THE GOVERNMENT OF MAURITIUS
MINISTRY OF ENERGY, WATER RESOURCES AND POSTAL SERVICES
CENTRAL WATER AUTHORITY

THE DETAILED DESIGN ON THE PORT LOUIS WATER SUPPLY PROJECT IN MAURITIUS

FINAL REPORT (2)

DATA BOOK

FOR

LOT III : RAW WATER TRANSMISSION PIPELINE AND TREATMENT FACILITIES

MARCH 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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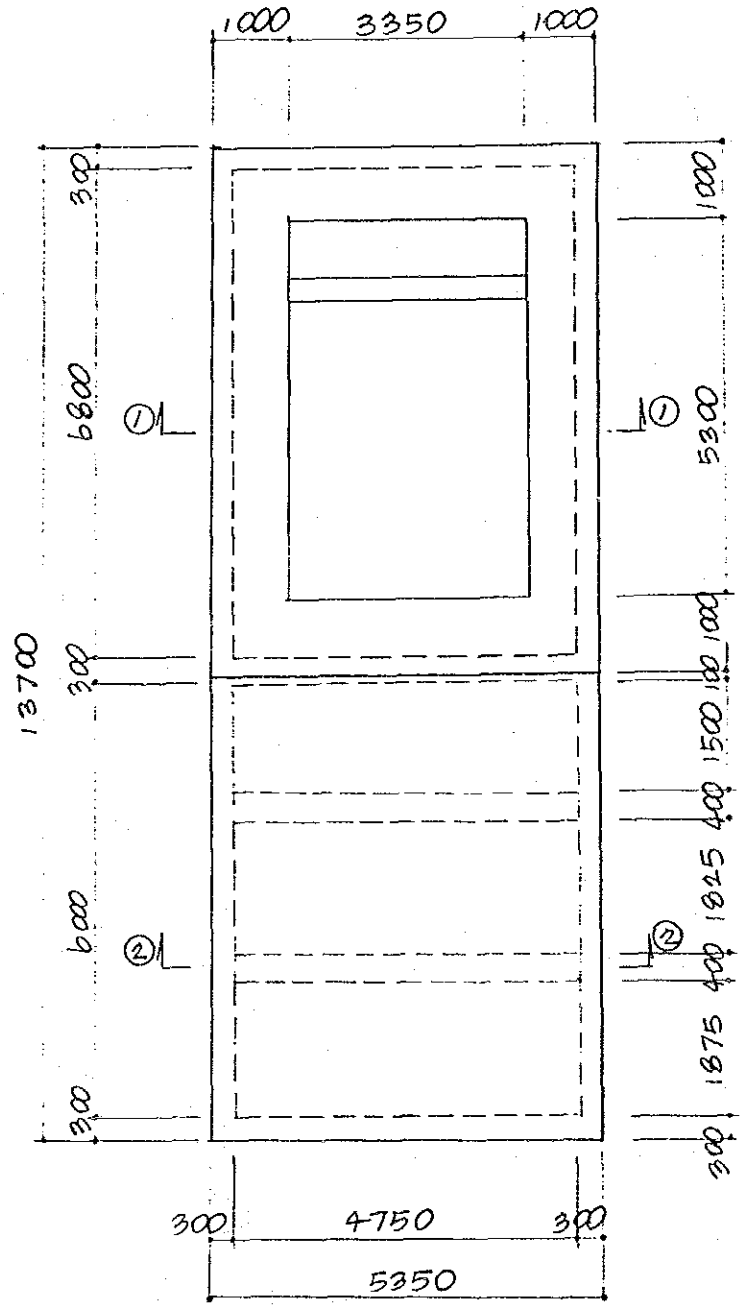
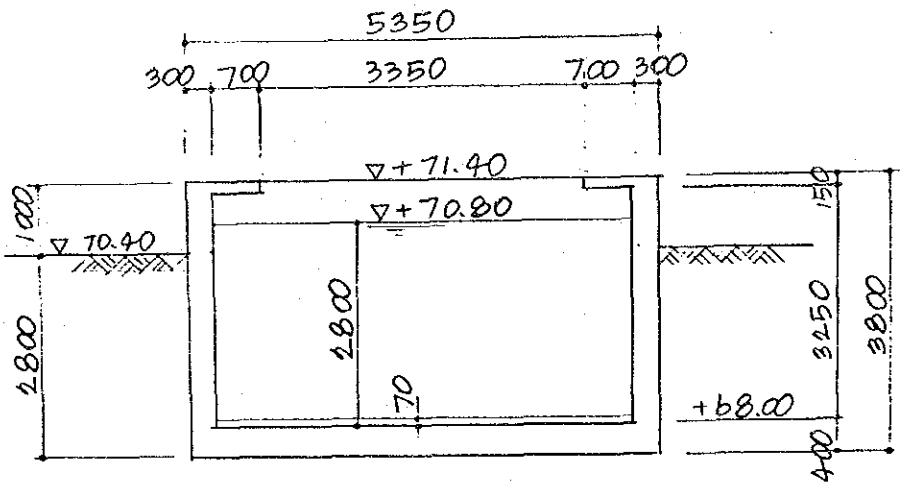
1. RECEIVING TANK

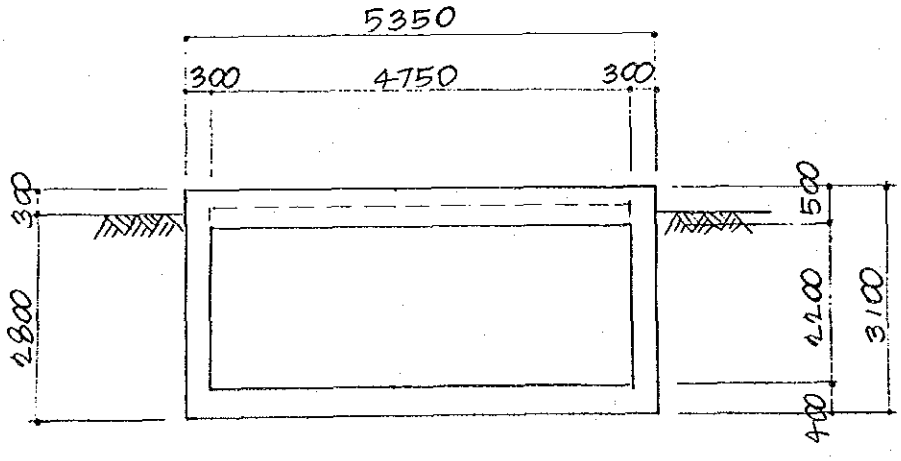
1. PLAN AND SECTION



PLAN



SECTION ①-①



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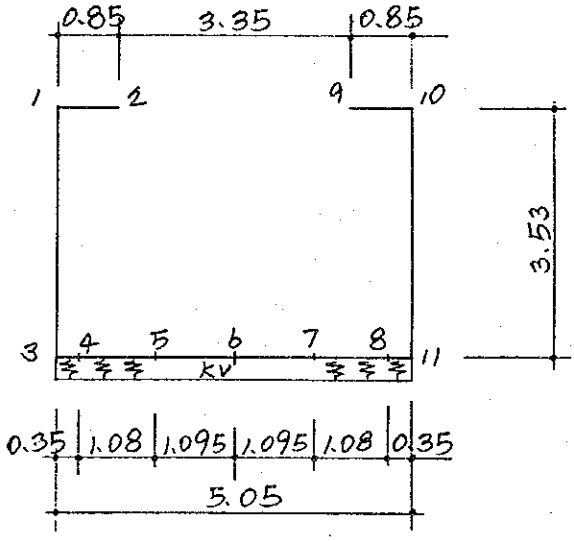
2. FRAME OF SECTION ①-①

2-1 DIMENSION OF FRAME



$$Kv = Kvo \left(\frac{Bv}{30}\right)^{-3/4}$$

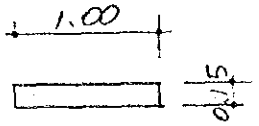
$$Kvo = \frac{1}{30} \times 1 \times 28 \times 25 = 23.33 \ kg/cm^3$$

$$Bv = \sqrt{1370 \times 535} = 856 \ cm$$

$$Kv = 23.33 \times \left(\frac{856}{30}\right)^{-3/4} = 1.89 \ kg/cm^3 = 1890 \ t/m^3$$

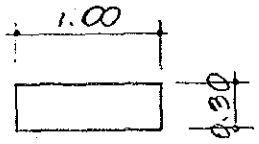
$$Kv = 1890 \times 1.00 \ m = 1890 \ t/m^2$$

2-2 INERTIA AND AREA



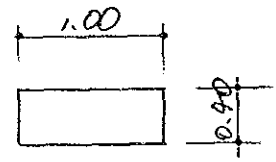
$$I = \frac{1}{12} \times 1.00 \times 0.15^3 = 0.0003\ m^4$$

$$A = 1.00 \times 0.15 = 0.15\ m^2$$



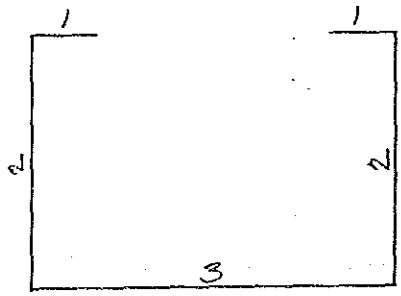
$$I = \frac{1}{12} \times 1.00 \times 0.30^3 = 0.0023\ m^4$$

$$A = 1.00 \times 0.30 = 0.30\ m^2$$



$$I = \frac{1}{12} \times 1.00 \times 0.40^3 = 0.0053\ m^4$$

$$A = 1.00 \times 0.40 = 0.40\ m^2$$



$I_1 = 0.0003\ m^4$ $A_1 = 0.15\ m^2$

$I_2 = 0.0023$ $A_2 = 0.30$

$I_3 = 0.0053$ $A_3 = 0.50$

2-3 CALCULATION OF LOAD

2-3-1 VERTICAL LOAD

(1) SLAB

DEAD LOAD	0.15×2.5	=	$0.38\ t/m^2$
LIVE LOAD		=	0.30 "
		W_1 =	$0.68\ t/m^2$

$P_1 = 0.68 \times 0.15 = 0.10^t$

(2) WALL

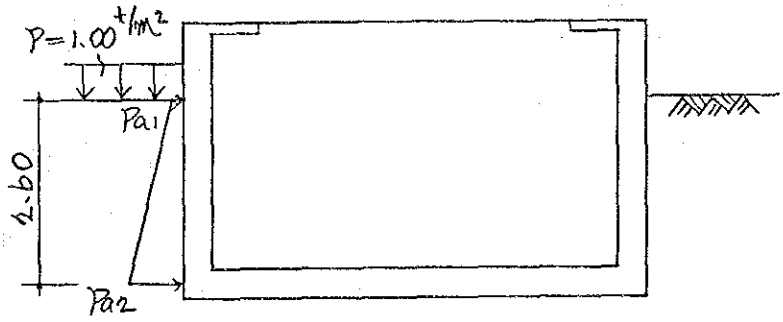
$t = 30^{cm}$ $\quad P_{W1} = 0.30 \times 2.5 = 0.75\ t/m^2$

(3) BASE SLAB

DEAD LOAD	0.40×2.5	=	$1.00\ t/m^2$
R.L CONCRETE	0.07×2.3	=	0.16 "
		W_2 =	$1.16\ t/m^2$

WATER LOAD $\quad W_3 = 2.73 \times 1.0 = 2.73\ t/m^2$

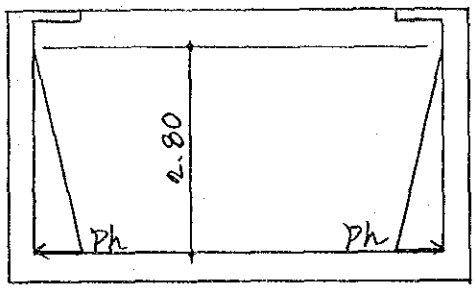
2-3-2 EARTH PRESSURE



$Pa1 = 1.00 \times 0.5 = 0.50\ t/m^2$

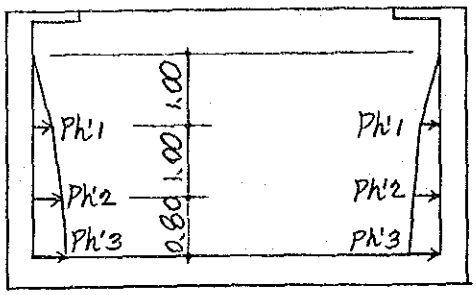
$Pa2 = (1.00 + 1.8 \times 2.60) \times 0.5 = 2.84$ "

2-3-3 WATER PRESSURE



$$Ph = 2.80 \times 1.0 = 2.80 \ t/m^2$$

2-3-4 DYNAMIC WATER PRESSURE



$$\tanh\left(\sqrt{3} \times \frac{2.375}{2.80}\right) = 0.90 \rightarrow 1.0$$

$$Ph'_1 = \sqrt{3} \times 0.05 \times 1.0 \times 2.80 \times \left\{\frac{1.00}{2.80} - \frac{1}{2} \times \left(\frac{1.00}{2.80}\right)^2\right\} = 0.07 \ t/m^2$$

$$Ph'_2 = \sqrt{3} \times 0.05 \times 1.0 \times 2.80 \times \left\{\frac{2.00}{2.80} - \frac{1}{2} \times \left(\frac{2.00}{2.80}\right)^2\right\} = 0.11 \ "$$

$$Ph'_3 = \sqrt{3} \times 0.05 \times 1.0 \times 2.80 \times \left\{\frac{2.80}{2.80} - \frac{1}{2} \times \left(\frac{2.80}{2.80}\right)^2\right\} = 0.12 \ "$$

2-3-5 EARTHQUAKE LOAD

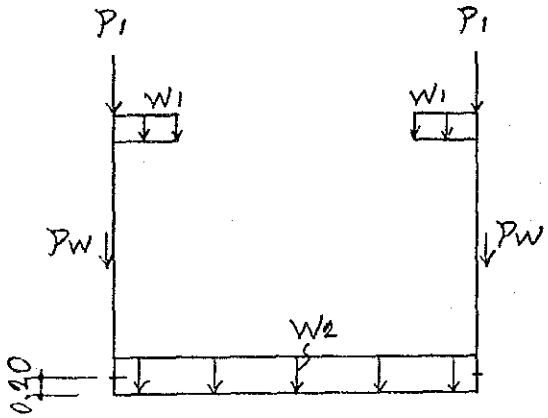
$$P_E = 0.68\ ^{t}/_{m^2} \times 1.00 \times 0.05 = 0.03^{t}$$

WALL

$$W_E = 0.30 \times 2.5 \times 0.05 = 0.04\ ^{t}/_{m^2}$$

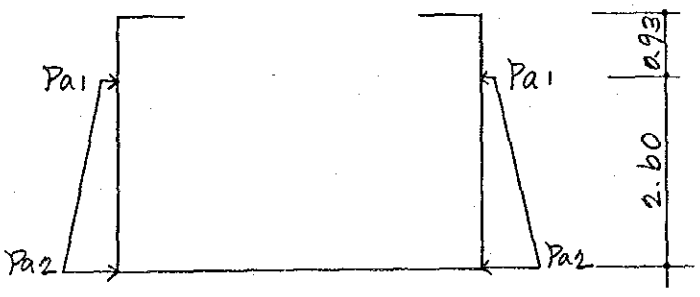
2-4 LOADING CHART

CASE1 VERTICAL LOAD



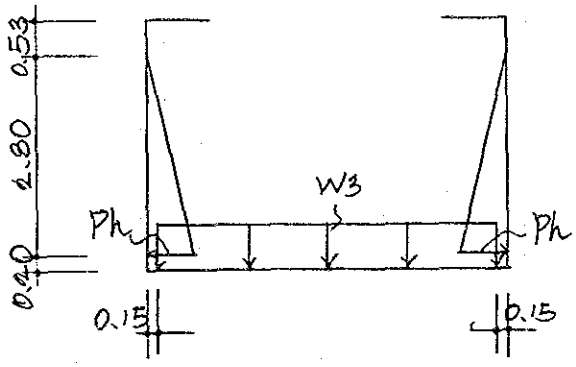
$W_1 = 0.68^{t/m^2}$ $W_2 = 1.16^{t/m^2}$ $P_1 = 0.10^{t}$ $P_w = 0.75^{t/m^2}$

CASE2 EARTH PRESSURE



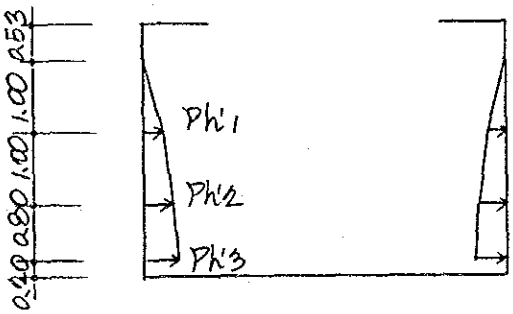
$P_{a1} = 0.50^{t/m^2}$ $P_{a2} = 2.84^{t/m^2}$

CASE 3 WATER PRESSURE



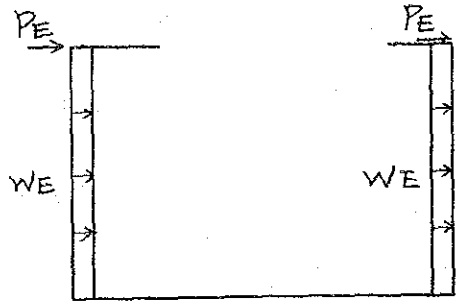
$W3 = 2.73\ t/m^2$ $Ph = 2.80\ t/m^2$

CASE 4 DYNAMIC WATER PRESSURE



$Ph'1 = 0.07\ t/m^2$ $Ph'2 = 0.11\ t/m^2$ $Ph'3 = 0.12\ t/m^2$

CASE 5 EARTHQUAKE LOAD



$P_E = 0.03^{t}$ $W_E = 0.04\ ^{t}/m^2$

PEMANENT LOAD

CASE 6 = ① + ②

7 = ① + ② + ③

8 = ① + ③

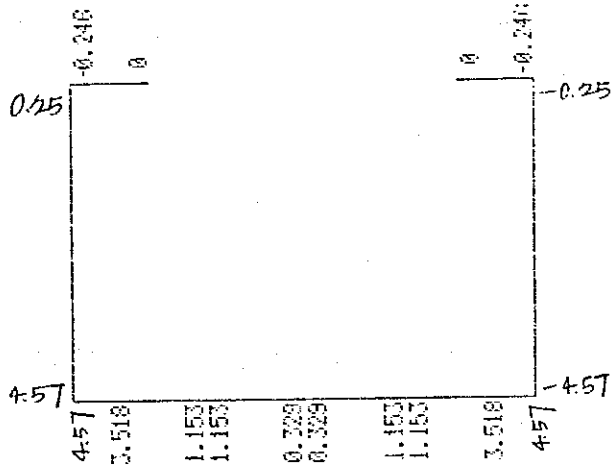
TEMPORARY LOAD ($\alpha = 0.667$)

CASE 9 = ① + ② + ⑤

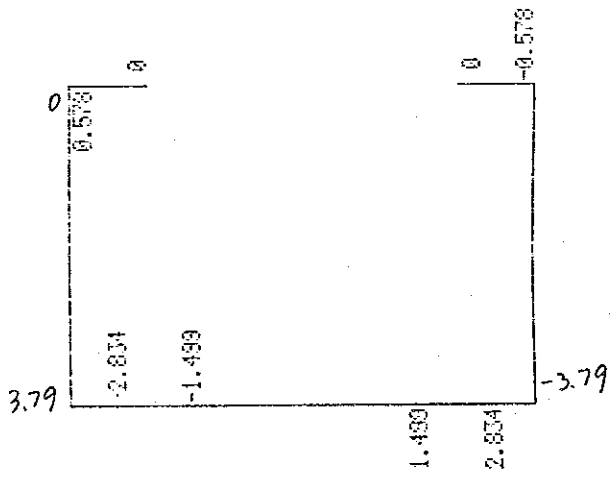
10 = ① + ② + ③ + ④ + ⑤

CASE 6 PERMANENT LOAD

MOMENT

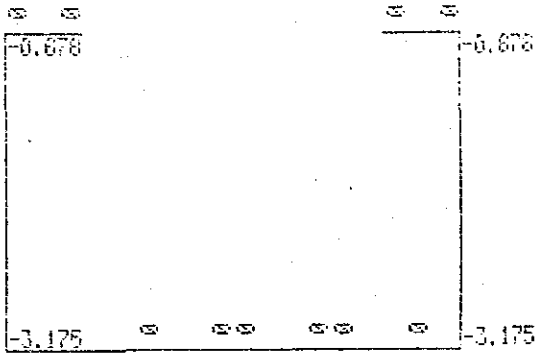


SHEAR



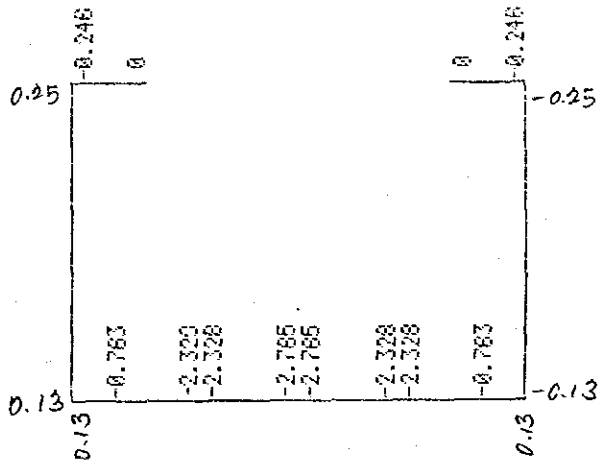
CASE 6 PERMANENT LOAD

AXIAL

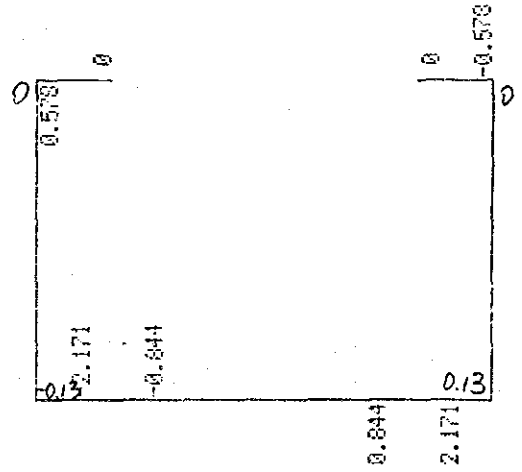


CASE 7 PERMANENT LOAD

MOMENT

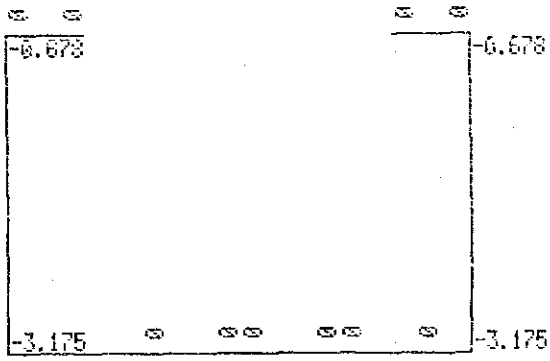


SHEAR



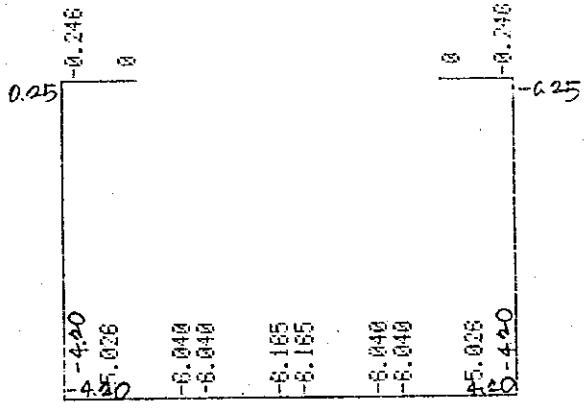
CASE 7 PERMANENT LOAD

AXIAL

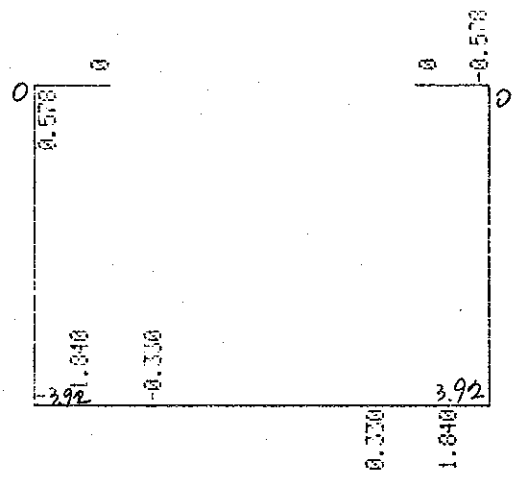


CASE 8 PERMANENT LOAD

MOMENT

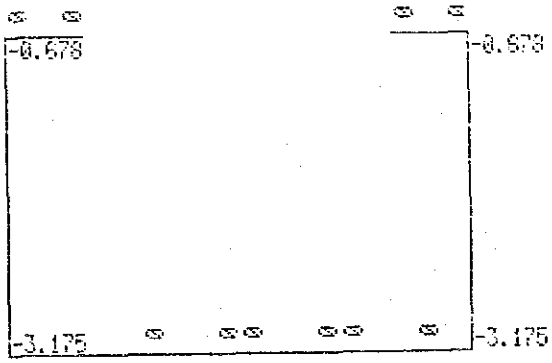


SHEAR



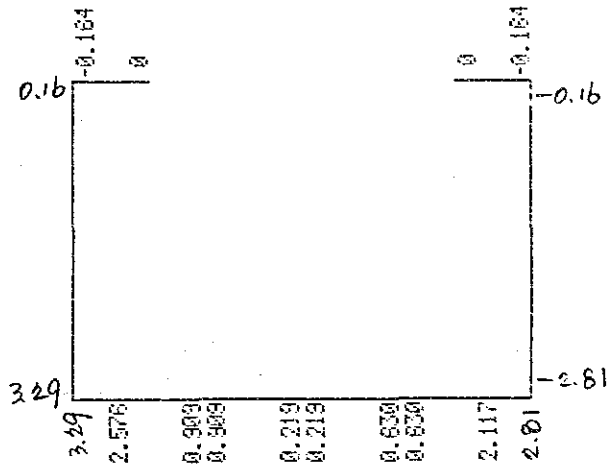
CASE 8 PERMANENT LOAD

AXIAL

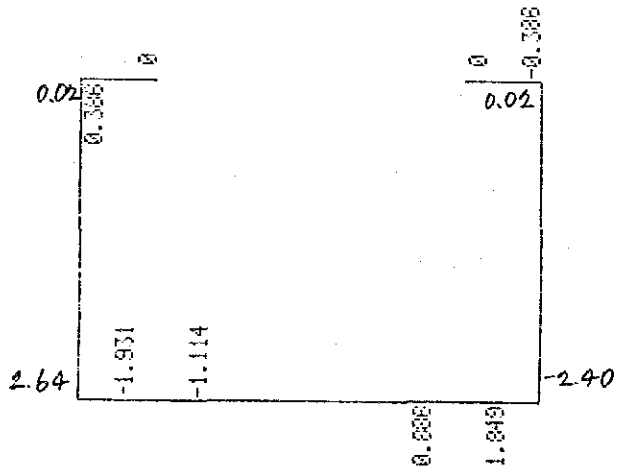


CASE 9 TEMPORARY LOAD

MOMENT

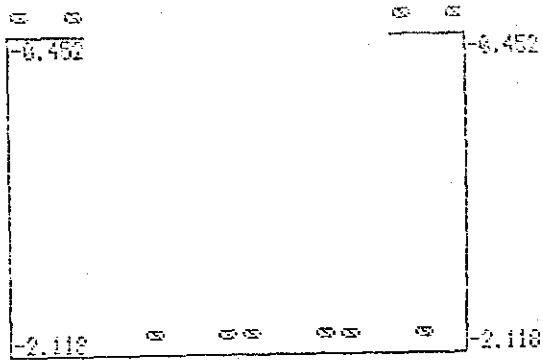


SHEAR



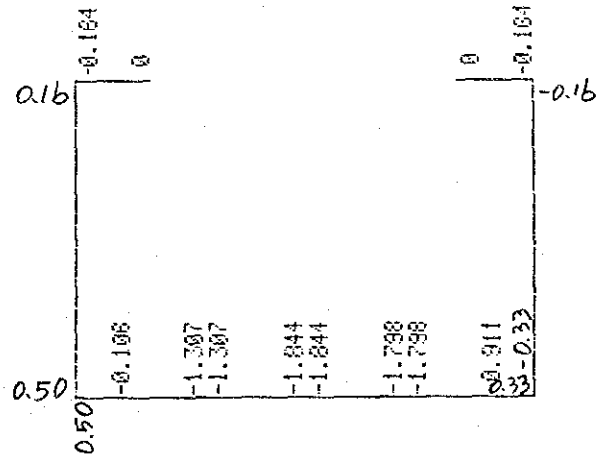
CASE 9 TEMPORARY LOAD

AXIAL

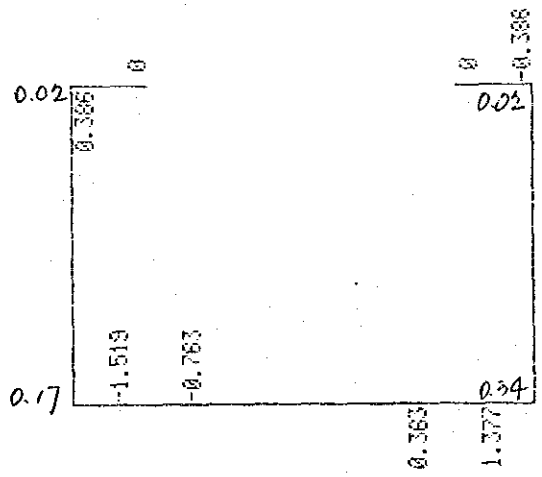


CASE 10 TEMPORARY LOAD

MOMENT

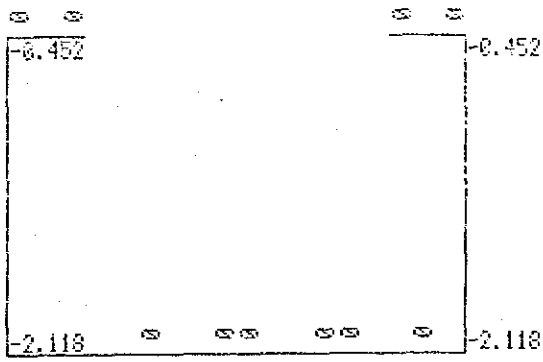


SHEAR



CASE 10 TEMPORARY LOAD

AXIAL



2-5 DESIGN OF SECTION

SLAB

1.10

MOMENT	M	(t·m)	=	0.250	Case b
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.580	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	15.000	
EFFECTIVE DEPTH	d	(〃)	=	10.000	
CONCRETE COVER	d′	(〃)	=	0.000	
CONCRETE COVER	d″	(〃)	=	5.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	6.330	D13@200 上
AREA OF REINFORCEMENT	As′	(〃)	=	0.000	

