

### Job Information

Engineer                      Checked                      Approved

#### Name:

Date: 10-Feb-13

Structure Type    SPACE FRAME

Number of Nodes        7    Highest Node                      7  
Number of Elements    6    Highest Beam                      6

Number of Basic Load Cases                      2  
Number of Combination Load Cases            2

Included in this printout are data for:

All                      The Whole Structure

Included in this printout are results for load cases:

Type                      L/C                      Name

Type	L/C	Name
Primary	1	DL
Primary	2	LL1
Combination	11	S1:DL
Combination	12	S2:DL+LL

Design of RC Retaining Wall

### Section Properties

Prop	Section	Area (cm <sup>2</sup> )	I <sub>yy</sub> (cm <sup>4</sup> )	I <sub>zz</sub> (cm <sup>4</sup> )	J (cm <sup>4</sup> )	Material
1	Rect 0.25x1.00	2.5E+3	2.08E+6	130E+3	439E+3	CONCRETE

### Materials

Mat	Name	E (kN/mm <sup>2</sup> )	v	Density (kg/m <sup>3</sup> )	α (1/°K)
1	STEEL	205.000	0.300	7.83E+3	12E-6
2	STAINLESSSTEEL	197.930	0.300	7.83E+3	18E-6
3	ALUMINUM	68.948	0.330	2.71E+3	23E-6
4	CONCRETE	21.718	0.170	2.4E+3	10E-6

### Supports

Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kN/m/deg)	rY (kN/m/deg)	rZ (kN/m/deg)
2	Fixed	Fixed	Fixed	-	-	-
3	Fixed	Fixed	Fixed	-	-	-
4	Fixed	Fixed	Fixed	-	-	-
5	Fixed	Fixed	Fixed	-	-	-

### Basic Load Cases

Number	Name
1	DL
2	LL1

### Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
11	S1:DL	1	DL	1.00
12	S2:DL+LL	1	DL	1.00
		2	LL1	1.00

### Node Loads : 1 DL

Node	FX (Mton)	FY (Mton)	FZ (Mton)	MX (MTon'm)	MY (MTon'm)	MZ (MTon'm)
7	-	-0.22	-	-	-	-

