Appendix B-12

Structure Calculation – Sludge Treatment Building

CONTENTS

APPENDIX

CALCULATION NOTE

1. General

1.1 Building character

(a) This is 2 storied building with basement, reinforced concrete structure..
2nd story floor is devided into 2 zone, First zone has 9 meter high, another zone has 4m high.
1st story is 5.2 high, basement is 7m high. Soil condition at site is generaly stiff soil .

(b) Structure element and finish specificaton.

b-1. Roof concrete slab thickness is 15 cm. Top face pitch is 1/100 made by slanted R.C. slab.
b-2. 2nd and 1st floor concrete slab's thickness is 18 cm.
b-3. Outside wall brick thickness is 49 cm .
b-4. Column, Beam and Girder. Reinforced concrete element with 2.5 cm thick finishing mortar.
b-5. Foundation: reinforced Concrete Mat slab, 800 mm thick.

1.2 Design principle.

(a) Ultimate stress Limit state design.

Profiles of girder,column,and sub beam etc is calculated based on SNIP 2.03.01-84.
This code shows the rules for limit state design of reinforced concrete structure.

(b) This calculation note takes consideration of Dead Load, Live Load.
Snow Load (Sn.L)is assumed as 100 kgf/cm2, but this note dose not use (Sn.L), because
Roof Live Load 100 kgf/cm2 covers enough for (Sn.L).
Wind load (W.L) is checked at APPENDIX.

(c.) As for Earthquake load, it is not necessary to talculate, because ASTANA city stays
at NO EARTHQUAKE Z ONE.

(d) Frame analysis is done by 2 dimensional analysis method, (Moment distribution method).

1. 3 Material and Allowable stress

TABLE - 1 Allowable Stress (N /mm2)

Item		Allowable stress Rb	Rbt	
Concrete	B30	17	1.2	-------
Item		Allowable stress Rs	Rsc	Rw
Steel Bar	Class A1	225	225	175
	Class A3	365	365	290

1. 4 Load Table

TABLE - 2 Dead Load Sludge Treatment Building

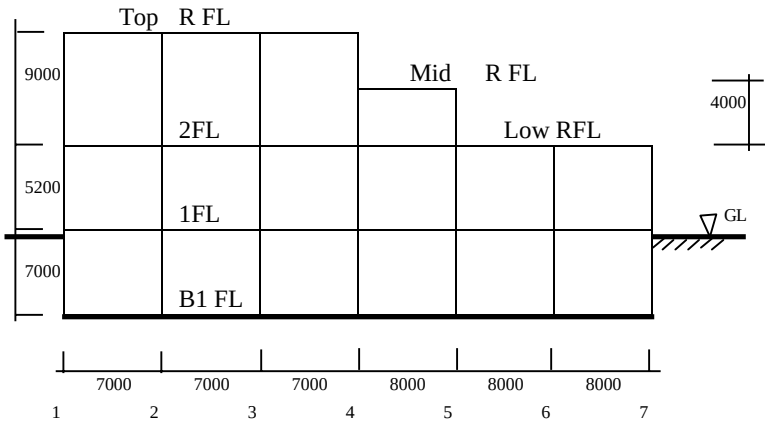
kN/m2

Loc.	item	thickness	W kN/m2	Total
Roof	Mortar Concrete slab Ceiling	5cm 15cm	1.00 3.60 0.25	4.85
Electorical Monitor room	Tile + free acces Concrete slab Ceiling	5cm 18cm	1.00 4.50 0.25	5.75
Electorical room	Tile + Mortar Concrete slab Ceiling	30cm 18cm	6.00 4.50 0.25	10.75
Machine room	Leveling motar Concrete slab Ceiling	5cm 18cm	1.00 4.50 0.25	5.75
Office room	Tile + Mortar Concrete slab Ceiling	5cm 18cm	1.00 4.50 0.25	5.75
Machine room Basement	Cinder con. Concrete slab	20cm 80cm	4.00 20.00	24.00
Stair	Tile + Mortar Concrete slab	5cm 27cm	1.00 6.75	7.75

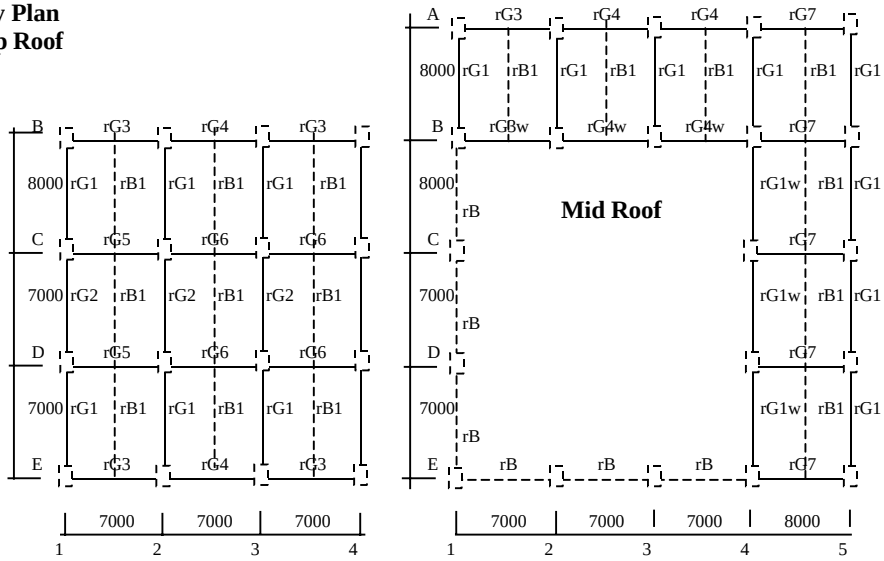
TABLE - 3 Dead Load Sludge Treatment Building

Loc.	Load type	slab	Beam	girder	γf	girder*γf	
roof	Dead Load	4.85	4.85	4.85	1.1	5.34	
	Live Load	1.00	1.00	1.00	1.2	1.20	
	Total Load	5.85	5.85	5.85		6.54	
Electorical Monitor room	Dead Load	5.75	5.75	5.75	1.1	6.33	
	Live Load	4.00	4.00	4.00	1.2	4.80	
	Total Load	9.75	9.75	9.75		11.13	
Electorical room	Dead Load	10.75	10.75	10.75	1.1	11.83	use as machine room
	Live Load	4.00	4.00	4.00	1.2	4.80	with cider 300mm
	Total Load	14.75	14.75	14.75		16.63	16.63
Machin room	Dead Load	5.75	5.75	5.75	1.1	6.33	
	Live Load	5.00	4.00	4.00	1.2	4.80	
	Total Load	10.75	9.75	9.75		11.13	12.33
Office room	Dead Load	4.85	4.85	4.85	1.1	5.34	
	Live Load	3.00	2.50	2.00	1.2	2.40	
	Total Load	7.85	7.35	6.85		7.74	8.94
Storage	Dead Load	5.75	5.75	5.75	1.1	6.33	
	Live Load	3.50	3.00	3.00	1.2	3.60	
	Total Load	9.25	8.75	8.75		9.93	10.53
Basement Mechanical	Dead Load	24.00	24.00	24.00	1.1	26.40	
	Live Load	4.00	4.00	3.00	1.2	3.60	
	Total Load	28.00	28.00	27.00		30.00	
Stair	Dead Load	7.75	7.75	7.75	1.1	8.53	
	Live Load	3.00	2.50	2.50	1.2	3.00	
	Total Load	10.75	10.25	10.25		11.53	
Machine 7.2 room	Dead Load	10.75	10.75	10.75	1.1	11.83	
	Live Load	7.20	7.20	7.20	1.2	8.64	
	Total Load	17.95	17.95	17.95		20.47	

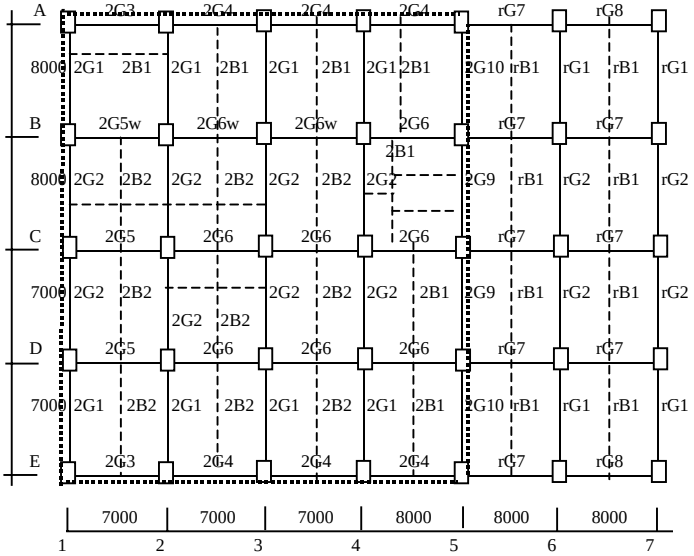
1. 5 Key Plan and Frame Structure



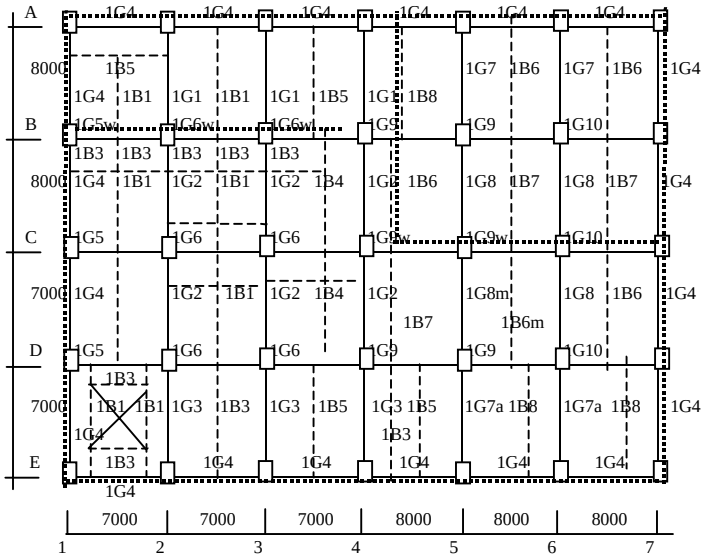
Key Plan
Top Roof



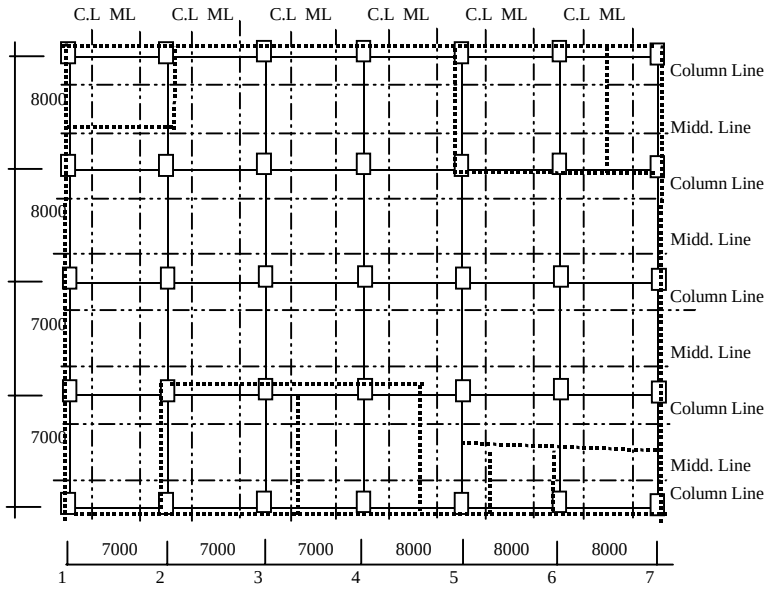
2nd FL



1st FL



Base Slab



2. Preparation SLUDGE TREATMENT BUILDING

2 - 1 Members stiffness

(a) Table - 4 Girder Stiffness

	Girder	b (cm)	D (cm)	B (cm)	t (cm)	B/b	t/D	ϕ	Io (x 10^{3} cm4)	I (x 10^{3} cm4)	*l* (x 10^{2} cm)	K (x 10^{3} cm3)	k = K/Ko
R	G1	40	75	110	15	2.75	0.200	1.53	14.063	21.516	7.00	3.07	3.07
	G2	40	75	180	15	4.50	0.200	1.82	14.063	25.594	7.00	3.66	3.66
	G3	40	75	120	15	3.00	0.200	1.57	14.063	22.078	8.00	2.76	2.76
	G4	40	75	200	15	5.00	0.200	1.89	14.063	26.578	8.00	3.32	3.32
2F	G1	40	75	110	15	2.75	0.200	1.53	14.063	21.516	7.00	3.07	3.07
	G2	40	75	180	15	4.50	0.200	1.82	14.063	25.594	7.00	3.66	3.66
	G3	40	75	120	15	3.00	0.200	1.57	14.063	22.078	8.00	2.76	2.76
	G4	40	75	200	15	5.00	0.200	1.89	14.063	26.578	8.00	3.32	3.32
1F	G1	40	75	110	15	2.75	0.200	1.53	14.063	21.516	7.00	3.07	3.07
	G2	40	75	110	15	2.75	0.200	1.82	14.063	25.594	7.00	3.66	3.66
	G3	40	75	120	15	3.00	0.200	1.57	14.063	22.078	8.00	2.76	2.76
	G4	40	75	200	15	5.00	0.200	1.89	14.063	26.578	8.00	3.32	3.32
B1F	FG1	150	80	1	1	0.01	0.013	1.00	64.000	64.000	7.00	9.14	9.14
	FG2	150	80	1	1	0.01	0.013	1.00	64.000	64.000	8.00	8.00	8.00
	FG3	150	80	1	1	0.01	0.013	1.00	64.000	64.000	8.00	8.00	8.00

FG1,FG2,FG : Use only at Frame analysis, Treat as Mat foundation at Profile design.

(b) Table - 5 Column Stiffness

	Colmn ID		b	D	I (x 10^{5} cm4)	*l* (x 10^{2} cm)	K (x 10^{3} cm3)	k = . K/Ko
2	C1	x,y	60	60	10.8	9.00	1.200	1.20
	C2	x,y	60	60	10.8	4.00	2.700	2.70
	C3	x,y	60	60	10.8	5.00	2.160	2.16
1	C1,C2	x,y	60	60	10.8	5.20	2.077	2.08
B1	C1	x,y	80	80	34.13	6.50	5.251	5.25
	C2	x,y	80	80	34.13	6.50	5.251	5.25

2. 2 Girder Fixed end moment(Co),Center moment(Mo),Shear at end(Q)

roof-c
roof-b floor

Fixed end bending moment (Co)
Middle span bending moment (Mo)
Shear force (Q) at gierder ends Sludge treatment building

	Load form	△ (slab load)		⏢ (slab load)		═ (gider load)		Σ
		w	Co	w	Co	w/1	Co	
rG1	Co	0.00	0.00	0.00	0.00	8.25	33.69	33.69
			Mo	w	Mo	w/1	Mo	
span 7m	Mo	0.00	0.00	0.00	0.00	8.25	50.53	50.53
apply on		w	Q	w	Q	w/1	Q	
4,5-frame also	Q	0.00	0.00	0.00	0.00	8.25	28.88	28.88

Slab load 0.00 (kN/m2)
Span 7 (m) a= 1.75 (m)
Span 3= 343 a3= 5.359375

	Load form	△ (slab load)		⏢ (slab load)		═ (gider load) .+W49		Σ
		w	Co	w	Co	w/1	Co	
rG1	Co	0.00	0.00	0.00	0.00	43.18	176.31	176.31
+wall 49c			Mo	w	Mo	w/1	Mo	
h=4.3m	Mo	0.00	0.00	0.00	0.00	43.18	264.46	264.46
		w	Q	w	Q	w/1	Q	
span 7m	Q	0.00	0.00	0.00	0.00	43.18	151.12	151.12

Slab load 0.00 (kN/m2)
Span 7 (m) a= 1.75 (m)
Span 3= 343 a3= 5.359375

	Load form	△ (slab load)		⏢ (slab load)		═ (gider load)		Σ
		w	Co	w	Co	w/1	Co	
rG2	Co	0.00	0.00	0.00	0.00	8.25	44.00	44.00
rG1			Mo	w	Mo	w/1	Mo	
Span 8m	Mo	0.00	0.00	0.00	0.00	8.25	66.00	66.00
apply on		w	Q	w	Q	w/1	Q	
4,5-frame also	Q	0.00	0.00	0.00	0.00	8.25	33.00	33.00

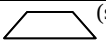
Slab load 0.00 (kN/m2)
Span 8 (m) a= 1.75 (m)
Span 3= 512 a3= 5.359375

	Load form	⩚ (slab load)		⏢ (slab load)		═ (gider load)+ wall		Σ
		w	Co	Co/w	Co	w/1	Co	
rG3	Co	14.30	93.45		0.00	8.25	33.69	127.14
rG4			Mo	Mo/w	Mo	w/1	Mo	
	Mo	24.50	160.11		0.00	8.25	50.53	210.64
No wall		w	Q	Q/w	Q	w/1	Q	
	Q	8.70	56.85		0.00	8.25	28.88	85.73

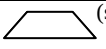
Slab load 6.54 (kN/m2)
Span 7 (m)

	Load form	⩚ (slab load)		⏢ (slab load)		═ (gider load)+ wall		Σ
		w	Co	Co/w	Co	w/1	Co	
rG3	Co	14.30	93.45		0.00	43.18	176.31	269.76
rG4			Mo	Mo/w	Mo	w/1	Mo	
	Mo	24.50	160.11		0.00	43.18	264.46	424.57
.+ Wall 49 cm		w	Q	Q/w	Q	w/1	Q	
	Q	8.70	56.85		0.00	43.18	151.12	207.97

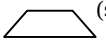
Slab load 6.54 (kN/m2)
Span 7 (m)

	Load form	 (slab load)		 (slab load)		 (gider load) .+ hoist 36kN		Σ
		Co/w	Co	Co/w	Co	w/1	Co	
rG5	Co	28.60	186.90		0.00	8.25	65.19	252.09
rG6		Mo/w	Mo	Mo/w	Mo	w/1	Mo	
	Mo	49.00	320.22		0.00	8.25	56.66	376.87
		Q/w	Q	Q/w	Q	w/1	Q	
	Q	17.40	113.71		0.00	8.25	46.88	160.58

Slab load 6.54 (kN/m2)
Span 7 (m)
.+49cm wall

	Load form	 (slab load)		 (slab load)		(gider load)		Σ
rG7		Co/w	Co	w	Co	w/1	Co	
	Co	36	235.26	0.00	0.00	8.25	44.00	279.26
		Mo/w	Mo	w	Mo	w/1	Mo	
	Mo	66	431.31	0.00	0.00	8.25	66.00	497.31
		Q/w	Q	w	Q	w/1	Q	
	Q	20	130.70	0.00	0.00	8.25	33.00	163.70

Slab load 6.54 (kN/m2)
Span 8 (m) a= 4 (m)

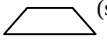
	Load form	(slab load)		 (slab load)		(gider load)		Σ
		w	Co	w	Co	w/1	Co	
rG2*0.5	Co	0.00	0.00	11.44	55.79	43.18	230.28	286.07
rG1*0.5			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	11.44	85.65	43.18	345.42	431.07
.+ wall 49cm		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	11.44	35.74	43.18	172.71	208.45

Slab load 6.54 (kN/m2)
Span 8 (m) a= 1.75 (m)
Span 3= 512 a3= 5.359375

Sludge treatment

	Load form	(slab load)		(slab load)		 (gider load) .+ p 30kN		Σ
		w	Co	w	Co	w/1	Co	
2G1a	Co	0.00	0.00	38.94	141.60	8.25	89.69	231.29
			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	38.94	218.62	8.25	134.53	353.15
		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	38.94	102.21	8.25	64.88	167.09

use this value for girder A-B,2 frame
Slab load 11.13 (kN/m2)
Span 7 (m) a= 1.75 (m)
Span 3= 343 a3= 5.359375

	Load form	(slab load)		 (slab load)		 (gider load) .+ P 30kN		Σ
2G1		w	Co	w	Co	w/1	Co	
2G2	Co	0.00	0.00	38.94	189.97	8.250	108.00	297.97
			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	38.94	291.63	8.250	162.00	453.63
Machine load		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	38.94	121.68	8.250	69.00	190.68

Slab load 11.13 (kN/m2)
Span 8 (m) a= 1.75 (m)
Span 3= 512 a3= 5.359375

	Load form	(slab load)		(slab load)		p p (gider load) .+ P 30kN		Σ
2G1w		w	Co	w	Co	w/1	Co	
	Co	0.00	0.00	38.94	189.97	28.050	149.60	339.57
			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	38.94	291.63	28.050	224.40	516.03
Machine load		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	38.94	121.68	28.050	112.20	233.88

Slab load 11.13 (kN/m2)
Span 8 (m) a= 1.75 (m)
Span 3= 512 a3= 5.359375

	Load form	(slab load)		(slab load)		(gider load)+ wall		Σ
		w	Co	Co/w	Co	w/1	Co	
2G3	Co	13.50	150.19		0.00	4.06	16.57	166.76
2G4			Mo	Mo/w	Mo	w/1	Mo	
	Mo	25.00	278.13		0.00	4.06	24.86	302.99
		w	Q	Q/w	Q	w/1	Q	
	Q	8.50	94.56		0.00	4.06	14.21	108.77

Slab load 11.13 (kN/m2)
Span 7 (m)

	Load form	(slab load)		P Hoist .+ 30*1.2kN		(gider load)		Σ
		Co/w	Co	P	Co	w/1	Co	
2G5	Co	27.00	300.38	36.00	31.50	8.25	33.69	365.56
2G6		Mo/w	Mo	P	Mo	w/1	Mo	
	Mo	50.00	556.25	36.00	63.00	8.25	50.53	669.78
C-frame		Q/w	Q	P	Q	w/1	Q	
	Q	17.00	189.13	36.00	18.00	8.25	28.88	236.00

Slab load = 11.13 (kN/m2)
Span = 7 (m)

2

	Load form	(slab load)		P Hoist .+ 15*1.2kn		(gider load) .+ wall 18cm		Σ
		Co/w	Co	P	Co	w/1	Co	
2G5w	Co	27.00	300.38	18.00	15.75	23.9316	97.72	413.85
2G6w		Mo/w	Mo	P	Mo	w/1	Mo	
	Mo	50.00	556.25	18.00	31.50	23.9316	146.58	734.33
C-frame		Q/w	Q	P	Q	w/1	Q	
	Q	17.00	189.13	18.00	9.00	23.9316	83.76	281.89

Slab load 11.13 (kN/m2)
Span 7 (m)

2

	Load form	(slab load)		(slab load)		(gider load)		Σ
office								
		w	Co	w	Co	w/1	Co	
2G7	Co	36.00	278.46	0.00	0.00	8.25	44.00	322.46
2G8			Mo	w	Mo	w/1	Mo	
	Mo	66.00	510.51	0.00	0.00	8.25	66.00	576.51
use at roof		w	Q	w	Q	w/1	Q	
also	Q	21.00	162.44	0.00	0.00	8.25	33.00	195.44

Slab load 7.74 (kN/m2)
2.285714 Span 8 (m) a= 8 (m)

	Load form		(slab load)		(slab load)		(gider load) .+wall 49cm	Σ
2G9		w	Co	w	Co	w/1	Co	
2G10	Co	0.00	0.00	19.00	146.97	40.2666	214.76	361.72
			Mo	w	Mo	w/1	Mo	
5-frame	Mo	0.00	0.00	29.00	224.32	40.2666	322.13	546.45
		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	12.00	92.82	40.2666	161.07	253.89

Slab load 7.74 (kN/m2)
2.285714 Span 8 (m) a= 7 (m)

5 Frame D-E	Load form		(slab load)		(slab load)		(gider load) .+wall 4.9cm	Σ
		w	Co	w	Co	w/1	Co	
2G10a	Co	0.00	0.00	35.32	124.04	40.2666	164.42	288.46
		w	Mo	w	Mo	w/1	Mo	
5-frame	Mo	0.00	0.00	35.32	192.79	40.2666	322.13	514.92
		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	35.32	88.30	40.2666	140.93	229.23

(roof.L+machine.L)/2→ Slab load 8.83 (kN/m2)
2.285714 Span 7 (m) a= 2 (m)
Span 3= 343 a3= 8

	Load form		(slab load)		(slab load)		(gider load)	Σ
		w	Co	w	Co	w/1	Co	
1G3	Co	0.00	0.00	38.94	141.60	8.25	33.69	175.29
			Mo	w	Mo	w/1	Mo	
D-end,E-end	Mo	0.00	0.00	38.94	218.62	8.25	50.53	269.15
2,3,4 frame		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	38.94	102.21	8.25	28.88	131.09

Slab load 11.13 (kN/m2)
Span 7 (m) a= 1.75 (m)
Span 3= 343 a3= 5.359375

	Load form		(slab load)		(slab load)		(gider load) P 20 kN	Σ
		w	Co	w	Co	w/1	Co	
1G1	Co	0.00	0.00	38.94	189.97	8.25	86.67	276.63
1G2			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	38.94	291.63	8.25	132.67	424.29
2,3,4Frame		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	38.94	121.68	8.25	58.00	179.68

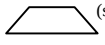
Slab load 11.13 (kN/m2)
Span 8 (m) a= 1.75 (m)
Span 3= 512 a3= 5.359375

	Load form		(slab load)		(slab load)		(gider load)	Σ
		w	Co	w	Co	w/1	Co	
1G1w	Co	0.00	0.00	40.34	196.80	29.634	158.05	354.84
1G2w			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	40.34	302.11	29.634	243.74	545.85
2,3,4Frame		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	40.34	126.05	29.634	121.04	247.09

Slab load 11.53 (kN/m2)
Span 8 (m) a= 1.75 (m)
Span 3= 512 a3= 5.359375

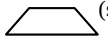
	Load form		(slab load)		(slab load)		(gider load)	Σ
1G3		Co/w	Co	Co/w	Co	w/1	Co	
1G4	Co	14.30	159.09		0.00	8.25	33.69	192.78
		Mo/w	Mo	Mo/w	Mo	w/1	Mo	
	Mo	24.50	272.56		0.00	8.25	50.53	323.09
		Q/w	Q	Q/w	Q	w/1	Q	
Use 2G4 value	Q	8.70	96.79		0.00	8.25	28.88	125.66

Slab load 11.13 (kN/m2)
B.12-10 Span 8 (m) a(m)=

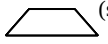
	Load form	 (slab load)		 (slab load)		(gider load)		Σ
		Co/w	Co	w	Co	w/1	Co	
1G5	Co	28.60	318.18	0.00	0.00	8.25	44.00	362.18
1G6		Mo/w	Mo	w	Mo	w/1	Mo	
	Mo	48.40	538.45	0.00	0.00	8.25	66.00	604.45
		Q/w	Q	w	Q	w/1	Q	
	Q	17.40	193.58	0.00	0.00	8.25	33.00	226.58

Slab load 11.13 (kN/m2)
Span 7 (m) a= 1.75 (m)
Span 3= 343 a3= 5.359375

Sludge treatment

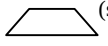
	Load form	 (slab load)		 (slab load)		(gider load)		Σ
		Co/w	Co	Co/w	Co	w/1	Co	
1G9	Co	35.00	581.88		0.00	9.28	49.50	631.38
1G10		Mo/w	Mo	Mo/w	Mo	w/1	Mo	
	Mo	64.00	1064.00		0.00	9.28	74.25	1138.25
		Q/w	Q	Q/w	Q	w/1	Q	
	Q	20.00	332.50		0.00	9.28	37.13	369.63

Slab load 16.63 (kN/m2)
b x D = 45 x 75 Span 8 (m)

	Load form	 (slab load)		 (slab load)		(gider load)+ wall		Σ
		w	Co	w	Co	w/1	Co	
1G7	Co	0.00	0.00	66.50	315.88	0.93	3.79	319.66
1G8			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	66.50	487.67	0.93	5.68	493.35
		w	Q	w	Q	w/1	Q	
A-end Bend	Q	0.00	0.00	66.50	199.50	0.93	3.25	202.75

C-end D-end Electric room

Slab load 16.63 (kN/m2)
Span 8 (m) a= 2 (m)
Span 3= 512 a3= 8

	Load form	 (slab load)		 (slab load)		(gider load)		Σ
		Co/w	Co	w	Co	w/1	Co	
1G5W	Co	28.60	318.18	0.00	0.00	22.79	121.53	439.70
1G6W		Mo/w	Mo	w	Mo	w/1	Mo	
	Mo	48.40	538.45	0.00	0.00	22.79	182.29	720.74
.+ wall 38cm		Q/w	Q	w	Q	w/1	Q	
B frame	Q	17.40	193.58	0.00	0.00	22.79	91.15	284.72

bxD 45x75

Slab load 11.13 (kN/m2)
Span 7 (m) a= 1.75 (m)
Span 3= 343 a3= 5.359375

	Load form	△	(slab load)	▱	(slab load)	═	(gider load)	Σ
		w	Co	Co/w	Co	w/1	Co	
FG1	Co	478.49	1221.14		0.00	0	0.00	1221.14
			Mo	Mo/w	Mo	w/1	Mo	
For reference	Mo	478.49	1953.83		0.00	0	0.00	1953.83
		w	Q	Q/w	Q	w/1	Q	
	Q	478.49	837.35		0.00	0	0.00	837.35

Slab load 68.355 (kN/m2)
Span 7 (m) a(m)=

	Load form	△	(slab load)	▱	(slab load)	═	(gider load)	Σ
		w	Co	w	Co	w/1	Co	
FG2	Co	546.84	1822.81	0.00	0.00	0	0.00	1822.81
			Mo	w	Mo	w/1	Mo	
For reference	Mo	546.84	2916.50	0.00	0.00	0	0.00	2916.50
		w	Q	w	Q	w/1	Q	
	Q	546.84	1093.69	0.00	0.00	0	0.00	1093.69

Slab load 68.355 (kN/m2)
Span 8 (m) a= 2 (m)
Span 3= 512 a3= 8

Sludge treatment (with Machine weight 0.72 t/m2)

	Load form	△	(slab load)	▱	(slab load)	═	(gider load)	Σ
		Co/w	Co	Co/w	Co	w/1	Co	
1G9w	Co	39.85	662.46		0.00	28.29	150.88	813.34
		Mo/w	Mo	Mo/w	Mo	w/1	Mo	
	Mo	72.86	1211.36		0.00	28.29	226.31	1437.68
		Q/w	Q	Q/w	Q	w/1	Q	
	Q	22.77	378.55		0.00	28.29	113.16	491.71

Slab load 16.63 (kN/m2)
b x D = 45 x 75 Span 8 (m)
new → slab load = 16.03+20.47.=36.5 (kN/m2)
old → slab load = 16.03+16.0.=32.06 (kN/m2)

Sludge treatment (with Machine weight 0.72 t/m2)

	Load form	△△	(slab load)	▱	(slab load)	═	(gider load)	Σ
		Co/w	Co	Co/w	Co	w/1	Co	
1G9m	Co	39.85	662.46		0.00	9.28	49.50	711.96
		Mo/w	Mo	Mo/w	Mo	w/1	Mo	
	Mo	72.86	1211.36		0.00	9.28	74.25	1285.61
		Q/w	Q	Q/w	Q	w/1	Q	
	Q	22.77	378.55		0.00	9.28	37.13	415.68

Slab load 16.63 (kN/m2)
b x D = 45 x 75 Span 8 (m)
new → slab load = 1.325+1.79.=3.12 (t/m2)
old → slab load = 1.325+1.32.=2.65 (t/m2)

	Load form	△	(slab load)	▱	(slab load)	═	(gider load)+ wall	Σ
		w	Co	w	Co	w/1	Co	
	Co	0.00	0.00	75.74	359.78	0.85	3.47	363.25
1G8m			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	75.74	555.45	0.85	5.21	560.66
		w	Q	w	Q	w/1	Q	
A-end Bend	Q	0.00	0.00	75.74	227.23	0.85	2.98	230.21

C-end D-end Electric room
Slab load 16.63 (kN/m2)
Span 8 (m) a= 2 (m)
Span 3= 512 a3= 8

2.3 Column Axial Force and Building weight

Table-6 Sludge Treatment building Weight γf (D.L): 1.1 Slab : Refer table 4

Story	Load type	Unit w*γf (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (kN)	S Wi (kN)
	Top roof slab	6.54	21.6	23.60	509.76	3331.28		
	M2 roof slab	6.54	8	53.00	424.00	2770.84		
	Girder 8m	8.25	10	8.00	80.00	660.00		
	Girder 7m	8.25	17	7.00	119.00	981.75		
2nd Story	Col. 9m	9.90	9	5.00	45.00	445.50		
	Col. 4m	9.90	16	9.00	144.00	1425.60		
	M2 Girder 8m	8.25	14	8.00	112.00	924.00		
	M2 Girder 7m	8.25	8	7.00	56.00	462.00		
	Wall.1 9m	9.70	9	45.20	406.80	3946.77		
	Wall.2 5m	9.70	5	45.20	226.00	2192.65		
	Waii.3 4m	9.70	4	76.00	304.00	2949.41		
	Wall in 1	7.52	4	46.20	184.80	1390.44		
	Wall in 2	7.52	3.5	46.00	161.00	1211.36		
	Wall in 3	2.38	3.5	38.00	133.00	316.01		
							23007.61	23007.61
	2F roof slab	6.54	16.3	31.60	515.08	3366.05		
	Machine rm	11.13	21.3	23.30	496.29	5521.23		
	Office room	6.85	8.3	21.30	176.79	1211.01		
	Staff office	6.85	8	8.00	64.00	438.40		
	Other floor	8.75	8	23.00	184.00	1610.00		
1st story	Girder 8m	8.25	36	8.00	288.00	2376.00		
	Girder 7m	8.25	22	7.00	154.00	1270.50		
	Col. 5.2m	9.90	35	5.20	182.00	1801.80		
on 2nd fl →	Machine 1	180.00	3	1.30	3.90	702.00		
on 2nd fl →	Machine 2	25.00	3	1.30	3.90	97.50		
on 2nd fl →	Machine 3	30.00	3	1.30	3.90	117.00		
	Wall.1 5.2m	9.70	5.2	154.40	802.88	7789.54		
	Wall in 4.5m	7.52	4.5	119.00	535.50	4029.10		
	Waii.in 4.5m	2.38	4.5	63.00	283.50	673.60		
							31003.73	54011.34
	1F electric slab	16.63	21.5	16.30	350.45	5826.23		
	Machine rm 1	11.13	21.3	21.10	449.43	4999.91		
	Machine rm 2	11.13	12.8	16.60	212.48	2363.84		
	Machine rm +	11.13	1	79.25	79.25	881.66		
	Storage.toilet	8.75	1	74.50	74.50	651.88		
	Elc. monitor	9.75	8.6	17.80	153.08	1492.53		
	Office room	6.85	8.6	7.00	60.20	412.37		
	Other floor	8.75	1	61.57	61.57	538.74		
B1 story	Girder 8m	10.31	36	8.00	288.00	2970.00		
	Girder 7m	10.31	22	7.00	154.00	1588.13		
	Col. 1 6.9m	17.60	35	5.20	182.00	3203.20		
	Machine 1	60.00	3	1.30	3.90	234.00		
	Machine 2	20.00	3	1.30	3.90	78.00		
	Machine 3	10.00	12	1.30	15.60	156.00		
	Machine 4	5.50	2	1.30	2.60	14.30		
	Wall.1 5.15m	13.75	5.15	135.20	696.28	9573.85		
	Wall.2 5.15m	13.75	5.15	125.00	643.75	8851.56		
	Water	44.00	1	374.00	374.00	16456.00		
	Machine 1	100.00	5	1.30	6.50	650.00		
	Base cocrete	30.00	31.6	45.60	1440.96	43228.80		
	(eaction cancel effect)							
								(kN)
							104170.99	158182.3

B.12-13 **Base Area 1440.96 (m2)** **Total W= 158,182.32**

Base Area	**1440.96 (m2)**				**Total W=**	**158,182.32**
		109.776	(kN/m2)		wall key	0.00
	w1=	16456.00	(kN)			
Foundation'sdesign force=109.63 -11.42 -30=		**68.355**	(kN/m2)	w1/(31.6*45.6)=	**11.42**	(kN/m2)

Table-7 Sludge Treatment building Weight

Story	Load type	Unit w (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (KN)	S Wi (kN)
	Top roof slab	6.54	8.00	7.00	56.00	365.96		
C1	Girder 8m	7.50	1.00	8.00	8.00	60.00		
	Girder 7m	7.50	1.00	7.00	7.00	52.50		
2nd Story	Col. 9m	9.90	1.00	9.00	9.00	89.10		
C-frame, 2	Wall.1 9m	0.00	9.00	45.20	406.80	0.00		
	Wall.2 5m	0.00	5.00	45.20	226.00	0.00		
	Waii.3 4m	0.00	4.00	76.00	304.00	0.00		
	Hoist	36.00	1.00	1.00	1.00	36.00	603.56	603.56
	2FL slab	11.13	8.00	7.00	56.00	623.00		
C1	Girder 8m	8.25	1.00	8.00	8.00	66.00		
	Girder 7m	8.25	1.00	7.00	7.00	57.75		
1st Story	Col. 5.2m	9.90	1.00	5.20	5.20	51.48		
C-frame, 2	Macine	30.00	1.00	1.00	1.00	30.00		
							828.23	1431.79
	1FL slab	11.13	8.00	7.00	56.00	623.00		
C1	Girder 8m	8.25	2.00	8.00	16.00	132.00		
	Girder 7m	8.25	2.00	7.00	14.00	115.50		
B1 Story	Col. 7m	17.60	1.00	7.00	7.00	123.20		
C-frame, 2	Machine	12.00	5.00	1.00	5.00	60.00	1053.70	2485.49
C1	Base Slab	22.00	8.00	7.00	56.00	1232.00		
C-frame, 2	Machine	120.00	2.00	1.00	2.00	240.00		
							1472.00	3957.49

Base design force=2331.49/56= 48.67 kN/m2 w/(8x7)= 70.669 (kNt/m2)

