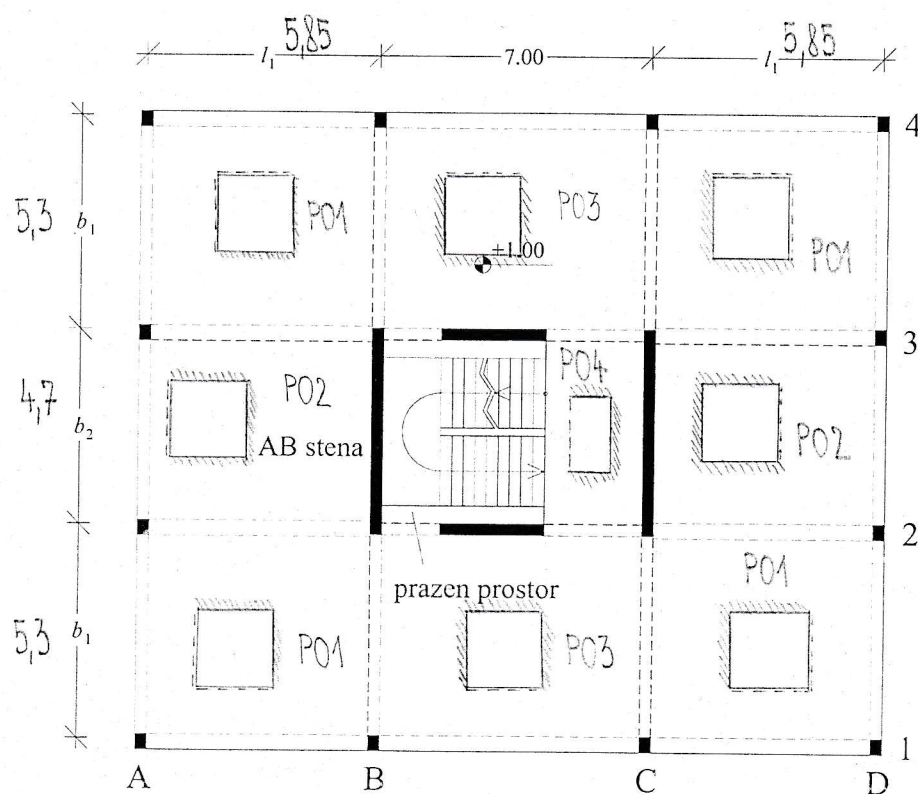
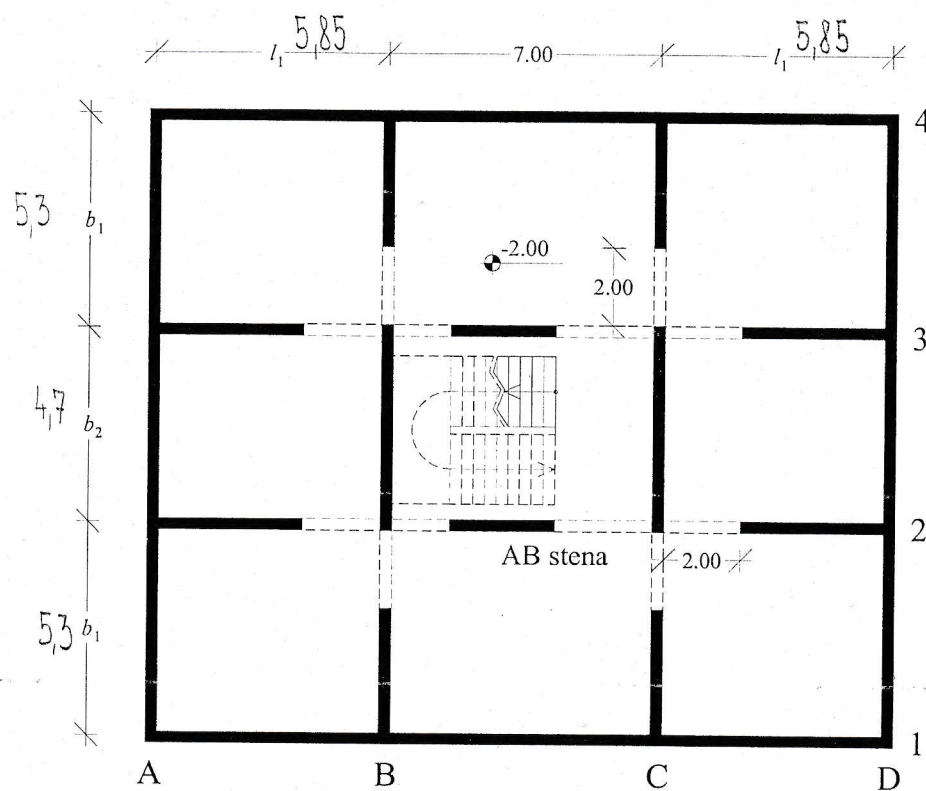


