

7.1.6

Water Supply Facility

CALCULATION FOR WATER SUPPLY FACILITY (FOR UNDER GROUND PART)

(The calculation based on Japanese standard)

1-GEOMETRY DATUM FOR CALCULATION

(As shown on drawings attached):

Ground level:	GL	2.2
Ground water level:	GW	0.0
Bottom level of chlorination house:	BL	-3.1
Bottom level of sand filtration tank:	BL	-2.23

Water level in filtration works: 3.28

Thickness of chlorination house bottom 0.70 m

Thickness of filtration works bottom: 0.70 m

Average thickness of non-reinforced concrete layer (Chlorination house): 0.25 m

2-PARAMETERS FOR CALCULATION:

Concrete: Grade C21, $R_n = 70$

$RS = 3.6$

Reinforcement type JIS: $R_a = 1600$

Back fill sand: $\gamma_s = 1.80T/m^3$; Coefficient of earth pressure at 0.5

Internal friction 20deg

2.1-BOUNDARY CONDITION:

Considering R.C piles as springs for analysing. Please refer to pile calculation part for further information about spring coefficients

3-LOAD CALCULATION (BASE ON JAPANESE STANDARD):**3.1- Maximum loads from architect part to be taken in calculation as in analysis****3.2- Soil load:****In case of ground water level at 0.00 (Permanent case):**

-Horizontal triangle distributed load due to earth under ground water level (Outside of chlorination house):

$$p_{h1} = (\gamma_s - 1) \times (GWL - BL) \times K_0 + (GWL - BL) \times 1.0 + p_{h3} = 6.32T/m^2$$

-Horizontal triangle distributed load due to earth under ground water level (Outside of filtration works):

$$p_{h2} = (\gamma_s - 1) \times (GWL - BL) \times K_0 + (GWL - BL) \times 1.0 + p_{h3} = 5.10T/m^2$$

-Horizontal triangle distributed load due to earth above ground water level

$$p_{h3} = \gamma_s (GL - GWL) K_0 = 1.98T/m^2$$

-Horizontal uniform load due to surcharge load on ground surface:

$$p_{h-surch} = 0.50T/m^2 \times K_0 = 0.25T/m^2$$

-Horizontal uniform load due to cover soil:

$$p_{h-coversoil} = 1.8 \times 1.20 \times K_0 = 1.08T/m^2$$

-Uplift pressure to bottom of chlorination house for this case:

$$p_{uplth} = (H_{ground\ water}) \times 1.0 = 3.80T/m^2$$

-Uplift pressure to bottom of filtration work for this case:

$$p_{uplth} = (H_{ground\ water}) \times 1.0 = 2.93T/m^2$$

3.3-Water load in filtration works:

-Water load in side tanks:

$$p_{water} = 5.51T/m^2$$

3.4-Load of non-reinforced concrete layer on bottom slab:

(Due to machanical supports and cinder concrete)

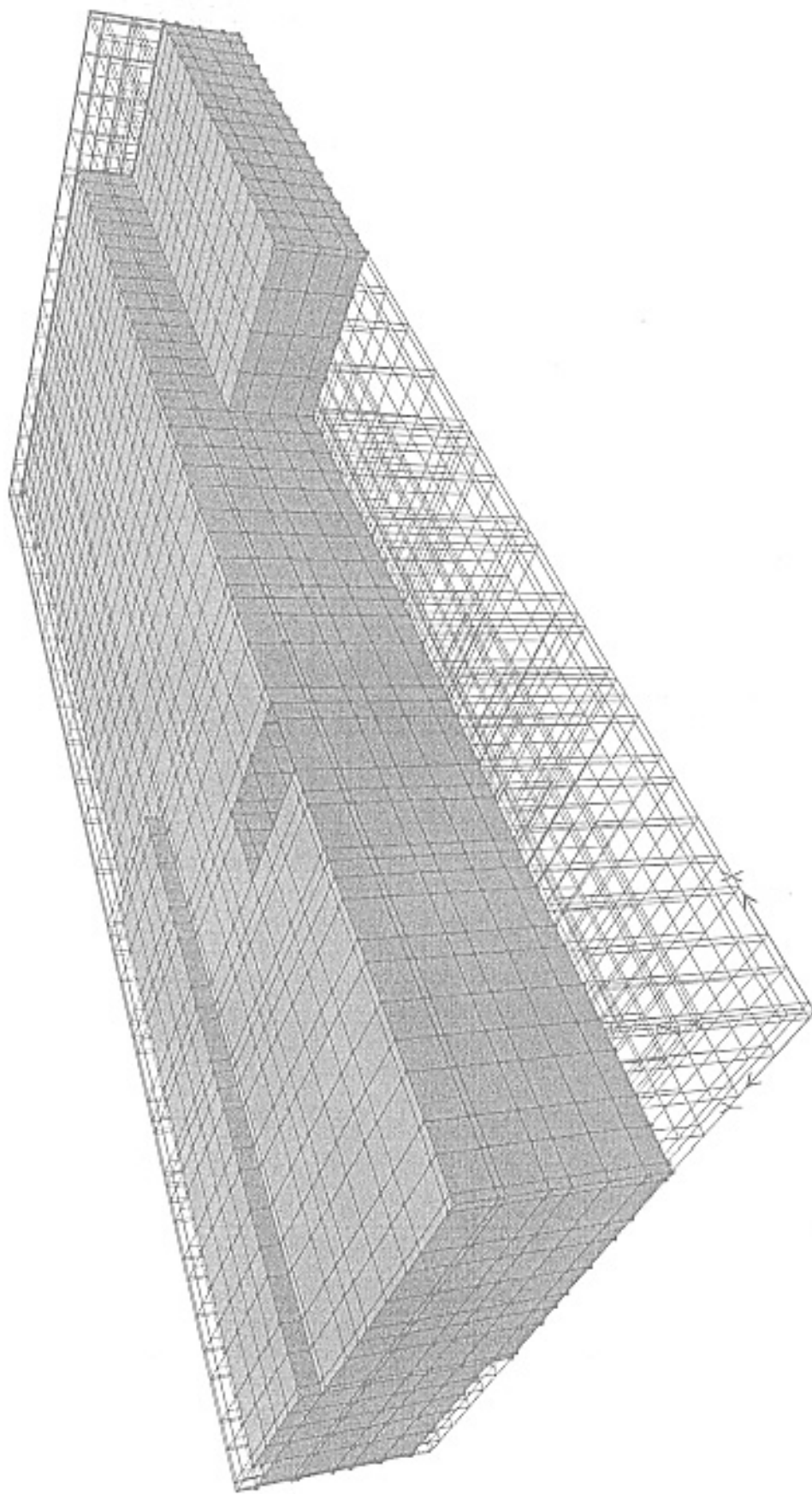
-Uniform load: $q_{con\ la} = 2.5 \times 0.25 = 0.625T/m^2$

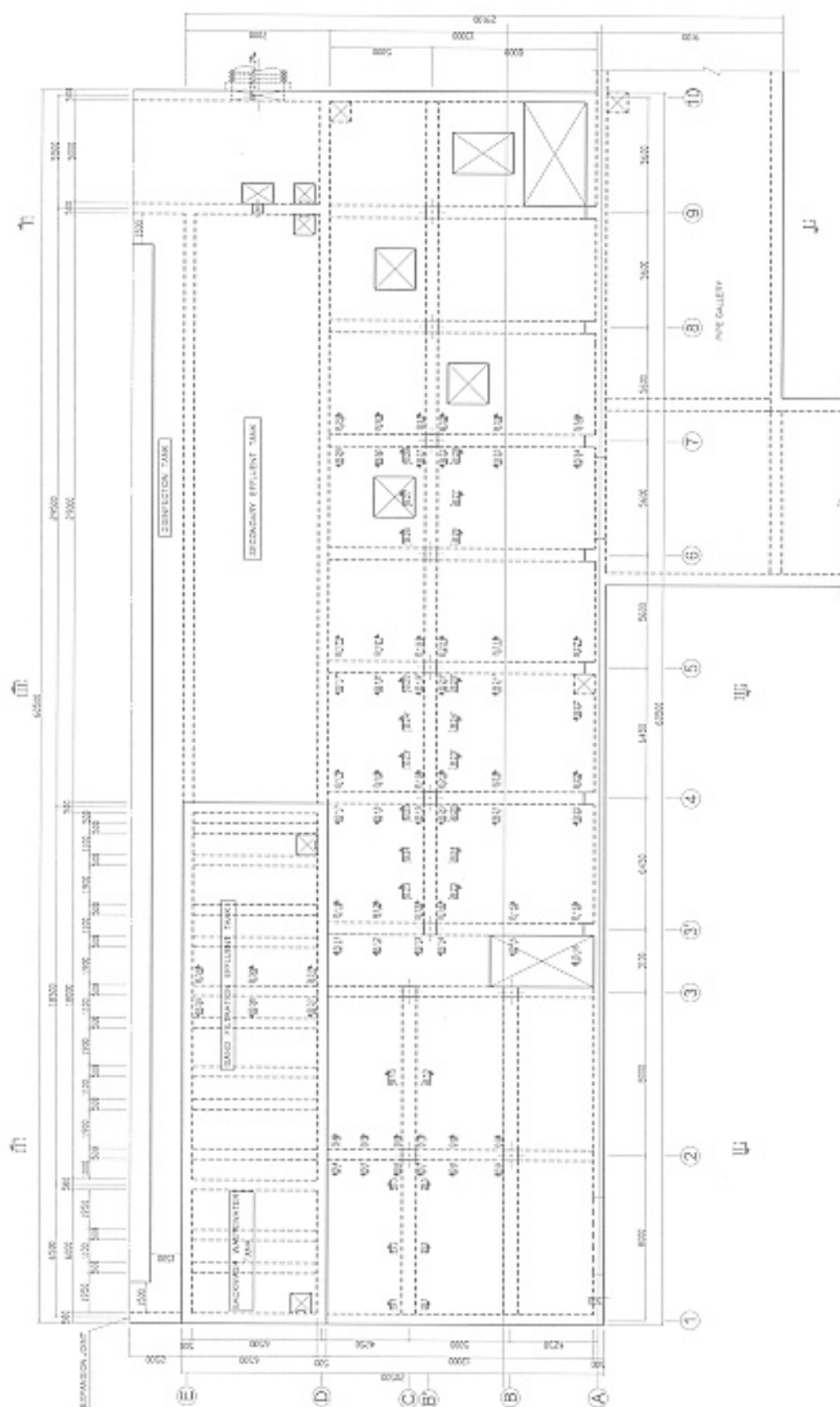
3.5-Live load:

-Live load for all operating floor and walking way: $q_{live} = 0.50T/m^2$

-Live load for electric room: $1.00T/m^2$

-Live load due to chlorination tank: $4.40T/m^2$





**4-ANALYSING BY SAP 2000: THERE ARE 4 COMBOS FOR ANALYSING AS ATTACHED HEREAFTER:
ALL THE LOADS, FACTORS, AND OTHER INPUT DATUM TO BE TAKEN IN ANALYSIS AND
CALCULATED BY SAP 2000**

LOAD COMBINATION MULTIPLIERS

COMBO	TYPE	CASE	FACTOR	TYPE	TITLE
COMB1	ADD				Disinfection tanks full of water, water supply facility tanks empty, and right wind load
	SELF	1.0000	STATIC(	DEAD)	
	MANBOTTO	1.0000	STATIC(	LIVE)	
	WATERDIS	1.0000	STATIC(	LIVE)	
	EARTH	1.0000	STATIC(	OTHER)	
	ELECFL00	1.0000	STATIC(	LIVE)	
	SURCHARG	1.0000	STATIC(	OTHER)	
	UPLIFT	1.0000	STATIC(	OTHER)	
	VVEHICLE	1.0000	STATIC(	LIVE)	
	ACHITEC2	1.0000	STATIC(	OTHER)	
	FILTER	1.0000	STATIC(	LIVE)	
	CHLOTANK	1.0000	STATIC(	LIVE)	
	BRICKWAL	1.0000	STATIC(	DEAD)	
	MANFFLOO	1.0000	STATIC(	LIVE)	
	COVERSOI	1.0000	STATIC(	OTHER)	
COMB2	ADD				Water supply facility tanks full of water, disinfection tanks empty, and right wind load
	SELF	1.0000	STATIC(	DEAD)	
	MANBOTTO	1.0000	STATIC(	LIVE)	
	EARTH	1.0000	STATIC(	OTHER)	
	ELECFL00	1.0000	STATIC(	LIVE)	
	SURCHARG	1.0000	STATIC(	OTHER)	
	UPLIFT	1.0000	STATIC(	OTHER)	
	VVEHICLE	1.0000	STATIC(	LIVE)	
	ACHITEC2	1.0000	STATIC(	OTHER)	
	FILTER	1.0000	STATIC(	LIVE)	
	CHLOTANK	1.0000	STATIC(	LIVE)	
	BRICKWAL	1.0000	STATIC(	DEAD)	
	MANFFLOO	1.0000	STATIC(	LIVE)	
	WATERFIL	1.0000	STATIC(	LIVE)	
	COVERSOI	1.0000	STATIC(	OTHER)	
COMB3	ADD				Disinfection tanks full of water water supply facility tanks empty, and left wind load
	SELF	1.0000	STATIC(	DEAD)	
	MANBOTTO	1.0000	STATIC(	LIVE)	
	WATERDIS	1.0000	STATIC(	LIVE)	
	EARTH	1.0000	STATIC(	OTHER)	
	ELECFL00	1.0000	STATIC(	LIVE)	
	SURCHARG	1.0000	STATIC(	OTHER)	
	UPLIFT	1.0000	STATIC(	OTHER)	
	VVEHICLE	1.0000	STATIC(	LIVE)	
	FILTER	1.0000	STATIC(	LIVE)	
	CHLOTANK	1.0000	STATIC(	LIVE)	
	BRICKWAL	1.0000	STATIC(	DEAD)	

MANFFLOO 1.0000 STATIC(LIVE)
 ACHITEC1 1.0000 STATIC(OTHER)
 COVERSOI 1.0000 STATIC(OTHER)

COMB4 ADD Water supply facility tanks full of water, disinfection tanks empty, and left wind load
 SELF 1.0000 STATIC(DEAD)
 MANBOTTO 1.0000 STATIC(LIVE)
 EARTH 1.0000 STATIC(OTHER)
 ELECFLoo 1.0000 STATIC(LIVE)
 SURCHARG 1.0000 STATIC(OTHER)
 VEHICLE 1.0000 STATIC(LIVE)
 FILTER 1.0000 STATIC(LIVE)
 CHLOTANK 1.0000 STATIC(LIVE)
 BRICKWAL 1.0000 STATIC(DEAD)
 MANFFLOO 1.0000 STATIC(LIVE)
 ACHITEC1 1.0000 STATIC(OTHER)
 WATERFIL 1.0000 STATIC(LIVE)
 COVERSOI 1.0000 STATIC(OTHER)

