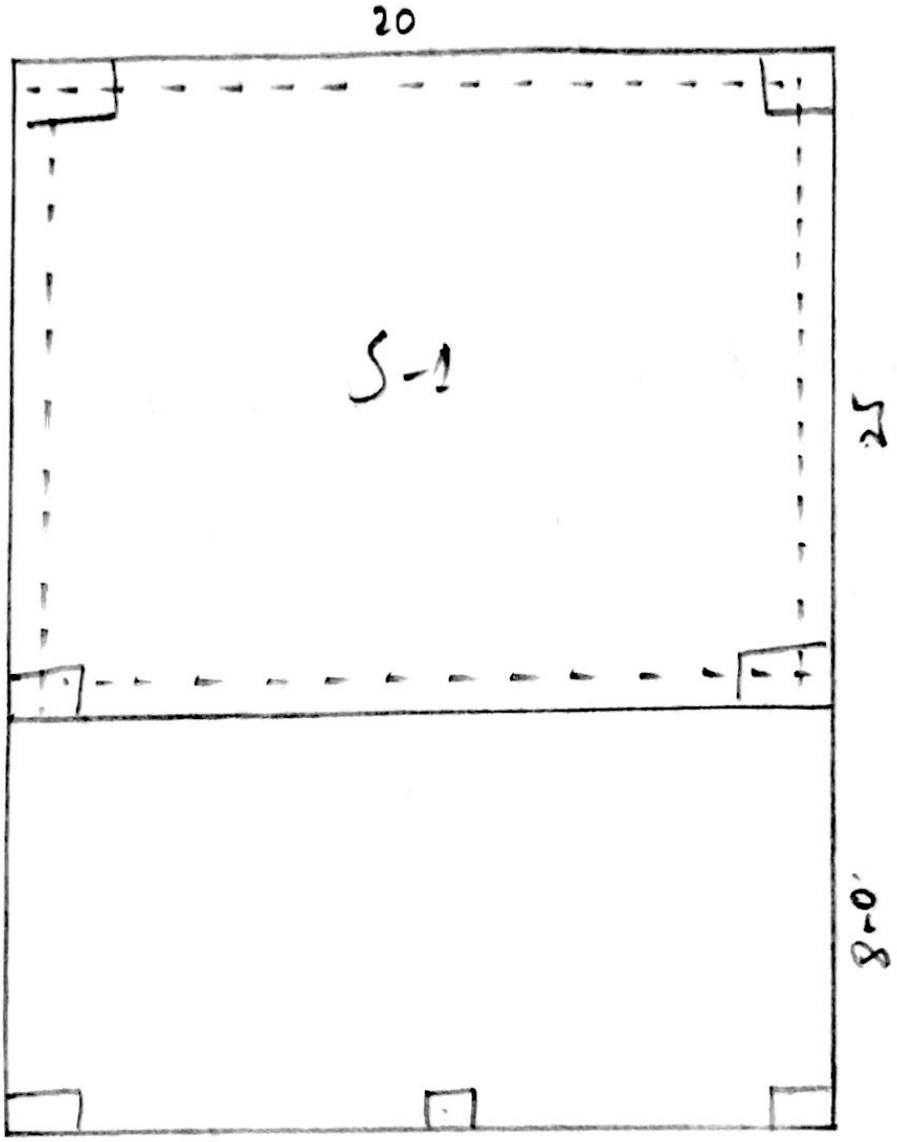
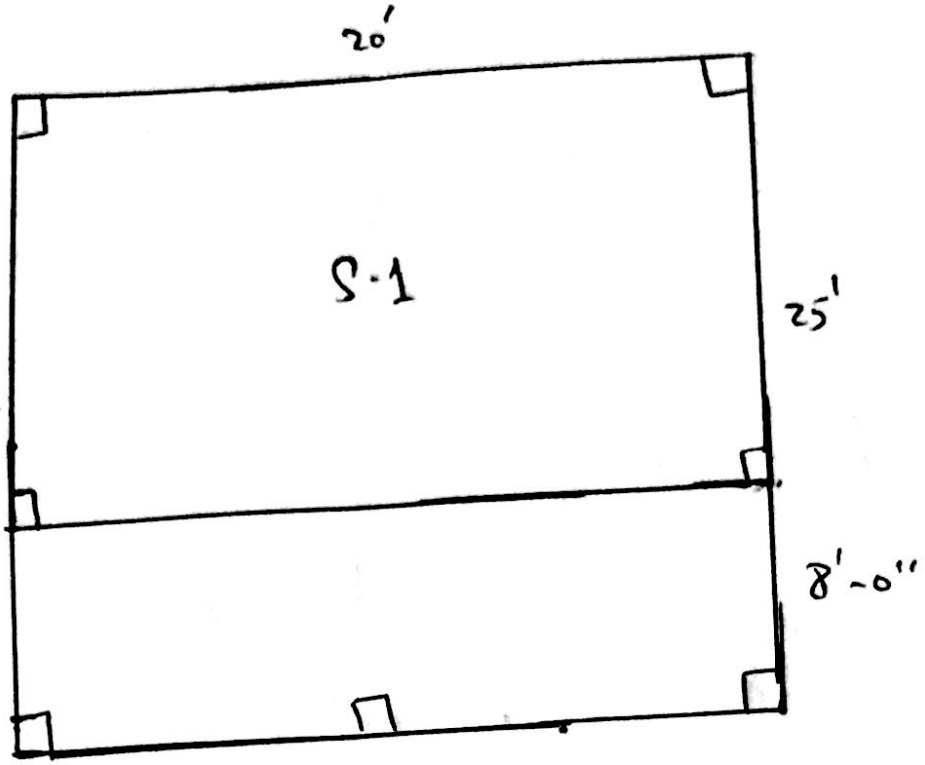
Iqtidar ali 15581