3.3. POZ P00 – Stropna konstrukcija nad kletjo

1. TLORIS KLETI IN POZICIJSKA SKICA:



2. OBTEŽBA:

(a) strop izven stopnišnega jedra:

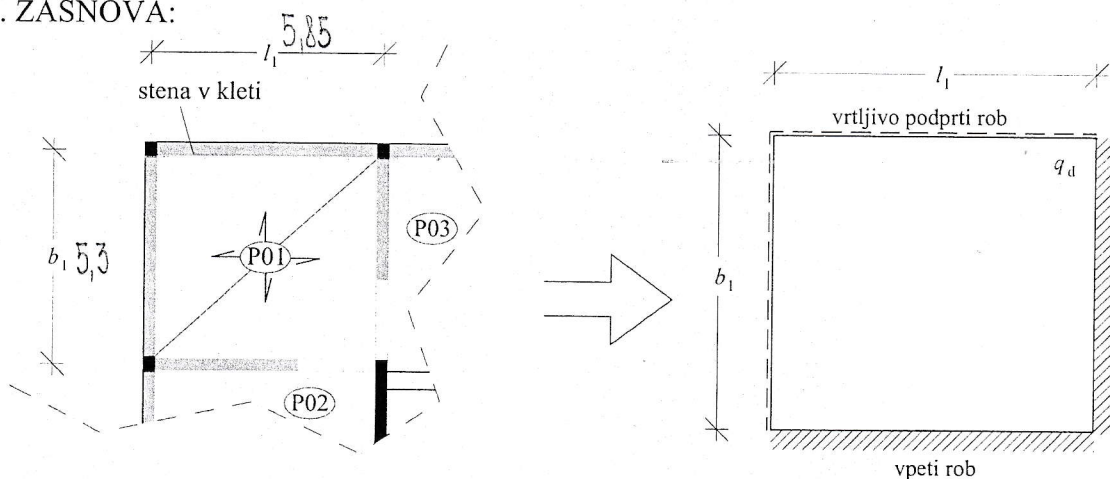
- stalna obtežba: $g = 6,67 \text{ kN/m}^2$
- koristna obtežba (kategorija C3-površine, kjer se zbirajo ljudje): $q = 5.0 \text{ kN/m}^2$

(b) območje stopnišnega jedra:

- stalna obtežba stopniščne rame: $g = 8,19 \text{ kN/m}^2$
plošča v stopniščnem jedru: $g = 7,17 \text{ kN/m}^2$
podest: $g = 5,42 \text{ kN/m}^2$
- koristna obtežba (kategorija C3): $q = 5.0 \text{ oz. } 3.0 \text{ kN/m}^2$

3.3.1. POZ P01 – dvosmerno nosilna AB plošča

1. ZASNOVA:



2. OBTEŽBA:

- stalna obtežba: $g = 6,67 \text{ kN/m}^2$
- koristna obtežba (kategorija C3): $q = 5.0 \text{ kN/m}^2$

računska (projektna) obtežba: $q_d = 1,35 \cdot 6,67 \text{ kN/m}^2 + 1,5 \cdot 5 \text{ kN/m}^2 = 16,5 \text{ kN/m}^2$