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	16.13
TENSILE STRESS	σs	(〃)	=	447.28
SHEARING STRESS	τ	(〃)	=	0.65

WALL

3.11

MOMENT	M	(t·m)	=	4.570	Case b
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	3.790	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	30.000	
EFFECTIVE DEPTH	d	(〃)	=	23.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	16.270	D16@200+D13@200 外
AREA OF REINFORCEMENT	As′	(〃)	=	12.670	D13@100 内

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	52.07
TENSILE STRESS	σs	(〃)	=	1405.29
SHEARING STRESS	τ	(〃)	=	1.89

MOMENT	M	(t·m)	=	※ 3.410	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	3.920	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	30.000	
EFFECTIVE DEPTH	d	(〃)	=	23.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	12.670	D13@100 内
AREA OF REINFORCEMENT	As′	(〃)	=	16.270	D16@200+D13@200 外

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	42.83
TENSILE STRESS	σs	(〃)	=	1325.36
SHEARING STRESS	τ	(〃)	=	1.93

BASE

3.11

MOMENT	M	(t·m)	=	4.570	Case 6
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	2.830	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	30.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	10.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	16.270	D16@200+D13@200 下
AREA OF REINFORCEMENT	As′	(〃)	=	9.930	D16@200 上

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	33.17
TENSILE STRESS	σs	(〃)	=	1059.55
SHEARING STRESS	τ	(〃)	=	1.06

〃

MOMENT	M	(t·m)	=	4.200	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	1.840	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	10.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	9.930	D16@200 上
AREA OF REINFORCEMENT	As′	(〃)	=	16.270	D16@200+D13@200 下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	33.58
TENSILE STRESS	σs	(〃)	=	1381.11
SHEARING STRESS	τ	(〃)	=	0.60

2b

BASE

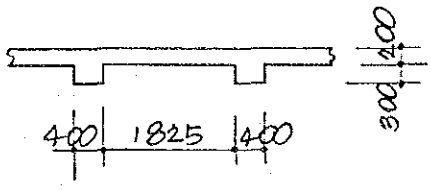
b

MOMENT	M	(t·m)	=	6.170	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.000	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	30.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	10.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	16.270	D16@200+D13@200 上
AREA OF REINFORCEMENT	As′	(〃)	=	9.930	D16@200 下

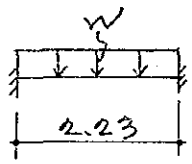
COMPRESSIVE STRESS	σc	(Kg/cm2)	=	44.79
TENSILE STRESS	σs	(〃)	=	1430.51
SHEARING STRESS	τ	(〃)	=	0.00

3. DESIGN OF SLAB

3-1 DIMENSION OF SLAB



3-2 MOMENT AND SHEAR



$$W = 0.20 \times 2.5 + 0.30 \ {}^{t/m^2} = 0.80 \ {}^{t/m^2}$$

$$-M = -\frac{1}{12} \times 0.80 \times 2.23^2 = -0.33 \ {}^{t\cdot m}$$

$$M = \frac{1}{24} \times 0.80 \times 2.23^2 = 0.17 \ {}^{"}$$

$$S = 0.80 \times 1.83 \times \frac{1}{2} = 0.73 \ {}^{t}$$

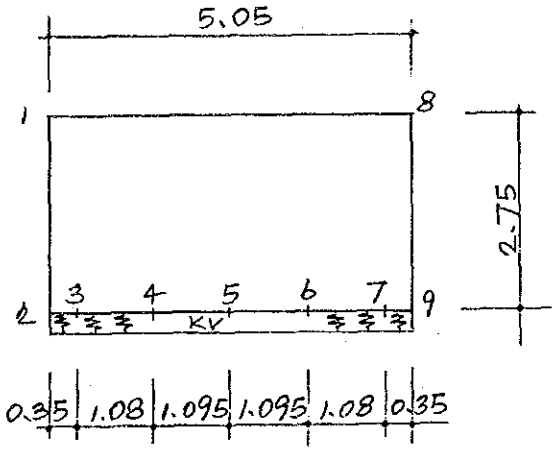
3-3 DESIGN OF SECTION

$$As = \frac{0.33 \times 10^5}{1600 \times 0.875 \times 15} = 1.57 \ {}^{cm^2} < D13 @ 200$$

$$\tau = \frac{0.73 \times 10^3}{100 \times 0.875 \times 15} = 0.6 \ {}^{kg/cm^2} < 4.25 \ {}^{kg/cm^2} \quad OK$$

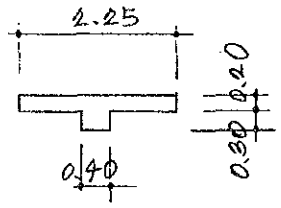
4. FRAME OF SECTION ②-②

4-1 DIMENSION OF FRAME



$Kv = 1890\ t/m^2$

4-2 INERTIA AND AREA

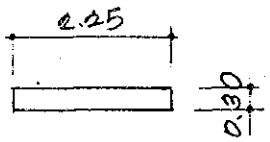


$be = 2.25\ m$

$\bar{x} = 0.15\ m$

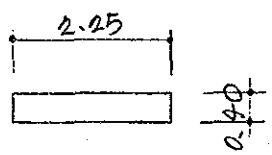
$I = 0.0083\ m^4$

$A = 0.57\ m^2$



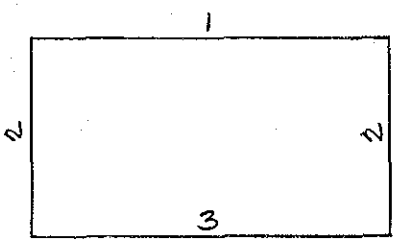
$I = \frac{1}{12} \times 2.25 \times 0.30^3 = 0.0051\ m^4$

$A = 2.25 \times 0.30 = 0.68\ m^2$



$I = \frac{1}{12} \times 2.25 \times 0.40^3 = 0.0120\ m^4$

$A = 2.25 \times 0.40 = 0.90\ m^2$



$I_1 = 0.0083\ m^4$ $A_1 = 0.57\ m^2$

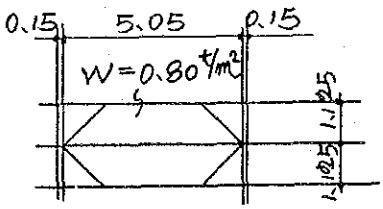
$I_2 = 0.0051$ $A_2 = 0.68$

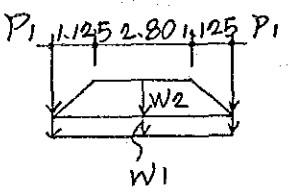
$I_3 = 0.0120$ $A_3 = 0.90$

4-3 CALCULATION OF LOAD

4-3-1 VERTICAL LOAD

(1) BEAM





$W_1 = 0.40 \times 0.30 \times 2.5 = 0.30^{t/m}$

$W_2 = 0.80 \times 2.25 = 1.80^{"}$

$P_1 = 0.80 \times (0.15 \times 2.25 + 1.125 \times 1.125 \times \frac{1}{2} \times 2) = 1.28^{t}$

(2) WALL

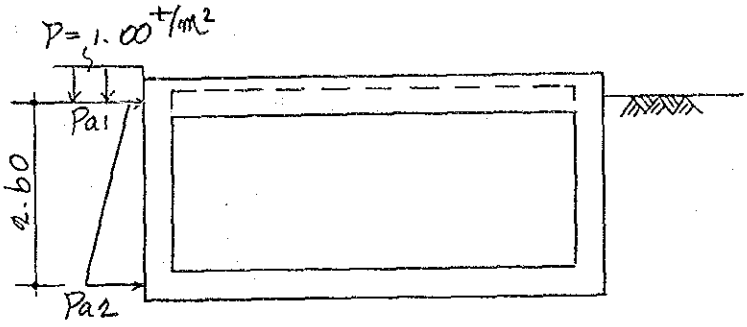
$t = 30^{cm}$

$P_W = 0.30 \times 2.25 \times 2.5 = 1.69^{t/m}$

(3) BASE SLAB

DEAD LOAD	$0.40 \times 2.25 \times 2.5$	=	$2.25^{t/m}$
DEAD LOAD	$0.50^{t/m^2} \times 2.25$	=	1.13 "
LIVE LOAD	$0.30^{t/m^2} \times 2.25$	=	0.68 "
		$W3$ =	$4.06^{t/m}$

4-3-2 EARTH PRESSURE



$Pa_1 = 1.00 \times 0.5 \times 2.25 = 1.13\ t/m$

$Pa_2 = (1.00 + 1.8 \times 2.60) \times 0.5 \times 2.25 = 6.39\ "$

4-3-3 EARTHQUAKE LOAD

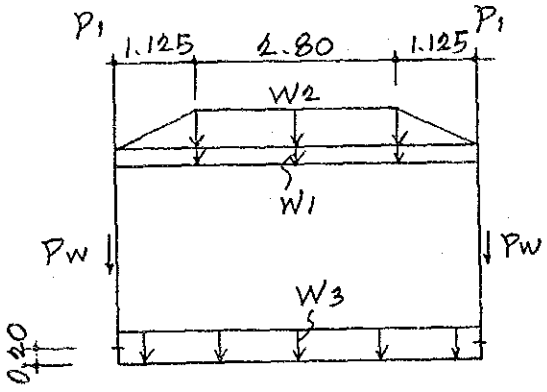
$$P_E = (0.80^{t/m^2} \times 2.675 \times 2.25 + 0.30^{t/m} \times 2.375) \times 0.05 = 0.28^{t}$$

WALL

$$WF = 0.30 \times 2.25 \times 2.5 \times 0.05 = 0.08^{t/m}$$

4-4 LOADING CHART

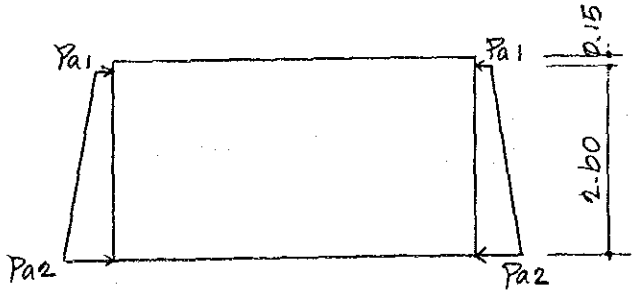
CASE 1 VERTICAL LOAD



$W_1 = 0.30^{t/m}$ $W_2 = 1.80^{t/m}$ $W_3 = 4.06^{t/m}$

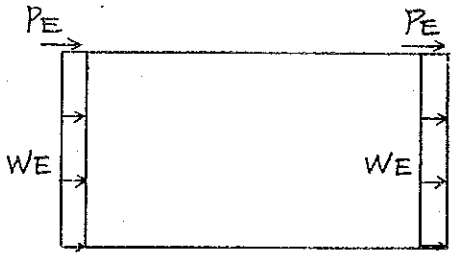
$P_1 = 1.28^{t}$ $P_W = 1.69^{t/m}$

CASE 2 EARTH PRESSURE



$P_{a1} = 1.13^{t/m}$ $P_{a2} = 6.39^{t/m}$

CASE 3 EARTHQUAKE LOAD



$P_E = 0.28^t$ $W_E = 0.08^{t/m}$

PERMANENT LOAD

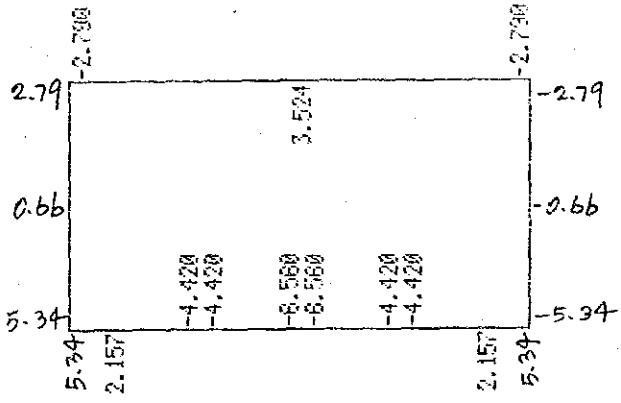
CASE 4 = ① + ②

TEMPORARY LOAD ($\alpha = 0.667$)

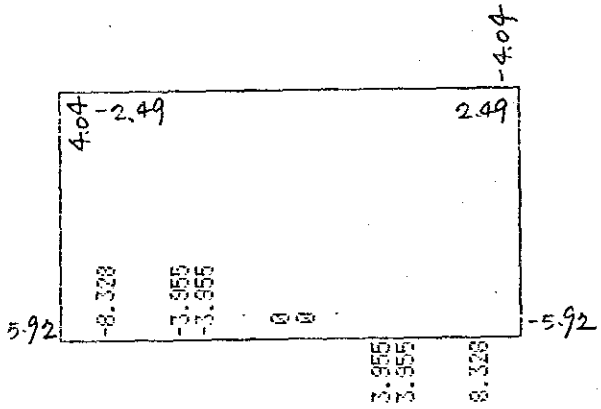
CASE 5 = ① + ② + ③

CASE 4 PERMANENT LOAD

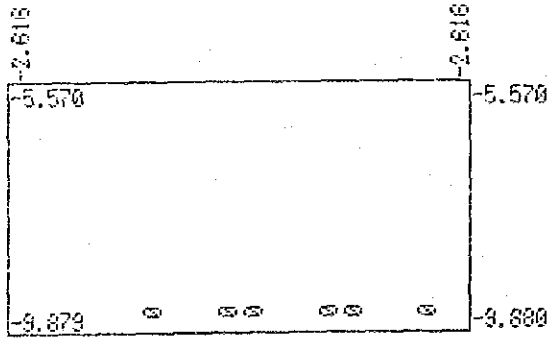
MOMENT



SHEAR

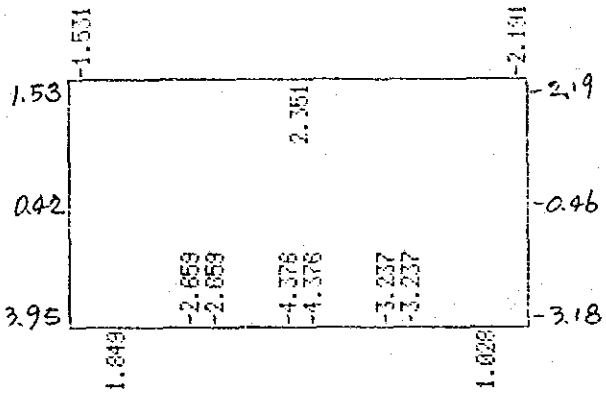


AXIAL

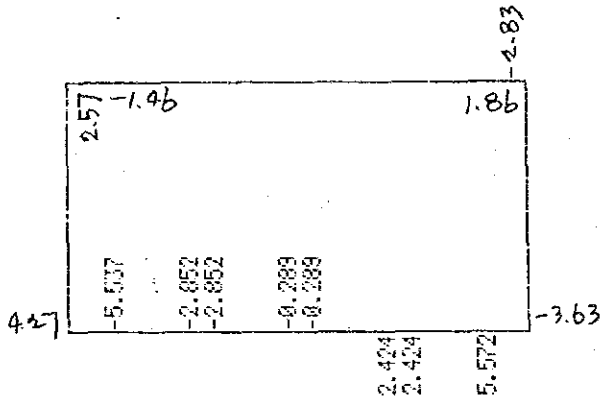


CASE 5 TEMPORARY LOAD

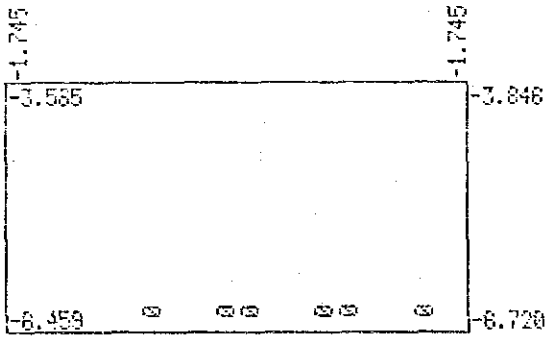
MOMENT



SHEAR



AXIAL



4-5 DESIGN OF SECTION

BEAM

1.8

MOMENT	M	(t·m)	=	2.790	Case 4
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	4.040	
WIDTH	b	(cm)	=	40.000	
DEPTH	h	(〃)	=	50.000	
EFFECTIVE DEPTH	d	(〃)	=	43.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	5.950	D16-3 上
AREA OF REINFORCEMENT	As′	(〃)	=	5.950	〃 下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	28.08
TENSILE STRESS	σs	(〃)	=	1206.51
SHEARING STRESS	τ	(〃)	=	2.59

BEAM

1-8

MOMENT	M	(t·m)	=	3.520	Case 5
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.000	
WIDTH	b	(cm)	=	40.000	
DEPTH	h	(〃)	=	50.000	
EFFECTIVE DEPTH	d	(〃)	=	43.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	5.950	D16-3 下
AREA OF REINFORCEMENT	As′	(〃)	=	5.950	〃 上

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	35.42
TENSILE STRESS	σs	(〃)	=	1522.19
SHEARING STRESS	τ	(〃)	=	0.00

BEAM

1-8

MOMENT	M	(t·m)	=	3.520	Case5
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.000	
WIDTH	b	(cm)	=	40.000	
DEPTH	h	(〃)	=	30.000	
EFFECTIVE DEPTH	d	(〃)	=	23.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	11.920	D16-6下
AREA OF REINFORCEMENT	As′	(〃)	=	9.930	D16-5上

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	77.12
TENSILE STRESS	σs	(〃)	=	1549.63
SHEARING STRESS	τ	(〃)	=	0.00

WALL 1.8

MOMENT	M	(t·m)	=	2.790	Case 4
AXIAL FORCE	N	(t)	=	2.620	
SHEAR FORCE	S	(t)	=	4.040	
WIDTH	b	(cm)	=	225.000	
DEPTH	h	(〃)	=	30.000	
EFFECTIVE DEPTH	d	(〃)	=	23.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	22.340	D16@200 外
AREA OF REINFORCEMENT	As′	(〃)	=	14.250	D13@200 内

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	17.23
TENSILE STRESS	σs	(〃)	=	539.38
SHEARING STRESS	τ	(〃)	=	0.89

WALL 2.9

MOMENT	M	(t·m)	=	5.340	Case 4
AXIAL FORCE	N	(t)	=	9.880	
SHEAR FORCE	S	(t)	=	5.920	
WIDTH	b	(cm)	=	225.000	
DEPTH	h	(〃)	=	30.000	
EFFECTIVE DEPTH	d	(〃)	=	23.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	22.340	D16@200 外
AREA OF REINFORCEMENT	As′	(〃)	=	14.250	D13@200 内

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	32.67
TENSILE STRESS	σs	(〃)	=	916.09
SHEARING STRESS	τ	(〃)	=	1.30

BASE 2.9

MOMENT	M	(t·m)	=	5.340	Case 4
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	8.330	
WIDTH	b	(cm)	=	225.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	30.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	10.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	22.340	D16@200 下
AREA OF REINFORCEMENT	As′	(〃)	=	22.340	〃 上

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	21.08
TENSILE STRESS	σs	(〃)	=	879.73
SHEARING STRESS	τ	(〃)	=	1.36

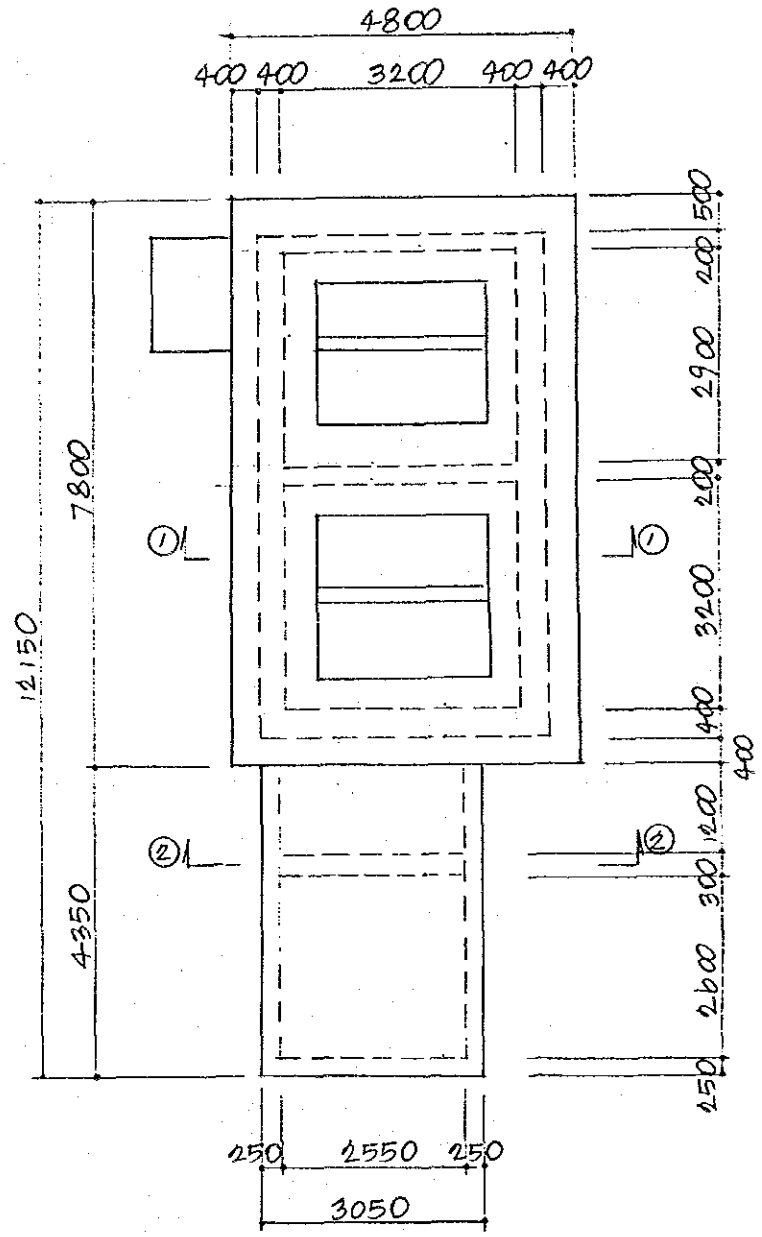
BASE 5

MOMENT	M	(t·m)	=	6.560	Case 4
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.000	
WIDTH	b	(cm)	=	225.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	10.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	22.340	D16@200 上
AREA OF REINFORCEMENT	As′	(〃)	=	22.340	〃 下

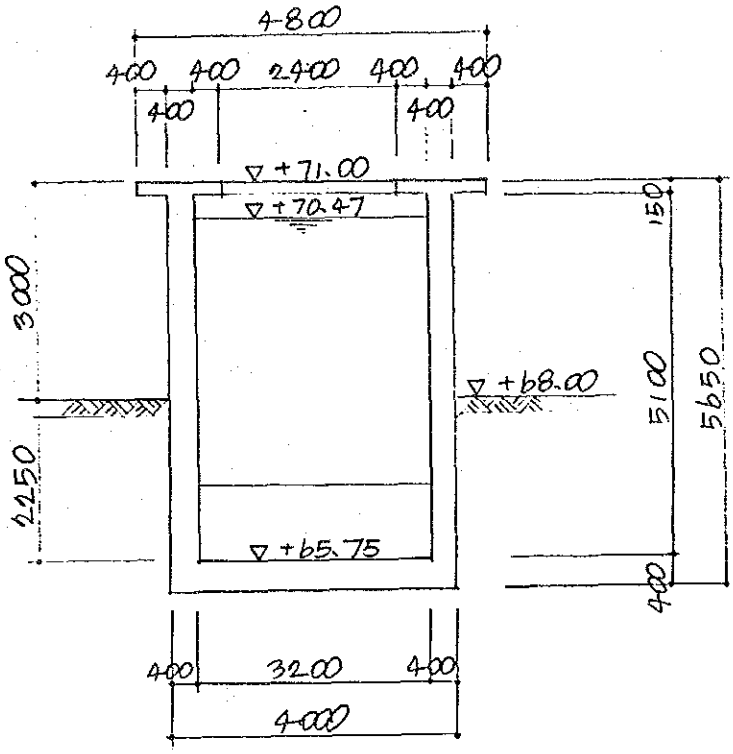
COMPRESSIVE STRESS	σc	(Kg/cm2)	=	23.09
TENSILE STRESS	σs	(〃)	=	963.88
SHEARING STRESS	τ	(〃)	=	0.00

2. RAPID MIXING TANK

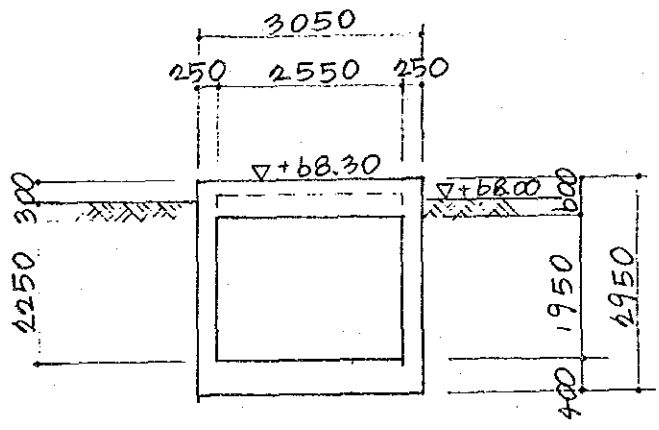
1. PLAN AND SECTION



PLAN



SECTION ①-①

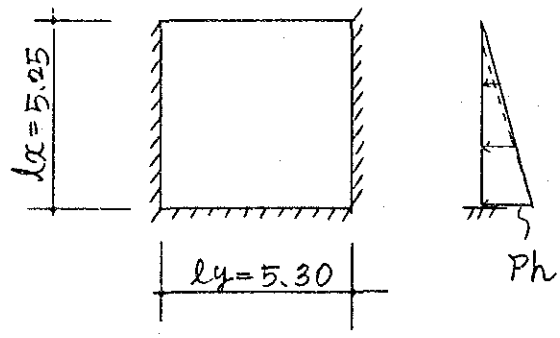


SECTION ②-②

2. DESIGN OF WALL (1)

2-1 MOMENT AND SHEAR

2-1-1 WATER PRESSURE



$$\frac{ly}{lx} \fallingdotseq 1.00$$

$$Ph = 4.72 \times 1.0 = 4.72^{t/m^2}$$

$$-Mx1 = -4.72 \times 5.25^2 \times 0.036 = -4.68^{t\,m}$$

$$-My3 = -4.72 \times 5.25^2 \times 0.03 = -3.90^{"}$$

$$My1 = 4.72 \times 5.25^2 \times 0.015 = 1.95^{"}$$

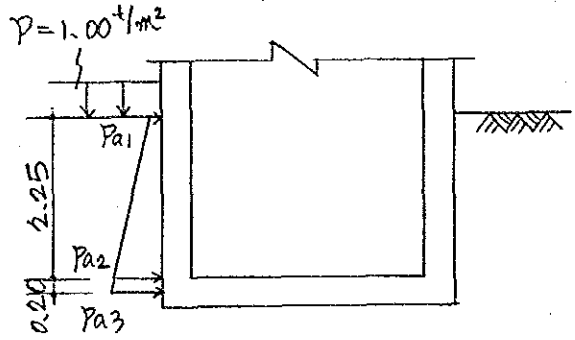
$$My2 = 4.72 \times 5.25^2 \times 0.01 = 1.30^{"}$$

$$Mx2 = 4.72 \times 5.25^2 \times 0.009 = 1.17^{"}$$

$$Qx1 = 4.72 \times 5.25 \times 0.325 = 8.05^{t}$$

$$Qy1 = 4.72 \times 5.25 \times 0.24 = 5.95^{"}$$

2-1-2 EARTH PPESSURE



$Pa_1 = 1.00 \times 0.5 = 0.50\ t/m^2$

$Pa_2 = (1.00 + 1.8 \times 2.25) \times 0.5 = 2.53$ "