Room:- 20"x23"

L.L = 40psf

D.L = 20psf

F_c' = 3000 psi

f_y = 60,000psi

$$\Rightarrow \frac{l_b}{l_a} = \frac{33}{20} \sim 1.6$$

To Find perimeter

$$h_{min} = \frac{\text{Perimeter}}{180} \times 12$$

$$= \frac{2(33+20)}{180} \times 12 = 7"$$

⇒ Self weight:-

12/12 x 7/12 x 150

Total Dead load = 20 + 87.5 = 107.5 lb/ft

Total load Factor: 1.4(DL) + 1.7(LL) = 1.4(108) = 151.2 lb/ft

Total Live load = 1.7(40) = 68 lb/ft

$$m = \frac{l_a}{l_b} = \frac{20}{25} = 0.80$$

$C_{adl} = 0.036$

$C_{adl} = 0.023$

$C_{all} = 0.056$

$C_{ald} = 0.025$

⇒ Moments:-

$M_a = 10743.9$ lb/ft

$M_b = 3094.2$ lb/ft

⇒ Find depth of slab:-
Assume #4

d = h - (cover - 1/2 (dia of bar))

= 7" - 3/4 - 1/2 (4/8) = 6"

* d = h - cover - 1/2 dia of shorter - 1/2 dia of bar

d = 5"

Find area of shorter side:-

$$A_s = \frac{M_a}{0.9\ F_y(d - a/2)}$$

$A_s = 0.0350$

$$a = \frac{(0.0359)(60000)}{0.85 \times 3000 \times 12}$$

$$a = 0.7039$$

$$A_s = \frac{1047 3.9}{0.9 \times 60000 (5.4 - \frac{0.7039}{2})}$$

$$a = 0.0384$$

$$A_s = 0.0360$$

we take area of steel = 0.0360

⇒ Spacing take # 4 bar:-

$$\frac{0.20}{0.036} = 6" \text{ c/c}$$

⇒ Shrinkage reinforcement:-

$$A_s = 0.168$$

using # bar for reinforcement

Spacing = 8" c/c

$$M_b = 3094.2$$

$$A_s = \frac{3094.2}{0.9 \times 60000 \times 5.4} = 0.01061$$

$$a = \frac{(0.01061)(60000)}{0.85 \times 3000 \times 12}$$

$$a = 0.0208$$

$$As = \frac{3094.2}{0.9 \times 60000 \left(5.4 - \frac{0.0208}{2}\right)}$$

$As = 0.01605$

$a = 0.0464$

$$As = \frac{3094.2}{0.9 \times 60000 \left(5.4 - \frac{0.0464}{2}\right)}$$

$As = 0.01067$

⇒ spacing :-

take #4 bar

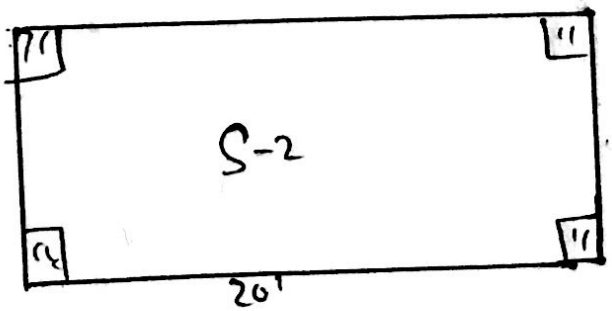
$$\frac{0.20}{0.01607} = 20 \text{ c/c}$$

⇒ Shrinkage reinforcement :-

$As = 0.002bh$

$= 0.002(12)(7)$

spacing $= \frac{0.11}{0.168} * 9''$ c/c



$L = 20'$

Solution:-

thickness of slab:-

$\because ln/20 = \frac{20 \times 12}{20} \sim 12''$

$d = h - c - 1/2$ (dia of bar)

$= 6 - 3/4 - 1/2\,(1/2) = 11''$

Self weight of strip $= bhr$

$12/12 \times 12/12 \times 150 = 150$ lb/Ft

imposed D.L $= 20 \times 1 = 20$ lb/Ft

Total D.L $= 3000$ lb/ft

L.L $= 40 \times 1 = 40$ lb/ft

$W_u = 3664$ lb/ft

⇒ Find moment of mid span-

$$M_0 = \frac{wl^2}{8} = \frac{(3664)(20)}{8}$$

$M_u = 153000 \times 12 = 183600$ in-lb

⇒ Find the steel area-

$$A_s = \frac{183600}{0.9 \times 60000 \times 10.8}$$

$A_s = 0.314$

$$a = \frac{(0.314)(60000)}{0.85 \times 300 \times 5.4}$$

$a = 1.368$

$$A_s = 183600 \Big/ 0.9 \times 60000\,(5.4 - 1.368/2)$$

$A_s = 0.721$

b) $q = 5.141$

$$A_s = \frac{183600}{0.9 \times 60000 (5.4 - 3.141/2)}$$

$$A_s = 0.890$$

$$\text{Spacing} = \frac{\text{Area of 1 bar}}{\text{total area of steel}} \times \text{width of strip}$$

a) $\frac{0.20}{0.890} \times 12 = 2.69 \approx 3''$ c/c

⇒ Shrinkage reinforcement:-

$$A_{s(dish)} = 0.002bh$$

$$= 0.002(12)(12)$$

$$= 0.28 \text{ in}^2$$

c) Using # 3 bar for Reinforcement:-

$$\text{spacing} = \frac{0.11}{0.288} = 5'' \text{ c/c}$$

Summary of design:-

Thickness = 12"

