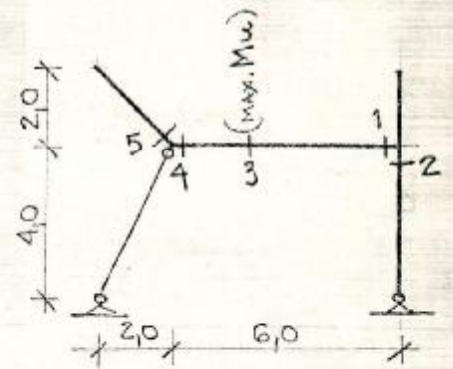
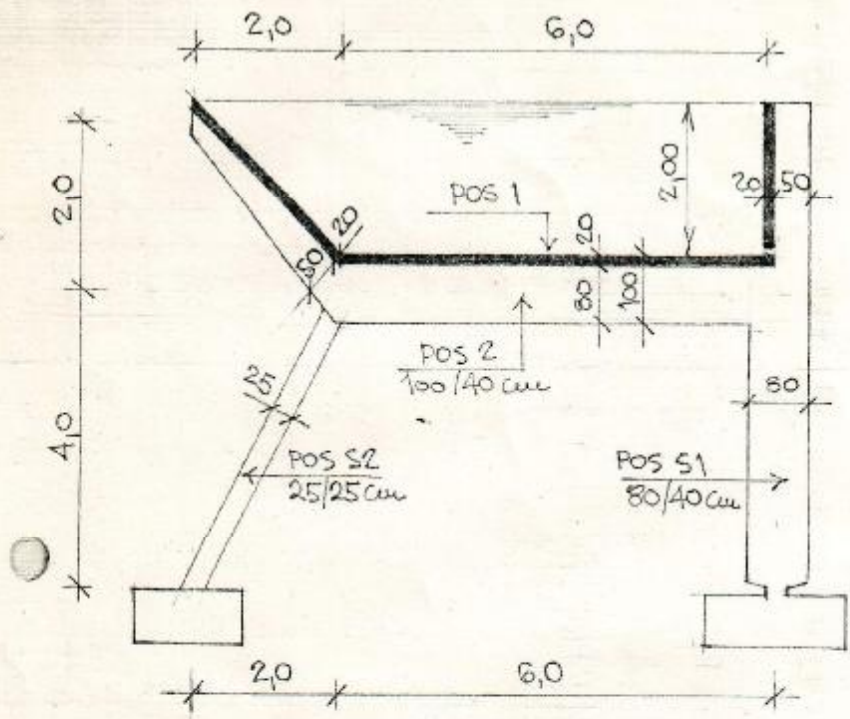


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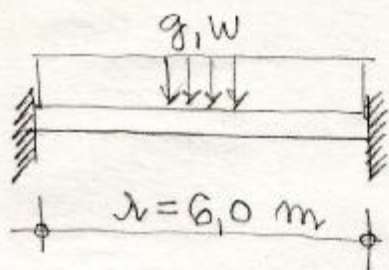


MB 40
RA 400/500
 $\lambda = 6,0 \text{ m}$
 $\gamma_w = 10,0 \text{ kN/m}^3$
 $b = 40 \text{ cm (POS 2, POS S1)}$
 $b = 25 \text{ cm (POS S2)}$

ЗА НЕКО СРЕДЊЕ ПОЉЕ КОНСТРУКЦИЈЕ АКВАДУКТА ЧИЈИ ЈЕ ПРЕСЕК ПРИКАЗАН НА СКИЦИ, ПОТРЕБНО ЈЕ:

1. ДИМЕНЗИОНИСАТИ POS 1 ($d_p = 20 \text{ cm}$) У КАРАКТЕРИСТИЧНИМ ПРЕСЕЦИМА. ЗА УСВОЈЕНИ РАСПОРЕД АРМАТУРЕ У НАЈОПТЕРЕЂЕНИЈЕМ ПРЕСЕКУ СРАЧУНАТИ КАРАКТЕРИСТИЧНУ ШИРИНУ ПРСЛИЦЕ. ($\alpha_{pk, dop.} = 0,20 \text{ mm}$)
2. НАЦРТАТИ ДИЈАГРАМЕ M, T, N ЗА POS 2, POS S1, POS S2 ЗА УТИЦАЈ СТАЛНОГ ОПТЕРЕЂЕЊА И ВОДЕ.
3. ДИМЕНЗИОНИСАТИ POS 2 И POS S1 У КАРАКТЕРИСТИЧНИМ ПРЕСЕЦИМА ПРЕМА M, T, N . ОСИГУРАЊЕ У ПРЕСЕКУ 1 (СКИЦА ГОРЕ ДЕСНО) ИЗВРШИТИ ВЕРТИКАЛНИМ УЗЕЊИЈАМА И КОСИМ ПРОФИЛИМА. ЗА СТУБ S1 ЗАДОВОЉИТИ УСЛОВ $\epsilon_{s1} \geq 5\%$. ДИМЕНЗИЈЕ ПРЕСЕКА НЕ МЕЊАТИ!
4. ДИМЕНЗИОНИСАТИ POS S2 ПО ТЕОРИЈИ ГРАНИЧНЕ НОСИВОСТИ ($l_1 = l$).
5. СКИЦИРАТИ ПЛАН АРМАТУРЕ POS 2, POS S1, POS S2 И ПРИКАЗАТИ КАРАКТЕРИСТИЧНЕ ПОПРЕЧНЕ ПРЕСЕКЕ. ПРОПИСНО ОЗНАЧИТИ ПОЈЕДИНЕ ШИПКЕ И КОТИРАТИ.