3. OBREMENITEV (uporaba Hahnovih tabel): (tabela 4, Czermy)

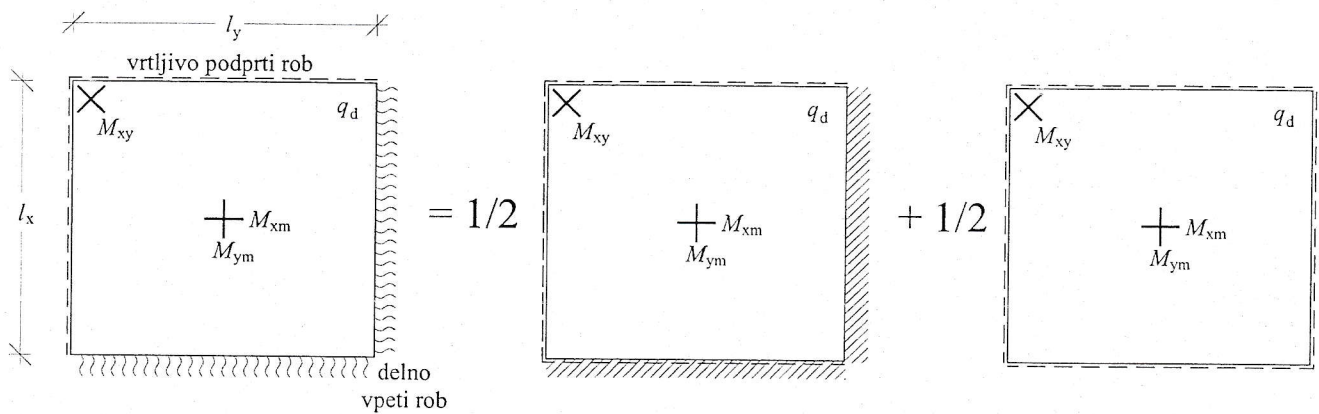
$$l_x = 5,3 \text{ m}$$

$$l_y = 5,85 \text{ m} \leftarrow \text{daljica}$$

$$\varepsilon = l_y / l_x = 5,85 / 5,3 = 1,1$$

$$K_d = q_d \cdot l_x \cdot l_y = 511,58 \text{ kN}$$

pozitivni momenti v polju plošče: *predpostavimo 50 % vpetost*

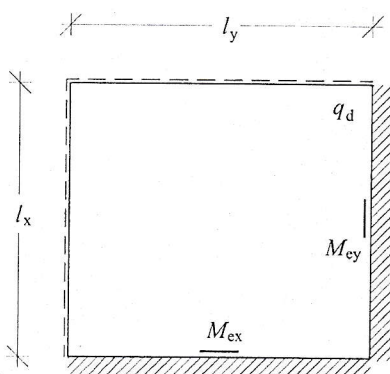


$$M_{xm,d} = \frac{1}{2} (M_{xm,d}^4 + M_{xm,d}^1) = \frac{1}{2} \left(\frac{K_d}{m_{xm}^4} + \frac{K_d}{m_{xm}^1} \right) = \frac{K_d}{2} \left(\frac{1}{m_{xm}^4} + \frac{1}{m_{xm}^1} \right) = \frac{511,58}{2} \cdot \left(\frac{1}{36,8} + \frac{1}{24,6} \right) = \underline{17,35 \text{ kNm}}$$

$$M_{ym,d} = \frac{1}{2} (M_{ym,d}^4 + M_{ym,d}^1) = \frac{K_d}{2} \left(\frac{1}{m_{ym}^4} + \frac{1}{m_{ym}^1} \right) = \frac{511,58}{2} \cdot \left(\frac{1}{46,2} + \frac{1}{30,9} \right) = \underline{13,87 \text{ kNm}}$$

$$M_{xy,d} = \frac{1}{2} (M_{xy,d}^4 + M_{xy,d}^1) = \frac{K_d}{2} \left(\frac{1}{m_{xy}^4} + \frac{1}{m_{xy}^1} \right) = \frac{511,58}{2} \cdot \left(\frac{1}{\text{---}} + \frac{1}{24,8} \right) = \underline{\pm 11,73 \text{ kNm}}$$

negativni momenti ob vpetih robovih plošče: *predpostavimo polno vpetost*

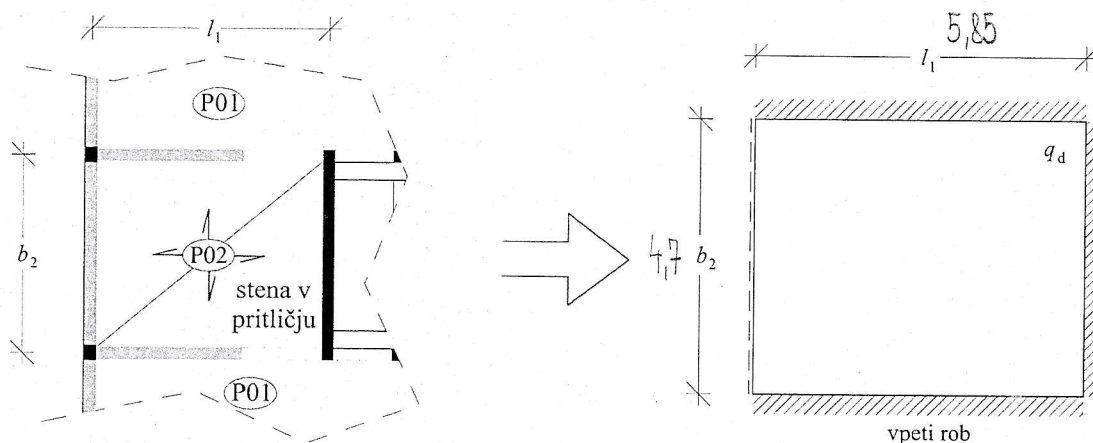


$$M_{ex,d} = \frac{K_d}{m_{ex}^4} = \frac{511,58}{14} = \underline{-36,54 \text{ kNm}}$$

$$M_{ey,d} = \frac{K_d}{m_{ey}^4} = \frac{511,58}{15} = \underline{-34,11 \text{ kNm}}$$