REINENVE ENVE MAX MIN OF ALL COMBOS TO CALCULATE FOR REINFORCEMENT
 COMB1 1.0000 COMBO
 COMB2 1.0000 COMBO
 COMB3 1.0000 COMBO
 COMB4 1.0000 COMBO

5-CALCULATION FOR BAR ARRANGEMENT:

Base on attached results of shell forces analysed by SAP2000, choosing the most dangerous forces for calculation:

$$A_o = M/R_n b h_o^2 \quad \text{Where, } M: \text{Maximum bending moment(T.m)}$$

$$h_o: \text{Effective depth of bearing area(cm)}$$

$$h_o = (\text{Element thickness} - \text{Cover thickness})$$

$$b: \text{Width of calculated area(cm)}$$

Required area of reinforcement:

$$F_a = M/\gamma R_a h_o \quad \text{Where: } \gamma = 0.5 + ((1 - 2A_o)^{1/2})/2$$

5.1-SLABS AND WALLS:

Moments	Values (T.m)	Ao	γ	Fa (cm ²)	Bar arrangement		Remarks
					ϕ (mm)	a(mm)	
sect. 1-1 (Bottom) t=0.70	17.700	0.0752	0.961	19.85	18	125	125
	36.300	0.1542	0.916	42.71	28	125	
	12.000	0.0510	0.974	13.28	16	125	
	11.400	0.0484	0.975	12.60	16	125	
	8.500	0.0361	0.982	9.33	18	250	
	14.400	0.0612	0.968	16.02	16	125	
	12.400	0.0527	0.973	13.73	16	125	
	13.600	0.0578	0.970	15.10	16	125	
	14.900	0.0633	0.967	16.60	18	125	
	6.900	0.0293	0.985	7.55	18	250	
	8.400	0.0357	0.982	9.22	18	250	
	-17.600	0.0633	0.967	18.05	20	150	
	-12.700	0.0457	0.977	12.90	16	125	
	-9.200	0.0331	0.983	9.28	14	125	

Moments	Values (T.m)	Ao	γ	Fa (cm ²)	Bar arrangement		Remarks
					ϕ (mm)	a(mm)	
	-8.500	0.0306	0.984	8.57	14	150	125not in Dwg
	-10.500	0.0378	0.981	10.62	14	125	
	-9.800	0.0353	0.982	9.90	14	125	
	-7.700	0.0277	0.986	7.75	14	150	125
sect. 1-1 (First floor) t=0.20	-1.830	0.1162	0.938	8.13	12	125	
	1.000	0.0635	0.967	4.31	12	250	
	-1.310	0.0832	0.957	5.71	12	150	125
	-2.560	0.1625	0.911	11.71	14	125	
	1.330	0.0844	0.956	5.80	14	250	
	-2.100	0.1333	0.928	9.43	14	125	
	2.630	0.1670	0.908	12.07	14	125	
	-2.350	0.1492	0.919	10.66	14	125	
	0.900	0.0571	0.971	3.86	12	250	
	1.640	0.1041	0.945	7.23	12	125	not in Dwg
	-4.300	0.2730	0.837	21.41	18	100	125not in Dwg
	-2.600	0.1651	0.909	11.91	14	125	
sect. 1-1 (Wall A) t=0.50	-14.200	0.1097	0.942	21.92	20	125	
	12.500	0.0966	0.949	19.14	18	125	
	4.000	0.0309	0.984	5.91	14	250	
	-2.600	0.0201	0.990	3.82	16	250	
	-12.000	0.0927	0.951	18.34	18	125	not in Dwg
sect. 1-1 (Wall D) t=0.50	14.000	0.1082	0.943	21.59	20	125	
	-6.000	0.0464	0.976	8.93	14	150	125
	3.400	0.0263	0.987	5.01	14	250	
	-1.750	0.0135	0.993	2.56	12	250	
sect. 1-1 (Wall E) t=0.50	10.470	0.0809	0.958	15.89	18	125	
	-12.000	0.0927	0.951	18.34	18	125	
	2.800	0.0216	0.989	4.11	14	250	
	-5.200	0.0402	0.979	7.72	16	250	
sect. 2-2 (Bottom) t=0.70	15.700	0.0667	0.965	17.52	24	250	
	15.400	0.0654	0.966	17.18	24	250	
	26.000	0.1104	0.941	29.76	24	125	
	16.190	0.0688	0.964	18.09	24	250	
	25.200	0.1070	0.943	28.79	24	125	
	28.800	0.1223	0.935	33.21	24	125	
	14.600	0.0620	0.968	16.25	18	125	
	9.400	0.0399	0.980	10.34	18	250	
	23.700	0.1006	0.947	26.97	22	125	not in Dwg
	18.700	0.0794	0.959	21.02	20	125	
	8.520	0.0362	0.982	9.35	20	250	
	-9.400	0.0338	0.983	9.49	14	125	
	-14.400	0.0518	0.973	14.68	16	125	
	-13.500	0.0486	0.975	13.74	16	125	
	-9.100	0.0328	0.983	9.18	14	150	
	-9.000	0.0324	0.984	9.08	14	150	
	-14.000	0.0504	0.974	14.26	16	125	not in Dwg
	-10.300	0.0371	0.981	10.42	14	125	
	-8.800	0.0317	0.984	8.87	14	150	125
	-5.230	0.1195	0.936	13.97	16	125	
	3.100	0.0709	0.963	8.05	12	125	

Moments	Values (T.m)	Ao	γ	Fa (cm ²)	Bar arrangement		Remarks
					ϕ (mm)	a(mm)	
sect. 2-2 (first floor)	-2.620	0.0599	0.969	6.76	12	150	not in Dwg
	1.250	0.0286	0.986	3.17	14	250	
	-6.400	0.1463	0.921	17.38	18	125	
	-4.920	0.1125	0.940	13.08	16	125	
	-2.940	0.0672	0.965	7.62	16	250	
0.3	1.900	0.0434	0.978	4.86	14	250	not in Dwg
0.25 (Sand filtration cover slab)	-3.400	0.1214	0.935	11.36	14	125	
	1.820	0.0650	0.966	5.89	14	250	
	-3.300	0.1179	0.937	11.00	14	125	
	1.500	0.0536	0.972	4.82	14	250	
	1.820	0.0650	0.966	5.89	14	250	
	-5.200	0.1857	0.896	18.13	18	125	
	-3.800	0.1357	0.927	12.81	16	125	
	-3.100	0.1107	0.941	10.29	16	150	
sect.2-2 wall A 0.5	-15.900	0.1228	0.934	24.74	20	125	
	4.100	0.0317	0.984	6.06	14	250	
	-9.100	0.0703	0.964	13.73	20	200	
	-4.000	0.0309	0.984	5.91	14	250	
sect.2-2 wall D 0.5	17.500	0.1352	0.927	27.44	22	125	
	-12.000	0.0927	0.951	18.34	18	125	
	5.300	0.0409	0.979	7.87	16	250	
	-2.100	0.0162	0.992	3.08	12	250	
sect.2-2 wall E 0.5	-14.200	0.1097	0.942	21.92	20	125	
	9.000	0.0695	0.964	13.57	18	150	
	-5.400	0.0417	0.979	8.02	16	250	
	4.520	0.0349	0.982	6.69	16	250	

5.1-BEAMS:

SECTION m2	LOCATION	Values (T.m)	Ao	γ	Fa (cm ²)	Bar arrangement		Remarks
						ϕ (mm)	quantity	
b=0.70 h=1.30	B1	-15.520	0.0209	0.989	7.97	25	2	
	B2	37.860	0.0511	0.974	19.76	25	5	
	B3	-62.820	0.0847	0.956	33.40	24	8	
	B10	45.430	0.0613	0.968	23.84	25	5	
b=0.50 h=0.60	B4	-5.760	0.0586	0.970	7.00	22	2	
	B5	5.200	0.0529	0.973	6.30	18	3	
	B6	-6.630	0.0674	0.965	8.10	22	3	
	B7	-5.870	0.0597	0.969	7.14	18	3	
	B8	2.940	0.0299	0.985	3.52	18	2	
	B9	-6.830	0.0695	0.964	8.36	22	3	
b=0.60 h=1.20	B11	-11.700	0.0218	0.989	6.54	22	2	
	B12	2.840	0.0053	0.997	1.57	20	2	
	B13	-41.480	0.0773	0.960	23.91	24	6	
	B14	-39.620	0.0739	0.962	22.79	24	6	
	B15	22.420	0.0418	0.979	12.67	20	5	
	B16	-23.750	0.0443	0.977	13.44	24	3	
	B17	-4.850	0.0090	0.995	2.69	24	2	

SECTION m2	LOCATION	Values (T.m)	Ao	γ	Fa (cm ²)	Bar arrangement		Remarks
						ϕ (mm)	quantity	
	B18	7.190	0.0134	0.993	4.00	22	2	
	B19	-37.580	0.0701	0.964	21.57	24	5	
	B20	-37.640	0.0702	0.964	21.61	24	5	
	B21	30.930	0.0577	0.970	17.63	22	5	
	B22	-31.750	0.0592	0.969	18.11	24	5	
	B17'	-11.470	0.0214	0.989	6.41	24	2	
	B18'	2.050	0.0038	0.998	1.14	22	2	
	B19'	-45.150	0.0842	0.956	26.12	24	6	
	B20'	-46.420	0.0866	0.955	26.89	24	6	
	B21'	40.970	0.0764	0.960	23.60	22	7	
	B22'	-39.660	0.0740	0.962	22.81	24	6	
b=0.60	B23	-9.490	0.0424	0.978	8.30	24	2	
h=0.80	B24	19.880	0.0888	0.953	17.85	24	4	
	B25	-29.990	0.1340	0.928	27.67	24	7	
	B23'	-29.690	0.1327	0.929	27.37	24	7	
	B24'	16.210	0.0724	0.962	14.42	24	4	
	B25'	-18.740	0.0837	0.956	16.78	24	4	
b=0.60	B26	-11.700	0.0992	0.948	14.56	24	4	
h=0.60	B27	5.810	0.0492	0.975	7.03	20	3	
	B28	-11.020	0.0934	0.951	13.67	24	4	
b=0.60	B29	-7.670	0.0211	0.989	5.21	24	2	
h=1.00	B30	0.000	0.0000	1.000	0.00	22	2	
	B31	-30.370	0.0836	0.956	21.34	24	5	
b=0.60	B32	-31.240	0.0860	0.955	21.98	24	5	
h=1.00	B33	25.090	0.0691	0.964	17.49	22	5	
	B34	-27.080	0.0745	0.961	18.93	24	5	
b=0.50	B35	-18.600	0.0771	0.960	14.59	20	5	
h=0.90	B36	31.110	0.1290	0.931	25.17	24	6	
	B37	-15.900	0.0659	0.966	12.40	20	4	

5.1.1-CHECKING SHEAR FORCES:

- Height of hand for supporting beam s , so the section need to be checked shear bearing capacity is $[c/2+(h+s)/2]$
 - In case $Q > R_{sxd}$ so the below case is to be considered
 - In case concrete is not enough to bear shearing force, stirrups will be considered
- $Sc/2 + Ss > Q$ (shearing force at section calculated)
 Where Sc : shearing bearing capacity of concrete (kg)
 Ss : shearing bearing capacity of reinforcement (kg)
 $Ss = A_{sx} R_{ax} / a = Q - Sc/2$

A_{sx} : area of all stirrup in section considered

d : effective height of beam

a : pitch of stirrup (distance between two stirrups)

j : coefficient that consider safety factor ($= 1/1.15$) $= 0.87$

Frame	height of beam h (m)	Width of beam b (m)	height of hand s (m)	height of column c (m)	$c/2 + (h+s)/2$	Values (T.m)	Capacity of concrete (ton)	Shearing stresses (Kg/cm ²)	Deqn Shear stress (Sc) (Kg/cm ²)	Compare & Conclud	Number of stirrup branches	Dia. Of stirrup (mm)	pitch of stirrup (cm)
Frame C	1.3	0.7	0	0.5	0.90	36.63	31.00	4.25	3.6	NOT OK!	2	12	18.3
Frame 2	0.6	0.5	0	0.7	0.65	8.32	9.54	3.14	3.6	OK!!!			
Frame 4	1.2	0.6	0	0.6	0.90	22.45	24.41	3.31	3.6	OK!!!			
Frame 5	1.2	0.6	0	0.6	0.90	29.83	24.41	4.40	3.6	NOT OK!	2	12	20.2
Frame 7	1.0	0.6	0	0.6	0.80	19.56	20.09	3.51	3.6	OK!!!			
Frame B'	1.0	0.6	0	0.6	0.80	19.72	20.09	3.53	3.6	OK!!!			

6. COLUMNS:

A. MATERIAL PROPERTIES:

- Concrete	Grade	E21	Rn	=	70 (Kg/cm ²)
			Eb	=	230000 (Kg/cm ²)
- Reinforcement	Grade	All	Ea	=	2000000 (Kg/cm ²)
			Ra = Ra'	=	1800 (Kg/cm ²)

B. CALCULATION:

NAME OF COLUMN	POSITION	l (cm)	b (cm)	h (cm)	area' (cm ²)	h ₀ (cm)	l ₀ (cm)	l _n	m _s	Rn* (Kg/cm ²)	α_s	A ₀	μ_s (%)	J _s (cm ⁴)	J ₀ (cm ⁴)	M (Kg.m)	N (Kg)	a ₀ (cm)	a ₀ /h
A-5	Upper	670	60	100	7	93	469	4.690	1.00	70	0.62	0.428	0.62	63968	500000.00	3.19E+04	2.03E+04	139.8	1.598
	Lower	670	60	100	7	93	469	4.690	1.00	70	0.62	0.428	0.4	41270	500000.00	2.42E+04	2.30E+04	119.1	1.091
B-4	Upper	670	60	60	7	53	469	3.817	1.00	70	0.62	0.428	0.2	3364	100000.00	2.25E+03	1.10E+05	4.4	0.074
	Lower	670	60	60	7	53	469	3.817	1.00	70	0.62	0.428	0.2	3364	100000.00	4.02E+03	1.17E+05	5.8	0.097
C-2	Upper	670	50	70	7	63	469	6.700	1.00	70	0.62	0.428	0.2	4939	1429166.67	4.59E+03	1.18E+05	6.8	0.097
	Lower	670	50	70	7	63	469	6.700	1.00	70	0.62	0.428	0.2	4939	1429166.67	5.65E+03	1.22E+05	7.4	0.110