$Pa_3 = (1.00 + 1.8 \times 2.45) \times 0.5 = 2.71$ "

$M = \frac{1}{2} \times 0.50 \times 2.25^2 + \frac{1}{6} \times 2.03 \times 2.25^2 = 2.98\ t\cdot m$

$Q = (0.50 + 2.53) \times 2.25 \times \frac{1}{2} = 3.41\ t$

2-2 DESIGN OF SECTION

$-Mx1 = -4.68^{t\cdot m}$ (WATER PRESSURE)

$$As = \frac{4.68 \times 10^5}{1600 \times 0.875 \times 33} = 10.13^{cm^2} < D16@200 + D13@200 \cdots \text{IN SIDE}$$

$M = 2.98^{t\cdot m}$ (EARTH PRESSURE)

$$As = \frac{2.98 \times 10^5}{1600 \times 0.875 \times 33} = 6.45^{cm^2} < D16@200 \cdots \text{OUT SIDE}$$

$-My1 = -3.90^{t\cdot m}$ (WATER PRESSURE)

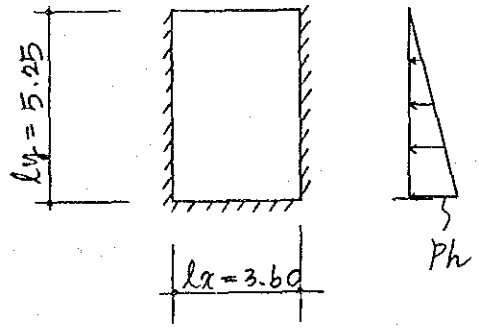
$$As = \frac{3.90 \times 10^5}{1600 \times 0.875 \times 31} = 8.99^{cm^2} < D16@200 \cdots \text{IN SIDE}$$

D16@200 ··· OUT SIDE

3. DESIGN OF WALL (2)

3-1 MOMENT AND SHEAR

3-1-1 WATER PRESSURE



$$\frac{l_y}{l_x} = 1.46$$

$$Ph = 4.72\ t/m^2$$

$$-My1 = -Mx3 = -4.72 \times 3.60^2 \times 0.042 = -2.57\ t\cdot m$$

$$-Mx1 = -4.72 \times 3.60^2 \times 0.01 = -0.62\ "$$

$$My2 = 4.72 \times 3.60^2 \times 0.01 = 0.61\ "$$

$$Mx2 = 4.72 \times 3.60^2 \times 0.006 = 0.37\ "$$

$$Qy1 = 4.72 \times 3.60 \times 0.36 = 6.12\ t$$

$$Qx1 = 4.72 \times 3.60 \times 0.31 = 5.27\ "$$

3-2 DESIGN OF SECTION

$-My1 = -2.57^{t\cdot m}$ (WATER PRESSURE)

$$As = \frac{2.57 \times 10^5}{1600 \times 0.875 \times 31} = 5.92^{cm^2} < D16@200 \cdots \text{IN SIDE}$$

$D16@200 \cdots$ OUT SIDE

4. DESIGN OF BASE

4-1 CALCULATION OF LOAD

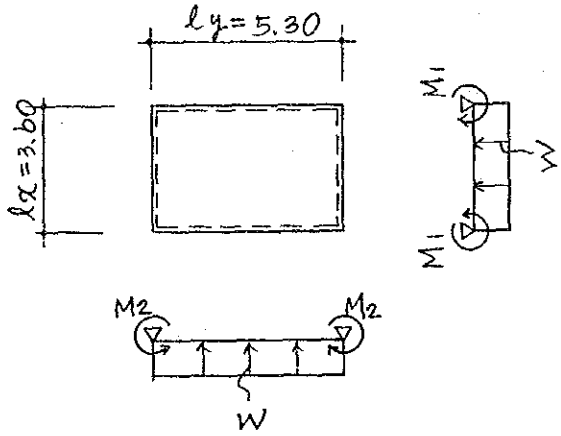
4-1-1 VERTICAL LOAD

SLAB	$0.68^{t/m^2} \times (7.80 \times 4.80 - 2.30 \times 2.40 - 1.90 \times 2.40)$	=	18.60^{t}
〃	$0.80^{t/m^2} \times 1.60 \times 1.49$	=	1.91 〃
〃	$0.50^{t/m^2} \times (1.20 \times 3.20 + 1.60 \times 1.49)$	=	3.11 〃
WATER	$0.79^{t/m^2} \times 1.20 \times 5.09$	=	4.83 〃
WALL	$0.20 \times 3.50 \times 3.20 \times 2.5$	=	5.60 〃
〃	$0.20 \times 4.10 \times 3.20 \times 2.5$	=	6.56 〃
〃	$0.20 \times 1.52 \times 3.20 \times 2.5$	=	2.43 〃
〃	$0.20 \times 3.05 \times 4.00 \times 2.5$	=	6.10 〃
〃	$0.20 \times 1.15 \times 1.49 \times 2 \times 2.5$	=	1.71 〃
〃	$0.40 \times 5.10 \times (3.20 + 5.70 + 5.50) \times 2.5$	=	73.44 〃
〃	$0.40 \times 3.00 \times 3.20 \times 2.5$	=	9.60 〃
〃	$0.40 \times 3.05 \times 1.00 \times 2.5$	=	3.05 〃
〃	$0.40 \times (3.05 \times 1.20 - 1.15 \times 1.20) \times 2.5$	=	2.28 〃
〃	$0.20 \times 2.05 \times 0.40 \times 2.5$	=	0.41 〃
		ΣW	= 139.63^{t}

$$W = \frac{139.63}{4.00 \times 5.70} = 6.12^{t/m^2}$$

4-2 MOMENT AND SHEAR

CASE 1 VERTICAL LOAD + WATERPRESSURE



$\frac{ly}{lx} = 1.47$

$W = 6.12\ t/m^2$

$M_1 = 4.68 + 8.05 \times 0.20 = 6.29\ t\cdot m$

$M_2 = 2.57 + 6.12 \times 0.20 = 3.79$ "

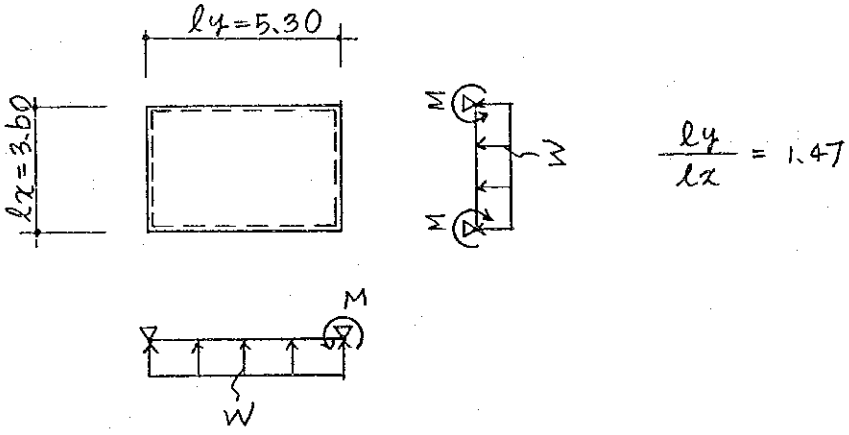
$M_{x1} = 6.12 \times 3.60^2 \times 0.079 + 6.29 = 12.56\ t\cdot m$

$M_{y1} = 6.12 \times 3.60^2 \times 0.027 + 3.79 = 5.93$ "

$Q_{y1} = 6.12 \times 3.60 \times 0.54 = 11.90\ t$

$Q_{x1} = 6.12 \times 3.60 \times 0.52 = 11.46$ "

CASE.2 VERTICAL LOAD+EARTH PRESSURE



$$\frac{ly}{lx} = 1.47$$

$$w = 6.12\ t/m^2$$

$$M = \frac{1}{2} \times 0.50 \times 2.45^2 + \frac{1}{6} \times 2.21 \times 2.45^2 = 3.71\ t\cdot m$$

$$Mx2 = 6.21 \times 3.60^2 \times 0.079 = 6.36\ t\cdot m$$

$$My2 = 6.21 \times 3.60^2 \times 0.027 = 2.17\ "$$

4-3 DESIGN OF SECTION

$M_{x2} = 12.5b^{t\cdot m}$ WATER PRESSURE

CENTER $As = \dfrac{12.5b \times 10^5}{1600 \times 0.875 \times 33} = 27.19^{cm^2} < D19@100$ UPPER

$M_1 = 6.29^{t\cdot m}$ WATER PRESSURE

END $As = \dfrac{6.29 \times 10^5}{1600 \times 0.875 \times 33} = 13.61^{cm^2} < D19@200$ UPPER

$M_{y2} = 5.93^{t\cdot m}$ WATER PRESSVRE

CENTER $As = \dfrac{5.93 \times 10^5}{1600 \times 0.875 \times 31} = 13.66^{cm^2} < D19@200$ UPPER

$M_2 = 3.79^{t\cdot m}$ WATER PRESSURE

END $As = \dfrac{3.79 \times 10^5}{1600 \times 0.875 \times 31} = 8.73^{cm^2} < D19@200$ UPPER

$M_{x2} = 6.36^{t\cdot m}$ EARTH PRESSURE

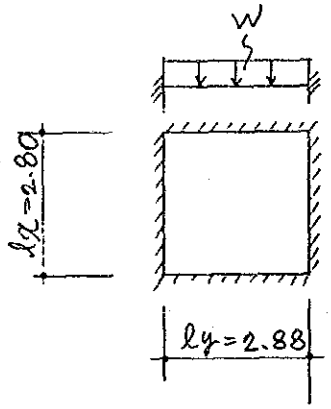
CENTER $As = \dfrac{6.36 \times 10^5}{1600 \times 0.875 \times 30} = 15.15^{cm^2} < D16@100$

$M = 3.71^{t\cdot m}$ EARTH PRESSURE

END $As = \dfrac{3.71 \times 10^5}{1600 \times 0.875 \times 30} = 8.83^{cm^2} < D16@200$

5. DESING OF SLAB

5-1 MOMENT AND SHEAR



$$\frac{ly}{lx} \fallingdotseq 1.00$$

$$w = 0.20 \times 2.5 + 0.30^{t/m^2} = 0.80^{t/m^2}$$

$$-Mx1 = -My1 = -0.80 \times 2.80^2 \times 0.052 = -0.33^{t\cdot m}$$

$$Mx2 = My2 = 0.80 \times 2.80^2 \times 0.0175 = 0.11^{\ "}$$

$$Qx1 = Qy1 = 0.80 \times 2.80 \times 0.44 = 0.99^{t}$$

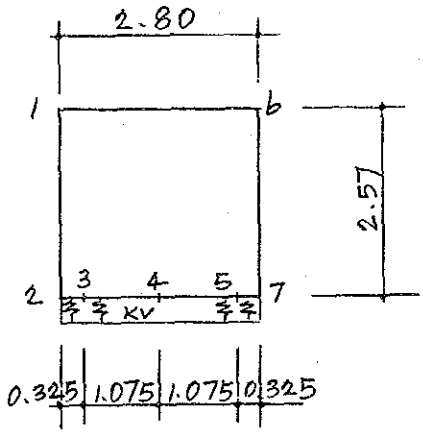
5-2 DESING OF SECTION

$$As = \frac{0.33 \times 10^5}{1600 \times 0.875 \times 15} = 1.57^{cm^2} < D13\ @200$$

$$\tau = \frac{0.99 \times 10^3}{100 \times 0.875 \times 15} = 0.8^{kg/cm^2} < 4.25^{kg/cm^2}\ OK$$

b. FRAME OF SECTION ②-②

b-1 DIMENSION OF FRAME



$$Kv = Kv0 \left(\frac{Bv}{30}\right)^{-3/4}$$

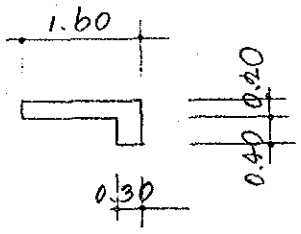
$$Kv0 = \frac{1}{30} \times 1 \times 28 \times 50 = 46.67 \ kg/cm^3$$

$$Bv = \sqrt{475 \times 305 + 570 \times 400} = 611 \ cm$$

$$Kv = 46.67 \times \left(\frac{611}{30}\right)^{-3/4} = 4.87 \ kg/cm^3 = 4870 \ t/m^3$$

$$Kv = 4870 \times 2.40 \ m = 11688 \ t/m^2$$

6-2 INERTIA AND AREA

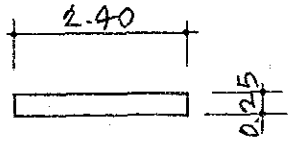


$be = 1.60\,m$

$x = 0.18\,m$

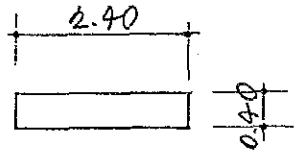
$I = 0.0105\,m^4$

$A = 0.44\,m^2$



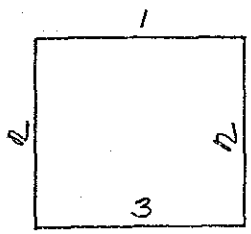
$I = \frac{1}{12} \times 2.40 \times 0.25^3 = 0.0031\,m^4$

$A = 2.40 \times 0.25 = 0.60\,m^2$



$I = \frac{1}{12} \times 2.40 \times 0.40^3 = 0.0128\,m^4$

$A = 2.40 \times 0.40 = 0.96\,m^2$



$I_1 = 0.0105\,m^4$ $\quad A_1 = 0.44\,m^2$

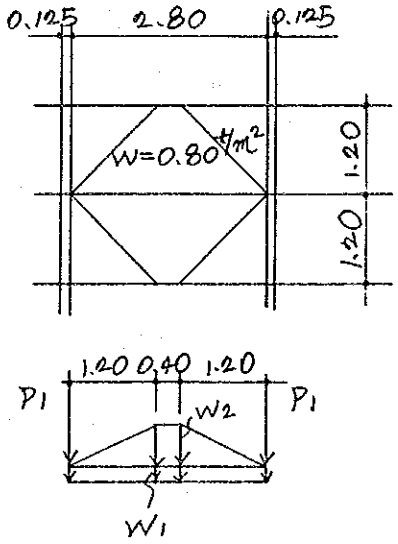
$I_2 = 0.0031$ $\quad A_2 = 0.60$

$I_3 = 0.0128$ $\quad A_3 = 0.96$

b-3 CALCULATION OF LOAD

b-3-1 VERTICAL LOAD

(1) BEAM



$W_1 = 0.30 \times 0.40 \times 2.5 = 0.30^{t/m}$

$W_2 = 0.80 \times 2.40 = 1.92^{"}$

$P_1 = 0.80 \times (0.125 \times 2.40 + 1.20 \times 1.20 \times \frac{1}{2} \times 2) = 1.39^{t}$

(2) WALL

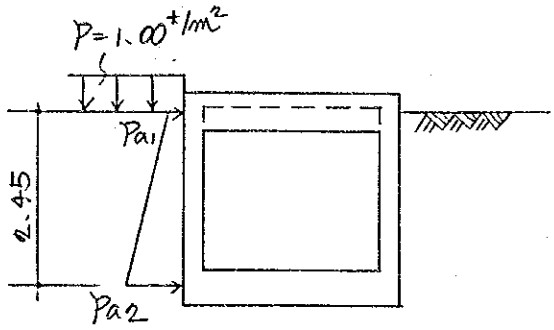
$t = 25^{cm}$

$P_W = 0.25 \times 2.40 \times 2.5 = 1.50^{t/m}$

(3) BASE SLAB

DEAD LOAD	$0.40 \times 2.40 \times 2.5$	=	$2.40^{t/m}$
DEAD LOAD	$0.50^{t/m^2} \times 2.40$	=	$1.20^{"}$
LIVE LOAD	$0.30^{t/m^2} \times 2.40$	=	$0.72^{"}$
		W3 =	$4.32^{t/m}$

b-3-2 EARTH PRESSURE



$Pa1 = 1.00 \times 0.5 \times 2.40 = 1.20^{t/m}$

$Pa2 = (1.00 + 1.8 \times 2.45) \times 0.5 \times 2.40 = 6.49$ "

b-3-3 EARTHQUAKE LOAD

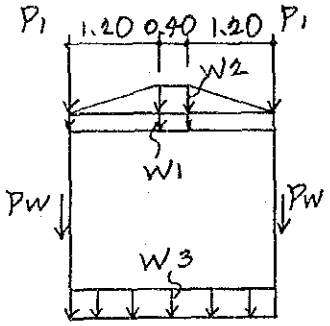
$$P_E = (0.80^{t/m^2} \times 1.525 \times 2.40 + 0.30^{t/m} \times 1.275) \times 0.05 = 0.17^{t}$$

WALL

$$W_E = 0.25 \times 2.40 \times 2.5 \times 0.05 = 0.08^{t/m}$$

6-4 LOADING CHART

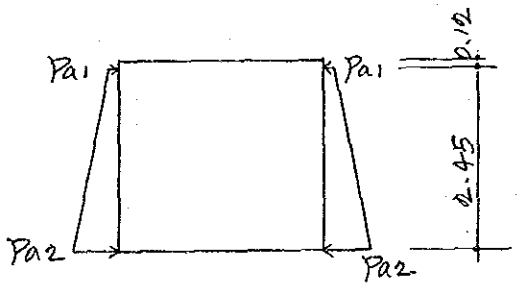
CASE 1 VERTICAL LOAD



$W_1 = 0.30^{t/m}$ $W_2 = 1.92^{t/m}$ $W_3 = 4.32^{t/m}$

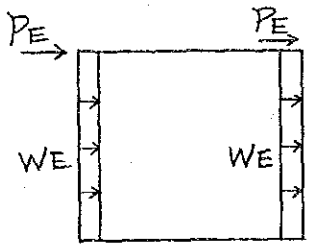
$P_1 = 1.39^{t}$ $P_W = 1.50^{t/m}$

CASE2 EARTH FRESSURE



$P_{a1} = 1.20^{t/m}$ $P_{a2} = 6.49^{t/m}$

CASE 3 EARTHQUAKE LOAD



$P_E = 0.17^{t}$ $W_E = 0.08^{t/m}$

PERMANENT LOAD

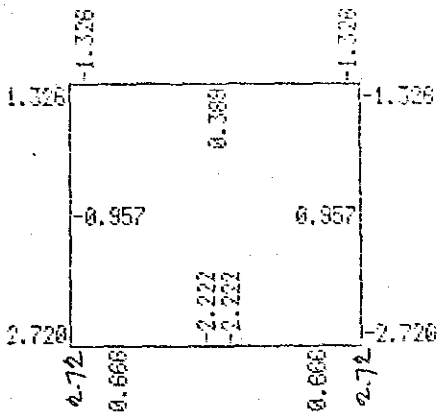
CASE 4 = ① + ②

TEMPORARY LOAD ($\alpha = 0.667$)

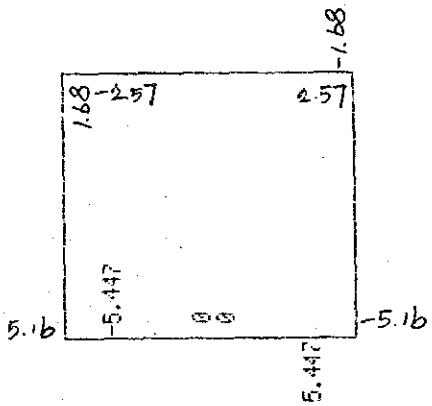
CASE 5 = ① + ② + ③

CASE 4 PERMANENT LOAD

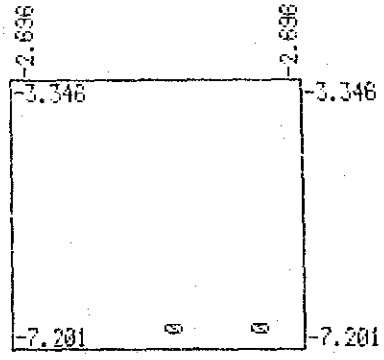
MOMENT



SHEAR

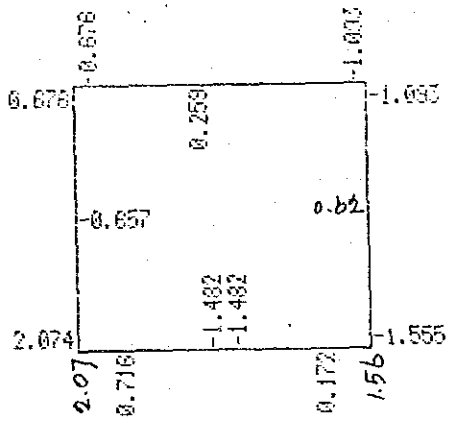


AXIAL

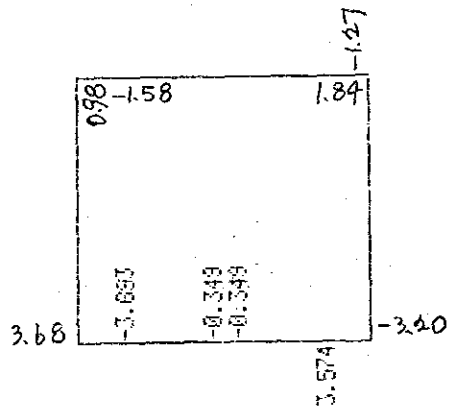


CASE 5 TEMPORARY LOAD

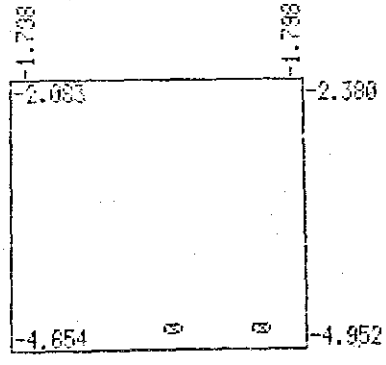
MOMENT



SHEAR



AXIAL



6-5 DESIGN OF SECTION

BEAM

MOMENT	M	(t·m)	=	1.330	Case 4
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	1.680	
WIDTH	b	(cm)	=	30.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	5.950	D16-3
AREA OF REINFORCEMENT	As′	(〃)	=	5.950	〃

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	24.33
TENSILE STRESS	σs	(〃)	=	773.01
SHEARING STRESS	τ	(〃)	=	1.93

WALL 1, 2, 6, 7

MOMENT	M	(t·m)	=	2.720	Case 4
AXIAL FORCE	N	(t)	=	7.210	
SHEAR FORCE	S	(t)	=	5.160	
WIDTH	b	(cm)	=	240.000	
DEPTH	h	(〃)	=	25.000	
EFFECTIVE DEPTH	d	(〃)	=	18.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	15.200	D13@200
AREA OF REINFORCEMENT	As′	(〃)	=	15.200	〃

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	27.34
TENSILE STRESS	σs	(〃)	=	792.89
SHEARING STRESS	τ	(〃)	=	1.36

BASE 2, 3, 5, 7 — Case 4

MOMENT	M	(t·m)	=	2.720
AXIAL FORCE	N	(t)	=	0.000
SHEAR FORCE	S	(t)	=	5.450
WIDTH	b	(cm)	=	240.000
DEPTH	h	(〃)	=	40.000
EFFECTIVE DEPTH	d	(〃)	=	30.000
CONCRETE COVER	d′	(〃)	=	7.000
CONCRETE COVER	d″	(〃)	=	10.000
MODULAR RATIO	n=Es/Ec		=	15
AREA OF REINFORCEMENT	As	(cm2)	=	15.200 D13@200
AREA OF REINFORCEMENT	As′	(〃)	=	15.200 〃

COMPRESSIVE STRESS	σc	(Kg/cm2)	= 12.32
TENSILE STRESS	σs	(〃)	= 643.01
SHEARING STRESS	τ	(〃)	= 0.81

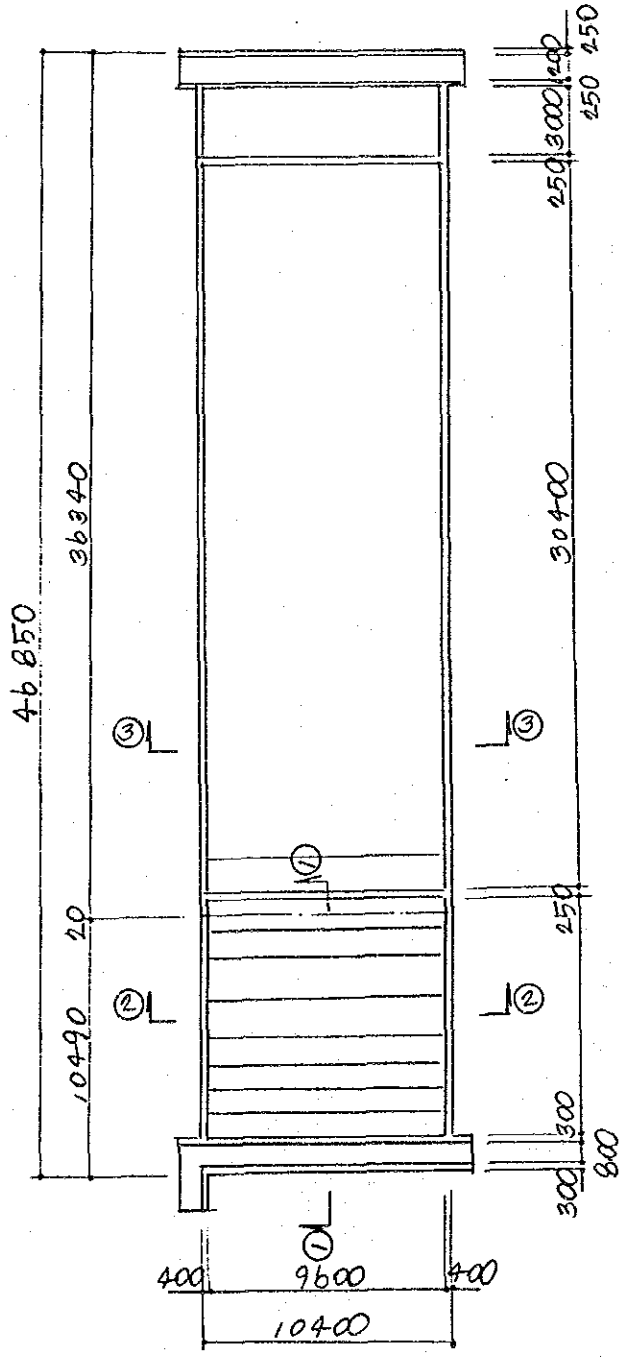
BASE 4 — Case 4

MOMENT	M	(t·m)	=	2.220
AXIAL FORCE	N	(t)	=	0.000
SHEAR FORCE	S	(t)	=	0.000
WIDTH	b	(cm)	=	240.000
DEPTH	h	(〃)	=	40.000
EFFECTIVE DEPTH	d	(〃)	=	33.000
CONCRETE COVER	d′	(〃)	=	10.000
CONCRETE COVER	d″	(〃)	=	7.000
MODULAR RATIO	n=Es/Ec		=	15
AREA OF REINFORCEMENT	As	(cm2)	=	15.200 D13@200
AREA OF REINFORCEMENT	As′	(〃)	=	15.200 〃