3.3.2. POZ P02 – dvosmerno nosilna AB plošča

1. ZASNOVA:



2. OBTEŽBA:

- stalna obtežba: $g = 6,67 \text{ kN/m}^2$
- koristna obtežba (kategorija C3): $q = 5,0 \text{ kN/m}^2$

računska (projektana) obtežba: $q_d = 16,5 \text{ kN/m}^2$

3. OBREMENITEV (uporaba Hahnovih tabel):

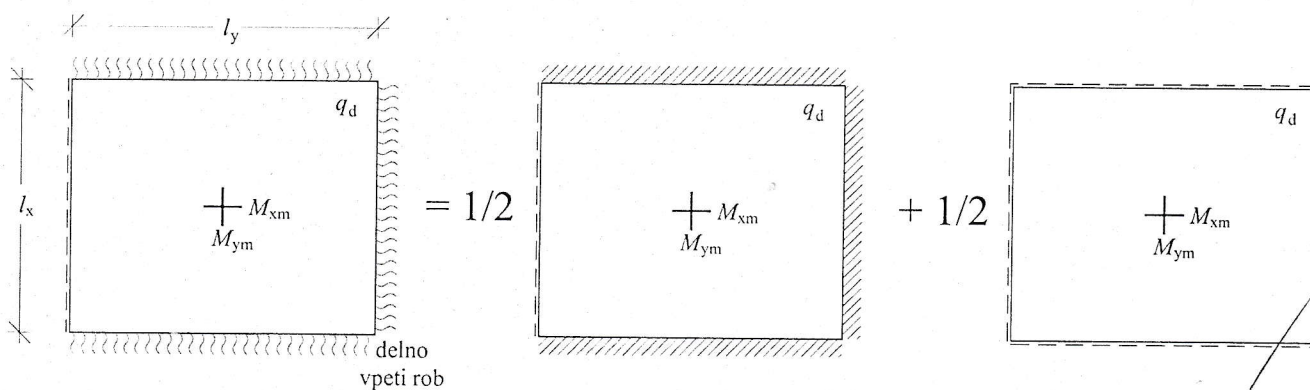
$$l_x = 4,7 \text{ m}$$

$$l_y = 5,85 \text{ m}$$

$$\varepsilon = l_y / l_x = 5,85 / 4,7 = 1,24$$

$$K_d = q_d \cdot l_x \cdot l_y = 453,67 \text{ kN}$$

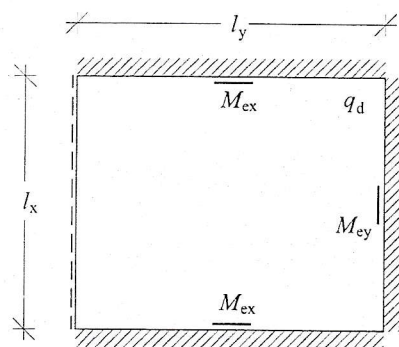
pozitivni momenti v polju plošče: predpostavimo 50 % vpetost



$$M_{x,m,d} = \frac{1}{2} (M_{x,m,d}^{5a} + M_{x,m,d}^1) = \frac{1}{2} \left(\frac{K_d}{m_{x,m}^{5a}} + \frac{K_d}{m_{x,m}^1} \right) = \frac{K_d}{2} \left(\frac{1}{m_{x,m}^{5a}} + \frac{1}{m_{x,m}^1} \right) = \frac{453,67}{2} \cdot \left(\frac{1}{40,44} + \frac{1}{22,42} \right) = 15,73 \text{ kNm}$$

$$M_{y,m,d} = \frac{1}{2} (M_{y,m,d}^{5a} + M_{y,m,d}^1) = \frac{K_d}{2} \left(\frac{1}{m_{y,m}^{5a}} + \frac{1}{m_{y,m}^1} \right) = \frac{453,67}{2} \cdot \left(\frac{1}{24,2} + \frac{1}{36,38} \right) = 8,9 \text{ kNm}$$