### Beam Loads : 1 DL

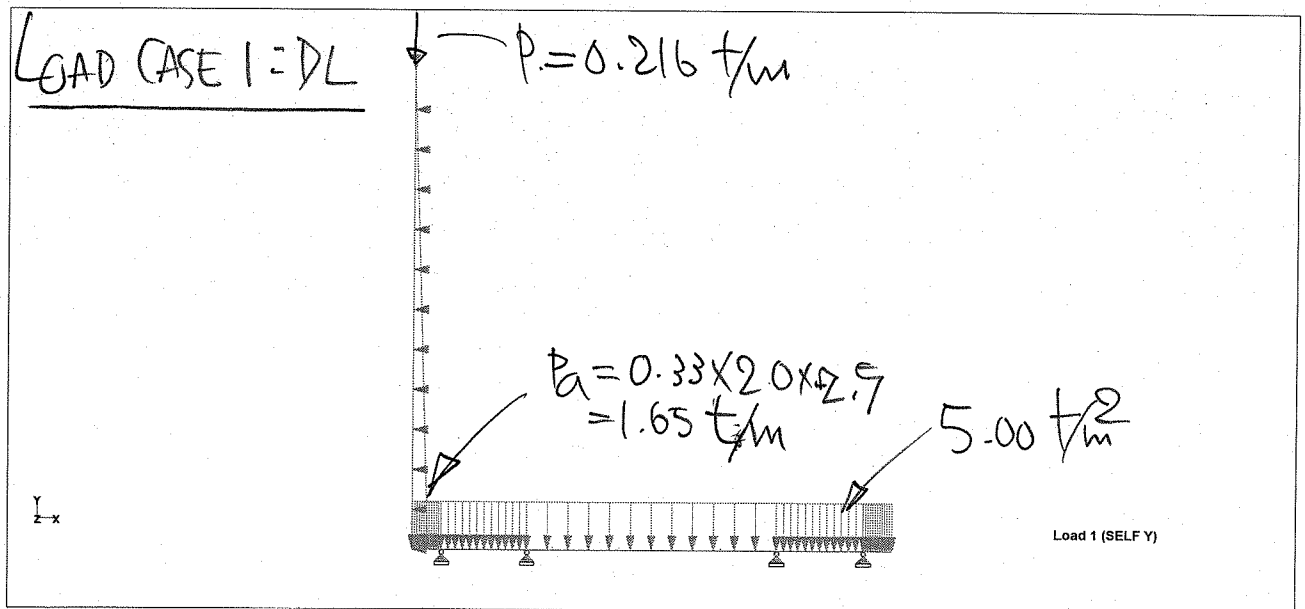
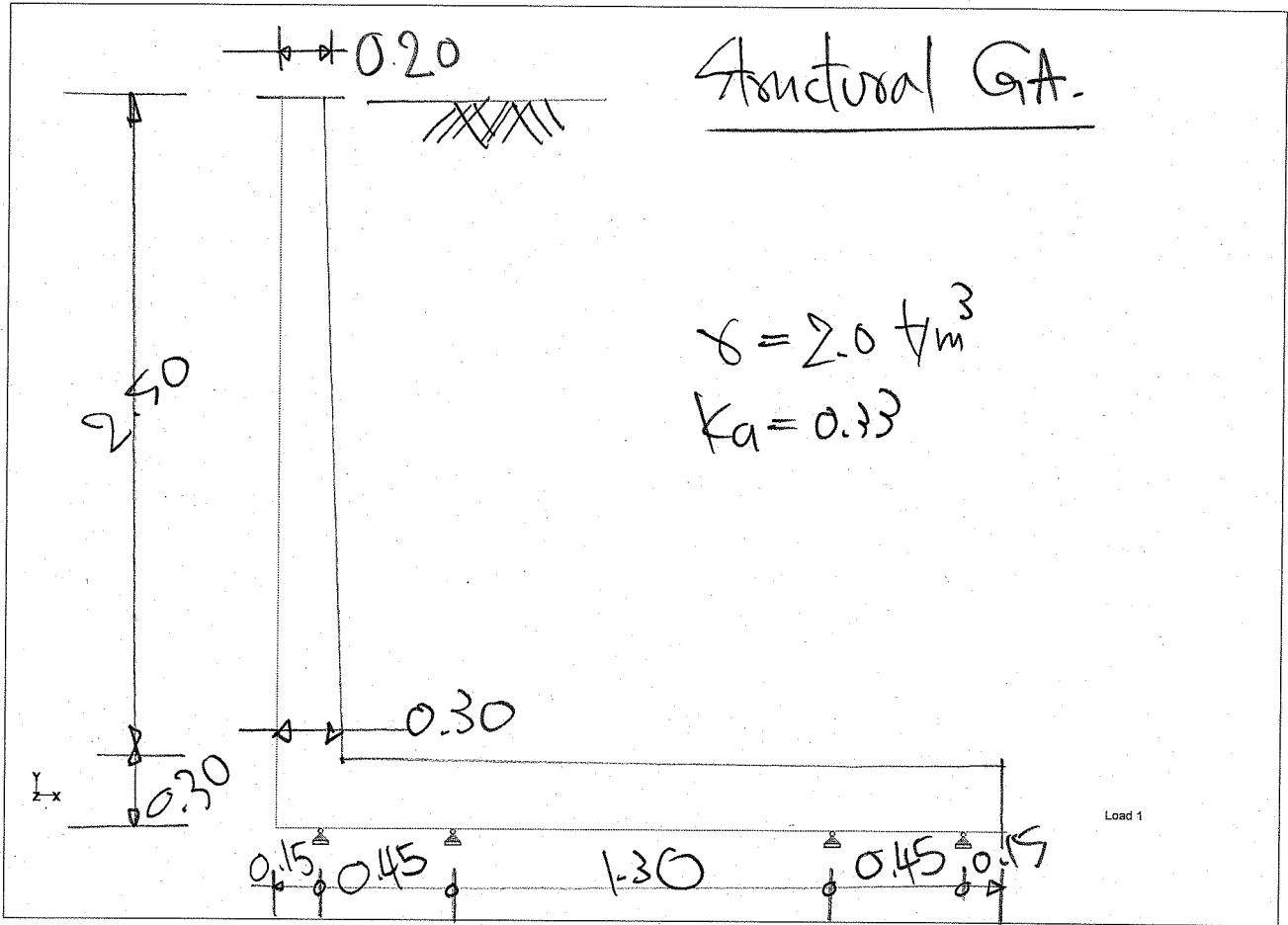
Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
1	LIN	MTon/m	Y	1.650	-	0.000	-
2	UNI	MTon/m	GY	-5.000	-	-	-
3	UNI	MTon/m	GY	-5.000	-	-	-
4	UNI	MTon/m	GY	-5.000	-	-	-
5	UNI	MTon/m	GY	-5.000	-	-	-
6	UNI	MTon/m	GY	-5.000	-	-	-