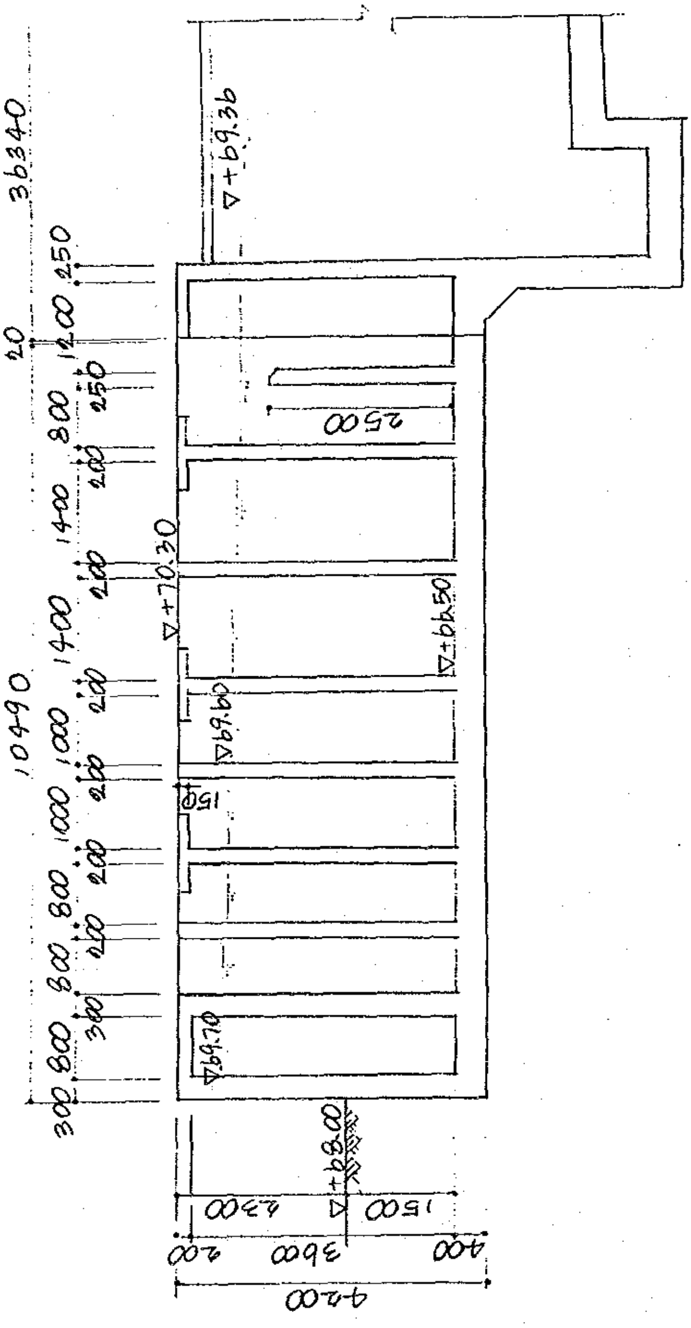
COMPRESSIVE STRESS	σc	(Kg/cm2)	= 8.88
TENSILE STRESS	σs	(〃)	= 466.04
SHEARING STRESS	τ	(〃)	= 0.00

3. FLOCCULATION & SEDIMENTATION TANK

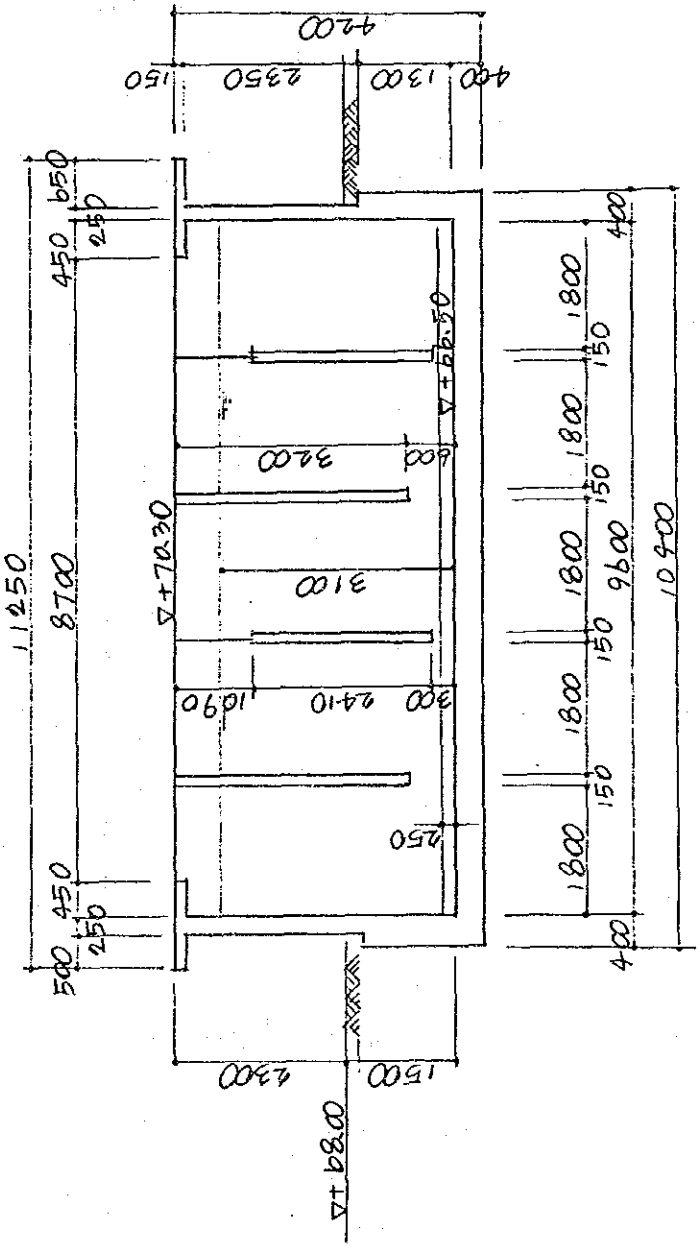
1. PLAN AND SECTION



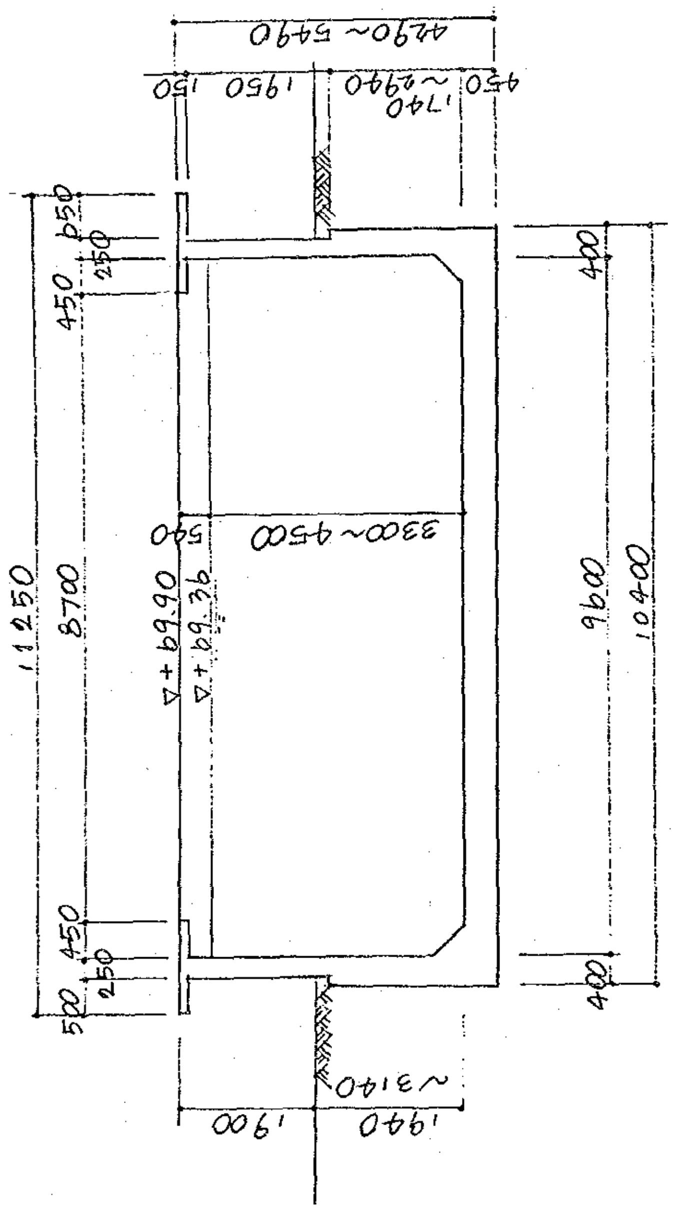
PLAN



SECTION ①-①


4200
400
1300
2350
150
650
250
450
11250
8700
500
250
450
4300
1500
▽+18.00
▽+70.30
▽+66.50
600
3200
3100
3000
2410
1090
250
400
1800
150
9600
10400

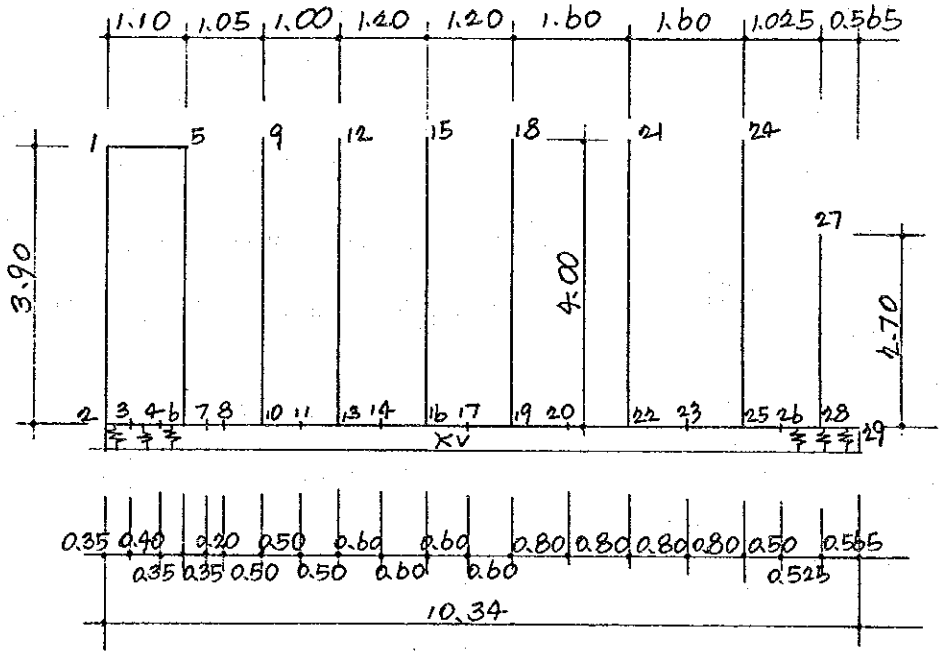
SECTION ②-②



SECTION ③-③

2. FRAME OF SECTION ①-①

2-1 DIMENTION OF FRAME



$$Kv = Kv0 \left(\frac{Bv}{30}\right)^{-3/4}$$

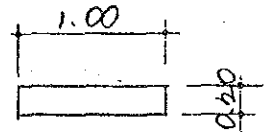
$$Kv0 = \frac{1}{30} \times 1 \times 28 \times 20 = 18.67 \ kg/cm^3$$

$$Bv = \sqrt{1049 \times 1040} = 1044 \ cm$$

$$Kv = 18.67 \times \left(\frac{1044}{30}\right)^{-3/4} = 1.30 \ kg/cm^3 = 1300 \ t/m^3$$

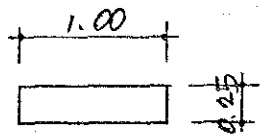
$$Kv = 1300 \times 1.00 = 1300 \ t/m^2$$

2-2 INERTIA AND AREA



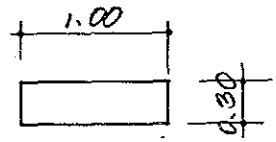
$I = \frac{1}{12} \times 1.00 \times 0.20^3 = 0.0007\ m^4$

$A = 1.00 \times 0.20 = 0.20\ m^2$



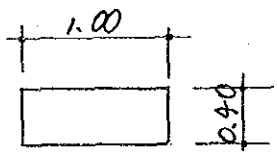
$I = \frac{1}{12} \times 1.00 \times 0.25^3 = 0.0013\ m^4$

$A = 1.00 \times 0.25 = 0.25\ m^2$



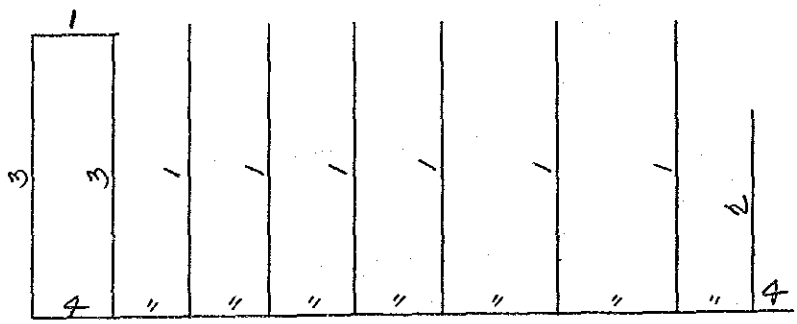
$I = \frac{1}{12} \times 1.00 \times 0.30^3 = 0.0023\ m^4$

$A = 1.00 \times 0.30 = 0.30\ m^2$



$I = \frac{1}{12} \times 1.00 \times 0.40^3 = 0.0053\ m^4$

$A = 1.00 \times 0.40 = 0.40\ m^2$



$I_1 = 0.0007^{m4}$ $A_1 = 0.20^{m2}$ $I_2 = 0.0013$ $A_2 = 0.25$

$I_3 = 0.0023$ $A_3 = 0.30$ $I_4 = 0.0053$ $A_4 = 0.40$

2-3 CALCULATION OF LOAD

2-3-1 VERTICAL LOAD

(1) SLAB

DEAD LOAD	$0.20 \times 2.5 =$	$0.50\ t/m^2$
LIVE LOAD	$=$	0.30 "
	$W_1 =$	$0.80\ t/m^2$

(2) WALL

$t = 20^{cm}$	$P_{W1} = 0.20 \times 2.5$	$=$	$0.50\ t/m^2$
$t = 25$ "	$P_{W2} = 0.25 \times 2.5$	$=$	0.63 "
$t = 30$ "	$P_{W3} = 0.30 \times 2.5$	$=$	0.75 "

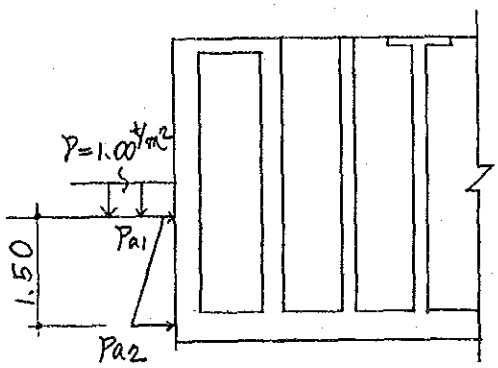
$P_1 = 0.15 \times 0.40 \times 2 \times 2.5 + 0.30\ t/m^2 \times 1.00 = 0.60\ t$

(3) BASE SLAB

DEAD LOAD	0.40×2.5	$=$	$1.00\ t/m^2$
P.L CONCRETE	0.25×2.3	$=$	0.58 "
	$W_2 =$		$1.58\ t/m^2$

WATER LOAD	$W_3 = 2.95 \times 1.0$	$=$	$2.95\ t/m^2$
	$W_4 = 2.85 \times 1.0$	$=$	2.85 "

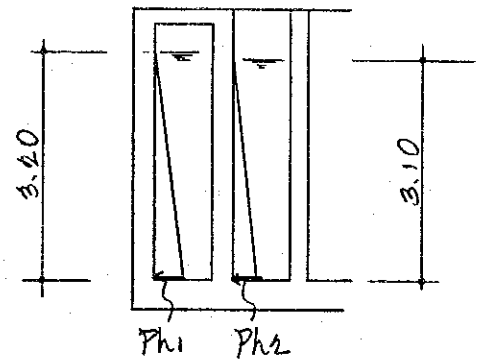
2-3-2 EARTH PRESSURE



$Pa_1 = 1.00 \times 0.5 = 0.50\ t/m^2$

$Pa_2 = (1.00 + 1.8 \times 1.50) \times 0.5 = 1.85$ "

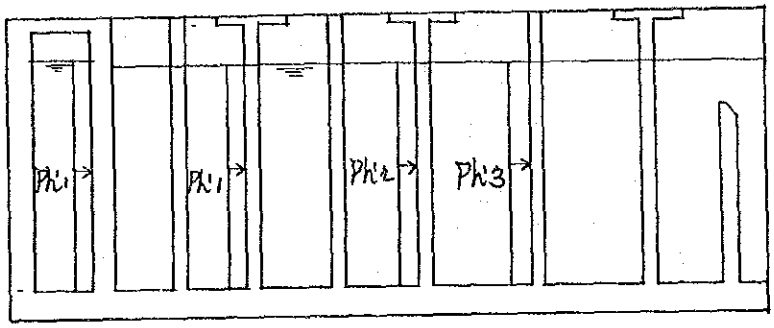
2-3-3 WATER PRESSURE



$Ph_1 = 3.20 \times 1.0 = 3.20\ t/m^2$

$Ph_2 = 3.10 \times 1.0 = 3.10$ "

2-3-4 DYNAMIC WATER PRESSURE



$$Ph'_1 = 0.80 \times \frac{1}{2} \times 1.0 \times 0.05 = 0.02 \text{ t/m}^2$$

$$Ph'_2 = 1.00 \times \frac{1}{2} \times 1.0 \times 0.05 = 0.03 \text{ "}$$

$$Ph'_3 = 1.40 \times \frac{1}{2} \times 1.0 \times 0.05 = 0.04 \text{ "}$$

2-3-5 EARTHQUAKE LOAD

$P_{E1} = 0.80^{t/m^2} \times 0.70 \times 0.05 = 0.03^{t}$

$P_{E2} = 0.60 \times 0.05 = 0.03$ "

WALL

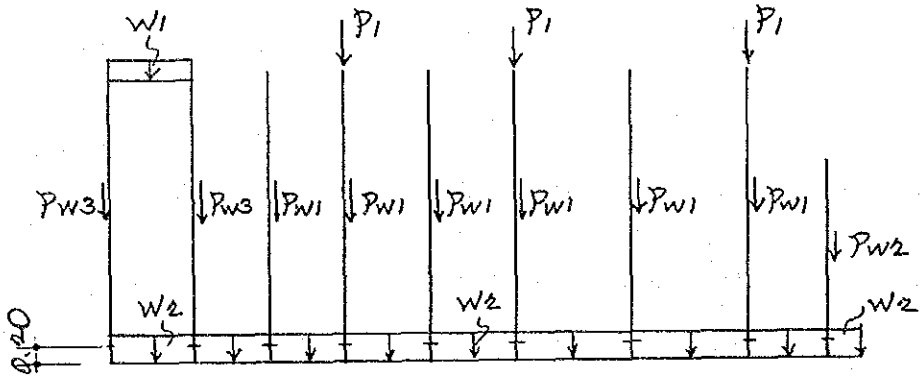
$W_{E1} = 0.30 \times 2.5 \times 0.05 = 0.04^{t/m^2}$

$W_{E2} = 0.20 \times 2.5 \times 0.05 = 0.03$ "

$W_{E3} = 0.25 \times 2.5 \times 0.05 = 0.03$ "

2-4 LOADING CHART

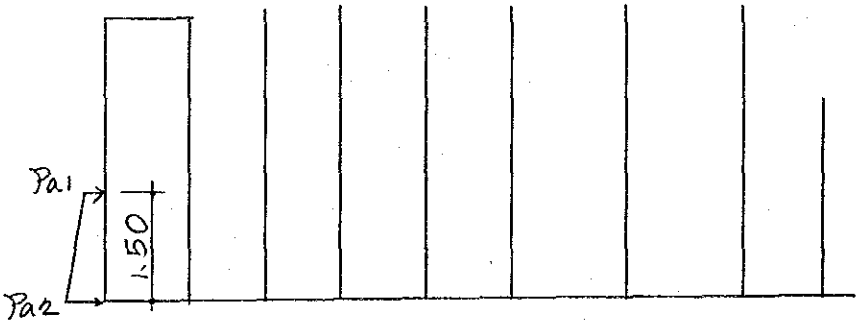
CASE 1 VERTICAL LOAD



$W_1 = 0.80^{t/m^2}$ $W_2 = 1.58^{t/m^2}$ $P_1 = 0.60^{t}$

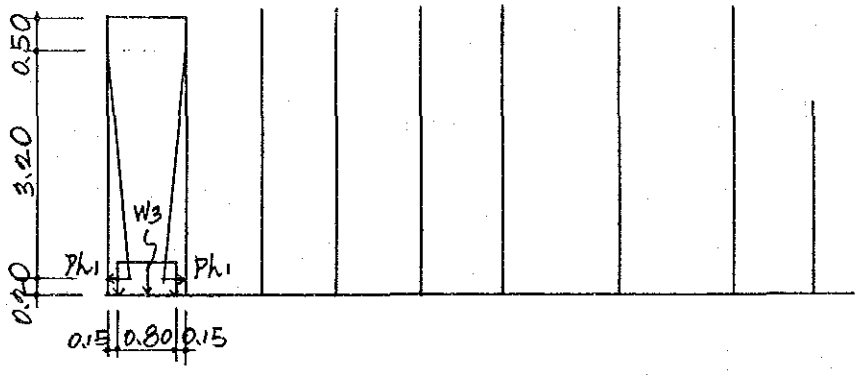
$P_{W1} = 0.50^{t/m^2}$ $P_{W2} = 0.63^{t/m^2}$ $P_{W3} = 0.75^{t/m^2}$

CASE 2 EARTH PRESSURE



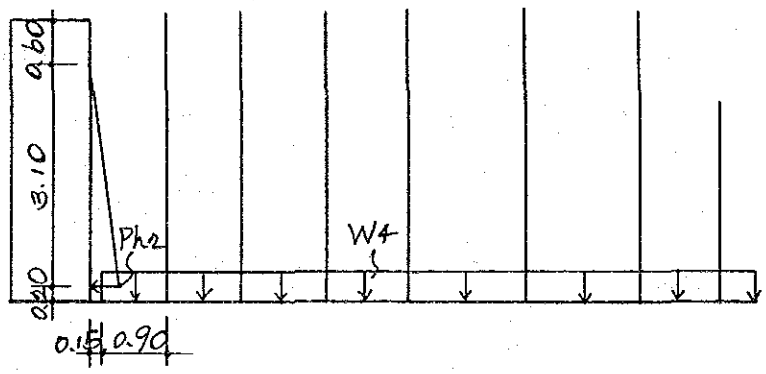
$P_{a1} = 0.50^{t/m^2}$ $P_{a2} = 1.85^{t/m^2}$

CASE 3 WATER PRESSURE (1)



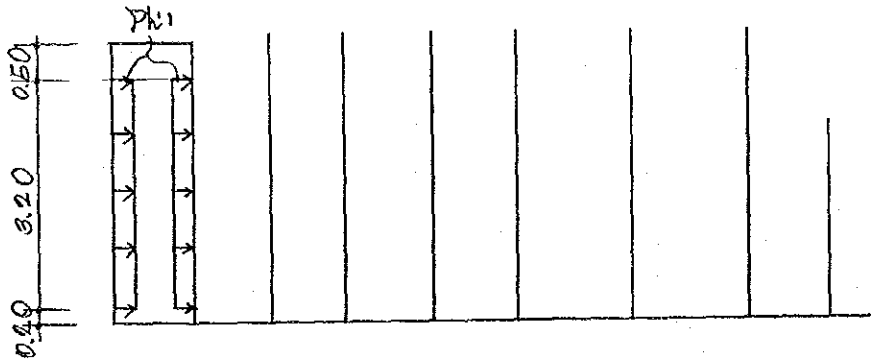
$W3 = 2.95\ t/m^2$ $Ph1 = 3.20\ t/m^2$

CASE 4 WATER PRESSURE (2)



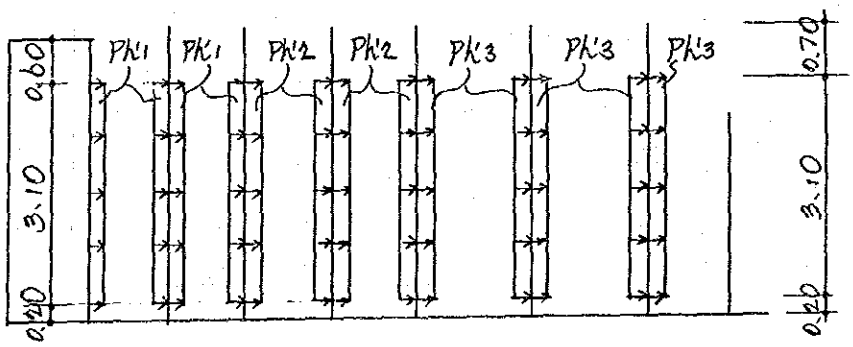
$W4 = 2.85\ t/m^2$ $Ph2 = 3.10\ t/m^2$

CASE 5 DYNAMIC WATER PRESSURE (1)



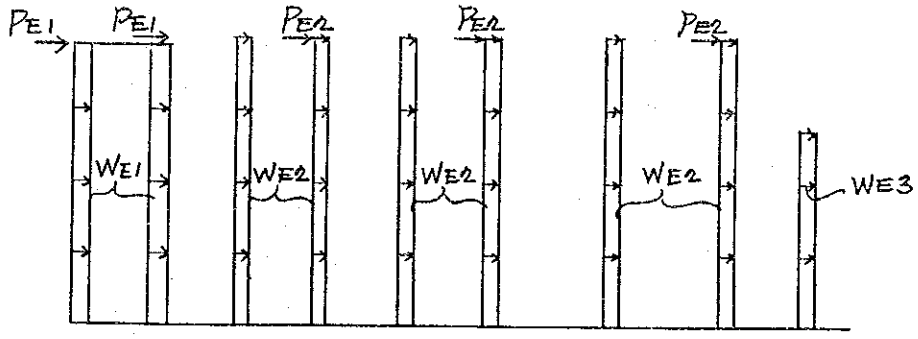
$Ph'1 = 0.02\ t/m^2$

CASE6 DYNAMIC WATER PRESSURE (2)



$Ph'1 = 0.02\ t/m^2$ $Ph'2 = 0.03\ t/m^2$ $Ph'3 = 0.04\ t/m^2$

CASE7 EARTHQUAKE LOAD



$P_{E1} = 0.03^{t}$ $P_{E2} = 0.03^{t}$

$W_{E1} = 0.04\ t/m^2$ $W_{E2} = 0.03\ t/m^2$ $W_{E3} = 0.03\ t/m$

PERMANENT LOAD

CASE 8 = ① + ②

9 = ① + ② + ③

10 = ① + ② + ③ + ④

11 = ① + ③ + ④

TEMPORARY LOAD (α = 0.667)