Рос 1 — КОНТИНУАЛНА ПЛОЧА



$$q = d_p \cdot \gamma_B = 0,20 \cdot 25,0 = 5,0 \text{ kN/m}^2$$
$$w = r_w \cdot \gamma_w = 2,0 \cdot 10,0 = 20,0 \text{ kN/m}^2$$

a) СТАЛНО ОПТЕРЕТЕНИЕ

$$M_g^0 = 5,0 \cdot 6,0^2 / 12 = 15,0 \text{ kNm/m}$$

$$M_g^p = 5,0 \cdot 6,0^2 / 24 = 7,5 \text{ kNm/m}$$

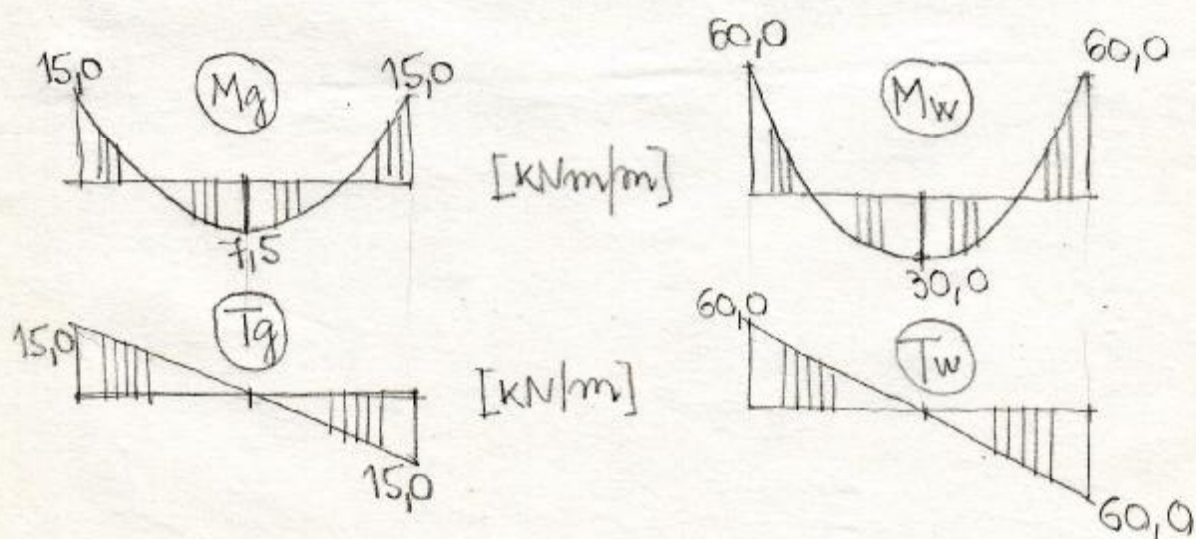
$$T_g = 5,0 \cdot 6,0 / 2 = 15,0 \text{ kN/m}$$

б) ВОДА

$$M_w^0 = 20,0 \cdot 6,0^2 / 12 = 60,0 \text{ kNm/m}$$

$$M_w^p = 20,0 \cdot 6,0^2 / 24 = 30,0 \text{ kNm/m}$$

$$T_w = 20,0 \cdot 6,0 / 2 = 60,0 \text{ kN/m}$$



а) ОСЛОЈАЦ

$$M_{лл} = 1,6 \cdot 15,0 + 1,8 \cdot 60,0 = 132,0 \text{ кНм/м}^1$$

$$b/d/r_v = 100/20/17 \text{ см}$$

$$K_v = \frac{17,0}{\sqrt{\frac{132,0}{2,55}}} = 2,363 \longrightarrow \varepsilon_b/\varepsilon_a = 3,325/10\%$$

$$\bar{\mu} = 19,950\%$$

$$A_a = 19,950 \cdot 17,0 \cdot \frac{2,55}{40,0} = 21,62 \text{ см}^2/\text{м}^1$$

УСВОЈЕНО $\boxed{R\phi 19/12,5}$ (22,68 см²/м¹)

$$A_{ар} = 0,20 \cdot 21,62 = 4,32 \text{ см}^2/\text{м}^1$$

УСВОЈЕНО $\boxed{R\phi 12/25}$ (4,52 см²/м¹)

б) ПОЉЕ

$$M_{лл} = 1,6 \cdot 7,5 + 1,8 \cdot 30,0 = 66,0 \text{ кНм/м}^1$$

$$K_v = \frac{17,0}{\sqrt{\frac{66,0}{2,55}}} = 3,342 \longrightarrow \varepsilon_b/\varepsilon_a = 1,775/10\%$$

$$\bar{\mu} = 9,421\%$$

$$A_a = 9,421 \cdot 17,0 \cdot \frac{2,55}{40,0} = 10,21 \text{ см}^2/\text{м}^1$$

УСВОЈЕНО $\boxed{R\phi 14/12,5}$ (12,32 см²/м¹)

$$A_{ар} = 0,2 \cdot 10,21 = 2,04 \text{ см}^2/\text{м}^1$$

УСВОЈЕНО $\boxed{R\phi 8/25}$ (2,01 см²/м¹)

в) КОНТРОЛА ГЛАВНИХ НАПОНА ЗАТЕЗАЊА

$$T_{лл} = 1,6 \cdot 15,0 + 1,8 \cdot 60,0 = 132,0 \text{ кН/м}^1$$

$$T_{лл} = \frac{132,0}{100,0 \cdot 0,9 \cdot 17,0} = 0,086 \text{ кН/см}^2 < T_{лл} = 0,13 \text{ кН/см}^2$$

НИЈЕ ПОТРЕБНО ОСИГУРАЊЕ АРМАТУРОМ ОД ГЛАВНИХ НАПОНА ЗАТЕЗАЊА.

ПРОРАЧУН ПРСЛИНА - ОСЛОНАЦ

$$M = M_g + M_w = 15,0 + 60,0 = 75,0 \text{ kNm/m'}$$

$$A_{a1} = 22,68 \text{ cm}^2/\text{m'} \quad (R\phi 19/12,5)$$

$$A_{a2} = 0$$

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

a) СРЕДЊЕ РАСТОЈАЊЕ ПРСЛИНА

$$l_{ps} = 2 \left(a_0 + \frac{e_{\phi}}{10} \right) + k_1 \cdot k_2 \cdot \frac{\phi}{\mu_{z,ef}}$$