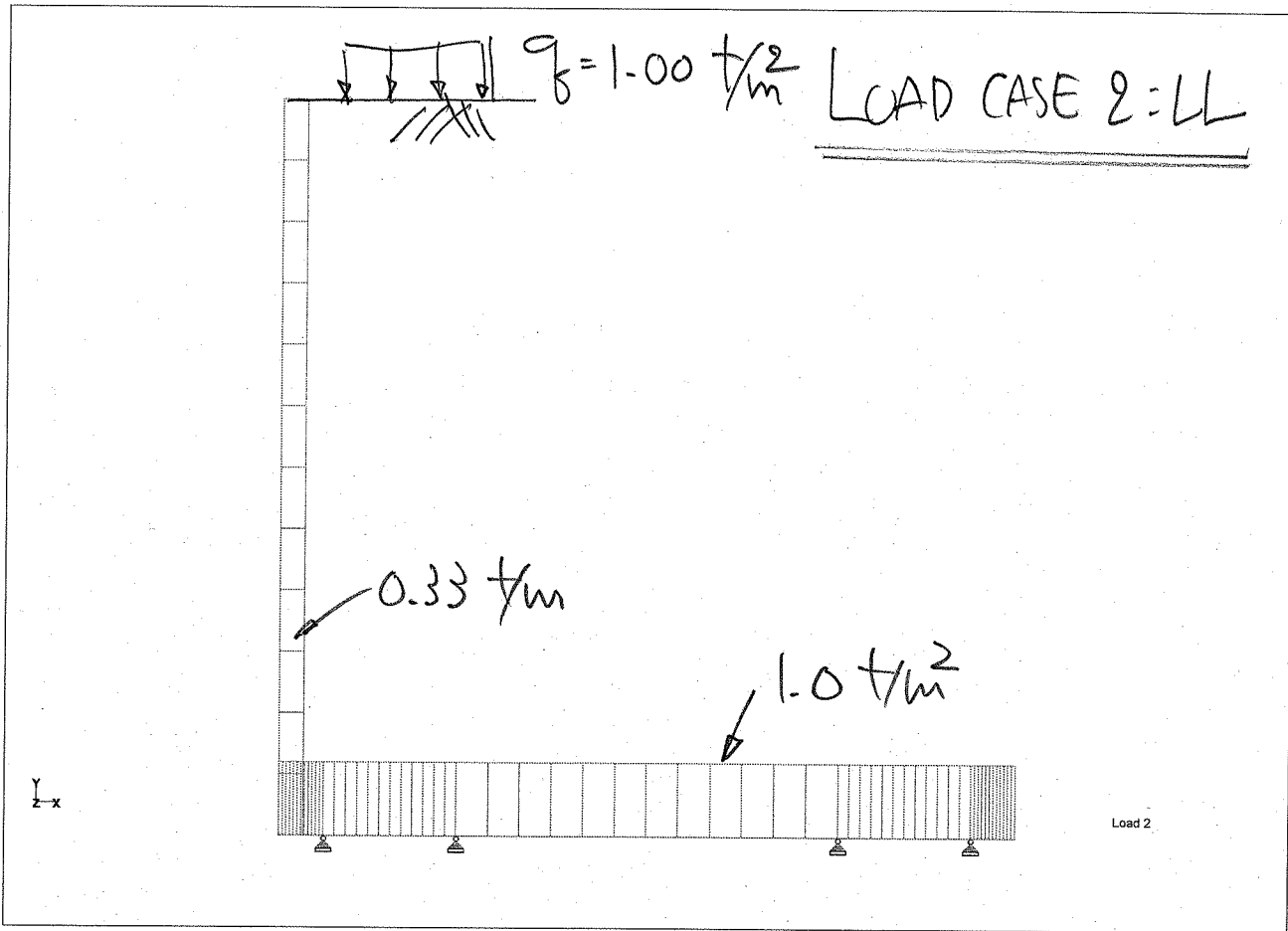
### Selfweight : 1 DL

Direction	Factor
Y	-1.000

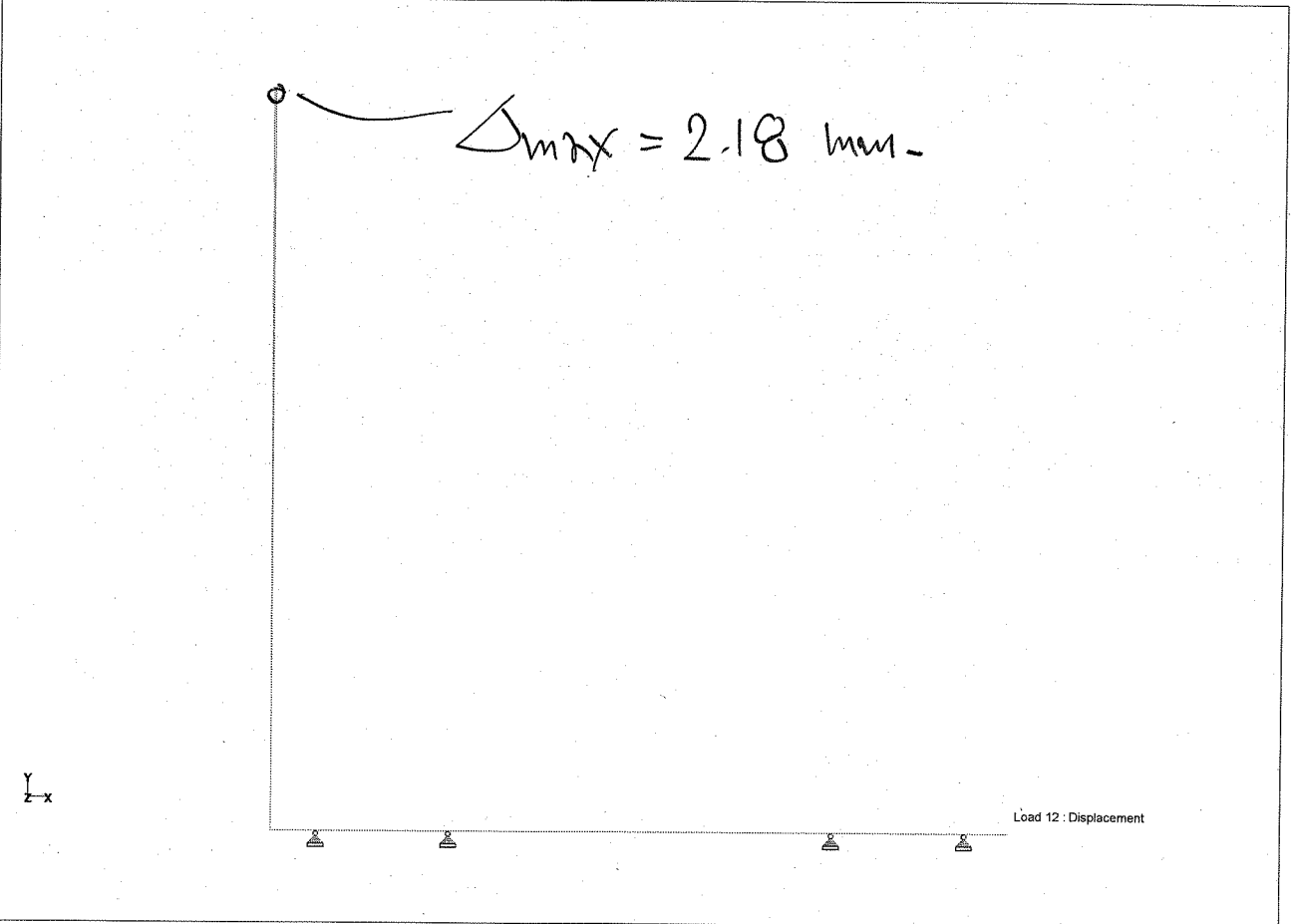
Beam Loads : 2 LL1

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
1	UNI	MTon/m	GX	-0.330	-	-	-
2	UNI	MTon/m	GY	-1.000	-	-	-
3	UNI	MTon/m	GY	-1.000	-	-	-
4	UNI	MTon/m	GY	-1.000	-	-	-
5	UNI	MTon/m	GY	-1.000	-	-	-
6	UNI	MTon/m	GY	-1.000	-	-	-



