| Madent Al-Elem University College | Monthly Exam | Stage: 4th Group A |
| --- | --- | --- |
| College Of Engineering | Reinforced Concrete Design II | Time: 1 hr. |
| Civil Engineering Department | Subjects: Punching in Two Way Slab and DDM | Date: 23 / 12/ 2017 |

# Answer all Questions

**Q1 (50 %):** Check the two way shear action (punching shear) only around an edge Column (300×300) mm in a flat plate floor of a span (5.5 × 5.5) m. Find the area of vertical shear reinforcement if required. Assume d = 190 mm. Total $q_u$ = 25 kPa (including slab weight), $f_c$` = 28 MPa, $f_y$ = 414 MPa.

**Q2 (50 %):** for the longitudinal interior frame (A) of the flat plate floor shown in figure below by using direct design method find:

1. Longitudinal distribution of the static moment at factored loads.
2. Lateral distribution of the moment at exterior support.

Slab thickness = 170 mm, d =144 mm

$q_u$ = 20.0 kN/m$^2$

All edge beams = 350 × 700 mm

All columns = 500 × 500 mm

fc`= 25 Mpa, fy = 420 Mpa

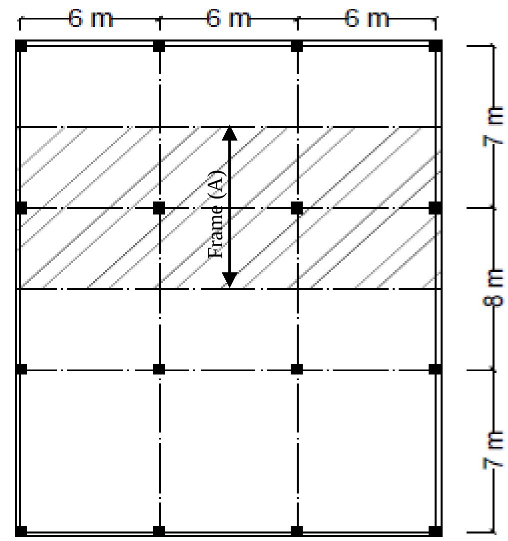


**Table 8.10.4.2—Distribution coefficients for end spans**

| | Exterior edge unrestrained | Slab with beams between all supports | Slab without beams between interior supports: Without edge beam | Slab without beams between interior supports: With edge beam | Exterior edge fully restrained |
| --- | --- | --- | --- | --- | --- |
| Interior negative | 0.75 | 0.70 | 0.70 | 0.70 | 0.65 |
| Positive | 0.63 | 0.57 | 0.52 | 0.50 | 0.35 |
| Exterior negative | 0 | 0.16 | 0.26 | 0.30 | 0.65 |

$$C = \Sigma\left(1 - 0.63\frac{x}{y}\right)\frac{x^3 y}{3} \qquad \beta_t = \frac{E_{cb}C}{2E_{cs}I_s}$$

**Table 8.10.5.1—Portion of interior negative $M_u$ in column strip**

| | $\ell_2/\ell_1$ | | |
| --- | --- | --- | --- |
| $\alpha_{f1}\ell_2/\ell_1$ | 0.5 | 1.0 | 2.0 |
| 0 | 0.75 | 0.75 | 0.75 |
| ≥1.0 | 0.90 | 0.75 | 0.45 |

Note: Linear interpolations shall be made between values shown.

**Table 8.10.5.2—Portion of exterior negative $M_u$ in column strip**

| | | $\ell_2/\ell_1$ | | |
| --- | --- | --- | --- | --- |
| $\alpha_{f1}\ell_2/\ell_1$ | $\beta_t$ | 0.5 | 1.0 | 2.0 |
| 0 | 0 | 1.0 | 1.0 | 1.0 |
| | ≥2.5 | 0.75 | 0.75 | 0.75 |
| ≥1.0 | 0 | 1.0 | 1.0 | 1.0 |
| | ≥2.5 | 0.90 | 0.75 | 0.45 |

Note: Linear interpolations shall be made between values shown. $\beta_t$ is calculated using Eq. (8.10.5.2a), where $C$ is calculated using Eq. (8.10.5.2b).

| | |
| --- | --- |
| $v_c$ with non shear reinforcement is least of | $0.33\,\lambda\sqrt{fc'}$ |
| | $0.17\left(1+\frac{2}{\beta}\right)\lambda\sqrt{fc'}$ |
| | $0.083\left(2+\frac{\alpha_s d}{b_o}\right)\lambda\sqrt{fc'}$ |
| $v_c$ with shear reinforcement | $v_c = 0.17\,\lambda\sqrt{fc'}$ |
| Maximum $v_u$ with shear reinforcement | $v_u = \phi 0.5\,\lambda\sqrt{fc'}$ |
| Shear resist by reinforcement | $v_s = \frac{v_u}{\phi} - v_c = \frac{A_V f_y}{b_o\,s}$ |

**Table 8.10.5.5—Portion of positive $M_u$ in column strip**

| | $\ell_2/\ell_1$ | | |
| --- | --- | --- | --- |
| $\alpha_{f1}\ell_2/\ell_1$ | 0.5 | 1.0 | 2.0 |
| 0 | 0.60 | 0.60 | 0.60 |
| ≥1.0 | 0.90 | 0.75 | 0.45 |

Note: Linear interpolations shall be made between values shown.

Note: β is the ratio of long side to short side of the column
$\lambda = 1$ for normal concrete ,$\alpha_s = 40$ for interior column,
$\alpha_s = 30$ for edge column & $\alpha_s = 20$ for corner column