NO. D BOX CULVERT FOR ROAD

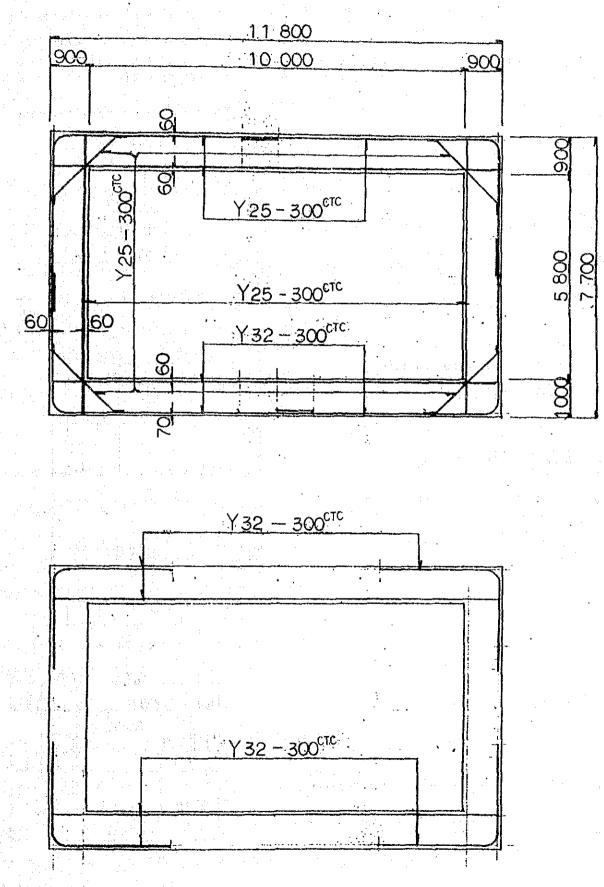
1. calculation for bending moment section $b = 100^{\circ m}$ h = 90d = 84.0 d' = 6.01) For upper slab a) middle point 2~3 Ми. max=1025. 5^{кмт} $A_{s} = \begin{pmatrix} Y_{32} - 300^{\text{ctc}} = 8.042/0.30 \\ Y_{25} - 300^{\text{ctc}} = 4.909/0.30 \end{pmatrix} = 43.17 \text{ cm}^{2}$ $X = \frac{0.87 \times 41000 \times 43.17}{0.40 \times 2500 \times 100} = 15.4^{\text{cm}}$ $Z = 84.0 - \frac{15.4}{2} = 76.3^{\circ m} < 0.95 \times 84.0 = 79.8^{\circ m}$ 0K $M_{Rs} = 0.87 \times 41000 \times 43.17 \times 76.3 \times 10^{-5} = 1175.0^{KNm} > Mu = 1025.5^{KNm}$ $M_{Rc} = 0.40 \times 2500 \times 100 \times 15.4 \times 76.3 \times 10^{-5} = 1175.0^{KNm} > Mu = 1025.5^{KNm}$ OK b) intersection point @=3 Mu.min=-753.6^{KNm} $A_s = Y_{25} - 150^{ctc} = 4.909 / 0.15 = 32.73 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 32.73}{0.40 \times 2500 \times 100} = 11.8^{\text{cm}}$ $Z = 84.0 - \frac{11.8}{2} = 78.1^{cm} < 0.95 \times 84.0 = 79.8^{cm}$ 0K $M_{Rs} = 0.87 \times 41000 \times 32.73 \times 78.1 \times 10^{-5} = 911.8^{KNm} > 753.6^{KNm}$ $M_{Rc} = 0.40 \times 2500 \times 100 \times 11.8 \times 78.1 \times 10^{-5} = 921.8^{KNm} > 753.6^{KNm}$ For bottom slab section $b = 100^{cm}$ h = 100d = 93.0(94.0) d' = 7.0(6.0)a) middle point ④~① Mu.max =1347.1^{кмm} $A_s = Y_{32} - 150^{c+c} = 8.042 / 0.150 = 53.61 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 53.16}{0.40 \times 2500 \times 100} = 15.2^{\text{cm}}$ $Z = 94.0 - \frac{19.2}{2} = 84.4^{cm} < 0.95 \times 94.0 = 89.3^{cm}$ 0K $M_{Rs} = 0.87 \times 41000 \times 53.16 \times 84.4 \times 10^{-5} = 1600.4^{KNm} > = 1347.1^{KNm}$ $M_{RC} = 0.40 \times 2500 \times 100 \times 19.2 \times 84.4 \times 10^{-5} = 1620.5^{KNm} > = 1347.1^{KNm} OK$

 $A_s = Y_{25} - 150^{ctc} = 4.909 / 0.15 = 32.73 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 32.73}{0.40 \times 2500 \times 100} = 11.8^{\text{cm}}$ $Z = 93.0 - \frac{11.8}{2} = 87.1^{\circ m} < 0.95 \times 93.0 = 88.3^{\circ m}$ OK $M_{RS} = 0.87 \times 41000 \times 32.73 \times 87.1 \times 10^{-5} = 1016.8^{KNm} > Mu = 917.9^{KNm}$ $M_{RC} = 0.40 \times 2500 \times 100 \times 11.8 \times 87.1 \times 10^{-5} = 1027.8^{KNm} > Mu = 917.9^{KNm}$ Notice: this bar is decide for shearing forces OK without bending moments. 2. calculation for shearing force (U.L.S) a) For upper slab intersection point @=3 Su.max = 408.1^{KN} section $b = 100^{cm}$ h = 90 d = 84.0 d' = 6.0 $A_{s} = \begin{pmatrix} Y_{s2} - 300^{\text{ctc}} \\ Y_{2s} - 300^{\text{ctc}} \end{pmatrix} = 43.17 \text{ cm}^{2}$ $P = \frac{43.17}{100 \times 84.0} \times 100 = 0.514 \%$ $V_{C} = \frac{408.1 \times 10^{3}}{100 \times 84.0} = 48.6 \text{ N/cm}^{2}$ $Vca = 50.0 + \frac{15.0}{0.50} (0.514 - 0.50) = 50.4$ N/cm² b) For bottom slab intersection point @=1 Su.max = 487.7^{KN} section $b = 100^{cm}$ h = 100 d = 93.0 d' = 7.0 $A_s = Y_{32} - 150^{ctc} = 8.042/0.15 = 53.61 \text{ cm}^2$ $P = \frac{53.61}{100 \times 93.0} \times 100 = 0.577 \%$ $Vc = \frac{487.7 \times 10^3}{100 \times 93.0} = 52.4 \text{ N/cm}^2$ \leq Vca= 50.0 + $\frac{15.0}{0.50}$ (0.577-0.50) = 52.4 N/cm² 0K Notice: this bar is decide for shearing force

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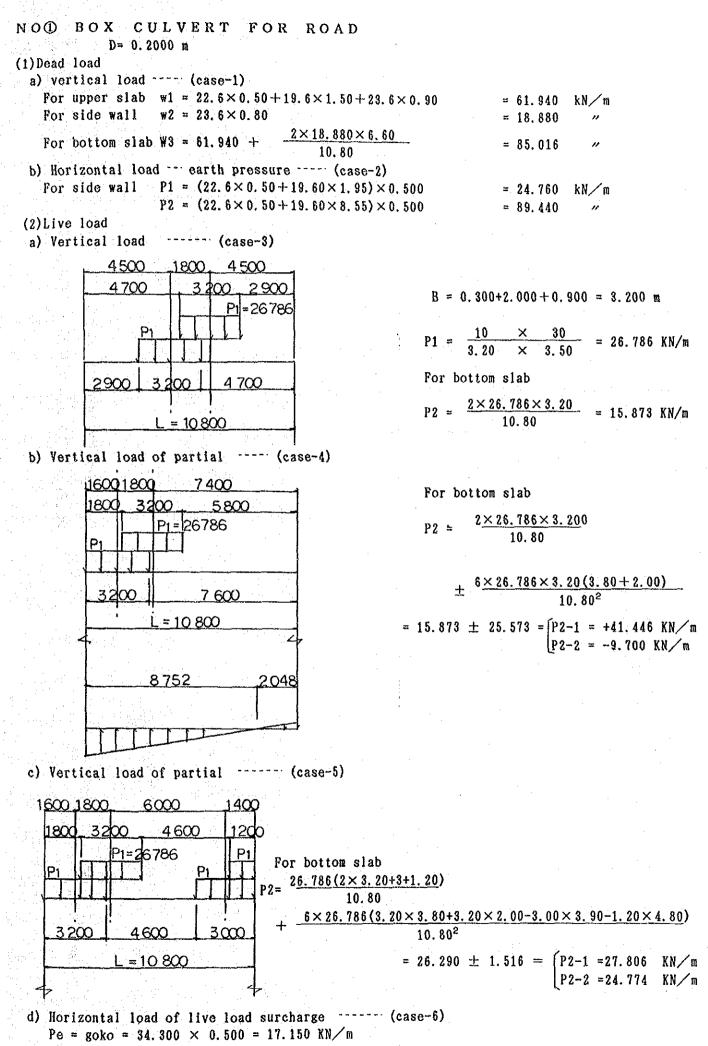
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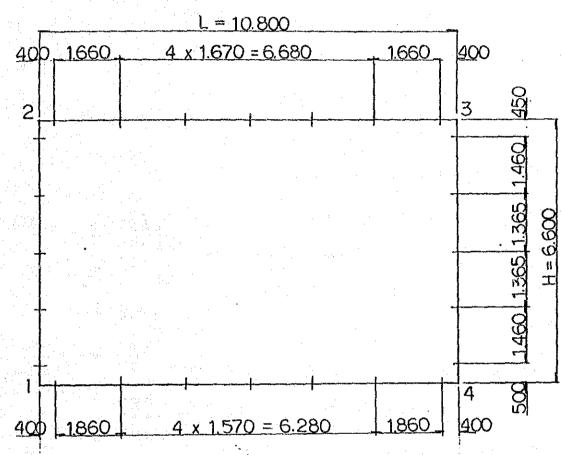
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CALCULATION POINTS OF EACH FORCE



