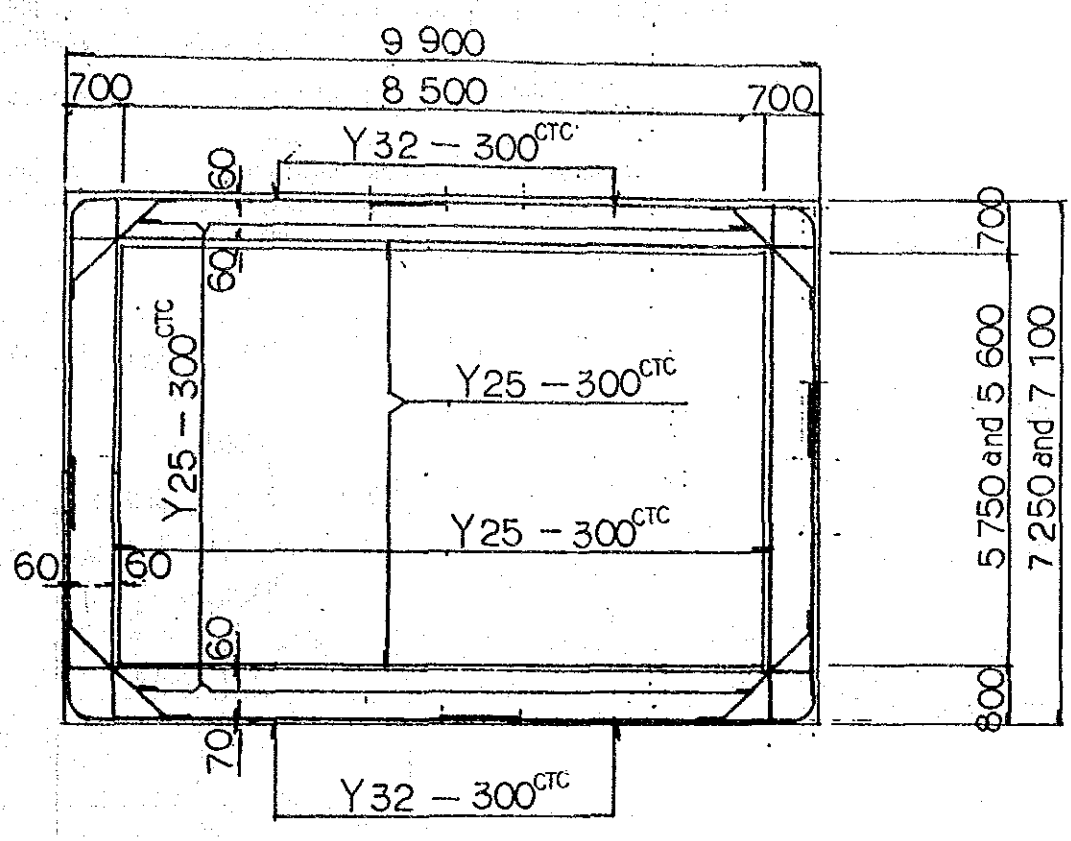
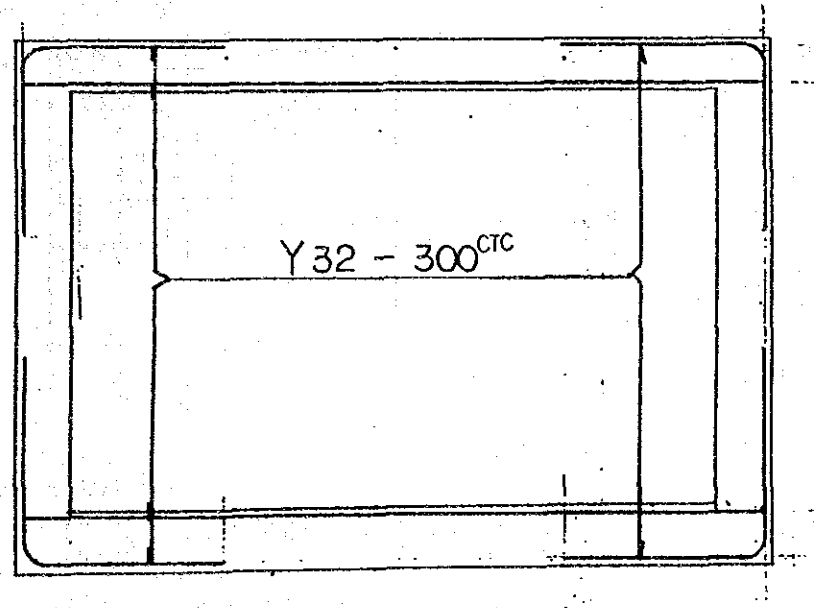
NO④⑤⑥ BOX CULVERT FOR ROAD





NO④ BOX FOR ROAD

(similar Box - NO⑤, NO⑥)

B. Type-2 D= 2.000 m

(1)Dead load

a)vertical load ----- (case-1)

For upper slab $w1 = 22.6\times0.50+19.6\times1.50+23.6\times0.70 = 57.220$ kN/m

For side wall $w2 = 23.6\times0.70 = 16.520$ 〃

For bottom slab $W3 = 57.220 + \dfrac{2\times16.520\times6.40}{9.20} = 80.204$ 〃

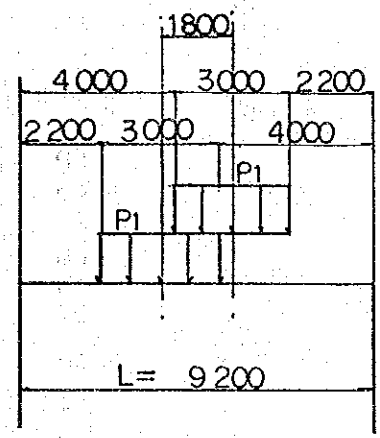
b)Horizontal load --- earth pressure ----- (case-2)

For side wall $P1 = (22.6\times0.50+19.60\times1.85)\times0.500 = 23.780$ kN/m

$P2 = (22.6\times0.50+19.60\times8.25)\times0.500 = 86.500$ 〃

(2)Live load

a) Vertical load of center ------- (case-3)



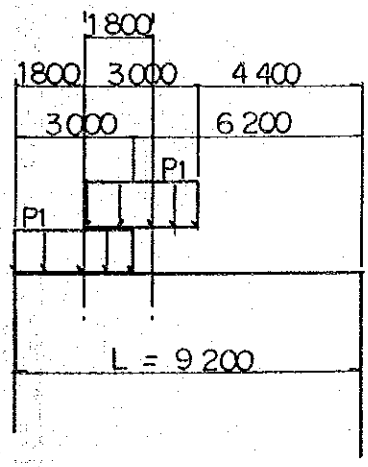
$B = 0.300+2.000+0.700 = 3.000$ m

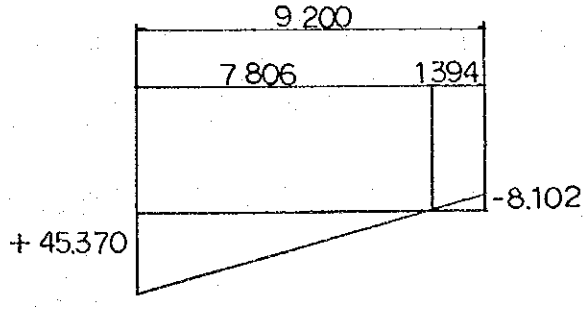
$$P1 = \frac{10\ (\text{kN/axle}) \times 30\ (\text{unit})}{3.50 \times B} = \frac{10 \times 30}{3.50 \times 3.00} = 28.572\ \text{KN/m}$$

For bottom slab

$$P2 = \frac{2\times28.572\times3.00}{9.20} = 18.634\ \text{KN/m}$$

b) Vertical load of partial ----- (case-4)





For bottom slab

$$P2 = \frac{2\times28.572\times3.00}{9.20} \pm \frac{6\times28.572\times3.00(3.10+1.30)}{9.20^2}$$

$= 18.634 \pm 26.736 =$ P2-1 = +45.370 KN/m, P2-2 = -8.102 KN/m

c) Horizontal loal (earth pressure of live load surcharge) ------- (case-5)

$$go = \frac{40\ (\text{kN/rihicle}) \times 30\ (\text{unit})}{3.50 \times 10.0} = 34.300\ \text{KN/m}$$

$Pe = goko = 34.300 \times 0.500 = 17.150$ KN/m

BOX FOR ROAD NO 4 Depth = 2.000 ___ APPLICATION BOXS NO5.NO6

No	X (m)	Y (m)
1	0.0000	0.0000
2	0.0000	6.4000
3	9.2000	6.4000
4	9.2000	0.0000

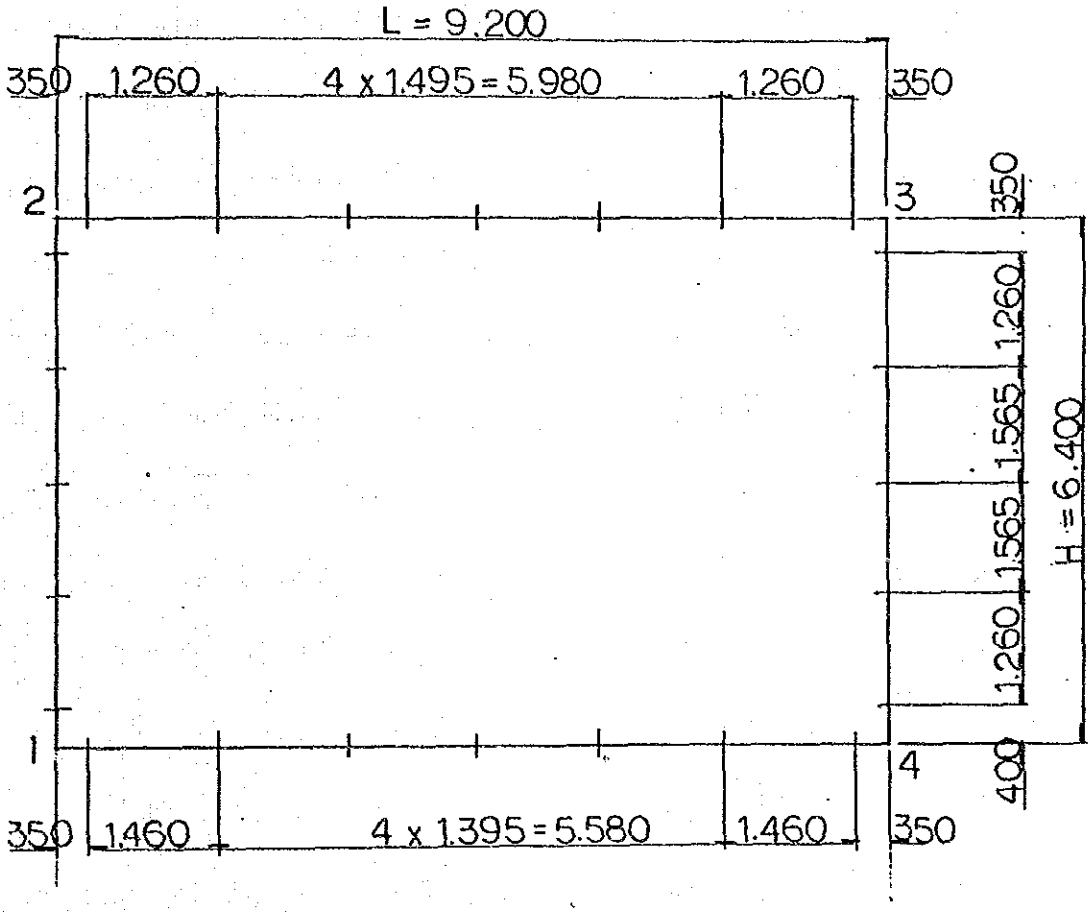
NOTE: THE DIMENSION(t) BE EXCHANG TO DIMENSION(KN) INTO THIS CALCULATION

No	I	J	A (m2)	I (m4)	I - J	L (m)	E (t/m2)	EPS
1	1	2	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
2	2	3	0.70000	0.028580	Fix - Fix	9.200	2.50E+07	1.00E-05
3	3	4	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
4	4	1	0.80000	0.042670	Fix - Fix	9.200	2.50E+07	1.00E-05

	X (t/m)	Y (t/m)	M(tm/Rad)
1	Fix	Fix	Free
4	Free	Fix	Free

No		L-No 1 11	L-No 2 12	L-No 3 13	L-No 4 14	L-No 5 15	L-No 6 16	L-No 7 17	L-No 8 18	L-No 9 19	L-No 10 20
1	5	0.400	1.660	3.225	4.790	6.050					
2	7	0.350	1.610	3.105	4.600	6.095	7.590	8.850			
3	5	0.350	1.610	3.175	4.740	6.000					
4	7	0.350	1.810	3.205	4.600	5.995	7.390	8.850			

CALCULATION POINTS OF EACH FORCE



: Dead load
No. : 1

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	-Y	0.000	6.400	-16.520	-16.520
3	3-	4	-Y	0.000	6.400	-16.520	-16.520
2	2-	3	-Y	0.000	9.200	-57.220	-57.220
4	4-	1	-Y	0.000	9.200	80.204	80.204

ΣV = -0.003 (t)
ΣH = 0.000 (t)

: Earth pressure
No. : 2

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	-X	0.000	6.400	86.500	23.780
3	3-	4	-X	0.000	6.400	-23.780	-86.500

ΣV = 0.000 (t)
ΣH = 0.000 (t)

: HB live load-VL-
No. : 3

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
2	2-	3	-Y	2.200	3.000	-28.572	-28.572
2	2-	3	-Y	4.000	3.000	-28.572	-28.572
4	4-	1	-Y	0.000	9.200	18.634	18.634

BOX FOR ROAD NO 4

: HB live load-VL-
No. : 4

No	i -j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
2	2- 3	-Y	0.000	3.000	-28.572	-28.572
2	2- 3	-Y	1.800	3.000	-28.572	-28.572
4	4- 1	-Y	0.000	1.394	-8.102	0.000
4	4- 1	-Y	1.394	7.806	0.000	45.370

ΣV = 0.000 (t)
ΣH = 0.000 (t)

: HB live load-HL-
No. : 5

No	i -j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1- 2	-X	0.000	6.400	17.150	17.150
3	3- 4	-X	0.000	6.400	-17.150	-17.150

ΣV = 0.000 (t)
ΣH = 0.000 (t)

BOX FOR ROAD NO 4

	C-No 1 No 6	C-No 2 No 7	C-No 3 No 8
No 1	1.3800	1.3800	1.3800
No 2	1.6500	1.6500	1.6500
No 3	1.4300	0.0000	0.0000
No 4	0.0000	1.4300	0.0000
No 5	0.0000	0.0000	1.6500

No 1 : 6 7 8

	Case. 1			Case. 2			Case. 3		
No.	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)
1.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Case. 4			Case. 5			Case. 6		
No.	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)
1.	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.000
4.	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.000

	Case. 7			Case. 8		
No.	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)
1.	0.000	0.001	0.000	0.000	0.002	0.000
4.	0.000	0.003	0.000	0.000	0.002	0.000

BOX FOR ROAD NO 4

No.	Case. 1 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 2 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 3 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	12.01597	0.00000	0.00000	-4.54327	0.00000	0.00000	3.3386
2.	-0.04369	-1.15594	-11.15536	-0.13444	0.00000	4.48011	0.04783	-0.31348	-4.2808
3.	0.00291	-1.15594	11.15536	-0.85681	0.00000	-4.48011	-0.00319	-0.31348	4.2808
4.	-0.04078	0.00000	-12.01597	-0.99124	0.00000	4.54327	0.04464	0.00000	-3.3386

No.	Case. 4 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 5 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 6 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	3.41742	0.00000	0.00000	-1.34866	0.00000	0.00000	13.8599
2.	1.44103	-0.47367	-4.22449	0.01154	0.00000	1.47088	-0.21371	-2.04346	-14.1238
3.	1.42140	-0.15328	2.62255	-0.27005	0.00000	-1.47088	-1.41428	-2.04346	14.1238
4.	0.01718	0.00000	-2.70462	-0.25851	0.00000	1.34866	-1.62799	0.00000	-13.8599

No.	Case. 7 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 8 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	13.97254	0.00000	0.00000	6.86036
2.	1.77857	-2.27254	-14.04324	-0.26307	-1.59519	-5.57526
3.	0.62289	-1.81438	11.75247	-1.85529	-1.59519	5.57526
4.	-1.66726	0.00000	-12.95325	-2.11836	0.00000	-6.86036

BOX FOR ROAD NO 4

No	L(m)	Case 1 Dead load M (tm)	S (t)	N (t)	Case 2 Earth pressure M (tm)	S (t)	N (t)	Case 3 HB live load-VI- M (tm)	S (t)	N (t)
1- 2	0.000	-287.053	8.864	-368.940	-105.359	215.488	0.000	-54.008	-9.705	-85.716
* 1	0.400	-283.507	8.864	-362.332	-25.980	181.672	0.000	-57.890	-9.705	-85.716
* 2	1.660	-272.338	8.864	-341.517	140.642	85.400	0.000	-70.119	-9.705	-85.716
* 3	3.225	-258.465	8.864	-315.663	194.548	-12.511	0.000	-85.307	-9.705	-85.716
* 4	4.790	-244.592	8.864	-289.809	114.003	-86.421	0.000	-100.495	-9.705	-85.716
* 5	6.050	-233.422	8.864	-268.994	-23.022	-128.485	0.000	-112.723	-9.705	-85.716
2- 1	6.400	-230.320	8.864	-263.212	-69.588	-137.408	0.000	-116.120	-9.705	-85.716
2- 3	0.000	-230.320	263.212	8.864	-69.588	0.000	-137.408	-116.120	85.716	-9.705
* 1	0.350	-141.700	243.185	8.864	-69.588	0.000	-137.408	-86.119	85.716	-9.705
* 2	1.610	119.291	171.088	8.864	-69.588	0.000	-137.408	21.883	85.716	-9.705
* 3	3.105	311.124	85.544	8.864	-69.588	0.000	-137.408	138.328	59.858	-9.705
* 4	4.600	375.068	0.000	8.864	-69.588	0.000	-137.408	190.743	0.000	-9.705
* 5	6.095	311.124	-85.544	8.864	-69.588	0.000	-137.408	138.328	-59.858	-9.705
* 6	7.590	119.291	-171.088	8.864	-69.588	0.000	-137.408	21.883	-85.716	-9.705
* 7	8.850	-141.700	-243.185	8.864	-69.588	0.000	-137.408	-86.119	-85.716	-9.705
3- 2	9.200	-230.320	-263.212	8.864	-69.588	0.000	-137.408	-116.120	-85.716	-9.705
3- 4	0.000	-230.320	-8.864	-263.212	-69.588	137.408	0.000	-116.120	9.705	-85.716
* 1	0.350	-233.422	-8.864	-268.994	-23.022	128.485	0.000	-112.723	9.705	-85.716
* 2	1.610	-244.592	-8.864	-289.809	114.003	86.421	0.000	-100.495	9.705	-85.716
* 3	3.175	-258.465	-8.864	-315.663	194.548	12.511	0.000	-85.307	9.705	-85.716
* 4	4.740	-272.338	-8.864	-341.517	140.642	-85.400	0.000	-70.119	9.705	-85.716
* 5	6.000	-283.507	-8.864	-362.332	-25.980	-181.672	0.000	-57.890	9.705	-85.716
4- 3	6.400	-287.053	-8.864	-368.940	-105.359	-215.488	0.000	-54.008	9.705	-85.716
4- 1	0.000	-287.053	368.938	-8.864	-105.359	0.000	-215.488	-54.008	85.716	9.705
* 1	0.350	-162.837	340.867	-8.864	-105.359	0.000	-215.488	-25.149	79.194	9.705
* 2	1.810	249.348	223.769	-8.864	-105.359	0.000	-215.488	70.615	51.989	9.705
* 3	3.205	483.466	111.885	-8.864	-105.359	0.000	-215.488	125.008	25.994	9.705
* 4	4.600	561.506	0.000	-8.864	-105.359	0.000	-215.488	143.139	0.000	9.705
* 5	5.995	483.466	-111.885	-8.864	-105.359	0.000	-215.488	125.008	-25.994	9.705
* 6	7.390	249.348	-223.769	-8.864	-105.359	0.000	-215.488	70.615	-51.989	9.705
* 7	8.850	-162.837	-340.867	-8.864	-105.359	0.000	-215.488	-25.149	-79.195	9.705
1- 4	9.200	-287.053	-368.938	-8.864	-105.359	0.000	-215.488	-54.008	-85.716	9.705

BOX FOR ROAD NO 4

No	L(m)	Case 4 HB live load-VL- M (tm)	S (t)	N (t)	Case 5 HB live load-HL- M (tm)	S (t)	N (t)	Case 6 M (tm)	S (t)	N (t)
1- 2	0.000	-73.366	-3.734	-129.520	-31.276	56.197	0.000	-647.208	353.910	-631.711
* 1	0.400	-74.860	-3.734	-129.520	-10.169	49.337	0.000	-516.889	298.114	-622.592
* 2	1.660	-79.565	-3.734	-129.520	38.382	27.728	0.000	-244.036	139.266	-593.867
* 3	3.225	-85.408	-3.734	-129.520	60.774	0.888	0.000	-157.666	-22.289	-558.189
* 4	4.790	-91.252	-3.734	-129.520	41.162	-25.951	0.000	-293.140	-144.240	-522.511
* 5	6.050	-95.956	-3.734	-129.520	-5.150	-47.560	0.000	-521.303	-213.645	-493.786
2- 1	6.400	-97.263	-3.734	-129.520	-22.847	-53.563	0.000	-598.713	-228.368	-485.806
2- 3	0.000	-97.263	129.520	-3.734	-22.847	0.000	-53.563	-598.713	485.806	-228.368
* 1	0.350	-53.681	119.519	-3.734	-22.847	0.000	-53.563	-433.517	458.169	-228.368
* 2	1.610	74.233	83.519	-3.734	-22.847	0.000	-53.563	81.095	358.675	-228.368
* 3	3.105	142.991	6.517	-3.734	-22.847	0.000	-53.563	512.339	203.648	-228.368
* 4	4.600	120.805	-36.198	-3.734	-22.847	0.000	-53.563	675.537	0.000	-228.368
* 5	6.095	58.717	-41.912	-3.734	-22.847	0.000	-53.563	512.339	-203.648	-228.368
* 6	7.590	-3.942	-41.912	-3.734	-22.847	0.000	-53.563	81.095	-358.675	-228.368
* 7	8.850	-56.752	-41.912	-3.734	-22.847	0.000	-53.563	-433.517	-458.169	-228.368
3- 2	9.200	-71.421	-41.912	-3.734	-22.847	0.000	-53.563	-598.713	-485.806	-228.368
3- 4	0.000	-71.421	3.734	-41.912	-22.847	53.563	0.000	-598.713	228.368	-485.806
* 1	0.350	-70.114	3.734	-41.912	-5.150	47.560	0.000	-521.303	213.645	-493.786
* 2	1.610	-65.410	3.734	-41.912	41.162	25.951	0.000	-293.140	144.240	-522.511
* 3	3.175	-59.566	3.734	-41.912	60.774	-0.888	0.000	-157.666	22.289	-558.189
* 4	4.740	-53.723	3.734	-41.912	38.382	-27.728	0.000	-244.036	-139.266	-593.867
* 5	6.000	-49.018	3.734	-41.912	-10.169	-49.337	0.000	-516.889	-298.114	-622.592
4- 3	6.400	-47.525	3.734	-41.912	-31.276	-56.197	0.000	-647.208	-353.910	-631.711
4- 1	0.000	-47.525	41.912	3.734	-31.276	0.000	-56.197	-647.208	631.709	-353.910
* 1	0.350	-32.401	44.392	3.734	-31.276	0.000	-56.197	-434.521	583.645	-353.910
* 2	1.810	35.863	47.056	3.734	-31.276	0.000	-56.197	271.236	383.146	-353.910
* 3	3.205	96.524	38.028	3.734	-31.276	0.000	-56.197	672.102	191.573	-353.910
* 4	4.600	136.701	17.689	3.734	-31.276	0.000	-56.197	805.724	0.000	-353.910
* 5	5.995	140.616	-13.961	3.734	-31.276	0.000	-56.197	672.102	-191.573	-353.910
* 6	7.390	92.491	-56.921	3.734	-31.276	0.000	-56.197	271.236	-383.146	-353.910
* 7	8.850	-30.772	-113.997	3.734	-31.276	0.000	-56.197	-434.521	-583.645	-353.910
1- 4	9.200	-73.366	-129.520	3.734	-31.276	0.000	-56.197	-647.208	-631.709	-353.910

BOX FOR ROAD NO 4

No	L(m)	Case 7 M (tm)	Case 7 S (t)	Case 7 N (t)	Case 8 M (tm)	Case 8 S (t)	Case 8 N (t)
1- 2	0.000	-674.890	362.449	-694.350	-621.580	460.513	-509.137
* 1	0.400	-541.156	306.652	-685.231	-450.884	393.398	-500.018
* 2	1.660	-257.543	147.804	-656.506	-80.436	198.895	-471.293
* 3	3.225	-157.811	-13.750	-620.828	64.600	-6.945	-435.615
* 4	4.790	-279.922	-135.701	-585.150	-81.514	-173.181	-399.937
* 5	6.050	-497.326	-205.106	-556.425	-368.606	-278.242	-371.212
2- 1	6.400	-571.747	-219.830	-548.445	-470.358	-302.869	-363.233
2- 3	0.000	-571.747	548.445	-219.830	-470.358	363.233	-302.869
* 1	0.350	-387.130	506.508	-219.830	-348.063	335.595	-302.869
* 2	1.610	155.955	355.533	-219.830	12.105	236.101	-302.869
* 3	3.105	519.009	127.370	-219.830	276.834	118.051	-302.869
* 4	4.600	575.525	-51.763	-219.830	365.077	0.000	-302.869
* 5	6.095	398.496	-177.985	-219.830	276.834	-118.051	-302.869
* 6	7.590	44.165	-296.036	-219.830	12.105	-236.101	-302.869
* 7	8.850	-391.521	-395.530	-219.830	-348.063	-335.595	-302.869
3- 2	9.200	-534.794	-423.167	-219.830	-470.358	-363.233	-302.869
3- 4	0.000	-534.794	219.830	-423.167	-470.358	302.869	-363.233
* 1	0.350	-460.372	205.106	-431.147	-368.606	278.242	-371.212
* 2	1.610	-242.968	135.701	-459.872	-81.514	173.181	-399.937
* 3	3.175	-120.857	13.750	-495.550	64.600	6.945	-435.615
* 4	4.740	-220.590	-147.804	-531.228	-80.436	-198.895	-471.293
* 5	6.000	-504.202	-306.652	-559.953	-450.884	-393.398	-500.018
4- 3	6.400	-637.936	-362.449	-569.072	-621.580	-460.513	-509.137
4- 1	0.000	-637.936	569.069	-362.449	-621.580	509.135	-460.513
* 1	0.350	-444.891	533.876	-362.449	-450.162	470.396	-460.513
* 2	1.810	221.541	376.092	-362.449	118.652	308.801	-460.513
* 3	3.205	631.370	208.780	-362.449	441.735	154.401	-460.513
* 4	4.600	796.518	25.295	-362.449	549.430	0.000	-460.513
* 5	5.995	694.422	-174.365	-362.449	441.735	-154.401	-460.513
* 6	7.390	302.519	-390.199	-362.449	118.652	-308.801	-460.513
* 7	8.850	-442.561	-633.412	-362.449	-450.162	-470.396	-460.513
1- 4	9.200	-674.890	-694.349	-362.449	-621.580	-509.135	-460.513

PICK-UP No. 1 *

No.	L (m)	M. MAXIMUM Case	M (tm)	S (t)	N (t)	M. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-621.580	460.513	-509.137	C- 7	-674.890	362.449	-694.350
* 1	0.400	C- 8	-450.884	393.398	-500.018	C- 7	-541.156	306.652	-685.231
* 2	1.660	C- 8	-80.436	198.895	-471.293	C- 7	-257.543	147.804	-656.506
* 3	3.225	C- 8	64.600	-6.945	-435.615	C- 7	-157.811	-13.750	-620.828
* 4	4.790	C- 8	-81.514	-173.181	-399.937	C- 6	-293.140	-144.240	-522.511
* 5	6.050	C- 8	-368.606	-278.242	-371.212	C- 6	-521.303	-213.645	-493.786
2 - 1	6.400	C- 8	-470.358	-302.869	-363.233	C- 6	-598.713	-228.368	-485.806
2 - 3	0.000	C- 8	-470.358	363.233	-302.869	C- 6	-598.713	485.806	-228.368
* 1	0.350	C- 8	-348.063	335.595	-302.869	C- 6	-433.517	458.169	-228.368
* 2	1.610	C- 7	155.955	355.533	-219.830	C- 8	12.105	236.101	-302.869
* 3	3.105	C- 7	519.009	127.370	-219.830	C- 8	276.834	118.051	-302.869
* 4	4.600	C- 6	675.537	0.000	-228.368	C- 8	365.077	0.000	-302.869
* 5	6.095	C- 6	512.339	-203.648	-228.368	C- 8	276.834	-118.051	-302.869
* 6	7.590	C- 6	81.095	-358.675	-228.368	C- 8	12.105	-236.101	-302.869
* 7	8.850	C- 8	-348.063	-335.595	-302.869	C- 6	-433.517	-458.169	-228.368
3 - 2	9.200	C- 8	-470.358	-363.233	-302.869	C- 6	-598.713	-485.806	-228.368
3 - 4	0.000	C- 8	-470.358	302.869	-363.233	C- 6	-598.713	228.368	-485.806
* 1	0.350	C- 8	-368.606	278.242	-371.212	C- 6	-521.303	213.645	-493.786
* 2	1.610	C- 8	-81.514	173.181	-399.937	C- 6	-293.140	144.240	-522.511
* 3	3.175	C- 8	64.600	6.945	-435.615	C- 6	-157.666	22.289	-558.189
* 4	4.740	C- 8	-80.436	-198.895	-471.293	C- 6	-244.036	-139.266	-593.867
* 5	6.000	C- 8	-450.884	-393.398	-500.018	C- 6	-516.889	-298.114	-622.592
4 - 3	6.400	C- 8	-621.580	-460.513	-509.137	C- 6	-647.208	-353.910	-631.711
4 - 1	0.000	C- 8	-621.580	509.135	-460.513	C- 6	-647.208	631.709	-353.910
* 1	0.350	C- 6	-434.521	583.645	-353.910	C- 8	-450.162	470.396	-460.513
* 2	1.810	C- 6	271.236	383.146	-353.910	C- 8	118.652	308.801	-460.513
* 3	3.205	C- 6	672.102	191.573	-353.910	C- 8	441.735	154.401	-460.513
* 4	4.600	C- 6	805.724	0.000	-353.910	C- 8	549.480	0.000	-460.513
* 5	5.995	C- 7	694.422	-174.365	-362.449	C- 8	441.735	-154.401	-460.513
* 6	7.390	C- 7	302.519	-390.199	-362.449	C- 8	118.652	-308.801	-460.513
* 7	8.850	C- 6	-434.521	-583.645	-353.910	C- 8	-450.162	-470.396	-460.513
1 - 4	9.200	C- 8	-621.580	-509.135	-460.513	C- 7	-674.890	-694.349	-362.449

PICK-UP No. 1 *

No.	L (m)	S. MAXIMUM Case	M (tm)	S (t)	N (t)	S. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-621.580	460.513	-509.137	C- 6	-647.208	353.910	-631.711
* 1	0.400	C- 8	-450.884	393.398	-500.018	C- 6	-516.889	298.114	-622.592
* 2	1.660	C- 8	-80.436	198.895	-471.293	C- 6	-244.036	139.266	-593.867
* 3	3.225	C- 8	64.600	-6.945	-435.615	C- 6	-157.666	-22.289	-558.189
* 4	4.790	C- 7	-279.922	-135.701	-585.150	C- 8	-81.514	-173.181	-399.937
* 5	6.050	C- 7	-497.326	-205.106	-556.425	C- 8	-368.606	-278.242	-371.212
2 - 1	6.400	C- 7	-571.747	-219.830	-548.445	C- 8	-470.358	-302.869	-363.233
2 - 3	0.000	C- 7	-571.747	548.445	-219.830	C- 8	-470.358	363.233	-302.869
* 1	0.350	C- 7	-387.130	506.508	-219.830	C- 8	-348.063	335.595	-302.869
* 2	1.610	C- 6	81.095	358.675	-228.368	C- 8	12.105	236.101	-302.869
* 3	3.105	C- 6	512.339	203.648	-228.368	C- 8	276.834	118.051	-302.869
* 4	4.600	C- 6	675.537	0.000	-228.368	C- 7	575.525	-51.763	-219.830
* 5	6.095	C- 8	276.834	-118.051	-302.869	C- 6	512.339	-203.648	-228.368
* 6	7.590	C- 8	12.105	-236.101	-302.869	C- 6	81.095	-358.675	-228.368
* 7	8.850	C- 8	-348.063	-335.595	-302.869	C- 6	-433.517	-458.169	-228.368
3 - 2	9.200	C- 8	-470.358	-363.233	-302.869	C- 6	-598.713	-485.806	-228.368
3 - 4	0.000	C- 8	-470.358	302.869	-363.233	C- 7	-534.794	219.830	-423.167
* 1	0.350	C- 8	-368.606	278.242	-371.212	C- 7	-460.372	205.106	-431.147
* 2	1.610	C- 8	-81.514	173.181	-399.937	C- 7	-242.968	135.701	-459.872
* 3	3.175	C- 6	-157.666	22.289	-558.189	C- 8	64.600	6.945	-435.615
* 4	4.740	C- 6	-244.036	-139.266	-593.867	C- 8	-80.436	-198.895	-471.293
* 5	6.000	C- 6	-516.889	-298.114	-622.592	C- 8	-450.884	-393.398	-500.018
4 - 3	6.400	C- 6	-647.208	-353.910	-631.711	C- 8	-621.580	-460.513	-509.137
4 - 1	0.000	C- 6	-647.208	631.709	-353.910	C- 8	-621.580	509.135	-460.513
* 1	0.350	C- 6	-434.521	583.645	-353.910	C- 8	-450.162	470.396	-460.513
* 2	1.810	C- 6	271.236	383.146	-353.910	C- 8	118.652	308.801	-460.513
* 3	3.205	C- 7	631.370	208.780	-362.449	C- 8	441.735	154.401	-460.513
* 4	4.600	C- 7	796.518	25.295	-362.449	C- 6	805.724	0.000	-353.910
* 5	5.995	C- 8	441.735	-154.401	-460.513	C- 6	672.102	-191.573	-353.910
* 6	7.390	C- 8	118.652	-308.801	-460.513	C- 7	302.519	-390.199	-362.449
* 7	8.850	C- 8	-450.162	-470.396	-460.513	C- 7	-442.561	-633.412	-362.449
1 - 4	9.200	C- 8	-621.580	-509.135	-460.513	C- 7	-674.890	-694.349	-362.449

