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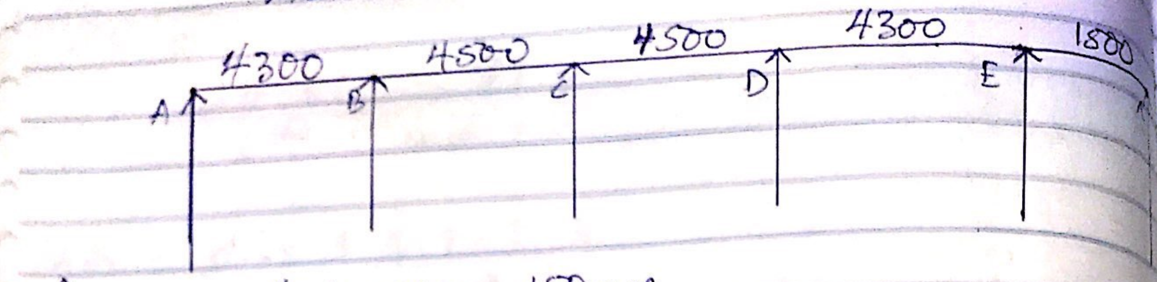
17/ENG03/040 (signature)

CIVIL ENGINEERING CVE 308

ASSIGNMENT 2



Assuming thickness = 150mm

f_{cu} = 25 N/mm²

f_y = 410 N/mm²

Slab Loading

Slab weight = 0.15 × 24 = 38KN/m²

Partition = 1.0 KN/m²

Finishes = 1.2 KN/m²

Total G.K 5.8 KN/m²

$D.L = 1.4(5.8) + 1.6(3.0) = 13KN/m^2$

Beam Loading

Self wt of beam = 0.225 × 0.6 × 24 = 5.24 KN/m²

finishes = 1.2KN/m²

Wall Load = 3×3.47 = 10.41 KN/m²

Total G.K = 14.85

$D.L = 14(14.85) = 20.79KN/m^2$

Slab Load on beam in longer direction = $\frac{1}{2}\omega l_x(1-\frac{1}{3}$

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

$\frac{4300}{4000} = 1.075$ $\frac{4500}{4000} = 1.125$

$\frac{1}{2} \times 13 \times 4.3\left(1 - \frac{1}{3 \times (1.075)^2}\right) = 19.89KN/m^2$

$\frac{1}{2} \times 13 \times 4.5 \left(1 - \frac{1}{3 \times (1.125)^2}\right) = 21.55 KN/m^2$

Slab load on beam in shorter direction = $\frac{1}{3} w l_x$

$\frac{1}{3} \times 13 \times 1.5 = 6.5 KN/m^2$.

Total Load = 19.89 + 20.79 = 40.68 KN/m

= 21.55 + 20.79 = 42.34 KN/m

= 6.5 + 20.79 = 27.29 KN/m

Distribution Factor

$K_{AB} = 1$

$K_{BA} = \frac{1/L_{BA}}{1/L_{BA} + 1/L_{BC}} = \frac{1/4.3}{1/4.2 + 1/4.3} = 0.51$

