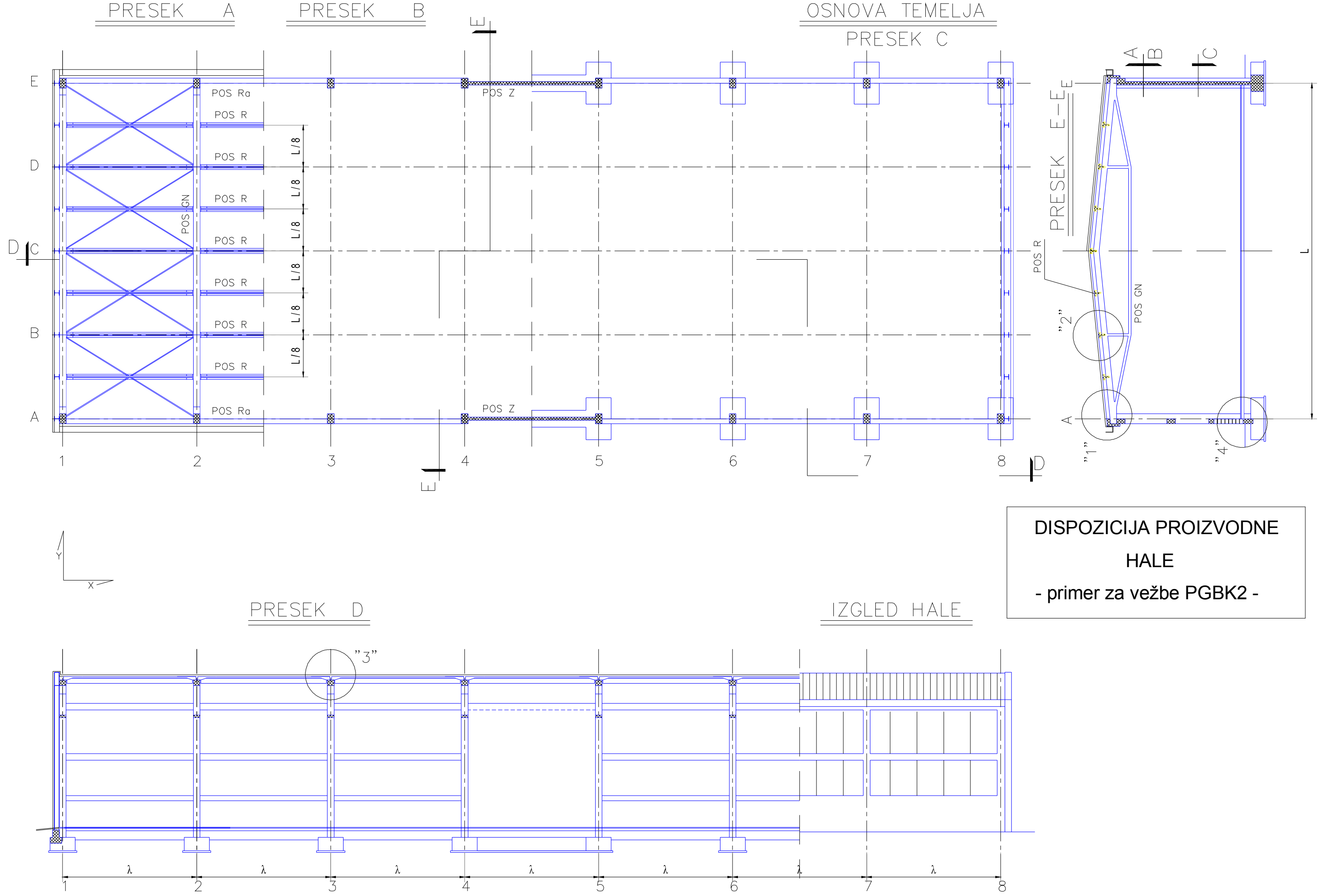
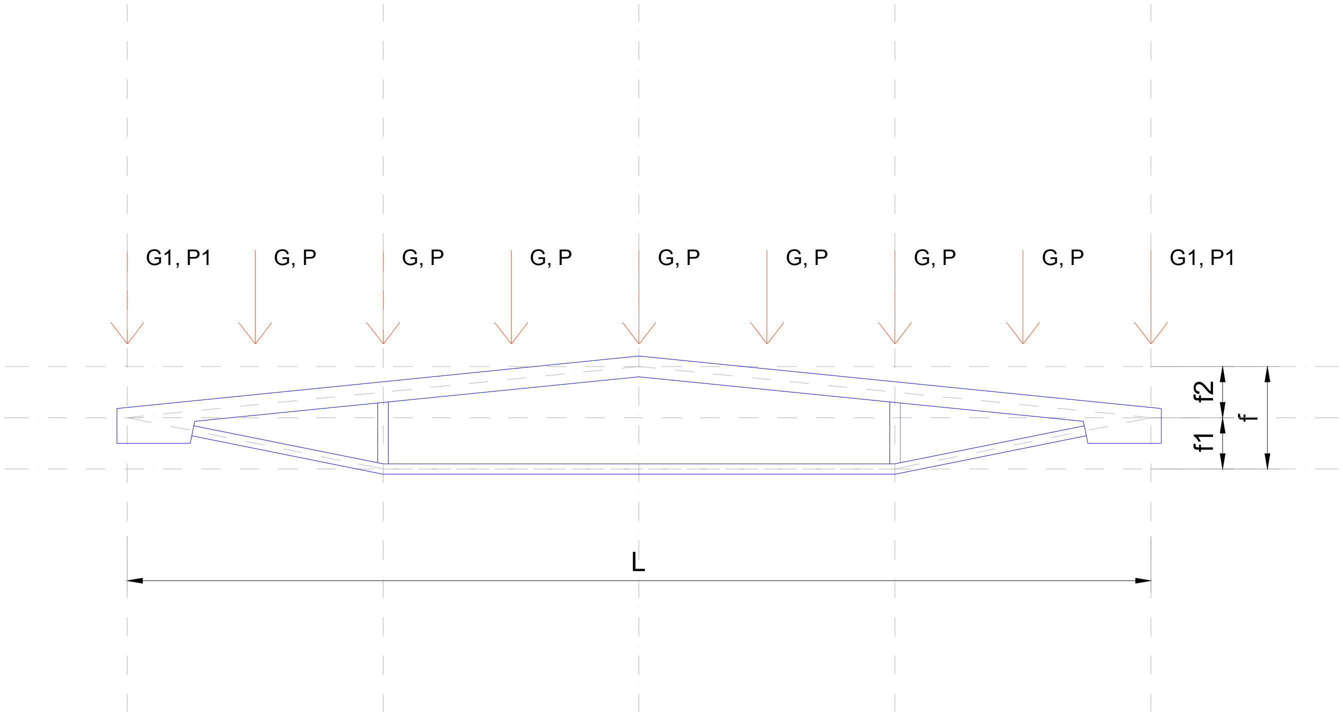
Dispozicija hale

