

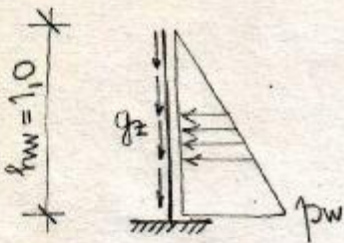
Za konstrukciju skvadukta prikazanu na skici potrebno je:

1. Dimenzionisati armaturu ploče POS 1 ($d_p = 20$ cm). Za usvojeni raspored armature sračunati razmak i karakterističnu širinu prslina (pri tome zanemariti silu zatezanja).
2. Sračunati uticaje i dimenzionisati gredu POS 2 u karakterističnim presecima. Osiguranje od glavnih napona zatezanja izvršiti vertikalnim uzengijama i kosim profilima.
3. Dimenzionisati POS 3 u karakterističnim presecima i po potrebi izvršiti osiguranje od glavnih napona zatezanja.
4. Dimenzionisati armaturu za POS S1 (40/30 cm). Usvojiti $l_1 = 5$ m.
5. Dimenzionisati armaturu za POS S2 (20/20 cm). Sa usvojenim rasporedom armature sračunati razmak i širinu prslina i izduženje štapa.

Sva dimenzionisanja sprovesti po teoriji granične nosivosti. Prikazati usvojeni raspored armature u svim sračunatim poprečnim presecima. Nedostajuće podatke usvojiti prema BAB 87.

POS 1 - ПЛОЧА

1.



$$g_z = 0,20 \cdot 25,0 = 5,0 \text{ kN/m}^2$$

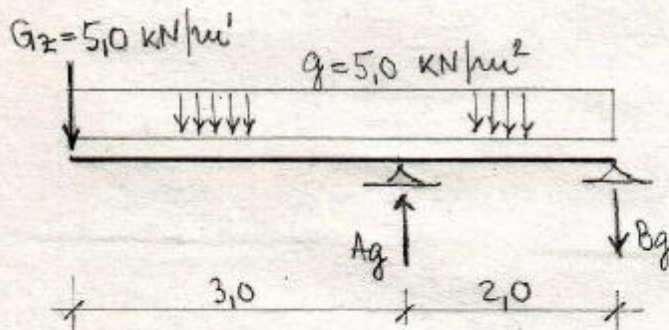
$$p_w = p_w \cdot \gamma_w = 10 \cdot 10,0 = 10,0 \text{ kN/m}^2$$

$$G_z = g_z \cdot h_w = 5,0 \cdot 1,0 = 5,0 \text{ kN/m}'$$

$$H_w = p_w \cdot h_w / 2 = 10,0 \cdot 1,0 / 2 = 5,0 \text{ kN/m}'$$

$$M_w = p_w \cdot h_w^2 / 6 = 10,0 \cdot 1,0^2 / 6 = 1,67 \text{ kNm/m}'$$

а) СТАЛНО ОПТЕРЕЋЕЊЕ



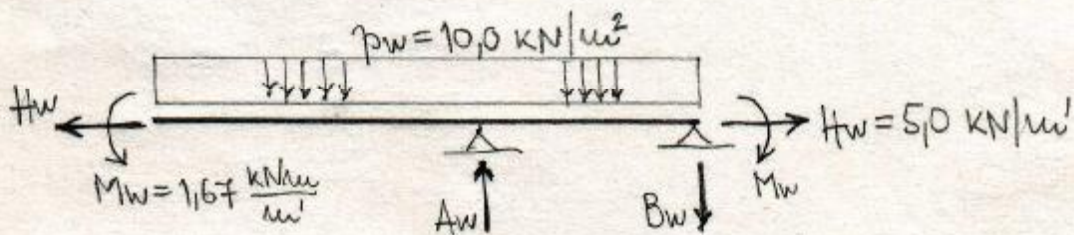
$$g = 0,20 \cdot 25,0 = 5,0 \text{ kN/m}^2$$

$$\Sigma V_g = 5,0 + 5,0 \cdot 5,0 = 30,0 \text{ kN/m}'$$

$$A_g = \frac{1}{2,0} \cdot (5,0 \cdot 5,0 + 5,0 \cdot 5,0^2 / 2) = 43,75 \text{ kN/m}'$$