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

$$k_1 = 0,4 \quad (RA 400/500)$$

$$k_2 = 0,125 \quad (\text{ЧИСТО САВИЈАЊЕ})$$

$$f_{bz,ef} = \min \left\{ \begin{array}{l} 3,0 + 7,5 \cdot 1,9 = 17,25 \text{ cm} \\ d/2 = 20,0/2 = 10,0 \text{ cm} \end{array} \right\} = 10,0 \text{ cm}$$

$$\mu_{z,ef} = \frac{22,68}{100,0 \cdot 10,0} = 2,268 \%$$

$$l_{ps} = 2 \cdot \left(2,05 + \frac{12,5}{10} \right) + 0,4 \cdot 0,125 \cdot \frac{1,9}{2,268 \cdot 10^{-2}} = 10,8 \text{ cm}$$

$$\boxed{l_{ps} = 10,8 \text{ cm}}$$

b) КАРАКТЕРИСТИЧНА ШИРИНА ПРСЛИНА

$$\sigma_{pk} = 1,7 \cdot \xi_a \cdot \frac{\sigma_{a1}}{E_a} \cdot l_{ps}$$

$$\xi_a = 1 - \beta_1 \cdot \beta_2 \cdot \left(\frac{M^*}{M} \right)^2 \quad \begin{array}{l} \geq 0,40 \\ \leq 1,00 \end{array}$$

$$MB 40 \rightarrow f_{b2m} = 2,9 \text{ MPa}$$

$$f_{bz} = 0,7 \cdot 2,9 = 2,03 \text{ MPa}$$

$$f_{bzS} = 2,03 \cdot \left(0,6 + \frac{0,4}{\sqrt[3]{0,20}} \right) = 2,43 \text{ MPa} = 0,243 \text{ kN/cm}^2$$

$$W_{b1} = \frac{100,0 \cdot 20,0^2}{6} = 6666,6 \text{ cm}^3$$

$$M^* \approx f_{bzS} \cdot W_{b1} = 0,243 \cdot 6666,6 = 1622 \text{ kNm}$$

$$\boxed{M^* = 16,22 \text{ kNm}}$$

$$\beta_1 = 1,0 \quad (RA \ 400/500)$$

$$\beta_2 = 1,0 \quad (\bar{f} = 0)$$

$$\xi_a = 1 - 1,0 \cdot 1,0 \cdot \left(\frac{16,22}{75,0} \right)^2 = 0,953$$

ПОЛОЖАЈ НЕУТРАЛНЕ ЛИНИЈЕ (ПРАВОУГАОНИ ПРЕСЕК, ЧИСТО САВИЈАЊЕ)

$$s^2 + 2n(\mu_1 + \mu_2) \cdot s - 2n(\mu_1 + d_2 \mu_2) = 0$$

$$n = \frac{E_a}{E_b} = \frac{210}{34} = 6,18$$

$$\mu_1 = \frac{22,68}{100,0 \cdot 1,7,0} = 1,334\% \quad ; \quad \mu_2 = 0$$

$$s^2 + 2 \cdot 6,18 \cdot (1,334 + 0) \cdot 10^{-2} \cdot s - 2 \cdot 6,18 \cdot (1,334 + 0) \cdot 10^{-2} = 0$$

$$s^2 + 0,165 \cdot s - 0,165 = 0 \quad \rightarrow \quad \boxed{s = 0,332}$$

$$z_b = h \left(1 - \frac{s}{3} \right) = 17,0 \cdot \left(1 - \frac{0,332}{3} \right) = 15,12 \text{ cm}$$

$$\sigma_{ay} = \frac{M}{z_b \cdot A_y} = \frac{75,0 \cdot 10^2}{15,12 \cdot 22,68} = 21,87 \text{ kN/cm}^2 = 218,7 \text{ MPa}$$

$$\sigma_{pk} = 1,7 \cdot 0,953 \cdot \frac{218,7}{210 \cdot 10^3} \cdot 10,8 = 18,2 \cdot 10^{-3} \text{ cm}$$

$$\boxed{\sigma_{pk} = 0,182 \text{ mm}} < \sigma_{pk, dop.} = 0,20 \text{ mm}$$

НАПОМЕНА:

УСВАЈАЊЕМ ПРИБЛИЖНЕ ВРЕДНОСТИ

$$z_b \approx 0,9 \cdot h$$

ДОБИЈА СЕ:

$$\sigma_{ay} \approx \frac{75,0 \cdot 10^2}{0,9 \cdot 17,0 \cdot 22,68} = 21,61 \text{ kN/cm}^2 = 216,1 \text{ MPa}$$

$$\sigma_{pk} = 1,7 \cdot 0,953 \cdot \frac{216,1}{210 \cdot 10^3} \cdot 10,80 = 18,0 \cdot 10^{-3} \text{ cm}$$

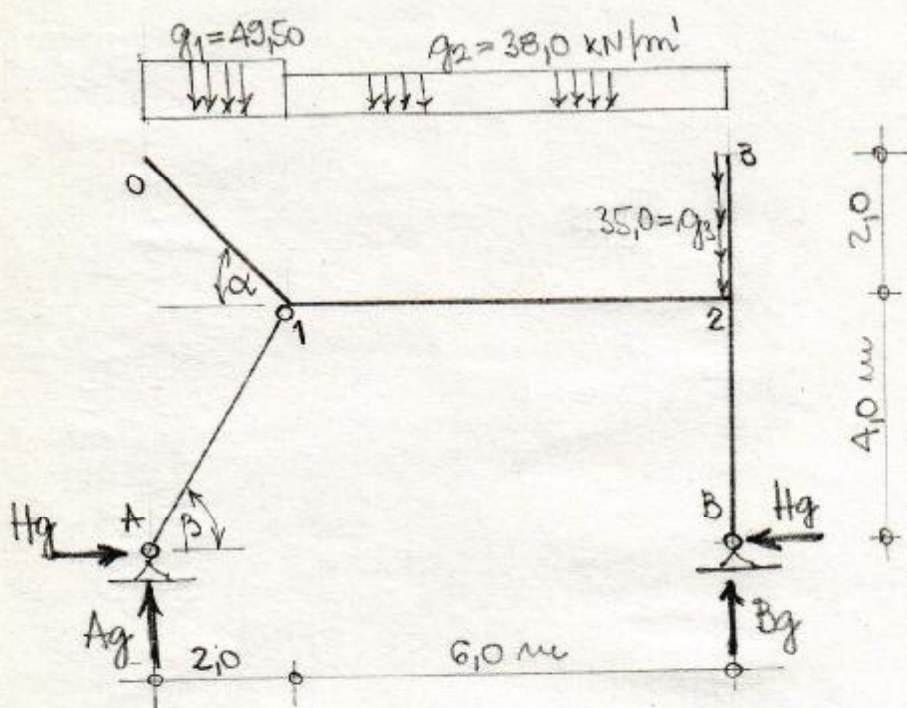
$$\sigma_{pk} = 0,18 \text{ mm}$$

ШТО ЈЕ ПРАКТИЧНО ИСТА ВРЕДНОСТ КАО ПРЕТХОДНО СРАЧУНАТА.