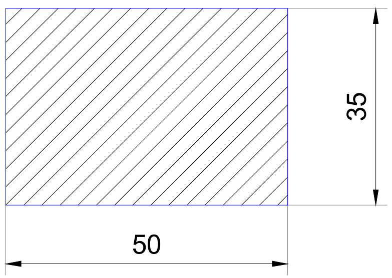


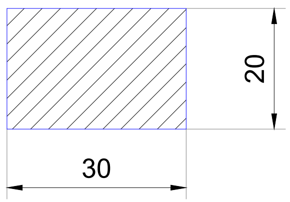
DISPOZICIJA PROIZVODNE HALE

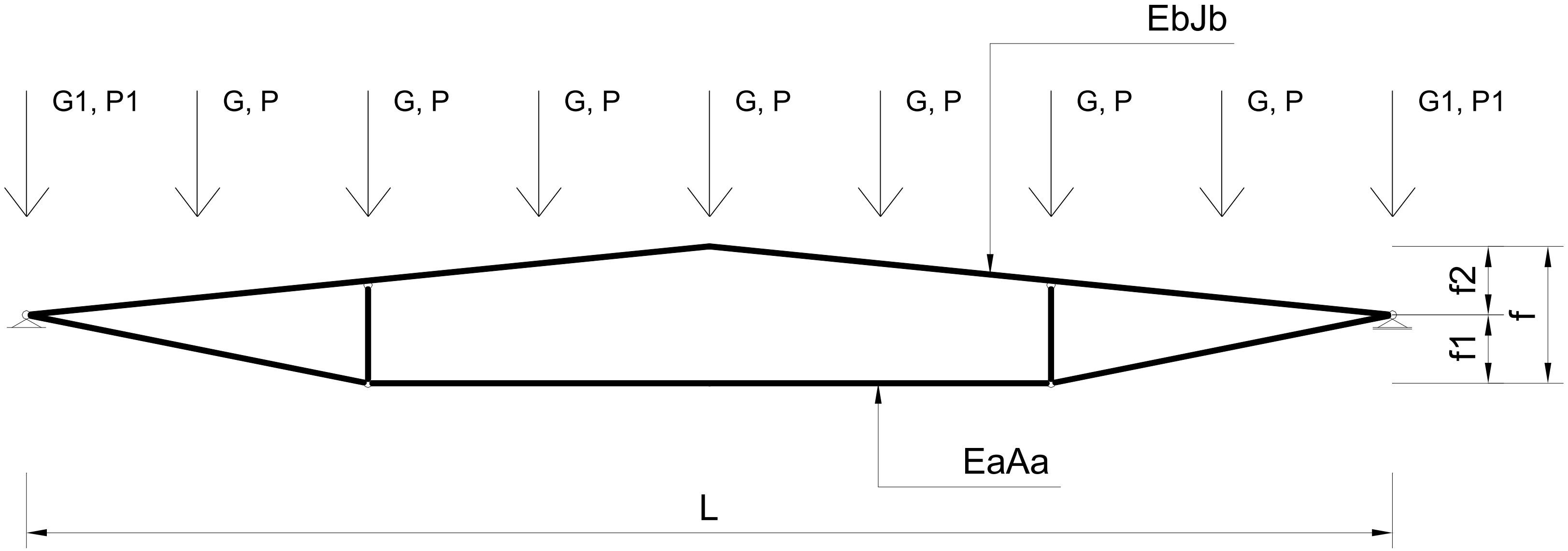
- primer za vežbe PGBK2 -

Glavni nosač







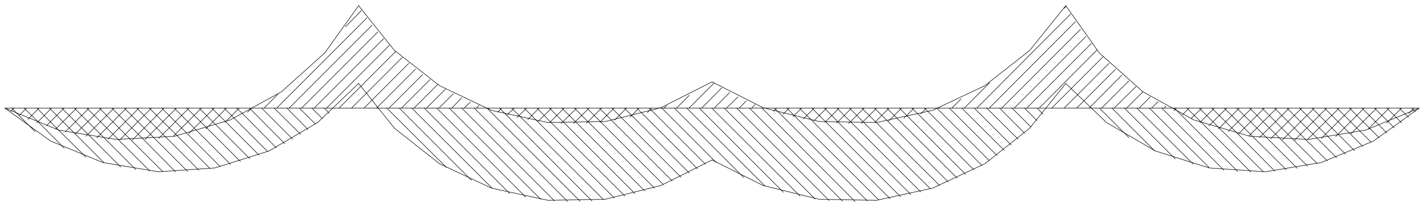


$$G = 2R_g^{POSR} \Rightarrow g = G/(L/8)$$

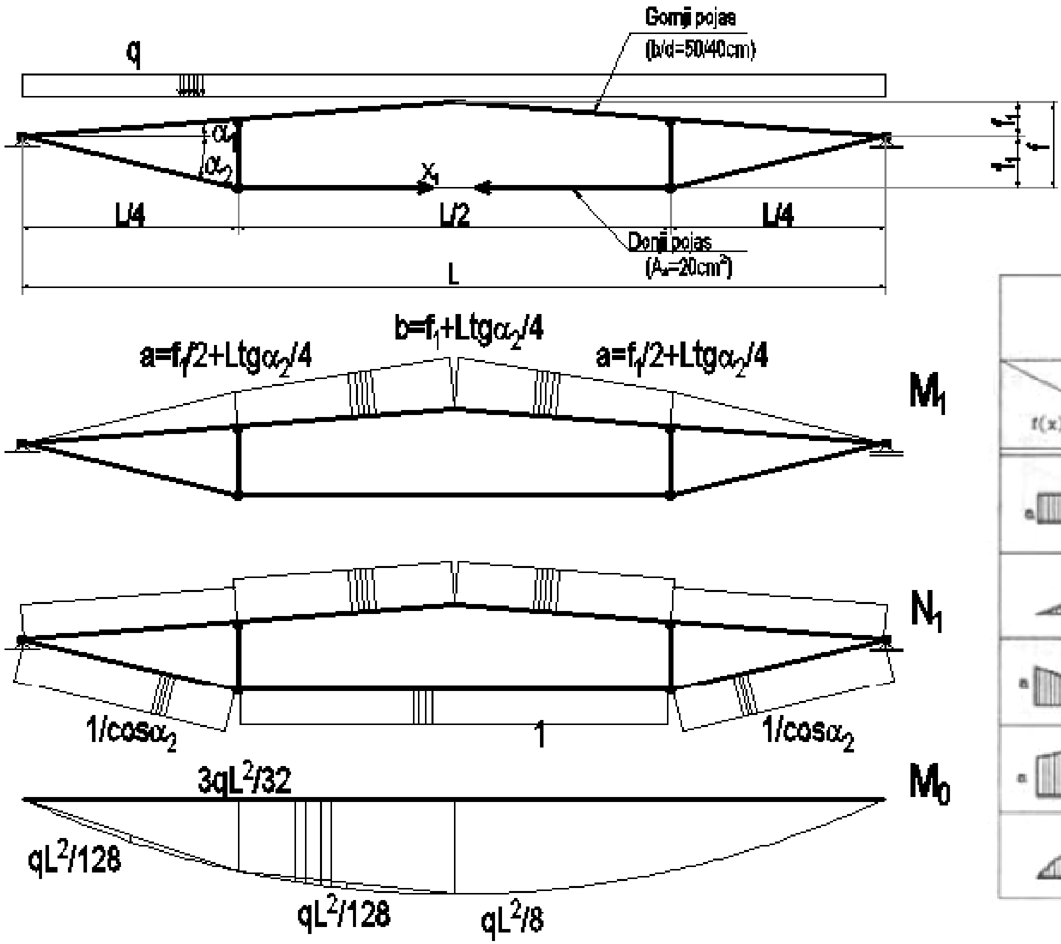
$$P = 2R_p^{POSR} \Rightarrow p = P/(L/8)$$

$$q_u = 1.6 \cdot g + 1.8 \cdot p \Rightarrow M_u = q_u L^2/8$$

$$A_a \approx \frac{M_u}{f \cdot \sigma_v}$$



Metoda sila



$I = \int_0^l f(x)\, g(x)\, dx$				
f(x) \ g(x)	c	c	c, d	a, b
a	$l\,ac$	$\frac{l}{2}ac$	$\frac{l}{2}a(c+d)$	—
a	$\frac{l}{2}ac$	$\frac{l}{3}ac$	$\frac{l}{6}a(c+2d)$	—
a	$\frac{l}{2}ac$	$\frac{l}{6}ac$	$\frac{l}{6}a(2c+d)$	—
a, b	$\frac{l}{2}c(a+b)$	$\frac{l}{6}c(a+2b)$	$\frac{l}{6}[a(2c+d)+b(c+2d)]$	$\frac{l}{3}(a^2+ab+b^2)$
a	$\frac{2}{3}l\,ac$	$\frac{l}{3}ac$	$\frac{l}{3}a(c+d)$	—