PICK-UP No. 1 *

No.	L (m)	N. MAXIMUM Case	M (tm)	S (t)	N (t)	N. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-621.580	460.513	-509.137	C- 7	-674.890	362.449	-694.350
* 1	0.400	C- 8	-450.884	393.398	-500.018	C- 7	-541.156	306.652	-685.231
* 2	1.660	C- 8	-80.436	198.895	-471.293	C- 7	-257.543	147.804	-656.506
* 3	3.225	C- 8	64.600	-6.945	-435.615	C- 7	-157.811	-13.750	-620.828
* 4	4.790	C- 8	-81.514	-173.181	-399.937	C- 7	-279.922	-135.701	-585.150
* 5	6.050	C- 8	-368.606	-278.242	-371.212	C- 7	-497.326	-205.106	-556.425
2 - 1	6.400	C- 8	-470.358	-302.869	-363.233	C- 7	-571.747	-219.830	-548.445
2 - 3	0.000	C- 7	-571.747	548.445	-219.830	C- 8	-470.358	363.233	-302.869
* 1	0.350	C- 7	-387.130	506.508	-219.830	C- 8	-348.063	335.595	-302.869
* 2	1.610	C- 7	155.955	355.533	-219.830	C- 8	12.105	236.101	-302.869
* 3	3.105	C- 7	519.009	127.370	-219.830	C- 8	276.834	118.051	-302.869
* 4	4.600	C- 7	575.525	-51.763	-219.830	C- 8	365.077	0.000	-302.869
* 5	6.095	C- 7	398.496	-177.985	-219.830	C- 8	276.834	-118.051	-302.869
* 6	7.590	C- 7	44.165	-296.036	-219.830	C- 8	12.105	-236.101	-302.869
* 7	8.850	C- 7	-391.521	-395.530	-219.830	C- 8	-348.063	-335.595	-302.869
3 - 2	9.200	C- 7	-534.794	-423.167	-219.830	C- 8	-470.358	-363.233	-302.869
3 - 4	0.000	C- 8	-470.358	302.869	-363.233	C- 6	-598.713	228.368	-485.806
* 1	0.350	C- 8	-368.606	278.242	-371.212	C- 6	-521.303	213.645	-493.786
* 2	1.610	C- 8	-81.514	173.181	-399.937	C- 6	-293.140	144.240	-522.511
* 3	3.175	C- 8	64.600	6.945	-435.615	C- 6	-157.666	22.289	-558.189
* 4	4.740	C- 8	-80.436	-198.895	-471.293	C- 6	-244.036	-139.266	-593.867
* 5	6.000	C- 8	-450.884	-393.398	-500.018	C- 6	-516.889	-298.114	-622.592
4 - 3	6.400	C- 8	-621.580	-460.513	-509.137	C- 6	-647.208	-353.910	-631.711
4 - 1	0.000	C- 6	-647.208	631.709	-353.910	C- 8	-621.580	509.135	-460.513
* 1	0.350	C- 6	-434.521	583.645	-353.910	C- 8	-450.162	470.396	-460.513
* 2	1.810	C- 6	271.236	383.146	-353.910	C- 8	118.652	308.801	-460.513
* 3	3.205	C- 6	672.102	191.573	-353.910	C- 8	441.735	154.401	-460.513
* 4	4.600	C- 6	805.724	0.000	-353.910	C- 8	549.430	0.000	-460.513
* 5	5.995	C- 6	672.102	-191.573	-353.910	C- 8	441.735	-154.401	-460.513
* 6	7.390	C- 6	271.236	-383.146	-353.910	C- 8	118.652	-308.801	-460.513
* 7	8.850	C- 6	-434.521	-583.645	-353.910	C- 8	-450.162	-470.396	-460.513
1 - 4	9.200	C- 6	-647.208	-631.709	-353.910	C- 8	-621.580	-509.135	-460.513

NO④ BOX FOR ROAD

(similar Box - NO⑤, NO⑥)

D= 0.500 m

(1)Dead load

a)vertical load ····· (case-1)

For upper slab w1 = 22.6×0.50+23.60×0.70 = 27.820 kN/m

For side wall w2 = 23.6×0.70 = 16.520 〃

For bottom slab $W3 = 27.820 + \frac{2\times 16.520\times 6.40}{9.20}$ = 50.804 〃

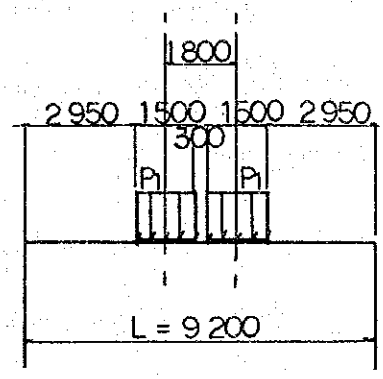
b)Horizontal load ··· earth pressure ····· (case-2)

For side wall P1 = (22.6×0.50+19.60×0.35)×0.500 = 9.080 kN/m

P2 = (22.6×0.50+19.60×6.75)×0.500 = 71.800 〃

(2)Live load

a) Vertical load of center ····· (case-3)



B = wide of despersal of HB-load

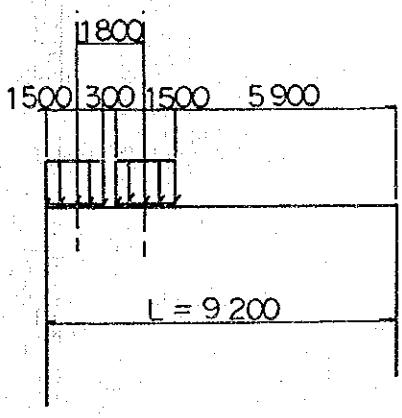
= 0.30+0.50+0.70 = 1.500 m

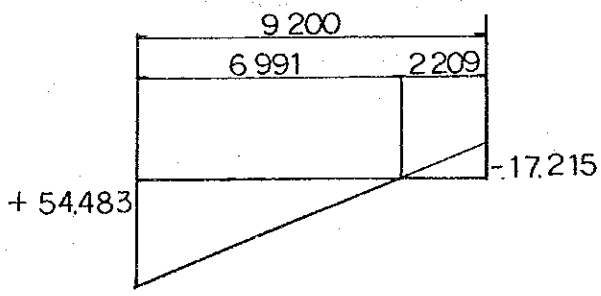
$$P1 = \frac{10\ (\text{kN/axle}) \times 30\ (\text{unit})}{3.50 \times B} = \frac{10 \times 30}{3.50 \times 1.50} = 57.143\ \text{KN/m}$$

For bottom slab

$$P2 = \frac{2\times 57.143\times 1.50}{9.20} = 18.634\ \text{KN/m}$$

b) Vertical load of partial ····· (case-4)





For bottom slab

$$P2 = \frac{2\times 57.143\times 1.50}{9.20} \pm \frac{6\times 57.143\times 1.50(3.85+2.050)}{9.20^2}$$

$$= 18.634 \pm 35.849 = \begin{cases} P2\text{-}1 = +54.483\ \text{KN/m} \\ P2\text{-}2 = -17.215\ \text{KN/m} \end{cases}$$

c) Horizontal loal (earth pressure of live load surcharge) ····· (case-5)

$$go = \frac{40\ (\text{kN/rihiole}) \times 30\ (\text{unit})}{3.50 \times 10.0} = 34.300\ \text{KN/m}$$

Pe = goko = 34.300 × 0.500 = 17.150 KN/m

BOX FOR ROAD NO 4 Depth = 0.500 For Check

NOTE: THE DIMENSION(t) BE EXCHANG TO DIMENSION(KN) INTO THIS CALCULATION

No	X (m)	Y (m)
1	0.0000	0.0000
2	0.0000	6.4000
3	9.2000	6.4000
4	9.2000	0.0000

No	I	J	A (m2)	I (m4)	I - J	L (m)	E (t/m2)	EPS
1	1	2	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
2	2	3	0.70000	0.028580	Fix - Fix	9.200	2.50E+07	1.00E-05
3	3	4	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
4	4	1	0.80000	0.042670	Fix - Fix	9.200	2.50E+07	1.00E-05

	X (t/m)	Y (t/m)	M(tm/Rad)
1	Fix	Fix	Free
4	Free	Fix	Free

No		L-No 1 / 11	L-No 2 / 12	L-No 3 / 13	L-No 4 / 14	L-No 5 / 15	L-No 6 / 16	L-No 7 / 17	L-No 8 / 18	L-No 9 / 19	L-No 10 / 20
1	5	0.400	1.660	3.225	4.790	6.050					
2	7	0.350	1.610	3.105	4.600	6.095	7.590	8.850			
3	5	0.350	1.610	3.175	4.740	6.000					
4	7	0.350	1.810	3.205	4.600	5.995	7.390	8.850			

: Dead load
No. : 1

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	-Y	0.000	6.400	-16.520	-16.520
3	3-	4	-Y	0.000	6.400	-16.520	-16.520
2	2-	3	-Y	0.000	9.200	-27.820	-27.820
4	4-	1	-Y	0.000	9.200	50.804	50.804

ΣV = -0.003 (t)
ΣH = 0.000 (t)

: Earth pressure
No. : 2

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	-X	0.000	6.400	71.800	9.080
3	3-	4	-X	0.000	6.400	-9.080	-71.800

ΣV = 0.000 (t)
ΣH = 0.000 (t)

: HB live load-VL-
No. : 3

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
2	2-	3	-Y	2.950	1.500	-57.143	-57.143
2	2-	3	-Y	4.750	1.500	-57.143	-57.143
4	4-	1	-Y	0.000	9.200	18.634	18.634

ΣV = 0.004 (t)
ΣH = 0.000 (t)

BOX FOR ROAD NO 4'

: HB live load-VL-
No. : 4

No	i -j		Li (m)	Lc (m)	Pi (t/m)	Pj (t/m)
2	2- 3	-Y	0.000	1.500	-57.143	-57.143
2	2- 3	-Y	1.800	1.500	-57.143	-57.143
4	4- 1	-Y	0.000	2.209	-17.215	0.000
4	4- 1	-Y	2.209	6.991	0.000	54.483

ΣV = 0.002 (t)
ΣH = 0.000 (t)

: HB live load-HL-
No. : 5

No	i -j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1- 2	-X	0.000	6.400	17.150	17.150
3	3- 4	-X	0.000	6.400	-17.150	-17.150

ΣV = 0.000 (t)
ΣH = 0.000 (t)

BOX FOR ROAD NO 4'

No / No	C-No 1 / No 6	C-No 2 / No 7	C-No 3 / No 8
No 1	1.3800	1.3800	1.3800
No 2	1.6500	1.6500	1.6500
No 3	1.4300	0.0000	0.0000
No 4	0.0000	1.4300	0.0000
No 5	0.0000	0.0000	1.6500

No 1 : 6 7 8

	Case. 1			Case. 2			Case. 3		
No.	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)
1.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	-0.002	0.000
4.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	-0.002	0.000

	Case. 4			Case. 5			Case. 6		
No.	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)
1.	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	-0.001	0.000
4.	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	-0.001	0.000

	Case. 7			Case. 8		
No.	RX (t)	RY (t)	RM (tm)	RX (t)	RY (t)	RM (tm)
1.	0.000	0.001	0.000	0.000	0.002	0.000
4.	0.000	0.000	0.000	0.000	0.002	0.000

BOX FOR ROAD NO 4'

No.	Case. 1 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 2 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 3 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	7.24551	0.00000	0.00000	-3.38728	0.00000	0.00000	3.3709
2.	-0.06646	-0.66134	-5.93643	-0.14433	0.00000	3.21935	0.05125	-0.31347	-4.3804
3.	0.00443	-0.66134	5.93643	-0.62534	0.00000	-3.21935	-0.00342	-0.31347	4.3804
4.	-0.06203	0.00000	-7.24551	-0.76967	0.00000	3.38728	0.04783	0.00000	-3.3709

No.	Case. 4 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 5 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 6 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	3.38152	0.00000	0.00000	-1.34866	0.00000	0.00000	9.2301
2.	1.06514	-0.52651	-3.68212	0.01154	0.00000	1.47088	-0.25656	-1.36092	-9.1443
3.	1.06691	-0.10043	1.99578	-0.27005	0.00000	-1.47088	-1.03058	-1.36092	9.1443
4.	-0.00155	0.00000	-2.36193	-0.25851	0.00000	1.34866	-1.28715	0.00000	-9.2301

No.	Case. 7 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 8 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	9.24536	0.00000	0.00000	2.18451
2.	1.19330	-1.66556	-8.14578	-0.31081	-0.91265	-0.45339
3.	0.49999	-1.05627	5.73431	-1.47128	-0.91265	0.45339
4.	-1.35777	0.00000	-7.78736	-1.78208	0.00000	-2.18451

BOX FOR ROAD NO 4'

No	L(m)	Case 1 Dead load M (tm)	S (t)	N (t)	Case 2 Earth pressure M (tm)	S (t)	N (t)	Case 3 HB live load-VL- M (tm)	S (t)	N (t)
1- 2	0.000	-190.313	13.484	-233.700	-78.552	167.319	0.000	-53.261	-10.398	-85.715
* 1	0.400	-184.919	13.484	-227.092	-17.264	139.383	0.000	-57.420	-10.398	-85.715
* 2	1.660	-167.929	13.484	-206.277	107.743	61.634	0.000	-70.522	-10.398	-85.715
* 3	3.225	-146.827	13.484	-180.423	142.455	-13.273	0.000	-86.796	-10.398	-85.715
* 4	4.790	-125.725	13.484	-154.569	78.721	-64.177	0.000	-103.069	-10.398	-85.715
* 5	6.050	-108.735	13.484	-133.754	-18.607	-87.719	0.000	-116.171	-10.398	-85.715
2- 1	6.400	-104.016	13.484	-127.972	-50.005	-91.497	0.000	-119.811	-10.398	-85.715
2- 3	0.000	-104.016	127.972	13.484	-50.005	0.000	-91.497	-119.811	85.715	-10.398
* 1	0.350	-60.929	118.235	13.484	-50.005	0.000	-91.497	-89.811	85.715	-10.398
* 2	1.610	65.963	83.182	13.484	-50.005	0.000	-91.497	18.190	85.715	-10.398
* 3	3.105	159.231	41.591	13.484	-50.005	0.000	-91.497	145.646	76.857	-10.398
* 4	4.600	190.320	0.000	13.484	-50.005	0.000	-91.497	197.333	0.000	-10.398
* 5	6.095	159.231	-41.591	13.484	-50.005	0.000	-91.497	145.646	-76.857	-10.398
* 6	7.590	65.963	-83.182	13.484	-50.005	0.000	-91.497	18.190	-85.715	-10.398
* 7	8.850	-60.929	-118.235	13.484	-50.005	0.000	-91.497	-89.811	-85.715	-10.398
3- 2	9.200	-104.016	-127.972	13.484	-50.005	0.000	-91.497	-119.811	-85.715	-10.398
3- 4	0.000	-104.016	-13.484	-127.972	-50.005	91.497	0.000	-119.811	10.398	-85.715
* 1	0.350	-108.735	-13.484	-133.754	-18.607	87.719	0.000	-116.171	10.398	-85.715
* 2	1.610	-125.725	-13.484	-154.569	78.721	64.177	0.000	-103.069	10.398	-85.715
* 3	3.175	-146.827	-13.484	-180.423	142.455	13.273	0.000	-86.796	10.398	-85.715
* 4	4.740	-167.929	-13.484	-206.277	107.743	-61.634	0.000	-70.522	10.398	-85.715
* 5	6.000	-184.919	-13.484	-227.092	-17.264	-139.383	0.000	-57.420	10.398	-85.715
4- 3	6.400	-190.313	-13.484	-233.700	-78.552	-167.319	0.000	-53.261	10.398	-85.715
4- 1	0.000	-190.313	233.698	-13.484	-78.552	0.000	-167.319	-53.261	85.716	10.398
* 1	0.350	-111.630	215.917	-13.484	-78.552	0.000	-167.319	-24.401	79.194	10.398
* 2	1.810	149.462	141.743	-13.484	-78.552	0.000	-167.319	71.363	51.989	10.398
* 3	3.205	297.761	70.872	-13.484	-78.552	0.000	-167.319	125.756	25.994	10.398
* 4	4.600	347.194	0.000	-13.484	-78.552	0.000	-167.319	143.887	0.000	10.398
* 5	5.995	297.761	-70.872	-13.484	-78.552	0.000	-167.319	125.756	-25.994	10.398
* 6	7.390	149.462	-141.743	-13.484	-78.552	0.000	-167.319	71.363	-51.989	10.398
* 7	8.850	-111.630	-215.917	-13.484	-78.552	0.000	-167.319	-24.401	-79.195	10.398
1- 4	9.200	-190.313	-233.698	-13.484	-78.552	0.000	-167.319	-53.261	-85.716	10.398

BOX FOR ROAD NO 4'

	No	L(m)	Case 4 HB live load-VL- M (tm)	S (t)	N (t)	Case 5 HB live load-HL- M (tm)	S (t)	N (t)	Case 6 M (tm)	S (t)	N (t)
1-	2	0.000	-79.939	0.338	-143.967	-31.276	56.197	0.000	-468.404	279.815	-445.078
*	1	0.400	-79.804	0.338	-143.967	-10.169	49.337	0.000	-365.784	233.720	-435.959
*	2	1.660	-79.379	0.338	-143.967	38.382	27.728	0.000	-154.813	105.433	-407.234
*	3	3.225	-78.850	0.338	-143.967	60.774	0.888	0.000	-91.688	-18.162	-371.555
*	4	4.790	-78.322	0.338	-143.967	41.162	-25.951	0.000	-191.000	-102.154	-335.877
*	5	6.050	-77.897	0.338	-143.967	-5.150	-47.560	0.000	-346.881	-140.998	-307.152
2-	1	6.400	-77.779	0.338	-143.967	-22.847	-53.563	0.000	-397.379	-147.232	-299.173
2-	3	0.000	-77.779	143.967	0.338	-22.847	0.000	-53.563	-397.379	299.173	-147.232
*	1	0.350	-30.890	123.967	0.338	-22.847	0.000	-53.563	-295.020	285.736	-147.232
*	2	1.610	80.294	58.253	0.338	-22.847	0.000	-53.563	34.532	237.363	-147.232
*	3	3.105	118.724	-16.319	0.338	-22.847	0.000	-53.563	345.505	167.301	-147.232
*	4	4.600	78.755	-27.462	0.338	-22.847	0.000	-53.563	462.320	0.000	-147.232
*	5	6.095	37.699	-27.462	0.338	-22.847	0.000	-53.563	345.505	-167.301	-147.232
*	6	7.590	-3.356	-27.462	0.338	-22.847	0.000	-53.563	34.532	-237.363	-147.232
*	7	8.850	-37.958	-27.462	0.338	-22.847	0.000	-53.563	-295.020	-285.736	-147.232
3-	2	9.200	-47.570	-27.462	0.338	-22.847	0.000	-53.563	-397.379	-299.173	-147.232
3-	4	0.000	-47.570	-0.338	-27.462	-22.847	53.563	0.000	-397.379	147.232	-299.173
*	1	0.350	-47.688	-0.338	-27.462	-5.150	47.560	0.000	-346.881	140.998	-307.152
*	2	1.610	-48.113	-0.338	-27.462	41.162	25.951	0.000	-191.000	102.154	-335.877
*	3	3.175	-48.641	-0.338	-27.462	60.774	-0.888	0.000	-91.688	18.162	-371.555
*	4	4.740	-49.170	-0.338	-27.462	38.382	-27.728	0.000	-154.813	-105.433	-407.234
*	5	6.000	-49.595	-0.338	-27.462	-10.169	-49.337	0.000	-365.784	-233.720	-435.959
4-	3	6.400	-49.730	-0.338	-27.462	-31.276	-56.197	0.000	-468.404	-279.815	-445.078
4-	1	0.000	-49.730	27.463	-0.338	-31.276	0.000	-56.197	-468.404	445.078	-279.815
*	1	0.350	-39.119	33.011	-0.338	-31.276	0.000	-56.197	-318.553	411.214	-279.815
*	2	1.810	20.476	45.857	-0.338	-31.276	0.000	-56.197	178.696	269.950	-279.815
*	3	3.205	83.946	42.612	-0.338	-31.276	0.000	-56.197	461.131	134.975	-279.815
*	4	4.600	132.311	24.201	-0.338	-31.276	0.000	-56.197	555.276	0.000	-279.815
*	5	5.995	144.414	-9.376	-0.338	-31.276	0.000	-56.197	461.131	-134.975	-279.815
*	6	7.390	99.099	-58.119	-0.338	-31.276	0.000	-56.197	178.696	-269.950	-279.815
*	7	8.850	-32.832	-125.376	-0.338	-31.276	0.000	-56.197	-318.553	-411.214	-279.815
1-	4	9.200	-79.939	-143.968	-0.338	-31.276	0.000	-56.197	-468.404	-445.078	-279.815

BOX FOR ROAD NO 4'

	No	L(m)	Case 7 M (tm)	S (t)	N (t)	Case 8 M (tm)	S (t)	N (t)
1-	2	0.000	-506.555	295.167	-528.379	-443.847	387.409	-322.506
*	1	0.400	-397.793	249.073	-519.260	-300.452	329.996	-313.387
*	2	1.660	-167.478	120.786	-490.535	9.365	166.054	-284.662
*	3	3.225	-80.326	-2.810	-454.857	132.708	-1.827	-248.984
*	4	4.790	-155.612	-86.801	-419.179	24.307	-130.104	-213.305
*	5	6.050	-292.148	-125.645	-390.454	-189.254	-204.603	-184.581
2-	1	6.400	-337.273	-131.879	-382.474	-263.746	-220.741	-176.601
2-	3	0.000	-337.273	382.474	-131.879	-263.746	176.601	-220.741
*	1	0.350	-210.763	340.437	-131.879	-204.287	163.164	-220.741
*	2	1.610	123.342	198.092	-131.879	-29.176	114.791	-220.741
*	3	3.105	307.006	34.059	-131.879	99.534	57.395	-220.741
*	4	4.600	292.753	-39.270	-131.879	142.437	0.000	-220.741
*	5	6.095	191.141	-96.666	-131.879	99.534	-57.395	-220.741
*	6	7.590	3.722	-154.061	-131.879	-29.176	-114.791	-220.741
*	7	8.850	-220.870	-202.435	-131.879	-204.287	-163.164	-220.741
3-	2	9.200	-294.074	-215.872	-131.879	-263.746	-176.601	-220.741
3-	4	0.000	-294.074	131.879	-215.872	-263.746	220.741	-176.601
*	1	0.350	-248.949	125.645	-223.851	-189.254	204.603	-184.581
*	2	1.610	-112.413	86.801	-252.576	24.307	130.104	-213.305
*	3	3.175	-37.127	2.810	-288.254	132.708	1.827	-248.984
*	4	4.740	-124.279	-120.786	-323.932	9.365	-166.054	-284.662
*	5	6.000	-354.594	-249.073	-352.657	-300.452	-329.996	-313.387
4-	3	6.400	-463.356	-295.167	-361.776	-443.847	-387.409	-322.506
4-	1	0.000	-463.356	361.777	-295.167	-443.847	322.504	-387.409
*	1	0.350	-339.600	345.172	-295.167	-335.264	297.965	-387.409
*	2	1.810	105.928	261.181	-295.167	25.042	195.606	-387.409
*	3	3.205	401.343	158.738	-295.167	229.695	97.803	-387.409
*	4	4.600	538.722	34.607	-295.167	297.912	0.000	-387.409
*	5	5.995	487.812	-111.211	-295.167	229.695	-97.803	-387.409
*	6	7.390	218.359	-278.716	-295.167	25.042	-195.606	-387.409
*	7	8.850	-330.609	-477.253	-295.167	-335.264	-297.965	-387.409
1-	4	9.200	-506.555	-528.378	-295.167	-443.847	-322.504	-387.409

BOX FOR ROAD NO 4'

PICK-UP No. 1 *

No.	L (m)	M. MAXIMUM Case	M (tm)	S (t)	N (t)	M. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-443.847	387.409	-322.506	C- 7	-506.555	295.167	-528.379
* 1	0.400	C- 8	-300.452	329.996	-313.387	C- 7	-397.793	249.073	-519.260
* 2	1.660	C- 8	9.365	166.054	-284.662	C- 7	-167.478	120.786	-490.535
* 3	3.225	C- 8	132.708	-1.827	-248.984	C- 6	-91.688	-18.162	-371.555
* 4	4.790	C- 8	24.307	-130.104	-213.305	C- 6	-191.000	-102.154	-335.877
* 5	6.050	C- 8	-189.254	-204.603	-184.581	C- 6	-346.881	-140.998	-307.152
2 - 1	6.400	C- 8	-263.746	-220.741	-176.601	C- 6	-397.379	-147.232	-299.173
2 - 3	0.000	C- 8	-263.746	176.601	-220.741	C- 6	-397.379	299.173	-147.232
* 1	0.350	C- 8	-204.287	163.164	-220.741	C- 6	-295.020	285.736	-147.232
* 2	1.610	C- 7	123.342	198.092	-131.879	C- 8	-29.176	114.791	-220.741
* 3	3.105	C- 6	345.505	167.301	-147.232	C- 8	99.534	57.395	-220.741
* 4	4.600	C- 6	462.320	0.000	-147.232	C- 8	142.437	0.000	-220.741
* 5	6.095	C- 6	345.505	-167.301	-147.232	C- 8	99.534	-57.395	-220.741
* 6	7.590	C- 6	34.532	-237.363	-147.232	C- 8	-29.176	-114.791	-220.741
* 7	8.850	C- 8	-204.287	-163.164	-220.741	C- 6	-295.020	-285.736	-147.232
3 - 2	9.200	C- 8	-263.746	-176.601	-220.741	C- 6	-397.379	-299.173	-147.232
3 - 4	0.000	C- 8	-263.746	220.741	-176.601	C- 6	-397.379	147.232	-299.173
* 1	0.350	C- 8	-189.254	204.603	-184.581	C- 6	-346.881	140.998	-307.152
* 2	1.610	C- 8	24.307	130.104	-213.305	C- 6	-191.000	102.154	-335.877
* 3	3.175	C- 8	132.708	1.827	-248.984	C- 6	-91.688	18.162	-371.555
* 4	4.740	C- 8	9.365	-166.054	-284.662	C- 6	-154.813	-105.433	-407.234
* 5	6.000	C- 8	-300.452	-329.996	-313.387	C- 6	-365.784	-233.720	-435.959
4 - 3	6.400	C- 8	-443.847	-387.409	-322.506	C- 6	-468.404	-279.815	-445.078
4 - 1	0.000	C- 8	-443.847	322.504	-387.409	C- 6	-468.404	445.078	-279.815
* 1	0.350	C- 6	-318.553	411.214	-279.815	C- 7	-339.600	345.172	-295.167
* 2	1.810	C- 6	178.696	269.950	-279.815	C- 8	25.042	195.606	-387.409
* 3	3.205	C- 6	461.131	134.975	-279.815	C- 8	229.695	97.803	-387.409
* 4	4.600	C- 6	555.276	0.000	-279.815	C- 8	297.912	0.000	-387.409
* 5	5.995	C- 7	487.812	-111.211	-295.167	C- 8	229.695	-97.803	-387.409
* 6	7.390	C- 7	218.359	-278.716	-295.167	C- 8	25.042	-195.606	-387.409
* 7	8.850	C- 6	-318.553	-411.214	-279.815	C- 8	-335.264	-297.965	-387.409
1 - 4	9.200	C- 8	-443.847	-322.504	-387.409	C- 7	-506.555	-528.378	-295.167

BOX FOR ROAD NO 4'

PICK-UP No. 1 *

No.	L (m)	S. MAXIMUM Case	M (tm)	S (t)	N (t)	S. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-443.847	387.409	-322.506	C- 6	-468.404	279.815	-445.078
* 1	0.400	C- 8	-300.452	329.996	-313.387	C- 6	-365.784	233.720	-435.959
* 2	1.660	C- 8	9.365	166.054	-284.662	C- 6	-154.813	105.433	-407.234
* 3	3.225	C- 8	132.708	-1.827	-248.984	C- 6	-91.688	-18.162	-371.555
* 4	4.790	C- 7	-155.612	-86.801	-419.179	C- 8	24.307	-130.104	-213.305
* 5	6.050	C- 7	-292.148	-125.645	-390.454	C- 8	-189.254	-204.603	-184.581
2 - 1	6.400	C- 7	-337.273	-131.879	-382.474	C- 8	-263.746	-220.741	-176.601
2 - 3	0.000	C- 7	-337.273	382.474	-131.879	C- 8	-263.746	176.601	-220.741
* 1	0.350	C- 7	-210.763	340.437	-131.879	C- 8	-204.287	163.164	-220.741
* 2	1.610	C- 6	34.532	237.363	-147.232	C- 8	-29.176	114.791	-220.741
* 3	3.105	C- 6	345.505	167.301	-147.232	C- 7	307.006	34.059	-131.879
* 4	4.600	C- 6	462.320	0.000	-147.232	C- 7	292.753	-39.270	-131.879
* 5	6.095	C- 8	99.534	-57.395	-220.741	C- 6	345.505	-167.301	-147.232
* 6	7.590	C- 8	-29.176	-114.791	-220.741	C- 6	34.532	-237.363	-147.232
* 7	8.850	C- 8	-204.287	-163.164	-220.741	C- 6	-295.020	-285.736	-147.232
3 - 2	9.200	C- 8	-263.746	-176.601	-220.741	C- 6	-397.379	-299.173	-147.232
3 - 4	0.000	C- 8	-263.746	220.741	-176.601	C- 7	-294.074	131.879	-215.872
* 1	0.350	C- 8	-189.254	204.603	-184.581	C- 7	-248.949	125.645	-223.851
* 2	1.610	C- 8	24.307	130.104	-213.305	C- 7	-112.413	86.801	-252.576
* 3	3.175	C- 6	-91.688	18.162	-371.555	C- 8	132.708	1.827	-248.984
* 4	4.740	C- 6	-154.813	-105.433	-407.234	C- 8	9.365	-166.054	-284.662
* 5	6.000	C- 6	-365.784	-233.720	-435.959	C- 8	-300.452	-329.996	-313.387
4 - 3	6.400	C- 6	-468.404	-279.815	-445.078	C- 8	-443.847	-387.409	-322.506
4 - 1	0.000	C- 6	-468.404	445.078	-279.815	C- 8	-443.847	322.504	-387.409
* 1	0.350	C- 6	-318.553	411.214	-279.815	C- 8	-335.264	297.965	-387.409
* 2	1.810	C- 6	178.696	269.950	-279.815	C- 8	25.042	195.606	-387.409
* 3	3.205	C- 7	401.343	158.738	-295.167	C- 8	229.695	97.803	-387.409
* 4	4.600	C- 7	538.722	34.607	-295.167	C- 6	555.276	0.000	-279.815
* 5	5.995	C- 8	229.695	-97.803	-387.409	C- 6	461.131	-134.975	-279.815
* 6	7.390	C- 8	25.042	-195.606	-387.409	C- 7	218.359	-278.716	-295.167
* 7	8.850	C- 8	-335.264	-297.965	-387.409	C- 7	-330.609	-477.253	-295.167
1 - 4	9.200	C- 8	-443.847	-322.504	-387.409	C- 7	-506.555	-528.378	-295.167

