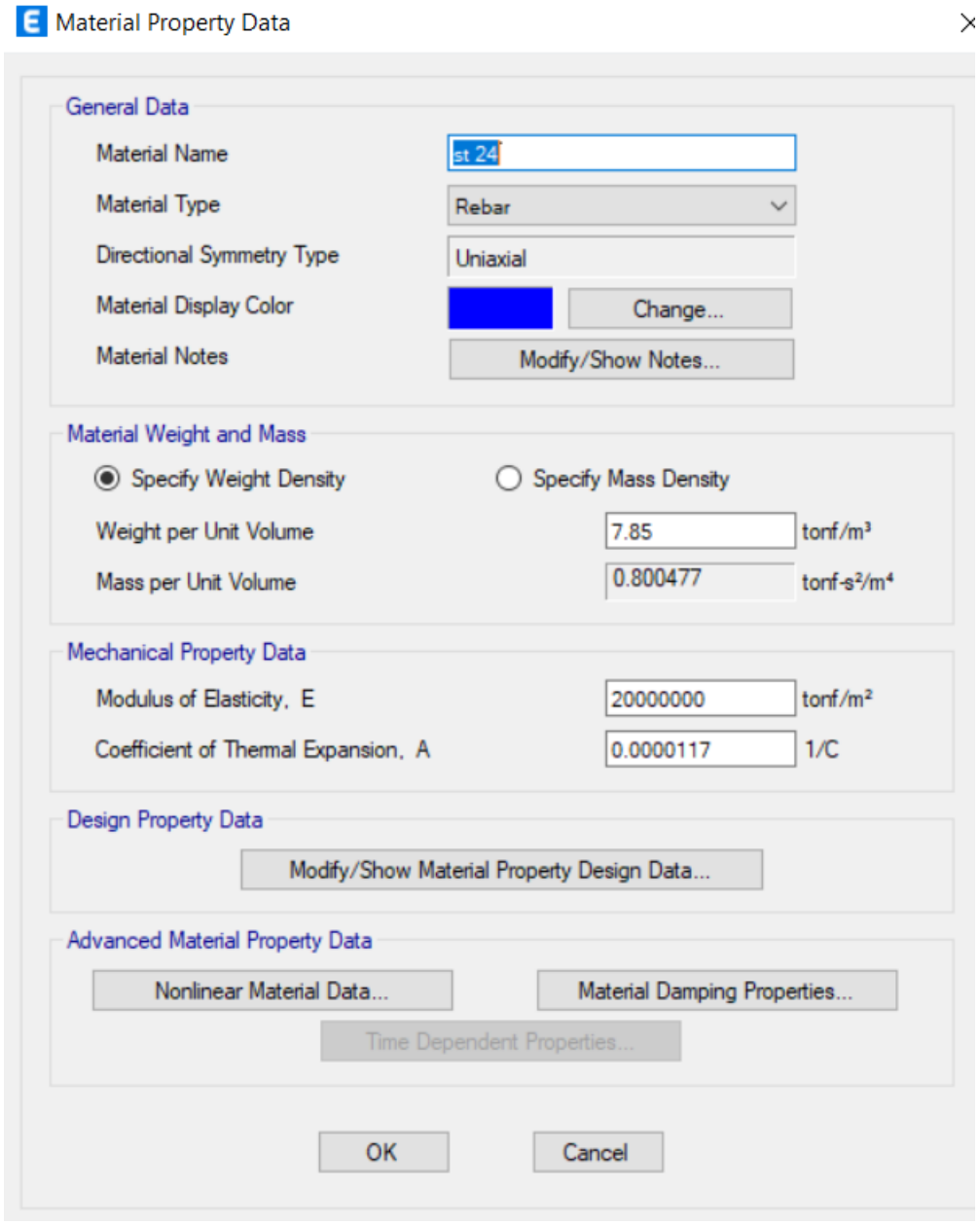
MOHAMED FARID .

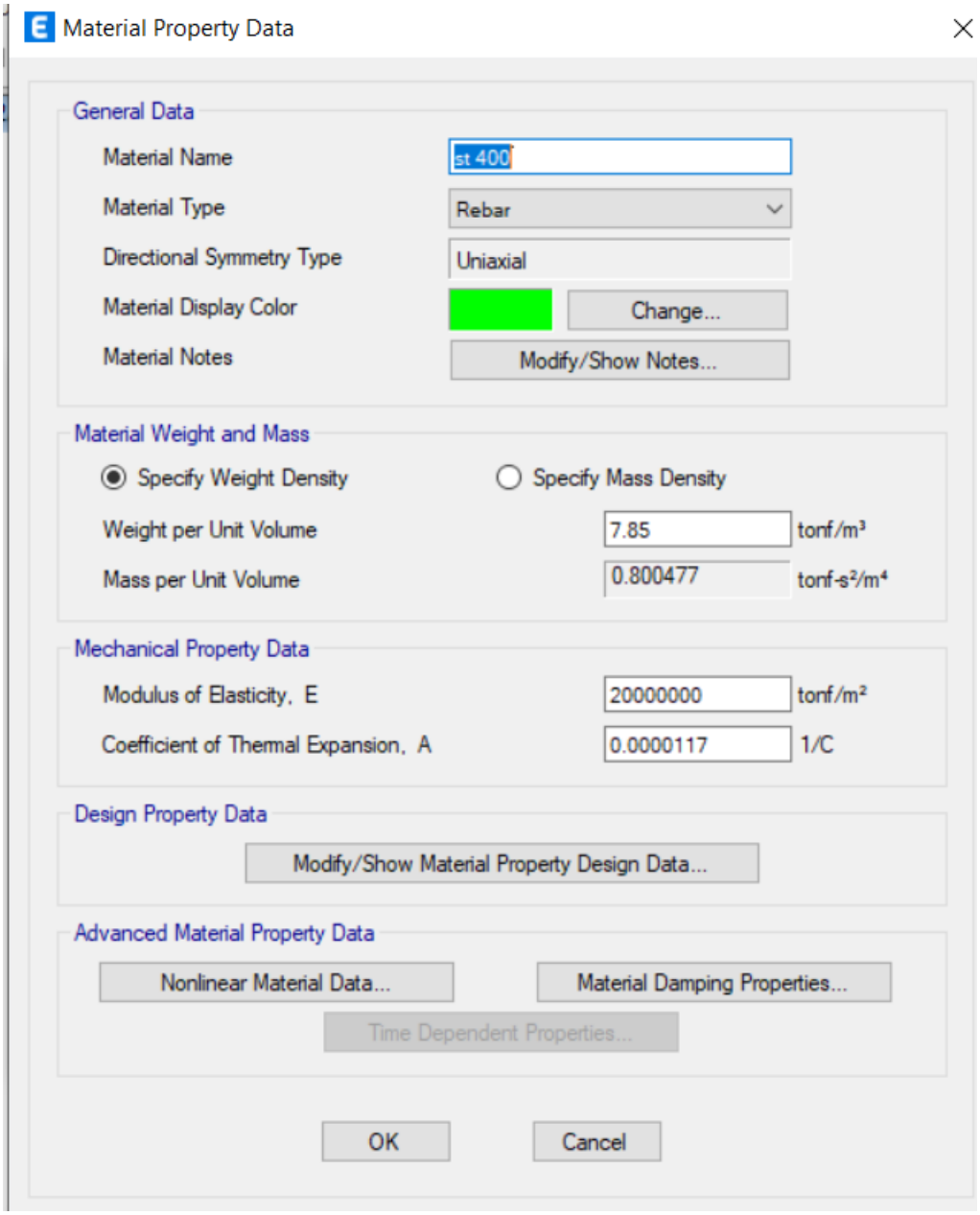
1601254

USING ETABS 20

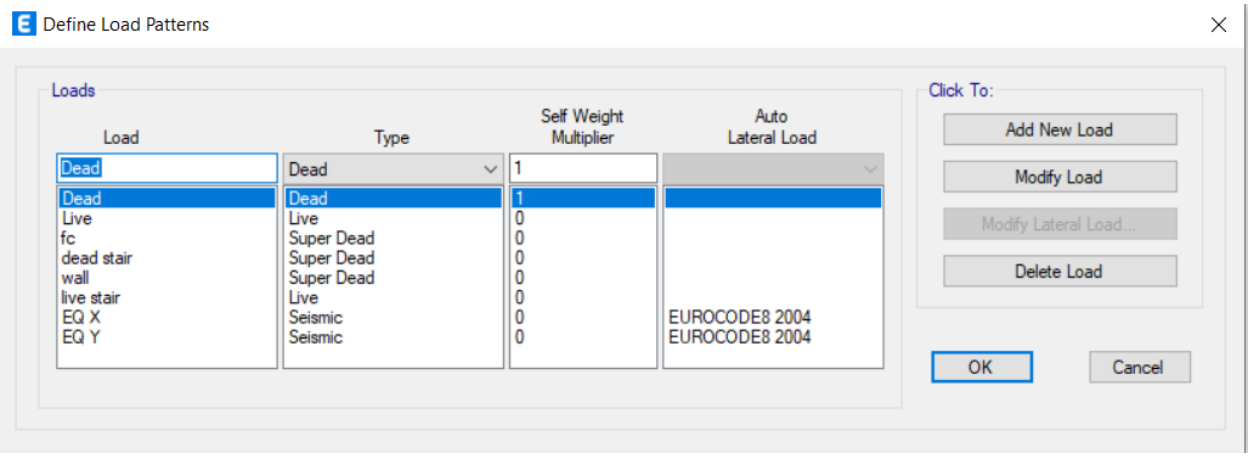
DEFINE MATERIAL :

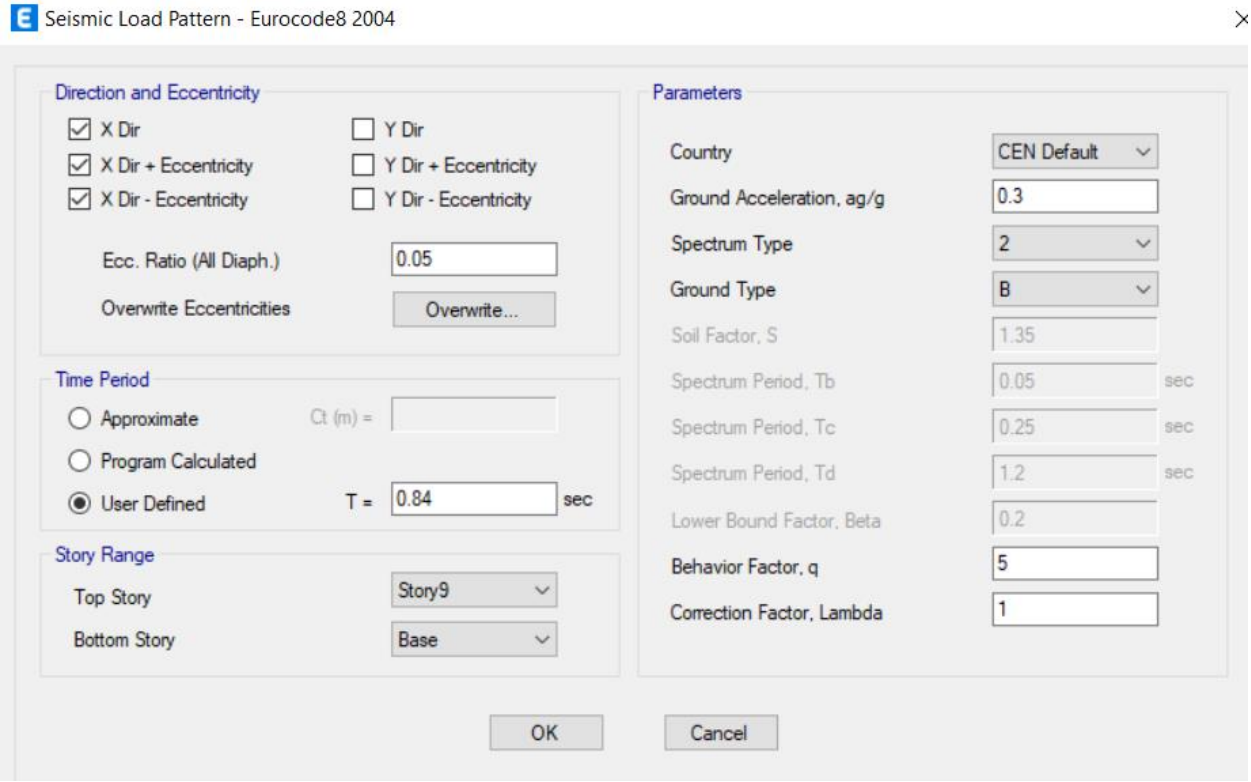


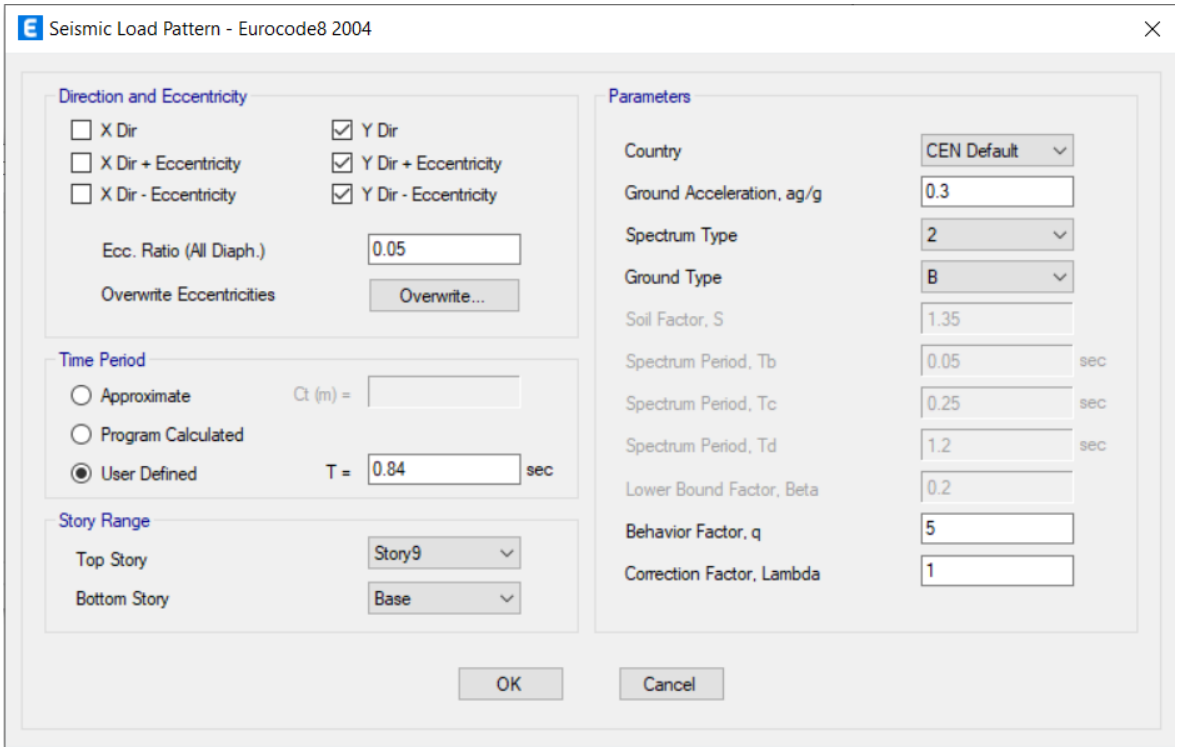

Material Property Data
General Data
Material Name
st 24
Material Type
Rebar
Directional Symmetry Type
Uniaxial
Material Display Color
Change...
Material Notes
Modify/Show Notes...
Material Weight and Mass
Specify Weight Density
Specify Mass Density
Weight per Unit Volume
7.85
tonf/m³
Mass per Unit Volume
0.800477
tonf-s²/m⁴
Mechanical Property Data
Modulus of Elasticity, E
20000000
tonf/m²
Coefficient of Thermal Expansion, A
0.0000117
1/C
Design Property Data
Modify/Show Material Property Design Data...
Advanced Material Property Data
Nonlinear Material Data...
Material Damping Properties...
Time Dependent Properties...
OK
Cancel

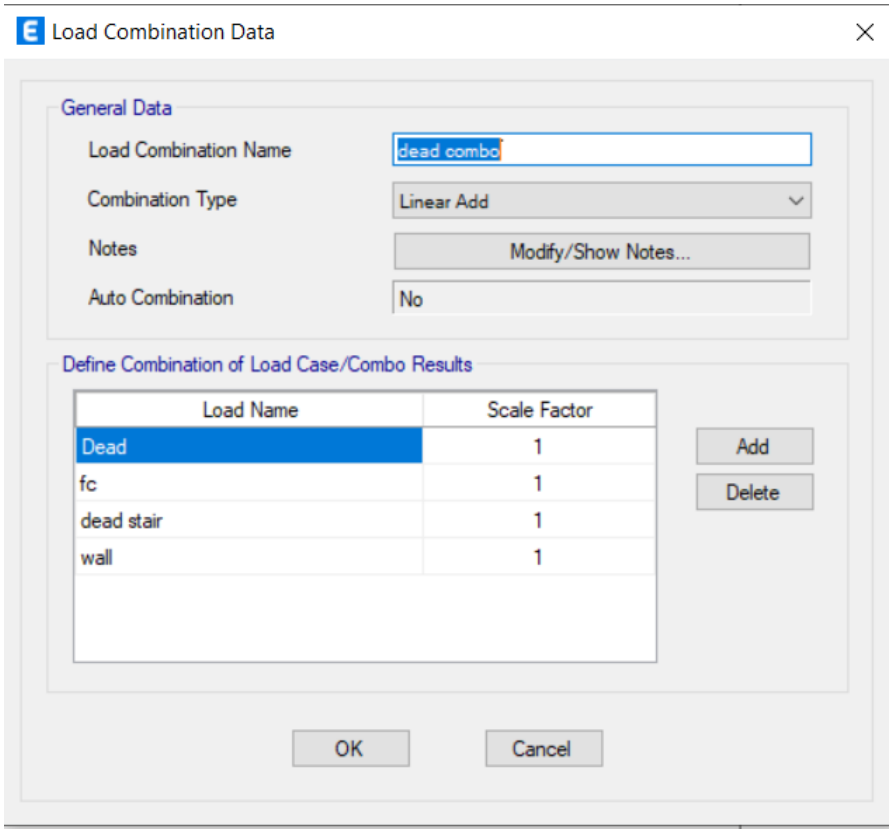

Material Property Data
General Data
Material Name
st 400
Material Type
Rebar
Directional Symmetry Type
Uniaxial
Material Display Color
Change...
Material Notes
Modify/Show Notes...
Material Weight and Mass
Specify Weight Density
Specify Mass Density
Weight per Unit Volume
7.85
tonf/m³
Mass per Unit Volume
0.800477
tonf-s²/m⁴
Mechanical Property Data
Modulus of Elasticity, E
20000000
tonf/m²
Coefficient of Thermal Expansion, A
0.0000117
1/C
Design Property Data
Modify/Show Material Property Design Data...
Advanced Material Property Data
Nonlinear Material Data...
Material Damping Properties...
Time Dependent Properties...
OK
Cancel

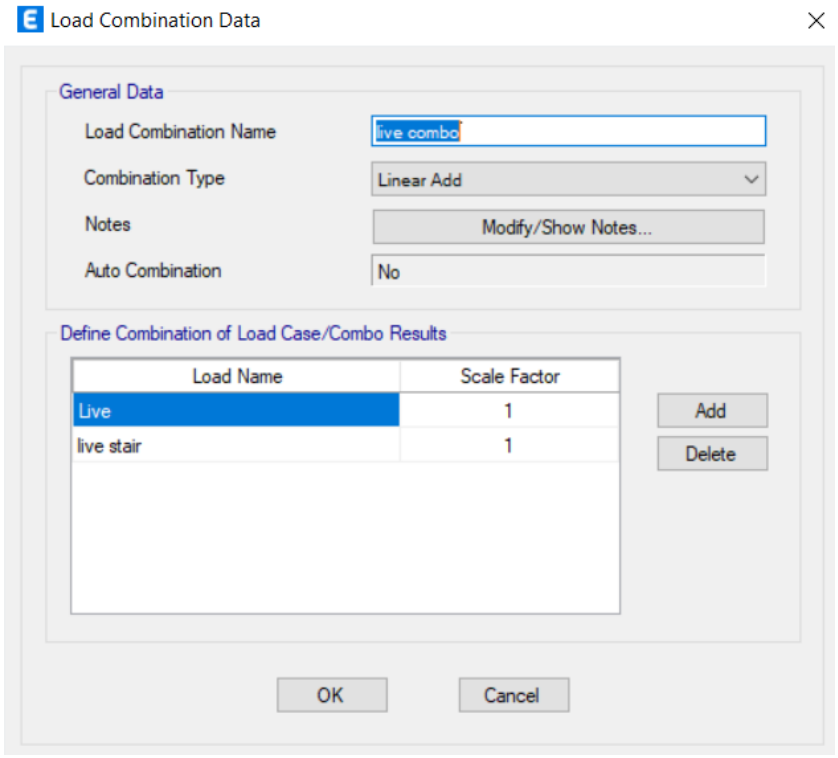
LOAD PATEREN :

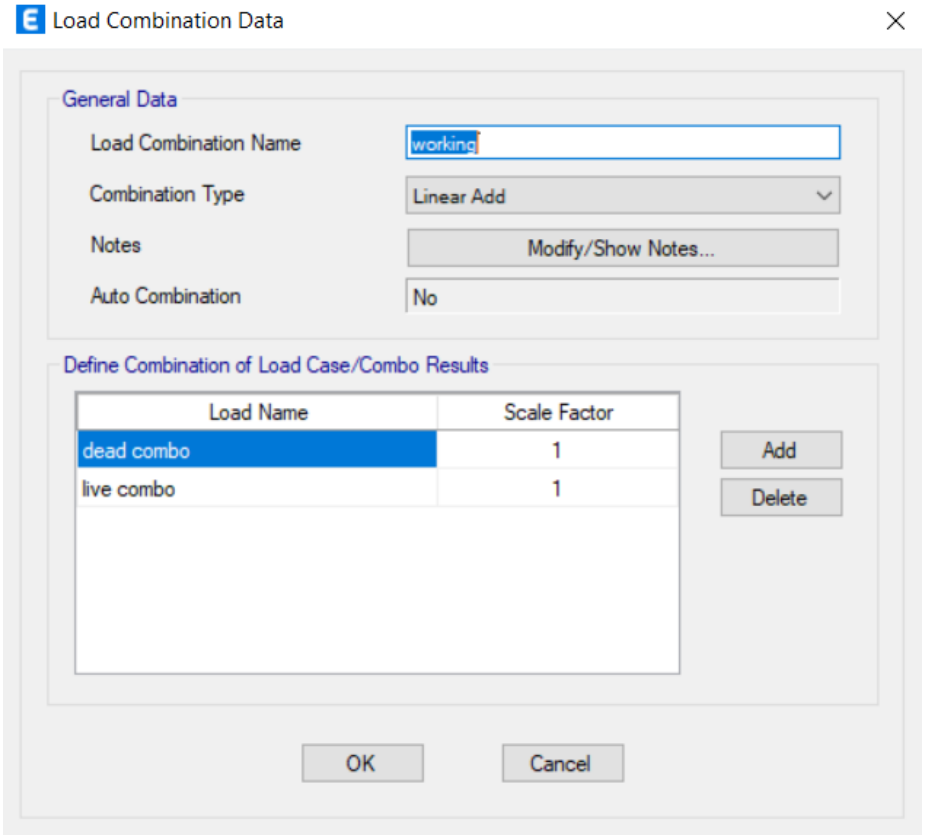


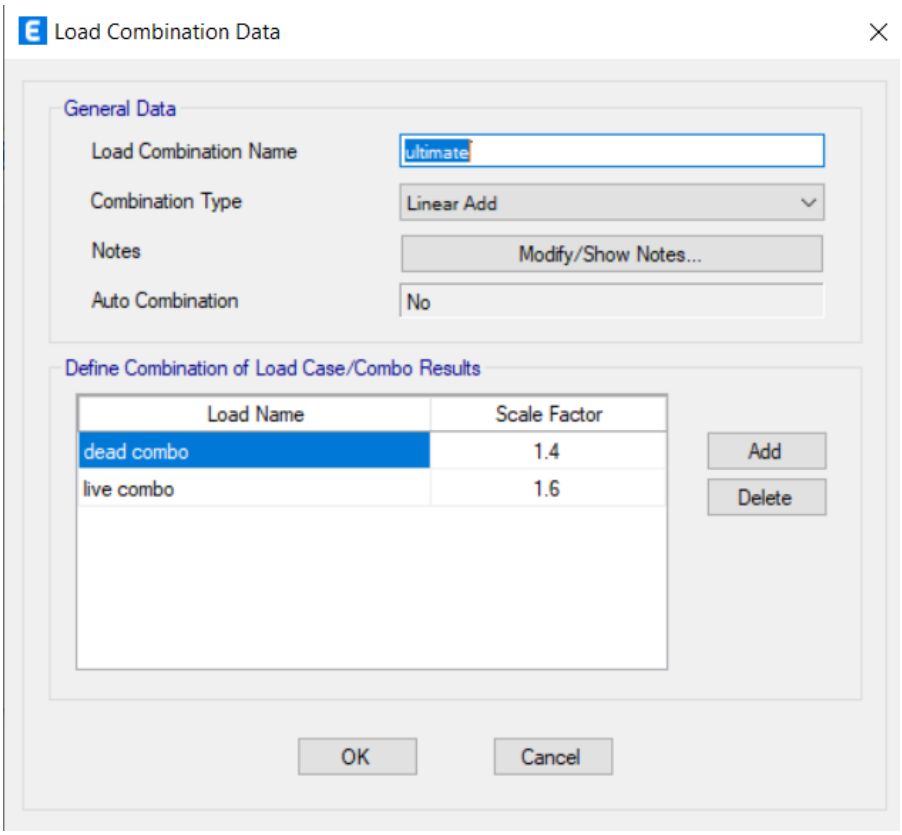



Seismic Load Pattern - Eurocode8 2004
Direction and Eccentricity
X Dir
Y Dir
X Dir + Eccentricity
Y Dir + Eccentricity
X Dir - Eccentricity
Y Dir - Eccentricity
Ecc. Ratio (All Diaph.)
0.05
Overwrite Eccentricities
Overwrite...
Time Period
Approximate
Ct (m) =
Program Calculated
User Defined
T =
0.84
sec
Story Range
Top Story
Story9
Bottom Story
Base
Parameters
Country
CEN Default
Ground Acceleration, ag/g
0.3
Spectrum Type
2
Ground Type
B
Soil Factor, S
1.35
Spectrum Period, Tb
0.05
sec
Spectrum Period, Tc
0.25
sec
Spectrum Period, Td
1.2
sec
Lower Bound Factor, Beta
0.2
Behavior Factor, q
5
Correction Factor, Lambda
1
OK
Cancel

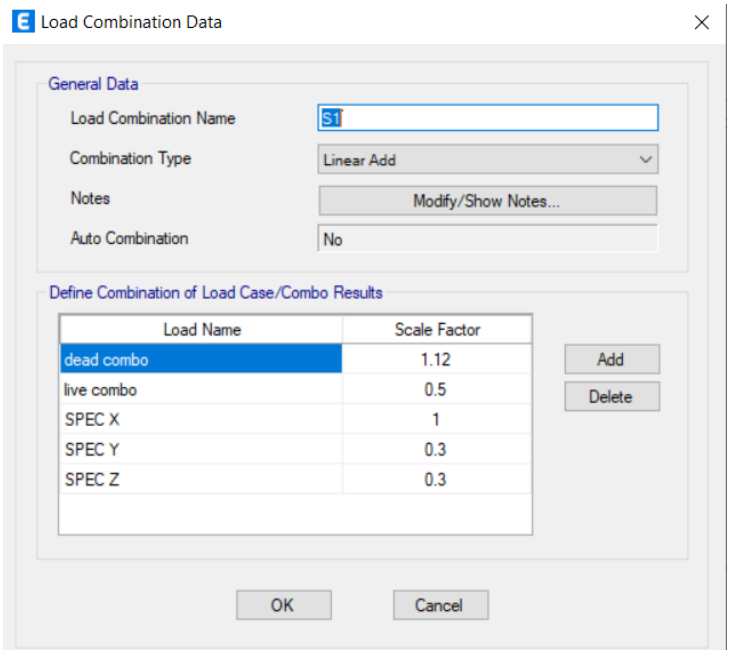

Load Combination Data
General Data
Load Combination Name
dead combo
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
Dead
1
fc
1
dead stair
1
wall
1
Add
Delete
OK
Cancel

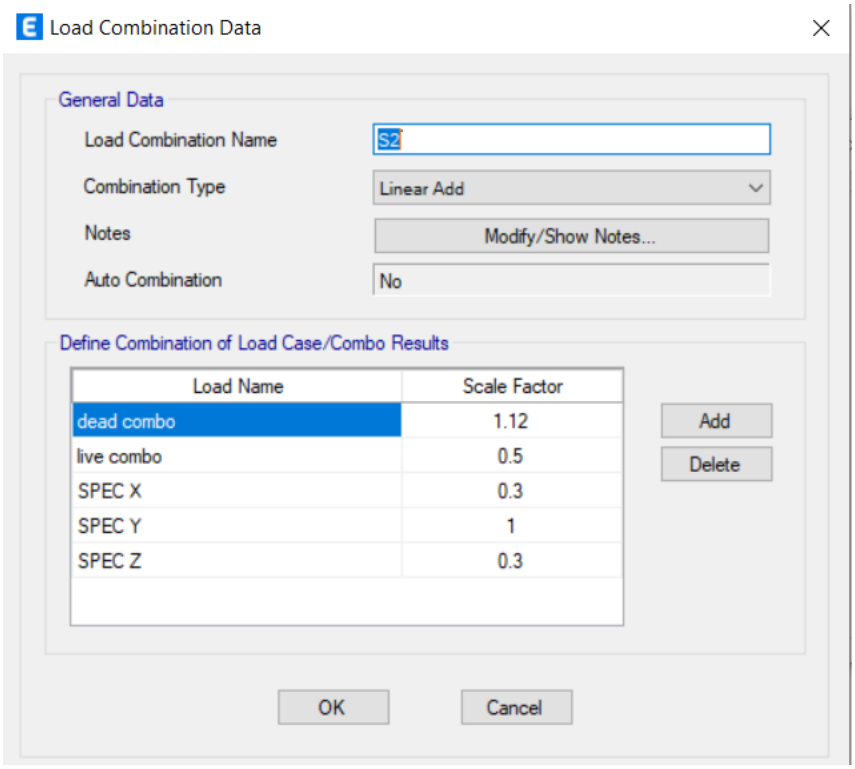

Load Combination Data
General Data
Load Combination Name
live combo
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
Live
1
live stair
1
Add
Delete
OK
Cancel

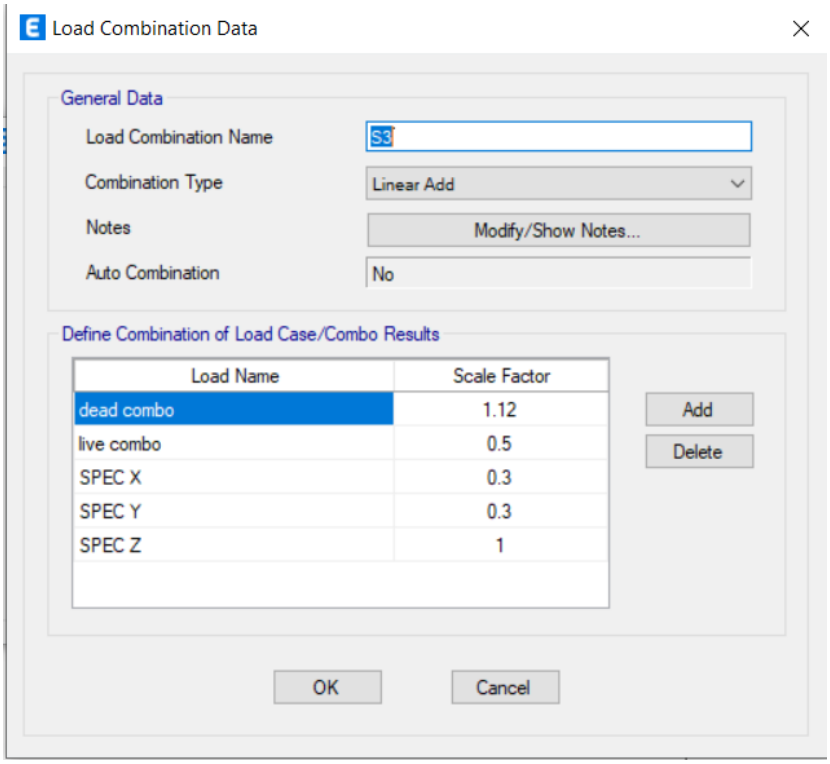

Load Combination Data
General Data
Load Combination Name
working
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
dead combo
1
live combo
1
Add
Delete
OK
Cancel

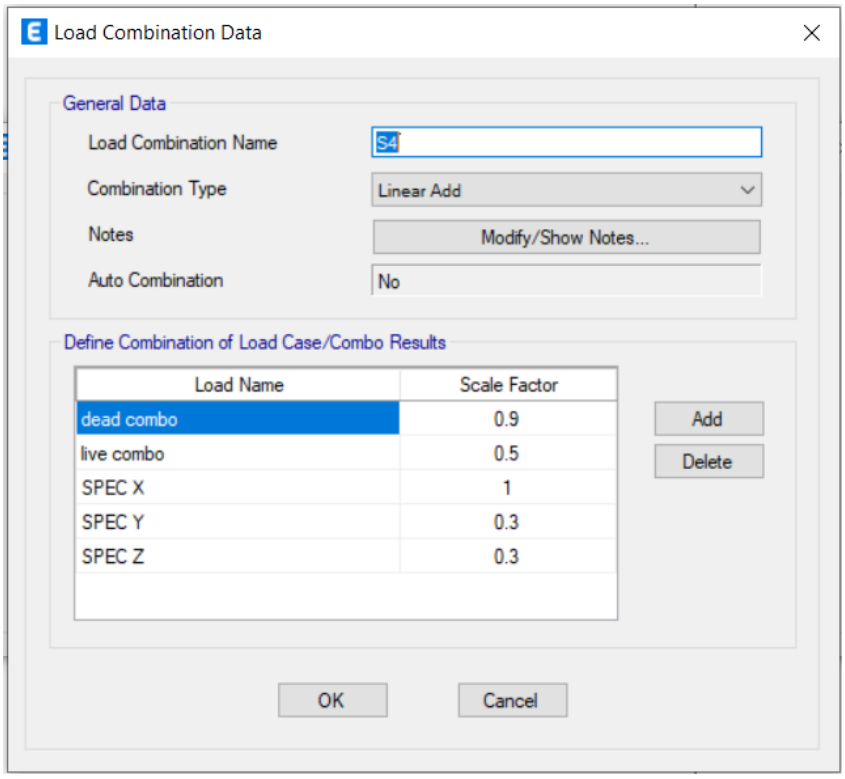


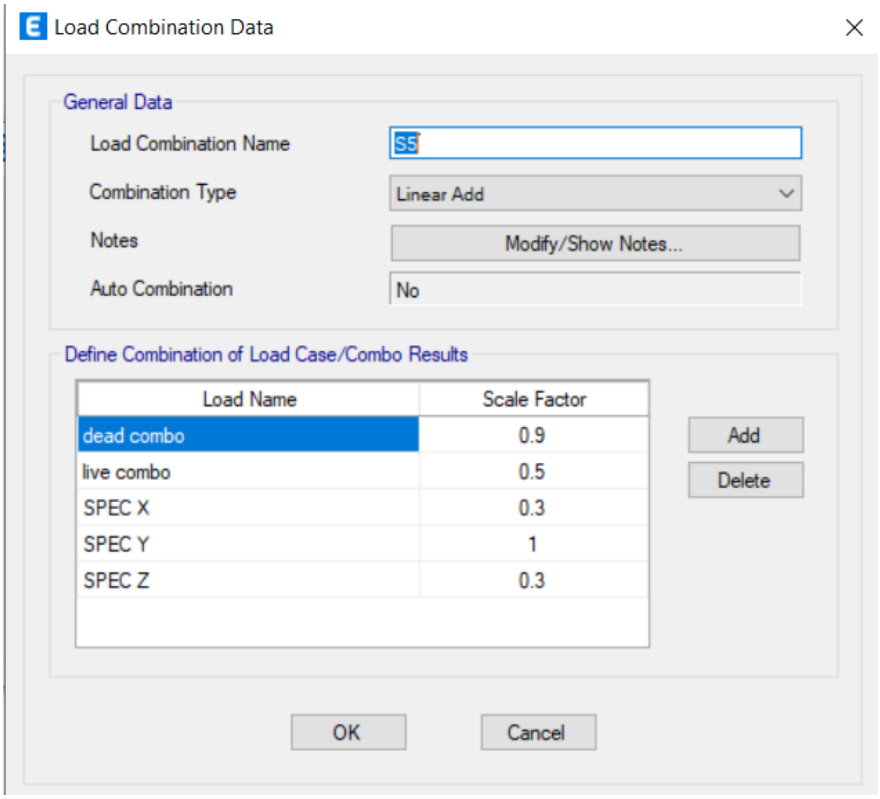
FOR EARTHQUICKS :