negativni momenti ob vpetih robovih plošče: *predpostavimo 100 % vpetost*

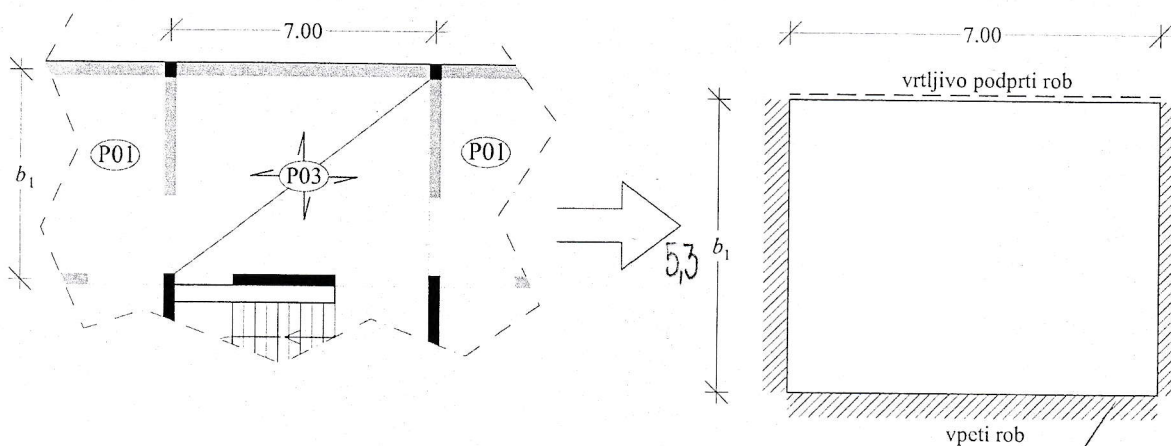


$$M_{ex,d} = \frac{K_d}{m_{ex}^{5a}} = \frac{453,67}{16,86} = -26,91 \text{ kNm}$$

$$M_{ey,d} = \frac{K_d}{m_{ey}^{5a}} = \frac{453,67}{21,54} = -21,06 \text{ kNm}$$

3.3.3. POZ P03 – dvosmerno nosilna AB plošča

1. ZASNOVA:



2. OBTEŽBA:

- stalna obtežba: $g = 6,67 \text{ kN/m}^2$
- koristna obtežba (kategorija C3): $q = 5,0 \text{ kN/m}^2$

računska (projektana) obtežba: $q_d = 16,5 \text{ kN/m}^2$

3. OBREMENITEV (uporaba Hahnovih tabel):

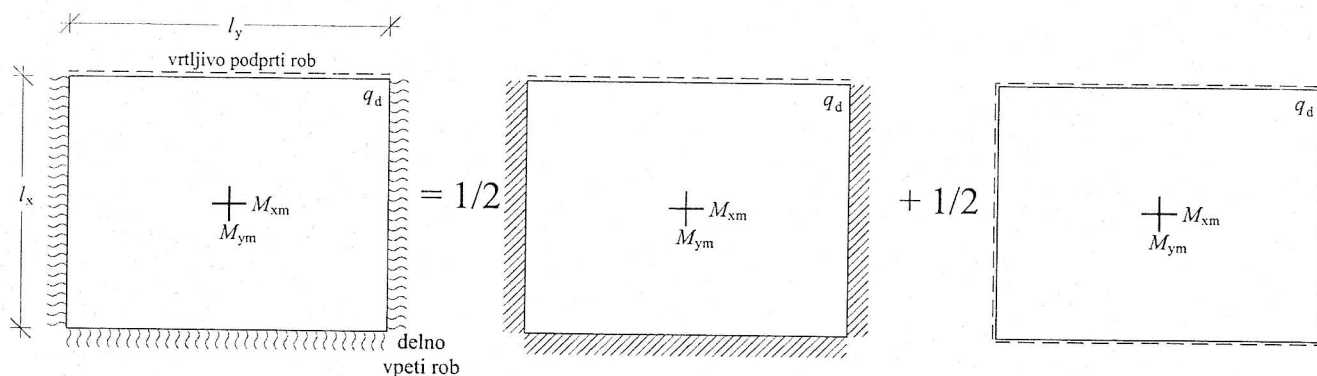
$$l_x = 5,3 \text{ m}$$

$$l_y = 7 \text{ m}$$

$$\varepsilon = l_y / l_x = 7 / 5,3 = 1,32$$

$$K_d = q_d \cdot l_x \cdot l_y = 612,15 \text{ kN}$$

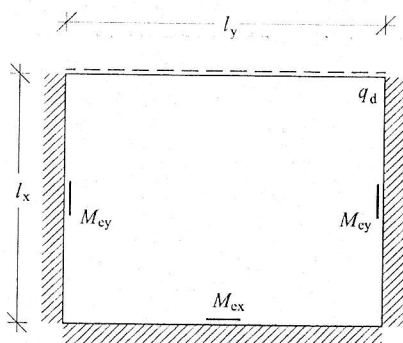
pozitivni momenti v polju plošče: *predpostavimo 50 % vpetost*



$$M_{xm,d} = \frac{1}{2} (M_{xm,d}^{sb} + M_{xm,d}^l) = \frac{1}{2} \left(\frac{K_d}{m_{xm}^{sb}} + \frac{K_d}{m_{xm}^l} \right) = \frac{K_d}{2} \left(\frac{1}{m_{xm}^{sb}} + \frac{1}{m_{xm}^l} \right) = \frac{612,15}{2} \cdot \left(\frac{1}{40,82} + \frac{1}{21,64} \right) = \underline{21,64 \text{ kNm}}$$

