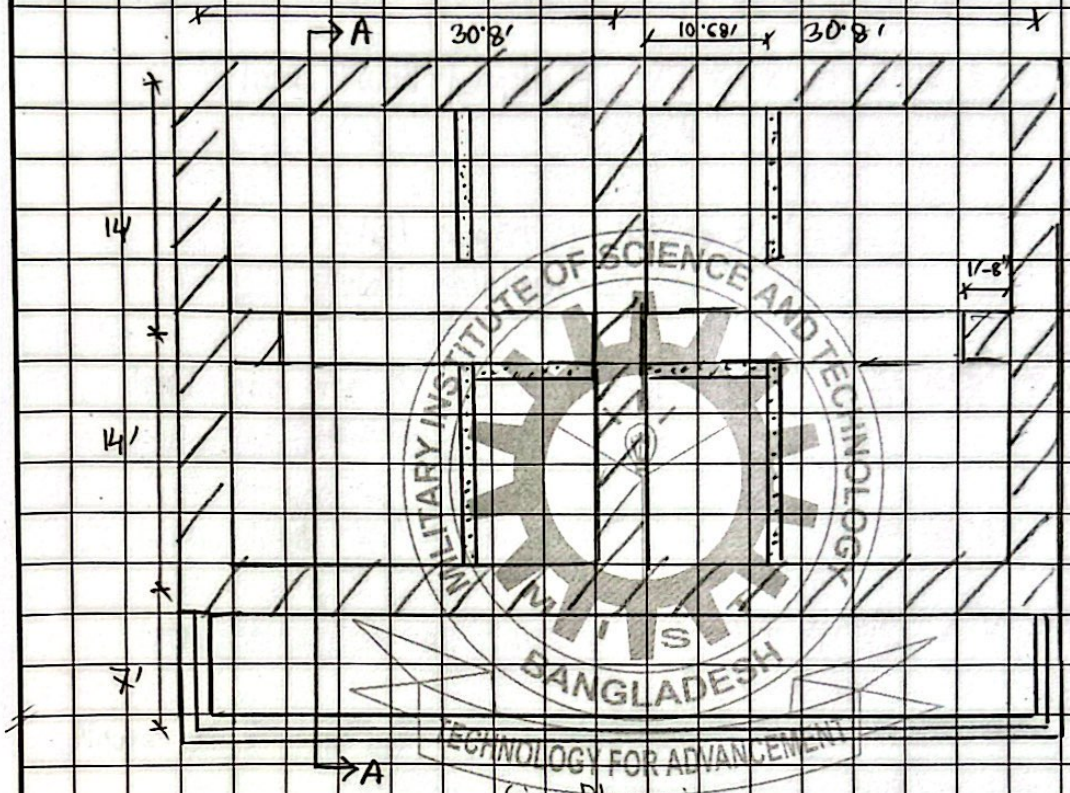
Student No : 202111021

Slab Design : 1st & 2nd Floor Plan

Given data, Live load, (LL) = 55 psf
Floor finish, (FF) = 35 psf
f_c' = 4 ksi
f_y = 45 ksi
Dimension, (x) = 14'



frg : Plan view

Calculation : Partition Wall:

For 10" wall, Total wall length = 3 x (14'+14') + 2x(30'-8" + 30'-8") + 2x1'-8"
= 207'-2" + 3'-334" = 210'-53"

Total wall length considering 80% of length for window & door
= 210.53 x .8 = 168.43'

Wall height = 10'
Wall thickness = 10" = $\frac{10'}{12}$

∴ Tota load for 10" wall = 168.43' x 10' x $\frac{10'}{12}$ x 120 lb [Brick unit wt = 120 lbf/ft³]
= 168.43 kip

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Student No : 202111091

For 5" wall, total wall length = $2\times(14+14')+10'\cdot64'\times2$ [Only Room]

$= 74'\cdot28'$

$= 61'\cdot82'$ [80% of total wall]

Wall height = $10'$,

Wall thickness = $\frac{5}{12}'$

∴ Total load for 5" Room wall = $61'\cdot82'\times10'\times\frac{5}{12}'\times120$ lb