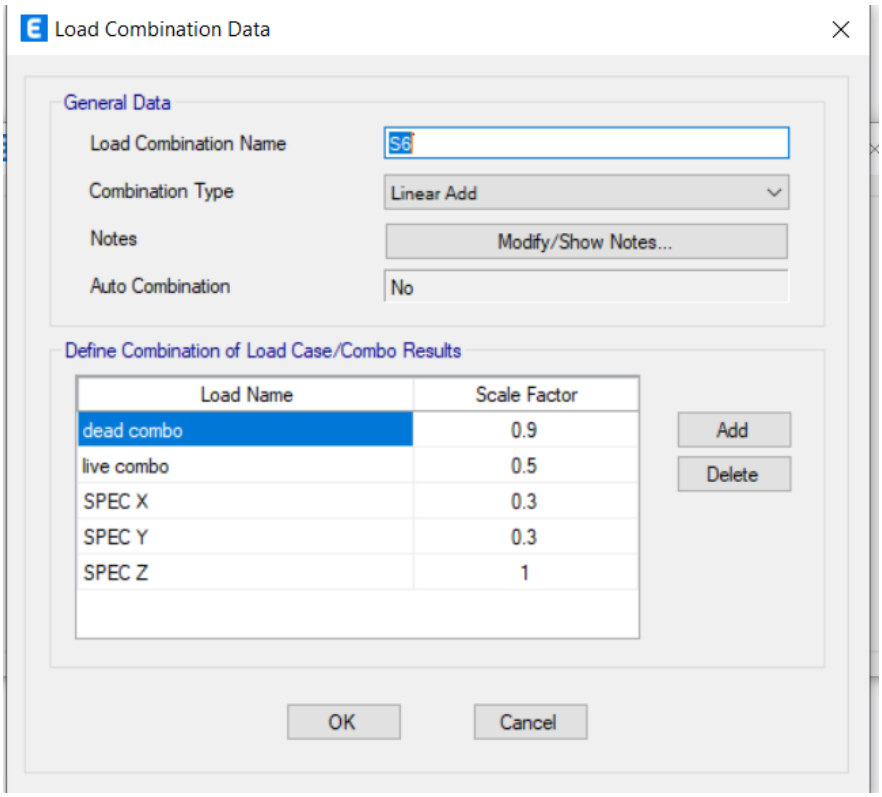



Load Combination Data
General Data
Load Combination Name
S2
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
dead combo
1.12
live combo
0.5
SPEC X
0.3
SPEC Y
1
SPEC Z
0.3
Add
Delete
OK
Cancel

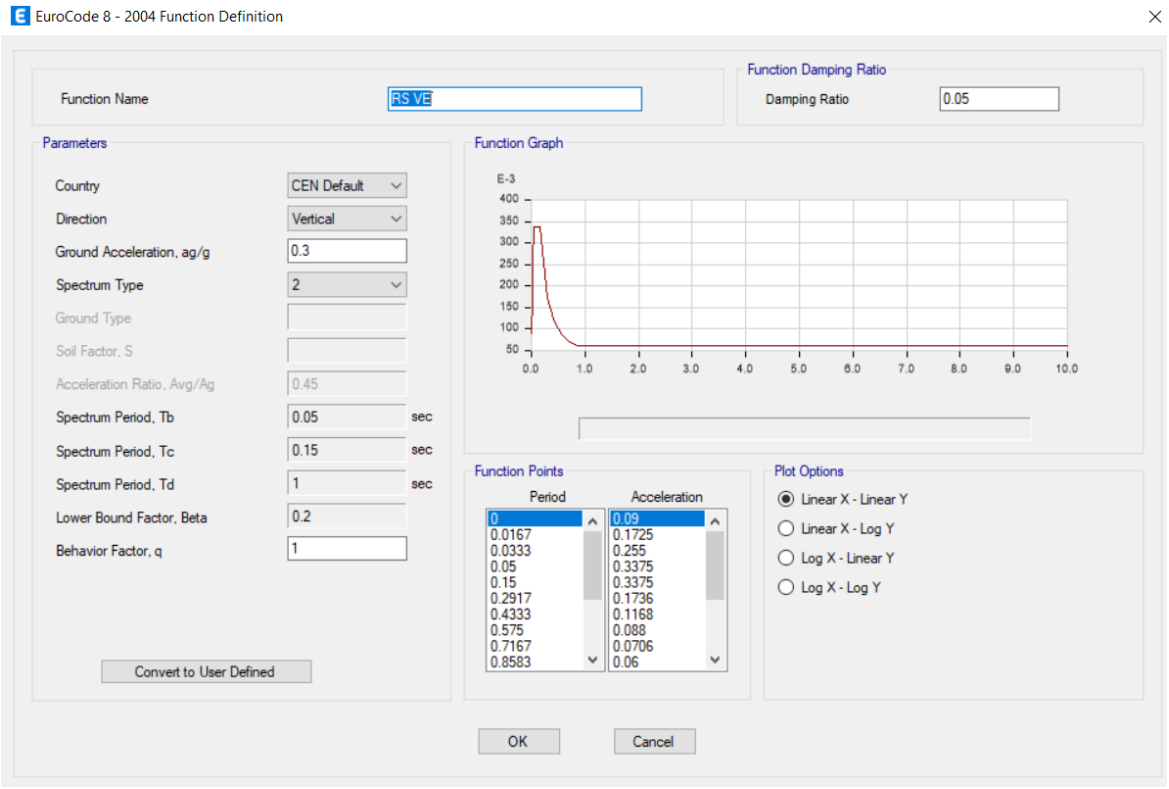

Load Combination Data
General Data
Load Combination Name
S3
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
dead combo
1.12
live combo
0.5
SPEC X
0.3
SPEC Y
0.3
SPEC Z
1
Add
Delete
OK
Cancel

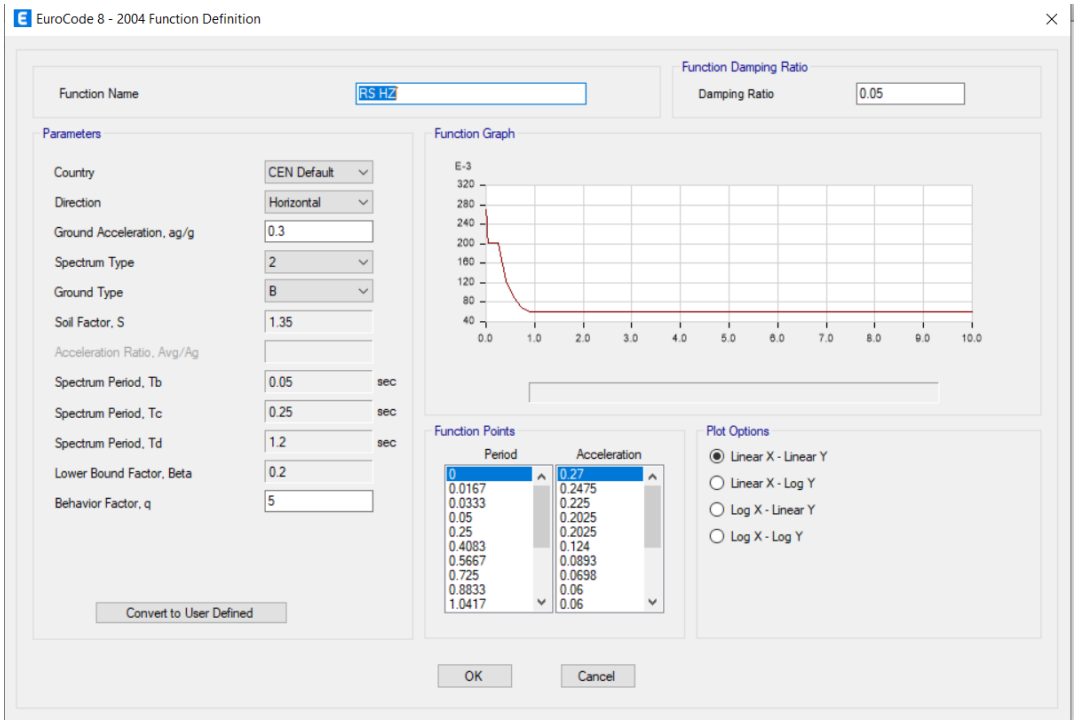

Load Combination Data
General Data
Load Combination Name
S4
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
dead combo
0.9
live combo
0.5
SPEC X
1
SPEC Y
0.3
SPEC Z
0.3
Add
Delete
OK
Cancel


Load Combination Data
General Data
Load Combination Name
S5
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
dead combo
0.9
live combo
0.5
SPEC X
0.3
SPEC Y
1
SPEC Z
0.3
Add
Delete
OK
Cancel

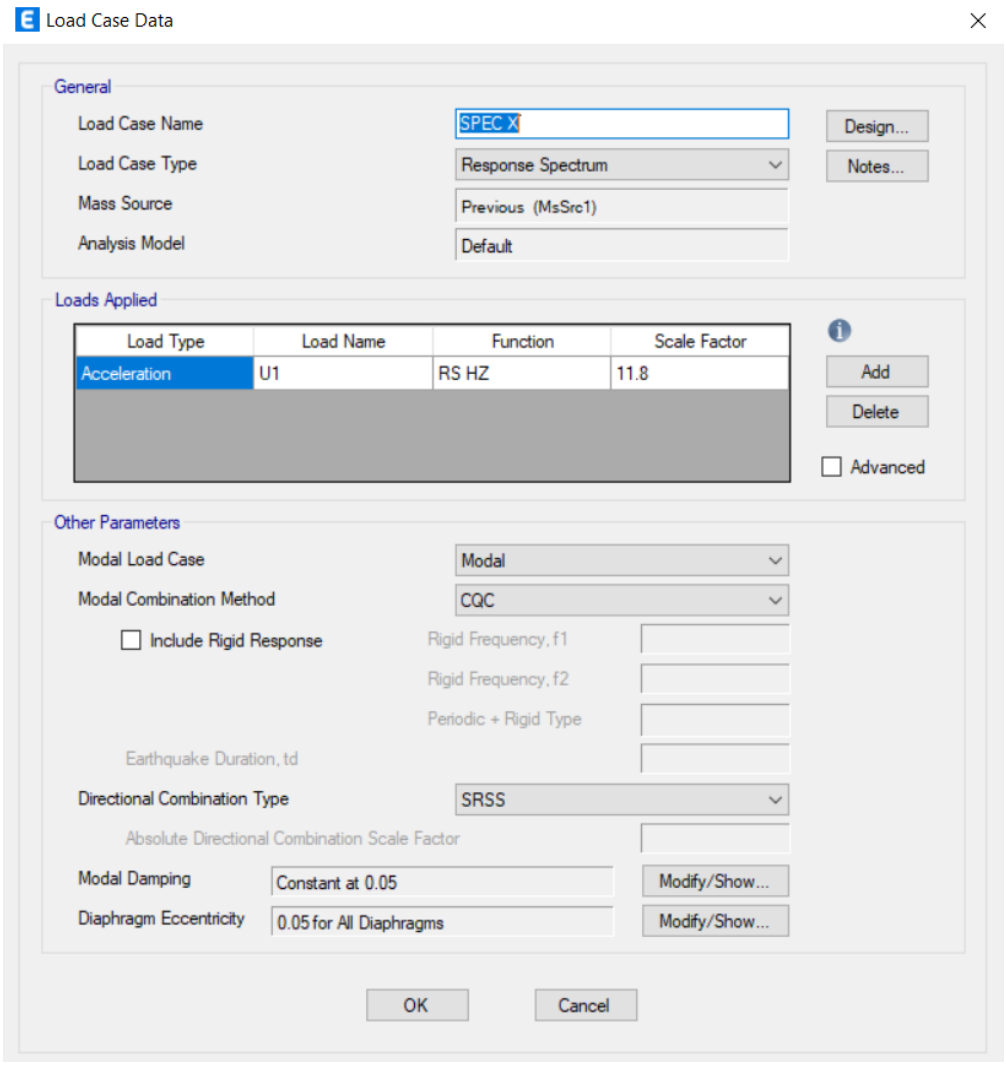

Load Combination Data
General Data
Load Combination Name
S6
Combination Type
Linear Add
Notes
Modify/Show Notes...
Auto Combination
No
Define Combination of Load Case/Combo Results
Load Name
Scale Factor
dead combo
0.9
live combo
0.5
SPEC X
0.3
SPEC Y
0.3
SPEC Z
1
Add
Delete
OK
Cancel

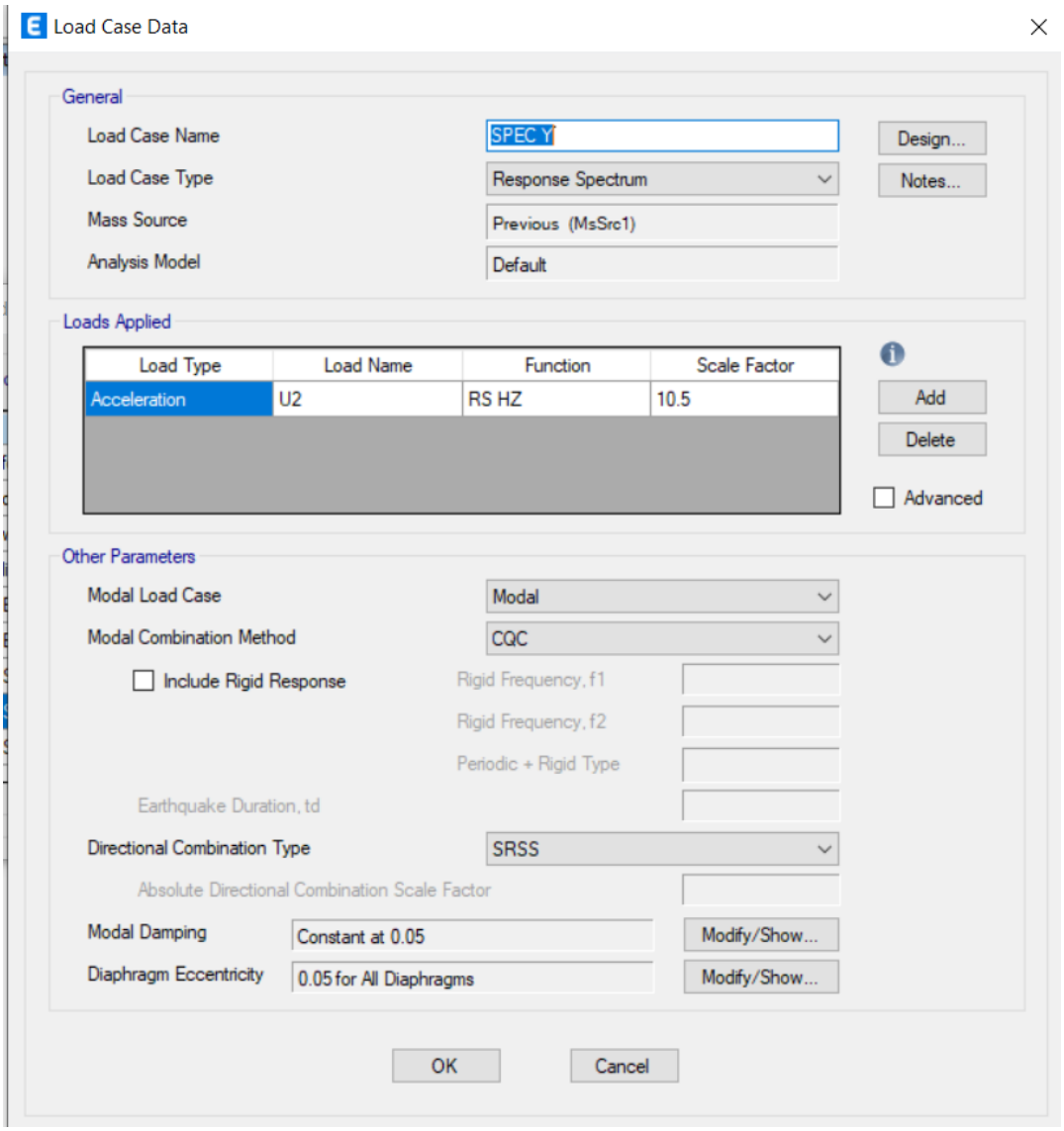
DEFINE FUNCTION :



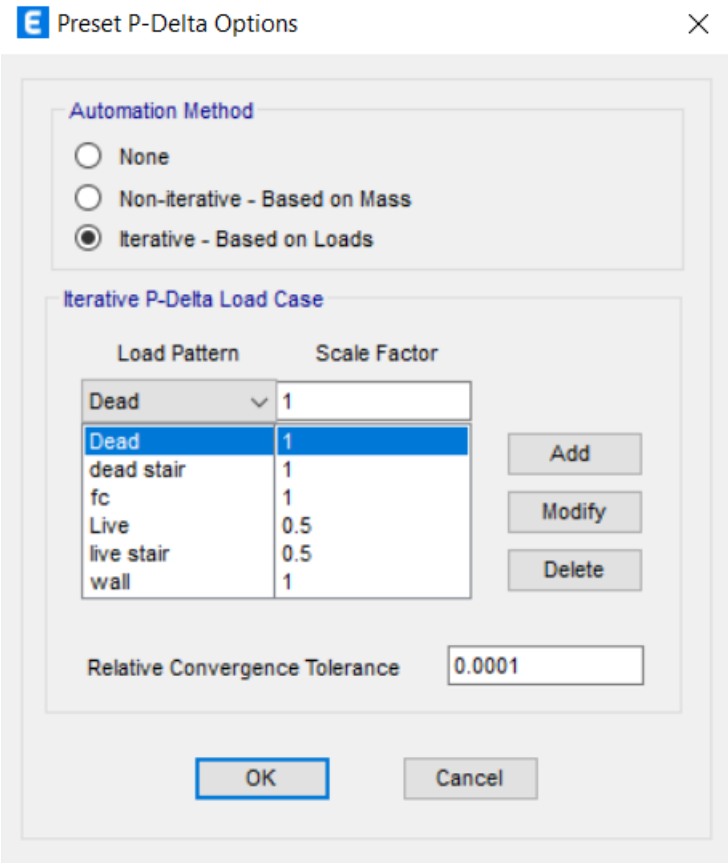


LOAD CASES :

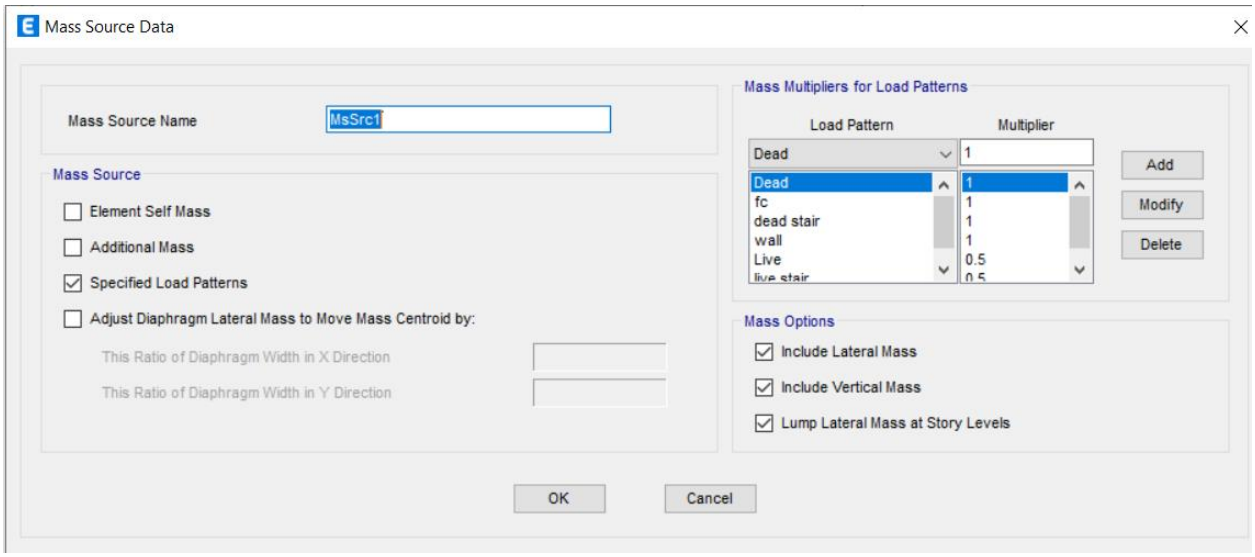

Load Case Data
General
Load Case Name
SPEC X
Design...
Load Case Type
Response Spectrum
Notes...
Mass Source
Previous (MsSrc1)
Analysis Model
Default
Loads Applied
Load Type
Load Name
Function
Scale Factor
Acceleration
U1
RS HZ
11.8
Add
Delete
Advanced
Other Parameters
Modal Load Case
Modal
Modal Combination Method
CQC
Include Rigid Response
Rigid Frequency, f1
Rigid Frequency, f2
Periodic + Rigid Type
Earthquake Duration, td
Directional Combination Type
SRSS
Absolute Directional Combination Scale Factor
Modal Damping
Constant at 0.05
Modify/Show...
Diaphragm Eccentricity
0.05 for All Diaphragms
Modify/Show...
OK
Cancel


Load Case Data
General
Load Case Name
SPEC Y
Design...
Load Case Type
Response Spectrum
Notes...
Mass Source
Previous (MsSrc1)
Analysis Model
Default
Loads Applied
Load Type
Load Name
Function
Scale Factor
Acceleration
U2
RS HZ
10.5
Add
Delete
Advanced
Other Parameters
Modal Load Case
Modal
Modal Combination Method
CQC
Include Rigid Response
Rigid Frequency, f1
Rigid Frequency, f2
Periodic + Rigid Type
Earthquake Duration, td
Directional Combination Type
SRSS
Absolute Directional Combination Scale Factor
Modal Damping
Constant at 0.05
Modify/Show...
Diaphragm Eccentricity
0.05 for All Diaphragms
Modify/Show...
OK
Cancel

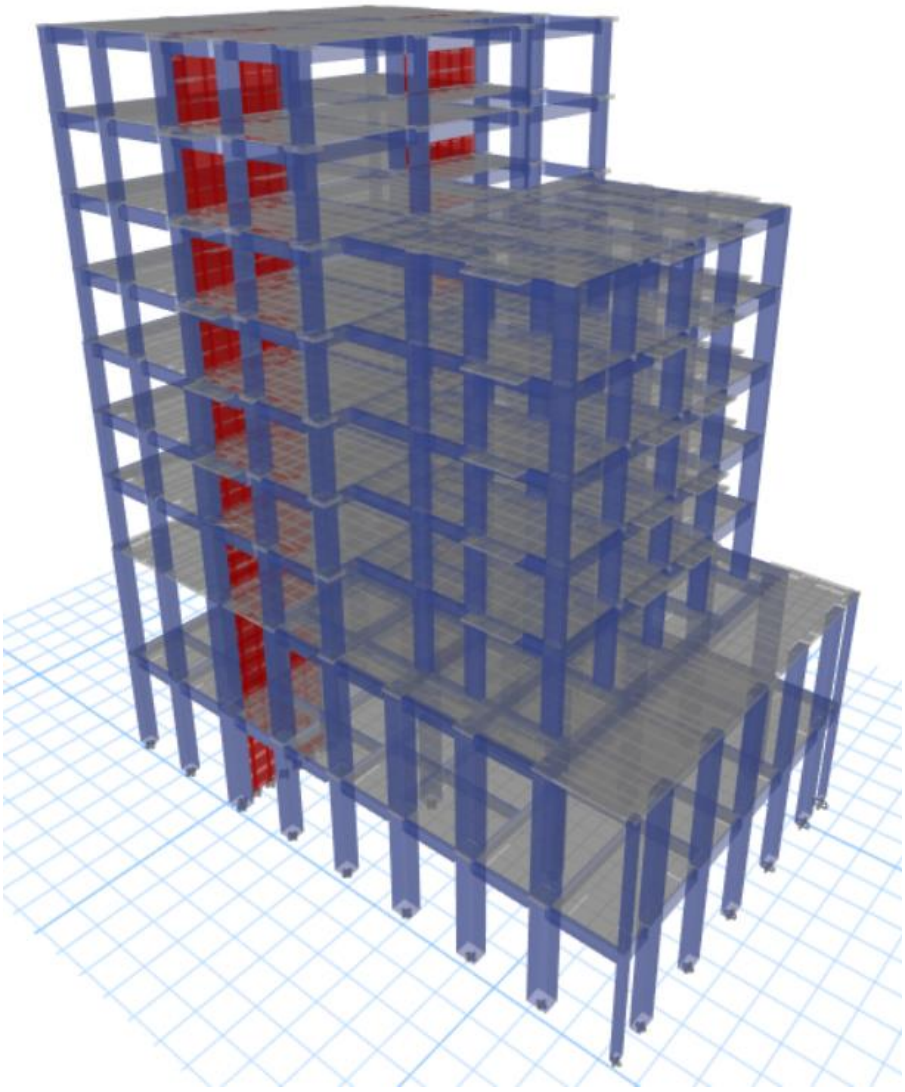
DEFINE P DELTA :



DEFINE MASS SOURCE :



MODEL 1



Modal Participating Mass Ratios

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None
Filter: None

Modal Participating Mass Ratios

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX
Modal	1	1.604	0.0001	0.8055	2.45E-05	0.0001	0.8055	2.45E-05	0.137
Modal	2	1.251	0.2496	0.0008	0	0.2497	0.8062	2.494E-05	3.121E-05
Modal	3	0.942	0.4623	0.0001	1.305E-05	0.712	0.8063	3.799E-05	2.43E-06
Modal	4	0.514	0.0002	0.0948	1.226E-05	0.7122	0.9011	0.0001	0.3152
Modal	5	0.448	0.0509	0.0005	8.279E-07	0.7631	0.9017	0.0001	0.002
Modal	6	0.292	0.0014	0.0281	0.0004	0.7645	0.9298	0.0005	0.0255
Modal	7	0.281	0.0147	0.0024	4.648E-05	0.7792	0.9322	0.0005	0.0019
Modal	8	0.242	0.1228	1.592E-06	0.0005	0.902	0.9322	0.001	1.826E-05
Modal	9	0.223	3.097E-05	0.0001	0.1832	0.902	0.9323	0.1843	0.0736
Modal	10	0.198	0.0012	0.0325	0.0012	0.9032	0.9648	0.1855	0.0565
Modal	11	0.194	0.0075	0.0043	0.0082	0.9107	0.9691	0.1937	0.0139
Modal	12	0.186	0.0017	1.748E-05	0.1181	0.9124	0.9691	0.3118	0.0253
Modal	13	0.16	0.0007	0.0005	0.1104	0.9131	0.9696	0.4222	0.0016
Modal	14	0.146	1.044E-05	0.0259	0.0087	0.9131	0.9955	0.4309	0.0392
Modal	15	0.13	0.0007	0.0023	0.0879	0.9138	0.9978	0.5188	0.0126

Record: << < 1 > >> of 20 Add Tables... Done

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None
Filter: None

Base Reactions

Output Case	Case Type	Step Type	Step Number	FX tonf	FY tonf	FZ tonf	MX tonf-m	MY tonf-m	MZ tonf-m
EQ X	LinStatic	Step By Step	1	-362.9318	0	0.0001	0.3548	-8964.5684	-4664.1216
EQ X	LinStatic	Step By Step	2	-362.9318	-6.071E-07	0.0001	0.6276	-8968.1587	-4297.0738
EQ X	LinStatic	Step By Step	3	-362.9318	0	0.0001	0.082	-8960.9782	-5031.1693
EQ Y	LinStatic	Step By Step	1	0	-362.9317	3.42E-05	9102.1645	-0.503	16420.7363
EQ Y	LinStatic	Step By Step	2	0	-362.9317	3.642E-05	9101.9152	2.6522	16112.0924
EQ Y	LinStatic	Step By Step	3	0	-362.9317	3.197E-05	9102.4139	-3.6583	16729.3801
SPEC X	LinRespSpec	Max		324.4052	10.8687	48.7657	650.1581	6678.6101	5609.0127
SPEC Y	LinRespSpec	Max		9.4573	326.9782	32.0008	7833.8389	1458.012	15106.2879

Record: << < 1 > >> of 8 Add Tables... Done

DRIFT

K4 =0.7*5*F4*0.5

	A	B	F	K
1	TABLE:	ory Drifts		DRV
4	Story9	SPEC X	0.000896	0.001568
5	Story9	SPEC X	0.000447	0.000782
7	Story8	SPEC X	0.001035	0.001811
8	Story8	SPEC X	0.000632	0.001106
10	Story7	SPEC X	0.001142	0.001999
11	Story7	SPEC X	0.000606	0.001061
13	Story6	SPEC X	0.001369	0.002396
14	Story6	SPEC X	0.000708	0.001239
16	Story5	SPEC X	0.001569	0.002746
17	Story5	SPEC X	0.000797	0.001395
20	Story4	SPEC X	0.001815	0.003176
21	Story4	SPEC X	0.00093	0.001628
24	Story3	SPEC X	0.002098	0.003672
25	Story3	SPEC X	0.001125	0.001969
27	Story2	SPEC X	0.001456	0.002548
28	Story2	SPEC X	0.000673	0.001178
30	Story1	SPEC X	0.000759	0.001328
31	Story1	SPEC X	0.000354	0.00062
33			MAX	0.003672

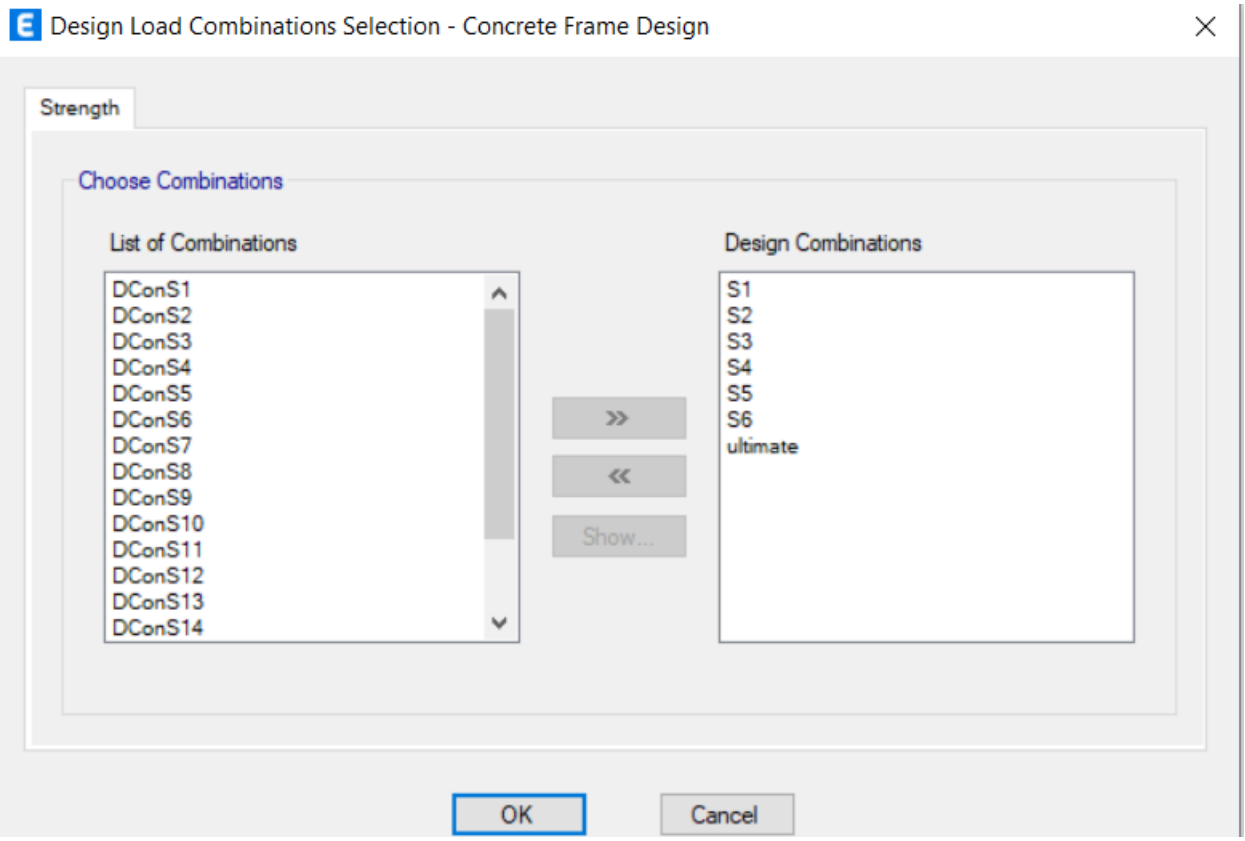
K9 =0.7*5*0.5*F9

	A	B	F	K
1	TABLE:	ory Drifts		DRV
6	Story9	SPEC Y	0.000818	0.001432
9	Story8	SPEC Y	0.001174	0.002055
12	Story7	SPEC Y	0.0014	0.00245
15	Story6	SPEC Y	0.001629	0.002851
18	Story5	SPEC Y	0.000315	0.000551
19	Story5	SPEC Y	0.001775	0.003106
22	Story4	SPEC Y	0.000363	0.000635
23	Story4	SPEC Y	0.002037	0.003565
26	Story3	SPEC Y	0.002396	0.004193
29	Story2	SPEC Y	0.002424	0.004242
32	Story1	SPEC Y	0.001266	0.002216
33			MAX Y	0.004242

COLUMNS

	A	B	H	L	M	N	O
	TABLE:	nt React	ıs				
	Story	Label	FZ	AC	B	T	T CHOOSEN
			tonf				
5	Base	61	11.2746	74.35288	30	2.478429	30
7	Base	66	11.5224	75.98705	30	2.532902	30
3	Base	71	43.4225	286.3594	30	9.545314	30
9	Base	76	73.3757	483.8925	30	16.12975	30
0	Base	81	79.4006	523.6251	30	17.45417	30
1	Base	86	76.4202	503.9701	30	16.799	30
2	Base	91	43.4891	286.7986	30	9.559954	30
3	Base	96	551.0013	3633.702	40	90.84254	100
4	Base	101	537.2757	3543.185	40	88.57963	100
5	Base	106	675.6525	4455.742	40	111.3935	110
6	Base	111	606.8526	4002.026	40	100.0506	100
7	Base	116	175.0244	1154.238	30	38.47459	40
8	Base	121	154.5737	1019.371	30	33.97903	50
9	Base	126	153.592	1012.897	30	33.76323	50
0	Base	131	171.2828	1129.563	30	37.65209	60
1	Base	136	179.2029	1181.794	30	39.39312	60
2	Base	141	199.2687	1314.122	30	43.80407	60
3	Base	146	335.4066	2211.914	30	73.73047	80
4	Base	151	354.6235	2338.644	30	77.95481	80
5	Base	156	374.6752	2470.88	30	82.36265	80
6	Base	161	328.283	2164.936	30	72.16453	70

DESIGN COMINATION :



Concrete Frame Design Preferences for BS 8110-97

	Item	Value
01	Design Code	BS 8110-97
02	Multi-Response Case Design	Step-by-Step - All
03	Number of Interaction Curves	24
04	Number of Interaction Points	11
05	Consider Minimum Eccentricity?	Yes
06	Ignore Beneficial Pu for Beam Design?	No
07	Gamma (Steel)	1.15
08	Gamma (Concrete)	1.5
09	Gamma (Concrete Shear)	1.5
10	User Defined Allowable PT Stresses?	No
11	Concrete Strength Ratio at Transfer f'ci / f'cu	0.8
12	Transfer: Top Fiber Tensile Stress / f'ci^(1/2)	3
13	Transfer: Bottom Fiber Tensile Stress / f'ci^(1/2)	3
14	Transfer: Extreme Fiber Compressive Stress / f'ci	0.6
15	Final: Top Fiber Tensile Stress / f'cu^(1/2)	6
16	Final: Bottom Fiber Tensile Stress / f'cu^(1/2)	6
17	Final: Extreme Fiber Compressive Stress / f'cu	0.6
18	Sustained: Extreme Fiber Compressive Stress /...	0.45

Item Description

The selected design code. Subsequent design is based on this selected code.