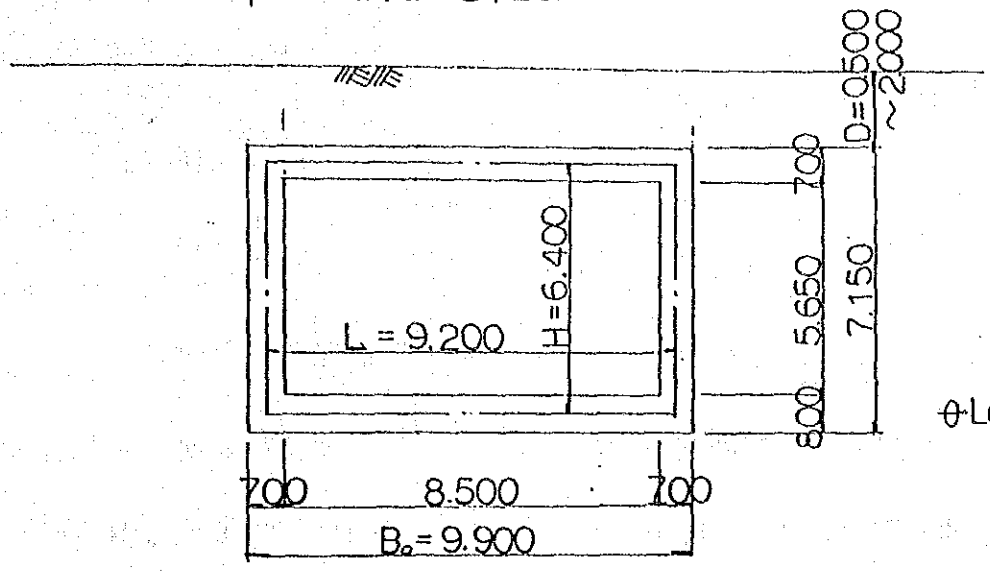
BOX FOR ROAD NO 4'

PICK-UP No. 1 *

No.	L (m)	N. MAXIMUM Case	M (tm)	S (t)	N (t)	N. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-443.847	387.409	-322.506	C- 7	-506.555	295.167	-528.379
* 1	0.400	C- 8	-300.452	329.996	-313.387	C- 7	-397.793	249.073	-519.260
* 2	1.660	C- 8	9.365	166.054	-284.662	C- 7	-167.478	120.786	-490.535
* 3	3.225	C- 8	132.708	-1.827	-248.984	C- 7	-80.326	-2.810	-454.857
* 4	4.790	C- 8	24.307	-130.104	-213.305	C- 7	-155.612	-86.801	-419.179
* 5	6.050	C- 8	-189.254	-204.603	-184.581	C- 7	-292.148	-125.645	-390.454
2 - 1	6.400	C- 8	-263.746	-220.741	-176.601	C- 7	-337.273	-131.879	-382.474
2 - 3	0.000	C- 7	-337.273	382.474	-131.879	C- 8	-263.746	176.601	-220.741
* 1	0.350	C- 7	-210.763	340.437	-131.879	C- 8	-204.287	163.164	-220.741
* 2	1.610	C- 7	123.342	198.092	-131.879	C- 8	-29.176	114.791	-220.741
* 3	3.105	C- 7	307.006	34.059	-131.879	C- 8	99.534	57.395	-220.741
* 4	4.600	C- 7	292.753	-39.270	-131.879	C- 8	142.437	0.000	-220.741
* 5	6.095	C- 7	191.141	-96.666	-131.879	C- 8	99.534	-57.395	-220.741
* 6	7.590	C- 7	3.722	-154.061	-131.879	C- 8	-29.176	-114.791	-220.741
* 7	8.850	C- 7	-220.870	-202.435	-131.879	C- 8	-204.287	-163.164	-220.741
3 - 2	9.200	C- 7	-294.074	-215.872	-131.879	C- 8	-263.746	-176.601	-220.741
3 - 4	0.000	C- 8	-263.746	220.741	-176.601	C- 6	-397.379	147.232	-299.173
* 1	0.350	C- 8	-189.254	204.603	-184.581	C- 6	-346.881	140.998	-307.152
* 2	1.610	C- 8	24.307	130.104	-213.305	C- 6	-191.000	102.154	-335.877
* 3	3.175	C- 8	132.708	1.827	-248.984	C- 6	-91.688	18.162	-371.555
* 4	4.740	C- 8	9.365	-166.054	-284.662	C- 6	-154.813	-105.433	-407.234
* 5	6.000	C- 8	-300.452	-329.996	-313.387	C- 6	-365.784	-233.720	-435.959
4 - 3	6.400	C- 8	-443.847	-387.409	-322.506	C- 6	-468.404	-279.815	-445.078
4 - 1	0.000	C- 6	-468.404	445.078	-279.815	C- 8	-443.847	322.504	-387.409
* 1	0.350	C- 6	-318.553	411.214	-279.815	C- 8	-335.264	297.965	-387.409
* 2	1.810	C- 6	178.696	269.950	-279.815	C- 8	25.042	195.606	-387.409
* 3	3.205	C- 6	461.131	134.975	-279.815	C- 8	229.695	97.803	-387.409
* 4	4.600	C- 6	555.276	0.000	-279.815	C- 8	297.912	0.000	-387.409
* 5	5.995	C- 6	461.131	-134.975	-279.815	C- 8	229.695	-97.803	-387.409
* 6	7.390	C- 6	178.696	-269.950	-279.815	C- 8	25.042	-195.606	-387.409
* 7	8.850	C- 6	-318.553	-411.214	-279.815	C- 8	-335.264	-297.965	-387.409
1 - 4	9.200	C- 6	-468.404	-445.078	-279.815	C- 8	-443.847	-322.504	-387.409

NO ⑦ BOX CULVERT FOR RORD

1) Shape and Size



θ Left ≒ 42° = skew angle

Where

D^m = depth of asphalt and similar surface soil.

2) Factor of section

A	= 1.00 x 0.70	= 0.7000 m^2
I	= $\frac{1.00 \times 0.70^3}{12}$	= 0.02858 m^2
A	= 1.00 x 0.80	= 0.8000 m^2
I	= $\frac{1.00 \times 0.80^3}{12}$	= 0.04267 m^2
A	=	=
I	=	=
Ec	= 25 KN/mm^2	= 2.5×10^7 KN/m^2

No.⑦ BOX CULVERT FOR ROAD

1. calculation for bending moment (U.L.S)

1) For upper slab

section $b=100^{cm}$ $h=70$ $d=64.0$ $d'=6.0$

a) middle point ②~③ $Mu.max=631.9^{KNm}$

$$A_s=\begin{cases} Y_{32}-300^{ctc}= 8.042/0.300 \\ Y_{25}-300^{ctc}= 4.909/0.300 \end{cases} = 43.17\ cm^2$$

$$X=\frac{0.87\times41000\times43.17}{0.40\times2500\times100}=15.4^{cm}$$

$$Z=64.0-\frac{15.4}{2}=56.3^{cm}<0.95\times64.0=60.8^{cm}$$

$M_{RS}=0.87\times41000\times43.17\times56.3\times10^{-5}=867.0^{KNm}>Mu=631.9^{KNm}$

$M_{RC}=0.40\times2500\times100\times15.4\times56.3\times10^{-5}=867.0^{KNm}>Mu=631.9^{KNm}$

OK

b) intersection point ②=③ $Mu.min=-580.7^{KNm}$

$$A_s=Y_{25}-150^{ctc}=4.909/0.150=32.73\ cm^2$$

$$X=\frac{0.87\times41000\times32.73}{0.40\times2500\times100}=11.8^{cm}$$

$$Z=64.0-\frac{11.8}{2}=58.1^{cm}<0.95\times64.0=60.8^{cm}$$ OK

$M_{RS}=0.87\times41000\times32.73\times58.1\times10^{-5}=678.3^{KNm}>Mu=580.7^{KNm}$

$M_{RC}=0.40\times2500\times100\times11.8\times58.1\times10^{-5}=685.5^{KNm}>Mu=580.7^{KNm}$

OK

2) For bottom slab

section $b=100^{cm}$ $h=80$ $d=73.0(74.0)$ $d'=7.0(6.0)$

a) middle point ④~① $Mu.max=802.1^{KNm}$

$$A_s=\begin{cases} Y_{32}-300^{ctc}= 8.042/0.300 \\ Y_{25}-300^{ctc}= 4.909/0.300 \end{cases} = 43.17\ cm^2$$

$$X=\frac{0.87\times41000\times43.17}{0.40\times2500\times100}=15.4^{cm}$$

$$Z=73.0-\frac{15.4}{2}=65.3^{cm}<0.95\times73.0=69.3^{cm}$$ OK

$M_{RS}=0.87\times41000\times43.17\times65.3\times10^{-5}=1005.5^{KNm}>Mu=802.1^{KNm}$

$M_{RC}=0.40\times2500\times100\times15.4\times65.3\times10^{-5}=1005.6^{KNm}>Mu=802.1^{KNm}$

OK

b) intersection point ④=① Mu.min $= -660.4^{KNm}$

$A_s = Y_{26} - 150^{ctc} = 4.909/0.15 = 32.73\ cm^2$

$$X = \frac{0.87\times 41000 \times 32.73}{0.40\times 2500\times 100} = 11.6^{cm}$$

$$Z = 73.0 - \frac{11.6}{2} = 67.2^{cm} < 0.95\times 73.0 = 69.3^{cm} \quad OK$$

$M_{RS} = 0.87\times 41000 \times 32.73 \times 67.2\times 10^{-5} = 784.5^{KNm} > Mu = 660.4^{Nm}$

$M_{RC} = 0.40\times 2500\times 100 \times 11.6\times 67.2\times 10^{-5} = 793.0^{KNm} > Mu = 660.4^{Nm}$

Notice: this bar is decide for shearing force without bending moments.

2. calculation for shearing force (U.L.S)

a) For upper slab

section b $=100^{cm}$ h $=70$ d $=64.0$ d′ $=6.0$

intersection point ②=③ Su.max $= 343.4^{KN}$

$$A_s = \begin{cases} Y_{32} - 300^{ctc} = 8.042/0.30 \\ Y_{25} - 300^{ctc} = 4.909/0.30 \end{cases} = 43.17\ cm^2$$

$$P = \frac{43.17}{100\times 64.0}\times 100 = 0.675\ \%$$

$$Vc = \frac{343.4\times 10^3}{100\times 64.0} = 53.7\ N/cm^2$$

$$< Vca = 50.0 + 15.0\ \frac{(0.675-0.50)}{0.50} = 55.2\ N/cm^2 \quad OK$$

b) For bottom slab

section b $=100$ h $=80$ d $=73.0$ d′ $=7.0$

intersection point ④=① Su.min $= -386.2^{KN}$

$$A_s = \begin{cases} Y_{32} - 300^{ctc} = 8.042/0.30 \\ Y_{25} - 300^{ctc} = 4.909/0.30 \end{cases} = 43.17\ cm^2$$

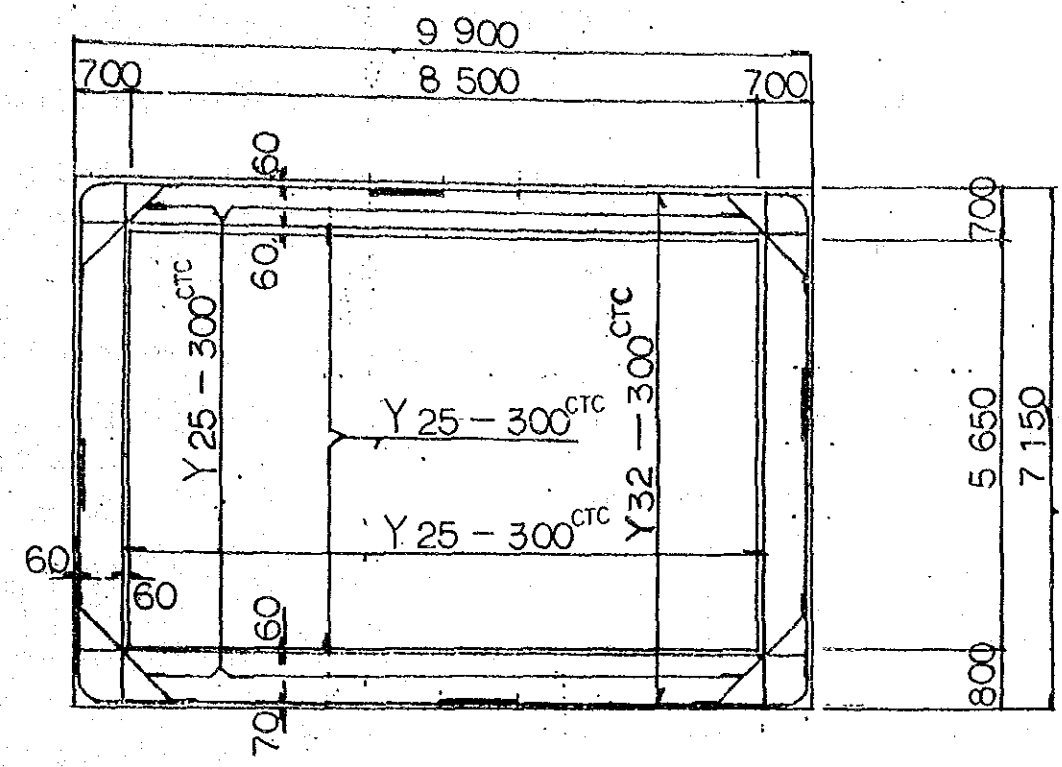
$$P = \frac{43.17}{100\times 73.0}\times 100 = 0.592\ \%$$

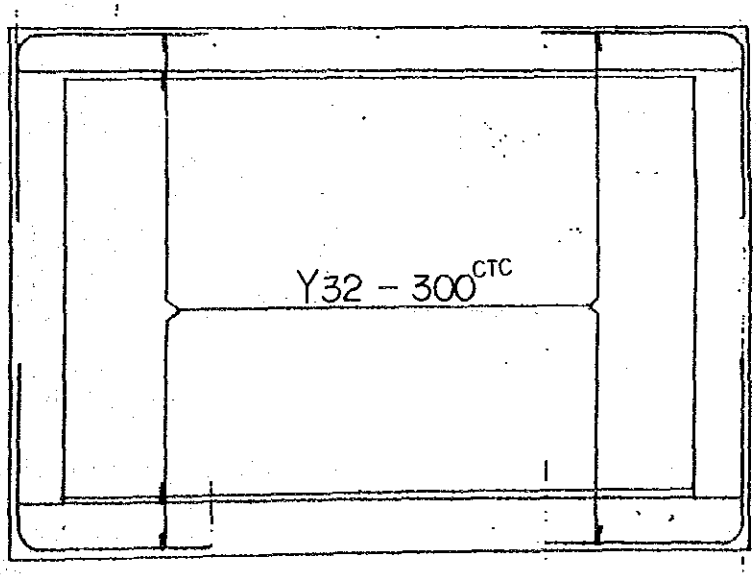
$$Vc = \frac{386.2\times 10^3}{100\times 73.0} = 52.8\ N/cm^2$$

$$< Vca = 50.0 + 15.0\ \frac{(0.592-0.50)}{0.50} = 52.8\ N/cm^2 \quad OK$$

Notice: this bar is decide for shearing force about point ②, ③ and ④, ①

NO ⑦ BOX CULVERT FOR ROAD





NO⑦ BOX CULVERT FOR ROAD

D= 2.000 m

(1)Dead load

a) vertical load ----- (case-1)

For upper slab w1 = 22.6×0.50+19.6×1.50+23.6×0.70 = 57.220 kN/m

For side wall w2 = 23.6×0.70 = 16.520 〃

For bottom slab $W3 = 57.220 + \frac{2\times16.52\times6.40}{9.20}$ = 80.204 〃

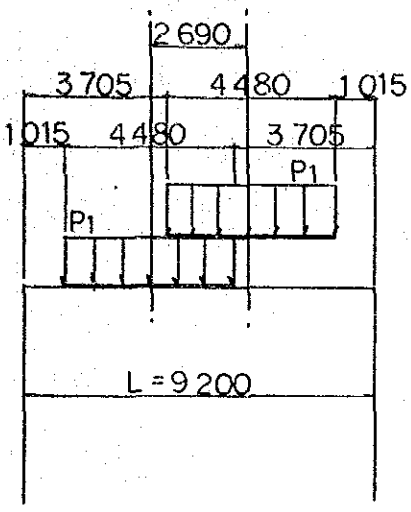
b) Horizontal load --- earth pressure ----- (case-2)

For side wall P1 = (22.6×0.50+19.60×1.85)×0.500 = 23.780 kN/m

P2 = (22.6×0.50+19.60×8.25)×0.500 = 86.500 〃

(2)Live load

a) Vertical load of center ------- (case-3)



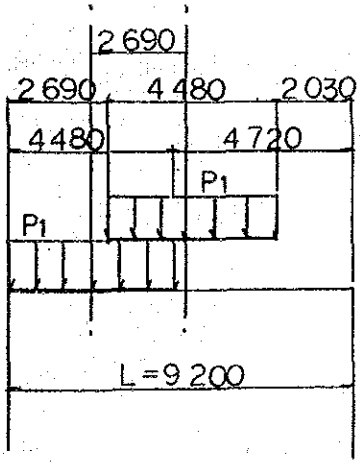
B = (0.30+2.0+0.70)cosec42° = 4.480 m

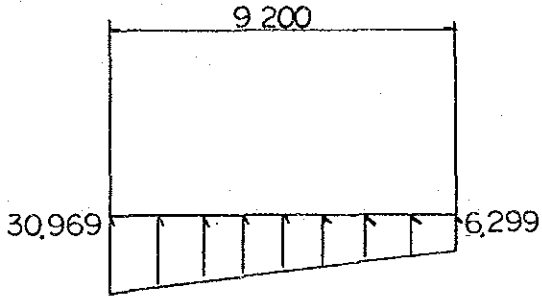
$$P1 = \frac{10\ \text{kN/axle} \times 30\ \text{unit}}{3.50 \times B} = \frac{10 \times 30}{3.50 \times 4.48} = 19.133\ \text{KN/m}$$

For bottom slab

$$P2 = \frac{2\times19.133\times4.480}{9.20} = 18.634\ \text{KN/m}$$

b) Vertical load of partial ------- (case-4)





For bottom slab

$$P2 = \frac{2\times19.133\times4.480}{9.20} \pm \frac{6\times19.133\times4.480(2.360-0.330)}{9.20^2}$$

$$= 18.634 \pm 12.335 = \begin{cases} P2\text{-}1 = 30.969\ \text{KN/m} \\ P2\text{-}2 = 6.299\ \text{KN/m} \end{cases}$$

C) Horizontal load of live load surcharge ------- (case-5)

Pe = goko = 34.300 × 0.500 = 17.150 KN/m

BOX FOR ROAD NO 7 Depth = 2.000

No	X (m)	Y (m)
1	0.0000	0.0000
2	0.0000	6.4000
3	9.2000	6.4000
4	9.2000	0.0000

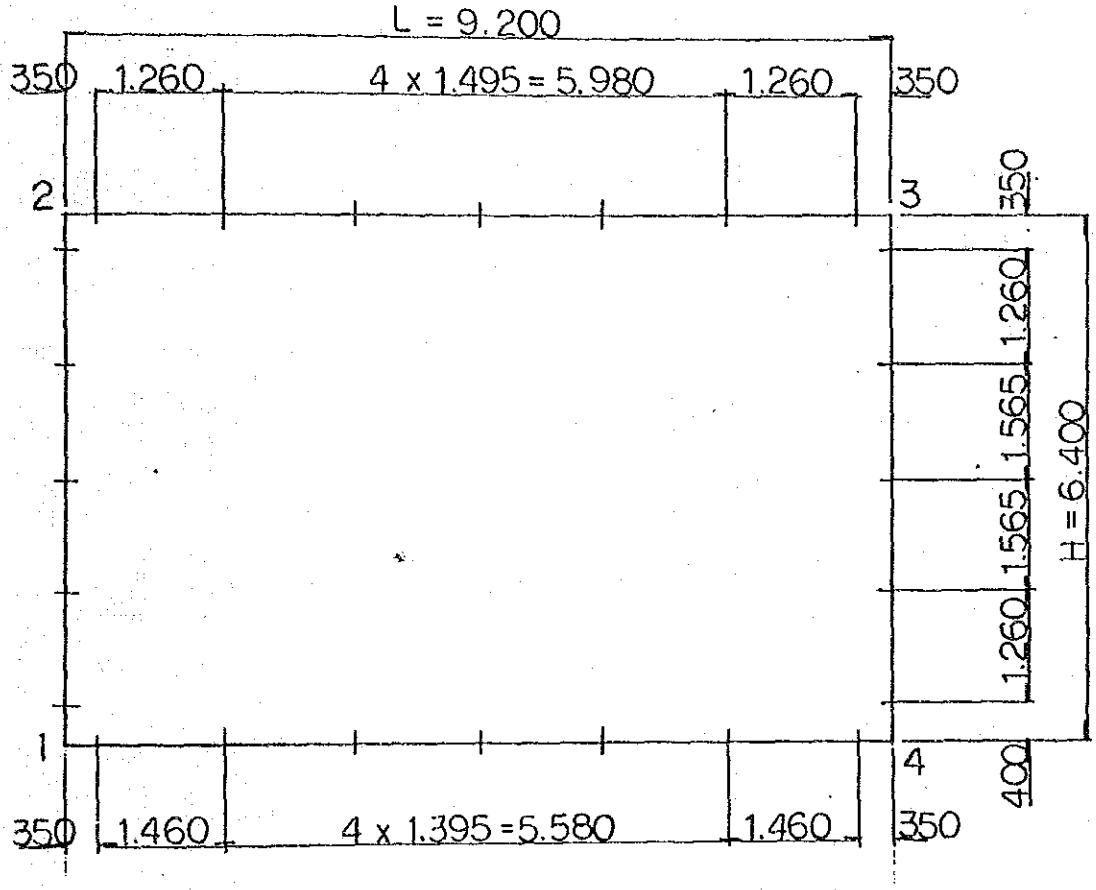
NOTE: THE DIMENSION(t) EE EXCHANG TO DIMENSION(KN) INTO THIS CALCULATION

No	I	J	A (m2)	I (m4)	I - J	L (m)	E (t/m2)	EPS
1	1 -	2	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
2	2 -	3	0.70000	0.028580	Fix - Fix	9.200	2.50E+07	1.00E-05
3	3 -	4	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
4	4 -	1	0.80000	0.042670	Fix - Fix	9.200	2.50E+07	1.00E-05

	X (t/m)	Y (t/m)	M(tm/Rad)
1	Fix	Fix	Free
4	Free	Fix	Free

No		L-No 1 11	L-No 2 12	L-No 3 13	L-No 4 14	L-No 5 15	L-No 6 16	L-No 7 17	L-No 8 18	L-No 9 19	L-No 10 20
1	5	0.400	1.660	3.225	4.790	6.050					
2	7	0.350	1.610	3.105	4.600	6.095	7.590	8.850			
3	5	0.350	1.610	3.175	4.740	6.000					
4	7	0.350	1.810	3.205	4.600	5.995	7.390	8.850			

CALCULATION POINTS OF EACH FORCE



: Dead load
No. : 1

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	Y	0.000	6.400	-16.520	-16.520
3	3-	4	Y	0.000	6.400	-16.520	-16.520
2	2-	3	Y	0.000	9.200	-57.220	-57.220
4	4-	1	Y	0.000	9.200	80.204	80.204

ΣV = -0.003 (t)
ΣH = 0.000 (t)

: Earth pressure
No. : 2

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	X	0.000	6.400	86.500	23.780
3	3-	4	X	0.000	6.400	-23.780	-86.500

ΣV = 0.000 (t)
ΣH = 0.000 (t)

: HB live load-VL-
: 3

				Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
2	2-	3	Y	1.015	4.480	-19.133	-19.133
2	2-	3	Y	3.705	4.480	-19.133	-19.133
4	4-	1	Y	0.000	9.200	18.634	18.634

: HB live load-VL-
No. : 4

No	i	-j	Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
2	2-	3	0.000	4.480	-19.133	-19.133
2	2-	3	2.690	4.480	-19.133	-19.133
4	4-	1	0.000	9.200	6.299	30.969

ΣV = 0.001 (t)
ΣH = 0.000 (t)

BOX FOR ROAD NO 7

: HB live load-HL-
No. : 5

No	i	-j	Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	0.000	6.400	17.150	17.150
3	3-	4	0.000	6.400	-17.150	-17.150

ΣV = 0.000 (t)
ΣH = 0.000 (t)

No	C-No 1 No 6	C-No 2 No 7	C-No 3 No 8
No 1	1.3800	1.3800	1.3800
No 2	1.6500	1.6500	1.6500
No 3	1.4300	0.0000	0.0000
No 4	0.0000	1.4300	0.0000
No 5	0.0000	0.0000	1.6500

No 1 : 6 7 8

No.	Case. 1 RX (t)	RY (t)	RM (tm)	Case. 2 RX (t)	RY (t)	RM (tm)	Case. 3 RX (t)	RY (t)	RM (tm)
1.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	-0.001	0.000
4.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	-0.001	0.000

No.	Case. 4 RX (t)	RY (t)	RM (tm)	Case. 5 RX (t)	RY (t)	RM (tm)	Case. 6 RX (t)	RY (t)	RM (tm)
1.	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000

No.	Case. 7 RX (t)	RY (t)	RM (tm)	Case. 8 RX (t)	RY (t)	RM (tm)
1.	0.000	0.001	0.000	0.000	0.002	0.000
4.	0.000	0.002	0.000	0.000	0.002	0.000

No.	Case. 1 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 2 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 3 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	12.01597	0.00000	0.00000	-4.54327	0.00000	0.00000	3.2284
2.	-0.04369	-1.15594	-11.15536	-0.13444	0.00000	4.48011	0.03615	-0.31348	-3.9405
3.	0.00291	-1.15594	11.15536	-0.85681	0.00000	-4.48011	-0.00241	-0.31348	3.9405
4.	-0.04078	0.00000	-12.01597	-0.99124	0.00000	4.54327	0.03374	0.00000	-3.2284

No.	Case. 4 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 5 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 6 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	3.34363	0.00000	0.00000	-1.34866	0.00000	0.00000	13.7023
2.	0.42620	-0.38684	-4.05612	0.01154	0.00000	1.47088	-0.23042	-2.04346	-13.6371
3.	0.39432	-0.24011	3.45983	-0.27005	0.00000	-1.47088	-1.41316	-2.04346	13.6371
4.	0.02789	0.00000	-2.99503	-0.25851	0.00000	1.34866	-1.64358	0.00000	-13.7023

No.	Case. 7 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 8 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	13.86702	0.00000	0.00000	6.86036
2.	0.32735	-2.14837	-13.80248	-0.26307	-1.59519	-5.57526
3.	-0.84583	-1.93855	12.94978	-1.85529	-1.59519	5.57526
4.	-1.65194	0.00000	-13.36853	-2.11836	0.00000	-6.86036

	No	L(m)	Case 1 Dead load M (tm)	S (t)	N (t)	Case 2 Earth pressure M (tm)	S (t)	N (t)	Case 3 HB live load-VL- M (tm)	S (t)	N (t)
1-	2	0.000	-287.053	8.864	-368.940	-105.359	215.488	0.000	-56.564	-7.334	-85.716
*	1	0.400	-283.507	8.864	-362.332	-25.980	181.672	0.000	-59.498	-7.334	-85.716
*	2	1.660	-272.338	8.864	-341.517	140.642	85.400	0.000	-68.739	-7.334	-85.716
*	3	3.225	-258.465	8.864	-315.663	194.548	-12.511	0.000	-80.217	-7.334	-85.716
*	4	4.790	-244.592	8.864	-289.809	114.003	-86.421	0.000	-91.695	-7.334	-85.716
*	5	6.050	-233.422	8.864	-268.994	-23.022	-128.485	0.000	-100.936	-7.334	-85.716
2-	1	6.400	-230.320	8.864	-263.212	-69.588	-137.408	0.000	-103.503	-7.334	-85.716
2-	3	0.000	-230.320	263.212	8.864	-69.588	0.000	-137.408	-103.503	85.716	-7.334
*	1	0.350	-141.700	243.185	8.864	-69.588	0.000	-137.408	-73.503	85.716	-7.334
*	2	1.610	119.291	171.088	8.864	-69.588	0.000	-137.408	31.112	74.382	-7.334
*	3	3.105	311.124	85.544	8.864	-69.588	0.000	-137.408	120.857	45.728	-7.334
*	4	4.600	375.068	0.000	8.864	-69.588	0.000	-137.408	160.176	0.000	-7.334
*	5	6.095	311.124	-85.544	8.864	-69.588	0.000	-137.408	120.857	-45.728	-7.334
*	6	7.590	119.291	-171.088	8.864	-69.588	0.000	-137.408	31.112	-74.382	-7.334
*	7	8.850	-141.700	-243.185	8.864	-69.588	0.000	-137.408	-73.503	-85.716	-7.334
3-	2	9.200	-230.320	-263.212	8.864	-69.588	0.000	-137.408	-103.503	-85.716	-7.334
3-	4	0.000	-230.320	-8.864	-263.212	-69.588	137.408	0.000	-103.503	7.334	-85.716
*	1	0.350	-233.422	-8.864	-268.994	-23.022	128.485	0.000	-100.936	7.334	-85.716
*	2	1.610	-244.592	-8.864	-289.809	114.003	86.421	0.000	-91.695	7.334	-85.716
*	3	3.175	-258.465	-8.864	-315.663	194.548	12.511	0.000	-80.217	7.334	-85.716
*	4	4.740	-272.338	-8.864	-341.517	140.642	-85.400	0.000	-68.739	7.334	-85.716
*	5	6.000	-283.507	-8.864	-362.332	-25.980	-181.672	0.000	-59.498	7.334	-85.716
4-	3	6.400	-287.053	-8.864	-368.940	-105.359	-215.488	0.000	-56.564	7.334	-85.716
4-	1	0.000	-287.053	368.938	-8.864	-105.359	0.000	-215.488	-56.564	85.716	7.334
*	1	0.350	-162.837	340.867	-8.864	-105.359	0.000	-215.488	-27.705	79.194	7.334
*	2	1.810	249.348	223.769	-8.864	-105.359	0.000	-215.488	68.059	51.989	7.334
*	3	3.205	483.466	111.885	-8.864	-105.359	0.000	-215.488	122.452	25.994	7.334
*	4	4.600	561.506	0.000	-8.864	-105.359	0.000	-215.488	140.584	0.000	7.334
*	5	5.995	483.466	-111.885	-8.864	-105.359	0.000	-215.488	122.452	-25.994	7.334
*	6	7.390	249.348	-223.769	-8.864	-105.359	0.000	-215.488	68.059	-51.989	7.334
*	7	8.850	-162.837	-340.867	-8.864	-105.359	0.000	-215.488	-27.705	-79.195	7.334
1-	4	9.200	-287.053	-368.938	-8.864	-105.359	0.000	-215.488	-56.564	-85.716	7.334

	No	L(m)	Case 4 HB live load-VL- M (tm)	S (t)	N (t)	Case 5 HB live load-HL- M (tm)	S (t)	N (t)	Case 6 M (tm)	S (t)	N (t)
1-	2	0.000	-63.209	-6.063	-105.776	-31.276	56.197	0.000	-650.862	357.300	-631.711
*	1	0.400	-65.634	-6.063	-105.776	-10.169	49.337	0.000	-519.188	301.504	-622.592
*	2	1.660	-73.274	-6.063	-105.776	38.382	27.728	0.000	-242.063	142.656	-593.867
*	3	3.225	-82.763	-6.063	-105.776	60.774	0.888	0.000	-150.388	-18.899	-558.189
*	4	4.790	-92.252	-6.063	-105.776	41.162	-25.951	0.000	-280.556	-140.849	-522.510
*	5	6.050	-99.892	-6.063	-105.776	-5.150	-47.560	0.000	-504.447	-210.255	-493.785
2-	1	6.400	-102.014	-6.063	-105.776	-22.847	-53.563	0.000	-580.671	-224.978	-485.806
2-	3	0.000	-102.014	105.776	-6.063	-22.847	0.000	-53.563	-580.671	485.806	-224.978
*	1	0.350	-66.164	99.079	-6.063	-22.847	0.000	-53.563	-415.475	458.169	-224.978
*	2	1.610	43.488	74.972	-6.063	-22.847	0.000	-53.563	94.293	342.396	-224.978
*	3	3.105	132.542	38.428	-6.063	-22.847	0.000	-53.563	487.356	183.441	-224.978
*	4	4.600	147.366	-16.484	-6.063	-22.847	0.000	-53.563	631.825	0.000	-224.978
*	5	6.095	101.341	-45.088	-6.063	-22.847	0.000	-53.563	487.356	-183.441	-224.978
*	6	7.590	14.241	-65.656	-6.063	-22.847	0.000	-53.563	94.293	-342.396	-224.978
*	7	8.850	-68.485	-65.656	-6.063	-22.847	0.000	-53.563	-415.475	-458.169	-224.978
3-	2	9.200	-91.465	-65.656	-6.063	-22.847	0.000	-53.563	-580.671	-485.806	-224.978
3-	4	0.000	-91.465	6.063	-65.656	-22.847	53.563	0.000	-580.671	224.978	-485.806
*	1	0.350	-89.343	6.063	-65.656	-5.150	47.560	0.000	-504.447	210.255	-493.785
*	2	1.610	-81.703	6.063	-65.656	41.162	25.951	0.000	-280.556	140.849	-522.510
*	3	3.175	-72.214	6.063	-65.656	60.774	-0.888	0.000	-150.388	18.899	-558.189
*	4	4.740	-62.725	6.063	-65.656	38.382	-27.728	0.000	-242.063	-142.656	-593.867
*	5	6.000	-55.085	6.063	-65.656	-10.169	-49.337	0.000	-519.188	-301.504	-622.592
4-	3	6.400	-52.660	6.063	-65.656	-31.276	-56.197	0.000	-650.862	-357.300	-631.711
4-	1	0.000	-52.660	65.656	6.063	-31.276	0.000	-56.197	-650.862	631.709	-357.300
*	1	0.350	-30.085	63.287	6.063	-31.276	0.000	-56.197	-438.176	583.645	-357.300
*	2	1.810	53.209	49.862	6.063	-31.276	0.000	-56.197	267.581	383.146	-357.300
*	3	3.205	110.703	31.695	6.063	-31.276	0.000	-56.197	668.447	191.573	-357.300
*	4	4.600	139.213	8.310	6.063	-31.276	0.000	-56.197	802.069	0.000	-357.300
*	5	5.995	131.462	-20.293	6.063	-31.276	0.000	-56.197	668.447	-191.573	-357.300
*	6	7.390	80.168	-54.115	6.063	-31.276	0.000	-56.197	267.581	-383.146	-357.300
*	7	8.850	-28.065	-95.102	6.063	-31.276	0.000	-56.197	-438.176	-583.645	-357.300
1-	4	9.200	-63.209	-105.777	6.063	-31.276	0.000	-56.197	-650.862	-631.709	-357.300