Main steel bar # 4 c/c

Distt bar # 3 @ 5" c/c

* Rectangular Column

D.L = 20
L.L = 40
f_c' = 3000
f_y = 60,000

Eccentricity, e = 12

Calculate Factor load:-

$P_u = (1.4)(DL) + 1.7(LL)$

$P_u = 84k'$

$e = m/p$

M = exp

$= 12 \times 84 = 1008 = 1008/12 = e = 84k'$

$A_g = 12'' \times 9 = 108$

$\Rightarrow \frac{M_u}{A_g} = \frac{84}{108} = 0.7$ ksi

$\Rightarrow \frac{M_u}{A_g} = \frac{84}{108(9)} = 0.068$

$\gamma = \frac{h-2(d)}{h} = \frac{9-2(2.5)}{20}$

$P_u/A_g = 84/108 = 0.7$ if it value is 1.9 o/c, greater then it column is unsafe.

Square Column:-

D.L = 20

L.L = 40

f'_c = 3000

f_y = 60000

Calculate Factor loads:-

$P_u = 1.4(DL) + 1.7(LL)$

$P_u = 1.4(20) + 1.7(40)$

$P_u = 84k'$

$e = m/p$

$M = e/p$

Assume

$12 \times 12 = 144 \text{ ft}^3/\text{ft}$

$M_u/A_g = 84/144 = 0.5 \text{ ksi}$

$$\frac{M_u}{A_g} = \frac{84}{(144)(20)} = 11.66$$

$$\delta = \frac{h - 2(d)}{h}$$

$\delta = 0.029$

$e/h = 12/12 = 1$

$$\frac{M_u}{A_g r} = \frac{84}{144 \times 12} = 0.048$$

$$P_u/A_g = \frac{84}{144} = 0.5$$

Beam self weight-

$$\frac{12 \times 18}{144} \times \frac{150}{1000} = 0.225 \text{ k/ft}$$

Finding Bending moment:-

⇒ Flexure design for negative moment:-

$$M_u^- = 72 \text{ k-ft} - 864 \text{ k-ft}$$

$$A_s = \left[0.85 \frac{f_c'}{f_y} \left(1 - \sqrt{1 - \frac{2R_n}{0.85 f_c'}} \right) \right] bd$$

$$R_n = \frac{M_u}{\phi b d^2} = \frac{864 \times 1000}{0.9 \times 12 \times 15} = 355.8$$

$$b = 12'', \quad d = 18 - 3 = 15''$$

$$A_s = \left(0.85 \times \frac{3000}{60000} \left(1 - \sqrt{1 - \frac{2 \times 355.6}{0.85 \times 3000}} \right) \right) 12 \times 15$$

$$A_s = 1.15 \text{ in}^2$$

$$\text{No of bars} = \frac{1.15}{0.44} = 3$$

use 3#6

$$M_u^+ = 36$$

$$\frac{M_u^-}{2} = 72/2$$

Shear Design

$V_u = 20.1 - 1.383 \times V_d$

$= 20.1 - 1.383 \times 1.25$

$V_u = 18.37$ kip

Checking whether shear reinforcement is needed.

$\phi V_c = (\phi \lambda \sqrt{f_c'})\, b\, d$

$\phi = 0.75$ (ACI)

