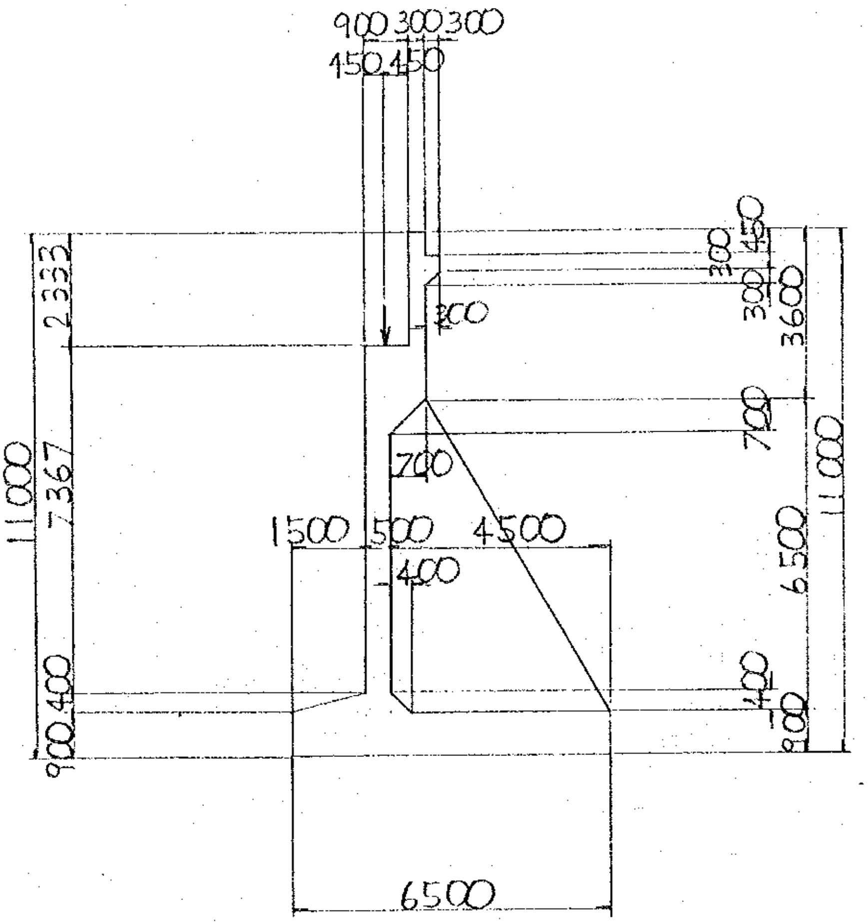
§§ 5 H = 11.00 m

A-L-1 A1
B-L-1 A1

§ 1 STRUCTURAL FIGURE



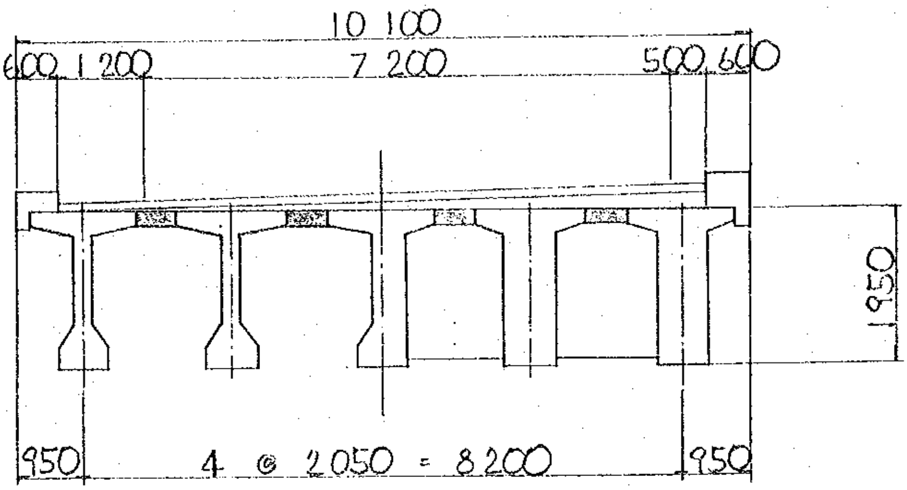
buttress span $l = 3.200^{m}$

(A LINE I A I)

(B LINE I A I)

§ 2 REACTION OF SUPERSTRUCTURE

2-1 structural figure

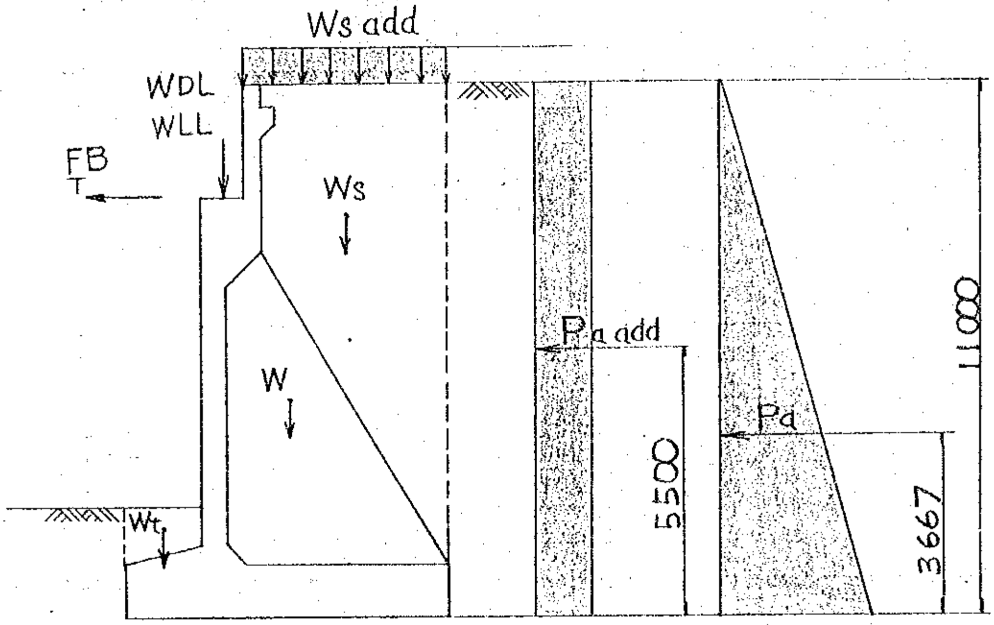


2-2 whole reaction of superstructure

		HA loading		HB loading	
		N (t)	H (t)	N (t)	H (t)
dead load of deck	I	229.8	—	229.8	—
	II	36.9	—	36.9	—
live load		128.6	—	145.9	—
crowd load		—	—	—	—
longitudinal force		—	25.8	—	38.2
TOTAL		395.3	25.8	412.6	38.2

§ 3 CALCULATION OF LOAD

3-1 loading diagram



WDL : dead load of deck

WLL : max LL reaction under HA & HB

F B : HA & HB braking

W : self weight

Ws : weight of soil

Wt : fill on toe

Ws add : weight of surcharge

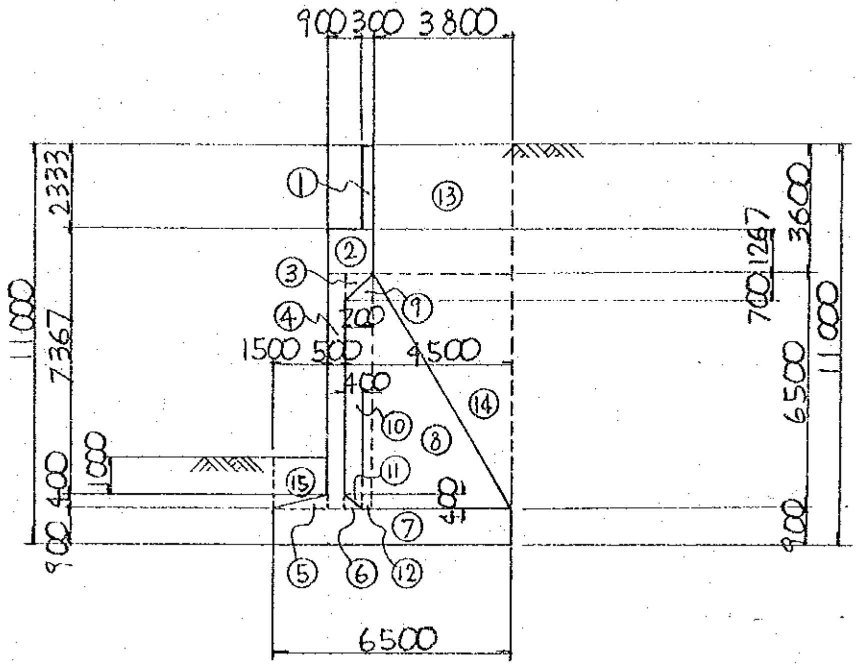
P_A : active pressure

P_P : passive pressure

P_A add : surcharge

T : temperature load

3-2 self weight and weight of soil



$$\bar{\gamma} = \frac{2.41 \times 0.60 \times 4 + 1.9 \times 7.70}{10.10} = 2.02 \ t/m^3$$

		N (t)	x (m)	N x (t m)
①	0.30 × 2.333 × 10.10 × 2.41	17.04	2.55	43.45
②	1.20 × 1.167 × 10.10 × 2.41	34.09	2.10	71.59
③	½ × 0.70 × 0.70 × 10.10 × 2.41	5.96	2.233	13.31
④	0.50 × 6.50 × 10.10 × 2.41	79.11	1.75	138.44
⑤	½ × 1.50 × 0.40 × 10.10 × 2.41	7.30	1.00	7.3
⑥	½ × 0.40 × 0.40 × 10.10 × 2.41	1.95	2.133	4.16
⑦	1.00 × 6.50 × 10.10 × 2.41	158.22	3.25	514.22
⑧	½ × 6.50 × 3.80 × 10.10 × 2.02	251.96	3.967	999.53
⑨	½ × 0.70 × 0.70 × 10.10 × 2.02	5.00	2.467	12.34
⑩	0.70 × 5.40 × 10.10 × 2.02	77.12	2.35	181.23
⑪	½ × 0.40 × 0.40 × 10.10 × 2.02	1.63	2.267	3.70
⑫	0.30 × 0.40 × 10.10 × 2.02	2.45	2.55	6.25
⑬	3.80 × 3.50 × 10.10 × 1.9	255.23	4.60	1 174.06
⑭	½ × 3.80 × 6.50 × 10.10 × 1.9	237.00	5.233	1 240.22
⑮	½ × (1.00 + 1.40) × 1.50 × 10.10 × 1.9	34.54	0.708	24.45
Σ		1 168.60		4 434.25

3-3 weight of surcharge

under H.A $= 1.02 \times 4.10 \times 10.10 = 42.24^t$

under H.B $= 1.66 \times 4.10 \times 10.10 = 68.74^t$

3-4 earth pressure

unit weight of soil $\gamma_s = 1.9\ ^t/m^3$

angle of internal friction $\phi = 35°$

(1) active pressure

$$Pa = \frac{1}{2} \cdot K \cdot \gamma_s \cdot H^2 \cdot L$$

$$= \frac{1}{2} \times \overset{0.579}{\frac{1 - \sin 35°}{1 + \sin 35°}} \times 1.9 \times 11.00^2 \times 10.10 = 314.22^t$$

(2) active pressure due to surcharge

under H.A surcharge

$q = 1.02\ ^t/m^2$

$Pa\ add = K \cdot q \cdot H \cdot L$

$= 0.27 \times 1.02 \times 11.00 \times 10.10 = 30.60^t$

under H.B surcharge

$q = 1.66\ ^t/m^2$

$Pa\ add = K \cdot q \cdot H \cdot L$

$= 0.27 \times 1.66 \times 11.00 \times 10.10 = 49.80^t$

3-5 temperature load

$$P_H = \frac{G_o \cdot A \cdot \delta}{\Sigma \cdot t_e}$$

$$\delta = \alpha \cdot l \qquad \alpha = \begin{cases} P.C \longrightarrow 0.7 \\ R.C \longrightarrow 0.5 \end{cases}$$

$$\begin{bmatrix} \delta = 0.7 \times 29.20 = 20.44^{mm} \\ R(d+l) = 395.3 \times 1/5 \times 1.4 = 110.7^{t} \end{bmatrix}$$

RING SHOE
- 120 TON
- $D\phi$: 66 cm
- $d\phi$: 33 cm
- A : 2463 cm^2
- t : 7.3 cm
- G_o : 13.5 kg/cm^2 (modulus of rigidity)

$$P_H = \frac{13.5 \times 2463 \times 2.04}{7.3} = 9292^{kg} = 9.29^{t}$$

$$\Sigma P_H = n \cdot P_H \cdot 1/2$$

$$= 5 \times 9.29 \times 1/2 = 23.23^{t}$$

§ 4 CALCULATION OF STABILITY

case 1 HA loading

	N (t)	x (m)	N·x (tm)	H (t)	y (m)	H·y (tm)
WDL, WLL	395.3	1.95	770.84	—	—	—
F B	—	—	—	25.80	8.667	223.61
T	—	—	—	23.23	8.667	201.33
W. Ws. Wr	1168.60		4434.25	—	—	—
Ws add	42.24	4.45	187.97	—	—	—
P a	—	—	—	314.22	3.667	1152.24
Pa add	—	—	—	30.60	5.50	168.30
TOTAL	1606.14		5393.06	393.85		1745.48

1) check for eccentric

$$x = \frac{\Sigma Nx - \Sigma HY}{\Sigma N} = \frac{5393.06 - 1745.48}{1606.14} = 2.27^{m}$$

$$e = \frac{B}{2} - x = \frac{6.50}{2} - 2.27 = 0.98^{m} < \frac{B}{6} = 1.08^{m}$$

2) soil reaction

$$q = \frac{\Sigma N}{B \cdot L}\left(1 \pm \frac{6 \cdot e}{B}\right) = \frac{1606.14}{6.50 \times 10.10} \times \left(1 \pm \frac{6 \times 0.98}{6.50}\right)$$

$$= \begin{cases} 46.60 \ t/m^2 \\ 2.33 \end{cases} < 60 \ t/m^2$$

3) check for sliding

$$Hu = C \cdot A' + N \cdot \tan\phi' \qquad c = 0 \qquad \tan\phi' = 0.6$$

$$F = \frac{Hu}{\Sigma H} = \frac{1606.14 \times 0.6}{393.85} = 2.45 > Fa = 1.5$$

case 2 HB loading

	N (t)	x (m)	N·x (tm)	H (t)	y (m)	H·y (tm)
WDL. WLL	412.6	1.95	804.57	—	—	—
F B	—	—	—	38.20	8.667	331.08
T	—	—	—	23.23	8.667	201.33
W, Ws, Wr	1168.60		4434.25	—	—	—
Ws add	68.74	4.45	305.89	—	—	—
P a	—	—	—	314.22	3.667	1152.24
Pa add	—	—	—	49.80	5.50	273.90
TOTAL	1649.94		5544.71	425.45		1958.55