No		L(m)	Case 7 M (tm)	S (t)	N (t)	Case 8 M (tm)	S (t)	N (t)
1-	2	0.000	-660.364	359.118	-660.397	-621.580	460.513	-509.137
*	1	0.400	-527.963	303.321	-651.278	-450.884	393.398	-500.018
*	2	1.660	-248.548	144.473	-622.553	-80.436	198.895	-471.293
*	3	3.225	-154.029	-17.081	-586.874	64.600	-6.945	-435.615
*	4	4.790	-281.352	-139.032	-551.196	-81.514	-173.181	-399.937
*	5	6.050	-502.953	-208.437	-522.471	-368.606	-278.242	-371.212
2-	1	6.400	-578.541	-223.161	-514.492	-470.358	-302.869	-363.233
2-	3	0.000	-578.541	514.492	-223.161	-470.358	363.233	-302.869
*	1	0.350	-404.981	477.279	-223.161	-348.063	335.595	-302.869
*	2	1.610	111.990	343.311	-223.161	12.105	236.101	-302.869
*	3	3.105	504.066	173.002	-223.161	276.834	118.051	-302.869
*	4	4.600	613.507	-23.572	-223.161	365.077	0.000	-302.869
*	5	6.095	459.449	-182.526	-223.161	276.834	-118.051	-302.869
*	6	7.590	70.167	-329.989	-223.161	12.105	-236.101	-302.869
*	7	8.850	-408.300	-429.483	-223.161	-348.063	-335.595	-302.869
3-	2	9.200	-563.456	-457.120	-223.161	-470.358	-363.233	-302.869
3-	4	0.000	-563.456	223.161	-457.120	-470.358	302.869	-363.233
*	1	0.350	-487.868	208.437	-465.100	-368.606	278.242	-371.212
*	2	1.610	-266.267	139.032	-493.825	-81.514	173.181	-399.937
*	3	3.175	-138.944	17.081	-529.503	64.600	6.945	-435.615
*	4	4.740	-233.463	-144.473	-565.181	-80.436	-198.895	-471.293
*	5	6.000	-512.878	-303.321	-593.906	-450.884	-393.398	-500.018
4-	3	6.400	-645.280	-359.118	-603.025	-621.580	-460.513	-509.137
4-	1	0.000	-645.280	603.023	-359.118	-621.580	509.135	-460.513
*	1	0.350	-441.580	560.897	-359.118	-450.162	470.396	-460.513
*	2	1.810	246.346	380.105	-359.118	118.652	308.801	-460.513
*	3	3.205	651.645	199.725	-359.118	441.735	154.401	-460.513
*	4	4.600	800.110	11.884	-359.118	549.430	0.000	-460.513
*	5	5.995	681.330	-183.420	-359.118	441.735	-154.401	-460.513
*	6	7.390	284.897	-386.186	-359.118	118.652	-308.801	-460.513
*	7	8.850	-438.690	-606.392	-359.118	-450.162	-470.396	-460.513
1-	4	9.200	-660.364	-660.396	-359.118	-621.580	-509.135	-460.513

PICK-UP No. 1 *

No.	L (m)	M. MAXIMUM Case	M (tm)	S (t)	N (t)	M. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-621.580	460.513	-509.137	C- 7	-660.364	359.118	-600.397
* 1	0.400	C- 8	-450.884	393.398	-500.018	C- 7	-527.963	303.321	-651.278
* 2	1.660	C- 8	-80.436	198.895	-471.293	C- 7	-248.548	144.473	-622.556
* 3	3.225	C- 8	64.600	-6.945	-435.615	C- 7	-154.029	-17.081	-586.874
* 4	4.790	C- 8	-81.514	-173.181	-399.937	C- 7	-281.352	-139.032	-551.196
* 5	6.050	C- 8	-368.606	-278.242	-371.212	C- 6	-504.447	-210.255	-493.785
2 - 1	6.400	C- 8	-470.358	-302.869	-363.233	C- 6	-580.671	-224.978	-485.806
2 - 3	0.000	C- 8	-470.358	363.233	-302.869	C- 6	-580.671	485.806	-224.978
* 1	0.350	C- 8	-348.063	335.595	-302.869	C- 6	-415.475	458.169	-224.978
* 2	1.610	C- 7	111.990	343.311	-223.161	C- 8	12.105	236.101	-302.869
* 3	3.105	C- 7	504.066	173.002	-223.161	C- 8	276.834	118.051	-302.869
* 4	4.600	C- 6	631.825	0.000	-224.978	C- 8	365.077	0.000	-302.869
* 5	6.095	C- 6	487.356	-183.441	-224.978	C- 8	276.834	-118.051	-302.869
* 6	7.590	C- 6	94.293	-342.396	-224.978	C- 8	12.105	-236.101	-302.869
* 7	8.850	C- 8	-348.063	-335.595	-302.869	C- 6	-415.475	-458.169	-224.978
3 - 2	9.200	C- 8	-470.358	-363.233	-302.869	C- 6	-580.671	-485.806	-224.978
3 - 4	0.000	C- 8	-470.358	302.869	-363.233	C- 6	-580.671	224.978	-485.806
* 1	0.350	C- 8	-368.606	278.242	-371.212	C- 6	-504.447	210.255	-493.785
* 2	1.610	C- 8	-81.514	173.181	-399.937	C- 6	-280.556	140.849	-522.510
* 3	3.175	C- 8	64.600	6.945	-435.615	C- 6	-150.388	18.899	-558.189
* 4	4.740	C- 8	-80.436	-198.895	-471.293	C- 6	-242.063	-142.656	-593.867
* 5	6.000	C- 8	-450.884	-393.398	-500.018	C- 6	-519.188	-301.504	-622.592
4 - 3	6.400	C- 8	-621.580	-460.513	-509.137	C- 6	-650.862	-357.300	-631.711
4 - 1	0.000	C- 8	-621.580	509.135	-460.513	C- 6	-650.862	631.709	-357.300
* 1	0.350	C- 6	-438.176	583.645	-357.300	C- 8	-450.162	470.396	-460.513
* 2	1.810	C- 6	267.581	383.146	-357.300	C- 8	118.652	308.801	-460.513
* 3	3.205	C- 6	668.447	191.573	-357.300	C- 8	441.735	154.401	-460.513
* 4	4.600	C- 6	802.069	0.000	-357.300	C- 8	549.430	0.000	-460.513
* 5	5.995	C- 7	681.330	-183.420	-359.118	C- 8	441.735	-154.401	-460.513
* 6	7.390	C- 7	284.897	-386.186	-359.118	C- 8	118.652	-308.801	-460.513
* 7	8.850	C- 6	-438.176	-583.645	-357.300	C- 8	-450.162	-470.396	-460.513
1 - 4	9.200	C- 8	-621.580	-509.135	-460.513	C- 7	-660.364	-660.396	-359.118

PICK-UP No. 1 *

No.	L (m)	S. MAXIMUM Case	M (tm)	S (t)	N (t)	S. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-621.580	460.513	-509.137	C- 6	-650.862	357.300	-631.711
* 1	0.400	C- 8	-450.884	393.398	-500.018	C- 6	-519.188	301.504	-622.592
* 2	1.660	C- 8	-80.436	198.895	-471.293	C- 6	-242.063	142.656	-593.867
* 3	3.225	C- 8	64.600	-6.945	-435.615	C- 6	-150.388	-18.899	-558.189
* 4	4.790	C- 7	-281.352	-139.032	-551.196	C- 8	-81.514	-173.181	-399.937
* 5	6.050	C- 7	-502.953	-208.437	-522.471	C- 8	-368.606	-278.242	-371.212
2 - 1	6.400	C- 7	-578.541	-223.161	-514.492	C- 8	-470.358	-302.869	-363.233
2 - 3	0.000	C- 7	-578.541	514.492	-223.161	C- 8	-470.358	363.233	-302.869
* 1	0.350	C- 7	-404.981	477.279	-223.161	C- 8	-348.063	335.595	-302.869
* 2	1.610	C- 7	111.990	343.311	-223.161	C- 8	12.105	236.101	-302.869
* 3	3.105	C- 6	487.356	183.441	-224.978	C- 8	276.834	118.051	-302.869
* 4	4.600	C- 6	631.825	0.000	-224.978	C- 7	613.507	-23.572	-223.161
* 5	6.095	C- 8	276.834	-118.051	-302.869	C- 6	487.356	-183.441	-224.978
* 6	7.590	C- 8	12.105	-236.101	-302.869	C- 6	94.293	-342.396	-224.978
* 7	8.850	C- 8	-348.063	-335.595	-302.869	C- 6	-415.475	-458.169	-224.978
3 - 2	9.200	C- 8	-470.358	-363.233	-302.869	C- 6	-580.671	-485.806	-224.978
3 - 4	0.000	C- 8	-470.358	302.869	-363.233	C- 7	-563.456	223.161	-457.120
* 1	0.350	C- 8	-368.606	278.242	-371.212	C- 7	-487.868	208.437	-465.100
* 2	1.610	C- 8	-81.514	173.181	-399.937	C- 7	-266.267	139.032	-493.825
* 3	3.175	C- 6	-150.388	18.899	-558.189	C- 8	64.600	6.945	-435.615
* 4	4.740	C- 6	-242.063	-142.656	-593.867	C- 8	-80.436	-198.895	-471.293
* 5	6.000	C- 6	-519.188	-301.504	-622.592	C- 8	-450.884	-393.398	-500.018
4 - 3	6.400	C- 6	-650.862	-357.300	-631.711	C- 8	-621.580	-460.513	-509.137
4 - 1	0.000	C- 6	-650.862	631.709	-357.300	C- 8	-621.580	509.135	-460.513
* 1	0.350	C- 6	-438.176	583.645	-357.300	C- 8	-450.162	470.396	-460.513
* 2	1.810	C- 6	267.581	383.146	-357.300	C- 8	118.652	308.801	-460.513
* 3	3.205	C- 7	651.645	199.725	-359.118	C- 8	441.735	154.401	-460.513
* 4	4.600	C- 7	800.110	11.884	-359.118	C- 6	802.069	0.000	-357.300
* 5	5.995	C- 8	441.735	-154.401	-460.513	C- 6	668.447	-191.573	-357.300
* 6	7.390	C- 8	118.652	-308.801	-460.513	C- 7	284.897	-386.186	-359.118
* 7	8.850	C- 8	-450.162	-470.396	-460.513	C- 7	-438.690	-606.392	-359.118
1 - 4	9.200	C- 8	-621.580	-509.135	-460.513	C- 7	-660.364	-660.396	-359.118

PICK-UP No. 1 *

No.	L (m)	N. MAXIMUM Case	M (tm)	S (t)	N (t)	N. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-621.580	460.513	-509.137	C- 7	-660.364	359.118	-660.397
* 1	0.400	C- 8	-450.884	393.398	-500.018	C- 7	-527.963	303.321	-651.278
* 2	1.660	C- 8	-80.436	198.895	-471.293	C- 7	-248.548	144.473	-622.553
* 3	3.225	C- 8	64.600	-6.945	-435.615	C- 7	-154.029	-17.081	-586.874
* 4	4.790	C- 8	-81.514	-173.181	-399.937	C- 7	-281.352	-139.032	-551.196
* 5	6.050	C- 8	-368.606	-278.242	-371.212	C- 7	-502.953	-208.437	-522.471
2 - 1	6.400	C- 8	-470.358	-302.869	-363.233	C- 7	-578.541	-223.161	-514.492
2 - 3	0.000	C- 7	-578.541	514.492	-223.161	C- 8	-470.358	363.233	-302.869
* 1	0.350	C- 7	-404.981	477.279	-223.161	C- 8	-348.063	335.595	-302.869
* 2	1.610	C- 7	111.990	343.311	-223.161	C- 8	12.105	236.101	-302.869
* 3	3.105	C- 7	504.066	173.002	-223.161	C- 8	276.834	118.051	-302.869
* 4	4.600	C- 7	613.507	-23.572	-223.161	C- 8	365.077	0.000	-302.869
* 5	6.095	C- 7	459.449	-182.526	-223.161	C- 8	276.834	-118.051	-302.869
* 6	7.590	C- 7	70.167	-329.989	-223.161	C- 8	12.105	-236.101	-302.869
* 7	8.850	C- 7	-408.300	-429.483	-223.161	C- 8	-348.063	-335.595	-302.869
3 - 2	9.200	C- 7	-563.456	-457.120	-223.161	C- 8	-470.358	-363.233	-302.869
3 - 4	0.000	C- 8	-470.358	302.869	-363.233	C- 6	-580.671	224.978	-485.806
* 1	0.350	C- 8	-368.606	278.242	-371.212	C- 6	-504.447	210.255	-493.785
* 2	1.610	C- 8	-81.514	173.181	-399.937	C- 6	-280.556	140.849	-522.510
* 3	3.175	C- 8	64.600	6.945	-435.615	C- 6	-150.388	18.899	-558.189
* 4	4.740	C- 8	-80.436	-198.895	-471.293	C- 6	-242.063	-142.656	-593.867
* 5	6.000	C- 8	-450.884	-393.398	-500.018	C- 6	-519.188	-301.504	-622.592
4 - 3	6.400	C- 8	-621.580	-460.513	-509.137	C- 6	-650.862	-357.300	-631.711
4 - 1	0.000	C- 6	-650.862	631.709	-357.300	C- 8	-621.580	509.135	-460.513
* 1	0.350	C- 6	-438.176	583.645	-357.300	C- 8	-450.162	470.396	-460.513
* 2	1.810	C- 6	267.581	383.146	-357.300	C- 8	118.652	308.801	-460.513
* 3	3.205	C- 6	668.447	191.573	-357.300	C- 8	441.735	154.401	-460.513
* 4	4.600	C- 6	802.069	0.000	-357.300	C- 8	549.430	0.000	-460.513
* 5	5.995	C- 6	668.447	-191.573	-357.300	C- 8	441.735	-154.401	-460.513
* 6	7.390	C- 6	267.581	-383.146	-357.300	C- 8	118.652	-308.801	-460.513
* 7	8.850	C- 6	-438.176	-583.645	-357.300	C- 8	-450.162	-470.396	-460.513
1 - 4	9.200	C- 6	-650.862	-631.709	-357.300	C- 8	-621.580	-509.135	-460.513

NO⑦ BOX CULVERT FOR ROAD

D= 0.500 m

(1)Dead load

a) vertical load ----- (case-1)

For upper slab w1 = 22.6×0.50+23.6×0.70 = 27.820 kN/m

For side wall w2 = 23.6×0.70 = 16.520 〃

For bottom slab W3 = 27.820 + $\frac{2\times16.52\times6.40}{9.20}$ = 50.804 〃

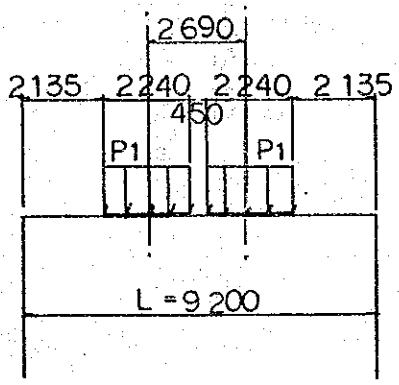
b) Horizontal load --- earth pressure ----- (case-2)

For side wall P1 = (22.6×0.50+19.60×0.35)×0.500 = 9.080 kN/m

P2 = (22.6×0.50+19.60×6.75)×0.500 = 71.800 〃

(2)Live load

a) Vertical load of center ------- (case-3)



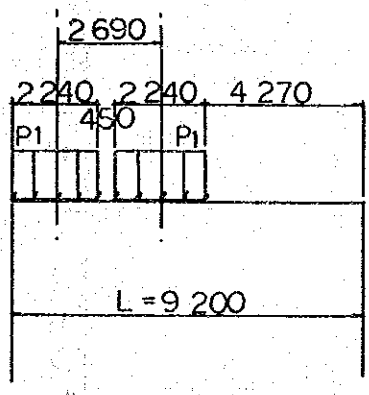
B = (0.30+0.50+0.70)cosec42° = 2.240 m

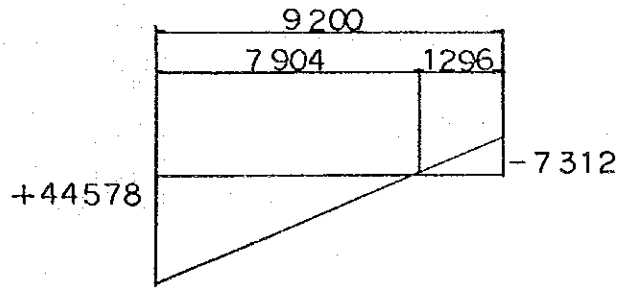
$$P1 = \frac{10\ (\text{kN/axle}) \times 30\ (\text{unit})}{3.50 \times B} = \frac{10 \times 30}{3.50 \times 2.24} = 38.265\ \text{KN/m}$$

For bottom slab

$$P2 = \frac{2\times38.265\times2.240}{9.20} = 18.633\ \text{KN/m}$$

b) Vertical load of partial ------- (case-4)





For bottom slab

$$P2 = \frac{2\times38.265\times2.240}{9.20} \pm \frac{6\times38.265\times2.240(3.480+0.790)}{9.20^2}$$

$$= 18.633 \pm 25.945 = \begin{cases} P2\text{-}1 = +44.578\ \text{KN/m} \\ P2\text{-}2 = -7.312\ \text{KN/m} \end{cases}$$

C) Horizontal load of live load surcharge ------- (case-5)

Pe = goko = 34.300 × 0.500 = 17.150 KN/m

BOX FOR ROAD NO 7' Depth = 0.500 For Check

NOTE: THE DIMENSION(t) BE EXCHANG TO DIMENSION(KN) INTO THIS CALCULATION

No	X (m)	Y (m)
1	0.0000	0.0000
2	0.0000	6.4000
3	9.2000	6.4000
4	9.2000	0.0000

No	I	J	A (m2)	I (m4)	I - J	L (m)	E (t/m2)	EPS
1	1	2	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
2	2	3	0.70000	0.028580	Fix - Fix	9.200	2.50E+07	1.00E-05
3	3	4	0.70000	0.028580	Fix - Fix	6.400	2.50E+07	1.00E-05
4	4	1	0.80000	0.042670	Fix - Fix	9.200	2.50E+07	1.00E-05

No	X (t/m)	Y (t/m)	M(tm/Rad)
1	Fix	Fix	Free
4	Free	Fix	Free

No		L-No 1 / 11	L-No 2 / 12	L-No 3 / 13	L-No 4 / 14	L-No 5 / 15	L-No 6 / 16	L-No 7 / 17	L-No 8 / 18	L-No 9 / 19	L-No 10 / 20
1	5	0.400	1.660	3.225	4.790	6.050					
2	7	0.350	1.610	3.105	4.600	6.095	7.590	8.850			
3	5	0.350	1.610	3.175	4.740	6.000					
4	7	0.350	1.810	3.205	4.600	5.995	7.390	8.850			

: Dead load
No. : 1

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	Y	0.000	6.400	-16.520	-16.520
3	3-	4	Y	0.000	6.400	-16.520	-16.520
2	2-	3	Y	0.000	9.200	-27.820	-27.820
4	4-	1	Y	0.000	9.200	50.804	50.804

ΣV = -0.003 (t)
ΣH = 0.000 (t)

: Earth pressure
No. : 2

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1-	2	X	0.000	6.400	71.800	9.080
3	3-	4	X	0.000	6.400	-9.080	-71.800

ΣV = 0.000 (t)
ΣH = 0.000 (t)

: HB live load-VL-
No. : 3

No	i	-j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
2	2-	3	Y	2.135	2.240	-38.265	-38.265
2	2-	3	Y	4.825	2.240	-38.265	-38.265
4	4-	1	Y	0.000	9.200	18.633	18.633

BOX FOR ROAD NO 7'

: HB live load-VL-
No. : 4

No	i -j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
2	2- 3	Y	0.000	2.240	-38.265	-38.265
2	2- 3	Y	2.690	2.240	-38.265	-38.265
4	4- 1	Y	0.000	1.296	-7.312	0.000
4	4- 1	Y	1.296	7.904	0.000	44.578

ΣV = 0.007 (t)
ΣH = 0.000 (t)

基本荷重ケース : HB live load-HL-
荷重 ケース No. : 5
支点条件ケース

No	i -j		Li (m)	Lo (m)	Pi (t/m)	Pj (t/m)
1	1- 2	X	0.000	6.400	17.150	17.150
3	3- 4	X	0.000	6.400	-17.150	-17.150

ΣV = 0.000 (t)
ΣH = 0.000 (t)

BOX FOR ROAD NO 7

No No	C-No 1 No 6	C-No 2 No 7	C-No 3 No 8
No 1	1.3800	1.3800	1.3800
No 2	1.6500	1.6500	1.6500
No 3	1.4300	0.0000	0.0000
No 4	0.0000	1.4300	0.0000
No 5	0.0000	0.0000	1.6500

No 1 : 6 7 8

No.	Case. 1 RX (t)	RY (t)	RM (tm)	Case. 2 RX (t)	RY (t)	RM (tm)	Case. 3 RX (t)	RY (t)	RM (tm)
1.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.002	0.000
4.	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.002	0.000

No.	Case. 4 RX (t)	RY (t)	RM (tm)	Case. 5 RX (t)	RY (t)	RM (tm)	Case. 6 RX (t)	RY (t)	RM (tm)
1.	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.005	0.000
4.	0.000	-0.005	0.000	0.000	0.000	0.000	0.000	0.005	0.000

No.	Case. 7 RX (t)	RY (t)	RM (tm)	Case. 8 RX (t)	RY (t)	RM (tm)

BOX FOR ROAD NO 7

No.	Case. 1 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 2 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 3 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	7.24551	0.00000	0.00000	-3.38728	0.00000	0.00000	3.3002
2.	-0.06646	-0.66134	-5.93643	-0.14433	0.00000	3.21935	0.04378	-0.31347	-4.1625
3.	0.00443	-0.66134	5.93643	-0.62534	0.00000	-3.21935	-0.00292	-0.31347	4.1625
4.	-0.06203	0.00000	-7.24551	-0.76967	0.00000	3.38728	0.04086	0.00000	-3.3002

No.	Case. 4 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 5 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 6 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	3.40303	0.00000	0.00000	-1.34866	0.00000	0.00000	9.1291
2.	0.91557	-0.46791	-4.00040	0.01154	0.00000	1.47088	-0.26725	-1.36091	-8.8328
3.	0.89844	-0.15902	2.71001	-0.27005	0.00000	-1.47088	-1.02987	-1.36091	8.8328
4.	0.01499	0.00000	-2.67484	-0.25851	0.00000	1.34866	-1.29712	0.00000	-9.1291

No.	Case. 7 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 8 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	9.27613	0.00000	0.00000	2.18451
2.	0.97941	-1.58177	-8.60091	-0.31081	-0.91265	-0.45339
3.	0.25908	-1.14005	6.75565	-1.47128	-0.91265	0.45339
4.	-1.33412	0.00000	-8.23481	-1.78208	0.00000	-2.18451

BOX FOR ROAD NO 7

	No	L(m)	Case 1 Dead load M (tm)	S (t)	N (t)	Case 2 Earth pressure M (tm)	S (t)	N (t)	Case 3 HB live load-VL- M (tm)	S (t)	N (t)
1-	2	0.000	-190.313	13.484	-233.700	-78.552	167.319	0.000	-54.892	-8.882	-85.714
*	1	0.400	-184.919	13.484	-227.092	-17.264	139.383	0.000	-58.445	-8.882	-85.714
*	2	1.660	-167.929	13.484	-206.277	107.743	61.634	0.000	-69.636	-8.882	-85.714
*	3	3.225	-146.827	13.484	-180.423	142.455	-13.273	0.000	-83.536	-8.882	-85.714
*	4	4.790	-125.725	13.484	-154.569	78.721	-64.177	0.000	-97.437	-8.882	-85.714
*	5	6.050	-108.735	13.484	-133.754	-18.607	-87.719	0.000	-108.628	-8.882	-85.714
2-	1	6.400	-104.016	13.484	-127.972	-50.005	-91.497	0.000	-111.737	-8.882	-85.714
2-	3	0.000	-104.016	127.972	13.484	-50.005	0.000	-91.497	-111.737	85.714	-8.882
*	1	0.350	-60.929	118.235	13.484	-50.005	0.000	-91.497	-81.737	85.714	-8.882
*	2	1.610	65.963	83.182	13.484	-50.005	0.000	-91.497	26.262	85.714	-8.882
*	3	3.105	159.231	41.591	13.484	-50.005	0.000	-91.497	136.402	48.597	-8.882
*	4	4.600	190.320	0.000	13.484	-50.005	0.000	-91.497	167.261	0.000	-8.882
*	5	6.095	159.231	-41.591	13.484	-50.005	0.000	-91.497	136.402	-48.597	-8.882
*	6	7.590	65.963	-83.182	13.484	-50.005	0.000	-91.497	26.262	-85.714	-8.882
*	7	8.850	-60.929	-118.235	13.484	-50.005	0.000	-91.497	-81.737	-85.714	-8.882
3-	2	9.200	-104.016	-127.972	13.484	-50.005	0.000	-91.497	-111.737	-85.714	-8.882
3-	4	0.000	-104.016	-13.484	-127.972	-50.005	91.497	0.000	-111.737	8.882	-85.714
*	1	0.350	-108.735	-13.484	-133.754	-18.607	87.719	0.000	-108.628	8.882	-85.714
*	2	1.610	-125.725	-13.484	-154.569	78.721	64.177	0.000	-97.437	8.882	-85.714
*	3	3.175	-146.827	-13.484	-180.423	142.455	13.273	0.000	-83.536	8.882	-85.714
*	4	4.740	-167.929	-13.484	-206.277	107.743	-61.634	0.000	-69.636	8.882	-85.714
*	5	6.000	-184.919	-13.484	-227.092	-17.264	-139.383	0.000	-58.445	8.882	-85.714
4-	3	6.400	-190.313	-13.484	-233.700	-78.552	-167.319	0.000	-54.892	8.882	-85.714
4-	1	0.000	-190.313	233.698	-13.484	-78.552	0.000	-167.319	-54.892	85.712	8.882
*	1	0.350	-111.630	215.917	-13.484	-78.552	0.000	-167.319	-26.034	79.190	8.882
*	2	1.810	149.462	141.743	-13.484	-78.552	0.000	-167.319	69.724	51.986	8.882
*	3	3.205	297.761	70.872	-13.484	-78.552	0.000	-167.319	124.115	25.993	8.882
*	4	4.600	347.194	0.000	-13.484	-78.552	0.000	-167.319	142.245	0.000	8.882
*	5	5.995	297.761	-70.872	-13.484	-78.552	0.000	-167.319	124.115	-25.993	8.882
*	6	7.390	149.462	-141.743	-13.484	-78.552	0.000	-167.319	69.724	-51.986	8.882
*	7	8.850	-111.630	-215.917	-13.484	-78.552	0.000	-167.319	-26.034	-79.190	8.882
1-	4	9.200	-190.313	-233.698	-13.484	-78.552	0.000	-167.319	-54.892	-85.712	8.882

BOX FOR ROAD NO 7

	No	L(m)	Case 4 HB live load-VL- M (tm)	S (t)	N (t)	Case 5 HB live load-HL- M (tm)	S (t)	N (t)	Case 6 M (tm)	S (t)	N (t)
1-	2	0.000	-72.228	-3.258	-127.945	-31.276	56.197	0.000	-470.737	281.983	-445.070
*	1	0.400	-73.531	-3.258	-127.945	-10.169	49.337	0.000	-367.249	235.889	-435.957
*	2	1.660	-77.636	-3.258	-127.945	38.382	27.728	0.000	-153.546	107.602	-407.232
*	3	3.225	-82.734	-3.258	-127.945	60.774	0.888	0.000	-87.027	-15.994	-371.554
*	4	4.790	-87.832	-3.258	-127.945	41.162	-25.951	0.000	-182.946	-99.985	-335.876
*	5	6.050	-91.937	-3.258	-127.945	-5.150	-47.560	0.000	-336.094	-138.829	-307.151
2-	1	6.400	-93.077	-3.258	-127.945	-22.847	-53.563	0.000	-385.833	-145.063	-299.172
2-	3	0.000	-93.077	127.945	-3.258	-22.847	0.000	-53.563	-385.833	299.172	-145.063
*	1	0.350	-50.640	114.553	-3.258	-22.847	0.000	-53.563	-283.474	285.735	-145.063
*	2	1.610	63.322	66.339	-3.258	-22.847	0.000	-53.563	46.076	237.361	-145.063
*	3	3.105	130.757	26.352	-3.258	-22.847	0.000	-53.563	332.286	126.889	-145.063
*	4	4.600	127.392	-30.854	-3.258	-22.847	0.000	-53.563	419.317	0.000	-145.063
*	5	6.095	64.470	-43.482	-3.258	-22.847	0.000	-53.563	332.286	-126.889	-145.063
*	6	7.590	-0.535	-43.482	-3.258	-22.847	0.000	-53.563	46.076	-237.361	-145.063
*	7	8.850	-55.322	-43.482	-3.258	-22.847	0.000	-53.563	-283.474	-285.735	-145.063
3-	2	9.200	-70.541	-43.482	-3.258	-22.847	0.000	-53.563	-385.833	-299.172	-145.063
3-	4	0.000	-70.541	3.258	-43.482	-22.847	53.563	0.000	-385.833	145.063	-299.172
*	1	0.350	-69.401	3.258	-43.482	-5.150	47.560	0.000	-336.094	138.829	-307.151
*	2	1.610	-65.296	3.258	-43.482	41.162	25.951	0.000	-182.946	99.985	-335.876
*	3	3.175	-60.198	3.258	-43.482	60.774	-0.888	0.000	-87.027	15.994	-371.554
*	4	4.740	-55.100	3.258	-43.482	38.382	-27.728	0.000	-153.546	-107.602	-407.232
*	5	6.000	-50.995	3.258	-43.482	-10.169	-49.337	0.000	-367.249	-235.889	-435.957
4-	3	6.400	-49.692	3.258	-43.482	-31.276	-56.197	0.000	-470.737	-281.983	-445.070
4-	1	0.000	-49.692	43.486	3.258	-31.276	0.000	-56.197	-470.737	445.072	-281.983
*	1	0.350	-34.065	45.700	3.258	-31.276	0.000	-56.197	-320.889	411.208	-281.983
*	2	1.810	35.420	47.480	3.258	-31.276	0.000	-56.197	176.353	269.946	-281.983
*	3	3.205	96.281	37.948	3.258	-31.276	0.000	-56.197	458.784	134.973	-281.983
*	4	4.600	136.191	17.441	3.258	-31.276	0.000	-56.197	552.927	0.000	-281.983
*	5	5.995	139.837	-14.042	3.258	-31.276	0.000	-56.197	458.784	-134.973	-281.983
*	6	7.390	91.910	-56.500	3.258	-31.276	0.000	-56.197	176.353	-269.946	-281.983
*	7	8.850	-30.136	-112.691	3.258	-31.276	0.000	-56.197	-320.889	-411.208	-281.983
1-	4	9.200	-72.228	-127.948	3.258	-31.276	0.000	-56.197	-470.737	-445.072	-281.983

BOX FOR ROAD NO 7'