POS 2, POS S1, POS S2

5.

a) СТАЛНО ОПТЕРЕТЉЕЊЕ



$$\alpha = \arctg \frac{2,0}{2,0} = 45^\circ$$

$$\beta = \arctg \frac{4,0}{2,0} = 63,4^\circ$$

ΔEO 0-1:

- ПЛОЧА: $d_p \cdot \gamma_B \cdot \lambda / \cos \alpha = 0,20 \cdot 25,0 \cdot 6,0 / \cos 45^\circ = 42,43 \text{ kN/m}$

- ТРЕЃА: $b(d-d_p) \cdot \gamma_B / \cos \alpha = 0,40 \cdot (0,70 - 0,20) \cdot 25,0 / \cos 45^\circ = 7,07 \text{ kN/m}$

$$q_1 = 49,50 \text{ kN/m}!$$

ΔEO 1-2:

- ПЛОЧА: $2Rq_1 = 2 \cdot 15,0 = 30,0 \text{ kN/m}!$

- ТРЕЃА: $0,40 \cdot (1,0 - 0,20) \cdot 25,0 = 8,0 \text{ kN/m}!$

$$q_2 = 38,0 \text{ kN/m}!$$

ΔEO 2-3:

- ЗИЃА: $0,20 \cdot 25,0 \cdot 6,0 = 30,0 \text{ kN/m}!$

- СТУБ: $0,40 \cdot 0,50 \cdot 25,0 = 5,0 \text{ kN/m}!$

$$q_3 = 35,0 \text{ kN/m}!$$

$$\Sigma Vq = 49,50 \cdot 2,0 + 38,0 \cdot 6,0 + 35,0 \cdot 2,0 = 397,0 \text{ kN}$$

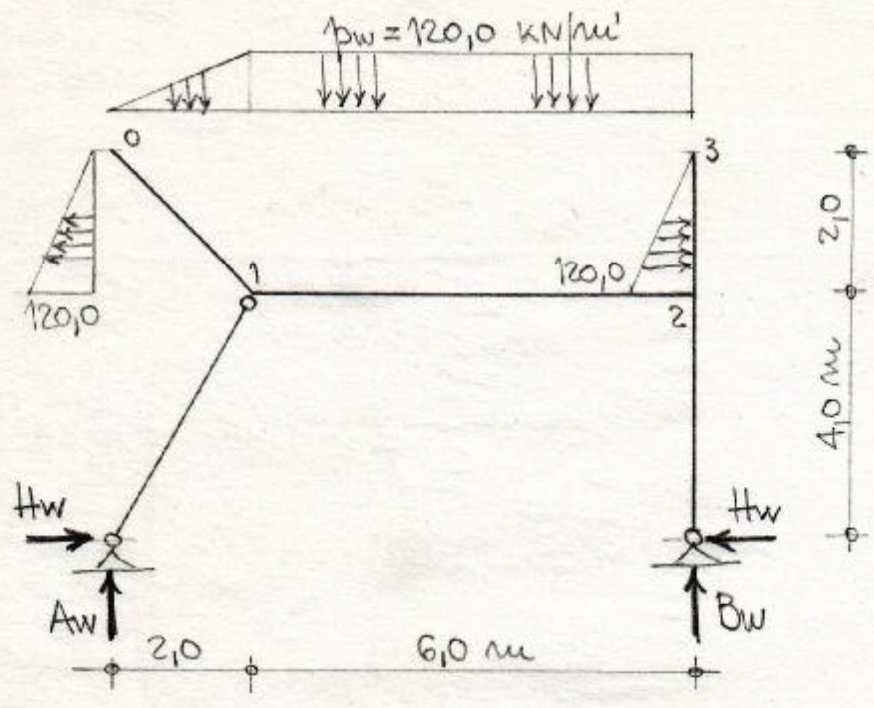
$$A_g = [49,50 \cdot 2,0 \cdot 7,0 + 38,0 \cdot 6,0 \cdot 3,0] / 8,0 = 172,12 \text{ kN}$$

$$B_g = 397,0 - 172,12 = 224,88 \text{ kN}$$

$$H_g = A_g \cdot \text{ctg } \beta = 172,12 \cdot 0,50 = 86,06 \text{ kN}$$

δ) ВОДА

$$\text{max. } p_w = \text{max. } h_v \cdot \gamma_w \cdot \lambda = 2R_{w1} = 2 \cdot 60,0 = 120,0 \text{ kN/m}$$