1) check for eccentric

$$x = \frac{\Sigma N \cdot x + \Sigma H \cdot y}{\Sigma N} = \frac{5544.71 - 1958.55}{1649.94} = 2.17^{m}$$

$$e = \frac{B}{2} - x = \frac{6.50}{2} - 2.17 = 1.08^{m} < \frac{B}{3} = 2.17^{m}$$

2) soil reaction

$$q = \frac{1649.94}{6.50 \times 10.10} \times \left(1 \pm \frac{6 \times 1.08}{6.50}\right) = \begin{cases} 50.19 \ {}^{t}/_{m^2} \\ 0.08 \end{cases}, < 75 \ {}^{t}/_{m^2}$$

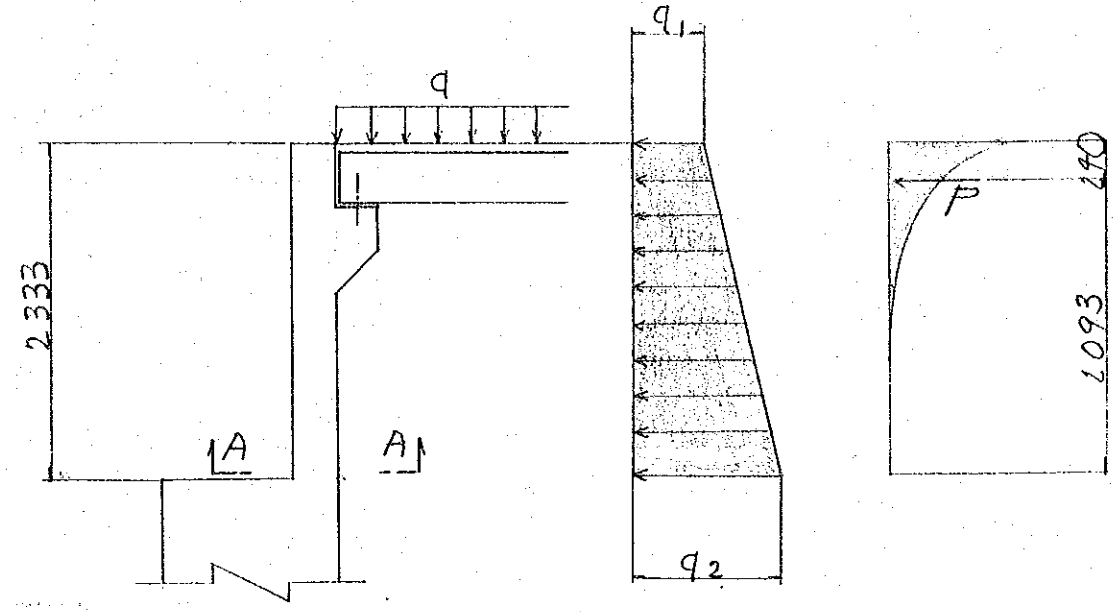
3) check for sliding

$$Hu = c \cdot A + N \cdot \tan\phi \qquad c = 0 \qquad \tan\phi = 0.6$$

$$F = \frac{Hu}{\Sigma H} = \frac{0.6 \times 1649.94}{425.45} = 2.3 \quad > Fa = 1.2$$

§ 5 CALCULATION OF PARAPET SECTION

5-1 dimenston and loading



	q_1	q_2
HA loading	0.28	1.47
HB loading	0.45	1.65

$q_1 = q \cdot K \qquad = 0.27 \cdot q \quad t/m^2$

$q_2 = K \cdot \gamma_s \cdot H + q_1 = 0.513 \cdot H + 0.27 \cdot q$ "

5 - 2 sectional force of parapet

CASE 1 (HA)

$$S = 1/2 \times (0.28 + 1.47) \times 2.333 = 2.04^{t}$$

$$M = 2.04 \times 1/3 \times 2.333 \times \frac{2 \times 0.28 + 1.47}{0.28 + 1.47} = 1.84^{tm}$$

CASE 2 (HB)

$$S = 1/2 \times (0.45 + 1.65) \times 2.333 = 2.45^{t}$$

$$M = 2.45 \times 1/3 \times 2.333 \times \frac{2 \times 0.45 + 1.65}{0.45 + 1.65} = 2.31^{tm}$$

CASE 3

$$S = 10.97 \times 0.27 = 2.96^{t}$$

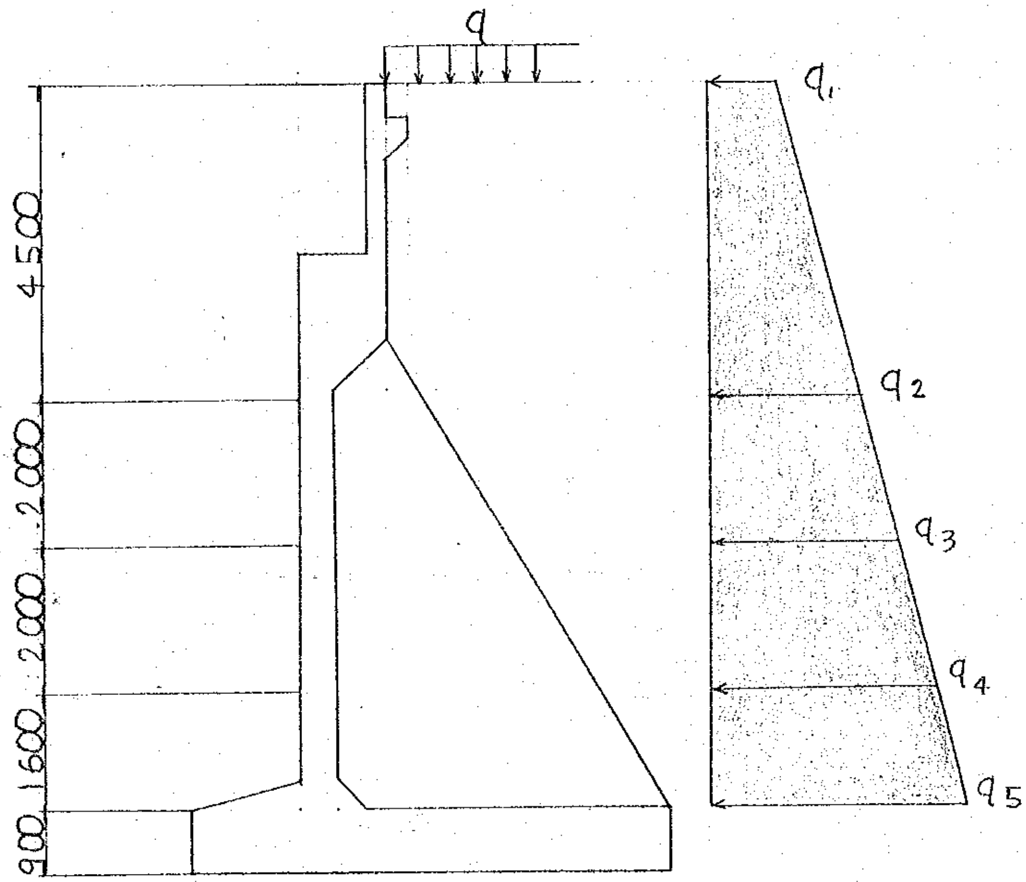
$$M = 2.96 \times 2.093 = 6.20^{tm}$$

5 - 3 list of stresses σc . σs . τ : working stress .
σca, σsa, τa : Permissible stress.

	case 1	case 2				
M	1.84	2.31				
N	—	—				
S	2.04	2.45				
b	100	100				
h	23	23				
d′	7	7				
As	D16@125 16.08	→				
As′	—	—				
f/d	│	│				
M′/bd²	│	│				
S/bd	│	│				
n·P	│	│				
C	│	│				
S	│	│				
Z	│	│				
σc	│	│				
σs	│	│				
τ						
σca	83	→				
σsa	2346	→				
τa	2.35	→				

§ 6 CALCULATION OF WALL SECTION

6-1 dimension and loading

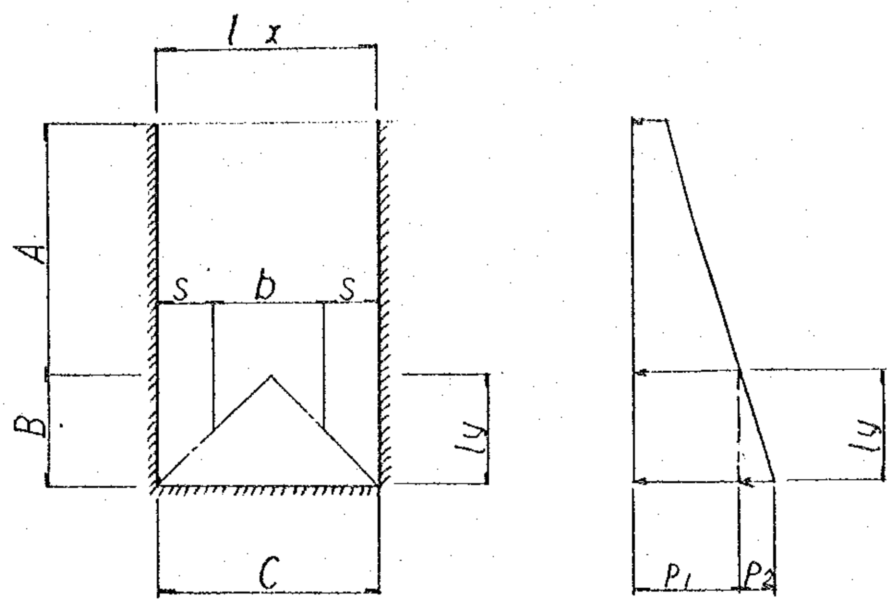


	q_1	q_2	q_3	q_4	q_5	q_6	q_7
HA loading	0.28	2.58	3.61	4.64	5.46		
HB loading	0.45	2.76	3.78	4.81	5.63		

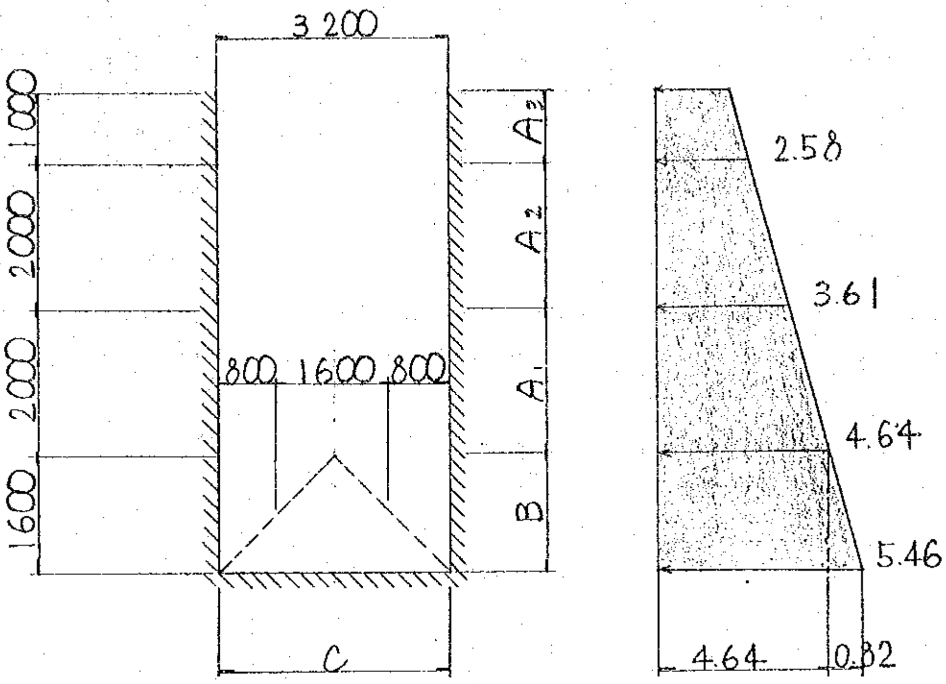
$$q_1 = q \cdot K = 0.27 \cdot q \quad t/m^2$$

$$q_x = K \cdot \gamma_s \cdot H_x + q_1 = 0.513 \cdot H_x + 0.27 \cdot q \quad "$$

6-2 sectional force of wall



	A	B	C
M (tm)	$\frac{p \cdot lx^2}{10}$	$\frac{p \cdot s^2}{6 \cdot lx}(2 \cdot lx + b)$	$\frac{1}{2}(\frac{P_1}{2} + \frac{P_2}{6})\, ly^2$
S (t)	$\frac{p \cdot lx}{2}$	$p \cdot s$	$(P_1 + \frac{P_2}{2})\, ly$



	M (tm)		S (t)	
C−C	$\frac{1}{2}\times(\frac{4.64}{2}+\frac{0.82}{6})\times 1.60^2$	3.14	$(4.64+\frac{0.82}{2})\times 1.60$	8.08
B−B	$\frac{5.05\times 0.80^2}{6\times 3.20}(2\times 3.20+1.60)$	1.35	5.05×0.80	4.04
A1−1	$\frac{4.64\times 3.20^2}{10}$	4.75	$\frac{4.64\times 3.20}{2}$	7.42
A2−2	$\frac{3.61\times 3.20^2}{10}$	3.70	$\frac{3.61\times 3.20}{2}$	5.78
A3−3	$\frac{2.58\times 3.20^2}{10}$	2.64	$\frac{2.58\times 3.20}{2}$	4.13
A4−4	———	——	———	——

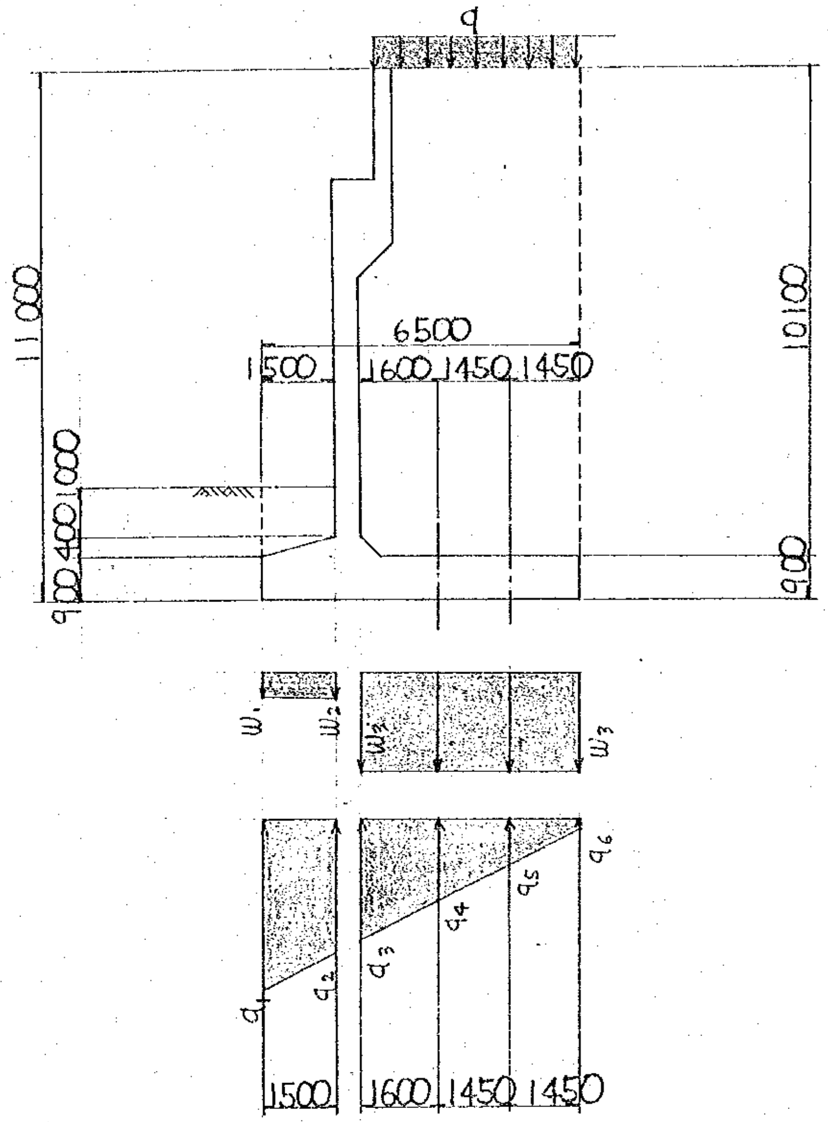
6 - 3 list of stresses σ_c. σ_s. τ : working stress.
σ_{ca}, σ_{sa}, τ_a : Permissible stress.