Explanation of Color Coding for Values

Blue: Default Value

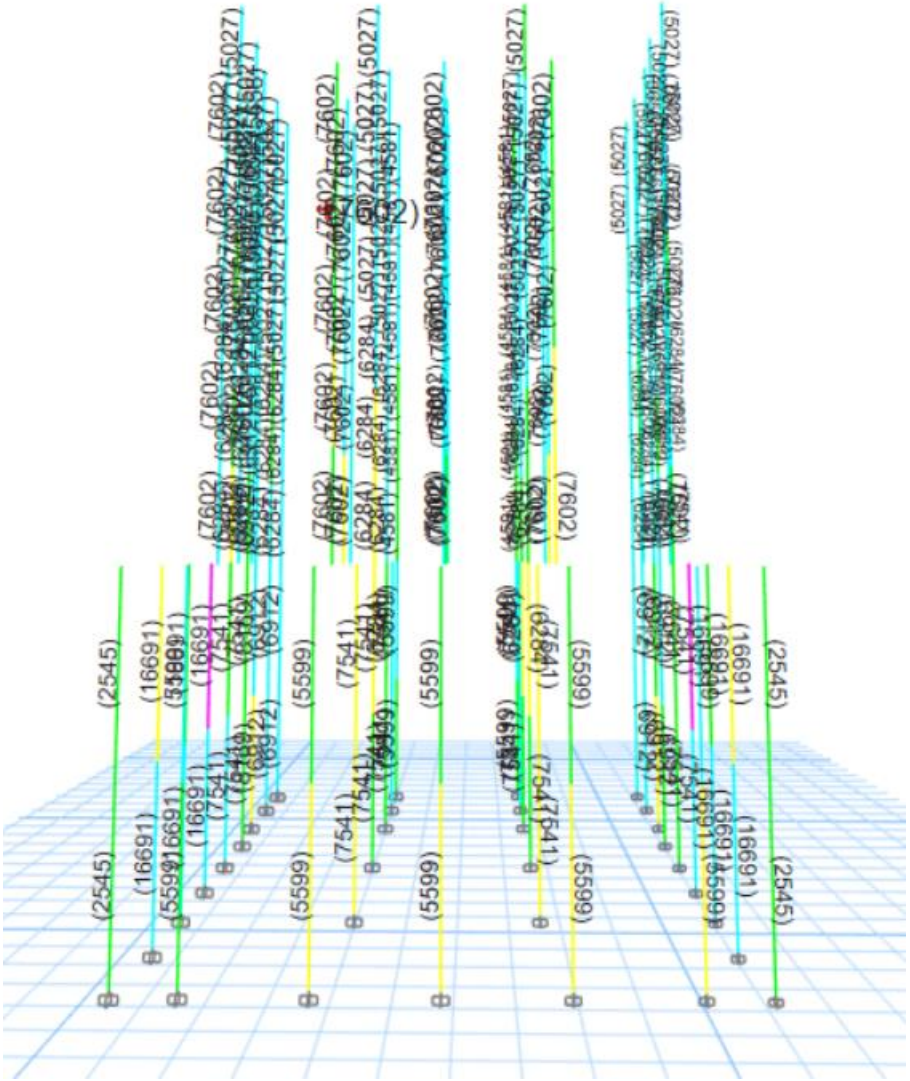
Black: Not a Default Value

Red: Value that has changed during the current session

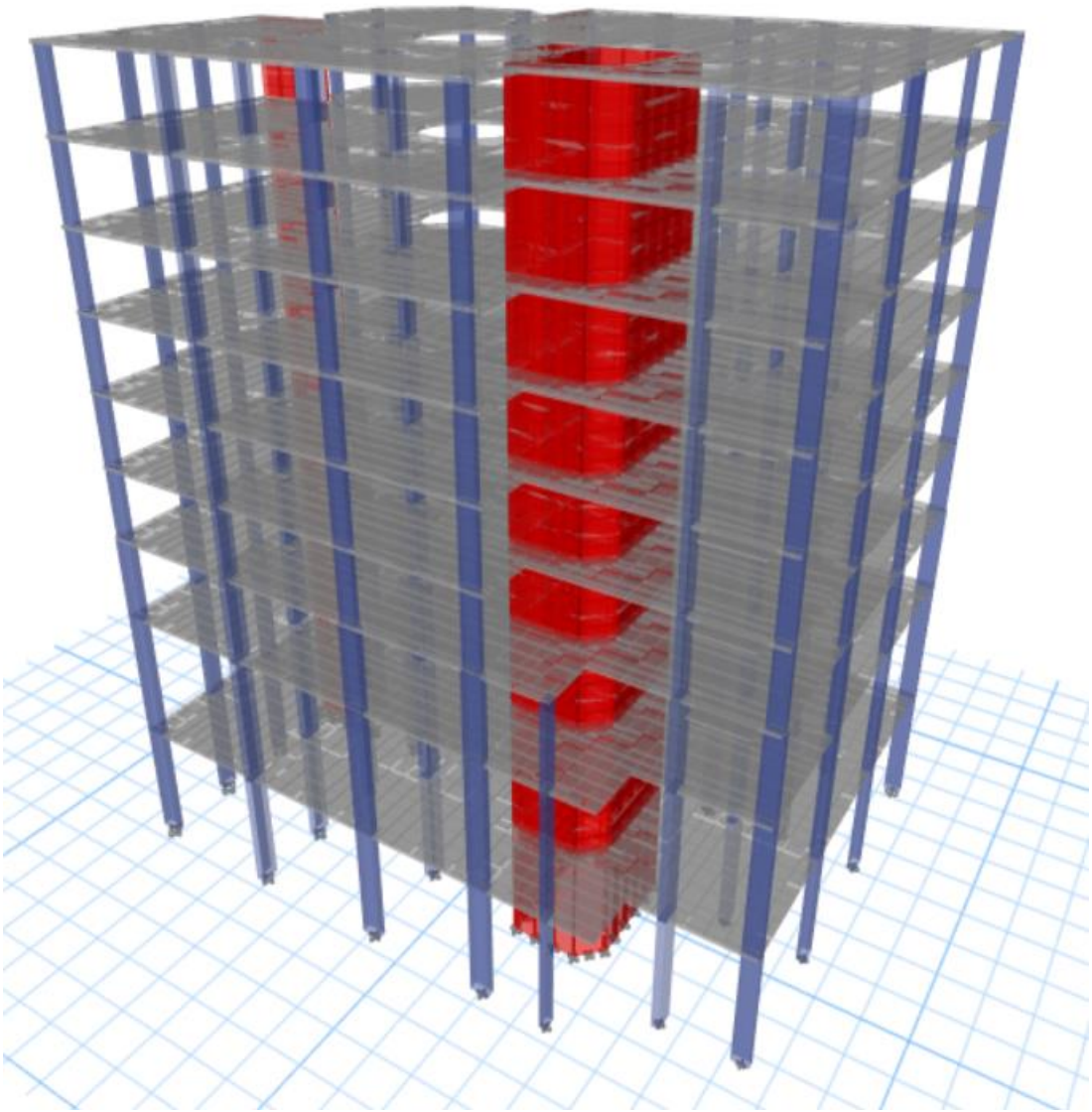
Set To Default Values: All Items | Selected Items

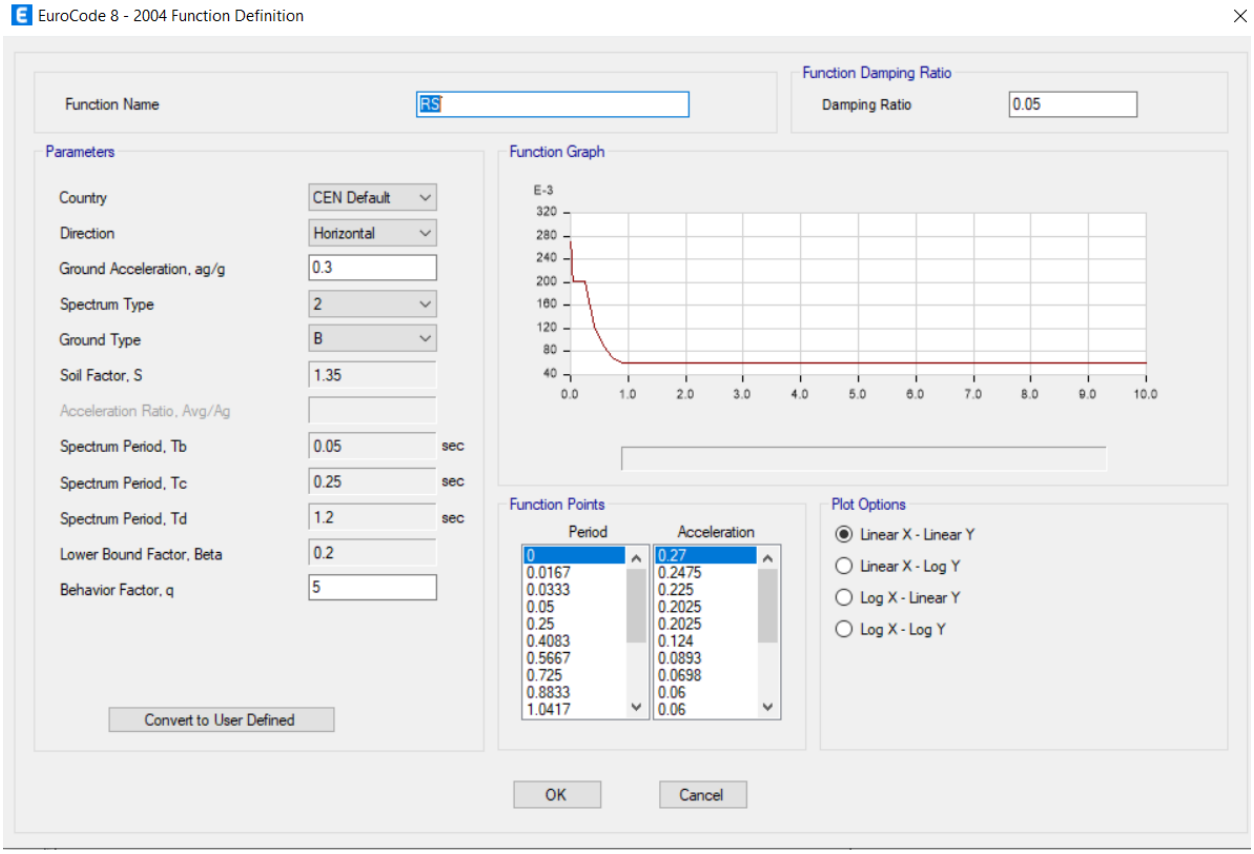
Reset To Previous Values: All Items | Selected Items

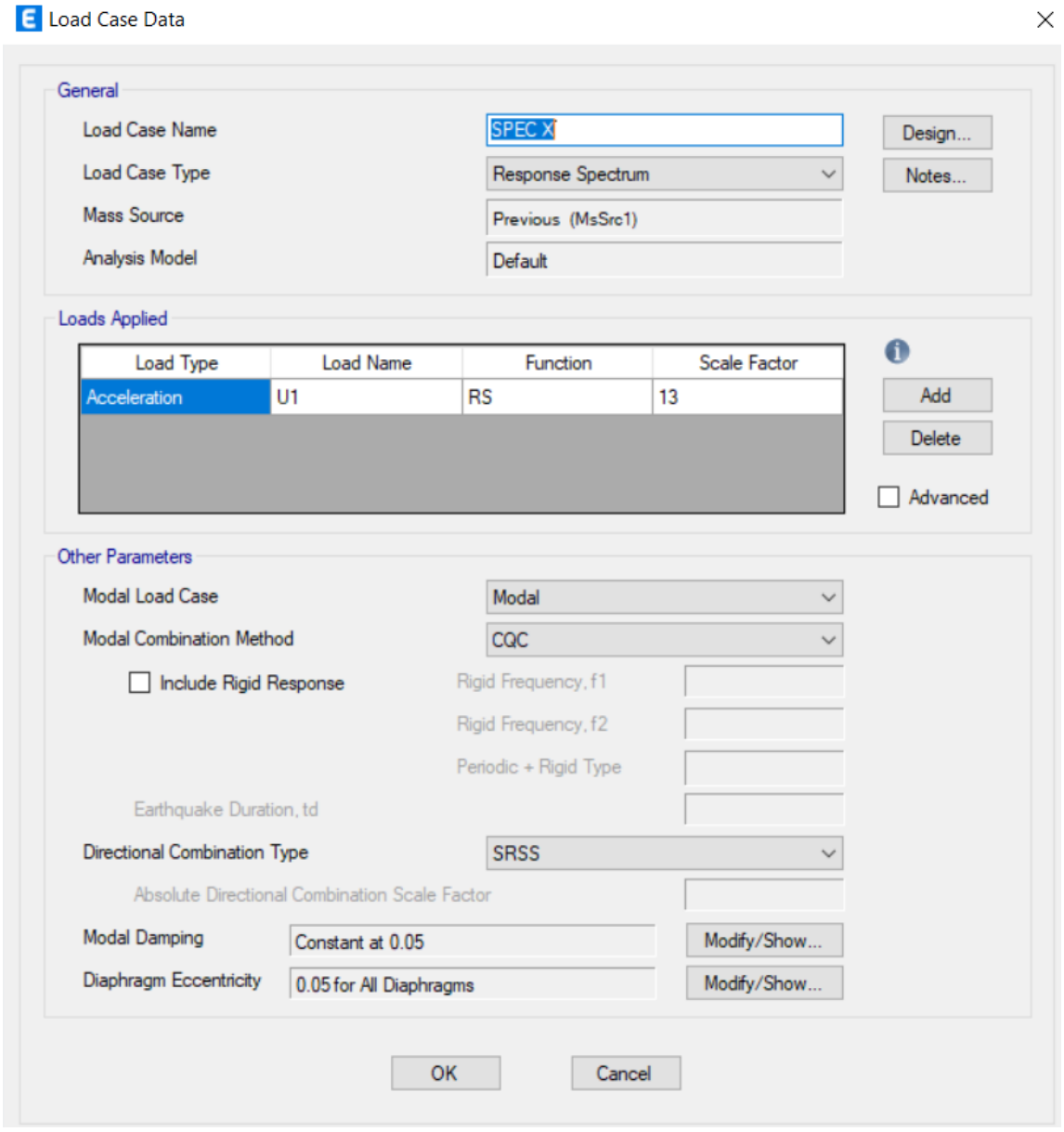
OK | Cancel



MODEL 2




EuroCode 8 - 2004 Function Definition
Function Name
RS
Function Damping Ratio
Damping Ratio
0.05
Parameters
Country
CEN Default
Direction
Horizontal
Ground Acceleration, ag/g
0.3
Spectrum Type
2
Ground Type
B
Soil Factor, S
1.35
Acceleration Ratio, Avg/Ag
Spectrum Period, Tb
0.05
sec
Spectrum Period, Tc
0.25
sec
Spectrum Period, Td
1.2
sec
Lower Bound Factor, Beta
0.2
Behavior Factor, q
5
Convert to User Defined
Function Graph
E-3
320
280
240
200
160
120
80
40
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Function Points
Period
Acceleration
0
0.0167
0.0333
0.05
0.25
0.4083
0.5667
0.725
0.8833
1.0417
0.27
0.2475
0.225
0.2025
0.2025
0.124
0.0893
0.0698
0.06
0.06
Plot Options
Linear X - Linear Y
Linear X - Log Y
Log X - Linear Y
Log X - Log Y
OK
Cancel


Load Case Data
General
Load Case Name
SPEC X
Design...
Load Case Type
Response Spectrum
Notes...
Mass Source
Previous (MsSrc1)
Analysis Model
Default
Loads Applied
Load Type
Load Name
Function
Scale Factor
Acceleration
U1
RS
13
Add
Delete
Advanced
Other Parameters
Modal Load Case
Modal
Modal Combination Method
CQC
Include Rigid Response
Rigid Frequency, f1
Rigid Frequency, f2
Periodic + Rigid Type
Earthquake Duration, td
Directional Combination Type
SRSS
Absolute Directional Combination Scale Factor
Modal Damping
Constant at 0.05
Modify/Show...
Diaphragm Eccentricity
0.05 for All Diaphragms
Modify/Show...
OK
Cancel

Load Case Data

General

Load Case Name: SPEC Y
Load Case Type: Response Spectrum
Mass Source: Previous (MsSrc1)
Analysis Model: Default

Design...
Notes...

Loads Applied

Load Type	Load Name	Function	Scale Factor
Acceleration	U2	RS	10

Add
Delete
Advanced

Other Parameters

Modal Load Case: Modal
Modal Combination Method: CQC
Include Rigid Response
Rigid Frequency, f1
Rigid Frequency, f2
Periodic + Rigid Type
Earthquake Duration, td
Directional Combination Type: SRSS
Absolute Directional Combination Scale Factor
Modal Damping: Constant at 0.05 — Modify/Show...
Diaphragm Eccentricity: 0.05 for All Diaphragms — Modify/Show...

OK
Cancel

Modal Participating Mass Ratios

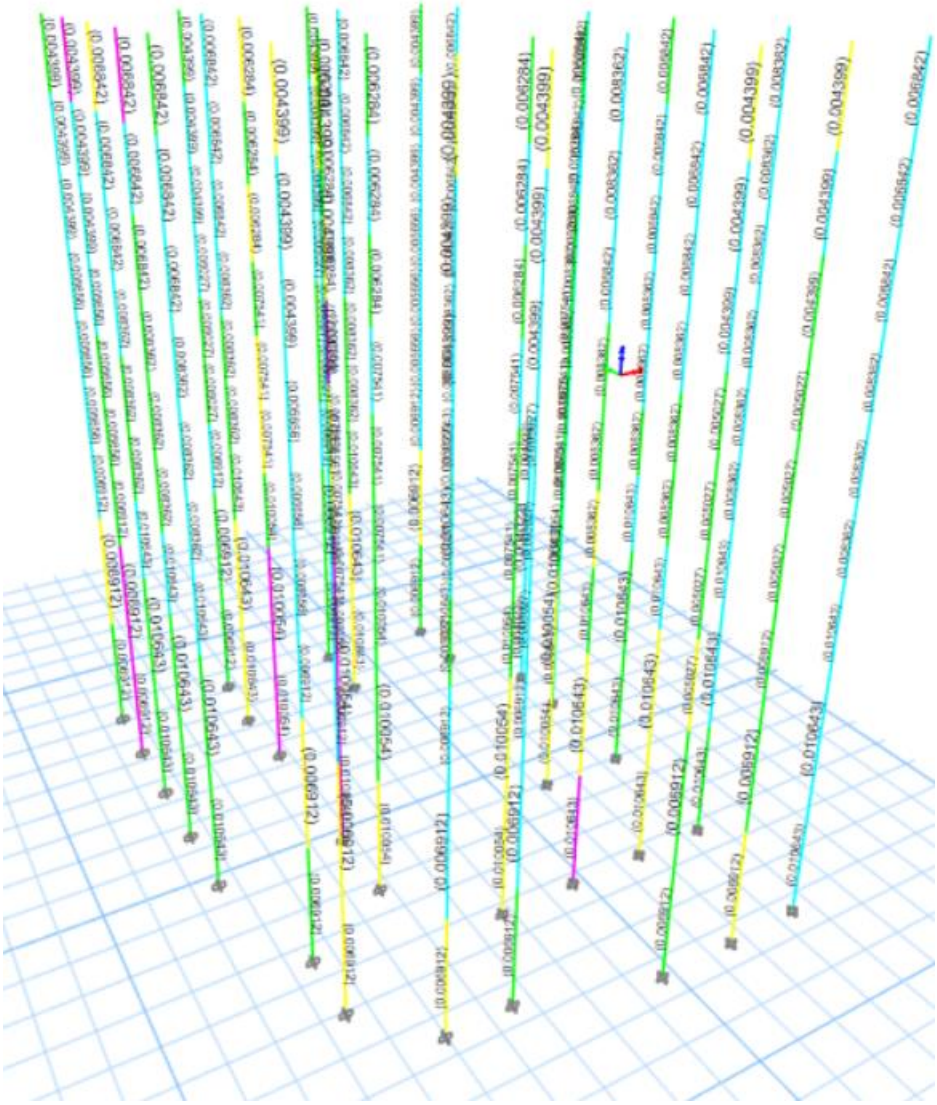
File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Modal Participating Mass Ratios
Filter: None

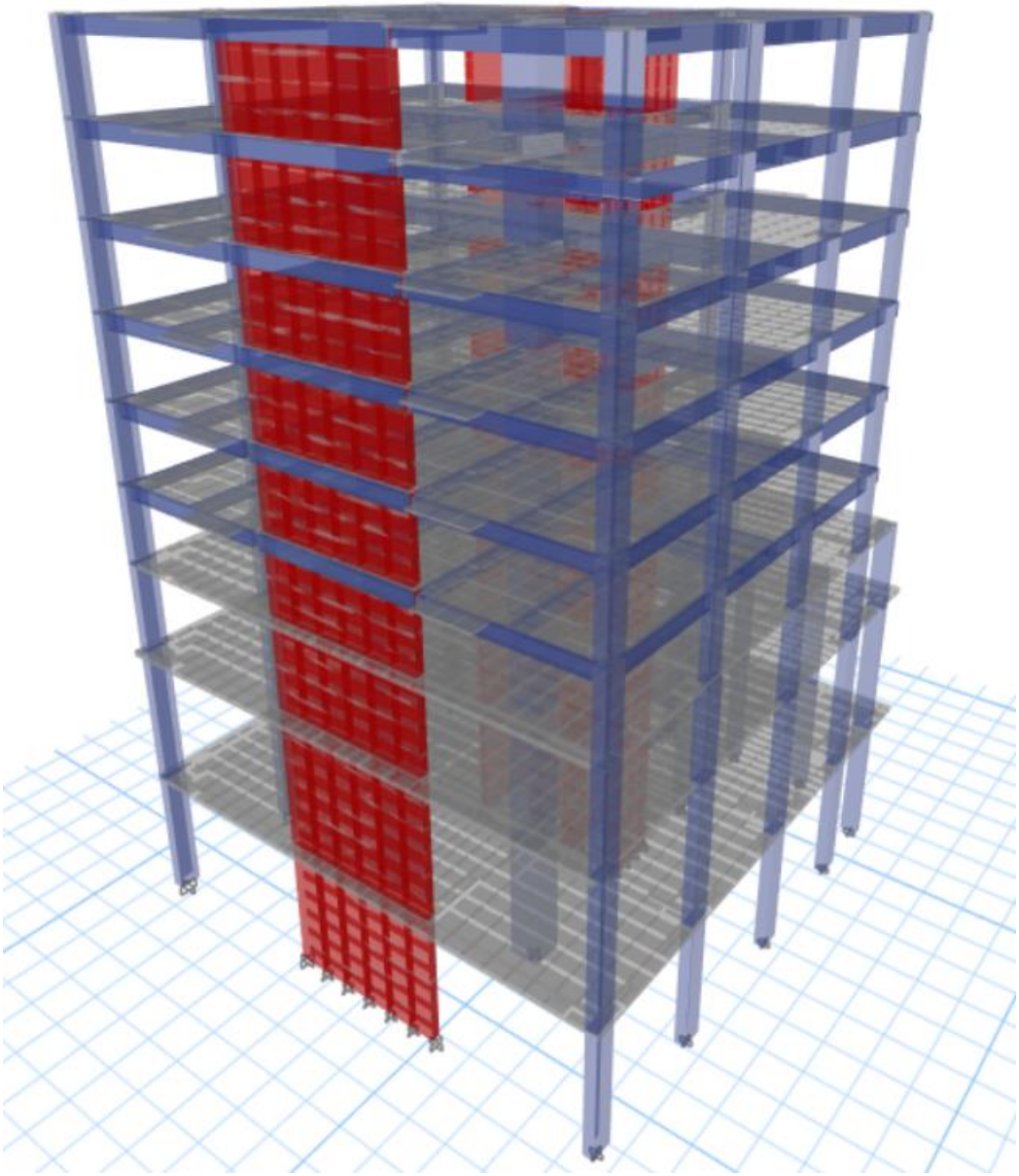
	Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX
▶	Modal	1	2.385	0.5197	0.0102	0	0.5197	0.0102	0	0.0043
	Modal	2	1.95	0.0014	0.7114	0	0.521	0.7216	0	0.3
	Modal	3	1.457	0.2142	0.0082	0	0.7352	0.7299	0	0.0028
	Modal	4	0.583	0.0768	0.0009	0	0.812	0.7308	0	0.0038
	Modal	5	0.381	0.001	0.1762	0	0.813	0.907	0	0.3874
	Modal	6	0.313	0.0714	8.389E-06	0	0.8844	0.907	0	0.0001
	Modal	7	0.27	0.0376	0.0004	0	0.922	0.9074	0	0.001
	Modal	8	0.162	0.0057	0.0021	0	0.9277	0.9095	0	0.0073
	Modal	9	0.15	0.0033	0.0431	0	0.931	0.9526	0	0.1262
	Modal	10	0.126	0.0293	0.0029	0	0.9603	0.9556	0	0.0079
	Modal	11	0.113	0.0051	0.0007	0	0.9653	0.9562	0	0.0025
	Modal	12	0.089	0.0047	0.0223	0	0.97	0.9785	0	0.0783
	Modal	13	0.085	0.0014	0.0001	0	0.9714	0.9786	0	0.0003
	Modal	14	0.074	0.0157	0.0052	0	0.9871	0.9838	0	0.0177
	Modal	15	0.065	0.0033	0.0105	0	0.9904	0.9942	0	0.0388

Record: << < 1 > >> of 20 Add Tables... Done

TABLE:	nt React	ns				
Base	1	46.5944	307.2772	30	10.24257	
Base	~19590	128.8699	849.8615	30	28.32872	
Base	86	130.6082	861.3251	30	28.71084	
Base	131	131.8441	869.4755	30	28.98252	
Base	~19601	135.1909	891.5467	30	29.71822	
Base	~19607	145.0096	956.2983	30	31.87661	
Base	36	147.6161	973.4875	30	32.44958	
Base	6	158.9777	1048.414	30	34.94714	
Base	91	160.5364	1058.693	30	35.28978	
Base	136	160.8965	1061.068	30	35.36893	60
Base	96	163.9022	1080.89	30	36.02966	
Base	126	179.6439	1184.702	30	39.49007	
Base	116	212.0397	1398.343	30	46.61144	
Base	76	214.1789	1412.451	30	47.08169	
Base	21	221.2357	1458.988	30	48.63295	
Base	11	228.852	1509.216	30	50.30719	
Base	121	244.1076	1609.822	30	53.66074	
Base	26	267.4835	1763.98	30	58.79933	
Base	106	275.0424	1813.829	30	60.46096	
Base	41	281.593	1857.028	30	61.90094	
Base	51	281.7236	1857.889	30	61.92965	
Base	101	287.3813	1895.2	30	63.17335	
Base	81	287.9648	1899.048	30	63.30161	80
Base	16	347.4724	2291.485	30	76.38282	
Base	66	395.1558	2605.944	30	86.86478	
Base	111	396.6911	2616.068	30	87.20228	
Base	46	428.1783	2823.718	30	94.12393	
Base	56	442.8351	2920.375	30	97.34585	
Base	141	446.3869	2943.799	30	98.12662	120
Base	61	456.6804	3011.681	30	100.3894	
Base	71	544.8286	3592.994	30	119.7665	
Base	31	557.8373	3678.783	30	122.6261	
Story	Label	FZ	ac	b	t	t choosen



MODEL 3



Load Case Data

General

Load Case Name	SPEC X
Load Case Type	Response Spectrum
Mass Source	Previous (MsSrc1)
Analysis Model	Default

Design... Notes...

Loads Applied

Load Type	Load Name	Function	Scale Factor
Acceleration	U1	RS HZ	13.9

Add Delete Advanced

Other Parameters

Modal Load Case	Modal
Modal Combination Method	CQC
Include Rigid Response	
Rigid Frequency, f1	
Rigid Frequency, f2	
Periodic + Rigid Type	
Earthquake Duration, td	
Directional Combination Type	SRSS
Absolute Directional Combination Scale Factor	
Modal Damping	Constant at 0.05 (Modify/Show...)
Diaphragm Eccentricity	0.05 for All Diaphragms (Modify/Show...)

OK Cancel

Load Case Data

General

Load Case Name	SPEC Y
Load Case Type	Response Spectrum
Mass Source	Previous (MsSrc1)
Analysis Model	Default

Design...
Notes...

Loads Applied

Load Type	Load Name	Function	Scale Factor
Acceleration	U2	RS HZ	10.2

Add
Delete
Advanced

Other Parameters

Modal Load Case	Modal
Modal Combination Method	CQC
Include Rigid Response	
Rigid Frequency, f1	
Rigid Frequency, f2	
Periodic + Rigid Type	
Earthquake Duration, td	
Directional Combination Type	SRSS
Absolute Directional Combination Scale Factor	
Modal Damping	Constant at 0.05
Diaphragm Eccentricity	0.05 for All Diaphragms

Modify/Show...
Modify/Show...