$$B_g = 30,0 - 43,75 = -13,75 \text{ kN/m}'$$

б) ВОДА



$$\Sigma V_w = 10,0 \cdot 5,0 = 50,0 \text{ kN/m}'$$

$$A_w = \frac{1}{2,0} \cdot 10,0 \cdot 5,0^2 / 2 = 62,5 \text{ kN/m}'$$

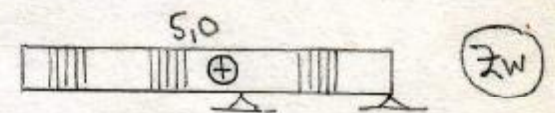
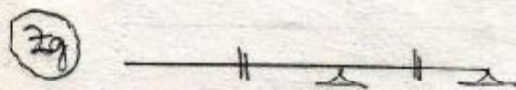
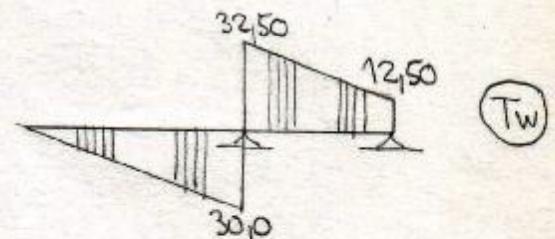
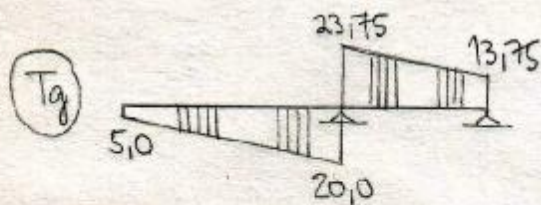
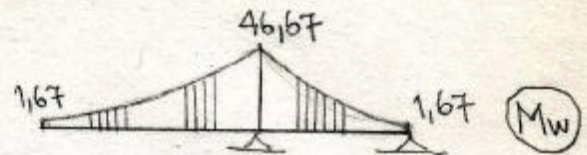
$$B_w = 50,0 - 62,5 = -12,5 \text{ kN/m}'$$

ДИЈАГРАМИ СТАТИЧКИХ УТИЦАЈА

2.

а) СТАЛНО ОПТЕРЕЋЕЊЕ

б) ВОДА



ДИМЕНЗИОНИСАЊЕ

$$b/d/h = 100/20/17 \text{ cm}$$

$$M_u = 1,6 \cdot 37,5 + 1,8 \cdot 46,67 = 144,0 \text{ kNm/m'}$$

$$z_u = 1,8 \cdot 5,0 = 9,0 \text{ kN/m'}$$

$$M_{all} = 144,0 - 9,0 \cdot \left(\frac{0,20}{2} - 0,03\right) = 143,37 \text{ kNm/m'}$$

$$k = \frac{17,0}{\sqrt{\frac{143,37}{2,05}}} = 2,033 \longrightarrow \epsilon_b/\epsilon_a = 3,5/6,5\%$$

$$\bar{\mu} = 28,333\%$$

$$A_a = 28,333 \cdot 17,0 \cdot \frac{2,05}{40,0} + \frac{9,0}{40,0} = 24,91 \text{ cm}^2/\text{m'}$$

УСВОЈЕНО R ϕ 19/10 (28,35 cm²/m')

$$A_{ap} = 0,20 \cdot 24,91 = 4,98 \text{ cm}^2/\text{m'}$$

УСВОЈЕНО R ϕ 12/20 (5,65 cm²/m')

$$T_{c, \max} = 1,6 \cdot 23,75 + 1,8 \cdot 32,5 = 96,5 \text{ kN/m'}$$

$$T_n = \frac{96,5}{100 \cdot 0,9 \cdot 17} = 0,063 \text{ kN/cm}^2 < T_c = 0,11 \text{ kN/cm}^2$$

НИЈЕ ПОТРЕБНО ОСИГУРАЊЕ АРМАТУРОМ ОД ГЛАВНИХ НАПОНА ЗАТЕЗАЊА.

ПРОРАЧУН ПРСЛИНА

$$a_0 = a - \phi/2 = 3,0 - 1,9/2 = 2,05 \text{ cm}$$

$$e_\phi = 10,0 \text{ cm}$$

$$k_1 = 0,4 \text{ (RA 400/500)}$$

$$k_2 = 0,125 \text{ (САБИЈАЊЕ)}$$

$$r_{bz,ef} = \text{MIN.} \left\{ \begin{array}{l} a + 7,5\phi = 3,0 + 7,5 \cdot 1,9 = 17,25 \text{ cm} \\ d_p/2 = 20,0/2 = 10,0 \text{ cm} \end{array} \right\} = 10,0 \text{ cm}$$

$$\mu_{z,ef} = \frac{A_{a1}}{b \cdot r_{bz,ef}} = \frac{28,35}{100,0 \cdot 10,0} = 0,028$$