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BCX FOR ROAD NO 1

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ROTA. (mmRad)	-3.19066 3.11516 -3.11516 3.19066	ROTA. (mmRad)		ROTA. (mmRad)	13.94402 -13.53128 -11.83169 -13.07435		
Z Y-DIS.(mm)	0.00000	5 Y-DIS. (mm)	0.00000 -0.45684 -0.05684	8 Y-DIS. (mm)	0.00000 -2.44134 -1.98151 0.00000		
Case. X-DIS.(mm)	0.00000 -0.14151 -0.84941 -0.99092	Case. X-DIS.(mm)	0.00000 0.95806 0.95806 0.95892 1.0.00438	Case. X-DIS.(mm)	0.00000 1.07336 -0.02886 -1.69426		
ROTA.(mmRad)	11.27220 -10.40786 -10.40786 -11.27220	ROTA. (mmRad)	-2.55453 -3.012950 -1.82438 -1.94637	ROTA. (mmRad)	13.86519 -13.84269 -13.84269 -13.84265	ROTA. (mmRad)	8.78251 17.59255 7.59255 7.59255 1.7.59255 1.7.59255 1.7.59255 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.59555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.595555 1.7.5955555 1.7.595555 1.7.5955555 1.7.5955555 1.7.5955555 1.7.5955555 1.7.5955555 1.7.5955555 1.7.5955555 1.7.5955555 1.7.5955555 1.7.59555555 1.7.5955555 1.7.59555555 1.7.59555555 1.7.59555555555555 1.7.595555555555555555555555555555555555
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s (t)	57.1	ю (?)	38.51	-4,20	117.19	4.69	224.71	69.63	20.12	04.08	54.30	37.08	179.83	00° 000	-659.540		17	04.69	17.19	4.20	138.91	-325-336	31.50	70.37	85.26	3 12	0.80		7.01	27.8.75
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N (1)	825.78	è	774.71	739.14	703.58	665.54	653.82	229.62	229.62	229.62	229.62	229.62	229.62	29.02	-229.629		514.47	526.20	564.24	599.80	635.37	-673.410	392.19	392.19	392.19	392.19	392.19	-352.190	392.19	392.19
S (t)	92.19		34.00	-9.11	122.10	9.60	229.62	53.8	04.30	\$8.87	38.49	-52,90	195.64	20.00	514.47		. 62	03.60	22.10	9.11	134.00	-3520-423	86.44	44.52	35 35	40.55	29.06	-199.113	43.98	755.69
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N (t)	756.10	80,	705.04	669.47	633.91	595.87	584.15	241.22	241.22	241.22	241.22	241.22	241.22	22.14	241.22	•.	584.15	595.87	633.91	669.47	705.04	-756.109	380.59	380.59	380.59	380.59	380.59	-380, 594	380.59	380 50
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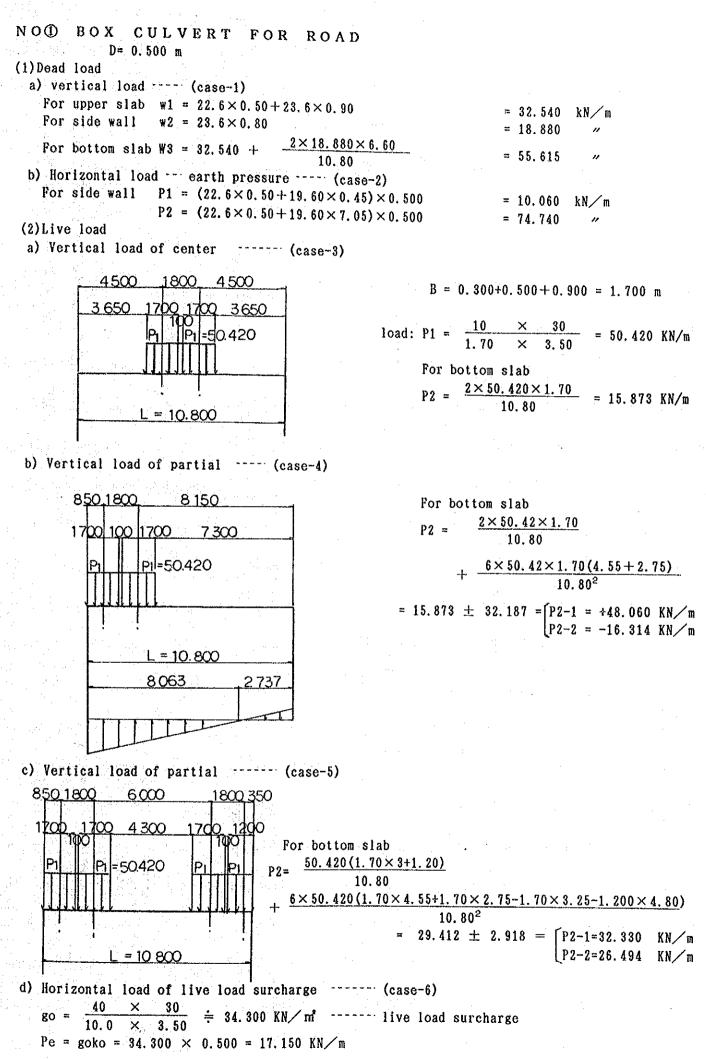
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Case. X-DIS.(mm)	0.00000 0.05071 -0.00267 0.04804	Case. X-DIS.(mm)	0.00000 0.00843 -0.25780 -0.24937	Case. X-DIS.(mm)	0.00000 -0.04892 -0.55346 -1.41462		
RoľA. (mmRaů)	-2.40753 -2.26829 -2.26829 -2.26829 -2.40753	ROTA. (mmRad)	3.92547 -3.68685 3.483325 -3.86439 -3.86439	ROTA. (mmRad)	9.41699 +8.04634 6.38527 -8.26379	· · ·	
2 Υ-DIS.(mm)	0.00000	5 Y-DIS.(mm)	0.00000 -0.54275 -0.50548 0.00000	8 Y-DIS. (mm)	0.00000 -1.77573 -1.20113 0.00000	•	
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ROTA. (mmRad)	7.08468 -5.86495 5.86495 -7.08468	ROTA. (mmRad)	2.52626 1.258419 1.71982	ROTA.(mmRad)	9.40451 -9.05534 9.05534 -9.405534	ROTA. (mmRad)	4.29691 -2.72072 -2.72072 -4.29691
	0.00000 -0.78547 -0.78547 -0.78547 0.00000	4 Y-DIS.(mm) 1	0.00000 10.48377 10.08197 0.00000	7 Y-DIS.(mm) ROTA.(mmRad	0.00000 -1.48843 -1.48843 0.00000	10 Y-DIS.(mm)	0.00000 -1.08394 -1.08394 0.00000
Case. 1 X-DIS.(mm) Y-DIS.(mm)	0.00000 -0.08010 0.00422 -0.07588	Case. X-DIS.(mm)	0.00000 0.57814 0.58641 -0.00744	Case. X-DIS.(mm)	0.00000 -0.28342 -1.03492 -1.31835	Case. X-DIS.(mm)	0.00000 -0.34203 -1.45648 -1.79852
R ROAD		No.		No.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	. oN	1004

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BOX FOR ROAD

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:	No	Ca L(m)	ase l'Dead N (tm)	load S(t)	N (t)	Case 2 Earth M (tm)	pressure S (t)	N (t)	Case 3 HB 11 M (tm)	ve load-VL- S (t)	(t) V (t)
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*		.690	184.88	7.56	211.77	97.35	62 84	\sim	100 500 L	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 1 1 0
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- -	с. 19	60	51.33	7 5	175.	-63.796	625 66-	0.000	-130.563	-11.121	-85.714
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BOX FOR ROAD

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			case 9 M (tm)		715 08	-570.432	293.84	212.91	261.57	410.49	468.99	00 001	000 C	87.18	269.00	514.95	61.00	481.76	45.44	287.62	-462.879		462.87	-404.379	205.40	206.79	287.73	564.31	712.96	712.96				865.27	16.21	874.257	36.336	469.034	-719-082	
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PICK-UP No. 1

BOX FOR ROAD

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PICK-UP No.

