| Company: | CRYSTALSOFT CONSULT | | | Two-way spanning reinforced concrete slab design to BS 8110-1 : 1997 | | |
|---|---|---|---|---|---|---|
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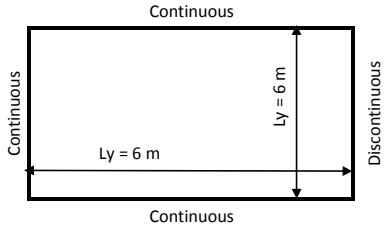
| Project: | LIBRARY COMPLEX | | | Atieku-Frans jonathan | November 28, 2010 | PG-20 |
| Client: | GnG | | | Checked by | Job number | Revision |
| Element: | ROOF SLAB - INTERIOR PANEL | | | A.A.A | CRY-14 | 1 |

| Reference | Calculation | Output |
|---|---|---|




Slab dimensions
Short span, Lx = 6 mm
Long span, Ly = 6 mm
Thickness, h= 150 mm
Cover, c= 20 mm

Material properties
concrete Strength, fcu = 30 N/mm²
Steel Strength, fy= 250 N/mm²
Density of concrete, ρ = 23.6 KN/m³
Reinforcement size, ϕ = 16 mm

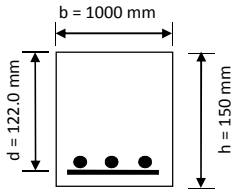
Loading
selfweight = 0.15 x 23.6 = 3.54 KN/m²
Partitions & finishes = 1.50 KN/m²
Total dead load, Gk = 5.04 KN/m²
Imposed Load, Qk = 2.50 KN/m²
Design Load, n = (1.4 x 5.04) + (1.6 x 2.5) = 11.06 KN/m² — n = 011.06 KN/m²

Bending Moment
Ly / Lx = 6 / 6 = 1.0
Slab designed as a two-way slab
One short edge discontinuous

BS 8110 Tab 3.14 — Mu = βsnLx

| Moment Coeff. | Ultimate Bending moment, Mu | Output |
|---|---|---|
| βsx⁺ = 0.029 | 0.029 x 11.06 x 6² = 11.6 KNm | Mux⁺ = 11.6 KNm |
| βsx⁻ = 0.039 | 0.039 x 11.06 x 6² = 15.4 KNm | Mux⁻ = 15.4 KNm |
| βsy⁺ = 0.028 | 0.028 x 11.06 x 6² = 10.9 KNm | Muy⁺ = 10.9 KNm |
| βsy⁻ = 0.037 | 0.037 x 11.06 x 6² = 14.6 KNm | Muy⁻ = 14.6 KNm |

**reinforcement for sagging moment - Short span**




d = 150 - 20 - 16 / 2 = 122.0 mm

$$k = \frac{M_u}{bd^2 f_{cu}} = \frac{1.6 \times 10^6}{0 \times 122.0^2 \times 30}$$

k = 0.026 ≤ 0.156 Hence compression reinforcement not needed

z = min {122.0 x [0.5 + √(0.25 - (0.026 / 0.9))] and 0.95 x 122.0}
z = min {118.37 , 115.9 }
z = 115.9 mm

$$A_{sreq} = \frac{M_u}{0.95 z f_y} = \frac{11.6 \times 10^6}{0.95 \times 115.9 \times 250.0}$$

Asreq = 420 mm² — Asreq = 420 mm²
Provide R16 @300 C-C B Asprov = 670 mm² — Provide R16 @300 C-C B, Asprov = 670 mm²

*checking for minimum reinforcement*

BS 8110 Tab 3.25 — $\frac{100 A_s}{bh}$ (100 x 670.206432765) / (1000 x 150) = 0.45 ≥ 0.24

Hence minimum reinforcement criteria satisfied

*checking for deflection*

$$\frac{M_u}{bd^2} = \frac{11.6 \times 10^6}{.000 \times 122.0^2}$$

= 0.78

BS 8110 Eqn 8 — $f_s = \frac{2}{3} f_y \frac{A_{sreq}}{A_{sprov}}$ (2 x 250 x 420 ) / (3 x 670) = 104.45 N/mm² — fs = 104.45 N/mm²