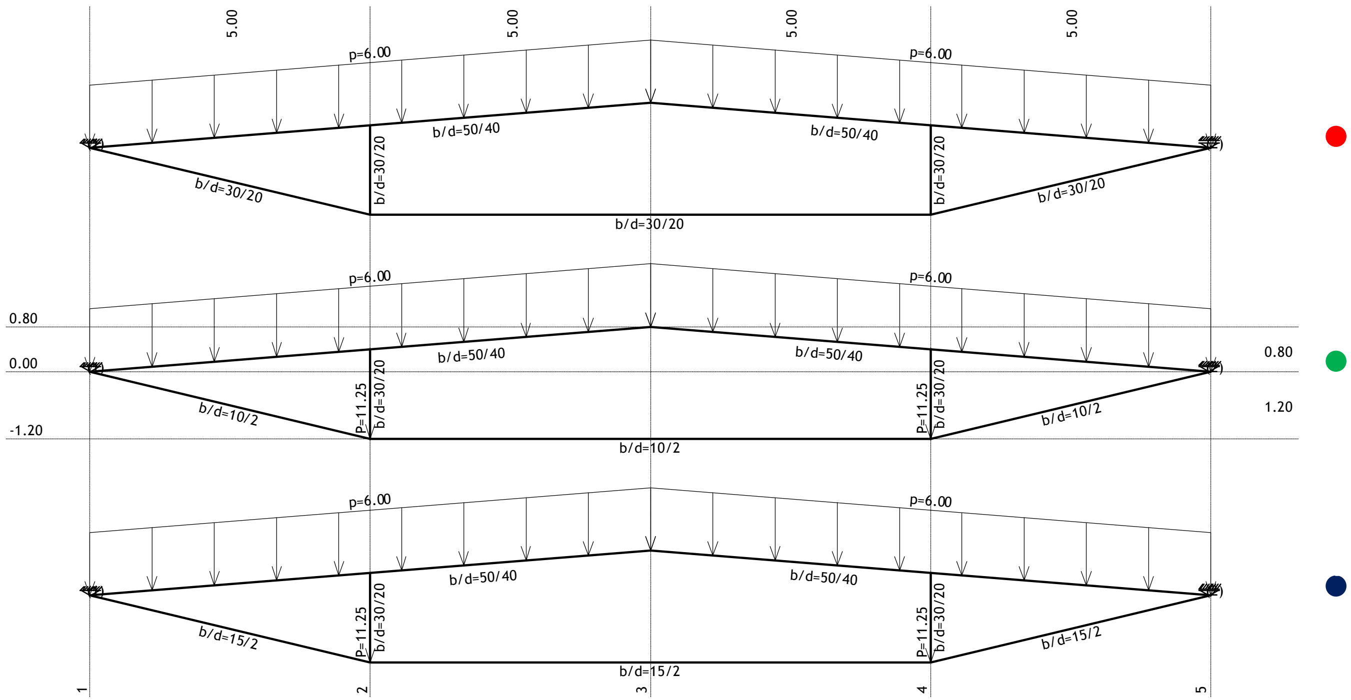
$$\delta_{ij} = \int_0^L \frac{M\overline{M}}{E_b I_b} ds + \int_0^L \frac{N\overline{N}}{E_b A_b} ds + \int_0^{L_z} \frac{Z\overline{Z}}{E_a A_a} ds$$

$$\delta_{11} = \frac{L}{6E_b I_b \cos\alpha_1}\left(2a^2 + ab + b^2\right) + \frac{L}{2E_a A_a}\left(1 + \frac{1}{\cos^3\alpha_2}\right)$$

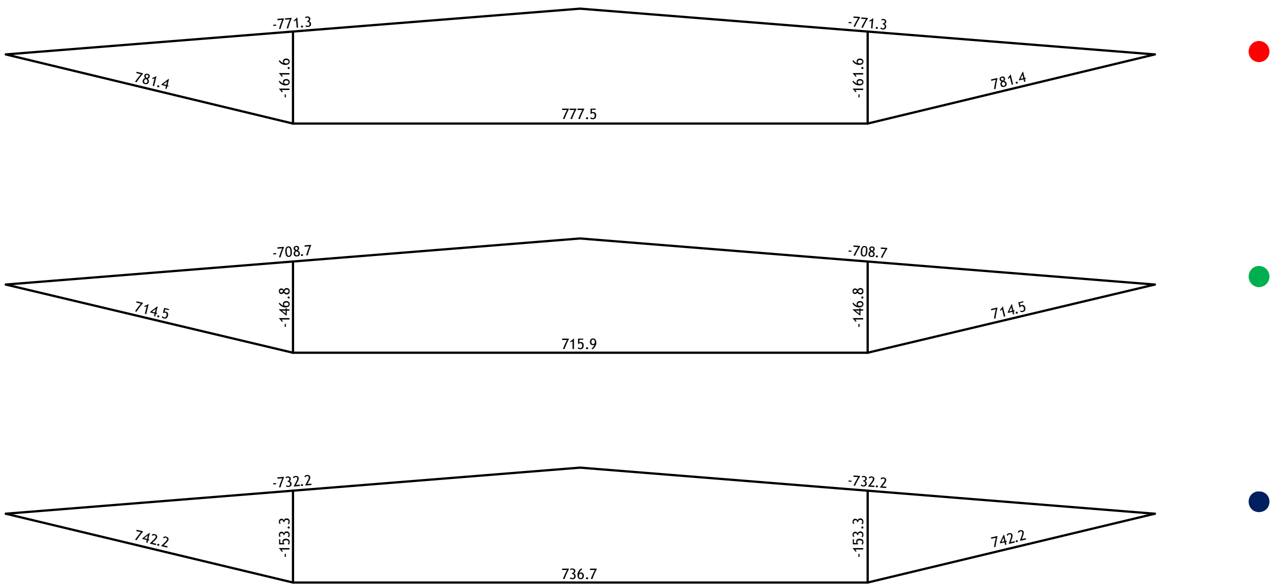
$$\delta_{10} = -\frac{qL^3}{798 E_b I_b}\left(34a + 23b\right)$$

$$\delta_{11} X_1 + \delta_{10} = 0 \Rightarrow X_1 = -\frac{\delta_{10}}{\delta_{11}}$$

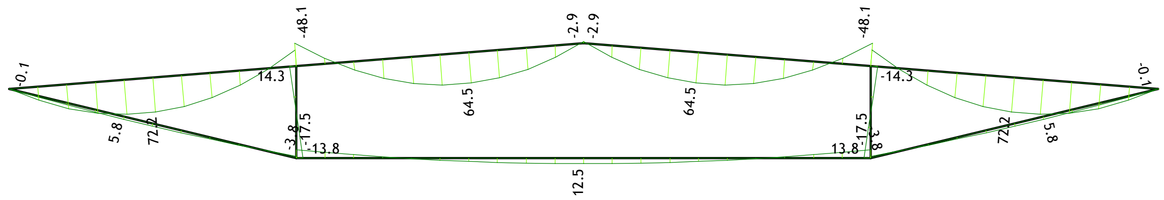
Tower

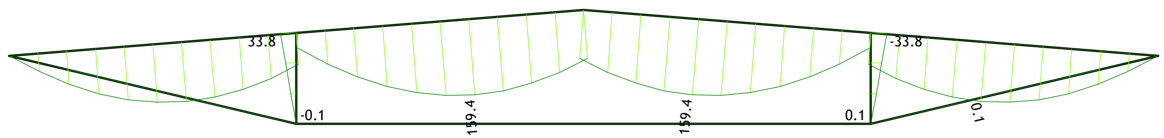


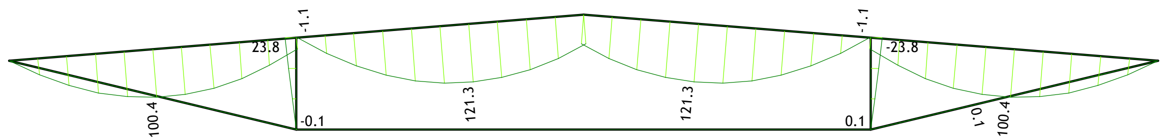
5.00
5.00
5.00
5.00
p=6.00
p=6.00
b/d=50/40
b/d=50/40
b/d=30/20
b/d=30/20
b/d=30/20
b/d=30/20
b/d=30/20
0.80
0.00
-1.20
0.80
1.20
b/d=10/2
b/d=10/2
b/d=10/2
P=11.25
P=11.25
b/d=15/2
b/d=15/2
b/d=15/2
1
2
3
4
5