$\lambda = 1$ for normal weight concrete

$\phi V_c = (0.75 \sqrt{3000})\, 12 \times 15$

$\phi V_c = 7394.3$ lb

$\phi V_c = 7.39$ k

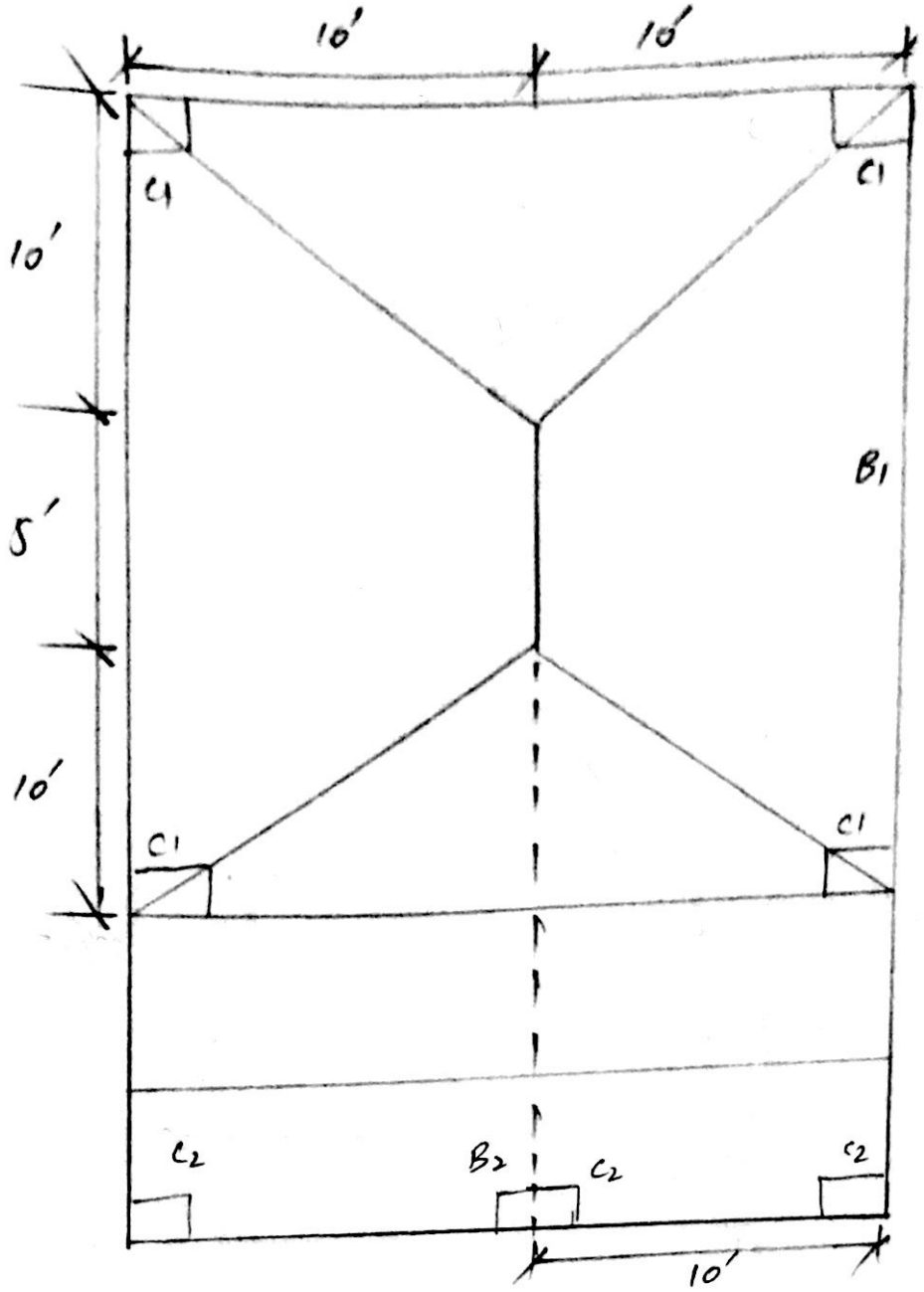
$\phi V_s = V_u - \phi V_c$

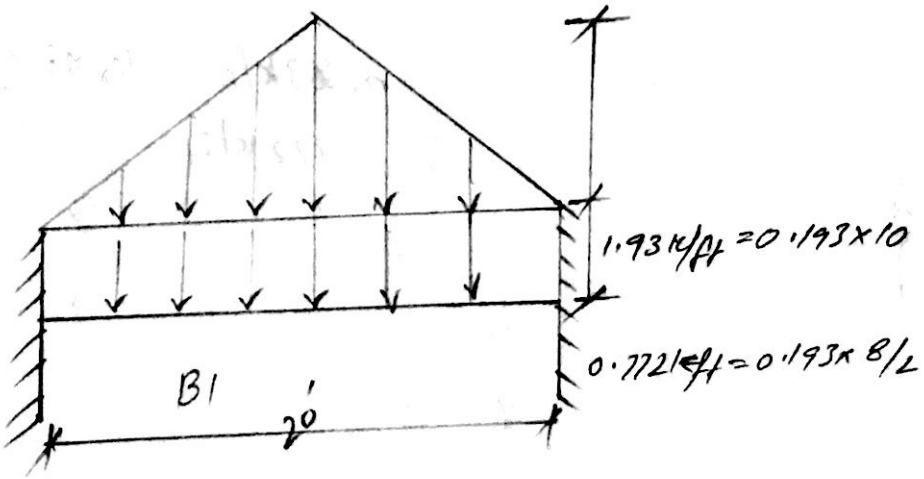
$= 20.1 - 7.39$

$\phi V_s = 12.7$ kip

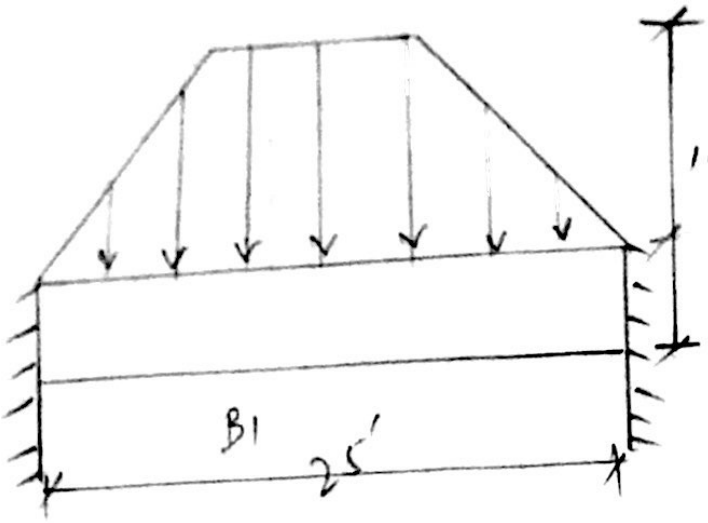
$s = \dfrac{\phi A_v f_y d}{V_u - \phi V_c} = 11.67''$