OK
Cancel

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Base Reactions
Filter: None

Output Case	Case Type	Step Type	Step Number	FX tonf	FY tonf	FZ tonf	MX tonf-m	MY tonf-m	MZ tonf-m
EQ X	LinStatic	Step By Step	1	-649.2055	1.425E-06	0.0021	-24.8848	-17397.6559	-29412.4342
EQ X	LinStatic	Step By Step	2	-649.2055	1.708E-06	0.0024	-30.5092	-17407.629	-28770.2464
EQ X	LinStatic	Step By Step	3	-649.2055	1.142E-06	0.0019	-19.2604	-17387.6827	-30054.622
EQ Y	LinStatic	Step By Step	1	6.268E-06	-649.2055	0.0066	17408.0226	24.8543	13655.9546
EQ Y	LinStatic	Step By Step	2	9.44E-06	-649.2055	0.0063	17414.0442	35.5408	12977.3884
EQ Y	LinStatic	Step By Step	3	3.097E-06	-649.2055	0.0069	17402.001	14.1678	14334.5208
SPEC X	LinRespSpec	Max		495.1581	305.9264	53.778	6633.1744	9493.6536	25195.5524
SPEC Y	LinRespSpec	Max		223.4529	400.3314	23.8735	8305.3142	4564.7918	9154.0659

Record: << < 1 > >> of 8 Add Tables... Done

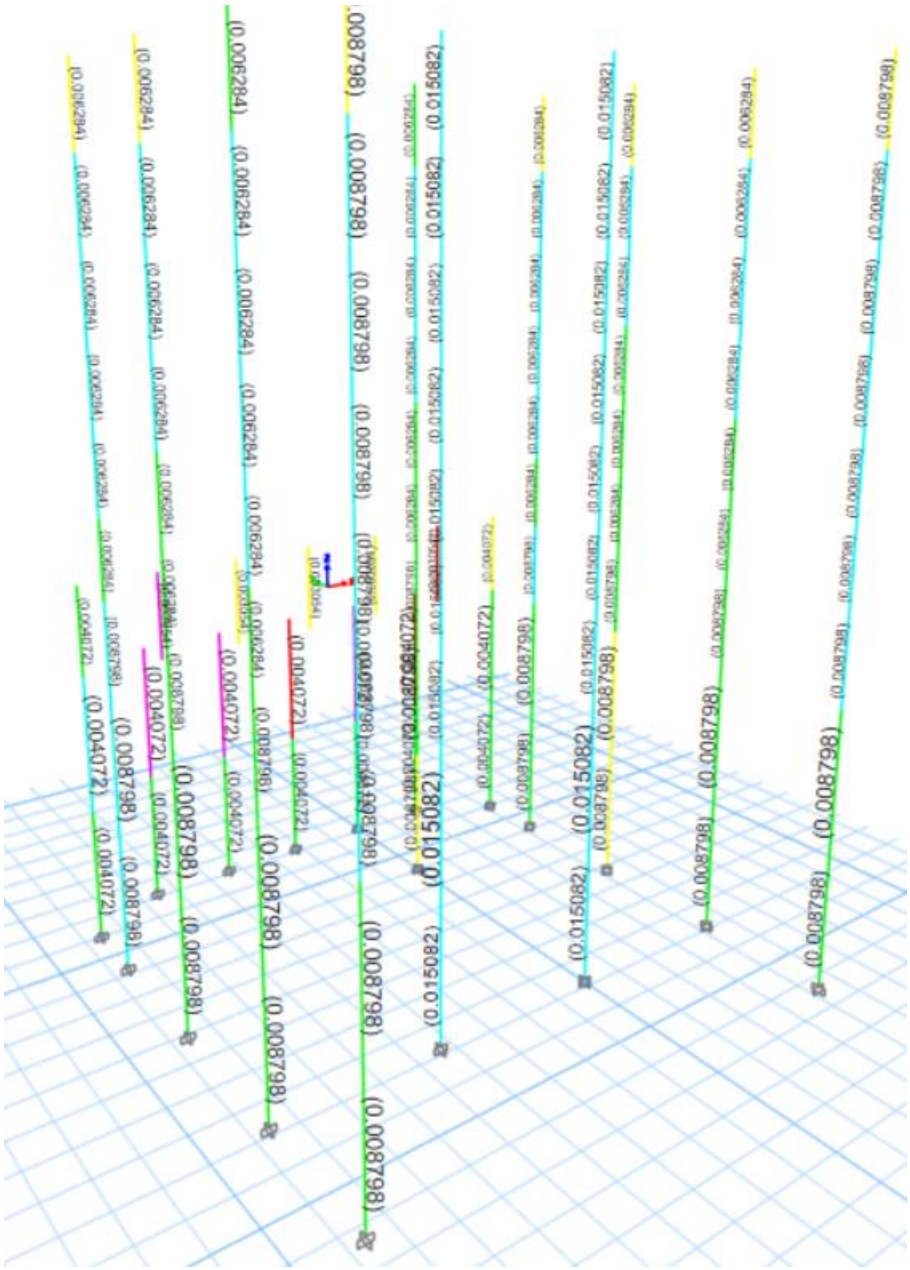
Modal Participating Mass Ratios

File Edit Format-Filter-Sort Select Options

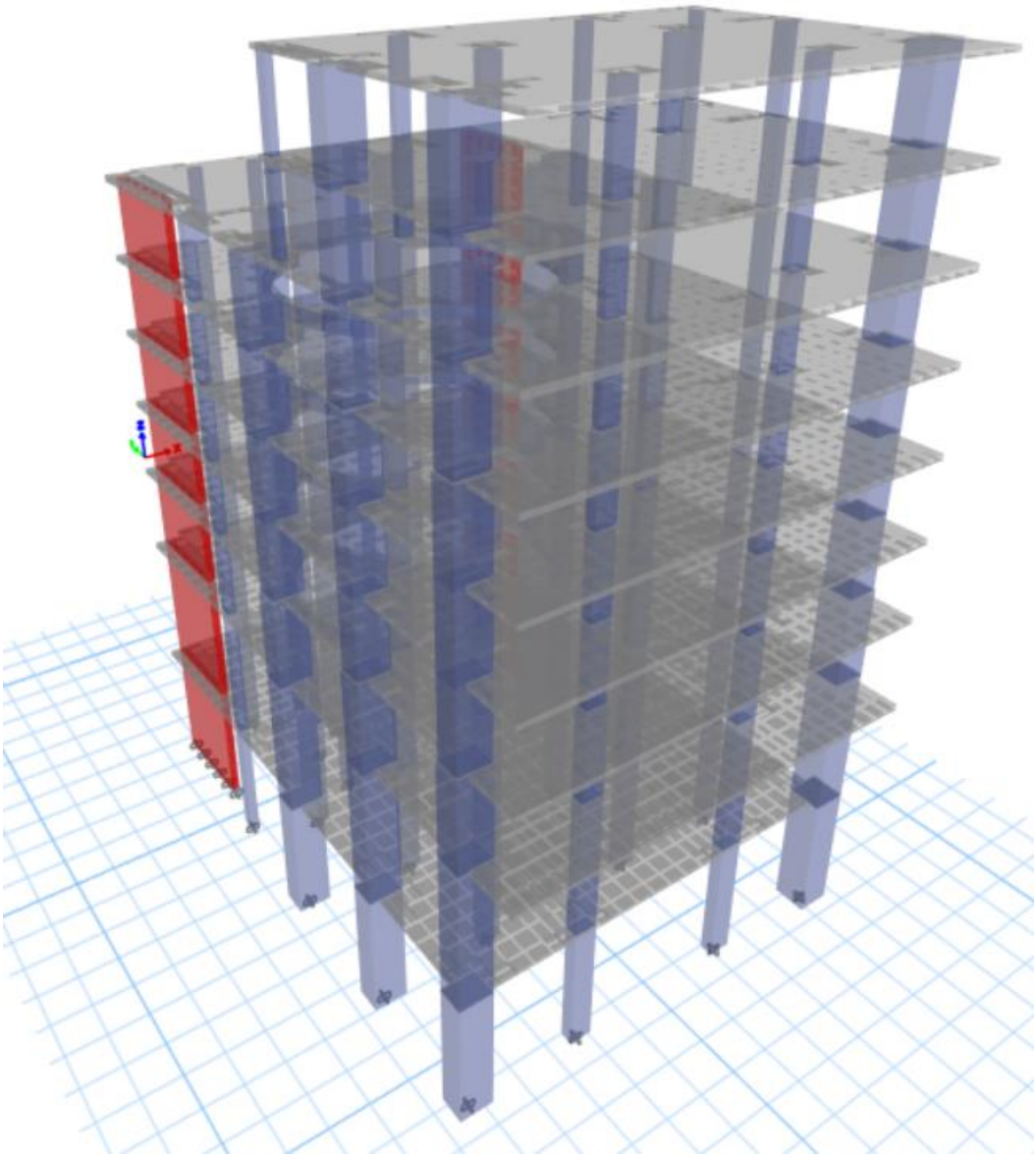
Units: As Noted Hidden Columns: No Sort: None Modal Participating Mass Ratios
Filter: None

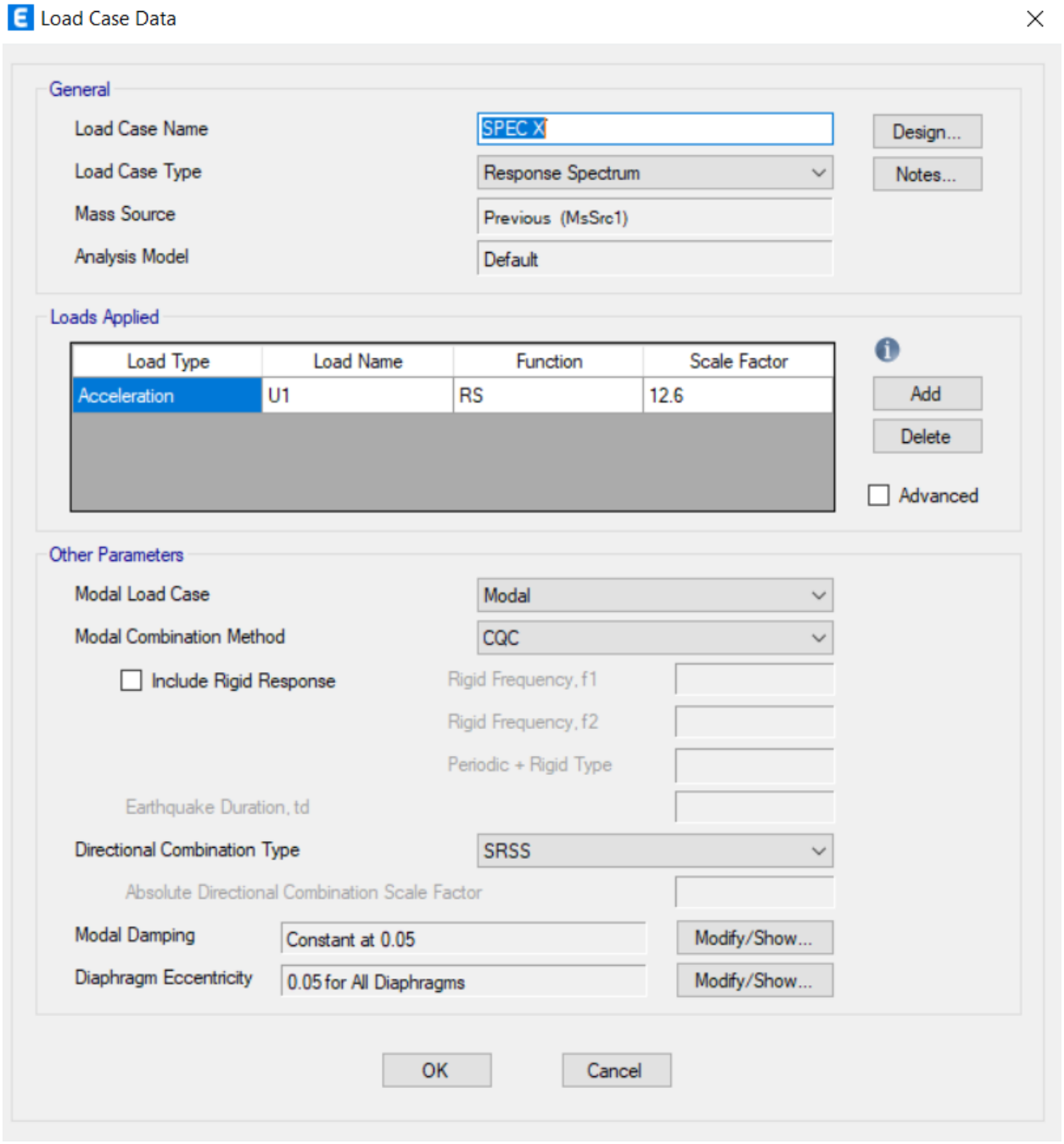
	Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX
▶	Modal	1	1.761	0.3665	0.2066	4.328E-05	0.3665	0.2066	4.328E-05	0.0573
	Modal	2	1.558	0.2187	0.5041	2.168E-05	0.5853	0.7106	0.0001	0.1484
	Modal	3	1.175	0.128	0.026	0	0.7132	0.7367	0.0001	0.0097
	Modal	4	0.415	0.0783	0.0323	0.0003	0.7916	0.769	0.0004	0.0568
	Modal	5	0.319	0.0393	0.1244	0.0005	0.8309	0.8934	0.0009	0.2027
	Modal	6	0.294	0	0.0001	0.1091	0.8309	0.8935	0.11	0.0194
	Modal	7	0.29	5.719E-06	0.0003	0.0229	0.8309	0.8938	0.1328	0.0052
	Modal	8	0.27	0.0001	1.485E-05	0.0483	0.8311	0.8938	0.1812	0.0117
	Modal	9	0.253	0.0042	0.0002	1.363E-05	0.8353	0.894	0.1812	0
	Modal	10	0.239	0.001	0.0006	0.0136	0.8363	0.8946	0.1947	0.0057
	Modal	11	0.229	0.0084	0.0011	0.1501	0.8447	0.8956	0.3449	0.0045
	Modal	12	0.224	0.0551	0.0031	0.025	0.8998	0.8987	0.3699	0.0019
	Modal	13	0.19	0.0005	0.0002	0.1144	0.9003	0.8989	0.4843	0.0002
	Modal	14	0.173	0.016	0.0105	0.0009	0.9164	0.9094	0.4851	0.0236
	Modal	15	0.145	0.012	2.206E-05	9.361E-07	0.9283	0.9095	0.4851	0.0001

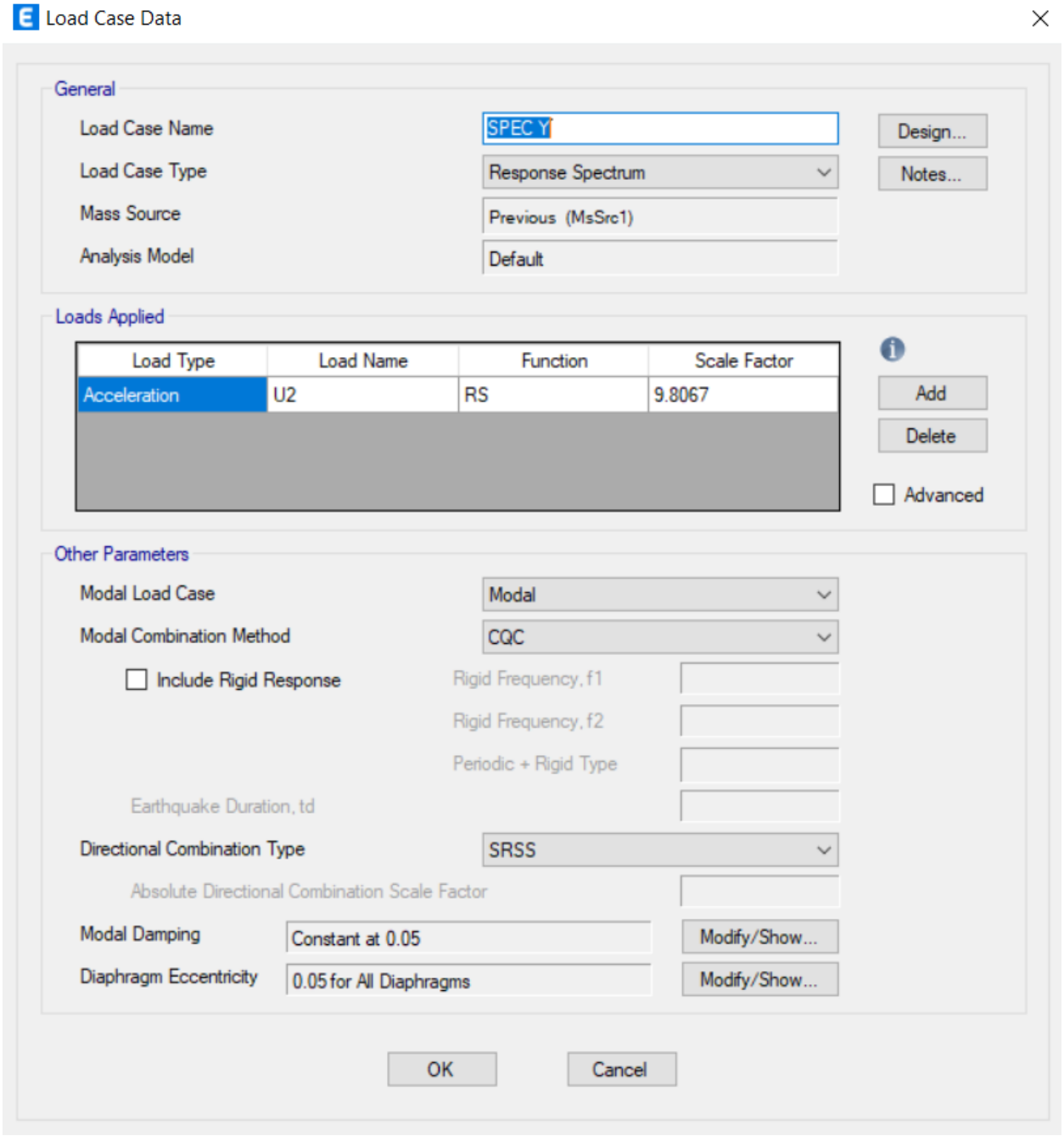
Record: << < 1 > >> of 20 Add Tables... Done



MODEL 4




Load Case Data
General
Load Case Name
SPEC X
Design...
Load Case Type
Response Spectrum
Notes...
Mass Source
Previous (MsSrc1)
Analysis Model
Default
Loads Applied
Load Type
Load Name
Function
Scale Factor
Acceleration
U1
RS
12.6
Add
Delete
Advanced
Other Parameters
Modal Load Case
Modal
Modal Combination Method
CQC
Include Rigid Response
Rigid Frequency, f1
Rigid Frequency, f2
Periodic + Rigid Type
Earthquake Duration, td
Directional Combination Type
SRSS
Absolute Directional Combination Scale Factor
Modal Damping
Constant at 0.05
Modify/Show...
Diaphragm Eccentricity
0.05 for All Diaphragms
Modify/Show...
OK
Cancel


Load Case Data
General
Load Case Name
SPEC Y
Design...
Load Case Type
Response Spectrum
Notes...
Mass Source
Previous (MsSrc1)
Analysis Model
Default
Loads Applied
Load Type
Load Name
Function
Scale Factor
Acceleration
U2
RS
9.8067
Add
Delete
Advanced
Other Parameters
Modal Load Case
Modal
Modal Combination Method
CQC
Include Rigid Response
Rigid Frequency, f1
Rigid Frequency, f2
Periodic + Rigid Type
Earthquake Duration, td
Directional Combination Type
SRSS
Absolute Directional Combination Scale Factor
Modal Damping
Constant at 0.05
Modify/Show...
Diaphragm Eccentricity
0.05 for All Diaphragms
Modify/Show...
OK
Cancel

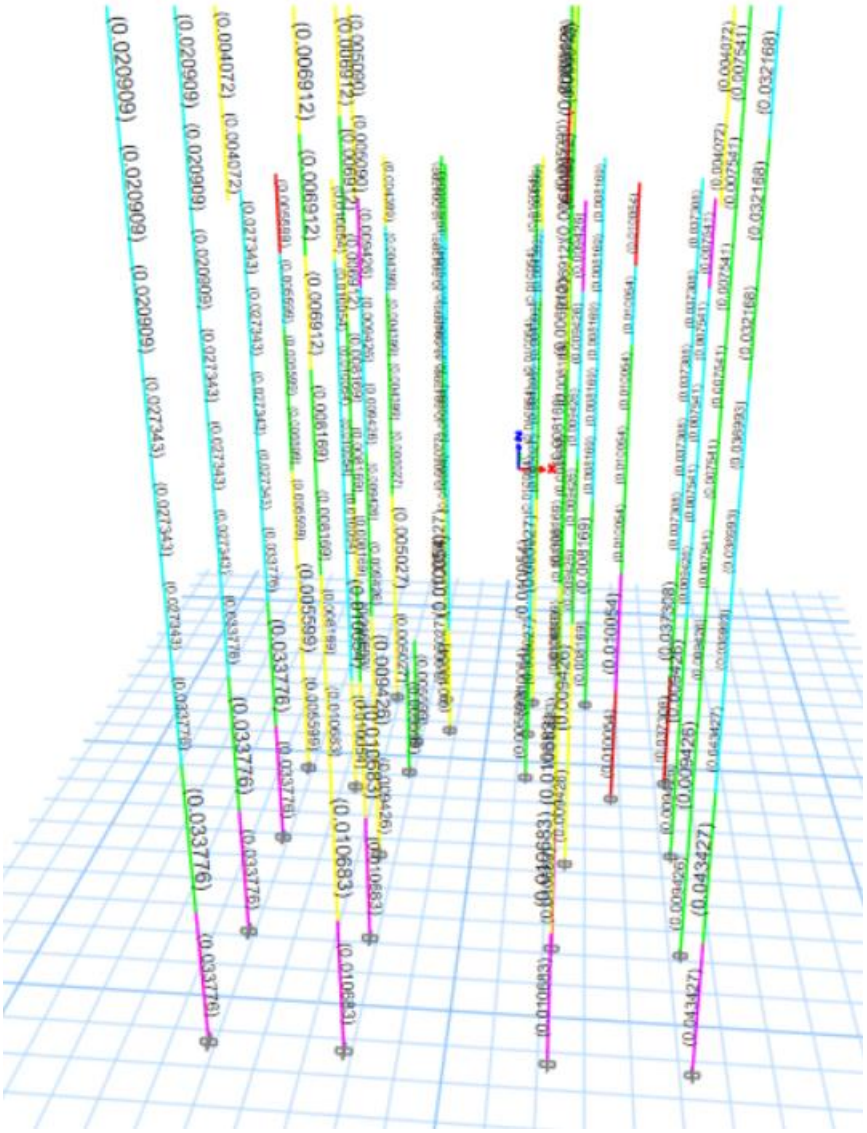
Modal Participating Mass Ratios

File Edit Format-Filter-Sort Select Options

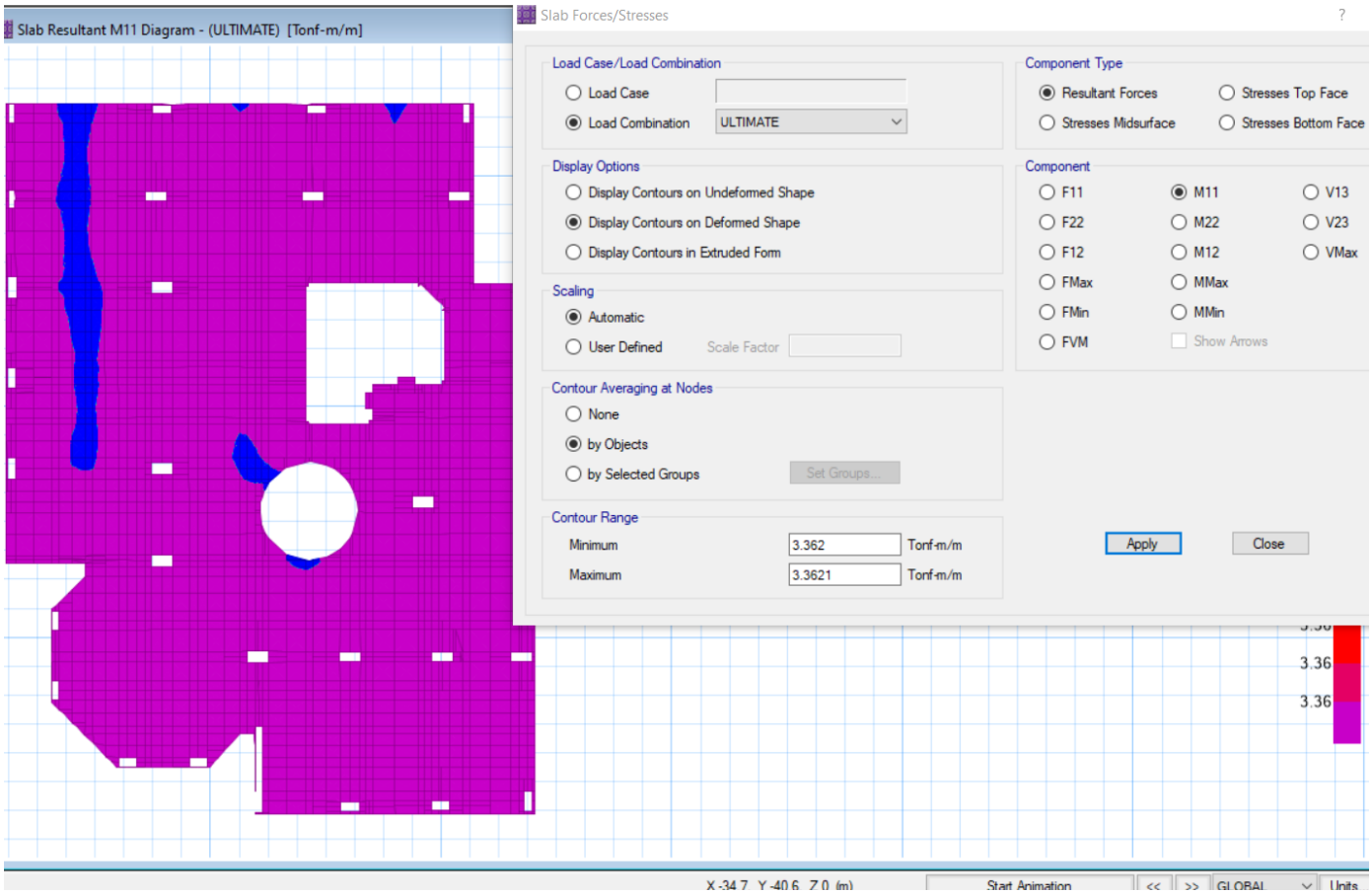
Units: As Noted Hidden Columns: No Sort: None Modal Participating Mass Ratios
Filter: None

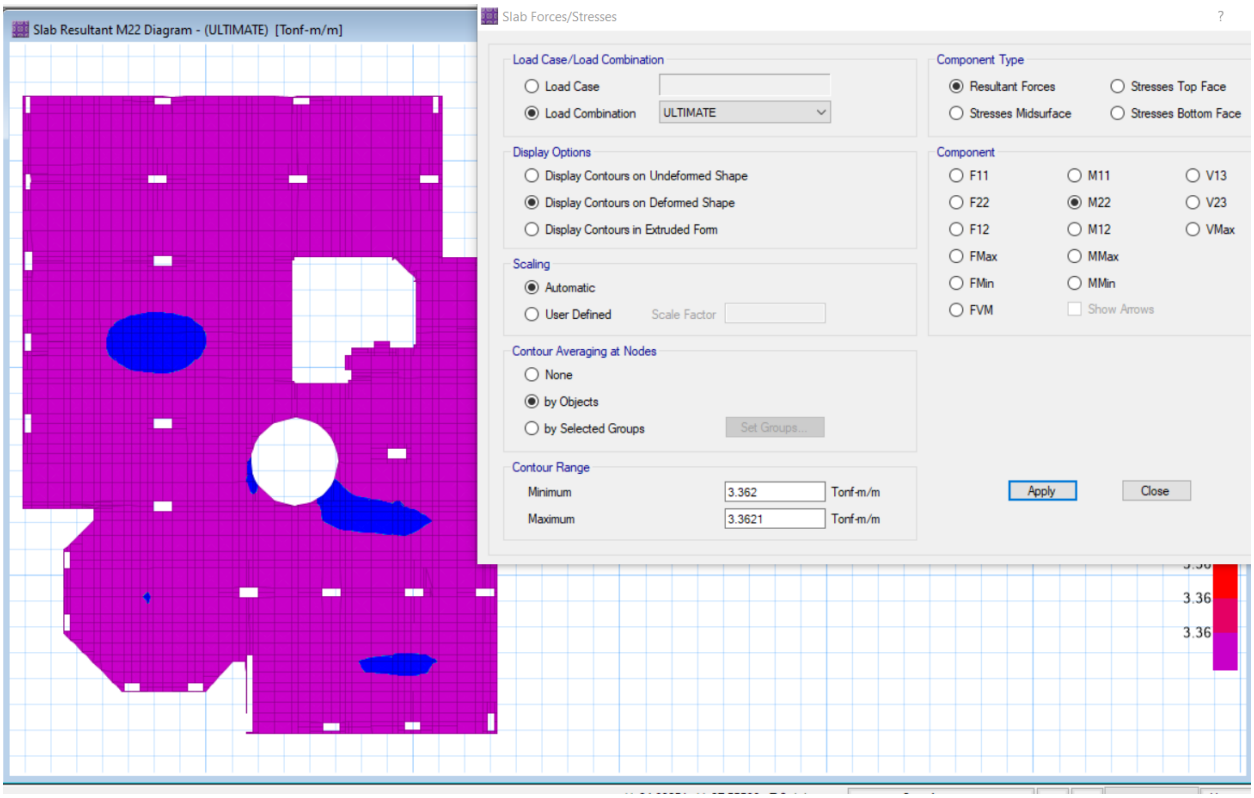
Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX
Modal	1	2.379	0.7521	0.0005	1.591E-06	0.7521	0.0005	1.591E-06	0.0001
Modal	2	1.57	0.0024	0.7254	0.0001	0.7546	0.726	0.0001	0.166
Modal	3	1.374	0.0487	0.0097	0	0.8032	0.7357	0.0001	0.0023
Modal	4	0.618	0.0834	1.293E-05	3.917E-06	0.8866	0.7357	0.0001	1.733E-05
Modal	5	0.462	5.624E-06	0.0836	0.001	0.8866	0.8193	0.0011	0.1063
Modal	6	0.368	0.0082	6.775E-07	0.0002	0.8948	0.8193	0.0013	0.0003
Modal	7	0.362	0.0003	0.005	0.0089	0.8951	0.8242	0.0102	0.0001
Modal	8	0.342	4.995E-05	0.0012	0.0088	0.8951	0.8254	0.019	0.0001
Modal	9	0.328	0.0296	0.0002	4.43E-05	0.9247	0.8256	0.0191	0.0004
Modal	10	0.312	7.45E-07	0.0003	0.0393	0.9247	0.8258	0.0584	0.0042
Modal	11	0.285	2.388E-05	0.0012	0.0717	0.9247	0.827	0.1301	0.0171
Modal	12	0.246	0.0005	0.0367	0.0324	0.9252	0.8637	0.1625	0.0344
Modal	13	0.236	2.499E-05	0.042	0.0668	0.9252	0.9057	0.2293	0.1194
Modal	14	0.22	0.0009	0.0112	0.0598	0.9261	0.917	0.2891	0.002
Modal	15	0.183	0.0315	0.0006	1.069E-05	0.9576	0.9175	0.2891	0.0001

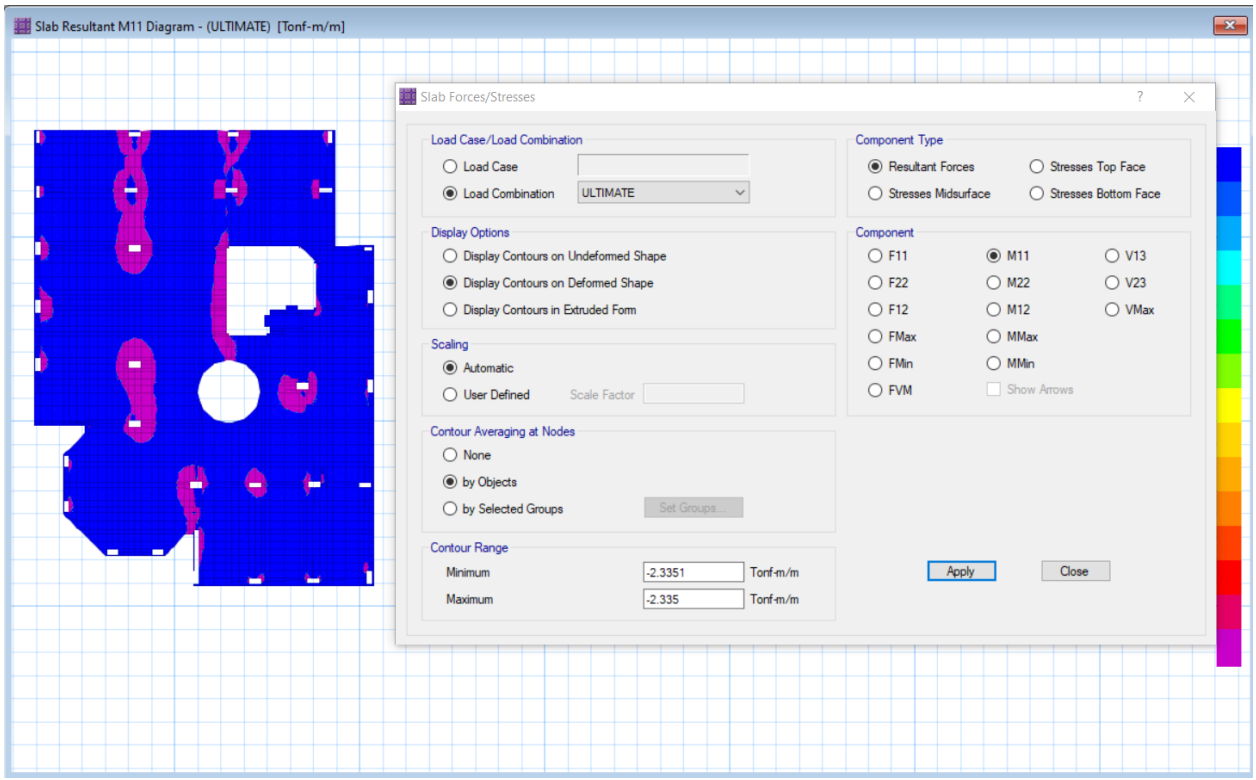
Record: << < 1 > >> of 20 Add Tables... Done

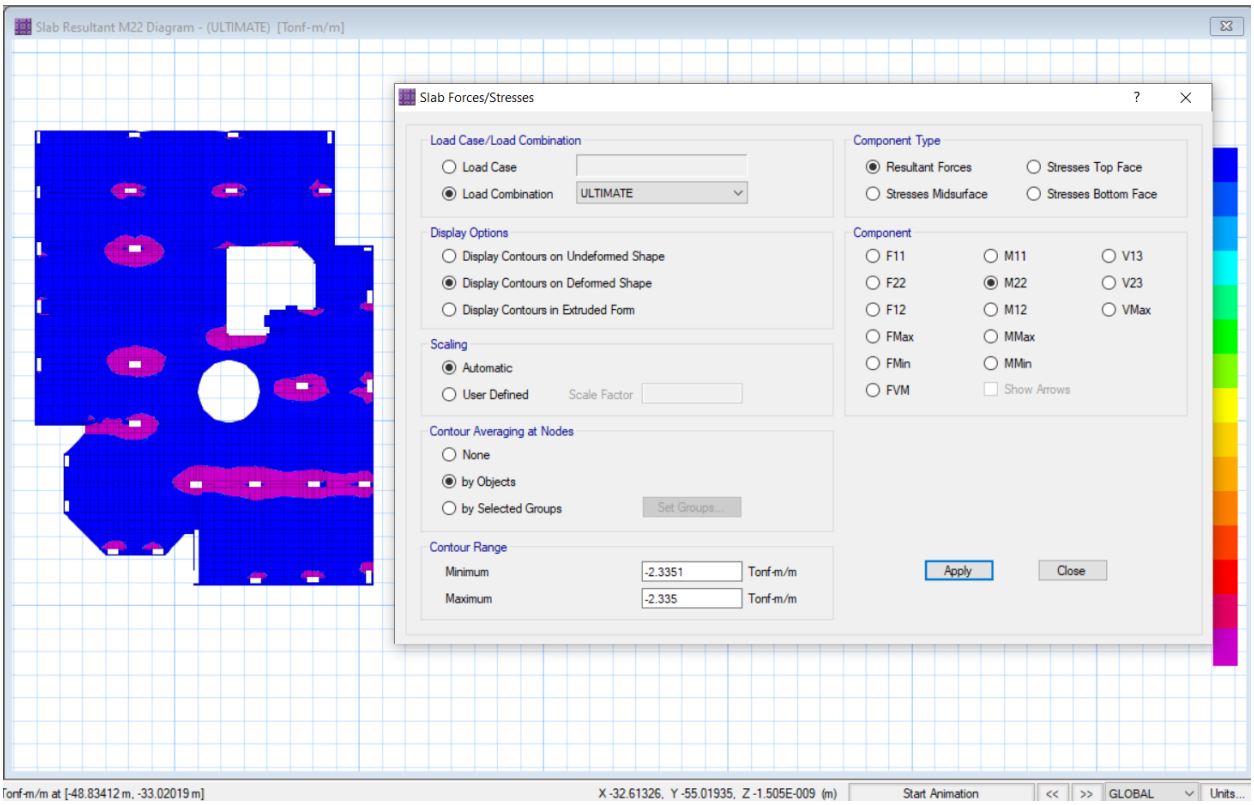


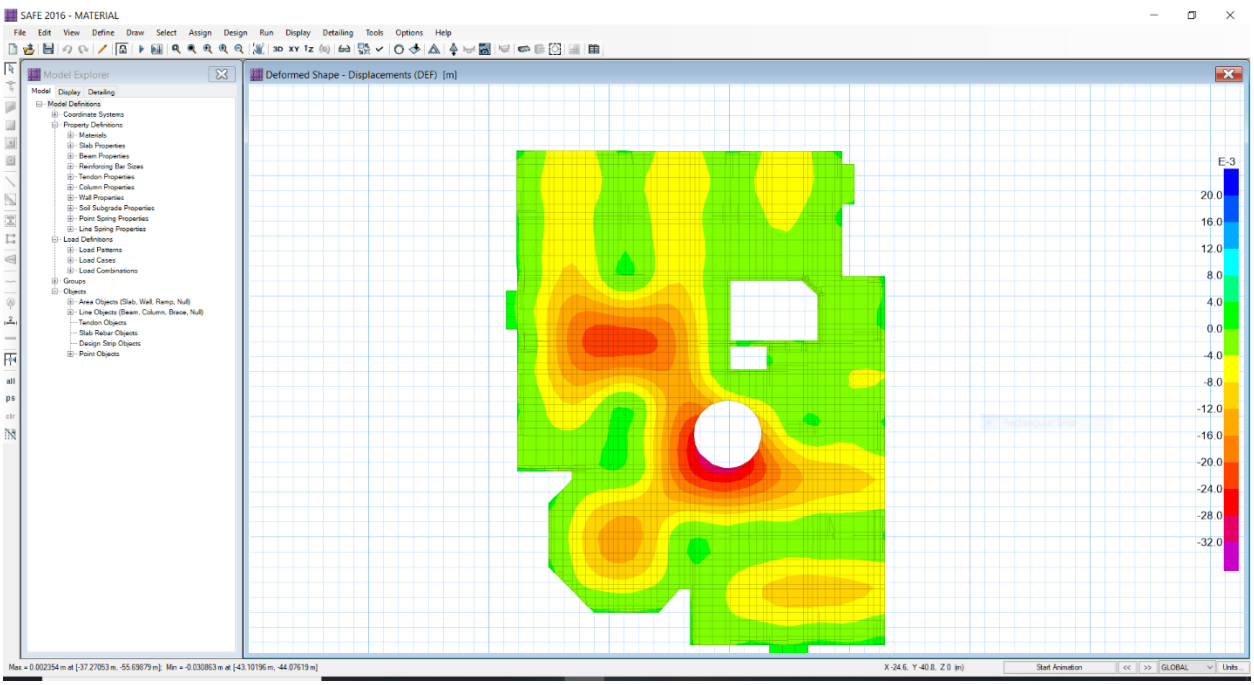
USING SAFE


Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
3.362
Tonf-m/m
Maximum
3.3621
Tonf-m/m
Apply
Close
3.36
3.36
Start Animation
GLOBAL
Units


Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
3.362
Tonf-m/m
Maximum
3.3621
Tonf-m/m
Apply
Close
3.36
3.36


Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
-2.3351
Tonf-m/m
Maximum
-2.335
Tonf-m/m
Apply
Close


Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
-2.3351
Tonf-m/m
Maximum
-2.335
Tonf-m/m
Apply
Close
Start Animation
GLOBAL
Units...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Model Explorer
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E-3
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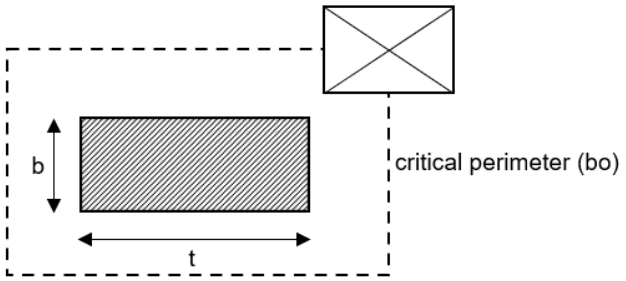
Start Animation
GLOBAL
Units

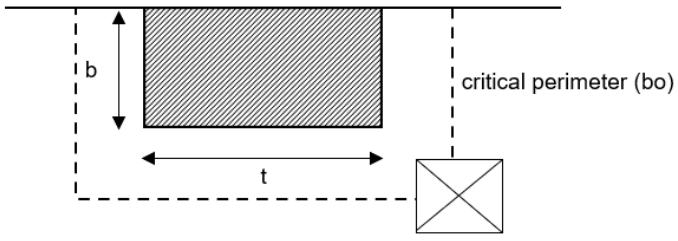
B28 60



Col.	Ult. Load N_u (ton)	Col. Dims. b (cm)	Col. Dims. t (cm)	Slab Thick (cm)	Critical Perimeter	b_o (cm)	q_{cpu} (kg/cm^2)	q_{pu} (kg/cm^2)	Notes
1	82	50	90	20	Auto	348	*16.32*	*15.94*	*Safe*
2	60	40	90	20	Auto	328	*15.41*	*12.37*	*Safe*
3	60	30	60	25	Auto	268	*16.32*	*11.70*	*Safe*
4	60	30	60	25	Auto	268	*16.32*	*11.70*	*Safe*
5	60	30	60	25	Auto	268	*16.32*	*11.70*	*Safe*
6	60	30	60	25	Auto	268	*16.32*	*11.70*	*Safe*
7	60	30	60	25	Auto	268	*16.32*	*11.70*	*Safe*
8	60	30	60	25	Auto	268	*16.32*	*11.70*	*Safe*
9	60	30	60	25	Auto	268	*16.32*	*11.70*	*Safe*

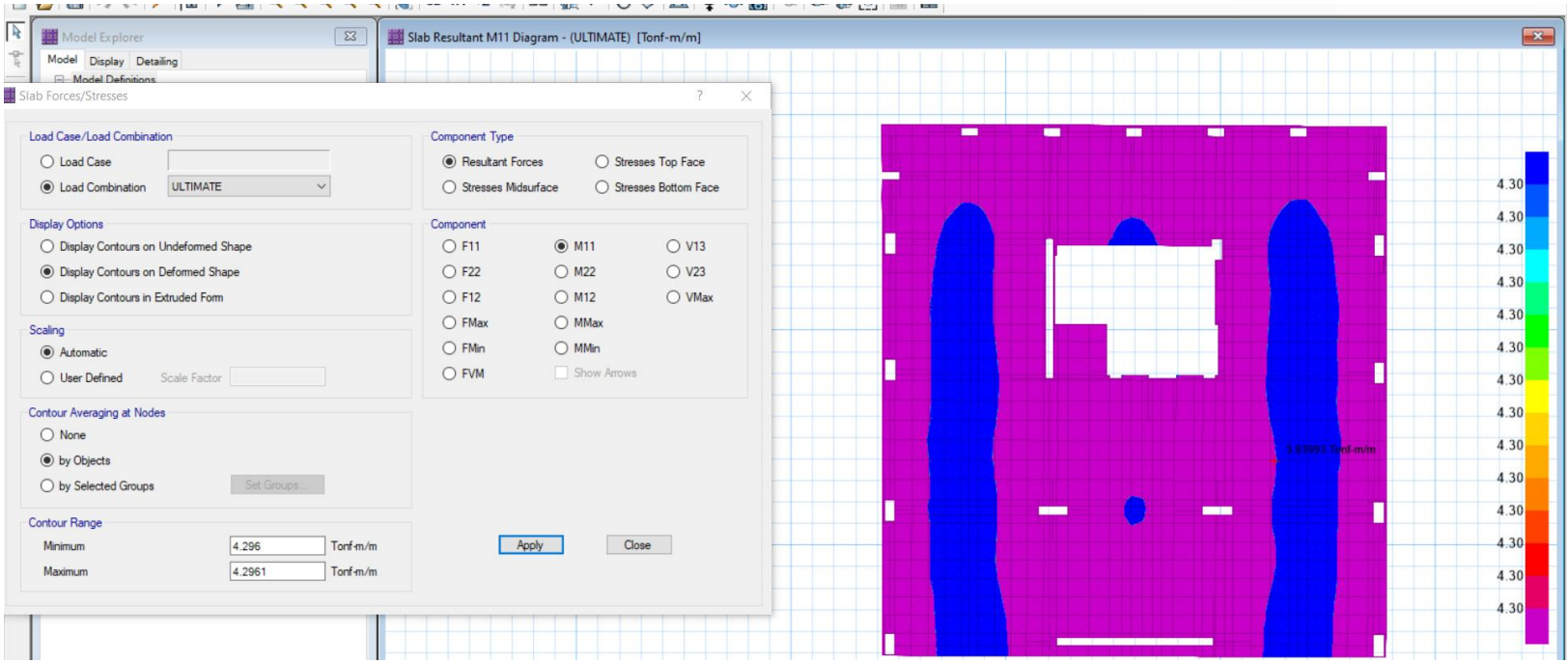
B28 60

Edge columns:



Col.	Ult. Load N_u (ton)	Col. Dims. b (cm)	Col. Dims. t (cm)	Slab Thick (cm)	Critical Perimeter	b_o (cm)	q_{cpu} (kg/cm^2)	q_{pu} (kg/cm^2)	Notes
1	25	30	80	20	Auto	174	*14.28*	*10.99*	*Safe*
2	27.9	40	80	20	Auto	194	*16.32*	*11.00*	*Safe*
3	35	40	90	20	Auto	204	*15.41*	*13.12*	*Safe*
4	32	40	90	20	Auto	204	*15.41*	*12.00*	*Safe*

MODEL 3 :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Model
Display
Detailing
Model Definitions
Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
4.296
Tonf-m/m
Maximum
4.2961
Tonf-m/m
Apply
Close
4.30
4.30
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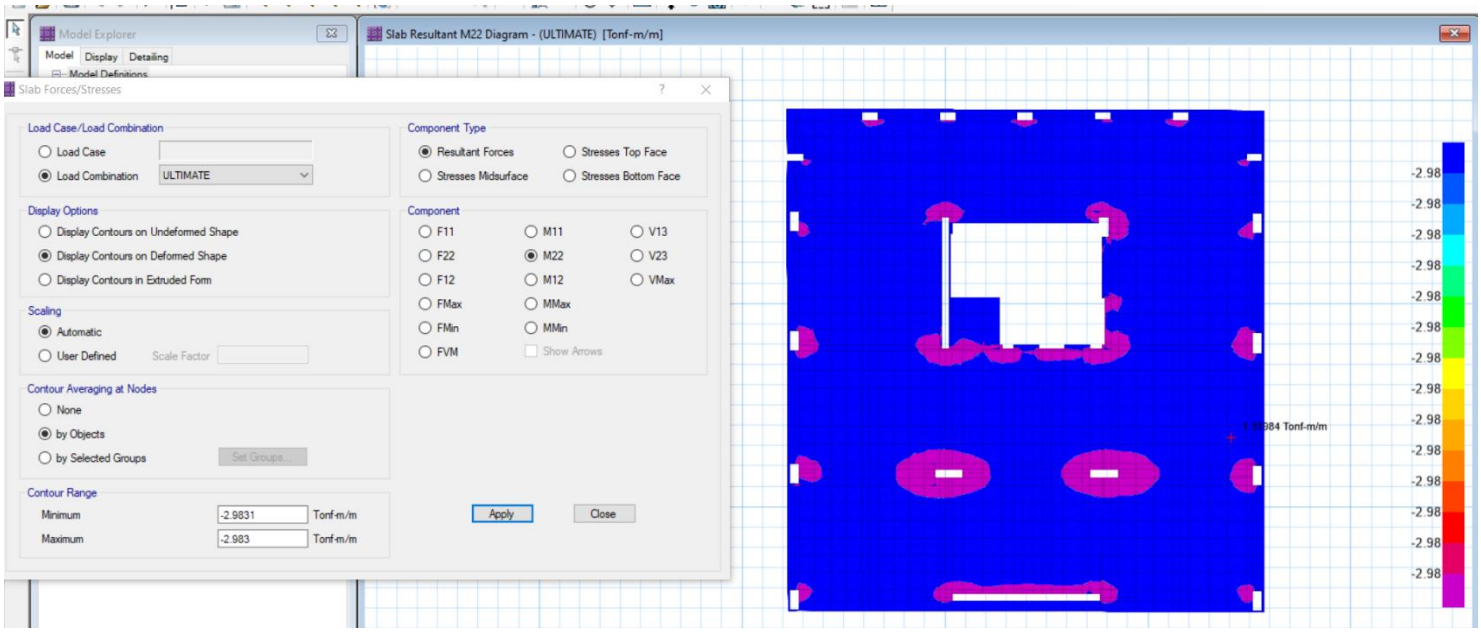
4.30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Display
Detailing
Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
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Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
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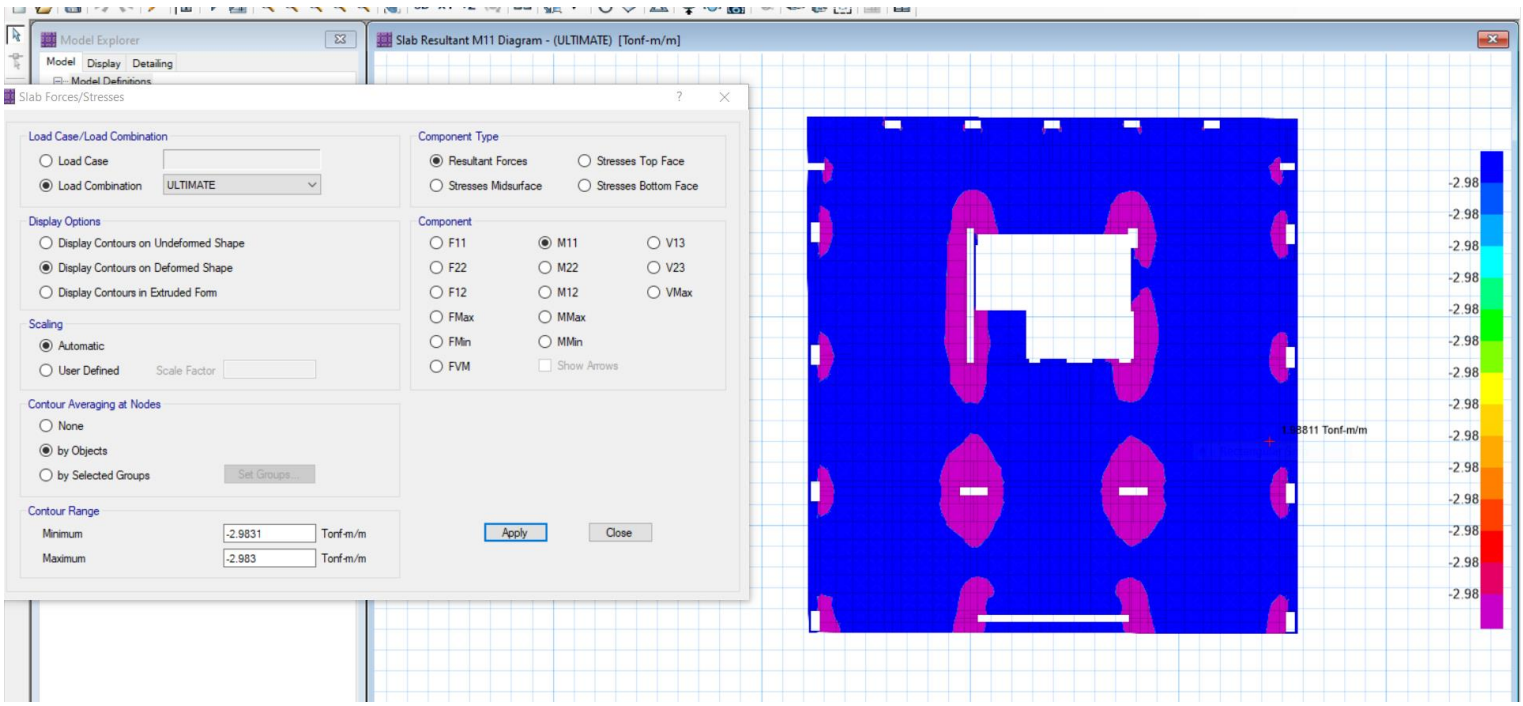
Tonf-m/m
Maximum
-2.983
Tonf-m/m
Apply
Close
-2.98
1.31984 Tonf-m/m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Detailing
Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
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Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
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Tonf-m/m
Maximum
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Tonf-m/m
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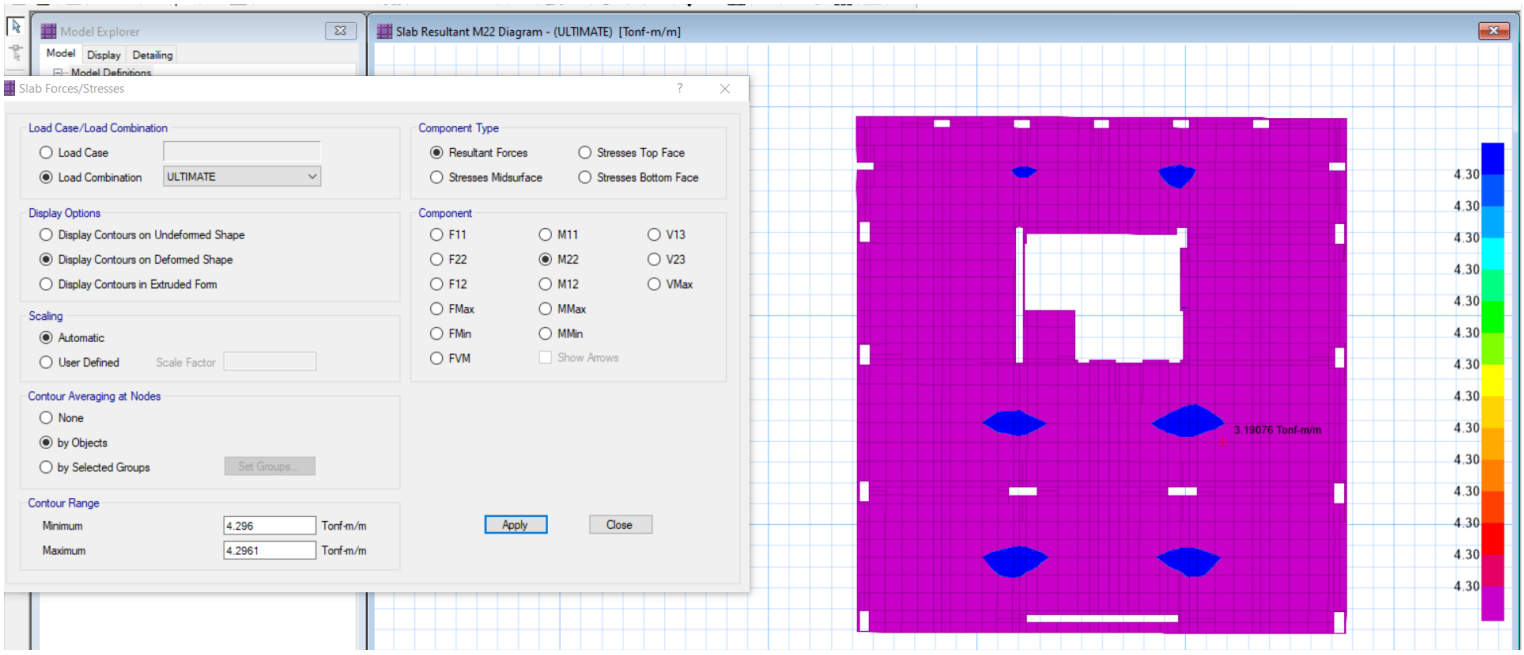
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Detailing
Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
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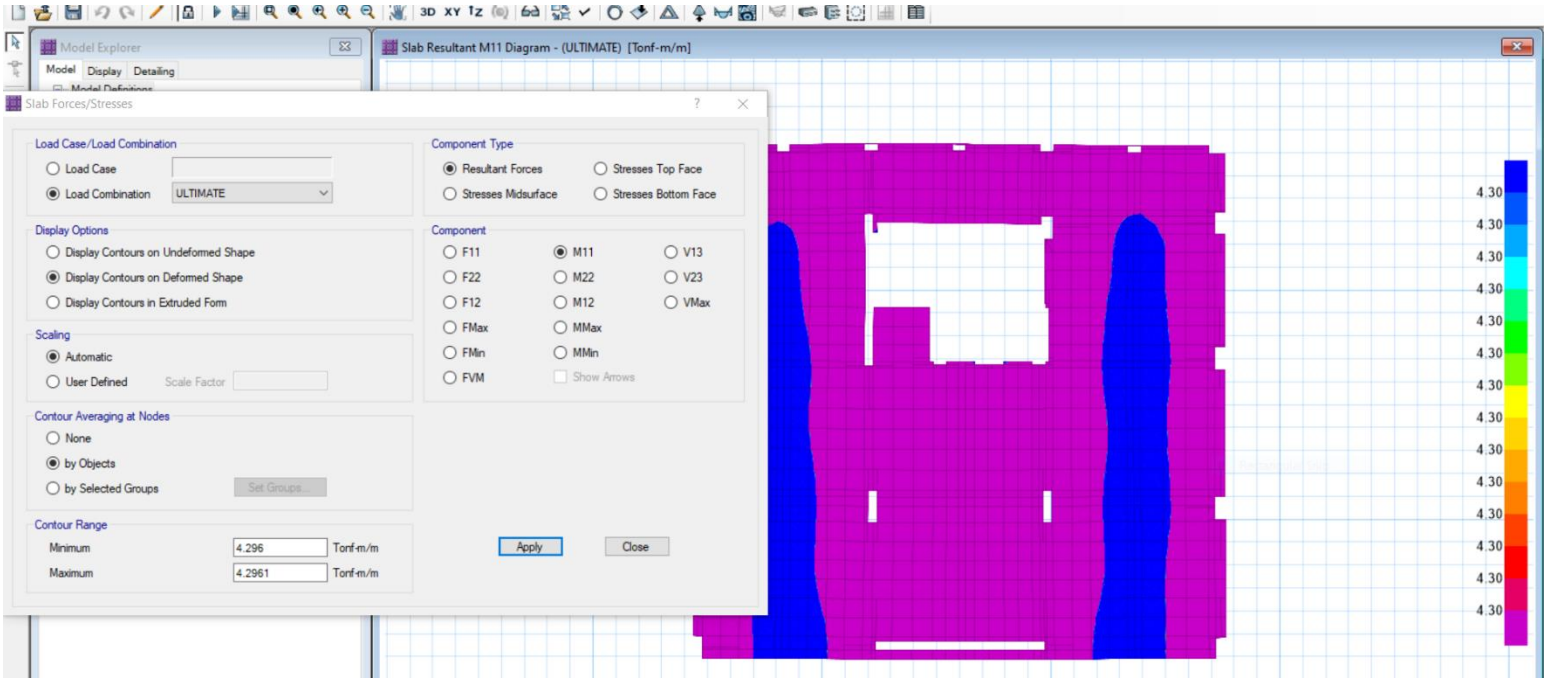
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
4.296
Tonf-m/m
Maximum
4.2961
Tonf-m/m
Apply
Close
3.19076 Tonf-m/m
4.30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Detailing
Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
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V23
F12
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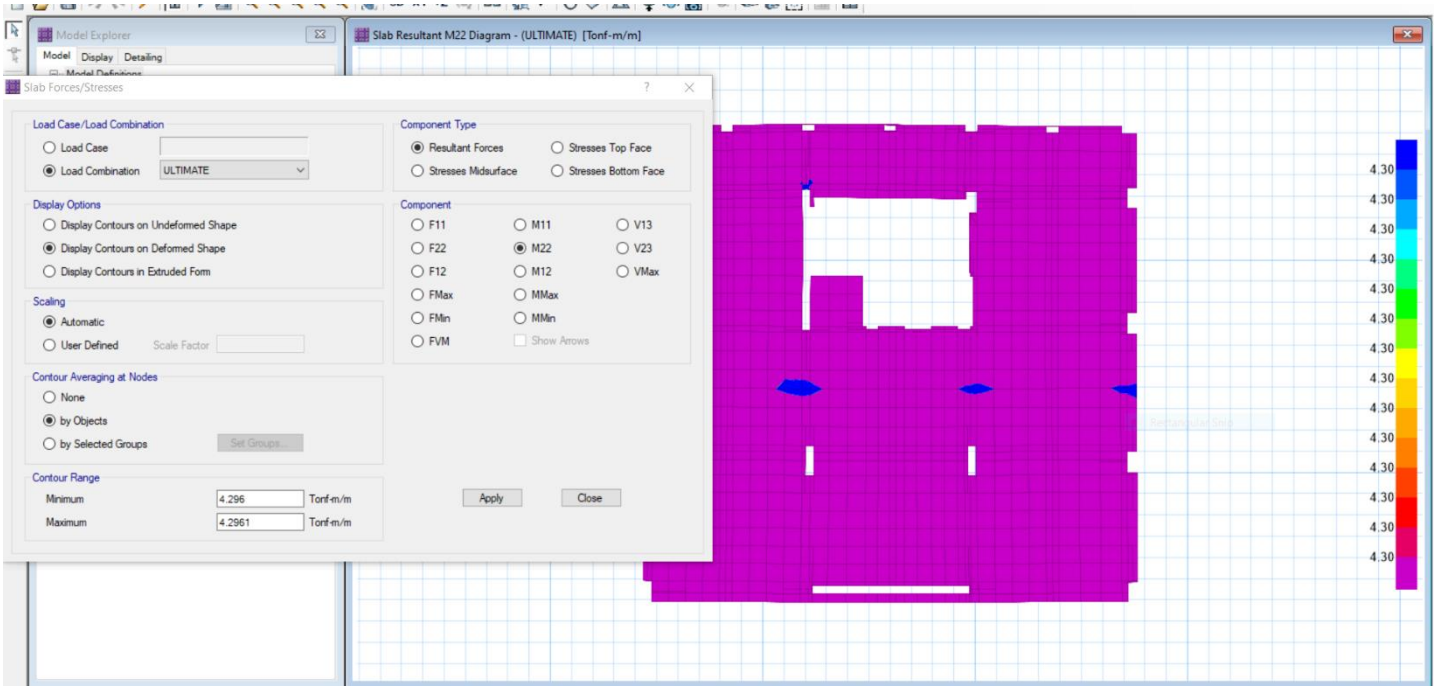
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
4.296
Tonf-m/m
Maximum
4.2961
Tonf-m/m
Apply
Close
4.30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Model
Display
Detailing
Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
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M22
V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
4.296
Tonf-m/m
Maximum
4.2961
Tonf-m/m
Apply
Close
4.30
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4.30
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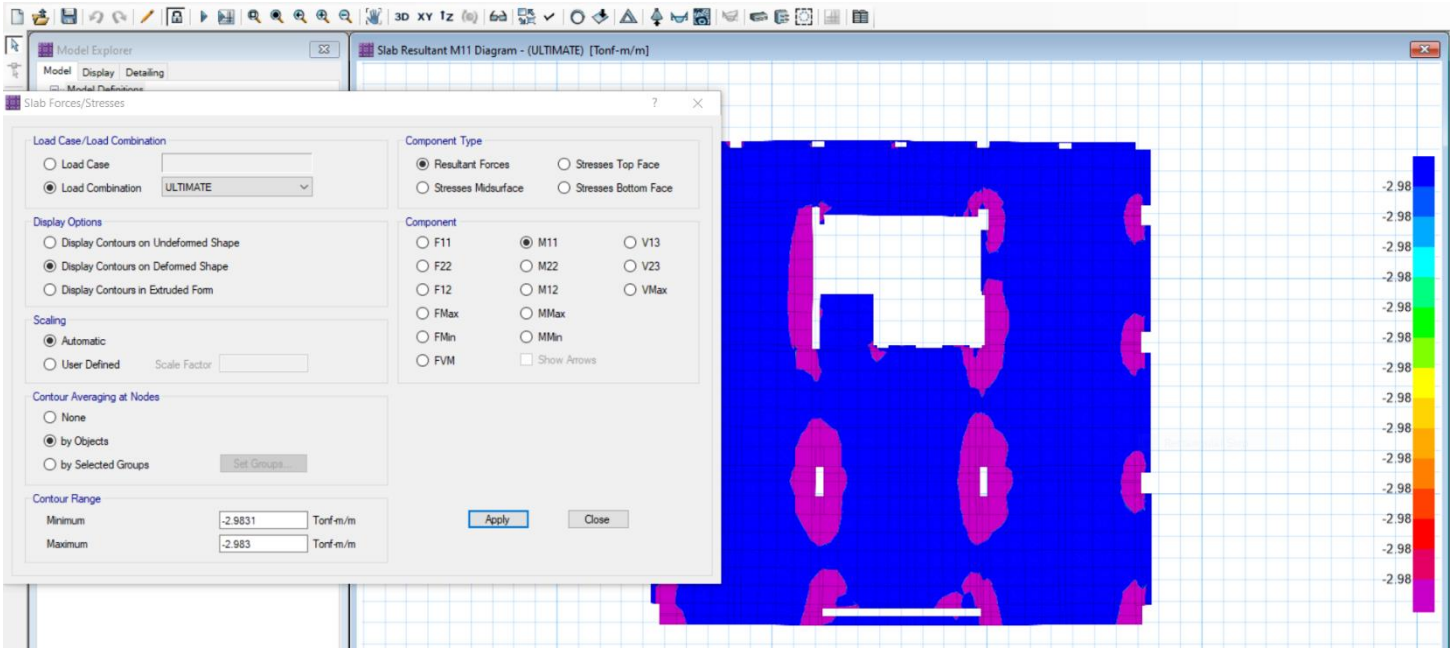
4.30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Model
Display
Detailing
Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
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V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
-2.9831
Tonf-m/m
Maximum
-2.983
Tonf-m/m
Apply
Close
-2.98
-2.98
-2.98
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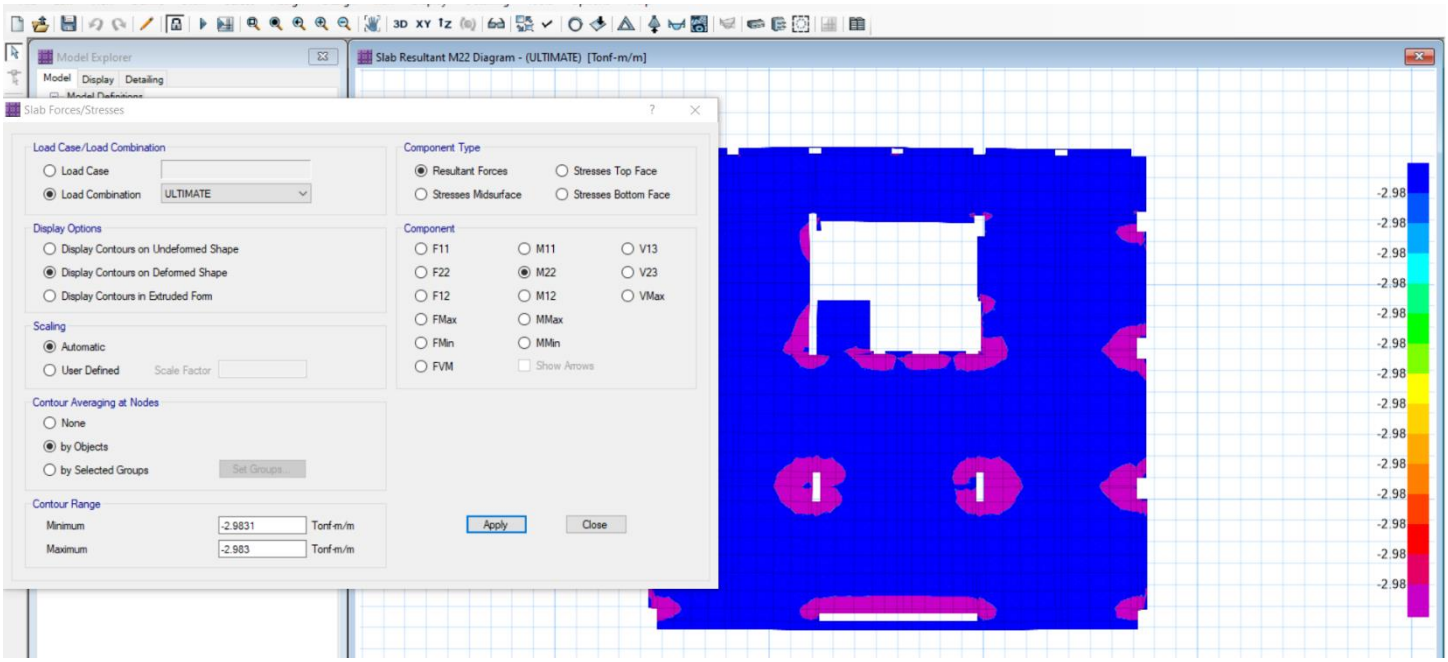
-2.98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Model
Display
Detailing
Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Slab Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
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VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Scaling
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
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Tonf-m/m
Maximum
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Tonf-m/m
Apply
Close
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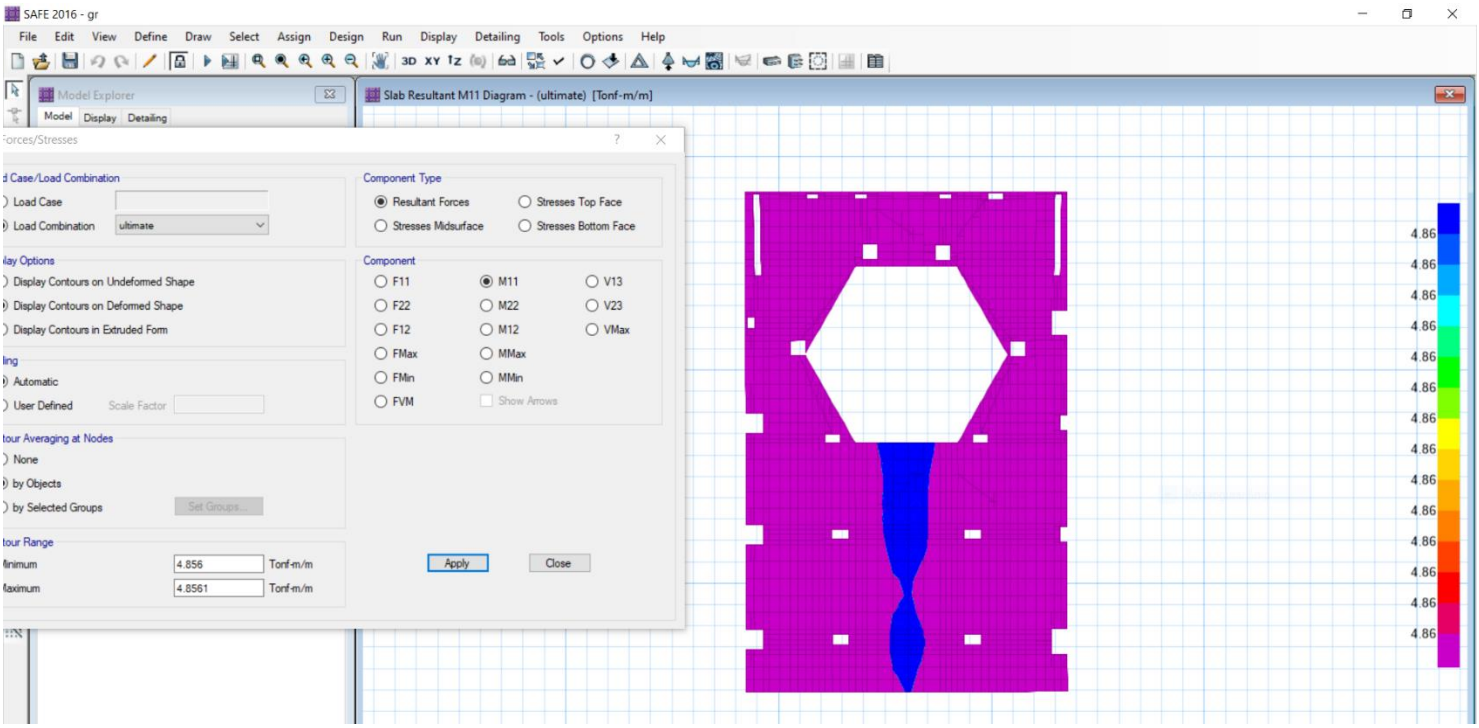
MODEL 4 :