$= 30'\cdot91$ kip

Total wall length = $7' + 7' + 30'\cdot8 + 30'\cdot8'$ [Verandah]

$= 75'\cdot6'$

Wall height = $42'' = \frac{42}{12}'$

Wall thickness = $\frac{5}{12}'$

∴ Total load for 5" Veranda wall = $75'\cdot6\times\frac{42}{12}'\times\frac{5}{12}'\times120$ lb

$= 13'\cdot23$ kip

∴ Total load for 5" wall = $30'\cdot91 + 13'\cdot23 = 44'\cdot14$ kip

∴ Total load for all wall = $168'\cdot43 + 44'\cdot14$ kip = 212'·56 kip

Now, Wall load on slab Area, PW = $\frac{212'\cdot56}{(30'\cdot8+30'\cdot8)\times(14+14+7)}$

$= 0'\cdot09737$ ksf

$= 97'\cdot37$ psf

Check for one way slab:

Given, L = 30'·8', B = 14'

∴ L/B = 30'·8/14 = 2·2 > 2

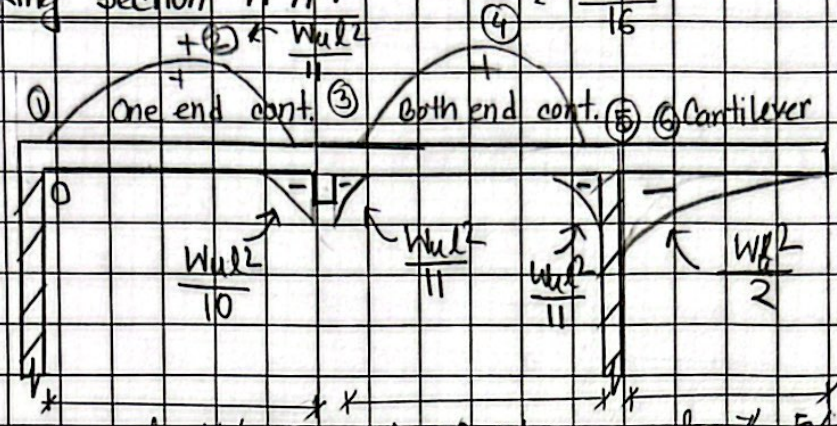
∴ One way slab

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Taking section A-A :



$l_1 = 14' - \frac{10}{12}'' = 13'.17'$ $\quad l_2 = 13'.17'$ $\quad l_3 = 7' - \frac{5}{12}'' = 6'.58'$

MF = .4 + fy/100 = .4 + 45/100 = 0.85

$t_1 = \frac{l_1}{24} \times MF = \frac{13'.17 \times 12}{24} \times .85 = 5'.59'' \approx 5'.75''$

$t_2 = \frac{l_2}{28} \times MF = \frac{13'.17 \times 12}{28} \times .85 = 4'.78 \approx 5''$

$t_3 = \frac{l_3}{10} \times MF = \frac{6'.58 \times 12}{10} \times .85 = 6'.71'' \approx 7''$

$\therefore t_{max} = 7''$

Load Calculation :

FF = 35 psf LL = 55 psf PW = 97.37 psf

∴ Self weight of slab, $DL_2 = \frac{t}{12} \times 150$ psf = 87.5 psf [Unit wt of concrete = 150 psf]

∴ Factored load, Wu = 1.2 DL + 1.6 LL
= 1.2(97.37 + 87.5 + 35) + 1.6 × 55
= 351.84 psf
= .35184 ksf

Moment Calculation :

①	→ (−)	$M_1 = 0$			
②	→ (+)	$M_2 = Wul^2/11$	= .35184 × 13.17²/11	= 5.55 kft/ft	= 66.57 kin/ft
③	→ (−)	$M_{3L} = Wul^2/10$	= 6.10 kft/ft	= 73.23 kin/ft	
④	→ (+)	$M_4 = Wul^2/16$	= 3.81 kft/ft	= 45.77 kin/ft	
⑤	→ (−)	$M_{3R} = M_5 = Wul^2/11$	= 5.59 kft/ft	= 66.57 kin/ft	