※ $As_{min} = 100 \times 43 \times 0.0015 = 6.45\ cm^2$

	C—C	B—B	A1-1	A2-2	A3-3	
M	3.14	1.35	4.75	3.70	2.64	
N	—	—	—	—	—	
S	8.08	4.04	7.42	5.78	4.13	
b	100	→				
h	43	→				
d'	7	→				
As	D16 c 250 ※ 8.04	→				
As'	—	—	—	—	—	
f/d						
M'/bd²						
S/bd						
n·P						
C						
S						
Z						
σ_c						
σ_s						
τ						
σ_{ca}	83	→				
σ_{sa}	2346	→				
τ_a	2.35	→				

§ 7 CALCULATION OF FOOTING SECTION

7-1 dimenston and loading



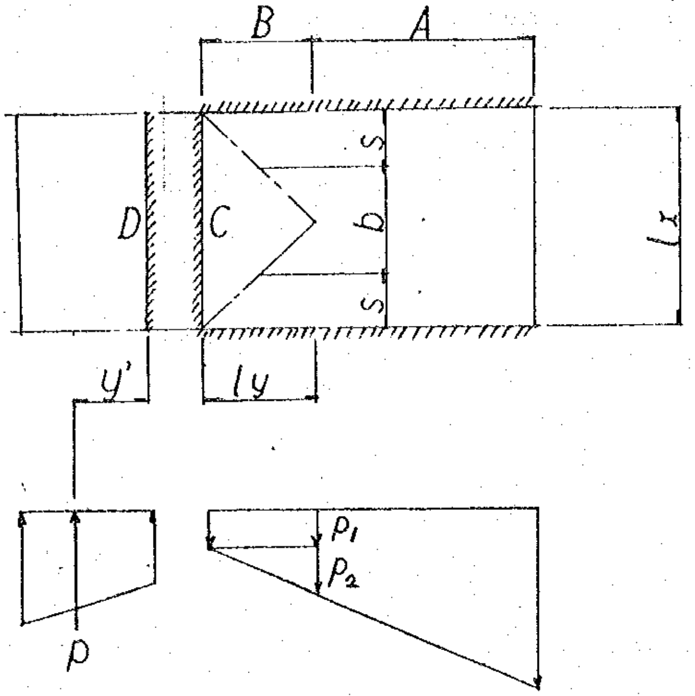
$w_1 = 0.90 \times 2.41 + 1.40 \times 1.9 = 4.83$ t/m²

$w_2 = 1.30 \times$ 〃 $+ 1.00 \times$ 〃 $= 5.03$ 〃

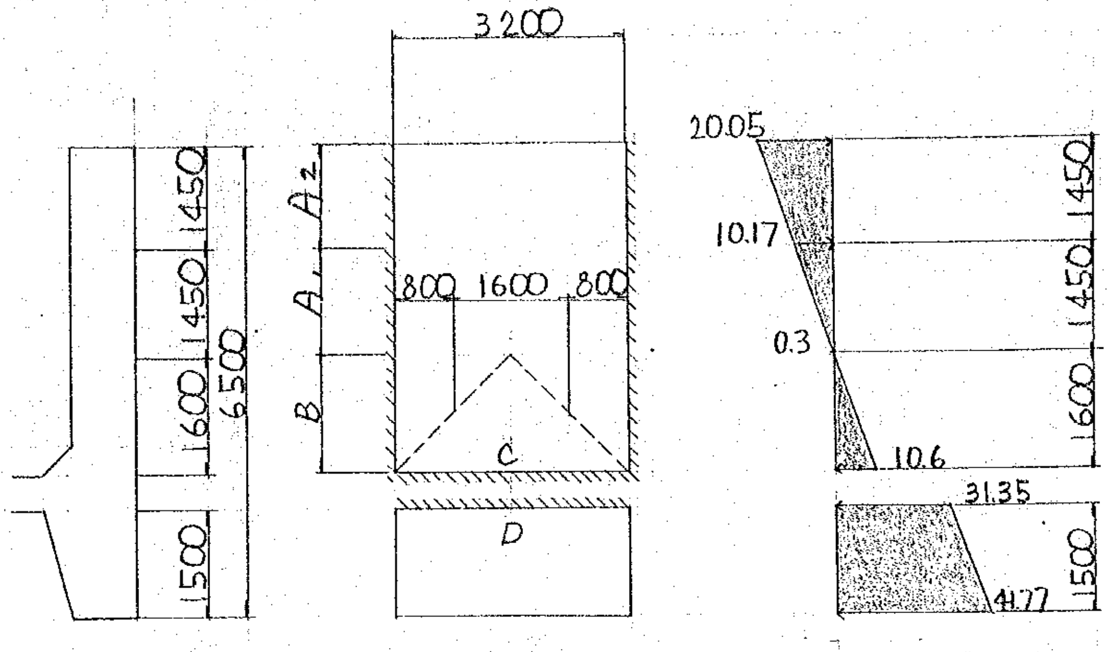
$w_3 = 0.90 \times$ 〃 $+ 10.10 \times$ 〃 $+ q = 21.36 + q$ 〃

	q 1	q 2	q 3	q 4	q 5	q 6
HA loading	46.60	36.38	32.98	22.08	12.21	2.33
HB loading	50.19	38.63	34.77	22.44	11.26	0.08

7 - 2 sectional force of footing



	A	B	C	D
(tm) M	$\frac{p \cdot lx^2}{10}$	$\frac{p \cdot s}{6 \cdot lx}(2 \cdot lx + b)$	$\frac{1}{2}(\frac{p_1}{2} + \frac{p_2}{6})ly^2$	$p \cdot y'$
(t) S	$\frac{p \cdot lx}{2}$	$p \cdot s$	$(p_1 + \frac{p_2}{2}) \cdot ly$	p



	M (tm)		S (t)	
D − D	$73.12 \times \frac{1.50}{3}\left(\frac{31.35+2\times 41.77}{31.35+41.77}\right)$	57.45	$\frac{1}{2}\times(31.35+41.77)\times 1.50$	54.84
C − C	$\frac{1}{2}\times\left(\frac{0}{2}+\frac{10.6}{6}\right)\times 1.60^2$	2.26	$\left(0+\frac{10.6}{2}\right)\times 1.60$	8.48
B − B	$\frac{5.30\times 0.8^2}{6\times 3.20}(2\times 3.20+1.60)$	1.41	5.30×0.80	4.24
A1 − 1	$\frac{10.17\times 3.20^2}{10}$	10.41	$\frac{10.17\times 3.20}{2}$	16.27
A2 − 2	$\frac{20.05\times 3.20^2}{10}$	20.53	$\frac{20.77\times 3.20}{2}$	33.23
A3 − 3	—	—	—	

7-3 list of stresses   σc, σs, τ : working stress.

σca, σsa, τa : Permissible stress.

	* As min = b·d·0.15% = 12.00 cm²					
	D—D	C—C	B—B	A1—1	A2—2	
M	57.45	2.26	1.41	10.41	20.53	
N	——	——	——	——	——	
S	54.84	8.48	4.24	16.27	33.23	
b	100	→	→	→	→	
h	120	80	→	→	→	
d′	10	10	→	→	→	
As	D20@125 25.12	*D16@125 16.08	*D16@125 16.08	*D16@125 16.08	D16@125 16.08	
As′	——	——	——	——	——	
f/d	0				0	
M′/bd²	3.99				3.21	
S/bd	4.57				4.15	
n·P	0.0314				0.0302	
C	9.77				9.93	
S	34.44				35.78	
Z	1.08				1.08	
σc	39				32	
σs	1060				1722	
τ	4.51				4.1	
σca	83	→	→	→	→	
σsa	2346	→	→	→	→	
τa	3.5	→	→	→	→	

Check for stirrups

Sect D - D

$$\tau = \frac{S}{b \cdot d} \cdot Z = \frac{54.84 \times 10^3}{100 \times 120} \times 1.08 = 4.94 \ kg/cm^2 > \tau_a = 2.35 \ kg/cm^2$$

$$S' = S - S_c$$

$$S_c = \tau_a \cdot b \cdot d \cdot 1/Z = 2.35 \times 100 \times 120 \times 1/1.08 = 26.11 \times 10^3 \ kg$$

$$S' = (54.84 - 26.11) \times 10^3 = 28.73 \times 10^3 \ kg$$

$$Req\ A_v = \frac{S' \times a}{\sigma_{sa} \times d} \times Z = \frac{28.73 \times 10^3 \times 25}{1780 \times 120} \times 1.08 = 3.63 \ cm^2$$

Φ16 - ctc 250 $n = 2$

$$A_v = 2.01 \times 2 = 4.02 \ cm^2 > Req\ A_v = 3.63 \ cm^2$$

Sect A2 - 2

$$\tau = \frac{S}{b \cdot d} \cdot Z = \frac{33.23 \times 10^3}{100 \times 80} \times 1.08 = 4.49 \ kg/cm^2 < \tau_a = 2.35 \ kg/cm^2$$

$$S' = S - S_c$$

$$S_c = \tau_a \cdot b \cdot d \cdot 1/Z = 2.35 \times 100 \times 80 \times 1/1.08 = 17.41 \times 10^3 \ kg$$

$$S' = (33.23 - 17.41) \times 10^3 = 15.82 \times 10^3 \ kg$$

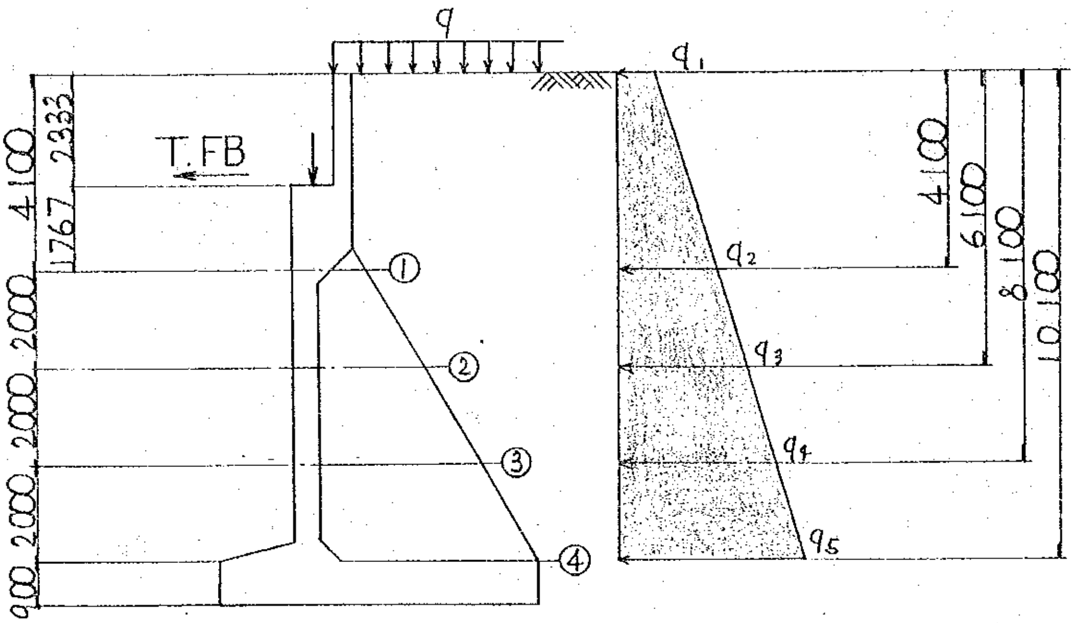
$$Req\ A_v = \frac{S' \times a}{\sigma_{sa} \times d} \times Z = \frac{15.82 \times 10^3 \times 25}{1780 \times 80} \times 1.08 = 3.00 \ cm^2$$