CASE 12 = ① + ② + ⑦

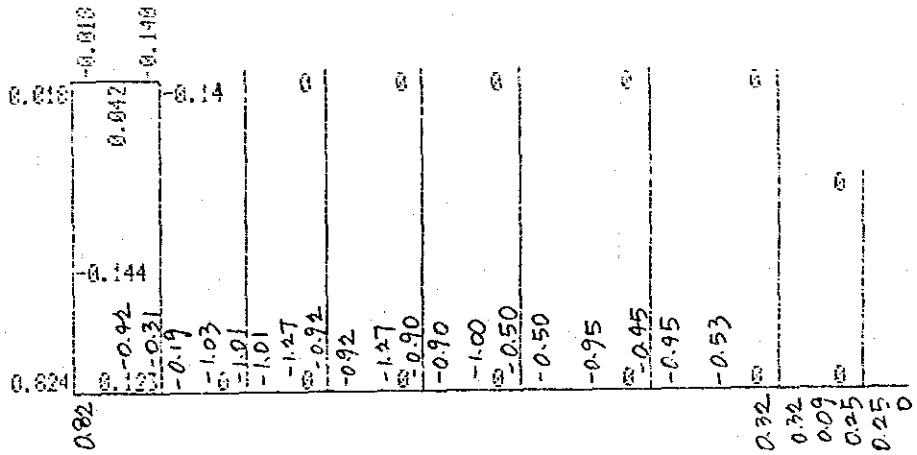
13 = ① + ② + ③ + ⑤ + ⑦

14 = ① + ② + ③ + ④ + ⑤ + ⑥ + ⑦

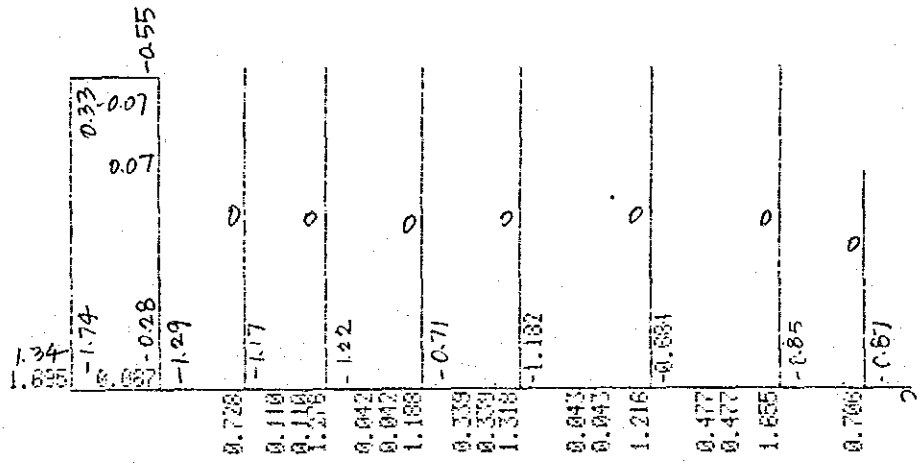
15 = ① + ② + ③ + ④ - ⑤ - ⑥ - ⑦

CASE 8 PERMANENT LOAD

MOMENT

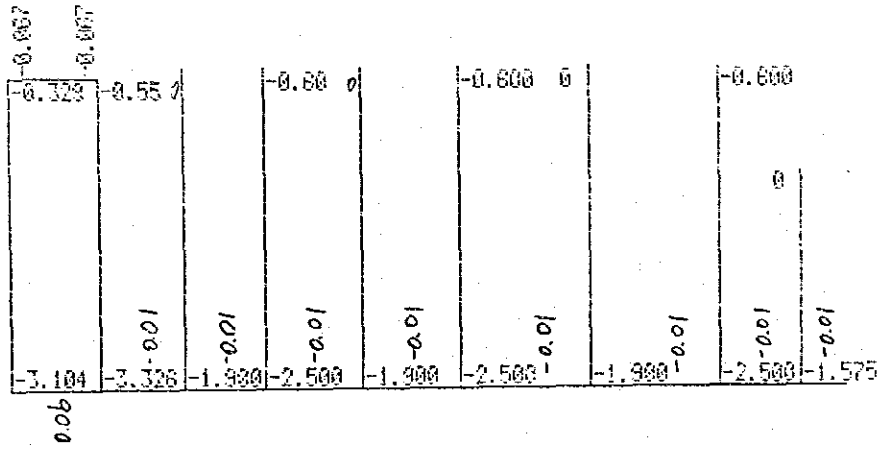


SHEAR



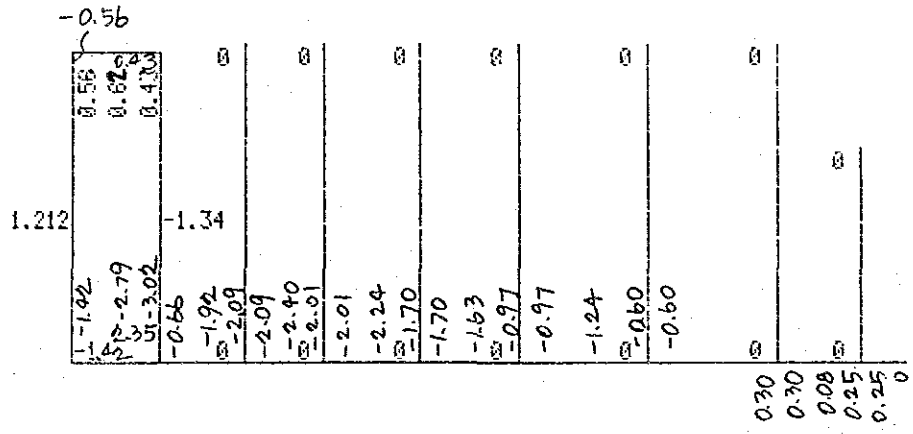
CASE 8 PERMANENT LOAD

AXIAL

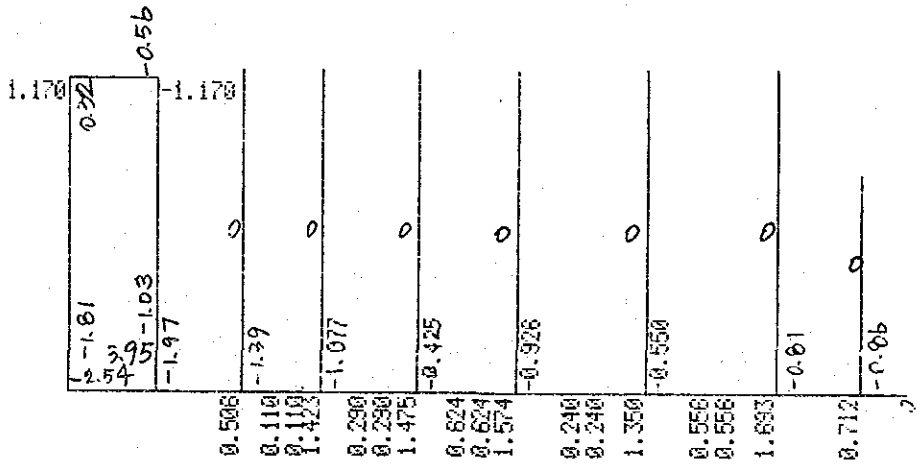


CASE 9 PERMANENT LOAD

MOMENT

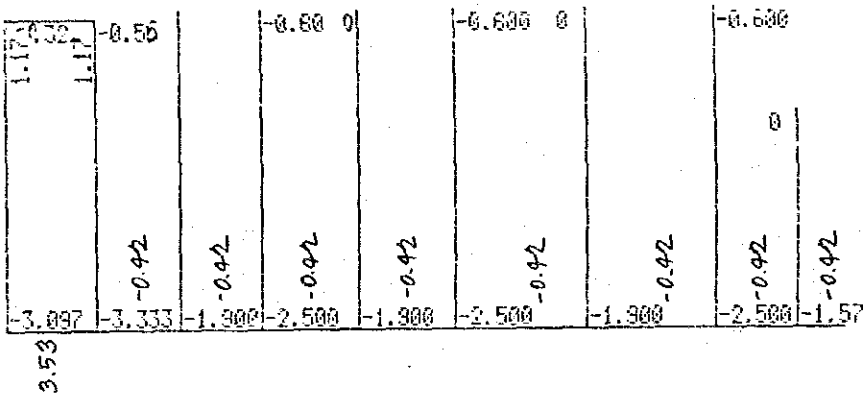


SHEAR



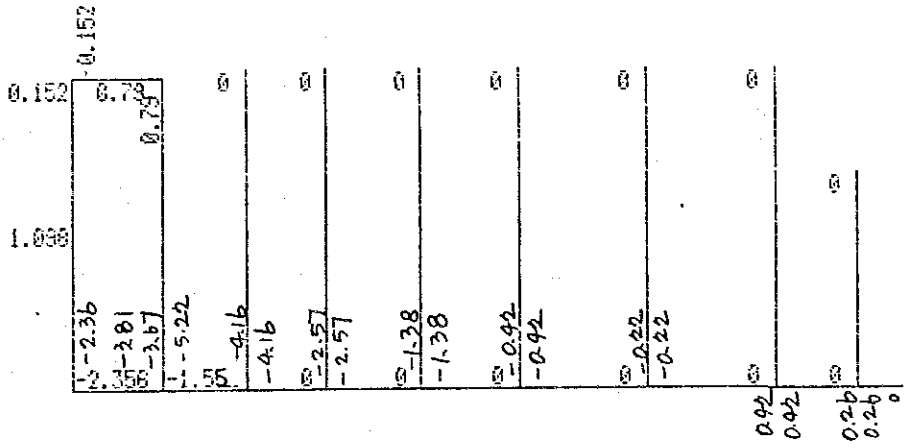
CASE 9 PERMANENT LOAD

AXIAL

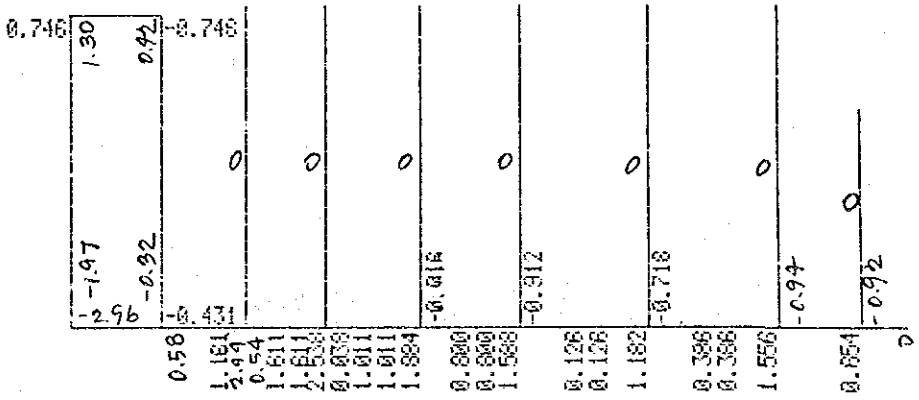


CASE 10 PERMANENT LOAD

MOMENT

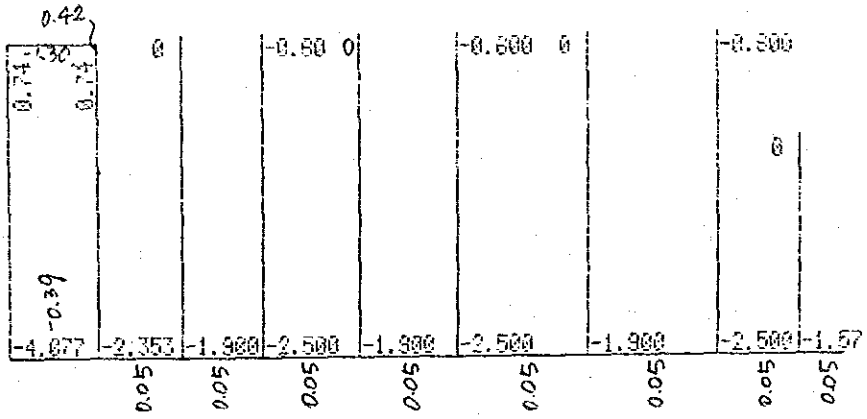


SHEAR



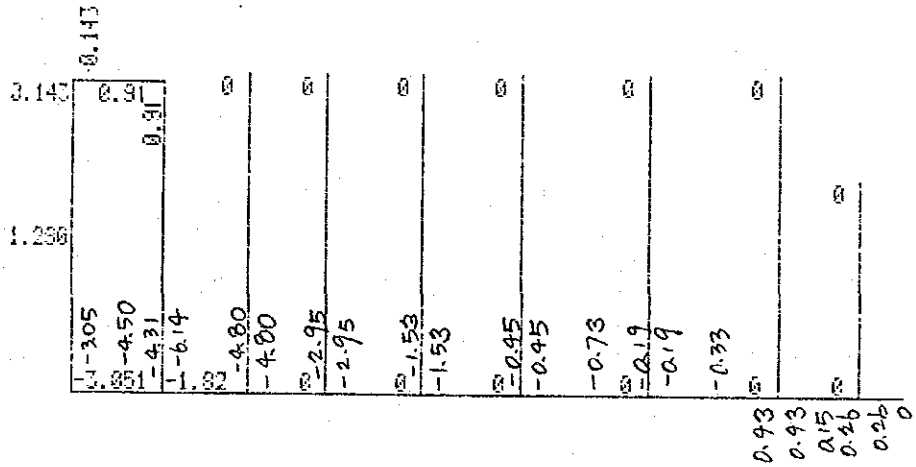
CASE 10 PERMANENT LOAD

AXIAL

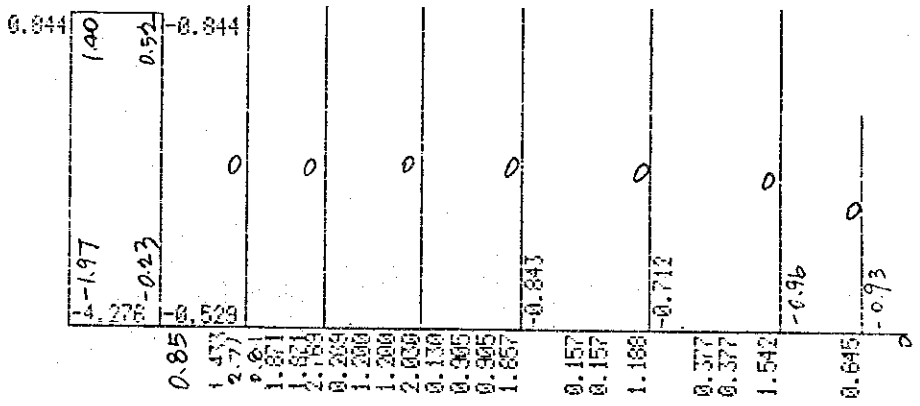


CASE// PERMANENT LOAD

MOMENT

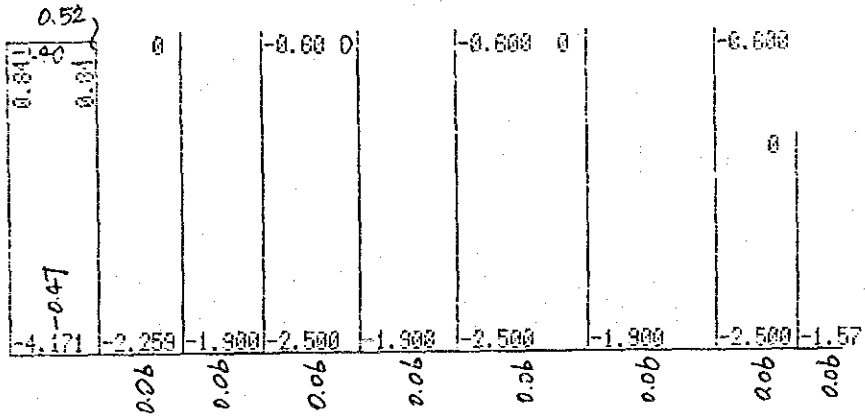


SHEAR



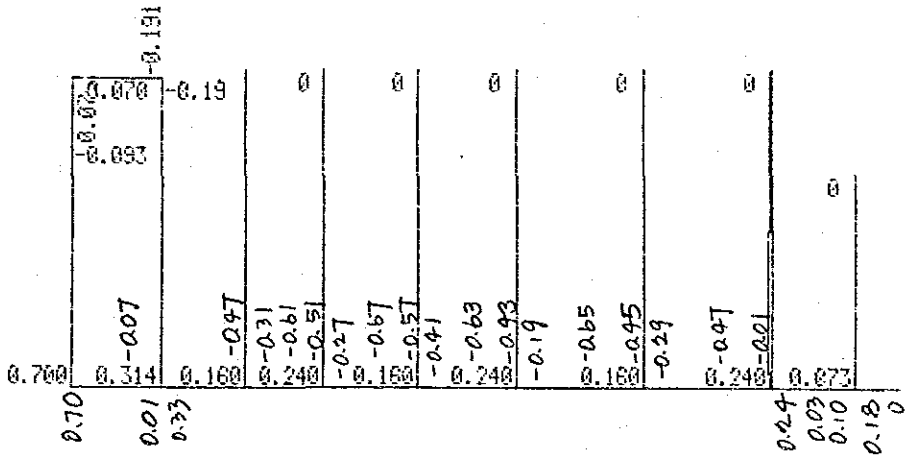
CASE // PERMANENT LOAD

AXIAL

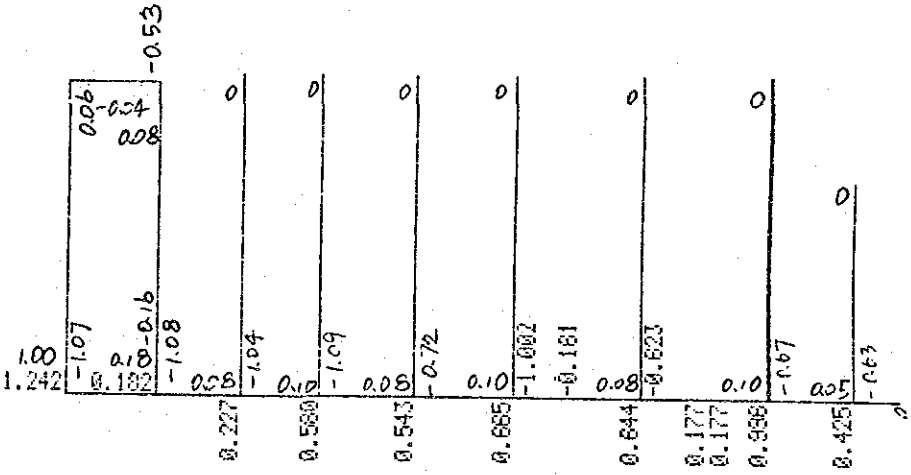


CASE 12 TEMPORARY LOAD

MOMENT

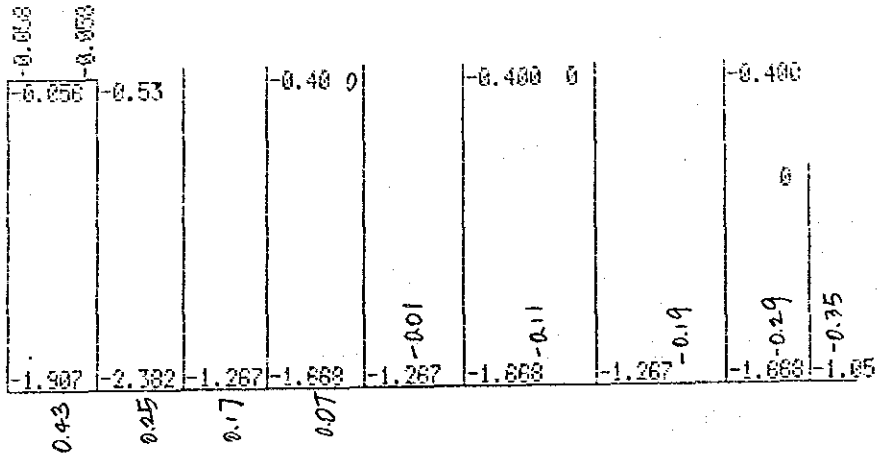


SHEAR



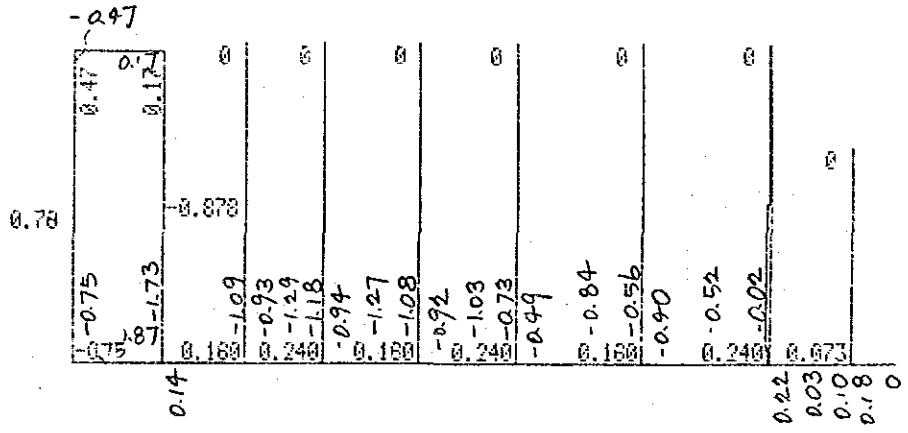
CASE 12 TEMPORARY LOAD

AXIAL

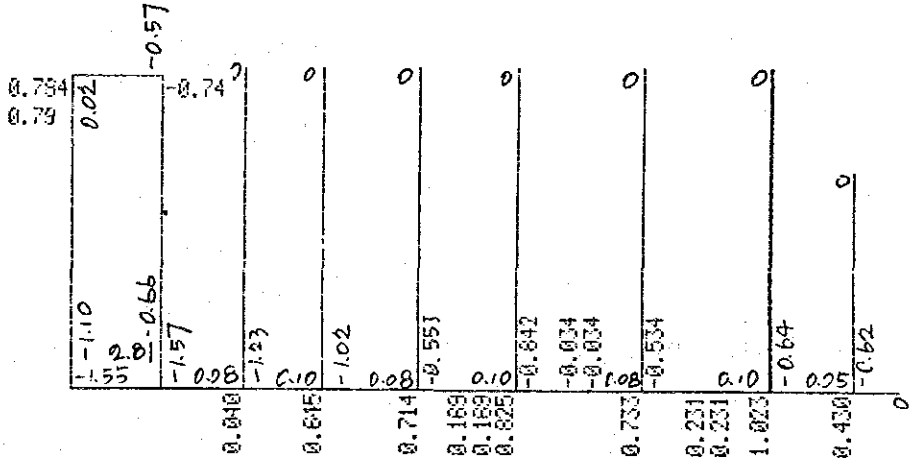


CASE 13 TEMPORARY LOAD

MOMENT

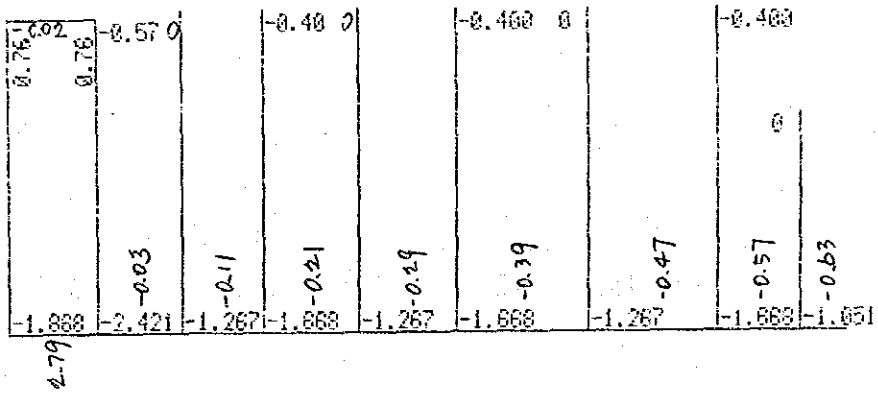


SHEAR



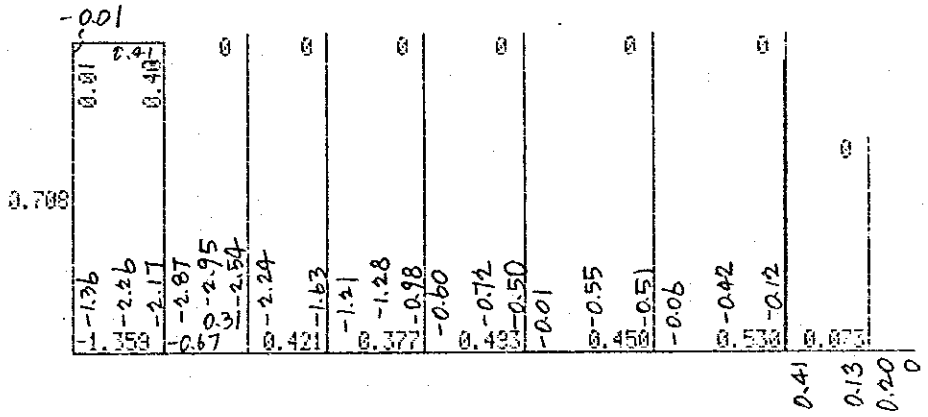
CASE /3 TEMPORARY LOAD

AXIAL

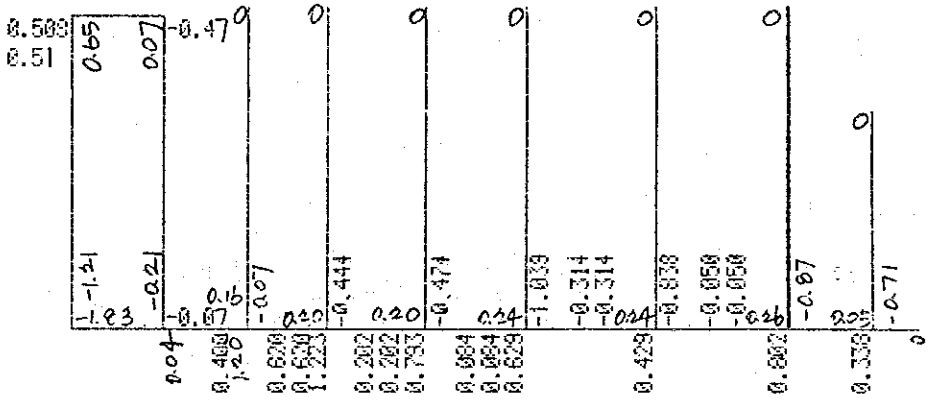


CASE 14 TEMPORARY LOAD

MOMENT

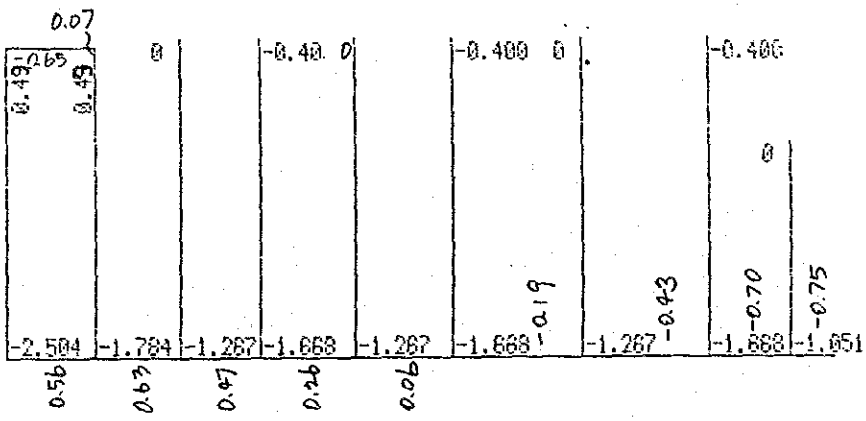


SHEAR



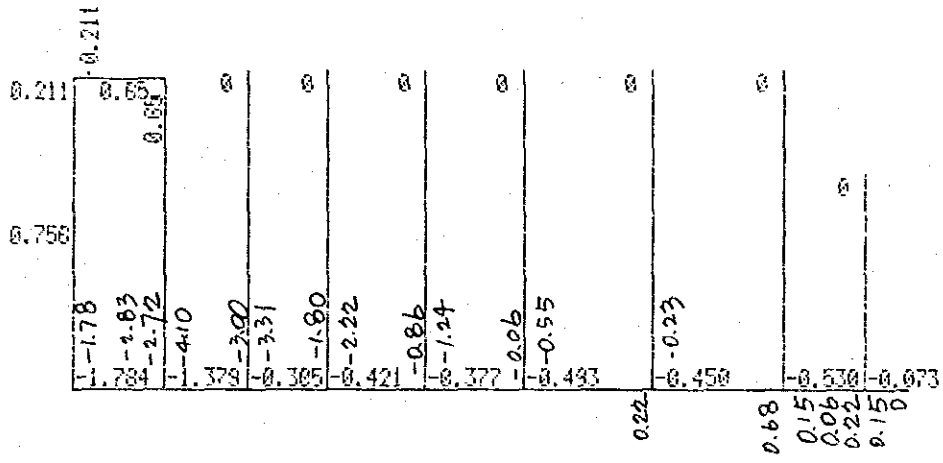
CASE 14 TEMPORARY LOAD

AXIAL

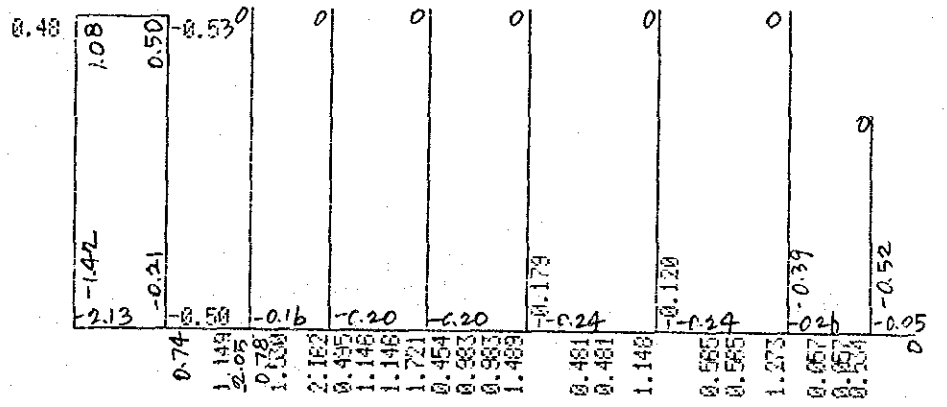


CASE 15 TEMPORARY LOAD

MOMENT

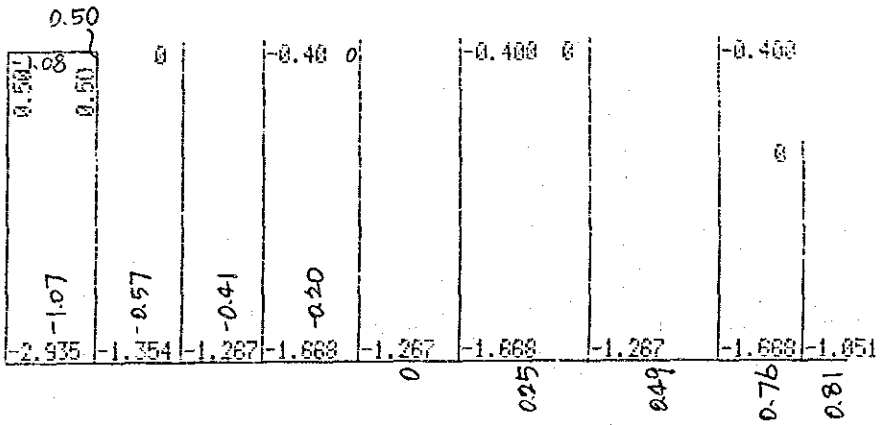


SHEAR



CASE 16 TEMPORARY LOAD

AXIAL



2-5 DESIGN OF SECTION

SLAB 1.5

MOMENT	M	(t·m)	=	0.910	Case 11
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.520	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	20.000	
EFFECTIVE DEPTH	d	(〃)	=	15.000	
CONCRETE COVER	d′	(〃)	=	5.000	
CONCRETE COVER	d″	(〃)	=	5.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	6.330	D13@200
AREA OF REINFORCEMENT	As′	(〃)	=	6.330	〃

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	30.60
TENSILE STRESS	σs	(〃)	=	1054.46
SHEARING STRESS	τ	(〃)	=	0.38

