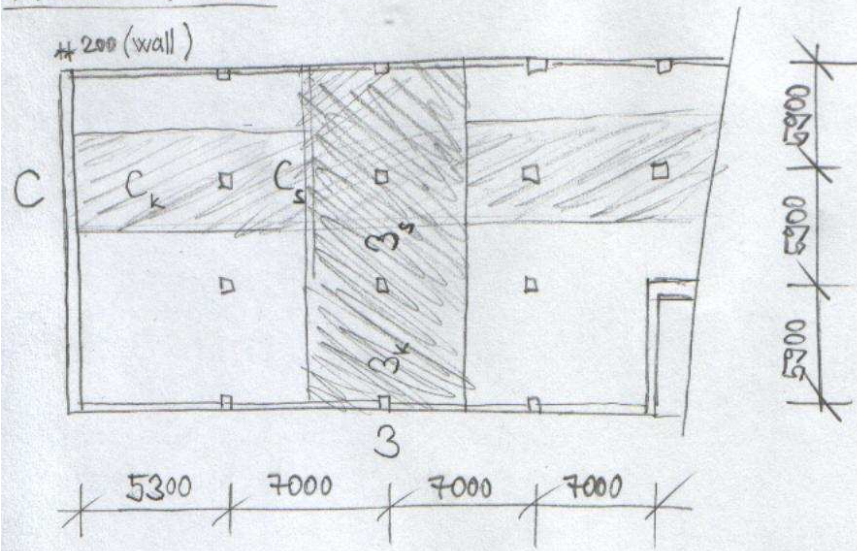


ASSIGNMENT

(1)



- $h_s = 220 \text{ mm}$ - depth of the slab
- $h_T = 500 \text{ mm}$ - height of edge beam
- $b_T = 200 \text{ mm}$ - width of edge beam
- $a = 400 \text{ mm}$ - dimension of the column
- $f = 15 \text{ kN/m}^2$ - design load

TOTAL MOMENTS (o = outer panel, in = inner panel)

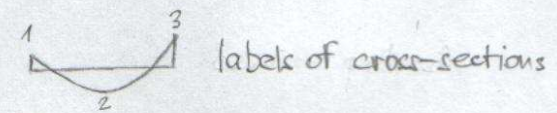
Panel C_o : $M_{tot} = \frac{1}{8} \cdot f \cdot b \cdot l_n^2 = \frac{1}{8} \cdot 15 \cdot 5,9 \cdot \left(5,3 - \frac{0,2}{2} - \frac{0,4}{2}\right)^2 = 276,56 \text{ kNm}$

Panel C_{in} : $M_{tot} = \frac{1}{8} \cdot f \cdot b \cdot l_n^2 = \frac{1}{8} \cdot 15 \cdot 5,9 \cdot \left(7 - \frac{0,4}{2} - \frac{0,4}{2}\right)^2 = 481,88 \text{ kNm}$

Panel 3_o : $M_{tot} = \frac{1}{8} \cdot f \cdot b \cdot l_n^2 = \frac{1}{8} \cdot 15 \cdot 7 \cdot \left(5,9 - \frac{0,4}{2} - \frac{0,4}{2}\right)^2 = 397,03 \text{ kNm}$

Panel 3_{in} : $M_{tot} = 397,03 \text{ kNm}$ (the same as 3_o)

POSITIVE AND NEGATIVE MOMENTS



Panel C_o :
 $M_1 = \mu_1 M_{tot} = 0,65 \cdot 276,56 = 179,76 \text{ kNm}$
 $M_2 = \mu_2 M_{tot} = 0,35 \cdot 276,56 = 96,80 \text{ kNm}$
 $M_3 = \mu_3 M_{tot} = 0,65 \cdot 276,56 = 179,76 \text{ kNm}$

μ coefficients for outer panel supported by wall

Panel C_{in} :
 $M_1 = \mu_1 M_{tot} = 0,65 \cdot 481,88 = 313,2 \text{ kNm}$
 $M_2 = \mu_2 M_{tot} = 0,35 \cdot 481,88 = 168,66 \text{ kNm}$
 $M_3 = \mu_3 M_{tot} = 0,65 \cdot 481,88 = 313,2 \text{ kNm}$