$$l_{ps} = 2 \cdot \left(2,05 + \frac{10,0}{10} \right) + 0,4 \cdot 0,125 \cdot \frac{1,9}{0,028} = 9,45 \text{ cm}$$

$$\boxed{l_{ps} = 9,45 \text{ cm}} \rightarrow \text{СРЕДЊЕ РАСТОЈАЊЕ ПРСЛИНА}$$

$$\left. \begin{array}{l} \mu = \frac{A_{a1}}{b \cdot l_p} = \frac{28,35}{100 \cdot 17} = 0,017 \\ n = \frac{210}{31,5} = 6,67 \\ \mu_2 = 0 \text{ (} A_{a2} = 0 \text{)} \end{array} \right\} \begin{array}{l} s^2 + 2 \cdot 6,67 \cdot 0,017 \cdot s - 2 \cdot 6,67 \cdot 0,017 = 0 \\ s^2 + 0,222 \cdot s - 0,222 = 0 \\ \boxed{s = 0,373} \end{array}$$

$$M = M_g + M_w = 37,5 + 46,67 = 84,17 \text{ kNm/m}$$

$$z_g = r \left(1 - \frac{s}{3} \right) = 17,0 \cdot \left(1 - \frac{0,373}{3} \right) = 14,89 \text{ cm}$$

$$\sigma_{a1} = \frac{M}{z_g \cdot A_{a1}} = \frac{84,17}{14,89 \cdot 28,35} = 19,94 \text{ kN/cm}^2 = 199,4 \text{ MPa}$$

$$\epsilon_{a1} = \frac{199,4}{210 \cdot 10^3} = 0,950 \%$$

$$f_{bzS} = 0,7 \cdot 2,4 \cdot \left(0,6 + \frac{0,4}{\sqrt[3]{0,20}} \right) = 2,01 \text{ MPa} = 0,201 \text{ kN/cm}^2$$

$$W_{b1} = \frac{100 \cdot 20^2}{6} = 6666,67 \text{ cm}^3$$

$$M^* \approx f_{bzS} \cdot W_{b1} = 0,201 \cdot 6666,67 \cdot 10^{-2} = 13,42 \text{ kNm/m}$$

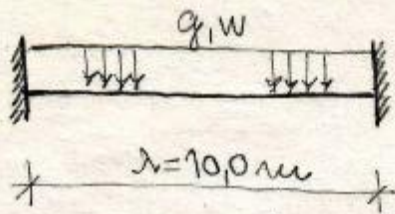
$$\left. \begin{array}{l} \beta_1 = 1,0 \text{ (RA 400/500)} \\ \beta_2 = 1,0 \text{ (} \epsilon = 0 \text{)} \end{array} \right\} \xi_a = 1 - 1,0 \cdot 1,0 \cdot \left(\frac{13,42}{84,17} \right)^2 = 0,975$$

$$\epsilon_{a1,SR} = \xi_a \cdot \epsilon_{a1} = 0,975 \cdot 0,950 = 0,926 \%$$

$$s_{prk} = 1,7 \cdot \epsilon_{a1,SR} \cdot l_{ps} = 1,7 \cdot 0,926 \cdot 10^{-3} \cdot 9,45 = 14,9 \cdot 10^{-3} \text{ cm}$$

$$\boxed{s_{prk} = 0,149 \text{ mm}} \rightarrow \text{КАРАКТЕРИСТИЧНА ШИРИНА ПРСЛИНА}$$

POS 2 - КОНТИНУАЛНА ГРЕДА



- СОПСТВЕНА ТЕЖИНА : $0,40 \cdot (1,0 - 0,20) \cdot 25,0 = 8,0 \text{ kN/m}'$
- СТАЛНО ОПТ. ОД POS 1 : $A_g = 43,75 \text{ kN/m}'$

$$q = 51,75 \text{ kN/m}'$$

- ВОДА (ОД POS 1):

