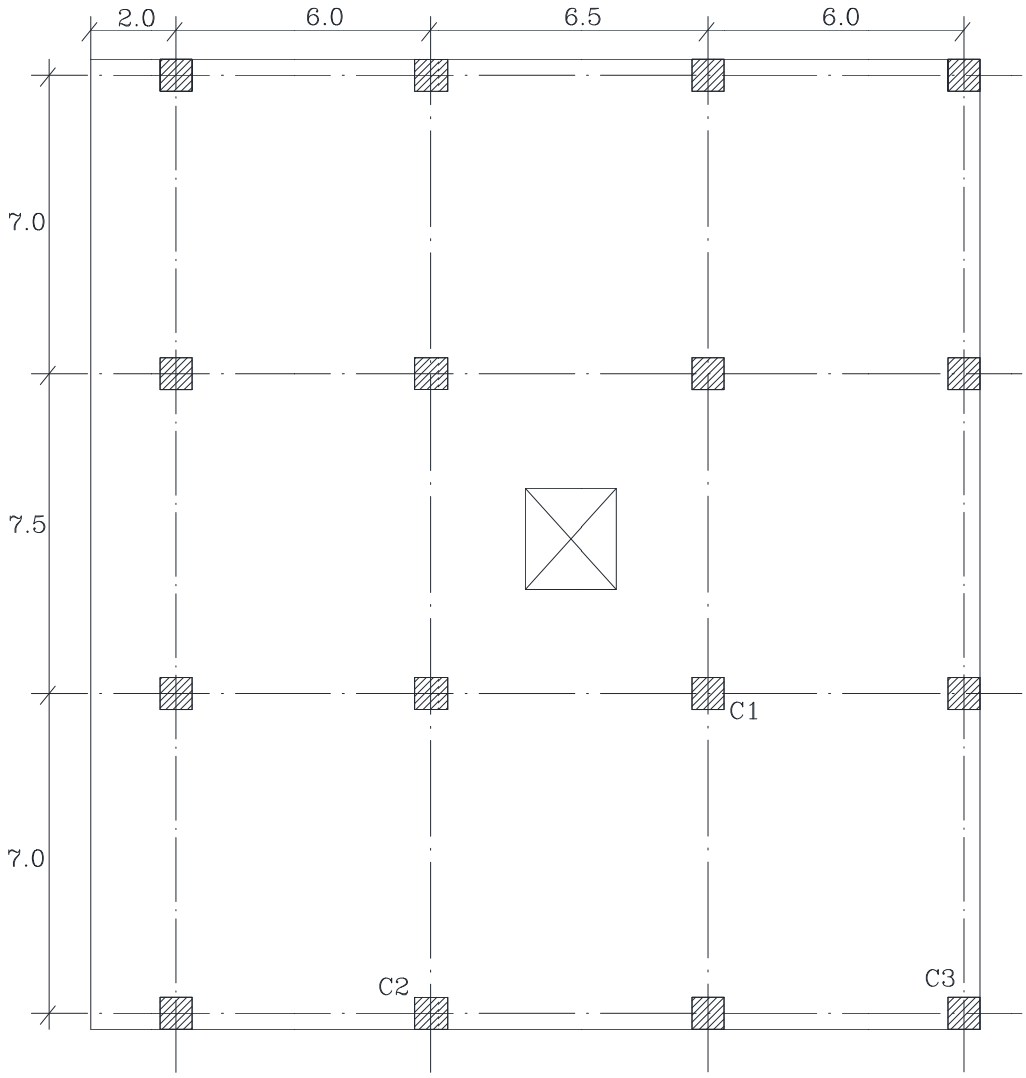
EXAMPLE

The Given plan shows a general layout of flat slab.

DATA

F.C=1.5 kN/m2 L.L= 6 kN/m2
No. of floors=4 Floor Height=4.50 m
Fcu=25 MPa Steel used 360/520



Concrete dimensions

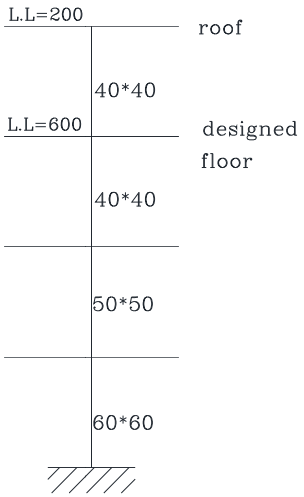
Column:

$b = 30cm$ (min)

$$= \frac{H}{15} = \frac{4.5}{15} = 30\ cm$$

$$= \frac{L}{20} = \frac{7.5}{20} = 37.5cm$$

$Use\ 40 \times 40\ cm$

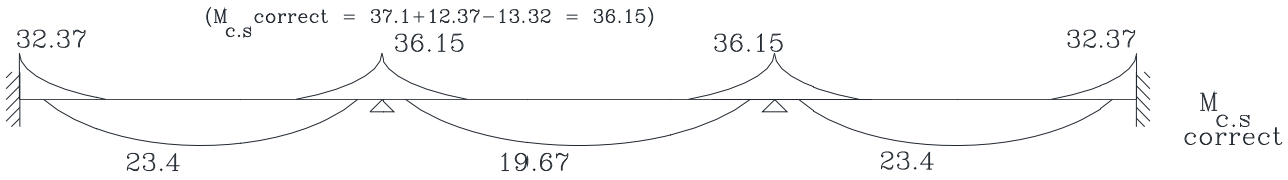


Loads

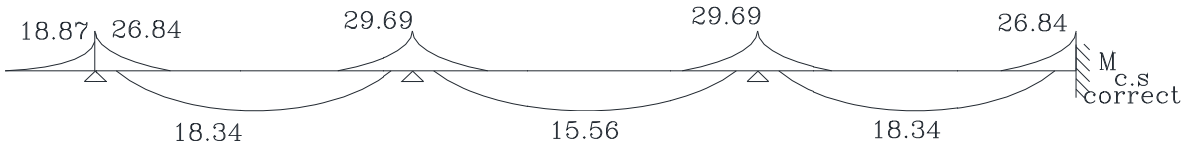
$w_u = 19.4\ kN/m^2$

Calculation of B.M.D

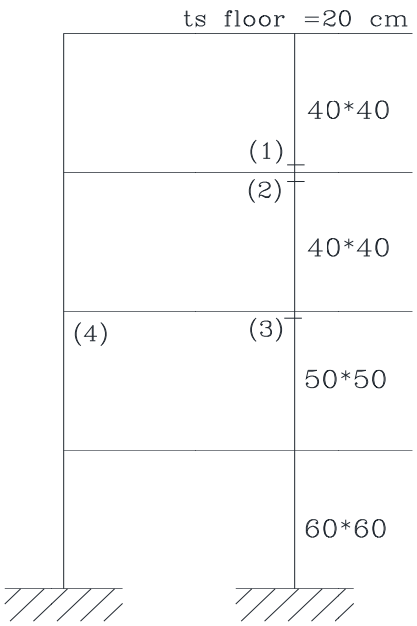
Long direction



Short direction:



Design of column



Interior column (C1)

$w_{u,roof} = 13\ kN/m^2$

Sec1:

Case1:

$$N = w_{u,roof} \times L_1 \times L_2 + o.w$$
$$= 13 \times 7.5 \times 6.5 + 0.4 \times 0.4 \times 4.5 \times 25 \times 1.4$$
$$= 659\ kN$$

$$k = 1.5, \lambda = \frac{4.5 \times 1.5}{0.4} = 16.9 \rightarrow \delta = \frac{\lambda^2 \times b}{2000}$$
$$= \frac{16.9^2 \times 0.4}{2000} = 0.057m$$

$$M_{add} = N.\delta = 659 \times 0.057 = 37.6\ kN.m$$

$$e = \frac{M}{N} = 0.057\ m, \qquad \frac{e}{t} = \frac{0.057}{0.4} = 0.1425 \rightarrow use\ interaction\ diagram$$

$$\mu = 0.5\%,\ \mu_{min} = 0.025 + 0.052\lambda_{max} = 1.13\%$$

$$A_s = \frac{1.13}{100} \times 400 \times 400 = 1808\ mm^2 \rightarrow 8\text{Ø}18$$

Case2:

$$N = (D.L. + 0.5 \times L.L) \times L_1 \times L_2 + o.w$$
$$= (9.8 + 0.5 \times 3.2) \times 7.5 \times 6.5 + 0.4 \times 0.4 \times 4.5 \times 25 \times 1.4 = 581\ kN$$

$$M = 50\% M_{-ve} of\ col\ strip \times stiffness\ ratio = 0.5 \times 361.5 \times 0.5 = 90.4\ kN.m$$

$$M_{add} = N.\delta = 581 \times 0.057 = 33.2\ kN.m \rightarrow M_{total} = 90.4 + 33.2 = 123.6\ kN.m$$

$$e = \frac{M}{N} = 0.213\ m, \quad \frac{e}{t} = \frac{0.213}{0.4} = 0.53 \rightarrow use\ interaction\ diagram - uniform\ steel$$

$$\frac{N_u}{f_{cu} \times b \times t} = 0.14, \frac{M_u}{f_{cu} \times b \times t^2} = 0.077 \rightarrow \rho = 4, A_s = \rho.f_{cu}.10^{-4} \times b \times t = 1600mm^2$$

Case3:

$N = 581\ kN$

$M = 50\%M_{-ve} of\ col\ strip \times stiffness\ ratio$
$= 0.5 \times 296.9 \times 0.5 = 74.23\ kN.m$

From Cases 1, 2 &3 $\rightarrow A_s = 8\emptyset 18$