NAME OF COLUMN	POSITION	S	M _{ch} (Kg.m)	N _{ch} (Kg)	K _{ch}	N _h (Kg)	η	h.e ₀ (cm)	e _{0gn}	e (cm)	x (cm)	α _a .h ₀	x' (cm)	Fa=Fa' (cm ²)	μ _h (%)	F _{a chosen} (cm ²)	μ _z (%)	CHECK	Same arrangement Fa=Fa'
A-5	Upper	0.16	3.19E+04	2.05E+04	2.00	6.48E+06	1.003	160.27	26.94	117.3	4.9	57.7	57.7	17.4	0.63		0.00	OK !	2 f25
	Lower	0.19	3.42E+04	2.30E+04	2.00	5.62E+06	1.004	109.54	26.94	66.5	5.5	57.7	57.7	11.1	0.40		0.00	OK !	3 f25
B-4	Upper	0.73	2.25E+05	1.10E+05	2.00	2.84E+06	1.040	4.62	16.86	27.6	26.3	32.9	53.1	-18.4	-1.15		0.00	RECH	-4 f26
	Lower	0.66	4.02E+05	1.17E+05	2.00	2.57E+06	1.048	6.12	16.86	29.1	27.8	32.9	50.8	-15.8	-1.00		0.00	RECH	-3 f27
C-2	Upper	0.66	4.59E+05	1.16E+05	2.00	3.44E+06	1.035	7.00	19.38	55.0	53.1	39.1	59.6	-14.8	-0.94		0.00	RECH	-3 f28
	Lower	0.63	5.65E+05	1.22E+05	2.00	3.32E+06	1.038	7.71	19.38	55.7	54.9	39.1	58.5	-13.4	-0.85		0.00	RECH	-3 f29

7- CALCULATION FOR PILE NUMBER

(Pile number to be decided by pile capacity as calculated, please refer to pile calculation part in the "Design report" for more information)

SAP2000 v6.11 File: CHLO-PILE-CAL Ton-m Units
March 25, 2001 13:33

JOINT REACTIONS

JOINT	LOAD	F1	F2	F3	M1	M2	M3
2	Minima	0.0000	0.0000	1138.4926	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
2	Maxima	0.0000	0.0000	1140.0933	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
13	Minima	0.0000	238.0364	797.2947	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
13	Maxima	0.0000	241.0088	797.5787	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
44	Minima	-137.6070	0.0000	117.1416	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
44	Maxima	-45.2618	0.0000	134.6723	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
219	Minima	0.0000	0.0000	1866.9232	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
219	Maxima	0.0000	0.0000	1874.2565	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
303	Minima	0.0000	0.0000	473.2465	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
303	Maxima	0.0000	0.0000	475.9105	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
450	Minima	0.0000	0.0000	233.7308	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE
450	Maxima	0.0000	0.0000	233.8615	0.0000	0.0000	0.0000
		PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE	PILEENVE

$$\sum R_i = 4664.4T \text{ So reaction pressure is: } 4664.4/(25.5 \times 23) = 7.953 \text{ (T/m}^2\text{)}$$

1: 2 - 49

Pile capacity= 45 ton for one pile so one pile can bear for an area less than $45/7.953 = 5.66\text{m}^2$
So the R.C piles to be arranged as on DWG No. PE-WWTP-254-01

8- CHECKING UPLIFT IN CASE GROUND WATER LEVEL UPTO +2.2

SAP2000 v6.11 File: CHLO-PILE-CAL Ton-m Units PAGE 1

March 25, 2001 14:16

LOAD COMBINATION MULTIPLIERS

COMBO TYPE CASE FACTOR TYPE TITLE

UPLIFT ADD Checking uplift, when ground water level upto +2.2

SELF 1.0000 STATIC(DEAD)
 ELECFLOO 1.0000 STATIC(LIVE)
 ACHITEC2 1.0000 STATIC(OTHER)
 FILTER 1.0000 STATIC(LIVE)
 CHLOTANK 1.0000 STATIC(LIVE)
 BRICKWAL 1.0000 STATIC(DEAD)
 COVERSOI 1.0000 STATIC(OTHER)
 MAXUPLIF 1.0000 STATIC(OTHER)

SAP2000 v6.11 File: CHLO-PILE-CAL Ton-m Units PAGE 2

March 25, 2001 14:16

JOINT REACTIONS

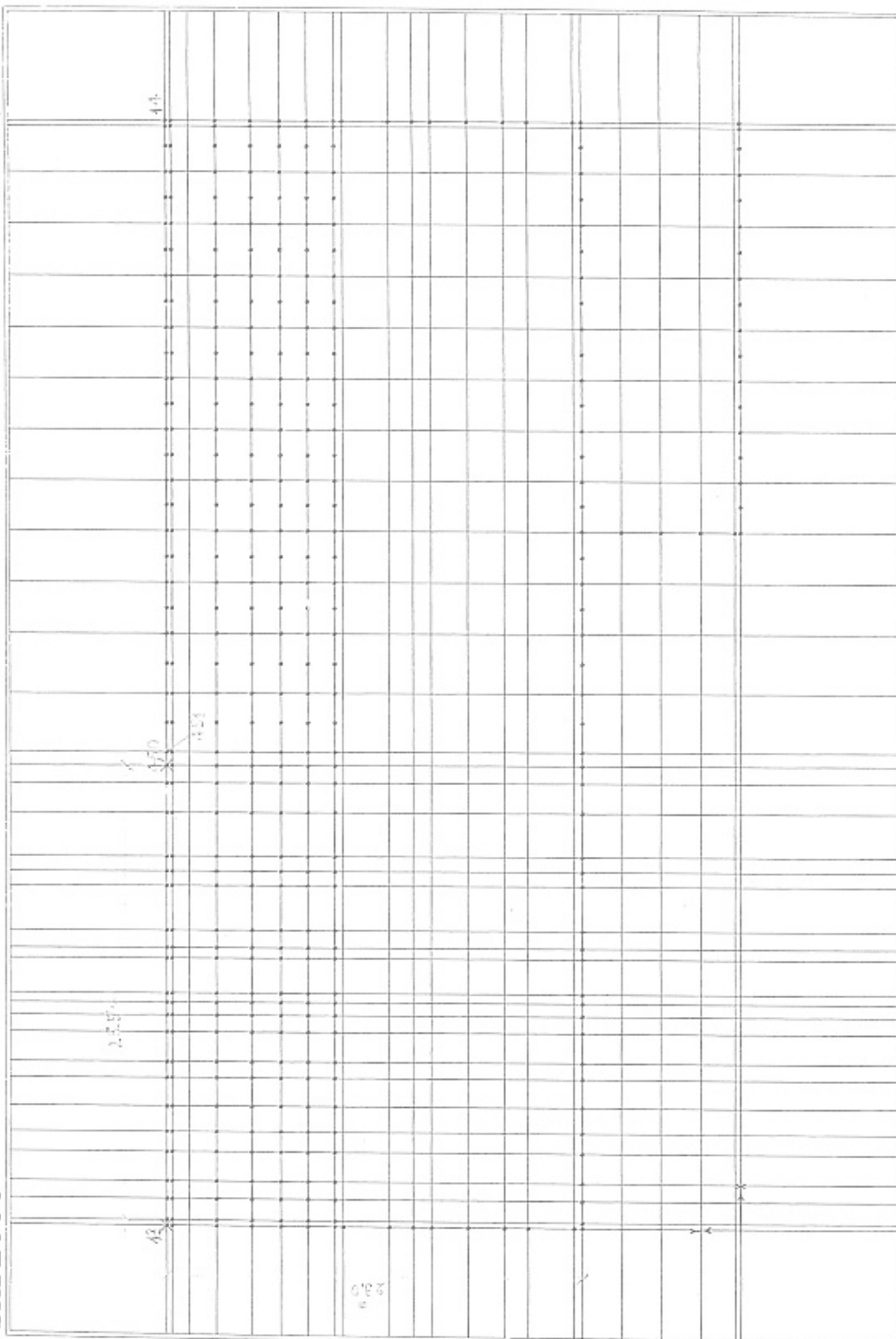
JOINT	LOAD	F1	F2	F3	M1	M2	M3
2	Minima	0.0000	0.0000	248.5001	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
2	Maxima	0.0000	0.0000	248.5001	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
4	Minima	0.0000	334.3679	38.4905	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
4	Maxima	0.0000	334.3679	38.4905	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
13	Minima	0.0000	290.5133	-5.0094	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
13	Maxima	0.0000	290.5133	-5.0094	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
14	Minima	-21.9829	0.0000	-26.8673	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
14	Maxima	-21.9829	0.0000	-26.8673	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
44	Minima	92.4739	0.0000	110.2682	0.0000	0.0000	0.0000

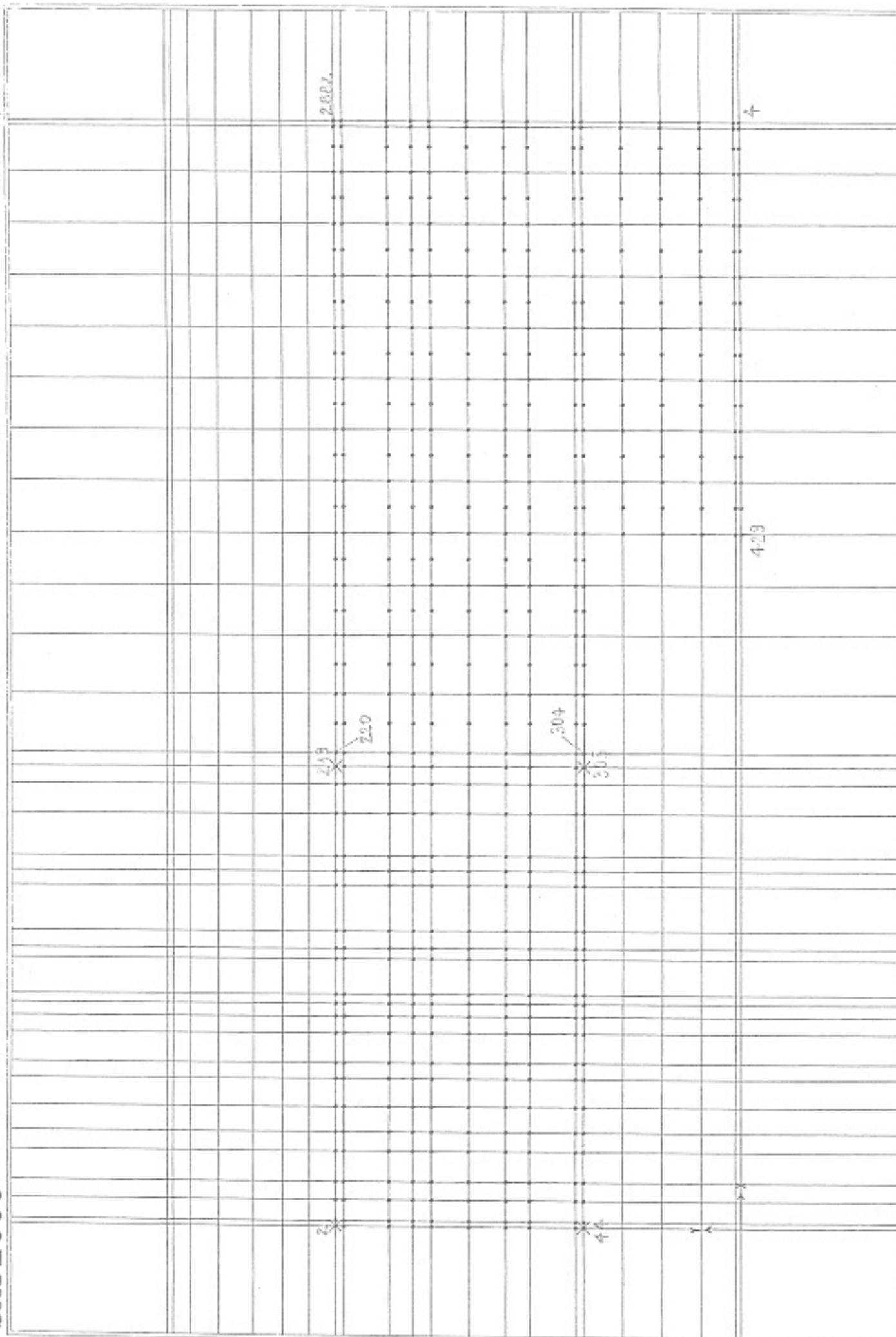
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
44	Maxima	92.4739	0.0000	110.2682	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
219	Minima	0.0000	0.0000	-132.7863	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
219	Maxima	0.0000	0.0000	-132.7863	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
220	Minima	0.0000	0.0000	-280.6315	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
220	Maxima	0.0000	0.0000	-280.6315	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
303	Minima	0.0000	0.0000	-22.8851	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
303	Maxima	0.0000	0.0000	-22.8851	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
304	Minima	0.0000	0.0000	-224.3280	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
304	Maxima	0.0000	0.0000	-224.3280	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
429	Minima	0.0000	0.0000	58.6100	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
429	Maxima	0.0000	0.0000	58.6100	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
450	Minima	0.0000	0.0000	-11.9780	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
450	Maxima	0.0000	0.0000	-11.9780	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
451	Minima	0.0000	0.0000	-44.6212	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
451	Maxima	0.0000	0.0000	-44.6212	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
2822	Minima	0.0000	0.0000	-342.6094	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT
2822	Maxima	0.0000	0.0000	-342.6094	0.0000	0.0000	0.0000
		UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT	UPLIFT

Total uplift upto the bottom slab = -635.85 Ton

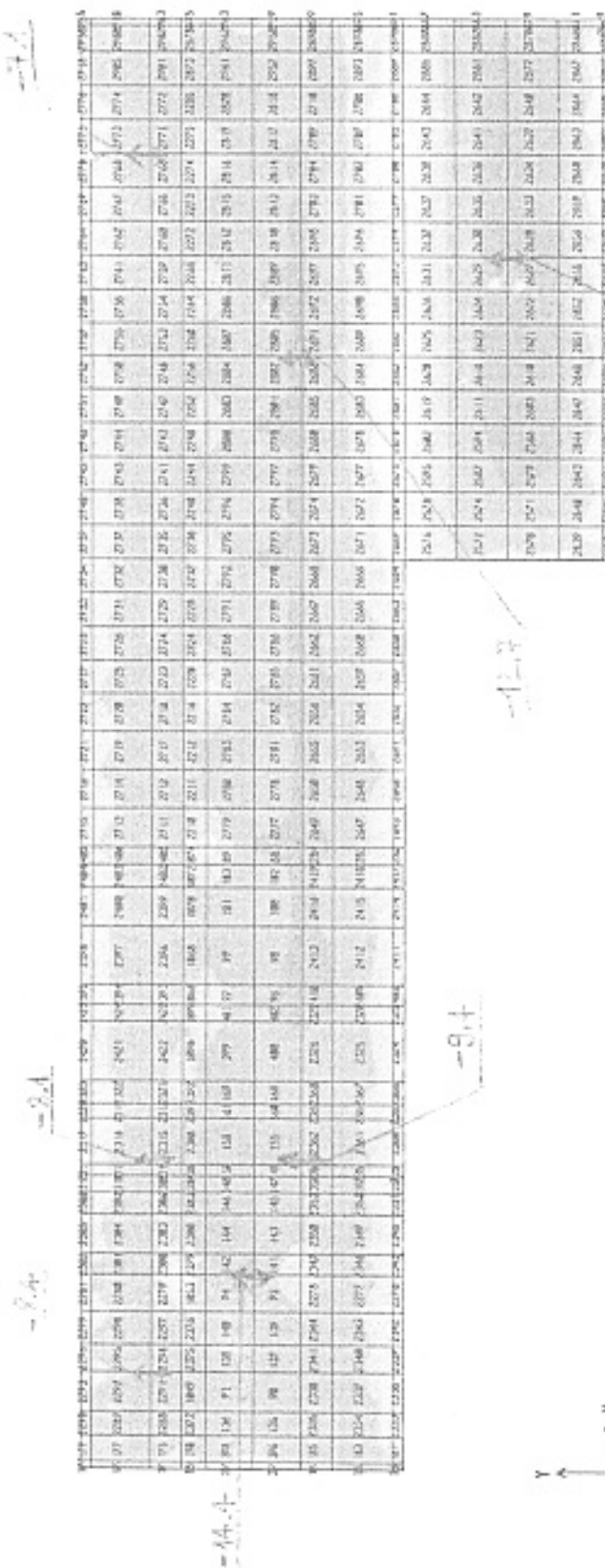
Tensile capacity of one pile as calculated is 20 ton (In case the pile be pulled up)

So the number of piles needed for preventing structure from uplifting is : 31.8 piles, but as number of piles calculated in part 7 above is 352 piles for water supply facility foundation, so uplift will never occur





BOTTOM SLAB ($Z=0$)
(M₂₂ - ENVE COMBO - MIN)



BOTTOM SLAB (Z.F.O.)