$$A_w = w = 62,5 \text{ kN/m}'$$

а) СТАЛНО ОПТЕРЕЋЕЊЕ

$$M_g^o = 51,75 \cdot 10,0^2 / 12 = 431,25 \text{ kNm}$$

$$M_g^p = 51,75 \cdot 10,0^2 / 24 = 215,63 \text{ kNm}$$

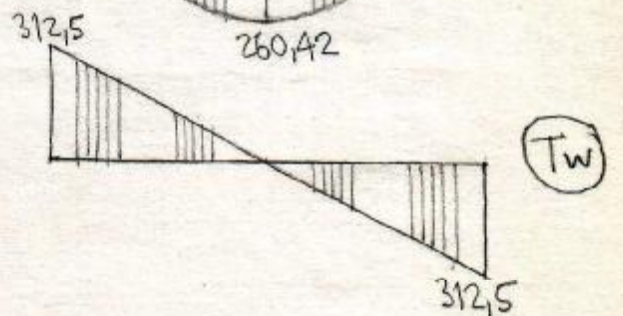
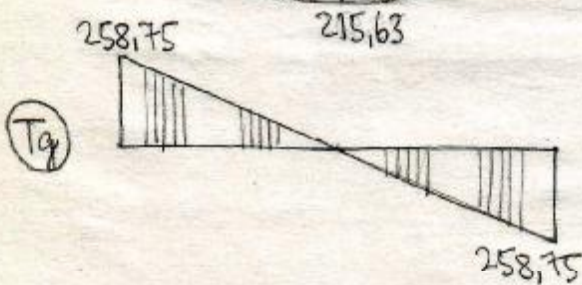
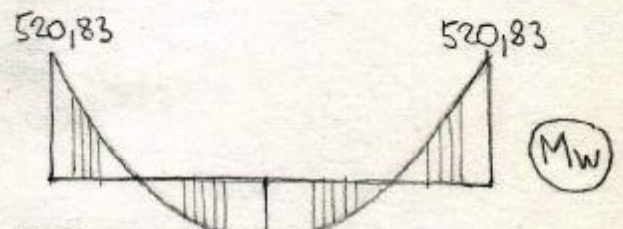
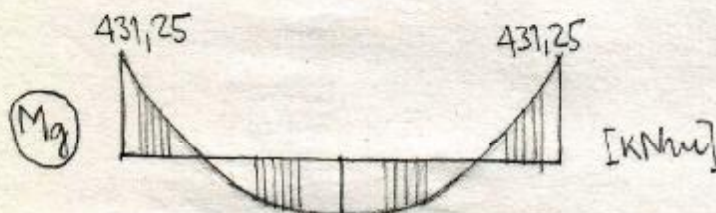
$$T_g = 51,75 \cdot 10,0 / 2 = 258,75 \text{ kN}$$

б) ВОДА

$$M_w^o = 62,5 \cdot 10,0^2 / 12 = 520,83 \text{ kNm}$$

$$M_w^p = 62,5 \cdot 10,0^2 / 24 = 260,42 \text{ kNm}$$

$$T_w = 62,5 \cdot 10,0 / 2 = 312,5 \text{ kN}$$



ДИМЕНЗИОНИСАЊЕ

ОСЛОЊАЦ

$$M_u = 1,6 \cdot 431,25 + 1,8 \cdot 520,83 = 1627,5 \text{ kNm}$$

$$b/d/r = 40/100/92 \text{ cm}$$

$$k_v = \frac{92,0}{\sqrt{\frac{1627,5}{0,40 \cdot 2,05}}} = 2,065$$

$$\epsilon_b / \epsilon_a = 3,5 / 6,90\%$$

$$\mu = 27,243\%$$

$$A_a = 27,243 \cdot \frac{40,0 \cdot 92,0}{100} \cdot \frac{2,05}{40} = 51,38 \text{ cm}^2$$

УСВОЈЕНО 9R \varnothing 28 (55,42 cm²)

ПОЛОЖ

$$M_u = 1,6 \cdot 215,63 + 1,8 \cdot 260,42 = 813,75 \text{ kNm}$$

$$B = \text{MIN.} \left\{ \begin{array}{l} 40 + 20 \cdot 20,0 = 440 \text{ cm} \\ 40 + 0,25 \cdot 0,7 \cdot 1000 = 215 \text{ cm} \\ 300 + 200/2 = 400 \text{ cm} \end{array} \right\} = 215 \text{ cm}$$

$$B/d/h = 215/100/95 \text{ cm}$$

$$k = \frac{95,0}{\sqrt{\frac{813,75}{2,15 \cdot 2,05}}} = 6,992 \longrightarrow \left\{ \begin{array}{l} \epsilon_b/\epsilon_{ay} = 0,725/10\% \\ \lambda = 0,068 \\ \bar{\mu} = 2,154\% \end{array} \right.$$

$$s \cdot h = 0,068 \cdot 95,0 = 6,46 \text{ cm} < d_p = 20 \text{ cm}$$

$$A_a = 2,154 \cdot \frac{215 \cdot 95}{100} \cdot \frac{2,05}{40} = 22,55 \text{ cm}^2$$

УСВОЈЕНО 4R \varnothing 28 (24,63 cm²)