μ coefficients for inner panel

Panel 3_o :
 $M_1 = \mu_1 M_{tot} = 0,3 \cdot 397,03 = 119,11 \text{ kNm}$
 $M_2 = \mu_2 M_{tot} = 0,5 \cdot 397,03 = 198,5 \text{ kNm}$
 $M_3 = \mu_3 M_{tot} = 0,7 \cdot 397,03 = 277,92 \text{ kNm}$

μ coefficients for outer panel with edge beam

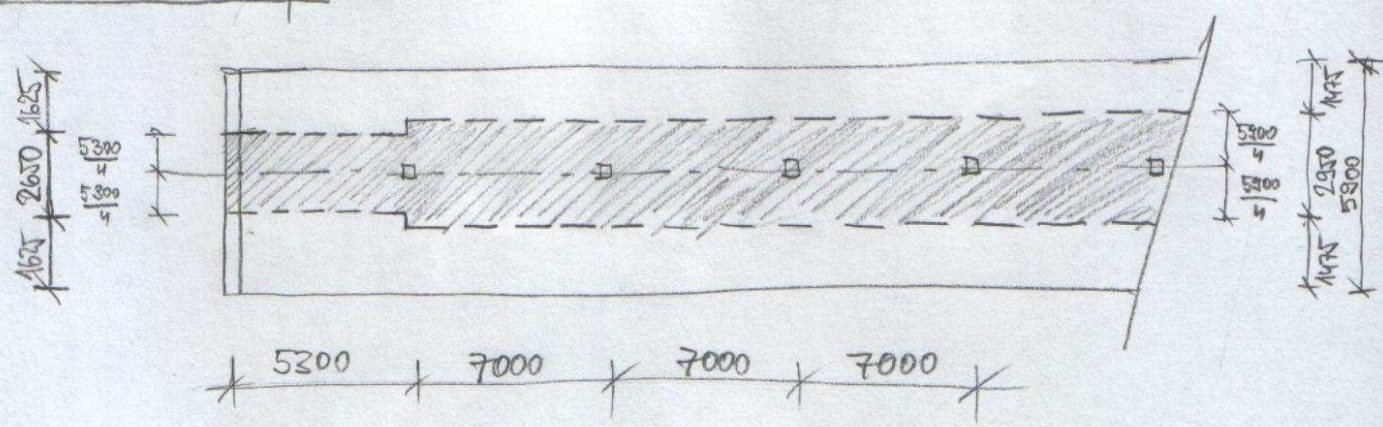
Panel 3_{in} :
 $M_1 = \mu_1 M_{tot} = 0,65 \cdot 397,03 = 258,07 \text{ kNm}$
 $M_2 = \mu_2 M_{tot} = 0,35 \cdot 397,03 = 138,96 \text{ kNm}$
 $M_3 = \mu_3 M_{tot} = 0,65 \cdot 397,03 = 258,07 \text{ kNm}$

μ coefficients for inner panel

MOMENTS IN COLUMN AND MIDDLE STRIPS

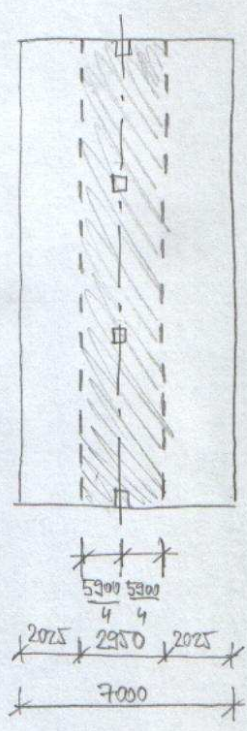
Dividing belts into strips

Belt C:



⇒ Panel C_o: column strip 2650 mm, middle strip 3250 mm
 Panel C_{in}: column strip 2950 mm, middle strip 2950 mm