FOR ROAD

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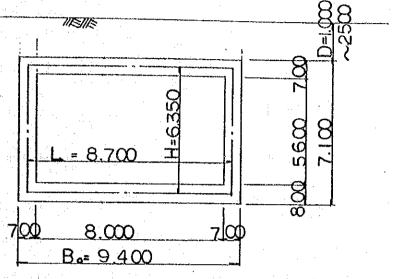
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PICK-UP No.

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-649.641 -6649.641 -536.614 -536.614 -558.574 -568.010 -477.446 -232.176 -232.176 -232.176 -232.176 -232.176 -2322.176 -2322.176 (4) $\boldsymbol{\mathcal{V}}$ M U M I N I M 327.457 267.818 116.807 6.800 -73.080 -125.172 -134.275 414.450 288.750 288.750 288.750 288.750 2883.750 120.498 120.9958 - 2240.9958 - 2240.9958 - 4500 134.279 125.172 73.080 -6.800 -116.807 -267.818 -327.457 3 S 2 -719.082 -570.432 -570.432 -293.849 -261.578 -1261.578 -1261.578 -1410.495 - 1 359.958 266.5555 266.5555 266.5555 284.287 284.287 2852.142 2855 282.142 2855 282.142 2855 282 259.955 259.958 259.558 259 - 462.879 - 404.379 - 255.462 - 255.462 - 255.462 - 255.462 - 733 - 733 - 733 - 733 - 733 - 712 - 966 (tm) > თთთთთით თთთთთთთ 56555565 7777777 11134.279 1134.279 1134.279 1134.279 1134.279 1134.279 1134.279 1134.279 (t) Ż Σ N. MAXIMU 477.582 430.879 243.860 65.043 65.043 65.043 65.043 1414.726 1.528 537.022 497.242 315.242 56.1368 156.1568 156.1568 156.1568 156.156 416.323 342.535 150.210 1.576 1.576 -116.929 -210.336 232.176 210.336 116.929 116.92 (t)in. - - 503.825 396.973 355.872 723.568 846.133 846.133 723.568 723.568 355.872 355.872 355.872 355.872 355.872 355.872 355.872 -468.994 -287.282 514.997 551.001 481.769 -287.447 -287.628 -452.879 M (tm) Case 0000000 ითიიიიიიიი 722277777 5555555555 0.000 0.400 2.050 3.730 5.400 8.740 8.740 8.740 8.740 10.800 0.000 1.910 3.275 6.100 6.100 6.600 (m) 0 0 7 0 0 F 0 01-00-07-00-'n **c**1 ŝ

NO @ BOX CULVERT FOR RORD 1) Shape and Size



Where

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D^m depth of asphalt and similar surface soil.

2) Factor of section

 $A = 1.00 \times 0.70 = 0.7000 \text{ m}^2$ $I = \frac{1.00 \times 0.70^3}{12} = 0.02858 \text{ m}^4$ $A = 1.00 \times 0.80 = 0.8000 \text{ m}^2$ $I = \frac{1.00 \times 0.80^3}{12} = 0.04267 \text{ m}^4$ A = = =

 $E_{C} = 25 \text{ KN/mm}^2$

 $= 2.5 \times 10^{7} \text{ KN/m^2}$

<u>No. ② BOX CULVERT FOR ROAD</u>

1. calculation for bending moment (U.L.S) 1) For upper slab $b = 100^{\circ m} h = 70$ d = 64.0d' = 6.0section a) middle point Mu. max = 667.4^{KNm} $2 \sim 3$ $A_{s} = \left(\begin{array}{c} Y_{32} - 300^{\text{ctc}} = 8.042/0.30\\ Y_{25} - 300^{\text{ctc}} = 4.909/0.30 \end{array}\right) = 43.17 \text{ cm}^{2}$ $X = \frac{0.87 \times 41000 \times 43.17}{0.40 \times 2500 \times 100} = 15.4^{\text{cm}}$ $Z = 64.0 - \frac{15.4}{2} = 56.3^{\circ m} < 0.95 \times 64.0 = 60.8^{\circ m}$ OK $M_{RS} = 0.87 \times 41000 \times 43.17 \times 56.3 \times 10^{-5} = 866.9^{KNm} > Mu = 667.4^{KNm}$ $M_{RC} = 0.40 \times 2500 \times 100 \times 15.4 \times 56.3 \times 10^{-5} = 867.0^{KNm} > Mu = 667.4^{KNm}$ b) intersection point @=3 Mu.min=-665.3^{KNm} $A_{Y} = Y_{25} - 150^{\text{ctc}} = 4.909 / 0.15 = 32.73 \text{ cm}^{2}$ $X = \frac{0.87 \times 41000 \times 32.73}{0.40 \times 2500 \times 100} = 11.8^{\circ m}$ $Z = 64.0 - \frac{11.8}{2} = 58.1^{cm} < 0.95 \times 64.0 = 60.8^{cm}$ 0K $M_{RS} = 0.87 \times 41000 \times 32.73 \times 58.1 \times 10^{-5} = 678.3^{KNm} > 605.3^{KNm}$ $M_{RC} = 0.40 \times 2500 \times 100 \times 11.8 \times 58.1 \times 10^{-5} = 685.5^{KNm} > 605.3^{KNm}$ 2) For bottom slab section $b = 100^{cm}$ h = 80 d = 73.0(74.0) d' = 7.0(6.0)Mu.max = 805.4^{KNm} a) middle point $@\sim ①$ $A_{s} = \begin{pmatrix} Y_{32} - 300^{\text{ctc}} = 8.042/0.30 \\ Y_{25} - 300^{\text{ctc}} = 4.909/0.30 \end{pmatrix}$ $\gamma = 43.17 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 43.17}{0.40 \times 2500 \times 100} = 15.4^{\text{cm}}$ $Z = 73.0 - \frac{15.4}{2} = 65.3^{cm} < 0.95 \times 73.0 = 69.3^{cm}$ OK $M_{RS} = 0.87 \times 41000 \times 43.17 \times 65.3 \times 10^{-5} = 1005.5^{KNm} > Mu = 805.4^{KNm}$

 $M_{RC} = 0.40 \times 2500 \times 100 \times 15.4 \times 65.3 \times 10^{-5} = 1005.6^{KNm} > Mu = 805.4^{KNm}$

1 - 34

OK

b) intersection point (4), (1) Mu.min = -671.0^{KNm} $A_{s} = Y_{2s} - 150^{ctc} = 4.909 / 0.15 = 32.73 \text{ cm}^{2}$

$$X = \frac{0.87 \times 41000 \times 32.73}{1.000 \times 32.73} = 11.8^{\text{cm}}$$

$$0.40 \times 2500 \times 100$$

$$Z = 74.0 - \frac{11.8}{2} = 68.1^{\text{cm}} < 0.95 \times 74.0 = 70.3^{\text{cm}}$$

$$\begin{split} M_{Rs} &= 0.87 \times 41000 \times 32.73 \times 68.1 \times 10^{-5} = 795.0^{KNm} > Mu = 671.0^{KNm} \\ M_{Rc} &= 0.40 \times 2500 \times 100 \times 11.8 \times 68.1 \times 10^{-5} = 803.5^{KNm} > Mu = 671.0^{KNm} \end{split}$$

OK

Notice: this bar is decide for shearing forces

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 @=③ Su.max = 376.0^{KN} $A_s = Y_{32} - 150^{ctc} = 8.042/0.15 = 53.61$ cm² $P = \frac{53.61}{100 \times 64.0} \times 100 = 0.838$ % $V_c = \frac{376.0 \times 10^3}{100 \times 64.0} = 58.8$ N/cm² $< V_{ca} = 50.0 + 15.0$ $\frac{(0.838 - 0.50)}{0.50} = 60.1$ N/cm²

b) For bottom slab

section b = 100^{cm} h = 80 d = 73.0 d' = 7.0intersection point @=① Su.min = -394.8^{KN}

$$A_{z} = Y_{32} - 150^{c+c} = 53.61 \text{ cm}^{2}$$

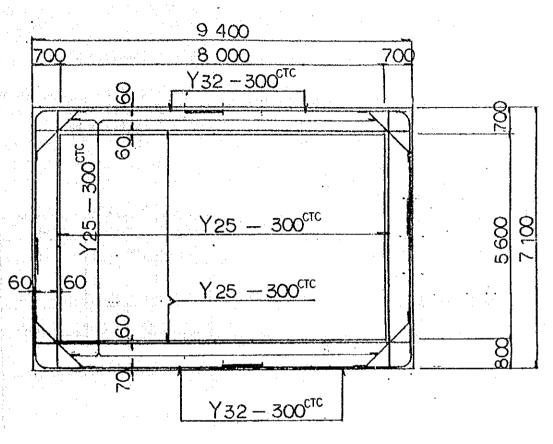
$$P = \frac{53.61}{100 \times 73.0} \times 100 = 0.734 \%$$