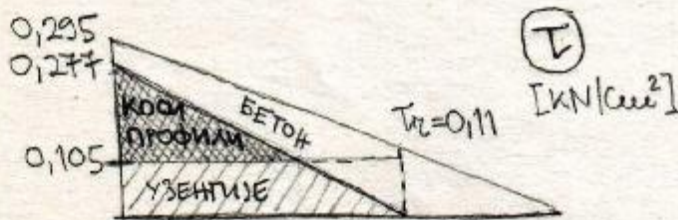
КОНТРОЛА ГЛАВНИХ НАПОНА ЗАТЕЗАЊА

$$T_u = 1,6 \cdot 258,75 + 1,8 \cdot 312,5 = 976,5 \text{ kN}$$

$$z = 0,9 \cdot h = 0,9 \cdot 92,0 = 82,8 \text{ cm}$$

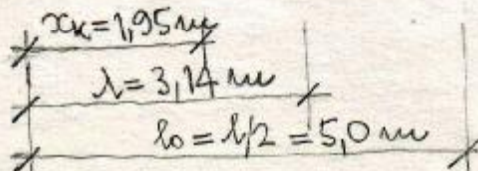
$$T_n = \frac{976,5}{40,0 \cdot 82,8} = 0,295 \text{ kN/cm}^2 > T_{cr} = 0,11 \text{ kN/cm}^2 < 3T_{cr}$$

$$T_{Rn} = \frac{3}{2} \cdot (0,295 - 0,11) = 0,277 \text{ kN/cm}^2$$



$$\lambda = 5,0 \cdot \left(1 - \frac{0,11}{0,295}\right) = 3,14 \text{ m}$$

$$x_k = 3,14 \cdot \left(1 - \frac{0,105}{0,277}\right) = 1,95 \text{ m}$$



ОСИГУРАЊЕ ВРШИМО ВЕРТИКАЛНИМ УЗЕЊИЈАМА И КОСИМ ПРОФИЛИМА.

6.

УСВОЈЕНО: $UR\emptyset 10/15$ ($m=2$) ЧА ДУЖИНИ $\lambda = 3,14$ м

$$m=2; \theta=45^\circ; \alpha=90^\circ; \alpha_{se}^{(1)} = 0,785 \text{ cm}^2$$

$$\mu_{uz} = \frac{m \cdot \alpha_{se}^{(1)}}{b \cdot e} = \frac{2 \cdot 0,785}{40,0 \cdot 15,0} = 0,262\% > \text{MIN. } \mu_{uz} = 0,2\%$$

$$T_{uz} = \frac{2 \cdot 0,785}{40,0 \cdot 15,0} \cdot 40,0 = 0,105 \text{ KN/cm}^2$$

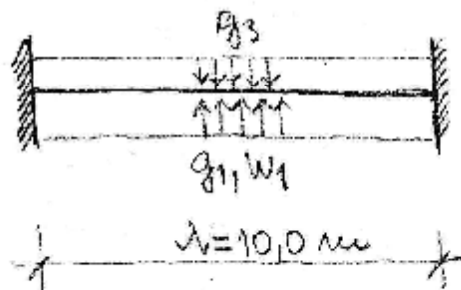
$$x_k = \lambda \left(1 - \frac{T_{uz}}{T_{uk}}\right) = 3,14 \cdot \left(1 - \frac{0,105}{0,277}\right) = 1,95 \text{ m} = 195 \text{ cm}$$

$$H_{uz,k} = \frac{T_{uk} - T_{uz}}{2} \cdot x_k \cdot b = \frac{0,277 - 0,105}{2} \cdot 195 \cdot 40 = 673,1 \text{ KN}$$

УСВОЈЕНО: $\alpha_k = 45^\circ \longrightarrow A_{ak} = \frac{673,1}{40,0 \cdot \sqrt{2}} = 11,90 \text{ cm}^2$

УСВОЈЕНО $2R\emptyset 28$ ($12,32 \text{ cm}^2$)

POS 3 — КОНТИНУАЛНА ГРЕДА



- СОПСТВЕНА ТЕЖИНА POS 3: $q_3 = 0,20 \cdot (1,20 - 0,20) \cdot 25,0 = 5,0 \text{ KN/m}^1$
- СТАЛНО ОПТЕРЕЋЕЊЕ СА POS 1: $B_{q1} = -13,75 \text{ KN/m}^1$

- ОПТЕРЕЋЕЊЕ ВОДОМ СА POS 1:

$$B_{w1} = \begin{cases} q = -8,75 \text{ KN/m}^1 \\ w = -12,5 \text{ KN/m}^1 \end{cases}$$