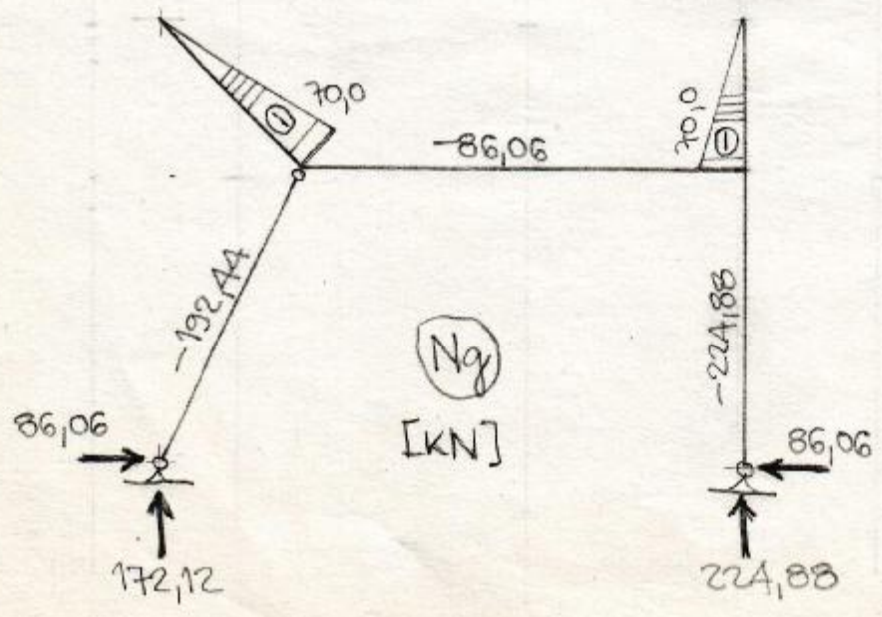
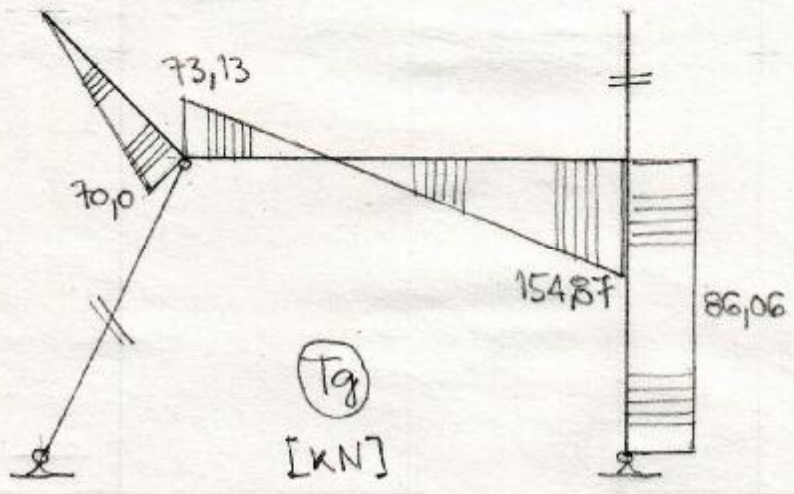
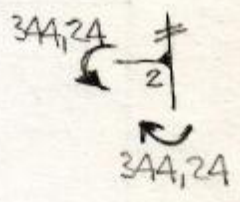
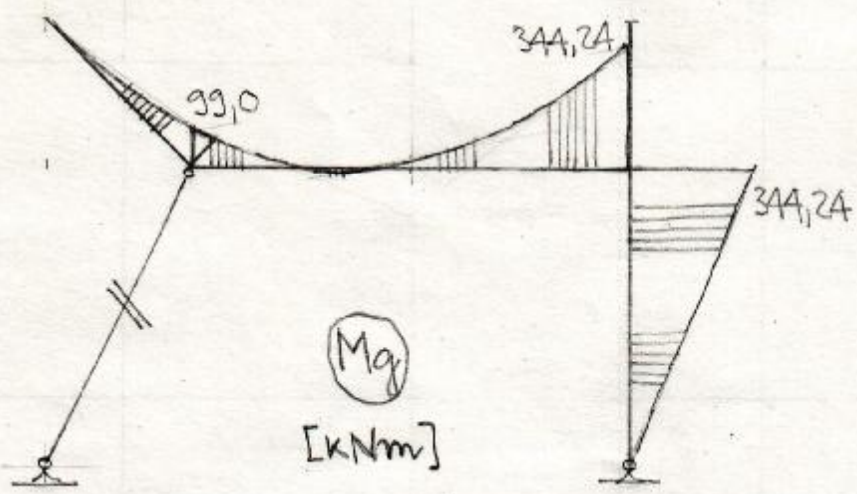
$$\Sigma V_w = 120,0 \cdot 2,0 / 2 + 120,0 \cdot 6,0 = 840,0 \text{ kN}$$

$$A_w = [120,0 \cdot \frac{2,0}{2} \cdot (\frac{2,0}{3} + 6,0) + 120,0 \cdot \frac{6,0^2}{2}] / 8,0 = 370,0 \text{ kN}$$