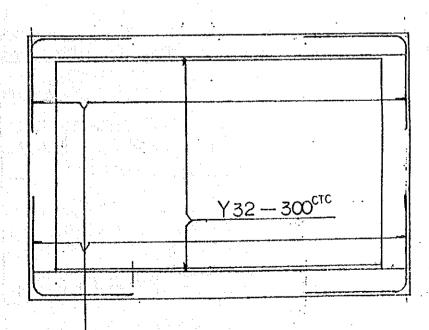
$$V_{c} = \frac{394.8 \times 10^{3}}{100 \times 73.0} = 54.1 \text{ N/cm}^{2}$$

$$V_{ca} = 50.0 + 15.0 \frac{(0.734 - 0.50)}{0.50} = 57.0 \text{ N/cm}^{2} \text{ OK}$$

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

NO BOX CULVERT FOR ROAD





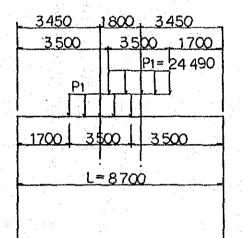
Y32-300^{cTC}

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(1)Dead load		
a) vertical load ····· (case-1)		
For upper slab w1 = 22.6 \times 0.50 + 19.6 \times 2.00 + 23.6 \times 0.70	= 67.020	kN∕m
For side wall $w^2 = 23.6 \times 0.70$	= 16.520	"
For bottom slab $W3 = 67.020 + \frac{2 \times 16.520 \times 6.35}{8.70}$	= 91.135	11
b) Horizontal load earth pressure (case-2)		
For side wall $P1 = (22.6 \times 0.50 + 19.60 \times 2.35) \times 0.500$	= 28.680	kN/m
$P2 = (22.6 \times 0.50 + 19.60 \times 8.70) \times 0.500$	= 90.910	"
(2)Live load		

a) Vertical load (case-3)



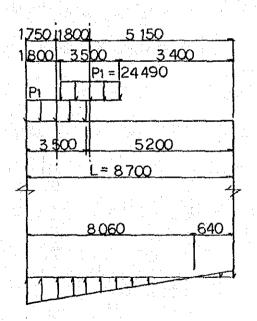
B = 0.30 + 2.50 + 0.70 = 3.500 m

load: P1 = $\frac{10 \times 30}{3.50 \times 3.50}$ = 24.490 KN/m

For bottom slab

 $P2 = \frac{2 \times 24.490 \times 3.50}{8.70} = 19.705 \text{ KN/m}$

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



For bottom slab

 $P2 = \frac{2 \times 24.490 \times 3.50}{8.70}$

 $\pm \frac{6 \times 24.490 \times 3.50(2.60 + 0.80)}{8.70^2}$

= 19.705 ± 23.102 = $\begin{bmatrix} P2-1 = +42.807 \text{ KN/m} \\ P2-2 = -3.397 \text{ KN/m} \end{bmatrix}$

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

Pe = 34.300 × 0.500 = 17.150 KN/m

NOTE: THE DIMENSIONCLIBE EXCHANG TO

Depth = 250

BOX FOR ROAD NO 2

DIMENSION(KN)INTO THIS CALCULATION

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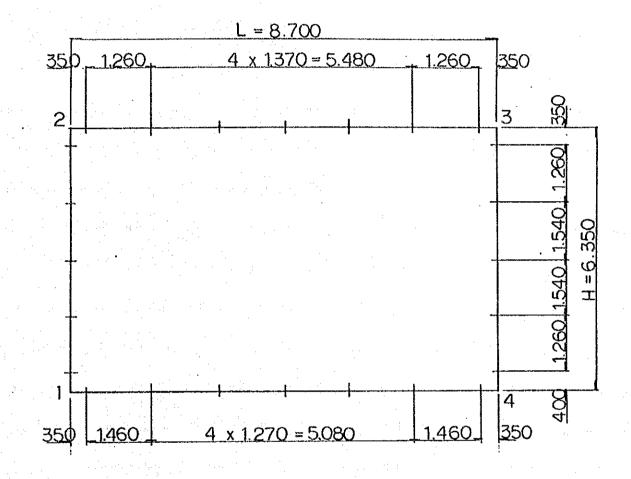
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CALCULATION POINTS OF EACH FORCE



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BOX FOR ROAD NO 2

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2 Y-DIS.(mm) ROTA.(mmRad)	-4.68205 4.66634 4.66634 4.68205 4.68205	ROTA.(mmRad)	-1.28591 1.40724 -1.40724 1.28591	ROTA.(mmRad)	6.58810 -5.48686 5.48686 -6.58810 -6.58810
2 Y-DIS.(mm)	0.00000 0.000000 0.000000	5 Υ-DIS.(mm)	0.00000	8 Y-DIS.(mm)	0.00000 -1.72250 -1.72250 0.00000
Case. X-DIS.(mm)	0.00000 -0.12250 -0.87273 -0.99524	Case. X-DIS.(mm)	0.00000 0.01074 -0.25337 -0.24263	Case. X-DIS.(mm)	0.00000 0.22962 1.855062 1.2.08468
(OTA.(mmRad)	11.90959 -11.23812 11.23812 -11.90959	ROTA. (mmRad)	3.12606 -3.92687 2.73274 -2.59727	ROTA.(mmRad)	13.18011 -13.42424 11.71664 -12.42394
Case. 1 X-DIS.(mm) Y-DIS.(mm) ROTA.(mmRad)	0.00000 -1.24819 -1.24819 0.00000	Case. 4 X-DIS.(mm) Y-DIS.(mm) I	0.00000 -0.44066 -0.18139 0.00000	7 Y-DIS.(mm) ROTA.(mmRad)	0.00000 -2.35264 -1.98188 0.00000
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BOX FOR ROAD NO 2

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BOX FOR ROAD NO 2

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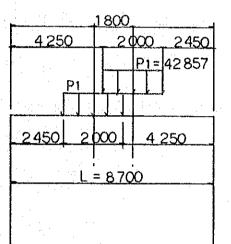
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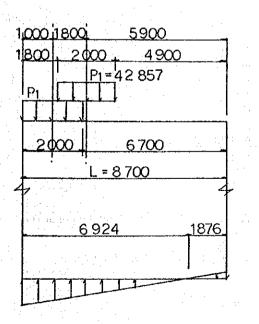
(1)Dead load		en a ser a	
a) vertical	load	(case-1)	
For upper	slab wi =	22.6 \times 0.50 + 1	9. $6 \times 0.50 + 23.6 \times 0.70$
For side w	wall w2 =	23.6×0.70	
For bottom	n slab W3 =	37.620 + -	$\frac{2 \times 16.520 \times 6.35}{8.70}$
b) Horizonta	al load	earth pressure	

For side wall P1 = $(22.6 \times 0.50 + 19.60 \times 0.85) \times 0.500$ P2 = $(22.6 \times 0.50 + 19.60 \times 7.20) \times 0.500$ (2) Live load

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



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



B = 0.30+1.00+0.70 = 2.000 m

= 76.210

 $P1 = \frac{10 \times 30}{2.00 \times 3.50} = 42.857 \text{ KN/m}$

= 37.620 kN/m

= 13.980 kN/m

11

= 16.520

= 61.735

For bottom slab

$$P2 = \frac{2 \times 42.857 \times 2.00}{8.70} = 19.704 \text{ KN/m}$$

For bottom slab $P2 = \frac{2 \times 42.857 \times 2.00}{8.70} + \frac{6 \times 42.857 \times 2.00(3.35 + 1.55)}{8.70^2}$ $= 19.704 \pm 33.294 = P2-1 = +52.998 \text{ KN/m} P2-2 = -13.590 \text{ KN/m}$

C) Horizontal load of live load surcharge ----- (case-5) Pe = 34.300 \times 0.500 = 17.150 KN/m

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BOX FOR ROAD NO 2'

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PICK-UP No. 1 *

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BCX FOR ROAD NO 2

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PICK-UP No.

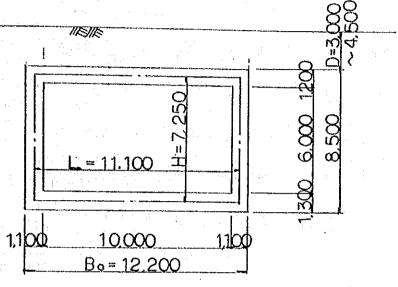
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2 ROAD PICK-UP No.