а) СТАЛНО ОПТЕРЕЋЕЊЕ

$$M_q^0 = 8,75 \cdot 10,0^2 / 12 = 72,92 \text{ KNm}$$

$$M_q^p = 8,75 \cdot 10,0^2 / 24 = 36,46 \text{ KNm}$$

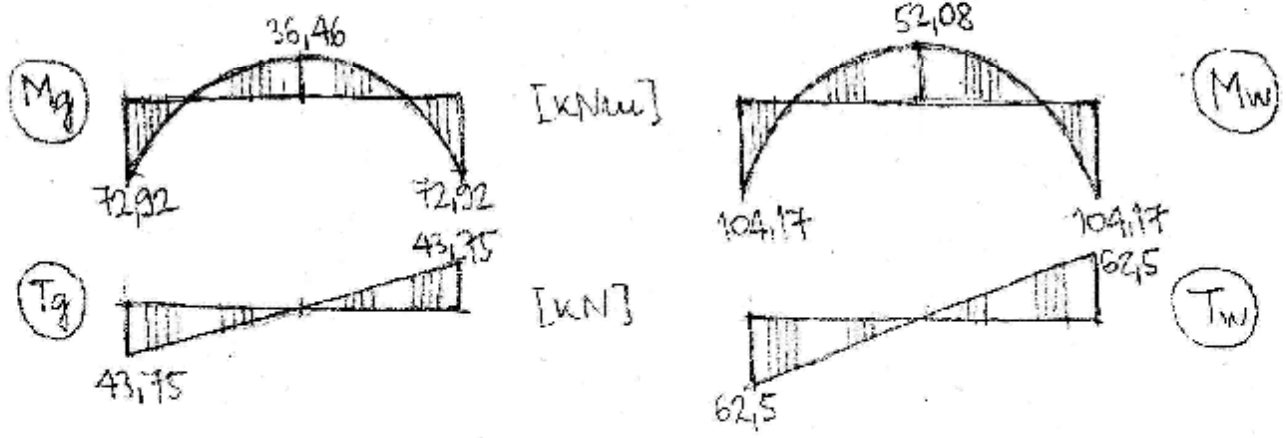
$$T_q = 8,75 \cdot 10,0 / 2 = 43,75 \text{ KN}$$

б) ВОДА

$$M_w^0 = 12,5 \cdot 10,0^2 / 12 = 104,17 \text{ KNm}$$

$$M_w^p = 12,5 \cdot 10,0^2 / 24 = 52,08 \text{ KNm}$$

$$T_w = 12,5 \cdot 10,0 / 2 = 62,5 \text{ KN}$$



ДИМЕНЗИОНИСАЊЕ

- ОСЛОЊАЊ

$$M_{uc} = 1,6 \cdot 72,92 + 1,8 \cdot 104,17 = 304,17 \text{ kNm}$$

$$b/d/r = 20/120/114 \text{ cm}$$

$$k = \frac{114,0}{\sqrt{\frac{304,17}{0,20 \cdot 2,05}}} = 4,185 \quad \longrightarrow \quad \begin{aligned} E_b/E_a &= 1,325 / 10\% \\ \bar{\mu} &= 6,039\% \end{aligned}$$

$$A_a = 6,039 \cdot \frac{20 \cdot 114}{100} \cdot \frac{2,05}{40} = 7,06 \text{ cm}^2$$

УЧВОЈЕНО 5RØ14 (7,70 cm²)

- ПОЈАС

$$M_{uc} = 1,6 \cdot 36,46 + 1,8 \cdot 52,08 = 152,08 \text{ kNm}$$

$$B = \text{MIN.} \left\{ \begin{aligned} 20 + 8 \cdot 20 &= 180 \text{ cm} \\ 20 + \frac{1}{3} \cdot 0,25 \cdot 700 &= 78,3 \text{ cm} \\ 200/2 &= 100 \text{ cm} \end{aligned} \right\} = 78,3 \text{ cm}$$

$$b/d/r = 78,3/120/115 \text{ cm}$$

$$k = \frac{115,0}{\sqrt{\frac{152,08 \cdot 10^2}{78,3 \cdot 2,05}}} = 11,817 \quad \longrightarrow \quad \begin{aligned} E_b/E_a &= 0,4 / 10\% \\ \delta &= 0,038 \\ \bar{\mu} &= 0,718\% \end{aligned}$$

$$\delta \cdot r = 0,038 \cdot 115,0 = 4,37 \text{ cm} < d_p = 20 \text{ cm}$$

$$A_a = 0,718 \cdot \frac{78,3 \cdot 115}{100} \cdot \frac{2,05}{40} = 3,32 \text{ cm}^2$$

$$\text{MIN. } A_a = 0,20 \cdot 20 \cdot 120 / 100 = 4,8 \text{ cm}^2 > \text{ПОТР. } A_a$$