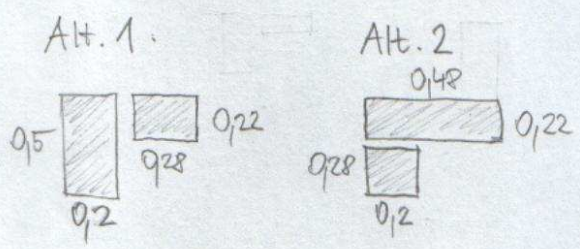
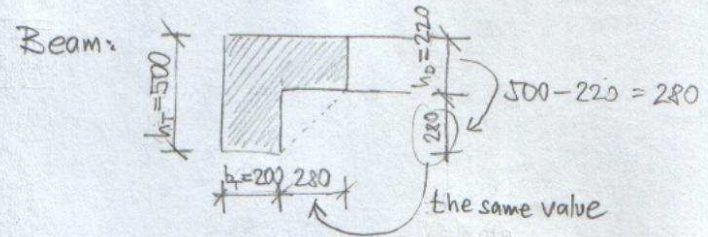
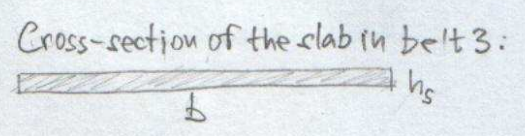
Belt 3:



⇒ For panels 3_o and 3_{in}:
 column strip 2950 mm
 middle strip 4050 mm

Calculation of R_t for edge beam

$$I_s = \frac{1}{12} \cdot b \cdot h_s^3 = \frac{1}{12} \cdot 7 \cdot 0,22^3 = 6,21 \cdot 10^{-3} \text{ m}^4$$



$I_t = \sum_{i=1}^2 (1 - 0,63 \frac{t_i}{a_i}) \frac{t_i^3 a_i}{3}$, where t_i is shorter and a_i is longer dimension of a rectangle

$$I_{t1} = (1 - 0,63 \cdot \frac{0,2}{0,28}) \cdot \frac{0,2^3 \cdot 0,28}{3} + (1 - 0,63 \cdot \frac{0,22}{0,28}) \cdot \frac{0,22^3 \cdot 0,28}{3} = 1,499 \cdot 10^{-3} \text{ m}^4$$

$$I_{t2} = (1 - 0,63 \cdot \frac{0,2}{0,28}) \cdot \frac{0,2^3 \cdot 0,28}{3} + (1 - 0,63 \cdot \frac{0,22}{0,48}) \cdot \frac{0,22^3 \cdot 0,48}{3} = 1,622 \cdot 10^{-3} \text{ m}^4$$

← We take higher value

$$R_t = \frac{I_t}{2I_s} = \frac{1,622 \cdot 10^{-3}}{2 \cdot 6,21 \cdot 10^{-3}} = 0,131$$

Calculation of moments in column and middle strips

• See attached table (I recommend you to do the calculation in Excel table as well)

• Values of ω coefficients:

- we take the values from the table from EC2 (see the presentation from the seminar)
- for negative moment on the edge with edge beam, we receive by interpolation:

$\beta_t = 0$	1,00
$\beta_t = 0,131$	ω
$\beta_t = 2,5$	0,75

$$\frac{2,5 - 0,131}{2,5 - 0} = \frac{0,75 - \omega}{0,75 - 1,00}$$

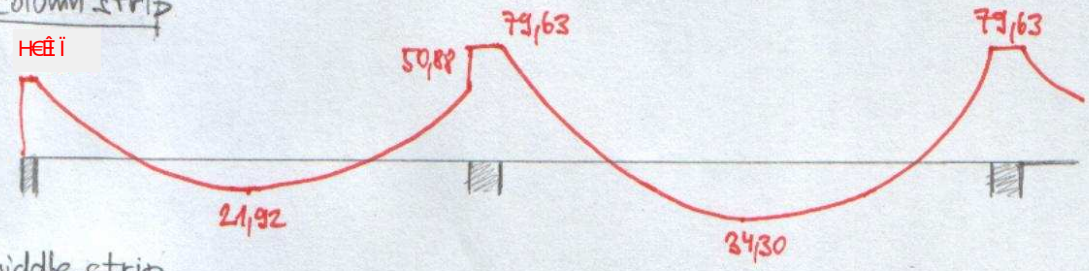
$$\omega = 0,986$$

• In the table, we have for column strip $M_j = \omega M_i$, for middle one $M_j = (1 - \omega) M_i$