(M11 - ENVE COMPO. M_{max})

-125.3

+24.0

+12.4

+14.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	12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Fig. 2.0.2.1 (2.0.2.1)



-15.0 -10.0 -5.0 0.0 5.0 10.0 15.0 20.0 25.0



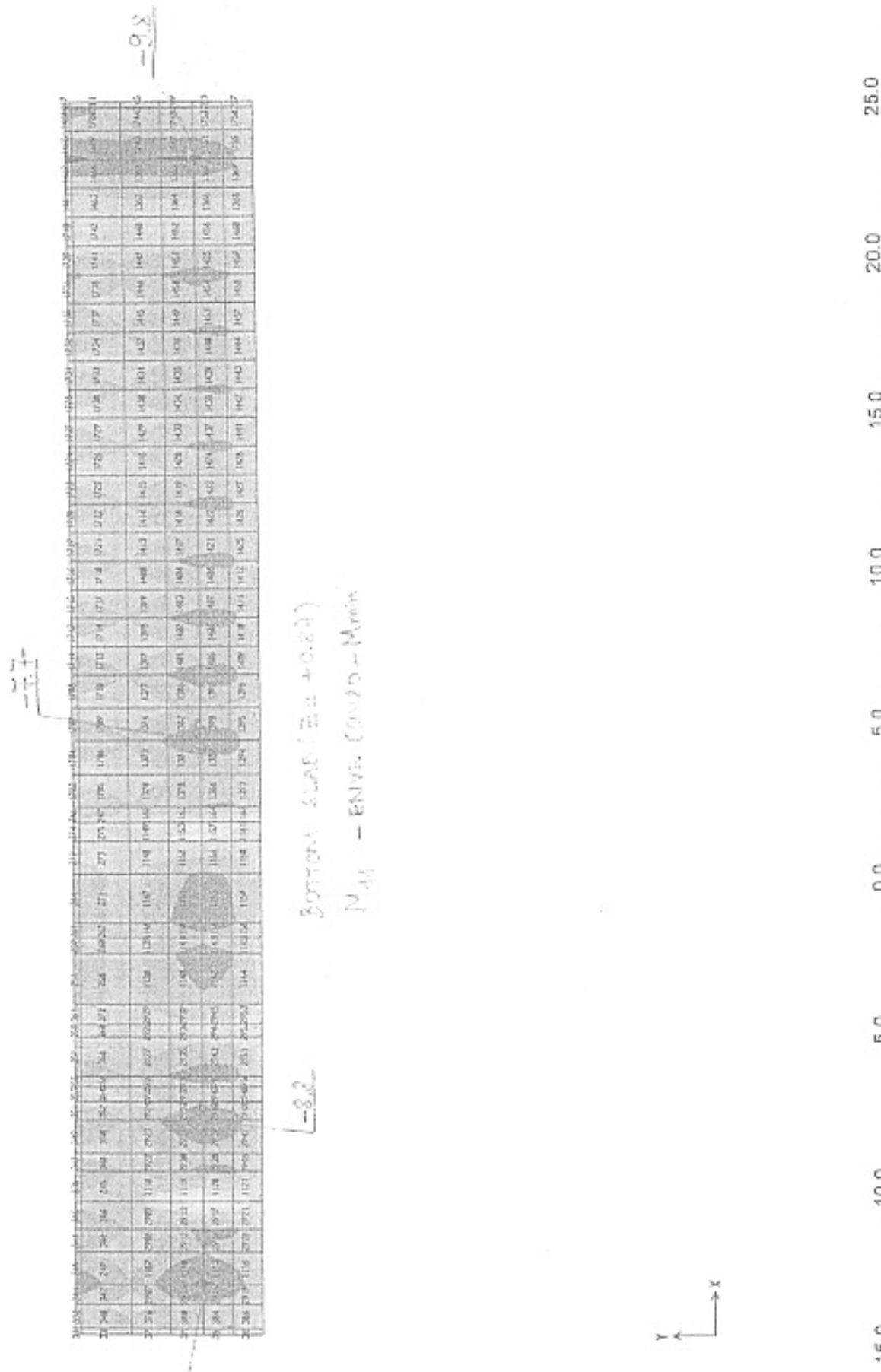
-40.0 -30.0 -20.0 -10.0 0.0 10.0 20.0 30.0 40.0

100

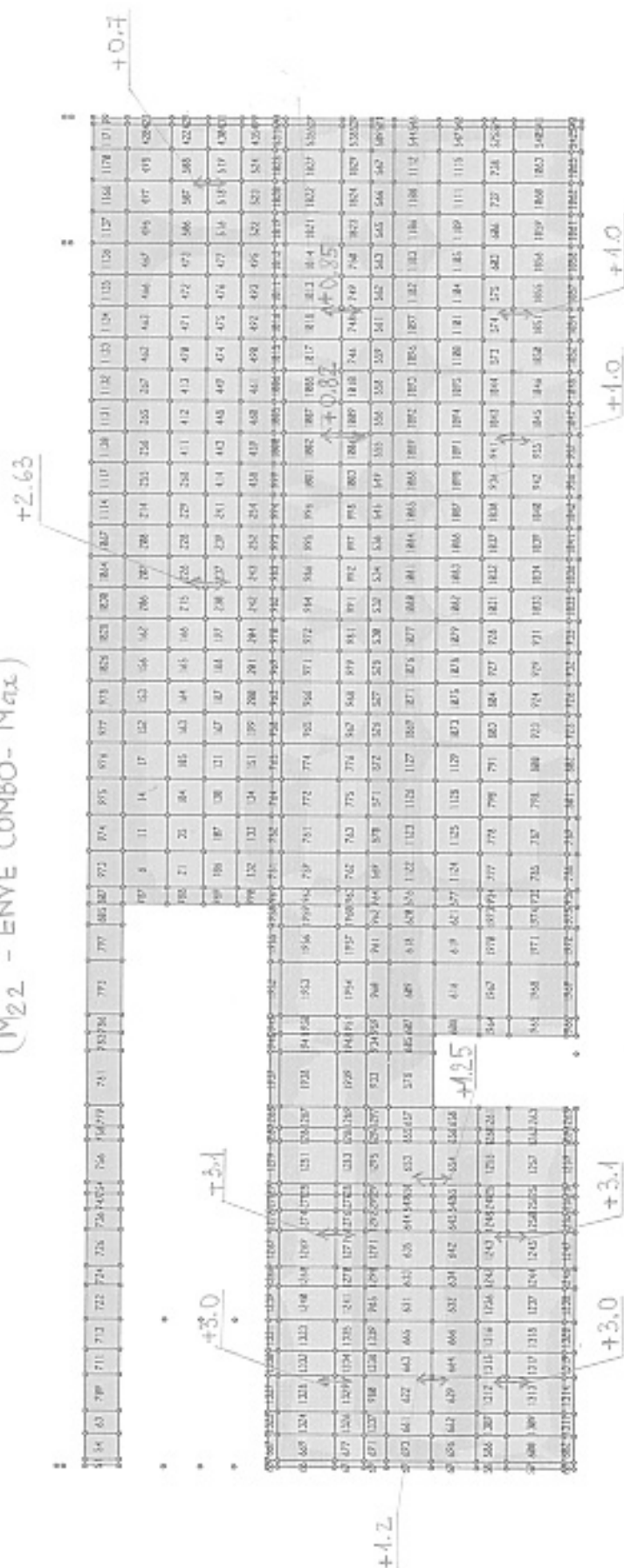
$$M_{\text{gas}} = \text{CIVE} \cdot \text{CIVEC} \cdot M_{\text{min}}$$