BOX FOR

NO [®] BOXCULVERT FOR RORD 1) Shape and Size



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

2) Factor of section

 $A = 1.00 \times 1.10 = 1.1000 \text{ m}^2$ $I = \frac{1.00 \times 1.10^3}{12} = 0.11092 \text{ m}^4$ $A = 1.00 \times 1.20 = 1.2000 \text{ m}^2$ $I = \frac{1.00 \times 1.20^3}{12} = 0.14400 \text{ m}^4$ $A = 1.00 \times 1.30 = 1.3000 \text{ m}^2$ $I = \frac{1.00 \times 1.30^3}{12} = 0.18308 \text{ m}^4$ $Ec = 25 \text{ KN/mm}^2 = 2.5 \times 10^7 \text{ KN/m}^2$

No. ③ BOX CULVERT FOR ROAD

- 1. calculation for bending moment (U.L.S)
- 1) For upper slab $b = 100^{cm}$ section h = 120d = 114.0 d' = 6.0a) middle point ②~③ Mu.max=1628.0^{кмm} $A_{s} = \begin{pmatrix} Y_{32} - 250^{ctc} = 8.042/0.25 \\ Y_{25} - 250^{ctc} = 4.909/0.25 \end{pmatrix}$ $= 51.80 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 51.80}{0.40 \times 2500 \times 100} = 18.6^{\circ m}$ $Z = 114.0 - \frac{18.6}{2} = 104.7^{\text{cm}} < 0.95 \times 114.0 = 108.3^{\text{cm}}$ $M_{RS} = 0.87 \times 41000 \times 51.80 \times 104.7 \times 10^{-5} = 1934.5^{KNm} > Mu = 1628.0^{KNm}$ $M_{Rc} = 0.40 \times 2500 \times 100 \times 18.6 \times 104.7 \times 10^{-5} = 1947.4^{KNm} > Mu = 1628.0^{KNm}$ 0K b) intersection point (2=3) Mu.min=1296.3^{KNm} $A_s = Y_{25} - 125^{ctc} = 4.909 / 0.125 = 39.27 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 39.27}{0.40 \times 2500 \times 100} = 14.00^{\text{cm}}$ $Z = 114.0 - \frac{14.00}{2} = 107.0^{cm} < 0.95 \times 114.0 = 108.3^{cm}$ OK $M_{RS} = 0.87 \times 41000 \times 39.27 \times 107.0 \times 10^{-5} = 1498.8^{KNm} > Mu = 1296.3^{KNm}$ $M_{RC} = 0.40 \times 2500 \times 100 \times 14.0 \times 107.0 \times 10^{-5} = 1498.0^{KNm} > Mu = 1296.3^{KNm}$ 0K 2) For bottom slab
 - section b = 100^{cm} h = 130 d = 123.0(124.0) d = 7.0(6.0)a) middle point $@\sim ①$ Mu.max = 2055.8^{KNm}

 $A_{s} = \left(\begin{array}{c} Y_{32} - 250^{\text{ctc}} = 8.042/0.25\\ Y_{25} - 250^{\text{ctc}} = 4.909/0.25\end{array}\right) = 51.80 \text{ cm}^{2}$ $X = \frac{0.87 \times 41000 \times 51.80}{0.40 \times 2500 \times 100} = 18.6^{\text{cm}}$

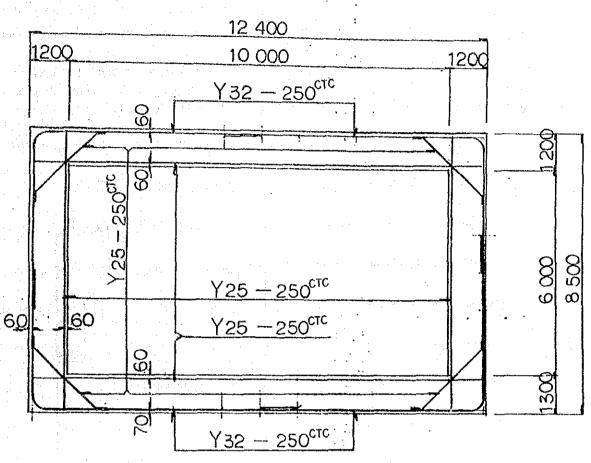
 $Z = 124.0 - \frac{18.6}{2} = 114.7^{cm} < 0.95 \times 124.0 = 117.8^{cm}$ OK

 $M_{RS} = 0.87 \times 41000 \times 51.80 \times 114.7 \times 10^{-5} = 2119.3^{KNm} > Mu = 2055.8^{KNm}$ $M_{Rc} = 0.40 \times 2500 \times 100 \times 18.6 \times 114.7 \times 10^{-5} = 2133.4^{KNm} > Mu = 2055.8^{KNm}$ OK

b) intersection point @= Mu.min=-1515.9^{KNm} $A_s = Y_{25} - 125^{ctc} = 4.909 / 0.125 = 39.27 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 39.27}{0.40 \times 2500 \times 100} = 14.0$ cm $Z = 123.0 - \frac{14.0}{2} = 116.0^{\text{cm}} < 0.95 \times 123.0 = 116.8^{\text{cm}}$ $M_{Rs} = 0.87 \times 41000 \times 39.27 \times 116.0 \times 10^{-5} = 1624.9^{KNm} > Mu = 1515.9^{KNm}$ $M_{Rc} = 0.40 \times 2500 \times 100 \times 14.0 \times 116.0 \times 10^{-5} = 1624.0^{KNm} > Mu = 1515.9^{KNm}$ 0K Notice: this bar is decide for shearing forces without bending moments. 2. calculation for shearing force (U.L.S) a) For upper slab section $b = 100^{cm}$ h = 120 d = 114.0 d' = 6.0intersection point (2=3) Su.max = 530.8^{KN} $A_s = Y_{32} - 125^{ctc} = 8.042/0.125 = 64.33 \text{ cm}^2$ $P = \frac{64.33}{100 \times 114.0} \times 100 = 0.564 \%$ $V_{c} = \frac{530.8 \times 10^{3}}{100 \times 114.0} = 46.6 \text{ N/cm}^{2}$ $< Vca = 50.0 + 15.0 \frac{(0.564 - 0.50)}{0.50} = 51.9 \text{ N/cm}^2$ b) For bottom slab section $b = 100^{cm}$ h = 130 d = 123.0d ' = 7.0intersection point @=① Su.max = 589.9^{KN} $A_s = Y_{32} - 125^{ctc} = 8.042/0.125 = 64.33 \text{ cm}^2$ $P = \frac{64.33}{100 \times 123.0} \times 100 = 0.523 \%$ $V_{C} = \frac{589.9 \times 10^{3}}{100 \times 123.0} = 48.0 \text{ N/cm}^{2}$ $< V_{ca} = 50.0 + 15.0 \frac{(0.523 - 0.500)}{0.500} = 50.6 \text{ N/cm}^2$ OK

> Notice: this bar is decide for shearing force about point ②, ③ and ④, ①, and the Bararrangement of this box culvert is arrange only at space 125mm

NOBBOX CULVERT FOR ROAD



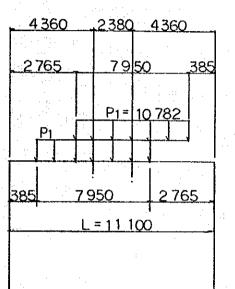
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N O ③	BOX	CULVERT	FOR	ROAD
		• 4.500 m		

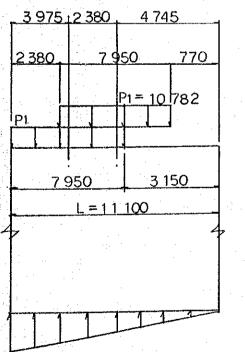
(1)Dead load				
a) vertical load				
For upper slab	$w1 = 22.6 \times 0.50 + 19.6 \times 4.00 + 23.6 \times 1.20$	=	118.020	kN⁄m
For side wall	$w^2 = 23.6 \times 1.10$	=	25.960	"
For bottom slab	$W3 = 118.020 + \frac{2 \times 25.960 \times 7.25}{11.10}$	=	151.932	"
b) Horizontal load	d earth pressure (case-2)			
For side wall	$P1 = (22.6 \times 0.50 + 19.60 \times 4.60) \times 0.500$	=	50.730	kN/m
	$P2 = (22.6 \times 0.50 + 19.60 \times 11.85) \times 0.500$	=	121.780	"

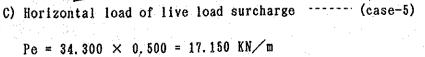
(2) Live load

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



b) Vertical load of partial (case-4)