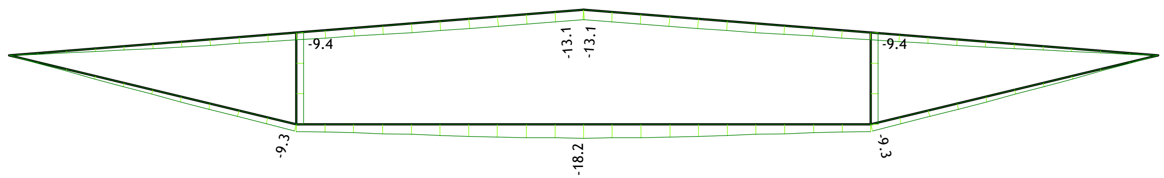


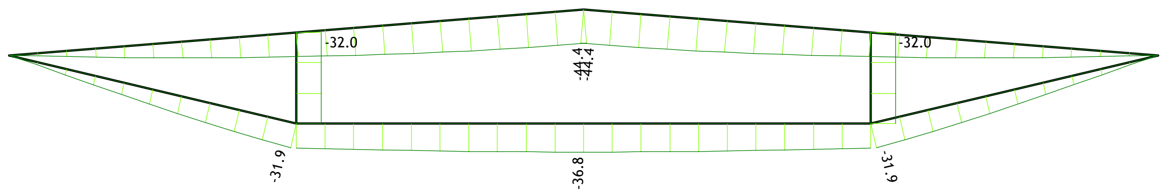
-771.3
-771.3
-161.6
-161.6
781.4
781.4
777.5
-708.7
-708.7
-146.8
-146.8
714.5
714.5
715.9
-732.2
-732.2
-153.3
-153.3
742.2
742.2
736.7

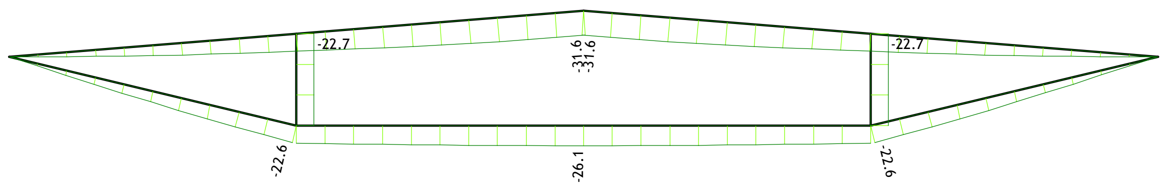

-0.1
14.3
-48.1
-2.9
-2.9
-48.1
-14.3
-0.1
5.8
72.2
-3.8
-17.5
-13.8
64.5
64.5
-17.5
-3.8
13.8
72.2
5.8
12.5