Table-8 Sludge Treatment building Weight

Story	Load type	Unit w (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (KN)	S Wi (kN)
	Rb roof slab	6.54	4.00	3.50	14.00	91.49		
	Rb roof slab	6.54	3.50	12.00	42.00	274.47		
2C2	Girder 8m	8.25	2.00	8.00	16.00	132.00		
	Girder 7m	8.25	1.00	7.00	7.00	57.75		
2nd Story	Hoist	36.00	1.00	1.00	1.00	36.00		
B-frame, 4	Wall.2 5m	9.70	5.00	7.50	37.50	363.83		
	Col. 9m	17.60	1.00	9.00	9.00	158.40	1113.94	1113.94
1C2	Wall in 38cm	7.52	4.00	20.00	80.00	601.92		
1st Story	2FL slab	9.93	8.00	7.50	60.00	595.50		
B-frame, 4	Machine	33.00	1.00	1.00	1.00	33.00		
	Girder 8m	8.25	1.00	8.00	8.00	66.00		
	Girder 7m	8.25	1.00	7.00	7.00	57.75		
	Col. 5.2m	17.60	1.00	5.20	5.20	91.52	1445.69	2559.63
	Wall in 38cm	7.52	4.50	13.00	58.50	440.15		
BC2	1FL slab	9.93	8.00	7.50	60.00	595.50		
B1 Story	Girder 8m	8.25	1.50	8.00	12.00	99.00		
	Girder 7m	8.25	0.50	7.00	3.50	28.88		
B-frame, 4	Col. 6.9m	1.76	1.00	6.90	6.90	12.14	1175.67	3735.30
	Base Slab	30.00	8.00	7.50	60.00	1800.00		
Foundation	Machine	120.00	1.00	1.00	1.00	120.00		
B-frame, 2								
							1920.00	5655.30

Base design force=330.71/60= 64.25 kN/m2 Soil reaction= 94.255

Table-9 Sludge Treatment building Weight (kNt/m2)

Story	Load type	Unit w (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (KN)	S Wi (kN)
	Rb roof	6.54	8.00	4.00	32.00	209.12		
2C3	Girder 8m	8.25	1.50	8.00	12.00	99.00		
2nd Story	Col. 4m	9.90	1.00	4.00	4.00	39.60		
B-frame, 5								
							347.72	347.72
	Wall.3 4m	9.70	4.00	9.00	36.00	349.27		
	Wall in 38cm	7.52	4.00	8.00	32.00	240.77		
	2FL roof	0.00	8.00	4.00	32.00	0.00		
		9.93	8.00	4.00	32.00	317.60		
1C3	Girder 8m	8.25	2.00	8.00	16.00	132.00		
	Girder 7m	8.25	1.00	7.00	7.00	57.75		
1st Story	Col. 5.2m	9.90	1.00	5.20	5.20	51.48		
B-frame, 5	Machine	0.00	1.00	1.00	1.00	0.00		
							558.83	906.55
	1FL slab	16.63	8.00	8.00	64.00	1064.00		
bC3	Girder 8m	8.25	1.50	8.00	12.00	99.00		
	Girder 7m	8.25	0.50	7.00	3.50	28.88		
B1 Story	Col. 7m	17.60	1.00	7.00	7.00	123.20		
B-frame, 5	Machine	0.00	0.00	0.00	0.00	0.00		
	Water	5.00	4	4.00	16.00	80.00	1395.08	2301.63
Foundation	Base Slab	30.00	8.00	8.00	64.00	1920.00		
B-frame, 5	Wall 55cm	15.13	6.50	8.00	52.00	786.50		
							2706.50	5008.13

Base design force=282.8/64= 48.25 kN/m2 w/64(kN/m2)= 78.252

Table-10 Sludge Treatment building Weight

Story	Load type	Unit w (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (kN)	S Wi (kN)
	Roof	6.54	8.00	8.00	64.00	418.24		
1C4	Girder 8m	8.25	2.00	8.00	16.00	132.00		
1st Story	Col. 5.2m	9.90	1.00	5.20	5.20	51.48		
B-frame, 6	Machine	0.00	0.00	0.00	0.00	0.00		
							601.72	601.72
	1FL slab	16.63	8.00	8.00	64.00	1064.00		
bC4	Girder 8m	8.25	1.50	8.00	12.00	99.00		
B1 Story	Col. 7m	17.60	1.00	7.00	7.00	123.20		
B-frame, 6								
	Water	42.00	4.00	8.00	32.00	1344.00		
							2630.20	3231.92
Foundation	Base Slab	30.00	8.00	8.00	64.00	1920.00		
B-frame, 6	Wall 55cm	15.13	6.50	12.00	78.00	1179.75		
							3099.75	6331.67

Base design force=(2711.2+1072)/64= 50.50 kN/m2 w/64(kN)= 98.932

Table-11 Sludge Treatment building Weight

Story	Load type	Unit w (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (KN)	S Wi (kN)
	Roof	6.54	8.00	4.00	32.00	209.12		
1C5	Girder 8m	8.25	1.50	8.00	12.00	99.00		
1st Story	Col. 5.2m	9.90	1.00	5.20	5.20	51.48		
B-frame, 7								
							359.60	359.60
	1FL slab	16.63	8.00	4.00	32.00	532.00		
	Wall 49cm	9.70	8.00	4.30	34.40	333.75		
bC5	Girder 8m	0.00	1.50	8.00	12.00	0.00		
B1 Story	Col. 7m	17.60	1.00	7.00	7.00	123.20		
B-frame, 7								
	Water	42.00	4.00	4.00	16.00	672.00		
							1660.95	2020.55
Foundation	Base Slab	30.00	4.00	8.00	32.00	960.00		
B-frame, 7	Wall 55cm	15.13	6.50	16.00	104.00	1573.00		
							2533.00	4553.55

Base design force=180.7/32= 112.30 kN/m2 w/32= 142.298 (kN/m2)

Table-12 Sludge Treatment building Weight

Story	Load type	Unit w (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (KN)	S Wi (kN)
	Roof	6.54	8.00	8.00	64.00	418.24		
1C6	Girder 8m	8.25	2.00	8.00	16.00	132.00		
1st Story	Col. 5.2m	9.90	1.00	5.20	5.20	51.48		
C-frame, 6	Machine	0.00	0.00	0.00	0.00	0.00		
							601.72	601.72
	1FL slab	16.63	8.00	8.00	64.00	1064.00		
bC6	Girder 8m	7.53	1.50	8.00	12.00	90.36		
B1 Story	Col. 7m	17.60	1.00	7.00	7.00	123.20		
C-frame, 6								
	Wall 38cm	7.52	4.40	8.00	35.20	264.84		
							1542.40	2144.12
Foundation	Base Slab	30.00	8.00	8.00	64.00	1920.00		
C-frame, 6								
							1920.00	4064.12
	Base design force=(4025.72-1920)/64=				33.50	kN/m2	w/64(kN/m2)=	63.502

Table-13 Sludge Treatment building Weight

Story	Load type	Unit w (kN/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (KN)	S Wi (kN)
	Roof	6.54	7.00	3.50	24.50	160.11		
2C7	Girder 7m	8.25	1.50	7.00	10.50	86.63		
2st Story	Col. 5.2m	9.90	1.00	5.20	5.20	51.48		
E-frame, 2	Machine	0.00	0.00	0.00	0.00	0.00		
							298.21	298.21
	1FL slab	11.13	7.00	3.50	24.50	272.56		
	Wall 49cm	9.70	8.30	7.00	58.10	563.69		
1C7	Girder 7m	8.25	1.50	7.00	10.50	86.63		
1 Story	Col. 9m	9.90	1.00	9.00	9.00	89.10		
E-frame, 2								
							1011.97	1310.19
	1FL slab	11.13	7.00	3.50	24.50	272.56		
	Wall 49cm	9.70	4.40	4.30	18.92	183.56		
b1C6	Girder 7m	8.25	1.50	7.00	10.50	86.63		
B1 Story	Col. 5.2m	17.60	1.00	5.20	5.20	91.52		
E-frame, 2								
	Water	60.00	4.00	4.00	16.00	960.00		
							1594.27	2904.46
Foundation	Base Slab	30.00	7.00	3.50	24.50	735.00		
E-frame, 2	Wall 55cm	15.13	6.50	10.50	68.25	1032.28		
							1767.28	4671.74
	Base design force=(253.29-wall49)/24.5=				88.05	kN/m2	w/24.5=	190.683

including water (kN/m2)

3 Girder and Column Profile Design

3-1Girder Profile Design **top roof**

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D22 As 380 mm2

Girder ID	top	rG1 2-frame 8m		top	rG2 2-frame 8m		top	rG1 2-frame 7m	
Position	B end	Mid	C end	C end	Mid	D end	D end	Mid	E end
D.L] M(kN.m) top	48.88		186.09	180.08		159.3	156.79		41.84
+] bott.		211.19			67.63			79.64	
L.L] Q (t)	88.92		106.07	106.68		104.08	105.34		88.92
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^b)		3332			3332			3332	
α_m (top)=M/z	0.0147		0.0558	0.0540		0.0478	0.0471		0.0126
α_m(bott.)		0.0634			0.0203			0.0239	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bot.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5	> M ok	278.5	278.5	> M ok	278.5	278.5	> M ok	278.5
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			278.5			278.5	
top	0.407		0.407	0.407		0.407	0.407		0.407
Pt (%) bott.		0.407			0.407			0.407	
top	1140		1140	1140		1140	1140		1140
as (mm2) bott.		1140			1140			1140	
Main top	3	3	3	3	3	3	3	3	3
Bars **D22**									
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho	201.6	(kN)	201.6	201.6	(kN)	201.6	201.6	(kN)	201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

ψb3= 0.6 by Table.21

Girder ID	top	rG3 B-frame		top	rG4 B-frame		top	rG5 D-frame	
Position	1 end	Mid	2 end	2 end	Mid	3 end	1 end	Mid	2 end
D.L] M(kN.m) top	55.47		146.19	152.39		134.73	110.05		211.33
+] bott.		109.81			111.42			216.18	
L.L] Q (t)	85.7		98.66	88.25		85.73	160.58		175.05
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^b)		3332			3332			3332	
a_m (top)=M/z	0.0166		0.0439	0.0457		0.0404	0.0330		0.0634
a_m(bott.)		0.0330			0.0334			0.0649	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bot.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5	> M ok	278.5	278.5	> M ok	278.5	278.5	> M ok	365.7
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			278.5			278.5	
top	0.407		0.407	0.407		0.407	0.407		0.543
Pt (%) bott.		0.407			0.407			0.407	
top	1140		1140	1140		1140	1140		1520
as (mm2) bott.		1140			1140			1140	
Main top	3	3	3	3	3	3	3	3	4
Bars **D22**									
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho(kN)	201.6	(kN)	201.6	201.6	(kN)	201.6	201.6	(kN)	201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150	(kN)	+D10-150
judge	ok		ok	ok		ok	ok		ok

ψb3= 0.6 by Table.2 Snip 2.03.01-84

Girder Profile Design **top roof and M2 roof**

M2 roof

Girder ID	top	rG6 D-frame			rG7 D-frame		
Position	2 end	Mid	3 end		4 end	Mid	5 end
D.L] M(tm) top	119.33		148.38		190.2		133.8
+] bott.		243.02				323.71	
L.L] Q (t)	160.58		164.73		160.8		153.7
] b x D (cm)	400	x	750		400	x	750
Size] ho (mm)	700	700	700		700	700	700
z= Rb.b.ho^2 (x 10^n)		3332				3332	
a_m (top)=M/z	0.0358		0.0445		0.0571		0.0402
a_m(bott.)		0.0729				0.0972	
α_r = 0.395	>	>	>		>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5		270.5		270.5
Bot.Mus=Rsc.A's.(ho-a')=		270.5				270.5	
Top Mu=Rs.As(ho-0.5ξho)=	450.1	> M ok	450.1		531.6	> M ok	278.5
Bot Mu=Rs.As(ho-0.5ξho)=		278.5				450.1	
Pt (%) top	0.679		0.679		0.814		0.407
Pt (%) bott.		0.407				0.679	
as (mm2) top	1900		1900		2280		1140
as (mm2) bott.		1140				1900	
Main top	5	3	5		6	3	3
D22						D22	
bott	3	3	3		3	5	3
Qbmin=ψb3.Rbt.b.ho=	201.6	(kN)	201.6		201.6	(kN)	201.6
(kN)	D10-150		D10-150		D10-150		D10-150
judge	ok		ok		ok		ok

ψb3= 0.6 by Table.2 Snip 2.03.01-84

Girder Profile Design **M2 roof** Use rG4 for rG1w, 4-frame

Girder ID	rG3w B-frame			rG4w B-frame			rG4w B-frame		
Position	1 end	Mid	2 end	2 end	Mid	3 end	3 end	Mid	4 end
D.L] M(tm) top	179.05		309.28	286.14		269.41	268.91		298.81
+] bott.		180.48			146.68			140.59	
L.L] Q (t)	207.97		226.57	207.97		207.97	207.97		212.2
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3332			3332			3332	
a_m (top)=M/z	0.0537		0.0928	0.0859		0.0809	0.0807		0.0897
a_m(bott.)		0.0542			0.0440			0.0422	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bot.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	365.7	> M ok	531.6	531.6	> M ok	531.6	531.6	> M ok	531.6
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			278.5			278.5	
Pt (%) top	0.543		0.814	0.814		0.814	0.814		0.814
Pt (%) bott.		0.407			0.407			0.407	
as (mm2) top	1520		2280	2280		2280	2280		2280
as (mm2) bott.		1140			1140			1140	
Main top	4	3	6	6	3	6	6	3	6
Bars **D22**									
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6	(kN)	201.6	201.6	(kN)	201.6	201.6	(kN)	201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

pw= 0.00377

Girder Profile Design **2nd Floor**

Girder ID	2nd fl 2G1 2-frame 8m			2G2 2-frame 8m			2G1 2-frame 7m		
Position	B end	Mid	C end	C end	Mid	D end	D end	Mid	E end
D.L] M(tm) top	312.29		301.53	305.05		299.81	291.42		120.60
+] bott.		196.0			151.2			147.1	
L.L] Q (t)	190.68		201.65	190.68		190.68	191.49		167.09
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3332			3332			3332	
a_m (top)=M/z	0.0937		0.0905	0.0916		0.0900	0.0875		0.0362
a_m(bott.)		0.0588			0.0454			0.0441	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bot.Mus=Rsc.A's.(ho-a')=		270.465			270.465			270.465	
Top Mu=Rs.As(ho-0.5ξho)=	365.7	> M ok	610.3	610.3	> M ok	610.3	610.3	> M ok	278.5
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			278.5			278.5	
Pt (%) top	0.543		0.950	0.950		0.950	0.950		0.407
Pt (%) bott.		0.543			0.407			0.407	
as (mm2) top	1520		2660	2660		2660	2660		1140
as (mm2) bott.		1520			1140			1140	
Main top D22	4	3	7	7	3	7	7	3	3
bott	3	4	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D12-150		D12-150	D12-150		D12-150	D12-150		D12-150
judge	ok		ok			ok			

use 2G5 D-frame for 2G3 use (2G6 D-frame), for 2G4

Girder ID	2G3 E-frame			2nd fl 2G4 E-frame			2G5 D-frame		
Position	1 end	Mid	2 end	2 end	Mid	3 end	1 end	Mid	2 end
D.L] M(tm) top	211.0		434.43	359.8		360.22	210.99		434.43
+] bott.		347.28			309.78			347.07	
L.L] Q (t)	263.9		295.8	236		236	236		267.92
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3332			3332			3332	
a_m (top)=M/z	0.0633		0.1304	0.1080		0.1081	0.0633		0.1304
a_m(bott.)		0.1042			0.0930			0.1042	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.465		360.62	270.465		270.465	270.465		360.62
Bot.Mus=Rsc.A's.(ho-a')=		270.465			270.465			270.465	
Top Mu=Rs.As(ho-0.5ξho)=	365.7	> M ok	610.3	610.3	> M ok	531.6	365.7	> M ok	610.3
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			278.5			365.7	
Pt (%) top	0.543		0.950	0.950		0.814	0.543		0.950
Pt (%) bott.		0.543			0.407			0.543	
as (mm2) top	1520		2660	2660		2280	1520		2660
as (mm2) bott.		1520			1140			1520	
Main top D22	4	3	7	7	3	6	4	3	7
bott	3	4	4	3	3	3	3	4	4
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D12-150		D12-150	D12-150		D12-150	D12-150		D12-150
judge	ok		ok	ok		ok	ok		ok

Girder Profile Design

Girder ID	2G6 D-frame			2G7 D-frame			2G8 D-frame		
Position	2 end	Mid	3 end	4 end	Mid	5 end	6 end	Mid	7 end
D.L] M(tm) top	359.8		360.22	349.27		357.42	426.27		174.58
+] bott.		309.78			338.5			300.4	
L.L] Q (t)	236		236	217.2		216.23	247.69		216.23
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3332			3332			3332	
a_m (top)=M/z	0.1080		0.1081	0.1048		0.1073	0.1279		0.0524
a_m(bott.)		0.0930			0.1016			0.0902	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bott.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	610.3	> M ok	531.6	531.6	> M ok	531.6	610.3	> M ok	278.5
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			365.7			531.6	
Pt (%) top	0.950		0.814	0.814		0.814	0.950		0.407
Pt (%) bott.		0.543			0.543			0.814	
as (mm2) top	2660		2280	2280		2280	2660		1140
as (mm2) bott.		1520			1520			2280	
Main top	7	3	6	6	3	6	7	3	3
Bars **D22**									
bott	3	4	3	3	4	3	3	6	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
	D12-150		D12-150	D12-150		D12-150	D12-150		D12-150
judge	ok		ok	ok		ok	ok		ok
							4/(M/Q+1) :		1.4700576
									1

2nd Floor

Girder ID	2G9 5-frame			2G10 5-frame			2G10a 5Fram		
Position	end	Mid	end	out end	Mid	in end	D end	Mid	E end
D.L] M(tm) top	403.20		384.54	251.20		435.84	367.0		150.8
+] bott.		180.77			169.22			252.55	
L.L] Q (t)	268.00		265.77	265.77		288.85	255.2		228.2
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3332			3332			3332	
a_m (top)=M/z	0.1210		0.1154	0.0754		0.1308	0.1101		0.0453
a_m(bott.)		0.0543			0.0508			0.0758	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	360.6		360.6	270.5		360.6	360.6		270.5
Bott.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	610.3	> M dk	610.3	365.7	> M dk	610.3	610.3	> M dk	365.7
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			365.7			365.7	
Pt (%) top	0.950		0.950	0.543		0.950	0.950		0.543
Pt (%) bott.		0.543			0.543			0.543	
as (mm2) top	2660		2660	1520		2660	2660		1520
as (mm2) bott.		1520			1520			1520	
Main top	7	3	7	4	3	7	7	3	4
D22									
bott	4	4	4	3	4	4	4	4	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D12-150		D12-150	D12-150		D12-150	D12-150		D12-150
judge	ok		ok	ok		ok	ok		ok
	4/(M/Q.d+1) :		1.270	4/(M/Q.d+1) :		1.702	4/(M/Q.d+1) :		1.3096054
			1.304			1.2676107			2.0577747
							pw=		0.004233

5-1Girder Profile Design **1st FL**

Girder ID	1G1 2 Frame			1G1a 2Frame			1G2 2Frame		
Position	A end	Mid	B end	D end	Mid	E end	end	Mid	end
D.L] M(tm) top	143.22		364.96	238.97		192.83	304.17		274.52
+] bott.		170.2			208.39			134.95	
L.L] Q (t)	179.68		207.4	186.27		179.68	183.38		179.68
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3332			3332			3332	
a_m (top)=M/z	0.0430		0.1095	0.0717		0.0579	0.0913		0.0824
a_m(bott.)		0.0511			0.0625			0.0405	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		450.8	270.5		270.5	270.5		270.5
Bott.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5	> M ok	610.3	531.6	> M ok	531.6	610.3	> M ok	610.3
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			365.7			365.7	
top	0.407		0.950	0.814		0.814	0.950		0.950
Pt (%) bott.		0.543			0.543			0.543	
top	1140		2660	2280		2280	2660		2660
as (mm2) bott.		1520			1520			1520	
Main top	3	3	7	6	3	6	7	3	7
Bars **D19**									
bott	3	4	5	3	4	3	3	4	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
	D10-150	D10-150	D10-150	D10-150	D10-150	D10-150	D10-150	D10-150	D10-150
judge	ok		ok	ok		ok	ok		ok
				1.75214		2	1.504502		2

With wall

Girder ID	1G3		1G4	1G5 D-Frame			1G6 D-Frame		
Position	end	Mid	end	1 end	Mid	2 end	2 end	Mid	3 end
D.L] M(tm) top	192.78		192.78	186.84		407.42	362.18		354.25
+] bott.		130.31			307.32			246.24	
L.L] Q (t)	125.7		125.66	226.58		258.09	226.58		226.58
] b x D (cm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3332			3332			3332	
a_m (top)=M/z	0.0579		0.0579	0.0561		0.1223	0.1087		0.1063
a_m(bott.)		0.0391			0.0922			0.0739	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bott.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5	> M ok	278.5	365.7	> M ok	610.3	531.6	> M ok	531.6
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			450.1			365.7	
top	0.407		0.407	0.543		0.950	0.814		0.814
Pt (%) bott.		0.407			0.679			0.543	
top	1140		1140	1520		2660	2280		2280
as (mm2) bott.		1140			1900			1520	
Main top	3	3	3	4	3	7	6	3	6
Bars **D22**									
bott	3	3	3	3	5	3	3	4	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150	D10-150	D10-150	D12-150	D12-150	D12-150	D12-150	D12-150	D12-150
judge	ok		ok	ok		ok			ok
4/(m/Q.d+1)	1.253279		1.253279			1.2288265			1.2370412

Girder Profile Design

Girder ID	1G5w B-Frame			1G6w B-Frame			1G7 5-Frame		
Position	1 end	Mid	2 end	2 end	Mid	3 end	A end	Mid	B end
D.L] M(tm) top	231.80		430.15	413.0		413.0	116.66		343.70
+] bott.		449.65			351.07			245.57	
L.L] Q (t)	314.66		339.45	281.0		281.0	195.6	195.6	228.03
] b x D (cm)	**450**	**x**	**750**	**450**	**x**	**750**	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^n)		3748.5			3748.5			3748.5	
a_m (top)=M/z	0.0618		0.1148	0.1102		0.1102	0.0311		0.0917
a_m(bott.)		0.1200			0.0937			0.0655	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	360.6		450.8	450.8		450.8	270.5		270.5
Bott.Mus=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	368.2	> M ok	618.0	618.0	> M ok	618.0	278.5	> M ok	531.6
Bot Mu=Rs.As(ho-0.5ξho)=		537.3			537.3			450.1	
top	0.483		0.844	0.844		0.844	0.407		0.814
Pt (%) bott.		0.724			0.724			0.679	
top	1520		2660	2660		2660	1140		2280
as (mm2) bott.		2280			2280			1900	
Main top	4	3	7	7	3	7	3	3	6
D22		D25			D25				
bott	4	6	5	5	6	5	3	5	3
Qbmin=ψb3.Rbt.b.ho=	226.8	(kN)	226.8	226.8	(kN)	226.8	201.6	(kN)	201.6
Rws.Aws			58	58					
Qbmin.a	442.0	> Q ok	322.8	292.7	> Q ok	292.7	435.4	> Q ok	255.7
Stirrup	D12-100	D12-150	D12-100	D12-100	D12-150	D12-100	D10-150	D10-150	D10-150
a=4/(M/Q.d+1) max=2	1.949		1.423	1.290		1.290	2.160		1.269

Girder ID	1G8 5-Frame			1G9 B-frame			1G10 B-frame		
Position	B end	Mid	C end	5 end	Mid	6 end	6 end	Mid	7 end
D.L] M(tm) top	315.87		319.40	621.76		640.81	644.2		427.1
+] bott.		158.12			468.57			596.85	
L.L] Q (t)	195.60		195.60	357.60		357.60	384.7		357.6
] b x D (cm)	400	x	750	**450**	**x**	**800**	**450**	**x**	**800**
Size] ho (mm)	700	700	700	750	750	750	750	750	750
z= Rb.b.ho^2 (x 10^6)		3332			3332			3332	
a_m (top)=M/z	0.0948		0.0959	0.1866		0.1923	0.1933		0.1282
a_m(bott.)		0.0475			0.1406			0.1791	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.465		270.465	450.775		540.93	450.775		360.62
Bott.Mus=Rsc.A's.(ho-a')=		270.465			270.465			360.62	
Top Mu=Rs.As(ho-0.5ξho)=	531.6	> M ok	531.6	666.6	> M ok	834.4	666.6	> M ok	396.0
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			488.7			666.6	
top	0.814		0.814	0.788		1.013	0.788		0.450
Pt (%) bott.		0.543			0.563			0.788	
top	2280		2280	2660		3420	2660		1520
as (mm2) bott.		1520			1900			2660	
Main top	6	3	6	7	3	9	7	4	4
D22					D25			D25	
bott	3	4	3	5	5	6	5	7	4
Qbmin=ψb3.Rbt.b.ho=	201.6	(kN)	201.6	243	(kN)	243	243	(kN)	243
a= 4/(M/Q+1)	1.210		1.200	1.205		1.180	1.237		1.543
a.Qbmin=	243.8		242.0	292.9		286.8	300.7		374.9
D12 -150 : Rs.Asw	65.54		65.54	65.54	ok	65.54	65.54		65.54
total Qr capacity	309.4	> Q ok	307.5	358.5	> Q ok	352.3	366.2	> Q ok	440.5
Stirrup	D12-150	D12-150	D12-150	D12-100	D12-150	D12-100	D12-100	D12-150	D12-150

Girder ID	1G7 5-Frame		
Position	D end	Mid	E end
D.L] M(tm) top	373.81		143.38
+] bott.		217.16	
L.L] Q (t)	228.5	195.6	195.6
] b x D (cm)	400	x	750
Size] ho (mm)	700	700	700
z= Rb.b.ho^2 (x 10^6)		3332	
a_m (top)=M/z	0.1122		0.0430
a_m(bott.)		0.0652	
α_r = 0.395	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.465		270.465
Bott.Mus=Rsc.A's.(ho-a')=		360.62	
Top Mu=Rs.As(ho-0.5ξho)=	686.2	> M ok	365.7
Bot Mu=Rs.As(ho-0.5ξho)=		450.1	
top	1.086		0.543
Pt (%) bott.		0.679	
top	3040		1520
as (mm2) bott.		1900	
Main top	8	4	4
D22			
bott	3	5	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6
Stirrup	D12-150		D12-150
judge	ok		ok

Girder with 7.2 kN/m2 Machine **1 fl** **D22 As 380** **Rb(Mpa)= 17** **Rbt(Mpa)= 1.2** **D25 As 491** **Rs(Mpa)= 365** **Rsw(Mpa)= 290**

Girder ID	1G8m, 5-frame 8m			1G9w, C-frame 8m			1G9m, D-frame 8m		
Position	B end (kN.m)	Mid	C end	4 end(kN.m)	Mid	5 end	4 end(kN.m)	Mid	5 end
D.L] M top	493.712		493.712	789.43		789.43	699.268		699.268
+] M bott.		266.21			615.02			561.68	
L.L]									
Total] Q(kN)	222.0		222.0	478.0		478.0	402		402
] b.h (mm)	400	x	750	**500**	**x**	**800**	**500**	**x**	**800**
Size] ho(mm	700	700	700	750	750	750	750	750	750
z= Rb.b.ho^2 (x 10^6)		3332			4781.25			4781.25	
a_m (top)=M/z	0.1482		0.1482	0.1651		0.1651	0.1463		0.1463
a_m(bott.)		0.0799			0.1286			0.1175	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	360.62		360.62	465.959		465.959	582.4488		582.44875
Bott.Mus=Rsc.A's.(ho-a')=		360.62			465.959			349.4693	
Top Mu=Rs.As(ho-0.5ξho)=	610.3	> M ok	610.3	954.4	> M ok	954.4	848.3	> M ok	848.3
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			738.5			624.8	
top	0.950		0.950	1.047		1.047	0.917		0.917
Pt (%) bott.		0.543			0.786			0.655	
top	2660		2660	3928		3928	3437		3437
as (mm2) bott.		1520			2946			2455	
Main top	7	4	7	8	4	8	7	3	7
Bars **D22**		**D22**			**D25**			**D25**	
bott	4	4	4	4	6	4	5	5	5
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	270 (kN)		270	270 (kN)		270
a=4/(M/Q.d+1) max=2	1.241		1.241	1.249		1.249	1.205		1.460
a.Qbmin	250.1		250.1	337.3		337.3	325.4		394.2
D12 -150 : fs.Asw	65.54		65.54	151.96		151.96	65.54		65.54
	D12-150	D12-150	D12-150	▯ D14-100	▯ D12-150	▯ D14-100	D12-100	D12-150	D12-150
judge	ok		ok	ok		ok	ok		ok

3 - 2 Column Profile Design

	Column ID	2C1 C-frame-2				1C1			
	Direction	X		Y		X		Y	
	Posission	T	B	T	B	T	B	T	B
	N (kN)	603.57	603.57	603.57	603.56	1431.79	1431.79	1431.69	1431.79
LT	M(kN.m)	55.92	25.71	6.01	0	15.64	8.56	2.23	1.11
	Q(kN)		9.07		1.5		4.48		0.62
Size	h x h (mm)	600	600	600	600	600	600	600	600
	lo (mm) Col. Height	8250	8250	3250	3250	4650	4650	4650	4650
	eo=M/Nn (mm)	92.65	42.60	9.96	0.00	10.92	5.98	1.56	0.78
	δe=(M/N)/h	0.15	0.07	0.02	0.00	0.02	0.01	0.00	0.00
	δe,min=0.5-0.01lo/h-0.01Rb		**0.193**		**0.193**		**0.253**		**0.253**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		13.8		5.4		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	7851	7851	50593	50593	21391	21391	21391	21391
	η=1/(1−N/Ncr)	1.083	1.083	1.012	1.012	1.072	1.072	1.072	1.072
	Rb.Ab (kN)=		5899.012		5913.537		5901.366		5901.366
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)	3048				3048			
	Min.Gross As %	0.85				0.85			
	Main Bars	4 Y				4			
	arrangement	4  4 X - X D18 Y 4				4  4 X - X D18, As= 4			
	ψb3=0.6	(kN)			(kN)	(kN)			(kN)
	Qbmin=ψb3.Rbt.b.ho=	237.6			237.6	237.6			237.6
	judge	ok			ok	ok			ok
	Pw (%)	0.174				0.174			
	hoop	D10 - @150				D10 - @150			

	Column ID	B1C1			
	Direction	X		Y	
	Posission	T	B	T	B
	N (kN)	2485.49	2485.49	2485.49	2485.49
LT	M(kN.m)	21.61	85.1	8.49	26.1
	Q(kN)		15.2		4.94
Size	h x h (mm)	800	800	800	800
	lo (mm) Col. Height	6250	6250	6250	6250
	eo=M/Nn (mm)	8.69	34.24	3.42	10.50
	δe=(M/N)/h	0.01	0.04	0.00	0.01
	δe,min=0.5-0.01lo/h-0.01Rb		**0.252**		**0.252**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0
	lo/h=		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0
	Ncr=	37473	37473	37473	37473
	η=1/(1−N/Ncr)	1.071	1.071	1.071	1.071
	Rb.Ab (kN)=		10588.7		10588.7
			> N ok		> N ok
	Gross As (mm2)	4560			
	Min.Gross As %	0.71			
	Main Bars	4			
	arrangement	4  4 X - X D22 4 min 0.8% x80x80			
	ψb3=0.6	(kN)			(kN)
	Qbmin=ψb3.Rbt.b.ho=	432			432
	judge	ok			ok
	Pw (%)	0.189			
	hoop	D12 - @150			

Rb=	17	Mpa
Rbt=	1.2	Mpa
Rs=Rsc=	365	Mpa
D22, As=	380	mm2
D25, As=	491	mm2
D18, As=	254	mm2
Eb=	32,500	Mpa
D10, As=	78.5	mm2
D12, As=	113.1	mm2

$$Ncr=0.533Eb.A[0.11/(0.1+\delta e)+0.1] \quad \overline{\psi 1(lo/h)^2}$$

	Column ID	2C2 B-frame-4				1C2			
	Direction	X		Y		X		Y	
	Posission	T	B	T	B	T	B	T	B
	N (kN)		1113.94		1113.94		2559.63		2559.63
LT	M(kN.m)	55.29	4.78	68.75	6.74	16.56	50.6	16.99	8.23
	Q(t)		15.02		18.87		12.44		4.67
Size	h x h (mm)	600	600	600	600	600	600	600	600
	lo (mm) Col. Height	3250	3250	3250	3250	4650	4650	4650	4650
	eo=M/Nn (mm)	49.63	4.29	61.72	6.05	6.47	19.77	6.64	3.22
	δe=(M/N)/h	0.08	0.01	0.10	0.01	0.01	0.03	0.01	0.01
	δe,min=0.5-0.01lo/h-0.01Rb		**0.276**		**0.276**		**0.253**		**0.253**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		5.4		5.4		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	41731	41731	41731	41731	21391	21391	21391	21391
	η=1/(1−N/Ncr)	1.027	1.027	1.027	1.027	1.136	1.136	1.136	1.136
	Rb.Ab (kN)=		5910.4		5910.4		5888.3		5888.3
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)		3048				3048		
	Min.Gross As %		0.85				0.85		
	Main Bars		4	Y			4		
	arrangement	4		4	X - X	4		4	X - X
				Y					
		D18	4			D18	4		
	ψb3=0.6		(kN)		(kN)		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		237.6		237.6		237.6		237.6
	judge		ok		ok		ok		ok
	Pw (%)		0.174				0.174		
	hoop		D10 - @150		ok		D10 - @150		ok

	Column ID	B1C2			
	Direction	X		Y	
	Posission	T	B	T	B
	N (kN)		3735.3		3735.3
LT	M(kN.m)	15.25	35.1	20.79	133.7
	Q(kN)		7.19		20.13
Size	h x h (mm)	800	800	800	800
	lo (mm)	6250	6250	6250	6250
	eo=M/N (mm)	4.08	9.40		35.79
	δe=(M/N)/h	0.01	0.01		
	δe,min=0.5-0.01lo/h-0.01Rb		**0.252**		**0.252**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0
	lo/h=	7.8	7.8	7.8	7.8
β=1	ψl=1+βM1i/M=	2.0	2.0	2.0	2.0
	Ncr=	37473	37473	37473	37473
	η=1/(1−N/Ncr)	1.111	1.111	1.111	1.111
	Rb.Ab (kN)=	10577.9	10577.9	10577.9	10577.9
			> N ok		> N ok
	Gross As (mm2)		4560		
	Gross As %		0.71		
	Main Bars		4		
	arrangement	4		4	X - X
		D22			
			4	min 0.8% x80x80	
	ψb3=0.6		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		432		432
	judge		ok		ok
	Pw (%)		0.1885		
	hoop		D12 - @150		ok

Rb= 17 Mpa
Rbt= 1.2 Mpa
Rs=Rsc= 365 Mpa
D18, As= 254 mm2
D22, As= 380 mm2
D25, As= 491 mm2
Eb= 32,500 Mpa

$$Ncr=0.533Eb.A[0.11/(0.1+\delta e)+0.1]\overline{\psi 1(lo/h)^2}$$

	Column ID	2C3 B-frame 5				1C3			
	Direction	X		Y		X		Y	
	Posission	T	B	T	B	T	B	T	B
	N (t)		347.72		347.72		1115.67		1115.67
LT	M(tm)	125.9	47.56	12.4	18.44	11.61	7.13	14.2	7.9
	Q(t)		43.4		7.71		3.47		4.09
Size	h x h (mm)	600	600	600	600	600	600	600	600
	lo (mm) Col. Height	3250	3250	3250	3250	4650	4650	4650	4650
	eo=M/Nn (mm)	362.07	136.78	35.66	53.03	10.41	6.39	12.73	7.08
	δe=(M/N)/h	0.60	0.23	0.06	0.09	0.02	0.01	0.02	0.01
	δe,min=0.5-0.01lo/h-0.01Rb		**0.276**		**0.276**		**0.253**		**0.253**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		5.4		5.4		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	27245	41731	41731	41731	21391	21391	21391	21391
	η=1/(1−N/Ncr)	1.013	1.008	1.008	1.008	1.055	1.055	1.055	1.055
	Rb.Ab (kN)=	5913.4	5914.3		5914.3		5904.8		5904.8
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)		3048				3048		
	Gross As %		0.85				0.85		
	Main Bars		4	Y			4		
	D22	4		4	X - X	4		4	X - X
	arrangement			Y					
		D18	4			D18	4		
	ψb3=0.6		(kN)		(kN)		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		237.6		237.6		237.6		237.6
	judge		ok		ok		ok		ok
	Pw (%)		0.174				0.174		
	hoop		D10 - 150		ok		D10 - 150		ok

	Column ID	B1C3			
	Direction	X		Y	
	Posission	T	B	T	B
	N (t)		2472.35		2472.35
LT	M(tm)	5.69	11.6	19.93	133.7
	Q(t)		2.47		21.95
Size	h x h (mm)	800	800	800	800
	lo (mm) Col. Height	6250	6250	6250	6250
	eo=M/Nn (mm)	2.30	4.69	8.06	54.08
	δe=(M/N)/h	0.00	0.01	0.01	0.07
	δe,min=0.5-0.01lo/h-0.01Rb		**0.252**		**0.252**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0
	lo/h=		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0
	Ncr=	37473	37473	37473	37473
	η=1/(1−N/Ncr)	1.071	1.071	1.071	1.071
	Rb.Ab (kN)=		10588.8		10588.8
			> N ok		> N ok
	Gross As (mm2)		4560		
	Gross As %		0.71		
	Main Bars		4		
		4		4	X - X
	arrangement				
		D22	4	min 0.8% x80x80	
	ψb3=0.6		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		432		432
	judge		ok		ok
	Pw (%)		0.189		
	hoop		D12 - 150		ok

Rb= 17 Mpa
Rbt= 1.2 Mpa
Rs=Rsc= 365 Mpa
D18, As= 254 mm2
D22, As= 380 mm2
D25, As= 491 mm2
Eb= 32,500 Mpa

$$Ncr=0.533\frac{Eb.A[0.11/(0.1+\delta e)+0.1]}{\psi 1(lo/h)^2}$$

	Column ID	1C4 B-frame 6				B1C4			
	Direction	X		Y		X		Y	
	Posission	T	B	T	B	T	B	T	B
	N (t)		601.72		601.72		3193.52		3193.52
LT	M(tm)	26.26	19.06	14.2	7.9	15.21	50.9	19.93	133.7
	Q(t)		8.39		4.09		9.44		21.95
Size	h x h (mm)	600	600	600	600	800	800	800	800
	lo (mm) Col. Height	4650	4650	4650	4650	4450	4450	4450	4450
	eo=M/Nn (mm)	43.64	31.68	23.60	13.13	4.76	15.94	6.24	41.87
	δe=(M/N)/h	0.07	0.05	0.04	0.02	0.01	0.02	0.01	0.05
	δe,min=0.5-0.01lo/h-0.01Rb		**0.253**		**0.253**		**0.274**		**0.274**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		7.8		7.8		5.6		5.6
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	21391	21391	21391	21391	70554	70554	70554	70554
	η=1/(1−N/Ncr)	1.029	1.029	1.029	1.029	1.047	1.047	1.047	1.047
	Rb.Ab (kN)=		5910.1		5910.1		10595.1		10595.1
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)		3048				4560		
	Min.Gross As %		0.85				0.71		
	Main Bars		4				4		
	D22	4		4	X - X	4		4	X - X
	arrangement								
		D18	4			D22	4		
	ψb3=0.6		(kN)		(kN)		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		237.6		237.6		432		432
	judge		ok		ok		ok		ok
	Pw (%)		0.174				0.189		
	hoop		D10 - 150		ok		D12 - 150		ok