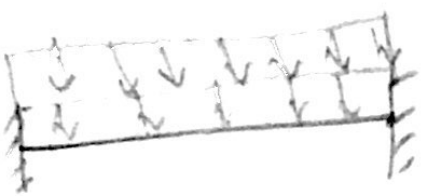
(14)


10'
10'
C1
C1
10'
B1
5'
10'
C1
C1
C2
B2
C2
C2
10'


1.93 K/ft = 0.193 x 10
0.7721 K/ft = 0.193 x 8/2
B1
20'

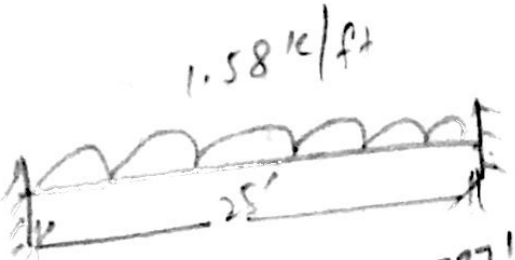
(15)

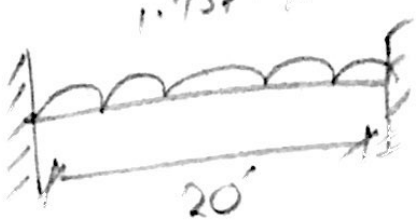


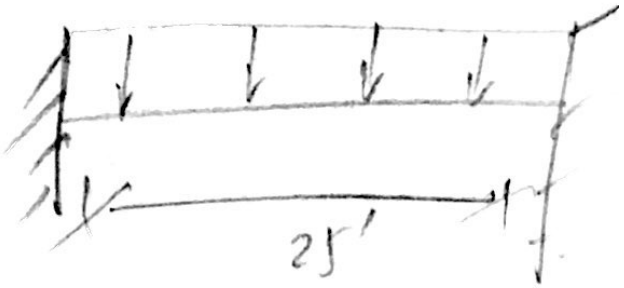


0.863 K/ft = 1/2 x 83 x 10 / 20

0.7721c/ft







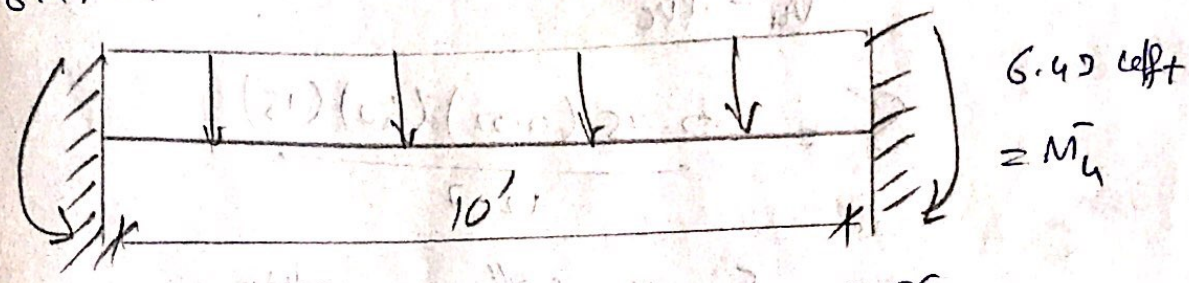
= 1/2 (25 x 5) x 1

25

1.1581c/ft = 28

6.47 k-ft

0.772 k/ft = 0.193 × 10.



6.47 k-ft
$= M_4^-$

3.86

3.86

$M_4^+ = \frac{wl^2}{24} = 3.22$ k-ft

(20)

$$\phi V_c = (0.75\ l.D\sqrt{3000})\ 12\times15$$

$$\phi V_c = 7394.3\ lb.$$

$$\phi V_c = 7.39\ k$$

$$\phi V_s = V_u - \phi V_c$$

$$= 20.1 - 7.39$$

$$\phi V_s = 12.7\ kip.$$

$$S = \frac{\phi A_v f_y d}{V_u - \phi V_c}$$

$$S = \frac{0.75\,(0.22)(60)(15)}{12.7}$$

$$S = 11.67''$$

$$S_{max} = \begin{cases} d/2 = 15/2 = 7.5'' \\ = 24'' \\ = 12\,d_s = 12\times6/8 = 9'' \end{cases}$$

So using

$$S_{provided} = 6''\ c/c$$

So) #3 @ 6" c/c for up to ϕV_c

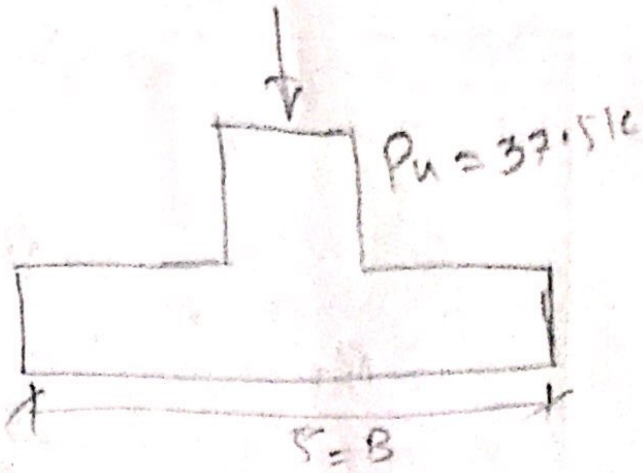
& on.