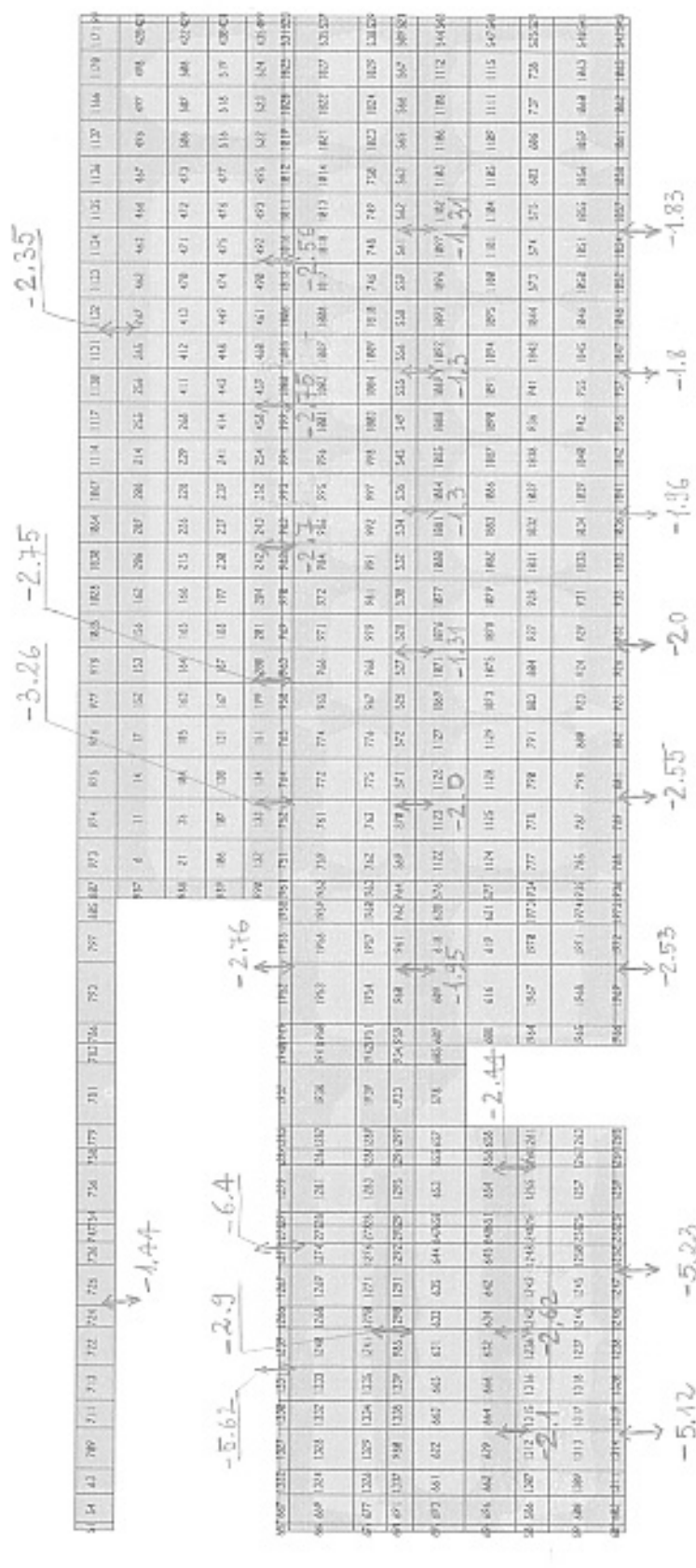

-44.0	-33.0	-22.0	-11.0	0.0	11.0	22.0	33.0	44.0
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2123	2041	1959	1877	1795	1713	1631	1549	1467	1385	1303	1221	1139	1057	975	893	811	729	647	565	483	401	319	237	155	73	-9	-121	-203	-285	-367	-449	-531	-613	-695	-777	-859	-941	-1023	-1105	-1187	-1269	-1351	-1433	-1515	-1597	-1679	-1761	-1843	-1925	-2007	-2089	-2171	-2253	-2335	-2417	-2499	-2581	-2663	-2745	-2827	-2909	-2991	-3073	-3155	-3237	-3319	-3401	-3483	-3565	-3647	-3729	-3811	-3893	-3975	-4057	-4139	-4221	-4303	-4385	-4467	-4549	-4631	-4713	-4795	-4877	-4959	-5041	-5123	-5205	-5287	-5369	-5451	-5533	-5615	-5697	-5779	-5861	-5943	-6025	-6107	-6189	-6271	-6353	-6435	-6517	-6599	-6681	-6763	-6845	-6927	-7009	-7091	-7173	-7255	-7337	-7419	-7501	-7583	-7665	-7747	-7829	-7911	-7993	-8075	-8157	-8239	-8321	-8403	-8485	-8567	-8649	-8731	-8813	-8895	-8977	-9059	-9141	-9223	-9305	-9387	-9469	-9551	-9633	-9715	-9797	-9879	-9961	-10043	-10125	-10207	-10289	-10371	-10453	-10535	-10617	-10699	-10781	-10863	-10945	-11027	-11109	-11191	-11273	-11355	-11437	-11519	-11601	-11683	-11765	-11847	-11929	-12011	-12093	-12175	-12257	-12339	-12421	-12503	-12585	-12667	-12749	-12831	-12913	-12995	-13077	-13159	-13241	-13323	-13405	-13487	-13569	-13651	-13733	-13815	-13897	-13979	-14061	-14143	-14225	-14307	-14389	-14471	-14553	-14635	-14717	-14799	-14881	-14963	-15045	-15127	-15209	-15291	-15373	-15455	-15537	-15619	-15701	-15783	-15865	-15947	-16029	-16111	-16193	-16275	-16357	-16439	-16521	-16603	-16685	-16767	-16849	-16931	-17013	-17095	-17177	-17259	-17341	-17423	-17505	-17587	-17669	-17751	-17833	-17915	-18000	-18080	-18160	-18240	-18320	-18400	-18480	-18560	-18640	-18720	-18800	-18880	-18960	-19040	-19120	-19200	-19280	-19360	-19440	-19520	-19600	-19680	-19760	-19840	-19920	-20000	-20080	-20160	-20240	-20320	-20400	-20480	-20560	-20640	-20720	-20800	-20880	-20960	-21040	-21120	-21200	-21280	-21360	-21440	-21520	-21600	-21680	-21760	-21840	-21920	-22000	-22080	-22160	-22240	-22320	-22400	-22480	-22560	-22640	-22720	-22800	-22880	-22960	-23040	-23120	-23200	-23280	-23360	-23440	-23520	-23600	-23680	-23760	-23840	-23920	-24000	-24080	-24160	-24240	-24320	-24400	-24480	-24560	-24640	-24720	-24800	-24880	-24960	-25040	-25120	-25200	-25280	-25360	-25440	-25520	-25600	-25680	-25760	-25840	-25920	-26000	-26080	-26160	-26240	-26320	-26400	-26480	-26560	-26640	-26720	-26800	-26880	-26960	-27040	-27120	-27200	-27280	-27360	-27440	-27520	-27600	-27680	-27760	-27840	-27920	-28000	-28080	-28160	-28240	-28320	-28400	-28480	-28560	-28640	-28720	-28800	-28880	-28960	-29040	-29120	-29200	-29280	-29360	-29440	-29520	-29600	-29680	-29760	-29840	-29920	-30000	-30080	-30160	-30240	-30320	-30400	-30480	-30560	-30640	-30720	-30800	-30880	-30960	-31040	-31120	-31200	-31280	-31360	-31440	-31520	-31600	-31680	-31760	-31840	-31920	-32000	-32080	-32160	-32240	-32320	-32400	-32480	-32560	-32640	-32720	-32800	-32880	-32960	-33040	-33120	-33200	-33280	-33360	-33440	-33520	-33600	-33680	-33760	-33840	-33920	-34000	-34080	-34160	-34240	-34320	-34400	-34480	-34560	-34640	-34720	-34800	-34880	-34960	-35040	-35120	-35200	-35280	-35360	-35440	-35520	-35600	-35680	-35760	-35840	-35920	-36000	-36080	-36160	-36240	-36320	-36400	-36480	-36560	-36640	-36720	-36800	-36880	-36960	-37040	-37120	-37200	-37280	-37360	-37440	-37520	-37600	-37680	-37760	-37840	-37920	-38000	-38080	-38160	-38240	-38320	-38400	-38480	-38560	-38640	-38720	-38800	-38880	-38960	-39040	-39120	-39200	-39280	-39360	-39440	-39520	-39600	-39680	-39760	-39840	-39920	-40000	-40080	-40160	-40240	-40320	-40400	-40480	-40560	-40640	-40720	-40800	-40880	-40960	-41040	-41120	-41200	-41280	-41360	-41440	-41520	-41600	-41680	-41760	-41840	-41920	-42000	-42080	-42160	-42240	-42320	-42400	-42480	-42560	-42640	-42720	-42800	-42880	-42960	-43040	-43120	-43200	-43280	-43360	-43440	-43520	-43600	-43680	-43760	-43840	-43920	-44000	-44080	-44160	-44240	-44320	-44400	-44480	-44560	-44640	-44720	-44800	-44880	-44960	-45040	-45120	-45200	-45280	-45360	-45440	-45520	-45600	-45680	-45760	-45840	-45920	-46000	-46080	-46160	-46240	-46320	-46400	-46480	-46560	-46640	-46720	-46800	-46880	-46960	-47040	-47120	-47200	-47280	-47360	-47440	-47520	-47600	-47680	-47760	-47840	-47920	-48000	-48080	-48160	-48240	-48320	-48400	-48480	-48560	-48640	-48720	-48800	-48880	-48960	-49040	-49120	-49200	-49280	-49360	-49440	-49520	-49600	-49680	-49760	-49840	-49920	-50000	-50080	-50160	-50240	-50320	-50400	-50480	-50560	-50640	-50720	-50800	-50880	-50960	-51040	-51120	-51200	-51280	-51360	-51440	-51520	-51600	-51680	-51760	-51840	-51920	-52000	-52080	-52160	-52240	-52320	-52400	-52480	-52560	-52640	-52720	-52800	-52880	-52960	-53040	-53120	-53200	-53280	-53360	-53440	-53520	-53600	-53680	-53760	-53840	-53920	-54000	-54080	-54160	-54240	-54320	-54400	-54480	-54560	-54640	-54720	-54800	-54880	-54960	-55040	-55120	-55200	-55280	-55360	-55440	-55520	-55600	-55680	-55760	-55840	-55920	-56000	-56080	-56160	-56240	-56320	-56400	-56480	-56560	-56640	-56720	-56800	-56880	-56960	-57040	-57120	-57200	-57280	-57360	-57440	-57520	-57600	-57680	-57760	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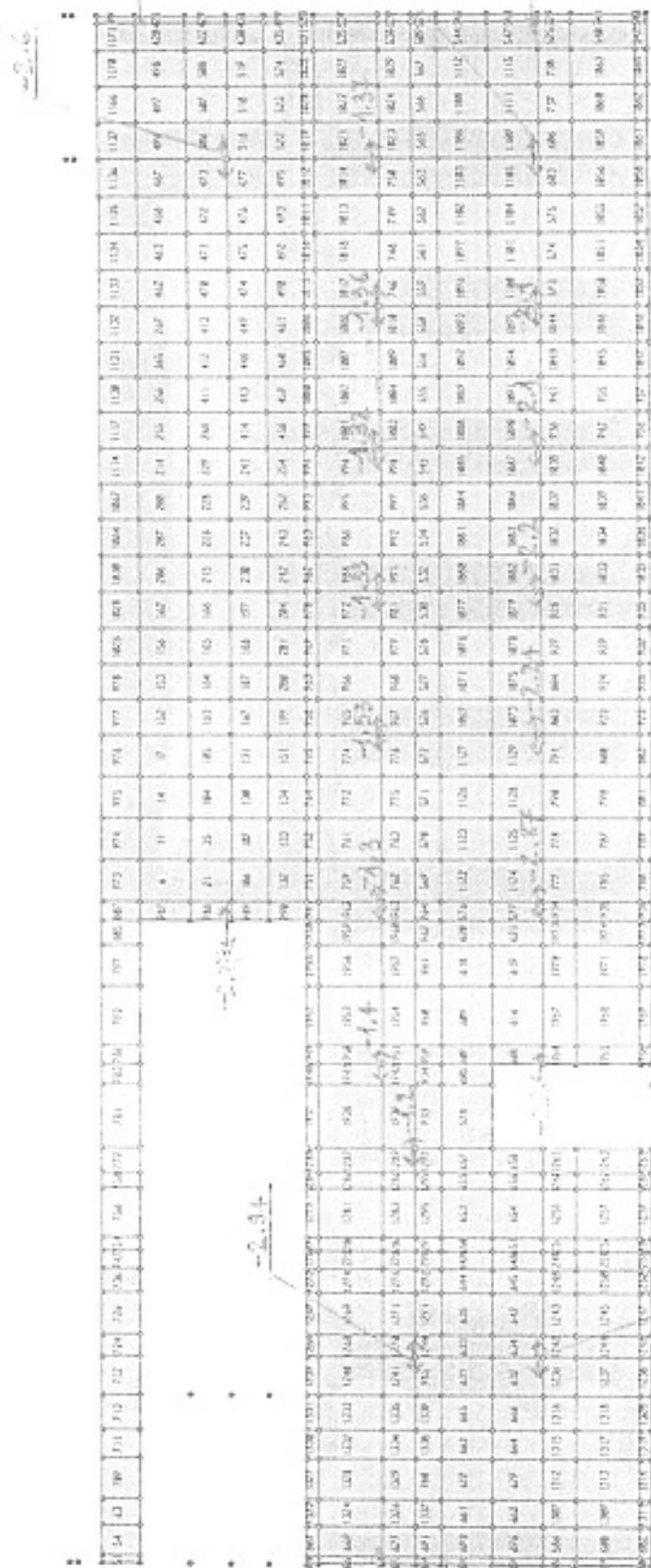


FIRST FLOOR SLAB (Z = +7.35)
(M₂₂ - ENVE COMBO - N_{ax})





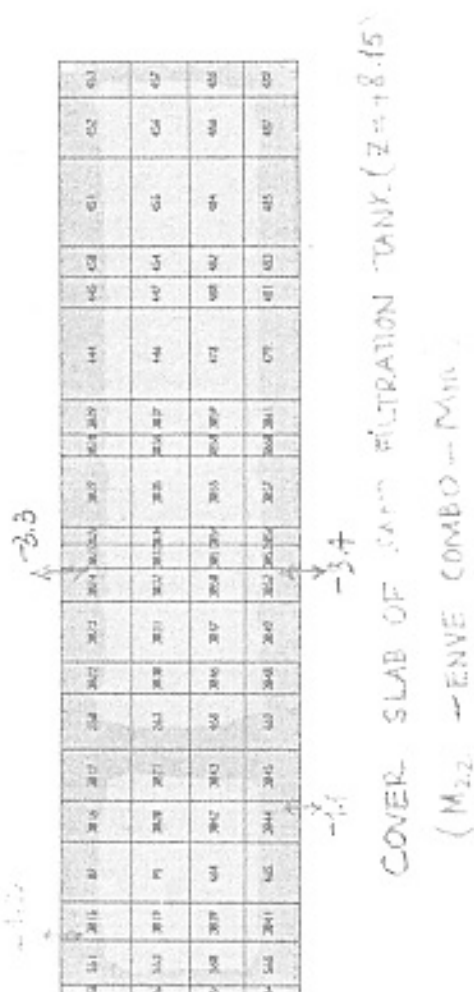
FIRST FLOOR SLAB (Z = +7.35)
(M₂₂ - ENVE COMBO - Min)



25

10	11.1	20.1	47	39.6	39.12	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	62	41.3
11	11.3	20.15	47	39.68	39.15	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	64	41.2
12	11.5	20.2	47	39.72	39.18	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	66	41.1
13	11.6	20.25	47	39.76	39.2	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	68	41
14	11.7	20.3	47	39.8	39.25	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	70	40.9
15	11.8	20.35	47	39.84	39.3	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	72	40.8
16	11.9	20.4	47	39.88	39.35	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	74	40.7
17	12	20.45	47	39.92	39.4	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	76	40.6
18	12.1	20.5	47	39.96	39.45	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	78	40.5
19	12.2	20.55	47	40	39.5	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	80	40.4
20	12.3	20.6	47	40.04	39.55	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	82	40.3
21	12.4	20.65	47	40.08	39.6	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	84	40.2
22	12.5	20.7	47	40.12	39.65	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	86	40.1
23	12.6	20.75	47	40.16	39.7	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	88	40
24	12.7	20.8	47	40.2	39.75	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	90	39.9
25	12.8	20.85	47	40.24	39.8	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	92	39.8
26	12.9	20.9	47	40.28	39.85	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	94	39.7
27	13	20.95	47	40.32	39.9	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	96	39.6
28	13.1	21	47	40.36	39.95	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	98	39.5
29	13.2	21.05	47	40.4	40	29.8	36.72	36.15	36.14	34.24	36.17	32.4	45.1	100	39.4

$$(M_{02} - \text{ENVÉ COMBO} - \text{MAX})$$



-44.0 -33.0 -22.0 -11.0 0.0 11.0 22.0 33.0 44.0

+1.42

+1.5

+1.2

54	55.1	2015	17	2014	2017	212	2021	2022	2023	2024	2025	2026	2027	2028	2029	444	445	428	431	432	433
55	55.2	2016	75	2020	2021	213	2022	2023	2024	2025	2026	2027	2028	2029	2030	445	446	429	432	433	434
56	56	2017	64	2022	2023	214	2024	2025	2026	2027	2028	2029	2030	2031	2032	446	447	430	433	434	435
57	56.1	2018	64	2023	2024	215	2025	2026	2027	2028	2029	2030	2031	2032	2033	447	448	431	434	435	436
58	56.2	2019	45	2024	2025	216	2026	2027	2028	2029	2030	2031	2032	2033	2034	448	449	432	435	436	437

COVER SLAB OF SAND FILTRATION TANK (Z=+8.15)

(M₁₁ - ENVE COMBO - Max)



10

-5.2

COVER SLAB OF SAND FILTRATION TANK ($Z = +2.15$)
$$(M_{11} - \text{ENVE COMBO} - \text{Min})$$


[illegible]

Year	Total	Native born	Foreign born
1990	0	0	0
1991	10	5	5
1992	15	10	5
1993	10	5	5
1994	5	0	5
1995	0	-5	5
1996	5	0	5
1997	10	5	5
1998	15	10	5
1999	20	15	5
2000	35	30	5

WALL AXIS \textcircled{E} ($\gamma = +28.55 \text{ m}$)
($M_{22} - \text{ENVE COMBO} - \text{Min}$)

81	233	3219	491	1228	3271	194	2126	5227	2208325.4	3211	2218123	548	3411641	143	1491	585
82	235	3223	494	1224	3225	127	2124	5226	22061485.3	5279	2218221	578	3411212	512	511	512
83	237	3244	514	1244	3245	127	2124	5226	22061485.3	5279	2218221	578	3411212	512	511	512
84	239	3247	528	1244	3249	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
85	241	3251	529	1252	3253	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
86	243	3257	537	1257	3259	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
87	245	3261	543	1261	3263	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
88	247	3267	551	1267	3269	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
89	249	3271	557	1271	3273	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
90	251	3275	563	1275	3277	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
91	253	3279	569	1279	3281	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
92	255	3283	575	1283	3285	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
93	257	3287	581	1287	3289	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
94	259	3291	587	1291	3293	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
95	261	3295	593	1295	3297	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
96	263	3299	599	1299	3301	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
97	265	3303	605	1303	3305	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
98	267	3307	611	1307	3309	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
99	269	3311	617	1311	3313	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
100	271	3315	623	1315	3317	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
101	273	3319	629	1319	3321	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
102	275	3323	635	1323	3325	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
103	277	3327	641	1327	3329	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
104	279	3331	647	1331	3333	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
105	281	3335	653	1335	3337	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
106	283	3339	659	1339	3341	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
107	285	3343	665	1343	3345	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
108	287	3347	671	1347	3349	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
109	289	3351	677	1351	3353	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
110	291	3355	683	1355	3357	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
111	293	3359	689	1359	3361	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
112	295	3363	695	1363	3365	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
113	297	3367	701	1367	3369	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
114	299	3371	707	1371	3373	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
115	301	3375	713	1375	3377	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
116	303	3379	719	1379	3381	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
117	305	3383	725	1383	3385	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
118	307	3387	731	1387	3389	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
119	309	3391	737	1391	3393	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
120	311	3395	743	1395	3397	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
121	313	3399	749	1399	3401	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
122	315	3403	755	1403	3405	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
123	317	3407	761	1407	3409	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
124	319	3411	767	1411	3413	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
125	321	3415	773	1415	3417	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
126	323	3419	779	1419	3421	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
127	325	3423	785	1423	3425	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
128	327	3427	791	1427	3429	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
129	329	3431	797	1431	3433	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
130	331	3435	803	1435	3437	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
131	333	3439	809	1439	3441	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
132	335	3443	815	1443	3445	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
133	337	3447	821	1447	3449	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
134	339	3451	827	1451	3453	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
135	341	3455	833	1455	3457	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
136	343	3459	839	1459	3461	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
137	345	3463	845	1463	3465	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
138	347	3467	851	1467	3469	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
139	349	3471	857	1471	3473	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
140	351	3475	863	1475	3477	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
141	353	3479	869	1479	3481	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
142	355	3483	875	1483	3485	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
143	357	3487	881	1487	3489	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
144	359	3491	887	1491	3493	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
145	361	3495	893	1495	3497	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
146	363	3499	899	1499	3501	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
147	365	3503	905	1503	3505	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
148	367	3507	911	1507	3509	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
149	369	3511	917	1511	3513	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
150	371	3515	923	1515	3517	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
151	373	3519	929	1519	3521	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
152	375	3523	935	1523	3525	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
153	377	3527	941	1527	3529	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
154	379	3531	947	1531	3533	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
155	381	3535	953	1535	3537	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
156	383	3539	959	1539	3541	345	2136	5257	220813827	5271	2212075	581	342251	102	103	103
157	385	3543														