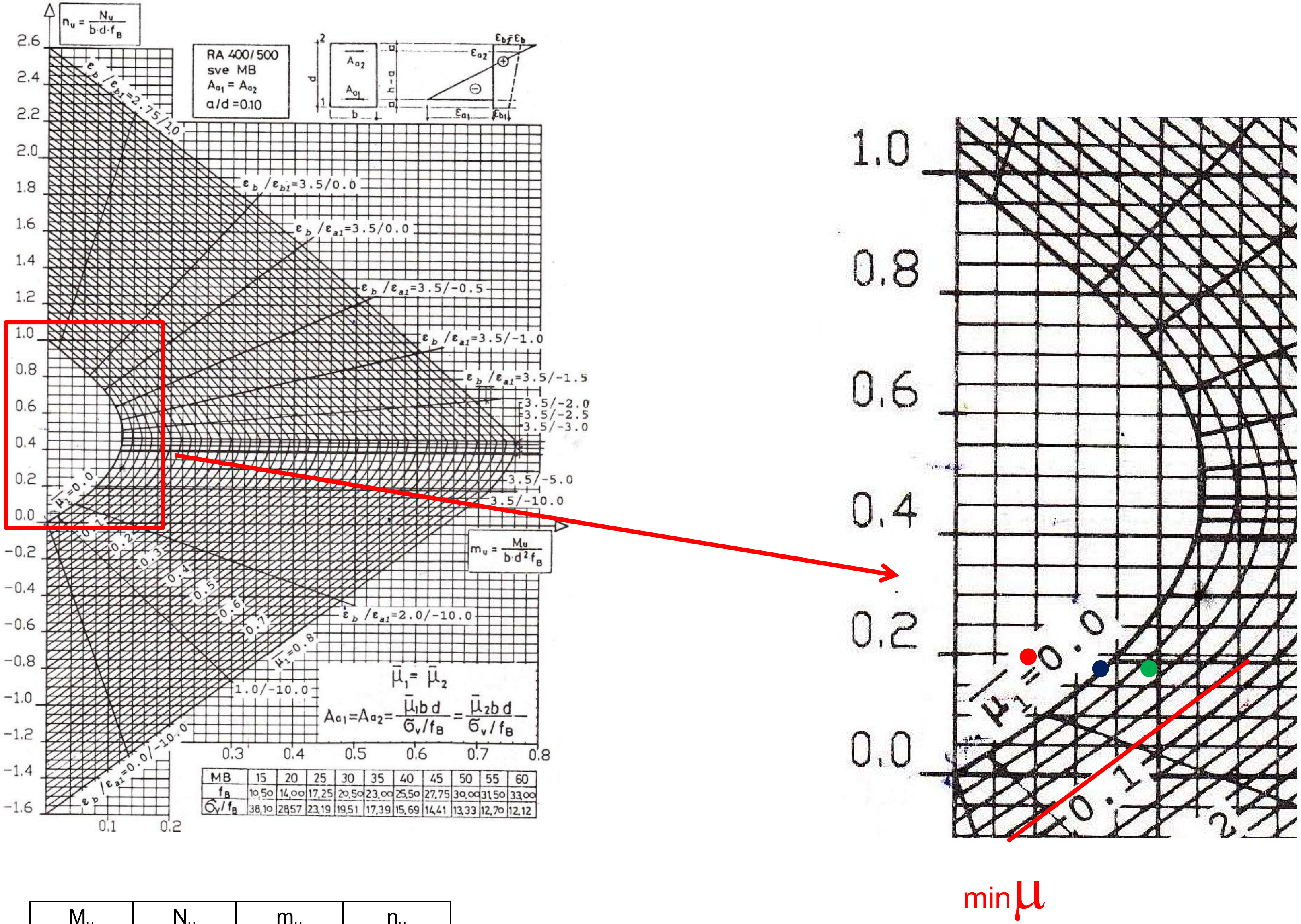

33.8
-33.8
-0.1
159.4
159.4
0.1
0.1


-1.1
23.8
-1.1
-23.8
100.4
-0.1
121.3
121.3
0.1
0.1
100.4


-9.4
-13.1
-13.1
-9.4
-9.3
-18.2
-9.3

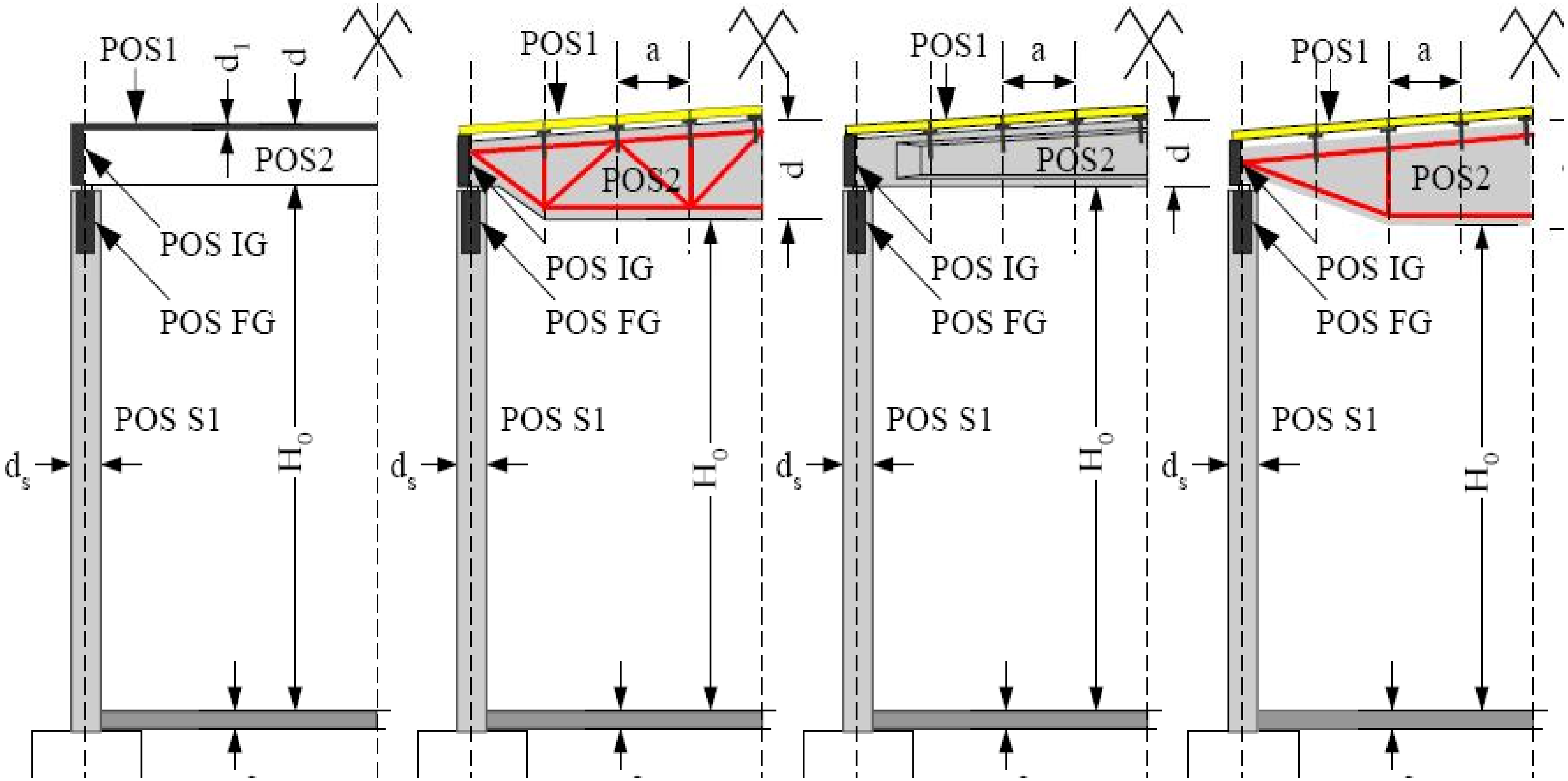

-32.0
-44.4
-44.4
-32.0
-31.9
-36.8
-31.9


-22.7
-31.6
-31.6
-22.7
-22.6
-26.1
-22.6



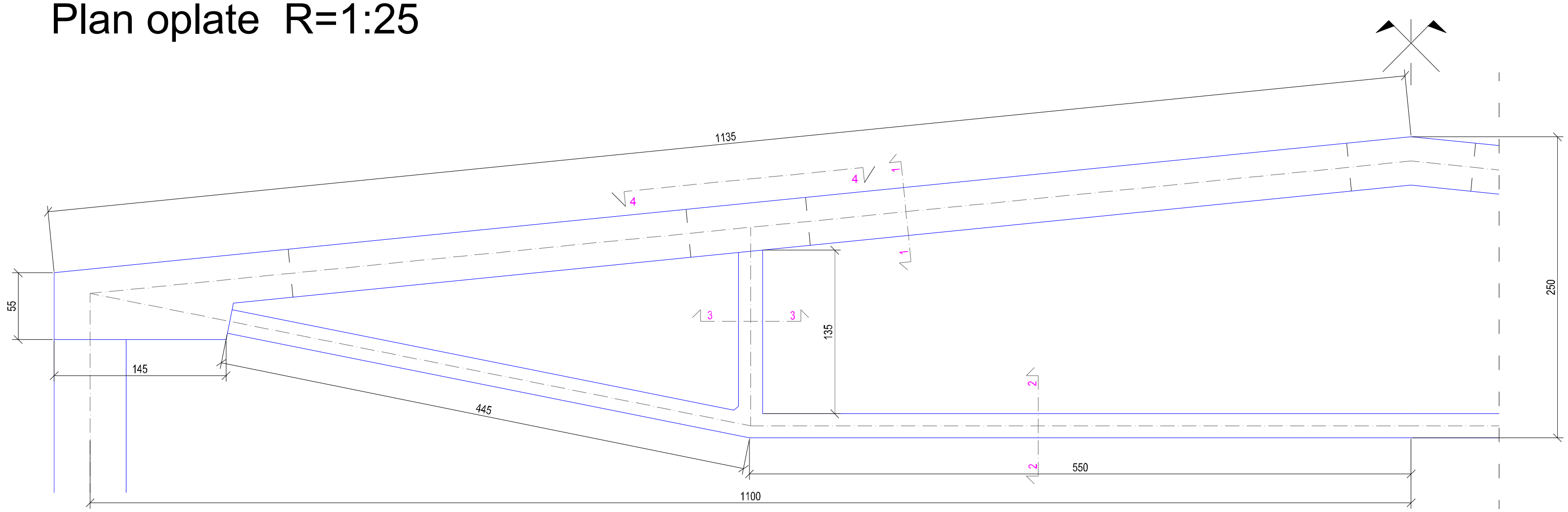
M_u	N_u	m_u	n_u
64.5	777.5	0.039	0.190
159.4	715.9	0.097	0.175
121.3	736.7	0.074	0.180