$$M_{ym,d} = \frac{1}{2} (M_{ym,d}^{sb} + M_{ym,d}^l) = \frac{K_d}{2} \left(\frac{1}{m_{ym}^{sb}} + \frac{1}{m_{ym}^l} \right) = \frac{612,15}{2} \cdot \left(\frac{1}{62,76} + \frac{1}{41,32} \right) = \underline{12,28 \text{ kNm}}$$

negativni momenti ob vpetih robovih plošče: *predpostavimo 100 % vpetost*

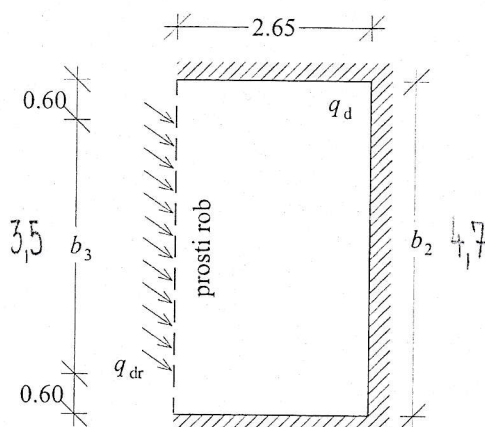


$$M_{cx,d} = \frac{K_d}{m_{cx}^{sb}} = \frac{612,15}{15,46} = \underline{-38,84 \text{ kNm}}$$

$$M_{cy,d} = \frac{K_d}{m_{cy}^{sb}} = \frac{612,15}{17,46} = \underline{-35,06 \text{ kNm}}$$

3.3.4. POZ P04 – AB plošča ob stopnišču

1. ZASNOVA:



2. OBTEŽBA:

- stalna obtežba: $g = 7,17 \text{ kN/m}^2$
stalna obtežba stopnic-akcija stopnic na prostem robu plošče: $g_r = 18,23 \text{ kN/m}$
- koristna obtežba (kategorija C3): $q = 5.0 \text{ kN/m}^2$
koristna obtežba stopnic (A)-akcija stopnic na prostem robu plošče: $q_r = 6,98 \text{ kN/m}$

3. OBREMENITEV (uporaba Hahnovih tabel):

$$l_y = 2,65 \text{ m}$$

$$l_x = 4,7 \text{ m}$$

$$\varepsilon = 0,56$$

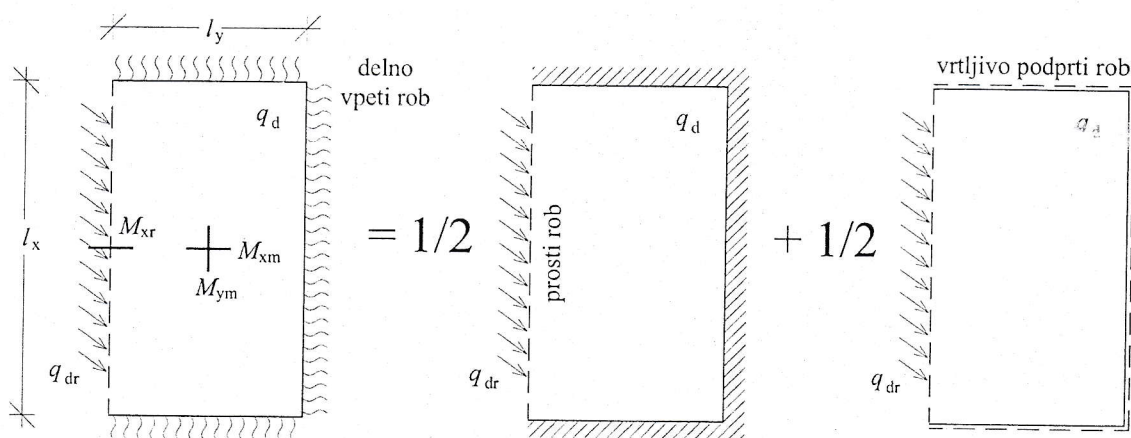
$$K_d = q_d \cdot l_x \cdot l_y = 213,98 \text{ kN}, \quad S_d = \bar{q}_{dr} \cdot l_x = 15,11 \text{ kN}$$