B

$P_u = 20.1 + 77.37$

$P_u = 37.47$ kip

Let



Let

$= 0.65$ ksf

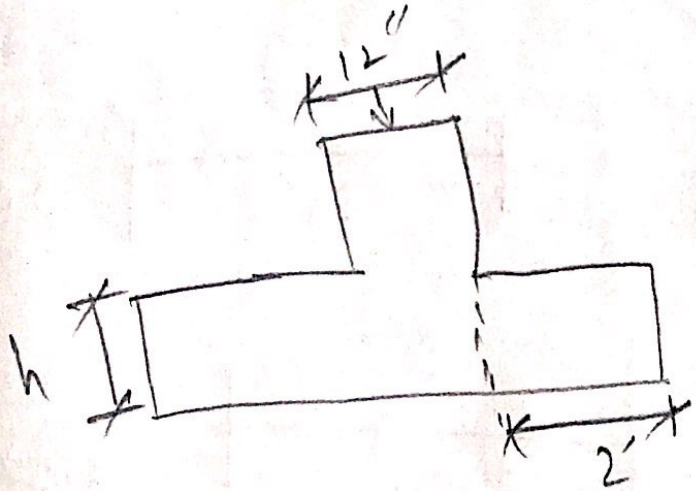
$q_a = 1.43$ ksf

$B^2 = B \times B = P_u / q_a = 37.5 / 1.43 = 26.2$

$B = \sqrt{26.2} = 5'$

So

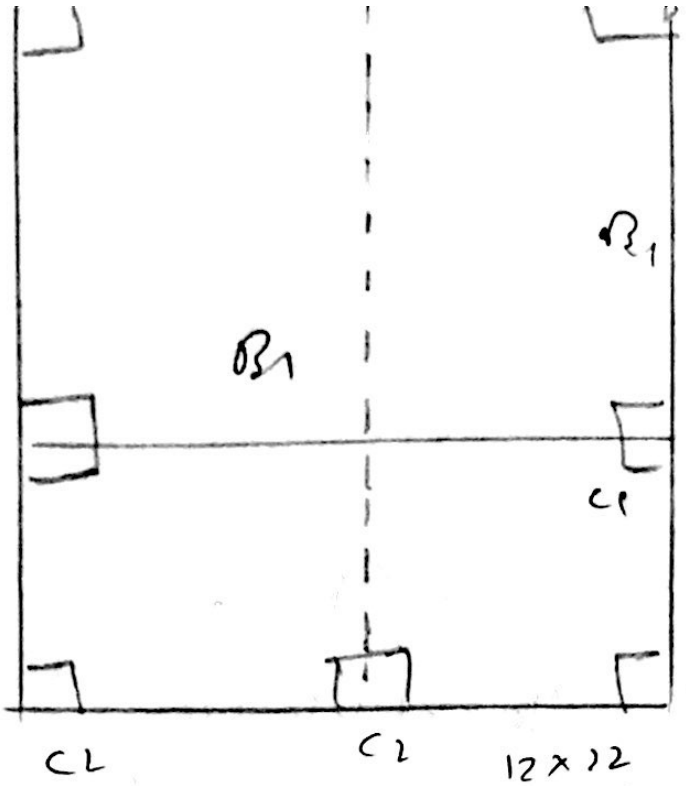
$5' \times 5'$



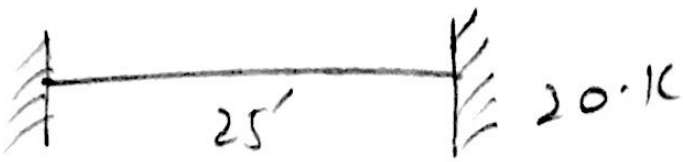
$h = 18"$

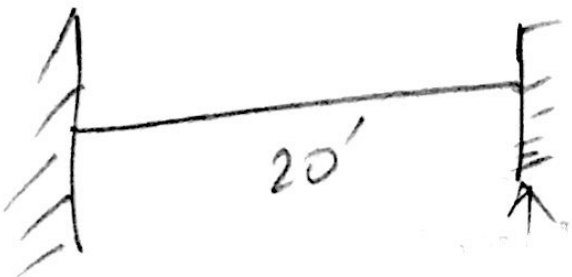
Then $d = 15"$

1 STRIP

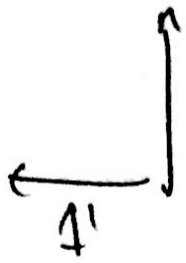


Beam B1 in both direction for C1.