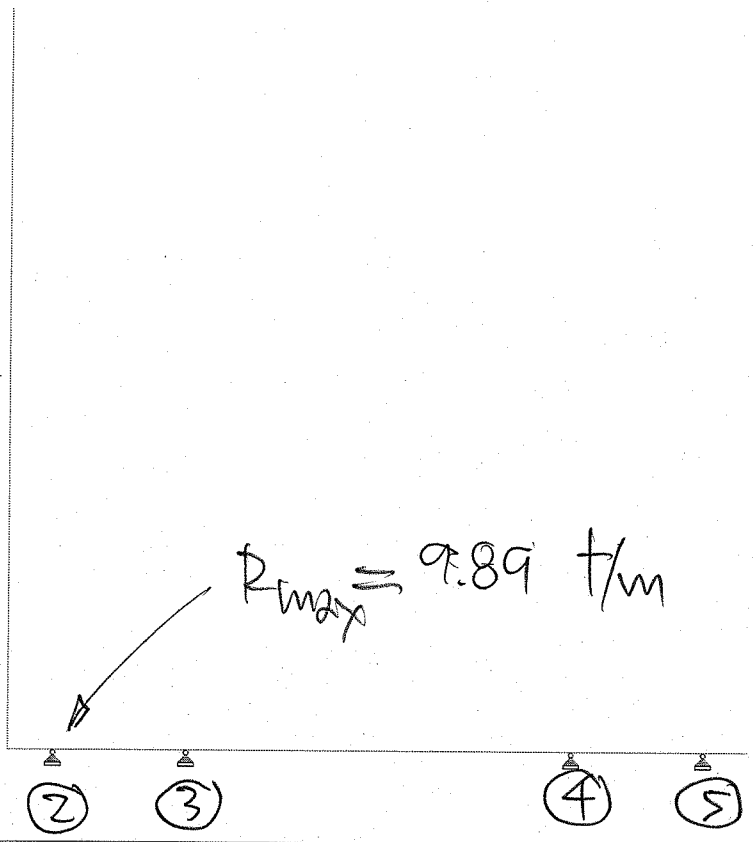


Whole Structure Loads 0.0101972Mton:1m 2 LL1 (Input data was modified after picture taken)



Whole Structure Displacements 390mm:1m 12 S2:DL+LL (Input data was modified after picture taken)