$$q_{nd} = 1,35 \cdot g_n + 1,5 \cdot q_n = 35,08 \text{ kN/m}$$

$$\bar{q}_{nd} = 32,79 \text{ kN/m}$$

$$q_d = 1,35 \cdot 7,17 + 1,5 \cdot 5 = 17,18 \text{ kN/m}^2$$

pozitivni momenti v polju plošče: predpostavimo 50 % vpetost

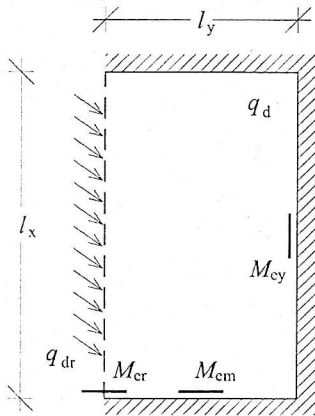


$$M_{x_{r,d}} = \frac{1}{2} (M_{x_{r,d}}^{22} + M_{x_{r,d}}^{17a}) = \frac{1}{2} \left[\left(\frac{K_d}{m_{x_r}^{22(1)}} + \frac{S_d}{m_{x_r}^{21(3)}} \right) + \left(\frac{K_d}{m_{x_r}^{17a(1)}} + \frac{S_d}{m_{x_r}^{17a(3)}} \right) \right] = \frac{1}{2} \cdot \left[\left(\frac{213,98}{20,4} + \frac{15,11}{7,48} \right) + \left(\frac{213,98}{9,44} + \frac{15,11}{4,66} \right) \right] = 43,85 \text{ kNm}$$

$$M_{x_{m,d}} = \frac{1}{2} (M_{x_{m,d}}^{22} + M_{x_{m,d}}^{17a}) = \frac{1}{2} \left[\left(\frac{K_d}{m_{x_m}^{22(1)}} + \frac{S_d}{m_{x_m}^{21(3)}} \right) + \left(\frac{K_d}{m_{x_m}^{17a(1)}} + \frac{S_d}{m_{x_m}^{17a(3)}} \right) \right] = \frac{1}{2} \cdot \left[\left(\frac{213,98}{41,4} + \frac{15,11}{24,2} \right) + \left(\frac{213,98}{15,92} + \frac{15,11}{9,36} \right) \right] = 21,16 \text{ kNm}$$

$$M_{ym,d} = \frac{1}{2}(M_{ym,d}^{22} + M_{ym,d}^{17a}) = \frac{1}{2} \left[\left(\frac{K_d}{m_{ym}^{22(1)}} + \frac{S_d}{m_{ym}^{21(3)}} \right) + \left(\frac{K_d}{m_{ym}^{17a(1)}} + \frac{S_d}{m_{ym}^{17a(3)}} \right) \right] = \frac{1}{2} \left[\left(\frac{243,98}{81,36} + \frac{154,41}{15,48} \right) + \left(\frac{243,98}{26,8} + \frac{154,41}{45,06} \right) \right] = 12,00 \text{ kNm}$$

negativni momenti ob vpetem robu plošče: predpostavimo 100 % vpetost



$$M_{cr,d} = \frac{K_d}{m_{cr}^{22(1)}} + \frac{S_d}{m_{cr}^{21(3)}} = \frac{243,98}{7,46} + \frac{154,41}{2,28} = -97,48 \text{ kNm}$$

$$M_{cm,d} = \frac{K_d}{m_{cm}^{22(1)}} + \frac{S_d}{m_{cm}^{21(3)}} = \frac{243,98}{15,44} + \frac{154,41}{10,56} = -28,73 \text{ kNm}$$

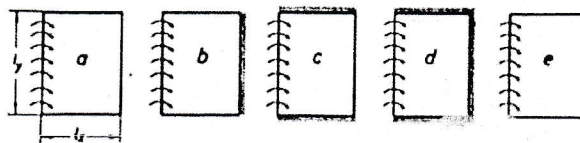
$$M_{ey,d} = \frac{K_d}{m_{ey}^{22(1)}} + \frac{S_d}{m_{ey}^{21(3)}} = \frac{243,98}{10,58} + \frac{154,41}{7,42} = -41,87 \text{ kNm}$$

3.3.5. Izravnava momentov v POZ P00

Bei $\epsilon \geq 1,0$: $k = E d^3 \rho : l_x$

Bei $\epsilon < 1,0$: $k = E d^3 \rho : l_y$

$$\epsilon = l_y : l_x$$



Fall	$\epsilon =$	0	1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2,0	3,0	4,0	8,0
a	alle Seiten frei gestützt	2,11	2,14	1,96	1,83	1,73	1,64	1,55	1,48	1,43	1,39	1,36	1,33	1,18	1,08	1,01
b	Gegenseite voll eingespannt	2,14	2,22	2,07	1,95	1,85	1,78	1,73	1,68	1,63	1,60	1,57	1,55	1,45	1,38	1,33
c	Nachbarseiten voll eingespannt	2,50	2,50	2,30	2,13	1,99	1,86	1,76	1,66	1,58	1,52	1,46	1,42	1,19	1,08	1,01
d	Drei Seiten voll eingespannt	2,50	2,50	2,32	2,17	2,05	1,94	1,86	1,79	1,73	1,68	1,64	1,61	1,42	1,37	1,33
e	Gegenseite ungestützt	2,14	2,07	1,86	1,68	1,52	1,39	1,27	1,17	1,08	1,00	0,95	0,90	0,50	0,32	0,10