(22)



$$R_n = \frac{2.86 \times 1000 \times 12}{0.9 \times 12 \times 15^2} \simeq 14.12 \text{ psi}$$

$$A_s = 0.85\left(\frac{3000}{60,000}\right)\left(1 - \sqrt{1 - \frac{2 \times 14.12}{0.85 \times 3000}}\right) 12 \times 15$$

$$A_s = 0.042 \text{ in}^2$$

$$A_{s\min} = \left(\frac{200 f_c'}{f_y}\right) bd$$

$$= \frac{75\sqrt{f_c'}}{f_y} bd$$

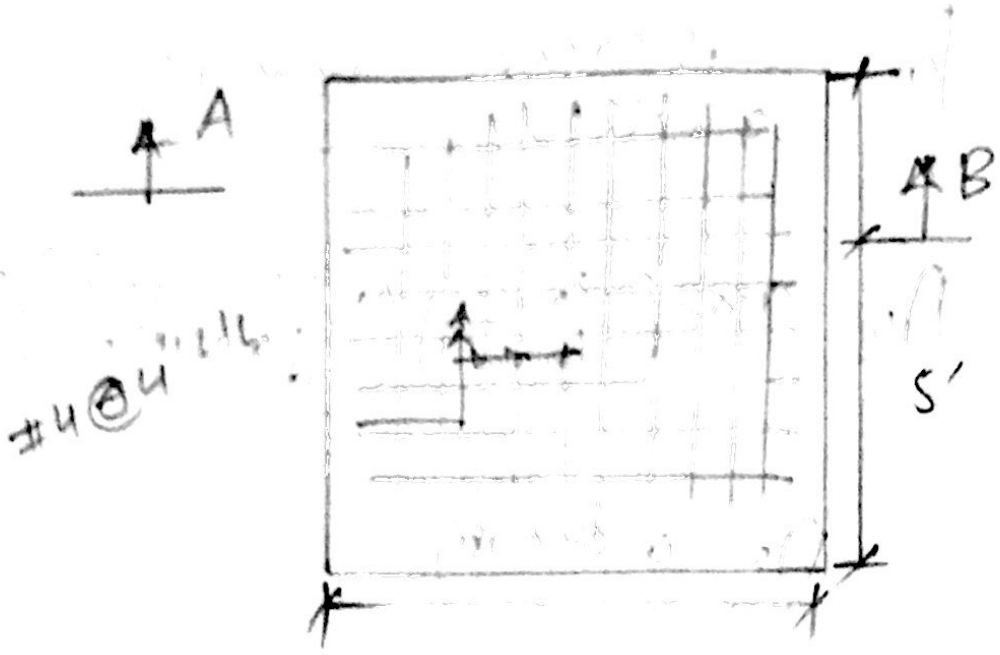
$$A_s = \begin{bmatrix} 3\frac{\sqrt{f_c'}}{f_y} bd \\ \frac{200}{f_y} bd \end{bmatrix} \rightarrow 0.6 \text{ in}^2$$

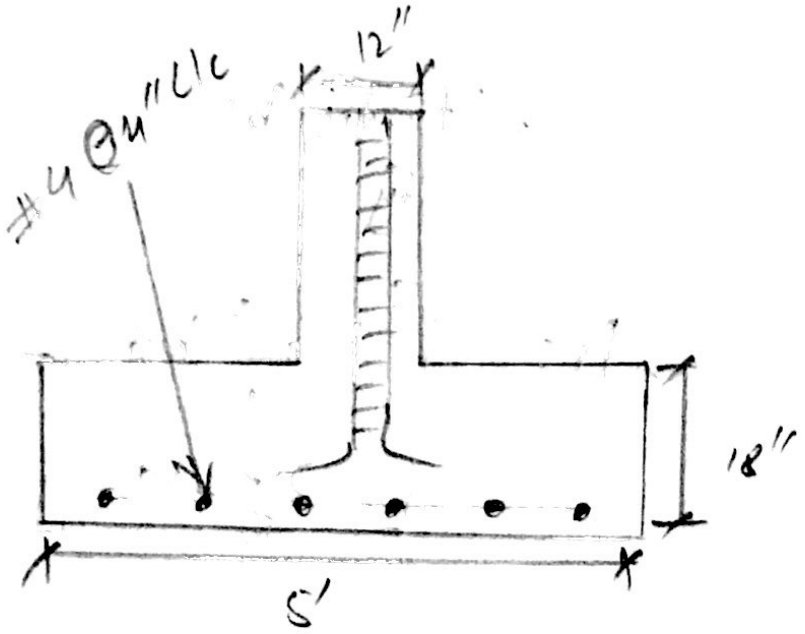
$$= 0.6 / 0.2 = 3$$

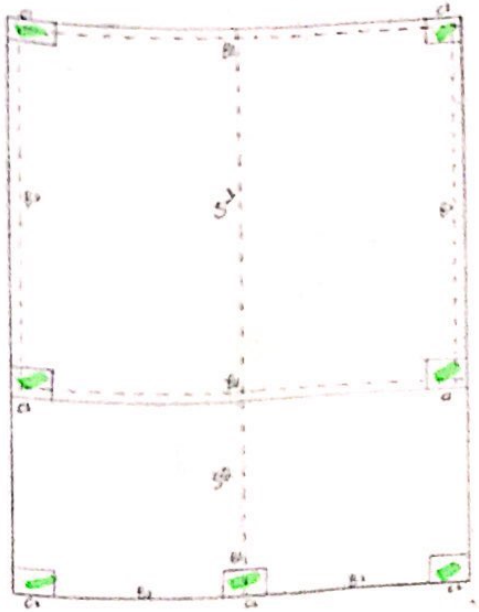
$$s = 0.2 / 0.6 \times 12 = 4''$$

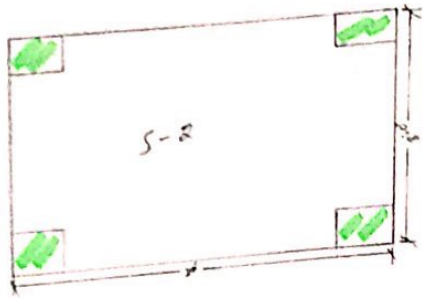
Minum Reinforcement

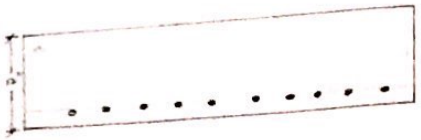
#4 @ 4" c/c both way.