$K_{BC} = 1 - 0.51 = 0.49$

$K_{CB} = \frac{1/4.5}{1/4.5 + 1/4.5} = 0.5$

$K_{CD} = 1 - 0.5 = 0.5$

$K_{DC} = 0.49$

$K_{DE} = 0.51$

$K_{ED} = \frac{1/4.3}{1/4.3 + 1/1.5} = 0.26$

$K_{EA'} = 1 - 0.26 = 0.79$

$K_{A'E} = 1$

F.E.M

U.D.L = $\frac{wl^2}{12}$

1. $\frac{40.68 \times (4.3)^2}{12} = 62.68 KN/m$

2) $\frac{42.34 \times (4.5)^2}{12} = 71.45 KN/m$

3) $\frac{27.29 \times 1.5^2}{12} = 5.1 \text{KN/m}$

	A	AB	BA	BC	CB	CD	DC	DE	ED	EA'	A'E	A'
D.F	0	1	0.51	0.49	0.5	0.5	0.49	0.51	0.26	0.74	1	0
F.E.M		-62.8	62.68	-71.45	71.45	-71.45	71.45	-62.68	62.68	-5.1	5.1	
O.B.M	-62.68		-8.77		0	0	8.77		57.58		-5.1	
B.M	62.68		8.77		0	0	-8.77		-57.58		5.1	
D.M	0	62.68	4.47	4.30	0	0	4.30	-4.47	-14.97	-42.61	-5.1	0
T.M		2.235	31.34	0	2.15	-2.15	0	-7.49	-2.24	-2.55	-21.305	
OBM	2.235		31.34		0	0	-7.49		-4.79		-21.305	
BM	-2.235		-31.34		0	0	7.49		4.79		21.305	
DM	0	-2.235	-15.98		0	0	3.67	3.82	1.25	3.54	21.30	0
TM		-7.99	-1.12		-7.69	1.84	0	0.63	1.91	10.66	1.77	
OBM	-7.99		-1.12		-5.85		0.63		12.57		1.77	
BM	7.99		1.12		5.85		-0.63		-12.57		-1.77	
DM	0	7.99	0.57	0.55	2.93	2.93	-0.31	-0.32	-3.27	-9.29	-1.77	0
TM		0.29	3.40	1.47	0.28	-0.16	1.47	-1.64	-0.16	-0.89	-4.65	
OBM	0.29		4.87		0.12		-0.17		-1.05		-4.65	
BM	-0.29		-4.87		-0.12		0.17		1.05		4.65	
DM	0	-0.29	-2.48	-2.39	-0.06	-0.06	0.08	0.09	0.27	0.78	4.65	0
Σ	=	0	22.88	-82.88	69.06	-69.05	72.06	-72.06	45.47	-45.46	0	

Moments

$M_a = 0$ KNm

$M_b = 82.88$ KNm

$M_c = 69.06$ KNm

$M_D = 72.06$ KNM

$M_E = 45.47$ KNm

$M_{A'} = 0$ KNm

Scanned with CamScanner

Free moment

for U·D·L = $\frac{wl^2}{8}$

1. $\frac{40.68 \times 4.3^2}{8} = 94.02\,kN/m^2$

2. $\frac{42.34 \times 4.5^2}{8} = 107.17\,kN/m^2$

3. $\frac{27.29 \times 1.5^2}{8} = 7.68\,kN/m^2$

Span Moment

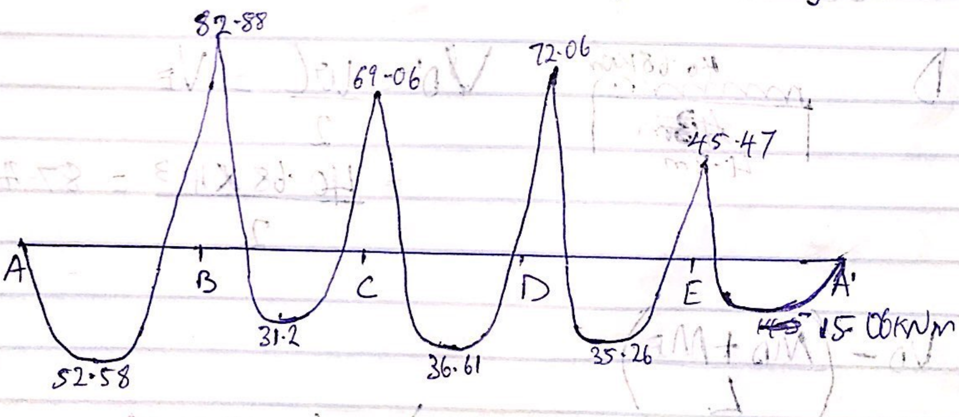
$M_{AB} = M - \left(\frac{M_A + M_B}{2}\right) = 94.02 - \left(\frac{0 + 82.88}{2}\right) = +52.58\,kNm$

$M_{BC} = M - \left(\frac{M_B + M_C}{2}\right) = 107.17 - \left(\frac{82.88 + 69.06}{2}\right) = 31.2\,kNm$

$M_{CD} = M - \left(\frac{M_C + M_D}{2}\right) = 107.17 - \left(\frac{69.06 + 12.06}{2}\right) = 36.6\,kNm$

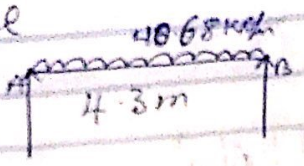
$M_{DE} = M - \left(\frac{M_D + M_E}{2}\right) = 94.02 - \left(\frac{72.06 + 45.47}{2}\right) = 35.26\,kNm$