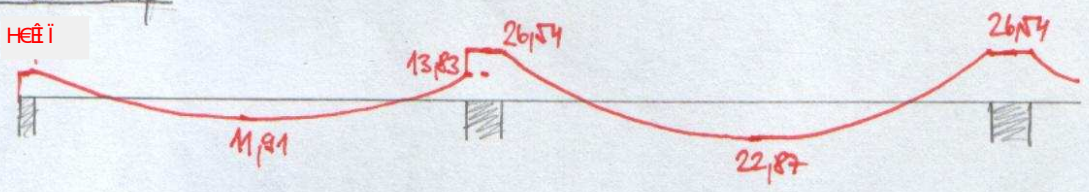
• Moments per 1m of the slab are: $m_j = \frac{M_i}{s_j}$

MOMENT CURVES [KNm/m]

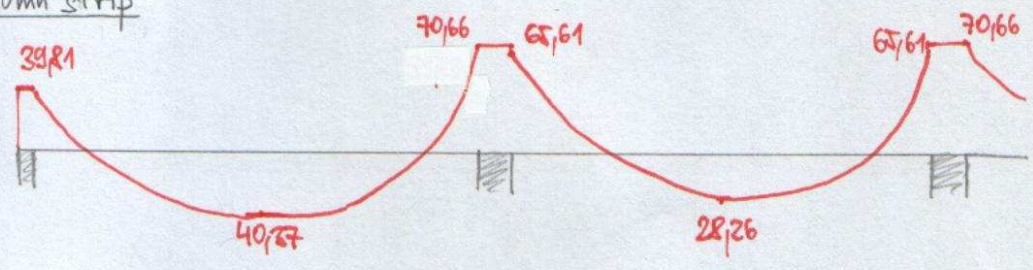
C-column strip



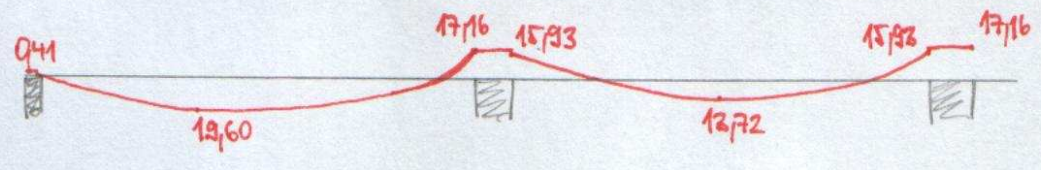
C-middle strip



B-column strip



B-middle strip



Moments in column and middle strips

Panel	Cross-section	Positive/negative moment M_i [kNm]	Strip	ω	Moment in column/middle strip M_j [kNm]	Width of the strip s_j [m]	Moment per 1 m of the slab m_j [kNm/m]
C_o	1 (left support)	179,76	no division	1,00	179,76	5,90	30,47
	2 (midspan)	96,80	Column	0,60	58,08	2,65	21,92
			Middle		38,72	3,25	11,91
	3 (right support)	179,76	Column	0,75	134,82	2,65	50,88
			Middle		44,94	3,25	13,83
	C_{in}	1 (left support)	313,20	Column	0,75	234,90	2,95
Middle				78,30		2,95	26,54
2 (midspan)		168,66	Column	0,60	101,20	2,95	34,30
			Middle		67,46	2,95	22,87
3 (right support)		313,20	Column	0,75	234,90	2,95	79,63
			Middle		78,30	2,95	26,54
3_o	1 (left support)	119,11	Column	0,99	117,44	2,95	39,81
			Middle		1,67	4,05	0,41
	2 (midspan)	198,50	Column	0,60	119,10	2,95	40,37
			Middle		79,40	4,05	19,60
	3 (right support)	277,92	Column	0,75	208,44	2,95	70,66
			Middle		69,48	4,05	17,16
3_{in}	1 (left support)	258,07	Column	0,75	193,55	2,95	65,61
			Middle		64,52	4,05	15,93
	2 (midspan)	138,96	Column	0,60	83,38	2,95	28,26
			Middle		55,58	4,05	13,72
	3 (right support)	258,07	Column	0,75	193,55	2,95	65,61
			Middle		64,52	4,05	15,93