SAFE 2016 - gr
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Model Explorer
Model Display Detailing
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Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Component
F11 M11 V13
F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
Load Case
Load Combination
ultimate
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Automatic
User Defined
Scale Factor
None
by Objects
by Selected Groups
Set Groups...
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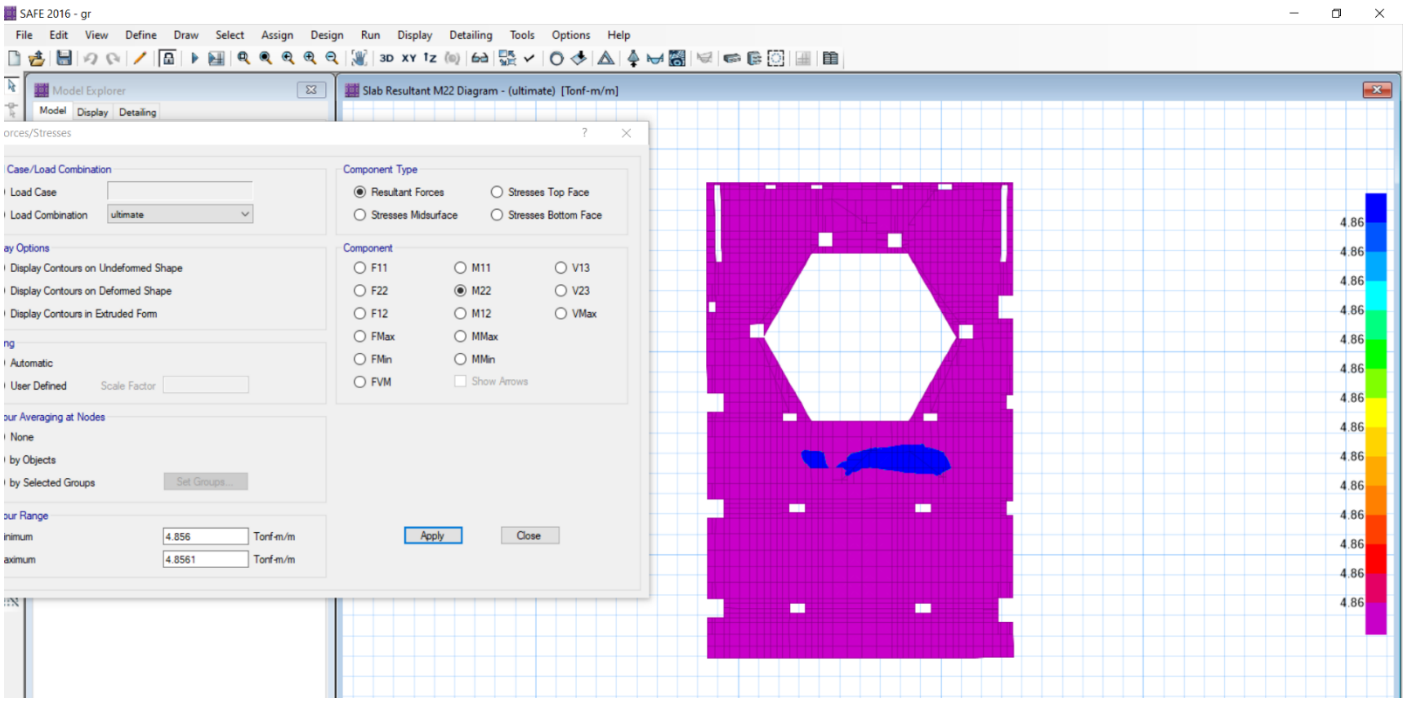
4.8561
Tonf-m/m
Apply
Close
4.86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Model Explorer
Model Display Detailing
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Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Component
F11 M11 V13
F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
Load Case
Load Combination
ultimate
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Automatic
User Defined
Scale Factor
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by Objects
by Selected Groups
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4.8561
Tonf-m/m
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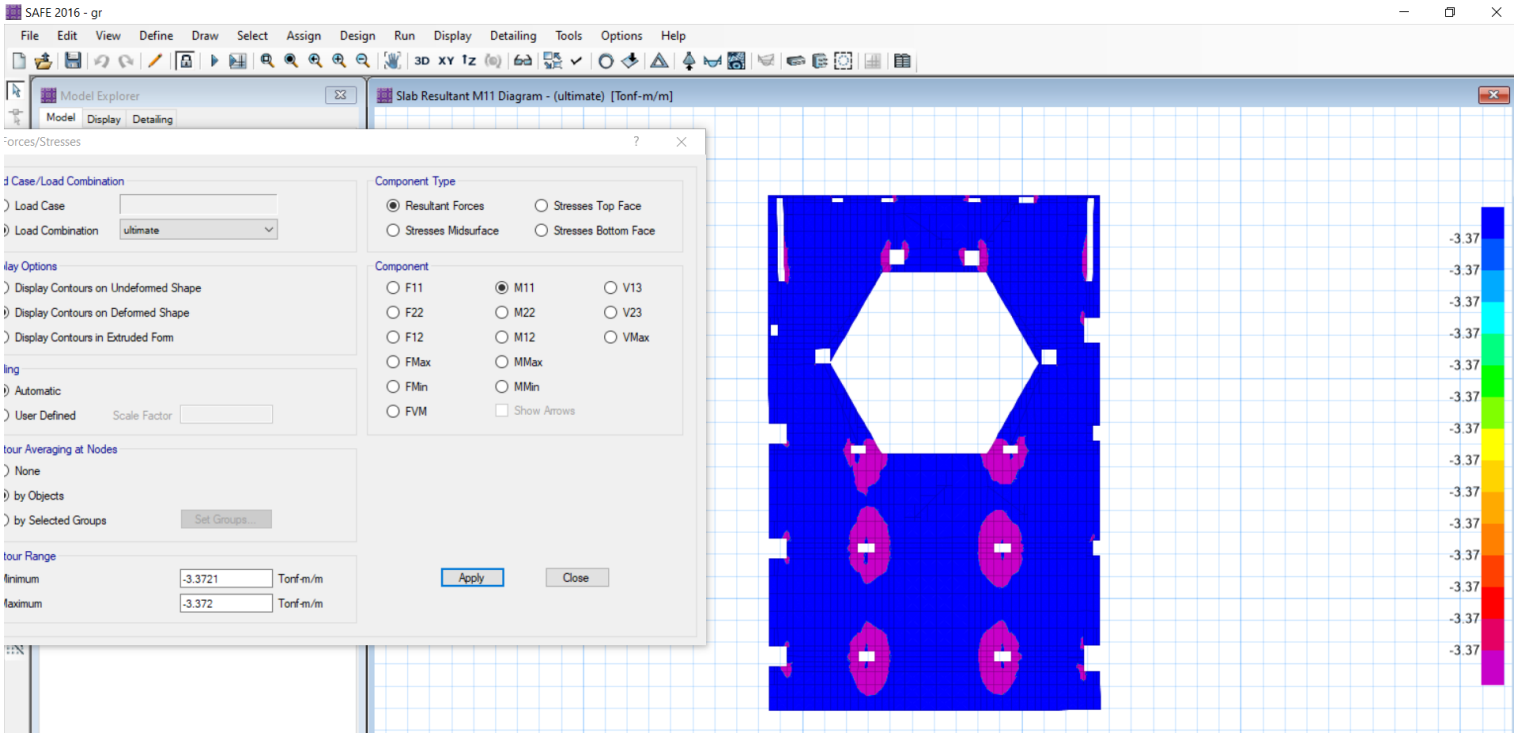
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Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Component
F11 M11 V13
F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
Load Case
Load Combination
ultimate
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Automatic
User Defined
Scale Factor
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by Objects
by Selected Groups
Set Groups...
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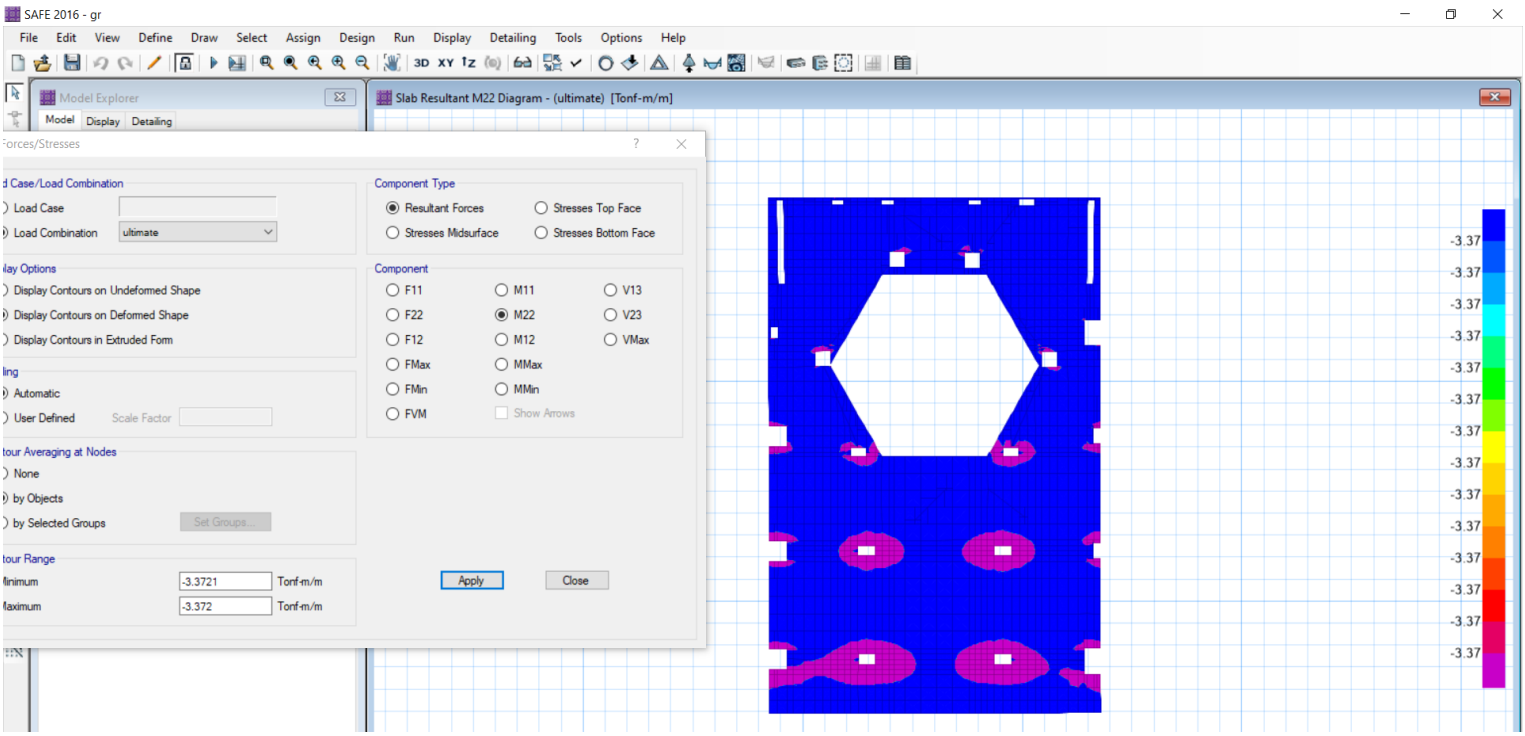
-3.372
Tonf-m/m
Apply
Close
-3.37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Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Component
F11 M11 V13
F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
Load Case
Load Combination
ultimate
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Automatic
User Defined
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by Objects
by Selected Groups
Set Groups...
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-3.372
Tonf-m/m
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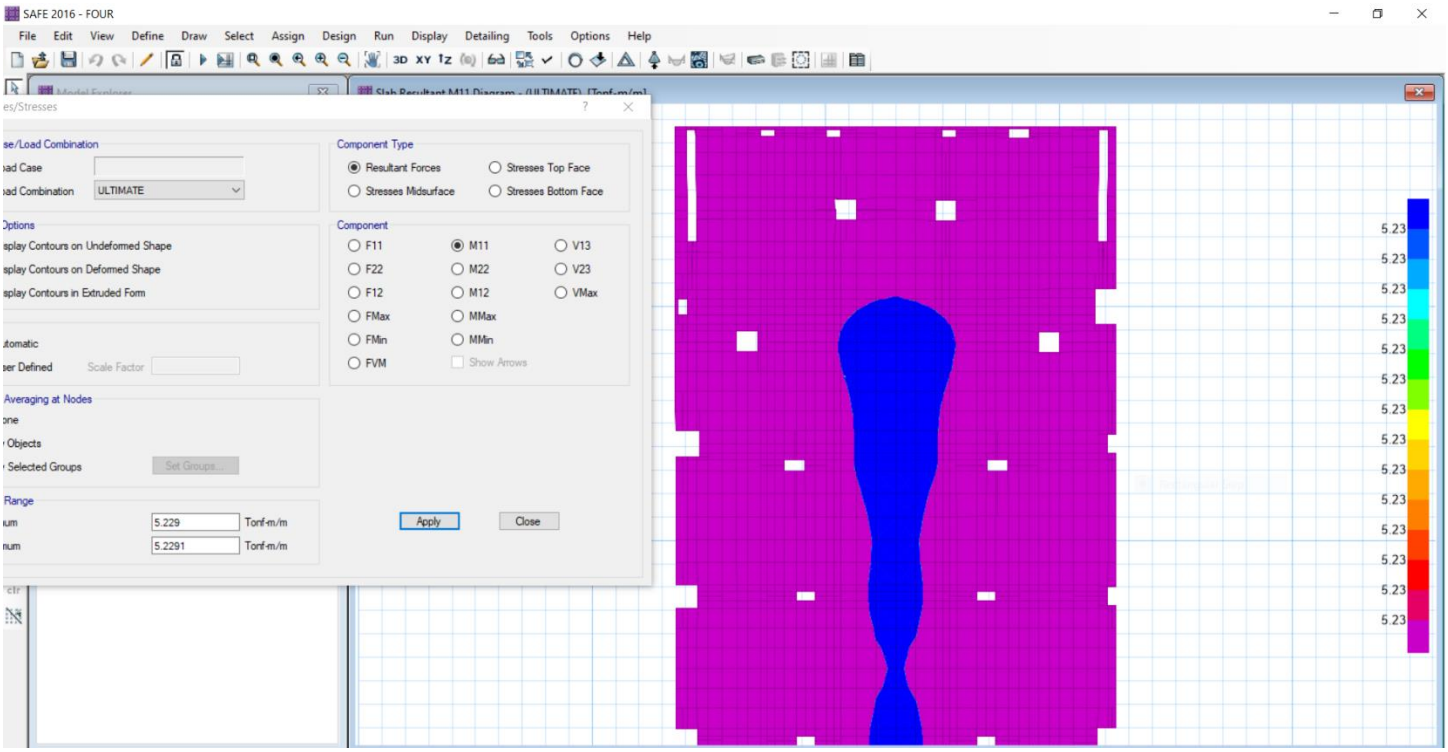
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Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Component
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F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
ULTIMATE
Scale Factor
Set Groups...
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Tonf-m/m
Apply
Close
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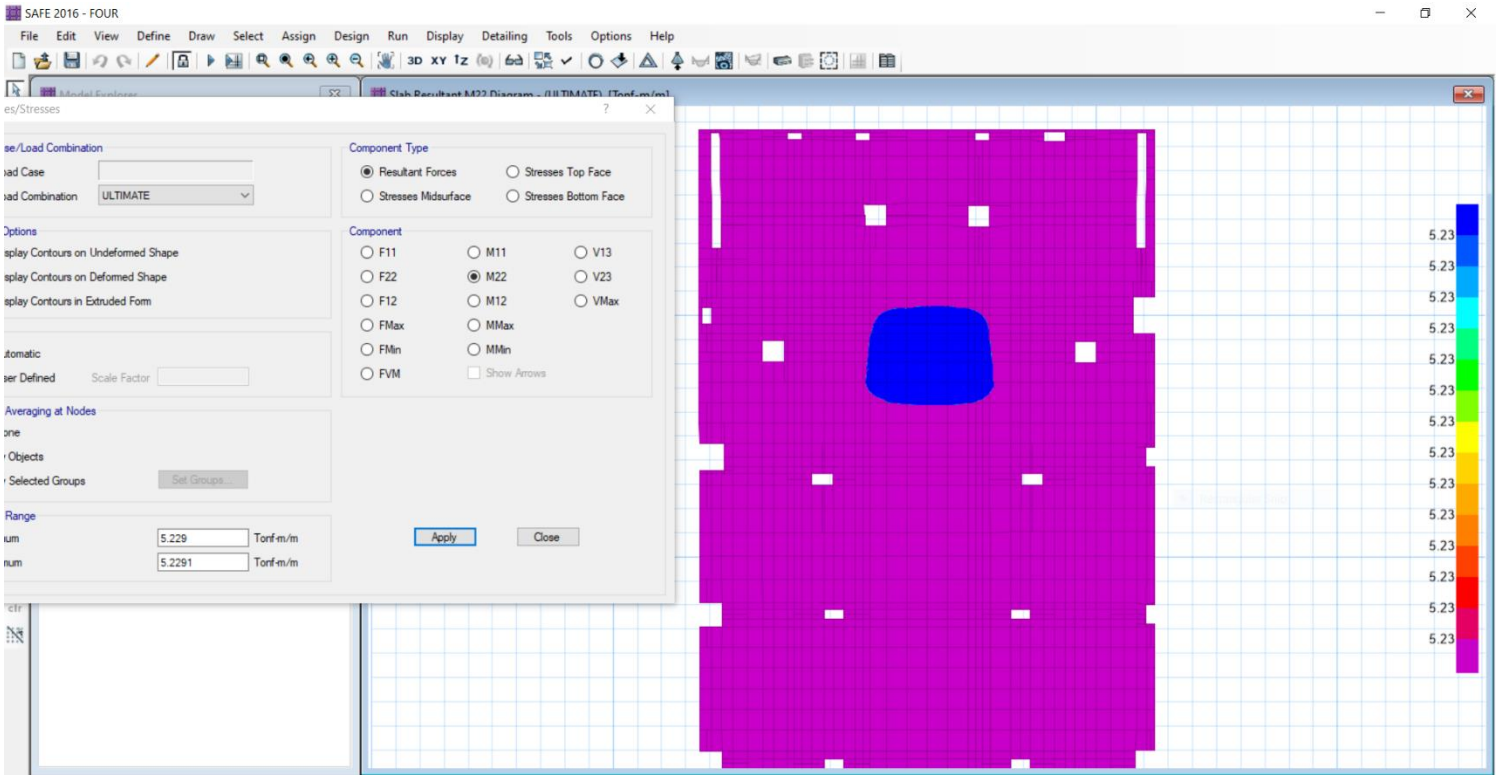
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Resultant Forces
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Stresses Midsurface
Stresses Bottom Face
Component
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F22 M22 V23
F12 M12 VMax
FMax MMax
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Scale Factor
Set Groups...
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Tonf-m/m
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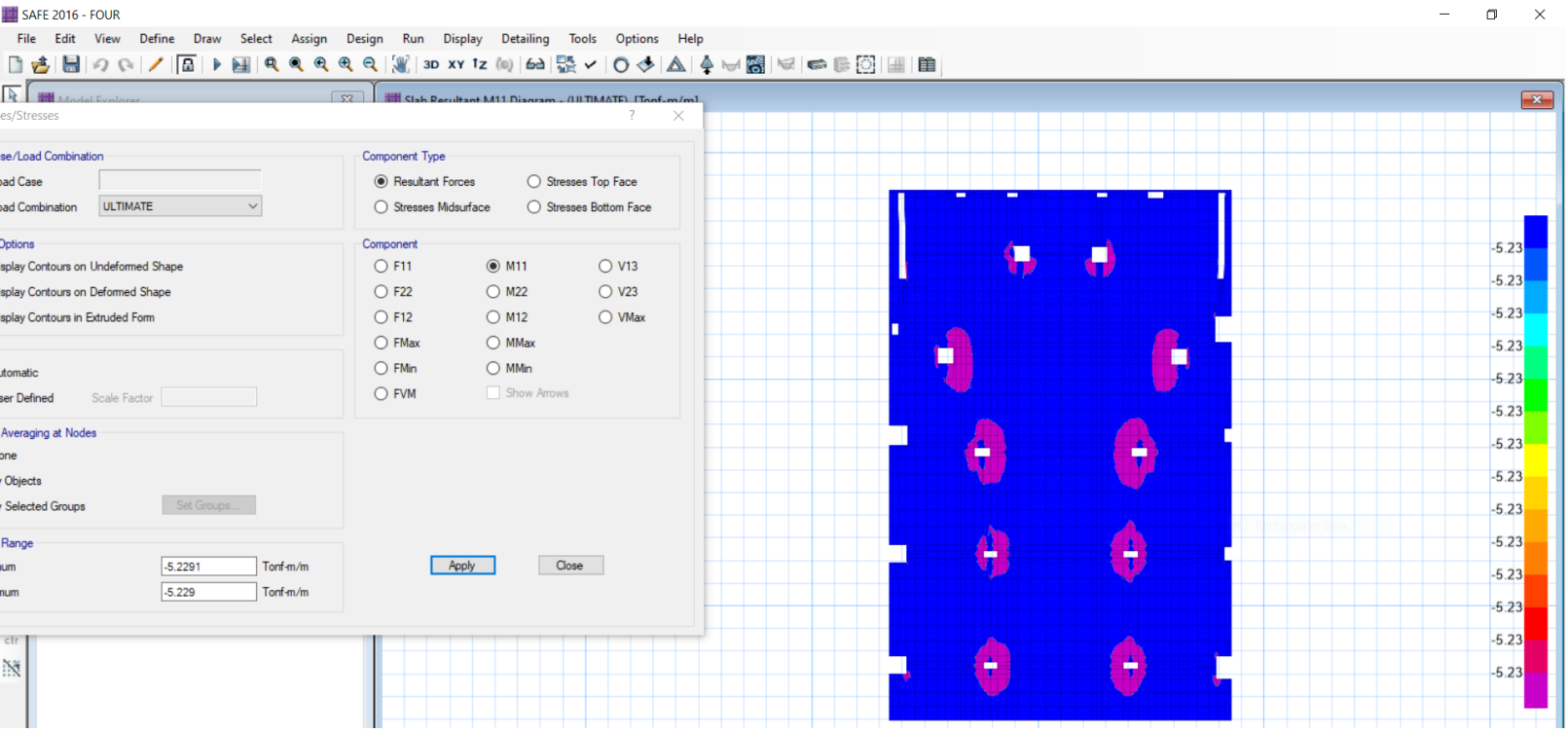
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Resultant Forces
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Stresses Midsurface
Stresses Bottom Face
Component
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F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
ULTIMATE
Scale Factor
Set Groups...
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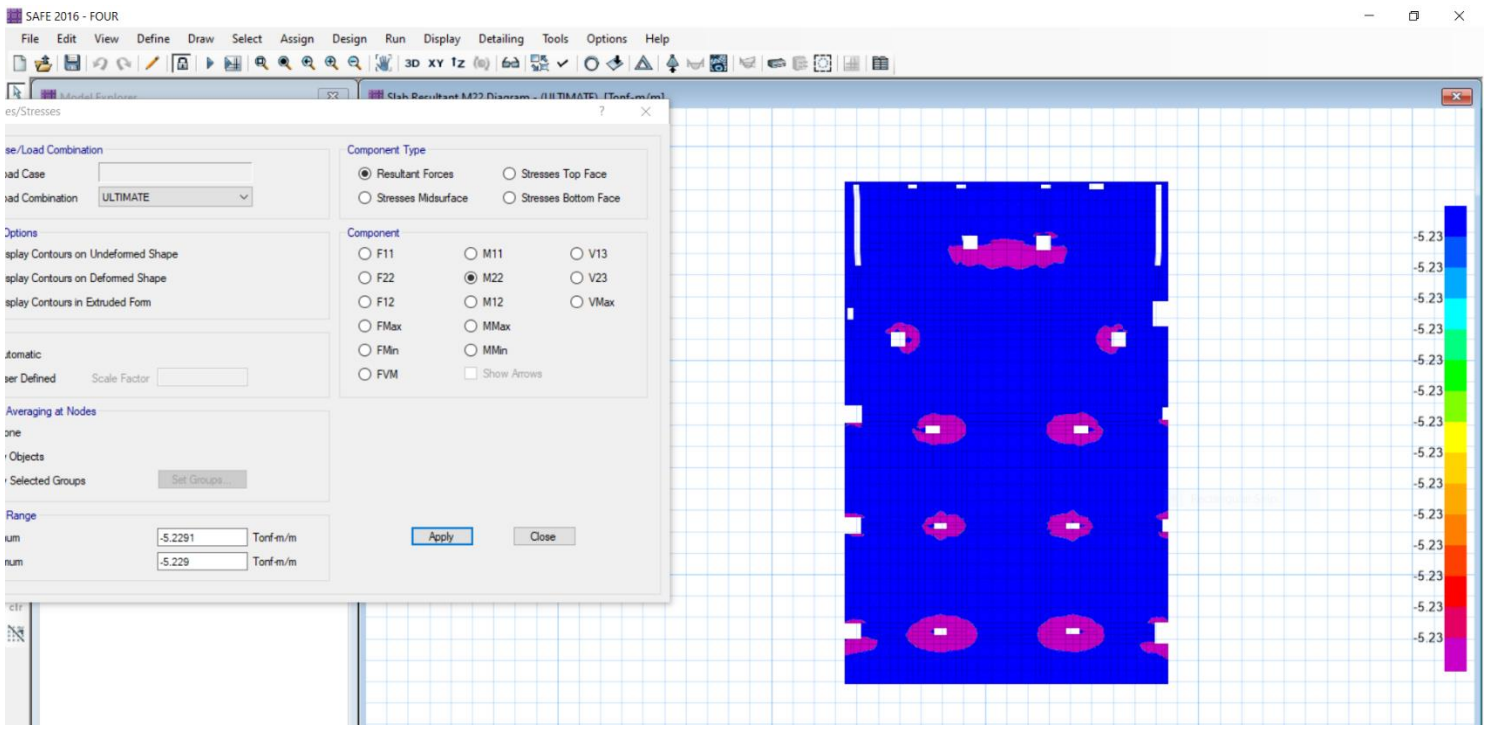
-5.229 Tonf-m/m
Apply
Close
-5.23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Stresses Midsurface
Stresses Bottom Face
Component
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F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
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Scale Factor
Set Groups...
-5.2291 Tonf-m/m
-5.229 Tonf-m/m
Apply
Close
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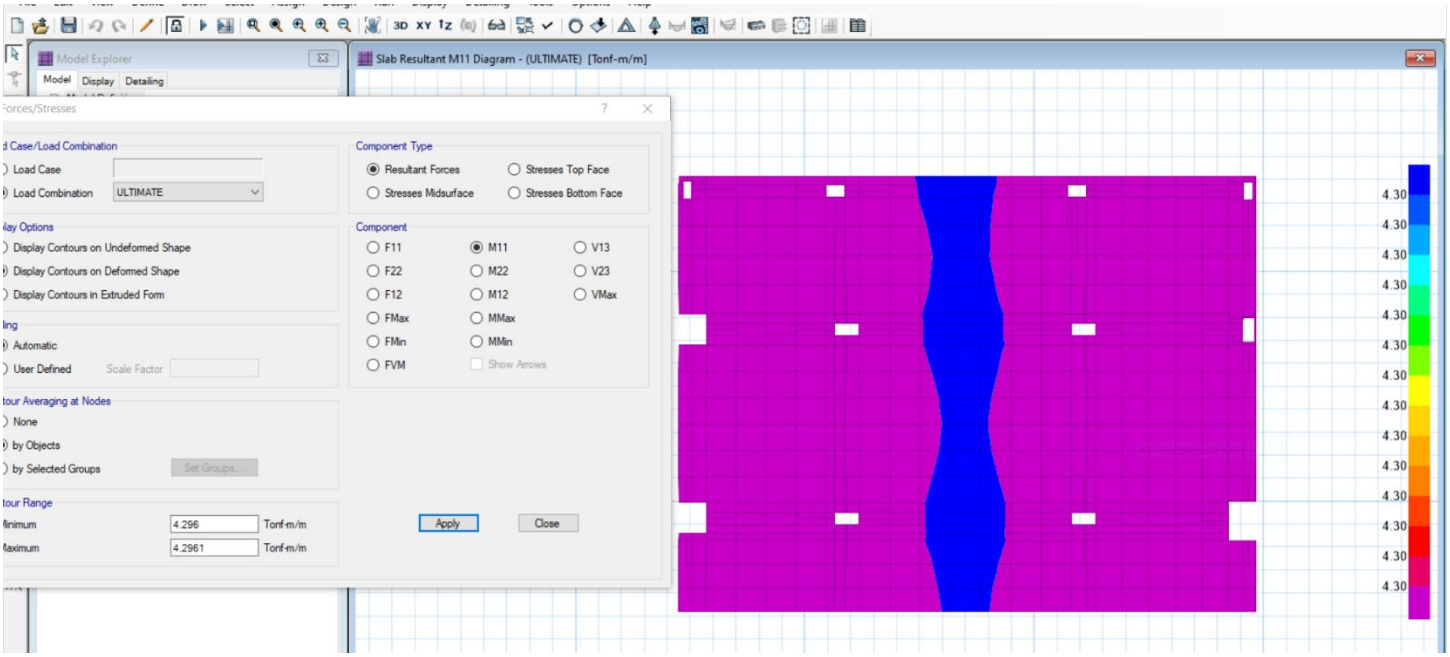
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Detailing
Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
V23
F12
M12
VMax
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MMax
FMin
MMin
FVM
Show Arrows
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
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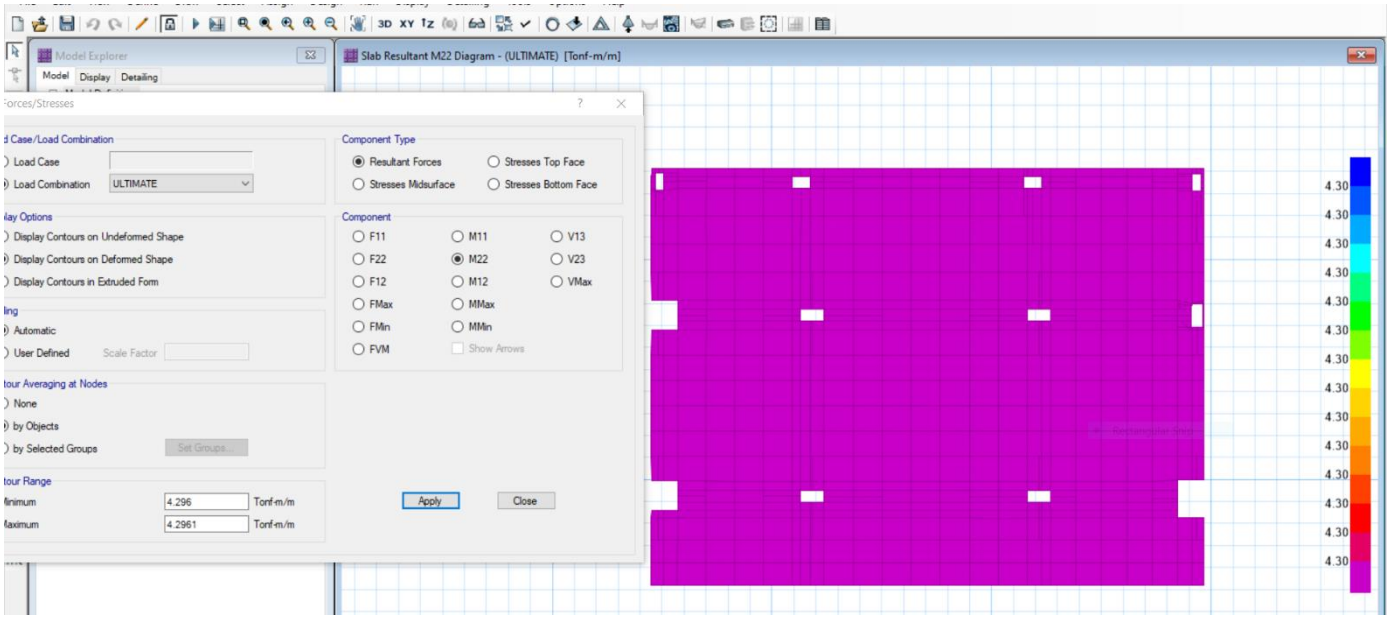
Tonf-m/m
Maximum
4.2961
Tonf-m/m
Apply
Close
4.30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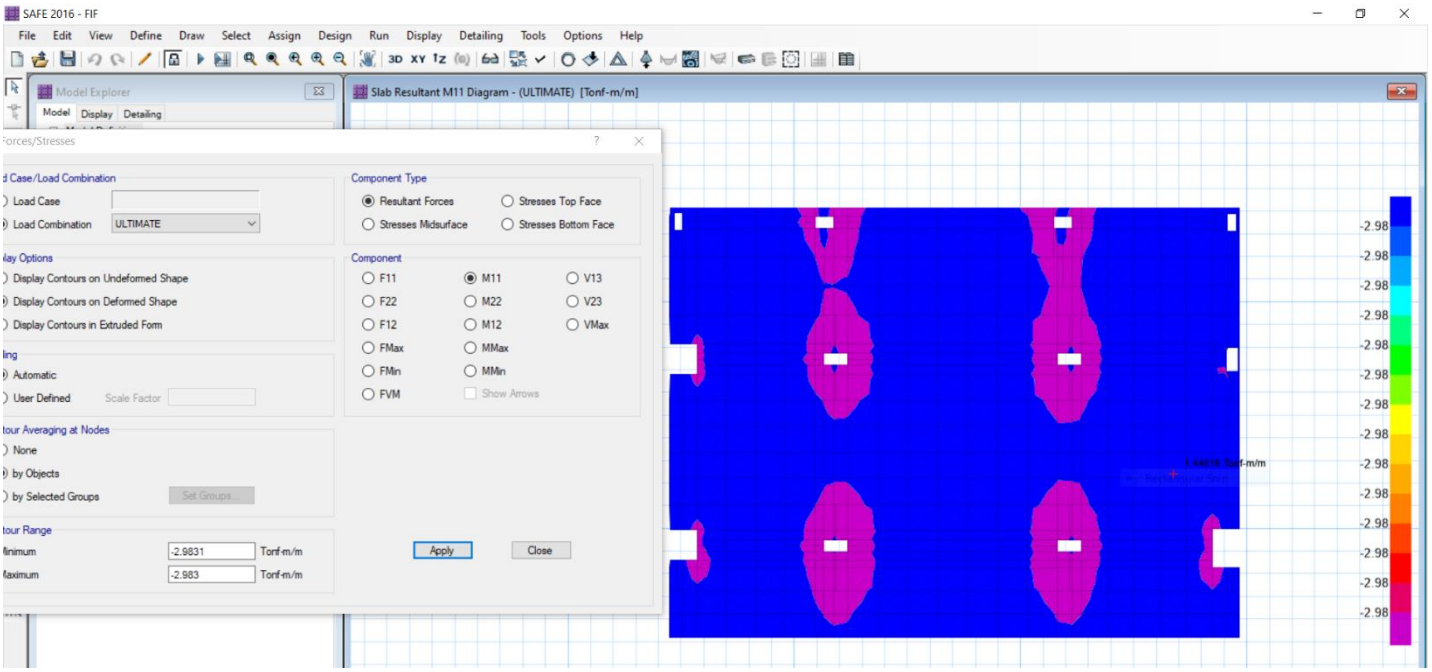
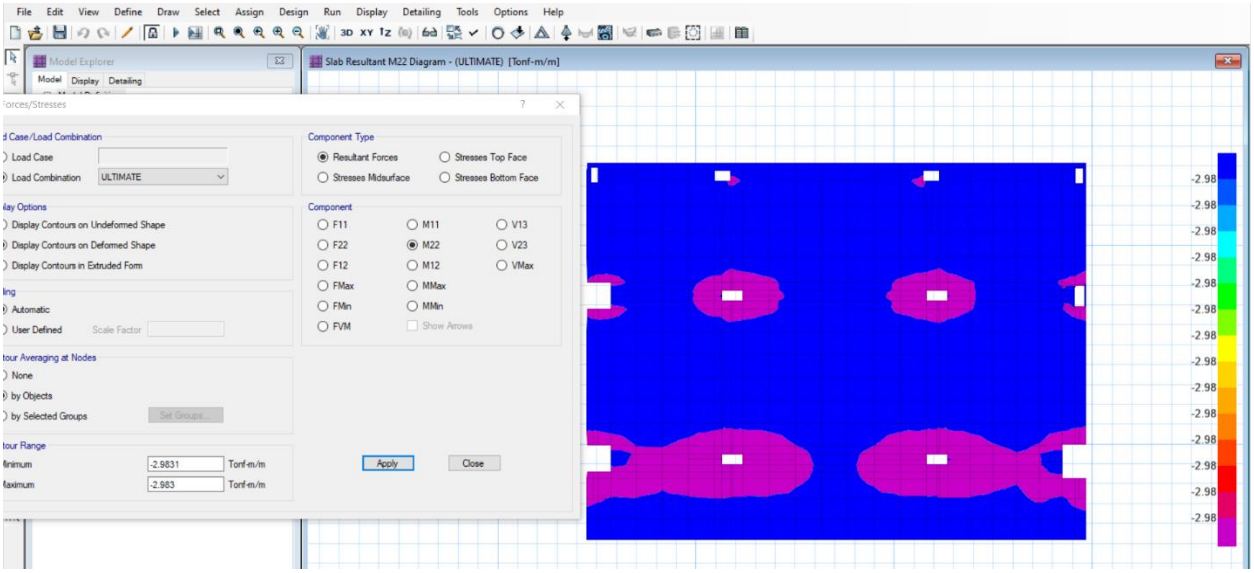
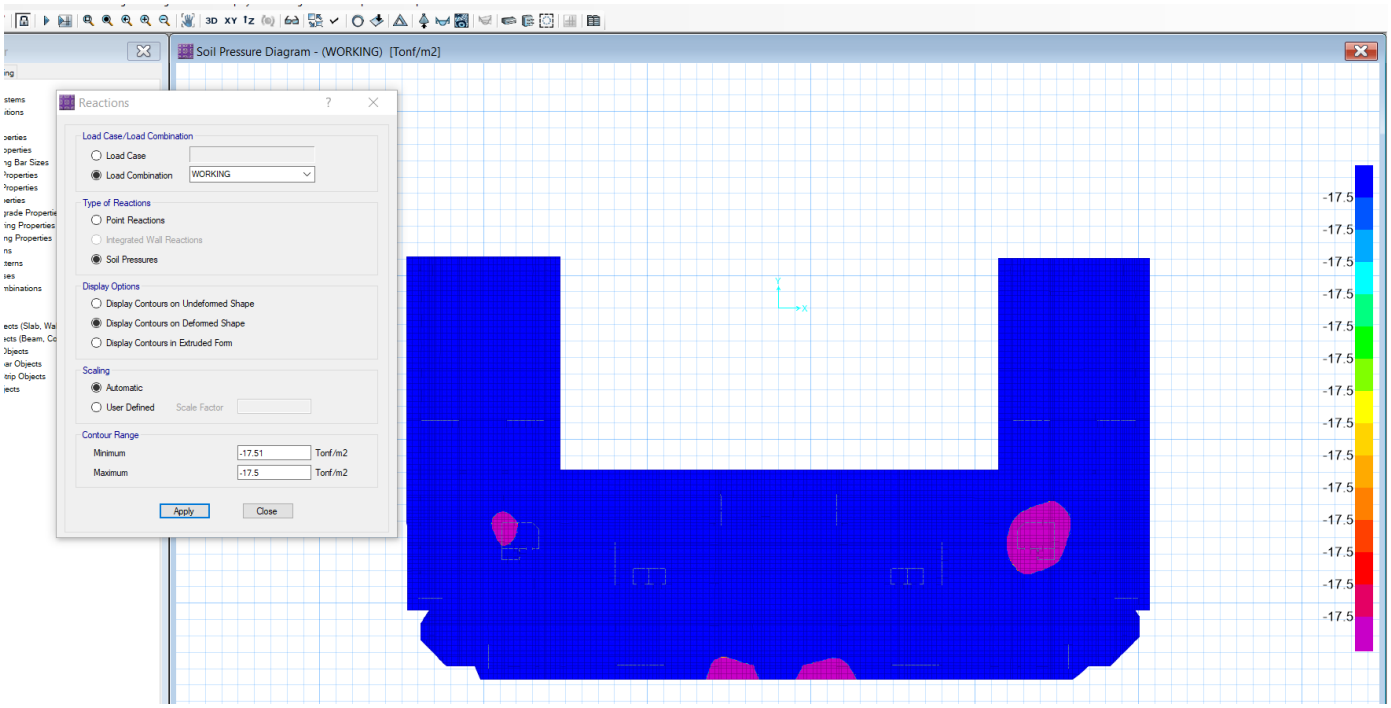
Display
Detailing
Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Component
F11
M11
V13
F22
M22
V23
F12
M12
VMax
FMax
MMax
FMin
MMin
FVM
Show Arrows
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
4.296
Tonf-m/m
Maximum
4.2961
Tonf-m/m
Apply
Close
4.30