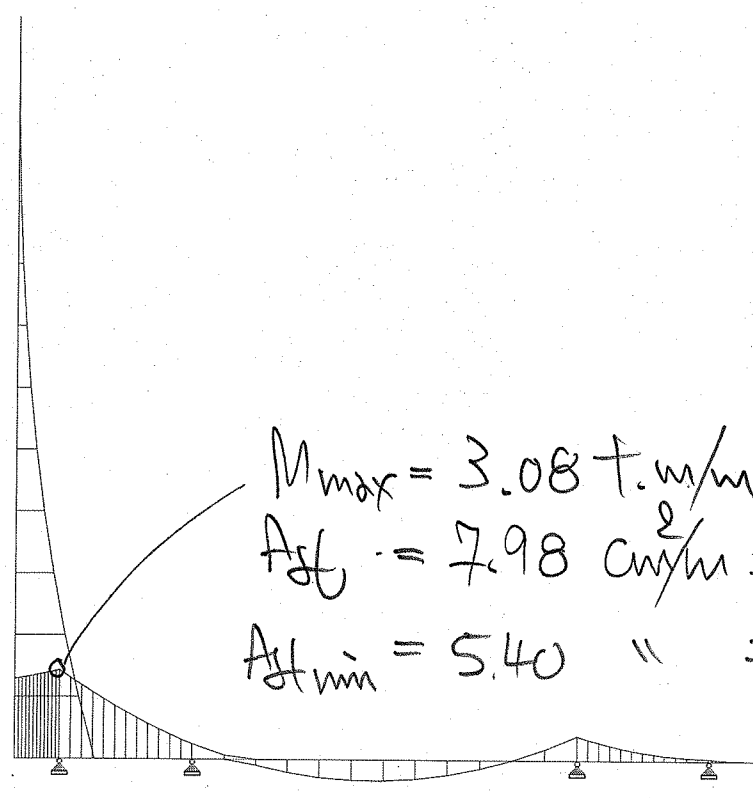
Y  
Z-x



Load 12

Whole Structure (Input data was modified after picture taken)

Y  
Z-x



Load 0 : Bending Z

Whole Structure Mz 10.1972MTon-m:1m 0 Envelope (Input data was modified after picture taken)

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	2	1:DL	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Min X	7	12:S2:DL+LL	-2.179	-0.047	0.000	2.179	0.00	0.00	0.00
Max Y	2	1:DL	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Min Y	7	12:S2:DL+LL	-2.179	-0.047	0.000	2.179	0.00	0.00	0.00
Max Z	1	1:DL	-0.001	-0.028	0.000	0.028	0.00	0.00	0.00
Min Z	1	1:DL	-0.001	-0.028	0.000	0.028	0.00	0.00	0.00
Max rX	1	1:DL	-0.001	-0.028	0.000	0.028	0.00	0.00	0.00
Min rX	1	1:DL	-0.001	-0.028	0.000	0.028	0.00	0.00	0.00
Max rY	1	1:DL	-0.001	-0.028	0.000	0.028	0.00	0.00	0.00
Min rY	1	1:DL	-0.001	-0.028	0.000	0.028	0.00	0.00	0.00
Max rZ	7	12:S2:DL+LL	-2.179	-0.047	0.000	2.179	0.00	0.00	0.00
Min rZ	3	12:S2:DL+LL	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
Max Rst	7	12:S2:DL+LL	-2.179	-0.047	0.000	2.179	0.00	0.00	0.00

Reactions

Node	L/C	Horizontal FX (Mton)	Vertical FY (Mton)	Horizontal FZ (Mton)	Moment MX (MTon'm)	Moment MY (MTon'm)	Moment MZ (MTon'm)
2	1:DL	2.06	7.27	0.00	0.00	0.00	0.00
	2:LL1	0.83	2.62	0.00	0.00	0.00	0.00
	11:S1:DL	2.06	7.27	0.00	0.00	0.00	0.00
	12:S2:DL+LL	2.89	9.89	0.00	0.00	0.00	0.00
3	1:DL	0.00	1.29	0.00	0.00	0.00	0.00
	2:LL1	0.00	-1.45	0.00	0.00	0.00	0.00
	11:S1:DL	0.00	1.29	0.00	0.00	0.00	0.00
	12:S2:DL+LL	0.00	-0.15	0.00	0.00	0.00	0.00
4	1:DL	0.00	6.45	0.00	0.00	0.00	0.00
	2:LL1	0.00	1.24	0.00	0.00	0.00	0.00
	11:S1:DL	0.00	6.45	0.00	0.00	0.00	0.00
	12:S2:DL+LL	0.00	7.69	0.00	0.00	0.00	0.00
5	1:DL	0.00	0.71	0.00	0.00	0.00	0.00
	2:LL1	0.00	0.09	0.00	0.00	0.00	0.00
	11:S1:DL	0.00	0.71	0.00	0.00	0.00	0.00
	12:S2:DL+LL	0.00	0.80	0.00	0.00	0.00	0.00

Provided PC Pile I-180x180 @ 0.50 m.

$$\text{load/pile} = \frac{9.89}{2} = \underline{\underline{4.95 \text{ t/pile}}}$$

