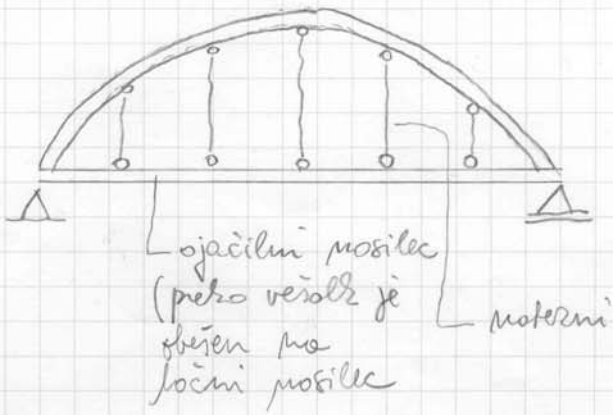
c) centrični moteg, vešalka – simetrični prerez

~ mostogradnje
~ VG nedreje

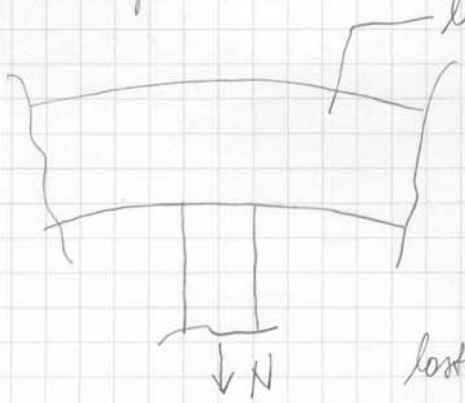


Obtežba;

- lastna teža: lok, vešalka, oj. nosilec — g_l
- stalna obtežba; na ojačilnem nosilcu — g_s
- spremenljiva –"–; koristna obt. na oj. nosilcu — q

XB vešalke → razpoke ~ propadanje

Računski primer;



C 30/37 — $f_{cd} = \frac{3,0}{1,5} = 2,0 \frac{kN}{cm^2}$

GA 240/360 (S 240) → $f_{yd} = 20,8 \frac{kN}{cm^2}$

Obremenitev;

lastna teža: $N_{g_l} = 100\ kN$

stalna obt.: $N_{g_s} = 40\ kN$

sprem. –"–: $N_q = 70\ kN$

Vešalka;

Mejno stanje nosilnosti; (betonu se ne pripiše nič)

$N_{sd} = \gamma_G (N_{g_l} + N_{g_s}) + \gamma_Q \cdot N_q = 1,35 (100+40) + 1,50 \cdot 70 = \underline{294,0\ kN}$

$M_{sd} = \emptyset$

$A_s = \frac{N_{sd}}{f_{yd}} = \frac{294,0}{20,8} = 14,1\ cm^2 \rightarrow 6\phi 18 \ (\Sigma A_s = 15,3\ cm^2)$

Izberem presek $b/h = 20/25\ cm$ (konec izbire – MSU-razpoke)

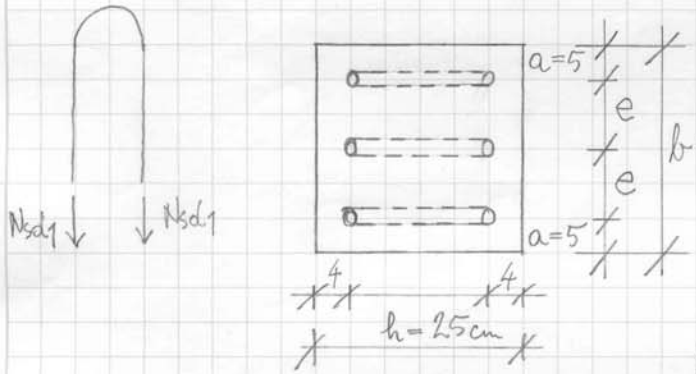
Priključek vešalke v lok: MSN

Notranjo silo v vešalki moramo prenesti v lok

- Omejiti moramo lokalne tlačne napetosti pod zanko (problem cepilnih sil)
- Preprečiti globalno izbočenje vešalke

• Kontrola lokalnih napetosti:

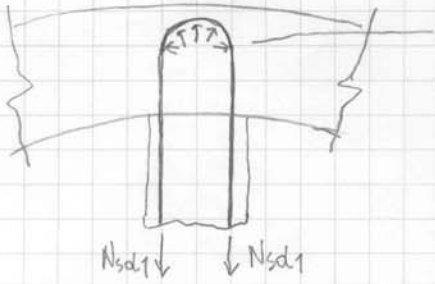
$6\phi 18 \rightarrow$ 3 zanke $\quad n_z = 3$

