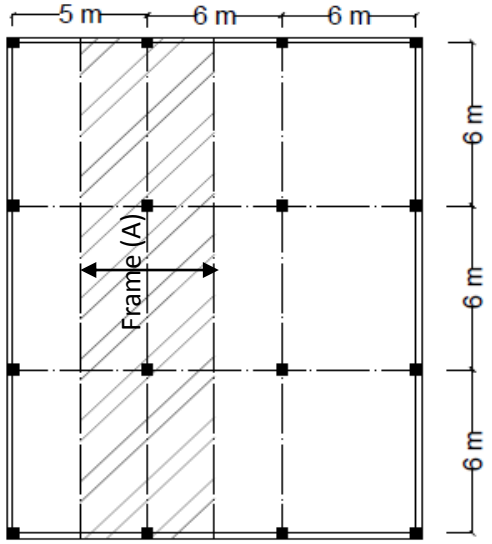
Madent Al-Elem University College | **Monthly Exam** | **Stage: 4th Group B**
College of Engineering | **Reinforced Concrete Design II** | **Time: 1 hr.**
Civil Engineering Department | **Subjects: Punching in Two Way Slab and DDM** | **Date: 23 / 12/ 2017**

Answer all Questions

Q1 (50 %): Check the two way shear action (punching shear) only around a corner column (450×450) mm in a flat plate floor of a span (7.5×7.5) m. Find the area of vertical shear reinforcement if required. Assume d =140 mm. Total q_u = 15 kPa (including slab weight), f_c`= 28 MPa, f_y = 414 MPa.

Q2 (50 %): for the transverse 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 = 35.0 kN/m^2
All edge beams = 350 × 700 mm
All columns = 400 × 400 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		Exterior edge fully restrained
			Without edge beam	With edge beam	
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

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

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	$v_s = \frac{v_u}{\phi} - v_c = \frac{A_V f_y}{b_o\, s}$

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

Table 8.10.5.1—Portion of interior negative M_u in column strip

$\alpha_{f1}\ell_2/\ell_1$	ℓ_2/ℓ_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

$\alpha_{f1}\ell_2/\ell_1$	β_t	ℓ_2/ℓ_1		
		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. β_t is calculated using Eq. (8.10.5.2a), where C is calculated using Eq. (8.10.5.2b).

Table 8.10.5.5—Portion of positive M_u in column strip

$\alpha_{f1}\ell_2/\ell_1$	ℓ_2/ℓ_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.