⑥ → (−) $M_6 = Wul^2/2$ = 7.62 kft/ft = 91.4 kin/ft

... 9 2 → 0.99 in²/ft (large sq)

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Effective depth 'd' check:

$\varepsilon_u = .003$
$f_c' = 4$ ksi
$f_y = 45$ ksi
$f_c' \leq 4$ ksi $\therefore \beta_1 = .85$
$\phi = .9$
$b = 12''$

$\therefore \rho_{.005} = .85 \times \beta_1 \frac{f_c'}{f_y} \times \frac{\varepsilon_u}{\varepsilon_u + .005}$

$= .85 \times .85 \times \frac{4}{45} \times \frac{.003}{.003 + .005}$

$= .02408$

$d^2 = M_u / \phi \rho f_y b \left(1 - .59 \rho \times \frac{f_y}{f_c'}\right)$

$= 91.4 / .9 \times .02408 \times 45 \times 12 \times \left(1 - .59 \times .02408 \times \frac{45}{4}\right)$

$d^2 = 9.295$

$d_{Req} = 3.05''$ → Required

$d_{prov} = t - 1 = 7'' - 1 = 6''$ → provided ∴ OK

Reinforcement Area Calculation:

$A_s = M_u / \phi f_y \left(d - \frac{a}{2}\right)$; $a = \frac{A_s f_y}{.85 f_c' b}$ [Trail & error]

① → $M_{u_1} = 0$. But we have to provided minimum Area.
$\therefore A_{s_1(min)} = .002bt = 0.168$ in²/ft

② → $M_{u_2} = 66.57$ kin/ft ∴ $A_{s_2} = .281$ in²/ft ; $a_2 = .31$ in

③ → $M_{u_{3L}} = 73.23$ kin/ft ∴ $A_{s_{3L}} = .310$ in²/ft ; $a_3 = .34$ in

④ → $M_{u_4} = 45.77$ kin/ft ∴ $A_{s_4} = .192$ in²/ft ; $a_4 = .211$ in

⑤ → $M_{u_{3R}} = M_5 = 66.57$ kin/ft ; $A_{s_5} = A_{s_{3R}} = .281$ in²/ft ; $a_5 = .31$ in

⑥ → $M_{u_6} = 91.4$ kin/ft ; $A_{s_6} = .390$ in²/ft ; $a_6 = .43$ in

Summary :

	1	→ (+)	.168 in²/ft
	2	→ (+)	.281 in²/ft
×	3L	→	.31 in²/ft —
	4	→ (+)	.192 in²/ft
×	5 = 3R	→	.281 in²/ft —
	6	→ (-)	.39 in²/ft

∴ 3 → (-) .31 in²/ft (largest) & 5 → (-) .39 in²/ft (largest)

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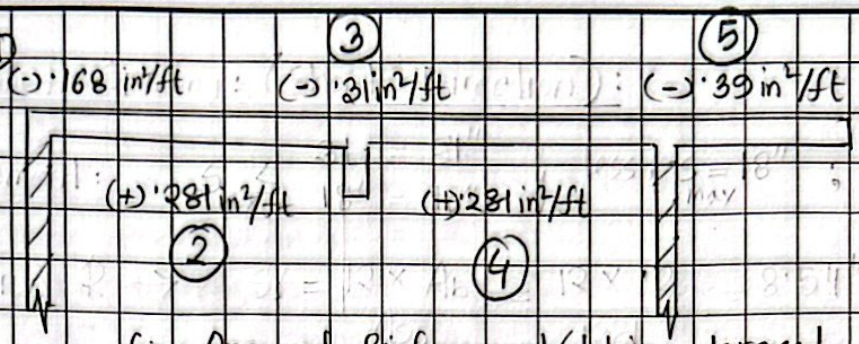


fig: Area of Reinforcement (taking largest value in common sections)

Reinforcement Spacing: (Shorter direction):

$S_{max} \leq \begin{cases} 3t = 21'' \\ 18'' = 18'' \end{cases}$ $S_{max} = 18''$; $S_{min} = 1.5t = 10.5''$

+ Moment:

Section 2 & 4 → $S_2 = S_4 = \frac{12 \times A_b}{A_{s_2}} = \frac{12 \times .2}{.281} = 8.54'' \approx 8.5''$

But S_{min} 10.5" ∴ $S_2 = S_4 = 10.5''$

∴ #4 @ 10.5" c/c is provided alt cranked bar

- Moment:

- Moment:

Section 1 → $A_{s_1} = .168$ in²/ft

In 12" area required = .168 in²

∴ In 10.5×2" " " = $\frac{.168 \times 10.5 \times 2}{12}$ = .294 in²

Already provided in 21" = .2 in²

∴ Extra top required = .294 − .2 = .094 in²

∴ If #3 is provided, No of extra top = .094/.11 = .85 ≈ 1

∴ 1 #3 extra top between ckd bars.

Section 3 → $A_{s_3} = .31$ in²/ft

In 12" area required = .31 in²

∴ In 21" " " = $\frac{.31 \times 21}{12}$ = .543 in²

Already provided in 21" = .2 in²

∴ Extra top required = .543 − .2 = .343 in²

∴ If #4 is provided, No of extra top = .343/.2 = 1.72 ≈ 2

∴ 2 #4 extra top between ckd bars

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Section → 5 $A_{s5} = .39 \text{ in}^2/\text{ft}$

In 12" area required = .39 in²

∴ In 21" " " = $\frac{.39 \times 21}{12} = .683 \text{ in}^2$

Already provided in 21" = .2 in²

∴ Extra to required = .683 − .2 = .483 in²

∴ If #4 is provided, No of extra top = $\frac{.483}{.2} = 2.42 \approx 3$

∴ 3 #4 extra top between akd bars.

Reinforcement Detailing: (Longer Direction):

In longer direction minimum reinforcemend is provided for temperature and shrinkage.

$S_{max} = \begin{cases} 5t = 35" \\ 18" = 18" \end{cases}$ ∴ $S_{max} = 18"$; $S_{min} = 1.5t = 10.5"$

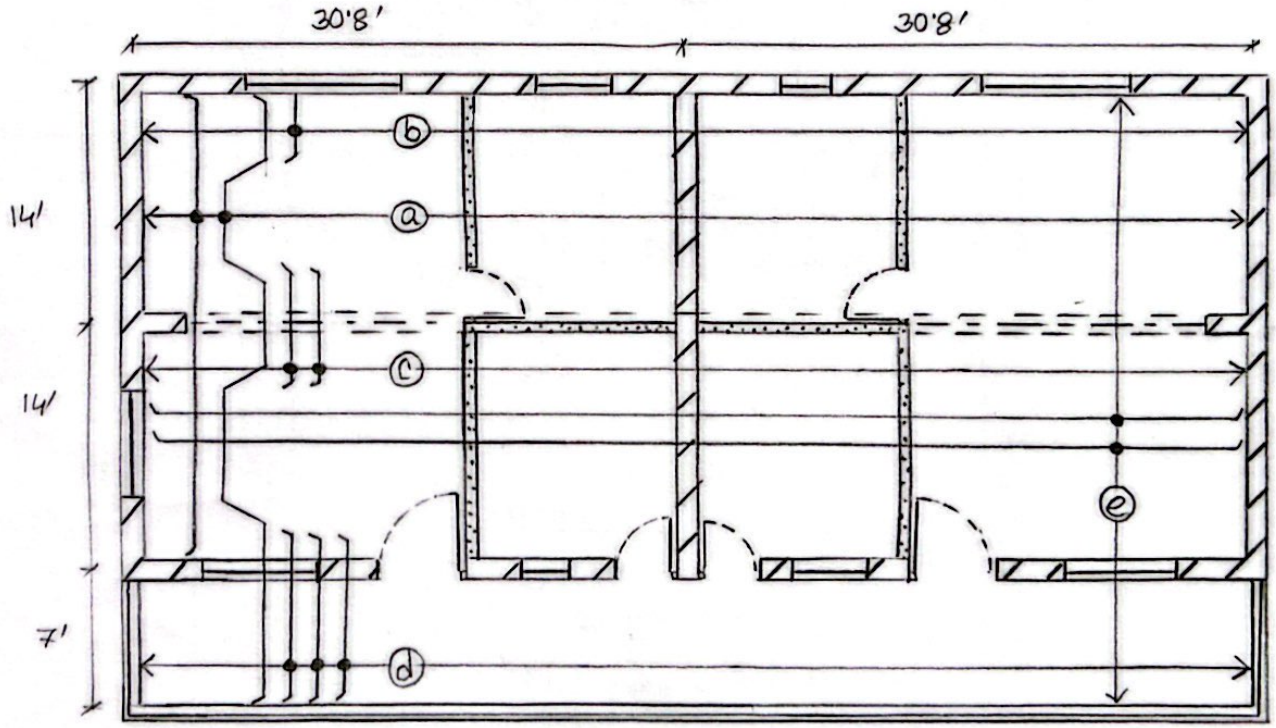
$A_{smin} = .002bt = .168 \text{ in}^2/\text{ft}$