Varijante glavnih nosača

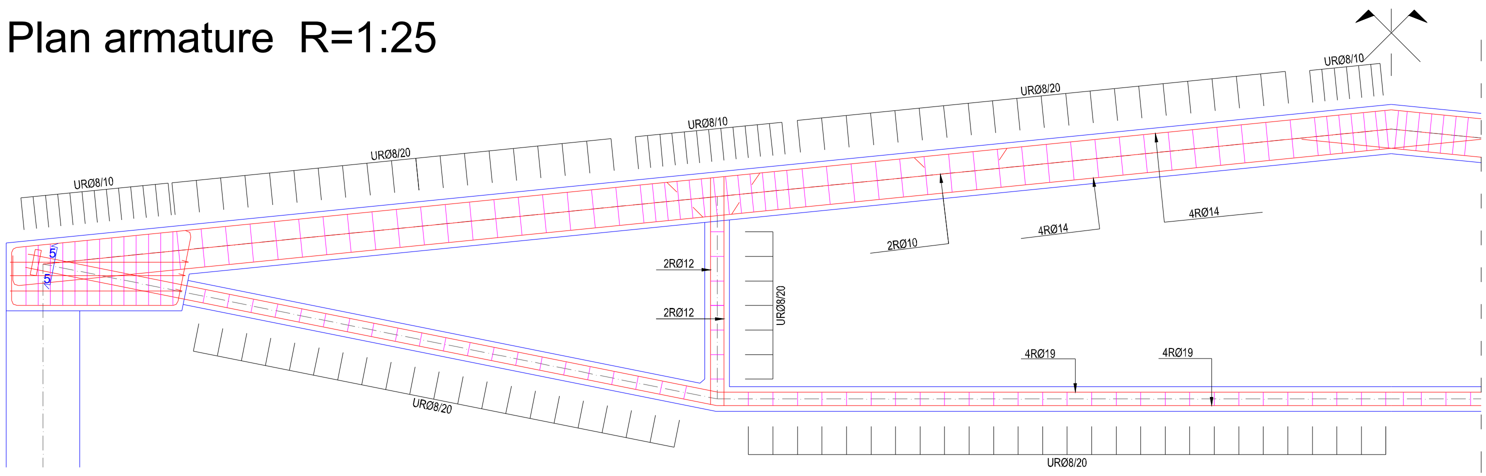


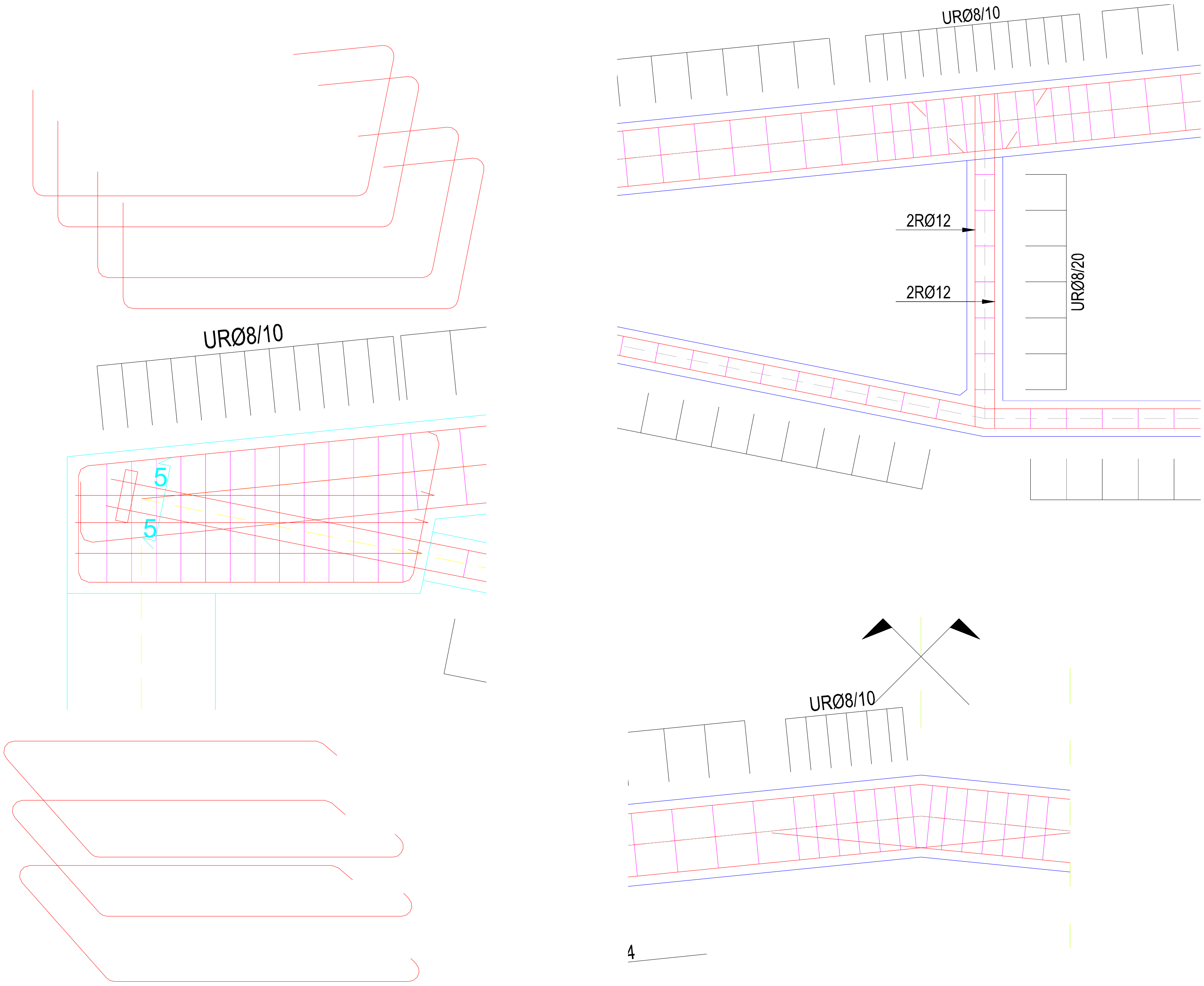
Nosač sa zatregom – Plan oplate i armature

Plan oplate R=1:25

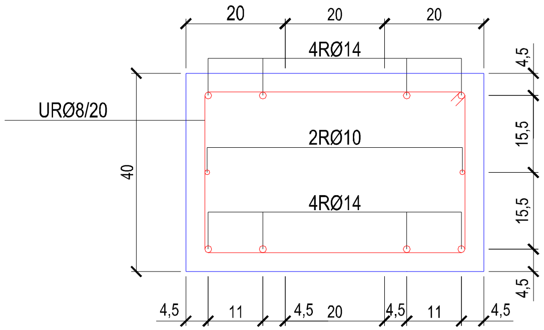


Plan armature R=1:25

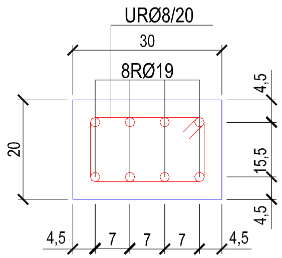



URØ8/10
5
5
URØ8/10
2RØ12
2RØ12
URØ8/20
URØ8/10
4

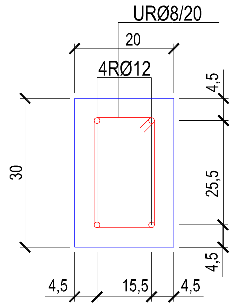
Presek 1-1



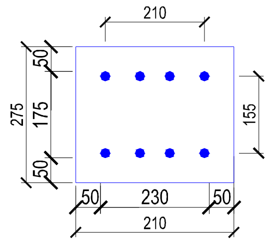
Presek 2-2



Presek3-3

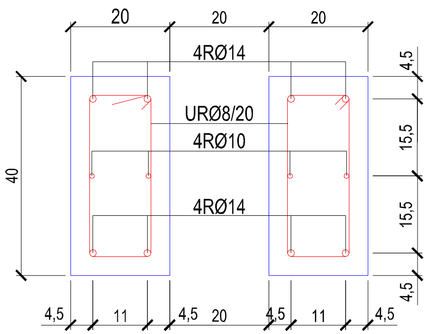


presek 4-4

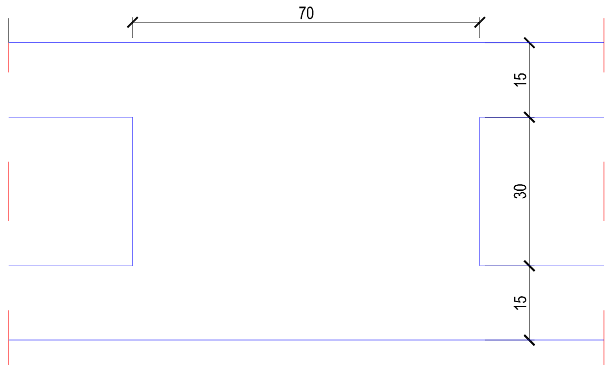


Varijanta:

Presek 1-1

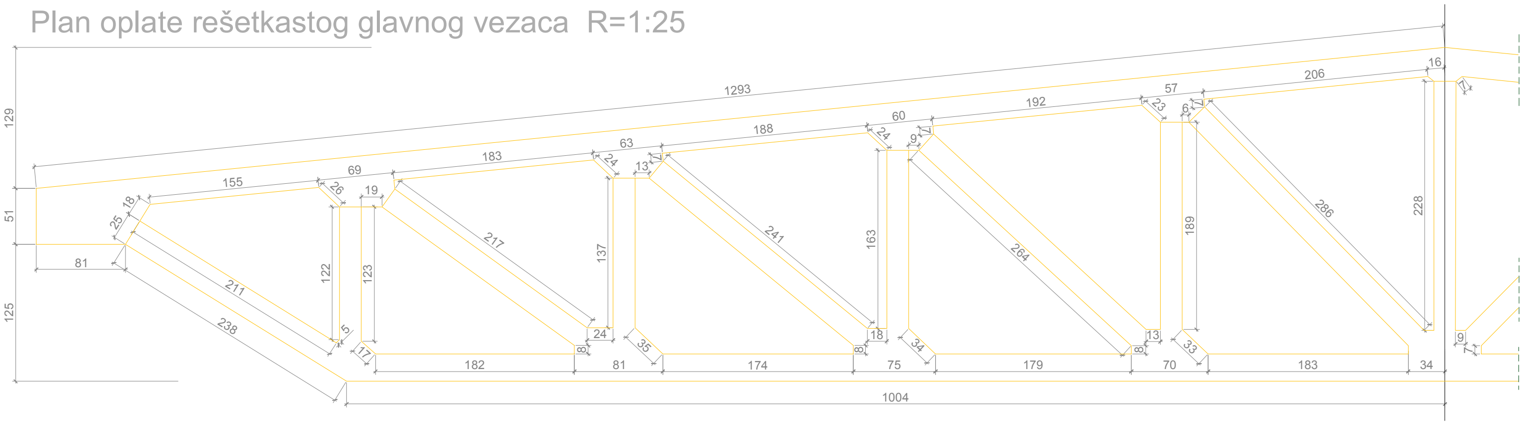


presek 5-5

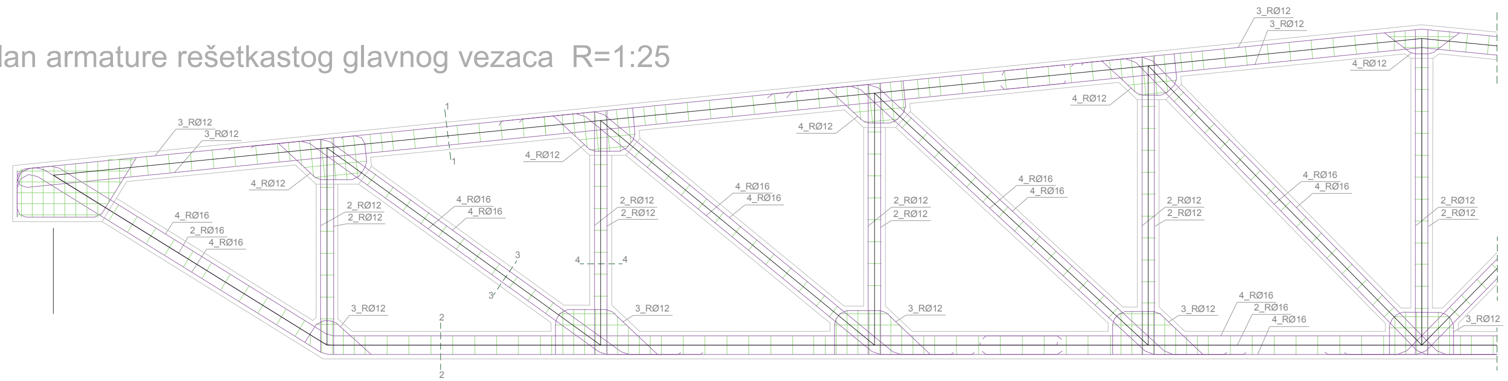


Glavni nosač - rešetka

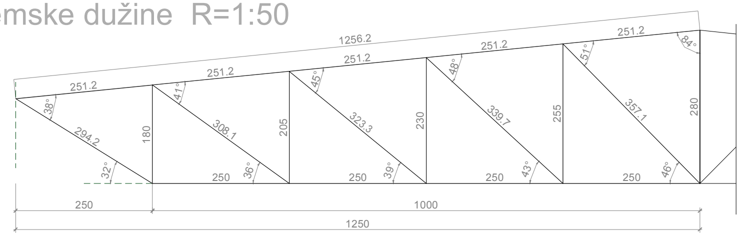
Plan oplate rešetkastog glavnog vezaca R=1:25



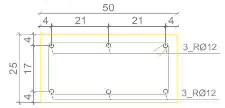
Plan armature rešetkastog glavnog vezaca R=1:25