	Column ID	1C5 B-frame 7				B1C5			
	Direction	X		Y		X		Y	
	Posission	T	B	T	B	T	B	T	B
	N (t)		359.6		359.6		2001.35		2001.35
LT	M(tm)	174.58	244.08	14.2	7.9	86.79	619.6	19.93	133.7
	Q(t)		77.53		4.09		318.376	with wall→	21.95
Size	h x h (mm)	600	600	600	600	800	800	800	800
	lo (mm) Col. Height	4650	4650	4650	4650	6250	6250	6250	6250
	eo=M/N (mm)	485.48	678.75	39.49	21.97	43.37	309.59	9.96	66.80
	δe=(M/N)/h	0.81	1.13	0.07	0.04	0.05	0.39	0.01	0.08
	δe,min=0.5-0.01lo/h-0.01Rb		**0.253**		**0.253**		**0.252**		**0.252**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		7.8		7.8		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	9829	9829	21391	21391	37473	29596	37473	37473
	η=1/(1−N/Ncr)	1.038	1.038	1.017	1.017	1.056	1.073	1.056	1.056
	Rb.Ab (kN)=		5908.3		5912.5		10588.3		10592.7
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)		3048				5320		
	Min.Gross As %		0.85				0.83		
	Main Bars		4				4	(B1C1) on Drwg.	
	D22	4		4	X - X	7	7		X - X
	arrangement					bott.			
		D18	4			D22	4	:op 12 D22	
	ψb3=0.6		(kN)		(kN)		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		237.6		237.6		432		432
	judge		ok		ok		ok		ok
	Pw (%)		0.174				0.189		
	hoop		D10 - 150		ok		D12 - 100		ok

	Column ID	1C6 C-frame 6				B1C6			
	Direction	X		Y		X		Y	
	Posission	T	B	T	B	T	B	T	B
LT	N (t)		601.72		601.72		2105.72		2105.72
	M(tm)	26.26	14.17	5.64	6.98	35.75	133.7	17.62	20.2
	Q(t)		7.49		2.33		24.21		5.4
Size	h x h (mm)	600	600	600	600	800	800	800	800
	lo (mm) Col. Height	4650	4650	4650	4650	6250	6250	6250	6250
eo=M/Nn (mm)		43.64	23.55	9.37	11.60	16.98	63.49	8.37	9.59
δe=(M/N)/h		0.07	0.04	0.02	0.02	0.02	0.08	0.01	0.01
δe,min=0.5-0.01lo/h-0.01Rb			**0.253**		**0.253**		**0.252**		**0.252**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		7.8		7.8		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	38250	21391	21391	21391	37473	37473	37473	37473
	η=1/(1−N/Ncr)	1.016	1.029	1.029	1.029	1.060	1.060	1.060	1.060
	Rb.Ab (kN)=		5910.1		5910.1		10591.8		10591.8
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)		3048				4560		
	Min.Gross As %		0.85				0.71		
	Main Bars		4				4		
		4		4	X - X	4		4	X - X
	arrangement								
		D18	4			D22	4		
	ψb3=0.6		(kN)		(kN)		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			237.6		237.6		432		432
	judge		ok		ok		ok		ok
	Pw (%)		0.174				0.189		
	hoop		D10 - 150		ok		D12 - 150		ok

	Column ID	B1C6			
	Direction	X		Y	
	Posission	T	B	T	B
LT	N (t)		2105.72		2105.72
	M(tm)	35.75	133.7	17.62	20.2
	Q(t)		24.21		5.4
Size	h x h (mm)	800	800	800	800
	lo (mm) Col. Height	6250	6250	6250	6250
eo=M/Nn (mm)		16.98	63.49	8.37	9.59
δe=(M/N)/h		0.02	0.08	0.01	0.01
δe,min=0.5-0.01lo/h-0.01Rb			**0.252**		**0.252**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0
	lo/h=		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0
	Ncr=	37473	37473	37473	37473
	η=1/(1−N/Ncr)	1.060	1.060	1.060	1.060
	Rb.Ab (kN)=		10591.8		10591.8
			> N ok		> N ok
	Gross As (mm2)		4560		
	Min.Gross As %		0.71		
	Main Bars		4		
		4		4	X - X
	arrangement				
		D22	4		
	ψb3=0.6		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			432		432
	judge		ok		ok
	Pw (%)		0.189		
	hoop		D12 - 150		ok

Reference

Acording J apan code

N < N1= 0.4bD.Fc= 6912 kN

Mu=0.8at.σy.D + 0.5N.D [1-N/(b.D.Fc)]

. = 1080.13 kN.m

No's Bar= 4 .-D22

N= 2105.72 kN

Rb= 17 Mpa

Rbt= 1.2 Mpa

Rs=Rsc= 365 Mpa

D22, As= 380 mm2

D25, As= 491 mm2

Eb= 32,500 Mpa

B.12-29

Column ID		2C7 E-frame 2				1C7			
Direction		X		Y		X		Y	
Posission		T	B	T	B	T	B	T	B
	N (t)		298.21		298.21		1310.19		1310.19
LT	M(tm)	55.92	25.71	41.84	47.2	15.64	8.56	73.4	17.48
	Q(t)		20.41		22.26		6.05		22.72
Size	h x h (mm)	600	600	600	600	600	600	600	600
	lo (mm) Col. Height	3250	3250	3250	3250	4650	4650	4650	4650
eo=M/Nn (mm)		187.52	86.21	140.30	158.28	11.94	6.53	56.02	13.34
δe=(M/N)/h		0.31	0.14	0.23	0.26	0.02	0.01	0.09	0.02
δe,min=0.5-0.01lo/h-0.01Rb			**0.276**		**0.276**		**0.253**		**0.253**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		5.4		5.4		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	38964	41731	41731	41731	21391	21391	21391	21391
	η=1/(1−N/Ncr)	1.008	1.007	1.007	1.007	1.065	1.065	1.065	1.065
	Rb.Ab (kN)=	5914.4	5914.5		5914.5		5902.7		5902.7
			> N ok		> N ok		> N ok		> N ok
Gross As (mm2)			3048				3048		
Min.Gross As %			0.85				0.85		
Main Bars			4	Y			4		
D22		4		4	X - X	4		4	X - X
arrangement				Y					
		D19	4			D19	4		
ψb3=0.6			(kN)		(kN)		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			237.6		237.6		237.6		237.6
judge			ok		ok		ok		ok
Pw (%)			0.174				0.174		
hoop			D10 - 150		ok		D10 - 150		ok

Column ID		B1C7			
Direction		X		Y	
Posission		T	B	T	B
	N (t)		2904.46		2904.46
LT	M(tm)	21.61	85.1	175.35	508.9
	Q(t)		15.24		97.75
Size	h x h (mm)	800	800	800	800
	lo (mm) Col. Height	6250	6250	6250	6250
eo=M/Nn (mm)		7.44	29.30	60.37	175.21
δe=(M/N)/h		0.01	0.04	0.08	0.22
δe,min=0.5-0.01lo/h-0.01Rb			**0.252**		**0.252**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0
	lo/h=		7.8		7.8
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0
	Ncr=	37473	37473	37473	37473
	η=1/(1−N/Ncr)	1.084	1.084	1.084	1.084
	Rb.Ab (kN)=		10585.1		# # # # # # # #
			> N ok		> N ok
Gross As (mm2)			4560		
Min.Gross As %			0.71		
Main Bars			4		
D22		4		4	X - X
arrangement					
		D25	4		
ψb3=0.6			(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			432		432
judge			ok		ok
Pw (%)			0.189		
hoop			D12 - 150		ok

Rb= 17 Mpa
Rbt= 1.2 Mpa
Rs=Rsc= 365 Mpa
D22, As= 380 mm2
D25, As= 491 mm2

Eb= 32,500 Mpa

$$Ncr=0.533\frac{Eb.A[0.11/(0.1+\delta e)+0.1]}{\psi 1(lo/h)^2}$$

4. Sub-Beam and Slab

4-1. Sub-Beam Co,Mo,Q

1

	Load form	△	(slab load)	⏢	(slab load)	P	(gider load P=35kN	Σ
Top roof								
		w	Co	w	Co	w/1	Co	
rB1	Co	0.00	0.00	17.00	111.18	5.63	33.50	144.68
rB2			Mo	w	Mo	w/1	Mo	
bxD 30x7	Mo	0.00	0.00	26.00	170.04	5.63	52.00	222.04
7x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	11.00	71.94	5.63	26.00	97.94

Slab load 6.54 (kN/m2) l 8

L = 7 (m) lx=3.5m λ=2.29

	Load form	△	(slab load)	⏢	(slab load)		(gider load P=35kN	Σ
Top roof								
		w	Co	w	Co	w/1	Co	
rB3	Co	0.00	0.00	13.00	85.02	5.63	26.03	111.05
			Mo	w	Mo	w/1	Mo	
bxD 30x7	Mo	0.00	0.00	20.00	130.80	5.63	40.58	171.38
7x7m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	9.00	58.86	5.63	23.19	82.05

Slab load 6.54 (kN/m2) ly= 7

L = 7 (m) lx=3.5m λ=2

rB4 1

Singl span 0.6C= 83.508

Mo-0.35C= 163.327

Office roof 2FL+4m	Load form	△	(slab load)	⏢	(slab load)		(gider load	Σ
		w	Co	w	Co	w/1	Co	
rB4	Co	0.00	0.00	17.00	111.18	5.25	28.00	139.18
			Mo	w	Mo	w/1	Mo	
bxD 30x7	Mo	0.00	0.00	26.00	170.04	5.25	42.00	212.04
7x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	11.00	71.94	5.25	21.00	92.94

Slab load 6.54 (kN/m2) ly= 8

lx=3.5m λ=2.29

Office roof 2FL+4m 4' frame	Load form	△	(slab load)	⏢	(slab load)		(gider load	Σ
		w	Co	w	Co	w/1	Co	
rB5	Co	0.00	0.00	19.20	125.57	5.25	28.00	153.57
			Mo	w	Mo	w/1	Mo	
bxD 30x7	Mo	0.00	0.00	30.00	196.20	5.25	42.00	238.20
8x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	12.00	78.48	5.25	21.00	99.48

Slab load 6.54 (kN/m2) ly= 8

lx=4m λ=2.0

7mx8m	Load form	△	(slab load)	⏢	(slab load)		(gider load	Σ
		w	Co	Co/w	Co	w/1	Co	
2B1	Co	0.00	0.00	17.00	141.78	0.53	4.58	146.36
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x70	Mo	0.00	0.00	26.00	216.84	0.53	6.20	223.04
office		w	Q	Q/w	Q	w/1	Q	
room	Q	0.00	0.00	11.00	91.74	0.53	3.10	94.84

Slab load 8.34 (kN/m2) ly= 8

0 ly = 8 (m) lx=3.5m λ=2.29

0.715

7mx8m	Load form	(slab load)		(slab load)		(gider load Brick wall		S
		w	Co	Co/w	Co	w/1	Co	
2B1	Co	0.00	0.00	9.00	89.37	5.25	15.75	105.12
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x70	Mo	0.00	0.00	14.00	139.02	5.25	23.63	162.65
storage		w	Q	Q/w	Q	w/1	Q	
6m	Q	0.00	0.00	7.40	73.48	5.25	16.75	90.23
				Slab load	9.93	(kN/m2) ly=	6	
			0 ly =		6	(m)	lx=3.5m	l=1.71

P-26

PS,DS	Load form	(slab load)		(slab load)		(gider load w=4*0.2		S
		w	Co	Co/w	Co	w/1	Co	
2B1	Co	13.80	137.03	0.00	0.00	14.27	76.08	213.11
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x70	Mo	20.80	206.54	0.00	0.00	14.27	114.12	320.66
		w	Q	Q/w	Q	w/1	Q	
	Q	8.30	82.42	0.00	0.00	14.27	57.06	139.48
	use Storage			Slab load	9.93	(kN/m2) ly=	ly=5.5m	
				Span	8	(m)	lx=2.667m	l=2.06

2' Frame	Load form	(slab load)		(slab load)		P (gider load P=35 kN		S
		w	Co	Co/w	Co	w/1	Co	
2B2	Co	0.00	0.00	17.00	168.81	5.63	65.00	233.81
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	26.00	258.18	5.63	115.00	373.18
		w	Q	Q/w	Q	w/1	Q	
	Q	0.00	0.00	11.00	109.23	5.63	40.00	149.23
				Slab load	9.93	(kN/m2) ly=	8	
				L=	7	(m)	lx=3.5m	l=2.29

4' Frame								
D-E			Co	Co/w	Co	w/1	Co	
2B5a	Co (.tm)	0.00	0.00	8.50	84.41	0.00	0.00	84.41
		w	Mo	Mo/w	Mo	w/1	Mo	
	Mo (.tm)	0.00	0.00	13.50	134.06	0.00	0.00	134.06
bxD 30x75		w	Q	Q/w	Q	w/1	Q	
8m x 7m	Q (t)	0.00	0.00	5.70	56.60	0.00	0.00	56.60
use values at 4-5,C-D	with rc wal			Slab load	9.93	(kN/m2) ly=	7	
							lx=5m	l=1.4

2' Frame D-E	Load form	(slab load)		(slab load)		P (gider load P=35 kN		S
		w	Co	Co/w	Co	w/1	Co	
2B3	Co	0.00	0.00	13.00	144.69	5.63	53.59	198.28
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	20.00	222.60	5.63	95.70	318.30
		w	Q	Q/w	Q	w/1	Q	
7m x7m	Q	0.00	0.00	9.20	102.40	5.63	37.19	139.58
				Slab load	11.13	(kN/m2) ly=	7	
				L=	7	(m)	lx=3.5m	l=2.0

4' Frame C-D	Load form	(slab load)		(slab load)		(gider load		S
		w	Co	Co/w	Co	w/1	Co	
2B5	Co	0.00	0.00	19.20	190.66	5.63	30.00	220.66
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	29.00	287.97	5.63	45.00	332.97
		w	Q	Q/w	Q	w/1	Q	
8m x8m	Q	0.00	0.00	12.00	119.16	5.63	22.50	141.66
				Slab load	9.93	(kN/m2) ly=	8	
				L=	8	(m)	lx=4m	l=2.0

Sub-beam Co,Mo,Q

1' Frame	Load form	(slab load)		(slab load)		(gider load		S
A--B		w	Co	Co/w	Co	w/1	Co	
2B5	Co	9.20	91.36	0.00	0.00	6.62	27.02	118.38
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x75	Mo	16.00	158.88	0.00	0.00	6.62	40.54	199.42
		w	Q	Q/w	Q	w/1	Q	
	Q	6.20	61.57	0.00	0.00	6.62	23.16	84.73
				Slab load	9.93	(kN/m2) ly:	5	
				ly=	7	(m)	lx=3.5m	l=1.43

B-C, 1-3	Load form	(slab load)		(slab load)		P	(gider load P=35 kN	S
		w	Co	Co/w	Co	w/1	Co	
2B4	Co	0.00	0.00	0.00	0.00	5.63	21.05	21.05
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	0.00	0.00	5.63	39.24	39.24
		w	Q	Q/w	Q	w/1	Q	
	Q	0.00	0.00	0.00	0.00	5.63	10.34	10.34
				Slab load	11.13	(kN/m2) ly:		
				Span	3.5	(m)	lx=3.5m	l=2.29

roof 1Fl+5.2	Load form	(slab load)		(slab load)		(gider load		S
		w	Co	w	Co	w/1	Co	
2B6	Co	0.00	0.00	19.00	188.67	5.63	30.00	218.67
2B7			Mo	w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	29.00	287.97	5.63	45.00	332.97
8x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	12.00	119.16	5.63	22.50	141.66
				Slab load	9.93	(kN/m2) ly:	8	
				L =	8	(m)	lx=4m	l=2

roof 1Fl+5.2	Load form	(slab load)		(slab load)		(gider load		S
		w	Co	w	Co	w/1	Co	
2B8	Co	0.00	0.00	15.00	148.95	5.63	30.00	178.95
			Mo	w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	24.00	238.32	5.63	45.00	283.32
8x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	11.00	109.23	5.63	22.50	131.73
				Slab load	9.93	(kN/m2) ly:	8	
				L =	8	(m)	lx=3m	l=2.67

1FL Sub-beam

monitor 3-4,A-B	Load form	(slab load)		(slab load)		P	(girder loa Floor	S
		w	Co	w	Co	w/1	Co	
1B1	Co	0.00	0.00	17.00	189.21	5.63	30.00	219.21
		w	Mo	w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	26.00	289.38	5.63	45.00	334.38
7x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	11.00	122.43	5.63	22.50	144.93
				Slab load	11.13	(kN/m2) ly:	ly=8m	
				L=	8	(m)	lx=3.5m	l=2.29

Machine room	Load form	(slab load)		(slab load)		(gider load		S
		w	Co	Co/w	Co	w/1	Co	
1B2	Co	0.00	0.00	17.00	189.21	5.63	30.00	219.21
			Mo	Mo/w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	26.00	289.38	5.63	45.00	334.38
7x8m		w	Q	Q/w	Q	w/1	Q	
	Q	0.00	0.00	11.00	122.43	5.63	22.50	144.93
				Slab load	11.13	(kN/m2) ly:	ly=8m	
				ly=	8	(m)	lx=3.5m	l=2.29

Machine room	Load form	(slab load)		(slab load)		(gider load		S
		w	Co	w	Co	w/1	Co	
1B3	Co	0.00	0.00	13.00	144.69	5.63	30.00	174.69
			Mo	w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	20.00	222.60	5.63	45.00	267.60
7x7m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	9.20	102.40	5.63	22.50	124.90

Slab load 11.13 (kN/m2) ly= 7 m
ly= 7 (m) lx=3.5m l=2.0

Machine room	Load form	(slab load)		(slab load)		P	(gider load + P 2kN	S
		w	Co	w	Co	w/1	Co	
1B4	Co	0.00	0.00	0.00	0.00	27.63	36.95	36.95
			Mo	w	Mo	w/1	Mo	
bxD 30x75	Mo	0.00	0.00	0.00	0.00	27.63	59.80	59.80
3.5		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	0.00	0.00	27.63	106.69	106.69

Slab load 11.13 (kN/m2) ly= 3.5 m
ly= 3.5 (m) lx=3.5m l=2.0

Valcony	Load form	(slab load)		(slab load)		P	(gider load .+ wall	S
1-2,A-B		w	Co	w	Co	w/1	Co	
1B5	Co	10.10	100.29	4.00	39.72	6.38	26.03	166.04
		w	Mo	w	Mo	w/1	Mo	
bxD 30x75	Mo	18.20	180.73	6.00	59.58	6.38	39.05	279.35
7x8m		w	Q	w	Q	w/1	Q	
	Q	6.80	67.52	3.00	29.79	6.38	25.81	123.13

Slab load 9.93 (kN/m2) ly= 6 m
L= 7 (m) lx=3.5m λ=1.71

Electric room	Load form	(slab load)		(slab load)		(gider load		S
1Fl -300		w	Co	w	Co	w/1	Co	
1B6	Co	0.00	0.00	19.00	315.97	5.63	30.00	345.97
1B7			Mo	w	Mo	w/1	Mo	
bxD 40x75	Mo	0.00	0.00	30.00	498.90	5.63	45.00	543.90
8x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	12.00	199.56	5.63	22.50	222.06

Slab load 16.63 (kN/m2) ly=
ly= 8 (m) lx=4m l=2.0

Machine RM	Load form	(slab load)		(slab load)		P	(gider load P 40 kN	S
1Fl -300		w	Co	w	Co	w/1	Co	
1B8	Co	0.00	0.00	14.00	232.82	5.63	70.00	302.82
			Mo	w	Mo	w/1	Mo	
bxD 40x75	Mo	0.00	0.00	22.00	365.86	5.63	125.00	490.86
8x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	10.00	166.30	5.63	42.50	208.80

Slab load 16.63 (kN/m2) ly= 7 m
ly= 8 (m) lx=4m l=2.0

1B8 single span 181.69
0.6C(kN.m)=

384.87 Q=208.8

.+0.72machine Mo-0.35C(kN.m)=

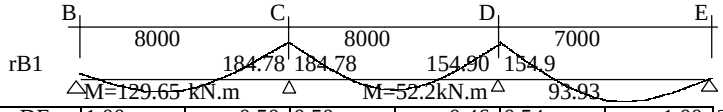
Electric room	Load form	(slab load)		(slab load)		(gider load		S
1Fl -300		w	Co	w	Co	w/1	Co	
	Co	0.00	0.00	19.00	388.93	5.63	30.00	418.93
1B7m			Mo	w	Mo	w/1	Mo	
bxD 40x75	Mo	0.00	0.00	30.00	614.10	5.63	45.00	659.10
8x8m		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	12.00	245.64	5.63	22.50	268.14

Slab load 20.47 (kN/m2) ly=
ly= 8 (m) lx=4m l=2.0

Sub-beam Bending moment

Top Roof

2' Frame rB1 rB2 rB3

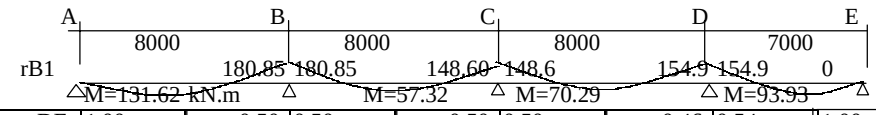


DF	1.00	0.50	0.50	0.46	0.54	1.00	20.87-
FEM	-144.68	144.68	-144.68	144.68	-111.05	111.05	
D1	144.68	0.00	0.00	-15.69	-17.94	-111.05	
C1	0.00	72.34	-7.85	0.00	-55.53	-0.92	
D2	0.00	-32.24	-32.25	25.91	29.62	0.92	
total	0.00	184.78	-184.78	154.90	-154.90	0	

Roof

4' Frame (Use 2' Frame sub-beams for 4' frame)

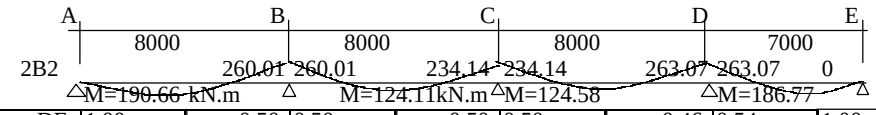
2Fl+4m rB1 rB2 rB2 rB3



DF	1.00	0.50	0.50	0.50	0.50	0.46	0.54	1.00
FEM	-144.68	144.68	-144.68	144.68	-144.68	144.68	-111.05	111.05
D1	144.68	0.00	0.00	0.00	0.00	-15.69	-17.94	-111.05
C1	0.00	72.34	0.00	0.00	-7.85	0	-55.53	-8.97
D2	0.00	-36.17	-36.17	3.92	3.93	25.91	29.62	8.97
total	0.00	180.85	-180.85	148.60	-148.60	154.90	-154.90	0.00

2 nd Floor

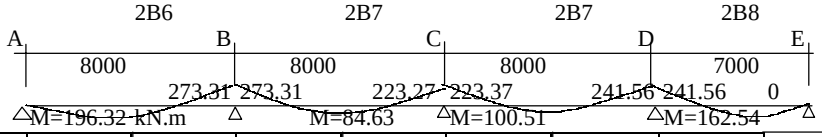
2' Frame 2B1 2B2 2B2 2B3



DF	1.00	0.50	0.50	0.50	0.50	0.46	0.54	1.00
FEM	-213.10	213.10	-233.81	233.81	-233.81	233.81	-198.28	198.28
D1	213.10	10.35	10.36	0.00	0.00	-16.34	-19.19	-198.28
C1	5.20	73.13	0.00	0.00	-0.65	0	-99.14	-9.595
D2	-5.20	-36.57	-36.56	0.33	0.32	45.6	53.54	9.595
total	0.00	260.01	-260.01	234.14	-234.14	263.07	-263.07	0.00

2 nd Floor (Low roof 1Fl+5.2m)

4' Frame



DF	1.00	0.50	0.50	0.50	0.50	0.46	0.54	1.00
FEM	-218.67	218.67	-218.67	218.67	-218.67	218.67	-178.95	178.95
D1	218.57	0.00	0.00	0.00	0.00	-18.27	-21.45	-178.95
C1	0.00	109.29	0.00	0.00	-9.40	0	-89.475	-10.725
D2	0.00	-54.65	-54.64	4.70	4.70	41.16	48.32	10.725
total	0.00	273.31	-273.31	223.37	-223.37	241.56	-241.56	0.00

B5

C 8000 D

2nd Floor kN.m

4' Frame 132.396 132.40 Co

M= 255.14 220.66 kN.m

4-5, C-D Q

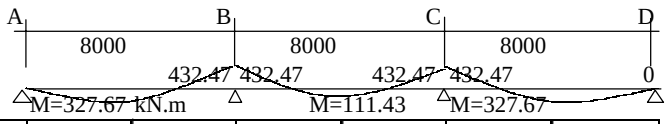
141.66 kN

Mo

332.37 kN.m

1st Floor

5' Frame Electric room



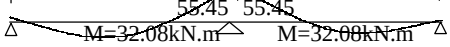
DF	1.00	0.50	0.50	0.50	0.50	1.00
FEM	-345.97	345.97	-345.97	345.97	-345.97	345.97
D1	345.97	0.00	0.00	0.00	0.00	-345.97
C1	0.00	173.00	0.00	0.00	-173.00	0.00
D2	0.00	-86.50	-86.50	86.50	86.50	0.00
total	0.00	432.47	-432.47	432.47	-432.47	0.00

1st Floor 1B4 1B4

B C D

1st Floor 8000 8000

1' Frame



	1.00	0.50	0.50	1.00
FEM	-36.95	36.95	-36.95	36.95
	36.95	0.00	0.00	-36.95
	0.00	18.50	-18.50	0
	0.00	0.00	0.00	0
	0.00	55.45	-55.45	0

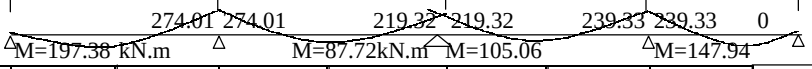
1st Floor

2' Frame

1B1 1B2 1B2 1B3

A B C D E

8000 8000 8000 7000



DF	1.00	0.50	0.50	0.50	0.50	0.46	0.54	1.00
FEM	-219.21	219.21	-219.21	219.21	-219.21	219.21	-174.69	176.49
D1	219.21	0.00	0.00	0.00	0.00	-20.48	-24.04	-176.49
C1	0.00	109.61	0.00	0.22	0.00	0	-88.25	-0.23
D2	0.00	-54.81	-54.80	-0.11	-0.11	40.6	47.65	0.23
total	0.00	274.01	-274.01	219.32	-219.32	239.33	-239.33	0.00

monitor room

1 B5

A 8000 B

1st Floor kN.m

1' Frame 99.624 99.62 Co

M= 221.24 166.04 kN.m

Q

123.13 kN

4. 2 Sub-Beam Profile

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D22 As 380 mm2

2' Frame (Between 2 and 3 Frame)

hoist 3t hoist 3t

Girder ID	**rB3**	**rB1**	2' Frame	**rB2**	2' Frame	**rB4**		
Position	Out end	Mid	In end	C end	Mid	D end	A end	Mid	B end
D.L] M(tm) top	0		180.85	180.85		148.6	83.51		83.51
+] bott.		131.62			70.26			163.33	
L.L] Q (t)	97.94		120.55	101.97		97.94	92.94		92.94
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^b)		3332			3332			3332	
α_m (top)=M/z	0.0000		0.0543	0.0543		0.0446	0.0251		0.0251
α_m(bott.)		0.0395			0.0211			0.0490	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bott.MuS=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5	> M ok	365.7	365.7	> M ok	365.7	278.5	> M ok	278.5
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			278.5			278.5	
top	0.407		0.543	0.543		0.543	0.407		0.407
Pt (%) bott.		0.407			0.407			0.407	
top	1140		1520	1520		1520	1140		1140
as (mm2) bott.		1140			1140			1140	
Main top	3	3	4	4	3	4	3	3	3
Bars		D22			D22			D22	
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

no use rB5
use 2' Frame subbeam

2' Frame

Girder ID	use 2B6 as **rB5**		4' Frame	**2B1**			**2B2**		
Position	A end	Mid	B end	A end	Mid	B end	B end	Mid	C end
D.L] M(tm) top	0		192.82	0		260.01	260.01		234.14
+] bott.		138.25			190.66			124.58	
L.L] Q (t)	100.98		125.08	139.48		171.98	149.23		152.46
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^b)		3332			3332			3332	
α_m (top)=M/z	0.0000		0.0579	0.0000		0.0780	0.0780		0.0703
α_m(bott.)		0.0415			0.0572			0.0374	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bott.MuS=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5		365.7	278.5	> M ok	365.7	450.1	> M ok	450.1
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			365.7			278.5	
top	0.407		0.543	0.407		0.543	0.679		0.679
Pt (%) bott.		0.407			0.543			0.407	
top	1140		1520	1140		1520	1900		1900
as (mm2) bott.		1140			1520			1140	
Main top	3	3	4	3	3	4	5	3	5
Bars		D22			D22			D22	
bott	3	3	3	3	4	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

Rs=Rsc= 365 Mpa Mus made by comp. Steel
Rb= 17 Mpa
Rbt= 1.2 Mpa Mu made by comp. Conc.
D22 As 380 mm2

2' Frame

Girder ID	2B3			2B4			2B5		
Position	C end	Mid	D end	end	Mid	end	end	Mid	end
D.L] M(tm) top	263.07		0	21.55		21.55	132.4		132.4
+] bott.		186.77			39.24			255.14	
L.L] Q (t)	177.16		139.58	10.34		10.34	141.66		141.66
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^{2} (x 10^{b})		3332			3332			3332	
α_m (top)=M/z	0.0790		0.0000	0.0065		0.0065	0.0397		0.0397
α_m(bott.)		0.0561			0.0118			0.0766	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bott.MuS=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	450.1 > M ok		278.5	278.5 > M ok		278.5	278.5 > M ok		278.5
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			278.5			278.5	
top	0.679		0.407	0.407		0.407	0.407		0.407
Pt (%) bott.		0.407			0.407			0.407	
top	1900		1140	1140		1140	1140		1140
as (mm2) bott.		1140			1140			1140	
Main top	5	3	3	3	3	3	3	3	3
Bars		D22			D22			D22	
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

Sub beam Profile 2nd floor

Girder ID	2B6			2B7			2B8		
Position	1 end	Mid	2 end	2 end	Mid	3 end	3 end	Mid	4 end
D.L] M(tm) top	0		273.31	273.31		223.27	241.56		0
+] bott.		196.32			84.63			162.54	
L.L] Q (t)	141.66		175.82	147.92		141.66	166.24		131.73
] b x D (mm)	400	x	750	400	x	750	400		750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^{2} (x 10^{b})		3332			3332			3332	
α_m (top)=M/z	0.0000		0.0820	0.0820		0.0670	0.0725		0.0000
α_m(bott.)		0.0589			0.0254			0.0488	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bott.MuS=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5 > M ok		365.7	450.1 > M ok		450.1	450.1 > M ok		278.5
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			278.5			278.5	
top	0.407		0.543	0.679		0.679	0.679		0.407
Pt (%) bott.		0.543			0.407			0.407	
top	1140		1520	1900		1900	1900		1140
as (mm2) bott.		1520			1140			1140	
Main top	3	3	4	5	3	5	5	3	3
Bars		D22			D22			D22	
bott	3	4	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

1FL

	5' Frame			5' Frame			5' Frame		
Girder ID	**1B6**			**1B7**			**1B6**		
Position	A end	Mid	B end	B end	Mid	C end	C end	Mid	D end
D.L] M(tm) top	0		432.47	34.34		34.34	432.47		0
+] bott.		327.67			111.43			327.67	
L.L] Q (t)	222.06		276.12	222.06		222.06	176.12		222.06
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^b)		3332			3332			3332	
α_m (top)=M/z	0.0000		0.1298	0.0103		0.0103	0.1298		0.0000
α_m(bott.)		0.0983			0.0334			0.0983	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		360.6	360.6		360.6	360.6		270.5
Bott.MuS=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5 > M ok		610.3	610.3 > M ok		610.3	610.3 > M ok		278.5
Bot Mu=Rs.As(ho-0.5ξho)=		450.1			278.5			450.1	
Pt (%) top	0.407		0.950	0.950		0.950	0.950		0.407
Pt (%) bott.		0.679			0.407			0.679	
as (mm2) top	1140		2660	2660		2660	2660		1140
as (mm2) bott.		1900			1140			1900	
Main top	3	3	7	7	3	7	7	3	3
Bars		D22			D22			D22	
bott	3	5	4	4	3	4	4	5	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150	D10-150	D10-100	D10-150	D10-150	D10-150	D10-100	D10-150	D10-150
judge	ok		ok	ok		ok	ok		ok
		pw=	0.00393					pw= 0.00393	

	3' Frame			2' Frame			2' Frame		
Girder ID	**1B4**			**1B1**			**1B2**		
Position	C end	Mid	D end	A end	Mid	B end	B end	Mid	C end
D.L] M(tm) top	36.95		36.95	0		274.01	274.01		219.32
+] bott.		59.8			197.38			87.72	
L.L] Q (t)	106.69		106.69	144.93		179.18	151.77		144.93
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^b)		3332			3332			3332	
α_m (top)=M/z	0.0111		0.0111	0.0000		0.0822	0.0822		0.0658
α_m(bott.)		0.0179			0.0592			0.0263	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	360.6		270.5	270.5		270.5	270.5		270.5
Bott.MuS=Rsc.A's.(ho-a')=		180.3			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	531.6 > M ok		365.7	278.5 > M ok		450.1	450.1 > M ok		450.1
Bot Mu=Rs.As(ho-0.5ξho)=		365.7			365.7			278.5	
Pt (%) top	0.814		0.543	0.407		0.679	0.679		0.679
Pt (%) bott.		0.543			0.543			0.407	
as (mm2) top	2280		1520	1140		1900	1900		1900
as (mm2) bott.		1520			1520			1140	
Main top	6	2	4	3	3	5	5	3	5
Bars		D22			D22			D22	
bott	4	4	3	3	4	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok
	pw=	0.00349			pw=	0.00349			

1st Floor

2' Frame

	2' Frame			2' Frame			5' Frame sigle span		
Girder ID	**1B2**			**1B3**			**1B8**		
Position	C end	Mid	D end	D end	Mid	E end	D end	Mid	E end
D.L] M(tm) top	219.32		239.33	239.33		0	181.69		181.69
+] bott.		105.06			147.94			384.87	
L.L] Q (t)	144.93		144.93	150.09		124.9	208.8		208.8
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^{2} (x 10^{b})		3332			3332			3332	
α_m (top)=M/z	0.0658		0.0718	0.0718		0.0000	0.0545		0.0545
α_m(bott.)		0.0315			0.0444			0.1155	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	270.5		270.5
Bott.MuS=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	450.1	> M ok	450.1	450.1	> M ok	450.1	278.5	> M ok	278.5
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			278.5			450.1	
top	0.679		0.679	0.679		0.679	0.407		0.407
Pt (%) bott.		0.407			0.407			0.679	
top	1900		1900	1900		1900	1140		1140
as (mm2) bott.		1140			1140			1900	
Main top	5	3	5	5	3	5	3	3	3
Bars		D22			D22			D22	
bott	3	3	3	3	3	3	3	5	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

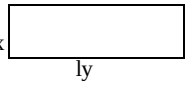
	2' Frame(use 2B4 value)			single span			Machne +0.72 t/m2		
Girder ID	**1B4**			**1B5**		1-2,A-B	**1B7**		
Position	B end	Mid	C end	end	Mid	end	C end	Mid	D end
D.L] M(tm) top	21.55		21.55	99.62		99.62	418.9		418.97
+] bott.		39.24			221.24			240.27	
L.L] Q (t)	10.34		10.34	123.13		123.13	268.14		268.14
] b x D (mm)	400	x	750	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^{2} (x 10^{b})		3332			3332			3332	
α_m (top)=M/z	0.0065		0.0065	0.0299		0.0299	0.1257		0.1257
α_m(bott.)		0.0118			0.0664			0.0721	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5	270.5		270.5	360.6		360.6
Bott.MuS=Rsc.A's.(ho-a')=		270.5			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5	> M ok	278.5	278.5	> M ok	278.5	610.3	> M ok	610.3
Bot Mu=Rs.As(ho-0.5ξho)=		278.5			278.5			278.5	
top	0.407		0.407	0.407		0.407	0.950		0.950
Pt (%) bott.		0.407			0.407			0.407	
top	1140		1140	1140		1140	2660		2660
as (mm2) bott.		1140			1140			1140	
Main top	3	3	3	3	3	3	7	3	7
Bars		D22			D22			D22	
bott	3	3	3	3	3	3	4	3	4
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
Stirrup	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

sigle span

Girder ID	1B7		
Position	D end	Mid	E end
D.L] M(tm) top	207.58		207.58
+] bott.		422.81	
L.L] Q (t)	222.06		222.06
] b x D (mm)	400	x	750
Size] ho (mm)	700	700	700
z= Rb.b.ho^{2} (x 10^{b})		3332	
α_m (top)=M/z	0.0623		0.0623
α_m(bott.)		0.1269	
α_r = 0.395	>	>	>
Top Mus=Rsc.A's.(ho-a')=	270.5		270.5
Bott.MuS=Rsc.A's.(ho-a')=		270.5	
Top Mu=Rs.As(ho-0.5ξho)=	278.5	> M ok	278.5
Bot Mu=Rs.As(ho-0.5ξho)=		450.1	
Pt (%) top	0.407		0.407
Pt (%) bott.		0.679	
as (mm2) top	1140		1140
as (mm2) bott.		1900	
Main top	3	3	3
Bars		D22	
bott	3	5	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6
Stirrup	D10-150		D10-150
judge	ok		ok

5-2. Slab

rS1



w= 6.54 kN/m2
lx= 3.2 m Thick 150 mm
ly= 7.6 m ho= 115 mm

	a	wlx2	M
Mx1=	0.081	66.9696	5.42454
Mx2=	0.054	66.9696	3.61636
My1=	0.042	66.9696	2.81272
My2=	0.028	66.9696	1.87515
		wlx	Q
Qx =	0.51	20.928	10.6733
Qy =	0.46	20.928	9.62688

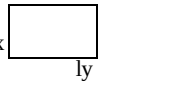
Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D10 As 78 mm2
D12 As 113.1 mm2