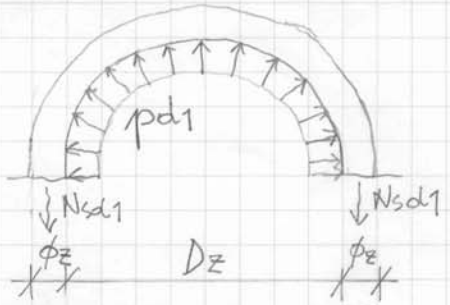


$e = \frac{b - 2a}{n_z - 1} = \frac{20 - 2 \cdot 5}{3 - 1} = 5\ cm$

Sila v eni polici zanke:

$N_{sd1} = \frac{N_{sd}}{2 \cdot n_z} = \frac{294}{2 \cdot 3} = 49,0\ kN$





Kotelna formula: pritisk pod eno zanko

$p_{d1} = \frac{N_{sd1}}{D_z/2} = \frac{49,0 \cdot 2}{15,2} = 6,44\ kN/cm$

$D_z = 25 - 2 \cdot 4 - 2 \cdot \frac{\phi_z}{2} = 17 - 1,8 = 15,2\ cm$

Kontaktne napetosti pod zanko:

$\sigma_{cd1} = \frac{p_{d1}}{\phi_z} = \frac{6,44}{1,8} = 3,6\ kN/cm^2$

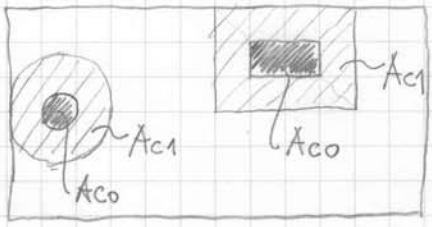
EC 2: $F_{Rdu} = A_{co} \cdot \overbrace{f_{cd} \cdot \sqrt{\frac{A_{c1}}{A_{co}}}}^{\sigma_{cRdu}} \not> 3{,}3\, f_{cd} \cdot A_{co}$

↑ enakomerno – "uniform"

$\sigma_{cRdu} = \min\left(f_{cd}\sqrt{\frac{A_{c1}}{A_{co}}};\ 3{,}3 f_{cd}\right)$

A_{co} – ploščev področja, kjer se napetosti prenašajo

A_{c1} – ploščev na katerega se napetosti prenašajo



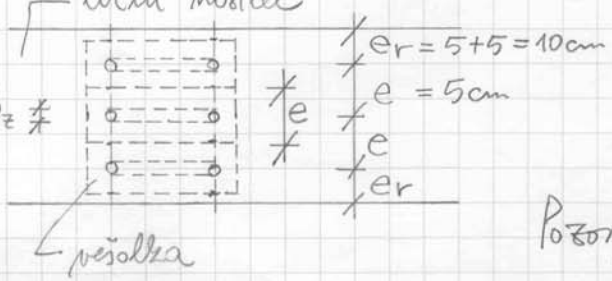
Zanke se nalaga v ložu!

merodajne srednje zanke:

$A_{co} = \frac{\pi \cdot D_z}{2} \cdot \phi_z$

$A_{c1} = \frac{\pi \cdot D_z}{2} \cdot e$

$\Rightarrow \sqrt{\frac{A_{c1}}{A_{co}}} = \sqrt{\frac{e}{\phi_z}} = \sqrt{\frac{5}{1{,}8}} = 1{,}66$



Pozor, če je $e_r < e$

$\sigma_{cRdu} = \min\left(1{,}66\, f_{cd};\ 3{,}3\, f_{cd}\right) = 1{,}66\, f_{cd} = 1{,}66 \cdot 2 = \underline{3{,}32}\ kN/cm^2$

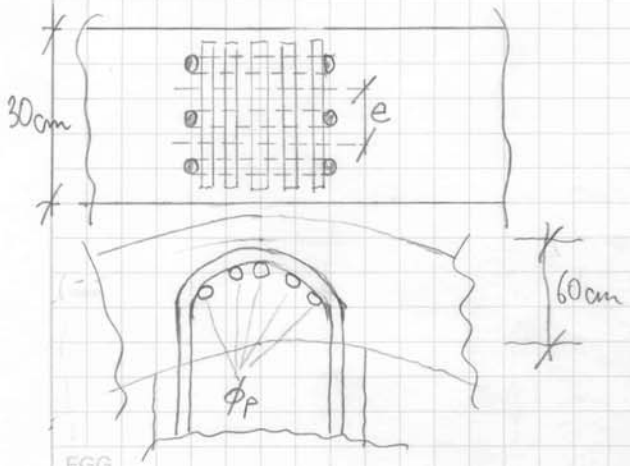
$\sigma_{cd1} = 3{,}6\ kN/cm^2 > \sigma_{cRdu} = 3{,}32\ kN/cm^2$

Kaj storiti:
- povečati D_z
- povečati e

} povečanje dimenzij vešalke

- armature – večji ϕ_z
- v nekaterih primerih lahko s povečanjem ploščine A_{co} zadostimo pogoju napetosti!