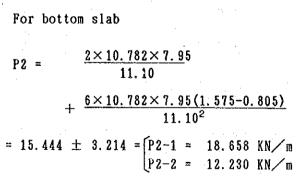


Skew angle $\theta = 49^{\circ}$ B = (0.30+4.50+1.20) cosec 49° = 7.950 m

P1 =
$$\frac{10 \times 30}{7.95 \times 3.50}$$
 = 10.782 KN/m

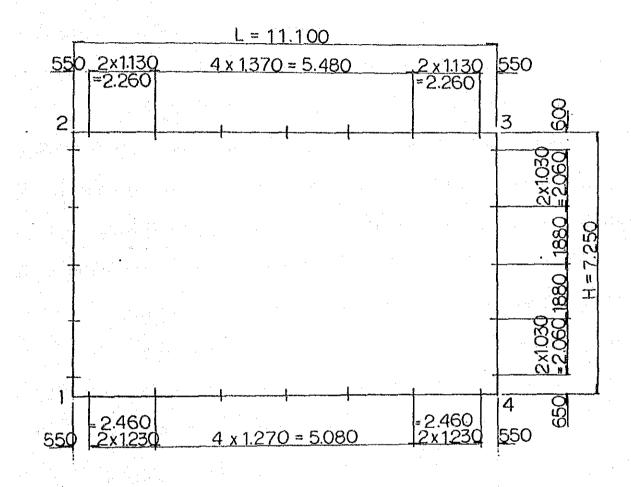
For bottom slab

 $P2 = \frac{2 \times 10.782 \times 7.950}{11.10} = 15.444 \text{ KN/m}$



$\begin{array}{cccccc} \text{Jex real yre 3} & \text{Depth} = 4.5 \text{CO} & \text{NOTE: THE DIMENSIONCE EXCHANG TO} \\ \text{NOTE: THE DIMENSIONCE EXCHANG TO} \\ Note: The Dimensional set of the set of the$	en andre son der son en			
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X (tm)	479.46	053.90	567.01	294.50	217.92	291.74	529.41	913.87	198.47	100 47	- U - U - U - U - U		000 - H 20	08.108	449.06	627.96	446.17	00.83	86.49	725.95	198.47		198.47	913.87	529.41	291.74	217.92	294.50	567.01	1053.90	1479.46	479.4	841.1	08.8	308.1	868.8	055.7	873.2	315.4	415.7	839.3	479.4
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-PICK-UP No.

JR ROAD NO 3

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BOX FOR ROAD NO 3

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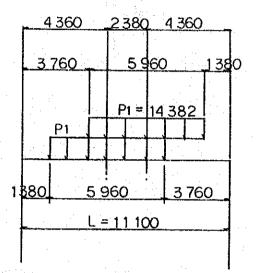
NO3 BOX CULVERT FOR ROAD

D = 3.000 m

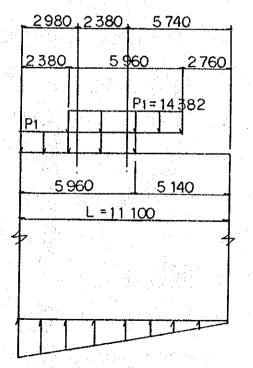
(1)Dead load a) vertical load (case-1)		
For upper slab $w1 = 22.6 \times 0.50 + 19.6 \times 2.50 + 23.6 \times 1.20$	= 88.620	kN/
For side wall $w^2 = 23.6 \times 1.10$		VII V
101 3100 Wall WZ ~ 23.0×1.10	= 25.960	
Por bottom slab $W3 = 88.620 + \frac{2 \times 25.960 \times 7.25}{11.10}$	= 122.532	,
b) Horizontal load earth pressure (case-2)	· .	
For side wall P1 = $(22.6 \times 0.50 + 19.60 \times 3.10) \times 0.500$	= 36.030	kN/
$P2 = (22.6 \times 0.50 + 19.60 \times 10.35) \times 0.500$	= 107.080	

(2)Live load

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



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



C) Horizontal load of live load surcharge ----- (case-5) Pe = 34.300 \times 0.500 = 17.150 KN/m

Skew angle $\theta = 49^{\circ}$ B =(0.30+3.00+1.20)cosec49° ÷ 5.960 m

/m

/ m

"

P1 =
$$\frac{10}{5.96} \times \frac{30}{\times 3.50}$$
 = 14.382 KN/m

For bottom slab

$$P2 = \frac{2 \times 14.382 \times 5.960}{11.10} = 15.444 \text{ KN/m}$$

For bottom slab

 $2 \times 14.382 \times 5.96$ P2 = 11.10 $+ \frac{6 \times 14.382 \times 5.96(2.57 + 0.190)}{11.10^2}$ = 15.444 ± 11.521 = P2-1 = 26.965 KN/m P2-2 = 3.923 KN∕m

L-N0 20 ..00E-05 ..00E-05 ..00E-05 EPS L-No 19 9.420 10.550 9.320 10.350 L-N0 18 2.50E+07 2.50E+07 E (t/m2) 2.50E+07 2.50日+01 6.630 8.290 8.090 8.090 L-N0 ----7.250 7.250 7.250 11.100 Ĵ 5.620 6.920 5.570 6.820 16 L-No L-No -1 Fix Fix M(tm/Rad) 4. 590 5. 550 4. 540 5. 550 12 1-No 12 Free Free 3.650 4.180 3.600 4.280 L-No -1 -1 0.110920 0.144000 0.110920 0.183080 I (m4) Depth = 3.00Y (t/m) 2.710 2.810 2.660 3.010 чх тіх L-No 13 7.2500 002 0.0000 e) L-No 12 680 680 780 .10000 .20000 .10000 A (m2) X (t/m) Fix Free 0.630 0.550 0.600 0.550 L-No 777 000 0.0000 1.1000 0000 (me × ດ ເ~ ດ 20 S. 0 7 Ô 20

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

1-80

BOX FOR ROAD NO 3'

Pj (l/m) -25.960 -88.620 -25.960 122.532		Pj (t/m) 36.030 -107.080	. •
Pi (t/m) -25.960 -25.960 122.532		Pi (t/m) 107.080 -36.030	
Lo (m) 7.250 11.100 7.250 11.100		Lo (m) 7.250 7.250	
Li (m) 0.000 0.000 0.000	0.003 (t) 0.000 (t) ressure	Li (m) 0.000 0.000	0.000 (t) 0.000 (t)
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	n 1997 - Maria Maria 1997 - Angelander 1997 - Angelander	N 1 6	
	1-2 -Y 0.000 7.250 -25.960 2-3 -Y 0.000 7.250 -25.960 3-4 -Y 0.000 11.100 -88.620 4-1 -Y 0.000 11.100 -25.960 4-1 -Y 0.000 11.100 122.532	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{bmatrix} 1+2\\2-3\\3-4\\4-1 \end{bmatrix} = \begin{bmatrix} -Y\\6&-000\\3-4\\4-1 \end{bmatrix} = \begin{bmatrix} -Y\\6&-000\\-25,960\\-2$

: Dead load

BOX FOR ROAD NO 3'

-14.582 +14.382 15.444 Pj (t/m) -14.382 -14.382 -14.44 Pi (t/m) 5.960 5.960 11.100 Lo (m) 1.580 3.760 0.000 Li (m) ~~~ ' ! ! **რ**ო --j---i oN' 111 0017

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: HB live load-VL-: 3

No.

	Pj (t/m)	-14.382	-14.382	26.965		
	Pi (t/m)	-14.382	-14.382	3.923		-
	Lo (m)	5.960	5.960	11.100		
	(m)	0.000	2.380	0.000	-0.005 (1)	0.000 (t)
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: HB live load-VL-: 4

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BOX FOR ROAD NO 3'

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No.

Pi (t/m)	17.150
Lo (m)	7.250
Li (m)	0.000.0
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0.000 (t) 0.000 (t)

11 II > H (24)

-17.150

Pj (t/m)

	. ² Case. 3 RY (t) RM (tm) RX (t) RY (t) RM 0.000 0.000 0.003	0.000 0.000 0.000 0.000	. J RY(t) RM(tm) RX(t) F	0.000 0.000 0.000 0.000 0.001 0.000 0.000 0.000 0.000 0.001 0.000	Case 8 RX (t) RY (t) RM (tm)	-0.002
	case. 2 Case. 3 Case. 3 (t) RY (t) RX (t) RY (t) RY (t) RY (t) COD 0.000	0.000 0.000 0.000 0.000 0.003 0.000 0.000 0.000	J RY(t) RM(tm) RX(t) RY(t) RM	0.000 0.000 0.000 0.001 0.000 0.000 0.000	8 RY (t)	-0.002
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Case. X-DIS.(mm)	0.00000 0.02465 -0.00099 0.02367	Case. X-DIS.(mm)	0.00000 -0.30158 -1.50815 -1.80973	en e	
2 Y-DIS.(mm) ROTA.(mmRad)	-2.11352 -2.05768 -2.05768 -2.11352	ROTA. (mmRad)	-0.48711 0.51505 -0.51505 0.48711	ROTA. (mmRad)	- 5.17082 - 5.17082 - 5.17082 - 5.17082 - 6.15661
2 Y-DIS.(mm)	0.00000 0.00000 0.00000 0.00000	5 Y-DIS.(mm)	0,00000	8 Y-DIS. (mm)	0.00000
Case. X-DIS.(mm)	0.00000 -0.13584 -0.91591 -1.05175	Case. X-DIS.(mm)	0.00000 0.00555 -0.22104 -0.21552	Case. X-DIS.(mm)	0.00000 -0.32771 -1.87146 -2.19918
ROTA. (mmRad)	7.57076 -6.82306 6.82306 6.82306 -7.57076	ROTA. (mmRad)	1.14516 -1.36004 1.14023 -1.00895	ROTA.(mmRad)	8.59792 -7.96552 -7.65119 -8.40313
1 Y-DIS.(mm)	0.00000 -1.54477 -1.54477 0.00000		0.0000 -0.28540 -0.16656 -0.0000	7 Y-DIS.(mm)	0.0000 12.53591 1.2.355951 0.0000
Case. X-DIS.(mm))	0.00000 -0.08166 0.00327 -0.07840	Case. 4 X-DIS.(mm) Y-DIS.(mm)	0.00000 0.17045 0.15077 0.01815	Case. X-DIS.(mm)	0.00000 -0.09312 -1.25114 -1.81762
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BOX FOR ROAD NO 3'