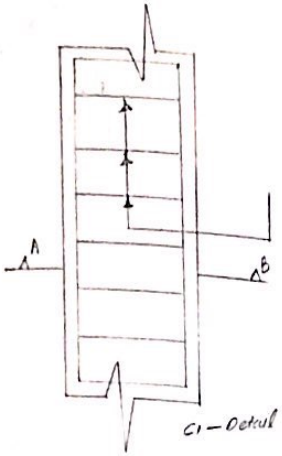


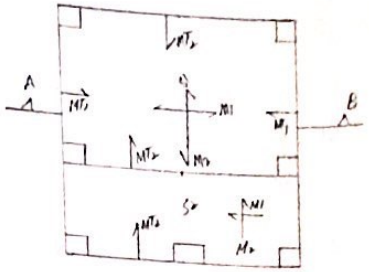




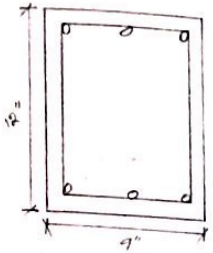




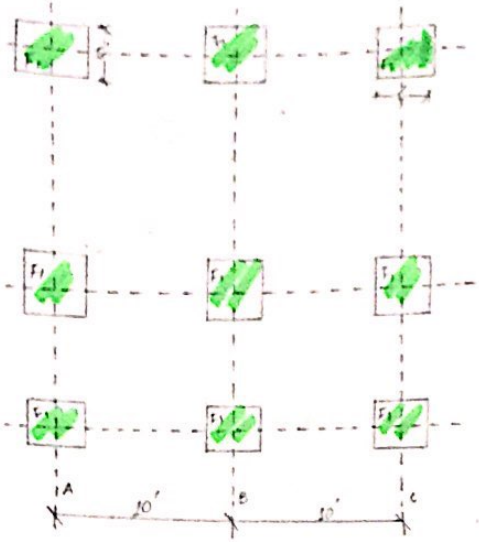


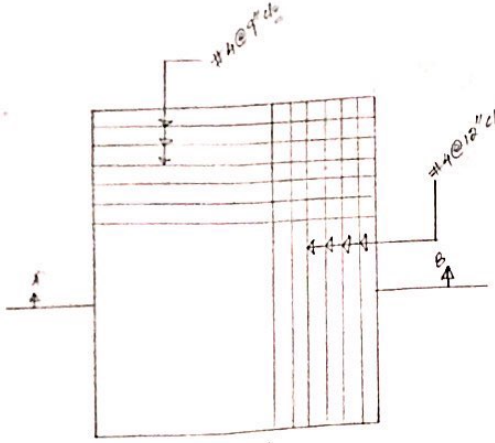


S1				S2			
Bottom		Top		Bottom		Top	
M1	M2	MT1	MT2	M1	M2	MT1	MT2

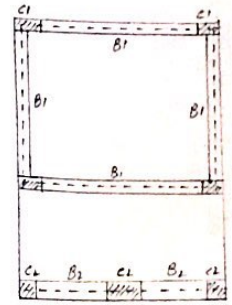


Section AB

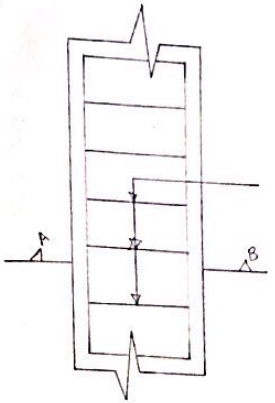


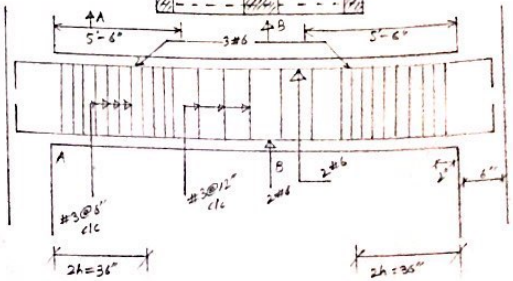


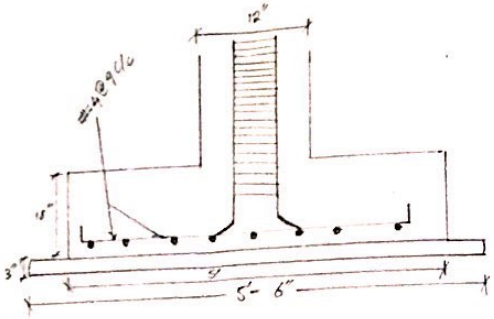
F-1 Detail



Framing Plan
→ Beam Detail
→ column Detail.







Section # A-B