1a) To design for Safety
b) The design must be Economical
c) The deformation of the Structure must not ~~with the taken~~ Impose with the intensity of the Structure

b) Limit State design Considers the disadvantages of load factor design and any other factors that can cause the Structure to be Structurally unfit While Elastic design is a method of analysis Which the design of a Structural member is based on a liner Stress-Strain relationship assuming that the working Stress are only a fraction of the elastic limit of the material

STIAR CASE Design

Slop Factor $= \frac{\sqrt{R^2+T^2}}{T} = \frac{\sqrt{180^2+275^2}}{275} = 1.14$

Load Analysis

A WAIST = $R \times 24$ kN/m²

= $0.15 \times 24 = 3.6$ kN/m²

B FINISHES = 1.2 kN/m²

C STEPS = $T \times 1/2 \times 24$ kN/m²

= $0.275 \times 0.5 \times 24 = 3.3$ kN

DGK = ((A+B) × SF) + C

= (4.8 × 1.14) 3.3

= 8.77 kN/m

DLF = 1.4 Gk + 1.6 Qk

= 1.4 (8.77) + 1.6 (1.5)

= 14.68 kN/m

Span = T total + 0.5 (a + b) = (275 × 12) + 0.5 (225 + 225) = 3.525 m

d = h - Cover - ½ø

= 180 - 25 - 6 = 119 mm

$m = \frac{FL^2}{10} = \frac{14.68 \times 3.525^2}{12} = 18.24$ kN

$K = \frac{M}{bd^2 f_{cu}} = \frac{18.24 \times 10^6}{1000 \times 119^2 \times 25} = 0.052$

$$l_a = 0.5 + \sqrt{0.25 - \frac{k}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.052}{0.9}} = 0.938$$

$$z = l_a d = 0.938 \times 119 = 111.622\,m$$

$$A_s = \frac{M}{0.95 f_y z} = \frac{8.24 \times 10^6}{0.95 \times 400 \times 111.622} = 419.53$$

$A_{s\,prov} = 452\,mm$

Provided Y12 @ 250 c/c ($A_{s\,prov} = 452\,mm$)

Deflection Check

$$f_s = \frac{2}{3} \times \frac{1}{\beta} \times \frac{A_{req}}{A_{prov}} \times f_y$$

$$f_s = \frac{2}{3} \times 1 \times \frac{419.53}{452} \times 280$$

$$= 154.69\,N/mm$$

$$M.F = 0.55 + \frac{477 - 154.69}{120\left(0.9 + \frac{8.24 \times 10^6}{1000 \times 119^2}\right)} = 1.78$$

$$d_{req} = \frac{Span}{MF \times B.R} = \frac{3528}{1.78 \times 26} = 76.17\,mm$$

Since $d_{req} < d$, Deflection is ok

2a)

$P1 = P2 = P3 = \frac{4300}{4000} = 1.075 < 2 =$ 2way slab

$P2 = P8 = P9 = \frac{4500}{4000} = 1.125 < 2 =$ 2way slab.

$P4 = P5 = P6 = \frac{4300}{4000} = 1.075 < 2 =$ 2way slab

$P10 = P11 = P12 = \frac{4000}{1500} = 2.667 > 2 =$ 1 way slab

Scanned with CamScanner

2b:: Designing for P2

$\frac{l_y}{l_x} = \frac{4300}{4000} = 1.075 = \simeq 1.1$

Shortspan Coefficient = $\frac{-}{0.054}$

Longspan Coefficient = $\frac{0.058}{0.044}$

Estiming Specification of Slab thickness 175mm

$f_{cu} = 25N/mm^2$

$f_y = 410 N/mm^2$

$DE = 1.4 G_k + 1.6 Q_k$

G_k = weight of Slab = 0.175×24

partition = 1.0

finishes = 1.2

6.41kN/m

Assuming for factory

$DL = (1.4 \times 6.4) + (1.6 \times 5)$

$= 16.96 \simeq 17 kN/m$ line

Short Span Coefficent $= 0.044$

0.033

Long Span Coefficent $= 0.037$

0.028

Shortspan mid = ρ

$M = \beta x\, wl^2 x = 0.044 \times 17 \times 4^2$

$= 11.968$

$d = h - \text{Cover} - \frac{1}{2}\phi = 144$

$k = \frac{M}{bd^2 f_{cu}} = \frac{11.968 \times 10^6}{1000 \times 144^2 \times 25} = 0.023$

$Pa = 0.5 + \sqrt{0.25 - \frac{k}{0.9}} = 0.97 > 0.95$

$Z = Pa \cdot d = 0.95 \times 144 = 136.8$

$As = \frac{M}{0.95 f_y z} = \frac{11.968 \times 10^6}{0.95 \times 460 \times 136.8} = 224.61$

Provide y12 @ 377m

Solution

$M = \beta \times w l^2 x = 0.033 \times 17 \times 4^2 = 8.976$

$d = 144$

$k = \frac{M}{b d^2 f_{cu}} = \frac{8.976 \times 10^6}{1000 \times 144^2 \times 25} = 0.0173$

$l_a = 0.5 \sqrt{0.25 - \frac{k}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.0173}{0.9}}$

$= 0.83$

$z = l_a \cdot d = 0.83 \times 144 = 119.52$

$A_s = \frac{M}{0.95 f_y z} = \frac{8.976 \times 10^6}{0.95 \times 410 \times 119.52} = 192.81 mm$

Provide Y8 @ 377mm

Long Span

MiT

$d = d(\text{short span}) - \text{Steel thickness}$

$= 144 - 12 = 132mm$

$M = \beta x\, al^2x = 0.037 \times 17 \times 4^2 = 10.06$

$k = \frac{M}{bd^2 f_{cu}} = \frac{10.064 \times 10^6}{1000 \times 132^2 \times 25} = 0.0231$

$la = 0.5 + \sqrt{0.25 - \frac{k}{0.9}} = 0.97 > 0.95 = 0.95$

$z = la\, d = 0.95 \times 132 = 125.4$

$\frac{M}{0.95 f_y z} = \frac{10.064 \times 10^6}{0.95 \times 125.4 \times 410} = 206.06$

Provide Y10 at 317mm

Long span Continuation

$d = 132mm$

$M = \beta x\, wl^2x = 0.028 \times 17 \times 4^2 = 7.616$

$k = \frac{M}{bd^2 f_{cu}} = \frac{7.616 \times 10^6}{1000 \times 132^2 \times 25} = 0.017$

$la\ 0.5 + \sqrt{0.25 \frac{k}{0.9}} = 0.98 > 0.95 = 0.95$

$z = la\, d = 125.4$

Q1=

$As = \frac{M}{0.95 f_y z} = \frac{2.616 \times 10^6}{0.95 \times 410 \times 125.4} = 155.93$

Provide Y12@ 377m

Deflection Check

$f_s = \frac{2}{3} f_y \beta \frac{As\ req}{As\ provided}$

$f_s = \frac{2}{3} \times 250 \times 1 \times \frac{224.61}{377} = 99.3$

$M.F = 0.55 + \frac{477 - 99.3}{120\left(0.9 + \frac{11.98 \times 10^6}{1000 \times 144^2}\right)} = 2.687$

$d_{req} = \frac{4 \times 1000}{2 \times 26} = 76.92 = Ok$

4

.16

17

.95