BOX FOR	FOR ROAD NO	0. 10 3			•.						
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	~1 *	ပ	595.13	2.95	636.43	39.68	41.88	•	79.39	6.93	85.71
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		e,	549.96	2.91	385.29	15.83	17.61		93.04	0 0 0 0 0 0 0 0	
		in	528.38	2.95	560.89	69.12	80.31		99.55		
	4	ŝ	504.74	295	034.15	55.24	139.08		106.70		
		9	481-10	2.95	507.41	3.8	11.18		13.83		
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	ം പ	. 68	33.90	•	0.1	133.47	•	210.82	25,36	147	6.93
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		.66	528.38	22.95	560.89	69.12	0.31	٠	99.50	<u></u>	85.71
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MAXIMUM	s (t)	43.9	514.082	22.35	47.78	3.44	126.61	252 72	19	50 L L	~ ~ ~ ~	78.74	.47	93.54	23.26	99.36	0.00	223.89	428:25	-589.689	611.47	678.74	; ; ;	20	20110	21.20	26,61	-3.44	147.78	322.35	14.08	643.9	38.47	955.895	20.74	85.59	42.79	0.00	231.70	481.68	728.35	15.07	938.47	
×		228.44	-852.473	423.18	182.52	112.57	171.58	368.41	686.20	920.26	2 4 • •	920.26	65.45	69.04	746.63	73.13	318.10	164.79	13.96	138	65.45	920.26	0000	1000 076-			2011108	112.57	182.52	423.18	852.47	228.44	228.44	-704.395	326.73	008.63	531.16	685.34	44.42	091.93	348.21	01.66	228.44	
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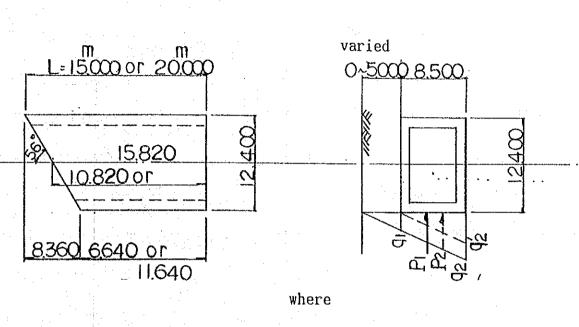
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	(-UP No. 1 *		M (tm)	228.44	802.47 423.18	-182.529	112.57	429.47	846.71	02.9.70	29.70	552.86	69.04 13.96	64.79	318.16	40.47	47.43	-565.455 -920.265	920.26	686.30 260.30	-171.585	370.88	418-23 605-41	951.21	259.05	59.05	326.73	039.64	512.20	74 · · · · · · · · · · · · · · · · · · ·	830.35	174 I5	-121.303
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		ŝ	N (tm)	259.05	951.21 605 -11	-418.239	370.88	171.58	586.30 586.30	\$20.26	920.26	5.45	47.43	48 47	92 89	II5.39 712 GE	138.82	-611.649 -1033.875	010.23	827.24	001-070-	112 57	182,52	852.47	228.44	28.44	137.86	30.35	239.44	531.16	68.63	548.21	-701.665 -1271.642
		MINIWUN MUN	S (t)	25.87	181 181 181 181	110.444	-7:30	126.61	261.67	17.23	78.74	11.47	73.28	67.54 67.54	-24.53	228.68 198.58	589.68	-734.053 -801.315	23.79	83.21 21	2051406	-3.44	7.78	514.08	643.50	38.47	14 10 14 10	29.49	14.75	0.00 242.79	480.084	728.35	-979.510
		×	N (t)	1061.04	037 75	10001	930.28	774.03	100 22	678.74	417.23	417.23	417.23	417.23	323.79	523° 79	326.10	-326.101 -326.101	769.08	790.57	-824-2418	807.71	841.38	915.18	538.47	643:90	643.90	643.90	643.90	1225.01 1256.01	10.50	532.18	-532.187

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•			7	V (t)	~1093.278 -1069.992	-966.19	962.51 928.84	16° 168	833.54	-417.231	417.23	417.23	17.23	117-23	417.23	417.23	801	12.958	89.6 . 60 930 . 28	-963.96	00.80 37.75	1061.04	643.90	643.90	643.50	643,90	06.010	643.90	-643.903 -643.903 -643.903
			N I N I M	s (t)	532.187 420.759	12.75	108.44	9 F 0 1 0 1 0	323.79	678.741 611.478	73.28	50.02 67.54	00 00	50	473 28	678.74 678.74	326.101 287.521	07.71	10.75 7.30	110.44	0.4	529.87	38.47	4 1 4	29.40	14.75	214.75	129.49	124.000
			N	M (tm)	-1271.642 -562.305 -614.73	424.56	375,03	592.57	029.70	-920.265 -565.455	47.43	04.10 48.47	3.24	10.16 04.16	47.43 101	0.26	-1033.875 -849.497	592.97	427.48 370.88	418.23	-951.21	259.05	28.44	174.15	830.35	39.44 75 e1	239.44	830.33	-737.863 -1228.448
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			×	N (t)	-928.470 -915.184 -070 905	841.38	807.71 774.03	737.13	678.74	323 323	323.79	323.79	23.79	323:79	323.79	323.79 323.79	-678.741 -700.235	737.13	807.71	841.38	15.18	938.47	529.87	529.87	329.87	529.87	529.87	529.87	
			MAXIMU	(†) S	643.903 514.082 322 256	47.78	3.44 26.61	252.72	417.23	833.548 754.974	93.54	95.96 96.36	24.53	124.40	63.62	769.08	417.231 361.672	52.72	20.02 -3.44	147.78	4.08	643.90	1.04	20.74	85.59	42.79	242.79	485.59	- 1061.044
		UP No. 1 *	~	M (tm)	-1228.448 -852.473 -473	182 52	112.57 171.58	358.41	920.26	-1029.708 -592.865	169.04	173.13	92.89	668.03	109 24	10.23	-920.265 -686.303	368.41	1/1.58 112.57	182,52	52.47	228.44	59 C5	326.73	068.63	31.16	531°16	068.63 336 73	- 104.395 - 104.395 - 1259.053
•		PICK-U		Case	တဆစ ပပင်	ο ω ι	00 00 F 1	1.1	1	てて		- 2-	~ r				စစ	1	3 6	1	1 1	ι	1		1		1		000 000 000
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	ROAD NO		• • • •	No.	01~0					34		:									01						. –		0 0 7 7
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, s. 1	BOX			·		÷.;								•••		 	. 1										·		



Calculation of revolution for skew box culverts [TO NO3 BOX FOR ROAD]

L: construction length

load

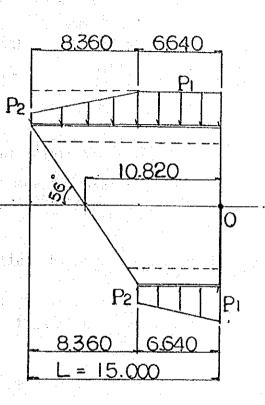
earth pressure

 $Q_1 = 19.6 \times 0.50 \times 5.00 = 49.000$ KN/m² $Q_2 = 19.6 \times 0.50 \times 13.50$ = 132.300KN/m² $Q_{2'} = 19.6 \times 0.50 \times 8.50$ 83.300 KN/m² \equiv $P_1 = \frac{1}{2}$ (49.000+132.300) × 8.50 = 770.525 KN/m $P_2 = \frac{1}{2} \times 83.300 \times 8.50$ = 354.025KN/m $P_1 - P_2 = 416.500$ KN/m

weight of concrete and surcharge

 $w_{1} = 23.6(12.4 \times 8.5 - 10.0 \times 6.0) \times 10.820 = 11592.980 \text{ KN}$ (15.820) = (16950.180) $w_{1} = 18.6 \times 12.4 \times 10.820 \times 5.00/2 = 6238.812 \text{ KN}$ (15.820) = (17831.9) w = 17831.9 KN (26072.0)

study of safety for L = 15.00 m



Revolution force for point 0

P _H (KN)	x (m)	Mo (KN⋅m)
$+ 770.525 \times 15.000 = 11557.9$	7.500	86684.3
$-\frac{1}{2} \times 416.500 \times 8.360 = -1741.0$	12.213	-21263.8
$-770.525 \times 6.640 = -5116.3$	3.320	- 16986.1
$+ \frac{1}{2} \times 416.500 \times 6.640 = 1382.8$	4.427	6121.6
total = 6083.4		54556.0