WALL AXIS \bar{E} ($\gamma = +28.55^\circ$)
($N_{M1} - ENVE\ COMBO - M_{TIX}$)[illegible]

WALL AXIS (Y = +28.55)
(N22 - ENVE COMBO - MIN)



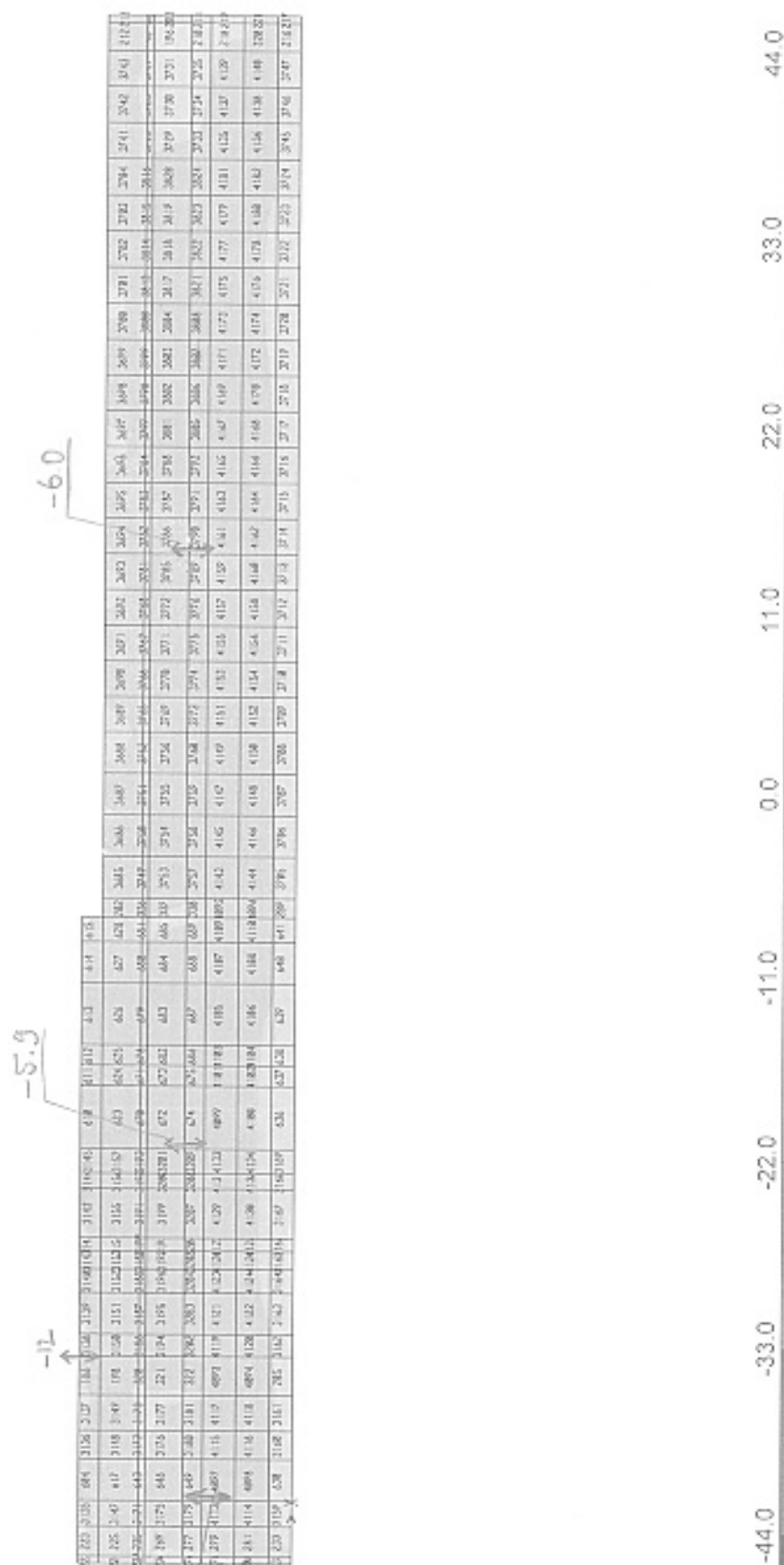
WALL AXIS @ ($Y = +22.05$)
($M_{22} - \text{ENVE COMBO} - \text{Max}$)

20	2023	2020	2018	2016	2014	2012	2010	2008	2006	2004	2002	2000	1998	1996	1994	1992	1990	1988	1986	1984	1982	1980	1978	1976	1974	1972	1970	1968	1966	1964	1962	1960	1958	1956	1954	1952	1950	1948	1946	1944	1942	1940	1938	1936	1934	1932	1930	1928	1926	1924	1922	1920	1918	1916	1914	1912	1910	1908	1906	1904	1902	1900	1898	1896	1894	1892	1890	1888	1886	1884	1882	1880	1878	1876	1874	1872	1870	1868	1866	1864	1862	1860	1858	1856	1854	1852	1850	1848	1846	1844	1842	1840	1838	1836	1834	1832	1830	1828	1826	1824	1822	1820	1818	1816	1814	1812	1810	1808	1806	1804	1802	1800	1798	1796	1794	1792	1790	1788	1786	1784	1782	1780	1778	1776	1774	1772	1770	1768	1766	1764	1762	1760	1758	1756	1754	1752	1750	1748	1746	1744	1742	1740	1738	1736	1734	1732	1730	1728	1726	1724	1722	1720	1718	1716	1714	1712	1710	1708	1706	1704	1702	1700	1698	1696	1694	1692	1690	1688	1686	1684	1682	1680	1678	1676	1674	1672	1670	1668	1666	1664	1662	1660	1658	1656	1654	1652	1650	1648	1646	1644	1642	1640	1638	1636	1634	1632	1630	1628	1626	1624	1622	1620	1618	1616	1614	1612	1610	1608	1606	1604	1602	1600	1598	1596	1594	1592	1590	1588	1586	1584	1582	1580	1578	1576	1574	1572	1570	1568	1566	1564	1562	1560	1558	1556	1554	1552	1550	1548	1546	1544	1542	1540	1538	1536	1534	1532	1530	1528	1526	1524	1522	1520	1518	1516	1514	1512	1510	1508	1506	1504	1502	1500	1498	1496	1494	1492	1490	1488	1486	1484	1482	1480	1478	1476	1474	1472	1470	1468	1466	1464	1462	1460	1458	1456	1454	1452	1450	1448	1446	1444	1442	1440	1438	1436	1434	1432	1430	1428	1426	1424	1422	1420	1418	1416	1414	1412	1410	1408	1406	1404	1402	1400	1398	1396	1394	1392	1390	1388	1386	1384	1382	1380	1378	1376	1374	1372	1370	1368	1366	1364	1362	1360	1358	1356	1354	1352	1350	1348	1346	1344	1342	1340	1338	1336	1334	1332	1330	1328	1326	1324	1322	1320	1318	1316	1314	1312	1310	1308	1306	1304	1302	1300	1298	1296	1294	1292	1290	1288	1286	1284	1282	1280	1278	1276	1274	1272	1270	1268	1266	1264	1262	1260	1258	1256	1254	1252	1250	1248	1246	1244	1242	1240	1238	1236	1234	1232	1230	1228	1226	1224	1222	1220	1218	1216	1214	1212	1210	1208	1206	1204	1202	1200	1198	1196	1194	1192	1190	1188	1186	1184	1182	1180	1178	1176	1174	1172	1170	1168	1166	1164	1162	1160	1158	1156	1154	1152	1150	1148	1146	1144	1142	1140	1138	1136	1134	1132	1130	1128	1126	1124	1122	1120	1118	1116	1114	1112	1110	1108	1106	1104	1102	1100	1098	1096	1094	1092	1090	1088	1086	1084	1082	1080	1078	1076	1074	1072	1070	1068	1066	1064	1062	1060	1058	1056	1054	1052	1050	1048	1046	1044	1042	1040	1038	1036	1034	1032	1030	1028	1026	1024	1022	1020	1018	1016	1014	1012	1010	1008	1006	1004	1002	1000	998	996	994	992	990	988	986	984	982	980	978	976	974	972	970	968	966	964	962	960	958	956	954	952	950	948	946	944	942	940	938	936	934	932	930	928	926	924	922	920	918	916	914	912	910	908	906	904	902	900	898	896	894	892	890	888	886	884	882	880	878	876	874	872	870	868	866	864	862	860	858	856	854	852	850	848	846	844	842	840	838	836	834	832	830	828	826	824	822	820	818	816	814	812	810	808	806	804	802	800	798	796	794	792	790	788	786	784	782	780	778	776	774	772	770	768	766	764	762	760	758	756	754	752	750	748	746	744	742	740	738	736	734	732	730	728	726	724	722	720	718	716	714	712	710	708	706	704	702	700	698	696	694	692	690	688	686	684	682	680	678	676	674	672	670	668	666	664	662	660	658	656	654	652	650	648	646	644	642	640	638	636	634	632	630	628	626	624	622	620	618	616	614	612	610	608	606	604	602	600	598	596	594	592	590	588	586	584	582	580	578	576	574	572	570	568	566	564	562	560	558	556	554	552	550	548	546	544	542	540	538	536	534	532	530	528	526	524	522	520	518	516	514	512	510	508	506	504	502	500	498	496	494	492	490	488	486	484	482	480	478	476	474	472	470	468	466	464	462	460	458	456	454	452	450	448	446	444	442	440	438	436	434	432	430	428	426	424	422	420	418	416	414	412	410	408	406	404	402	400	398	396	394	392	390	388	386	384	382	380	378	376	374	372	370	368	366	364	362	360	358	356	354	352	350	348	346	344	342	340	338	336	334	332	330	328	326	324	322	320	318	316	314	312	310	308	306	304	302	300	298	296	294	292	290	288	286	284	282	280	278	276	274	272	270	268	266	264	262	260	258	256	254	252	250	248	246	244	242	240	238	236	234	232	230	228	226	224	222	220	218	216	214	212	210	208	206	204	202	200	198	196	194	192	190	188	186	184	182	180	178	176	174	172	170	168	166	164	162	160	158	156	154	152	150	148	146	144	142	140	138	136	134	132	130	128	126	124	122	120	118	116	114	112	110	108	106	104	102	100	98	96	94	92	90	88	86	84	82	80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
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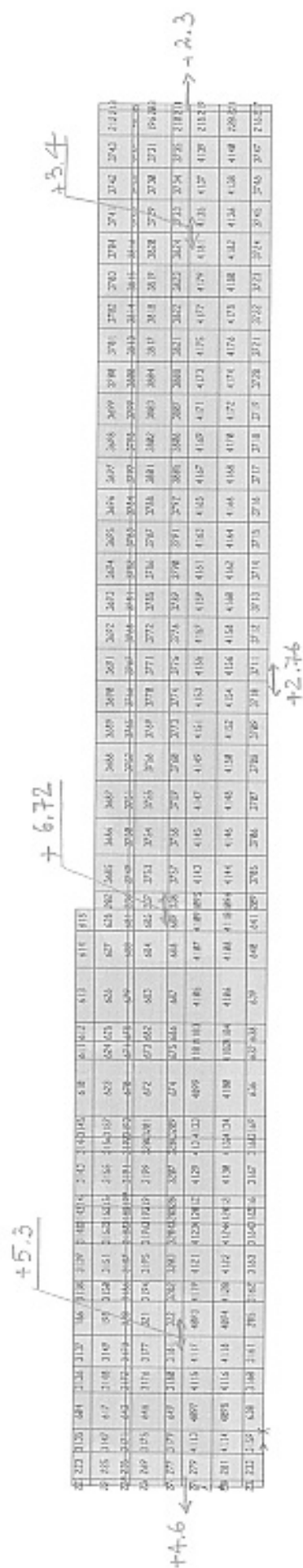
9.5.6

5. Feb

14

WALL AXIS ① ($Y = +22.05$)
($M_{22} - ENVE COMBO - M_{in}$)

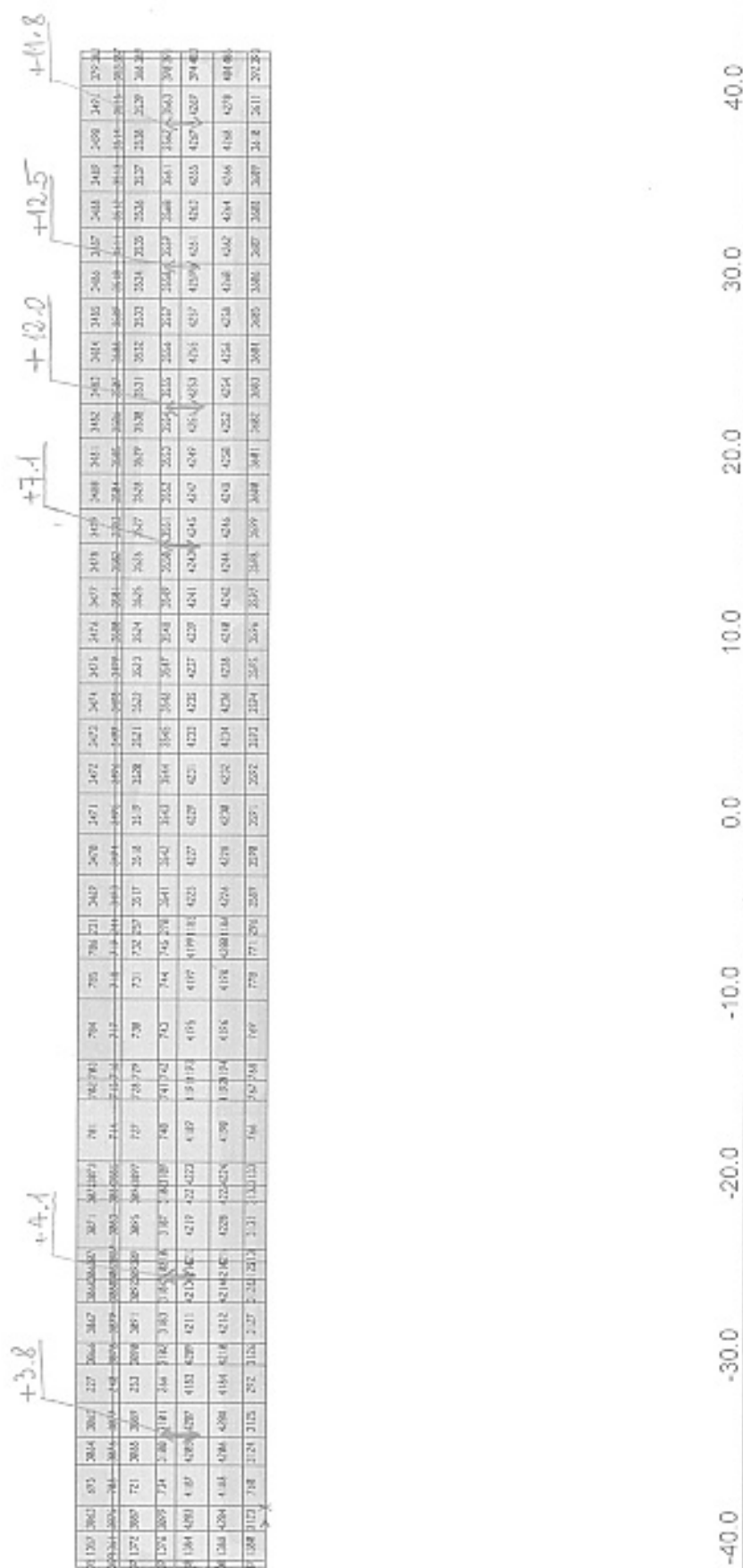
WALL AXIS ① ($Y = +22.05$)
 ($M_{11} - \text{ENVE COMBO} - \text{Max}$)