$M_{EA'} = M - \left(\frac{M_E + M_{A'}}{2}\right) = 7.68 - \left(\frac{45.47 + 0}{2}\right) = -15.06\,kNm$



Shear Force

For A



$V_A = \frac{wl}{2} = V_B$

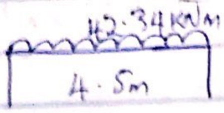
$= \frac{40.68 \times 4.3}{2} = 87.462KN$

$V_{AB} = V_A + \left(\frac{M_A - M_B}{L}\right) = 87.462 + \left(\frac{0 - 82.88}{4.3}\right) = 68.19$

$V_{BA} = Wl - V_{AB}$

$= (40.68 \times 4.3) - 68.19 = 106.73KN$

For B



$V_{B'C} = \frac{wl}{2} = V_C$

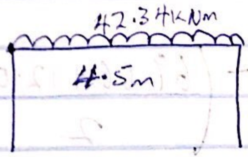
$= \frac{42.34 \times 4.5}{2} = 95.27KN$

$V_{BC} = V_B + \left(\frac{M_B + M_C}{L}\right) = 95.27 + \left(\frac{82.68 + 69.06}{4.5}\right) = 129.03KN$

$V_{CB} = (42.34 \times 4.5) - 129.03$

$= 61.5KN$

For C



$V_C = \frac{Wl}{2} = V_D$

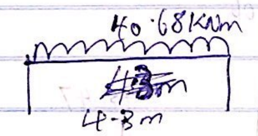
$= \frac{42.34 \times 4.5}{2} = 95.27KN$

$V_{CD} = 95.27 + \left(\frac{69.06 + 72.06}{4.5}\right) = 126.63KN$

$V_{DC} = (42.34 \times 4.5) - 126.63$

$= 63.191KN$

For D



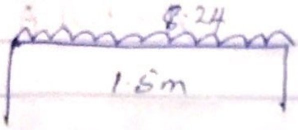
$V_{D'} = \frac{Wl}{2} = V_E$

$= \frac{40.68 \times 4.3}{2} = 87.46KN$

$V_{DE} = V_D - \left(\frac{M_D + M_E}{L}\right)$

$= 87.46 - \left(\frac{72.06 + 45.47}{4.3}\right) = 60.13KN$

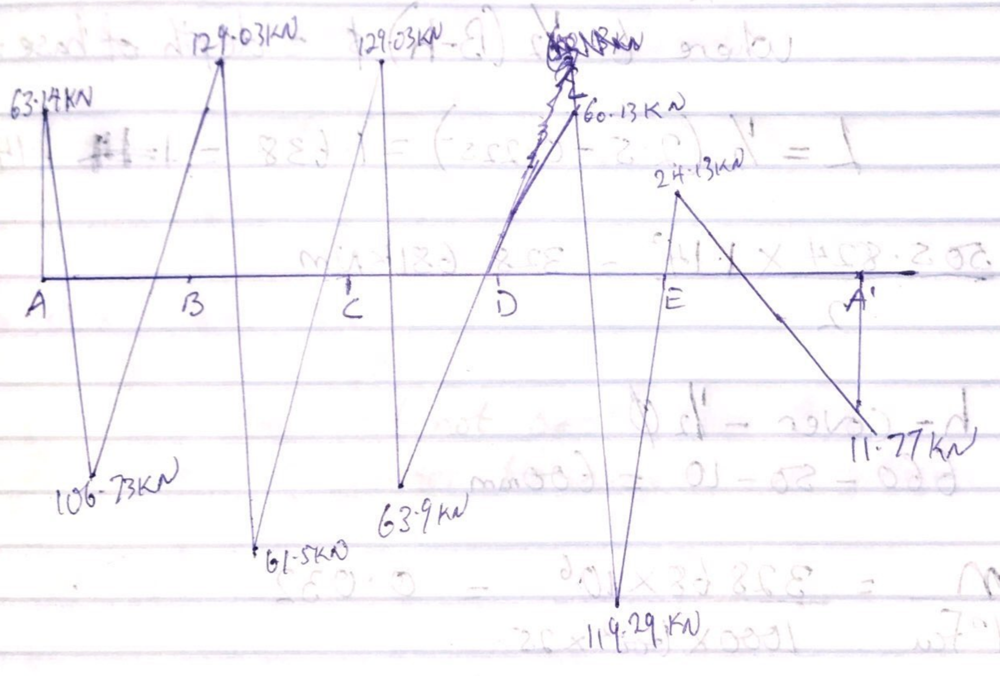
$V_{ED} = Wl - V_{DE}$
$= (40.68 \times 4.3) - 60.13$
$= 114.79KN$