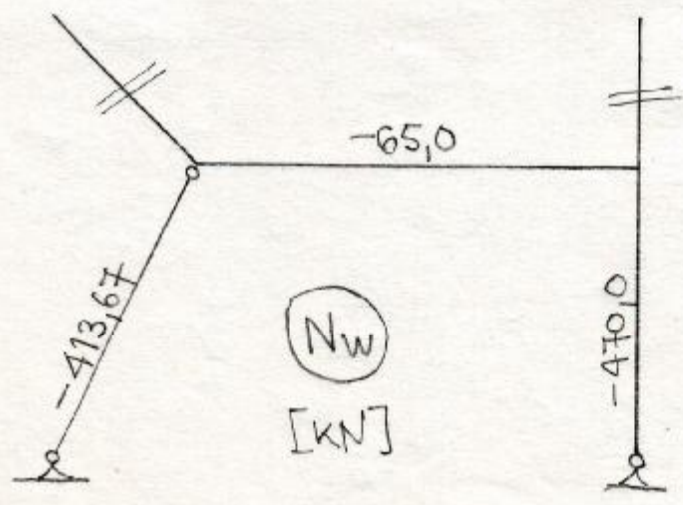
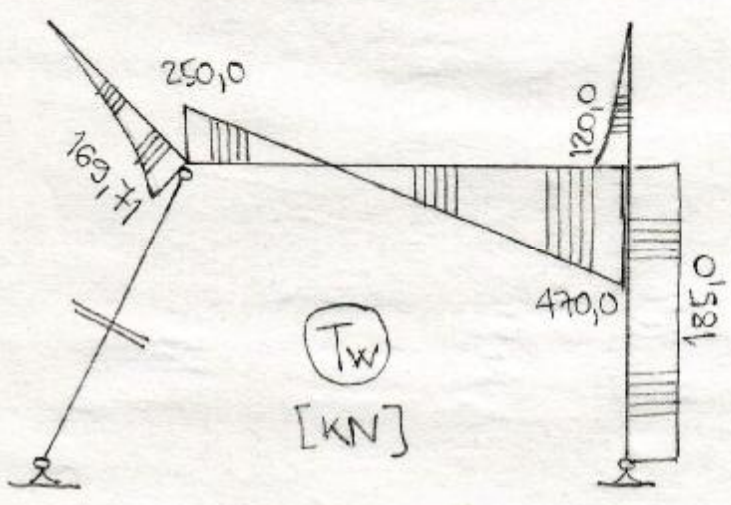
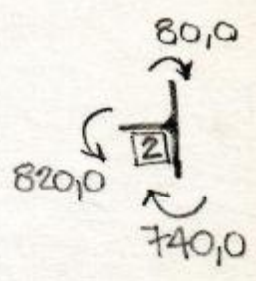
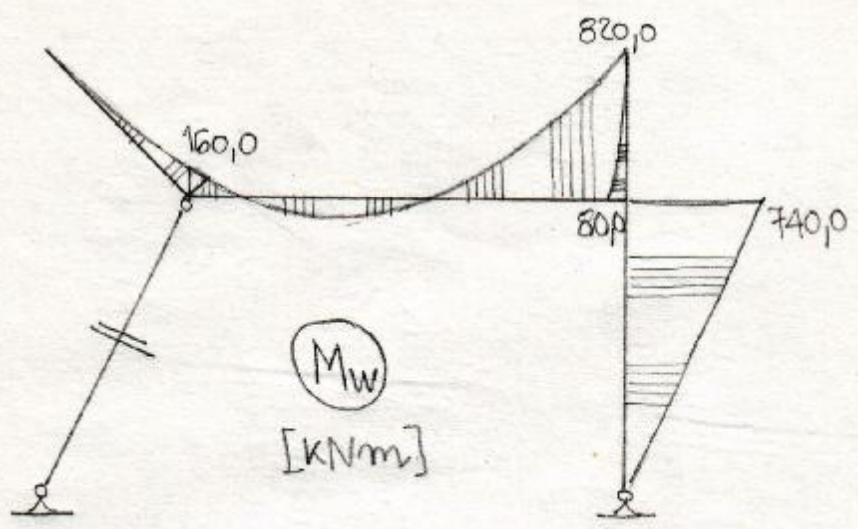
$$B_w = 840,0 - 370,0 = 470,0 \text{ kN}$$

$$H_w = A_w \cdot \text{ctg } \beta = 370,0 \cdot 0,50 = 185,0 \text{ kN}$$

ДИЈАГРАМИ M, T, N ОД СТАЛНОГ ОПТЕРЕЋЕЊА



ДИЈАГРАМИ M, T, N ОД ВОДЕ



ДИМЕНЗИОНИСАЊЕ POS2, POS S1

9.

ПРЕСЕК 1-1

$$M_u = 1,6 \cdot 344,24 + 1,8 \cdot 820,0 = 2026,8 \text{ kNm}$$

$$N_u = 1,6 \cdot 86,06 + 1,8 \cdot 65,0 = 254,7 \text{ kN}$$

$$b/d/r = 40/100/90 \text{ cm}$$

$$M_{au} = 2026,8 + 254,7 \cdot \left(\frac{10}{2} - 0,10\right) = 2128,7 \text{ kNm}$$

$$k = \frac{90,0}{\sqrt{\frac{2128,70}{0,40 \cdot 2,55}}} = 1,970 \rightarrow \epsilon_b/\epsilon_a = 3,50/5,75\%$$

$$\bar{\mu} = 30,630\%$$

$$A_a = 30,630 \cdot \frac{40,0 \cdot 90,0}{100} \cdot \frac{2,55}{40,0} - \frac{254,7}{40,0} = 70,30 - 6,37 = 63,93 \text{ cm}^2$$

УСВОЈЕНО $\boxed{13 R\phi 25}$ ($63,81 \text{ cm}^2$)

ПРЕСЕК 2-2

$$M_u = 1,6 \cdot 344,24 + 1,8 \cdot 740,0 = 1882,8 \text{ kNm}$$

$$N_u = 1,6 \cdot 224,88 + 1,8 \cdot 470,0 = 1205,8 \text{ kN}$$

$$b/d/r = 40/80/70 \text{ cm}$$

$$M_{au} = 1882,8 + 1205,8 \cdot \left(\frac{0,80}{2} - 0,10\right) = 2244,5 \text{ kNm}$$

$$k = \frac{70,0}{\sqrt{\frac{2244,50}{0,40 \cdot 2,55}}} = 1,492 \rightarrow \epsilon_a < 5\% \text{ (УСЛОВ ЗАДАТКА)}$$

↓
ДВОСТРУКО АРМИРАЊЕ

$$\epsilon_b/\epsilon_a = 3,5/5,0\% \rightarrow k = 1,903$$

$$\bar{\mu} = 33,332\%$$

$$M_{abu} = \left(\frac{70,0}{1,903}\right)^2 \cdot 0,40 \cdot 2,55 = 1380,1 \text{ kNm}$$

$$\Delta M_{au} = 2244,5 - 1380,1 = 864,4 \text{ kNm}$$

ПРЕТП. $a_2 = 6,0 \text{ cm}$:

$$A_{a2} = \frac{864,4 \cdot 10^2}{40,0 \cdot (70,0 - 6,0)} = 33,77 \text{ cm}^2$$

УСВОЈЕНО $\boxed{7 R\phi 25}$ ($34,36 \text{ cm}^2$)

$$A_{ay} = 33,332 \cdot \frac{40,0 \cdot 70,0}{100} \cdot \frac{2,55}{40,0} + 33,77 - \frac{1205,8}{40,0} = 63,12 \text{ cm}^2$$

УСВОЈЕНО $\boxed{13 R\phi 25}$ (63,81 cm²)