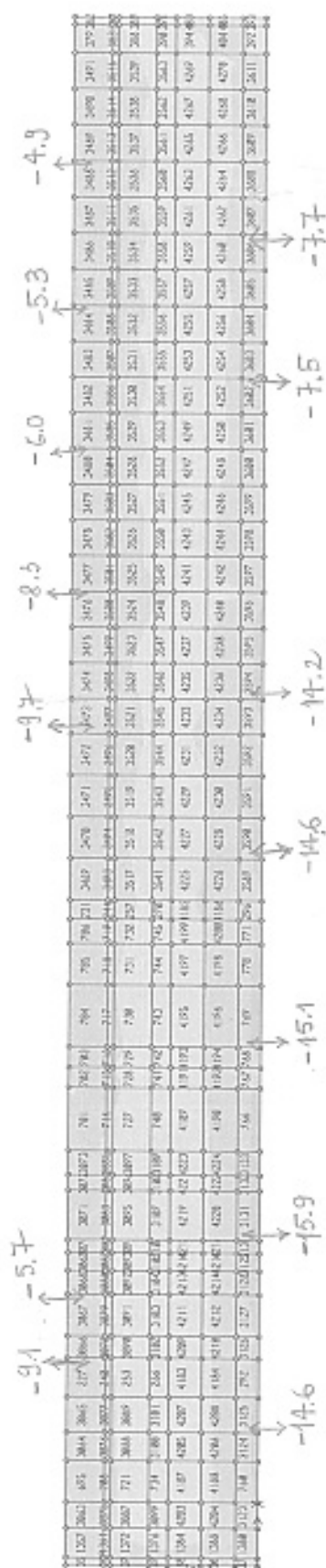
WALL AXIS \textcircled{D} ($Y = +22.05$)
($M_{M1} - \text{ENVE COMBO} - \text{Min.}$)

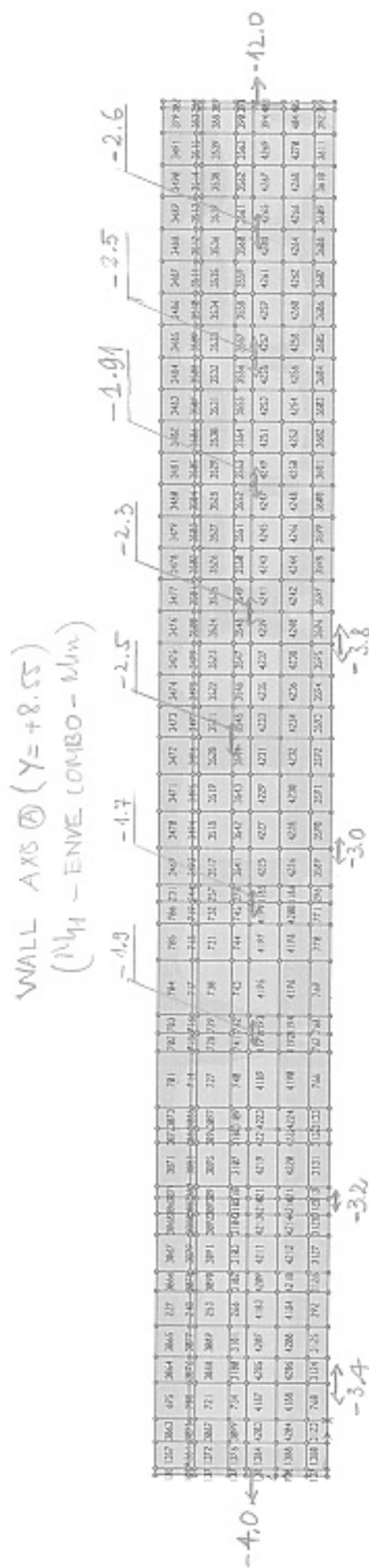


WALL AXIS @ ($\gamma = +8.55$)
(M_{22} - ENVE COMBO - Max)



WALL AXIS \oplus ($Y = +8.55$)
 (M_{22} - ENVE COMBO - MIN)





WALL AXIS \oplus ($Y = +8.55$)
($M_{W1} - \text{ENVE COMBO} - M_{W2}$)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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PIPE GALLERY WALL (Y=0)
(M₂₂ - ENVE COMBO-Min)

-22.8

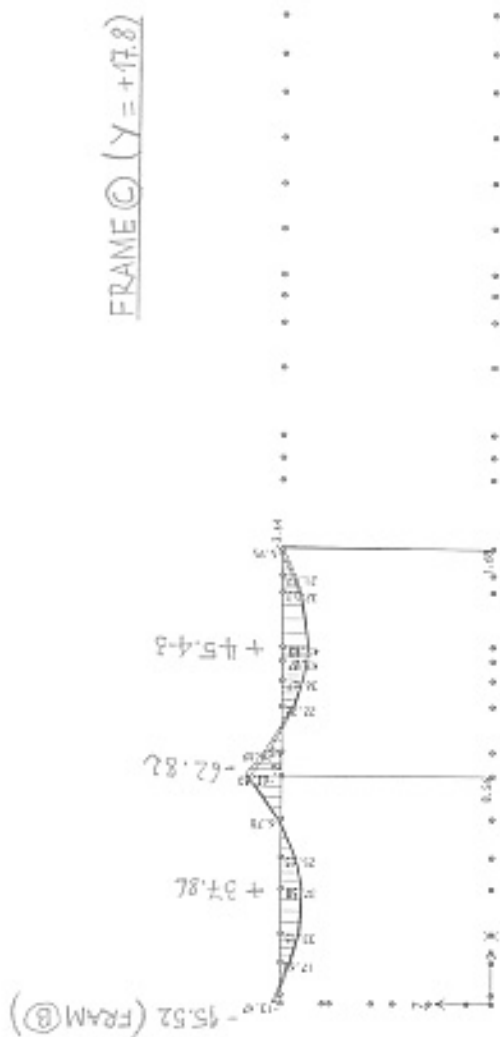
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-10.8

-17.3



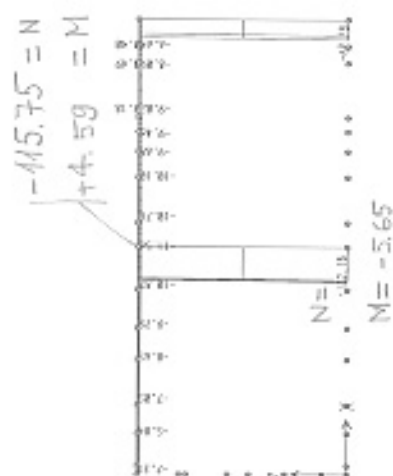
-44.0 -33.0 -22.0 -11.0 0.0 11.0 22.0 33.0 44.0



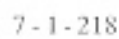
FRAME (C) ($\gamma = +17.8$)



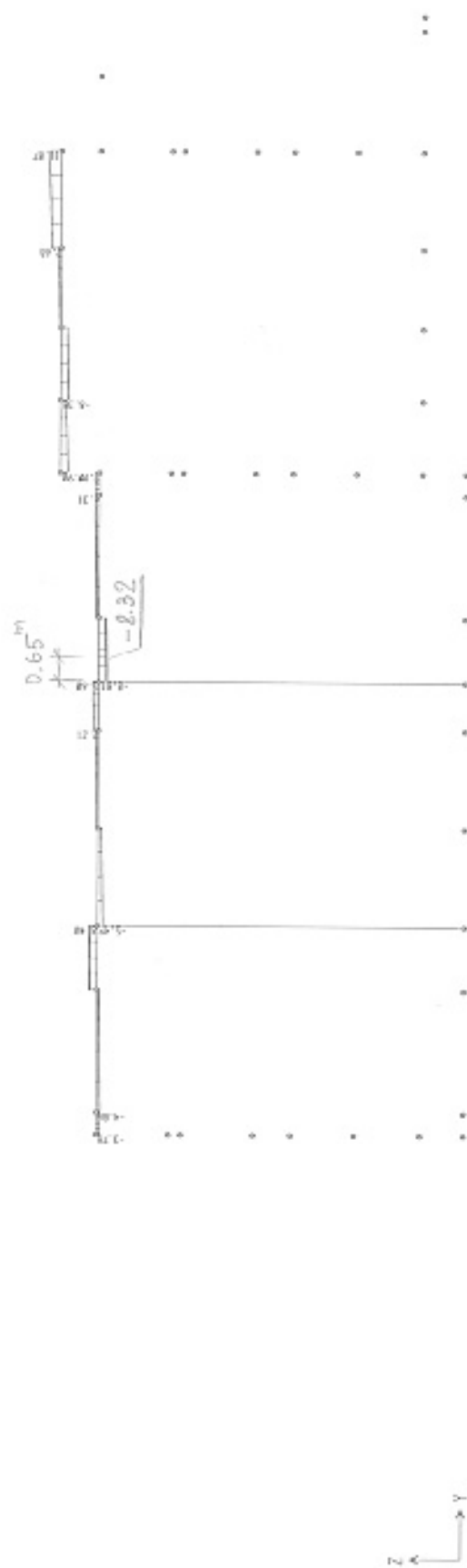
FRAME ② ($\gamma = +17.8$)



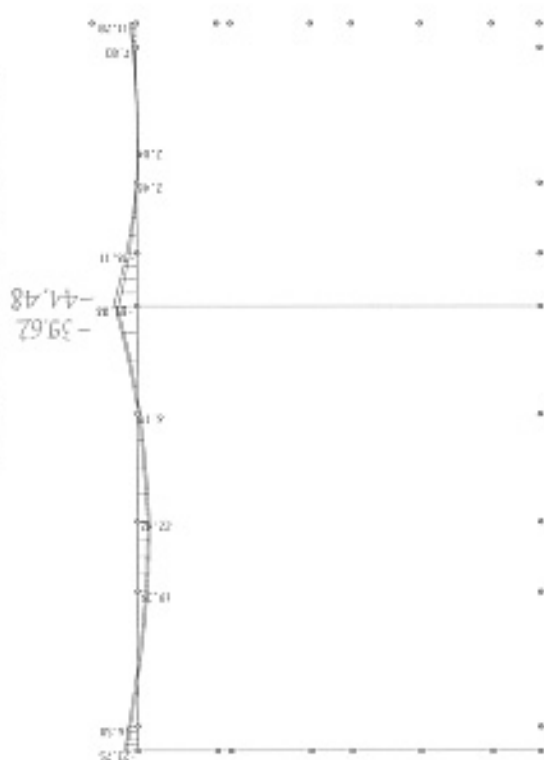
(COLUMN C2)



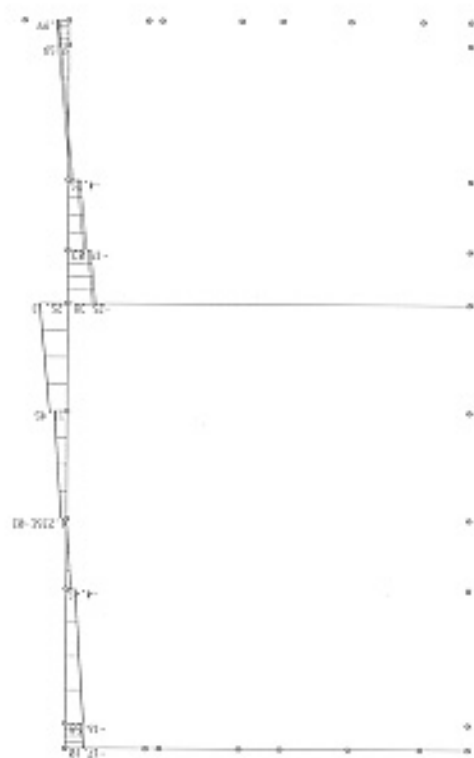
FRAME ② (X = +8)



FRAME (3) (X = +19.25)