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10 @	200	5	390	8.37	0.0728	15.774	> Mx1 ok
Mux2	D10 @	200	5	390	8.37	0.0728	15.774	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0583	12.715	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0583	12.715	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok

rS2



w= 6.54 kN/m2
lx= 3.7 m Thick 150 mm
ly= 7.6 m ho= 115 mm

	a	wlx2	M
Mx1=	0.079	89.5326	7.07308
Mx2=	0.053	89.5326	4.74523
My1=	0.042	89.5326	3.76037
My2=	0.028	89.5326	2.50691
		wlx	Q
Qx =	0.52	24.198	12.583
Qy =	0.46	24.198	11.1311

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10 @	150	6.667	520.03	11.17	0.0971	20.768	> Mx1 ok
Mux2	D10 @	200	5	390	8.37	0.0728	15.774	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0583	12.715	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0583	12.715	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok

Machine room

w= 12.33 kN/m2

2S1 lx= 3.7 m Thick 180 mm

lx ly= 7.6 m ho= 145 mm

ly

	a	wlx2	M	re-bars
Mx1=	0.079	168.798	13.335	D12-@179--> @150
Mx2=	0.053	168.798	8.94628	D12-@268--> @200
My1=	0.042	168.798	7.0895	D10-@338--> @250
My2=	0.028	168.798	4.72634	D10-@507--> @250
		wlx	Q	
Qx =	0.52	45.621	23.7229	
Qy =	0.46	45.621	20.9857	

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	150	6.667	754.038	16.19	0.1117	29.4228	> Mx1 ok
Mux2	D12 @	200	5	565.5	12.14	0.0837	22.4838	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0462	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0462	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

Office

w= 8.94 kN/m2

2S2 lx= 3.2 m Thick 150 mm

lx ly= 7.6 m ho= 115 mm

ly

	a	wlx2	M
Mx1=	0.081	91.5456	7.41519
Mx2=	0.054	91.5456	4.94346
My1=	0.042	91.5456	3.84492
My2=	0.028	91.5456	2.56328
	wlx	Q	
Qx =	0.51	28.608	14.5901
Qy =	0.46	28.608	13.1597

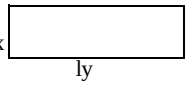
Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10 @	200	5	390	8.37	0.0728	15.7743	> Mx1 ok
Mux2	D10 @	200	5	390	8.37	0.0728	15.7743	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0583	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0583	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok

Storage

2S3



w= 10.53 kN/m2
lx= 4.7 m Thick 180 mm
ly= 7.6 m ho= 145 mm

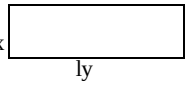
	a	wlx2	M
Mx1=	0.073	232.608	16.9804
Mx2=	0.049	232.608	11.3978
My1=	0.042	232.608	9.76952
My2=	0.028	232.608	6.51302
		wlx	Q
Qx =	0.52	49.491	25.7353
Qy =	0.46	49.491	22.7659

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	15	6.66	753.246	16.17	0.1115	29.3943	> Mx1 ok
Mux2	D12 @	200	5	565.5	12.14	0.0837	22.4838	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0462	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0462	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

2S4



w= 12.33 kN/m2
lx= 3.2 m Thick 180 mm
ly= 5.3 m ho= 145 mm

	a	wlx2	M
Mx1=	0.074	126.259	9.34318
Mx2=	0.049	126.259	6.1867
My1=	0.042	126.259	5.30289
My2=	0.028	126.259	3.53526
		wlx	Q
Qx =	0.52	39.456	20.5171
Qy =	0.46	39.456	18.1498

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	200	5	565.5	12.14	0.0837	22.4838	> Mx1 ok
Mux2	D10 @	200	5	390	8.37	0.0577	15.7743	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0462	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0462	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

2S5

lx ly

w= 12.33 kN/m2
lx= 2.5 m Thick 180 mm
ly= 3.5 m ho= 145 mm

	a	wlx2	M
Mx1=	0.066	77.0625	5.08613
Mx2=	0.045	77.0625	3.46781
My1=	0.042	77.0625	3.23663
My2=	0.028	77.0625	2.15775
		wlx	Q
Qx =	0.51	30.825	15.7208
Qy =	0.46	30.825	14.1795

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10 @	200	5	390	8.37	0.0577	15.7743	> Mx1 ok
Mux2	D10 @	200	5	390	8.37	0.0577	15.7743	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0462	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0462	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

1S1

lx ly

w= 16.63 kN/m2
lx= 3.7 m Thick 180 mm
ly= 7.6 m ho= 145 mm

	a	wlx2	M
Mx1=	0.079	227.665	17.9855
Mx2=	0.053	227.665	12.0662
My1=	0.042	227.665	9.56192
My2=	0.028	227.665	6.37461
		wlx	Q
Qx =	0.52	61.531	31.9961
Qy =	0.46	61.531	28.3043

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	200	15	1170	25.12	0.1732	43.7469	> Mx1 ok
Mux2	D12 @	200	5	390	8.37	0.0577	15.7743	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0462	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0462	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

1S2

lx

ly

w= 12.33 kN/m2

lx= 3.2 m Thick 180 mm

ly= 7.6 m ho= 145 mm

	a	wlx2	M
Mx1=	0.081	126.259	10.227
Mx2=	0.054	126.259	6.818
My1=	0.042	126.259	5.30289
My2=	0.028	126.259	3.53526
		wlx	Q
Qx =	0.51	39.456	20.1226
Qy =	0.46	39.456	18.1498

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	200	5	565.5	12.14	0.0675	22.4838	> Mx1 ok
Mux2	D10 @	200	5	390	8.37	0.0465	15.7743	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0372	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0372	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

1S3

lx

ly

w= 12.33 kN/m2

lx= 2.5 m Thick 180 mm

ly= 3.5 m ho= 145 mm

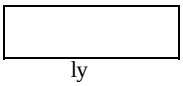
	a	wlx2	M
Mx1=	0.066	77.0625	5.08613
Mx2=	0.045	77.0625	3.46781
My1=	0.042	77.0625	3.23663
My2=	0.028	77.0625	2.15775
		wlx	Q
Qx =	0.51	30.825	15.7208
Qy =	0.46	30.825	14.1795

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10 @	200	5	390	8.37	0.0577	15.7743	> Mx1 ok
Mux2	D10 @	200	5	390	8.37	0.0577	15.7743	> Mx2 ok
Muy1	D10 @	250	4	312	6.70	0.0462	12.7148	> My1 ok
Muy2	D10 @	250	4	312	6.70	0.0462	12.7148	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

1S4



w= 16.63 kN/m2
lx= 5.2 m Thick 200 mm
ly= 7.6 m ho= 165 mm

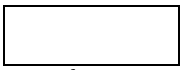
	a	wlx2	M
Mx1=	0.068	449.675	30.5779
Mx2=	0.046	449.675	20.6851
My1=	0.042	449.675	18.8864
My2=	0.028	449.675	12.5909
		wlx	Q
Qx =	0.51	86.476	44.1028
Qy =	0.46	86.476	39.779

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	100	10	1131	24.28	0.1472	42.4615	> Mx1 ok
Mux2	D12 @	150	6.667	754.038	16.19	0.0981	29.4228	> Mx2 ok
Muy1	D12 @	100	6.667	754.038	16.19	0.0981	29.4228	> My1 ok
Muy2	D12 @	150	6.667	754.038	16.19	0.0981	29.4228	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok

1S5



w= 16.63 kN/m2
lx= 5.2 m Thick 200 mm
ly= 6.6 m ho= 165 mm

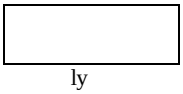
	a	wlx2	M
Mx1=	0.06	449.675	26.9805
Mx2=	0.04	449.675	17.987
My1=	0.042	449.675	18.8864
My2=	0.028	449.675	12.5909
		wlx	Q
Qx =	0.51	86.476	44.1028
Qy =	0.46	86.476	39.779

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	100	10	1131	24.28	0.1472	42.4615	> Mx1 ok
Mux2	D12 @	150	6.667	754.038	16.19	0.0981	29.4228	> Mx2 ok
Muy1	D12 @	100	6.667	754.038	16.19	0.0981	29.4228	> My1 ok
Muy2	D12 @	150	6.667	754.038	16.19	0.0981	29.4228	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok

1S5a



w= 16.63 kN/m2
lx= 4 m Thick 200 mm
ly= 5.5 m ho= 165 mm

	a	wlx2	M
Mx1=	0.064	266.08	17.0291
Mx2=	0.044	266.08	11.7075
My1=	0.042	266.08	11.1754
My2=	0.028	266.08	7.45024
		wlx	Q
Qx =	0.51	66.52	33.9252
Qy =	0.46	66.52	30.5992

Ultimate Moment

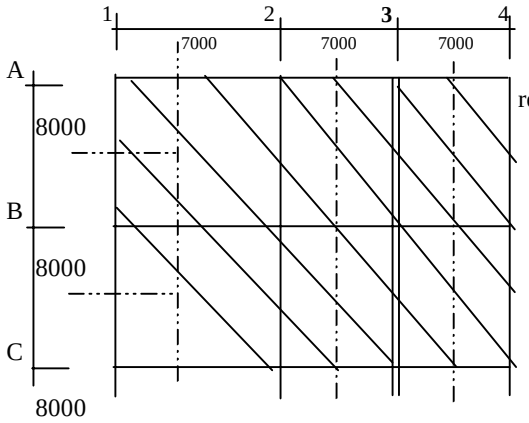
		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12 @	100	10	1131	24.28	0.1472	42.4615	> Mx1 ok
Mux2	D12 @	150	6.667	754.038	16.19	0.0981	29.4228	> Mx2 ok
Muy1	D12 @	150	6.667	754.038	16.19	0.0981	29.4228	> My1 ok
Muy2	D12 @	200	5	565.5	12.14	0.0736	22.4838	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok

5. FOUNDATION and BASEMENT EXTERIOR WALL

5. 1 Foundation

Load condition Base Slab is analysed as " FLAT SLAB STRUCTURES" .

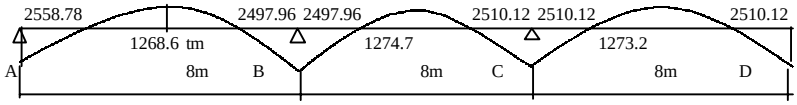


refer 2.3 Building weight at page 10

Design Pressure : 68.36 (kN/m2)

FRAME-3 w/1 = 478.49 kN/m for 7m wide. Span(m)= 8.00

	(kN.m)		(kN.m)		(kN)
FEM Co=	2551.9	Center Mc=	3827.9	Sheear Q=	1914.0



DF	0	1	0.5	0.5	0.5	0.5
FEM	-2558.78	2546.50	-2546.50	2546.50	-2546.5	2546.5
D1	0.00	12.28	0.00	0.00	0	0
C1	0.00	0.00	6.14	0.00	0	0
D2	0.00	0.00	-3.07	-3.07	0	0
Total M	-2558.78	2558.78	-2543.43	2543.43	-2546.5	2546.5

Refer wall bottom Bending Moment at Section 6.2, Basement Exterior WALL .
Wall F.E.M= Mb x Frame bay (7m)

FRAME-3 1st span Design forces (kN.m), (kN) 2nd span

		A-end	mid	B-end	B-end	mid	C-end
Col. Line	0.55		697.73			701.09	
	Bot. 0.75	1919.09		1907.57	1907.57		1909.88
Mid. Line	0.45		570.87			573.62	
	Bot. 0.25	639.70		635.86	635.86		636.63
	Total M	2558.78	1268.60	2543.43	2543.43	1274.70	2546.50

3rd Span

		C-end	mid	D-end
Col. Line	Top 0.55		700.26	
	Bot. 0.75	1909.88		1909.88
Mid. Line	Top 0.45		572.94	
	Bot. 0.25	636.63		636.63
	Total M	2546.50	1273.20	2546.50

Ultimate Bending Moment Capacity of Mat slab (kN.m) (value per 3.5m width.)
Ultimate Bending Moments are greater than design moments.

Table. Ultimate Bending moment

		A-end	mid	B-end	B-end	mid	C-end
Col.line	Top		2175.45			2175.45	
	Bot	5145.57		5145.57	5145.57		5145.57
Mid.line	Top		2175.45			2175.45	
	Bot	2175.45		2175.45	2175.45		2175.45
Col. Line	no's of bar At top	35	17.5	35	35	17.5	35
Mid. Line	At bott	17.5	17.5	17.5	17.5	17.5	17.5

(mm2)

D28 Area	616		
D25 Area	491	B (mm)	3500
D22 Area	380	ho=h-80 m	720
Rb (N/mm2)	17	Rs (N/mm2)	365

A end ΣAs=491∗23.33
x=ΣAs x 365/(Rb x B) comp. Z one height
Ult.Moment=Rb x B(d-x/2)

When crackwidth < 0.2 mm,σ tw has to be under 125 Mpa
Crack bending moment are shown in the table below.

Table. Crack Bending moment

		A-end	mid	B-end	B-end	mid	C-end
Col.line	Top		711.46			711.46	
	Bot	1785.17		1785.17	1785.17		1785.17
Mid.line	Top		711.46			711.46	
	Bot	711.46		711.46	711.46		711.46
Col. Line	no's of bar At top	35	17.5	35	35	17.5	35
Mid. Line	At bott	17.5	17.5	17.5	17.5	17.5	17.5

(mm2)

D25 Area	491	B (mm)	3500
D22 Area	380	ho=h-80mn	720
Rb (N/mm2)	17	Rs (N/mm2)	365
Rcr	125		

D28 area 616

A end ΣAs=491∗23.33
x=ΣAs x 365/(Rb x B) comp. Z one height
Crack bend. Moment = 0.8Rcr.As.h0 kN.m

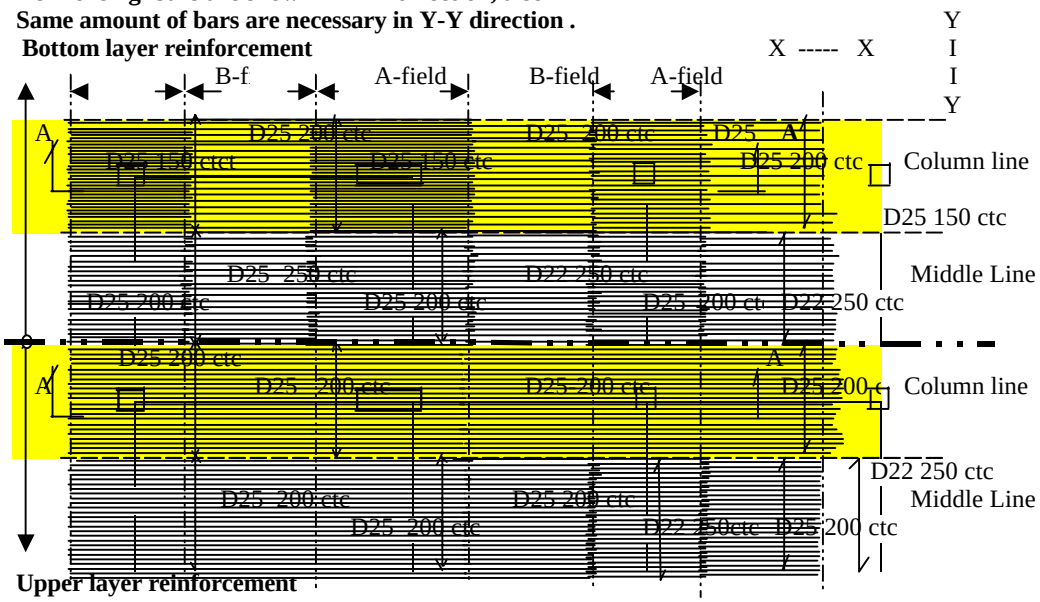
Reinforce. Bar This color shows this rule applied.

		A-end	mid	B-end	B-end	mid	C-end
Col.line	Top	D25@200	D25 @200	D25@200	D25@200	D25 @200	D22@200
	Bot	D28 @100	D25 @200	D28 @100	D28 @100	D25 @200	D28 @100
Mid.line	Top	D25 @200	D25 @200	D25 @200	D25 @200	D25 @200	D22@200
	Bot	D25 @200	D25 @200	D25 @200	D25 @200	D25 @200	D25 @200

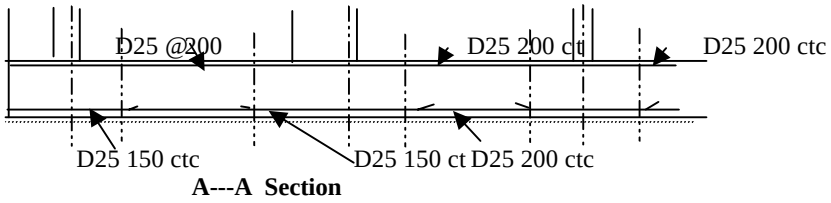
		C-end	mid	D-end
Col.line	Top	D22@200	D25 @200	D22@200
	Bot	D28 @100	D25 @200	D28 @100
Mid.line	Top	D22@200	D25 @200	D22@200
	Bot	D25 @200	D22@200	D25 @ 200

Reinforcing bars are shown in X-X direction, also
Same amount of bars are necessary in Y-Y direction .

Bottom layer reinforcement



Upper layer reinforcement



A---A Section

Design Pressure : 68.36 (kN/m2)

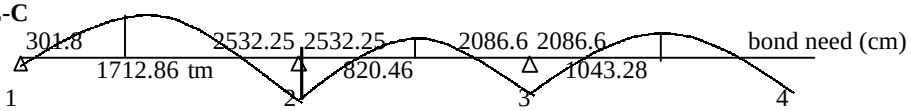
FRAME-C for 8m wide. Base Slab thickness 80cm 546.84 kN/m

FRAME-C w/1= 546.84 kN/m for 7m wide. Span(m)= 7.00

	(kN.m)		(kN.m)		(kN)
FEM Co=	2232.95	Center Mc=	3349.42	Sheear Q=	1913.95

Bending Moment (kN.m)

FRAME-C



DF	0	1	0.5	0.5	0.5	0.5
FEM	-304	2086.6	-2086.6	2086.6	-2086.6	2086.6
D1	0	-1782.6	0	0	0	0
C1	0	0	-891.3	0	0	0
D2	0	0	445.65	445.65	0	0
Total M	-304	304	-2532.25	2532.25	-2086.6	2086.6

Use same reinforcing bars as Frame 3.

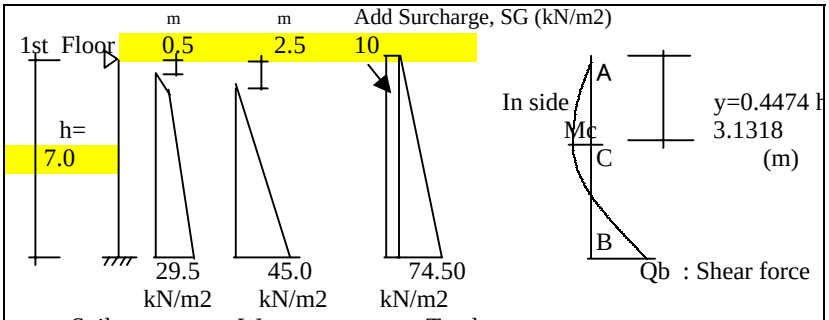
Frame-C has almost same value (allitle smaller) of Frame -3.

5. 2 Basement Exterior Wall

THICHNESS 55cm

Input Data in yellow frame

LOAD CONDITION For wall's unit width



Soil pressu	p= Ka γ h	Soil pressure (kN/m2)	
Ka	0.5		
γ =	16	Soil specific weight	
γ '= :	6	Soil specific weight in water	
ps= 0.5 x 1.6 x 2.5 + 0.5 x 0.6 x 4.5=	29.5	kN/m2	Use γf=1.2
Water pressure			
pw= 10 x 5=	45.0	kN/m2	Use γf=1.2

BENDING MOMENT and SHEAR FORCE

For wall's unit width

Mc=0 .06 W h =	131.42	kN.m	Wo=77x7x1.2/2	312.9	kN
Mc by SG: 9xW1.h/12	41.34	kN.m	W1=10 x 7=	84.0	kN
Total Mc=	172.76	kN.m			
Mb= 2/15 W h =	292.04	kN.m	Wo	312.9	kN
Mb By SG: W1.h/8=	73.50	kN.m	W1=10 x 7=	84.0	kN
Total Mb=	365.54	kN.m/m			
Qb= 4/5 Wo=	250.32	kN			
Qb By SG 5/8 W1=	52.50	kN			
Total Qb=	302.82	kN			

Exterior Wall Profile

Mb profile

Wall thickness	h	550.0	mm	ΣAs=	3273.333	Wall bott. D25 As mm2
	ho :	470.0	mm			**D25 @150** 491
	b:	1000.0	mm			
Re bar	Rs :	365.0	N/mm2			
Concrete	Rb :	17.0	N/mm2			

x=(ΣAs.Rs-0.5*Σas*Rsc)/(Rb. b) = 35.14 mm

ξ=x/h0= 0.074766 < 0.582 ok

Ultimate Bending.moment=

(Rbxbx(ho-0.5x)+ΣAsRsc*(ho-60)*0.5)/10' 515.20 kN.m

		ΣAs(mm2)=	1900	Wall bott. D22 As mm2
Mc profile				**D22 @200** 380
x=(ΣAs.Rs-0.5*Σas*Rsc)/(Rb. b) =			20.40	
ξ=x/h0=	0.043398	< 0.582	ok	
Ultimate Bending.moment=				
Rbxbx(ho-0.5x)+ΣAsRsc*(ho-60)*0.5=			413.38	kN.m
Shear stress= Qb/(Wa j)=		pending		

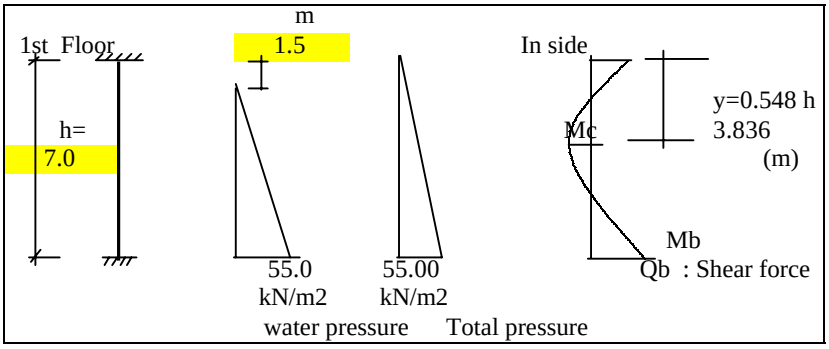
BASEMENT Water Tank Wall

Wall THICHNESS 45cm

LOAD CONDITION

INPUT DATA in yellow frame

For wall's unit width



BENDING MOMENT and SHEAR FORCE

For wall's unit width

Ma= 1/15 W h =	107.80	kN.m	
Mc=0 .043 W h =	69.53	kN.m	W=55*1.2x7/2= 231 kN
Mb= 1/10 W h =	161.70	kN.m	
Qb= 4/5 W=	184.8	kN	

TANK Wall Profile

Mb profile

Wall thickness	h	450.0	mm	ΣAs=	2533.333	Wall bott. D22 As
	ho :	370.0	mm			**D22 @150** 380
unit width	b:	1000.0	mm			
Re bar	Rs :	365.0	N/mm2			pt = 0.685%
	Rsc :	300.0	N/mm2			
Concrete	Rb :	17.0	N/mm2			
x=(ΣAs.Rs-0.5*Σas*Rsc)/(Rb. b) =					27.19608	mm
ξ=x/h0=		0.073503	< 0.582	ok		
Ultimate Bending.moment=						kN.m
(Rbxbx(ho-0.5x)+ΣAsRsc*(ho-60)*0.5)/10'					308.1	kN.m > 147=Mb

Ma profile

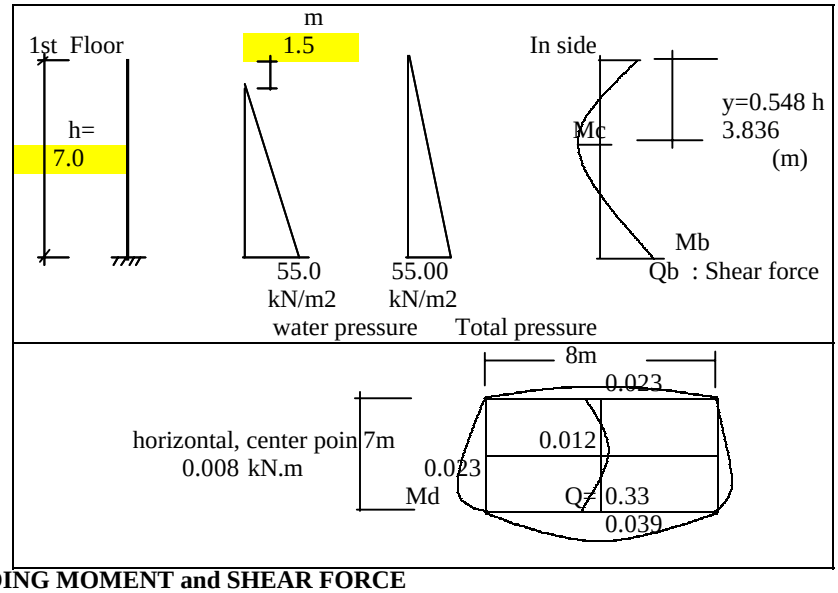
	ΣAs(mm2)=	1693.333	Wall bott.D18 As mm2	
			D18 @150	254
x=(ΣAs.Rs-0.5*Σas*Rsc)/(Rb. b) =		18.17843		
ξ=x/h0=	0.049131	< 0.582	ok	pt = 0.46%
Ultimate Bending.moment=				
Rbxbx(ho-0.5x)+ΣAsRsc*(ho-60)*0.5=		111.5	kN.m	
Shear stress= Qb/(Wa j)=	pending			

Mc profile

	ΣAs(mm2)= 1270		Wall bott.D25 As mm2
			D18 @200 254
x=(ΣAs.Rs-0.5*Σas*Rsc)/(Rb. b) =		13.63382	
ξ=x/h0=	0.036848 < 0.582	ok	pt = 0.34%
Ultimate Bending.moment=			
Rbxbx(ho-0.5x)+ΣAsRsc*(ho-60)*0.5=		237.4 kN.m	
Shear stress= Qb/(Wa j)=	pending		

LOAD CONDITION **2ways distribution** INPUT DATA in yellow frame

for Reference For wall's unit width



BENDING MOMENT and SHEAR FORCE

For wall's unit width				
Ma= 0.023 w h2	61.99	kN.m		
Mc=0 .012 w h2	32.34	kN.m	W= 7.7 x 7/2=	192.5 kN
Mb=0.043 w h2 =	115.89	kN.m		
Md= 0.023 w h2	61.99	kN.m		
Qb= 4/5 W=	154	kN		

Tank Wall Profile 2 wayes distribution for referrence

Md profile

Wall thickness	h	450.0	mm ΣAs=	1270	Wall bott. D18 As
	ho :	370.0	mm		**D18 @200** 254
	b:	1000.0	mm		
Re bar	Rs :	365.0	N/mm2		pt = 0.34%
	Rsc :	300.0	N/mm2		
Concrete	Rb :	17.0	N/mm2		
x=(ΣAs.Rs-0.5*Σas*Rsc)/(Rb. b) =				13.63382	mm
ξ=x/h0=		0.036848	< 0.582	ok	
Ultimate Bending.moment=					kN.m
(Rbxbx(ho-0.5x)+ΣAsRsc*(ho-60)*0.5)/10'				156.0	kN.m > 61.9=Md

SLUDGE TREATMENT BUILDING
BENDING MOMENT CALCULATION (.kN.m)

	end M left girder	Top M col. Dwn	Bot. M col. Up	end M right girder
Destribution factor	0.25	0.25	0.20	0.30
Fixed end Moment	11.14			-7.00
Destributed Moment 1	-1.04	-1.04	-0.83	-1.24
Contributed Moment	6.00	0.00	1.20	0.00
Destributed Moment 2	-1.80	-1.80	-1.44	-2.16
total by virtical line	14.31	-2.84	-1.07	-10.40

B FRAME

Y1 Y2 Y3 Y4 Y5 Y6 Y7

2.76 2.76 2.76

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF	0.303		0.697	0.411	0.179		0.411	0.411	0.179		0.411	0.561	0.439													
FEM			-127.14	127.14			-127.14	127.14			-127.14	127.14														
D1	38.53		88.61	0.00	0.00		0.00	0.00	0.00		0.00	-71.32	-55.82													
C1	24.30		0.00	44.31	17.18		0.00	0.00	17.18		-35.66	0.00	0.94													
D2	-7.36		-16.94	-25.25	-10.98		-25.25	7.59	3.30		7.59	-0.53	-0.41													
Σ	55.47		-55.47	146.19	6.20		-152.39	134.73	20.48		-155.21	55.29	-55.29													

1.20 1.20 1.20 2.16

2.76 2.76 2.76 3.32

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF	0.405	0.180	0.414	0.293	0.287	0.127	0.293	0.293	0.287	0.127	0.293	0.252	0.247	0.197	0.303	0.551	0.449									
FEM			-269.76	269.76			-269.76	269.76			-269.76	269.76			-279.26	279.26										
D1	109.36	48.61	111.79	0.00	0.00	34.36	0.00	0.00	0.00	34.36	0.00	2.40	2.34	1.88	2.88	-154.01	-125.25									
C1	31.60	19.26	0.00	55.90	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.00	-0.72	-27.91	-77.01	1.44	0.00									
D2	-20.62	-9.17	-21.08	-16.38	-16.02	0.00	-16.38	-0.35	-0.34	-0.15	-0.35	26.65	26.07	20.86	32.06	-0.79	-0.65									
Σ	120.34	58.70	-179.05	309.28	-16.02	34.36	-286.14	269.41	-0.34	34.21	-268.91	298.81	27.70	-5.18	-321.33	125.90	-125.90									

2.70 2.70 2.70 2.70 2.70

3.66 3.66 3.66 3.32 3.32 3.32

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF	0.300	0.173	0.527	0.345	0.196	0.113	0.345	0.345	0.196	0.113	0.345	0.326	0.185	0.193	0.296	0.291	0.182	0.236	0.291	0.381	0.239		0.381	0.615	0.385	
FEM			-365.56	365.56			-365.56	365.56			-365.56	365.56			-358.10	358.10			-358.10	358.10			-358.10	358.10		
D1	109.56	63.21	192.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.43	-1.38	-1.44	-2.21	0.00	0.00	0.00	0.00	0.00	0.00		0.00	-220.17	-137.93	
C1	40.65	54.68	0.00	96.39	0.00	0.00	0.00	0.00	-4.61	0.00	-1.22	0.00	22.30	1.17	0.00	-1.10	0.00	-62.62	0.00	0.00	0.00		-110.08	0.00	-31.12	
D2	-28.57	-16.48	-50.28	-33.28	-18.92	-10.91	-33.28	2.01	1.14	0.66	2.01	-7.66	-4.35	-4.52	-6.95	18.53	11.61	15.07	18.53	41.91	26.26		41.91	19.13	11.99	
Σ	121.64	101.41	-223.05	428.67	-18.92	-10.91	-398.84	367.57	-3.47	0.66	-364.76	355.47	16.56	-4.78	-367.25	375.52	11.61	-47.56	-339.57	400.01	26.26		-426.27	157.07	-157.07	

2.08 2.08 2.08 2.08 2.08 2.08 2.08

3.66 3.66 3.66 3.32 3.32 3.32

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF	0.478	0.189	0.333	0.331	0.150	0.188	0.331	0.331	0.150	0.188	0.331	0.341	0.155	0.194	0.310	0.320	0.160	0.200	0.320	0.320	0.160	0.200	0.320	0.163	0.735	0.102
FEM			-429.60	429.60			-429.60	429.60			-380.53	380.53			-610.38	610.38			-610.38	610.38			-610.38	610.38		
D1	205.22	81.31	143.07	0.00	0.00	0.00	0.00	-16.24	-7.36	-9.23	-16.24	78.47	35.59	44.60	71.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-99.34	-448.81	-62.23
C1	-219.11	54.78	0.00	71.53	0.00	0.00	-8.12	0.00	0.00	0.00	39.24	-8.12	-25.69	-0.69	0.00	35.59	0.00	0.00	0.00	0.00	0.00	0.00	-49.67	0.00	584.64	-68.97
D2	78.50	31.10	54.73	-20.99	-9.52	-11.93	-20.99	-12.98	-5.89	-7.38	-12.98	11.78	5.34	6.69	10.68	-11.38	-5.69	-7.13	-11.38	15.89	7.94	9.95	15.89	-83.92	-379.17	-52.58
Σ	64.61	167.19	-231.80	480.15	-9.52	-11.93	-458.70	400.38	-13.25	-16.61	-370.52	462.66	15.25	50.60	-528.51	634.59	-5.69	-7.13	-621.76	626.27	7.94	9.95	-644.16	427.12	-243.34	-183.78

5.25 1.66 1.66 1.66 1.66 1.66 15.00

9.14 9.14 9.14 8.00 8.00 8.00

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF		0.36	0.64	0.46		0.08	0.46	0.46		0.08	0.46	0.49		0.09	0.43	0.45		0.09	0.45	0.45		0.09	0.45	0.35		0.65
FEM			1201.1	-1201.1			1201.1	-1201.1			1201.1	-1201.1			1782.9	-1792.9			1792.9	-1792.9			1792.9	-1792.9		
D1		-438.22	-762.91	0.00		0.00	0.00	0.00		0.00	0.00	-282.85		-51.37	-247.57	0.00		0.00	0.00	0.00		0.00	0.00	623.62		1169.28
C1		102.61	0.00	-381.46		0.00	0.00	0.00		-3.68	-141.43	0.00		17.80	0.00	-123.79		0.00	0.00	0.00		0.00	311.81	0.00		-224.40
D2		-37.44	-65.18	174.85		31.76	174.85	66.51		12.08	66.51	-8.65		-1.57	-7.57	56.08		11.64	56.08	-141.25		-29.31	-141.25	78.05		146.35
Σ		-373.0	373.0	-1407.7		31.8	1376.0	-1134.6		8.4	1126.2	-1492.6		-35.1	1527.8	-1860.6		11.6	1849.0	-1934.1		-29.3	1963.5	-1091.2		1091.2

B.12-56

D FRAME

Y1 Y2 Y3 Y4 Y5 Y6 Y7

2.76 2.76 2.76

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF	0.30		0.70	0.41	0.18		0.41	0.41	0.18		0.41	0.56	0.44													
FEM			-252.09	252.09			-65.19	65.19			-252.09	252.09														
D1	76.39		175.70	-76.76	-33.38		-76.76	76.76	33.38		103.54	-141.42	-110.67													
C1	31.60		-38.38	87.85	0.00		38.38	-38.38	0.00		-70.71	51.77	-0.72													
D2	2.05		4.72	-51.84	-22.54		-15.76	44.80	19.48		29.04	-28.64	-22.41													
Σ	110.05		-110.05	211.33	-55.92		-119.33	148.38	52.86		-190.22	133.80	-133.80													

1.20 1.20 1.20 2.16

3.32

	Y4				Y5			
		0.33	0.26	0.41	0.55	0.45		
				-279.26	279.26			
		92.18	73.74	113.34	-154.01	-125.25		
		18.04	-55.34	-77.01	56.67	0.00		
		37.73	30.18	46.39	-31.25	-25.42		
		147.94	48.59	-196.53	150.67	-150.67		

2.70 2.70

3.66 3.66 3.66 3.32 3.32 3.32

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF	0.30	0.17	0.53	0.35	0.20	0.11	0.35	0.35	0.20	0.11	0.35	0.33	0.19	0.19	0.30	0.38	0.24	0.00	0.38	0.38	0.24		0.38	0.61	0.39	
FEM			-365.56	365.56			-365.56	365.56			-365.56	365.56			-358.10	358.10			-358.10	358.10			-358.10	358.10		
D1	109.56	63.21	192.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.43	-1.38	-1.44	-2.21	0.00	0.00	0.00	0.00	0.00	0.00		0.00	-220.17	-137.93	
C1	34.27	38.20	0.00	96.39	0.00	-16.69	0.00	0.00	0.00	16.69	-1.22	0.00	18.04	-55.34	0.00	-1.10	0.00	0.00	0.00	0.00	0.00		-110.08	0.00	-59.61	
D2	-21.72	-12.53	-38.22	-27.52	-15.64	-9.02	5.76	-5.34	-3.04	-1.75	-5.34	12.17	6.91	7.18	11.04	0.42	0.26	0.00	0.42	41.91	26.26		41.91	36.65	22.96	
Σ	122.12	88.87	-210.99	434.43	-15.64	-25.71	-359.80	360.22	-3.04	14.94	-372.12	375.29	23.57	-49.59	-349.27	357.42	0.26	0.00	-357.68	400.01	26.26		-426.27	174.58	-174.58	

2.08 2.08 2.08 2.08 2.08 2.08 2.08

3.66 3.66 3.66 3.32 3.32 3.32

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF	0.48	0.19	0.33	0.25	0.36	0.14	0.29	0.25	0.36	0.14	0.25	0.26	0.37	0.15	0.23	0.24	0.38	0.15	0.24	0.24	0.38	0.15	0.24	0.31	0.49	0.20
FEM			-362.18	362.18			-362.18	362.18			-362.18	362.18			-610.38	610.38			-610.38	610.38			-610.38	610.38		
D1	173.02	68.55	120.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.48	91.06	36.08	57.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-190.28	-300.89	-119.21
C1	-219.11	54.78	0.00	60.31	0.00	0.00	0.00	0.00	0.00	0.00	31.74	0.00	-68.21	-0.69	0.00	28.79	0.00	0.00	0.00	0.00	0.00	0.00	-95.14	0.00	355.20	-68.97
D2	78.50	31.10	54.73	-15.07	-21.61	-8.56	0.00	-7.93	-11.37	-4.51	-7.93	17.62	25.28	10.02	15.99	-6.84	-10.82	-4.29	-6.84	22.61	35.75	14.17	22.61	-89.23	-141.10	-55.90
Σ	32.41	154.43	-186.84	407.42	-21.61	-8.56	-362.18	354.25	-11.37	-4.51	-338.37	443.28	48.13	45.40	-536.81	632.33	-10.82	-4.29	-617.22	632.99	35.75	14.17	-682.91	330.87	-86.79	-244.08