Φ16 - ctc 250 $n = 2$

$$A_v = 2.01 \times 2 = 4.02 \ cm^2 > Req\ A_v = 3.00 \ cm^2$$

§ 8 CALCULATION OF BUTTRESS SECTION

8 - 1 dimenston and loading



$$q_x = (K \cdot \gamma_s \cdot H + q \cdot K) \cdot l$$

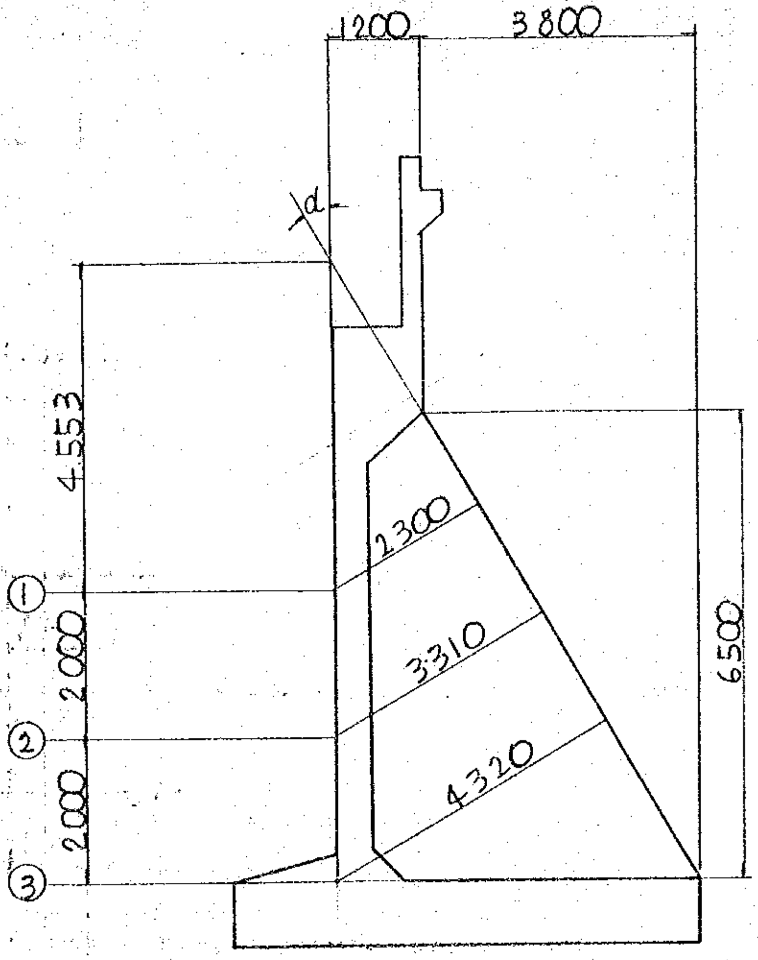
	F B (t)	T (t)	FB + T (t)	(FB+T) l / B (t)
HA loading	25.80	23.23	49.03	15.53
HA loading	38.20	23.23	61.43	19.64

	q 1	q 2	q 3	q 4	q 5	q 6
HA loading	0.88	7.61	10.90	14.18	17.46	——
HB loading	1.64	8.16	11.45	14.73	18.01	——

8 - 2 sectional force of buttress

		HA loading			HB loading		
		H (t)	y (m)	H·y (tm)	H (t)	y (m)	H·y (tm)
1-1	FB · T	15.53	1.767	27.44	19.64	1.767	34.70
	Pa	17.40	1.508	26.24	20.09	1.595	32.04
	Σ	32.93		53.68	39.73		66.74
2-2	FB · T	15.53	3.767	58.50	19.64	3.767	73.98
	Pa	41.23	2.508	103.40	39.92	2.288	91.34
	Σ	56.76		161.90	59.56		165.32
3-3	FB · T	15.53	5.767	89.56	19.64	5.767	113.26
	Pa	60.99	2.858	174.31	66.30	2.97	196.91
	Σ	76.52		263.87	85.94		310.17
4-4	FB · T	15.53	7.767	120.62	19.64	7.767	152.54
	Pa	92.62	3.528	326.76	99.23	3.648	361.99
	Σ	108.15		447.38	118.87		514.53
5-5	FB · T						
	Pa						
	Σ						

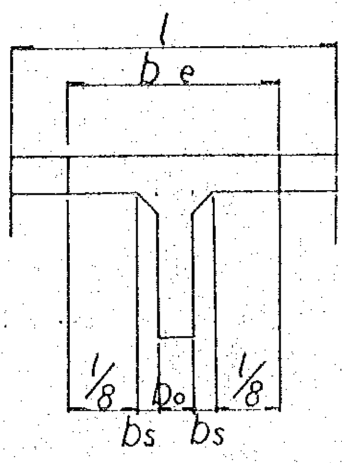
8 - 3 calculation of members



$$\tan\alpha = \frac{380}{650} = 0.585$$

$$\alpha = 30°18'$$

$$H = h \cdot \sin\alpha$$
$$= 0.5045 \cdot h$$

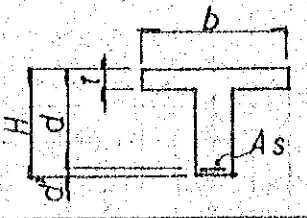


$$b_e = b_o + 2\left(b_s + \frac{l}{8}\right) = 60 + 2 \times (30 + 40)$$
$$= 200 \text{ cm}$$

8 - 4 list of stresses σ_c, σ_s, τ : working stress.

σ_{ca}, σ_{sa}, τ_a : Permissible stress.

		1 — 1	2 — 2	3 — 3		
M	tm	161.90	263.87	447.38		
S	t	56.76	76.52	108.15		
b	cm	200	→	→		
t	〃	50	→	→		
d	〃	220	321	417		
A s	cm²	5, 3 > D25 39.28	5, 5 > D25 49.10	5, 5, 2 > D25 58.92		
P		0.0009	0.0006	0.0007		
t/d		0.23	0.16	0.12		
K		0.164	0.129	0.136		
j		0.973	0.962	0.956		
σ_s	kg/cm²	1882	2125	1995		
σ_c	〃	26	21	21		
τ	〃	4.3	4.0	4.3		
σ_{sa}	〃	2346	→	→		
σ_{ca}	〃	83	→	→		
τ_a	〃	8.2	→	→		



8 - 5 check for tie bers

1) wall and buttress

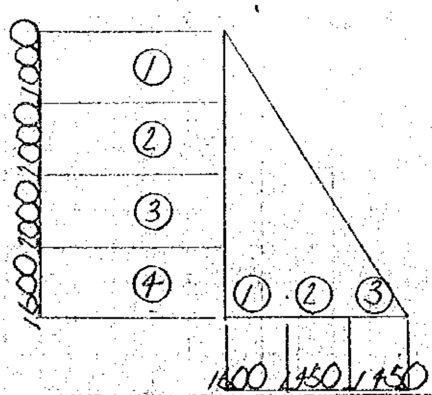
$$A_s = \frac{S}{\sigma_{sa}} \quad (cm^2)$$

		S (t)	As (cm^2)	As'	(cm^2)
section	1 — 1	4.13	1.76	D16 @ 250	8.04
	2 — 2	5.78	2.46	↓	↓
	3 — 3	7.42	3.16		
	4 — 4	4.04	1.72		
	5 — 5	—	—	—	—

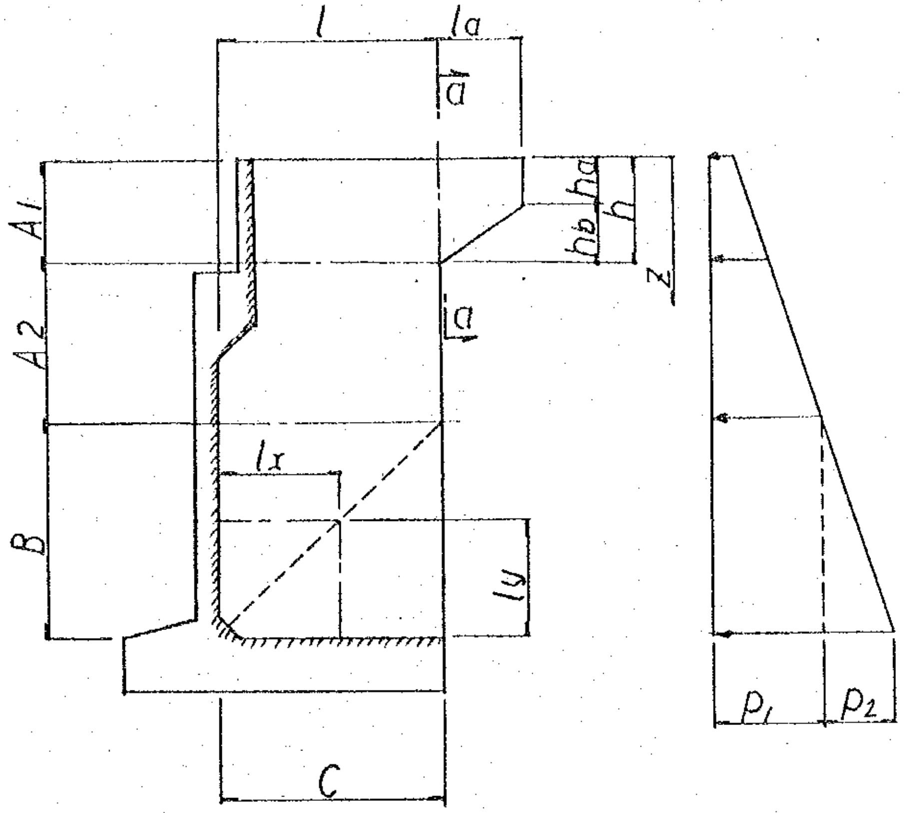
2) footing and buttress

$$A_s = \frac{S}{\sigma_{sa}} \quad (cm^2)$$

		S (t)	As (cm^2)	As'	(cm^2)
section	1 1	4.24	1.81	D16 @ 250	8.04
	2 2	16.27	6.94	↓	↓
	3 3	33.23	14.16	D16 @ 125	16.08



§ 9 CALCULATION OF WING SECTION



		S (t)	M (tm)
a – a	$0 < z < h_a$	$(q + \gamma \cdot z) \cdot K \cdot l_a$	$(q + \gamma \cdot z) \cdot K \cdot \frac{l_a^2}{2}$
	$h_a < z < h$	$(q + \gamma \cdot z) \cdot K \cdot l_a \cdot \frac{h - z}{h_b}$	$(q + \gamma \cdot z) \cdot K \cdot \frac{l_a^2}{2} \cdot \left(\frac{h - z}{h_b}\right)^2$

$$M_{max} \quad (h_a < z < h) \longrightarrow z = \frac{\gamma \cdot h - 2 \cdot q}{3 \gamma} \quad (m)$$

$q = 1.02 \; t/m^2$

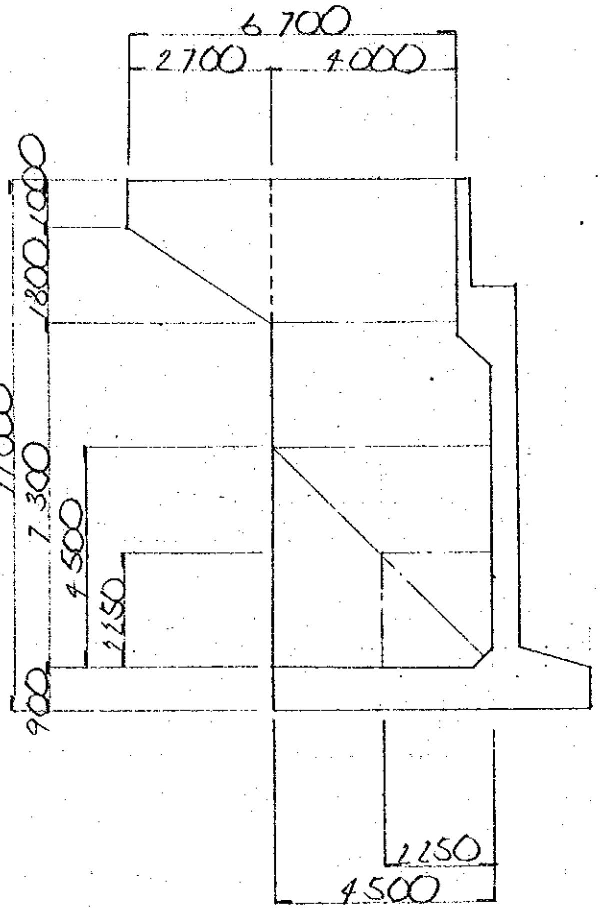
$K = 0.27$

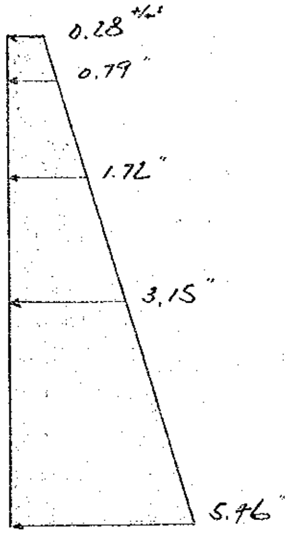
$\gamma = 1.9 \; t/m^3$

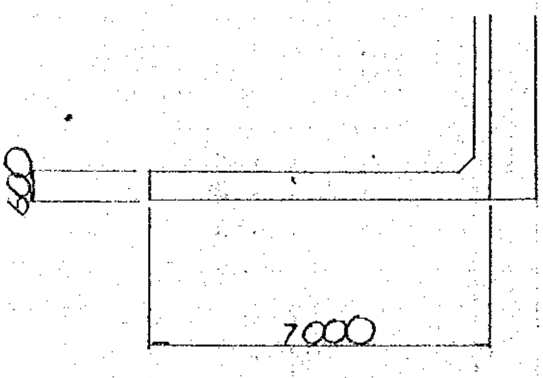
	M (t)	S (tm)
A1 − 1	$\frac{1}{2} p \cdot l^2 + Ma + Sa \cdot l$	$p \cdot l + Sa$
A2 − 2	$\frac{1}{2} \cdot p \cdot l^2$	$p \cdot l$
B − B	$\frac{1}{2} \cdot p \cdot lx^2$	$p \cdot lx$
C − C	$(\frac{p_1}{2} + \frac{p_2}{6})\, ly^2$	$(p_1 + \frac{p_2}{2}) \cdot ly$

(B-LINE 1, A1, L)

9 — 1 dimension and loading







		$\bar{x}$ (m)	M (tm)		S (t)	
a – a	1 – 1	1.00	$\frac{1}{2} \times 0.79 \times 2.70^2$	2.88	0.79×2.70	2.13
	2 – 2	1.00 ~2.80	―――	―	―――	―
A 1		1.00 ~2.80	$\frac{1}{2} \times 1.72 \times 4.50^2$	17.42	1.72×4.50	7.74
A 2	1 – 1	5.600	$\frac{1}{2} \times 3.15 \times 4.50^2$	31.89	3.15×4.50	14.18
	2 – 2	―	―――	―	―――	―
B – B		5.600 ~10.10	$\frac{1}{2} \times \frac{3.15 + 5.46}{2} \times 2.25^2$	10.90	$\frac{3.15 + 5.46}{2} \times 2.25$	9.69
C – C		10.100	$(\frac{3.15}{2} + \frac{2.31}{6}) \times 2.25^2$	9.92	$(3.15 + \frac{2.31}{2}) \times 2.25$	9.69

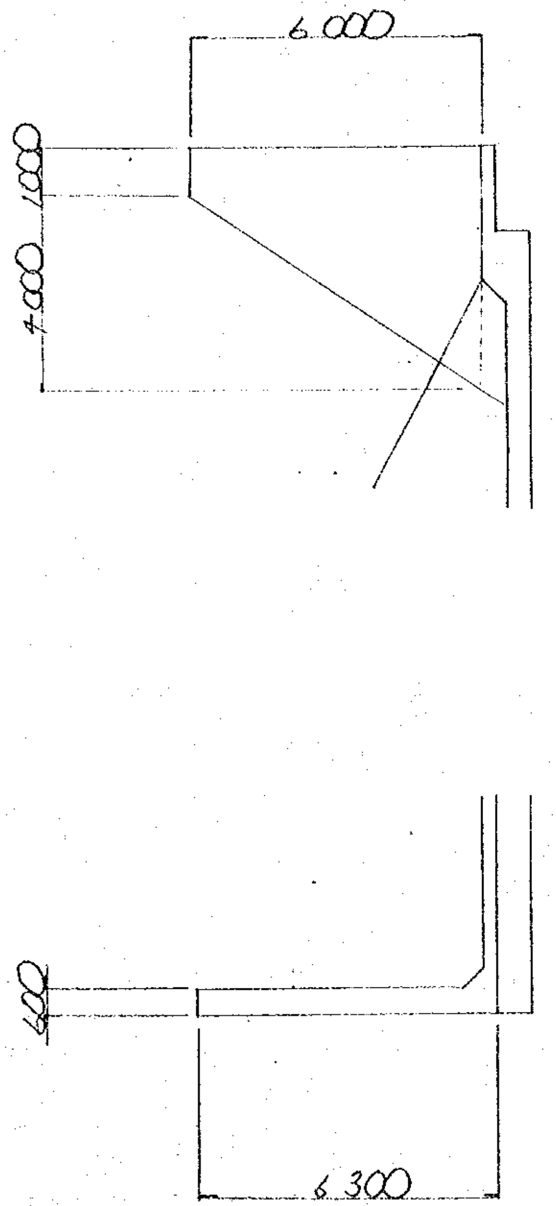
$$\bar{x} = \frac{1.9 \times 2.80 - 2 \times 1.02}{3 \times 1.9} = 0.58^m < 1.00^m$$

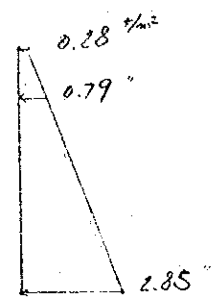
9 - 2 list of stresses σc, σs, τ : working stress.
σca, σsa, τa : Permissible stress.