For E 

$V_{E'} = \frac{Wl}{2} = V_{E'}$
$= \frac{8.24 \times 1.5}{2} = 6.18KN$

$V_{EA'} = V_E - \left(\frac{M_E + M_{A'}}{L}\right) = 6.18 - \left(\frac{45.47 + 0}{1.57}\right) = 24.13KN$

$V_{A'E'} = (8.24 \times 1.5) - 24.13 = 11.77KN$



Assignment 2 NO. 2

Base design

$N = 1200KN$

Strength = 25 – 410N/mm²

$f_b = 150KN/m^2$

Area of base req $= \frac{N \times 1.1}{\lambda \times f_b}$ $\lambda = 1.46$

$\frac{1200 \times 1.1}{1.46 \times 150} = 6.027m^2$

$\sqrt{6.027} = 2.45m \simeq 2.5$

Net pressure, $F_{net} = \frac{N \times 1.1}{B}$

$\frac{1200 \times 1.1}{2.5} + 24 \times 0.660 \times 1.4$

$= 505.824 KN/m$

Moment. $M = \frac{F_{net} \, l^2}{2}$

where $l = \frac{1}{2}(B - h)$. ϕ = depth of base = 660

$L = \frac{1}{2}(2.5 - 0.225) = 1.638 = 1.14m$

$M = \frac{505.824 \times 1.14^2}{2} = 328.681 KNm$

$d = h - cover - \frac{1}{2}\phi$

$= 660 - 50 - 10 = 600mm$

$K = \frac{M}{bd^2 F_{cu}} = \frac{328.68 \times 10^6}{1000 \times 600^2 \times 25} = 0.032$

$l_u = 0.5 + \sqrt{0.25 + \frac{2.032}{0.9}} = 0.96 > 0.95$

$Z = l_a d = 0.95 \times 600 = 570mm$

$A_s = \frac{M}{0.95 f_y z} = \frac{328.68 \times 10^6}{0.95 \times 410 \times 570} = 1480.44mm^2$

Provide Y25 @ 300 c/c (1640)

Punching Shear

Column size = 225 x 450mm

f_{cu} f_y = 25 - 410mm

Area Rooting = 6.027m²

Six of footing = 2500 x 2500

q_1 - Net pressure = 505.824 kNm

depth = 600

Critical section = $\frac{d}{2}$ = 300

300 + 300 + 225 = 825mm

300 + ... 300 + 450 = 1050mm

Shear force $V_B = q_n \times [\text{Area of footing} - (0.3 + d)^2]$

$= 505.824 [2.5 \times 2.5 - (0.3 + 0.6)^2]$

$V_A = 2751.68$

Normal Shear Stress $\tau_v = V_a/bd$

b = parameter of critical section

d = effective span/depth

$J_v = \frac{2751.68 \times 10^3}{((2 \times (825) + 2(1050)) \times 600)}$

$J_v = 1.223 \, N/mm^2$

Permisble Shear stress

$J_c' = K_s \times J_c$

$K_s = (0.5 + \beta_c)$ but not greater than 1

β_c = Ratio of Shorter to larger side colums

$\tau_c = 0.25 \sqrt{f_{ck}}$

$K_s = 1$

$\tau_c' = 0.25\sqrt{25} = 1.25 \, N/mm^2$

$\tau_u = 1.223 \, N/mm^2$

$\tau_v \leq \tau_v'$

Hence depth assumed is okay

Checking for f_b with actual size of footing

Unit weight of Concrete = $24KN/m^3$

Unit weight of Soil = $1.091 \times 10^{-6} KN/mm$

Actual pressure footing below

$$q = (1200 \times 2.5 \times 2.5) + (24 \times 0.660) + (1.091 \times 10^{6} \times 0.69)$$

$$= 214.94 KN/m^2$$