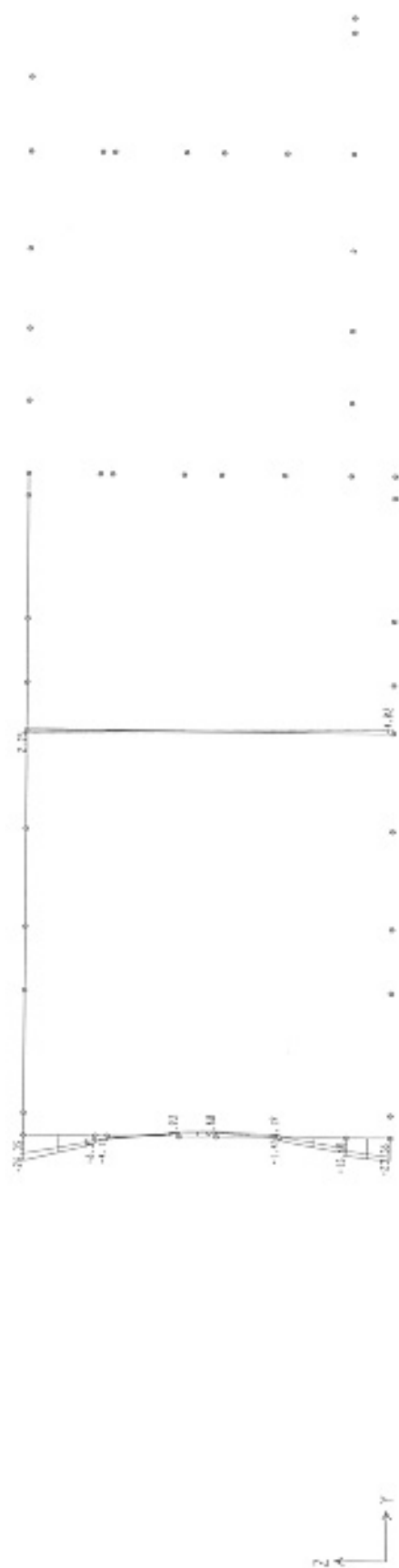


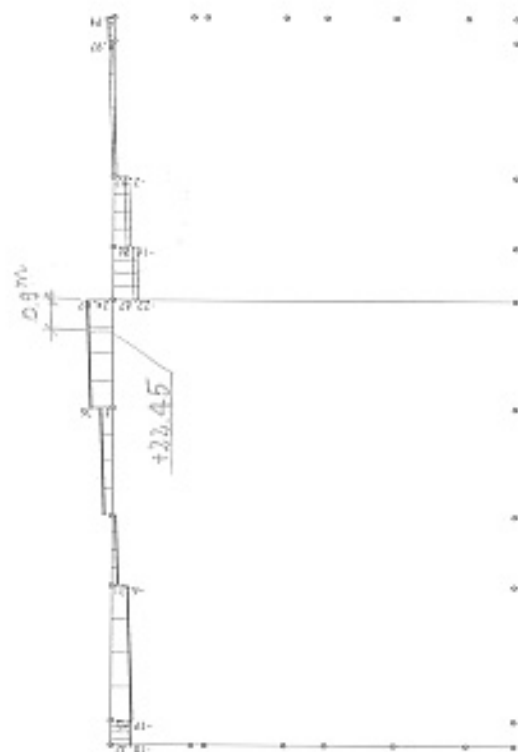
FRAM 3 (X = +19.25)



FRAME ④ ($X=25.75$)

FRAME ④ (X=+25.15)



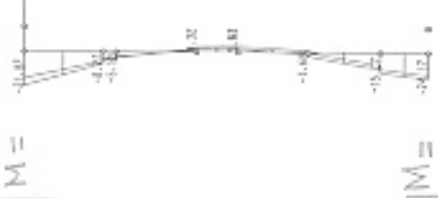
FRAME ④ ($X = 25.75$)



FRAME (5) (X = +32.25)

N = -20.46

M =



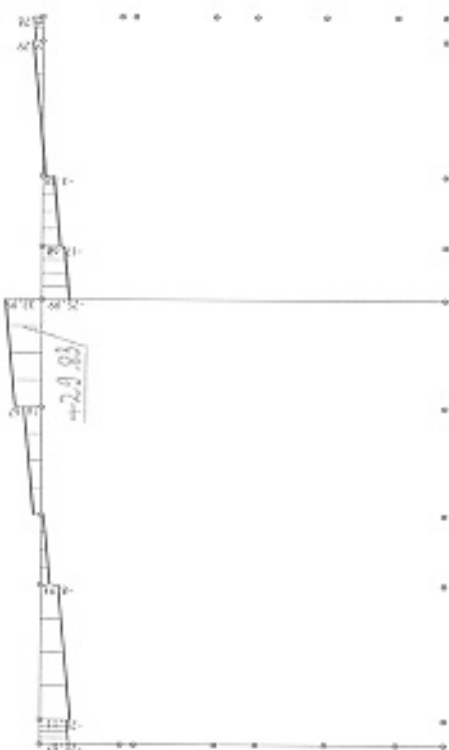
M =

N = -23.0

(COLUMN A5)

FRAME ⑤ ($X = +32.25$)

0.5m



FRAME (B) ($\gamma = +16.8$)

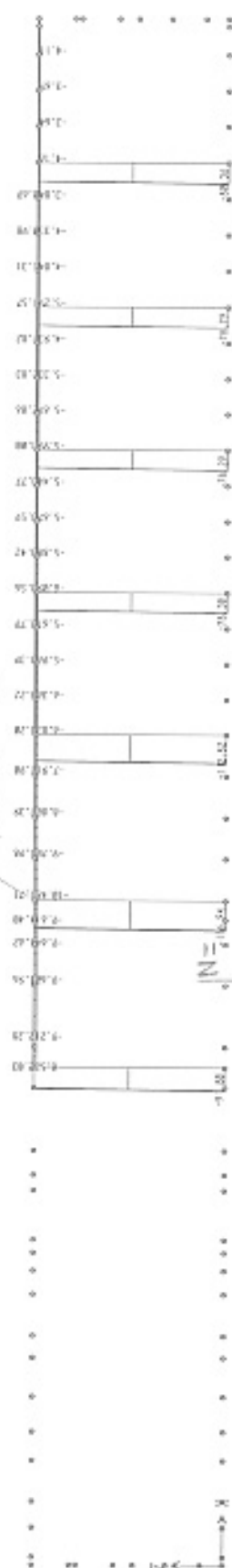
FRAME (B) ($\gamma = +16.8$)



FRAM (B') (Y = +16.8)

-10032 = N

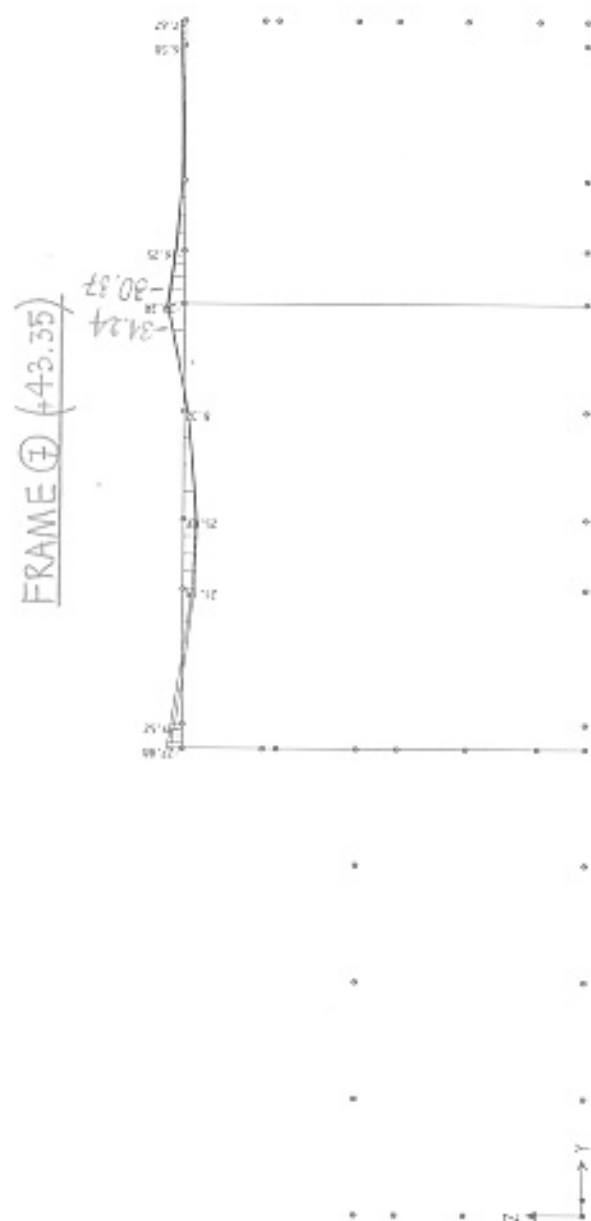
+2,25 = M



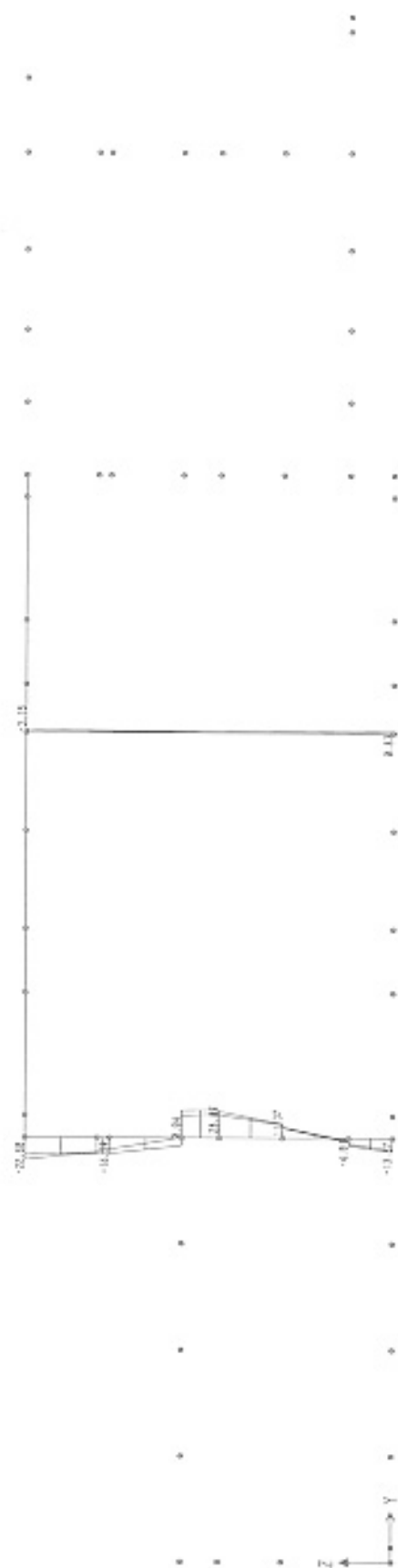
N = -10032

M = -4.02

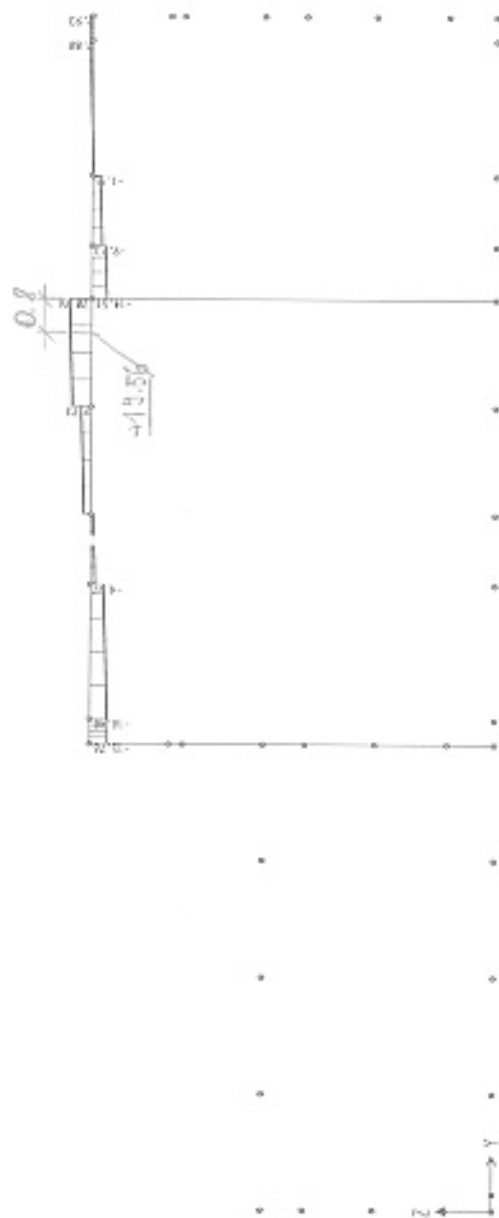
(COLUMN B'4)



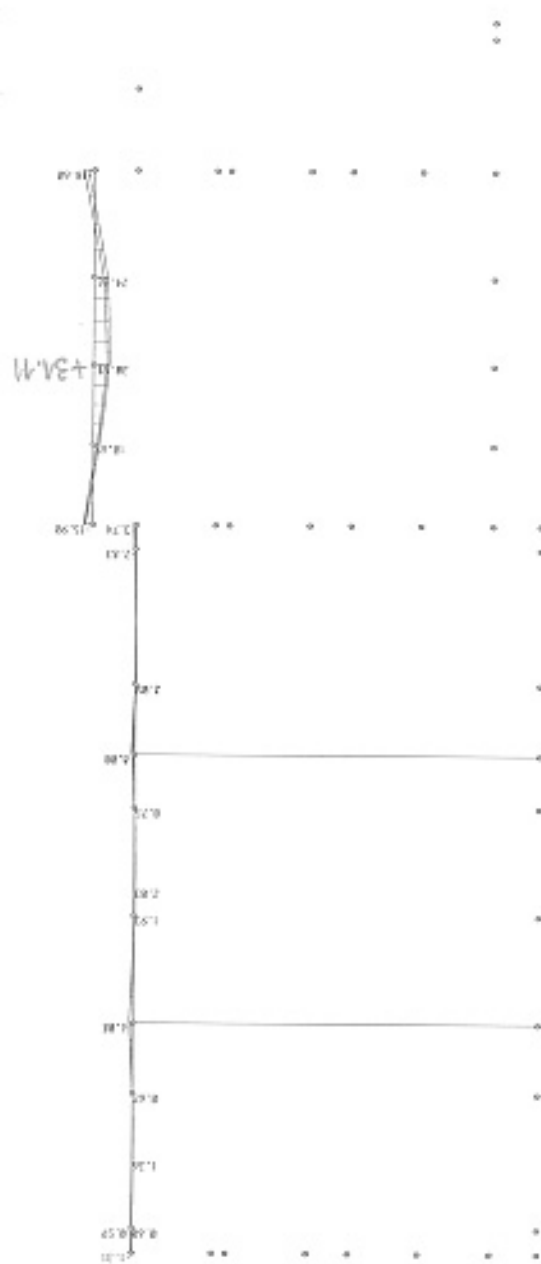
FRAME ③ (+43.35)



FRAME ⑦ (X = +43.35)

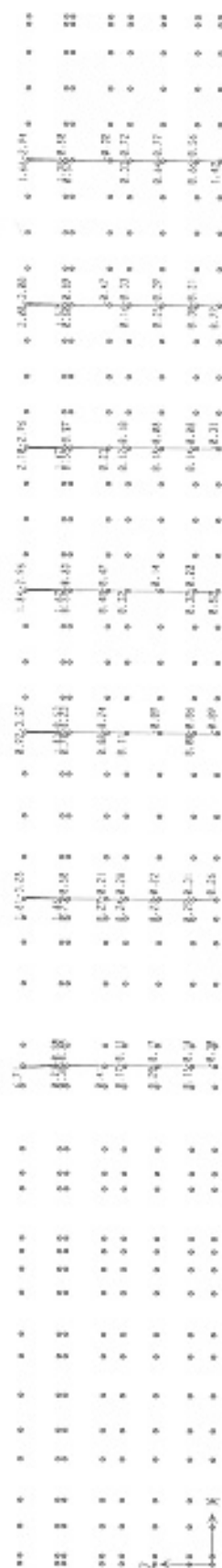


BEAM OF SAND FILTRATION TANK (X = +16)





FRAME (A) (Y = + 8.55)



FRAME (A) ($Y = +8.55$)