	As min = 100 × 53 × 0.0015 = 7.95 cm²					
	a - a	A_1	A_2	B	C	
M	2.88	17.42	31.89	10.90	9.92	
N	—	—	—	—	—	
S	2.13	7.74	14.18	9.69	9.69	
b	100	→				
h	53	→				
d'	7	→				
As	D16@250 ※ 8.04	D25/D16 7@125 27.68	D25/D16 7@125 27.68	D25@250 19.64	D16@125 16.08	
As'		—	—	—	—	
f/d		0	0	0	0	
M'/bd²		8.75	11.35	3.88	3.53	
S/bd		1.48	2.68	1.83	1.83	
n·P		0.0783	0.0183	0.0556	0.0455	
C		6.90	6.90	7.82	8.44	
S		14.32	14.32	19.87	24.08	
Z		1.12	1.12	1.10	1.10	
σc		60	78	30	30	
σs		1880	2339	1157	1275	
τ		1.67	3.0	2.01	2.0	
σca	83	→				
σsa	2346	→				
τa	2.35	3.47	→	2.35	→	

(B-LINE I , A I, R)

9 — 3 dimension and loading





		$\bar{z}$ (m)	M	(tm)	S	(t)
a-a	1 − 1	1.00	$\frac{1}{2} \times 0.79 \times 6.00^2$	14.22	0.79×6.00	4.74
	2 − 2	1.00 ~ 5.00	$(1.02 + 1.9 \times 1.308) \times 0.27 \times \frac{6.00^2}{2} \times \left(\frac{5.00 - 1.308}{4.00}\right)^2$	14.51	$(1.02 + 1.9 \times 1.308) \times 0.27 \times 6.00 \times \left(\frac{5.00 - 1.308}{4.00}\right)$	5.24
A 1		—	—	—	—	—
A 2	1 − 1	—	—	—	—	—
	2 − 2	—	—	—	—	—
B − B		—	—	—	—	—
C − C		—	—	—	—	—

$$\bar{z} = \frac{1.9 \times 5.00 - 2 \times 1.02}{3 \times 1.9} = 1.308^{m}$$

9 - 4 list of stresses σ_c, σ_s, τ : working stress.

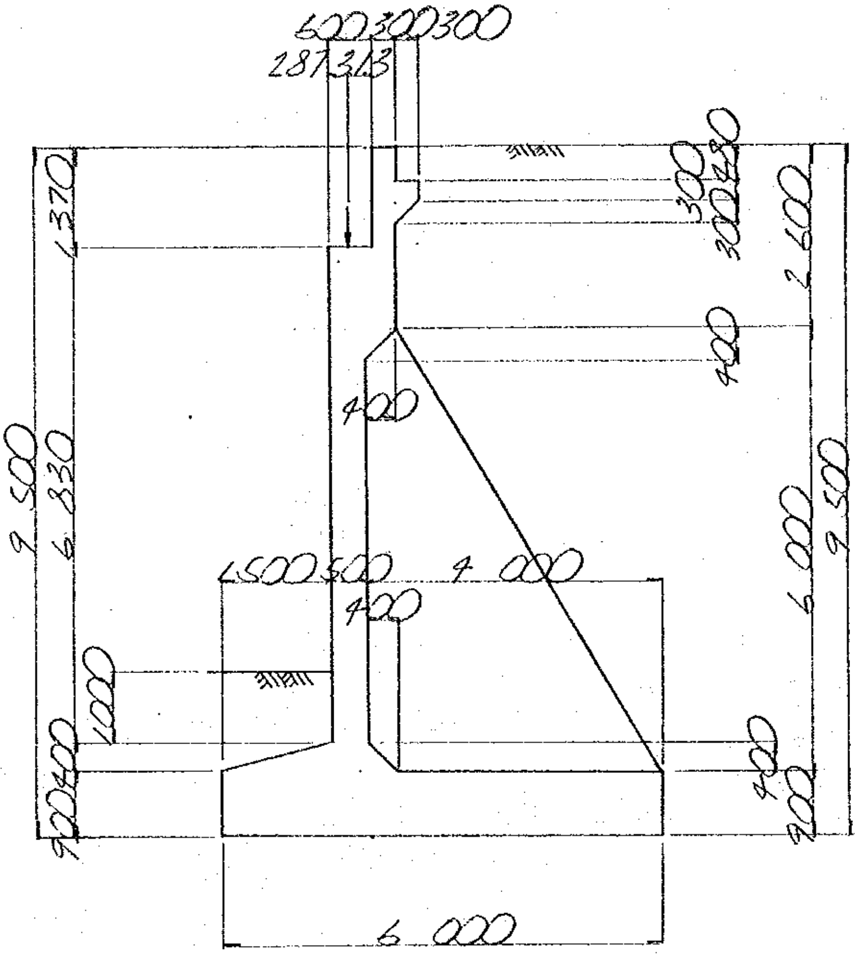
$\sigma_{ca}, \sigma_{sa}, \tau_a$: Permissible stress.

	As min = 100 × 53 × 0.0015 = 7.95 cm²					
	a - a					
M	14.51					
N	——					
S	5.24					
b	100					
h	53					
d'	7					
As	D16 c 125 16.08					
As'	——					
f/d	0					
M'/bd^2	5.17					
S/bd	0.99					
n·P	0.0455					
C	8.44					
S	24.08					
Z	1.09					
σ_c	44					
σ_s	1865					
τ	1.08					
σ_{ca}	83					
σ_{sa}	2346					
τ_a	2.35					

§§ 6 $H = 9.50$ m

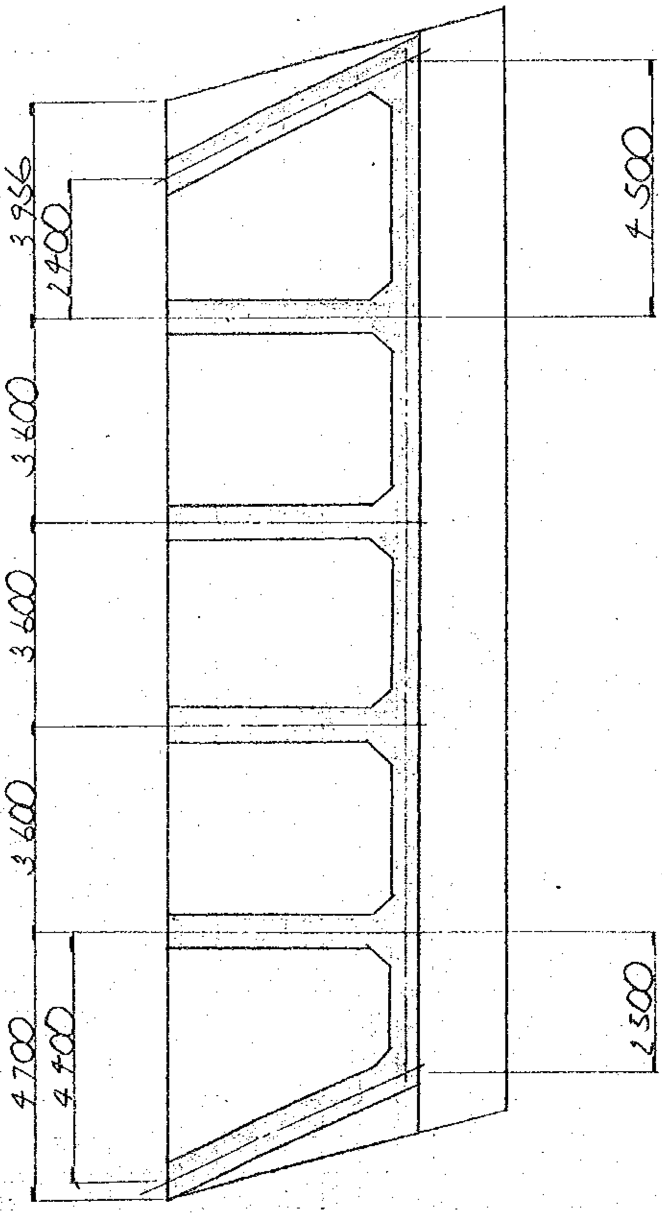
A – L – 3 A_2

§ 1 STRUCTURAL FIGURE



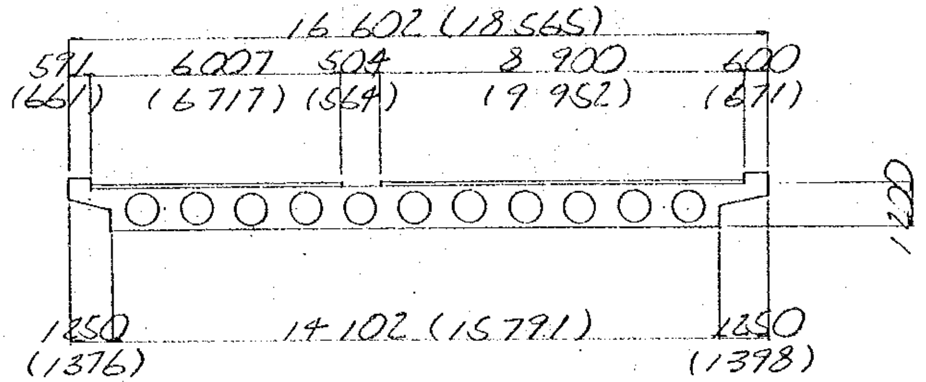
buttress span $l = 3.600^{m}$

(A-LINE 3, A2)


3956
2400
3600
3600
3600
4700
4400
4500
2300

§ 2 REACTION OF SUPERSTRUCTURE

2 - 1 structural figure



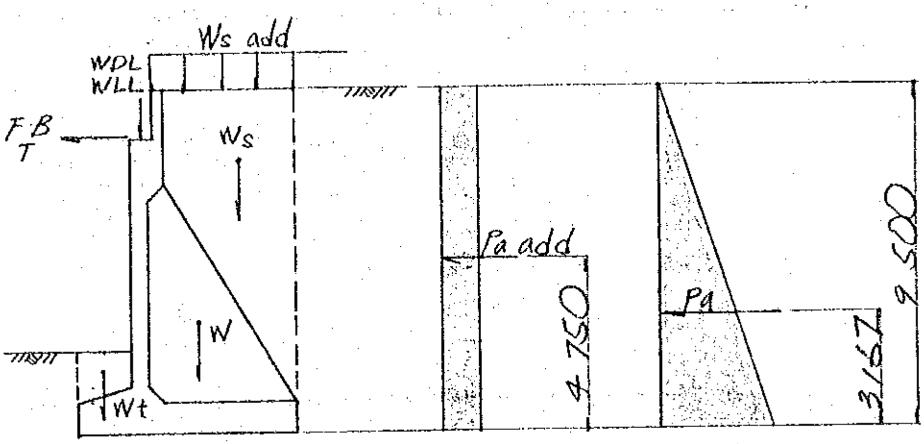
θ = 63°25′

2 - 2 whole reaction of superstructure

		HA loading		HB loading	
		N (t)	H (t)	N (t)	H (t)
dead load of deck	I	136.7	———	136.7	———
	II	21.5	———	21.5	———
live load		89.0	———	120.5	———
crowd load		———	———	———	———
longitudinal forse		———	51.6	———	76.4
TOTAL		247.2	51.6	278.7	76.4

§ 3 CALCULATION OF LOAD

3-1 loading diagram



WDL : dead load of deck

WLL : max LL reaction under HA & HB

F B : HA & HB braking

W : self weight

Ws : weight of soil

Wt : fill on toe

Ws add : weight of surcharge

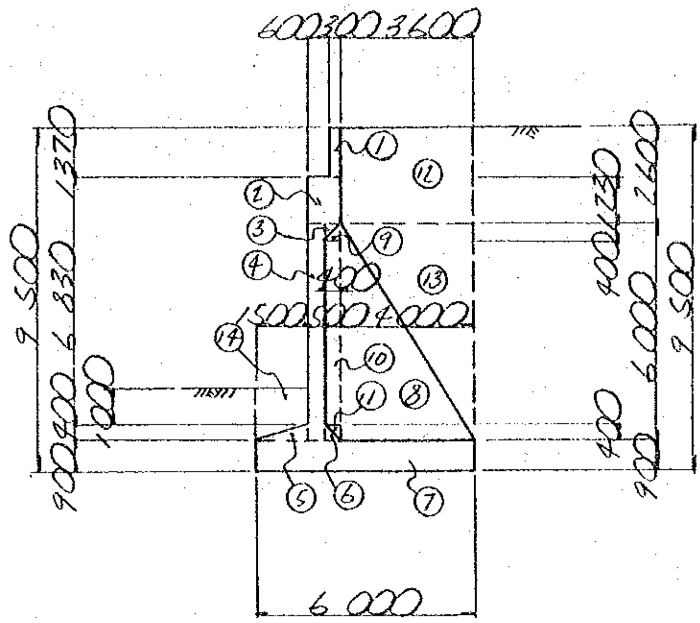
P_A : active pressure

P_P : passive pressure

P_A add : surcharge

T : temperatwe load

3-2 self weight and weight of soil



$$\overline{\gamma} = \frac{2.41 \times 0.60 \times 6 + 1.9 \times 14.965}{18.565} = 2.00 \ t/m^3$$