BS 8110 Tab 3.10 — Modification factor = 2.0

$$\text{Limiting } \frac{\text{span}}{\text{effective depth}} = 26 \times 2.0 = 52.00$$

$$\text{Actual } \frac{\text{span}}{\text{effective depth}} = (6 \times 10^3) / 122.0 = 49.18$$

**Deflection is within limit** — Deflection Ok

| Reference | Calculation | Output |
|---|---|---|
| | **reinforcement for hogging moment - Short span** | |
| | d = 150 - 20 - 16 - 8 = 122.0 mm | |
| | $k = \frac{M_u}{bd^2 f_{cu}} = \frac{15.4 \times 10^6}{1000 \times 122.0^2 \times 30}$ | |
| | k = 0.034 ≤ 0.156 Hence compression reinforcement not required | |
| | z = min {122.0 x [0.5 + √(0.25 - (0.034 / 0.9))] and 0.95 x 122.0} | |
| | z = min {117.13 , 115.9 } | |
| | z = 115.9 mm | |
| | $A_{sreq} = \frac{M_u}{0.95 z f_y} = \frac{15.4 \times 10^6}{0.95 \times 115.9 \times 250.0}$ | |
| | Asreq = 559 mm² | Asreq = 559 mm² |
| | Provide R16 @300 C-C T Asprov = 670 mm² | Provide R16 @300 C-C T<br>Asprov = 670 mm² |
| | *checking for minimum reinforment* | |
| BS 8110 Tab 3.25 | $\frac{100 A_s}{bh}$ =(100 x 670) / (1000 x 150) = 0.45 ≥ 0.24 | |
| | Hence minimum reinforcement criteria satisfied | |
| | **reinforcement for sagging moment - long span** | |
| | d = 150 - 20 - 16 - 8 = 106.0 mm | |
| | $k = \frac{M_u}{bd^2 f_{cu}} = \frac{10.9 \times 10^6}{1000 \times 106.0^2 \times 30}$ | |
| | k = 0.032 ≤ 0.156 Hence compression reinforcement not required | |
| | z = min {106.0 x [0.5 + √(0.25 - (0.032 / 0.9))] and 0.95 x 106.0} | |
| | z = min {102.04 , 100.7 } | |
| | z = 100.7 mm | |
| | $A_{sreq} = \frac{M_u}{0.95 z f_y} = \frac{10.9 \times 10^6}{0.95 \times 100.7 \times 250.0}$ | |
| | Asreq = 456 mm² | Asreq = 456 mm² |
| | Provide R16 @300 C-C B Asprov = 670 mm² | Provide R16 @300 C-C B<br>Asprov = 670 mm² |
| | *checking for minimum reinforcement* | |
| BS 8110 Tab 3.25 | $\frac{100 A_s}{bh}$ =(100 x 670.206432765) / (1000 x 150) = 0.45 ≥ 0.24 | |
| | Hence minimum reinforcement criteria satisfied | |
| | **reinforcement for hogging moment - Long span** | |
| | d = 150 - 20 - 16 - 8 = 106.0 mm | |
| | $k = \frac{M_u}{bd^2 f_{cu}} = \frac{14.6 \times 10^6}{1000 \times 106.0^2 \times 30}$ | |
| | k = 0.043 ≤ 0.156 Hence compression reinforcement not required | |
| | z = min {106.0 x [0.5 + √(0.25 - (0.043 / 0.9))] and 0.95 x 106.0} | |
| | z = min {100.63 , 100.7 } | |
| | z = 100.6 mm | |
| | $A_{sreq} = \frac{M_u}{0.95 z f_y} = \frac{14.6 \times 10^6}{0.95 \times 100.6 \times 250.0}$ | |
| | Asreq = 611 mm² | Asreq = 611 mm² |
| | Provide R16 @300 C-C T Asprov = 670 mm² | Provide R16 @300 C-C T<br>Asprov = 670 mm² |
| | *checking for minimum reinforcement* | |
| BS 8110 Tab 3.25 | $\frac{100 A_s}{bh}$ =(100 x 670) / (1000 x 150) = 0.45 ≥ 0.24 | |
| | Hence minimum reinforcement criteria satisfied | |