ПРЕСЕК 3-3 (МЕСТО MAX. M_u)

$$M_u = 1,6 \cdot M_g + 1,8 \cdot M_w$$

$$M_g = -99,0 + 73,13 \cdot x - 38,0 \cdot \frac{x^2}{2}$$

$$M_w = -160,0 + 250,0 \cdot x - 120,0 \cdot \frac{x^2}{2}$$

$$M_u = -446,39 + 567,0 \cdot x - 276,8 \cdot \frac{x^2}{2}$$

$$dM_u/dx = 567,0 - 276,8 \cdot x = 0 \rightarrow x_0 = 2,05 \text{ m}$$

$$\text{MAX. } M_u = M_u(x=2,05 \text{ m}) = 134,33 \text{ kNm}$$

$$N_u = 1,6 \cdot 86,06 + 1,8 \cdot 65,0 = 254,7 \text{ kN}$$

РАЗМАК НУЛТИХ ТАЧАКА МОМЕНТНОГ ДИЈАГРАМА МОЖЕМО ПРОЦЕНИТИ, ИЛИ СРАЧУНАТИ ИЗ АНАЛИТИЧКОГ ИЗРАЗА ЗА M_u:

$$-446,39 + 567,0 \cdot x - 138,4 \cdot x^2 = 0$$

$$x^2 - 4,097 \cdot x + 3,225 = 0 \rightarrow x_1 = 3,03 \text{ m}$$

$$x_2 = 1,06 \text{ m}$$

$$l_0 = 3,03 - 1,06 = 1,97 \text{ m}$$

$$B = \min \left\{ \begin{array}{l} 40,0 + 20 \cdot 20,0 = 440,0 \text{ cm} \\ 40,0 + 0,25 \cdot 197,0 = 89,3 \text{ cm} \\ 600,0 \text{ cm} \end{array} \right\} = 89,3 \text{ cm}$$

$$B/d/h = 89,3/100/95 \text{ cm}$$

$$M_{au} = 134,33 + 254,7 \cdot \left(\frac{1,0}{2} - 0,05 \right) = 248,9 \text{ kNm}$$

$$\kappa = \frac{95,0}{\sqrt{\frac{248,9 \cdot 10^2}{89,3 \cdot 2,55}}} = 9,084 \rightarrow \begin{array}{l} \varepsilon_b/\varepsilon_a = 0,55/10 \% \\ s = 0,052 \\ \mu = 1,302 \% \end{array}$$

$$s \cdot h = 0,052 \cdot 95,0 = 4,94 \text{ cm} < d_p = 20 \text{ cm} \rightarrow \text{н.о. у плочи}$$

$$A_a = 1,302 \cdot \frac{89,3 \cdot 95,0}{100} \cdot \frac{2,55}{40} - \frac{254,7}{40,0} = 0,67 \text{ cm}^2$$

$$\text{min. } A_a = 0,20 \cdot \frac{40,0 \cdot 100,0}{100} = 8,0 \text{ cm}^2$$

УСВОЈЕНО $\boxed{2 R\phi 25}$ (9,82 cm²)

ПРЕСЕК 4-4

$$M_u = 1,6 \cdot 99,0 + 1,8 \cdot 160,0 = 446,4 \text{ kNm}$$

$$N_u = 254,7 \text{ kN}$$

$$b/d/h = 40/100/95 \text{ см}$$

$$M_{au} = 446,4 + 254,7 \cdot \left(\frac{10}{2} - 0,05\right) = 561,0 \text{ kNm}$$

$$k = \frac{95,0}{\sqrt{\frac{561,0}{0,40 \cdot 2,55}}} = 4,051 \rightarrow \varepsilon_b/\varepsilon_a = 1,375/10\%$$

$$\bar{\mu} = 6,406\%$$

$$A_a = 6,406 \cdot \frac{40,0 \cdot 95,0 \cdot 2,55}{100 \cdot 40,0} - \frac{254,7}{40} = 9,15 \text{ см}^2 > A_{a, \text{MIN.}}$$

УСВОЈЕНО $\boxed{2R\phi 25}$ (9,82 см²)

ПРЕСЕК 5-5

$$M_u = 446,4 \text{ kNm}$$

$$N_u = 1,6 \cdot 70,0 = 112,0 \text{ kN}$$

$$b/d/h = 40/70/65 \text{ см}$$

$$M_{au} = 446,4 + 112,0 \cdot \left(\frac{0,70}{2} - 0,05\right) = 480,0 \text{ kNm}$$

$$k = \frac{65,0}{\sqrt{\frac{480,0}{0,40 \cdot 2,55}}} = 2,996 \rightarrow \varepsilon_b/\varepsilon_a = 2,125/10\%$$

$$\bar{\mu} = 12,027\%$$

$$A_a = 12,027 \cdot \frac{40,0 \cdot 65,0 \cdot 2,55}{100 \cdot 40,0} - \frac{112,0}{40,0} = 17,14 \text{ см}^2$$

УСВОЈЕНО $\boxed{4R\phi 25}$ (19,64 см²)

КОНТРОЛ ГЛАВНИХ НАПОНА ЗАТЕЗАЊА

По читавој дужини носача УСВОЈЕНО

$$z_b = 0,9 \cdot h_{\text{MIN.}} = 0,9 \cdot 90,0 = 81,0 \text{ см} \quad (\text{ДЕО 1-2})$$

$$z_b = 0,9 \cdot 65,0 = 58,5 \text{ см} \quad (\text{ПРЕСЕК 5-5})$$

$$z_b = 0,9 \cdot 70,0 = 63,0 \text{ см} \quad (\text{СТУБ 51})$$

$$T_u^4 = 1,6 \cdot 73,13 + 1,8 \cdot 250,0 = 567,0 \text{ KN}$$

$$T_n^4 = \frac{567,0}{40,0 \cdot 81,0} = 0,175 \text{ KN/cm}^2 \quad \begin{matrix} > T_{rc} \\ < 3T_{rc} \end{matrix}$$

$$T_{re} = \frac{1}{2} \cdot (3 \cdot 0,13 - 0,175) \cdot 40,0 \cdot 81,0 = 348,3 \text{ KN}$$

$$T_{ru} = 567,0 - 348,3 = 218,7 \text{ KN}$$

$$T_{ru}^4 = \frac{218,7}{40,0 \cdot 81,0} = 0,068 \text{ KN/cm}^2$$

УСВОЈЕНЕ МИНИМАЛНЕ УЗЕШТИЈЕ UR ϕ 8/12,5 ($m=2$)

$$T_{u,u} = 0,080 \text{ KN/cm}^2 > T_{ru}^4 = 0,068 \text{ KN/cm}^2$$

$$\lambda_2 = k_1 \cdot \left(1 - \frac{T_{rc}}{T_n^4}\right) = 2,05 \cdot \left(1 - \frac{0,13}{0,175}\right) = 0,53 \text{ m}$$