∴ $S = \frac{12 \times A_b}{A_{smin}} = \frac{12 \times .2}{.168} = 14.29 \approx 14"$

∴ $S_{min} < S \leq S_{max}$ ∴ OK

∴ #4 @ 14" c/c is provided in longer direction.

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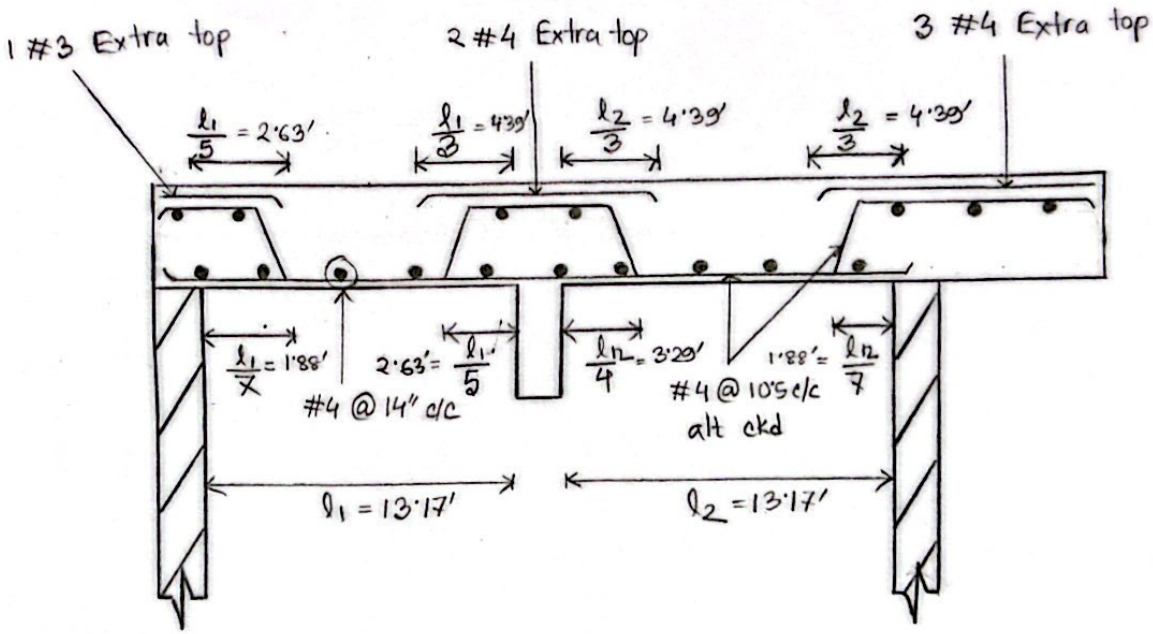
ⓐ#4 @ 10·5" c/c alt cranked
ⓑ1#3 extra top between ckd bars
ⓒ2#4 extra top between ckd bars
ⓓ3#4 extra top between ckd bars
ⓔ#4 @ 14" c/c

1st & 2nd Floor Plan

fig: Detailing in Top View

PTO PTO PTO PTO

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Section A-A

fig: Longitudinal Detailing

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