УЧВОЈЕНО 3RØ14 (4,62 cm²)

$$T_{\Sigma} = 1,6 \cdot 43,75 + 1,8 \cdot 62,5 = 182,5 \text{ kN}$$

$$T_{\Sigma} = \frac{182,5}{20 \cdot 0,9 \cdot 11,4} = 0,89 \text{ kN/cm}^2 < T_{\Sigma} = 0,11 \text{ kN/cm}^2$$

НИЈЕ ПОТРЕБНО ОСИГУРАЊЕ АРМАТУРОМ ОД ГЛАВНИХ НАПОНА ЗАТЕЗАЊА.

POS 51 - СТУБ

$$l_i = 500 \text{ cm} = 5,0 \text{ m}$$

$$b/d = 40/30 \text{ cm}$$

$$i_{\text{MIN.}} = \frac{30,0}{\sqrt{12}} = 8,66 \text{ cm}$$

$$\lambda = \frac{500}{8,66} = 57,74 \begin{matrix} < 25 \\ > 75 \end{matrix} \left. \vphantom{\lambda} \right\} \text{МЕТОД ДОПУШКЕ ЕКСЦЕНТРИЧНОСТИ}$$

$$2 \text{ cm} \leq e_0 = \frac{l_i}{300} \leq 10 \text{ cm}$$

$$e_0 = \frac{500}{300} = 1,67 \text{ cm} < 2 \text{ cm} \rightarrow \text{УСВ. } e_0 = 2 \text{ cm}$$

$\lambda > 50 \rightarrow$ УЗИМАМО У ОБЗИР И ТЕЧЕЊЕ

$$J_B = \frac{30^3 \cdot 40}{12} = 90000 \text{ cm}^4$$

$$N_E = E_B J_B \cdot \frac{\pi^2}{l_i^2} = 31,5 \cdot 10^6 \cdot 90000 \cdot 10^{-8} \cdot \frac{\pi^2}{5,0^2} = 11192 \text{ kN}$$

$$N_g = 2R_{g2} = 2 \cdot 258,75 = 517,5 \text{ kN}$$

$$N_w = 2R_{w2} = 2 \cdot 312,5 = 625,0 \text{ kN}$$

$$\alpha_E = \frac{N_g}{N_E} = \frac{517,5}{11192} = 0,046$$

УСВАЈАМО: $w_1 = 70\%$
 $\tau = 28 \text{ kN/m}^2$
 $d_{\text{min}} \approx 20 \text{ cm}$ } $\psi_{100} = 2,6$

$$e_{\varphi} = (e_0 + e_g) \cdot \left(e^{\frac{\alpha_E}{1 - \alpha_E} \cdot \psi_{100}} - 1 \right)$$

$$e_{\varphi} = (2,0 + 0) \cdot \left(e^{\frac{0,046}{1 - 0,046} \cdot 2,6} - 1 \right) = 0,27 \text{ cm}$$

$$e_d = 30,0 \cdot \frac{57,74-25}{100} \cdot \sqrt{0,1} = 3,11 \text{ см}$$

$$e = e_0 + e_f + e_d = 2,0 + 0,27 + 3,11 = 5,38 \text{ см}$$

ПРЕТНОСТАВЬВАМО $\epsilon_{ay} \leq 0\%$. $\rightarrow \gamma_{leg} = 1,9$
 $\gamma_{sw} = 2,1$

$$N_u = 1,9 \cdot 517,5 + 2,1 \cdot 625,0 = 2295,75 \text{ kN}$$

$$M_u = 2295,75 \cdot 5,38 \cdot 10^{-2} = 123,38 \text{ kNm}$$

$\frac{a}{d} \approx \frac{4,5}{30} = 0,15$ } ДИЗАЙНА ИТЕРАЦИЈЕ 2.4.12.
 $A_{ay} = A_{az}$
 RA 400/500