		N (t)	x (m)	N x (t m)
①	0.30×1.37×18.565×2.41	18.39	2.250	41.38
②	0.90×1.23×18.565×2.41	49.53	1.950	96.58
③	1/2×0.40×0.40×18.565×2.41	3.58	2.133	7.64
④	0.50×6.00×18.565×2.41	134.22	1.750	234.89
⑤	1/2×1.50×0.40×18.565×2.41	13.42	1.000	13.42
⑥	1/2×0.40×0.40×18.565×2.41	3.58	2.133	7.64
⑦	6.00×0.90×18.565×2.41	241.60	3.000	724.80
⑧	1/2×3.60×6.00×18.565×2.00	401.00	3.600	1,443.60
⑨	1/2×0.40×0.40×18.565×2.00	2.97	2.267	6.73
⑩	0.40×5.20×18.565×2.00	77.23	2.200	169.91
⑪	1/2×0.40×0.40×18.565×2.00	2.97	2.267	6.73
⑫	3.60×2.60×18.565×1.9	330.16	4.200	1,386.67
⑬	1/2×3.60×6.00×18.565×1.9	380.95	4.800	1,828.56
⑭	1/2×(1.00+1.40)×1.50×18.565×1.9	63.49	0.708	44.95
⑮				
Σ		1,723.09		6,013.50

3-3 weight of surcharge

under H.A $= 1.02 \times 3.60 \times 18.565 = 68.17^t$

under H.B $= 1.66 \times 3.60 \times 18.565 = 110.94^t$

3-4 earth pressure

unit weight of soil $\gamma_s = 1.9\ ^t/m^3$

angle of internal friction $\phi = 35°$

(1) active pressure

$$Pa = \frac{1}{2} \cdot K \cdot \gamma_s \cdot H^2 \cdot L$$

$$= 1/2 \times \frac{1 - \sin 35°}{1 + \sin 35°} \times 1.9 \times 9.50^2 \times 18.565 = 431.34^t$$

(2) active pressure due to surcharge

under H.A surcharge

$q = 1.02\ ^t/m^2$

$Pa\ add = K \cdot q \cdot H \cdot L$

$= 0.27 \times 1.02 \times 9.50 \times 18.565 = 48.57^t$

under H.B surcharge

$q = 1.66\ ^t/m^2$

$Pa\ add = K \cdot q \cdot H \cdot L$

$= 0.27 \times 1.66 \times 9.50 \times 18.565 = 79.05^t$

3-5 temperatwe load

$$P_H = \frac{G_0 \cdot A \cdot \delta}{\Sigma \cdot te}$$

$$\delta = \bar{\alpha} \cdot l \qquad \bar{\alpha} = \begin{cases} P.C \rightarrow 0.7 \\ R.C \rightarrow 0.5 \end{cases}$$

$$\left[\begin{array}{ll} \delta = 0.5 \times 16.40 & = 8.20^{mm} \\ A = 30 \times 1579 & = 47370^{t} \end{array} \right]$$

RING SHOE

	—	TON
$D\phi$	: —	cm
$d\phi$	: —	cm
A	: 47370	cm^2
t	: 5.0	cm
G_0	: 13.5	kg/cm^2 (modulus of rigidity)

$$P_H = \frac{13.5 \times 47370 \times 0.82}{5.0} = 104877^{kg} = 104.88^{t}$$

$$\Sigma P_H = \cdot P_H \cdot 1/2$$

$$= 104.88 \times 1/2 = 52.44^{t}$$

§ 4 CALCULATION OF STABILITY

case 1 HA loading

	N (t)	x (m)	N·x (tm)	H (t)	y (m)	H·y (tm)
WDL, WLL	247.20	1.787	441.75	—	—	—
F B	—	—	—	51.60	8.130	419.51
T	—	—	—	52.44	8.130	426.34
W. Ws. Wt	1723.09	—	6013.50	—	—	—
Ws add	68.17	4.200	286.31	—	—	—
P a	—	—	—	431.34	3.167	1366.05
Pa add	—	—	—	48.57	4.750	230.71
TOTAL	2038.46		6741.56	583.95		2442.61

1) check for eccentric

$$x = \frac{\Sigma Nx - \Sigma Hy}{\Sigma N} = \frac{6741.56 - 2442.61}{2038.46} = 2.11^{m}$$

$$e = \frac{B}{2} - x = \frac{6.00}{2} - 2.11 = 0.89^{m} < \frac{B}{6} = 1.00^{m}$$

2) soil reaction

$$q = \frac{\Sigma N}{B \cdot L}\left(1 \pm \frac{6 \cdot e}{B}\right) = \frac{2038.46}{6.00 \times 18.565} \times \left(1 \pm \frac{6 \times 0.89}{6.00}\right)$$

$$= \begin{cases} 34.59\ t/m^2 \\ 2.01 \end{cases} < 60\ t/m^2$$

3) check for sliding

$$H_u = c \cdot A' + N \cdot \tan\phi' \qquad c = 0 \qquad \tan\phi' = 0.6$$

$$F = \frac{H_u}{\Sigma H} = \frac{2038.46 \times 0.6}{583.95} = 2.09 > F_a = 1.5$$

case 2 HB loading

	N (t)	x (m)	N·x (tm)	H (t)	y (m)	H·y (tm)
WDL.WLL	278.70	1.787	498.04	——	——	——
F B	——	——	——	76.40	8.130	621.13
T	——	——	——	52.44	8.130	426.34
W, Ws, W_T	1,723.09	——	6,013.50	——	——	——
Ws add	110.94	4.200	465.95	——	——	——
P a	——	——	——	431.34	3.167	1,366.05
Pa add	——	——	——	79.05	4.750	375.49
TOTAL	2,112.73		6,977.49	639.23		2,789.01

1) check for eccentric

$$x = \frac{\Sigma N \cdot x + \Sigma H \cdot y}{\Sigma N} = \frac{6977.49 - 2789.01}{2112.73} = 1.98^{m}$$

$$e = \frac{B}{2} - x = \frac{6.00}{2} - 1.98 = 1.02^{m} < \frac{B}{3} = 2.00^{m}$$

2) soil reaction

$$q = \frac{2 \cdot N}{3 \cdot L \cdot x} = \frac{2 \times 2112.73}{3 \times 18.565 \times 1.98} = 38.32\ t/m^2 < 75\ t/m^2$$

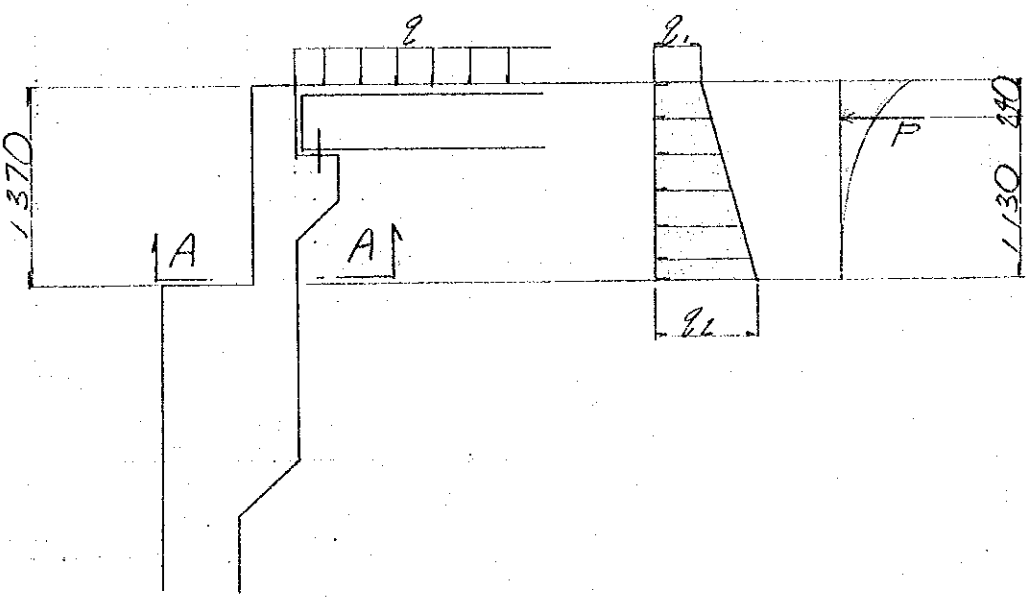
3) check for sliding

$$Hu = c \cdot A + N \cdot \tan\phi \qquad c = 0 \qquad \tan\phi = 0.6$$

$$F = \frac{Hu}{\Sigma H} = \frac{0.6 \times 2112.73}{639.23} = 1.98 > Fa = 1.2$$

§ 5 CALCULATION OF PARAPET SECTION

5-1 dimenston and loading



	q_1	q_2
HA loading	0.28	0.98
HB loading	0.45	1.15

$$q_1 = q \cdot K \qquad = 0.27 \cdot q \quad t/m^2$$

$$q_2 = K \cdot \gamma_s \cdot H + q_1 = 0.513 \cdot H + 0.27 \cdot q \quad ''$$

5 - 2 sectional force of parapet

CASE 1 (HA)

$S = 1/2 \times (0.28 + 0.98) \times 1.37 = 0.86^{t}$

$M = 0.86 \times 1/3 \times 1.370 \times \frac{2 \times 0.28 + 0.98}{0.28 + 0.98} = 0.48^{tm}$

CASE 2 (HB)

$S = 1/2 \times (0.45 + 1.15) \times 1.37 = 1.10^{t}$

$M = 1.10 \times 1/3 \times 1.370 \times \frac{2 \times 0.45 + 1.15}{0.45 + 1.15} = 0.64^{tm}$

CASE 3

$S = 10.97 \times 0.27 = 2.96^{t}$

$M = 2.96 \times 1.13 = 3.34^{tm}$

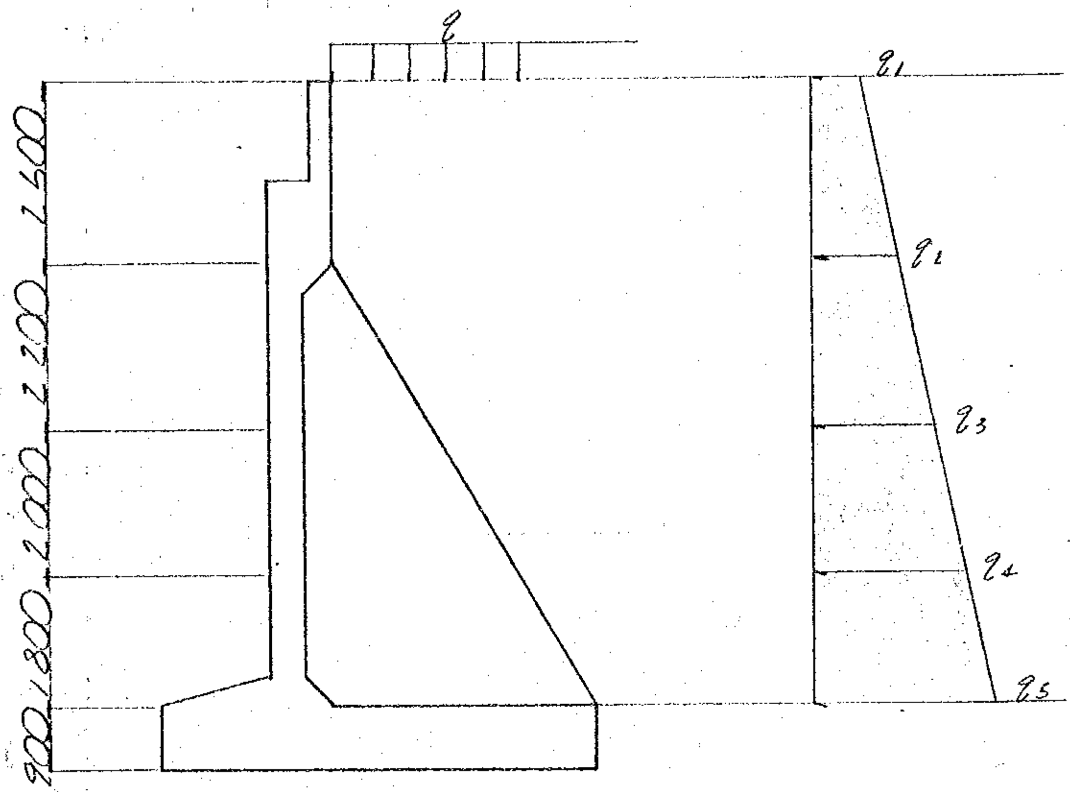
5-3 list of stresses $\sigma_c . \sigma_s . \tau$: working stress.

$\sigma_{ca}, \sigma_{sa}, \tau_a$: Permissible stress.