5.25 5.25 5.25 5.25 5.25 5.25 5.25

9.14 9.14 9.14 8.00 8.00 8.00

	Y1			Y2				Y3				Y4				Y5				Y6				Y7		
DF		0.36	0.64	0.39		0.22	0.45	0.39		0.22	0.39	0.41		0.23	0.36	0.38		0.25	0.38	0.38		0.25	0.38	0.60		0.40
FEM			1201.1	-1201.1			1201.1	-1201.1			1201.1	-1201.1			1782.9	-1792.9			1792.9	-1792.9			1792.9	-1792.9		
D1		-438.22	-762.91	0.00		0.00	0.00	0.00		0.00	0.00	-237.50		-136.42	-207.88	0.00		0.00	0.00	0.00		0.00	0.00	1082.51		710.39
C1		86.51	0.00	-381.46		0.00	0.00	0.00		0.00	-118.75	0.00		45.53	0.00	-103.94		0.00	0.00	0.00		0.00	541.25	0.00		-150.45
D2		-31.56	-54.95	148.17		85.11	171.24	46.13		26.50	46.13	-18.59		-10.68	-16.27	39.13		25.68	39.13	-203.77		-133.72	-203.77	90.84		59.61
Σ		-383.3	383.3	-1434.4		85.1	1372.3	-1155.0		26.5	1128.5	-1457.2		-101.6	1558.8	-1857.7		25.7	1832.0	-1996.7		-133.7	2130.4	-619.56		619.56

SLUDGE TREATMENT BUILDING

BENDING MOMENT CALCULATION (.kN.m)

2 FRAME

	A			B				C				D				E		
							3.32				3.32				3.66			
DF				0.394		0.606	0.423	0.153		0.423	0.406	0.147		0.447	0.753	0.247		
FEM						-155.59	155.59			-155.59	155.59			-116.87	116.87			
D1				61.33		94.26	0.00	0.00		0.00	-15.72	-5.68		-17.32	-88.01	-28.86		
C1				-20.54		0.00	47.13	0.00		-7.86	0.00	-3.85		-44.01	-8.66	-20.08		
D2				8.10		12.45	-16.63	-6.01		-16.63	19.42	7.02		21.41	21.65	7.10		
Σ				48.88		-48.88	186.09	-6.01		-180.08	159.30	-2.51		-156.79	41.84	-41.84		
				2.16				1.20				1.20				1.20		
			3.32															
DF	0.231		0.769		0.406	0.330	0.264											
FEM			-155.59		155.59													
D1	36.02		119.57		-63.15	-51.36	-41.08											
C1	23.28		-31.57		59.79	0.00	30.66											
D2	1.92		6.38		-36.71	-29.86	-23.88											
Σ	61.22		-61.22		115.52	-81.21	-34.31											
	1.00					2.70												
			3.32				3.32				3.32				3.66			
DF	0.325	0.156	0.519		0.305	0.191	0.199	0.305	0.335	0.210	0.121	0.335	0.324	0.203	0.117	0.357	0.527	0.300	0.173
FEM			-297.97		297.97			-297.97	297.97			-297.97	297.97			-232.19	232.29		
D1	96.84	46.56	154.57		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-21.29	-13.34	-7.69	-23.47	-122.50	-69.62	-40.17
C1	33.16	18.01	0.00		77.29	-4.69	-25.68	0.00	0.00	0.00	0.00	-10.64	0.00	-7.37	-2.84	-61.25	-11.73	-16.59	-14.43
D2	-16.63	-7.99	-26.54		-14.32	-8.97	-9.32	-14.32	3.56	2.23	0.00	3.56	23.12	14.49	8.36	25.49	22.54	12.81	7.39
Σ	113.37	56.57	-169.94		360.94	-13.66	-34.99	-312.29	301.53	2.23	0.00	-305.05	299.81	-6.21	-2.18	-291.42	120.60	-73.40	-47.20
	2.08					2.08				2.08				2.08				2.08	
			3.32				3.32				3.32				3.66			
DF	0.493	0.195	0.312		0.238	0.376	0.149	0.238	0.279	0.442	0.149	0.238	0.232	0.367	0.145	0.256	0.333	0.478	0.189
FEM			-339.57		339.57			-276.63	276.63			-276.63	276.63			-175.29	175.29		
D1	167.39	66.32	105.86		-14.96	-23.65	-9.37	-14.96	0.00	0.00	0.00	0.00	-23.51	-37.18	-14.73	-25.92	-58.38	-83.74	-33.18
C1	-355.21	48.42	-7.48		52.93	0.00	0.00	0.00	-7.48	0.00	0.00	-11.76	0.00	69.38	-6.67	-29.19	-12.96	-219.10	-34.81
D2	154.92	61.38	97.97		-12.58	-19.89	-7.88	-12.58	5.37	8.49	1.11	4.57	-7.78	-12.30	-4.87	-8.58	88.88	127.49	50.51
Σ	-32.89	176.12	-143.22		364.96	-43.54	-17.25	-304.17	274.52	8.49	1.11	-283.81	245.34	19.90	-26.27	-238.97	192.83	-175.35	-17.48
	5.25					5.25				5.25				5.25				5.25	
			8.00				8.00				8.00				9.14			
DF		0.396	0.604		0.376	0.247	0.376		0.376		0.247	0.376		0.357	0.234	0.408		0.635		0.365
FEM			1792.9		-1792.9			1792.9	-1792.9			1792.9	-1792.9			1201.1	1201.1		
D1		-710.41	-1082.5		0.00		0.00	0.00	0.00		0.00	0.00	211.46		138.77	241.59	-762.89		-438.21
C1		83.70	0.00		-541.26		-11.83	0.00	0.00		0.00	105.73	0.00		-18.59	-381.45	120.79		-41.87
D2		-33.16	-50.53		208.22		136.65	208.22	-39.80		-26.12	-39.80	142.93		93.80	163.30	-50.13		-28.79
Σ		-659.9	659.9		-2126.0		124.8	2001.2	-1832.7		-26.1	1858.9	-1438.6		214.0	1224.6	508.9		-508.9

B12-57

SLUDGE TREATMENT

BENDING MOMENT CALCULATION (.kN.m)

4 FRAME

	A			B				C				D				E		
							3.32				3.32				3.66			
DF				0.394		0.606	0.377	0.245		0.377	0.363	0.236		0.400	0.629	0.371		
FEM						-155.59	155.59			-155.59	155.59			-116.97	116.87			
D1				61.33		94.26	0.00	0.00		0.00	-14.03	-9.13		-15.46	-73.50	-43.37		
C1				12.25		0.00	47.13	0.00		-7.01	0.00	0.00		-36.75	-7.73	-36.26		
D2				-4.83		-7.42	-15.14	-9.85		-15.14	13.35	8.68		14.72	27.67	16.33		
Σ				68.75		-68.75	187.59	-9.85		-177.74	154.91	-0.44		-154.47	63.31	-63.31		
				2.16				2.16				2.16				2.16		
			3.32				3.32				3.32				3.66			
DF	0.449		0.551		0.289	0.235	0.188	0.289	0.289	0.235	0.188	0.289	0.280	0.228	0.182	0.309	0.430	0.317	0.254
FEM			-155.59		155.59			-286.07	286.07			-286.07	286.07			-286.07	286.07		
D1	69.78		85.81		37.67	30.63	24.51	37.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-122.89	-90.66	-72.52
C1	63.42		18.83		42.90	0.00	30.66	0.00	18.83	0.00	0.00	0.00	0.00	-10.73	-4.56	-61.44	0.00	-39.24	-21.69
D2	-36.89		-45.36		-21.24	-17.27	-13.82	-21.24	-5.44	-4.42	-3.54	-5.44	21.52	17.50	14.00	23.72	26.17	19.31	15.45
Σ	96.31		-96.31		214.92	13.36	41.35	-269.64	299.47	-4.42	-3.54	-291.51	307.59	6.77	9.44	-323.79	189.36	-110.59	-78.76
	2.70					2.70				2.70				2.70				2.70	
			3.32				3.32				3.32				3.66			
DF	0.257	0.333	0.410		0.291	0.182	0.236	0.291	0.291	0.182	0.236	0.291	0.282	0.177	0.230	0.311	0.463	0.263	0.273
FEM			-380.53		380.53			-380.53	380.53			-380.53	380.53			-287.06	287.06		
D1	97.72	126.84	155.97		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-26.39	-16.53	-21.46	-29.09	-132.99	-75.58	-78.49
C1	34.65	34.89	0.00		77.99	0.00	15.32	0.00	0.00	0.00	0.00	-13.19	0.00	0.00	0.00	-66.50	-14.55	-33.58	-45.33
D2	-17.86	-23.18	-28.50		-27.12	-16.99	-22.06	-27.12	3.84	2.40	3.12	3.84	18.77	11.76	15.27	20.70	43.30	24.61	25.55
Σ	114.51	138.55	-253.06		431.39	-16.99	-6.74	-407.65	384.37	2.40	3.12	-389.89	372.91	-4.77	-6.19	-361.95	182.82	-84.55	-98.26
	2.08					2.08				2.08				2.08				2.08	
			3.32				3.32				3.32				3.66			
DF	0.493	0.195	0.312		0.238	0.376	0.149	0.238	0.279	0.442		0.279	0.232	0.367	0.145	0.256	0.333	0.478	0.189
FEM			-354.84		354.84			-354.84	354.84			-354.84	354.84			-354.84	354.84		
D1	174.92	69.30	110.62		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-118.17	-169.51	-67.16
C1	-355.21	48.86	0.00		55.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.38	-8.27	-59.09	0.00	219.10	-37.79
D2	151.02	59.83	95.50		-13.14	-20.79	-8.23	-13.14	0.00	0.00	0.00	0.00	-0.47	-0.75	-0.30	-0.52	-60.38	-86.61	-34.32
Σ	-29.27	177.99	-148.72		397.00	-20.79	-8.23	-367.98	354.84	0.00	0.00	-354.84	354.37	68.64	-8.56	-414.45	176.29	-37.02	-139.26
	5.25					5.25				5.25				5.25				5.25	
			8.00				8.00				8.00				9.14			
DF		0.396	0.604		0.376	0.247	0.376		0.376		0.247	0.376		0.357	0.234	0.408		0.635		0.365
FEM			1792.9		-1792.9			1792.9	-1792.9			1792.9	-1792.9			1201.1	-1201.1		
D1		-710.41	-1082.5		0.00		0.00	0.00	0.00		0.00	0.00	211.46		138.77	241.59	762.89		438.21
C1		87.46	0.00		-541.26		0.00	0.00	0.00		0.00	105.73	0.00		0.00	381.45	120.79		-84.75
D2		-34.65	-52.81		203.77		133.72	203.77	-39.80		-26.12	-39.80	-136.29		-89.44	-155.71	-22.89		-13.15
Σ		-657.6	657.6		-2130.4		133.7	1996.7	-1832.7		-26.1	1858.9	-1717.8		49.3	1668.5	-340.3		340.3

5 FRAME

	A				B				C				D				E		
				3.32				3.32				3.32				3.66			
DF	0.45		0.55		0.36	0.29	0.36		0.42	0.15	0.42		0.41	0.15	0.45		0.75	0.25	
FEM			-155.59		155.59		-155.59		155.59		-155.59		155.59		-116.87		116.87		
D1	69.78		85.81		0.00	0.00	0.00		0.00	0.00	0.00		-15.72	-5.68	-17.32		-88.01	-28.86	
C1	63.42		0.00		42.90	0.00	0.00		0.00	0.00	-7.86		0.00	-5.47	-44.01		-8.66	-24.82	
D2	-28.44		-34.98		-15.25	-12.40	-15.25		3.33	1.20	3.33		20.08	7.26	22.14		25.21	8.27	
Σ	104.76		-104.76		183.24	-12.40	-170.84		158.92	1.20	-160.12		159.95	-3.89	-156.07		45.41	-45.41	
	2.70				2.70				1.20				1.20				1.20		
				3.32				3.32				3.32				3.66			
DF	0.26	0.33	0.41		0.29	0.18	0.24	0.29	0.33	0.21	0.12	0.33	0.32	0.20	0.12	0.36	0.53	0.30	0.17
FEM			-380.53		380.53			-380.53	380.53			-380.53	380.53			-287.06	287.06		
D1	97.72	126.84	155.97		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-30.25	-18.95	-10.93	-33.34	-151.39	-86.04	-49.64
C1	30.10	34.89	0.00		77.99	0.00	0.00	0.00	0.00	3.13	0.00	-15.12	0.00	-3.05	-2.84	-75.69	-16.67	-29.17	-14.43
D2	-16.69	-21.66	-26.64		-22.67	-14.20	-18.44	-22.67	4.01	2.52	1.45	4.01	26.40	16.54	9.54	29.10	31.79	18.06	10.42
Σ	111.13	140.07	-251.20		435.84	-14.20	-18.44	-403.20	384.54	5.64	1.45	-391.64	376.69	-5.46	-4.23	-366.99	150.79	-97.14	-53.64
	2.08				2.08				2.08				2.08				2.08		
				3.32				3.32				3.32				3.66			
DF	0.49	0.20	0.31		0.24	0.38	0.15	0.24	0.24	0.38	0.15	0.24	0.23	0.37	0.15	0.26	0.33	0.48	0.19
FEM			-308.26		308.26			-308.26	308.26			-350.27	350.27			-308.26	308.26		
D1	151.96	60.20	96.10		0.00	0.00	0.00	0.00	9.98	15.79	6.25	9.98	-9.75	-15.41	-6.11	-10.74	-102.66	-147.26	-58.34
C1	-355.21	48.86	0.00		48.05	0.00	0.00	4.99	0.00	0.00	0.00	-4.87	4.99	69.38	-9.47	-51.33	-5.37	219.10	-43.02
D2	151.02	59.83	95.50		-12.61	-19.93	-7.90	-12.61	1.16	1.83	0.73	1.16	-3.15	-4.98	-1.97	-3.47	-56.85	-81.55	-32.31
Σ	-52.23	168.89	-116.66		343.70	-19.93	-7.90	-315.87	319.40	17.62	6.98	-344.00	342.37	48.99	-17.55	-373.81	143.38	-9.71	-133.67
	5.25				5.25				5.25				5.25				5.25		
				8.00				8.00				8.00				9.14			
DF		0.40	0.60		0.38		0.25	0.38	0.38		0.25	0.38	0.36		0.23	0.41	0.64		0.36
FEM			1792.9		-1792.9			1792.9	-1792.9			1792.9	-1792.9			1201.1	-1201.1		
D1		-710.41	-1082.5		0.00		0.00	0.00	0.00		0.00	0.00	211.46		138.77	241.59	762.89		438.21
C1		75.98	0.00		-541.26		0.00	0.00	0.00		7.89	105.73	0.00		-7.71	381.45	120.79		-73.63
D2		-30.11	-45.87		203.77		133.72	203.77	-42.78		-28.07	-42.78	-133.54		-87.63	-152.57	-29.96		-17.21
Σ		-664.5	664.5		-2130.4		133.7	1996.7	-1835.7		-20.2	1855.9	-1715.0		43.4	1671.6	-347.4		347.4

Appendix B-13

Structure Calculation – Return Sludge Pump Building

CONTENTS

Contents end

Appendix

Frame bending moment analysis on Dead load and Live load

CALCULATION RECORD

1. General

1.1 Building character

(a) This is 1 storied building with basement reinforced concrete structure..
2 span on y-y direction, 6 bayes on x-x diretion.
Soil condition at site is generaly stiff.

(b) Structure element and finish specificaton.

b-1. Roof concrete slab is 15 cm thick. Top face pitch is 1/100 by slanted concrete slab.
b-2. 1st floor concrete slab's thickness is 18 cm.
b-3. Outside wall brick thickness is 59 cm including 10cm insuration.

1.2 Design principle.

(a) Ultimate stress Limit state design

Profiles of girder,column,and sub beam etc is calculated based on Snip
1.02.03-84 Reinforced concrete design.

(b) This calculation takes consideration of Dead Load, Live Load
Snow Load (Sn.L)..

Wind load (W.L) is 0.48 kN/m2 to meet with Astana city's instruction.
Refer D.L and L..L at Table-3.

(c.) No Earthquake load at Astana city. Astana city stays at NO EARTHQUAKE Z ONE.

Return Sludge Pump

1-3 Material and Allowable stress

TABLE - 1 Allowable Stress (Mpa)

Item		Allowable stress Rb	Rbt	
Concrete	B30	17	1.2	-------
Item		Allowable stress Rs	Rsc	Rw
Steel Bar	Class A1	225	225	175
	Class A3	365	365	290

1-4 Load Table

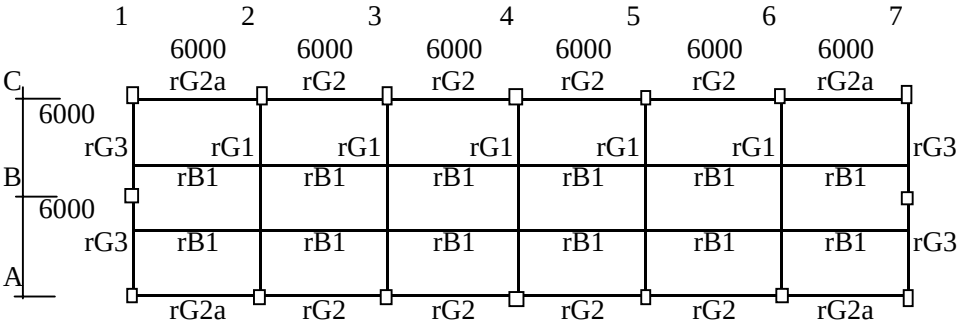
TABLE - 2 Dead Load

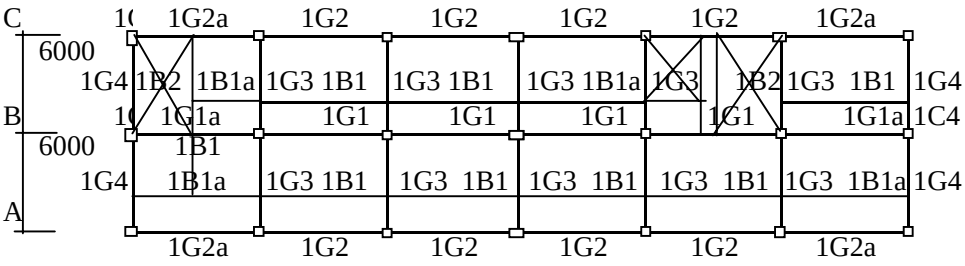
Loc.	item	thickness	kN/m2	total kN/m2
Roof	Mortar Concrete slab Ceiling	5cm 15cm	1.00 3.60 0.25	4.85
Electorical Monitor room	Tile + Mortar or free a Concrete slab Ceiling	5cm 18cm	1.00 4.50 0.25	5.75
Electorical room	Tile + Mortar or free a Concrete slab Ceiling	30cm 18cm	6.00 4.55 0.25	10.80
Machine room	Leveling motar Concrete slab Ceiling	5cm 18cm	1.16 4.55 0.25	5.96
Office room	Tile + Mortar Concrete slab Ceiling	5cm 15cm	1.00 3.75 0.25	5.00
Machine room Basement	Cinder con. Concrete slab	20cm 55cm	4.00 13.75	17.75
Stair	Cinder con. Concrete slab	20cm 27cm	4.00 6.75	10.75

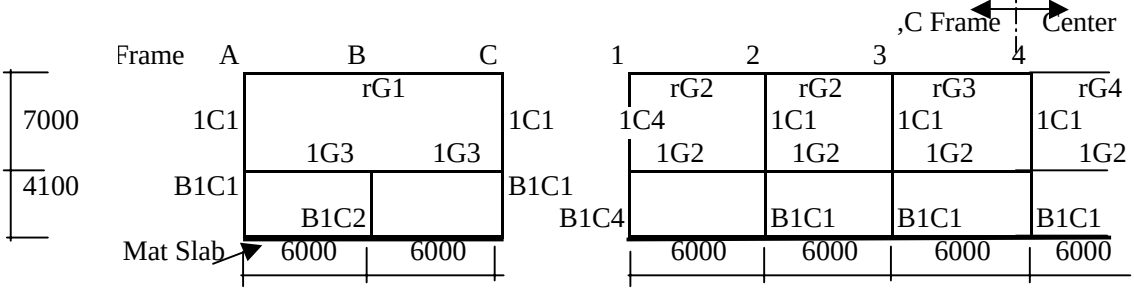
TABLE - 3 Live Load and Floor Load (kN/m2) (Girder, Sub beam : Self weight not included

Loc.	load type	slab	beam	girder	γf	girder*γf
Roof	Dead Load	4.85	4.85	4.85	1.1	5.34
	Live Load	1.00	1.00	1.00	1.2	1.20
	Total Load	5.85	5.85	5.85		6.54
Electorical room	Dead Load	10.80	10.80	10.80	1.1	11.87
	Live Load	4.00	4.00	3.50	1.2	4.20
	Total Load	14.80	14.80	14.30		16.07
Machin room	Dead Load	5.96	5.96	5.96	1.1	6.55
	Live Load	5.00	4.00	4.00	1.2	4.80
	Total Load	10.96	9.96	9.96		11.35
Office room	Dead Load	5.00	5.00	5.00	1.1	5.50
	Live Load	3.00	2.50	2.00	1.2	2.40
	Total Load	8.00	7.50	7.00		7.90
Storage	Dead Load	5.00	5.00	5.00	1.1	5.50
	Live Load	3.50	3.00	3.00	1.2	3.60
	Total Load	8.50	8.00	8.00		9.10
Basement Mechanical	Dead Load	17.75	17.75	17.75	1.1	19.53
	Live Load	4.00	4.00	3.00	1.2	3.60
	Total Load	21.75	21.75	20.75		23.13
Stair	Dead Load	10.75	10.75	10.75	1.1	11.83
	Live Load	3.00	2.50	2.50	1.2	3.00
	Total Load	13.75	13.25	13.25		14.83

1 - 5 Key plan and Frame Structure







2. PREPARATION

2 - 1 Members stiffness

(a) Table - 5 Girder Stiffness RETURN SLUDGE PUMP BUILDING

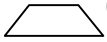
	Girder	b (cm)	D (cm)	B (cm)	t (cm)	B/b	t/D	ϕ	Io (x 10^5 cm4)	I (x 10^5 cm4)	*l* (x 10^2 cm)	K (x 10^3 cm3)	k K/Ko
Roof	G1	40	100	354	15	8.85	0.150	2.21	33.3	73.7	12.00	6.14	6.14
	G2	40	60	100	15	2.50	0.250	1.48	7.2	10.7	6.00	1.78	1.78
1F	G1	40	70	160	18	4.00	0.257	1.77	11.4	20.2	6.00	3.37	3.37
	G2	40	60	100	18	2.50	0.300	1.50	7.2	10.8	6.00	1.80	1.80
	G3	40	70	160	18	4.00	0.257	1.77	11.4	20.2	6.00	3.37	3.37
F	FG1	150	60					1.00	27.0	27.0	6.00	4.50	4.50

(b) Table - 6 Column Stiffness RETURN SLUDGE PUMP BUILDING

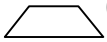
	Colmn ID		b	D	I (x 10^5 cm4)	*l* (x 10^2 cm)	K (x 10^3 cm3)	k K/Ko
1	C1	x,y	50	50	5.208	7.00	0.744	0.74
B1	C1,C2	x,y	50	50	5.208	4.10	1.270	1.27

2-2 Fixed end moment (Co),Center moment(Mo),Shear at end(Q)

Fixed end bending moment (Co)
Middle span bending moment (Mo)
Shear force (Q) at gierder ends

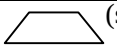
	Load form	 (slab load)		 (slab load)		(gider load)		Σ
		w	Co	w	Co	w/1	Co	
rG1	Co	70.00	457.45	0.00	0.00	9.50	114.00	571.45
			Mo	w	Mo	w/1	Mo	
	Mo	102.00	666.57	0.00	0.00	9.50	171.00	837.57
		w	Q	w	Q	w/1	Q(kN)	
	Q	28.50	186.25	0.00	0.00	9.50	57.00	243.25

Slab load 6.54 (kN/m2)
Span 12 (m) a= 1.75 (m)
Span 3= 1728 a3= 5.359

	Load form	 (slab load)		 (slab load)		(gider load)		Σ
		w	Co	w	Co	w/1	Co	
rG2	Co	0.00	0.00	4.80	31.37	6.00	18.00	49.37
			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	7.80	50.97	6.00	27.00	77.97
		w	Q	w	Q	w/1	Q(kN)	
	Q	0.00	0.00	4.00	26.14	6.00	18.00	44.14

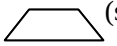
Slab load 6.54 (kN/m2)

4m 2m
Span 6 (m) lx=4m λ=1.5
Span 3= 216

	Load form	 (slab load)		 (slab load)		(gider load)		Σ
		p	28.00	w	Co	w/1	Co	65.61
rG3	Co	63.00	56.00	0.00	0.00	12.54	37.61	93.61
		p	Mo	w	Mo	w/1	Mo	
	Mo	63.00	84.00	0.00	0.00	12.54	56.41	140.41
		p	21.00	w	Q	w/1	Q(kN)	58.61
	Q	63.00	42.00	0.00	0.00	12.54	37.61	79.61

P= 22.5*2+18

Slab load 6.54 (kN/m2)
Span 6 (m) lx=4m λ=1.5
Span 3= 216

	Load form	 (slab load)		 (slab load)		 (gider load) P=10kN		Σ
		w	Co	Co/w	Co	w/1	Co	
1G1	Co	0.00	0.00	5.00	56.75	7.50	35.83	92.59
		w	Mo	Mo/w	Mo	w/1	Mo	
	Mo	0.00	0.00	7.80	88.53	7.50	53.75	142.28
		w	Q	Q/w	Q	w/1	Q(kN)	
	Q	0.00	0.00	4.00	45.40	7.50	32.50	77.90

Slab load 11.35 (kN/m2)
Span 6 (m) lx=4m l=1.5

	Load form	(slab load)			(slab load)		(gider load)+ wall	Σ
		w	Co	Co/w	Co	w/1	Co	
1G2	Co	0.00	0.00	5.00	56.75	7.50	22.50	79.25
			Mo	Mo/w	Mo	w/1	Mo	
	Mo	0.00	0.00	7.80	88.53	7.50	33.75	122.28
		w	Q	Q/w	Q	w/1	Q(kN)	
	Q	0.00	0.00	4.00	45.40	7.50	22.50	67.90
				Slab load	11.35	(kN/m2)		
				Span	6	(m)		

4m 2m

	Load form	80kn (slab load)			(slab load)		(gider load)+ wall	S
		w	35.56	Co/w	Co	w/1	Co	92.11
1G3	Co	80.00	142.22	0.00	0.00	18.85	56.55	198.77
			Mo	Mo/w	Mo	w/1	Mo	
3 Frame	Mo	80.00	106.67	0.00	0.00	18.85	84.83	191.49
		w	26.67	Q/w	Q	w/1	Q(kN)	83.22
	Q	80.00	53.33	0.00	0.00	18.85	56.55	109.88
				Slab load	11.35	(kN/m2)		
				Span	6	(m)		

4m 2m

	Load form	40kN (slab load)			(slab load)		(gider load)+ wall	S
		w	17.78	Co/w	Co	w/1	Co	74.33
1G3	Co	40.00	71.11	0.00	0.00	18.85	56.55	127.66
			Mo	Mo/w	Mo	w/1	Mo	
1 Frame	Mo	40.00	53.33	0.00	0.00	18.85	84.83	138.16
		w	13.33	Q/w	Q	w/1	Q(kN)	69.88
	Q	40.00	26.67	0.00	0.00	18.85	56.55	83.22
				Slab load	11.35	(kN/m2)		
				Span	6	(m)		

	Load form	(slab load)			(slab load)		(gider load)+ wall	S
		w	Co	Co/w	Co	w/1	Co	
FG1	Co	11.20	624.57	0.00	0.00	0.00	0.00	624.57
			Mo	Mo/w	Mo	w/1	Mo	
use for frame	Mo	19.00	1059.53	0.00	0.00	0.00	0.00	1059.53
analysis		w	Q	Q/w	Q	w/1	Q(kN)	
	Q	9.00	501.88	0.00	0.00	0.00	0.00	501.88
				Slab load	55.76	(kN/m2)		
				Span	6	(m)		

Base Slab profile: Designed as Flat Slab Frame

2.3 Building Weight and Column Axial force

Table-8 Return Sludge Building Weight

Story	Load type	Unit w (kN/n	width /hi (m) or ur	Length (m)	Area or (m2), (m	Weight (kN)	Small Total (kN)	S Wi (kN)
	Roof slab	6.54	36.6	12.60	461.16	3013.7		
	Sub beam	4.50	12	6.00	72.00	324.0		
	Girder 12r	10.00	5	12.00	60.00	600.0		
	Girder 6m	6.00	22	6.00	132.00	792.0		
1st Story	Col. 7m	9.00	16	7.00	112.00	1008.0		
	machine	######	1	1.00	1.00	150.0		
	Crane girde	4.88	12	6.00	72.00	351.0		
	Wall.1 7n	8.82	7.5	96.00	720.00	6350.4		
							12589.08	12589.08
	1F slab							
	Machine rn	11.4	12.6	36.60	461.16	5234.4		
B1story	Girder 6m	7.0	16	6.00	96.00	672.0		
	Col. 4.1m	3.0	10	5.50	55.00	165.0		
	Col. 4.1m	9.0	5	5.50	27.50	247.5		
	Machine 2	25.0	3	1.30	3.90	97.5		
	Machine 3	30.0	3	1.30	3.90	117.0		
	Wall.1 0.4	10.0	5.5	96.00	528.00	5280.0		
	Water pipe	874.0	1	1.00	1.00	874.0		
	Machine	80.0	5	1.00	5.00	400.0		
	Machine	20.0	2	1.00	2.00	40.0		
							13127.40	25716.48
Foundation								
	Base cocret	23.13	12.6	36.60	461.16	10664.3		
	(Reaction cancel effect)							
								(kN)
							10664.33	36380.80
	Base Area		**461.16 (m2)**			**Total W=**		**36,380.80**

soil reaction =W/(Base area)=	**78.890**	(kN/m2)	
Base concrete w/basearea=	23.13	(kN/m2)	(kN/m2)
Foundation's Design force=78.89-23.1	**55.765**	(kN/m2)	

)

Column Axial Force

Story	Load type	Unit w (kg/m	width /hi (m) or	Length (m)	Area or (m2), (m	Weight (kN)	Small Tota (kN)	S Wi (kN)
	Rb roof slab	6.54	6.00	6.00	36.00	235.26		
	Sub beam	4.50	1.00	6.00	6.00	27.00		
1C1	Girder 12r	9.50	1.00	6.00	6.00	57.00		
	Girder 6m	6.00	1.50	6.00	9.00	54.00		
A-Frame 3	Crane W	100.00	1.00	1.00	1.00	100.00		
	Wall.2 7r	0.39	7.00	6.00	42.00	16.46		
	Col. 9m	9.00	7.00	1.00	7.00	63.00	552.72	552.72
	Wall 50cm	1.00	4.00	6.00	24.00	24.00		
BC1								
	1FL slab	11.35	6.00	6.00	36.00	408.62		
	Girder 6m	6.00	0.50	6.00	3.00	18.00		
	Col. 4m	1.50	1.00	4.00	4.00	6.00	456.62	1009.34
	Base Slab	23.13	6.00	3.30	19.80	457.88		
Mat slab	Machine	80.00	1.00	1.00	1.00	80.00		
	Water	120.00	1.00	1.00	1.00	120.00		
							657.88	1667.22
	Foundation						reaction	46.312
	Base design force=(211.77-baseSlab)/1				33.59	kN/m2	of soil	(kN/m2)

Column Axial Force

Story	Load type	Unit w (kg/m	width /hi (m) or	Length (m)	Area or (m2), (m	Weight (kN)	Small Tota (kN)	S Wi (kN)
	Wall 50cm	12.50	0.00	6.00	0.00	0.00		
BC2	Machine	60.00	1.00	1.00	1.00	60.00		
	1FL slab	11.35	6.00	6.00	36.00	408.62		
B-Frame 3	Sub-beam	6.13	1.00	6.00	6.00	36.75		
	Girder 6m	7.00	2.00	6.00	12.00	84.00		
	Col. 4m	9.00	1.00	4.00	4.00	36.00	625.37	625.37
	Base Slab	23.13	6.00	6.00	36.00	832.50		
Mat slab	Machine	50.00	2.00	1.00	2.00	100.00		
	Water	18.00	2.00	1.00	2.00	36.00		
							968.50	1593.87
	Foundation				21.15	t/m2	reaction	44.274
	Base design force=(139.86-Base.slab)/36=						of soil	(kN/m2)

Story	Load type	Unit w (kg/m	width /hi (m) or	Length (m)	Area or (m2), (m	Weight (kN)	Small Tota (kN)	S Wi (kN)
	Rb roof slat	6.54	3.30	6.00	19.80	129.39		
	Sub beam	4.50	1.00	6.00	6.00	27.00		
1C3	Girder 6m	6.00	0.50	6.00	3.00	18.00		
B-Frame 1	Wall.2 7r	8.82	7.00	6.00	42.00	370.44		
	Col. 9m	6.25	7.00	1.00	7.00	43.75	588.58	588.58
	Wall 40cm	10.00	4.00	6.00	24.00	240.00		
BC3								
	1FL slab	11.35	3.00	6.00	18.00	204.31		
	Girder 6m	6.00	0.50	6.00	3.00	18.00		
	Col. 4m	1.25	1.00	4.00	4.00	5.00	467.31	1055.89
	Base Slab	23.13	3.30	6.00	19.80	457.88		
Mat slab	Machine	0.00	0.00	1.00	0.00	0.00		
	Water	60.00	6.00	1.00	6.00	360.00		
							817.88	1873.77
	Foundation				65.33	kN./m2	reaction	104.098
	Base design force=(151.21-wall.2-baseSlab)/18=						of soil	(kN/m2)

Story	Load type	Unit w (kg/m	width /hi (m) or	Length (m)	Area or (m2), (m	Weight (kN)	Small Tota (kN)	S Wi (kN)
	Rb roof slat	6.54	3.30	3.30	10.89	71.17		
	Sub beam	4.50	1.00	6.00	6.00	27.00		
1C4	Girder 12r	0.00	1.00	6.00	6.00	0.00		
	Girder 6m	6.00	1.00	6.00	6.00	36.00		
A-Frame 1	Crane W	80.00	1.00	1.00	1.00	80.00		
	Wall.2 7m	8.82	7.00	6.00	42.00	370.44		
	Col. 9m	9.00	7.00	1.00	7.00	63.00	647.61	647.61
	Wall 40cm	10.00	4.00	6.00	24.00	240.00		
BC4								
	1FL slab	11.35	3.30	3.30	10.89	123.61		
	Girder 6m	7.00	0.50	6.00	3.00	21.00		
	Sub-beam	6.13	1.00	6.00	6.00	36.75		
	Col. 4m	0.25	1.00	4.00	4.00	1.00	422.36	1069.96
	Base Slab	23.13	3.30	3.30	10.89	251.83		
Mat slab	Machine	80.00	1.00	1.00	1.00	80.00		
	Water	60.00	1.00	1.00	1.00	60.00		
							391.83	1461.79
	Foundation				56.76	kN./m2	reaction	138.395
	Base design force=(150.21-Base.slab-wall)/9=						of soil	(kN/m2)

3 Girder and Column Profile Design

3-1Girder Profile Design top roof

Girder ID	rG1			rG2			rG3 1,7Frame		
Position	A end	Mid	C end	2 end	Mid	3 end	Out end	Mid	In end
D.L] M(tm) top	94.57		94.57	59.59		49.37	24.39		116.78
+] bott.		743			23.49			69.83	
L.L] Q (t)	243.25		243.25	44.14		44.14	58.61		90.34
] b x D (mm)	400	x	1000	400	x	600	400	x	600
Size] ho (mm)	950	950	950	550	550	550	550	550	550
$z= Rb.b.ho^2 (x 10^6)$		6137			2057			2057	
α_m (top)=M/z	0.0154		0.0154	0.0290		0.0240	0.0119		0.0568
α_m(bott.)		0.1211			0.0114			0.0339	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	645.2		645.2	139.1		139.1	139.1		139.1
Bott.MuS=Rsc.A's.(ho-a')=		967.8			139.1			139.1	
Top Mu=Rs.As(ho-0.5ξho)=	643.2		643.2	147.3		147.3	147.3		193.9
Bot Mu=Rs.As(ho-0.5ξho)=		1210.9			147.3			147.3	
top	0.517		0.517	0.346		0.346	0.346		0.462
Pt (%) bott.		1.034			0.346			0.346	
top	1964		1964	762		762	762		1016
as (mm2) bott.		3928			762			762	
Main top	4	6	4	3	3	3	3	3	4
Bars		D25			D18			D18	
bott	4	8	4	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	273.6 (kN)		273.6	158.4 (kN)		158.4	158.4 (kN)		158.4
(kN)	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

ψb3= 0.6 by Table.21of Snip 2.03.01-84

Girder Profile Design

Girder ID	1G1a B-Frame			1G1		
Position	out end	Mid	in end	end	Mid	end
D.L] M(tm) top	31.35		105.25	100.34		92.59
+] bott.		55.98			45.82	
L.L] Q (t)	77.9		90.22	77.90		77.90
] b x D (mm)	400	x	750	400	x	750
Size] ho (mm)	700	700	700	700	700	700
		3332			3332	
α_m (top)=M/z	0.0094		0.0316	0.0301		0.0278
α_m(bott.)		0.0168			0.0138	
α_r = 0.395	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	180.8		180.8	180.8		180.8
Bott.MuS=Rsc.A's.(ho-a')=		180.8			180.8	
Top Mu=Rs.As(ho-0.5ξho)=	189.0		249.5	189.0		366.6
Bot Mu=Rs.As(ho-0.5ξho)=		249.5			249.5	
top	0.272		0.363	0.272		0.544
Pt (%) bott.		0.363			0.363	
top	762		1016	762		1524
as (mm2) bott.		1016			1016	
Main top	3	3	4	3	3	6
		D18			D18	
bott	3	4	3	3	4	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6
(kN)	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok

ψb3= 0.6 by Table.21 of Snip 2.03.01-84

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D25 As 491 mm2
D22 As 380 mm2
D18 As 254 mm2

Force at 1G4 : set as 1/2 of 1G3

Girder ID	with wall 1G2 A,C-Frame			1G3 3-Frame			with wall 1G4 1,7-Frame		
Position	2 end	Mid	3 end	A end	Mid	B end	A end	Mid	B end
D.L] M(tm) top	79.25		79.25	10.79		227.97	5.40		114.00
+] bott.		43.03			72.11			36.1	
L.L] Q (t)	67.9		67.9	83.22		101.64	41.70		50.82
] b x D (mm)	400	x	600	400	x	700	400	x	600
Size] ho (mm)	550	550	550	650	650	650	550	550	550
z= Rb.b.ho^2 (x 10^5)		2057			2873			2057	
α_m (top)=M/z	0.0385		0.0385	0.0038		0.0793	0.0026		0.0554
α_m(bott.)		0.0209			0.0251			0.0175	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	139.1		139.1	166.9		166.9	139.1		139.1
Bott.MuS=Rsc.A's.(ho-a')=		139.1			166.9			139.1	
Top Mu=Rs.As(ho-0.5ξho)=	147.3		147.3	175.1		338.8	147.3		147.3
Bot Mu=Rs.As(ho-0.5ξho)=		147.3			230.9			147.3	
Pt (%) top	0.346		0.346	0.293		0.586	0.346		0.346
Pt (%) bott.		0.346			0.391			0.346	
as (mm2) top	762		762	762		1524	762		762
as (mm2) bott.		762			1016			762	
Main top	3	3	3	3	3	6	3	3	3
		D18			D18			D18	
bott	3	3	3	3	4	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	158.4 (kN)		158.4	187.2 (kN)		187.2	158.4 (kN)		158.4
(kN)	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