Check stability

CASE DL:

$$M_0 = 1.65 \times 2.5 \times 0.5 \times 2.5 / 3 = 1.72 \text{ t.m/m}$$

$$M_g = 5.0 \times 2.5 \times 2.5 / 2 = 15.62 \text{ t.m/m}$$

$$\zeta F = \frac{M_g}{M_0} = \frac{15.62}{1.72} = 9.08 > 2.0 \text{ ok}$$

CASE DL+LL

$$M_0 = 1.72 + 0.33 \times 2.5 \times 2.5 / 2 = 2.75 \text{ t.m/m}$$

$$M_g = 15.62 + 1.0 \times 2.5 \times 2.5 / 2 = 18.75 \text{ t.m/m}$$

$$\zeta F = \frac{18.75}{2.75} = 6.82 > 2.0 \text{ ok}$$



Pile Configuration :  
 Cross Section Area of Pile, Ap = 0.02 m<sup>2</sup>  
 Parameter of Pile, P = 0.92 m  
 Ground Water Table, GWT = 1.00 m  
 Factor of Safety, FS = 2.50

Depth (m)	Soil Parameter and Effective Overburden Pressure										Ultimate Skin Friction Capacity of Pile										Ultimate End Bearing Capacity of Pile					Depth (m)	Qa = Qult/FS (T)
	Soil Type	k(eqv) (T/m <sup>2</sup> )	γe (T/m <sup>3</sup> )	σ <sub>voe</sub> (T/m <sup>2</sup> )	σ <sub>ovf</sub> (T/m <sup>2</sup> )	Su (T/m <sup>2</sup> )	SPT (Blows/ft)	α	αc	φ	C <sub>h</sub>	N'	Ks	Q <sub>fs</sub>	Q <sub>f</sub> (T)	Q <sub>ec</sub>	N <sub>q</sub>	Q <sub>es</sub>	Q <sub>eb</sub>	Q <sub>ult</sub> (T)							
1.00	1.00	1.50	0.50	0.50	0.25	0.70	1.10	0.71	-	-	-	-	-	0.71	0.62	-	-	-	0.62	1.33	0.53						
2.00	1.00	1.50	0.50	1.00	0.50	0.70	1.10	1.42	-	-	-	-	-	1.42	1.12	-	-	-	1.12	2.54	1.02						
3.00	1.00	1.50	0.50	1.50	0.75	0.82	1.09	2.24	-	-	-	-	-	2.24	1.64	-	-	-	1.64	3.88	1.55						
4.00	1.00	1.50	0.50	2.00	1.00	0.85	1.07	3.17	-	-	-	-	-	3.17	2.16	-	-	-	2.16	5.34	2.13						
5.00	1.00	1.50	0.50	2.50	1.25	1.07	1.05	4.21	-	-	-	-	-	4.21	2.68	-	-	-	2.68	6.89	2.76						
6.00	1.00	1.50	0.50	3.00	1.50	1.19	1.04	5.34	-	-	-	-	-	5.34	3.20	-	-	-	3.20	8.54	3.42						
7.00	1.00	1.75	0.75	3.75	1.88	1.32	1.02	6.58	-	-	-	-	-	6.58	3.97	-	-	-	3.97	10.55	4.22						
8.00	1.00	1.75	0.75	4.50	2.25	1.44	1.00	7.90	-	-	-	-	-	7.90	4.74	-	-	-	4.74	12.65	5.06						
9.00	1.00	1.75	0.75	5.25	2.63	1.56	0.98	9.31	-	-	-	-	-	9.31	5.52	-	-	-	5.52	14.63	5.83						
10.00	1.00	1.75	0.75	6.00	3.00	1.68	0.97	10.61	-	-	-	-	-	10.61	6.29	-	-	-	6.29	17.10	6.84						
11.00	1.00	1.75	0.75	6.75	3.38	1.81	0.95	12.39	-	-	-	-	-	12.39	7.06	-	-	-	7.06	19.45	7.78						
12.00	1.00	1.75	0.75	7.50	3.75	1.93	0.93	14.05	-	-	-	-	-	14.05	7.83	-	-	-	7.83	21.87	8.75						
13.00	1.00	1.86	0.86	8.36	4.18	2.05	0.92	15.77	-	-	-	-	-	15.77	8.71	-	-	-	8.71	24.48	9.79						
14.00	1.00	1.86	0.86	9.22	4.61	2.18	0.90	17.57	-	-	-	-	-	17.57	9.59	-	-	-	9.59	27.18	10.87						
15.00	1.00	1.86	0.86	10.08	5.04	2.30	0.88	19.44	-	-	-	-	-	19.44	10.47	-	-	-	10.47	29.91	11.96						
16.00	1.00	2.10	1.10	11.18	5.59	2.50	0.86	21.97	-	-	-	-	-	21.97	12.13	-	-	-	12.13	34.10	13.64						
17.00	1.00	2.10	1.10	12.28	6.14	2.69	0.84	24.50	-	-	-	-	-	24.50	13.23	-	-	-	13.23	37.73	15.09						
18.00	1.00	2.10	1.10	13.38	6.69	2.84	0.82	27.03	-	-	-	-	-	27.03	14.33	-	-	-	14.33	41.96	16.52						
19.00	1.00	2.10	1.10	14.48	7.24	2.99	0.80	30.47	-	-	-	-	-	30.47	15.08	-	-	-	15.08	46.55	18.00						
20.00	1.00	2.10	1.10	15.58	7.79	3.14	0.79	33.92	-	-	-	-	-	33.92	16.08	-	-	-	16.08	51.10	20.44						
21.00	1.00	2.10	1.10	16.68	8.34	3.29	0.78	37.36	-	-	-	-	-	37.36	17.18	-	-	-	17.18	55.64	22.26						
22.00	1.00	2.10	1.10	17.78	8.89	3.44	0.77	40.81	-	-	-	-	-	40.81	18.28	-	-	-	18.28	60.19	24.08						
23.00	1.00	1.96	0.96	18.74	9.37	3.59	0.76	44.26	-	-	-	-	-	44.26	19.38	-	-	-	19.38	64.60	25.84						
24.00	1.00	1.96	0.96	19.70	9.85	3.74	0.75	47.70	-	-	-	-	-	47.70	20.34	-	-	-	20.34	69.00	27.60						
25.00	1.00	1.96	0.96	20.66	10.33	3.89	0.74	51.15	-	-	-	-	-	51.15	21.30	-	-	-	21.30	73.41	29.36						
26.00	1.00	1.96	0.96	21.62	10.81	4.04	0.73	54.60	-	-	-	-	-	54.60	22.26	-	-	-	22.26	77.81	31.13						
27.00	1.00	1.96	0.96	22.58	11.29	4.19	0.72	58.04	-	-	-	-	-	58.04	23.22	-	-	-	23.22	82.22	32.89						
28.00	1.00	1.96	0.96	23.54	11.77	4.34	0.71	61.49	-	-	-	-	-	61.49	24.18	-	-	-	24.18	86.63	34.65						
29.00	1.00	1.96	0.96	24.50	12.25	4.49	0.70	64.93	-	-	-	-	-	64.93	25.14	-	-	-	25.14	91.03	36.41						
30.00	1.00	1.96	0.96	25.46	12.73	4.64	0.69	68.38	-	-	-	-	-	68.38	27.06	-	-	-	27.06	95.44	38.18						