	No	L(m)	Case 7 M (tm)	S (t)	N (t)	Case 8 M (tm)	S (t)	N (t)
1-	2	0.000	-495.528	290.026	-505.468	-443.847	387.409	-322.506
*	1	0.400	-388.822	243.932	-496.349	-300.452	329.996	-313.387
*	2	1.660	-164.985	115.645	-467.624	9.365	166.054	-284.662
*	3	3.225	-85.879	-7.951	-431.946	132.708	-1.827	-248.984
*	4	4.790	-169.211	-91.942	-396.267	24.307	-130.104	-213.305
*	5	6.050	-312.225	-130.786	-367.542	-189.254	-204.603	-184.581
2-	1	6.400	-359.149	-137.020	-359.563	-263.746	-220.741	-176.601
2-	3	0.000	-359.149	359.563	-137.020	-263.746	176.601	-220.741
*	1	0.350	-239.005	326.975	-137.020	-204.287	163.164	-220.741
*	2	1.610	99.072	209.655	-137.020	-29.176	114.791	-220.741
*	3	3.105	324.213	95.079	-137.020	99.534	57.395	-220.741
*	4	4.600	362.304	-44.122	-137.020	142.437	0.000	-220.741
*	5	6.095	229.422	-119.574	-137.020	99.534	-57.395	-220.741
*	6	7.590	7.756	-176.970	-137.020	-29.176	-114.791	-220.741
*	7	8.850	-245.702	-225.343	-137.020	-204.287	-163.164	-220.741
3-	2	9.200	-326.923	-238.780	-137.020	-263.746	-176.601	-220.741
3-	4	0.000	-326.923	137.020	-238.780	-263.746	220.741	-176.601
*	1	0.350	-279.999	130.786	-246.759	-189.254	204.603	-184.581
*	2	1.610	-136.985	91.942	-275.484	24.307	130.104	-213.305
*	3	3.175	-53.653	7.951	-311.163	132.708	1.827	-248.984
*	4	4.740	-132.759	-115.645	-346.841	9.365	-166.054	-284.662
*	5	6.000	-356.597	-243.932	-375.566	-300.452	-329.996	-313.387
4-	3	6.400	-463.302	-290.026	-384.685	-443.847	-387.409	-322.506
4-	1	0.000	-463.302	384.689	-290.026	-443.847	322.504	-387.409
*	1	0.350	-332.372	363.317	-290.026	-335.264	297.965	-387.409
*	2	1.810	127.297	263.501	-290.026	25.042	195.606	-387.409
*	3	3.205	418.982	152.068	-290.026	229.695	97.803	-387.409
*	4	4.600	544.270	24.940	-290.026	297.912	0.000	-387.409
*	5	5.995	481.267	-117.883	-290.026	229.695	-97.803	-387.409
*	6	7.390	208.079	-276.400	-290.026	25.042	-195.606	-387.409
*	7	8.850	-326.755	-459.113	-290.026	-335.264	-297.965	-387.409
1-	4	9.200	-495.528	-505.469	-290.026	-443.847	-322.504	-387.409

BOX FOR ROAD NO 7

PICK-UP No. 1 *

No.	L (m)	M. MAXIMUM Case	M (tm)	S (t)	N (t)	M. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-443.847	387.409	-322.506	C- 7	-495.528	290.026	-505.468
* 1	0.400	C- 8	-300.452	329.996	-313.387	C- 7	-388.822	243.932	-496.349
* 2	1.660	C- 8	9.365	166.054	-284.662	C- 7	-164.985	115.645	-467.624
* 3	3.225	C- 8	132.708	-1.827	-248.984	C- 6	-87.027	-15.994	-371.554
* 4	4.790	C- 8	24.307	-130.104	-213.305	C- 6	-182.946	-99.985	-335.876
* 5	6.050	C- 8	-189.254	-204.603	-184.581	C- 6	-336.094	-138.829	-307.151
2 - 1	6.400	C- 8	-263.746	-220.741	-176.601	C- 6	-385.833	-145.063	-299.172
2 - 3	0.000	C- 8	-263.746	176.601	-220.741	C- 6	-385.833	299.172	-145.063
* 1	0.350	C- 8	-204.287	163.164	-220.741	C- 6	-283.474	285.735	-145.063
* 2	1.610	C- 7	99.072	209.655	-137.020	C- 8	-29.176	114.791	-220.741
* 3	3.105	C- 6	332.286	126.889	-145.063	C- 8	99.534	57.395	-220.741
* 4	4.600	C- 6	419.317	0.000	-145.063	C- 8	142.437	0.000	-220.741
* 5	6.095	C- 6	332.286	-126.889	-145.063	C- 8	99.534	-57.395	-220.741
* 6	7.590	C- 6	46.076	-237.361	-145.063	C- 8	-29.176	-114.791	-220.741
* 7	8.850	C- 8	-204.287	-163.164	-220.741	C- 6	-283.474	-285.735	-145.063
3 - 2	9.200	C- 8	-263.746	-176.601	-220.741	C- 6	-385.833	-299.172	-145.063
3 - 4	0.000	C- 8	-263.746	220.741	-176.601	C- 6	-385.833	145.063	-299.172
* 1	0.350	C- 8	-189.254	204.603	-184.581	C- 6	-336.094	138.829	-307.151
* 2	1.610	C- 8	24.307	130.104	-213.305	C- 6	-182.946	99.985	-335.876
* 3	3.175	C- 8	132.708	1.827	-248.984	C- 6	-87.027	15.994	-371.554
* 4	4.740	C- 8	9.365	-166.054	-284.662	C- 6	-153.546	-107.602	-407.232
* 5	6.000	C- 8	-300.452	-329.996	-313.387	C- 6	-367.249	-235.889	-435.957
4 - 3	6.400	C- 8	-443.847	-387.409	-322.506	C- 6	-470.737	-281.983	-445.076
4 - 1	0.000	C- 8	-443.847	322.504	-387.409	C- 6	-470.737	445.072	-281.983
* 1	0.350	C- 6	-320.889	411.208	-281.983	C- 8	-335.264	297.965	-387.409
* 2	1.810	C- 6	176.353	269.946	-281.983	C- 8	25.042	195.606	-387.409
* 3	3.205	C- 6	458.784	134.973	-281.983	C- 8	229.695	97.803	-387.409
* 4	4.600	C- 6	552.927	0.000	-281.983	C- 8	297.912	0.000	-387.409
* 5	5.995	C- 7	481.267	-117.883	-290.026	C- 8	229.695	-97.803	-387.409
* 6	7.390	C- 7	208.079	-276.400	-290.026	C- 8	25.042	-195.606	-387.409
* 7	8.850	C- 6	-320.889	-411.208	-281.983	C- 8	-335.264	-297.965	-387.409
1 - 4	9.200	C- 8	-443.847	-322.504	-387.409	C- 7	-495.528	-505.469	-290.026

BOX FOR ROAD NO 7'

PICK-UP No. 1 *

No.	L (m)	S. MAXIMUM Case	M (tm)	S (t)	N (t)	S. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-443.847	387.409	-322.506	C- 6	-470.737	281.983	-445.076
* 1	0.400	C- 8	-300.452	329.996	-313.387	C- 6	-367.249	235.889	-435.957
* 2	1.660	C- 8	9.365	166.054	-284.662	C- 6	-153.546	107.602	-407.232
* 3	3.225	C- 8	132.708	-1.827	-248.984	C- 6	-87.027	-15.994	-371.554
* 4	4.790	C- 7	-169.211	-91.942	-396.267	C- 8	24.307	-130.104	-213.305
* 5	6.050	C- 7	-312.225	-130.786	-367.542	C- 8	-189.254	-204.603	-184.581
2 - 1	6.400	C- 7	-359.149	-137.020	-359.563	C- 8	-263.746	-220.741	-176.601
2 - 3	0.000	C- 7	-359.149	359.563	-137.020	C- 8	-263.746	176.601	-220.741
* 1	0.350	C- 7	-239.005	326.975	-137.020	C- 8	-204.287	163.164	-220.741
* 2	1.610	C- 6	46.076	237.361	-145.063	C- 8	-29.176	114.791	-220.741
* 3	3.105	C- 6	332.286	126.889	-145.063	C- 8	99.534	57.395	-220.741
* 4	4.600	C- 8	142.437	0.000	-220.741	C- 7	362.304	-44.122	-137.020
* 5	6.095	C- 8	99.534	-57.395	-220.741	C- 6	332.286	-126.889	-145.063
* 6	7.590	C- 8	-29.176	-114.791	-220.741	C- 6	46.076	-237.361	-145.063
* 7	8.850	C- 8	-204.287	-163.164	-220.741	C- 6	-283.474	-285.735	-145.063
3 - 2	9.200	C- 8	-263.746	-176.601	-220.741	C- 6	-385.833	-299.172	-145.063
3 - 4	0.000	C- 8	-263.746	220.741	-176.601	C- 7	-326.923	137.020	-238.780
* 1	0.350	C- 8	-189.254	204.603	-184.581	C- 7	-279.999	130.786	-246.759
* 2	1.610	C- 8	24.307	130.104	-213.305	C- 7	-136.985	91.942	-275.484
* 3	3.175	C- 6	-87.027	15.994	-371.554	C- 8	132.708	1.827	-248.984
* 4	4.740	C- 6	-153.546	-107.602	-407.232	C- 8	9.365	-166.054	-284.662
* 5	6.000	C- 6	-367.249	-235.889	-435.957	C- 8	-300.452	-329.996	-313.387
4 - 3	6.400	C- 6	-470.737	-281.983	-445.076	C- 8	-443.847	-387.409	-322.506
4 - 1	0.000	C- 6	-470.737	445.072	-281.983	C- 8	-443.847	322.504	-387.409
* 1	0.350	C- 6	-320.889	411.208	-281.983	C- 8	-335.264	297.965	-387.409
* 2	1.810	C- 6	176.353	269.946	-281.983	C- 8	25.042	195.606	-387.409
* 3	3.205	C- 7	418.982	152.068	-290.026	C- 8	229.695	97.803	-387.409
* 4	4.600	C- 7	544.270	24.940	-290.026	C- 6	552.927	0.000	-281.983
* 5	5.995	C- 8	229.695	-97.803	-387.409	C- 6	458.784	-134.973	-281.983
* 6	7.390	C- 8	25.042	-195.606	-387.409	C- 7	208.079	-276.400	-290.026
* 7	8.850	C- 8	-335.264	-297.965	-387.409	C- 7	-326.755	-459.113	-290.026
1 - 4	9.200	C- 8	-443.847	-322.504	-387.409	C- 7	-495.528	-505.469	-290.026

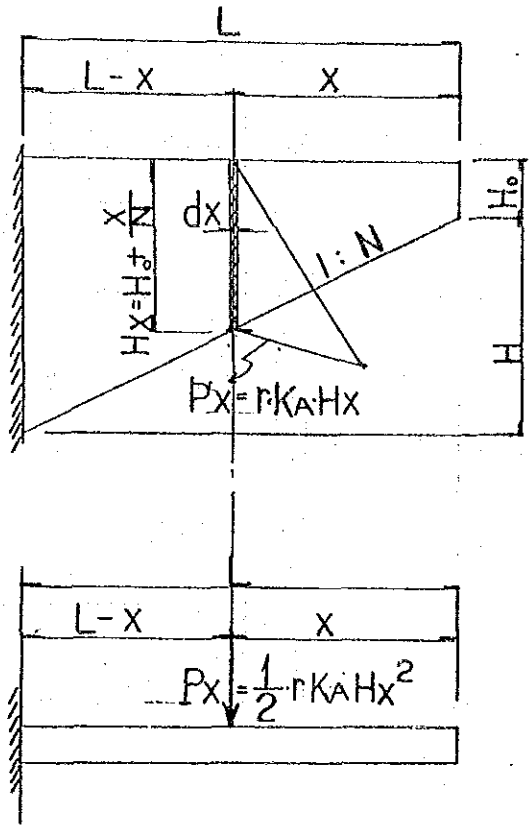
BOX FOR ROAD NO 7'

PICK-UP No. 1 *

No.	L (m)	N. MAXIMUM Case	M (tm)	S (t)	N (t)	N. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 8	-443.847	387.409	-322.506	C- 7	-495.528	290.026	-505.468
* 1	0.400	C- 8	-300.452	329.996	-313.387	C- 7	-388.822	243.932	-496.349
* 2	1.660	C- 8	9.365	166.054	-284.662	C- 7	-164.985	115.645	-467.624
* 3	3.225	C- 8	132.708	-1.827	-248.984	C- 7	-85.879	-7.951	-431.946
* 4	4.790	C- 8	24.307	-130.104	-213.305	C- 7	-169.211	-91.942	-396.267
* 5	6.050	C- 8	-189.254	-204.603	-184.581	C- 7	-312.225	-130.786	-367.542
2 - 1	6.400	C- 8	-263.746	-220.741	-176.601	C- 7	-359.149	-137.020	-359.563
2 - 3	0.000	C- 7	-359.149	359.563	-137.020	C- 8	-263.746	176.601	-220.741
* 1	0.350	C- 7	-239.005	326.975	-137.020	C- 8	-204.287	163.164	-220.741
* 2	1.610	C- 7	99.072	209.655	-137.020	C- 8	-29.176	114.791	-220.741
* 3	3.105	C- 7	324.213	95.079	-137.020	C- 8	99.534	57.395	-220.741
* 4	4.600	C- 7	362.304	-44.122	-137.020	C- 8	142.437	0.000	-220.741
* 5	6.095	C- 7	229.422	-119.574	-137.020	C- 8	99.534	-57.395	-220.741
* 6	7.590	C- 7	7.756	-176.970	-137.020	C- 8	-29.176	-114.791	-220.741
* 7	8.850	C- 7	-245.702	-225.343	-137.020	C- 8	-204.287	-163.164	-220.741
3 - 2	9.200	C- 7	-326.923	-238.780	-137.020	C- 8	-263.746	-176.601	-220.741
3 - 4	0.000	C- 8	-263.746	220.741	-176.601	C- 6	-385.833	145.063	-299.172
* 1	0.350	C- 8	-189.254	204.603	-184.581	C- 6	-336.094	138.829	-307.151
* 2	1.610	C- 8	24.307	130.104	-213.305	C- 6	-182.946	99.985	-335.876
* 3	3.175	C- 8	132.708	1.827	-248.984	C- 6	-87.027	15.994	-371.554
* 4	4.740	C- 8	9.365	-166.054	-284.662	C- 6	-153.546	-107.602	-407.232
* 5	6.000	C- 8	-300.452	-329.996	-313.387	C- 6	-367.249	-235.889	-435.957
4 - 3	6.400	C- 8	-443.847	-387.409	-322.506	C- 6	-470.737	-281.983	-445.076
4 - 1	0.000	C- 6	-470.737	445.072	-281.983	C- 8	-443.847	322.504	-387.409
* 1	0.350	C- 6	-320.889	411.208	-281.983	C- 8	-335.264	297.965	-387.409
* 2	1.810	C- 6	176.353	269.946	-281.983	C- 8	25.042	195.606	-387.409
* 3	3.205	C- 6	458.784	134.973	-281.983	C- 8	229.695	97.803	-387.409
* 4	4.600	C- 6	552.927	0.000	-281.983	C- 8	297.912	0.000	-387.409
* 5	5.995	C- 6	458.784	-134.973	-281.983	C- 8	229.695	-97.803	-387.409
* 6	7.390	C- 6	176.353	-269.946	-281.983	C- 8	25.042	-195.606	-387.409
* 7	8.850	C- 6	-320.889	-411.208	-281.983	C- 8	-335.264	-297.965	-387.409
1 - 4	9.200	C- 6	-470.737	-445.072	-281.983	C- 8	-443.847	-322.504	-387.409

CALCULATION OF WINGWALL

Caluculation formula for wingwalls



bending moment

$$Mx = \int_0^L Px \ (L-x)\ dx$$

$$= \int_0^L \frac{1}{2} rK_A \left(H_o + \frac{x}{N} \right)^2 \ (L-x)\ dx$$

shearing force

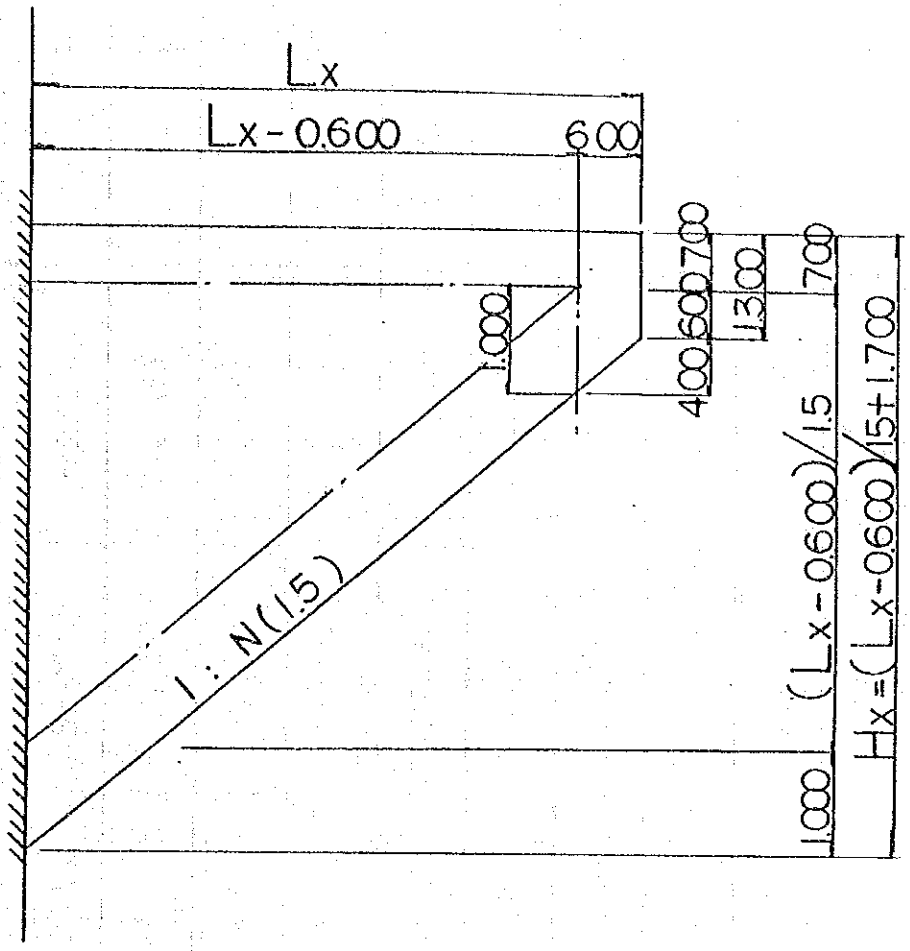
$$Sx = \int_0^L Px \cdot dx$$

$$= \int_0^L \frac{1}{2} rK_A \left(H_o + \frac{x}{N} \right)^2 dx$$

∴ Analysis of upper formula for earth pressure

$$Mx = \frac{1}{2} rK_A \left(\frac{H_o \cdot x^2}{2} + \frac{H_o \cdot x^3}{3 \cdot N} + \frac{x^4}{12 \cdot N^2} \right)$$

$$Sx = \frac{1}{2} rK_A \left(H_o^2 \cdot x + \frac{H_o \cdot x^2}{N} + \frac{x^3}{3 \cdot N^2} \right)$$



from general formula

where

$r = 19.6 \ \ KN/m^2$

$$K_A = \tan^2(45^\circ - \frac{\phi}{2}) = \tan^2(45^\circ - \frac{30^\circ}{2}) = 0.5774^2$$

$$= 0.3334 \fallingdotseq 0.400$$

$$Mx = \frac{1}{2} \times 19.6 \times 0.400 \left(\frac{1.30^2}{2}x^2 + \frac{1.30}{3 \times 1.5}x^3 + \frac{1}{12 \times 1.5^2}x^4\right) / Hx$$

$$= (3.312 \cdot x^2 + 1.132 \cdot x^3 + 0.145 \cdot x^4) / Hx \quad (KNm/m)$$

$$Sx = \frac{1}{2} \times 19.6 \times 0.400 \left(1.30^2 \cdot x^2 + \frac{1.30}{1.5}x^2 + \frac{1}{3 \times 1.5^2}x^3\right) / Hx$$

$$= (6.628 \cdot x + 3.397 \cdot x^2 + 0.581 \cdot x^3) / Hx \quad (KN/m)$$

Calculation of bending moment and shearing force

Lx(m)	Hx(m)	S . L . S		U . L . S		Area of reinforced	thickness of menber	
		Mx($^{KNm}/_{m}$)	Sx($^{KN}/_{m}$)	Mx($^{KNm}/_{m}$)	Sx($^{KN}/_{m}$)		D cm	d cm
5.0	4.633	67.975	41.159	117.257	71.000	$Y_{16}-150^{ctc}$	40	34.0
5.5	4.967	84.802	47.489	146.283	81.919	$Y_{16}-150^{ctc}$	40	34.0
6.0	5.300	104.088	54.256	179.552	93.592	$Y_{16}-150^{ctc}$	50	44.0
8.0	6.633	208.876	85.618	360.312	147.691	$Y_{20}-150^{ctc}$	60	54.0
8.5	6.967	242.772	94.528	418.782	163.061	$Y_{25}-150^{ctc}$	60	53.5
9.0	7.300	280.116	103.885	483.200	179.202	$Y_{25}-150^{ctc}$	60	53.5
9.5	7.633	321.039	113.675	553.792	196.090	$Y_{25}-150^{ctc}$	60	53.5
10.0	7.967	365.658	123.884	630.760	213.700	$Y_{25}-150^{ctc}$	70	63.5
10.5	8.300	414.225	134.541	714.538	232.083	$Y_{20}-300^{ctc}$ $Y_{32}-300^{ctc}$	70	63.0
11.0	8.633	466.858	145.634	805.330	251.219	$Y_{25}-300^{ctc}$ $Y_{32}-300^{ctc}$	70	63.0
11.5	8.967	523.665	157.143	903.322	271.072	$Y_{32}-150^{ctc}$	70	63.0

Each calculation of

Resisting moment and shearing intension for U.L.S and S.L.S

1) Lx = 5.0^{m} and 5.5^{m}

b = 100^{cm} h = 40 d = 34.0 d´ = 6.0

As = Y_{16}−150^{ctc}= 2.011/0.15 = 13.41 cm^{2}

p = As × 100/bd =13.41 ×100 ／100 ×34.0=0.394 %

a) S.L.S

$$x = \frac{0.8fy \cdot As}{0.25fcu \cdot b} = \frac{0.8 \times 41000 \times 13.41}{0.25 \times 2500 \times 100} = 7.0\ ^{cm}$$

Z= d − x/3= 34.0 − 7.0/3= 31.7 ^{cm}

M_{Rs}=0.8fy As Z

=0.8 ×41000 ×13.41 ×31.7×10^{-5}

= 139.4 ^{KNm} = Ms =67.975 ^{KNm}or 84.802^{KNm}

M_{Rc}=0.25fcub·xZ

=0.25×2500×100 ×7.0 ×31.7×10^{-5}

= 138.7 ^{KNm} > M OK

b) U.L.S

$$x = \frac{0.87fy \cdot As}{0.40fcu \cdot b} = \frac{0.87 \times 41000 \times 13.41}{0.40 \times 2500 \times 100} = 4.8\ ^{cm}$$

Z= d − x/2= 34.0 − 4.8/3= 31.6 ^{cm} <0.95×34.0=32.3^{cm}

M_{Rs}=0.87fy As Z

=0.87×41000 ×13.41 ×31.6×10^{-5}

= 151.1 ^{KNm} > Mu =117.257 ^{KNm}or 146.283^{KNm}

M_{Rc}=0.40fcub·xZ

=0.40×2500×100 ×4.8 ×31.6×10^{-5}

= 151.7 ^{KNm} > Mu OK

Notice : the U.L.S is critical from result of both calculation of resisting moment and the other case is exclude calculation of resisting moment for S.L.S

Shearing intension (U.L.S)

$$\tau = \frac{Su}{bd} = \frac{81.919 \times 10^3}{100 \times 34.0} = 24.1 \ N/cm^2$$

$$< \ \tau a = 35.0 + \frac{15.00}{0.25} (0.394 - 0.25) = 43.6 \ N/cm^2$$

2) $Lx = 6.0^m$ (for U.L.S)

$b = 100^{cm}$ $h=50$ $d=44.0$ $d' = 6.0$

$As = Y_{16} - 150^{ctc} = 2.011/0.15 = 13.41 \ ^{cm}$

$P = 13.41 \times 100 / 100 \times 44.0 = 0.305$

$$X = \frac{0.87 \times 41000 \times 13.41}{0.40 \times 2500 \times 100} = 4.8 \ ^{cm}$$

$Z = 44.0 - 4.8/2 = 41.6^{cm} < 0.95 \times 44.0 = 41.8 \ ^{cm}$

$M_{RS} = 0.87 \times 41000 \times 13.41 \times 41.6 \times 10^5 = 199.0^{KNm} > Mu = 179.552^{KNm}$

$M_{RC} = 0.40 \times 2500 \times 100 \times 4.8 \times 41.6 \times 10^5 = 199.7^{KNm} > Mu = 179.552^{KNm}$

OK

$$\tau = \frac{93.592 \times 10^3}{100 \times 44.0} = 21.3 \ N/cm^2$$

$$< \tau a = 35.0 + \frac{15.0}{0.25} (0.305 - 0.25) = 38.3 \ N/cm^2$$

OK

3) Lx = 8.0^{m} (for U.L.S)

b = 100^{cm} h=60 d=54.0 d´ = 6.0

As= $Y_{20}-150^{ctc}$= 3.141/0.15 = 20.94 cm^2

P = 20.94×100/ 100×54.0 = 0.388

$$X = \frac{0.87\times 41000 \times 20.94}{0.40 \times 2500\times 100} = 7.4 \text{ cm}$$

Z = 54.0 −7.4/2 = 50.3^{cm} < 0.95×54.0= 51.3 ^{cm} OK

M_{Rs} = 0.87 ×41000 ×20.94 ×50.3×10^{-5}= 375.7^{KNm} > Mu =360.312^{KNm}

M_{Rc} = 0.40 ×2500×100 × 7.4×50.3×10^{-5}=372.2^{KNm}> Mu =360.312^{KNm} OK

$$\tau = \frac{147.691 \times 10^3}{100\times 54.0} = 27.4 \text{ N/cm}^2$$

$$< \tau a = 35.0 + \frac{15.0}{0.25}(0.388-0.25) = 43.3 \text{ N/cm}^2$$

4) Lx = 8.5^{m} 9.0^{m} and 9.5^{m} (for U.L.S)

b = 100^{cm} h=60 d=53.5 d´ =6.5

As= $Y_{25}-150^{ctc}$= 4.909/0.15 = 32.73 cm^2

P = 32.73×100/ 100×53.5 = 0.612

$$X = \frac{0.87\times 41000 \times 32.73}{0.40 \times 2500\times 100} = 11.8 \text{ cm}$$

Z = 53.5 −11.8/2= 47.6^{cm} <0.95×53.5= 50.8 ^{cm} OK

M_{Rs} = 0.87 ×41000 ×32.73 ×47.6×10^{-5}= 555.7^{KNm} > Mu =418.782^{KNm} ~553.792^{KNm}

M_{Rc} = 0.40 ×2500×100 ×11.8×47.6×10^{-5}=561.7^{KNm}> OK

$$\tau = \frac{196.090 \times 10^3}{100 \times 53.5} = 36.7 \text{ N/cm}^2$$

$$< \tau a = 50 + \frac{15.0}{0.50}(0.612-0.50) = 53.4 \text{ N/cm}^2 \quad \text{OK}$$

5) Lx = 10.0^{m} (for U.L.S)

b = 100^{cm} h=70 d=63.5 d´ = 6.5

As= $Y_{25}-150^{ctc}$= 4.909/0.15 = 32.73 cm^2

P = 32.73×100/ 100×63.5 = 0.515

$$X = \frac{0.87\times41000\times32.73}{0.40\times2500\times100} = 11.8\ ^{cm}$$

Z = 63.5 −11.8/2= 57.6^{cm} <0.95×63.5= 60.3 ^{cm} OK

M_{RS} = 0.87 ×41000 ×32.73 ×57.6×10^{-5}= 672.5^{KNm} > Mu =630.760^{KNm}

M_{RC} = 0.40 ×2500×100 ×11.8×57.6×10^{-5}=679.7^{KNm}> Mu =630.760^{KNm} OK

$$\tau = \frac{263.700\times10^{3}}{100\times63.5} = 33.7\ N/cm^2$$

$$< \tau a = 50 + \frac{15.0}{0.50}(0.515-0.50) = 50.4\ N/cm^2$$

6) Lx = 10.5^{m} (for U.L.S)

b = 100^{cm} h=70 d=63.0 d´ =7.0

$$As = \begin{matrix} Y_{20}-300^{ctc} \\ Y_{32}-300^{ctc} \end{matrix} = \left[\begin{matrix} 3.142/0.300 \\ 8.042/0.300 \end{matrix} \right] = 37.28\ cm^2$$

P = 37.28×100/ 100×63.0 = 0.592

$$X = \frac{0.87\times41000\times37.28}{0.40\times2500\times100} = 13.4\ ^{cm}$$

Z = 63.0 −13.4/2= 56.3^{cm} <0.95×63.0= 59.8 ^{cm} OK

M_{RS} = 0.87 ×41000 ×37.28 ×56.3×10^{-5}= 748.6^{KNm} > Mu =714.538^{KNm}

M_{RC} = 0.40 ×2500×100 ×13.4×56.3×10^{-5}=754.4^{KNm}> Mu =714.538^{KNm} OK

$$\tau = \frac{232.083\times10^{3}}{100\times63.0} = 36.8\ N/cm^2$$

$$< \tau a = 50 + \frac{15.0}{0.50}(0.592-0.50) = 52.7\ N/cm^2 \quad OK$$

7) Lx = 11.0^{m} (for U.L.S)

b = 100^{cm} h=70 d=63.0 d´ = 7.0

$$As = \begin{matrix} Y_{25}-300^{ctc} \\ Y_{32}-300^{ctc} \end{matrix} = \begin{bmatrix} 4.909/0.300 \\ 8.042/0.300 \end{bmatrix} = 43.17\ cm^2$$

$$P = 43.17\times100/\ 100\times63.5 = 0.685$$

$$X = \frac{0.87\times41000\ \times43.17}{0.40\ \times2500\times100} = 15.4\ ^{cm}$$

$$Z = 63.0\ -15.4/2 = 55.3^{cm} < 0.95\times63.0 = 59.8\ ^{cm}$$ OK

$$M_{Rs} = 0.87\ \times41000\ \times43.17\ \times55.3\times10^{-5} = 851.5^{KNm} > Mu = 805.330^{KNm}$$

$$M_{Rc} = 0.40\ \times2500\times100\ \times15.4\times55.3\times10^{-5} = 851.6^{KNm} > Mu = 805.330^{KNm}$$ OK

$$\tau = \frac{251.219\ \times10^{3}}{100\times63.0} = 39.9\ N/cm^2$$

$$< \tau a = 50.0 + \frac{15.0}{0.50}\ (0.685-0.50) = 55.4\ N/cm^2$$

check of S.L.S

$$X = \frac{0.80\times41000\ \times43.17}{0.25\ \times2500\times100} = 22.8\ ^{cm}$$

$$Z = 63.0\ -22.8/3 = 55.4^{cm}$$

$$M_{Rs} = 0.80\ \times41000\ \times43.17\ \times55.4\times10^{-5} = 784.4^{KNm} > Mu = 466.858^{KNm}$$

$$M_{Rc} = 0.25\ \times2500\times100\ \times22.8\times55.4\times10^{-5} = 789.4^{KNm} > Mu = 466.858^{KNm}$$ OK

8) Lx = 11.5^{m} (for U.L.S)

b = 100^{cm} h=70 d=63.0 d′ = 7.0

As= Y_{32}−150^{ctc}= 8.042/0.15 = 53.61 cm^2

P = 53.61×100/ 100×63.0 = 0.851

$$X = \frac{0.87\times 41000 \times 53.61}{0.40 \times 2500\times 100} = 19.2 \text{ cm}$$

Z = 63.0 −19.2/2= 53.4^{cm} <0.95×63.0= 59.8 ^{cm} OK

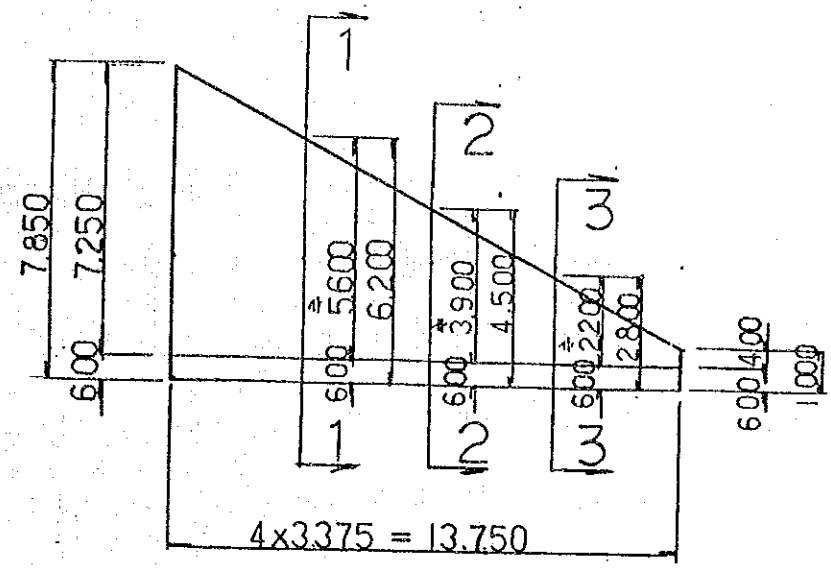
M_{RS} = 0.87 ×41000 ×53.61 ×53.4×10^{-5}=1021.1^{KNm} > Mu =903.322^{KNm}

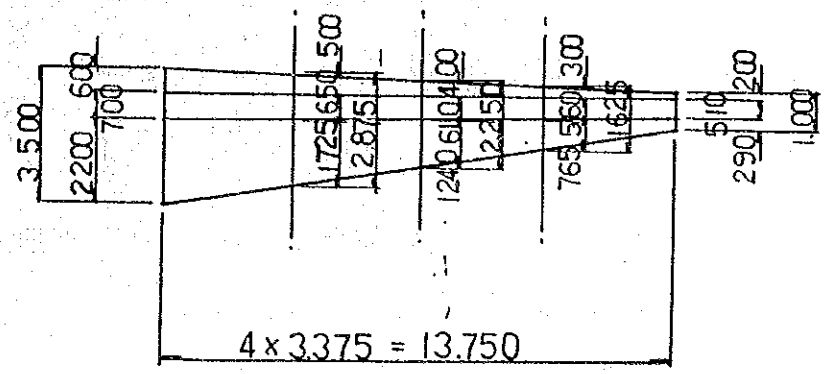
M_{RC} = 0.40 ×2500×100 ×19.2×53.4×10^{-5}=1025.8^{KNm} > Mu =903.322^{KNm} OK