ψb3= 0.6 by Table Snip 2.03.01-84

3 - 2 Column Profile Design **2 FL**

	Column ID	crane	1C1 A-frame-3			B1C1	Exterior wall		
	Direction	X		Y		X with wall		Y	
	Posission	T	B	T	B	T	B	T	B
LT	N (t)		552.72		552.72		1009.34		1009.34
LT	M(tm)	0	0	94.5	201.19	0	0	37.98	128.95
LT	Q(t)		0.04		2.02		0.1		3.51
Size	h x h (mm)	500	500	500	500	600	600	600	600
Size	lo (mm) Col. Height	8250	8250	8250	8250	5500	5500	5500	5500
	eo=M/Nn (mm)	0.00	0.00	170.97	364.00	0.00	0.00	37.63	127.76
	δe=(M/N)/h	0.00	0.00	0.34	0.73	0.00	0.00	0.06	0.21
	δe,min=0.5-0.01lo/h-0.01Rb		**0.165**		**0.165**		**0.238**		**0.238**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		16.5		16.5		9.2		9.2
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	4097	4097	2775	1852	15775	15775	15775	15775
	η=1/(1–N/Ncr)	1.156	1.156	1.249	1.425	1.068	1.068	1.068	1.068
	Rb.Ab (kN)=	4053.5	4053.5	4037.7	4007.7	5902.1	5902.1	5902.1	5902.1
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)		2540				2540		
	Min.Gross As %		1.02				0.71		
	Main Bars		4	Y			4-D20		
	arrangement	D18	3  4	3	I Y	ok	2-D20,1D18 D18  4-D20	2-D20,1-D1 use this profile	X - X
	ψb3=0.6		(kN)		(kN)		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		162		162		237.6		237.6
	judge		ok		ok		ok		ok
	Pw (%)		0.302				0.377		
	hoop		D12 - @150				D12 - @100		

	Column ID	B1C2 B-Frame 3			
	Direction	X		Y	
	Posission	T	B	T	B
LT	N (t)		625.37		625.37
LT	M(tm)	4.91	34.16	0	0
LT	Q(t)		0		0
Size	h x h (mm)	600	600	600	600
Size	lo (mm) Col. Height	5500	5500	5500	5500
	eo=M/Nn (mm)	7.85	54.62	0.00	0.00
	δe=(M/N)/h	0.01	0.09	0.00	0.00
	δe,min=0.5-0.01lo/h-0.01Rb		**0.238**		**0.238**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0
	lo/h=		9.2		9.2
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0
	Ncr=	15775	15775	15775	15775
	η=1/(1–N/Ncr)	1.041	1.041	1.041	1.041
	Rb.Ab (kN)=		5907.6		5907.6
			> N ok		> N ok
	Gross As (mm2)		3048		
	Min.Gross As %		0.85		
	Main Bars		4		
	arrangement	D18	3  4	3	X - X min 0.8% x60x60
	ψb3=0.6		(kN)		(kN)
	Qbmin=ψb3.Rbt.b.ho=		237.6		237.6
	judge		ok		ok
	Pw (%)		0.377		
	hoop		D12 - @100		

Rs=Rsc=	365	Mpa
Rb=	17	Mpa
Rbt=	1.2	Mpa
D25 As	491	mm2
D22 As	380	mm2
D18 As	254	mm2
D12, As=	113.1	mm2
Eb=	32,500	Mpa

$$Ncr=0.533\frac{Eb.A[0.11/(0.1+\delta e)+0.1]}{\psi 1(lo/h)^2}$$

Column ID		1C3 B-Frame 1				B1C3			
Direction		X		Y		X		Y with wall	
Posission		T	B	T	B	T	B	T	B
LT	N (t)		588.58		588.58		1055.89		1055.89
	M(tm)	0	0	0	0	31.35	366.57	0	0
	Q(t)		0.05		0.45		1.14		0.09
Size	h x h (mm)	500	500	500	500	600	600	600	600
	lo (mm) Col. Height	8250	8250	8250	8250	5500	5500	5500	5500
eo=M/Nn (mm)		0.00	0.00	0.00	0.00	29.69	347.17	0.00	0.00
δe=(M/N)/h		0.00	0.00	0.00	0.00	0.05	0.58	0.00	0.00
δe,min=0.5-0.01lo/h-0.01Rb			**0.165**		**0.165**		**0.396**		**0.396**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		16.5		16.5		9.2		9.2
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	4097	4097	4097	4097	11935	9726	11935	11935
	η=1/(1−N/Ncr)	1.168	1.168	1.168	1.168	1.097	1.122	1.097	1.097
	Rb.Ab (kN)=		4051.478		4051.478		5891.155		5896.200
			> N ok		> N ok		> N ok		> N ok
	Gross As (mm2)		2540				2540		
	Gross As %		1.02				0.71		
	Main Bars		3	Y			2-D20,1-D18		
	D22	4		4	X - X	4-D2(		4-D20	X - X
	arrangement			Y					
		D18	3			D18	)20,1-D18		
	ψb3=0.6		(kN)		(kN)		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			162		162		237.6		237.6
	judge		ok		ok		ok		ok
	Pw (%)		0.302				0.251		
	hoop		D12 - @150				D12 - @100		

D.L]	M(	0		9.6	9.6		7.68
+]	bott.		7.01			3.17	
L.L]	Q (	6.4	6.4	8	6.72	6.4	6.4
]	M(tm)						
E.T]	Q(t) x2						
]	M(	0		9.6	9.6		7.68
S.T]	b	0		9.6	9.6		7.68
]	Q (	6.4		8	6.72		6.4
] b x]		40	x	70	40	x	70
Size]	d (cm)			65			65
]	j(cm)			56.875			56.875
]	bD² (x 10⁻)		1.69			1.69	
C	LT.	0	4.148	5.6805	5.6805	1.8757	4.5444
(kg/cm2)							
	t	0.3		0.4	0.4		0.4
Pt (%)	bott.		0.4			0.3	
		7.8		10.4	10.4		10.4
at (cm2)	bott.		10.4			7.8	
Main		4	2	5	5	2	5
Bars			D18			D18	
		3	4	3	3	4	3
ϕ (cm)		28		35	35		35
Q /fa.j	(c	6.94614		8.6827	7.2934		6.9461
judge		ok		ok	ok		ok
fs.bj	LT	17.5175		17.518	17.518		17.518
(t)		D10-150	D10-15	D10-150	D10-150	D10-150	D10-150
judge		ok		ok	ok		ok

4. Sub-Beam and Slab

4-1. Sub-Beam

	Load form	(slab load)		(slab loa		(gider loa		Σ
		w	Co	w	Co	w/1	Co	
rB1	Co	0.00	0.00	10.00	65.35	4.50	13.50	78.85
			Mo	w	Mo	w/1	Mo	
bxD 30x6	Mo	0.00	0.00	15.50	101.29	4.50	20.25	121.54
		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	8.00	52.28	4.50	13.50	65.78

Slab load 6.54 (kN/m2)
Span 6 (m) lx=4m λ=1.5

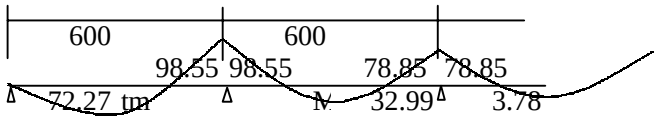
	Load form	(slab load)		(slab loa		p p (gider loa P=15kN		Σ
		w	Co	Co/w	Co	w/1	Co	
1B1	Co	0.00	0.00	5.00	56.75	5.25	35.75	92.50
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x70	Mo	0.00	0.00	7.80	88.53	5.25	53.63	142.16
		w	Q	Q/w	Q	w/1	Q	
	Q	0.00	0.00	4.00	45.40	5.25	30.75	76.15

Slab load 11.35 (kN/m2)
Span 6 (m) lx=4m l=1.5

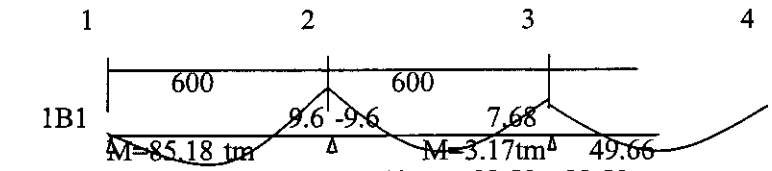
	Load form	(slab load)		(slab loa		(gider loa		Σ
		w	Co	Co/w	Co	w/1	Co	
1B2	Co	5.30	60.16	0.00	0.00	5.25	15.75	75.91
		w	Mo	Mo/w	Mo	w/1	Mo	
bxD 30x70	Mo	9.00	102.15	0.00	0.00	5.25	23.63	125.78
		w	Q	Q/w	Q	w/1	Q	
	Q	4.20	47.67	0.00	0.00	5.25	15.75	63.42

Slab load 11.35 (kN/m2)
lx-4m Span 6 (m) lx=4m l=1.5

1 2 3 4



FEM	-78.85	78.85	-78.85	78.85	-78.85
D1	78.85	0.00	0.00	0.00	0.00
C1	0.00	39.40	0.00	0.00	0.00
D2	0.00	-19.70	-19.70	0.00	0.00
total	0.00	98.55	-98.55	78.85	-78.85



	-92.50	92.50	-92.50	92.50	-92.50
D1	85.85	0.00	0.00	0.00	0.00
C1	0.00	42.92	0.00	0.00	0.00
D2	0.00	-21.46	-21.46	0.00	0.00
total	0.00	113.96	-113.96	92.50	-92.50

4.2 Sub beam Profile

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D18 As 254 mm2

Sub-beam Profile Design Roof Floor

Sub-beam ID		rB1a			rB1			
Position		out end	Mid	in end	2 end	Mid	3 end	
D.L] M(tm)	top	0.00		98.55	78.85		78.85	
+]	bott.		72.3			42.69		
L.L] Q (t)		65.78		88.73	65.78		65.78	
] b x D (cm)		300	x	600	300	x	600	
Size] ho (mm)		550	550	550	550	550	550	
$z= Rb.b.ho^2 (x 10^5)$			1542.75			1542.75		
a_m (top)=M/z		0.0000		0.0639	0.0511		0.0511	
a_m(bott.)			0.0468			0.0277		
α_r = 0.395		>	>	>	>	>	>	
Top Mus=Rsc.A's.(ho-a')=		153.0		153.0	153.0		153.0	
Bott.MuS=Rsc.A's.(ho-a')=			153.0			153.0		
Top Mu=Rs.As(ho-0.5ξho)=		**145.4**		**190.5**	**190.5**		**190.5**	> Moment ok
Bot Mu=Rs.As(ho-0.5ξho)=			**102.2**			**102.2**		> Moment ok
Pt (%)	top	0.462		0.616	0.616		0.616	
	bott.		0.462			0.462		
as (mm2)	top	762		1016	1016		1016	
	bott.		762			762		
Main D22	top	3	3	4	4	3	4	
	bott	3	3	3	3	3	3	
Qbmin=ψb3.Rbt.b.ho=		118.8 (kN)		118.8	118.8 (kN)		118.8	
Stirrup		D10-150		D10-150	D10-150		D10-150	
judge		ok		ok	ok		ok	

Sub-beam Profile Design 1st Floor

Girder ID	1B1a	1B1

Position		Out end	Mid	In end	2 end	Mid	3 end	
D.L] M(tm)	top	0.00		113.96	92.50		92.50	
+]	bott.		85.2			49.66		
L.L] Q (t)		76.15		95.14	76.15		76.15	
] b x D (cm)		400	x	700	400	x	700	
Size] ho (mm)		650	650	650	650	650	650	
z= Rb.b.ho^2 (x 10^5)			2873			2873		
a_m (top)=M/z		0.0000		0.0397	0.0322		0.0322	
a_m(bott.)			0.0296			0.0173		
α_r = 0.395		>	>	>	>	>	>	
Top Mus=Rsc.A's.(ho-a')=		166.9		166.9	166.9		166.9	
Bott.MuS=Rsc.A's.(ho-a')=			166.878			166.878		
Top Mu=Rs.As(ho-0.5ξho)=		**230.9**		**285.5**	**285.5**		**285.5**	> Moment ok
Bot Mu=Rs.As(ho-0.5ξho)=			**230.9**			**173.4**		> Moment ok
Pt (%)	top	0.391		0.488	0.488		0.488	
	bott.		0.391			0.391		
as (mm2)	top	1016		1270	1270		1270	
	bott.		1016			1016		
Main D22	top	4	3	5	5	3	5	
	bott	3	4	3	3	4	3	
Qbmin=ψb3.Rbt.b.ho=		187.2 (kN)		187.2	187.2 (kN)		187.2	
Stirrup		D10-150		D10-150	D10-150		D10-150	
judge		ok		ok			ok	

Girder ID		1B2		
Position		B end	Mid	C end
D.L] M(tm)	top	113.96		92.50
+]	bott.		125.8	
L.L] Q (t)		63.42		63.42
] b x D (cm)		300	x	700
Size] ho (mm)		650	650	650
z= Rb.b.ho^2 (x 10^5)			2154.75	
a_m (top)=M/z		0.0529		0.0429
a_m(bott.)			0.0584	
α_r = 0.395		>	>	>
Top Mus=Rsc.A's.(ho-a')=		111.3		111.3
Bott.MuS=Rsc.A's.(ho-a')=			111.3	
Top Mu=Rs.As(ho-0.5ξho)=		**173.2**		**173.2**
Bot Mu=Rs.As(ho-0.5ξho)=			**227.6**	
Pt (%)	top	0.391		0.391
	bott.		0.521	
as (mm2)	top	762		762
	bott.		1016	
Main D22	top	3	2	3
	bott	2	4	2
Qbmin=ψb3.Rbt.b.ho=		140.4 (kN)		140.4
Stirrup		D12-150		D12-150
judge		ok		ok

> Moment. ok
> Moment ok

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D18 As 254 mm2

4-2. Slab

w= 6.54 kN/m2

rS1 lx ly — lx= 3.7 m, ly= 5.6 m, thick= 150 mm, ho= 115

kN.m

	a	wlx2	M
Mx1=	0.071	89.533	6.3568
Mx2=	0.047	89.533	4.208
My1=	0.042	89.533	3.7604
My2=	0.028	89.533	2.5069
		wlx	Q
Qx =	0.52	24.198	12.583
Qy =	0.46	24.198	11.131

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D10 As 78 mm2

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10	200	5	390	8.37	0.0558	15.774	> Mx1 ok
Mux2	D10	200	5	390	8.37	0.0558	15.774	> Mx2 ok
Muy1	D10	250	4	312	6.70	0.0447	12.715	> My1 ok
Muy2	D10	250	4	312	6.70	0.0447	12.715	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok

1S1 lx ly

	a	wlx2	M
Mx1=	0.079	91.49	7.2277
Mx2=	0.053	91.49	4.8489
My1=	0.042	91.49	3.8426
My2=	0.028	91.49	2.5617
		wlx	Q
Qx =	0.52	33.885	17.62
Qy =	0.46	33.885	15.587

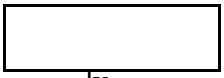
w= 12.55 kN/m2, lx= 2.7 m, ly= 5.6 m, thick= 180 mm, ho= 145

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10	200	5	390	8.37	0.0558	15.774	> Mx1 ok
Mux2	D10	200	5	390	8.37	0.0558	15.774	> Mx2 ok
Muy1	D10	250	4	312	6.70	0.0447	12.715	> My1 ok
Muy2	D10	250	4	312	6.70	0.0447	12.715	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

1S2



	a	wlx2	M					
Mx1=	0.079	171.81	13.573	w=	12.55	t/m2		
Mx2=	0.053	171.81	9.1059	lx=	3.7	m	thick=	180 mm
				ly=	4.6	m	ho=	145
My1=	0.042	171.81	7.216					
My2=	0.028	171.81	4.8107					
		wlx	Q					
Qx =	0.52	46.435	24.146					
Qy =	0.46	46.435	21.36					

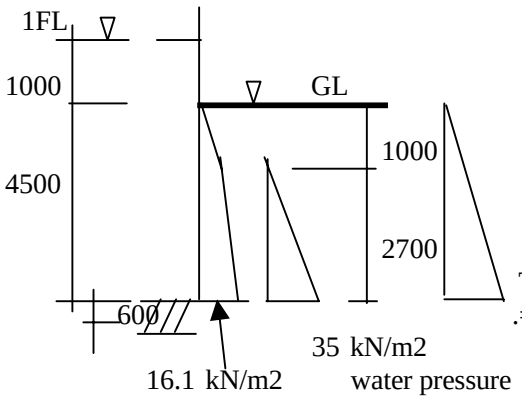
Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10	150	6.67	520.26	11.17	0.0745	20.777	> Mx1 ok
Mux2	D10	200	5	390	8.37	0.0558	15.774	> Mx2 ok
Muy1	D10	250	4	312	6.70	0.0447	12.715	> My1 ok
Muy2	D10	250	4	312	6.70	0.0447	12.715	> My2 ok

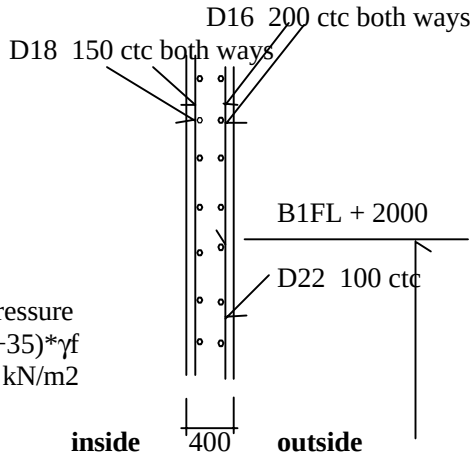
Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

5. FOUNDATION and BASEMENT WALL

5.1 Wall Load Condition



Total pressure
.=(16.1+35)*γf
61.32 kN/m2

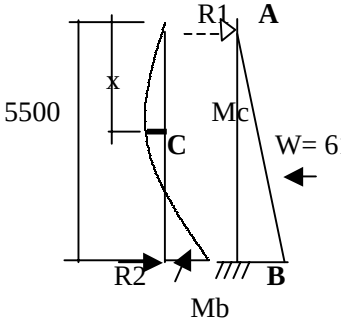


Soil pressure=(16x1+06x2.7)xk

Soil weight	16	kN/m2
Soil weight inwater	6	kN/m3
k=0.5		
γf =	1.2	

Bending moment and Reaction forces

Load condition



for unit width

	M(kN.m)
Mb=2/15 xW x L =	123.66
Mc=0.06 W x L=	55.65

x= 0.4474 L= 2.46 m

	R (kN)
R1=1/5 W	33.73
R2=4/5 W	134.90

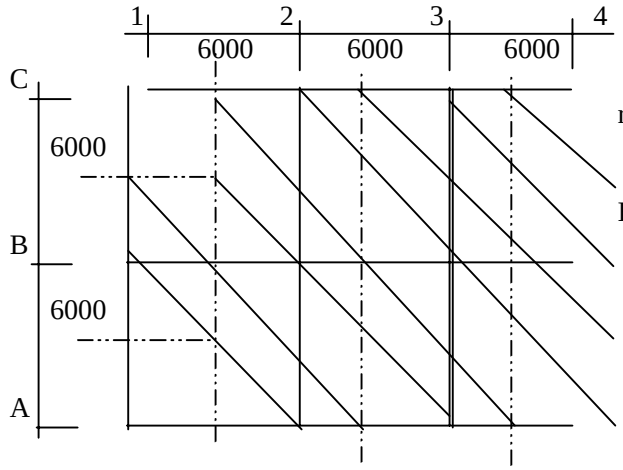
when Crack width 0.2mm, Rs shall be under 130 Mpa

Wall reinforcement wall thickness 40 cm

Wall thickness	h :	400.0	mm	ΣAs=	Wall bott. D22,	
	ho :	320.0	mm	3800.0	**D22 @100**	380
	b:	1000.0	mm	1693.3	D18 @200	254
Re bar	Rs :	365.0	N/mm2			(mm2)
	Rscr	130.0				
Concrete	Rb :	17.0	N/mm2			
x=(ΣAs.Rs-0.5*Σas*Rsc)/(Rb. b) =				40.79	mm	
ξ=x/h0=		0.127482	< 0.582	ok		
Ultimate Bending.moment= (Rbxbx(ho-0.5x)+ΣAsRsc*(ho-60)*0.5)/10				246.80	kN.m	
Crack moment =0.8*ΣRs.Rscr*ho=				**126.464**	kN.m >**Mb**	ok
Crack moment =0.8*ΣRs.Rscr*ho=				**56.353**	kN.m >**Mc**	ok

58.1152

5.2 FOUNDATION



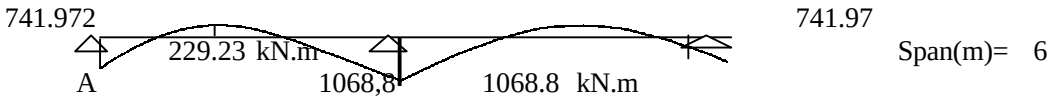
refer 2.3 Building weight
55.765 kN/m2

Base slab thickness 600 mm.

Base Slab is analysed as FLAT SLAB STRUCTURES.

FRAME-3 w/1 = 4.01x6= 334.588566 kN/m for 6m wide.

	(kN.m)		(kN.m)		(kN)	
FEM Co=	1003.8	Center Mc=	1505.6	Sheear Q=	1003.8	Midd zone



DF		1	0.5	0.5	1
FEM	-741.972	1003.8	-1003.8	1003.8	-1003.1
D1		-261.8	0	0	0
C1		0.0	-131	0	0
D2		0.0	66	65	0
Total M		742.0	-1068.8	1068.8	-1003.1

FRAME-3 1st span Design forces (kN.m) 2nd span

		A-end	mid	B-end	B-end	mid	C-end
Col. Line	0.55		126.08			126.08	
	Bot. 0.75	556.48		801.60	801.60		556.48
Mid. Line	0.45		103.15			103.15	
	Bot. 0.25	185.49		267.20	267.20		185.49
	Total M	741.97	229.23	1068.80	1068.80	229.23	741.97

Ultimate Bending Moment Capacity of Mat slab (kN.m) (value per 3.0m width.)

Ultimate Bending Moments are greater than design moments.

Table. Ultimate Bending moment (kN.m)

		A-end	mid	B-end	B-end	mid	C-end
	Top		1070.87			1070.87	
Col.line	Bot	1957.90		2507.82	2507.82		1957.90
	Top		1070.87			1070.87	
Mid.line	Bot	1324.47		1324.47	1324.47		1324.47
	no's of bar		12			12	
Col. Line	At top	30		30	30		30
			12			12	
Mid. Line	At bott	15		15	15		15

x=ΣAs x 365/(Rb x B) comp. Z one height

When crackwidth < 0.2 mm,σ tw has to be under 125 Mpa

Crack bending moment are shown in the table below.

Table. Crack Bending moment (kN.m)

		A-end	mid	B-end	B-end	mid	C-end
	Top		351.62			351.62	
Col.line	Bot	668.27		879.06	879.06		668.27
	Top		351.62			351.62	
Mid.line	Bot	439.53		439.53	439.53		439.53
	no's of bar		12			12	
Col. Line	At top	30		30	30		30
			12			12	
Mid. Line	At bott	15		15	15		15

D25. D18 372.5

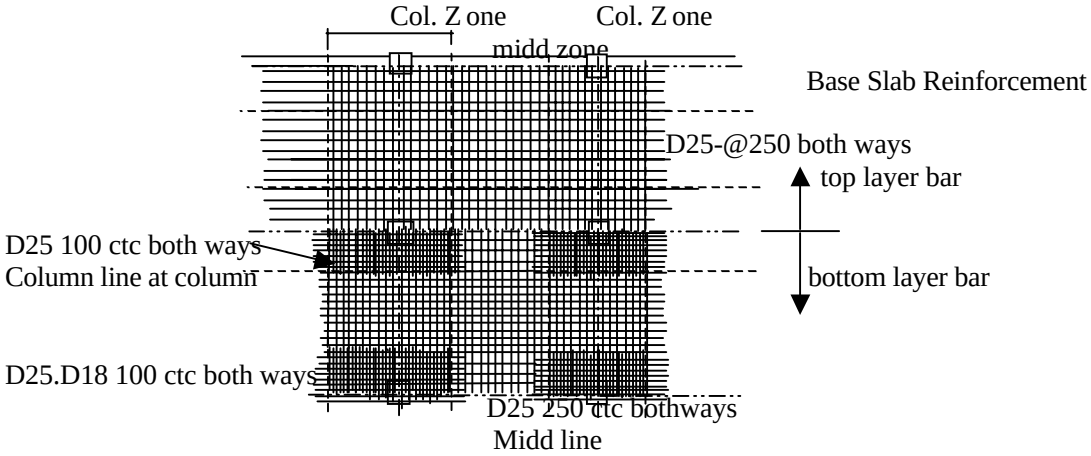
D25 Area	490	B (mm)	3000
D22 Area	380	ho=h-80mr	520
D18 Area	254		
Rb (N/mm2)	17	Rs (N/mm2)	365
Rcr	125		

A end ΣAs=491∗23.33

x=ΣAs x 365/(Rb x B) comp. Z one height

Crack bend. Moment = 0.8Rcr.As.h0 kN.m

D28 area 616



Reinforce. Bar This color shows this rule applied.

		A-end	mid	B-end	B-end	mid	C-end
	Top	D25@250	D25 @250	D25@250	D25@250	D25 @250	D25@250
Col.line	Bot	D25D18 .@100	D25 @200	D25 @100	D25 @100	D25 @200	D25D18 .@100
	Top	D25@250	D25 @250	D25@250	D25@250	D25 @250	D25@250
Mid.line	Bot	D25 @200	D25 @150	D25 @200	D25 @200	D25 @200	D25 @200

FRAME-1 1st spa Design forces (kN.m) 2nd span

		A-end	mid	B-end	B-end	mid	C-end

Col. Line	0.55		126.08			126.08	
	Bot. 0.75	556.48		801.60	801.60		556.48
	Total	741.97	229.23	1068.80	1068.80	229.23	741.97

At the bay along the exterior wall, forces are counted 0.5 of Design forces.
for example , along A line and C line, also 1 line and 7 line.

1st bay at wall	Top	D25@250	D25 @250	D25@250	D25@250	D25 @250	D25@250
Col.line	Bot	D25D18 alt .@100	D25 @200	D25D18 alt .@100	D25D18 alt .@100	D25 @200	D25D18alt .@100

Table. Crack Bending moment (kN.m)

		A-end	mid	B-end	B-end	mid	C-end
Col.line	Top		351.62			351.62	
	Bot	668.27		668.27	668.27		668.27
Mid.line	Top		351.62			351.62	
	Bot	303.78		303.78	303.78		303.78
Col. Line	no's of bar At top	30	12	30	30	12	30
Mid. Line	At bott	20	12	20	20	12	20

D25. D18 372.5

D25 Area	490	B (mm)	3000
D22 Area	380	ho=h-80mr	520
D18 Area	254		
Rb (N/mm2)	17	Rs (N/mm2)	365
Rcr	125		

A end ΣAs=491∗23.33

x=ΣAs x 365/(Rb x B) comp. Z one height

Crack bend. Moment = 0.8Rcr.As.h0 kN.m

Return Sludge

3- Frame

Destribution factor	0.25	0.25	0.20	0.30
Fixed end Moment	11.14			-7.00
Destributed Moment 1	-1.04	-1.04	-0.83	-1.24
Contributed Moment	6.00	-0.80	1.20	0.00
Destributed Moment 2	-1.60	-1.60	-1.28	-1.92
total by virtical line	14.51	-3.44	-0.91	-10.16

end M left girder | Top M col. Dwn | Bot. M col. Up | end M right girder

	A				B				C		
			6.14								
DF	0.108		0.892						0.892	0.108	
FEM			-571.45						571.45		
D1	61.46		509.99						-509.99	-61.46	
C1	6.37		-254.99						254.99	-6.37	
D2	26.74		221.88						-221.88	-26.74	
Σ	94.57		-94.57						94.57	-94.57	
	0.74									0.74	
			3.37					3.37			
DF	0.236	0.138	0.626		0.421	0.159		0.421	0.626	0.236	0.138
FEM			-92.59		198.77			-198.77	92.59		
D1	21.86	12.74	58.00		0.00	0.00		0.00	-58.00	-21.86	-12.74
C1	-68.74	30.73	0.00		29.00	0.00		-29.00	0.00	68.74	-30.73
D2	8.97	5.23	23.80		0.00	0.00		0.00	-23.80	-8.97	-5.23
Σ	-37.91	48.69	-10.79		227.77	0.00		-227.77	10.79	37.91	-48.69
	1.27					1.27				1.27	
			4.50					4.50			
DF		0.220	0.780		0.438		0.124	0.438	0.780		0.220
FEM			624.57		-624.57			624.57	-624.57		
D1		-137.47	-487.10		0.00		0.00	0.00	487.10		137.47
C1		10.93	0.00		-243.55		0.00	243.55	0.00		-10.93
D2		-2.41	-8.52		0.00		0.00	0.00	8.52		2.41
Σ		-128.95	128.95		-868.12		0.00	868.12	-128.95		128.95

1-Frame

	A				B				C		
			1.78					1.78			
DF	0.294		0.706		0.414	0.172		0.414	0.706	0.294	
FEM			-65.61		93.61			-93.61	65.61		
D1	19.27		46.34		0.00	0.00		0.00	-46.34	-19.27	
C1	7.26		0.00		23.17	0.00		-23.17	0.00	-7.26	
D2	-2.13		-5.13		0.00	0.00		0.00	5.13	2.13	
Σ	24.39		-24.39		116.78	0.00		-116.78	24.39	-24.39	
	0.74					0.74				0.74	
			1.78					1.78			
DF	0.335	0.195	0.470		0.320	0.228	0.133	0.320	0.470	0.335	0.195
FEM			-74.33		127.66			-127.66	74.33		
D1	24.91	14.51	34.91		0.00	0.00	0.00	0.00	-34.91	-24.91	-14.51
C1	-34.41	9.63	0.00		17.45	0.00	0.00	-17.45	0.00	34.41	-9.63
D2	8.30	4.84	11.64		0.00	0.00	2.32	0.00	-11.64	-8.30	-4.84
Σ	-1.20	28.98	-27.78		145.11	0.00	2.32	-145.11	27.78	1.20	-28.98
	1.27			with RC wall		1.27			with RC wall	1.27	
			4.50					4.50			
DF		0.220	0.780		0.438		0.124	0.438	0.780		0.220
FEM			312.70		-312.70			312.70	-312.70		
D1		-68.83	-243.87		0.00		0.00	0.00	243.87		68.83
C1		12.45	0.00		-121.94		0.00	121.94	0.00		-12.45
D2		-2.74	-9.71		0.00		0.00	0.00	9.71		2.74
Σ		-59.11	59.11		-434.64		0.00	434.64	-59.11		59.11

A-Frame

	1				2				3			
			1.78				1.78					1.78
DF	0.294		0.706		0.414	0.172		0.414	0.414	0.172		0.414
FEM			-49.37		49.37			-49.37	49.37			-49.37
D1	14.50		34.87		0.00	0.00		0.00	0.00	0.00		0.00
C1	7.08		0.00		17.44	0.00		0.00	0.00	0.00		0.00
D2	-2.08		-5.00		-7.22	-3.00		-7.22	0.00	0.00		0.00
Σ	19.50		-19.50		59.59	-3.00		-56.59	49.37	0.00		-49.37
	0.74					0.74				0.74		
			1.8				1.8					1.8
DF	0.333	0.194	0.472		0.321	0.226	0.132	0.321	0.321	0.226	0.132	0.321
FEM			-72.95		72.95			-72.95	72.95			-72.95
D1	24.32	14.17	34.46		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	-34.41	7.25	0.00		17.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D2	9.05	5.28	12.83		-5.53	-3.90	0.00	-5.53	0.00	0.00	0.00	0.00
Σ	-1.04	26.69	-25.65		84.65	-3.90	0.00	-78.48	72.95	0.00	0.00	-72.95
	1.27		with RC wall			1.27		with RC wall		1.27		
			4.50				4.50					4.50
DF		0.220	0.780		0.438		0.124	0.438	0.438		0.124	0.438
FEM			312.70		-312.70			312.70	-312.70			312.70
D1		-68.83	-243.87		0.00		0.00	0.00	0.00		0.00	0.00
C1		12.16	0.00		-121.94		0.00	0.00	0.00		0.00	0.00
D2		-2.68	-9.48		53.43		15.08	53.43	0.00		0.00	0.00
Σ		-59.34	59.34		-381.21		15.08	366.13	-312.70		0.00	312.70

B-Frame

	1				2				3			
			4.15				4.15					4.15
DF	0.559	0.000	0.441		0.380	0.241	0.000	0.380	0.380	0.241	0.000	0.380
FEM			-92.59		92.59			-92.59	92.59			-92.59
D1	51.76	0.00	40.83		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	-188.43	0.00	0.00		20.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D2	105.33	0.00	83.10		-7.75	-4.91	0.00	-7.75	0.00	0.00	0.00	0.00
Σ	-31.35	0.00	31.35		105.25	-4.91	0.00	-100.34	92.59	0.00	0.00	-92.59
	5.26					2.63				2.63		
			3.47				3.47					3.47
DF		0.603	0.397		0.363		0.275	0.363	0.363		0.275	0.363
FEM			625.47		-625.47			625.47	-625.47			625.47
D1		-376.86	-248.61		0.00		0.00	0.00	0.00		0.00	0.00
C1		25.88	0.00		-124.31		0.00	0.00	0.00		0.00	0.00
D2		-15.59	-10.29		45.07		34.16	45.07	0.00		0.00	0.00
Σ		-366.57	366.57		-704.70		34.16	670.54	-625.47		0.00	625.47

Appendix B-14

Structure Calculation – Hopper House

CONTENTS

Contents end

Appendix

Frame Bending Moment analysis on Dead load and Live load

CALCULATION NOTE

1. General

1.1 Building character

(a) This is 2 storied building, reinforced concrete structure..
3 span on y-y direction, 3 baies on x-x diretion.
Soil condition at site is not stiff . This building is supported by Pile foundations.

(b) Structure element and finish specificaton.

b-1. Roof concrete slab thickness is 15 cm. Top face pitch is made 1/100 by slanted concrete slab.
b-2. 2nd floor concrete slab is 18 cm thick.
b-3. Outside wall brick thickness is 59 cm including 10cm insuration.
b-4. Pile foundations are set under Columns

1.2 Design principle.

(a) Ultimate stress Limit state design

Profiles of girder,column,and sub beam etc is calculated based on Snip
1.02.03-84 Reinforced concrete design.

(b) This calculation takes consideration of Dead Load, Live Load
Snow Load (Sn.L)..

Wind load (W.L) is 0.48 kN/m2 to meet with Astana city's instruction.
Refer D.L and L..L at Table-3.

(c.) No Earthquake load at Astana city. Astana city stays at NO EARTHQUAKE Z ONE.