WALL 2 — Case 11

MOMENT	M	(t·m)	=	3.050	
AXIAL FORCE	N	(t)	=	4.170	
SHEAR FORCE	S	(t)	=	4.270	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	30.000	
EFFECTIVE DEPTH	d	(〃)	=	23.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	9.930	D16@200 内
AREA OF REINFORCEMENT	As′	(〃)	=	6.330	D13@200 外

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	42.21
TENSILE STRESS	σs	(〃)	=	1255.96
SHEARING STRESS	τ	(〃)	=	2.12

WALL 6 — Case 9

MOMENT	M	(t·m)	=	2.350	
AXIAL FORCE	N	(t)	=	3.330	
SHEAR FORCE	S	(t)	=	3.950	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	30.000	
EFFECTIVE DEPTH	d	(〃)	=	23.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	6.330	D13@200
AREA OF REINFORCEMENT	As′	(〃)	=	6.330	〃

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	38.77
TENSILE STRESS	σs	(〃)	=	1451.84
SHEARING STRESS	τ	(〃)	=	1.96

WALL 10,13,16 19,22,25

MOMENT	M	(t·m)	=	0.530	Case 14
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.260	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	20.000	
EFFECTIVE DEPTH	d	(〃)	=	13.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	6.330	D13@200
AREA OF REINFORCEMENT	As′	(〃)	=	6.330	〃

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	22.98
TENSILE STRESS	σs	(〃)	=	640.44
SHEARING STRESS	τ	(〃)	=	0.19

WALL 28

MOMENT	M	(t·m)	=	2.600	
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.000	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	25.000	
EFFECTIVE DEPTH	d	(〃)	=	18.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	12.670	D13@100
AREA OF REINFORCEMENT	As′	(〃)	=	6.330	D13@200

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	50.24
TENSILE STRESS	σs	(〃)	=	1293.15
SHEARING STRESS	τ	(〃)	=	0.00

BASE
2,3,6,7,8,9

MOMENT	M	(t·m)	=	6.140	Case 11
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	2.720	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	10.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	16.270	D16@200+D13@200上
AREA OF REINFORCEMENT	As′	(〃)	=	9.930	D16@200下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	39.50
TENSILE STRESS	σs	(〃)	=	1281.61
SHEARING STRESS	τ	(〃)	=	0.92

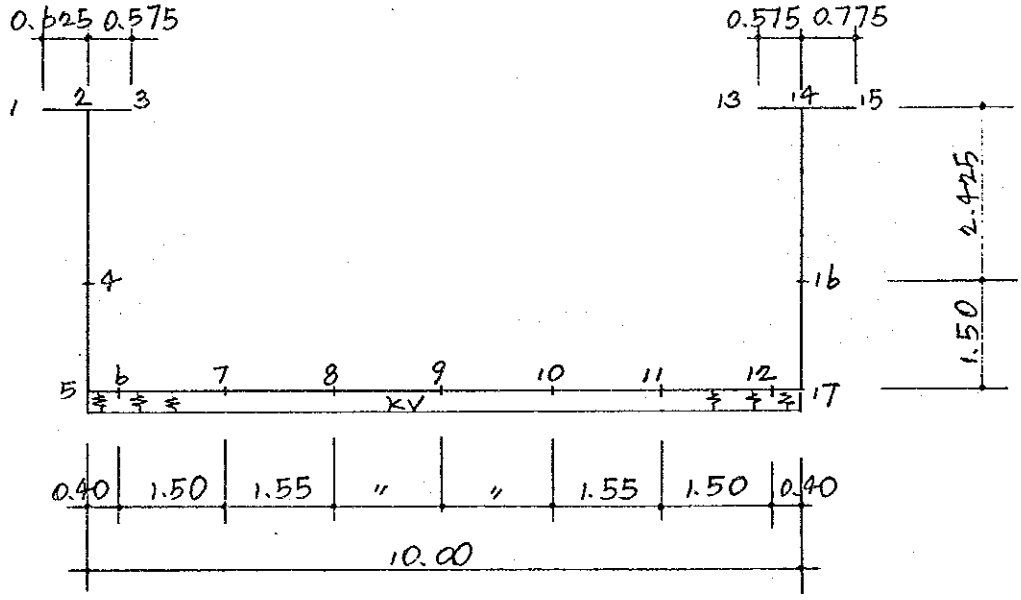
BASE
11~29

MOMENT	M	(t·m)	=	4.120	Case 11
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	2.770	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	10.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	9.930	D16@200上
AREA OF REINFORCEMENT	As′	(〃)	=	9.930	〃 下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	32.63
TENSILE STRESS	σs	(〃)	=	1361.92
SHEARING STRESS	τ	(〃)	=	0.90

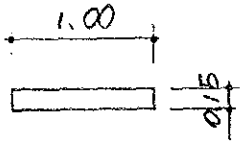
3. FRAME OF SECTION ②-②

3-1 DIMENTION OF FRAME



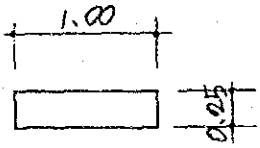
$Kv = 1300 t/m^2$

3-2 INERTIA AND AREA



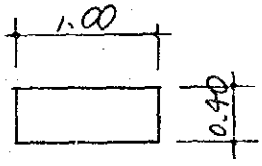
$$I = \frac{1}{12} \times 1.00 \times 0.15^3 = 0.0003\ m^4$$

$$A = 1.00 \times 0.15 = 0.15\ m^2$$



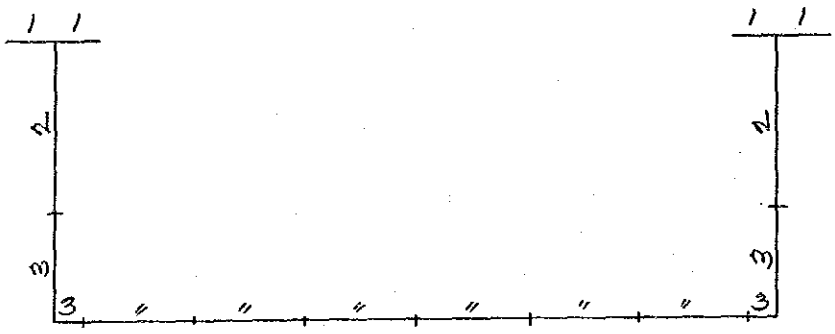
$$I = \frac{1}{12} \times 1.00 \times 0.25^3 = 0.0013\ m^4$$

$$A = 1.00 \times 0.25 = 0.25\ m^2$$



$$I = \frac{1}{12} \times 1.00 \times 0.40^3 = 0.0053\ m^4$$

$$A = 1.00 \times 0.40 = 0.40\ m^2$$



$I_1 = 0.0003\ m^4$ $A_1 = 0.15\ m^2$

$I_2 = 0.0013$ $A_2 = 0.25$

$I_3 = 0.0053$ $A_3 = 0.40$

3-3 CALCULATION OF LOAD

3-3-1 VERTICAL LOAD

(1) SLAB

DEAD LOAD	$0.15 \times 2.5 =$	$0.38\ t/m^2$
LIVE LOAD	$=$	0.30 "
	$W_1 =$	$0.68\ t/m^2$

(2) WALL

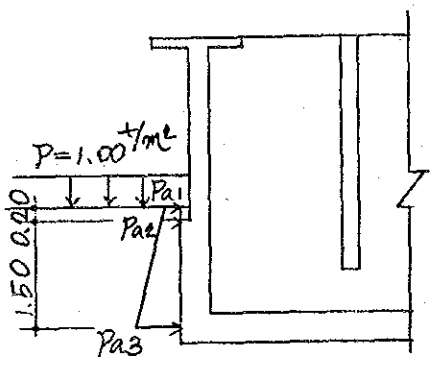
$t = 25$ cm	$P_{W1} = 0.25 \times 2.5 =$	$0.63\ t/m^2$
$t = 40$ "	$P_{W2} = 0.40 \times 2.5 =$	1.00 "

(3) BASE SLAB

DEAD LOAD	$0.40 \times 2.5 =$	$1.00\ t/m^2$
P.L CONCRETE	$0.25 \times 2.3 =$	0.58 "
	$W_2 =$	$1.58\ t/m^2$

WATER LOAD $W_3 = 2.85 \times 1.0 = 2.85\ t/m^2$

3-3-2 EARTH PRESSURE

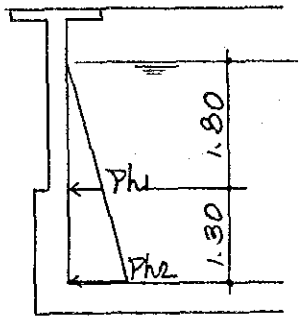


$Pa_1 = 1.00 \times 0.5 = 0.50\ t/m^2$

$Pa_2 = (1.00 + 1.8 \times 0.20) \times 0.5 = 0.68$ "

$Pa_3 = (1.00 + 1.8 \times 1.70) \times 0.5 = 2.03$ "

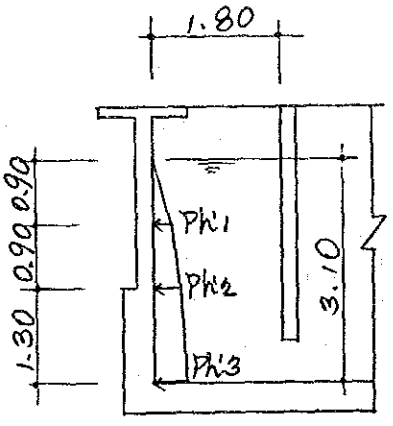
3-3-3 WATER PRESSURE



$Ph_1 = 1.80 \times 1.0 = 1.80\ t/m^2$

$Ph_2 = 3.10 \times 1.0 = 3.10\ "$

3-3-4 DYNAMIC WATER PRESSURE



$$\tanh\left(\sqrt{3} \times \frac{0.90}{3.10}\right) = 0.46$$

$$Ph'1 = \sqrt{3} \times 0.05 \times 1.0 \times 3.10 \times \left\{\frac{0.90}{3.10} - \frac{1}{2} \times \left(\frac{0.90}{3.10}\right)^2\right\} \times 0.46 = 0.03\ t/m^2$$

$$Ph'2 = \sqrt{3} \times 0.05 \times 1.0 \times 3.10 \times \left\{\frac{1.80}{3.10} - \frac{1}{2} \times \left(\frac{1.80}{3.10}\right)^2\right\} \times 0.46 = 0.05\ "$$

$$Ph'3 = \sqrt{3} \times 0.05 \times 1.0 \times 3.10 \times \left\{\frac{3.10}{3.10} - \frac{1}{2} \times \left(\frac{3.10}{3.10}\right)^2\right\} \times 0.46 = 0.06\ "$$

3-3-5 EARTHQUAKE LOAD

$P_{E1} = 0.68\ t/m^2 \times 1.20 \times 0.05 = 0.04\ t$

$P_{E2} = 0.68 \times 1.35 \times 0.05 = 0.05\ "$

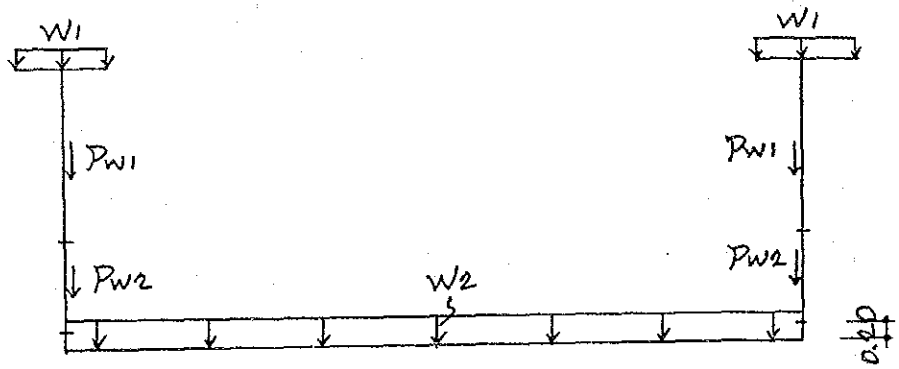
WALL

$W_{E1} = 0.25 \times 2.5 \times 0.05 = 0.03\ t/m^2$

$W_{E2} = 0.40 \times 2.5 \times 0.05 = 0.05\ "$

3-4 LOADING CHART

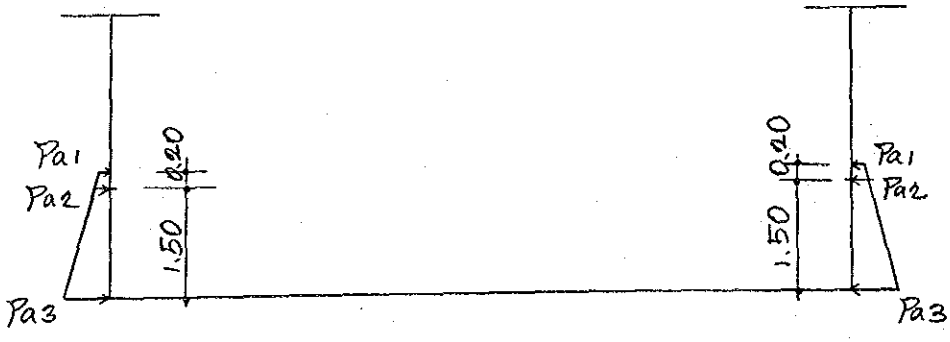
CASE 1 VERTICAL LOAD



$W1 = 0.68\ t/m^2$ $W2 = 1.58\ t/m^2$

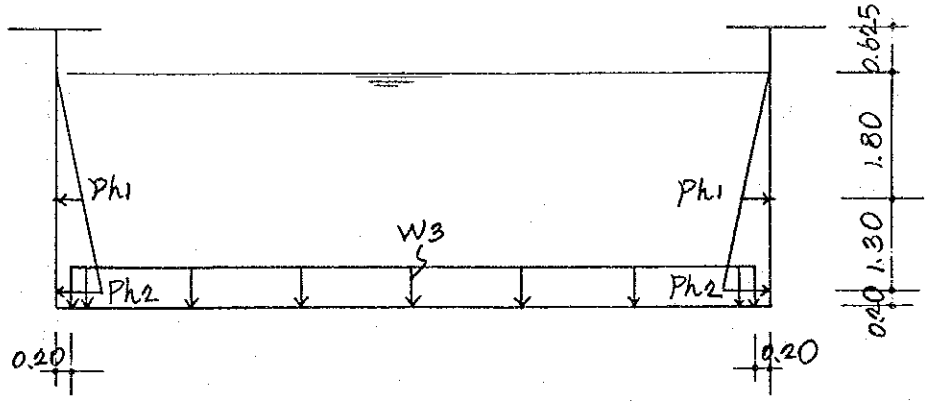
$Pw1 = 0.63\ t/m^2$ $Pw2 = 1.00\ t/m^2$

CASE 2 EARTH PRESSURE



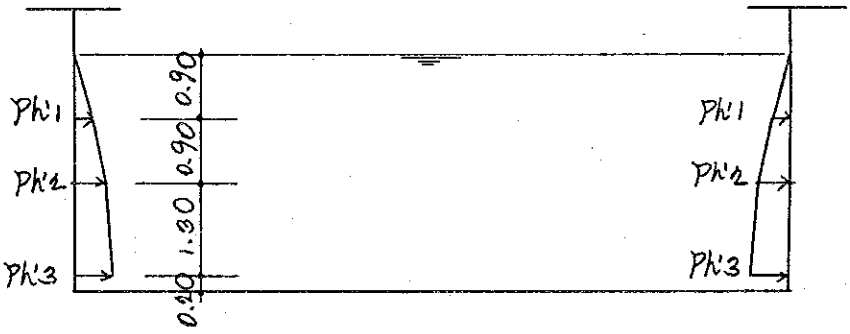
$Pa1 = 0.50\ t/m^2$ $Pa2 = 0.68\ t/m^2$ $Pa3 = 2.03\ t/m^2$

CASE 3 WATER PRESSURE



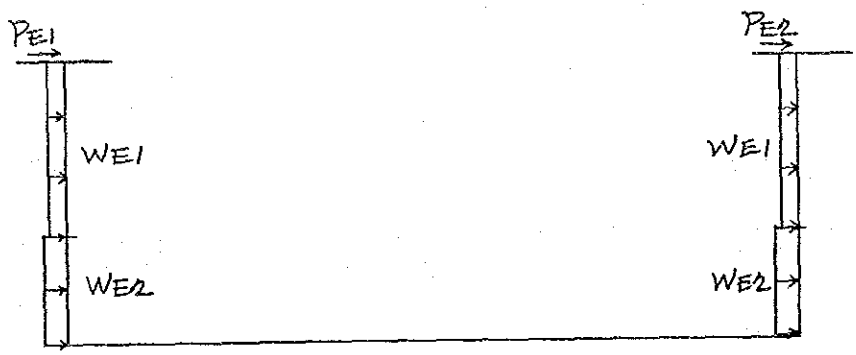
$W3 = 2.85\ t/m^2$ $Ph1 = 1.80\ t/m^2$ $Ph2 = 3.10\ t/m^2$

CASE 4 DYNAMIC WATER PRESSURE



$Ph'1 = 0.03\ t/m^2$ $Ph'2 = 0.05\ t/m^2$ $Ph'3 = 0.06\ t/m^2$

CASE 5 EARTHQUAKE LOAD



$P_{E1} = 0.04^{t}$ $P_{E2} = 0.05^{t}$ $W_{E1} = 0.03^{t/m^2}$ $W_{E2} = 0.05^{t/m^2}$

PERMANENT LOAD

CASE 6 = ① + ②

7 = ① + ② + ③

8 = ① + ③

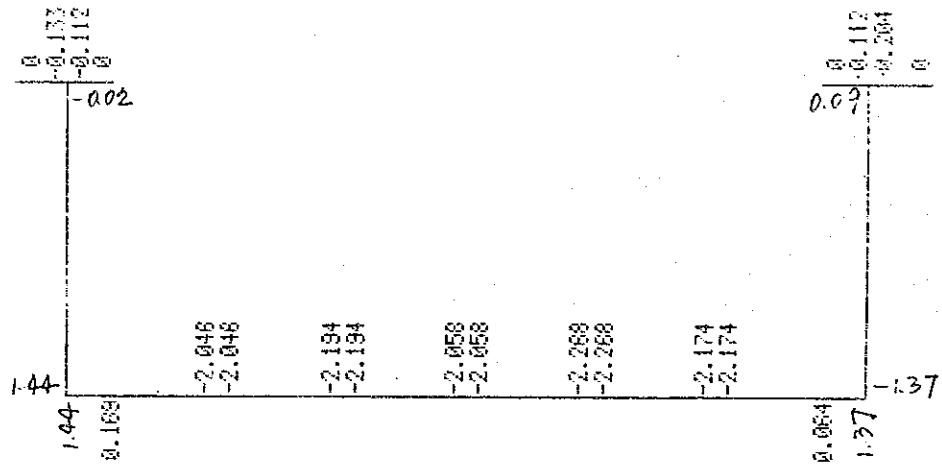
TEMPORARY LOAD ($\alpha = 0.667$)