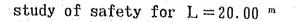
Resistance force for point O

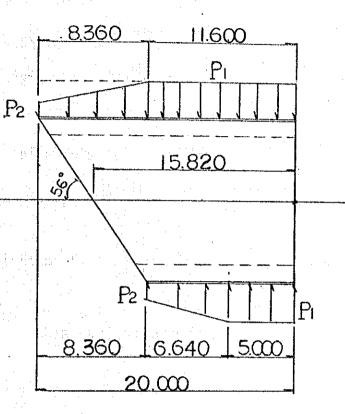
Pv (KN)	$P_{H} = 0.55 \cdot P (KN)$	x (m)	M _R (KNm)
17831.9	9807.5	5.410	53058.6

stady of safety for revolution

Slide	Fs=	$\frac{9807.5 \times 1.2 \times 1.15}{6083.4 \times 1.5 \times 1.15}$	=	1.29	>	1.0	OK
Revolutio	n F _R	$=\frac{53058.6 \times 1.2 \times 1.15}{54556.0 \times 1.5 \times 1.15}$	ureda iunus	0.78	<	1.0	OUT

Where this case is insecurity





Revolution force for point 0

P _H (KN)			x (m)	Mo (KN·m)
+ 770.525×20.000	II	15410.5	10.000	154105.0
$-\frac{1}{2} \times 416.500 \times 8.360$	= -	-1741.0	17.213	29967.8
- 770.525×6.640	= -	- 8968.9	5.820	- 52199.0
$+\frac{1}{2} \times 416.500 \times 6.640$	Ξ	1382.8	9.427	13035.8
total		6083.4		84974.0

- 94

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Resistance force for point O

Pv (KN) P _H	$= 0.55 \cdot Pv$ (K)	N) x (m)	M _R (KNm)
26072.0	14339.6	7.910	113426.2

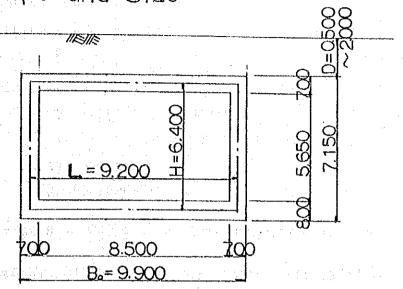
stady of safety for revolution

Slide
$$F_s = \frac{14339.6 \times 1.2 \times 1.15}{6083.4 \times 1.5 \times 1.15} = 1.57 > 1.0$$
 OK

Revolution $F_R = \frac{113426.2 \times 1.2 \times 1.15}{84974.0 \times 1.5 \times 1.15} = 1.07 > 1.0$ OK

95

Where this case is security NO @ BOXCULVERT FOR RORD(similar Box-NO.6), NO.6) 1) Shape and Size



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

2) Factor of section

 $A = 1.00 \times 0.70 = 0.7000 \text{ m}^2$ $I = \frac{1.00 \times 0.70^3}{12} = 0.02858^{\text{m}^2}$ $A = 1.00 \times 0.80 = 0.8000 \text{ m}^2$ $I = \frac{1.00 \times 0.80^3}{12} = 0.04267^{\text{m}^2}$ $A = \frac{1.00 \times 0.80^3}{12} = 0.04267^{\text{m}^2}$

$$I = 25 \text{ KN}_{\text{mm}^2} = 25 \times 10^7 \text{ KN}_{\text{mm}^2}$$

1 - 96

 $= 2.5 \times 10^7 \text{ KN/m^2}$

NO. ④ BOX CULVERT FOR ROAD

application Boxculverts No.56

- 1. calculation for bending moment (U.L.S)
 - For upper slab section b=100^{cm} h=70 d=64.0 d'=6.0
 a) middle point ②~③ Mu.max=675.6^{KNm}

$$A_{s} = \left(\begin{array}{c} Y_{32} - 300^{\circ t \circ} = 8.042/0.300\\ Y_{25} - 300^{\circ t \circ} = 4.909/0.300 \end{array}\right) = 43.17 \text{ cm}^{2}$$

$$X = \frac{0.87 \times 41000 \times 43.17}{0.40 \times 2500 \times 100} = 15.4^{\text{cm}}$$

$$Z = 64.0 - \frac{15.4}{2} = 56.3^{\circ m} < 0.95 \times 64.0 = 60.8^{\circ m}$$

 $M_{RS} = 0.87 \times 41000 \times 43.17 \times 56.3 \times 10^{-5} = 867.0^{KNm} > Mu = 675.6^{KNm}$ $M_{RC} = 0.40 \times 2500 \times 100 \times 15.4 \times 56.3 \times 10^{-5} = 867.0^{KNm} > Mu = 675.6^{KNm} OK$

b) intersection point @=③ Mu.min=-548.8^{KNm} $A_s = Y_{25} - 150^{\text{ctc}} = 4.909 \neq 0.15 = 32.73 \text{ cm}^2$ $X = \frac{0.87 \times 41000 \times 32.73}{0.40 \times 2500 \times 100} = 11.8^{\text{cm}}$

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

$$M_{RS} = 0.87 \times 41000 \times 32.73 \times 58.1 \times 10^{-5} = 678.3^{KNm} > Mu = 598.8^{KNm}$$

$$M_{RC} = 0.40 \times 2500 \times 100 \times 11.8 \times 58.1 \times 10^{-5} = 685.5^{KNm} > Mu = 598.8^{KNm}$$

2) For bottom slab

section $b = 100^{cm}$ h = 80 d = 73.0(74.0) d' = 7.0(6.0)a) middle point $@\sim(1)$ Mu.max = 805.8^{KNm}

$$A_{s} = \left(\begin{array}{c} Y_{3z} - 300^{\circ tc} = 8.042/0.300\\ Y_{25} - 300^{\circ tc} = 4.909/0.300\end{array}\right) = 43.17 \text{ cm}^{2}$$

$$X = \frac{0.87 \times 41000 \times 43.17}{0.40 \times 2500 \times 100} = 15.4^{\circ m}$$

$$Z = 74.0 - \frac{15.4}{2} = 66.3^{\circ m} < 0.95 \times 74.0 = 70.3^{\circ m}$$

$$\begin{split} M_{Rs} &= 0.87 \times 41000 \times 43.17 \times 66.3 \times 10^{-5} = 1021.0^{\text{KNm}} > \text{Mu} = 805.8^{\text{KNm}} \\ M_{Rc} &= 0.40 \times 2500 \times 100 \times 15.4 \times 66.3 \times 10^{-5} = 1021.0^{\text{KNm}} > \text{Mu} = 805.8^{\text{KNm}} \end{split}$$

OK

0K

0K

b) intersection point
$$\textcircled{(0)}=\textcircled{(0)}$$
 Mu.min=-674.9***
As = Yns-150***= 4.909/0.15=32.73 cm²
 $X = \frac{0.87 \times 41000 \times 32.73}{0.40 \times 2500 \times 100} = 11.8^{cm}$
 $Z = 73.0 - \frac{11.8}{2} = 67.1^{cm} < 0.95 \times 73.0 = 69.3^{cm}$ OK
Mas = 0.87 × 41000 × 32.73 × 67.1 × 10*= 783.4 **** > Mu=674.9***
Mac = 0.40 × 2500 × 100 × 11.8 × 67.1 × 10*= 791.8*** > Mu=674.9***
Mac = 0.40 × 2500 × 100 × 11.8 × 67.1 × 10*= 791.8*** > Mu=674.9***
Mac = 0.40 × 2500 × 100 × 11.8 × 67.1 × 10*= 791.8*** > Mu=674.9***
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Mac = 0.40 × 2500 × 100 × 11.8 × 67.1 × 10*= 791.8*** > Mu=674.9***
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Mac = 0.40 × 2500 × 100 × 11.8 × 67.1 × 10*= 791.8*** > Mu=674.9***
Mac = 0.40 × 2500 × 100 × 11.8 × 67.1 × 10*= 791.8*** > Mu=674.9***
Mac = 0.40 × 2500 × 100 × 11.8 × 67.1 × 10*= 791.8*** > Mu=674.9***
0K
Notice: this bar is decide for shearing forces
without bending moments.
2. calculation for shearing force (U.1.S)
a) For upper slab
section b = 100*** h = 70 d=64.0 d' = 6.0
intersection point $\textcircled{0}=\textcircled{0}$ Su.max = 358.7**
A.= Yas - 150***= 8.042/0.15=53.61 cm²
P = $\frac{53.61}{100 × 64.0}$ × 100 = 0.838 %
Vc = $\frac{358.7 \times 10^{5}}{100 × 64.0}$ = 56.1 N/cm²
A.= Yas - 150***= 53.61 cm²
P = $\frac{53.61}{100 × 73.0}$ × 100 = 0.734 %
Vc = $\frac{380.2 \times 10^{4}}{100 × 73.0}$ = 53.5 N/cm²
< Vca = 50.0 + 15.0 $\frac{(0.734 - 0.50)}{0.50}$ = 57.0 N/cm² OK
Notice: this bar is decide for shearing force

I.

about point ②, ③ and ④, ①