1-3 Material and Allowable stress

(kgf /cm2)

TABLE - 1 Allowable Stress (Mpa)

Item		Allowable stress Rb	Rbt	
Concrete	B30	17	1.2	-------
Item		Allowable stress Rs	Rsc	Rw
Steel Bar	Class A1	225	225	175
	Class A3	365	365	290

1-4 Dead Load and Live Load

TABLE - 2 Dead Load Sludge Treatment Building

Loc.	item	thickness	kN/m2	totl kN/m2
Roof	Mortar	5cm	1.00	
	Concrete slab	15cm	3.60	
	Ceiling		0.25	4.85
Machine Room	Leveling motar	5cm	1.00	
	Concrete slab	18cm	4.50	
	Ceiling		0.25	5.75

TABLE - 3 Live Load and Dead Load Sludge Cake

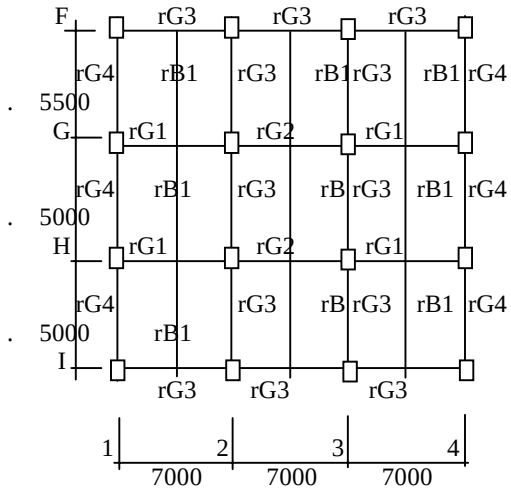
kN/m2 (Girder, Sub beam : Self weight not included

Loc.	load type	slab	beam	girder	γf	girder*γf
Roof	Dead Load	4.85	4.85	4.85	1.1	5.34
	Live Load	1.00	1.00	1.00	1.2	1.20
	Total Load	5.85	5.85	5.85		6.54
Machin room	Dead Load	5.75	5.75	5.75	1.1	6.33
	Live Load	5.00	4.00	4.00	1.2	4.80
	Total Load	10.75	9.75	9.75		11.13

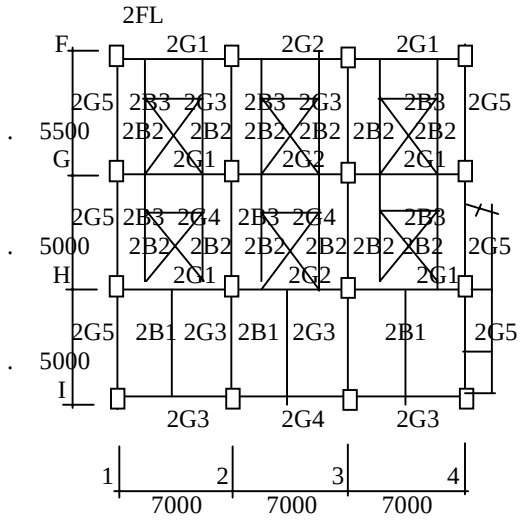
1.5 Key Plan and Frame Structure Hopper House

E Sludge treatment building

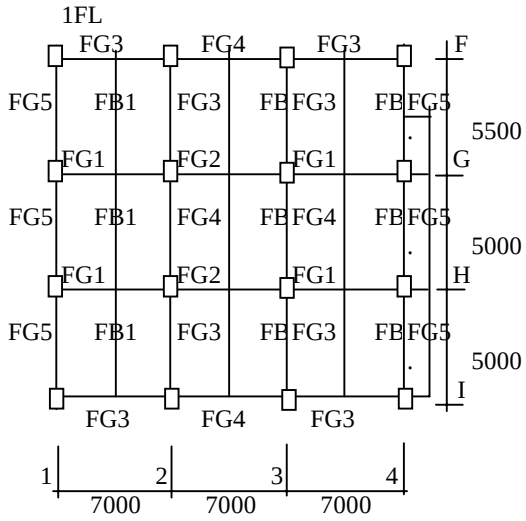
RFL



2FL



1FL



2. Preparation Hopper

2 - 1 Members stiffness

(a) Table - 5 Girder Stiffness

	Girder	b (cm)	D (cm)	B (cm)	t (cm)	B/b	t/D	ϕ	Io (x 10^5 cm4)	I (x 10^5 cm4)	*l* (x 10^2 cm)	K (x 10^3 cm3)	k K/Ko
R	G1	40	60	180	15	4.50	0.250	1.84	7.20	13.25	6.00	2.21	2.21
	G2	40	60	110	15	2.75	0.250	1.45	7.20	10.44	6.00	1.74	1.74
	G3	40	60	150	15	3.75	0.250	1.73	7.20	12.46	6.00	2.08	2.08
	G4	40	60	100	15	2.50	0.250	1.48	7.20	10.66	6.00	1.78	1.78
2F	G1	40	75	98	18	2.45	0.240	1.47	14.06	20.67	6.00	3.45	3.45
	G2	40	75	90	18	2.25	0.240	1.42	14.06	19.97	6.00	3.33	3.33
	G3	40	75	110	18	2.75	0.240	1.54	14.06	21.66	6.00	3.61	3.61
	G4	40	75	100	18	2.50	0.240	1.48	14.06	20.81	6.00	3.47	3.47
FG	FG1	40	90	180	20	4.50	0.222	1.87	24.30	45.44	6.00	7.57	7.57
	FG2	40	90	110	20	2.75	0.222	1.54	24.30	37.42	6.00	6.24	6.24
	FG3	40	90	150	20	3.75	0.222	1.73	24.30	42.04	6.00	7.01	7.01
	FG4	40	90	110	20	2.75	0.222	1.69	24.30	41.07	6.00	6.84	6.84

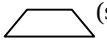
(b) Table - 6 Column Stiffnes SLUDGE TREATMENT BUILDING

	Colmn ID		b	D	I (x 10^5 cm4)	*l* (x 10^2 cm)	K (x 10^3 cm3)	k K/Ko
2	C1	x,y	50	50	5.208	4.00	1.302	1.3
	C2	x,y	50	50	5.208	4.00	1.302	1.3
	C3	x,y	50	50	5.208	4.00	1.302	1.3
1	C1,C2	x,y	50	50	5.208	6.20	0.840	0.8

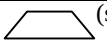
2-2 Girder Fixed end moment (Co),Center moment(Mo), Shear (Q)

2-1 Girders Co Mo Q Roof

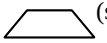
Fixed end bending moment (Co)
Middle span bending moment (Mo)
Shear force (Q) at gierder ends

	Load form	 (slab load)		 (slab load)			gider load	Σ kN.m
		w	Co	w	Co	w/1	Co	
rG1	Co	19.00	124.17	0.00	0.00	6.00	15.13	139.29
rG2			Mo	w	Mo	w/1	Mo	
	Mo	34.00	222.19	0.00	0.00	6.00	22.69	244.88
		w	Q	w	Q	w/1	Q	kN
	Q	12.60	82.34	0.00	0.00	6.00	16.50	98.84

Slab load 6.54 (kN/m2) span =7m
ly= 5.5 (m)
lx = 3.5 a3= 1.571

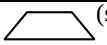
	Load form	 (slab load)		 (slab load)			gider load	Σ kN.m
		w	Co	w	Co	w/1	Co	
rG3	Co	9.50	62.08	0.00	0.00	14.10	35.54	97.63
			Mo	w	Mo	w/1	Mo	
	Mo	17.00	111.10	0.00	0.00	14.10	53.32	164.41
		w	Q	w	Q	w/1	Q	kN
	Q	6.30	41.17	0.00	0.00	14.10	38.78	79.95

Slab load 6.54 (kN/m2) span =7m
Span 5.5 (m)
Span 3= 3.5 a3= 1.57

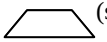
	Load form	 (slab load)		 (slab load)			gider load	Σ kN.m
		w	Co	Co/w	Co	w/1	Co	
	Co	0.00	0.00	7.40	48.36	14.82	37.36	85.72
rG4			Mo	Mo/w	Mo	w/1	Mo	
	Mo	0.00	0.00	11.40	74.50	14.82	56.04	130.54
		w	Q	Q/w	Q	w/1	Q	
	Q	0.00	0.00	6.60	43.13	14.82	40.76	83.89

Slab load 6.54 (kN/m2)
Span 5.5 (m)

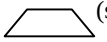
refer 1B1 end shear

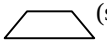
G Frame	Load form	 (slab load)		 (slab load)		P P	(gider load P=280.7kN	Σ kN.m
		Co/w	Co	Co/w	Co	w/1	Co	
2G1	Co	0.00	0.00		0.00	17.51	402.33	402.33
2G2		Mo/w	Mo	Mo/w	Mo	w/1	Mo	
	Mo	0.00	0.00		0.00	17.51	528.31	528.31
		Q/w	Q	Q/w	Q	w/1	Q	kN
	Q	0.00	0.00		0.00	17.51	341.99	341.99

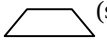
Slab load 11.13 (kN/m2)
Span 7 (m)
ly = 5.0 m lx = 3.5 m

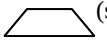
H Frame	Load form	 (slab load)		 (slab load)		P P	gider load P=164.9kN	Σ kN.m
		Co/w	Co	w	Co	w/1	Co	
2G1	Co	9.5	105.69	0.00	0.00	7.5	224.97	330.66
2G2		Mo/w	Mo	w	Mo	w/1	Mo	
	Mo	17	189.13	0.00	0.00	7.5	293.29	482.41
		Q/w	Q	w	Q	w/1	Q	kN
	Q	6.3	70.09	0.00	0.00	7.5	191.15	261.24

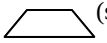
Slab load 11.13 (kN/m2) ly/lx=1.43
Span 7 (m)

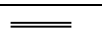
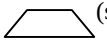
F-Frame	Load form	 (slab load)		 (slab load)		P ↓ P 	gider load p 164.9kN	Σ kN.m
		w	Co	w	Co	w/1	Co	
2G1	Co	9.50	105.69	0.00	0.00	7.5	224.97	330.66
2G2			Mo	w	Mo	w/1	Mo	
	Mo	17.00	189.13	0.00	0.00	7.5	293.29	482.41
		w	Q	w	Q	w/1	Q	kN
	Q	6.30	70.09	0.00	0.00	7.5	191.15	261.24
				Slab load	11.13	(kN/m2)		
				Span	7	(m) a=	1.75	(m)

I-Frame	Load form	 (slab load)		 (slab load)			gider load .+wall	Σ kN.m
2G3		w	Co	w	Co	w/1	Co	
2G4	Co	8.80	35.93	0.00	0.00	55.569	226.91	262.84
			Mo	w	Mo	w/1	Mo	
	Mo	16.00	98.00	0.00	0.00	55.569	340.36	438.36
		w	Q	w	Q	w/1	Q	kN
	Q	6.20	21.70	0.00	0.00	55.569	152.81	174.51
				Slab load	11.13	(kN/m2)		
				Span	7	(m) a=	1.43	(m)

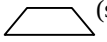
	Load form	 (slab load)		 (slab load)			gider load .+wall	Σ kN.m
		w	Co	w	Co	w/1	Co	
2G5	Co	0.00	0.00	4.00	44.50	36.61	92.28	136.78
			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	6.00	66.75	36.61	138.42	205.17
		w	Q	w	Q	w/1	Q	kN
	Q	0.00	0.00	3.30	36.71	36.61	100.67	137.38
				Slab load	11.13	(kN/m2)		
				Span	5.5	(m) a=	1.57	(m)
				Span 3=	3.5			

	Load form	 (slab load)		 (slab load)			gider load .+ wall	Σ kN.m
		w	Co	Co/w	Co	w/1	Co	
FG1	Co	19.00	211.38		0.00	45.28	184.89	396.27
FG2			Mo	Mo/w	Mo	w/1	Mo	
G-Frame	Mo	34.00	378.25		0.00	45.28	277.34	655.59
		w	Q	Q/w	Q	w/1	Q	kN
	Q	12.60	140.18		0.00	45.28	158.48	298.66
				Slab load	11.13	(kN/m2)		
				Span	7	(m)		
	ly =	5.0	m	lx =	3.5	m l=	1.43	

	Load form	 (slab load)		 (slab load)			gider load .+ wall	Σ kN.m
FG2		w	Co	w	Co	w/1	Co	
	Co	9.50	105.74	0.00	0.00	54.1	220.91	326.64
			Mo	w	Mo	w/1	Mo	
F-Frame	Mo	17.00	189.21	0.00	0.00	54.1	331.36	520.57
		w	Q	w	Q	w/1	Q	kN
	Q	6.30	70.12	0.00	0.00	54.1	189.35	259.47
				Slab load	11.13	(kN/m2)	ly/lx=1.43	
Use(FG1 C,M,Q) for FG2				Span	7	(m)		

	Load form	 (slab load)		 (slab load)		(gider load		Σ
FG3		w	Co	w	Co	w/1	Co	
FG5	Co	0.00	0.00	6.00	66.78	54.100	136.38	203.16
			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	9.20	102.40	54.100	331.36	433.76
		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	4.90	54.54	54.100	148.78	203.31

0.955 Slab load 11.13 (t/m2)
Span 5.5 (m) a= 1.43 (m)
Span 3= 3.5

	Load form	 (slab load)		 (slab load)		(gider load wall		Σ
		w	Co	w	Co	w/1	Co	
	Co	0.00	0.00	6.00	66.78	10.00	25.21	91.99
FG4			Mo	w	Mo	w/1	Mo	
	Mo	0.00	0.00	9.20	102.40	10.00	37.81	140.21
		w	Q	w	Q	w/1	Q	
	Q	0.00	0.00	4.90	54.54	10.00	27.50	82.04

0.955 Slab load 11.13 (t/m2)
Span 5.5 (m) a= 1.43 (m)
Span 3= 3.5

Use (2G4 C,M,Q) for FG3 and FG4

2.3 Column Axial forces g waight and Buildin

Table-7 Sludge Cake building Weight

Story	Load type	Unit w (kg/m2)	width /hight (m) or unit	Length (m)	Area or L (m2), (m)	Weight (kN)	Small Total (KN)	S Wi (kN)
	roof slab	6.54	14.40	15.90	228.96	1496.25		
	Cylinder roof	1.80	7.00	15.00	105.00	189.00		
	Girder 7m	6.50	12.00	7.00	84.00	546.00		
	Girder 5.5m	6.00	4.00	5.50	22.00	132.00		
2nd	Girder 5.0m	6.00	8.00	5.00	40.00	240.00		
Story	Col. 4m	6.25	16.00	4.00	64.00	400.00		
	Beam	4.50	3.00	15.50	46.50	209.25		
	Sky light wall	10.80	2.00	15.50	31.00	334.80	3547.30	3547.30
	Wall.1 4m	8.82	5.70	89.80	511.86	4514.61		
	Window	-8.82	10.00	3.00	30.00	-264.60		
	2F slab	11.13	21.40	15.90	340.26	3785.39		
	oppening	-11.13	6.00	13.69	82.14	-914.22		
	Machine	400.00	6.00	1.00	6.00	2400.00		
	Convyer	5.00	3.00	10.00	30.00	150.00		
	Girder 7m	7.00	12.00	7.00	84.00	588.00		
1st	Girder 5.5m	7.00	4.00	5.50	22.00	154.00		
Story	Girder 5.0m	7.00	8.00	5.00	40.00	280.00		
	Col. 1 5.7m	6.25	16.00	5.70	91.20	570.00		
	Beam	5.25	6.00	15.50	93.00	488.25		
	Bridge							
	roof+ floor	11.13	3.00	7.50	22.50	250.43		
	wall	8.82	6.00	89.80	538.80	4752.22		
								(t)
							16754.07	20301.37
							Total W=	**20,301.37**

Table-8 Hopper house Column Axial force

Story	Load type	Unit w (kg/m2)	width /high (m) or un	Length (m)	Area or L (m2), (m)	Weight (t)	Small Total (t)	S Wi (t)
	roof slab	6.54	3.50	2.95	10.33	67.47		
	Cylinder roof	1.80	3.50	2.75	9.63	17.33		
2C1	Girder 5.5m	6.50	0.50	5.50	2.75	17.88		
	Girder 7m	6.00	1.00	7.00	7.00	42.00		
	Sky light wall	10.80	2.00	2.75	5.50	59.40		
2-frame								
F	Col. 4m	6.25	1.00	4.00	4.00	25.00	229.07	229.07
	Wall.2 4m	8.82	4.50	4.00	18.00	158.76		
1C1	oppning	-8.82	2.50	3.00	7.50	-66.15		
	Bridge	8.48	2.50	1.00	2.50	21.19		
	2FL slab	11.13	3.70	1.80	6.66	74.09		
	Machine	75.00	2.00	1.00	2.00	150.00		
	Girder 7m	7.00	1.00	7.00	7.00	49.00		
	Girder 5.5m	7.00	0.50	7.00	3.50	24.50		
	Beam 2B2	5.25	1.00	5.50	5.50	28.88		
	Beam 2B3	5.25	1.00	3.70	3.70	19.43		
	Col. 5.7m	6.25	1.00	5.70	5.70	35.63	495.32	724.39
	Wall in 47cm	8.82	5.00	3.00	15.00	132.30		
C1	1FL slab	0.00	8.00	7.50	60.00	0.00		
foundation	Girder 7m	10.00	1.00	7.00	7.00	70.00		
	Girder 5.5m	10.00	0.50	5.50	2.75	27.50		
							229.80	954.19

Story	Load type	Unit w (kg/m2)	width /high (m) or un	Length (m)	Area or L (m2), (m)	Weight (t)	Small Total (t)	S Wi (t)
	roof slab	6.54	3.50	5.25	18.38	120.08		
	Cylinder roof	1.80	3.50	5.25	18.38	33.08		
2C2	Girder 5.5m	6.50	1.00	5.25	5.25	34.13		
	Girder 7m	6.00	1.00	7.00	7.00	42.00		
	Beam 5.5m	6.00	1.00	5.25	5.25	31.50		
2-frame	Sky light wall	10.80	2.00	5.25	10.50	113.40		
G	Col. 4m	6.25	1.00	4.00	4.00	25.00	399.18	399.18
	Wall.3 4m	8.82	4.00	9.00	36.00	317.52		
	2F Slab	11.13	3.30	5.25	17.33	192.74		
1C2	Girder 7m	7.00	1.00	7.00	7.00	49.00		
	Girder 5.5m	7.00	1.00	5.25	5.25	36.75		
1st Stor	Col. 5.7m	6.25	1.00	5.70	5.70	35.63		
	Machine	80.00	4.00	1.00	4.00	320.00		
							634.12	1033.30
Foundatio	Girder 7m	10.00	1.00	7.00	7.00	70.00		
C2	Girder 5.5m	10.00	1.00	5.25	5.25	52.50		
							122.50	1155.80

Story	Load type	Unit w (kg/m2)	width /high (m) or un	Length (m)	Area or L (m2), (m)	Weight (t)	Small Total (t)	S Wi (t)
	roof slab	6.54	3.50	5.00	17.50	114.36		
	Cylinder roof	1.80	3.50	5.00	17.50	31.50		
2C3	Girder 5.0m	6.50	1.00	5.00	5.00	32.50		
	Girder 7m	6.50	1.00	7.00	7.00	45.50		
	Beam 5.05m	6.00	1.00	5.00	5.00	30.00		
2-frame	Sky light wall	10.80	2.00	5.00	10.00	108.00		
H	Col. 4m	6.25	1.00	4.00	4.00	25.00	386.86	386.86
	Wall.3 4m	8.82	4.00	9.00	36.00	317.52		
	2F Slab	11.13	3.30	5.00	16.50	183.56		
1C3	Girder 7m	7.00	1.00	7.00	7.00	49.00		
	Girder 5.0m	7.00	1.00	5.00	5.00	35.00		
	Col. 5.7m	6.88	1.00	5.70	5.70	39.19		
	Machine	150.00	2.00	1.00	2.00	300.00		
							606.75	993.61
Foundatio	Girder 7m	10.00	1.00	7.00	7.00	70.00		
C3	Girder 5.0m	10.00	1.00	5.00	5.00	50.00		
							120.00	1113.61

Story	Load type	Unit w (kg/m2)	width /high (m) or un	Length (m)	Area or L (m2), (m)	Weight (t)	Small Total (t)	S Wi (t)
	roof slab	6.54	3.50	2.90	10.15	66.33		
	Cylinder roof	1.80	3.50	2.50	8.75	15.75		
2C4	Girder 5.5m	6.50	0.50	5.00	2.50	16.25		
	Girder 7m	6.50	1.00	7.00	7.00	45.50		
	Sky light wall	10.80	2.00	2.50	5.00	54.00		
2-frame, I								
	Col. 4m	6.25	1.00	4.00	4.00	25.00	222.83	222.83
	Hoist	3.00	1.00	1.00	1.00	3.00		
	Wall.2 4m	8.82	4.50	4.00	18.00	158.76		
1C4	oppening	-8.82	2.40	2.00	4.80	-42.34		
	2FL slab	11.13	7.00	2.50	17.50	194.69		
	Machine	0.00	1.00	1.00	1.00	0.00		
	Girder 7m	7.00	1.00	7.00	7.00	49.00		
	Girder 5.5m	7.00	0.50	7.00	3.50	24.50		
	Beam 2B1	5.25	0.50	5.00	2.50	13.13		
	Col. 5.7m	6.25	1.00	5.70	5.70	35.63	436.36	659.19
	Wall in 47cm	8.82	5.00	7.00	35.00	308.70		
C4	1FL slab	0.00	8.00	7.50	60.00	0.00		
	Door	-8.82	3.50	3.50	12.25	-108.05		
foundation	Girder 7m	10.00	1.00	7.00	7.00	70.00		
	Girder 5.5m	10.00	0.50	5.00	2.50	25.00		
							295.66	954.85

Story	Load type	Unit w (kg/m2)	width /high (m) or un	Length (m)	Area or L (m2), (m)	Weight (t)	Small Total (t)	S Wi (t)
	roof slab	6.54	5.00	3.50	17.50	114.36		
	Cylinder roof	0.00	3.50	2.50	8.75	0.00		
2C5	Girder 5.5m	6.00	1.00	5.00	5.00	30.00		
	Girder 7m	6.00	0.50	7.00	3.50	21.00		
1-frame								
G	Col. 4m	6.25	1.00	4.00	4.00	25.00	190.36	190.36
	Wall.2 4m	8.82	5.00	5.00	25.00	220.50		
1C5								
	2FL slab	11.13	5.00	1.75	8.75	97.34		
	Machine	80.00	2.00	1.00	2.00	160.00		
	Girder 7m	7.00	0.50	7.00	3.50	24.50		
	Girder 5.5m	7.00	1.00	5.25	5.25	36.75		
	Beam 2B1	5.25	0.50	5.00	2.50	13.13		
	Col. 5.7m	6.25	1.00	5.70	5.70	35.63	587.84	778.21
	Wall in 47cm	8.82	5.00	5.00	25.00	220.50		
C5	1FL slab	0.00	7.00	7.50	52.50	0.00		
foundation	Girder 7m	10.00	0.50	7.00	3.50	35.00		
	Girder 5.5m	10.00	1.00	5.25	5.25	52.50		
							308.00	1086.21

Story	Load type	Unit w (kg/m2)	width /high (m) or un	Length (m)	Area or L (m2), (m)	Weight (t)	Small Total (t)	S Wi (t)
	roof slab	6.54	3.50	2.90	10.15	66.33		
	Cylinder roof	0.00	3.50	2.50	8.75	0.00		
2C6	Girder 5.5m	6.00	0.50	5.00	2.50	15.00		
	Girder 7m	6.00	0.50	7.00	3.50	21.00		
	Sky light wall	0.00	2.00	2.50	5.00	0.00		
1-frame, F								
F	Col. 4m	10.00	1.00	4.00	4.00	40.00	142.33	142.33
	Wall.2 4m	8.82	4.00	6.00	24.00	211.68		
1C6	oppening	-8.82	1.25	2.00	2.50	-22.05		
	2FL slab	11.13	3.50	2.50	8.75	97.34		
	Machine	8.00	1.00	1.00	1.00	8.00		
	Girder 7m	7.00	0.50	7.00	3.50	24.50		
	Girder 5.5m	7.00	1.00	7.00	7.00	49.00		
	Beam 2B1	5.25	0.50	5.50	2.75	14.44		
	Col. 5.7m	6.25	1.00	5.75	5.75	35.94	418.85	561.18
	Wall in 47cm	8.82	5.70	6.00	34.20	301.64		
C6	1FL slab	0.00	8.00	7.50	60.00	0.00		
	Door	-8.82	1.75	3.50	6.13	-54.02		
foundation	Girder 7m	10.00	0.50	7.00	3.50	35.00		
	Girder 5.5m	10.00	1.00	5.50	5.50	55.00		
							337.62	898.80

3 Girder and Column Profile Design **Sludge cake**

3-1Girder Profile Design **Roof**

Girder ID	rG1 G-frame			rG2 G-frame			rG3 F-frame		
Position	0ut end	Mid	In end	2 end	Mid	3 end	1 end	Mid	2 end
D.L] M(tm) top	81.04		166.2	156.23		156.23	64.24		115.38
+] bott.		121.26			88.65			74.6	
L.L] Q (t)	98.84		111	98.84		98.84	79.95		87.22
] b x D (cm)	**400**	**x**	**600**	**400**	**x**	**600**	**400**	**x**	**600**
Size] d (cm)	550	550	550	550	550	550	550	550	550
$z= Rb.b.ho^2 (x 10^b)$		2057			2057			2057	
α_m (top)=M/z	0.0394		0.0808	0.0760		0.0760	0.0312		0.0561
α_m(bott.)		0.0589			0.0431			0.0363	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	208.1		208.1	208.1		139.1	208.1		139.1
Bott.Mus=Rsc.A's.(ho-a')=		208.1			208.1			208.1	
Top Mu=Rs.As(ho-0.5ξho)=	216.1		282.5	282.5		282.5	216.1		216.1
Bot Mu=Rs.As(ho-0.5ξho)=		282.5			216.1			216.1	
top	0.518		0.691	0.691		0.691	0.518		0.518
Pt (%) bott.		0.691			0.518			0.518	
top	1140		1520	1520		1520	1140		1140
as (mm2) bott.		1520			1140			1140	
Main top	3	3	4	4	3	4	3	3	3
Bars **D22**		D22			D22			D22	
bott	3	4	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	158.4	(kN)	158.4	158.4	(kN)	158.4	158.4	(kN)	158.4
(kN)	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D25 As 491 mm2
D22 As 380 mm2
D18 As 254 mm2

Girder ID	rG3 F-frame			rG3 2-frame			rG3 2-frame		
Position	1 end	Mid	2 end	2 end	Mid	3 end	1 end	Mid	2 end
D.L] M(tm) top	107.82		107.82	55.83		116.23	109.07		109.07
+] bott.		57			3.98			55.34	
L.L] Q (t)	80.0		79.95	79.95		88.58	5.38	5.38	5.38
] b x D (cm)	**400**	**x**	**600**	**400**	**x**	**600**	**400**	**x**	**600**
Size] d (cm)	550	550	550	550	550	550	550	550	550
z= Rb.b.ho^2 (x 10^6)		2057			2057			2057	
α_m (top)=M/z	0.0524		0.0524	0.0271		0.0565	0.0530		0.0530
α_m(bott.)		0.0277			0.0019			0.0269	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	208.1		208.1	208.1		139.1	208.1		139.1
Bott.Mus=Rsc.A's.(ho-a')=		208.1			208.1			208.1	
Top Mu=Rs.As(ho-0.5ξho)=	216.1		216.1	216.1		216.1	216.1		216.1
Bot Mu=Rs.As(ho-0.5ξho)=		216.1			216.1			216.1	
top	0.518		0.518	0.518		0.518	0.518		0.518
Pt (%) bott.		0.518			0.518			0.518	
top	1140		1140	1140		1140	1140		1140
as (mm2) bott.		1140			1140			1140	
Main top	3	3	3	3	3	3	3	3	3
Bars **D22**		D22			D22			D22	
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	158.4	(kN)	158.4	158.4	(kN)	158.4	158.4	(kN)	158.4
(kN)	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

Girder ID		4-Frame rG4	1-frame		4-Frame rG4	1-frame	2G1 G,H-frame		
Position	out end	Mid	in end	end	Mid	end	1 end	Mid	2 end
D.L] M(tm) top	45.34		101.42	94.79		94.79	182.16		479.16
+] bott.		57.16			35.41			197.65	
L.L] Q (t)	83.89		91.90	83.89		83.89	341.99		381.42
] b x D (cm)	**400**	**x**	**600**	**400**	**x**	**600**	**500**	**x**	**750**
Size] d (cm)	550	550	550	550	550	550	700	700	700
z= Rb.b.ho^2 (x 10^6)		2057			2057			4165	
α_m (top)=M/z	0.0220		0.0493	0.0461		0.0461	0.0437		0.1150
α_m(bott.)		0.0278			0.0172			0.0475	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	208.1		208.1	208.1		139.1	270.5		361.6
Bott.Mus=Rsc.A's.(ho-a')=		208.1			208.1			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	216.1		216.1	216.1		216.1	370.3		624.2
Bot Mu=Rs.As(ho-0.5ξho)=		216.1			216.1			370.3	
top	0.518		0.518	0.518		0.518	0.561		0.982
Pt (%) bott.		0.518			0.518			0.561	
top	1140		1140	1140		1140	1964		3437
as (mm2) bott.		1140			1140			1964	
Main top	3	3	3	3	3	3	4	3	7
D22		D22			D22			D25	
bott	3	3	3	3	3	3	3	4	6
Qbmin=ψb3.Rbt.b.ho=	158.4	(kN)	158.4	158.4	(kN)	158.4	252	(kN)	252
a= 4/(M/Q+1)	2.017		1.330	1.310		1.310	2.000		1.431
a.Qbmin=	319.6		210.7	207.4		207.4	504.0		360.7
D12 -150 : Rs.Asw	65.54		65.54	65.54	ok	65.54	65.54		65.54
total Qr capacity	385.1	> Q ok	276.3	273.0	> Q ok	273.0	569.5	> Q ok	426.2
Stirrup	D12-150	D12-150	D12-150	D12-100	D12-150	D12-100	D12-100	D12-150	D12-150

Girder ID	2G2 G,H-frame			2G3 F,I-frame			2G4 F,I-frame		
Position	out end	Mid	in end	out end	Mid	In end	end	Mid	end
D.L] M(tm) top	449.71		449.71	156.34		393.22	368.75		368.75
+] bott.		78.6			232.37			14	
L.L] Q (t)	341.99		341.99	261.24		295.08	261.24		261.24
] b x D (cm)	**500**	**x**	**750**	**400**	**x**	**750**	**400**	**x**	**750**
Size] d (cm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^6)		4165			3332			3332	
α_m (top)=M/z	0.1080		0.1080	0.0469		0.1180	0.1107		0.1107
α_m(bott.)		0.0189			0.0697			0.0042	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	540.9		540.9	270.5		180.8	270.5		180.8
Bott.Mus=Rsc.A's.(ho-a')=		360.6			270.5			270.5	
Top Mu=Rs.As(ho-0.5ξho)=	624.2		624.2	278.5		450.1	450.1		450.1
Bot Mu=Rs.As(ho-0.5ξho)=		370.3			278.5			278.5	
top	0.760		0.760	0.407		0.679	0.679		0.679
Pt (%) bott.		0.434			0.407			0.407	
top	2660		2660	1140		1900	1900		1900
as (mm2) bott.		1520			1140			1140	
Main top	7	4	7	3	3	5	5	3	5
Bars **D25**		D25			D25			D25	
bott	6	4	6	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	252 (kN)		252	201.6 (kN)		201.6	201.6 (kN)		201.6
a= 4/(M/Q+1)	1.390		1.390	2.000		1.378	2.000		1.326
a.Qbmin=	350.2		350.2	403.2		277.7	403.2		267.3
D12 -150 : Rs.Asw	65.54		65.54	65.54 ok		65.54	65.54		65.54
total Qr capacity	415.7 > Q ok		415.7	468.7 > Q ok		343.3	468.7 > Q ok		332.9
Stirrup	D12-100	D12-150	D12-100	D12-100	D12-150	D12-100	D12-100	D12-150	D12-150

2nd Floor

Girder ID	2G3 2-frame			2G4 2-frame			2G5 1-frame		
Position	out end	Mid	in end	end	Mid	end	2 end	Mid	3 end
D.L] M(tm) top	118.44		313.53	294.66		294.66	70.24		162.92
+] bott.		222.38			143.7			88.59	
L.L] Q (t)	174.51		213.53	174.51		175.41	137.38		155.92
] b x D (cm)	**400**	**x**	**750**	**400**	**x**	**750**	**400**	**x**	**750**
Size] d (cm)	700	700	700	700	700	700	700	700	700
z= Rb.b.ho^2 (x 10^6)		3332			3332			3332	
α_m (top)=M/z	0.0355		0.0941	0.0884		0.0884	0.0211		0.0489
α_m(bott.)		0.0667			0.0431			0.0266	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	349.5		349.5	349.5		349.5	349.5		349.5
Bott.Mus=Rsc.A's.(ho-a')=		349.5			349.5			349.5	
Top Mu=Rs.As(ho-0.5ξho)=	355.1		568.2	568.2		568.2	355.1		355.1
Bot Mu=Rs.As(ho-0.5ξho)=		355.1			355.1			355.1	
top	0.407		0.679	0.679		0.679	0.407		0.407
Pt (%) bott.		0.407			0.407			0.407	
top	1140		1900	1900		1900	1140		1140
as (mm2) bott.		1140			1140			1140	
Main top	3	3	5	5	3	5	3	3	3
D25		D25			D25			D25	
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	201.6 (kN)		201.6	201.6 (kN)		201.6
a= 4/(M/Q+1)	2.000		1.291	1.172		1.177	2.000		1.605
a.Qbmin=	403.2		260.3	236.3		237.2	403.2		323.5
D12 -150 : Rs.Asw	65.54		65.54	65.54 ok		65.54	65.54		65.54
total Qr capacity	468.7 > Q ok		325.9	301.9 > Q ok		302.7	468.7 > Q ok		389.0
Stirrup	D12-100	D12-150	D12-100	D12-100	D12-150	D12-100	D12-100	D12-150	D12-150

Girder ID	2G5 1-frame			FG1 G-frame			FG2 G-frame		
Position	4 end	Mid	5 end	out end	Mid	in end	end	Mid	end
D.L] M(tm) top	152.95		152.95	66.79		490.13	480.76		480.76
+] bott.		52.22			377.13			174.83	
L.L] Q (t)	137.38		137.38	298.66		359.14	298.66		298.66
] b x D (cm)	**400**	**x**	**750**	**400**	**x**	**1000**	**400**	**x**	**1000**
Size] d (cm)	700	700	700	950	950	950	950	950	950
z= Rb.b.ho^2 (x 10^6)		3332			6137			6137	
α_m (top)=M/z	0.0459		0.0459	0.0109		0.0799	0.0783		0.0783
α_m(bott.)		0.0157			0.0615			0.0285	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	349.5		349.5	483.9		483.9	483.9		483.9
Bott.Mus=Rsc.A's.(ho-a')=		349.5			483.9			483.9	
Top Mu=Rs.As(ho-0.5ξho)=	355.1		355.1	489.5		643.2	643.2		643.2
Bot Mu=Rs.As(ho-0.5ξho)=		355.1			489.5			489.5	
top	0.407		0.407	0.300		0.400	0.400		0.400
Pt (%) bott.		0.407			0.300			0.300	
top	1140		1140	1140		1520	1520		1520
as (mm2) bott.		1140			1140			1140	
Main top	3	3	3	3	3	4	4	3	4
D25		D25			D-25			D-25	
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	201.6 (kN)		201.6	273.6 (kN)		273.6	273.6 (kN)		273.6
a= 4/(M/Q+1)	2.000		1.544	2.000		1.642	1.485		1.485
a.Qbmin=	403.2		311.3	547.2		449.2	406.2		406.2
D12 -150 : Rs.Asw	65.54		65.54	65.54 ok		65.54	65.54		65.54
total Qr capacity	468.7 > Q ok		376.8	612.7 > Q ok		514.7	471.7 > Q ok		471.7
Stirrup	D12-100	D12-150	D12-100	D12-100	D12-150	D12-100	D12-100	D12-150	D12-150

Girder Profile Design **1st floor**

Girder ID	FG3 F-frame			FG4 F-frame			FG3 2-frame		
Position	out end	Mid	In end	end	Mid	end	out end	Mid	In end
D.L] M(tm) top	69.39		489.09	478.08		478.08	45.27		324.84
+] bott.		376.35			177.51			253.31	
L.L] Q (t)	298.66		358.62	298.7		298.66	174.51		225.34
] b x D (mm)	400	x	1000	400	x	1000	400	x	1000
Size] ho (mm)	950	950	950	950	950	950	950	950	950
z= Rb.b.ho^2 (x 10^6)		6137			6137			6137	
α_m (top)=M/z	0.0113		0.0797	0.0779		0.0779	0.0074		0.0529
α_m(bott.)		0.0613			0.0289			0.0413	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	483.9		483.9	483.9		483.9	483.9		483.9
Bott.Mus=Rsc.A's.(ho-a')=		483.9			483.9			483.9	
Top Mu=Rs.As(ho-0.5ξho)=	489.5		643.2	643.2		643.2	489.5		489.5
Bot Mu=Rs.As(ho-0.5ξho)=		489.5			489.5			489.5	
top	0.388		0.517	0.517		0.517	0.388		0.388
Pt (%) bott.		0.388			0.388			0.388	
top	1473		1964	1964		1964	1473		1473
as (mm2) bott.		1473			1473			1473	
Main top	3	3	4	4	3	4	3	3	3
Bars **D25**		D-25			D-25			D25	
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	273.6 (kN)		273.6	273.6 (kN)		273.6	273.6 (kN)		273.6
(kN)	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

Girder Profile Design **1st floor**

Girder ID	FG4 2-frame			FG5 1-frame			FG5 1-frame		
Position	end	Mid	end	out end	Mid	In end	end	Mid	end
D.L] M(tm) top	318.20		318.20	31.34		251.01	245.78		245.78
+] bott.		120.16			292.59			187.98	
L.L] Q (t)	174.51		174.51	203,31			203.31		203.31
] b x D (cm)	**400**	**x**	**1000**	**400**	**x**	**1000**	**400**	**x**	**1000**
Size] ho (mm)	950	950	950	950	950	950	950	950	950
$z= Rb.b.ho^2 (x 10^6)$		6137			6137			6137	
α_m (top)=M/z	0.0518		0.0518	0.0051		0.0409	0.0400		0.0400
α_m(bott.)		0.0196			0.0477			0.0306	
α_r = 0.395	>	>	>	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	483.9		483.9	483.9		483.9	483.9		483.9
Bott.Mus=Rsc.A's.(ho-a')=		483.9			483.9			483.9	
Top Mu=Rs.As(ho-0.5ξho)=	489.5		489.5	489.5		489.5	489.5		489.5
Bot Mu=Rs.As(ho-0.5ξho)=		489.5			489.5			489.5	
top	0.388		0.388	0.388		0.388	0.388		0.388
Pt (%) bott.		0.388			0.388			0.388	
top	1473		1473	1473		1473	1473		1473
as (mm2) bott.		1473			1473			1473	
Main top	3	3	3	3	3	3	3	3	3
D25		D25			D25			D25	
bott	3	3	3	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	273.6 (kN)		273.6	273.6 (kN)		273.6	273.6 (kN)		273.6
(kN)	D10-150		D10-150	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok	ok		ok

3 - 2 Column Profile Design **2 FL**

Column ID		2C1 F-frame-2				2C2			
Direction		X		Y		X		Y	
Posission		T	B	T	B	T	B	T	B
	N (t)		229.07		229.07		399.18		399.18
LT	M(tm)	7.6	14.87	55.83	70.78	9.97	17.85	7.15	11.46
	Q(t)		5.62		31.65		6.96		4.65
Size	b x d (cm), J(cm)	500	500	500	500	500	500	500	500
	lo (mm) Col. Height	4000	4000	4000	4000	4000	4000	4000	4000
eo=M/Nn (mm)		33.18	64.91	243.72	308.99	24.98	44.72	17.91	28.71
δe=(M/N)/h		0.07	0.13	0.49	0.62	0.05	0.09	0.04	0.06
δe,min=0.5-0.01lo/h-0.01Rb			**0.250**		**0.250**		**0.250**		**0.250**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		8.0		8.0		8.0		8.0
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	14017	14017	14017	14017	14017	14017	14017	14017
	η=1/(1-N/Ncr)	1.017	1.017	1.017	1.017	1.029	1.029	1.029	1.029
	Rb.Ab (kN)=	4077.2	4077.2	4077.2	4077.2	4075.0	4075.0	4075.0	4075.0
			>N ok		>N ok		>N ok		>N ok
Gross As (mm2)			2032				2032		
Gross As %			0.81				0.81		
Main Bars D25 arrangement		3 D18 3	 3	3 Y	X - X	3 D18 3	 3	3	X - X
ψb3=0.6			(kN)		(kN)		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			162		162		162		162
judge			ok		ok		ok		ok
Pw (%)			0.302				0.302		
hoop			D12 - @150				D12 - @100		