Vstavimo dodatne preče: 5 prečk ϕ 18 mm



$A'_{co} = \frac{\pi D_z}{2}\phi_z + n \cdot e \cdot \phi_p - n \cdot \phi_z \cdot \phi_p =$

$= \frac{3{,}14 \cdot 15{,}2}{2} \cdot 1{,}8 + 5 \cdot 5 \cdot 1{,}8 - 5 \cdot 1{,}8^2 = \underline{71{,}7\ cm^2}$

$A'_{c1} = A_{c1} = \frac{\pi \cdot D_z}{2} \cdot e = \frac{3{,}14 \cdot 15{,}2}{2} \cdot 5 = 119{,}30\ cm^2$

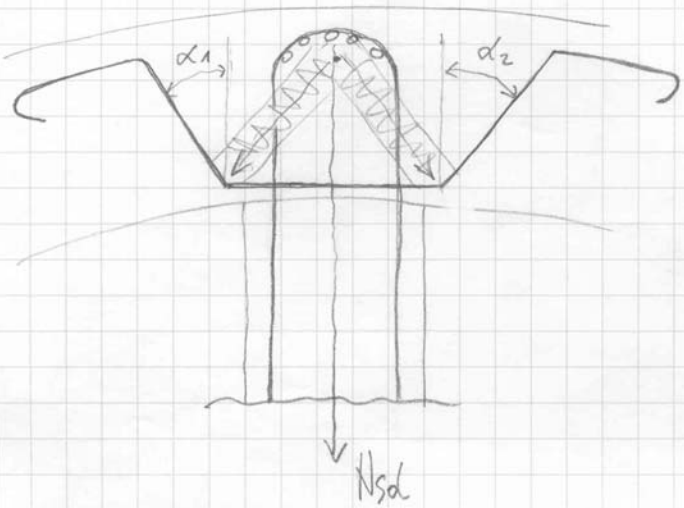
$\sigma'_{cd1} = \frac{p_{d1} \cdot \Delta l}{A'_{co}} = \frac{6{,}44 \cdot 23{,}9}{71{,}7} = \underline{2{,}15\ \frac{kN}{cm^2}}$

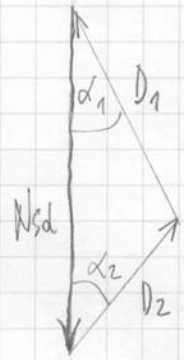
$\Delta l = \frac{\pi \cdot D_z}{2} = \frac{3{,}14 \cdot 15{,}2}{2} = 23{,}9\ cm$

$$\sigma'_{CRdu} = f_{cd} \cdot \sqrt{\frac{A_{C1}}{A_{C0}}} = 2{,}0 \cdot \sqrt{\frac{119{,}3}{71{,}7}} = 2{,}58 \text{ kN/cm}^2$$

$$\sigma'_{cd1} = 2{,}15 \text{ kN/cm}^2 < \sigma'_{CRdu} = 2{,}58 \text{ kN/cm}^2 \quad \checkmark$$

o Zavarovanje pred iztrganjem vešalke – armature zlobnice





Polica je ena sama → → merodajna je večja sila

$$A_{sk} = \frac{\max(D_1, D_2)\,d}{f_{yd}} =$$

($\alpha = 45°$)
$\alpha_1 = \alpha_2 \longrightarrow$

$$D_{1,d} = D_{2,d} = \frac{N_{sd}}{2} \cdot \frac{1}{\cos 45°} = \frac{294}{2} \cdot \frac{1}{\cos 45°} = 207{,}9 \text{ kN}$$

$$A_{s,k} = \frac{D_{1,d}}{f_{yd}} = \frac{207}{20{,}8} = 10{,}0 \text{ cm}^2 \Rightarrow \text{Izberem } 4\phi 18 \quad (A_{s,k} = 10{,}20 \text{ cm}^2)$$

D.N.: ZRISATI DETAJL PRIKLJUČKA VEŠALKE V LOK

M 1:10; Strmena v vešalki $\phi 6$ mm, $e_s = 15$ cm
— " — v ločnem nos. $\phi 8$, $e_s = 20$ cm