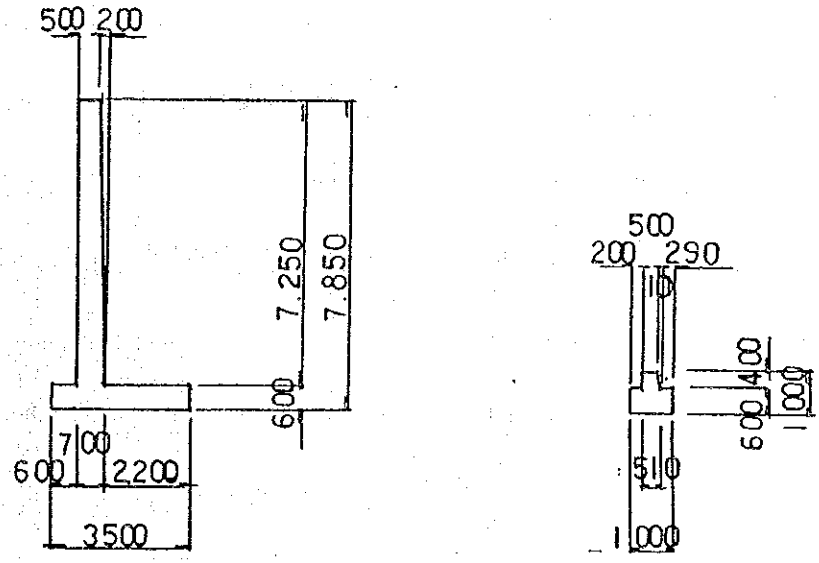
$$\tau = \frac{271.072 \times 10^3}{100\times 63.0} = 43.1 \text{ N/cm}^2$$

$$< \tau a = 50.0 + \frac{15.0}{0.50} (0.851-0.50) = 60.5 \text{ N/cm}^2$$

Retaining wall of NO 7 Boxcluvert for road



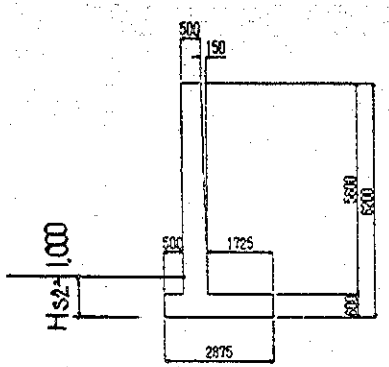




BOTH EDGE

CALCULATION OF RETAINING WALLS
FOR ROAD STRUCTURE

(1) SHAPE AND SIZE



(2) Earth hight and
Water level

HS2 = 1.000 (m)

HW1 = 0.000 (m)

(3) Each Factor

kN ↑

Unit volume weights			
for concrete	GAMC	= 23.600	(t/m³)
for back fill	GAM1	= 19.600	(t/m³)
〃 (underwater)	GAM1S	= 10.780	(t/m³)
Internal friction angle	FA1	= 30.000	(°)
for above toe slab	GAM2	= 18.600	(t/m³)
〃 (underwater)	GAM2S	= 9.780	(t/m³)
for water	WATS	= 9.800	(t/m³)

For Foundation Ground

Cohesive power	C	= 0.000	(t/m²)
Friction facter	tanφB	= 0.600	
Allowable Pressure	Qa	= 350.000	(t/m²)

NOTE : THE DIMENSION(t) BE EXCHANG TO DIMENSION(kN) INTO
THIS CALCULATION

EARTH PRESSURE (COULOMB FORMULA)

EARTH PRESSURE COEFFICIENT : Ka

φ : FAi	30.000 (°)
δ :	= 0.000 (°)
β :	0.000 (°)
θ :	0.000 (°)

$$Ka = \frac{\cos^2(\phi-\theta)}{\cos^2\theta*\cos(\theta+\delta)*\left[1+\sqrt{\frac{(\sin(\phi+\delta)*\sin(\phi-\beta))}{(\cos(\theta+\delta)*\cos(\theta-\beta))}}\right]^2}$$

= 0.333

Ka =	0.333
———	0.000 (°)
———	0.000 (°)
H = Structure High	6.200 (m)
GAMi =	19.600 (t/m³)
	0.000 (t/m²)
	0.000 (t/m²)

p = Ka*γo*H - 2*C*√Ka + Ka*Q

p1 = 0.000 (t/m²)

p2 = 40.507 (t/m²)

EARTH PRESSURE

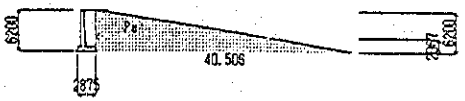
P = (p1+p2) * H / 2 = 125.571 (t/m)

Ph = 125.571 (t/m)

Pv = 0.000 (t/m)

y = 2.067 (m)

x = 0.000 (m)



CALCULATION OF WEIGHT OR FORCE

(1) CONCRETE

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
1	40.710	0.000	1.438	0.300	58.521	0.000
6	66.080	0.000	0.750	3.400	49.560	0.000
7	9.912	0.000	1.050	2.467	10.408	0.000
Σ_1	116.702	0.000			118.488	0.000

V = Xi*Yi*GAMC　　H = V*KH1
Mx = V*x　　My = H*y

(2) BACK FILLING

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
2	8.232	0.000	1.100	4.333	9.055	0.000
3	189.336	0.000	2.013	3.400	381.039	0.000
Σ_2	197.568	0.000			390.094	0.000

V = Xi*Yi*GAM1　　H = V*KH1
Mx = V*x　　My = H*y

(3) SURCHAGE OF TOE SLAB

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
2	3.720	0.000	0.250	0.000	0.930	0.000
Σ_3	3.720	0.000			0.930	0.000

V = Xi*Yi*GAM2　　H = V*KH2
Mx = V*x　　My = H*y

(4) EARTH PRESSURE

	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
Σ_4	0.000	125.571	2.875	2.067	0.000	259.513

TOTAL OF ACTION FORCE FOR FOUNDATION EDGE

LOADS	V(t)	H(t)	Mx(t·m)	My(t·m)
Σ_1	116.702		118.488	
Σ_2	197.568		390.094	
Σ_3	3.720		0.930	
Σ_4	0.000	125.571	0.000	259.513
Total	317.990	125.571	509.512	259.513

Mo = ΣMx - ΣMy = 249.999 (t·m)

TOTAL FORCE FOR UNDER FOUNDATION CENTER

	V(t)	H(t)	e(m)	Mc(t·m)
	317.990	125.571	0.651	207.111

e = B0/2 - Mo/V　　:　　Mc = V * e

B0 : STRUCTURE WIDTH

CALCULATION OF SECURITY OF DIRECTION FOUNDATION (SLS)

FOR INVERSION

	V(t)	Mc(t·m)	e(m)
	317.990	207.111	0.651 > 0.479

e = Mc/V

FOR SLIDE

	D(m)	V(t)	H(t)	Hu(t)	Fs
	2.359	317.990	125.571	190.794	1.519 > 1.5

C = 0.00 (t/m^2) tan(δ) = 0.60

Hu = C*D+ V*tan(δ)

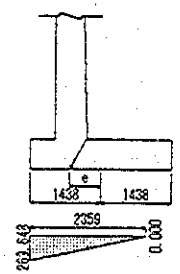
Fs = Hu/H

FOR CONTACT PRESSURE UNDER FOUNDATION.

B	(m)	2.875
L	(m)	1.000
V	(t)	317.990
H	(t)	125.571
Mc	(t·m)	207.111
e	(m)	0.651
X	(m)	2.359
Qmax(t/m^2)		269.648
Qmin(t/m^2)		0.000
Qa		29.4000

Q = V/(B*L) + 6*Mc/(L*B*B)

Q = 2*V/(L*X) : X = 3*(B/2-Mc/V)



A. for section 1)

I calculation of stability

1) for S,L,S

load	N(KN)	H(KN)	MX(KNm)	Mg(KNm)
concrete of structure, surcharge of heel slab and toe slab	317.990	—	509.512	—
earth pressure	—	125.571	—	259.513
total	317.990	125.571	509.512	259.513

a) for inversion — U,L,S

$$Fin = \frac{509.512}{259.513 \times 1.50 \times 1.15} = 1.14 > 1.0$$

b) for sliding — S,L,S

$$Fsl = \frac{317.990 \times 0.60}{125.571} = 1.519 > 1.5$$

C) for pressure of bottom — S,L,S

$$X = \frac{509.512 - 259.513}{317.990} = 0.786 > \frac{B}{3} = \frac{2.875}{3} = 0.958 \text{ m}$$

$$< \frac{B}{6} = \frac{2.875}{6} = 0.480 \text{ m}$$

$$qmax = \frac{2 \times 317.990}{3 \times 0.786 \times 1.00} = 269.8 \text{ KN/m}^2 < qa = 350 \text{ KN/m}^2$$

1 calculation of stability

2) for U.L.S

load	N(KN)	H(KN)	MX(KNm)	Mg(KNm)
concrete of structure, surcharge of heel slab and toe slab	317.990×1.2 ×1.15	—	509.512×1.2 ×1.15	—
earth pressure	—	125.571×1.5 ×1.1 =216.610	—	259.513×1.5 ×1.1 =447.660
total	438.827	216.610	703.126	447.660

a) for inersion

$$X = \frac{703.126-447.660}{438.827} = 0.582\ \text{m} > \frac{B}{3} = \frac{2.875}{3} = 0.958\ \text{m}$$

$$< \frac{B}{6} = \frac{2.875}{6} = 0.480\ \text{m}$$

$$Fin = \frac{509.512}{447.660} = 1.138 > 1.00 \qquad \text{OK}$$

b) for sliding

$$Fsl = \frac{438.827\times 0.60}{216.610} = 1.215 > 1.1$$

C) for pressure of bottom

$$qmax = \frac{2\times 438.827}{3\times 0.582\times 1.00} = 502.7\ \text{KN/m}^2 < qa = 525\ \text{KN/m}^2$$

2. calculation of each section

1) Vertical wall for U, L, S

a) bending moment and shearing force

$$M = \frac{1}{6} \times 19.6 \times 0.333 \times 5.60^3 \times 1.5 \times 1.15 = 329.6 \text{ KNm}$$

$$S = \frac{1}{2} \times 19.6 \times 0.333 \times 5.60^2 \times 1.5 \times 1.15 = 176.6 \text{ KN}$$

b) calculation of stress

b=100cm h=65 d=59.0 d'=6.0

$AS = Y20 - 150^{CTC} = 3.1416 / 0.15 = 20.944 \text{ cm}^2$

$$P = \frac{20.944}{100 \times 59.0} \times 100 = 0.355\%$$

$$X = \frac{0.87 \times 41000 \times 20.944}{0.40 \times 2500 \times 100} = 7.4 \text{ cm}$$

$$Z = 59.0 - \frac{1}{2} \times 7.4 = 55.3 \text{ cm} < 0.95 \times 5.90 = 56.0 \text{ cm}$$

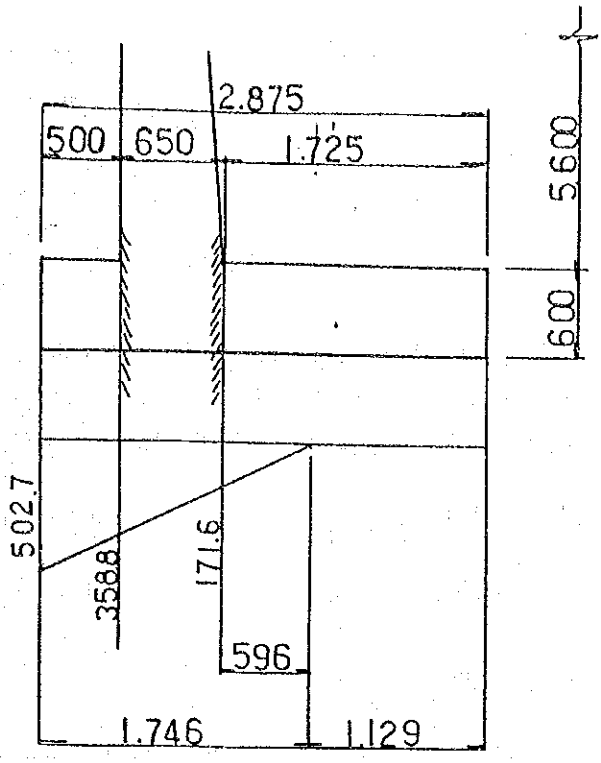
$MRS = 0.87 \times 41000 \times 20.944 \times 55.3 \times 10^{-5} = 413.1 \text{ KNm} > 329.6 \text{ KNm}$

$MRC = 0.40 \times 2500 \times 100 \times 7.4 \times 55.3 \times 10^{-5} = 409.2 \text{ KNm} > 329.6 \text{ KNm}$

$$\tau = \frac{176.6 \times 10^3}{100 \times 59.0} = 30.0 \text{ N/cm}^2 < \tau a = 50 + 15 \frac{0.355 - 0.25}{0.25} = 56.3 \text{ cm}^2$$ OK

2) Footing slab for U.L.S

a) load of surcharge



$W1 = (23.6 \times 0.60 + 18.6 \times 0.40) \times 1.2 \times 1.15 = 19.8$ KN/m

$W2 = (23.6 \times 0.60 + 19.6 \times 5.60) \times 1.2 \times 1.15 = 171.1$ KN/m

b) for toe footing slab

$$M = \frac{0.50^2}{6}\{2 \times 502.7 + 358.8\} - \frac{0.50^2}{2} \times 29.8 = 53.2 \text{ KNm}$$

$$S = \frac{0.50}{2}(502.7 + 358.8) 29.8 \times 0.500 = 200.5 \text{ KN}$$

C) for heel footing slab

$$M = \frac{1.725^2}{2} \times 171.1 - \frac{0.596^2}{6} \times 171.6 = 244.4 \text{ KNm}$$

$$S = 171.1 \times 1.725 - \frac{1}{2} \times 171.6 \times 0.596 = 44.1 \text{ KN}$$

d) calculation of stress

(1) for toe footing slab

b=100cm h=60 d=54.0 d'=60

AS = Y20−150 c t c $= 20.944$ cm^2

$$P = \frac{20.944}{100 \times 54.0} \times 100 = 0.388\%$$

$$X = \frac{0.87 \times 41000 \times 20.944}{0.40 \times 2500 \times 100} = 7.4 \text{ cm}$$

$$Z = 54.0 - \frac{1}{2} \times 7.4 = 50.3 \text{ cm} < 54.0 \times 0.95 = 51.3 \text{ cm}$$

$MRS = 0.87 \times 41000 \times 20.944 \times 50.3 \times 10^{-5} = 375.8$ KNm > 53.2 KNm

$MRc = 0.40 \times 2500 \times 100 \times 7.4 \times 50.3 \times 10^{-5} = 372.2$ KNm > 53.2 KNm

$$\tau = \frac{200.5 \times 10^3}{100 \times 54.0} = 37.2 \text{ N/cm}^2 < \tau a = 50 + 15 \times \frac{(0.388 - 0.25)}{0.25} = 58.3 \text{ cm}^2$$ OK

(2) for feel footing slab

b=100cm h=60 d=54.0 d'=60

AS = Y20－150c t c =20.944 cm^2

$$P = \frac{20.944}{100 \times 54.0} \times 100 = 0.388\%$$

$$X = \frac{0.87 \times 41000 \times 20.944}{0.40 \times 2500 \times 100} = 7.4 \text{ cm}$$

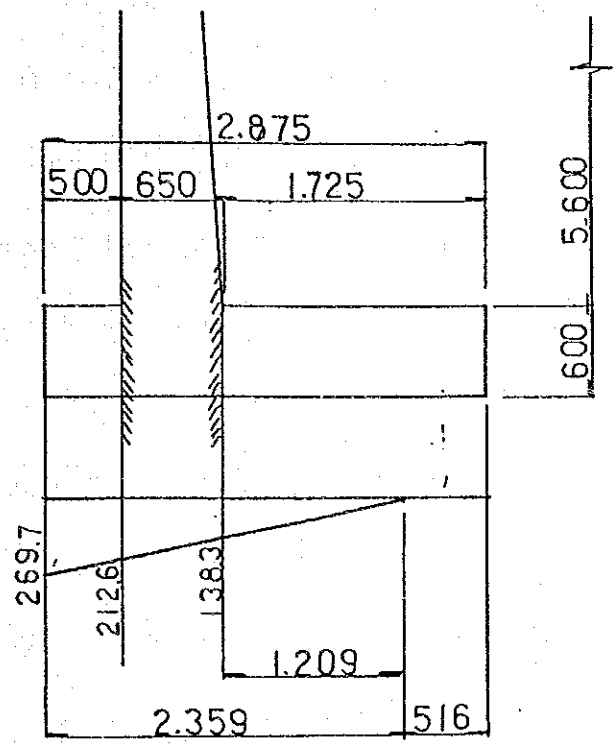
$$Z = 54.0 - \frac{1}{2} \times 7.4 = 50.3 \text{ cm} < 0.95 \times 54.0 = 51.3 \text{ cm} \quad \text{OK}$$

$$MRS = 0.87 \times 41000 \times 20.944 \times 50.3 \times 10^{-5} = 375.8 \text{ KNm} > 244.1 \text{ KNm}$$

$$MRc = 0.40 \times 2500 \times 100 \times 7.4 \times 50.3 \times 10^{-5} = 372.2 \text{ KNm} > 244.1 \text{ KNm} \quad \text{OK}$$

$$\tau = \frac{244.1 \times 10^3}{100 \times 54.0} = 45.2 \text{ N/cm}^2 < \tau a = 50 + 15 \times \frac{(0.388 - 0.25)}{0.25} = 58.3 \text{ cm}^2 \quad \text{OK}$$

3) footing slab for S,L,S



a) load of surcharge

W1 = 23.6×0.6+18.6×0.40 = 21.600 KN/m

W2 = 23.6×0.6+19.6×5.60 = 123.920 KN/m

b) for toe footing slab

$$M = \frac{0.50^2}{6} \cdot (2 \times 269.7 + 212.6) - \frac{0.50^2}{2} \times 21.60 = 28.7 \text{ KN}$$

$$S = \frac{0.50^2}{2} 289.7 + 212.6) - 21.60 \times 0.50 = 109.8 \text{ KN}$$

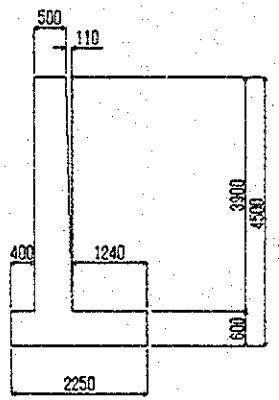
c) for heel footing slab

$$M = \frac{1.725^2}{2} \times 123.920 - \frac{1.209^2}{6} \times 138.3 = 150.7 \text{KNm}$$

$$S = 123.920 \times 1.725 - \frac{1}{2} \times 138.3 \times 1.209 = 130.2 \text{ KN}$$

note:this case is abridge

(1)



(2)

β = 0.000 (°)

HS2 = 1.000 (m)

HW1 = 0.000 (m)

GAMC = 23.600 (t/m^3)

GAM1 = 19.600 (t/m^3)

GAM1S = 10.780 (t/m^3)

FAi = 30.000 (°)

GAM2 = 18.600 (t/m^3)

GAM2S = 9.780 (t/m^3)

WATS = 9.800 (t/m^3)

C = 0.000 (t/m^2)

$\tan\phi B$ = 0.600

Qa = 29.400 (t/m^2)

30.000 (°)

= 0.000 (°)

0.000 (°)

0.000 (°)

$$Ka = \frac{\cos^2(\phi-\theta)}{\cos^2\theta*\cos(\theta+\delta)*\left[1+\sqrt{\frac{(\sin(\phi+\delta)*\sin(\phi-\beta))}{(\cos(\theta+\delta)*\cos(\theta-\beta))}}\right]^2}$$

= 0.333

0.333

0.000 (°)

0.000 (°)

4.500 (m)

19.600 (t/m³)

0.000 (t/m²)

0.000 (t/m²)

$p = Ka*\gamma o*H - 2*C*\sqrt{Ka} + Ka*Q$

p1 = 0.000 (t/m²)

p2 = 29.400 (t/m²)

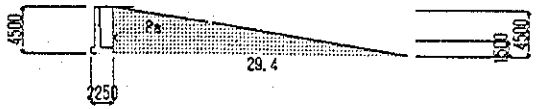
P = (p1+p2) * H / 2 = 66.150 (t/m)

Ph = 66.150 (t/m)

Pv = 0.000 (t/m)

y = 1.500 (m)

x = 0.000 (m)



(1)

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
1	31.860	0.000	1.125	0.300	35.843	0.000
6	46.020	0.000	0.650	2.550	29.913	0.000
7	5.062	0.000	0.937	1.900	4.742	0.000
	82.942	0.000			70.497	0.000

V = Xi*Yi*GAMC　　H = V*KH1
Mx = V*x　　My = H*y

(2)

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
2	4.204	0.000	0.973	3.200	4.092	0.000
3	94.786	0.000	1.630	2.550	154.501	0.000
	98.990	0.000			158.593	0.000

V = Xi*Yi*GAM1　　H = V*KH1
Mx = V*x　　My = H*y

(3)

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
2	2.976	0.000	0.200	0.000	0.595	0.000
	2.976	0.000			0.595	0.000

V = Xi*Yi*GAM2　　H = V*KH2
Mx = V*x　　My = H*y

(4)

	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
	0.000	66.150	2.250	1.500	0.000	99.225

	V(t)	H(t)	Mx(t·m)	My(t·m)
	82.942		70.497	
	98.990		158.593	
	2.976		0.595	
	0.000	66.150	0.000	99.225
	184.908	66.150	229.685	99.225

Mo = ΣMx - ΣMy = 130.460 (t·m)

	V(t)	H(t)	e(m)	Mc(t·m)
2	184.908	66.150	0.419	77.562

e = B0/2 - Mo/V　　:　　Mc = V * e

B0 :

	V(t)	Mc(t·m)	e(m)
	184.908	77.562	0.419 > 0.375

e = Mc/V

		常　時
B	(m)	2.250
L	(m)	1.000
V	(t)	184.908
H	(t)	66.150
Mc	(t·m)	77.562
e	(m)	0.419
X	(m)	2.117
Qmax	(t/m²)	174.720
Qmin	(t/m²)	0.000
		29.400

Q = V/(B*L) + 6*Mc/(L*B*B)

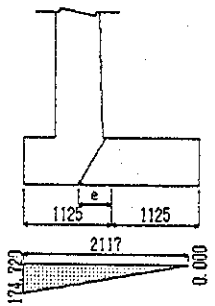
Q = 2*V/(L*X) : X = 3*(B/2-Mc/V)

	D(m)	V(t)	H(t)	Hu(t)	Fs
	2.117	184.908	66.150	110.945	1.677 > 1.5

C = 0.00 (t/m²)　　tan(δ) = 0.60

Hu = C*D+ V*tan(δ)

Fs = Hu/H



B. for section 2)

1 calculation of stability

2) for U, L, S

load	N(KN)	H(KN)	MX(KNm)	Mg(KNm)
concrete of stucture, surcherge of heel slab and toe slab	184.908×1.2 ×1.15 =255.2	—	229.685×1.2 ×1.15 =317.0	—
earth pressure	—	66.150×1.5 ×1.10 = 114.1	—	99.225×1.5 ×1.10 =171.2
total	255.2	114.1	317.0	171.2

a) for inversion

$$Fin = \frac{229.685}{171.2} = 1.34 > 1.00 \qquad \text{OK}$$

b) for sliding

$$Fs = \frac{255.2 \times 0.6}{114.1} = 1.3 > 1.1$$

c) for pressure of bottom

$$X = \frac{317.0 - 171.2}{255.2} = 0.571 \text{ m} < \frac{2.250}{3} = 0.750 \text{ m}$$

$$< \frac{4.250}{6} = 0.375 \text{ m}$$

$$q = \frac{2 \times 255.2}{3 \times 0.571 \times 1.00} = 298.0 \quad kN/m^2$$

2. calculation of each section (U, L, S)

1) vertical wall

a) bending moment and shearing force

$$M = \frac{1}{6} \times 19.6 \times 0.333 \times 3.90^3 \times 1.5 \times 1.15 = 111.3 \text{ KNm}$$

$$S = \frac{1}{2} \times 19.6 \times 0.333 \times 3.90^2 \times 1.5 \times 1.15 = 85.7 \text{ KN}$$

b) calculation of stress

b=100cm h=61 d=55.0 d'=6.0

$AS = Y20 - 300^{ctc} = 3.1416 / 0.30 = 10.472 cm^2$

$$P = \frac{10.472}{100 \times 55.0} \times 100 = 0.190\% > 0.15\ \%$$

$$X = \frac{0.87 \times 41000 \times 10.472}{0.40 \times 2500 \times 100} = 5.6 \text{ cm}$$

$$Z = 55.0 - \frac{1}{2} \times 5.6 = 52.2 \text{ cm} = 0.95 \times 5.40 = 52.2 \text{ cm}$$

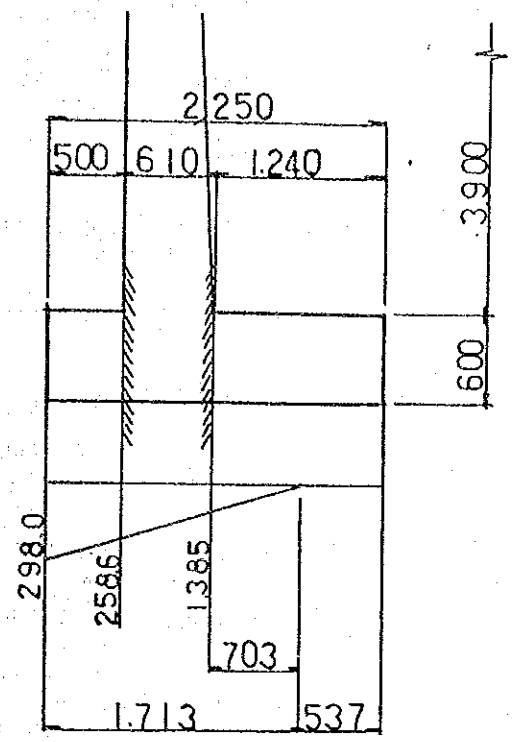
$MRS = 0.87 \times 41000 \times 10.472 \times 52.2 \times 10^{-5} = 195.0$ KNm $>$ 111.3 KNm

$MRc = 0.40 \times 2500 \times 100 \times 5.6 \times 52.2 \times 10^{-5} = 292.3$ KNm $>$ 111.3 KNm

$$\tau = \frac{85.7 \times 10^3}{100 \times 55.0} = 15.6 \text{ N/cm}^2 < \tau a = 35.0 \times \frac{0.19}{0.25} = 26.6 \text{ N/cm}^2$$

2) footing slab

a) load of surcharge



$W1 = (23.6 \times 0.60 + 18.6 \times 0.40) \times 1.20 \times 1.15 = 29.8 \ KN/m$

$W2 = (23.6 \times 0.60 + 19.6 \times 3.90) \times 1.20 \times 1.15 = 125.1 \ KN/m$

b) for toe footing slab

$$M = \frac{0.40^2}{6}(2 \times 298.0 + 258.6) - \frac{0.40^2}{2} \times 29.8 = 20.4 \ KN/m$$

$$S = \frac{0.40}{2}(298.0 + 258.6) - 29.8 \times 0.40 = 99.4 \ KN$$

C) for heel footing slab

$$M = \frac{1.24^2}{2} \times 125.1 - \frac{0.703^2}{6} \times 138.5 = 84.8 \ KN/m$$

$$S = 125.1 \times 1.24 - \frac{1}{2} \times 138.5 \times 0.703 = 106.5 \ KN$$

d) calculation of stress

(1) for toe footing slab

b=100 h=60 d=54.0 d' = 6.0

$$\tau = \frac{99.4\times10^{3}}{100\times54.0} = 18.4\ N/cm^2 \quad < \quad \tau a = 27.2\ N/cm^2$$

As = Y20-300$^{c\,t\,c}$ = 10.472 cm^2

$$P = \frac{10.472}{100\times54.0}\times 100 = 0.194\% \quad > \quad 0.15\%$$

$$\tau a = 35.0 \times \frac{0.194}{0.25} = 27.2\ N/cm^2$$

(2) for heel footing slab

b=100cm h=60 d=54.0 d'=6.0

As = Y20－300 $^{c\,t\,c}$ =10.472

$$P = \frac{10.472}{100\times54.0}\times100 = 0.194\% > 0.15\%$$

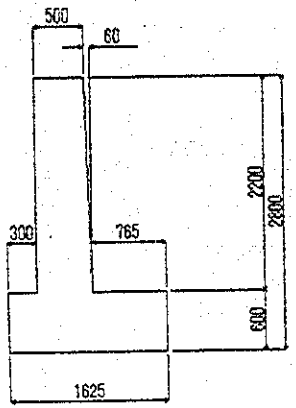
$$X = \frac{0.87\times41000\times10.472}{0.40\times2500\times100} = 5.4\ cm$$

$$Z = 54.0 - \frac{1}{2}\times5.4 = 51.3\ cm \quad = 0.95\times54.0 = 51.3\ cm^{2}$$

MRS = $0.87\times41000\times10.472\times51.3\times10^{5}$ = 191.6 KNm > 84.8 KNm

MRC = $0.40\times2500\times100\times5.4\times51.3\times10^{5}$ = 277.0 KNm > 84.8 KNm OK

$$\tau = \frac{106.5\times10^{3}}{100\times54.4} = 19.8\ N/cm^2 \quad < \quad \tau a = 35.0 \times \frac{0.194}{0.25} = 27.2\ N/cm^2$$



GAMC = 23.600 (t/m^3)

GAM1 = 19.600 (t/m^3)

GAM1S = 10.780 (t/m^3)

FAi = 30.000 (°)

GAM2 = 18.600 (t/m^3)

GAM2S = 9.780 (t/m^3)

WATS = 9.800 (t/m^3)

HS2 = 1.000 (m)

HW1 = 0.000 (m)

C = 0.000 (t/m^2)

tanϕB = 0.600

Qa = 29.400 (t/m^2)

ϕ 30.000 (°)

δ

= 0.000 (°)

β 0.000 (°)

θ 0.000 (°)

$$Ka = \frac{\cos^2(\phi-\theta)}{\cos^2\theta*\cos(\theta+\delta)*\left[1+\sqrt{\frac{(\sin(\phi+\delta)*\sin(\phi-\beta))}{(\cos(\theta+\delta)*\cos(\theta-\beta))}}\right]^2}$$

= 0.333

0.333

0.000 (°)

0.000 (°)

2.800 (m)

19.600 (t/m³)

0.000 (t/m²)

0.000 (t/m²)

$p = Ka*\gamma o*H - 2*C*\sqrt{Ka} + Ka*Q$

p1 = 0.000 (t/m²)

p2 = 18.293 (t/m²)

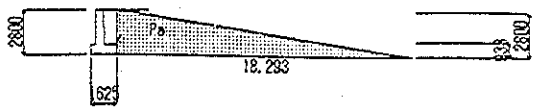
P = (p1+p2) * H / 2 = 25.611 (t/m)

Ph = 25.611 (t/m)

Pv = 0.000 (t/m)

y = 0.933 (m)

x = 0.000 (m)



(1)

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
1	23.010	0.000	0.813	0.300	18.696	0.000
6	25.960	0.000	0.550	1.700	14.278	0.000
7	1.558	0.000	0.820	1.333	1.277	0.000
	50.528	0.000			34.251	0.000

V = Xi*Yi*GAMC　　H = V*KH1
Mx = V*x　　My = H*y

(2)

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
2	1.294	0.000	0.840	2.067	1.087	0.000
3	32.987	0.000	1.243	1.700	40.986	0.000
	34.280	0.000			42.073	0.000

V = Xi*Yi*GAM1　　H = V*KH1
Mx = V*x　　My = H*y

(3)

NO.	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
2	2.232	0.000	0.150	0.000	0.335	0.000
	2.232	0.000			0.335	0.000

V = Xi*Yi*GAM2　　H = V*KH2
Mx = V*x　　My = H*y

(4)

	V(t)	H(t)	x(m)	y(m)	Mx(t·m)	My(t·m)
	0.000	25.611	1.625	0.933	0.000	23.903

	V(t)	H(t)	Mx(t·m)	My(t·m)
	50.528		34.251	
	34.280		42.073	
	2.232		0.335	
	0.000	25.611	0.000	23.903
	87.040	25.611	76.658	23.903

Mo = ΣMx - ΣMy = 52.755 (t·m)

	V(t)	H(t)	e(m)	Mc(t·m)
2	87.040	25.611	0.206	17.965

e = B0/2 - Mo/V　　:　　Mc = V * e

	V(t)	Mc(t·m)	e(m)
	87.040	17.965	0.206 < 0.271

e = Mc/V

B	(m)	1.625
L	(m)	1.000
V	(t)	87.040
H	(t)	25.611
Mc	(t·m)	17.965
e	(m)	0.206
X	(m)	1.625
Qmax(t/m²)		94.383
Qmin(t/m²)		12.743
		29.400

Q = V/(B*L) + 6*Mc/(L*B*B)

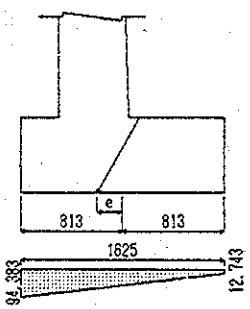
Q = 2*V/(L*X) : X = 3*(B/2-Mc/V)

	D(m)	V(t)	H(t)	Hu(t)	Fs
	1.625	87.040	25.611	52.224	2.039 > 1.5

C = 0.00 (t/m²) tan(δ) = 0.60

Hu = C*D+ V*tan(δ)

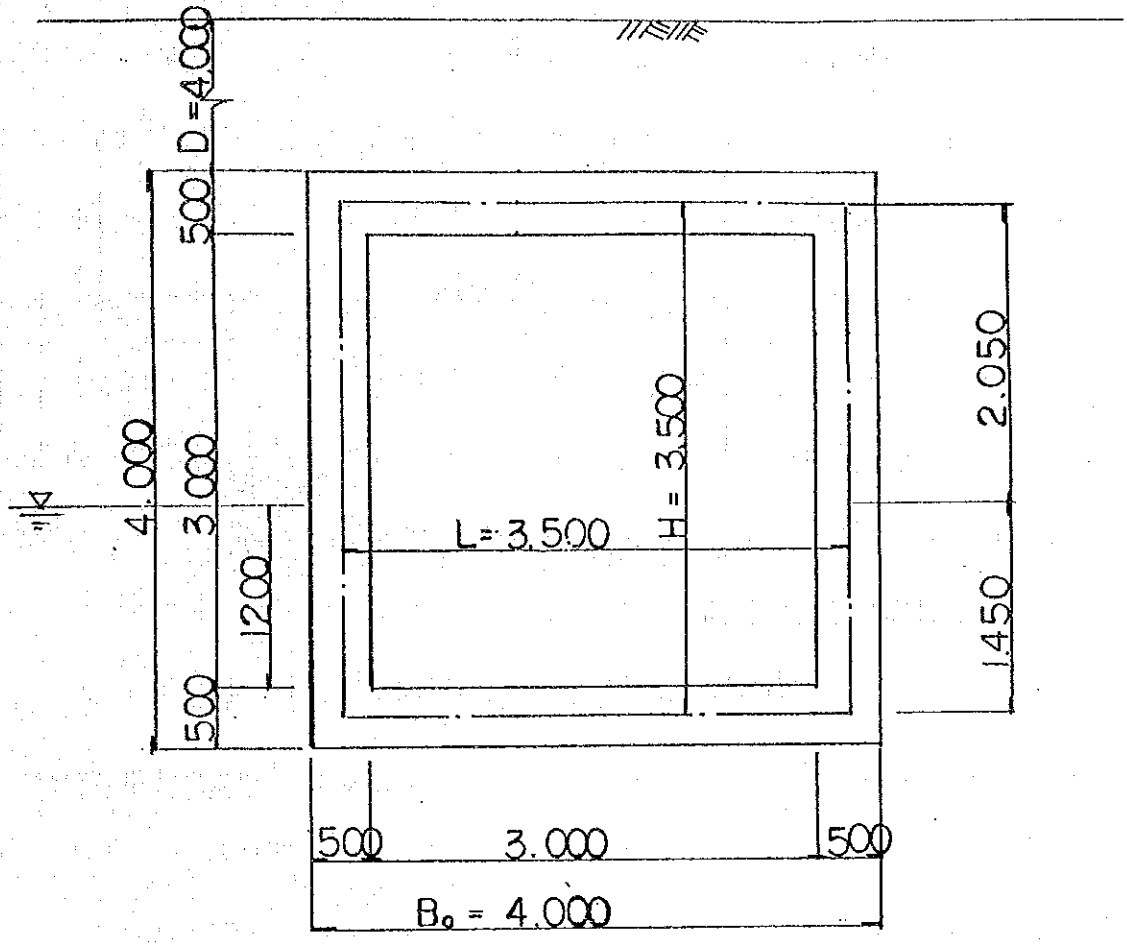
Fs = Hu/H



WATER BOX CULVERTS

NO ① BOX-CULVERT FOR DRAINAGE

1) Shape and Size



Where ··· D^m = depth of asphalt and similar surface soil.