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D25 As 491 mm2
D22 As 380 mm2
D18 As 254 mm2
D12, As= 113.1 mm2
Eb= 32,500 Mpa

$$Ncr=\frac{0.533Eb.A[0.11/(0.1+\delta e)+0.1]}{\psi 1(lo/h)^2}$$

Column ID		2C3				1C1			
Direction		X		Y		X		Y	
Posission		T	B	T	B	T	B	T	B
LT	N (t)		386.86		386.86		724		724
	M(tm)	9.97	17.85	7.15	11.46	9.61	11.01	47.66	45.27
	Q(t)		6.96		4.65		3.33		14.99
Size	b x d (cm), J(cm)	500	500	500	500	500	500	500	500
	lo (mm) Col. Height	4000	4000	4000	4000	6200	6200	6200	6200
eo=M/Nn (mm)		25.77	46.14	18.48	29.62	13.27	15.21	65.83	62.53
δe=(M/N)/h		0.05	0.09	0.04	0.06	0.03	0.03	0.13	0.13
δe,min=0.5-0.01lo/h-0.01Rb			**0.250**		**0.250**		**0.206**		**0.206**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		8.0		8.0		12.4		12.4
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	14017	14017	14017	14017	6471	6471	6471	6471
	η=1/(1−N/Ncr)	1.028	1.028	1.028	1.028	1.126	1.126	1.126	1.126
	Rb.Ab (kN)=	4075.2	4075.2	4075.2	4075.2	4058.6	4058.6	4058.6	4058.6
			>N ok		>N ok		>N ok		>N ok
Gross As (mm2)			2032				3040		
Min.Gross As %			0.81				1.22		
Main Bars D25 arrangement			3 3  3 X - X D18 3 min 0.8% 50x50				3 3  3 X - X Y D18 3		Y
ψb3=0.6			(kN)		(kN)		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			162		162		162		162
judge			ok		ok		ok		ok
Pw (%)			#REF!				#REF!		
hoop			D12 - @150				D12 - @100		

Column ID		1C2				1C3			
Direction		X		Y		X		Y	
Posission		T	B	T	B	T	B	T	B
LT	N (t)		1033.3		1033.3		993.61		993.61
	M(tm)	11.54	17.85	7.4	6.63	11.54	17.85	7.4	6.63
	Q(t)		4.74		2.26		4.74		2.26
Size	b x d (cm), J(cm)	500	500	500	500	500	500	500	500
	lo (mm) Col. Height	6200	6200	6200	6200	6200	6200	6200	6200
eo=M/Nn (mm)		11.17	17.27	7.16	6.42	11.61	17.96	7.45	6.67
δe=(M/N)/h		0.02	0.03	0.01	0.01	0.02	0.04	0.01	0.01
δe,min=0.5-0.01lo/h-0.01Rb			**0.206**		**0.206**		**0.206**		**0.206**
	M1l/M=Ni/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		12.4		12.4		12.4		12.4
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	6471	6471	6471	6471	6471	6471	6471	6471
	η=1/(1−N/Ncr)	1.190	1.190	1.190	1.190	1.181	1.181	1.181	1.181
	Rb.Ab (kN)=	4047.7	4047.7	4047.7	4047.7	4049.2	4049.2	4049.2	4049.2
			>N ok		>N ok		>N ok		>N ok
Gross As (mm2)			3040				3040		
Min.Gross As %			1.22				1.22		
Main Bars D19 arrangement			3 3  3 X - X D18 3				3 3  3 X - X D18 3 min 0.8% 50x50		
ψb3=0.6			(kN)		(kN)		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			162		162		162		162
judge			ok		ok		ok		ok
Pw (%)			0.302				0.302		
hoop			D12 - @150				D12 - @100		

Column ID		2C4				1C4			
Direction		X		Y		X		Y	
Posission		T	B	T	B	T	B	T	B
LT	N (t)		222.84		222.84		659.19		659.19
	M(tm)	7.6	14.87	55.86	70.76	9.61	11.01	47.66	45.27
	Q(t)		5.62		31.66		3.33		14.99
Size	b x d (cm), J(cm)	500	500	500	500	500	500	500	500
	lo (mm) Col. Height	4000	4000	4000	4000	6200	6200	6200	6200
eo=M/Nn (mm)		34.11	66.73	250.67	317.54	14.58	16.70	72.30	68.68
δe=(M/N)/h		0.07	0.13	0.50	0.64	0.03	0.03	0.14	0.14
δe,min=0.5-0.01lo/h-0.01Rb			**0.250**		**0.250**		**0.206**		**0.206**
	M1l/M=N1/N=	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	lo/h=		8.0		8.0		12.4		12.4
β=1	ψ1=1+βM1i/M=	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Ncr=	14017	14017	14017	14017	6471	6471	6471	6471
	η=1/(1-N/Ncr)	1.016	1.016	1.016	1.016	1.113	1.113	1.113	1.113
	Rb.Ab (kN)=	4077.3	4077.3	4077.3	4077.3	4060.7	4060.7	4060.7	4060.7
			>N ok		>N ok		>N ok		>N ok
Gross As (mm2)			2032				3040		
Min.Gross As %			0.81				1.22		
Main Bars D22 arrangement		3		3	Y / X - X	3		3	X - X
		D18	3		Y	D18	3		
ψb3=0.6			(kN)		(kN)		(kN)		(kN)
Qbmin=ψb3.Rbt.b.ho=			162		162		162		162
judge			ok		ok		ok		ok
Pw (%)			0.302				0.302		
hoop			D12 - @150				D12 - @100		

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D25 As 491 mm2
D22 As 380 mm2
D18 As 254 mm2
D12, As= 113.1 mm2
Eb= 32,500 Mpa

$$Ncr=\frac{0.533Eb.A[0.11/(0.1+\delta e)+0.1]}{\psi 1(lo/h)^2}$$

4. Sub-beam, Slab and Stair

4.1 Sub-beam

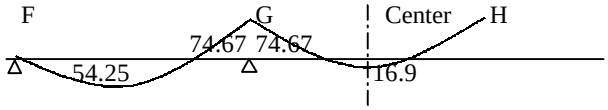
Sub-beam Co Mo Q

	Load form	(slab load)		(slab load)		(gider load)		Σ kN.m
		w	Co	Co/w	Co	w/1	Co	
rB1	Co	0.00	0.00	7.40	48.40	4.50	11.34	59.74
			Mo	Mo/w	Mo	w/1	Mo	
	Mo	0.00	0.00	11.40	74.56	4.50	17.02	91.57
		w	Q	Q/w	Q	w/1	Q	
	Q	0.00	0.00	6.60	43.16	4.50	12.38	55.54
				Slab load	6.54	(kN/m2)	span =7m	
				ly=	5.5	(m)		
				lx =	3.5		1.571	

	Load form	(slab load)		(slab load)			(gider load) P=100kN	Σ kN.m
		w	Co	w	Co	w/1	204.01	204.01
1B2	Co	0.00	0.00	0.00	0.00	15.85	255.25	255.25
			Mo	w	Mo	w/1		
	Mo	0.00	0.00	0.00	0.00	15.85	301.79	301.79
		w	Q	w	Q	w/1	119.04	119.04
	Q	0.00	0.00	0.00	0.00	15.85	118.13	118.13
				Slab load	11.13	(kN/m2)		
				ly=	5.5	(m)		

Bending moment

rB1 F G Center H 1.47



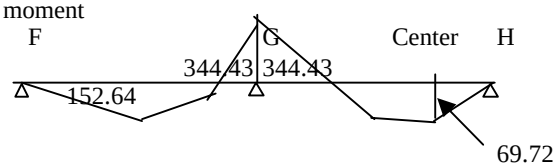
FEM	-59.74	59.74	-59.74
D1	59.74	0	0
C1	0	29.87	0
D2	0	-14.94	-14.93
Total	0	74.67	-74.67

177.21

244.03

Bending moment

1B2 F G Center H



96.44

-166.16

FEM	-204.01	255.25	-204.01	255.25
D1	204.01	-25.62	-25.62	-255.25
C1	0	102	-127.6	0
D2	0	12.8	12.8	0
Total	0	344.43	-344.43	

Sub-beam Profile

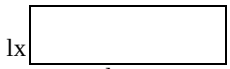
Girder ID	rB1			rB1		
Position	F end	Mid	G end	G end	Mid	H end
D.L] M(tm) top	0		74.67	74.7		74.67
+] bott.		54.25			16.9	
L.L] Q (t)	55.54		69.12	55.54		55.54
] b x D (cm)	300	x	600	300	x	600
Size] d (cm)	550	550	550	550	550	550
$z = Rb.b.ho^2$ (x 10^b)		1542.75			1542.75	
α_m (top)=M/z	0.0000		0.0484	0.0484		0.0484
α_m(bott.)		0.0352			0.0110	
α_r = 0.395	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	208.1		208.1	208.1		208.1
Bott.MuS=Rsc.A's.(ho-a')=		208.1			208.1	
Top Mu=Rs.As(ho-0.5ξho)=	211.9		211.9	211.9		211.9
Bot Mu=Rs.As(ho-0.5ξho)=		211.9			211.9	
top	0.691		0.691	0.691		0.691
Pt (%) bott.		0.691			0.691	
top	1140		1140	1140		1140
as (mm2) bott.		1140			1140	
Main top	3	3	3	3	3	3
Bars **D22**		D22			D22	
bott	3	3	3	3	3	3
Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)		118.8	118.8 (kN)		118.8
(kN)	D10-150		D10-150	D10-150		D10-150
judge	ok		ok	ok		ok

Girder ID	2B2			2B2		
Position	F end	Mid	G end	G end	Mid	E end
D.L] M(tm) top	0		344.3	344.3		0
+] bott.		152.63			152.63	
L.L] Q (t)	118.13		180.75	180.75		118.13
] b x D (cm)	350	x	750	350	x	750
Size] d (cm)	700	700	700	700	700	700
$z = Rb.b.ho^2$ (x 10^b)		2915.5			2915.5	
α_m (top)=M/z	0.0000		0.1181	0.1181		0.0000
α_m(bott.)		0.0524			0.0524	
α_r = 0.395	>	>	>	>	>	>
Top Mus=Rsc.A's.(ho-a')=	0.0		0.0	0.0		0.0
Bott.MuS=Rsc.A's.(ho-a')=		0.0			0.0	
Top Mu=Rs.As(ho-0.5ξho)=	276.7		445.0	445.0		276.7
Bot Mu=Rs.As(ho-0.5ξho)=		362.5			362.5	
top	0.465		0.776	0.776		0.465
Pt (%) bott.		0.620			0.620	
top	1140		1900	1900		1140
as (mm2) bott.		1520			1520	
Main top	3	3	5	5	3	3
Bars **D22**						
bott	3	4	3	3	4	3
Qbmin=ψb3.Rbt.b.ho=	176.4 (kN)		176.4	176.4 (kN)		176.4
a= 4/(M/Q+1)	2.000		1.075	1.075		2.000
a.Qbmin=	352.8		189.6	189.6		352.8
Asw.Rsw	65.5		65.5	65.5		65.5
Total Qr	418.3 ok Q <		255.2	ok Q <		418.3
(kN)	D12-150		D12-150	D12-150		D12-150
judge	ok		ok	ok		ok

Rs=Rsc=	365 Mpa
Rb=	17 Mpa
Rbt=	1.2 Mpa
D25 As	491 mm2
D22 As	380 mm2
D18 As	254 mm2
D12 As	113 mm2

4.2 Slab

rS1



w= 6.54 kN/m2
lx= 3.2 m thick= 150 mm
ly= 5.1 m ho= 115 mm

	a	wlx2	M
Mx1=	0.073	66.9696	4.89
Mx2=	0.048	66.9696	3.21
My1=	0.042	66.9696	2.81
My2=	0.028	66.9696	1.88
		wlx	Q
Qx =	0.52	20.928	10.88
Qy =	0.46	20.928	9.63

Rs=Rsc= 365 Mpa
Rb= 17 Mpa
Rbt= 1.2 Mpa
D12 As 113 mm2
D10 As 78 mm2

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D10	200	5	390	8.37	0.0728	15.77	> Mx1 ok
Mux2	D10	200	5	390	8.37	0.0728	15.77	> Mx2 ok
Muy1	D10	250	4	312	6.70	0.0583	12.71	> My1 ok
Muy2	D10	250	4	312	6.70	0.0583	12.71	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	82.8 (kN)	> Q	ok

2S1

w= 12.33 kN/m2
lx= 3.2 m thick= 180 mm
ly= 4.6 m ho= 145 mm

	a	wlx2	M
Mx1=	0.068	126.259	8.58563
Mx2=	0.046	126.259	5.80792
My1=	0.042	126.259	5.30289
My2=	0.028	126.259	3.53526
		wlx	Q
Qx =	0.51	39.456	20.1226
Qy =	0.46	39.456	18.1498

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12	200	5	565	12.13	0.1055	22.47	> Mx1 ok
Mux2	D12	200	5	565	12.13	0.1055	22.47	> Mx2 ok
Muy1	D12	250	4	452	9.70	0.0844	18.17	> My1 ok
Muy2	D12	250	4	452	9.70	0.0844	18.17	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

2S2

w= 12.33 kN/m2

lx= 1.25 m thick= 180 mm

ly= 4.6 m ho= 145 mm

lx

ly

	a	wlx2	M
Mx1=	0.083	19.2656	1.59905
Mx2=	0.042	19.2656	0.80916
My1=	0.042	19.2656	0.80916
My2=	0.028	19.2656	0.53944
		wlx	Q
Qx =	0.52	15.4125	8.0145
Qy =	0.46	15.4125	7.08975

Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12	200	5	565	12.13	0.1055	22.47	> Mx1 ok
Mux2	D12	200	5	565	12.13	0.1055	22.47	> Mx2 ok
Muy1	D12	250	4	452	9.70	0.0844	18.17	> My1 ok
Muy2	D12	250	4	452	9.70	0.0844	18.17	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	104.4 (kN)	> Q	ok

1S1

w= 12.33 kN/m2

lx= 3.2 m thick= 200 mm

ly= 5.5 m ho= 165 mm

λ= 1.72

lx

ly

for 1m width

	a	wlx2	M(kN.m)	
Mx1=	0.075	126.259	9.46944	.+17.5kN.m
Mx2=	0.05	126.259	6.31296	.+17.5kN.m
My1=	0.042	126.259	5.30289	
My2=	0.028	126.259	3.53526	
		wlx	Q	
Qx =	0.52	39.456	20.5171	.+40kN
Qy =	0.46	39.456	18.1498	

Track Load

40kN

Co=P.L/8 17.5 kN.m/m

3.5 m

17.5

17.5 kN.m Q=40 kN/m

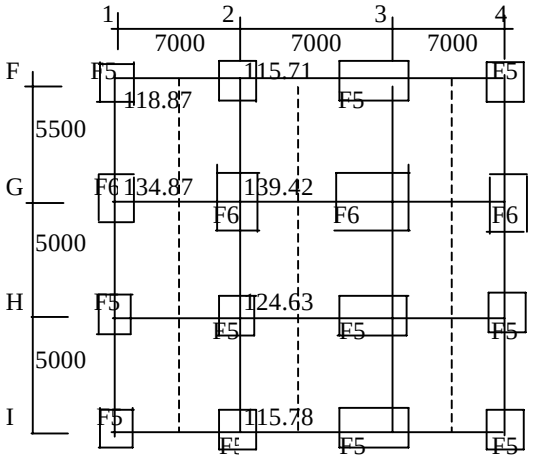
Ultimate Moment

		space	Bar no.s/m	(mm2) Σas	(mm) x	ξ	kN.m Mu	
Mux1	D12	150	6.67	753.71	16.18	0.1407	29.41	> Mx1 ok
Mux2	D12	150	6.67	753.71	16.18	0.1407	29.41	> Mx2 ok
Muy1	D12	250	4	452	9.70	0.0844	18.17	> My1 ok
Muy2	D12	250	4	452	9.70	0.0844	18.17	> My2 ok

Qmin x	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok
Qmin y	Qbmin=ψb3.Rbt.b.ho=	118.8 (kN)	> Q	ok

5. FOUNDATION

5. 1 Foundation Layout



Refer 2.3 Building at page 8-11

Footing Bottom GL-2500

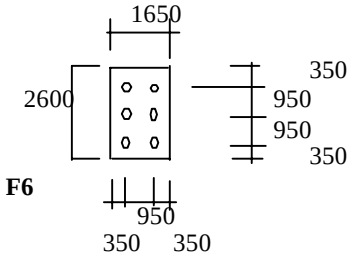
Pile length 10m

Pile 30 x 30 cm

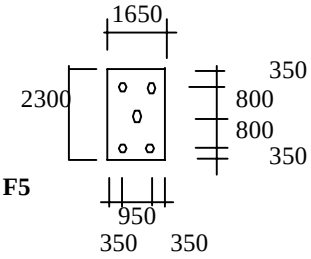
Pile bearing 280.0 kN/pile

280

	2-Frame (kN)				1-Frame (kn)	
	F	G	H	I	F	G
Axial Force	954.19	1155.8	1113.6	954.85	1086.21	898.8
Foundation Weight	252.00	277.20	252.00	252.00	252.00	252.00
Total Weight	1206.19	1433.00	1365.60	1206.85	1338.21	1150.80
Capacity(t)	1400.00	1680.00	1400.00	1400.00	1400.00	1680.00
Nos of Pile	5	6	5	5	5	6



F6



F5

6.2 Footing reinforcement

Rs=Rsc=	365	Mpa
Rb=	17	Mpa
Rbt=	1.2	Mpa
D18 As	254	mm2
h0=	400	mm
b=	2600	mm

F6 2-Frame G

F6

Bending moment at A-A

pile reaction force P (kN) 280.00

(kN.m)

M=(280-277./6) x (0.475-0.25)= 157.82

AS= 3048 mm2 **12-D18**

x= 25.17014

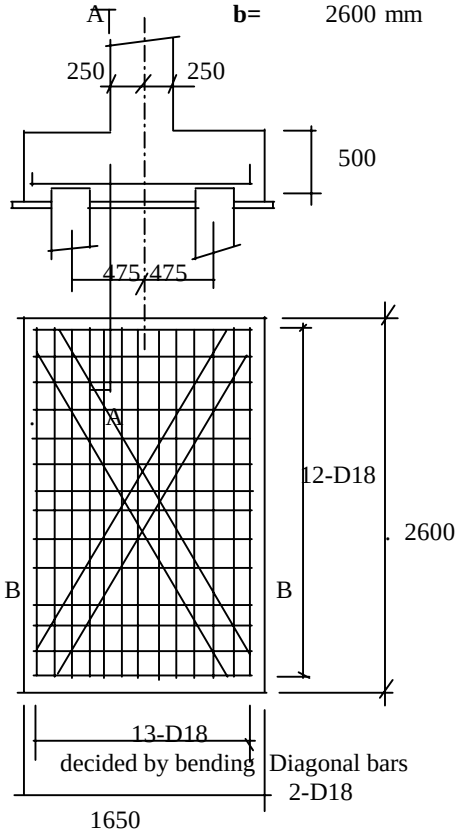
Mu= 431.01 kN.m

(kN)

Existing Shear Force=3 x (280-277.2/6)= 701.4

Qbmin=ψb3.Rbt.b.ho **748.8** kN > 701.4 ok

Resisting Capacity



Bending moment at B-B

b=1650

ho= 400

pile reaction force P (kN) = 280 kN

M=2x(280-277./6) x (0.475-0.25)= 327.32 kN.m (Existing)

13-D18 **As=** 3302 mm2

x=As.Rs/Rb.b= 42.97 mm

Mu=As.Rs(ho-0.5x)= 456.20 kN.m

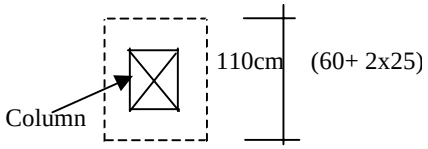
Need < designed at=38.1¤ok

Punching Shear check

Existing Shear Forc **1155.8 (kN)**

rQ (kN)= 0.6Rbt.b.ho

.= **1267.2** kN > 1155.8 oK



F5 2-Frame H

F5

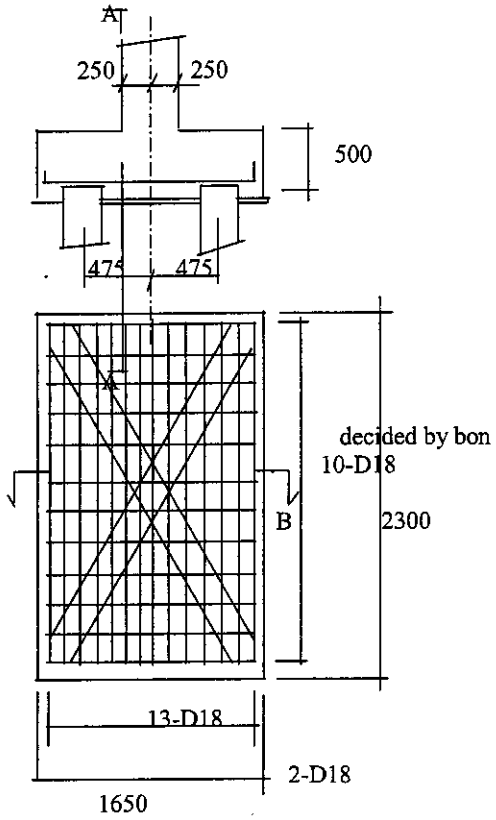
Bending moment at A-A

pile reaction force P (kN 180.00
(kN.m)
M=2 x (28-252/5) x (0.475-0.25) 103.32

10-D18 As= 2540 mm2
x=Rs.As/Rb.b= 23.71 mm2
Mu= Rs.As(ho-0.5x)= 359.85 kN.m

Existing Shear Force=	**259.2 (kN)**	
Resisting Capacity		
rQ (kN)= 0.6Rbt.b.h		
.=	**662.4** kN	> 259.2 oK

Resisting > Existing ok



Bending moment at column face at B-B

pile reaction force P (kN 280.00

M=2 x (280-252/5) x (0.95-0.25)=	321.44	(kN.m)	
13-D18 **As=**	3302 mm2		
x=As.Rs/Rb.b=	2.88 mm		
Mu=As.Rs(ho-0.5x)=	480.36 kN.m	> M=321.44	ok

Existing Shear force is same value as section A-A
Q=259.2 kN

Resisting Capacity
rQ (kN)= 0.6Rbt.b.h .=
475.2 kN > 259.2 oK

b=1650 mm
ho= 400 mm

APPENDIX

BENDING MOMENT CALCULATION kN.m

Destribution factor	0.25	0.25	0.20	0.30
Fixed end Moment	11.14			-7.00
Destributed Moment 1	-1.04	-1.04	-0.83	-1.24
Contributed Moment	6.00	0.00	1.20	0.00
Destributed Moment 2	-1.80	-1.80	-1.44	-2.16
total by virtical line	14.31	-2.84	-1.07	-10.40

end M left girder | Top M col. Dwn | Bot. M col. Up | end M right girder

F FRAME G1 G2 G1

	1			2			3			4		
			1.74			1.74			1.74			
DF	0.428		0.572	0.364	0.272	0.364	0.364	0.272	0.364	0.572	0.428	
FEM			-97.63	97.63		-97.63	97.63		-97.63	97.63		
D1	41.75		55.88	0.00	0.00	0.00	0.00	0.00	0.00	-55.88	-41.75	
C1	39.29		0.00	27.94	0.00	0.00	0.00	0.00	-27.94	0.00	-39.29	
D2	-16.80		-22.49	-10.17	-7.60	-10.17	10.17	7.60	10.17	22.49	16.80	
Σ	64.24		-64.24	115.40	-7.60	-107.80	107.80	7.60	-115.40	64.24	-64.24	
	1.30				1.30			1.30			1.30	
			3.33			3.33			3.33			
DF	0.154	0.238	0.609	0.378	0.095	0.148	0.378	0.378	0.095	0.148	0.378	0.609	0.154	0.238
FEM			-330.66	330.66			-330.66	330.66			-330.66	330.66		
D1	50.78	78.58	201.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-201.30	-50.78	-78.58
C1	23.51	20.87	0.00	100.65	0.00	0.00	0.00	0.00	0.00	0.00	-100.65	0.00	-23.51	-20.87
D2	-6.82	-10.55	-27.02	-38.09	-9.61	-14.87	-38.09	38.09	9.61	14.87	38.09	27.02	6.82	10.55
Σ	67.47	88.91	-156.38	393.22	-9.61	-14.87	-368.75	368.75	9.61	14.87	-393.22	156.38	-67.47	-88.91
	0.84				0.84			0.84			0.84			
			6.24			6.24			6.24			
DF		0.12	0.88	0.47		0.06	0.47	0.47		0.06	0.47	0.88		0.12
FEM			-396.27	396.27			-396.27	396.27			-396.27	396.27		
D1		47.02	349.25	0.00		0.00	0.00	0.00		0.00	0.00	-349.25		-47.02
C1		25.39	0.00	174.63		0.00	0.00	0.00		0.00	-174.63	0.00		-25.39
D2		-3.01	-22.38	-81.81		-11.01	-81.81	81.81		11.01	81.81	22.38		3.01
Σ		69.39	-69.39	489.09		-11.01	-478.08	478.08		11.01	-489.09	69.39		-69.39

G FRAME

	1			2			3			4		
			2.21			2.21			2.21			
DF	0.37		0.63	0.39	0.23	0.39	0.39	0.23	0.39	0.63	0.37	
FEM			-139.29	139.29		-139.29	139.29		-139.29	139.29		
D1	51.59		87.70	0.00	0.00	0.00	0.00	0.00	0.00	-87.70	-51.59	
C1	46.78		0.00	43.85	0.00	0.00	0.00	0.00	-43.85	0.00	-46.78	
D2	-17.33		-29.46	-16.94	-9.97	-16.94	16.94	9.97	16.94	29.46	17.33	
Σ	81.04		-81.04	166.20	-9.97	-156.23	156.23	9.97	-166.20	81.04	-81.04	
	1.30				1.30			1.30			1.30	
			3.45			3.45			3.45			
DF	0.15	0.23	0.62	0.38	0.09	0.14	0.38	0.38	0.09	0.14	0.38	0.62	0.15	0.23
FEM			-402.33	402.33			-402.33	402.33			-402.33	402.33		
D1	60.46	93.57	248.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-248.31	-60.46	-93.57
C1	19.79	25.79	0.00	124.15	0.00	0.00	0.00	0.00	0.00	0.00	-124.15	0.00	-19.79	-25.79
D2	-6.85	-10.60	-28.13	-47.38	-11.54	-17.85	-47.38	47.38	11.54	17.85	47.38	28.13	6.85	10.60
Σ	73.40	108.76	-182.16	479.10	-11.54	-17.85	-449.71	449.71	11.54	17.85	-479.10	182.16	-73.40	-108.76
	0.84				0.84			0.84			0.84			
			7.57			7.57			7.57			
DF		0.10	0.90	0.47		0.05	0.47	0.47		0.05	0.47	0.90		0.10
FEM			-396.27	396.27			-396.27	396.27			-396.27	396.27		
D1		39.58	356.69	0.00		0.00	0.00	0.00		0.00	0.00	-356.69		-39.58
C1		30.23	0.00	178.35		0.00	0.00	0.00		0.00	-178.35	0.00		-30.23
D2		-3.02	-27.21	-84.49		-9.37	-84.49	84.49		9.37	84.49	27.21		3.02
Σ		66.79	-66.79	490.13		-9.37	-480.76	480.76		9.37	-490.13	66.79		-66.79

Hopper house

BENDING MOMENT CALCULATION kN.m

1 FRAME **G5**

4 FRAME

	F			rG5	G			rG5	H			rG5	I		
				1.78				1.78				1.78			
DF	0.422		0.578		0.366	0.267		0.366	0.366	0.267		0.366	0.578	0.422	
FEM			-85.72		85.72			-85.72	85.72			-85.72	85.72		
D1	36.18		49.54		0.00	0.00		0.00	0.00	0.00		0.00	-49.54	-85.75	
C1	15.85		0.00		24.77	0.00		0.00	0.00	0.00		-24.77	0.00	-15.85	
D2	-6.69		-9.16		-9.07	-6.63		-9.07	9.07	6.63		9.07	0.00	6.69	
Σ	45.34		-45.34		101.42	-6.63		-94.79	94.79	6.63		-101.42	36.18	-94.91	
	1.30					1.30				1.30				1.30	
				3.47				3.47				3.47			
DF	0.150	0.232	0.619		0.382	0.093	0.143	0.382	0.382	0.093	0.143	0.382	0.619	0.150	0.232
FEM			-136.78		136.78			-136.78	136.78			-136.78	136.78		
D1	20.48	31.70	84.60		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-84.60	-20.48	-31.70
C1	11.11	18.09	0.00		42.30	0.00	0.00	0.00	0.00	0.00	0.00	-42.30	0.00	-11.11	-42.87
D2	-4.37	-6.77	-18.06		-16.17	-3.91	-6.06	-16.17	16.17	3.91	0.00	16.17	0.00	8.08	12.51
Σ	27.22	43.02	-70.24		162.92	-3.91	-6.06	-152.95	152.95	3.91	0.00	-162.92	52.18	-23.51	-62.06
	0.84					0.84				0.84				0.84	
				6.84				6.84				6.84			
DF		0.109	0.891		0.471		0.058	0.471	0.471		0.058	0.471	0.891		0.109
FEM			-203.16		203.16			-203.16	203.16			-203.16	203.16		
D1		22.22	180.94		0.00		0.00	0.00	0.00		0.00	0.00	-180.94		-22.22
C1		10.24	0.00		90.47		0.00	0.00	0.00		0.00	-90.47	0.00		-10.24
D2		-1.12	-9.12		-42.62		-5.23	-42.62	42.62		5.23	42.62	14.11		1.12
Σ		31.34	-31.34		251.01		-5.23	-245.78	245.78		5.23	-251.01	36.34		-31.34

2 FRAME

	F			rG3	G			rG3	H			rG3	I		
				2.08				2.08				2.08			
DF	0.385		0.615		0.381	0.238		0.381	0.381	0.238		0.381	0.615	0.385	
FEM			-97.63		97.63			-97.63	97.63			-97.63	97.63		
D1	37.55		60.08		0.00	0.00		0.00	0.00	0.00		0.00	-60.04	-37.55	
C1	29.71		0.00		30.04	0.00		0.00	0.00	0.00		-30.02	0.00	-29.71	
D2	-11.43		-18.28		-11.44	-7.15		-11.44	11.44	7.15		11.44	18.27	11.43	
Σ	55.83		-55.83		116.23	-7.15		-109.07	109.07	7.15		-116.21	55.86	-55.83	
	1.30					1.30				1.30				1.30	
				3.61				3.61				3.61			
DF	0.146	0.226	0.628		0.386	0.090	0.139	0.386	0.386	0.090	0.139	0.386	0.628	0.146	0.226
FEM			-262.84		262.84			-262.84	262.84			-262.84	262.84		
D1	38.40	59.42	165.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-165.02	-38.40	-59.42
C1	14.06	18.78	0.00		82.51	0.00	0.00	0.00	0.00	0.00	0.00	-82.51	0.00	-14.06	-18.78
D2	-4.80	-7.42	-20.62		-31.82	-7.40	-11.46	-31.82	31.82	7.40	11.46	31.82	20.62	4.80	7.42
Σ	47.66	70.78	-118.44		313.53	-7.40	-11.46	-294.66	294.66	7.40	11.46	-313.53	118.44	-47.66	-70.78
	0.84					0.84				0.84				0.84	
				7.01				7.01				7.01			
DF		0.107	0.893		0.472		0.057	0.472	0.472		0.057	0.472	0.893		0.107
FEM			-262.84		262.84			-262.84	262.84			-262.84	262.84		
D1		28.13	234.71		0.00		0.00	0.00	0.00		0.00	0.00	-234.71		-28.13
C1		19.20	0.00		117.36		0.00	0.00	0.00		0.00	-117.36	0.00		-19.20
D2		-2.05	-17.14		-55.36		-6.63	-55.36	55.36		6.63	55.36	17.14		2.05
Σ		45.27	-45.27		324.84		-6.63	-318.20	318.20		6.63	-324.84	45.27		-45.27

Hopper House

BENDING M CALCULATION

Appendix B-15

Summary of Manhole Cover Investigation

APPENDIX B.15 Summary of Manhole cover investigation

1) Total number 5213

2) Condition Manhole Cover good approx. 100 pieces 2%
others approx. 5100 pieces 98%

3) Unevenness(projection or depression) of Manhole covers
average for all the manhles investigated +29.6 mm(projection)

4) Typical " GOOD" manhole covers are limited in the location of outside of roads as shown in the picture below.

Figure B.15.1 Typical Manhole Cover in " good" condition

Location : Samal No.9 in the green belt
Depth of emboss : 6mm (Groove of surface design)
Thickness of abrasion 0mm (No abrasion since the location is not on the road)
Surface condition : Rusted

5) Typical " USABLE" manhole covers are located on the roads as shown in the picture below.

Figure B.15.2 Typical Manhole Cover in " usable" condition on the road

Location : On the road of ABAY Street in front of the ASA building
Depth of emboss : 3mm
Thickness of abrasion 3mm (Location is in the heavy traffic road)
Surface condition : Rusted

Appendix B-16

Issues relevant to the construction work in STP

APPENDIX B-16 Issues relevant to the construction work in STP

B.16.1 Method of facility take-over from the contractor by the Employer during the construction

1) Need of arrangements during construction work

During the construction and rehabilitation work for the sewage treatment plant, intermediate arrangements shall be made according the following procedure.

Step 1: Construction of new facilities prior to the rehabilitation of the existing facilities.
Step 2: Commencement of service of the new facility (i.e. Take-over by Employer upon construction)
Step 3: Stepwise rehabilitation of existing facilities

For typical example, the facilities for which such a procedure is required are primary sedimentation tanks (2 new tanks and 6 rehabilitation tanks) and secondary sedimentation tank (2 new tanks and 10 rehabilitation tanks).

2) Take-over of the facility

Take-over of the facility from the Contractor by the Employer usually occurs upon completion of construction/test run before overall completion of the construction work

The procedure for the take-over shall comply with the Specifications and the Conditions of Contract.

B.16.2 Arrangement with the Taldykol liquidation project

1) General description of the Taldykol liquidation project

1) Taldykol liquidation project (herein after Taldykol project) consists of two components, namely, Taldykol elimination and construction of advanced treatment facilities entailing the modification of aeration tank.
2) Taldykol elimination will be performed by evaporation.
3) Taldykol liquidation project is going to start in 2004, one year before the J BIC project.
4) Alternative discharge point is necessary for the replacement of Taldykol reservoir.
5) Discharge point of the treated water has not yet determined.

2) Time schedule and the influence to the JBIC project

Time schedule of the both projects is shown in Table 1. From the Table 1, construction of the Taldykol project is scheduled from 2004 to 2006. Liquidation and reclamation work will continue until year 2020. While, the J BIC project will start in 2005, and be completed

in 2008. Thus, both projects will overlap from 2005 to 2008.

Discharge point of treated water will be changed in 2007 to the river. Treated water quality must conform to the regulation for the fishery water body, therefore blower house rehabilitation and blower installation, new construction of sludge return house with the equipment and pipelines must be first priority in the J BIC project.

3) Influence to the JBIC project and remarks for the Taldykol project

(1) Construction site

Advanced Treatment Facilities are located beside existing sewage treatment facilities within the premises of the STP. Both projects need to construct a lot of facilities including pipelines and cables. There may arise many troubles for the work in transportation, excavation and construction, if there is no arrangement between the two projects.

Periodic meetings are necessary between two projects to avoid disorder and complexity during the construction period.

(2) Aeration tank

Though details are not shown in the drawings as of November 2003, the modified anaerobic-anoxic-oxic (aerobic) process (hereinafter referred to A2O process) seems to be employed to remove nitrogen and phosphorus through the Taldy-kol project.

Facilities, equipment, conduits and pipelines are designed in assumption that conventional activated sludge treatment method is maintained in the J BIC project. Equipment such as blowers and return sludge pump, and channels/pipelines to be constructed must be arranged between two projects, because additional capacity of the aeration tank is required for Taldy-kol project.

(3) Discharge/Temporary discharge pump station

Upon commencement of effluent discharge to the river instead of Taldykol reservoir, existing discharge pump station will be unnecessary. Referring to the construction schedule of Taldy-kol project, the operation of advanced treatment plant will be started earlier than rehabilitation work of existing discharge pump station.

According to the implementation schedule, rehabilitation of the existing discharge pumping station and construction of temporary pumping station in the J BIC project may be omitted.

(4) Process control

Process control design in the J BIC project was made applying conventional activated sludge treatment process. A process control system must be modified by AKIMAT after

clarification of the operation method of modified aeration tank and supporting equipment.

Regarding the process control system for other facilities in the Taldykol project, new sludge treatment building, gravity thickener, rapid sand filter and pumping station must be constructed/installed.

(5) Power supply

The Taldykol project must establish power supply facilities, since J BIC project does not include the demand by Taldykol project.

(6) Sewage/water distribution tank

Two additional aeration tanks will be constructed in the Taldykol project. Since the facilities are located far from the primary sedimentation tanks, distribution tank with the flow rate regulation device must be constructed by the Taldykol project.

(7) Boiler

According to F/S report of the Taldykol project, extra one (1) boiler is necessary for the Taldykol project. Existing boiler house must be extended or newly constructed, since the existing boiler house does not have a room. In addition, extension of both of the coal and ash conveyors, and increase of water tank for the condenser and hot water pump must be managed by the Taldykol project.

(8) Connecting pipes and channels

Arrangements by AKIMAT shall be necessary for the pipes and channels around the aeration tank, since J BIC Project is designed base on conventional activated sludge treatment method.

B.16.3. Further issues for the arrangement between both projects

1) Boundary of the STP cannot be determined, since the plot plan of the Taldykol project is unclear and the north-side boundary of sludge drying beds is not known.
2) Arrangements for disposal of surplus soil caused by the Taldykol project is necessary.
3) Aesthetics of the STP must be re-organized .
4) According to the F/S report for Taldykol liquidation, generated water from sludge treatment facilities for the Taldykol reservoir will be returned to the reservoir. The organic substances in the water of the reservoir will be decomposed emitting offensive odor. Countermeasures on the odor problem are requisites for the governmental area.

Table 1 Taldykol liquidation project Construction schedule and Taldykol Evaporation Schedule

			Q'ty	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Remarks
Tender		Tender		☆ ←		October												
		Construction start			☆ ←			December										
Construction	Existing (Rehabil.)	Aeration	4 units															
		Blower	1 unit															
	New	Aeration	2 units															
		Secondary.Sed.Tank	2 units															
		Return sludge PS	1 LS															
		Rapid sand filter	1 LS															
		Chlorination house	1 LS															
		Discharge PS	1 LS															
		Chemical House	1 LS															
		Sludge treatment	1 LS															
		Effluent disacharge facilities	1 LS															
Liquidation Reclamation	Works	Removal of bottom sludge	1 LS															up to 2020
		Evaporation of the reservoir	1 LS															
		Dismantling the dyke	1 LS															
		Reclamation of land	1 LS															
	Talykol Evaporation Schedule	Water Volume	mil. m3	50.3	50.3	50.3	50.3	42.4	34.5	26.6	18.7	10.8	2.9	-	-	-	-	
			%	100	100	100	100	84.3	68.6	52.9	37.2	21.5	5.8					
		Water Surface area	ha	1900	1900	1900	1900	1690	1480	1270	1060	849.8	429.7	-	-	-	-	
		Average water depth	m	2.647	2.647	2.647	2.647	2.232	1.816	1.4	0.984	0.568	0.153	-	-	-	-	
								←					→					
								Evaporation Period										

J BIC PROJ ECT

Construction period of JBIC project

B-16-4