SAFE 2016 - FIF
File Edit View Define Draw Select Assign Design Run Display Detailing Tools Options Help
Model Explorer
Model Display Detailing
Slab Resultant M11 Diagram - (ULTIMATE) [Tonf-m/m]
Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
Maximum
-2.9831
-2.983
Tonf-m/m
Component
F11 M11 V13
F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
Apply
Close
-2.98


File Edit View Define Draw Select Assign Design Run Display Detailing Tools Options Help
Model Explorer
Model Display Detailing
Slab Resultant M22 Diagram - (ULTIMATE) [Tonf-m/m]
Forces/Stresses
Load Case/Load Combination
Load Case
Load Combination
ULTIMATE
Component Type
Resultant Forces
Stresses Top Face
Stresses Midsurface
Stresses Bottom Face
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Automatic
User Defined
Scale Factor
Contour Averaging at Nodes
None
by Objects
by Selected Groups
Set Groups...
Contour Range
Minimum
Maximum
-2.9831
-2.983
Tonf-m/m
Component
F11 M11 V13
F22 M22 V23
F12 M12 VMax
FMax MMax
FMin MMin
FVM
Show Arrows
Apply
Close
-2.98

FOR RAFT


Soil Pressure Diagram - (WORKING) [Tonf/m2]
Reactions
Load Case/Load Combination
Load Case
Load Combination
WORKING
Type of Reactions
Point Reactions
Integrated Wall Reactions
Soil Pressures
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Scaling
Automatic
User Defined
Scale Factor
Contour Range
Minimum
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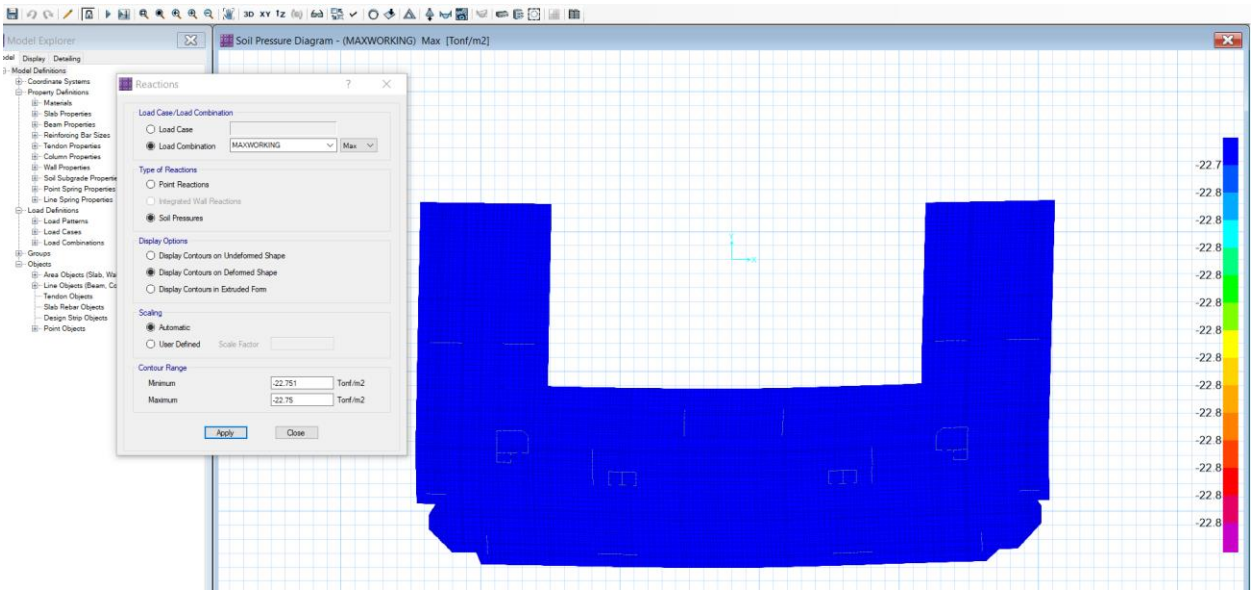
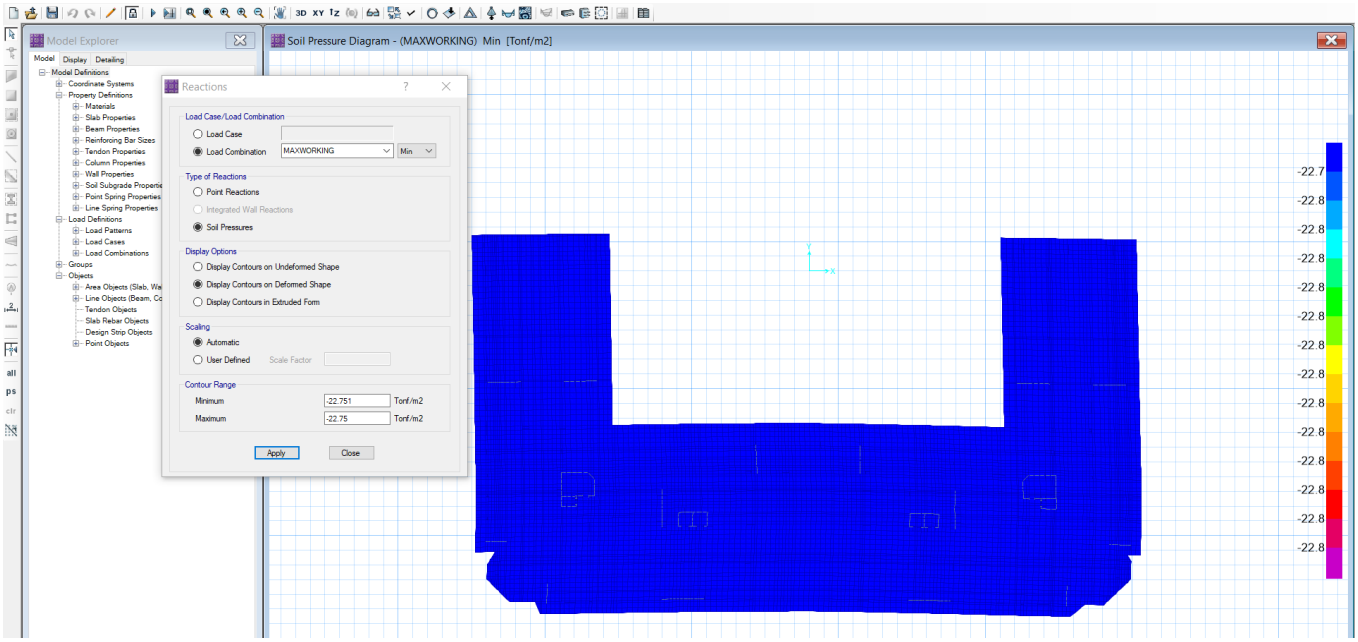
Tonf/m2
Maximum
-17.5
Tonf/m2
Apply
Close
-17.5


Model Explorer
Soil Pressure Diagram - (MAXWORKING) Max [Tonf/m2]
Reactions
Load Case/Load Combination
Load Case
Load Combination
MAXWORKING
Max
Type of Reactions
Point Reactions
Integrated Wall Reactions
Soil Pressures
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Scaling
Automatic
User Defined
Scale Factor
Contour Range
Minimum
-22.751
Tonf/m2
Maximum
-22.75
Tonf/m2
Apply
Close
-22.7
-22.8


Model Explorer
Model
Display
Detailing
Model Definitions
Coordinate Systems
Property Definitions
Materials
Slab Properties
Beam Properties
Reinforcing Bar Sizes
Tendon Properties
Column Properties
Wall Properties
Soil Subgrade Properties
Point Spring Properties
Line Spring Properties
Load Definitions
Load Patterns
Load Cases
Load Combinations
Groups
Objects
Area Objects (Slab, Wa
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Tendon Objects
Slab Rebar Objects
Design Strip Objects
Point Objects
Reactions
Load Case/Load Combination
Load Case
Load Combination
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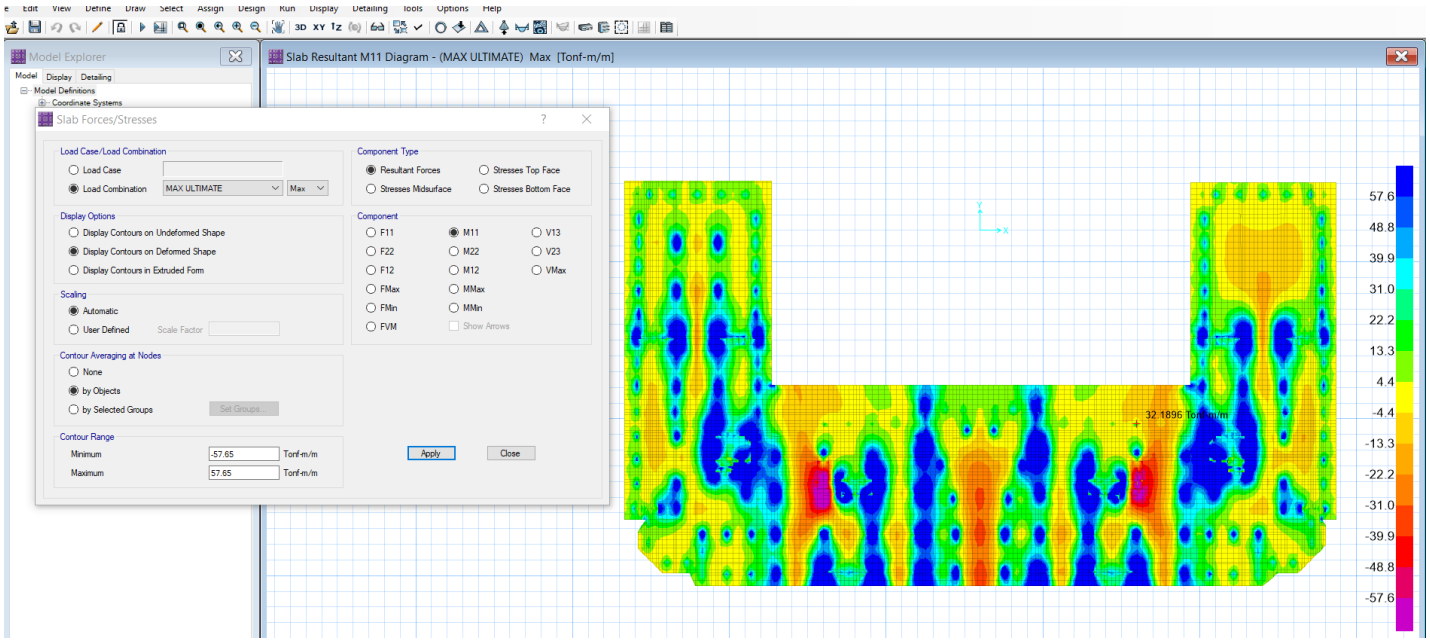
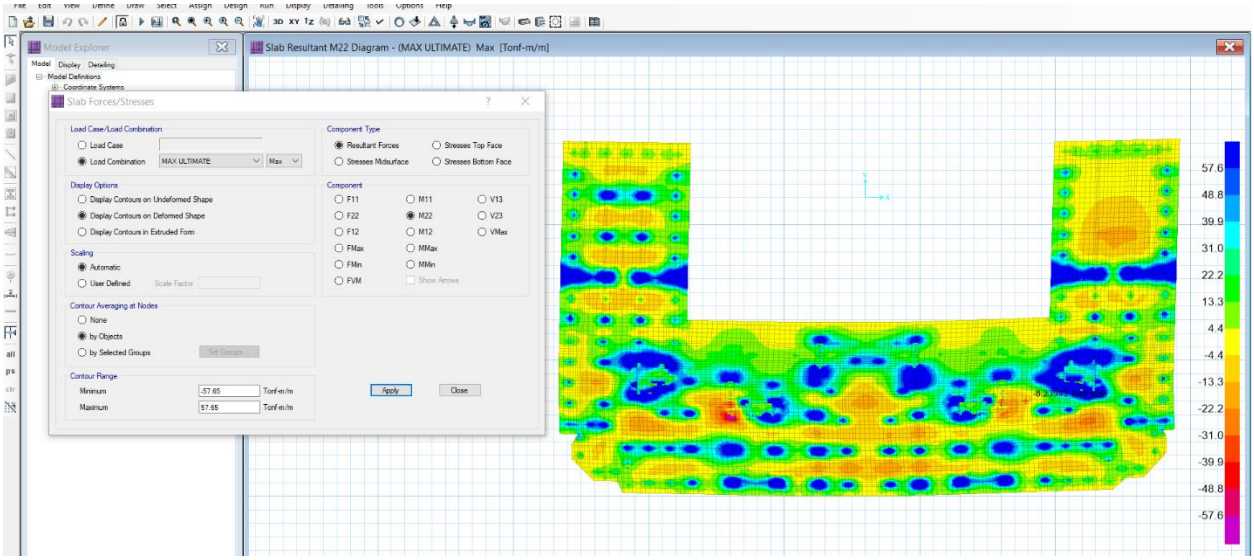
Min
Type of Reactions
Point Reactions
Integrated Wall Reactions
Soil Pressures
Display Options
Display Contours on Undeformed Shape
Display Contours on Deformed Shape
Display Contours in Extruded Form
Scaling
Automatic
User Defined
Scale Factor
Contour Range
Minimum
-22.751
Tonf/m2
Maximum
-22.75
Tonf/m2
Apply
Close
Soil Pressure Diagram - (MAXWORKING) Min [Tonf/m2]
-22.7
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8
-22.8

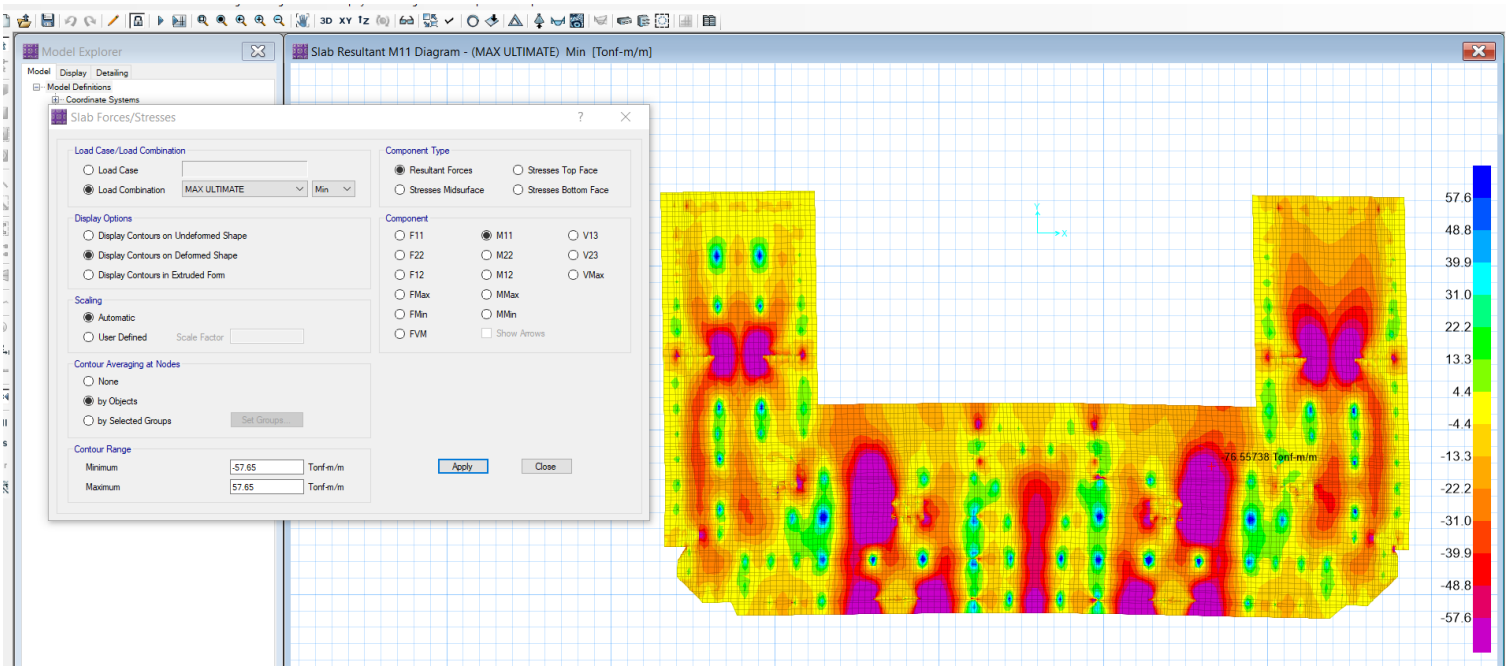
M11 BLUE BOTTOM



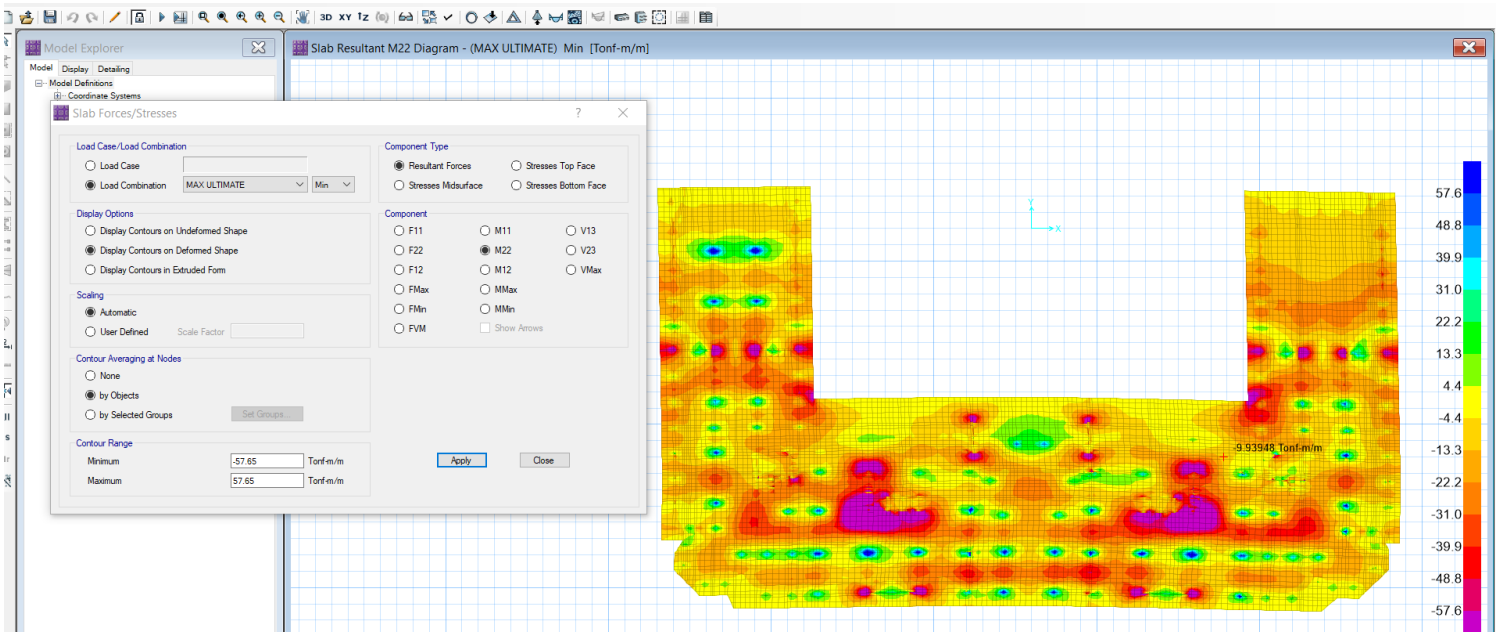
M22 BLUE BOTTOM



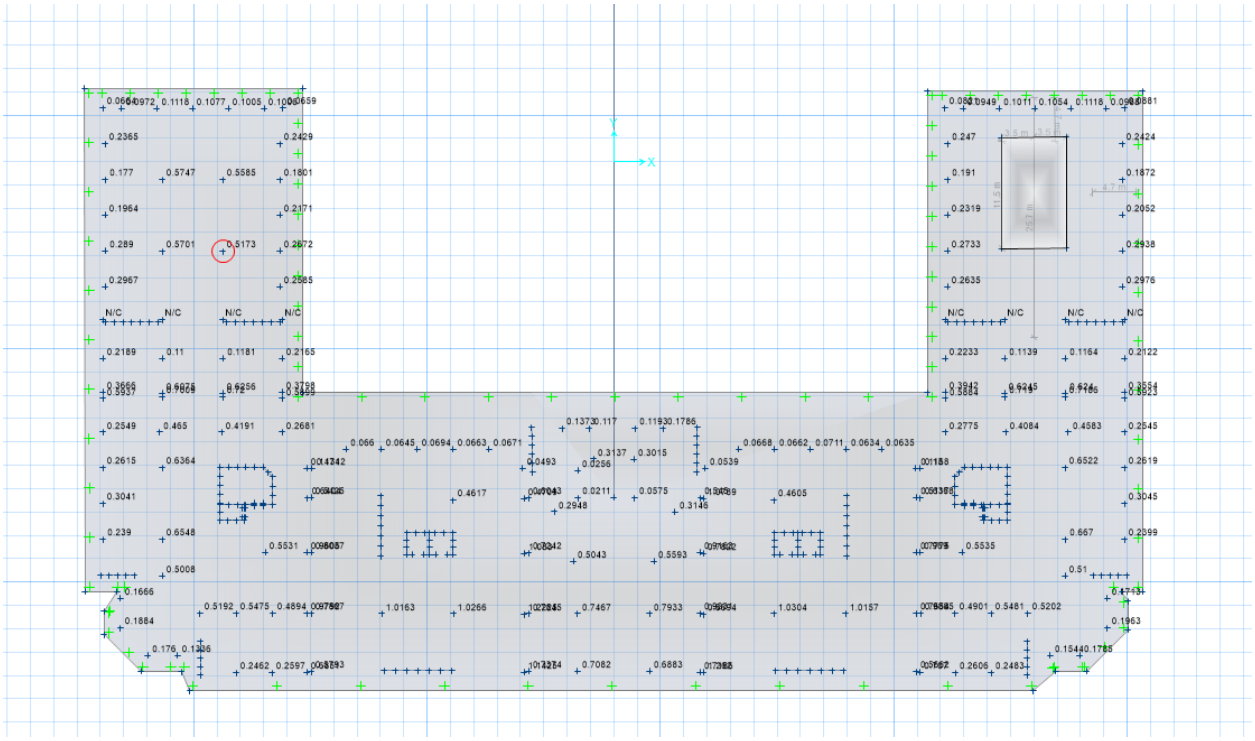
M11 PURPLE TOP



M22 PURPLE TOP

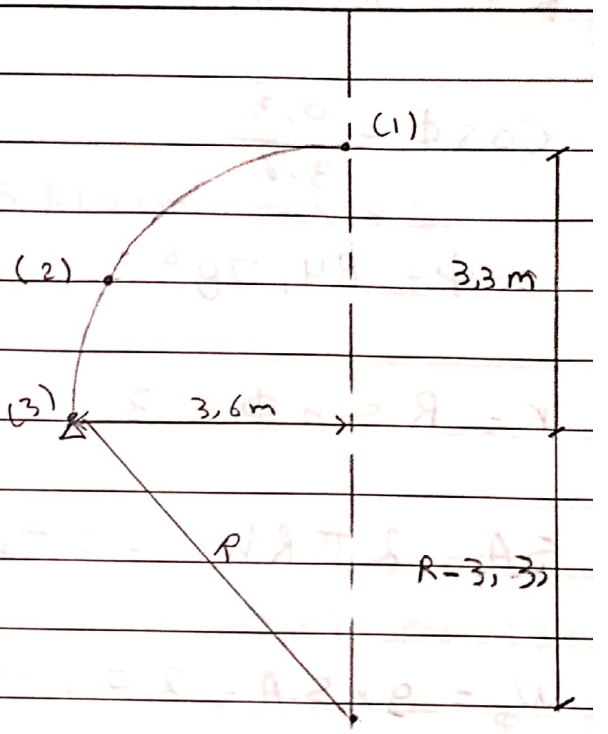


PUNCHING



$R^2 = (3,6)^2 + (R-3)^2$

$R = 3,6\ m$



* For Sec (1)

ϕ = Zero

$Z = g \cos\phi$

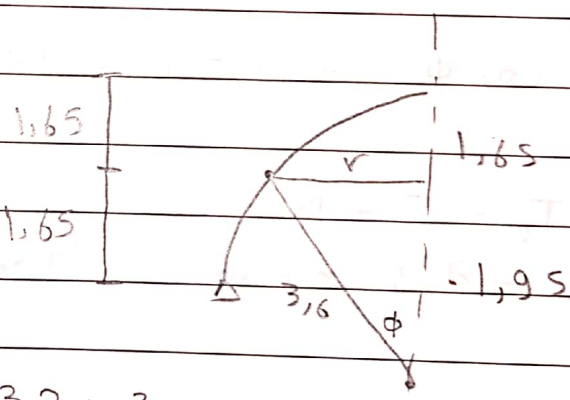
$g = t_s \gamma_c + F.C$

$= 0,1 * 25 + 0,2 = 2,7\ KN/m^2$

$\therefore Z = 2,7\ KN/m^2$

* For Sec (2)

$\cos\phi = \frac{1,95}{3,6} \quad \therefore \phi = 57,2°$



$r = R \sin\phi$

$= 3,6 \sin 57,2$

$= 3,02\ m$

$SA = 2\pi Rh$

$= 2\pi * 3,6 * 1,65 = 37,32\ m^2$

$W_\phi = g * S.A = 2,7 * 37,32 = 100,76\ KN$

$T_1 = \frac{100,76}{2\pi * 3,02 * \sin 57,2} = 6,3\ KN/m$ "Comp"

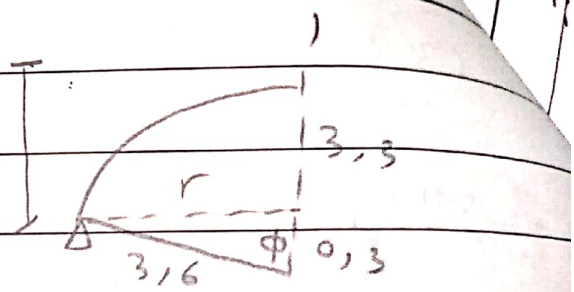
$R_1 = R_2 = R = 3,6\ m$

$Z = g \cos\phi = 2,7 \cos 57,2 = 1,46$

$T_1 + T_2 = Z * R$

$T_2 = -1,04$ (1)

▶ For sec (3)



$\cos\phi = \frac{0,3}{3,6}$

$\therefore \phi = 84,78°$

$r = R \sin\phi = 3,6 \sin 84,78 = 3,5 m$

$SA = 2\pi Rh = 2\pi * 3,6 * 3,3 = 74,64 m^2$

$W_\phi = g * S.A = 2,7 * 74,64 = 201,528$

$T_1 = \frac{201,528}{2\pi * 3,5 * \sin 84,78} = 9,2 KN/m$ "comp"

$Z = g \cos\phi = 2,7 \cos 84,78 = 0,24 KN/m^2$

$T_1 + T_2 = Z * R$

$T_2 = -8,33 KN/m$ "Tens"

* FoR Design :

$T_{max} = 9,2 KN/m$ "comp"

Actual stRess $= \frac{T_{max}}{Ac} = \frac{9,2 * 10^3}{1000 * 100} = 0,092 N/mm^2$

$\therefore F_{cu} = 35$ $\therefore F_{co} = 8 N/mm^2$

Allowable stresse $= \frac{F_{co}}{2} = \frac{8}{2} = 4 >$ Actuall

$\therefore t_s = 100\,mm$ is ok

T_1 → No tens → $\therefore$ use $5\phi 10/m'$ each side.

T_2 "max Tens" $= 8,33\ KN/m$

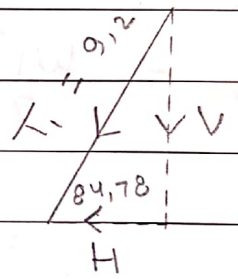
$$\therefore A_s = \frac{1,5 * 8,33 * 10^3}{400/1,15} = 35,9\ mm^2/m$$

$$\therefore \frac{35,9}{2} = 17,96\ mm^2/m \longrightarrow \text{use min } 5\phi 10 \text{ each side}$$

▶ Loads on Beam

$$\frac{V}{9,2} = \sin 84,78$$

$$V = 9,16\ KN/m$$



$$\frac{H}{9,2} = \cos 84,78$$

$$H = 0,83\ KN/m$$

$$L = \frac{2\pi r}{n} = \frac{2\pi * 3,6}{12} = 1,88\ m$$

$$t = \frac{L}{12} + 0,2 = \frac{1,88}{12} + 0,2 = 0,35\ m$$

$\therefore$ Take B (250 * 400)

$$o.w_{(Beam)} = b * t * \gamma_c$$

$$= 0,25 * 0,40 * 25 = 2,5 KN/m$$

$$w = o.w + V = 2,5 + 9,16 = 11,66 \ KN/m$$

$$\text{Normal Force} = H * r = 0,83 * 3,6 = 3 \ KN$$

$$P = w * 2\pi * r$$

$$= 11,66 * 2\pi * 3,6$$

$$= 264 \ KN$$

$$\therefore n = 12$$

$$\max M_{-ve} = \frac{w_1^2}{12} = \frac{11,66 * (1,88)^2}{12} = 3,43 \ KN.m$$

$$\max M_{+ve} = \frac{w_1^2}{24} = \frac{11,66 * (1,88)^2}{24} = 1,7 \ KN.m$$

$$\max Q = \frac{wl}{2} = \frac{11,66 * 1,88}{2} = 11 \ KN$$

Design of B :-

"sec -V moment"

$T = H * r = 0,83 * 3,6 = 3$

$M = 3,43 * 1,5 = 5,145 \text{ KN.m}$

$T = 1,5 * 3 = 4,5 \text{ KN}$

$e = \frac{M}{T} = \frac{5,145}{4,5} = 1,14 > 0,5 \xrightarrow{\text{use}} e_s$

$e_s = e - \frac{b}{2} + c = 1,14 - \frac{0,4}{2} + 0,05 = 0,99 \simeq 1$

$M_s = T * e_s = 4,5 \text{ KN}$

$d = c_1 \sqrt{\frac{M_s}{f_{cu}\, b}}$

$350 = c_1 \sqrt{\frac{4,5 * 10^6}{35 * 250}} = 15$ $\qquad J = 0,826$

$A_s = \frac{4,5 * 10^6}{0,826 * 400 * 350} + \frac{4,5 * 10^3}{(400/1,15)}$

$= 51,85 \text{ mm}^2$

check $(A_s)_{min}$

$\mu_{min}\, bd = \left(0,225 * \frac{\sqrt{35}}{400}\right) * 250 * 350 = 291 \text{ mm}^2$

$1,3\, A_{s,req} = 1,3 * 51,85 = 67,405$

(S)

$\frac{0,15}{100} * 250 * 350 = 131,25$

$\therefore$ use it $3\phi 12$

* For Sec of +ve moment

use $A_s = A_{s\,min} = 3\phi 12$

* check shear

$$q_{cu\,un} = 0,16\sqrt{\frac{f_{cu}}{\gamma_c}} = 0,16\sqrt{\frac{35}{1,5}} = 0,77\ N/mm^2$$

$$q_{cu\,cr} = 0,12\sqrt{\frac{f_{cu}}{\gamma_c}} = 0,12\sqrt{\frac{35}{1,5}} = 0,57$$

$$q_{um\,ax} = 0,7\sqrt{\frac{f_{cu}}{\gamma_c}} = 0,7\sqrt{\frac{35}{1,5}} = 3,38\ N/mm^2$$

Actual Shear

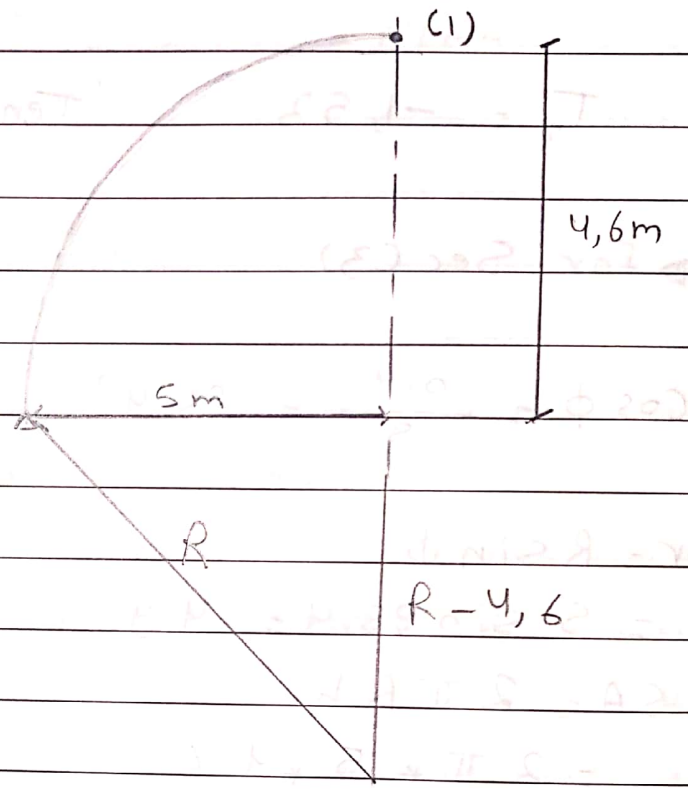
$$q_u = \frac{\Phi_{max}}{bd} = \frac{1,5 * 11 * 10^3}{250 * 350} = 0,18\ N/mm^2$$