CASE 9 = ① + ② + ⑤

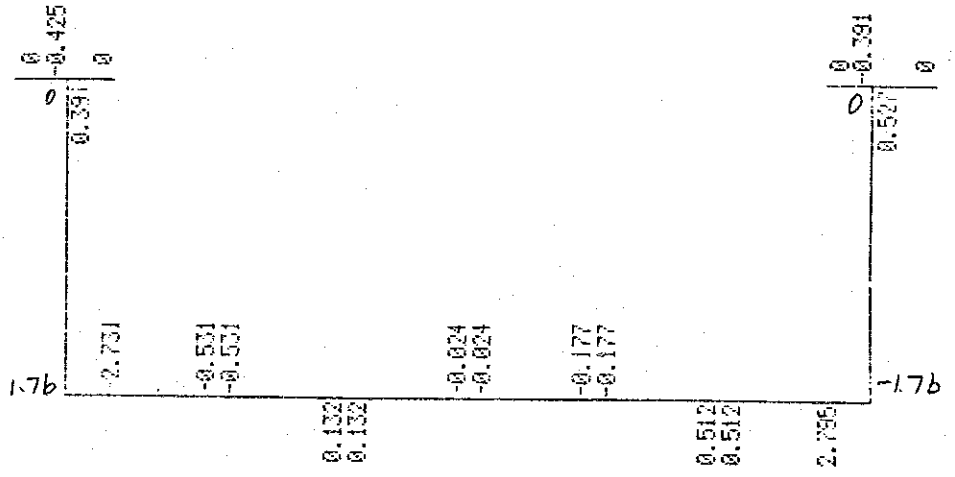
10 = ① + ② + ③ + ④ + ⑤

CASE 6 PERMANENT LOAD

MOMENT

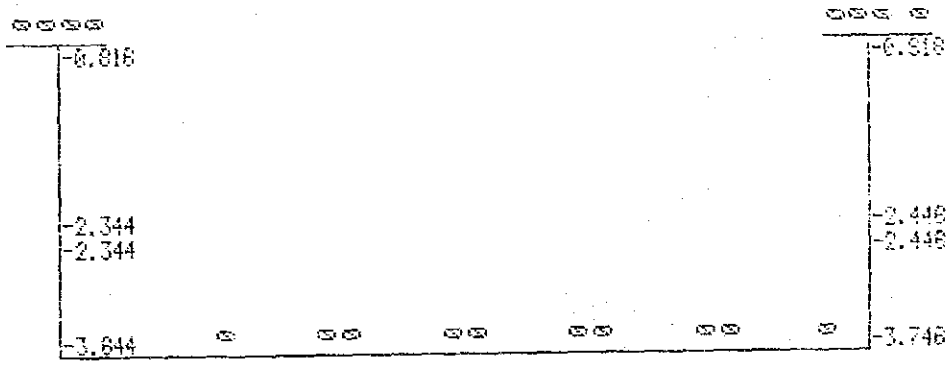


SHEAR



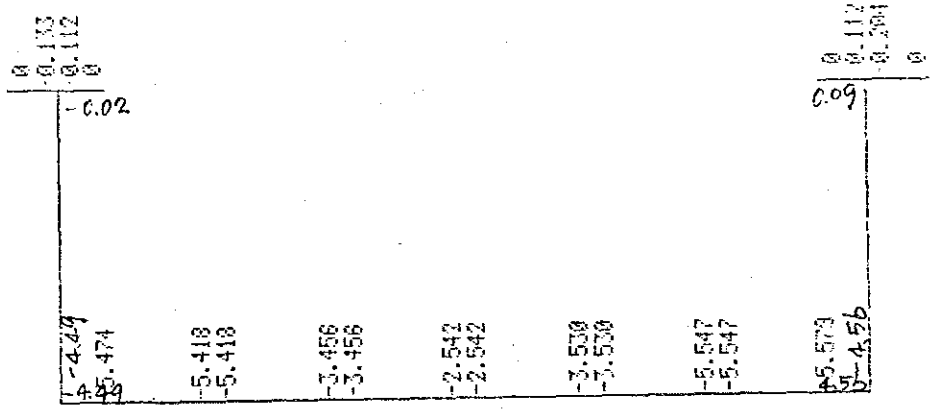
CASE 6 PERMANENT LOAD

AXIAL

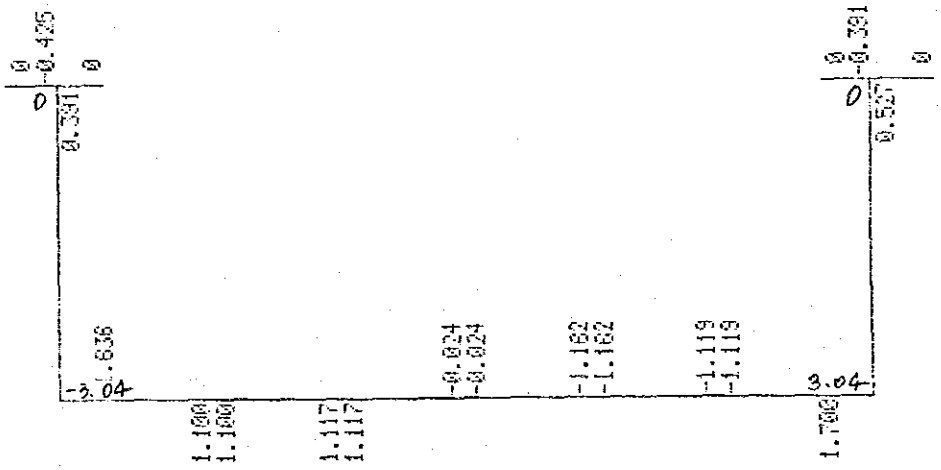


CASE 7 PERMANENT LOAD

MOMENT

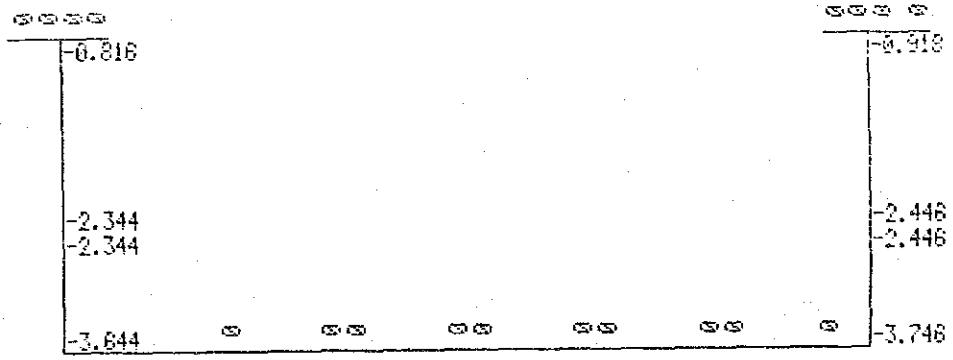


SHEAR



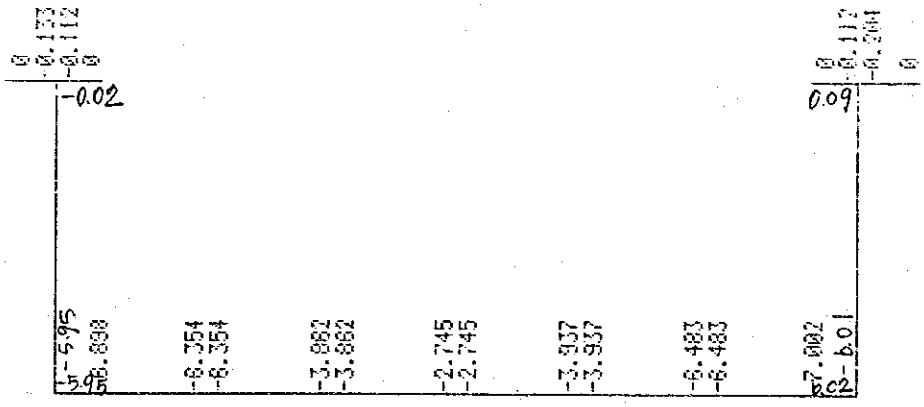
CASE 7 PERMANENT LOAD

AXIAL

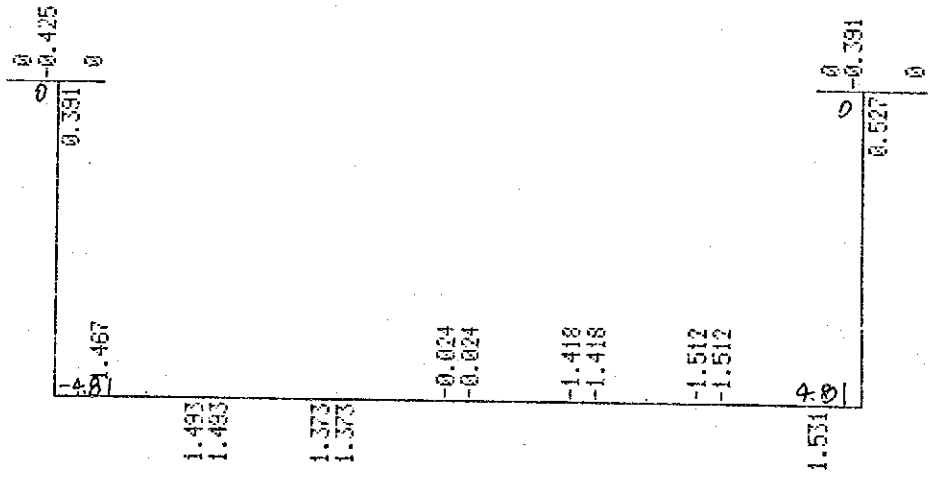


CASE 8 PERMANENT LOAD

MOMENT

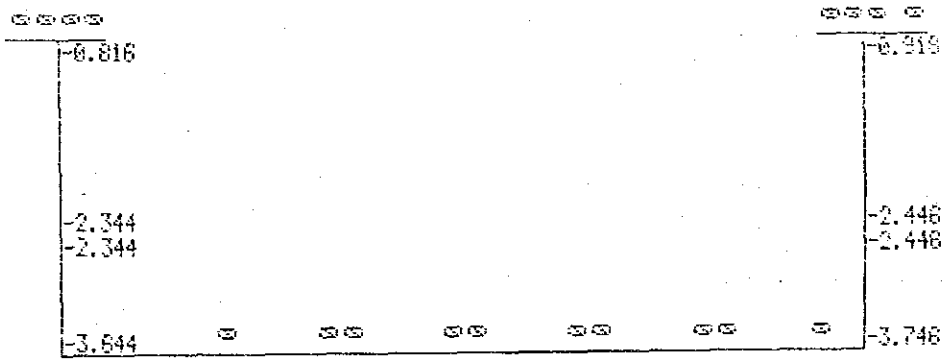


SHEAR



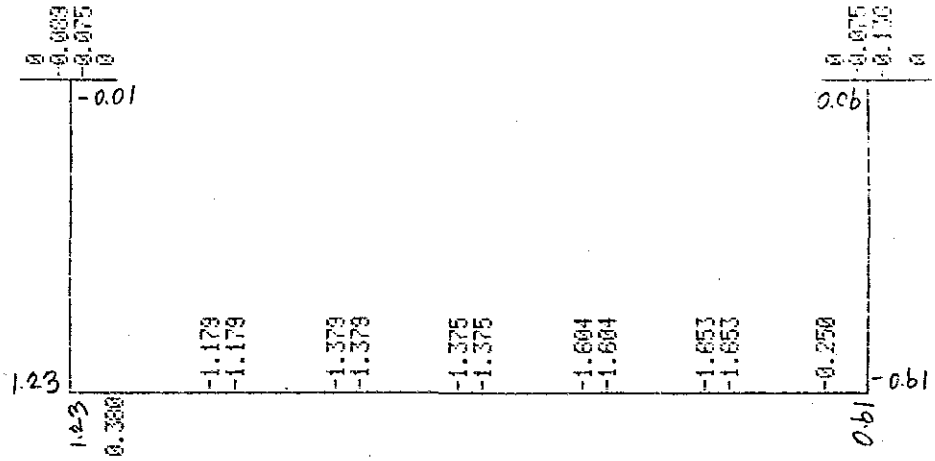
CASE 8 PERMANENT LOAD

AXIAL

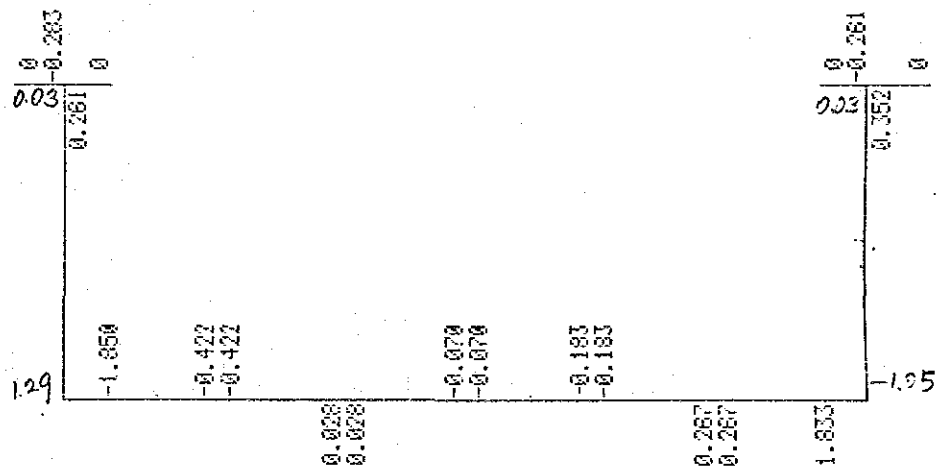


CASE 9 TEMPORARY LOAD

MOMENT

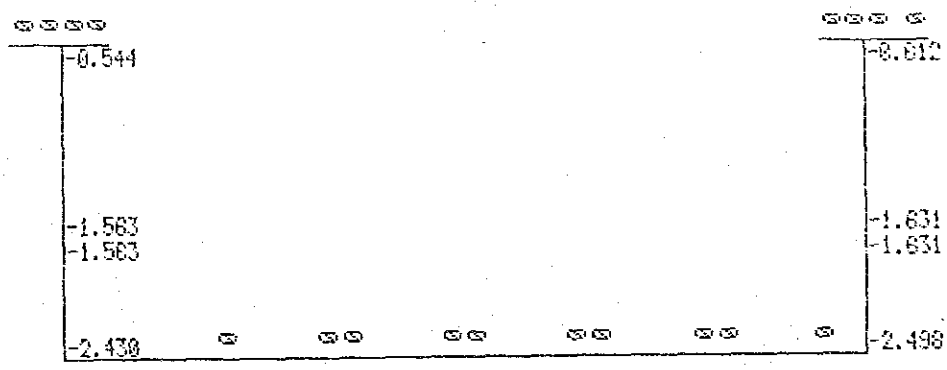


SHEAR



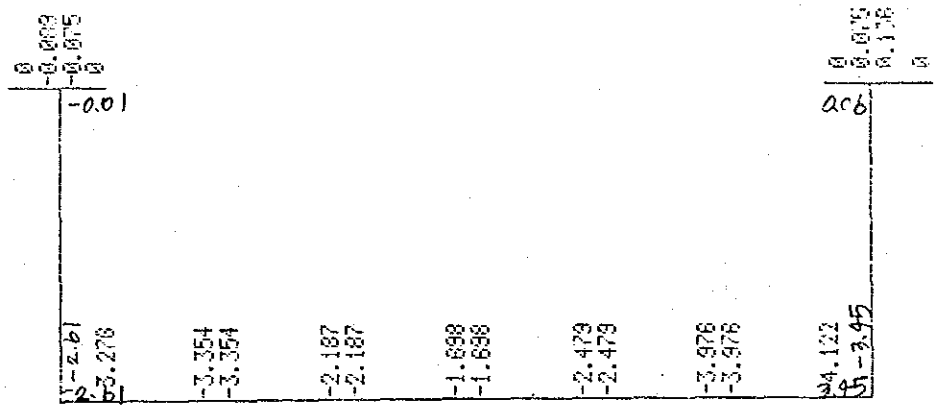
CASE 9 TEMPORARY LOAD

AXIAL

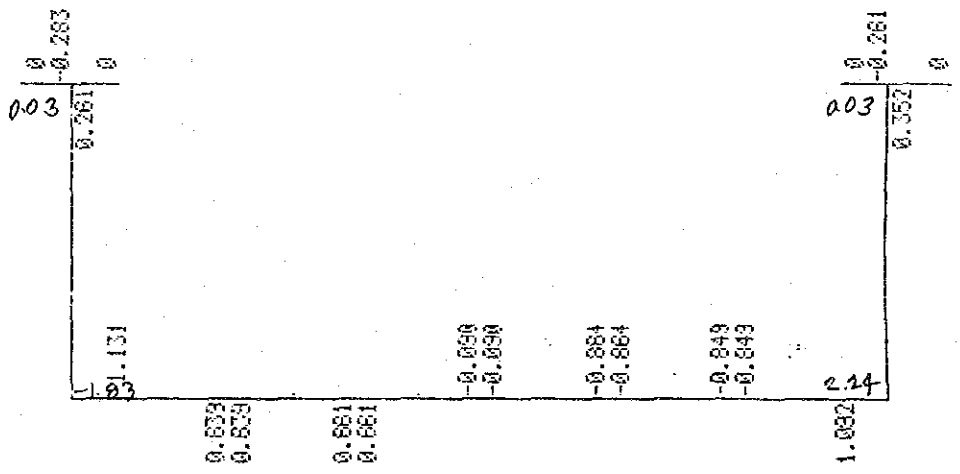


CASE 10 TEMPORARY LOAD

MOMENT

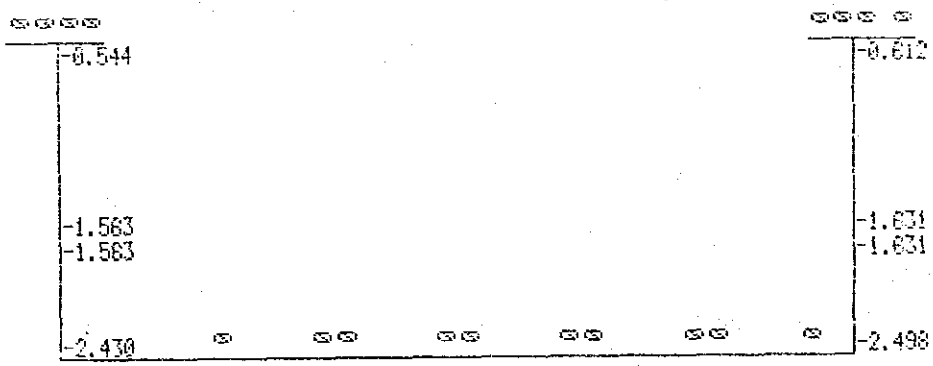


SHEAR



CASE 10 TEMPORARY LOAD

AXIAL



3-5 DESIGN OF SECTION

SLAB

2.14

MOMENT	M	(t·m)	=	0.200	Case 6
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.530	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	15.000	
EFFECTIVE DEPTH	d	(〃)	=	10.000	
CONCRETE COVER	d′	(〃)	=	0.000	
CONCRETE COVER	d″	(〃)	=	5.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	6.330	D13@200 上
AREA OF REINFORCEMENT	As′	(〃)	=	0.000	

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	12.90
TENSILE STRESS	σs	(〃)	=	357.82
SHEARING STRESS	τ	(〃)	=	0.60

WALL

4,16

MOMENT	M	(t·m)	=	0.990	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	1.620	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	25.000	
EFFECTIVE DEPTH	d	(〃)	=	18.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	9.930	D16@200 内
AREA OF REINFORCEMENT	As′	(〃)	=	6.330	D13@200 外

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	21.00
TENSILE STRESS	σs	(〃)	=	615.12
SHEARING STRESS	τ	(〃)	=	1.00

WALL

5,17

MOMENT	M	(t·m)	=	※ 5.060	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	4.810	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	16.270	D16@200+D13@200 内
AREA OF REINFORCEMENT	As′	(〃)	=	9.930	D16@200 外

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	31.26
TENSILE STRESS	σs	(〃)	=	1060.52
SHEARING STRESS	τ	(〃)	=	1.64

BASE
5,6,7,
11,12,17

Case 6

MOMENT	M	(t・m)	=	1.440	
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	2.730	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	29.000	
CONCRETE COVER	d′	(〃)	=	8.000	
CONCRETE COVER	d″	(〃)	=	11.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	9.330	D16@200 下
AREA OF REINFORCEMENT	As′	(〃)	=	16.270	D16@200+D13@200 上

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	14.22
TENSILE STRESS	σs	(〃)	=	582.27
SHEARING STRESS	τ	(〃)	=	1.03

〃

Case 8

MOMENT	M	(t・m)	=	7.000	
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.000	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	32.000	
CONCRETE COVER	d′	(〃)	=	11.000	
CONCRETE COVER	d″	(〃)	=	8.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	16.270	D16@200+D13@200 上
AREA OF REINFORCEMENT	As′	(〃)	=	9.330	D16@200 下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	47.91
TENSILE STRESS	σs	(〃)	=	1500.50
SHEARING STRESS	τ	(〃)	=	0.00

BASE 8,9,10

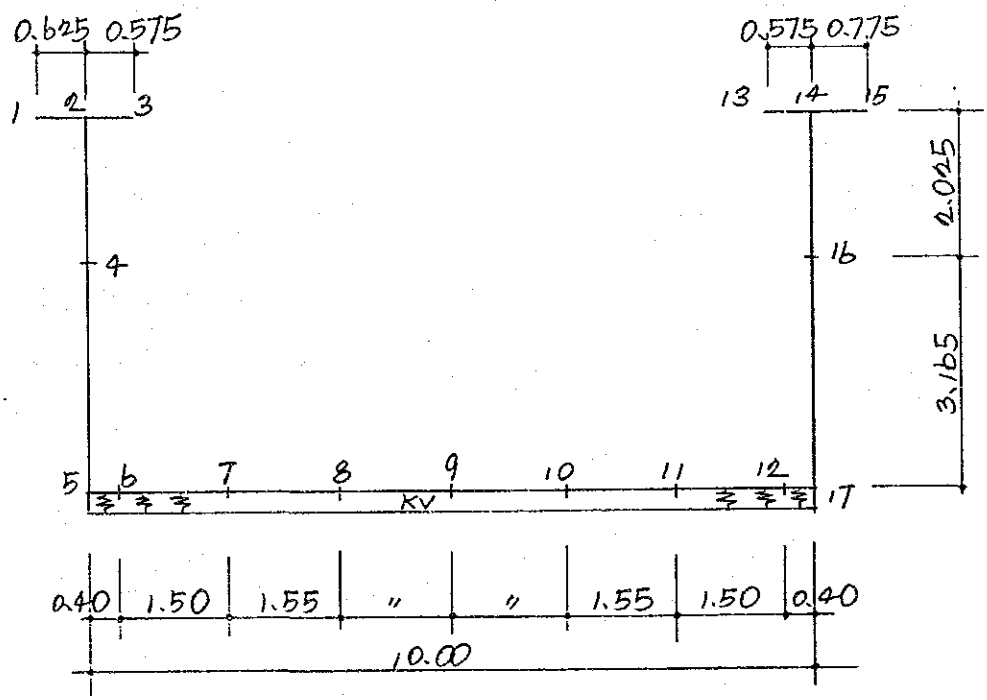
Case 8

MOMENT	M	(t·m)	=	3.940	
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	0.000	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	32.000	
CONCRETE COVER	d′	(〃)	=	11.000	
CONCRETE COVER	d″	(〃)	=	8.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	9.930	D16@200 上
AREA OF REINFORCEMENT	As′	(〃)	=	9.330	〃 下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	33.12
TENSILE STRESS	σs	(〃)	=	1329.38
SHEARING STRESS	τ	(〃)	=	0.00

4. FRAME OF SECTION ③-③

4-1 DIMENTION OF FRAME



$$Kv = Kv0 \left(\frac{Bv}{30}\right)^{-3/4}$$

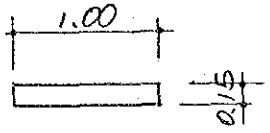
$$Kv0 = \frac{1}{30} \times 1 \times 28 \times 20 = 18.69^{kg/cm^3}$$

$$Bv = \sqrt{3634 \times 1040} = 1944^{cm}$$

$$Kv = 18.67 \times \left(\frac{1944}{30}\right)^{-3/4} = 0.82^{kg/cm^3} = 820^{t/m^3}$$

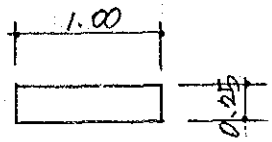
$$Kv = 820 \times 1.00^{m} = 820^{t/m^2}$$

4-2 INERTIA AND AREA



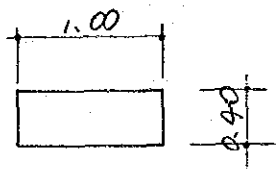
$I = \frac{1}{12} \times 1.00 \times 0.15^3 = 0.0003\ m^4$

$A = 1.00 \times 0.15 = 0.15\ m^2$



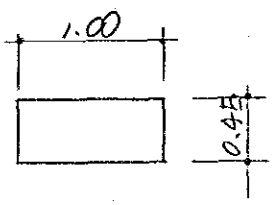
$I = \frac{1}{12} \times 1.00 \times 0.25^3 = 0.0013\ m^4$

$A = 1.00 \times 0.25 = 0.25\ m^2$



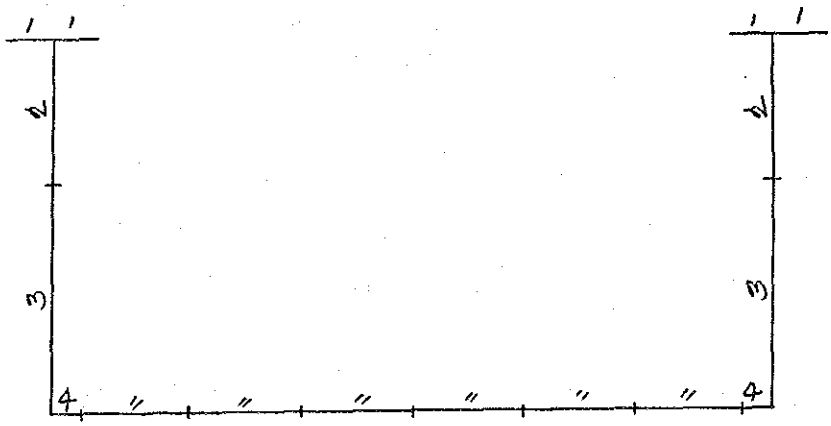
$I = \frac{1}{12} \times 1.00 \times 0.40^3 = 0.0053\ m^4$

$A = 1.00 \times 0.40 = 0.40\ m^2$



$I = \frac{1}{12} \times 1.00 \times 0.45^3 = 0.0076\ m^4$

$A = 1.00 \times 0.45 = 0.45\ m^2$



$I_1 = 0.0003\ m^4$ $A_1 = 0.15\ m^2$ $I_2 = 0.0013$ $A_2 = 0.25$

$I_3 = 0.0053$ $A_3 = 0.40$ $I_4 = 0.0076$ $A_4 = 0.45$

4-3 CALCULATION OF LOAD

4-3-1 VERTICAL LOAD

(1) SLAB

DEAD LOAD	$0.15 \times 2.5 =$	$0.38\ t/m^2$
LIVE LOAD	$=$	$0.30\ "$
	$W_1 =$	$0.68\ t/m^2$

(2) WALL

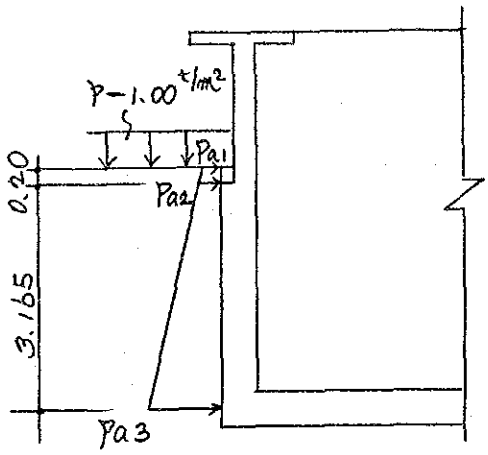
$t = 25cm$	$P_{W1} = 0.25 \times 2.5 =$	$0.63\ t/m^2$
$t = 40\ "$	$P_{W2} = 0.40 \times 2.5 =$	$1.00\ "$

(3) BASE SLAB

DEAD LOAD	$0.45 \times 2.5 =$	$1.13\ t/m^2$
P.L CONCRETE	$0.15 \times 2.3 =$	$0.35\ "$
	$W_2 =$	$1.48\ t/m^2$

WATER LOAD $W_3 = 4.35 \times 1.0 = 4.35\ t/m^2$

4-3-2 EARTH PRESSURE

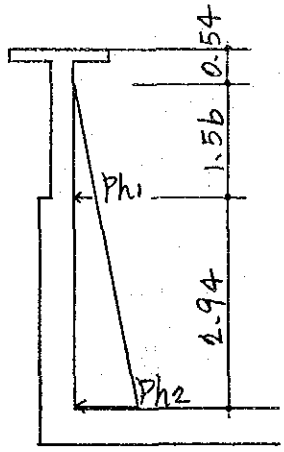


$Pa_1 = 1.00 \times 0.5 = 0.50\ t/m^2$

$Pa_2 = (1.00 + 1.8 \times 0.20) \times 0.5 = 0.68$ "

$Pa_3 = (1.00 + 1.8 \times 3.365) \times 0.5 = 3.53$ "

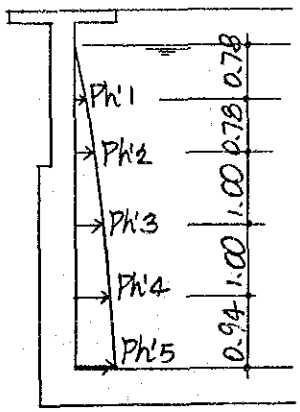
4-3-3 WATER PRESSURE



$Ph_1 = 1.56 \times 1.0 = 1.56\ t/m^2$

$Ph_2 = 4.50 \times 1.0 = 4.50$"

4-3-4 DYNAMIC WATER PRESSURE



$$\tanh\left(\sqrt{3} \times \frac{4.80}{4.50}\right) = 0.95 \rightarrow 1.0$$

$$Ph'1 = \sqrt{3} \times 0.05 \times 1.0 \times 4.50 \times \left\{\frac{0.78}{4.50} - \frac{1}{2} \times \left(\frac{0.78}{4.50}\right)^2\right\} = 0.06\ t/m^2$$

$$Ph'2 = \sqrt{3} \times 0.05 \times 1.0 \times 4.50 \times \left\{\frac{1.56}{4.50} - \frac{1}{2} \times \left(\frac{1.56}{4.50}\right)^2\right\} = 0.11\ "$$

$$Ph'3 = \sqrt{3} \times 0.05 \times 1.0 \times 4.50 \times \left\{\frac{2.56}{4.50} - \frac{1}{2} \times \left(\frac{2.56}{4.50}\right)^2\right\} = 0.16\ "$$

$$Ph'4 = \sqrt{3} \times 0.05 \times 1.0 \times 4.50 \times \left\{\frac{3.56}{4.50} - \frac{1}{2} \times \left(\frac{3.56}{4.50}\right)^2\right\} = 0.19\ "$$

$$Ph'5 = \sqrt{3} \times 0.05 \times 1.0 \times 4.50 \times \left\{\frac{4.50}{4.50} - \frac{1}{2} \times \left(\frac{4.50}{4.50}\right)^2\right\} = 0.19\ "$$

4-3-5 EARTHQUAKE LOAD

$P_{E1} = 0.68\ t/m^2 \times 1.20 \times 0.05 = 0.04\ t$

$P_{E2} = 0.68 \times 1.35 \times 0.05 = 0.05$ "

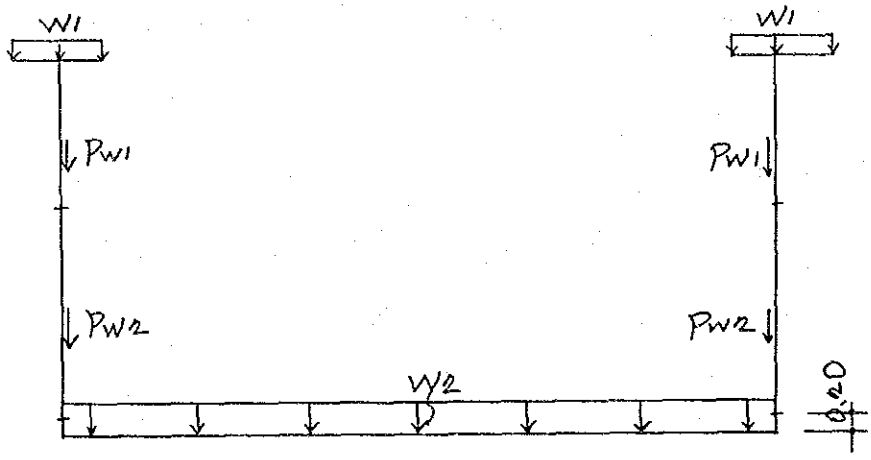
WALL

$W_{E1} = 0.25 \times 2.5 \times 0.05 = 0.03\ t/m^2$

$W_{E2} = 0.90 \times 2.5 \times 0.05 = 0.05$ "

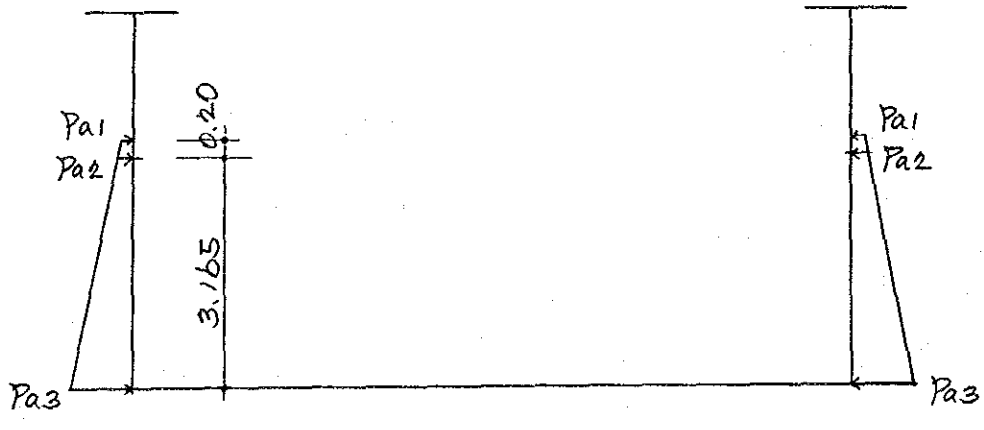
4-4 LOADING CHART

CASE 1 VERTICAL LOAD



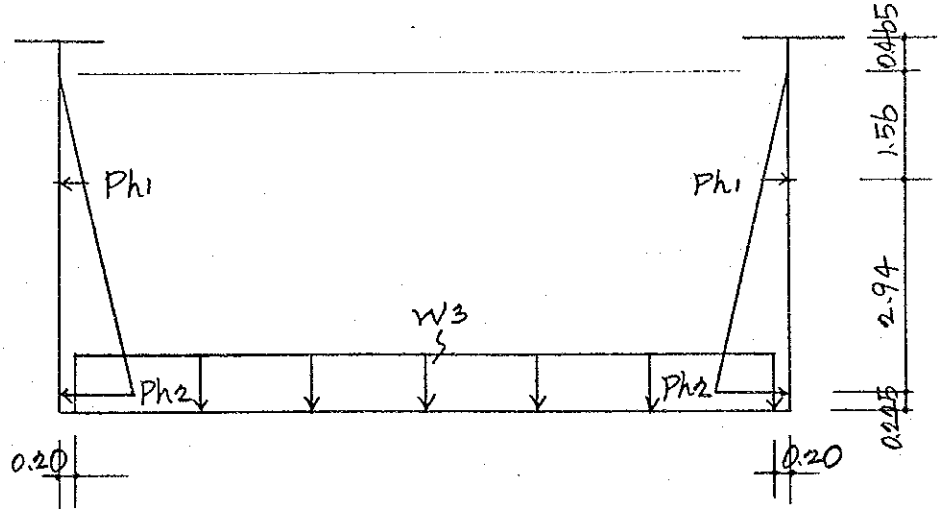
$W_1 = 0.68^{t}/m^2$ $W_2 = 1.48^{t}/m^2$ $P_{W1} = 0.63^{t}/m^2$ $P_{W2} = 1.00^{t}/m^2$

CASE 2 EARTH PRESSURE



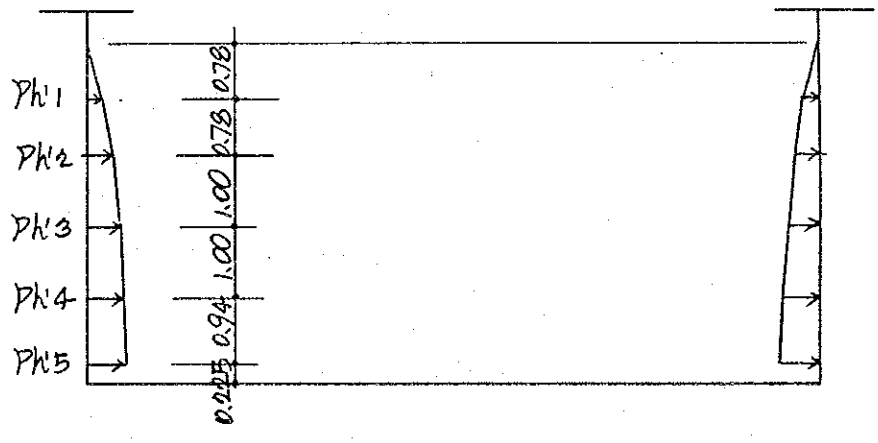
$P_{a1} = 0.50^{t}/m^2$ $P_{a2} = 0.68^{t}/m^2$ $P_{a3} = 3.53^{t}/m^2$

CASE 3 WATER PRESSURE



$W3 = 4.35\ t/m^2$ $Ph1 = 1.56\ t/m^2$ $Ph2 = 4.50\ t/m^2$

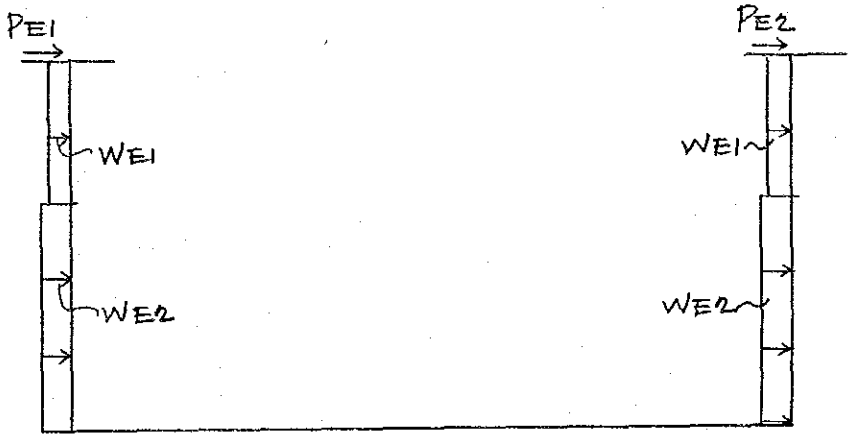
CASE 4 DYNAMIC WATER PRESSURE



$Ph'1 = 0.06\ t/m^2$ $Ph'2 = 0.11\ t/m^2$ $Ph'3 = 0.16\ t/m^2$

$Ph'4 = 0.19\ t/m^2$ $Ph'5 = 0.19\ t/m^2$

CASE 5 EARTHQUAKE LOAD



$P_{E1} = 0.04^{t}$ $P_{E2} = 0.05^{t}$ $W_{E1} = 0.03^{t/m^2}$ $W_{E2} = 0.05^{t/m^2}$