LEGEND:-  
 1) Soil Type, 1  
 2) Soil Type, 2  
 3) γc  
 4) γe  
 5) σ<sub>voe</sub>  
 6) Su  
 7) SPT  
 8) C<sub>u</sub> = 0.77 \* Log(195.3 / σ<sub>voe</sub>)  
 9) α  
 10) φ  
 11) Ks  
 12) N<sub>q</sub>  
 13) Q<sub>i(c,s)</sub> = Σ α<sub>i</sub> Su<sub>i</sub> A<sub>s</sub>  
 14) Q<sub>e(c,s)</sub> = (Su<sub>1</sub> N<sub>c</sub> + α<sub>1</sub> Q<sub>es</sub>) A<sub>p</sub>  
 15) NF  
 16) Q<sub>ult</sub>  
 17) Qa  
 = Cohesive Soil  
 = Cohesionless Soil  
 = Total Unit Weight (T/m<sup>3</sup>)  
 = Effective Unit Weight (T/m<sup>3</sup>)  
 = Effective Stress End of Layer (T/m<sup>2</sup>)  
 = Shear Strength (T/m<sup>2</sup>)  
 = Standard Penetration Test (blows/ft)  
 = Corrected Factor  
 = Corrected Standard Penetration Test (blows/ft)  
 NOTE:- Negative skin friction is not considered and Positive skin friction in soft clay is considered