	Case 1	Case 2				
M	0.48	0.64				
N	—	—				
S	0.86	1.10				
b	100	100				
h	23	23				
d'	7	7				
As	D16@150 8.04	→				
As'	—	—				
f/d						
M'/bd^2						
S/bd						
n·P						
C						
S						
Z						
σ_c						
σ_s						
τ						
σ_{ca}	83	→				
σ_{sa}	2346	→				
τ_a	2.35	→				

§ 6 CALCULATION OF WALL SECTION

6 - 1 dimension and loading

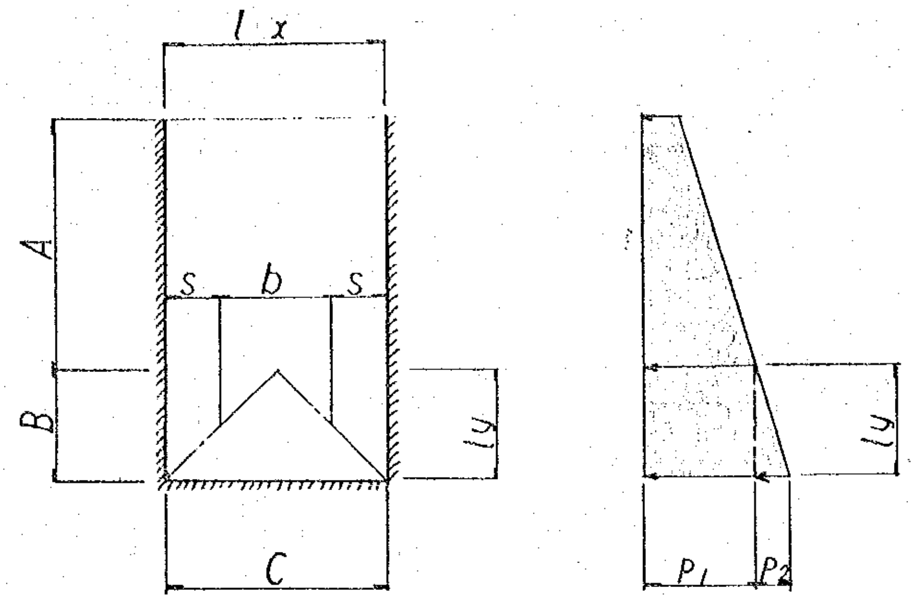


	q1	q2	q3	q4	q5	q6	q7
HA loading	0.28	1.61	2.74	3.56	4.69	—	—
HB loading	0.45	1.78	2.91	3.73	4.86	—	—

$q_1 = q \cdot K \qquad = 0.27 \cdot q \quad t/m^2$

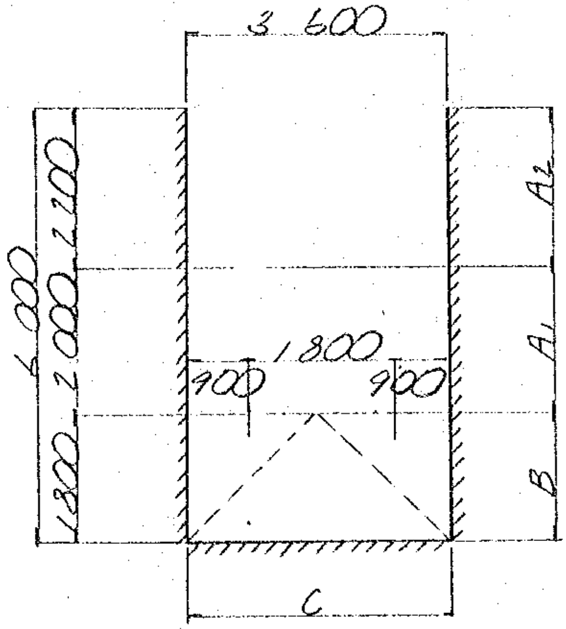
$q_x = K \cdot \gamma_s \cdot H_x + q_1 \quad = 0.513 \cdot H_x + 0.27 \cdot q \quad "$

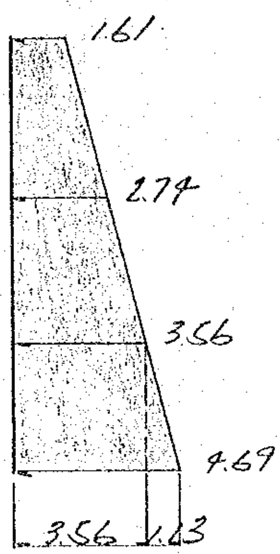
6-2 sectional force of wall



	A	B	C
M (tm)	$\frac{p \cdot lx^2}{10}$	$\frac{p \cdot s^2}{6 \cdot lx}(2 \cdot lx + b)$	$\frac{1}{2}(\frac{P_1}{2}+\frac{P_2}{6}) ly^2$
S (t)	$\frac{p \cdot lx}{2}$	$p \cdot s$	$(P_1+\frac{P_2}{2}) ly$

٢



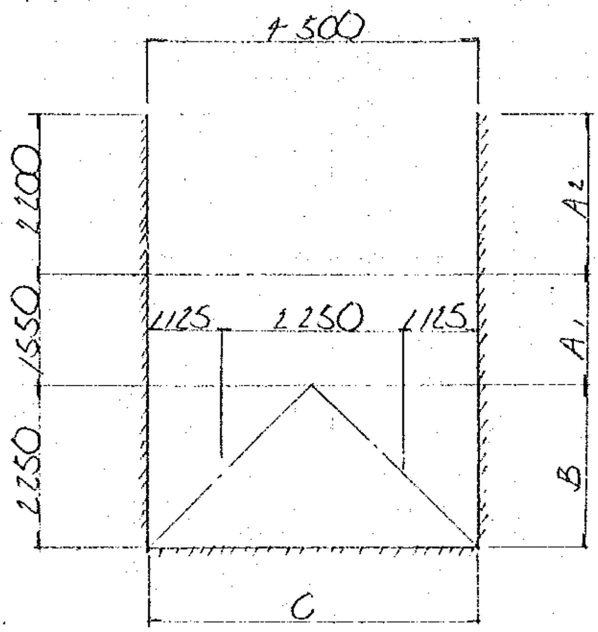


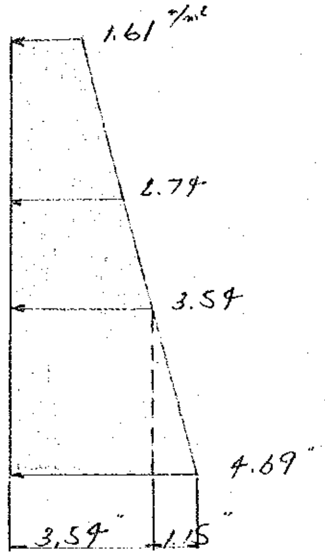
	M (tm)		S (t)	
C−C	$\frac{1}{2}\times\left(\frac{3.56}{2}+\frac{1.13}{6}\right)\times1.800^2$	3.19	$\left(3.56+\frac{1.13}{2}\right)\times1.800$	7.43
B−B	$\frac{4.125\times0.90^2}{6\times3.60}\times(2\times3.60+1.80)$	1.39	4.125×0.90	3.71
A1−1	$\frac{3.56\times3.60^2}{10}$	4.61	$\frac{3.56\times3.60}{2}$	6.41
A2−2	$\frac{2.74\times3.60^2}{10}$	3.55	$\frac{2.74\times3.60}{2}$	4.93
A3−3	———	——	———	——
A4−4	———	——	———	——

6,3 list of stresses $\sigma_c . \sigma_s . \tau$: working stress.

$\sigma_{ca}, \sigma_{sa}, \tau_a$: Permissible stress.

	C − C	B − B	A1 − 1	A2 − 2		
	※As min = 100×43×0.0015 = 6.45 cm²					
M	3.19	1.39	4.61	3.55		
N	——	——	——	——		
S	7.43	3.71	6.41	4.93		
b	100	——	——	——		
h	43	——	——	——		
d′	7	——	——	——		
As	D16@250 ※ 8.04	※ →	※ →	※ →		
As′	——	——	——	——		
f/d						
M′/bd²						
S/bd						
n·P						
C						
S						
Z						
σ_c						
σ_s						
τ						
σ_{ca}	83	→	→	→		
σ_{sa}	2346	→	→	→		
τ_a	2.35	→	→	→		





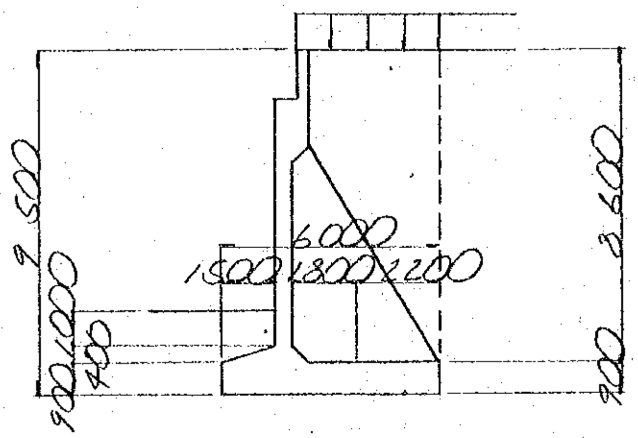
	M	(tm)	S	(t)
C − C	$\frac{1}{2}\times\left(\frac{3.54}{2}+\frac{1.15}{6}\right)\times 2.25^2$	4.97	$\left(3.54+\frac{1.15}{2}\right)\times 2.25$	9.26
B − B	$\frac{4.115\times 1.125^2}{6\times 4.50}\times(2\times 4.50+2.25)$	2.17	4.115×1.125	4.63
A1 − 1	$\frac{3.54\times 4.50^2}{10}$	7.17	$\frac{3.54\times 4.50}{2}$	7.97
A2 − 2	$\frac{2.74\times 4.50^2}{10}$	5.55	$\frac{2.74\times 4.50}{2}$	6.17
A3 − 3	——	——	——	——
A4 − 4	——	——	——	——

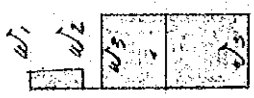
6 - 4 list of stresses σc, σs, τ : working stress.
σca, σsa, τa : Permissible stress.

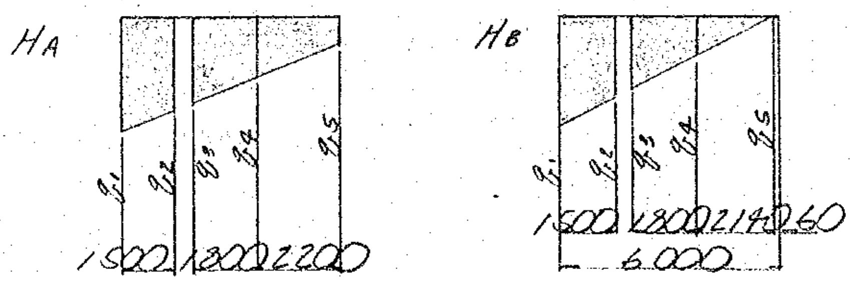
	C - C	B - B	A1-1	A2-2		
	※ As min = 100 × 43 × 0.0015 = 6.45 cm²					
M	4.97	2.17	7.17	5.55		
N	——	——	——	——		
S	9.26	4.63	7.97	6.17		
b	100	→				
h	43	→				
d'	7	→				
As	D16@250 ※ 8.04	※ →		※ →		
As'	——	——	——	——		
f/d			0			
M'/bd²			3.88			
S/bd			1.85			
n·P			0.0280			
C			10.22			
S			38.36			
Z			1.08			
σc			39			
σs			2231			
τ			1.99			
σca	83	→				
σsa	2346	→				
τa	2.35	→				

§ 7 CALCULATION OF FOOTING SECTION

7-1 dimenston and loading







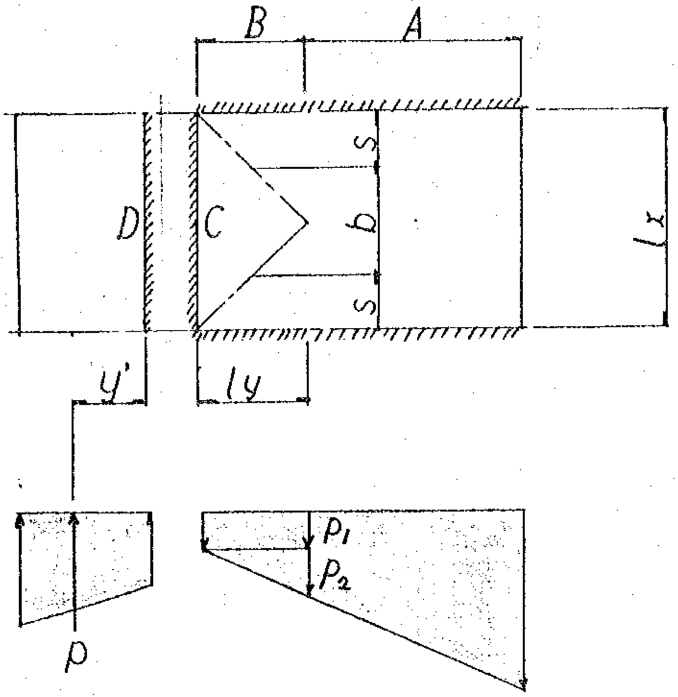
$w_1 = 0.90 \times 2.41 + 1.40 \times 1.9 = 4.83$ t/m²

$w_2 = 1.30 \times$ 〃 $+ 1.00 \times$ 〃 $= 5.03$ 〃

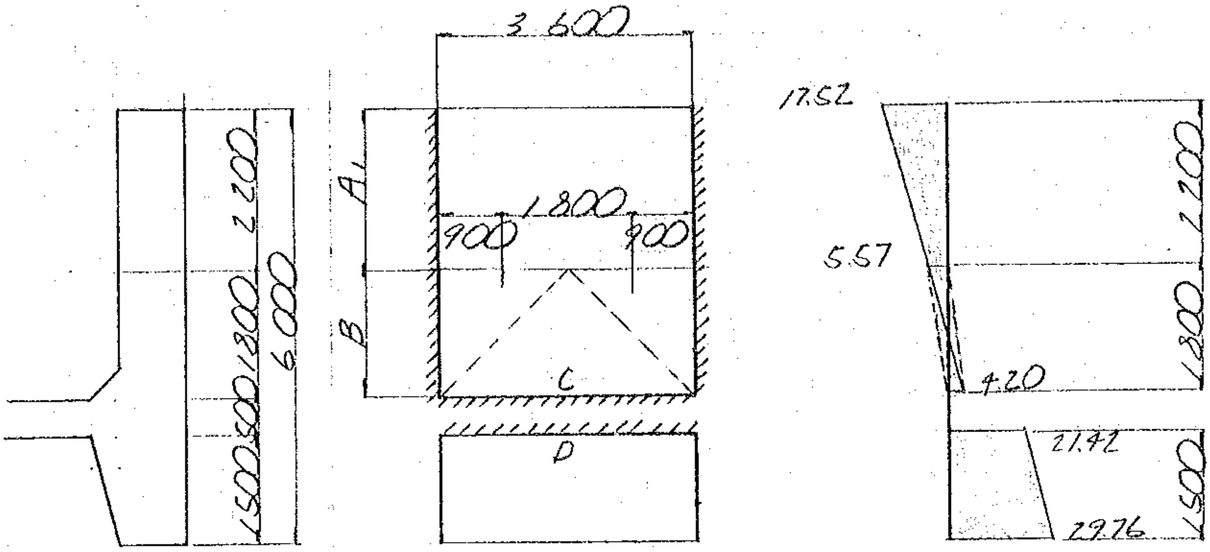
$w_3 = 0.90 \times$ 〃 $+ 8.60 \times$ 〃 $+ q = 18.51 + q$ 〃

	q 1	q 2	q 3	q 4	q 5	q 6
HA loading	34.59	26.45	23.73	13.96	2.01	—
HB loading	38.32	28.64	25.42	13.81	0	—

7-2 sectional force of footing



	A	B	C	D
(tm) M	$\frac{p \cdot lx^2}{10}$	$\frac{p \cdot s}{6 \cdot lx}(2 \cdot lx + b)$	$\frac{1}{2}(\frac{p_1}{2} + \frac{p_2}{6}) ly^2$	$p \cdot y'$
(t) S	$\frac{p \cdot lx}{2}$	$p \cdot s$	$(p_1 + \frac{p_2}{2}) \cdot ly$	p



	M	(tm)	S	(t)
D − D	$38.39 \times \frac{1.50}{3} \times \left(\frac{2 \times 29.76 + 21.42}{29.76 + 21.42}\right)$	30.36	$\frac{1}{2} \times (21.42 + 29.76) \times 1.50$	38.39
C − C	$\frac{1}{2} \times \left(0 + \frac{5.57}{6}\right) \times 1.80^2$	1.50	$\frac{5.57}{2} \times 1.80$	5.01
B − B	$\frac{2.785 \times 0.90}{6 \times 3.60} \times (2 \times 3.60 + 1.80)$	1.04	2.785×0.90	2.51
A1 − 1	$\frac{17.52 \times 3.60^2}{10}$	22.71	$\frac{17.52 \times 3.60}{2}$	31.54
A2 − 2	―		―	―
A3 − 3	―		―	―

7 - 3 list of stresses σ_c, σ_s, τ : working stress.
$\sigma_{ca}, \sigma_{sa}, \tau_a$: permissible stress.