PERMANENT LOAD

CASE 6 = ① + ②

7 = ① + ② + ③

8 = ① + ③

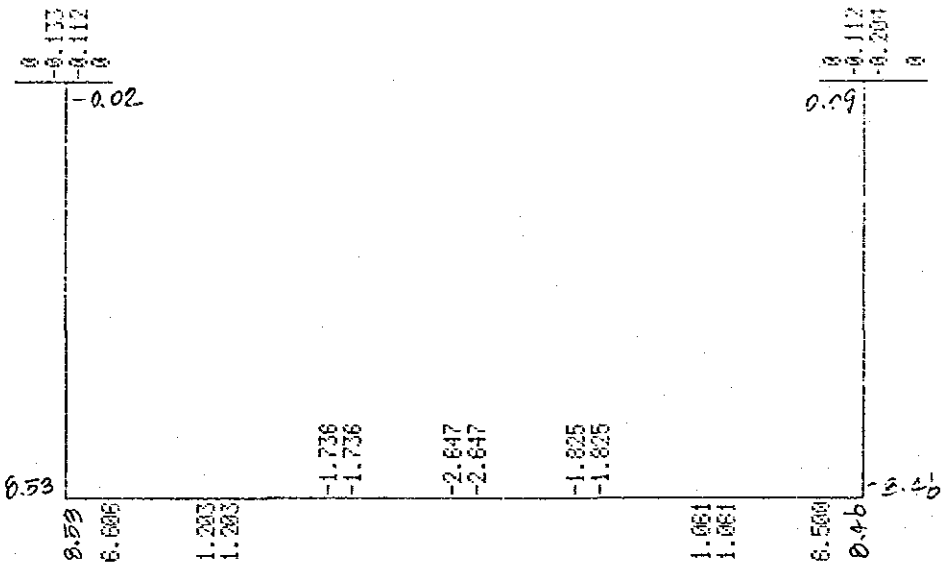
TEMPORARY LOAD ($\alpha = 0.667$)

CASE 9 = ① + ② + ⑤

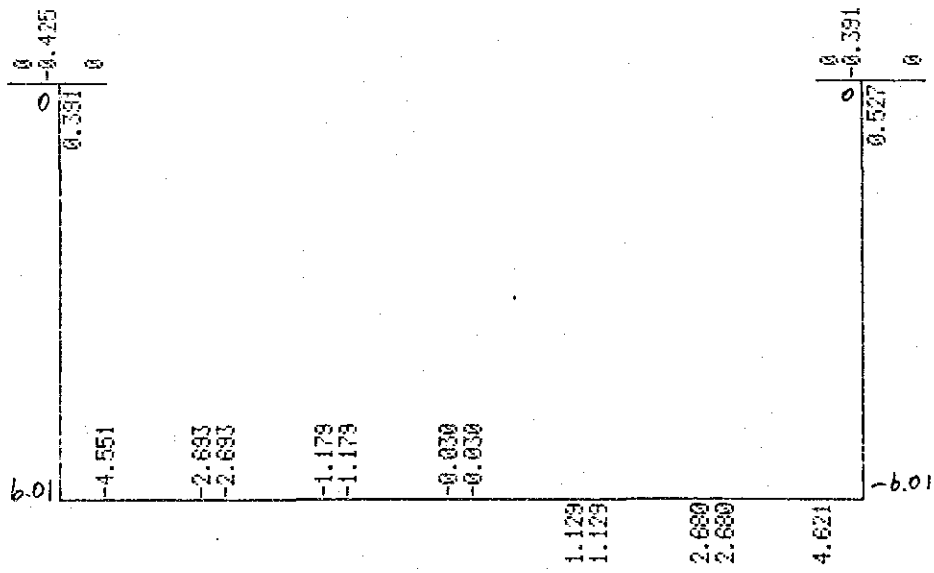
10 = ① + ② + ③ + ④ + ⑤

CASE 6 PERMANENT LOAD

MOMENT

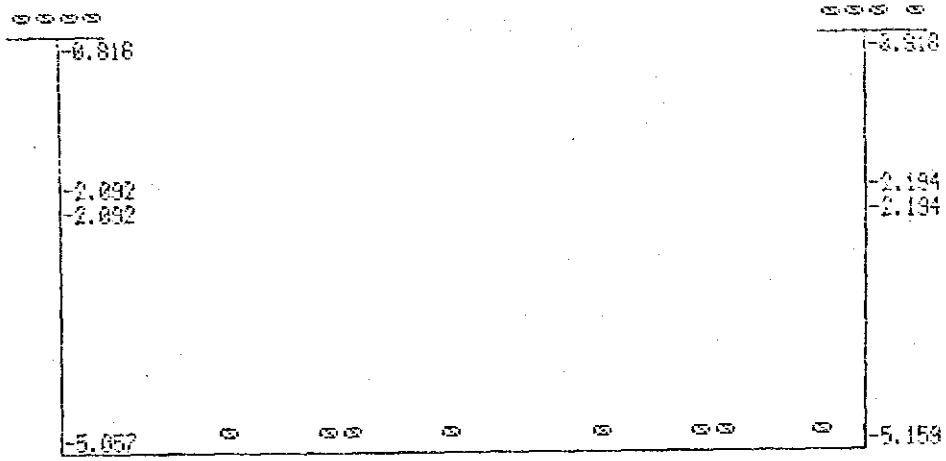


SHEAR



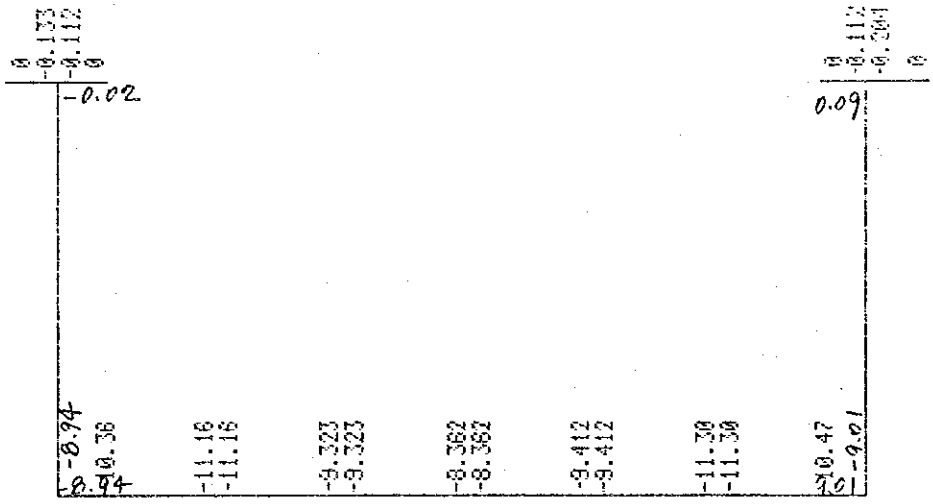
CASE 6 PERMANENT LOAD

AXIAL

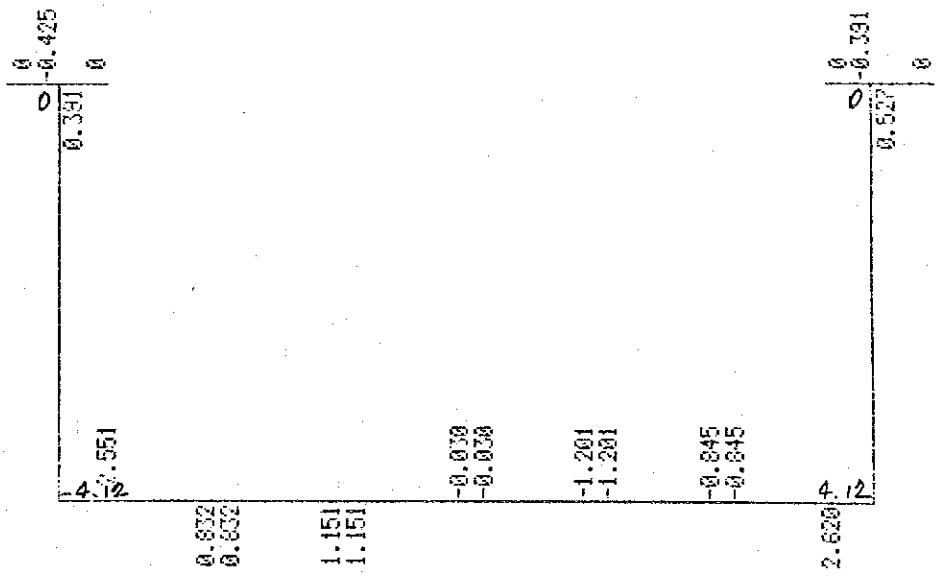


CASE 7 PERMANENT LOAD

MOMENT

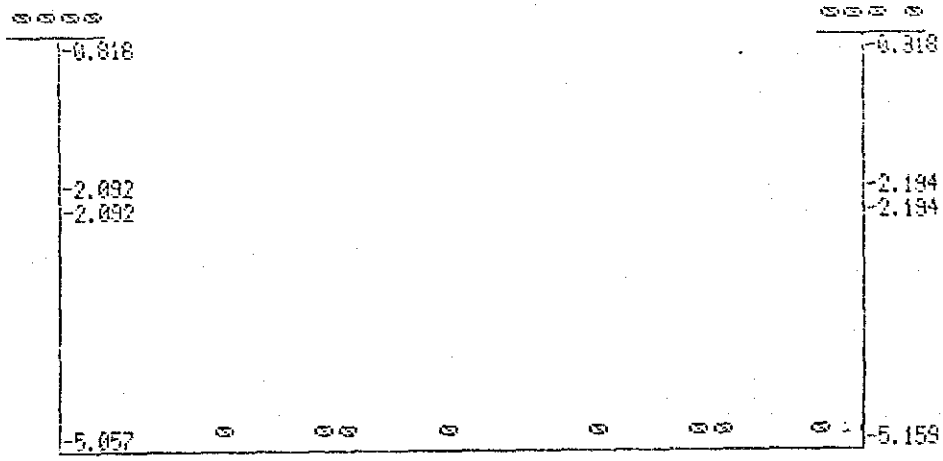


SHEAR



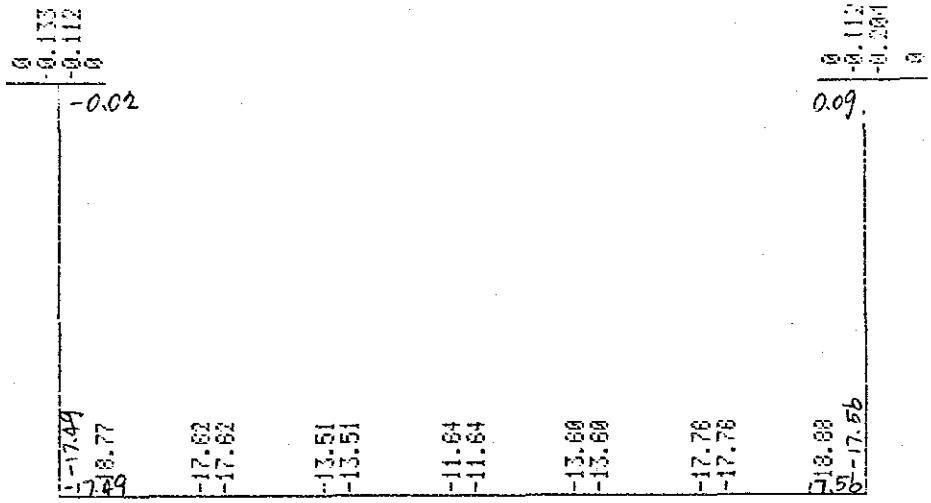
CASE 7 PERMANENT LOAD

AXIAL

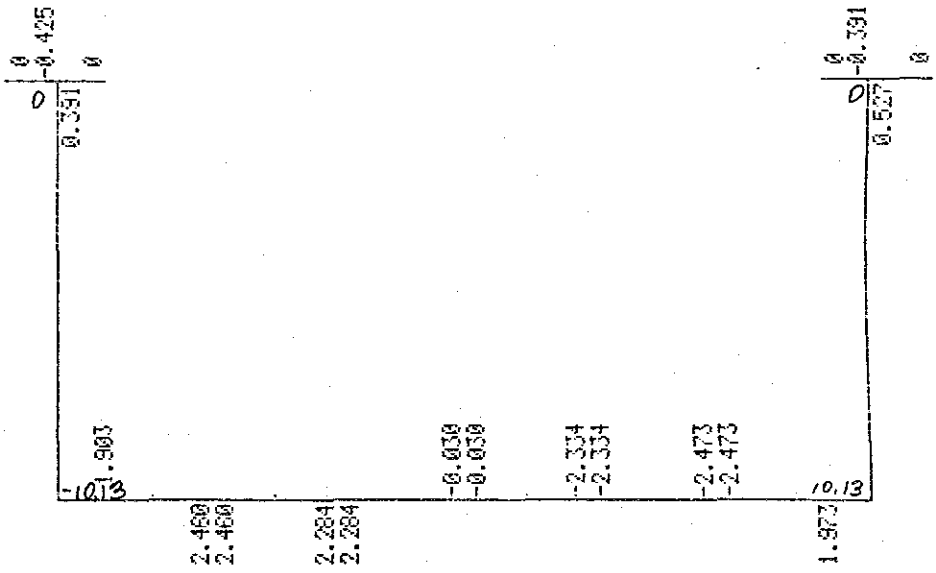


CASE 8 PERMANENT LOAD

MOMENT

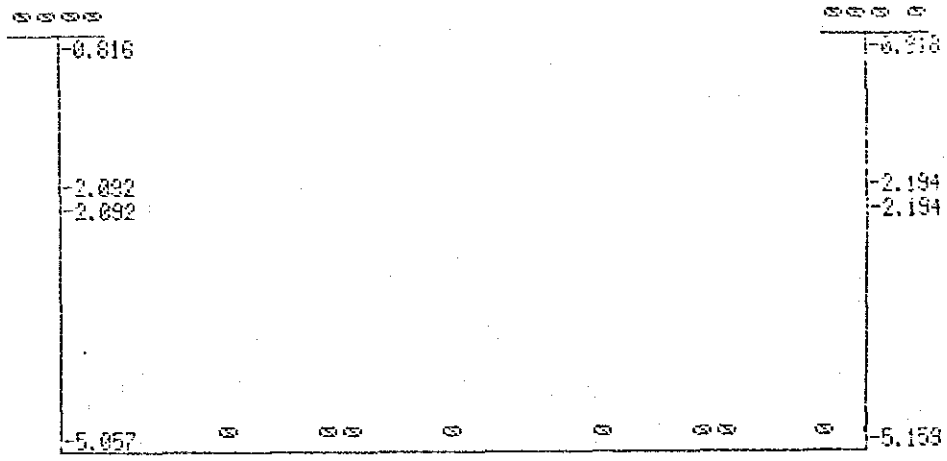


SHEAR



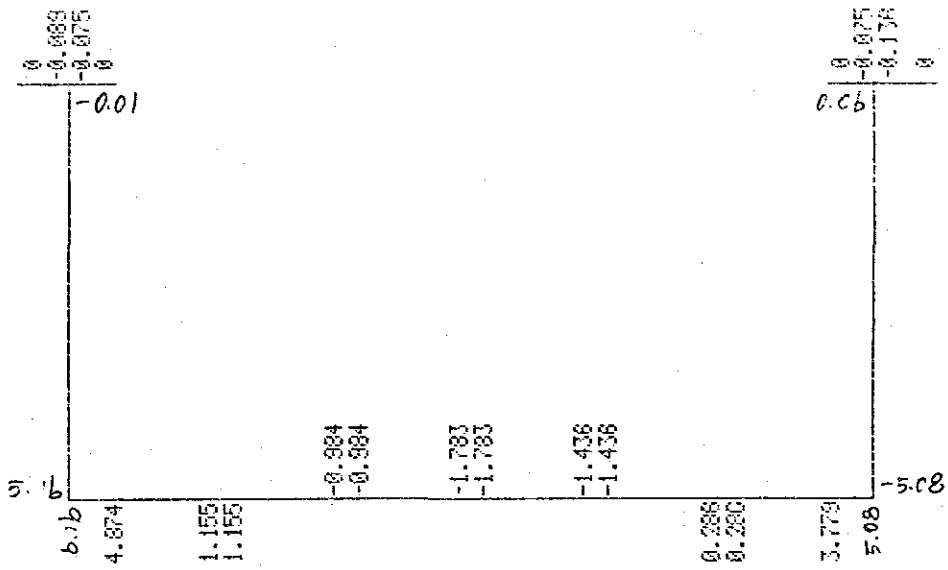
CASE 8 PERMANENT LOAD

AXIAL

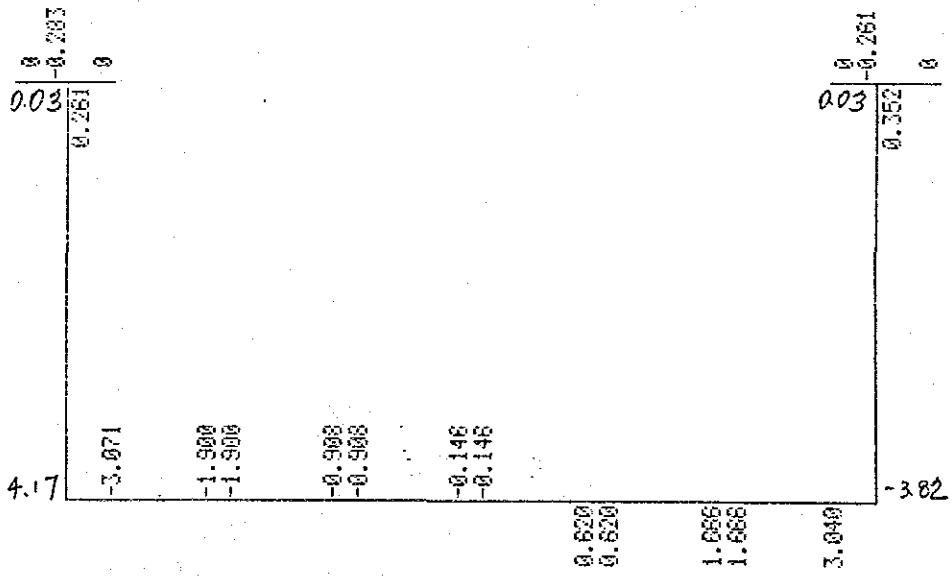


CASE 9 TEMPORARY LOAD

MOMENT

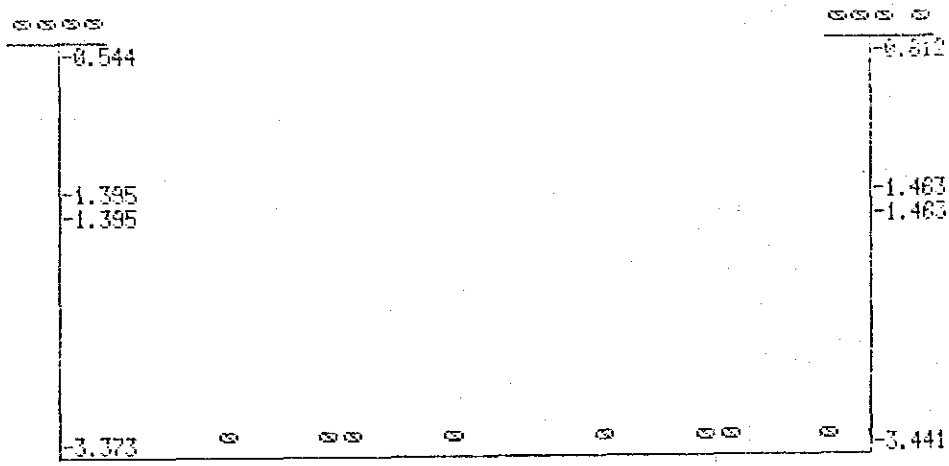


SHEAR



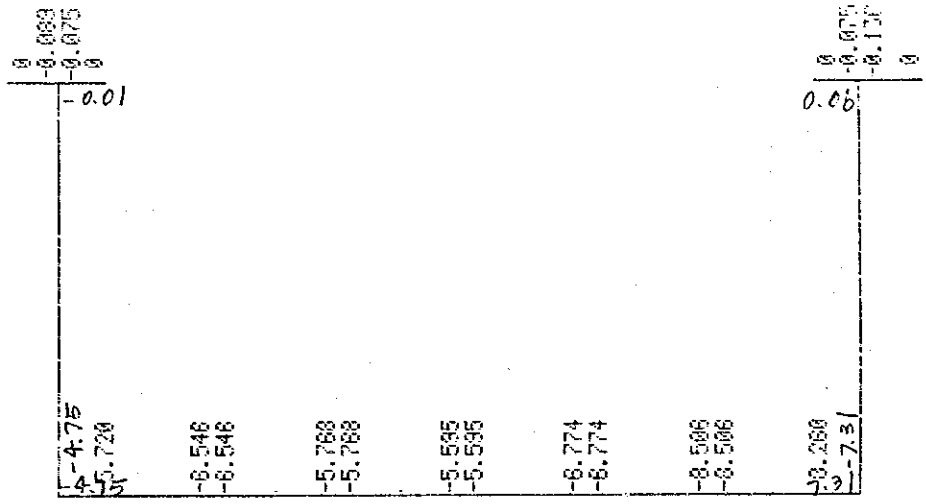
CASE 9 TEMPORARY LOAD

AXIAL

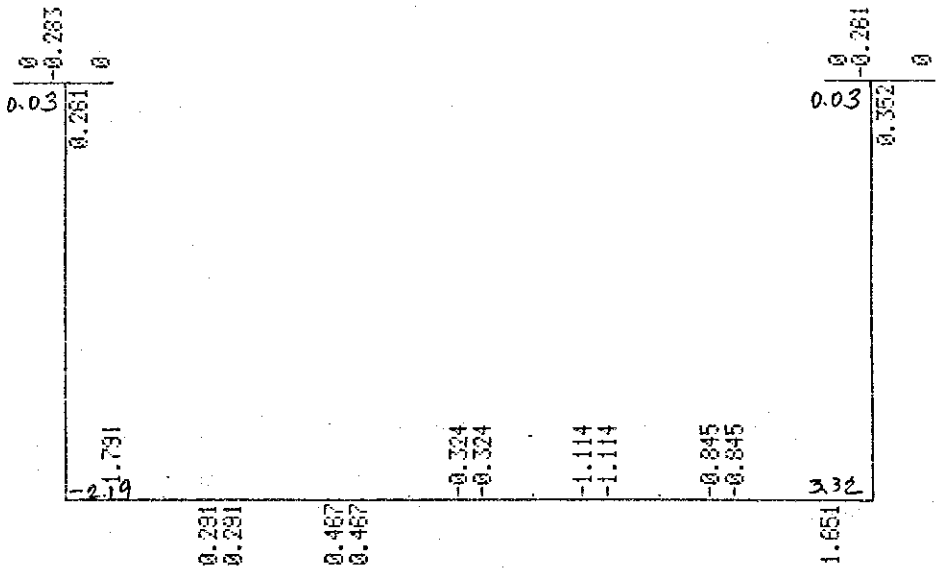


CASE/0 TEMPORARY LOAD

MOMENT

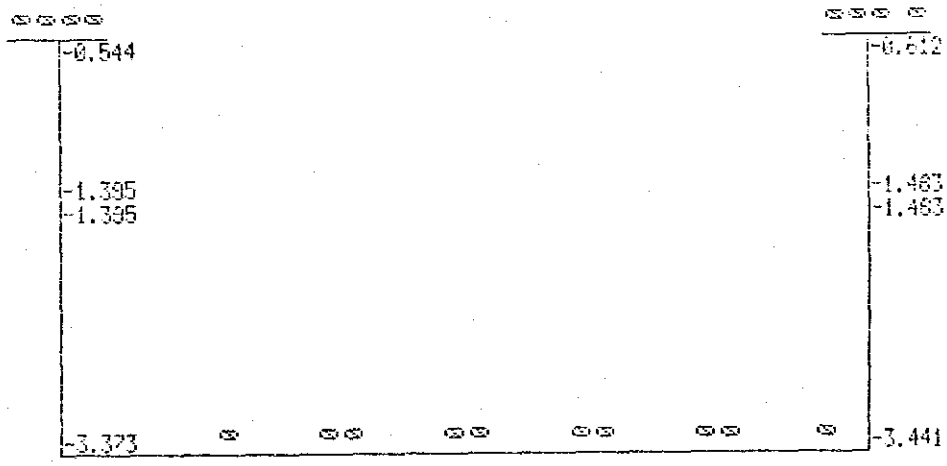


SHEAR



CASE 10 TEMPORARY LOAD

AXIAL



4-5 DESIGN OF SECTION

SLAB 2,14 Case 6

MOMENT	M	(t·m)	=	0.200
AXIAL FORCE	N	(t)	=	0.000
SHEAR FORCE	S	(t)	=	0.530
WIDTH	b	(cm)	=	100.000
DEPTH	h	(〃)	=	15.000
EFFECTIVE DEPTH	d	(〃)	=	10.000
CONCRETE COVER	d′	(〃)	=	0.000
CONCRETE COVER	d″	(〃)	=	5.000
MODULAR RATIO	n=Es/Ec		=	15
AREA OF REINFORCEMENT	As	(cm2)	=	6.330 D13@200上
AREA OF REINFORCEMENT	As′	(〃)	=	0.000

COMPRESSIVE STRESS	σc	(Kg/cm2)	= 12.90
TENSILE STRESS	σs	(〃)	= 357.82
SHEARING STRESS	τ	(〃)	= 0.60

WALL

4,16						
MOMENT	M	(t·m)	=	0.730	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	1.220	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	25.000	
EFFECTIVE DEPTH	d	(〃)	=	18.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	9.930	D16@200 内
AREA OF REINFORCEMENT	As′	(〃)	=	6.330	D13@200 外

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	15.48
TENSILE STRESS	σs	(〃)	=	453.57
SHEARING STRESS	τ	(〃)	=	0.75

WALL

5,17						
MOMENT	M	(t·m)	=	※15.280	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	10.130	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	33.680	D19@200+D22@200 内
AREA OF REINFORCEMENT	As′	(〃)	=	19.860	D16@100 外

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	69.10
TENSILE STRESS	σs	(〃)	=	1599.93
SHEARING STRESS	τ	(〃)	=	3.59

WALL

5,17

MOMENT	M	(t·m)	=	8.530	Case b
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	6.010	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	40.000	
EFFECTIVE DEPTH	d	(〃)	=	33.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	19.860	D16@100 外
AREA OF REINFORCEMENT	As′	(〃)	=	33.680	D19@200+D22@200 内

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	44.46
TENSILE STRESS	σs	(〃)	=	1493.86
SHEARING STRESS	τ	(〃)	=	2.09

BASE
5,6,7,
11,12,17

MOMENT	M	(t·m)	=	8.530	Case 6
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	4.620	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	45.000	
EFFECTIVE DEPTH	d	(〃)	=	35.000	
CONCRETE COVER	d′	(〃)	=	7.000	
CONCRETE COVER	d″	(〃)	=	10.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	19.860	D16@100 下
AREA OF REINFORCEMENT	As′	(〃)	=	38.710	D22@100 上

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	39.41
TENSILE STRESS	σs	(〃)	=	1403.74
SHEARING STRESS	τ	(〃)	=	1.51

MOMENT	M	(t·m)	=	18.880	Case 8
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	2.470	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	45.000	
EFFECTIVE DEPTH	d	(〃)	=	38.000	
CONCRETE COVER	d′	(〃)	=	10.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	38.710	D22@100 上
AREA OF REINFORCEMENT	As′	(〃)	=	19.860	D16@100 下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	67.46
TENSILE STRESS	σs	(〃)	=	1508.53
SHEARING STRESS	τ	(〃)	=	0.76

BASE

8,9,10 Case 8

MOMENT	M	(t・m)	=	13.600	
AXIAL FORCE	N	(t)	=	0.000	
SHEAR FORCE	S	(t)	=	2.330	
WIDTH	b	(cm)	=	100.000	
DEPTH	h	(〃)	=	45.000	
EFFECTIVE DEPTH	d	(〃)	=	38.000	
CONCRETE COVER	d′	(〃)	=	10.000	
CONCRETE COVER	d″	(〃)	=	7.000	
MODULAR RATIO	n=Es/Ec		=	15	
AREA OF REINFORCEMENT	As	(cm2)	=	29.290	D22@200+D16@200上
AREA OF REINFORCEMENT	As′	(〃)	=	9.930	D16@200下

COMPRESSIVE STRESS	σc	(Kg/cm2)	=	55.17
TENSILE STRESS	σs	(〃)	=	1406.95
SHEARING STRESS	τ	(〃)	=	0.70