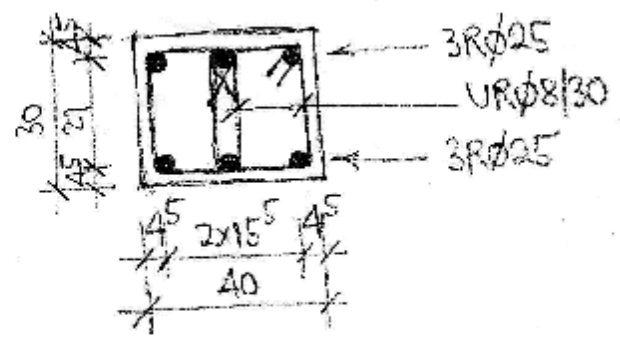
$$\eta_u = \frac{2295,75}{40 \cdot 30 \cdot 2,05} = 0,933$$

$$\eta_{sw} = \frac{123,38 \cdot 10^2}{40 \cdot 30^2 \cdot 2,05} = 0,167$$

$\epsilon_s / \epsilon_{ay} \approx 3,5 / 0\%$
 $\eta = 0,22$

$$A_{ay} = A_{az} = 0,22 \cdot 40 \cdot 30 \cdot \frac{2,05}{40} = 13,53 \text{ см}^2$$

УСЛОВИЕНО $\boxed{\pm 3R\phi 25}$ ($\pm 14,73 \text{ см}^2$)



MAX. $e_{re} = \text{MIN.}$ $\left\{ \begin{array}{l} 15 \cdot 25 = 37,5 \text{ см} \\ 30 \text{ см} \\ d = 30 \text{ см} \end{array} \right\} = 30 \text{ см}$

УСЛОВИЕНО $\boxed{UR\phi 8/30}$

POS 52 - ZATETA

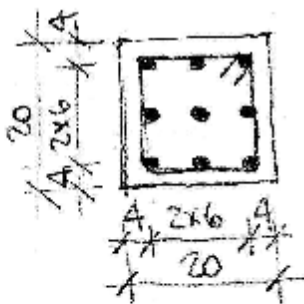
$$Z_g = 2R_{g3} = 2 \cdot 43,75 = 87,5 \text{ kN}$$

$$Z_w = 2R_{w3} = 2 \cdot 62,50 = 125,0 \text{ kN}$$

$$Z_u = 1,6 \cdot 87,5 + 1,8 \cdot 125,0 = 365,0 \text{ kN}$$

$$A_a = \frac{365,0}{40,0} = 9,13 \text{ cm}^2$$

УЧЕБНОЕ 3R012 (10,18 cm²)



$$A_b = 20 \cdot 20 = 400 \text{ cm}^2$$

$$A_a = 10,18 \text{ cm}^2$$

$$\eta = \frac{210}{31,5} = 6,67$$

$$A_i = 400 + 6,67 \cdot 10,18 = 467,86 \text{ cm}^2$$

$$f_{bz} = 0,7 \cdot 2,4 = 1,68 \text{ MPa} = 0,168 \text{ kN/cm}^2$$

$$Z^* = 0,168 \cdot 467,86 = 78,6 \text{ kN}$$

$$Z = Z_g + Z_w = 87,5 + 125,0 = 212,5 \text{ kN}$$

$$\sigma_a = \frac{212,5}{10,18} = 20,88 \text{ kN/cm}^2 = 208,8 \text{ MPa}$$

$$\mu_{z,ef} = \frac{A_a}{A_{b,ef}} = \frac{A_a}{A_b} = \frac{10,18}{400} = 2,545\%$$

$$e_{\phi} = 6,0 \text{ cm}$$

$$a_0 = 4,0 - 1/2 \cdot 2 = 3,4 \text{ cm}$$

$$K_1 = 0,4 \text{ (RA 400/500)}$$

$$K_2 = 0,25 \text{ (ZATEZANJE)}$$

$$\lambda_{ps} = 2 \cdot (3,4 + \frac{6,0}{10}) + 0,4 \cdot 0,25 \cdot \frac{12}{2,545 \cdot 10^2} = 12,72 \text{ cm}$$

$$\xi_a = 1 - 10 \cdot 10 \cdot \left(\frac{78,6}{212,5}\right)^2 = 0,863$$

$$\sigma_{pk} = 1,7 \cdot 0,863 \cdot \frac{208,8}{210 \cdot 10^3} \cdot 12,72 \cdot 10^3 = 18,6 \cdot 10^3 \text{ cm}$$

$\sigma_{pk} = 0,186 \text{ mm}$

ЗА ПРОПАЧУ# ИЗДУЖЕЊА $f_{bz} = f_{bz,uz} = 0,24 \text{ kN/cm}^2$

$$Z^* = 0,24 \cdot 467,86 = 112,29 \text{ kN}$$

$$\xi_a = 1 - 10 \cdot 10 \cdot \left(\frac{112,29}{212,5}\right)^2 = 0,721$$

$$\Delta l = 0,721 \cdot \frac{208,8}{210 \cdot 10^3} \cdot 500,0 = 0,36 \text{ cm}$$

$\Delta l = 3,6 \text{ mm}$