	※ As min = b·d·0.0015 = 18.00 mm² (12.00)					
	D — D	C — C	B — B	A1 — 1		
M	30.36	1.50	1.04	22.71		
N	—	—	—	—		
S	38.39	5.01	2.51	31.54		
b	100	→	→	→		
h	120	80	→	→		
d'	10	→	→	→		
As	D20@125 ※25.12	D16@125 ※16.08	※ →	→		
As'	—	—	—	—		
f/d	—	—	—	0		
M'/bd²	—	—	—	3.55		
S/bd	—	—	—	3.94		
n·P	—	—	—	0.0302		
C	—	—	—	9.93		
S	—	—	—	35.78		
Z	—	—	—	1.08		
σ_c	—	—	—	36		
σ_s	—	—	—	1903		
τ	3.19	—	—	3.9		
σ_{ca}	83	→	→	→		
σ_{sa}	2346	→	→	→		
τ_a	2.35	→	→	→		

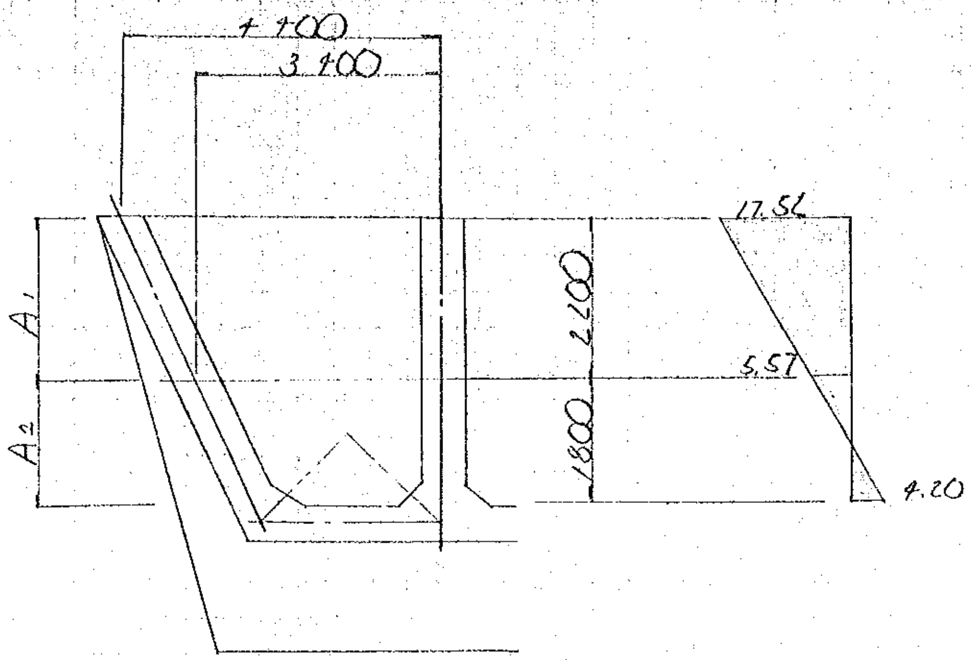
Check for stirrups.

Sect D - D

Φ16 - ctc 250 n = 2

Sect A1 - 1

Φ16 - ctc 250 n = 2



	M	(tm)	S	(t)
C−C	———	——	———	——
B−B	———	——	———	——
A1−1	$\frac{17.52 \times 4.40^2}{10}$	33.91	$\frac{17.52 \times 4.40}{2}$	38.54
A2−2	$\frac{5.57 \times 3.40^2}{10}$	6.44	$\frac{5.57 \times 3.40}{2}$	9.47
A3−3	———	——	———	——
A4−4	———	——	———	——

7 - 5 list of stresses σ_c, σ_s, τ : working stress.
$\sigma_{ca}, \sigma_{sa}, \tau_a$: permissible stress.

	A1-1					
M	33.91					
N	—					
S	38.54					
b	100					
h	80					
d'	10					
As	D16 D10 ?C125 20.60					
As'	—					
f/d	0					
M'/bd^2	5.30					
S/bd	4.82					
n·P	0.0386					
C	8.99					
S	28.18					
Z	1.09					
σ_c	48					
σ_s	2240					
τ	4.81					
σ_{ca}	83					
σ_{sa}	2346					
τ_a	1.35					

Check for stirrups.

Sect A1-1

$$\tau = \frac{S}{b \cdot d} \times z = \frac{38.54 \times 10^3}{100 \times 80} \times 1.09 = 5.25 \ kg/cm^2 > \tau a = 2.35$$

$$S' = S - Sc$$

$$Sc = \tau a \cdot b \cdot d \cdot 1/z = 2.35 \times 100 \times 80 \times 1/1.09 = 17.25 \times 10^3 \ kg$$

$$S' = (38.54 - 17.25) \times 10^3 = 21.29 \times 10^3 \ kg$$

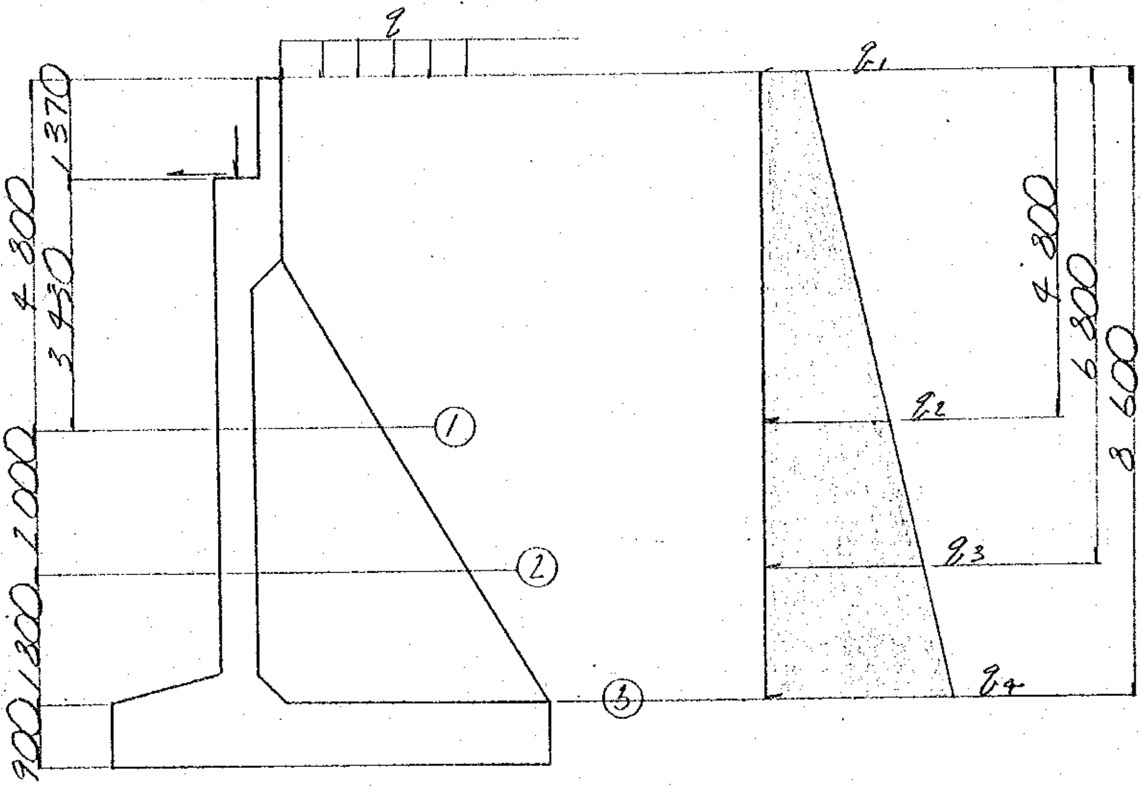
$$Req\ As = \frac{S' \times a}{\sigma sa \times d} z = \frac{21.29 \times 10^3 \times 25}{1780 \times 80} \times 1.09 = 4.0 \ cm^2$$

Φ16 - ctc 250 n = 2

$$Av = 2.01 \times 2 = 4.0 \ cm^2 = Req\ Av = 4.0 \ cm^2$$

§ 8 CALCULATION OF BUTTRESS SECTION

8-1 dimenston and loading



$$q_x = (K \cdot \gamma_s \cdot H + q \cdot K) \cdot l$$

	F B (t)	T (t)	FB + T (t)	$\frac{(FB+T) l}{B}$ (t)
HA loading	51.60	52.44	104.04	20.17
HA loading	76.40	52.44	128.84	24.98

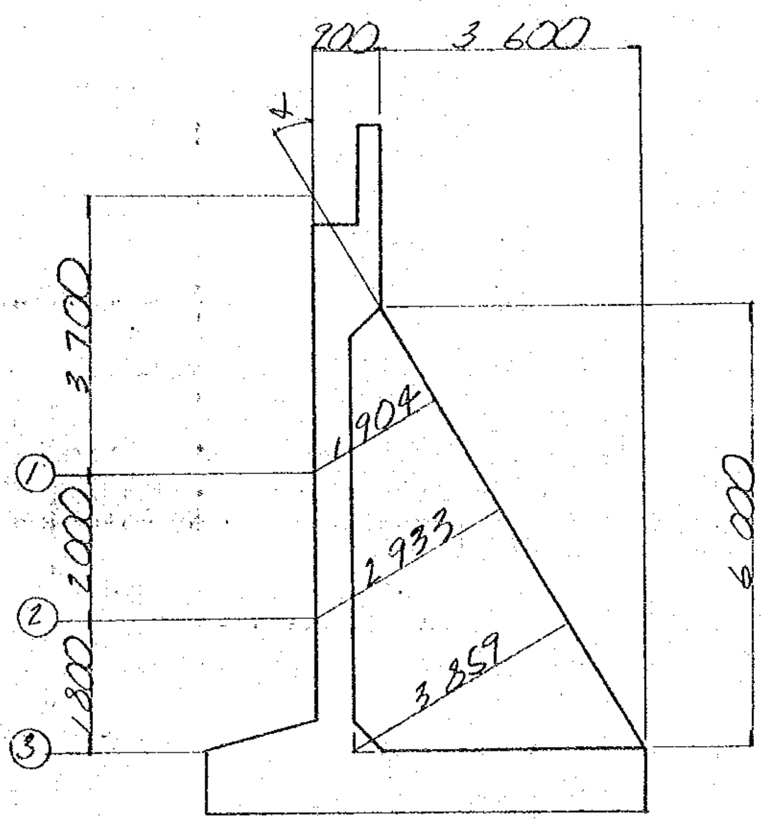
	q1	q2	q3	q4	q5	q6
HA loading	1.01	9.87	13.57	16.89	—	—
HB loading	1.62	10.38	14.08	17.40	—	—

8 - 2 sectional force of buttress

		HA loading			HB loading		
		H (t)	y (m)	H·y (tm)	H (t)	y (m)	H·y (tm)
1-1	FB·T	20.17	3.430	69.18	24.98	3.430	85.68
	Pa	26.11	1.749	45.67	28.80	1.816	52.30
	Σ	46.28		114.85	53.78		137.98
2-2	FB·T	20.17	5.430	109.52	24.98	5.430	135.64
	Pa	49.57	2.424	120.16	53.38	2.501	133.50
	Σ	69.74		229.68	78.36		269.14
3-3	FB·T	20.17	7.230	145.83	24.98	7.230	180.61
	Pa	76.97	3.028	233.07	81.79	3.111	254.45
	Σ	97.14		378.90	106.77		435.06
4-4	FB·T						
	Pa						
	Σ						
5-5	FB·T						
	Pa						
	Σ						

۲

8 − 3 calculation of members

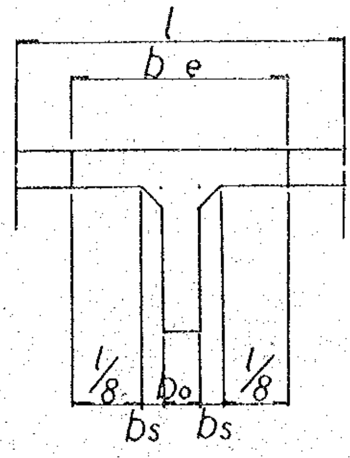


$\tan\alpha = \frac{3.60}{6.00} = 0.60$

$\alpha = 30°58'$

$H = h \cdot \sin\alpha$

$= 0.5145 \cdot h$



$be = b_o + 2(bs + \frac{l}{8}) = 60 + 2 \times (30 + 45)$

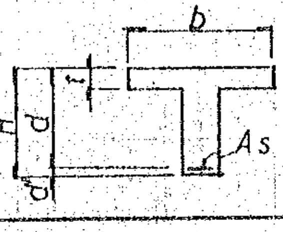
$= 210^{cm}$

8 - 4 list of stresses

σ_c , σ_s , τ : working stress.

σ_{ca} , σ_{sa} , τ_a : Permissible stress.

		※ A_s min = 60 × d × 0.0015				
		1 1	2 2	3 3		
M	tm	114.85	229.68	378.90		
S	t	46.28	69.74	97.14		
b	cm	210	210	210		
t	〃	50	50	50		
d	〃	180	283	376		
A s	cm^2	5/2 > D25 34.37 ※(16.20)	5/3 > D25 39.28 ※(25.47)	5/5 > D25 49.10 ※(33.84)		
P		0.0009	0.0007	0.0006		
t/d		0.28	0.18	0.13		
K		0.18	0.14	0.13		
j		1.02	0.96	0.96		
σ_s	kg/cm^2	1816	2146	2140		
σ_c	〃	26	23	21		
τ	〃	2.5	2.8	3.2		
σ_{sa}	〃	2346	→	→		
σ_{ca}	〃	83	→	→		
τ_a	〃	8.2	→	→		



8 - 5 check for tie bers

1) wall and buttress

$$As = \frac{S}{\sigma sa} \quad (cm^2)$$

		S (t)	As (cm²)	As'	(cm²)
section	1 — 1	3.71	1.58	D16@250	8.04
	2 — 2	6.41	2.73	↓	↓
	3 — 3	4.93	2.10		
	4 — 4	—	—	—	—
	5 — 5	—	—	—	—

2) footing and buttress

$$As = \frac{S}{\sigma sa} \quad (cm^2)$$

		S (t)	As (cm²)	As'	(cm²)
section	1 1	2.51	1.07	D16@250	8.04
	2 2	31.54	13.44	D16@125	16.08
	3 3	—	—	—	—