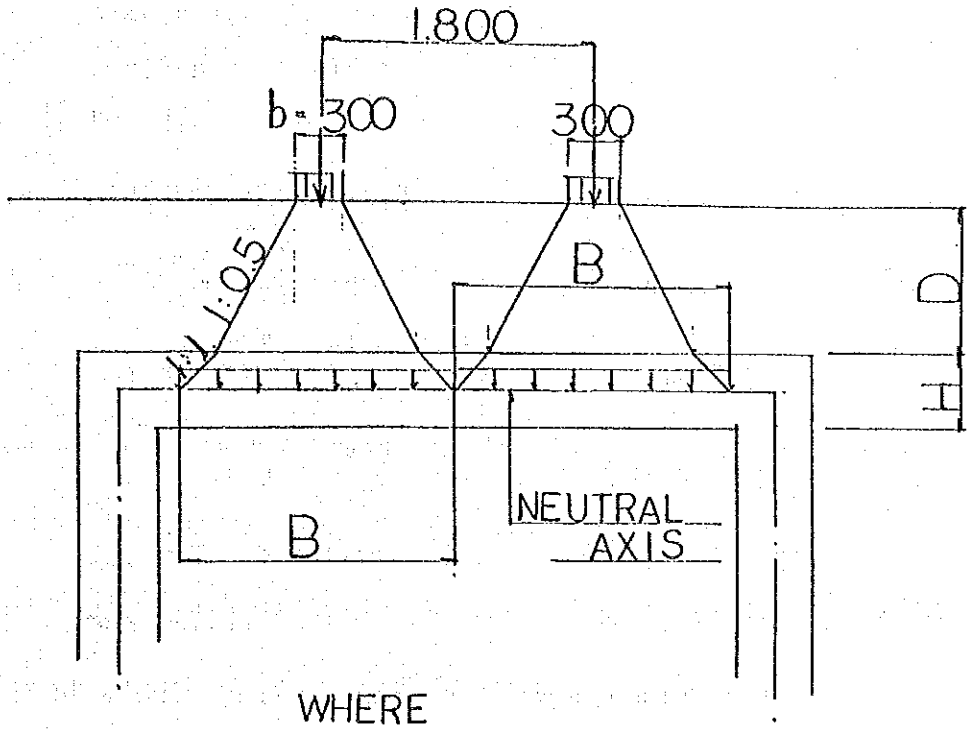
2) Factor of section

$A = 1.00 \times 0.50 = 0.5000\ m^2$

$I = \frac{1.00 \times 0.50^3}{12} = 0.01041\ m^4$

$Ec = 25\ kN/mm^2 = 2.5 \times 10^7\ kN/m^2$

LIVE LOAD --- HB loading



WHERE

D = DEPTH OF ASPHALT AND SIMILAR SURFACE SOIL

H = DEPTH OF CONCRTE SLAB

DISPERSAL OF WHEEL

$$B^{m} = b + D + H$$

LOADED STRENGTH

$$P = \frac{100 \times Uno}{B \times L} \quad (KN/m^2)$$

WHERE

Uno = NUMBER OF UNITS = 30

L = WIDTH OF HB-VEHICLE = 3.500^{m}

No.① BOX CULVERT FOR DRAINAGE

1. calculation for bending moment (U.L.S)

section $b=100^{cm}$ $h=50$ $d=44.0$ $d'=6.0$

1) For upper slab

a) intersection point②=③ $Mu.min=-133.9^{KNm}$

$$A_s=\begin{cases} Y_{12}-300^{ctc}=1.131/0.300 \\ Y_{16}-300^{ctc}=2.011/0.300 \end{cases}=10.47\ cm^2$$

$$X=\frac{0.87\times41000\times10.47}{0.40\times2500\times100}\fallingdotseq4.0^{cm}$$

$$Z=44.0-\frac{4.0}{2}=42.0^{cm}\fallingdotseq41.8^{cm}\fallingdotseq0.95\times44.0=41.8^{cm}\quad OK$$

$M_{RS}=0.87\times41000\times10.47\times41.8\times10^{-5}=156.1^{KNm}>Mu=133.9^{KNm}$

$M_{RC}=0.40\times2500\times100\times4.0\times41.8\times10^{-5}=167.2^{KNm}>Mu=133.9^{KNm}$ OK

b) middle point ②~③ $Mu.max=135.1^{KNm}$

$M_R=156.1^{KNm}>Mu=135.1^{KNm}$

(Where : M_R : From calculation of point②)

2) For bottom slab

a) intersection point ④=① $Mu.min=-160.9^{KNm}$

$A_s=Y_{16}-150^{ctc}=2.011/0.150=13.41\ cm^2$

$$X=\frac{0.87\times41000\times13.41}{0.40\times2500\times100}\fallingdotseq4.8^{m}$$

$$Z=44.0-\frac{4.8}{2}=41.6^{cm}<0.95\times44.0=41.8^{cm}\quad OK$$

$M_{RS}=0.87\times41000\times13.41\times41.6\times10^{-5}=199.0^{KNm}>Mu=160.9^{KNm}$

$M_{RC}=0.40\times2500\times100\times4.8\times41.6\times10^{-5}=199.0^{KNm}>Mu=160.9^{KNm}$

OK

b) middle point ④~① $Mu.max=-157.9^{KNm}$

$M_R=199.0^{KNm}>Mu=157.9^{KNm}$

(Where : M_R : From calculation of point④)

2. calculation for shearing force (U.L.S)

section $b=100^{cm}$ $h=50$ $d=44.0$ $d'=6.0$

a) For upper slab

intersection point ②=③ $Su.max=123.0^{KN}$

$$A_s = \begin{cases} Y_{12}-300^{ctc} = 1.131/0.300 \\ Y_{16}-300^{ctc} = 2.011/0.300 \end{cases} = 10.47\ cm^2$$

$$P = \frac{10.47}{100 \times 44.0} \times 100 = 0.238\ \%$$

$$Vc = \frac{123.0 \times 10^3}{100 \times 44.0} = 28.0\ N/cm^2$$

$$< Vca = 35.0 \times \frac{0.238}{0.250} = 33.3\ N/cm^2 \quad OK$$

b) For bottom slab

intersection point ④=① Su.max =145.8^{KN}

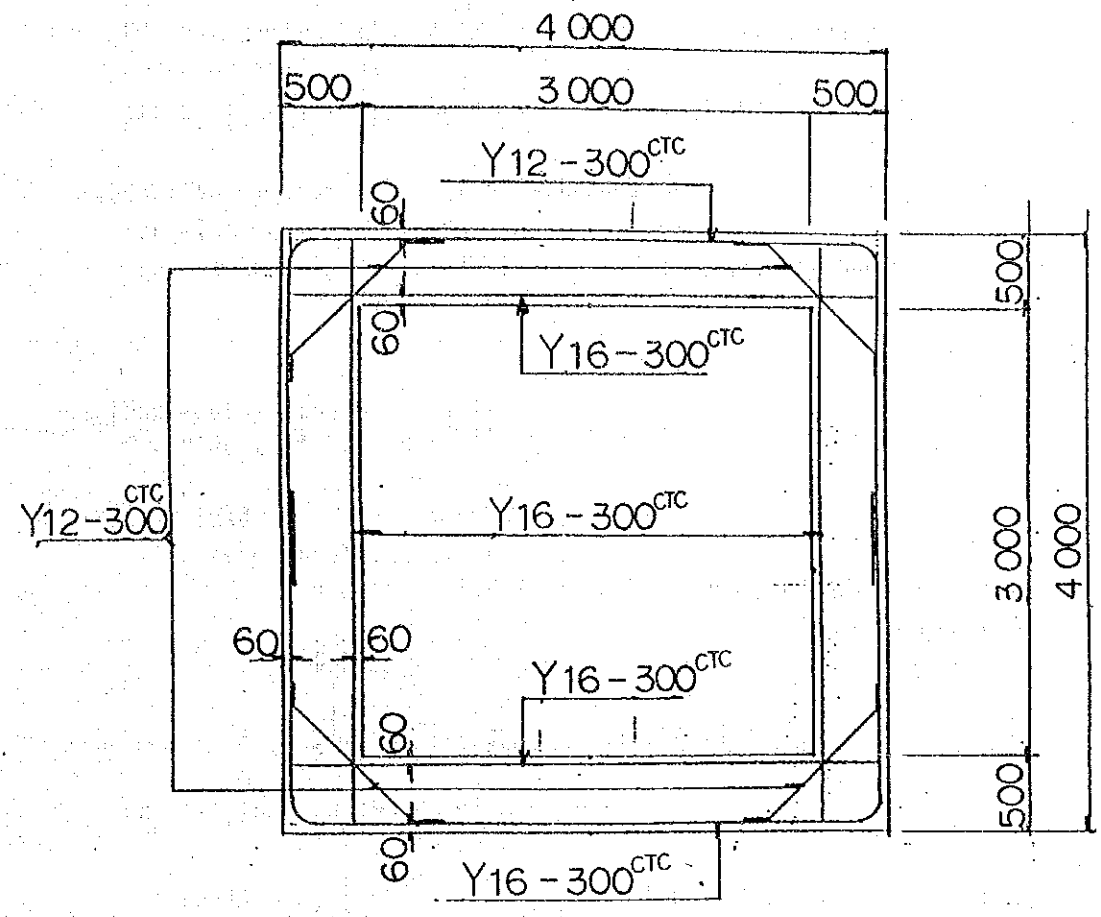
$$A_s = Y_{16}-150^{ctc} = 13.41\ cm^2$$

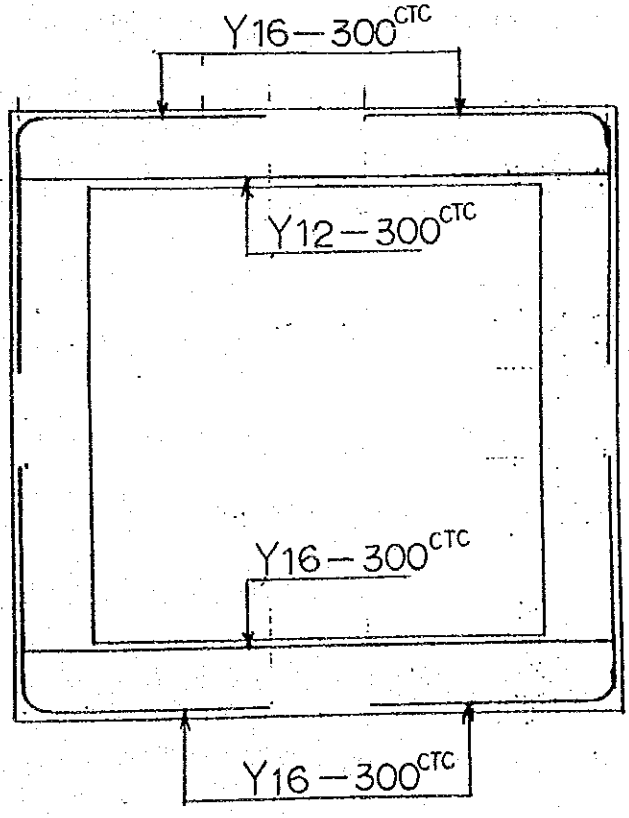
$$P = \frac{13.41}{100 \times 44.0} \times 100 = 0.305\ \%$$

$$Vc = \frac{145.8 \times 10^3}{100 \times 44.0} = 33.2\ N/cm^2$$

$$< Vca = 35.0 + \frac{15}{0.25}(0.305 - 0.25) = 38.3\ N/cm^2 \quad OK$$

NO ① BOX CULVERT FOR DRAINAGE





NO① BOX FOR DRAINAGE

Load

(1)Dead load

a)Vertical load Where $\alpha = 1.0$ (earth pressure factor of vertical) $\because \frac{D}{B_o} = 1.00$

For upper slab $w1 = 22.6\times0.50+19.6\times3.50+23.60\times0.50$ $= 91.700$ kN/m

For side wall $w2 = 23.6\times0.50$ $= 11.800$ 〃

For bottom slab $W3 = 91.700 + \frac{2\times11.800\times3.50}{3.50}$ $= 115.300$ 〃

b)Horizontal load ----- earth pressure

For side wall $P1 = (22.6\times0.50+19.6\times3.75)\times0.500$ $= 42.400$ kN/m

〃 $P2 = (22.6\times0.50+19.6\times5.80)\times0.500$ $= 62.490$ 〃

〃 $P3 = (22.6\times0.50+19.6\times5.80+10.8\times14.5)\times0.500$ $= 70.320$ 〃

C)Horizontal load water Pressure

For side wall $Pw = 9.80\times1.45$ $= 14.210$ kN/m

(2)Live load

live load surcharge of axle

$$P = \frac{10\ (\text{KN/axle}) \times 30\ (\text{unite})}{3.50 \times B}$$

width of despersal of wheel

$B = 0.300+4.00+0.500 = 4.80$ m

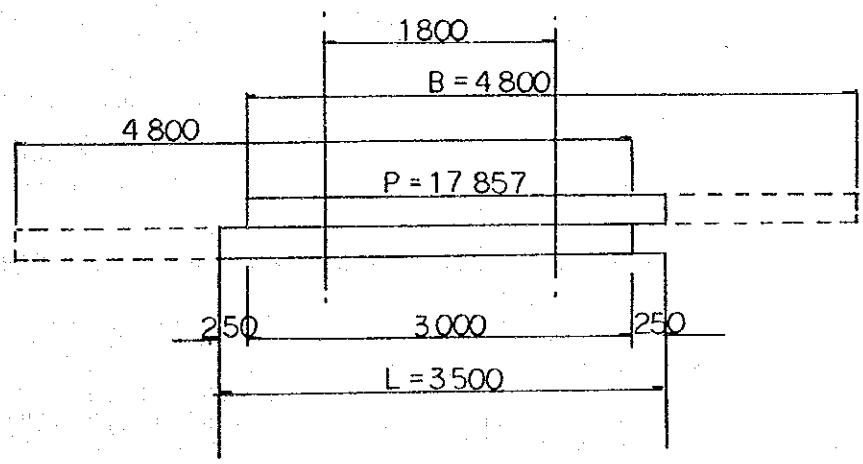
$$= \frac{10 \times 30}{3.50 \times 4.80} = 17.857\ \text{KN/m}^2$$

or live load surcharge of a vihicle

$$go = \frac{40\ (\text{kN/rihicle}) \times 30\ (\text{unit})}{3.50 \times 10.0} \fallingdotseq 34.300\ \text{KN/m}^2 < 2P = 35.714\ \text{KN/m}^2$$

OF curse the loaded of live load is consider as following

case-1 Vaertical load



For bottom slab

$$P1 = P2 = \frac{2\times17.857\times3.25}{3.500} = 33.163\ \text{kN/m} < 34.300\ \text{kN/m}$$

case-2 Horizontal load eath pressure of live load surcharge

For side wall: $pe = go\cdot ko = 34.300 \times 0.500 = 17.150$ KN/m

BOX FOR DRAINAGE-NO 1 Depth=4000

COORDINATES

No	X (m)	Y (m)
1	0.0000	0.0000
2	0.0000	3.5000
3	3.5000	3.5000
4	3.5000	0.0000

Where
NO : Each intersecting points.
X.Y : Abscissa and Ordinate

CONDITION OF MEMBER

No	I	J	A (m2)	I (m4)	I - J	L (m)	E (kN/m2)	EPS
1	1	2	0.50000	0.010417	Fix - Fix	3.500	2.50E+07	1.00E-05
2	2	3	0.50000	0.010417	Fix - Fix	3.500	2.50E+07	1.00E-05
3	3	4	0.50000	0.010417	Fix - Fix	3.500	2.50E+07	1.00E-05
4	4	1	0.50000	0.010417	Fix - Fix	3.500	2.50E+07	1.00E-05

CONDITION OF FULCRUM

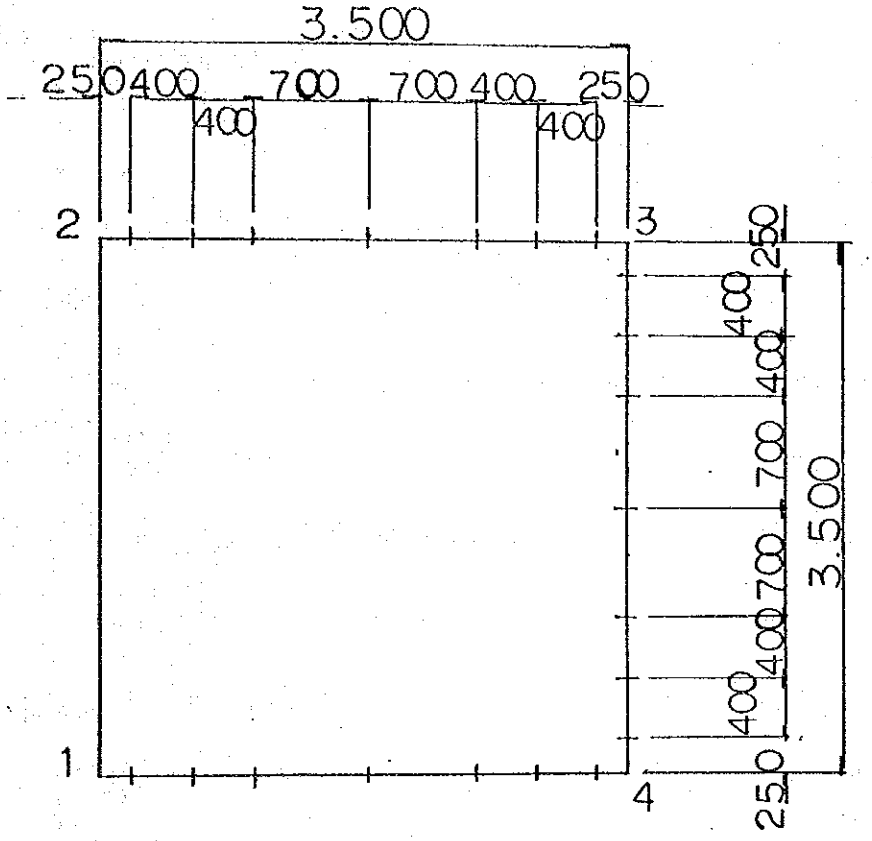
No	X (kN/m)	Y (kN/m)	M (kNm/Rad)
1	Fix	Fix	Free
4	Free	Fix	Free

CALCULATION POINTS

NO	no	L-No 1	L-No 2	L-No 3	L-No 4	L-No 5	L-No 6	L-No 7
		11	12	13	14	15	16	17
		m						
1	7	0.250	0.650	1.050	1.750	2.450	2.850	3.250
2	7	0.250	0.650	1.050	1.750	2.450	2.850	3.250
3	7	0.250	0.650	1.050	1.750	2.450	2.850	3.250
4	7	0.250	0.650	1.050	1.750	2.450	2.850	3.250

NOTE : THE DIMENSION(t) BE EXCHANG TO DIMENSION(kN) INTO THIS CALCULATION

CALCULATION POINTS OF EACH FORCE



BOX FOR DRAINAGE-NO 1

LOAD : Dead load
LOAD CASE No. : 1

No	i	-j		Li (m)	Lo (m)	Pi (kN/m) (t/m)	Pj (kN/m) (t/m)
1	1-	2	Y	0.000	3.500	-11.800	-11.800
3	3-	4	Y	0.000	3.500	-11.800	-11.800
2	2-	3	Y	0.000	3.500	-91.700	-91.700
4	4-	1	Y	0.000	3.500	115.300	115.300

ΣV = 0.000 (t)
ΣH = 0.000 (t)

BOX FOR DRAINAGE-NO 1

: Earth pressure load
No. : 2

No	i	-j		Li (m)	Lo (m)	Pi (kN/m) (t/m)	Pj (kN/m) (t/m)
1	1-	2	X	0.000	1.450	70.320	62.490
1	1-	2	X	1.450	2.050	62.490	42.400
3	3-	4	X	0.000	2.050	-42.400	-62.490
3	3-	4	X	2.050	1.450	-62.490	-70.320

ΣV = 0.000 (t)
ΣH = 0.000 (t)

BOX FOR DRAINAGE-NO 1

: Water pressure load
No. : 3

No	i	-j		Li (m)	Lo (m)	Pi (kN/m) (t/m)	Pj (kN/m) (t/m)
1	1-	2	X	0.000	1.450	14.210	0.000
3	3-	4	X	2.050	1.450	0.000	-14.210

ΣV = 0.000 (t)
ΣH = 0.000 (t)

LOAD CASE No. : 4 : HB live load-VL-

No	i	-j		Li (m)	Lo (m)	kN ↑ Pi (t/m)	kN ↑ Pj (t/m)
2	2-	3	Y	0.000	3.500	-34.300	-34.300
4	4-	1	Y	0.000	3.500	34.300	34.300

ΣV = 0.000 (t)
ΣH = 0.000 (t)

BOX FOR DRAINAGE-NO 1

No. : 5 : HB live load-HL-

No	i	-j		Li (m)	Lo (m)	kN ↑ Pi (t/m)	kN ↑ Pj (t/m)
1	1-	2	X	0.000	3.500	17.150	17.150
3	3-	4	X	0.000	3.500	-17.150	-17.150

ΣV = 0.000 (t)
ΣH = 0.000 (t)

BOX FOR DRAINAGE-NO 1

COMBINATION (ULS)

CASE OF CALCULATION AND LOAD FACTOR	No No	C-No 1 No 6	C-No 2 No 7
	No 1	1.3800	1.3800
	No 2	1.6500	1.6500
	No 3	0.0000	1.6500
	No 4	1.4300	0.0000
	No 5	0.0000	1.6500

SELECTED CASE FOR MAX OR MIN FORCE

No 1 : 6.7

BOX FOR DRAINAGE-NO 1

DEFLECTION

No.	Case. 1 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 2 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 3 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	3.75538	0.00000	0.00000	-2.05728	0.00000	0.00000	-0.0841
2.	-0.01438	-0.50715	-3.34449	-0.02439	0.00000	1.96817	-0.01086	0.00000	0.0485
3.	0.00000	-0.50715	3.34449	-0.28532	0.00000	-1.96817	-0.01442	0.00000	-0.0485
4.	-0.01438	0.00000	-3.75538	-0.30970	0.00000	2.05728	-0.02529	0.00000	0.0841

No.	Case. 4 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 5 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)	Case. 6 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	1.17645	0.00000	0.00000	-0.58823	0.00000	0.00000	3.4703
2.	0.00000	-0.16807	-1.17645	0.00000	0.00000	0.58823	-0.06008	-0.94021	-3.0503
3.	0.00000	-0.16807	1.17645	-0.08404	0.00000	-0.58823	-0.47078	-0.94021	3.0503
4.	0.00000	0.00000	-1.17645	-0.08404	0.00000	0.58823	-0.53086	0.00000	-3.4703

No.	Case. 7 X-DIS.(mm)	Y-DIS.(mm)	ROTA.(mmRad)
1.	0.00000	0.00000	0.67852
2.	-0.07801	-0.69987	-0.31731
3.	-0.63323	-0.69987	0.31731
4.	-0.71124	0.00000	-0.67852

BOX FOR DRAINAGE-NO 1

REACTION FOR BALANCE

No.	Case. 1 RX (t)	RY (t)	RM (tm)	Case. 2 RX (t)	RY (t)	RM (tm)	Case. 3 RX (t)	RY (t)	RM (tm)
1.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

No.	Case. 4 RX (t)	RY (t)	RM (tm)	Case. 5 RX (t)	RY (t)	RM (tm)	Case. 6 RX (t)	RY (t)	RM (tm)
1.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

No.	Case. 7 RX (t)	RY (t)	RM (tm)
1.	0.000	0.000	0.000
4.	0.000	0.000	0.000

NOTE : DIMENSIONS (t) BE EXCHANGE TO (KN)

BOX FOR DRAINAGE-NO 1

No	L(m)	Case 1 Dead load M (tm)	S (t)	N (t)	Case 2 Earth pressure load M (tm)	S (t)	N (t)	Case 3 Water pressure load M (tm)	S (t)	N (t)
1- 2	0.000	-61.817	5.136	-201.775	-30.615	110.609	0.000	-1.252	9.031	0.000
* 1	0.250	-60.533	5.136	-198.825	-5.146	93.198	0.000	0.587	5.785	0.000
* 2	0.650	-58.478	5.136	-194.105	26.673	66.042	0.000	2.065	1.865	0.000
* 3	1.050	-56.424	5.136	-189.385	47.802	39.750	0.000	2.288	-0.487	0.000
* 4	1.750	-52.828	5.136	-181.125	60.116	-3.984	0.000	1.503	-1.271	0.000
* 5	2.450	-49.233	5.136	-172.865	43.297	-43.268	0.000	0.613	-1.271	0.000
* 6	2.850	-47.178	5.136	-168.145	21.879	-63.560	0.000	0.104	-1.271	0.000
* 7	3.250	-45.124	5.136	-163.425	-7.342	-82.284	0.000	-0.404	-1.271	0.000
2- 1	3.500	-43.840	5.136	-160.475	-29.289	-93.191	0.000	-0.722	-1.271	0.000
2- 3	0.000	-43.840	160.475	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
* 1	0.250	-6.586	137.550	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
* 2	0.650	41.098	100.870	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
* 3	1.050	74.110	64.190	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
* 4	1.750	96.576	0.000	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
* 5	2.450	74.110	-64.190	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
* 6	2.850	41.098	-100.870	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
* 7	3.250	-6.586	-137.550	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
3- 2	3.500	-43.840	-160.475	5.136	-29.289	0.000	-93.191	-0.722	0.000	-1.271
3- 4	0.000	-43.840	-5.136	-160.475	-29.289	93.191	0.000	-0.722	1.271	0.000
* 1	0.250	-45.124	-5.136	-163.425	-7.342	82.284	0.000	-0.404	1.271	0.000
* 2	0.650	-47.178	-5.136	-168.145	21.879	63.560	0.000	0.104	1.271	0.000
* 3	1.050	-49.233	-5.136	-172.865	43.297	43.268	0.000	0.613	1.271	0.000
* 4	1.750	-52.828	-5.136	-181.125	60.116	3.984	0.000	1.503	1.271	0.000
* 5	2.450	-56.424	-5.136	-189.385	47.802	-39.750	0.000	2.288	0.487	0.000
* 6	2.850	-58.478	-5.136	-194.105	26.673	-66.042	0.000	2.065	-1.865	0.000
* 7	3.250	-60.533	-5.136	-198.825	-5.146	-93.198	0.000	0.587	-5.785	0.000
4- 3	3.500	-61.817	-5.136	-201.775	-30.615	-110.609	0.000	-1.252	-9.031	0.000
4- 1	0.000	-61.817	201.775	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
* 1	0.250	-14.976	172.950	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
* 2	0.650	44.980	126.830	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
* 3	1.050	86.488	80.710	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
* 4	1.750	114.736	0.000	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
* 5	2.450	86.488	-80.710	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
* 6	2.850	44.980	-126.830	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
* 7	3.250	-14.976	-172.950	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031
1- 4	3.500	-61.817	-201.775	-5.136	-30.615	0.000	-110.609	-1.252	0.000	-9.031