ПРЕСЕК 5-5

ЗА НЕМАРУЈУЋИ ПРОМЕНУ ВИСИНЕ НОСАЧА И НОРМАЛНЕ СИЛЕ,
ДОБИЈА СЕ:

$$T_u^5 = 1,6 \cdot 70,0 + 1,8 \cdot 169,70 = 417,47 \text{ KN}$$

$$T_n^5 = \frac{417,47}{40,0 \cdot 58,5} = 0,178 \text{ KN/cm}^2 \quad \begin{matrix} > T_{rc} \\ < 3T_{rc} \end{matrix}$$

$$T_{ru}^5 = \frac{3}{2} \cdot (T_n^5 - T_{rc}) = \frac{3}{2} \cdot (0,178 - 0,13) = 0,073 \text{ KN/cm}^2$$

УСВОЈЕНО UR ϕ 8/12,5 ($m=2$; $T_{u,u} = 0,080 \frac{\text{KN}}{\text{cm}^2}$)

ПРЕСЕК 2-2

$$T_u^2 = 1,6 \cdot 86,06 + 1,8 \cdot 185,0 = 470,7 \text{ KN}$$

$$T_n^2 = \frac{470,7}{40,0 \cdot 63,0} = 0,187 \text{ KN/cm}^2 \quad \begin{matrix} > T_{rc} \\ < 3T_{rc} \end{matrix}$$

$$T_{ru}^2 = \frac{3}{2} \cdot (0,187 - 0,13) = 0,085 \text{ KN/cm}^2$$

УСВ. $m=2$; $\theta = 45^\circ$; $\alpha = 90^\circ$; $a_e^{(1)} = 0,503 \text{ cm}^2$ (UR ϕ 8)

$$\text{ПОТР. } e_u \leq \frac{2 \cdot 0,503}{0,085 \cdot 40,0} \cdot 40,0 = 11,8 \text{ cm}$$

УСВОЈЕНО UR ϕ 8/10 ($m=2$)

ПО ЧИТАВОЈ ВИСИНИ СТУБА ($T_u = \text{const.}$)

POS 32

14.

$$l_i = l = 4,47 \text{ m}$$

$$b/d = 25/25 \text{ cm} \rightarrow i_{\min} = 25,0/\sqrt{12} = 7,22 \text{ cm}$$

$$\lambda = \frac{447}{7,22} = 62,0$$

$$J_b = 25,0^4/12 = 32552 \text{ cm}^4$$

$$e_0 = \frac{l_i}{300} = \frac{447}{300} = 1,49 \text{ cm} < \min e_0 = 2 \text{ cm} \rightarrow \text{УСВ. } e_0 = 2,0 \text{ cm}$$

$$N_E = E_b \cdot J_b \cdot \frac{\pi^2}{l_i^2} = 34,0 \cdot 10^6 \cdot 32552 \cdot 10^{-8} \cdot \frac{\pi^2}{4,47^2} = 5461,7 \text{ kN}$$

$$\alpha_E = \frac{N_g}{N_E} = \frac{192,44}{5461,7} = 0,035 ; \quad \varphi_{\infty} = 2,6$$

$$e_p = (e_0 + e_g) \cdot \left(e^{\frac{\alpha_E}{1-\alpha_E} \cdot \varphi_{\infty}} - 1 \right) = (2,0 + 0) \cdot \left(e^{\frac{0,035}{1-0,035} \cdot 2,6} - 1 \right) = 0,20 \text{ cm}$$

$$e_d = d \cdot \frac{\lambda_i - 25}{100} \cdot \sqrt{0,10 + \frac{e}{d}} = 25,0 \cdot \frac{62,0 - 25,0}{100} \cdot \sqrt{0,1 + 0} = 2,92 \text{ cm}$$

$$e = e_0 + e_p + e_d = 2,0 + 0,2 + 2,92 = 5,12 \text{ cm}$$

$$N_u = 1,9 \cdot 192,44 + 2,1 \cdot 413,67 = 1234,3 \text{ kN}$$

$$M_u = 1234,3 \cdot 5,12 \cdot 10^{-2} = 63,2 \text{ kNm}$$

$$m_u = \frac{1234,3}{25,0 \cdot 25,0 \cdot 2,55} = 0,774$$

$$m_{uu} = \frac{63,2 \cdot 10^2}{25,0 \cdot 25,0^2 \cdot 2,55} = 0,159$$

$$\frac{a}{d} = \frac{5,0}{25,0} = 0,20$$

$$A_{a1} = A_{a2}$$

$$R_A 400/500$$

$$\frac{1 \text{ ЛИНАТРАМ}}{2,4,13} \rightarrow \boxed{\bar{\mu}_y = 0,15}$$

$\epsilon_{a1} \approx 0\%$ $\rightarrow \left. \begin{matrix} \gamma_{\text{изг}} = 1,9 \\ \gamma_{\text{уп}} = 2,1 \end{matrix} \right\}$ НИЈЕ ПОТРЕБНА КОРЕКЦИЈА ВРЕДНОСТИ КОЕФИЦИЈЕНТА СИГУРНОСТИ

$$A_{a1} = A_{a2} = \bar{\mu}_y \cdot b \cdot d \cdot \frac{f_b}{\sigma_V} = 0,15 \cdot 25,0 \cdot 25,0 \cdot \frac{2,55}{40,0} = 5,98 \text{ cm}^2$$

$$A_a = A_{a1} + A_{a2} = 11,96 \text{ cm}^2$$

УСВОЈЕНО

$$\boxed{4R\phi 22} \quad (15,20 \text{ cm}^2)$$

$$\text{MAX. } e_u = \text{MIN.} \left\{ \begin{matrix} 15\phi = 15 \cdot 2,2 = 33,0 \text{ cm} \\ b = 25,0 \text{ cm} \\ 30 \text{ cm} \end{matrix} \right\} = 25,0 \text{ cm}$$

УСВОЈЕНО

$$\boxed{UR\phi 8/25}$$