IZRAVNAVA MOMENTOV

- POZ P01 - POZ P02

$$M_{e1} = -36,54 \text{ kNm}$$

$$M_{e2} = -26,91 \text{ kNm}$$

$$K_{d1} = 511,58 \text{ kN}$$

$$K_{d2} = 453,67 \text{ kN}$$

$$M_{e12} = \frac{K_{d2}}{K_{d1} + K_{d2}} \cdot M_{e1} + \frac{K_{d1}}{K_{d1} + K_{d2}} \cdot M_{e2} = 0,470 \cdot (-36,54) + 0,530 \cdot (-26,91) = \underline{-31,44 \text{ kNm}}$$

- POZ P01 - POZ P03

$$M_{e1} = -34,11 \text{ kNm}$$

$$M_{e3} = -35,06 \text{ kNm}$$

$$K_{d1} = 511,58 \text{ kN}$$

$$K_{d3} = 612,15 \text{ kN}$$

$$M_{e13} = 0,5448 \cdot (-34,11) + 0,4552 \cdot (-35,06) = \underline{-34,54 \text{ kNm}}$$

- POZ P02 - POZ P04

$$M_{e2} = -21,06 \text{ kNm}$$

$$M_{e4} = -41,87 \text{ kNm}$$

$$K_{d2} = 453,67 \text{ kN}$$

$$K_{d4} = 213,98 \text{ kN}$$

$$M_{e24} = 0,3205 \cdot (-21,06) + 0,6795 \cdot (-41,87) = \underline{35,20 \text{ kNm}}$$

- POZ P03 - POZ P04

$$M_{e3} = -38,84 \text{ kNm}$$

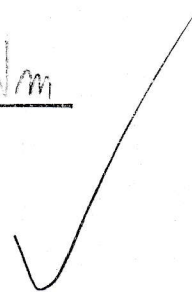
$$M_{e4} = -97,48 \text{ kNm}$$

$$K_{e3} = \frac{2,65 \text{ m}}{7 \text{ m}} \cdot 612,15 \text{ kN} = 231,74 \text{ kN}$$

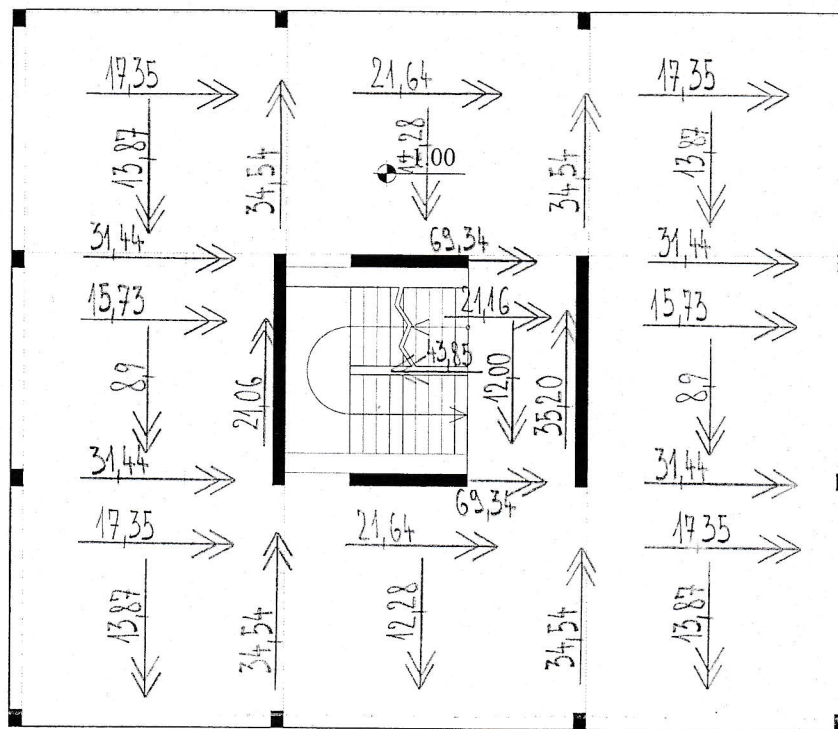
$$K_{d4} = 213,98 \text{ kN}$$

↑
reduciran, ker ni stikovanja po celi dolžini

$$M_{e34} = 0,48 \cdot (-38,84) + 0,52 \cdot (-97,48) = \underline{-69,34 \text{ kNm}}$$



→ v spodnjo skico vpišemo ekstremne vrednosti momentov ("peš" postopek računa):



← lege obramenitve
niso čisti ok!