NOTE: DIMENSIONS (t),(tm) BE EXCHAGE TO (KN),(KNm) AT AFTER PAGE

BOX FOR DRAINAGE-NO 1

No	L(m)	Case 4 HB live load-VL- M (tm)	S (t)	N (t)	Case 5 HB live load-HL- M (tm)	S (t)	N (t)	Case 6 M (tm)	S (t)	N (t)
1- 2	0.000	-17.507	0.000	-60.025	-8.754	30.012	0.000	-160.857	189.593	-364.285
* 1	0.250	-17.507	0.000	-60.025	-1.786	25.725	0.000	-117.062	160.864	-360.214
* 2	0.650	-17.507	0.000	-60.025	7.132	18.865	0.000	-61.725	116.057	-353.701
* 3	1.050	-17.507	0.000	-60.025	13.306	12.005	0.000	-24.027	72.675	-347.187
* 4	1.750	-17.507	0.000	-60.025	17.507	0.000	0.000	1.253	0.514	-335.788
* 5	2.450	-17.507	0.000	-60.025	13.306	-12.005	0.000	-21.536	-64.305	-324.389
* 6	2.850	-17.507	0.000	-60.025	7.132	-18.865	0.000	-54.041	-97.787	-317.876
* 7	3.250	-17.507	0.000	-60.025	-1.786	-25.725	0.000	-99.420	-128.681	-311.362
2- 1	3.500	-17.507	0.000	-60.025	-8.754	-30.013	0.000	-133.861	-146.677	-307.291
2- 3	0.000	-17.507	60.025	0.000	-8.754	0.000	-30.013	-133.861	307.291	-146.677
* 1	0.250	-3.573	51.450	0.000	-8.754	0.000	-30.013	-62.526	263.392	-146.677
* 2	0.650	14.263	37.730	0.000	-8.754	0.000	-30.013	28.784	193.154	-146.677
* 3	1.050	26.611	24.010	0.000	-8.754	0.000	-30.013	91.998	122.917	-146.677
* 4	1.750	35.015	0.000	0.000	-8.754	0.000	-30.013	135.019	0.000	-146.677
* 5	2.450	26.611	-24.010	0.000	-8.754	0.000	-30.013	91.998	-122.917	-146.677
* 6	2.850	14.263	-37.730	0.000	-8.754	0.000	-30.013	28.784	-193.155	-146.677
* 7	3.250	-3.573	-51.450	0.000	-8.754	0.000	-30.013	-62.526	-263.393	-146.677
3- 2	3.500	-17.507	-60.025	0.000	-8.754	0.000	-30.013	-133.861	-307.291	-146.677
3- 4	0.000	-17.507	0.000	-60.025	-8.754	30.012	0.000	-133.861	146.677	-307.291
* 1	0.250	-17.507	0.000	-60.025	-1.786	25.725	0.000	-99.420	128.681	-311.362
* 2	0.650	-17.507	0.000	-60.025	7.132	18.865	0.000	-54.041	97.787	-317.876
* 3	1.050	-17.507	0.000	-60.025	13.306	12.005	0.000	-21.536	64.305	-324.389
* 4	1.750	-17.507	0.000	-60.025	17.507	0.000	0.000	1.253	-0.514	-335.788
* 5	2.450	-17.507	0.000	-60.025	13.306	-12.005	0.000	-24.027	-72.675	-347.187
* 6	2.850	-17.507	0.000	-60.025	7.132	-18.865	0.000	-61.725	-116.057	-353.701
* 7	3.250	-17.507	0.000	-60.025	-1.786	-25.725	0.000	-117.062	-160.864	-360.214
4- 3	3.500	-17.507	0.000	-60.025	-8.754	-30.013	0.000	-160.857	-189.593	-364.285
4- 1	0.000	-17.507	60.025	0.000	-8.754	0.000	-30.013	-160.857	364.285	-189.593
* 1	0.250	-3.573	51.450	0.000	-8.754	0.000	-30.013	-76.291	312.245	-189.593
* 2	0.650	14.263	37.730	0.000	-8.754	0.000	-30.013	31.954	228.979	-189.593
* 3	1.050	26.611	24.010	0.000	-8.754	0.000	-30.013	106.892	145.714	-189.593
* 4	1.750	35.015	0.000	0.000	-8.754	0.000	-30.013	157.892	0.000	-189.593
* 5	2.450	26.611	-24.010	0.000	-8.754	0.000	-30.013	106.892	-145.714	-189.593
* 6	2.850	14.263	-37.730	0.000	-8.754	0.000	-30.013	31.954	-228.979	-189.593
* 7	3.250	-3.573	-51.450	0.000	-8.754	0.000	-30.013	-76.291	-312.245	-189.593
1- 4	3.500	-17.507	-60.025	0.000	-8.754	0.000	-30.013	-160.857	-364.285	-189.593

BOX FOR DRAINAGE-NO 1

Case 7

	No	L(m)	M (tm)	S (t)	N (t)
1-	2	0.000	-152.331	254.014	-278.449
*	1	0.250	-94.005	212.855	-274.379
*	2	0.650	-21.516	150.261	-267.865
*	3	1.050	26.738	91.679	-261.351
*	4	1.750	57.655	-1.584	-249.953
*	5	2.450	26.465	-86.211	-238.554
*	6	2.850	-17.066	-131.011	-232.040
*	7	3.250	-77.999	-173.225	-225.527
2-	1	3.500	-124.460	-198.295	-221.456
2-	3	0.000	-124.460	221.455	-198.295
*	1	0.250	-73.051	189.819	-198.295
*	2	0.650	-7.247	139.201	-198.295
*	3	1.050	38.309	88.582	-198.295
*	4	1.750	69.313	0.000	-198.295
*	5	2.450	38.309	-88.582	-198.295
*	6	2.850	-7.247	-139.201	-198.295
*	7	3.250	-73.051	-189.819	-198.295
3-	2	3.500	-124.460	-221.456	-198.295
3-	4	0.000	-124.460	198.295	-221.455
*	1	0.250	-77.999	173.225	-225.527
*	2	0.650	-17.066	131.011	-232.040
*	3	1.050	26.465	86.211	-238.554
*	4	1.750	57.655	1.584	-249.953
*	5	2.450	26.738	-91.679	-261.351
*	6	2.850	-21.516	-150.261	-267.865
*	7	3.250	-94.005	-212.855	-274.379
4-	3	3.500	-152.331	-254.014	-278.450
4-	1	0.000	-152.331	278.450	-254.014
*	1	0.250	-87.691	238.671	-254.014
*	2	0.650	-4.952	175.025	-254.014
*	3	1.050	52.329	111.380	-254.014
*	4	1.750	91.312	0.000	-254.014
*	5	2.450	52.329	-111.380	-254.014
*	6	2.850	-4.952	-175.025	-254.014
*	7	3.250	-87.691	-238.671	-254.014
1-	4	3.500	-152.331	-278.449	-254.014

BOX FOR DRAINAGE-NO 1

PICK-UP No. 1 *

No.	L (m)	M. MAXIMUM Case	M (tm)	S (t)	N (t)	M. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 7	-152.331	254.014	-278.449	C- 6	-160.857	189.593	-364.285
* 1	0.250	C- 7	-94.005	212.855	-274.379	C- 6	-117.062	160.864	-360.214
* 2	0.650	C- 7	-21.516	150.261	-267.865	C- 6	-61.725	116.057	-353.701
* 3	1.050	C- 7	26.738	91.679	-261.351	C- 6	-24.027	72.675	-347.187
* 4	1.750	C- 7	57.655	-1.584	-249.953	C- 6	1.253	0.514	-335.788
* 5	2.450	C- 7	26.465	-86.211	-238.554	C- 6	-21.536	-64.305	-324.389
* 6	2.850	C- 7	-17.066	-131.011	-232.040	C- 6	-54.041	-97.787	-317.876
* 7	3.250	C- 7	-77.999	-173.225	-225.527	C- 6	-99.420	-128.681	-311.362
2 - 1	3.500	C- 7	-124.460	-198.295	-221.456	C- 6	-133.861	-146.677	-307.291
2 - 3	0.000	C- 7	-124.460	221.455	-198.295	C- 6	-133.861	307.291	-146.677
* 1	0.250	C- 6	-62.526	263.392	-146.677	C- 7	-73.051	189.819	-198.295
* 2	0.650	C- 6	28.784	193.154	-146.677	C- 7	-7.247	139.201	-198.295
* 3	1.050	C- 6	91.998	122.917	-146.677	C- 7	38.309	88.582	-198.295
* 4	1.750	C- 6	135.019	0.000	-146.677	C- 7	69.313	0.000	-198.295
* 5	2.450	C- 6	91.998	-122.917	-146.677	C- 7	38.309	-88.582	-198.295
* 6	2.850	C- 6	28.784	-193.155	-146.677	C- 7	-7.247	-139.201	-198.295
* 7	3.250	C- 6	-62.526	-263.393	-146.677	C- 7	-73.051	-189.819	-198.295
3 - 2	3.500	C- 7	-124.460	-221.456	-198.295	C- 6	-133.861	-307.291	-146.677
3 - 4	0.000	C- 7	-124.460	198.295	-221.455	C- 6	-133.861	146.677	-307.291
* 1	0.250	C- 7	-77.999	173.225	-225.527	C- 6	-99.420	128.681	-311.362
* 2	0.650	C- 7	-17.066	131.011	-232.040	C- 6	-54.041	97.787	-317.876
* 3	1.050	C- 7	26.465	86.211	-238.554	C- 6	-21.536	64.305	-324.389
* 4	1.750	C- 7	57.655	1.584	-249.953	C- 6	1.253	-0.514	-335.788
* 5	2.450	C- 7	26.738	-91.679	-261.351	C- 6	-24.027	-72.675	-347.187
* 6	2.850	C- 7	-21.516	-150.261	-267.865	C- 6	-61.725	-116.057	-353.701
* 7	3.250	C- 7	-94.005	-212.855	-274.379	C- 6	-117.062	-160.864	-360.214
4 - 3	3.500	C- 7	-152.331	-254.014	-278.450	C- 6	-160.857	-189.593	-364.285
4 - 1	0.000	C- 7	-152.331	278.450	-254.014	C- 6	-160.857	364.285	-189.593
* 1	0.250	C- 6	-76.291	312.245	-189.593	C- 7	-87.691	238.671	-254.014
* 2	0.650	C- 6	31.954	228.979	-189.593	C- 7	-4.952	175.025	-254.014
* 3	1.050	C- 6	106.892	145.714	-189.593	C- 7	52.329	111.380	-254.014
* 4	1.750	C- 6	157.892	0.000	-189.593	C- 7	91.312	0.000	-254.014
* 5	2.450	C- 6	106.892	-145.714	-189.593	C- 7	52.329	-111.380	-254.014
* 6	2.850	C- 6	31.954	-228.979	-189.593	C- 7	-4.952	-175.025	-254.014
* 7	3.250	C- 6	-76.291	-312.245	-189.593	C- 7	-87.691	-238.671	-254.014
1 - 4	3.500	C- 7	-152.331	-278.449	-254.014	C- 6	-160.857	-364.285	-189.593

BOX FOR DRAINAGE-NO 1

PICK-UP No. 1 *

No.	L (m)	S. MAXIMUM Case	M (tm)	S (t)	N (t)	S. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 7	-152.331	254.014	-278.449	C- 6	-160.857	189.593	-364.285
* 1	0.250	C- 7	-94.005	212.855	-274.379	C- 6	-117.062	160.864	-360.214
* 2	0.650	C- 7	-21.516	150.261	-267.865	C- 6	-61.725	116.057	-353.701
* 3	1.050	C- 7	26.738	91.679	-261.351	C- 6	-24.027	72.675	-347.187
* 4	1.750	C- 6	1.253	0.514	-335.788	C- 7	57.655	-1.584	-249.953
* 5	2.450	C- 6	-21.536	-64.305	-324.389	C- 7	26.465	-86.211	-238.554
* 6	2.850	C- 6	-54.041	-97.787	-317.876	C- 7	-17.066	-131.011	-232.040
* 7	3.250	C- 6	-99.420	-128.681	-311.362	C- 7	-77.999	-173.225	-225.527
2 - 1	3.500	C- 6	-133.861	-146.677	-307.291	C- 7	-124.460	-198.295	-221.456
2 - 3	0.000	C- 6	-133.861	307.291	-146.677	C- 7	-124.460	221.455	-198.295
* 1	0.250	C- 6	-62.526	263.392	-146.677	C- 7	-73.051	189.819	-198.295
* 2	0.650	C- 6	28.784	193.154	-146.677	C- 7	-7.247	139.201	-198.295
* 3	1.050	C- 6	91.998	122.917	-146.677	C- 7	38.309	88.582	-198.295
* 4	1.750	C- 7	69.313	0.000	-198.295	C- 6	135.019	0.000	-146.677
* 5	2.450	C- 7	38.309	-88.582	-198.295	C- 6	91.998	-122.917	-146.677
* 6	2.850	C- 7	-7.247	-139.201	-198.295	C- 6	28.784	-193.155	-146.677
* 7	3.250	C- 7	-73.051	-189.819	-198.295	C- 6	-62.526	-263.393	-146.677
3 - 2	3.500	C- 7	-124.460	-221.456	-198.295	C- 6	-133.861	-307.291	-146.677
3 - 4	0.000	C- 7	-124.460	198.295	-221.455	C- 6	-133.861	146.677	-307.291
* 1	0.250	C- 7	-77.999	173.225	-225.527	C- 6	-99.420	128.681	-311.362
* 2	0.650	C- 7	-17.066	131.011	-232.040	C- 6	-54.041	97.787	-317.876
* 3	1.050	C- 7	26.465	86.211	-238.554	C- 6	-21.536	64.305	-324.389
* 4	1.750	C- 7	57.655	1.584	-249.953	C- 6	1.253	-0.514	-335.788
* 5	2.450	C- 6	-24.027	-72.675	-347.187	C- 7	26.738	-91.679	-261.351
* 6	2.850	C- 6	-61.725	-116.057	-353.701	C- 7	-21.516	-150.261	-267.865
* 7	3.250	C- 6	-117.062	-160.864	-360.214	C- 7	-94.005	-212.855	-274.379
4 - 3	3.500	C- 6	-160.857	-189.593	-364.285	C- 7	-152.331	-254.014	-278.450
4 - 1	0.000	C- 6	-160.857	364.285	-189.593	C- 7	-152.331	278.450	-254.014
* 1	0.250	C- 6	-76.291	312.245	-189.593	C- 7	-87.691	238.671	-254.014
* 2	0.650	C- 6	31.954	228.979	-189.593	C- 7	-4.952	175.025	-254.014
* 3	1.050	C- 6	106.892	145.714	-189.593	C- 7	52.329	111.380	-254.014
* 4	1.750	C- 7	91.312	0.000	-254.014	C- 6	157.892	0.000	-189.593
* 5	2.450	C- 7	52.329	-111.380	-254.014	C- 6	106.892	-145.714	-189.593
* 6	2.850	C- 7	-4.952	-175.025	-254.014	C- 6	31.954	-228.979	-189.593
* 7	3.250	C- 7	-87.691	-238.671	-254.014	C- 6	-76.291	-312.245	-189.593
1 - 4	3.500	C- 7	-152.331	-278.449	-254.014	C- 6	-160.857	-364.285	-189.593

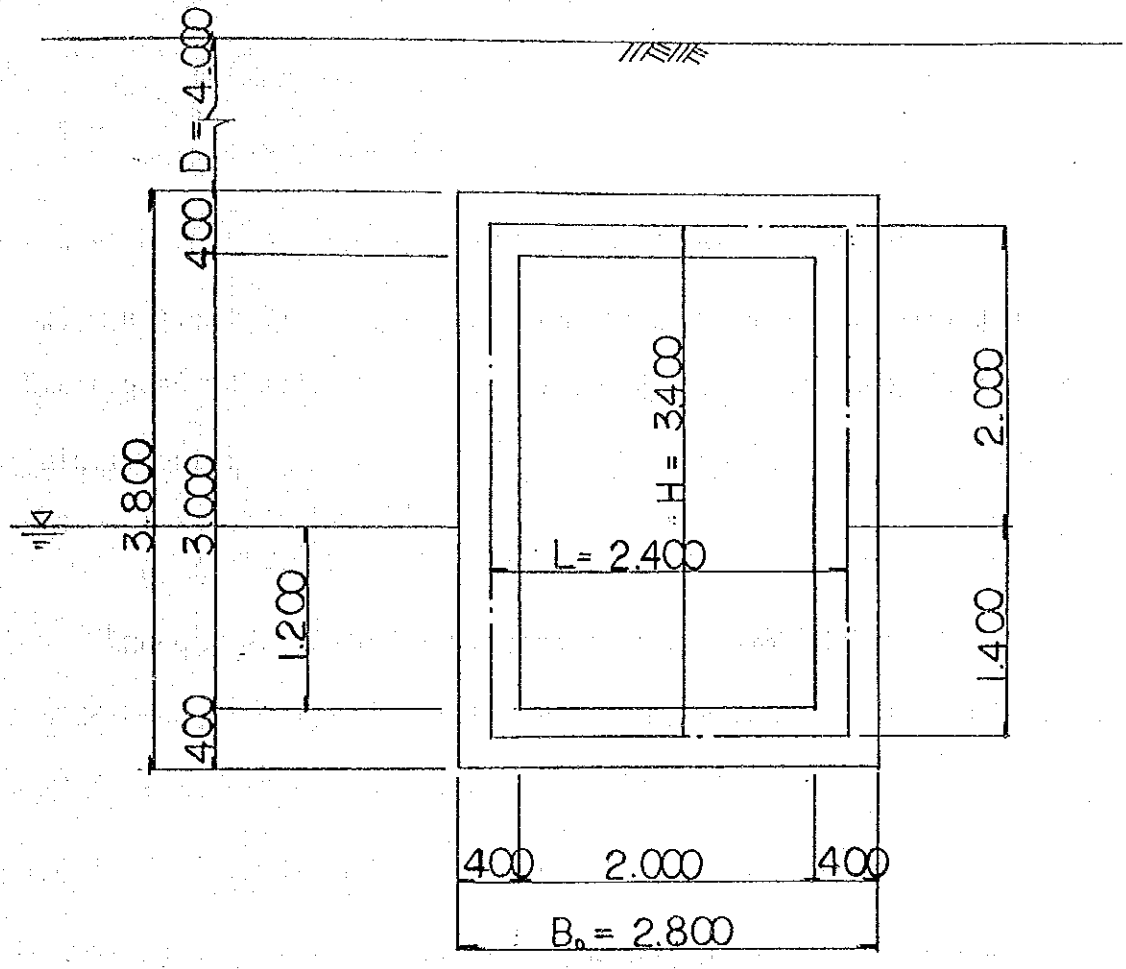
BOX FOR DRAINAGE-NO 1

PICK-UP No. 1 *

No.	L (m)	N. MAXIMUM Case	M (tm)	S (t)	N (t)	N. MINIMUM Case	M (tm)	S (t)	N (t)
1 - 2	0.000	C- 7	-152.331	254.014	-278.449	C- 6	-160.857	189.593	-364.285
* 1	0.250	C- 7	-94.905	212.855	-274.379	C- 6	-117.062	160.864	-360.214
* 2	0.650	C- 7	-21.516	150.261	-267.865	C- 6	-61.725	116.057	-353.701
* 3	1.050	C- 7	26.738	91.679	-261.351	C- 6	-24.027	72.675	-347.187
* 4	1.750	C- 7	57.655	-1.584	-249.953	C- 6	1.253	0.514	-335.788
* 5	2.450	C- 7	26.465	-86.211	-238.554	C- 6	-21.536	-64.305	-324.389
* 6	2.850	C- 7	-17.066	-131.011	-232.040	C- 6	-54.041	-97.787	-317.876
* 7	3.250	C- 7	-77.999	-173.225	-225.527	C- 6	-99.420	-128.681	-311.362
2 - 1	3.500	C- 7	-124.460	-198.295	-221.456	C- 6	-133.861	-146.677	-307.291
2 - 3	0.000	C- 6	-133.861	307.291	-146.677	C- 7	-124.460	221.455	-198.295
* 1	0.250	C- 6	-62.526	263.392	-146.677	C- 7	-73.051	189.819	-198.295
* 2	0.650	C- 6	28.784	193.154	-146.677	C- 7	-7.247	139.201	-198.295
* 3	1.050	C- 6	91.998	122.917	-146.677	C- 7	38.309	88.582	-198.295
* 4	1.750	C- 6	135.019	0.000	-146.677	C- 7	69.313	0.000	-198.295
* 5	2.450	C- 6	91.998	-122.917	-146.677	C- 7	38.309	-88.582	-198.295
* 6	2.850	C- 6	28.784	-193.155	-146.677	C- 7	-7.247	-139.201	-198.295
* 7	3.250	C- 6	-62.526	-263.393	-146.677	C- 7	-73.051	-189.819	-198.295
3 - 2	3.500	C- 6	-133.861	-307.291	-146.677	C- 7	-124.460	-221.456	-198.295
3 - 4	0.000	C- 7	-124.460	198.295	-221.455	C- 6	-133.861	146.677	-307.291
* 1	0.250	C- 7	-77.999	173.225	-225.527	C- 6	-99.420	128.681	-311.362
* 2	0.650	C- 7	-17.066	131.011	-232.040	C- 6	-54.041	97.787	-317.876
* 3	1.050	C- 7	26.465	86.211	-238.554	C- 6	-21.536	64.305	-324.389
* 4	1.750	C- 7	57.655	1.584	-249.953	C- 6	1.253	-0.514	-335.788
* 5	2.450	C- 7	26.738	-91.679	-261.351	C- 6	-24.027	-72.675	-347.187
* 6	2.850	C- 7	-21.516	-150.261	-267.865	C- 6	-61.725	-116.057	-353.701
* 7	3.250	C- 7	-94.005	-212.855	-274.379	C- 6	-117.062	-160.864	-360.214
4 - 3	3.500	C- 7	-152.331	-254.014	-278.450	C- 6	-160.857	-189.593	-364.285
4 - 1	0.000	C- 6	-160.857	364.285	-189.593	C- 7	-152.331	278.450	-254.014
* 1	0.250	C- 6	-76.291	312.245	-189.593	C- 7	-87.691	238.671	-254.014
* 2	0.650	C- 6	31.954	228.979	-189.593	C- 7	-4.952	175.025	-254.014
* 3	1.050	C- 6	106.892	145.714	-189.593	C- 7	52.329	111.380	-254.014
* 4	1.750	C- 6	157.892	0.000	-189.593	C- 7	91.312	0.000	-254.014
* 5	2.450	C- 6	106.892	-145.714	-189.593	C- 7	52.329	-111.380	-254.014
* 6	2.850	C- 6	31.954	-228.979	-189.593	C- 7	-4.952	-175.025	-254.014
* 7	3.250	C- 6	-76.291	-312.245	-189.593	C- 7	-87.691	-238.671	-254.014
1 - 4	3.500	C- 6	-160.857	-364.285	-189.593	C- 7	-152.331	-278.449	-254.014

NO ② BOX CULVERT FOR DRAINAGE

1) Shape and Size



Where ··· D^m = depth of asphalt and similar surface soil.

2) Factor of section

$A = 1.00 \times 0.40 \quad = 0.4000\ m^2$

$I = \frac{1.00 \times 0.40^3}{12} \quad = 0.00533\ m^4$

$Ec = 25\ kN/mm^2 = 2.5 \times 10^7\ kN/m^2$

No.② BOX CULVERT FOR DRAINAGE

1. calculation for bending moment (U.L.S)

section b=100^{cm} h=40 d =34.0 d ′ =6.0

a) intersection point①=④ (②=③) Mu.min=−111.4^{KNm}(−95.5^{KNm})

A_s= Y_{16}−150^{ctc}= 13.41 cm^2

$$X = \frac{0.87\times41000\times13.41}{0.40\times2500\times100} \fallingdotseq 4.8^{cm}$$

$$Z = 34.0 - \frac{4.8}{2} = 31.6^{cm} < 0.95\times34.0 = 32.3^{cm}$$ OK

M_{RS} =0.87×41000 ×13.41 ×31.6×10^{-5}=151.2^{KNm}>Mu=111.4^{KNm}

M_{RC} =0.40×2500×100 ×4.8 ×31.6×10^{-5}=151.6^{KNm}>Mu=111.4^{KNm} OK

b) middle point ①～②=③～④ Mu.max=79.2^{KNm}

A_s= Y_{12}−150^{ctc}= 7.54 cm^2

M_R = 87.4^{KNm}> Mu= 79.2^{KNm}

(Where : M_R : From calculation of point④～①)

c) middle point ④～①= (②～③) Mu.max=63.1^{KNm} (51.3^{KNm})

A_s= Y_{12}−150^{ctc}= 1.131/0.15 =7.54 cm^2

$$X = \frac{0.87\times41000\times7.54}{0.40\times2500\times100} \fallingdotseq 3.0^{cm}$$

$$Z = 34.0 - \frac{3.0}{2} = 32.5^{cm} \fallingdotseq 0.95\times34.0 = 32.3^{cm}$$ OK

M_{RS} =0.87×41000 ×7.54×32.5×10^{-5}=87.4^{KNm} >Mu=63.1^{KNm}

M_{RC} =0.40×2500×100 ×3.0 ×32.5×10^{-5}=97.5^{KNm} >Mu=63.1^{KNm}

2. calculation for shearing force (U.L.S)

section b =100^{cm} h =40 d=34.0 d ′ =6.0

a) side wall ①, ④ Su.max= 116.3^{KN}

$$Vc = \frac{116.3\times10^3}{100\times34.0} = 34.2\ N/cm^2 < Vca = 43.6\ N/cm^2$$ OK

b) upper slab ②, ③ Su.max= 77.8^{KN}

$$Vc = \frac{77.8\times10^3}{100\times34.0} = 22.9\ N/cm^2 < Vca = 43.6\ N/cm^2$$ OK

c) botton slab ①, ④ Su.max= 92.6^{KN}

$$Vc = \frac{92.6 \times 10^3}{100 \times 34.0} = 27.3 \ N/cm^2 < Vca = 43.6 \ N/cm^2 \ OK$$

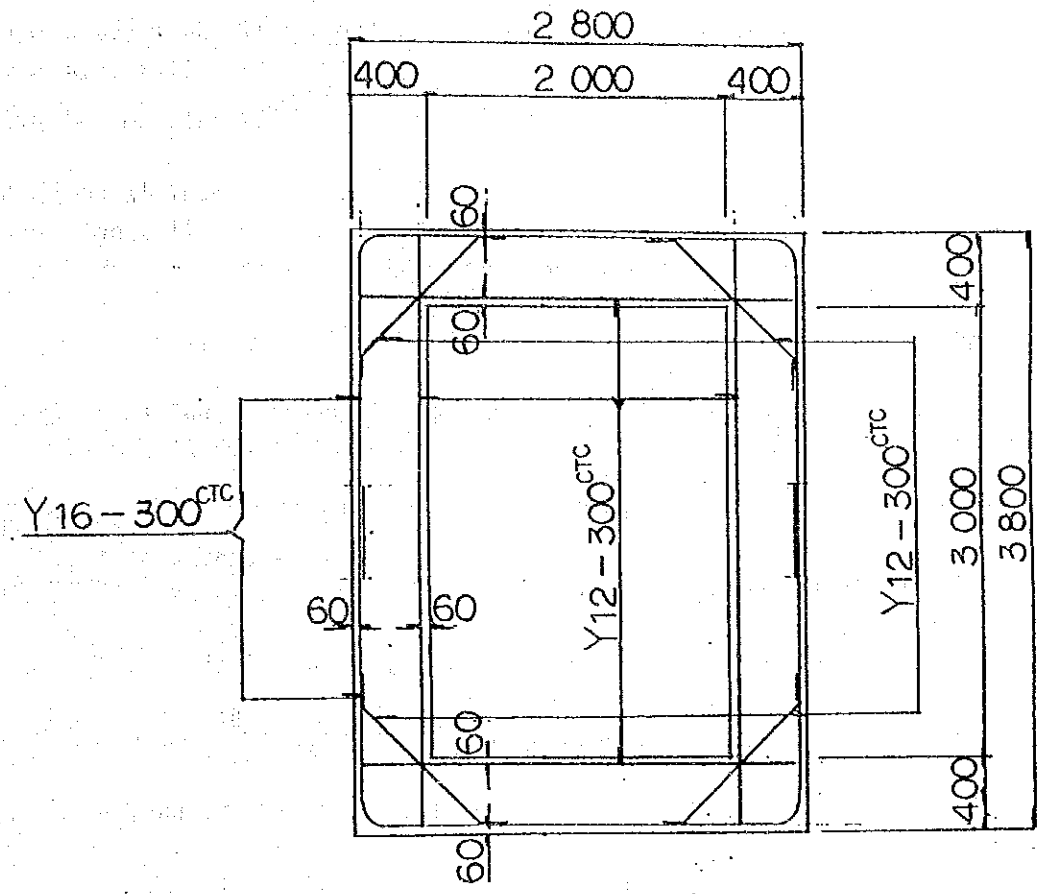
where

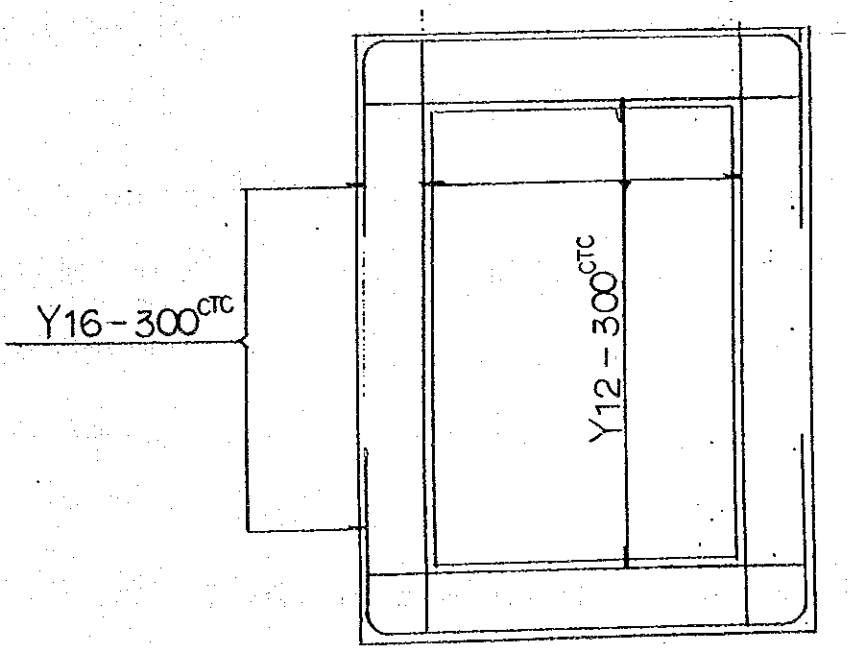
$$A_s = Y_{16} - 150^{ctc} = 13.41 \ cm^2$$

$$P = \frac{13.41}{100 \times 34.0} \times 100 = 0.394 \ \%$$

$$\therefore Vca = 35.0 + \frac{15}{0.25}(0.394 - 0.25) = 43.6 \ N/cm^2$$

NO ② BOX CULVERT FOR DRAINAGE





NO② BOX FOR DRAINAGE

Load

(1)Dead load

a)Vertical load Where $\alpha = 1.2$ {earth pressure factor of vertical $\because \frac{D}{B_o} = \frac{4.0}{2.8} = 1.4$ $\begin{matrix}>1.0\\<2.0\end{matrix}$

For upper slab $w1 = 22.6\times0.50+19.6\times3.50\times1.20+23.60\times0.400 = 103.060$ kN/m

For side wall $w2 = 23.6\times0.40 = 9.440$ 〃

For bottom slab $W3 = 103.060 + \frac{2\times9.440\times3.40}{2.40} = 129.807$ 〃

b)Horizontal load ----- earth pressure

For side wall $P1 = (22.6\times0.50+19.60\times3.70)\times0.500 = 41.910$ kN/m

〃 $P2 = (22.6\times0.50+19.60\times5.70)\times0.500 = 61.510$ 〃

〃 $P3 = (22.6\times0.50+19.60\times5.70+10.8\times1.40)\times0.500 = 69.070$ 〃

C)Horizontal load ----- water Pressure

For side wall $Pw = 9.80\times1.40 = 13.720$ kN/m

(2)Live load

live load surcharge of axle

$$P = \frac{10\ (\text{KN/axle}) \times 30\ (\text{unite})}{3.50 \times B}$$

width of despersal of wheel

$B = 0.300+4.00+0.400 = 4.700$ m

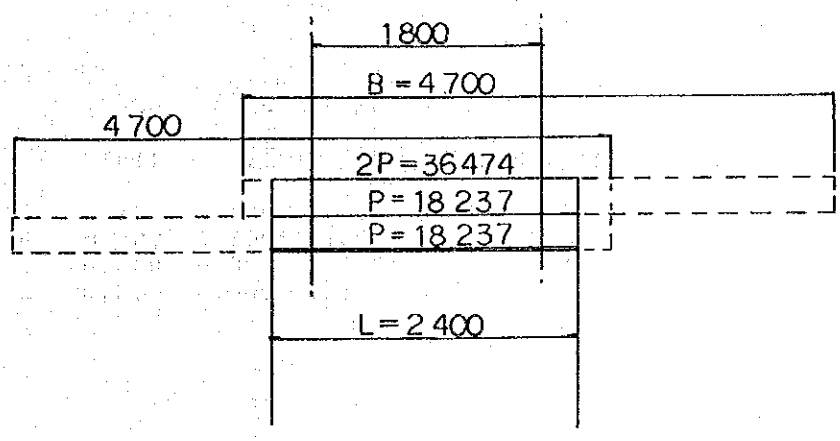
$$= \frac{10 \times 30}{3.50 \times 4.70} = 18.237\ \text{KN/m}^2$$

or live load surcharge of vihicle

$$go = \frac{40\ (\text{kN/rihicle}) \times 30\ (\text{unit})}{3.50 \times 10.0} = 34.300\ \text{KN/m}^2 < 2P = 36.474\ \text{KN/m}^2$$

OF curse the loaded of live load is consider as following

case-1 Vaertical load



For upper slab and bottom slab $w1 = w2 = 36.474$ KN/m

case-2 Horizontal load ----- eath pressure of live load surcharge

For side wall: $pe = go\cdot ko = 34.300 \times 0.500 = 17.150$ KN/m

BOX FOR DRIANAGE-NO 2 Depth = 4.000

No	X (m)	Y (m)
1	0.0000	0.0000
2	0.0000	3.4000
3	2.4000	3.4000
4	2.4000	0.0000

No	I	J	A (m2)	I (m4)	I - J	L (m)	E (t/m2)	EPS
1	1	2	0.40000	0.005330	Fix - Fix	3.400	2.50E+07	1.00E-05
2	2	3	0.40000	0.005330	Fix - Fix	2.400	2.50E+07	1.00E-05
3	3	4	0.40000	0.005330	Fix - Fix	3.400	2.50E+07	1.00E-05
4	4	1	0.40000	0.005330	Fix - Fix	2.400	2.50E+07	1.00E-05

No. 1

No	X (t/m)	Y (t/m)	M(tm/Rad)
1	Fix	Fix	Free
4	Free	Fix	Free

No		L-No 1 11	L-No 2 12	L-No 3 13	L-No 4 14	L-No 5 15
1	5	0.200	0.800	1.700	2.600	3.200
2	5	0.200	0.800	1.200	1.600	2.200
3	5	0.200	0.800	1.700	2.600	3.200
4	5	0.200	0.800	1.200	1.600	2.200

NOTE: THE DIMENSION(t) BE EXCHANG TO DIMENSION(KN) INTO THIS CALCULATION

CALCULATION POINTS OF EACH FORCE