$q_u < q_{cu\,unc}$ $\therefore$ use $5\phi 8$

* Dome above Roof *

$R^2 = (5)^2 + (R - 4,6)^2$

$R = 5m$



* For sec (1)

ϕ = Zero

$Z = g \cos \phi$

$g = t_s \gamma_c + f.c$

$= 0,1 * 25 + 0,2 = 2,7 \ kN/m^2$

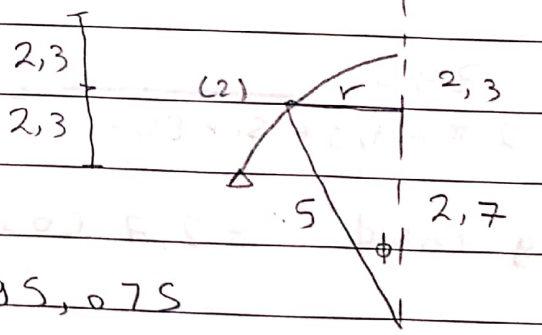
$Z = g \cos \phi = 2,7 \ kN/m^2$

* For sec (2)

$\cos \phi = \frac{2,7}{5}$ $\quad \therefore \phi = 57,31°$

$r = R \sin \phi$

$= 5 \sin 57,31 = 4,2m$



$S.A = 2 \pi R h$

$= 2 \pi * 5 * 2,3$

$= 72,25 \ m^2$

$W_\phi = g * SA = 2,7 * 72,25 = 195,075$

$\therefore T_1 = \frac{195,075}{2 \pi * 4,2 * \sin 57,31} = 8,78$ "Comp"

$R_1 = R_2 = R = 5m$

$Z = g \cos \phi = 2,7 \cos 57,31 = 1,45$

(1)

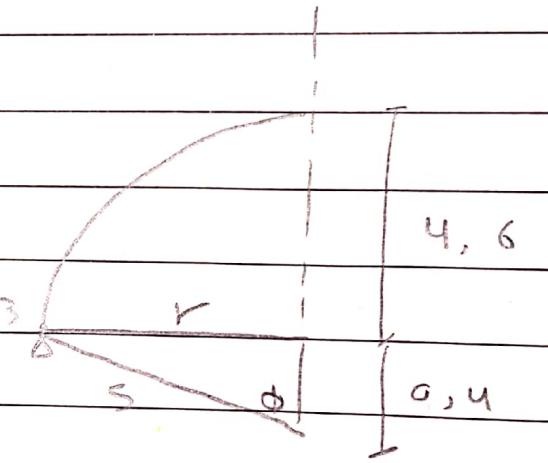
$T_1 + T_2 = Z * R$

$8,78 + T_2 = 1,45 * 5$

$T_2 = -1,53$ "Tens"

▶ For Sec (3)

$\cos\phi = \frac{0,4}{5} = 85,4°$



$r = R \sin\phi$

$= 5 \sin 85,4 = 4,9$

$SA = 2\pi R h$

$= 2\pi * 5 * 4,6$

$= 144,5\ m^2$

$W_\phi = g * S.A = 2,7 * 144,5 = 390\ kN$

$T_1 = \frac{390}{2\pi * 4,9 * \sin 85,4} = 12,7$ "comp"

$Z = g \cos\phi = 2,7 \cos 85,4° = 0,216\ kN/m^2$

$T_1 + T_2 = Z * R$ $T_2 = -11,62\ kN/m$ "Tens"

* For Design

$T_{max} = 12,7$ "comp"

Actual stress $= \frac{T_{max}}{A_c} = \frac{12,7 * 10^3}{1000 * 100} = 0,127\ N/mm^2$

$F_{co} = 35$ $\quad F_{co} = 8\ N/mm^2$

Allowable stresses : $\frac{f_{co}}{2} = \frac{8}{2} = 4 >$ Actual

$\therefore$ Sufficient for $t_s = 100\ mm$

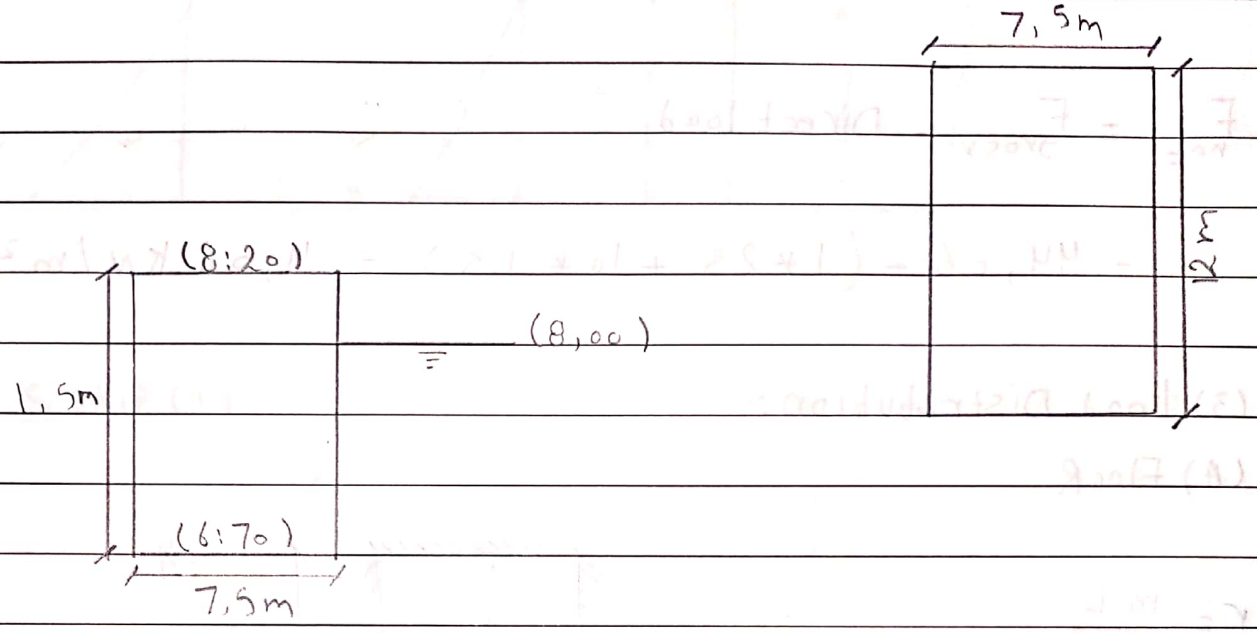
$T_1 \rightarrow$ No tens $\quad$ use $5\phi 10/m'$ each side

T_2 "max tens" $= -11,62\ KN/m$

$\therefore A_s = \frac{1,5 * 11,62 * 10^3}{400/1,15} = 50,11\ mm^2/m$

$\therefore \frac{50,11}{2} = 25,05\ mm^2/m \longrightarrow$ use min $5\phi 10$ each side

* Design of Pool *



(1) Concrete Dimension.

$* t_w = \frac{h}{16} = \frac{1500}{16} = 93mm < 250mm$

$\therefore$ take $t_w = 250mm$

$* t_f = 1m = 1000mm$

(2) Check Soil Stress

ΣW = own weight of elements + weight of water in tank

$\therefore \Sigma W = (7,5 * 12 * 1) * 25 + (1,5 * 12 * 0,25) * 25 * 2$ (Number of walls ← 1)

$+ (1,5 * 7,5 * 0,25) * 25 * 2 + (7,5 * 1,5 * 12) * 10$ (Number of walls ← 1)

$\Sigma W = 2250 + 225 + 140,625 + 1350 = 3965,625\ KN$

(1)

$$F_{gross} = \frac{\Sigma W}{A} = \frac{3965,625}{7,5 * 12} = 44,06 \ KN/m^2$$

$$F_{net} = F_{gross} - \text{Direct load}$$

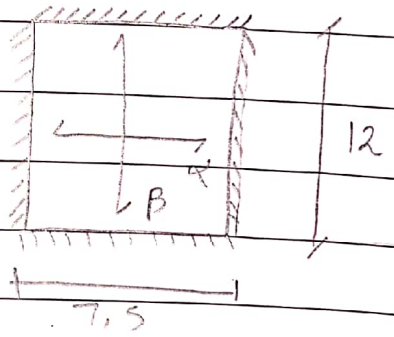
$$= 44,06 - (1 * 25 + 10 * 1,5) = 4,06 \ KN/m^2$$

(3) Load Distribution :-

(A) FLOOR

$$r = \frac{m L}{m' L_s}$$

$$\therefore \frac{12}{7,5} = 1,6$$



$$\alpha = \frac{r^4}{1+r^4} = \frac{(1,6)^4}{1+(1,6)^4} = 0,86$$

$$\beta = 1 - \alpha = 0,14$$

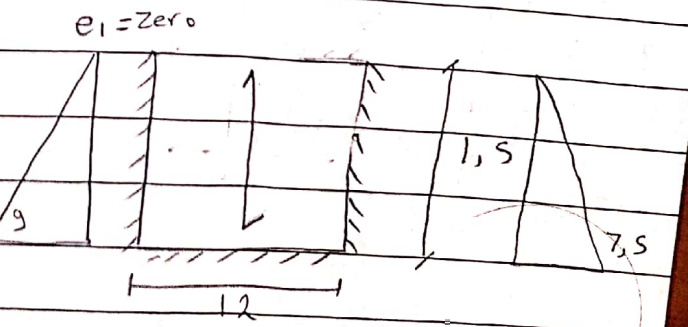
(B) WALL (1)

one way in V.L Direction

e_1 = zero

$$e_2 = e_1 + K_a * \gamma_{soil} * h$$

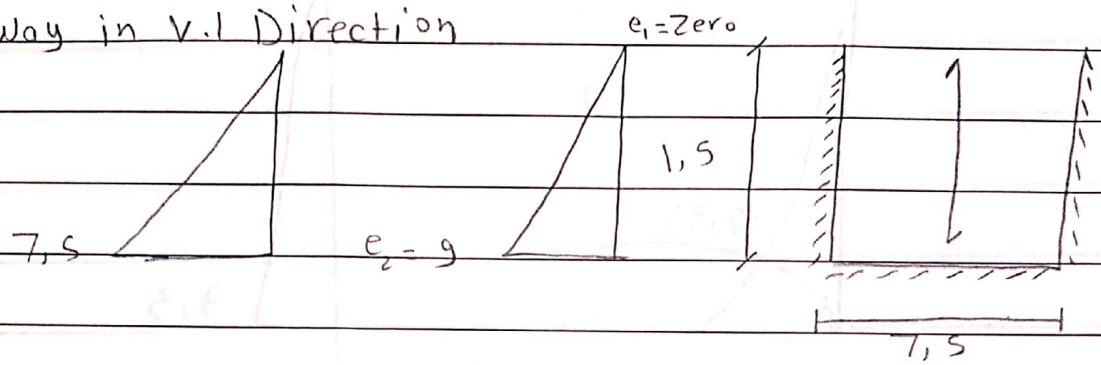
$$= \frac{1}{3} * 18 * 1,5 = 9 KN/m^2$$



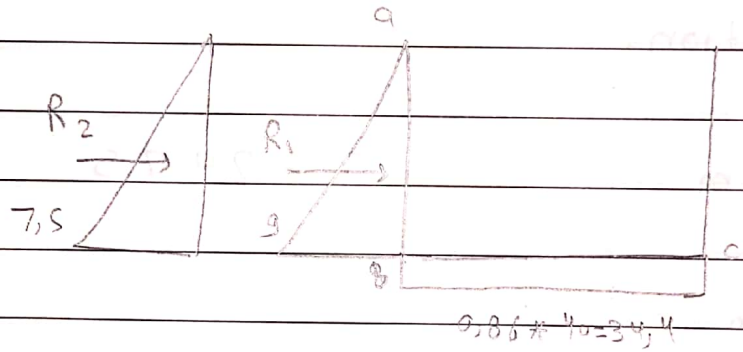
$\therefore h_w > \frac{h}{2}$ $\quad \therefore e = \frac{1,3 (1 - \frac{1}{3}) * 10 * 1,3}{1,5} = 7,5 \ KN/m^2$

(c) Wall (2)

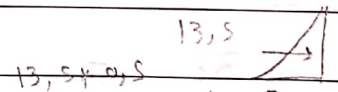
one Way in V.L Direction



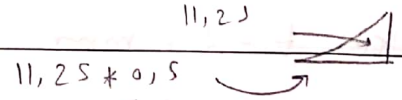
* For V.L STRIP (1)

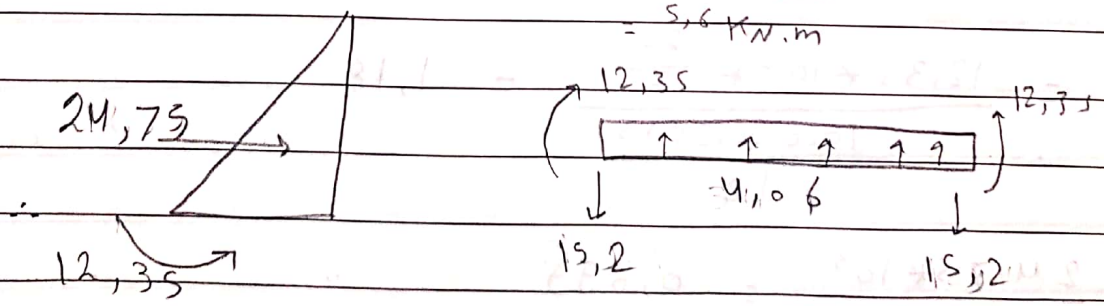


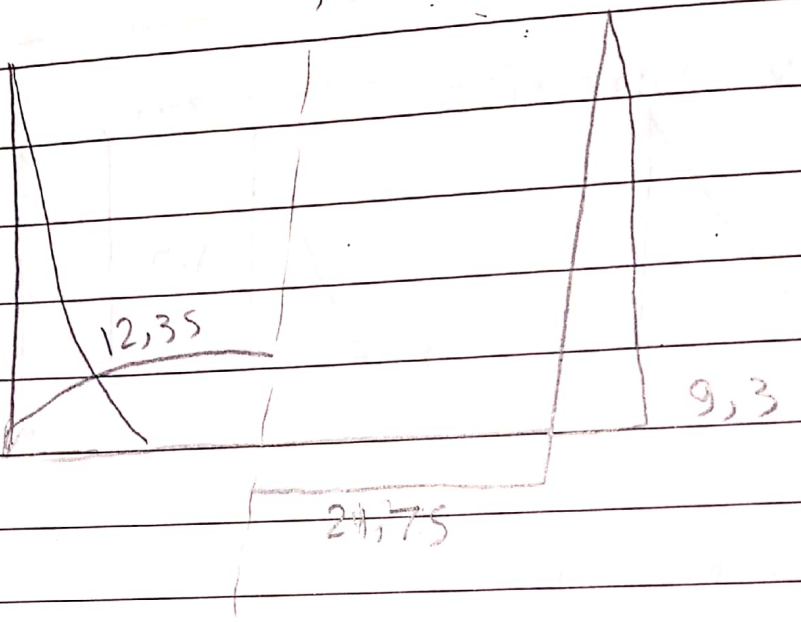
$R_1 = \frac{9*3}{2} = 13,5\ KN$



$R_2 = \frac{7,5*3}{2} = 11,25\ KN$







* Design of Section.

$M = 12,35\ KN.m$ $\quad T = 24,75$

$$t = \sqrt{\frac{M * 10^3}{0,3}} + 30$$

$$= \sqrt{\frac{12,35 * 10^3}{0,3}} + 30 = 232\ mm$$

take $t = 250mm$

$$F_m = \frac{M * y}{I} = \frac{12,35 * 10^6 * \frac{250}{2}}{\frac{1000 * (250)^3}{12}} = 1,18$$

$$F_N = \frac{N}{A} = \frac{24,75 * 10^3}{1000 * 250} = 0,099$$

$$\therefore f_{tot} = 0,099 + 1,18 = 1,2$$

$$F_{all} = \frac{0,6\sqrt{35}}{1,7} = 2,08 > f_{tot} \quad \therefore \text{safe}$$

(4)

* For Design

$M_u = 1,5 * 12,35 = 20 KN.m$ $\quad T_u = 1,5 * 24,75 = 40 KN$

$e = \frac{M}{F} = \frac{20}{40} = 0,5 > \frac{t}{2}$ - cover

$\therefore e_s = e - \frac{t}{2} + cover$

$= 0,5 - \frac{0,25}{2} + 0,04 = 0,415$

$M_s = T_u * e_s = 0,415 * 40 = 16,6$

$d = c_1 \sqrt{\frac{M_u * 10^6}{F_{cu} * 1000}}$

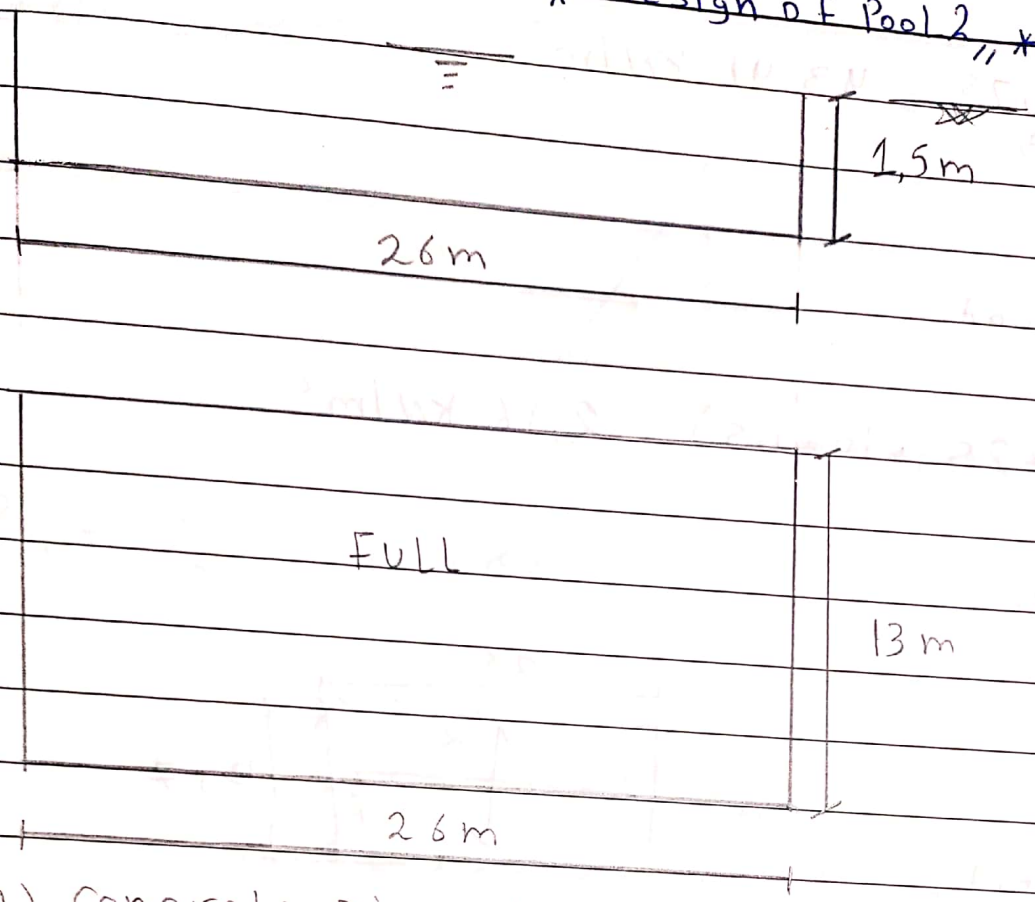
$210 = c_1 \sqrt{\frac{16,6 * 10^6}{35 * 1000}}$ $\quad c_1 = 9,6$ $\quad J = 0,826$

$A_s = \frac{1}{\beta_{cr}} \left(\frac{M * 10^6}{f_y * J * d} + \frac{N * 10^3}{f_y / \gamma_s} \right)$

$= \frac{1}{0,75} \left(\frac{16,6 * 10^6}{400 * 0,826 * 210} + \frac{40 * 10^3}{400 / 1,15} \right)$

$= 510 mm^2 \rightarrow 5 \phi 16 / m'$

* Design of Pool 2 *



(1) Concrete Dimension:

* $t_w = \frac{h}{16} = \frac{1500}{16} = 93mm < 250mm$

$\therefore$ take $t_w = 250mm$

* $t_f = \frac{L}{12} = \frac{13000}{12} = 1033mm$

take $t_f = 1050mm$

(2) Check Soil stresses

Σw = own weight of elements + weight of water in tank

$\Sigma w = (26 * 13 * 1,05) * 25 + (1,5 * 13 * 0,25) * 25 * 2$

$+ (1,5 * 26 * 0,25) * 25 * 2 + (26 * 13 * 1,5) * 10$

$\Sigma w = 8872,5 + 243,75 + 487,5 + 5070 = 14673,75 KN$

$$F_{gross} = \frac{\Sigma W}{A} = \frac{14673,75}{26 * 13} = 43,41 \ KN/m^2$$

$$F_{net} = F_{gross} - \text{Direct load}$$

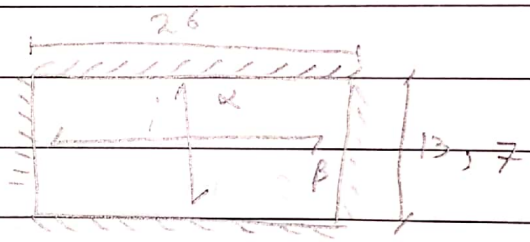
$$= 43,41 - (1,05 * 25 + 10 * 1,5) = 2,16 \ KN/m^2$$

(3) Load Distribution :-

(A) Floor

$$\frac{26}{13,7} = 1,8$$

$\alpha = 0,9$ $\beta = 0,1$



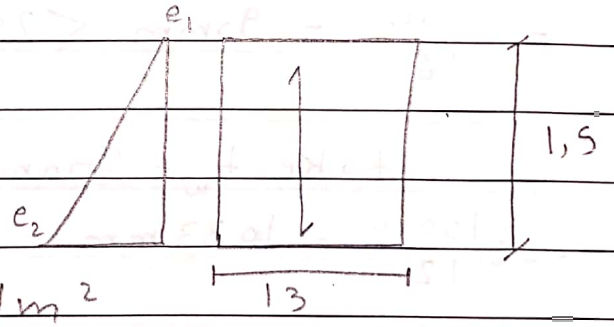
(B) Wall (1)

one way in V.I Direction.

e_1 = Zero

$e_2 = K_a * \gamma_{soil} * h$

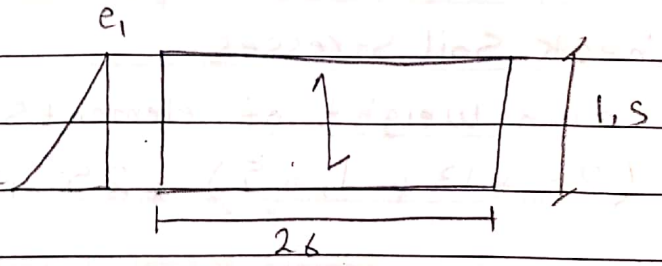
$= \frac{1}{3} * 18 * 1,5 = 9 KN/m^2$



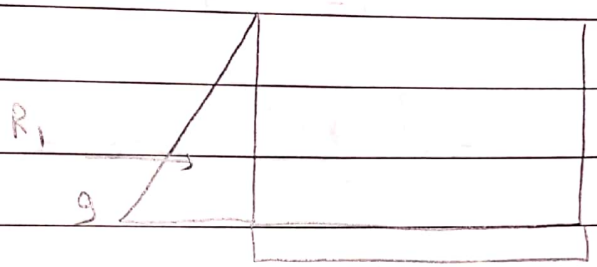
(C) Wall (2)

e_1 = Zero

$e_2 = \frac{1}{3} * 18 * 1,5 = 9 KN/m^2$

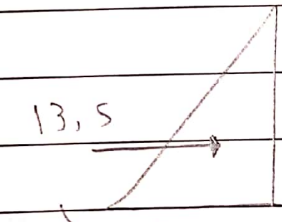


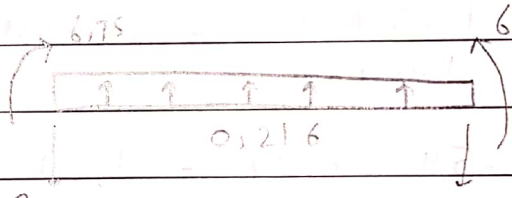
for V.1 strip



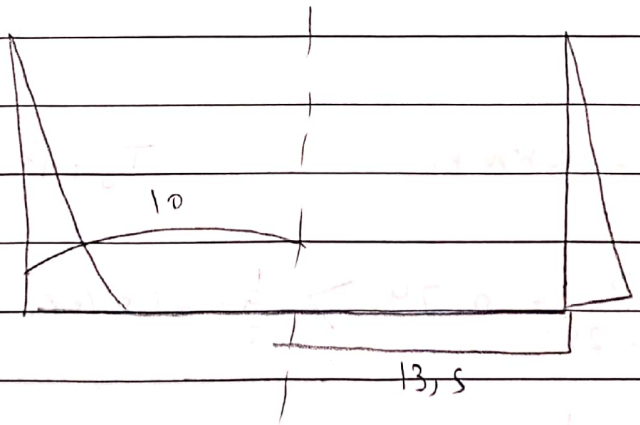
$0,1 * 2,16 = 0,216$ KN/m

$R_1 = \frac{9 * 3}{2} = 13,5$ KN





$\frac{0,216 * 26}{2} = 2,8$



$0,25 * 1,5 * 25 = 9,375$

* Design of Section

$M = 10\ KN.m$ $\quad T = 13,5$

$$t = \sqrt{\frac{M * 10^3}{0,3}} + 30 = \sqrt{\frac{10 * 10^3}{0,3}} + 30 = 212mm$$

take $t = 250mm$

$$f_m = \frac{M * y}{I} = \frac{10 * 10^6 * \frac{250}{2}}{\frac{1000 * (250)^3}{12}} = 0,96$$

$$f_N = \frac{N}{A} = \frac{13,5 * 10^3}{1000 * 250} = 0,054$$

$$f_{tot} = 0,054 + 0,96 = 1,014$$

$$f_{all} = \frac{0,6\sqrt{35}}{1,7} = 2,08 > f_{tot} \quad \therefore Safe$$

* For Design

$M_0 = 1,5 * 10 = 15\ KN.m$ $\quad T_0 = 13,5 * 1,5 = 20,25\ KN$

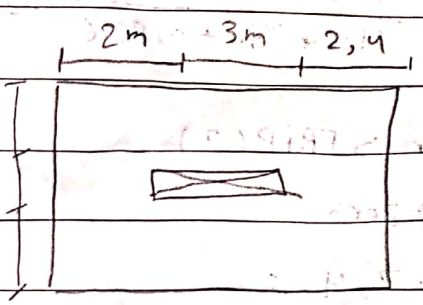
$$e = \frac{M}{t} = \frac{15}{20,25} = 0,74 > \frac{t}{2} - cover$$

$$\therefore e_s = e - \frac{t}{2} + cover$$

$$= 0,5 - \frac{0,25}{2} + 0,04 = 0,415$$

Mezanine left stair

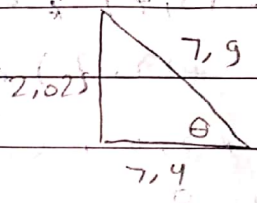
$W_{sh} = 1,4(t_s \gamma_c + F.C) + 1,6 L.L$



$= 1,4(0,3 * 25 + 2) + 1,6 * 4$

$= 19,7 \text{ KN/m}'$

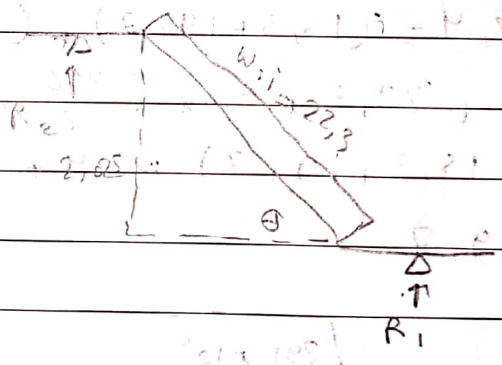
$W_{si} = 1,4(t_{avg} \gamma_c + F.C) + 1,6 L.L \cos\theta$



$= 1,4(0,38 * 25 + 2) + 1,6 * 4 * \frac{7,4}{7,9}$

$= 22,3 \text{ KN/m}'$

$\Sigma M @ A = Zero$

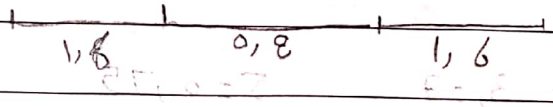


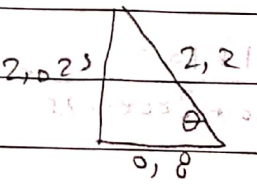
$22,3 * 2,2 * \left(\frac{0,8}{2} + \frac{1,6}{2}\right)$

$= R_1 \left(\frac{1,6}{2} + \frac{1,6}{2} + 0,8\right)$

$\therefore R = 24,5$

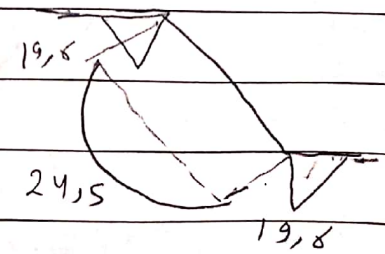
$W = \frac{R}{X} = \frac{24,5}{1,6} = 15,3$





* For Design

$\therefore 280 = C * \sqrt{\frac{24,5 * 10^6}{35 * 1000}}$



$C = 10,5 \qquad J = 0,826 \qquad (1)$

$A_s = \frac{24,5 * 10^6}{400 * 280 * 0,826} = 264,8$ → use 5 ϕ10

* For STRIP(2)

ΣM@zero

$R_1 * 7,4 =$

$(15,3 + 19,7) * 2,4 * (\frac{2,4}{2} + 3 + 2)$

$+ (15,3 + 19,7) * 2 * (\frac{2}{2}) +$

$22,3 * 3,6 * (\frac{3}{2} + 2)$

$R_1 = 117,8$

ΣM@B-zero

$R_2 * 7,4 = (15,3 + 19,7) * (\frac{2}{2} + 3 + 2,4)$

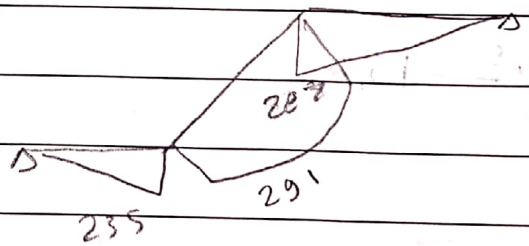
$* 2 + 22,3 * 3,6 * (\frac{3,6}{2} + 2,4)$

$+ (15,3 + 19,7) * 2,4 * \frac{2,4}{2}$

$R_2 = 119,7$

$280 = C * \sqrt{\frac{291 * 10^6}{35 * 1000}}$

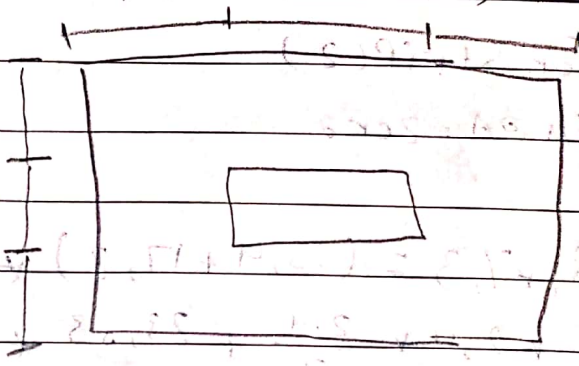
$C = 3,07 \qquad J = 0,75$



$A_s = \frac{291 * 10^6}{400 * 280 * 0,75} = 3464$

10 ϕ22

Typ. stair 2,4 3,5 1,4

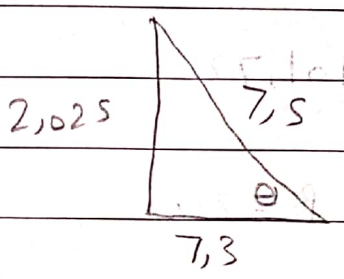


$$w_{sh} = 1,4(0,32*25+2)+1,6*4$$

$$= 20,4 \text{ KN/m}'$$

$$w_{si} = 1,4(0,4*25+2)+1,6*4*\frac{7,3}{7,5}$$

$$= 23,03$$

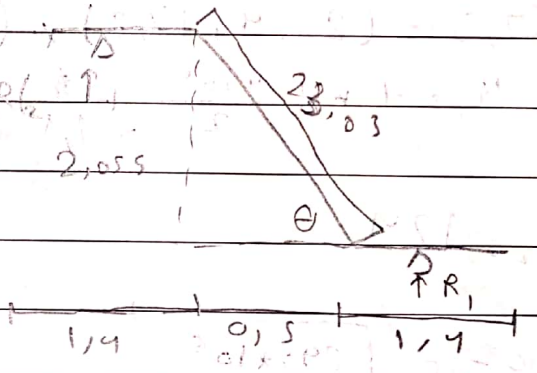


$$23,03*2,1*\left(\frac{0,5}{2}+\frac{1,4}{2}\right)$$

$$= R*(0,5+1,4)$$

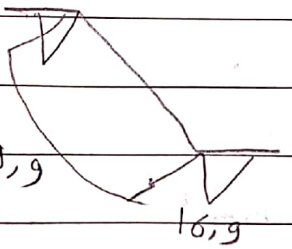
$$R = 24,2$$

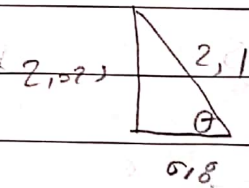
$$w = \frac{R}{x} = 17,2$$



* For Design

$$300 = c*\sqrt{\frac{19,9*10^6}{35*100c}}$$





$$c = 12,5 \quad J = 0,826$$

$$A_s = \frac{19,9*10^6}{400*300*0,826} = 200,7 \rightarrow 5\phi 10 / m'$$

For strip(2)

$\Sigma M @ A = zero$

$$R_1 * 7,3 = (20,4+17,2) * \left(\frac{1,4}{2} + 3,5 + 2,4\right) + (20,4+17,2) * 2,4 * \frac{2,4}{2} + 23,03 * 4,04 * \left(\frac{3,5}{2} + 2,4\right)$$

$R_1 = 101,72$

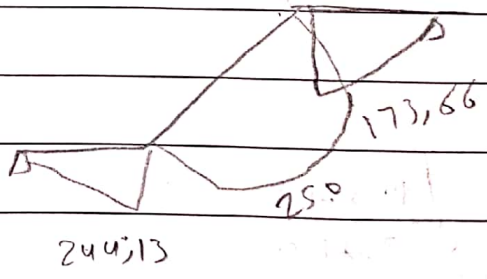
$\Sigma M @ B = zero$

$$R_2 * 7,3 = (20,4+17,2) * \left(\frac{2,4}{2} + 3,5 + 1,4\right) * 2,4 + 23,03 * 4,04 * \left(\frac{4,04}{2} + 1,4\right) + (20,4+17,2) * 1,4 * \frac{1,4}{2}$$

$R_2 = 124$

$$300 = c\sqrt{\frac{290 * 10^6}{35 * 100}}$$

$c = 3,5 \qquad J = 0,78$



$$A_s = \frac{250 * 10^6}{400 * 300 * 0,78} = 2670\ mm^2$$

$= 10\ \phi 18$