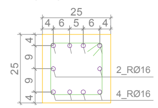
Sistemske dužine R=1:50



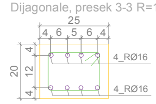
Gornji pojas, presek1-1 R=1:10



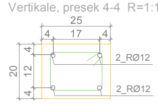
Donji pojas, presek 2-2 R=1:10



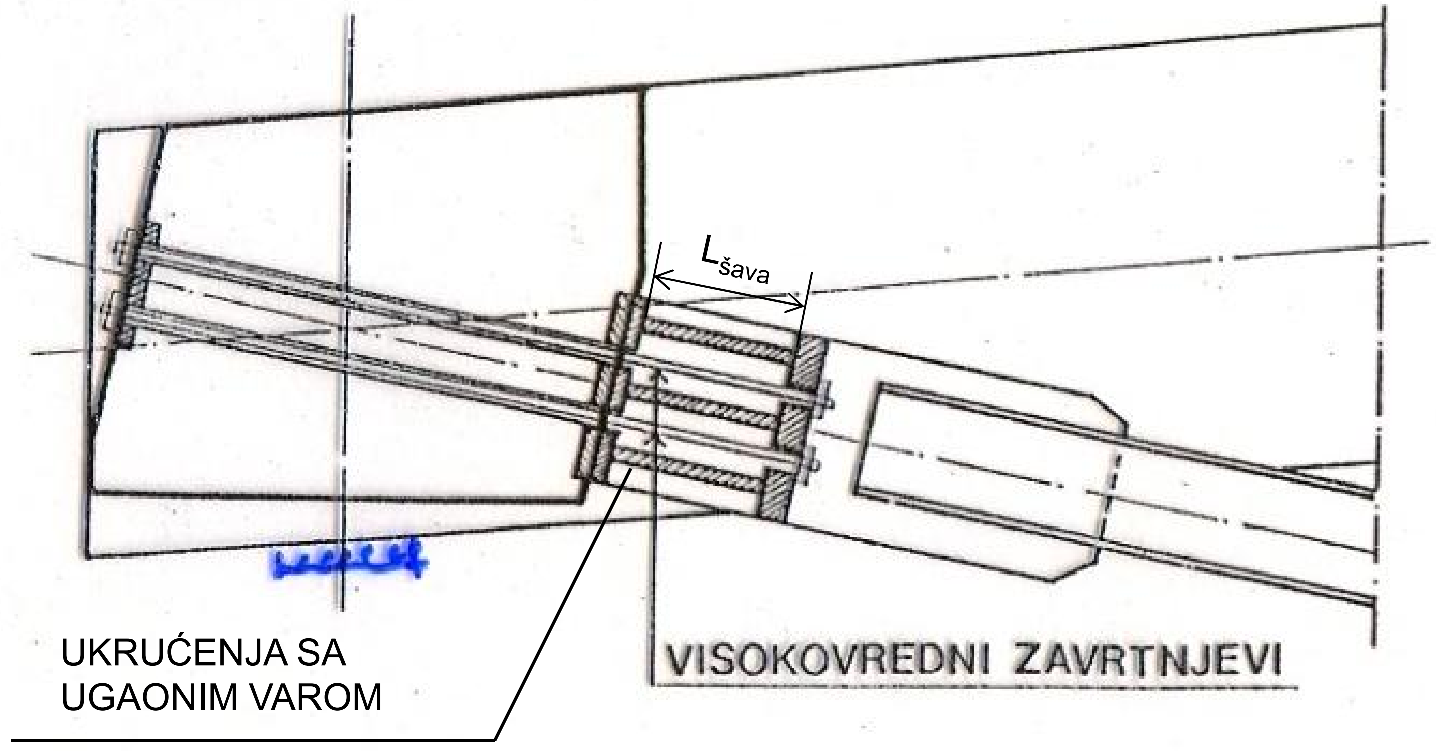
Dijagonale, presek 3-3 R=1:10

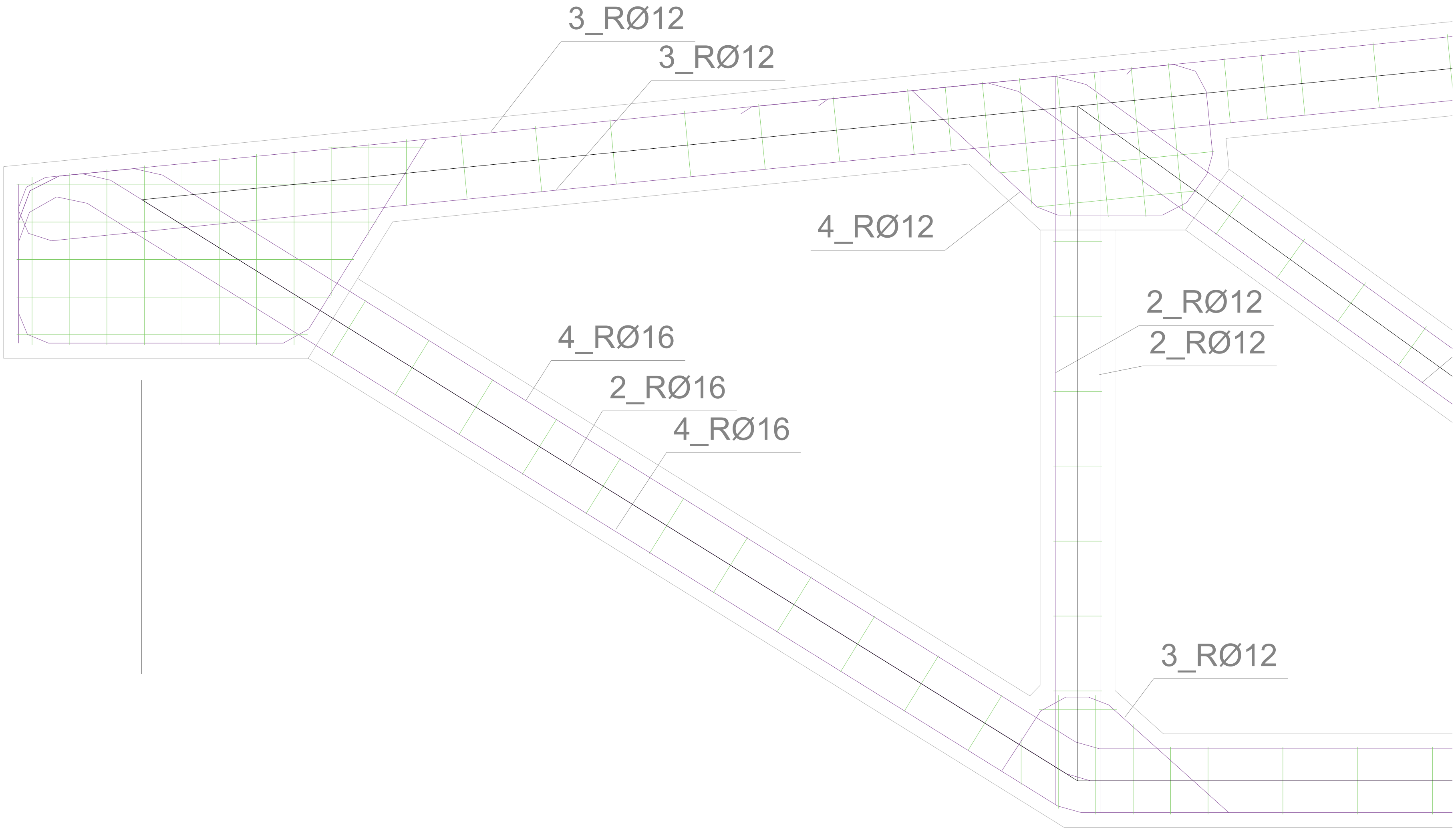


Vertikale, presek 4-4 R=1:10



Primer sidrenja čelične zatege




3_RØ12
3_RØ12
4_RØ12
2_RØ12
2_RØ12
4_RØ16
2_RØ16
4_RØ16
3_RØ12

PRORAČUN GORNJEG POJASA GLAVNOG NOSAČA NA IZBOČAVANJE U FAZI MONTAŽE

(numerički primer za vežbe)

Ulazni podaci:

- raspon glavnog nosača L=20.0 m
- dimenzije poprečnog preseka gornjeg pojasa b/d = 50/40 cm
- normalna sila pritiska od sopstvene težine nosača:
- N_{st}= 200 kN
- beton MB30, f_b= 2.05 kN/cm^2
- armatura RA400/500, σ_v=40.0 kN/cm^2

Proračun vitkosti:

- dužina izvijanja: l_i=2000 cm
- poluprečnik inercije preseka za ravan izvijanja: - vitkost: $\lambda = l_i/i$ = 2000/14.43 = 139 > 75

Proračun sa uvođenjem uticaja po teoriji drugog reda

Ekscentricitet po teoriji prvog reda

e_1= M/N = 0 (moment savijanja u ravni izvijanja je jednak nuli)

Imperfekcija ose stuba

$e_0 = l_i/300 = 2000/300 = 6.7$ cm

Uticaj tečenja betona se zanemaruje: $e_\varphi = 0$

Ukupan bezdimenzionalni ekscentricitet po teoriji prvog reda

(d = 50 cm - dimenzija u ravni mogućeg izbočavanja)

$e_l/d = (e_1 + e_0 + e_\varphi)/d = (0.0 + 6.7 + 0.0)/50 = 0.134$

Dimenzionisanje

Usvojeno simetrično armiranje

Računska normalna sila $n_r = N_u/(b \times d \times f_b) = 1.9 \times 200/(40 \times 50 \times 2.05) = 0.09$

Usvojena računska normalna sila $n_r = 0.10 > 0.09$

dimenzije preseka b/d = 40/50 cm (!), h = d - a = 50 - 5 = 45 cm, a/d = 5/50 = 0.1

Pretpostavljamo bezdimenzinalnu krivinu k=2 (optimalne vrednosti bezdimenzionalna krivine se nalaze u granicama od k=2 do k=3)

$k = \kappa \times h \times 10^3 = 2.0$

(ovo je vrednost krivine)

Bezdimenzionalni ekscentricitet spoljnih sila po teoriji drugog reda

$e_2/d = 0.1 \times \kappa \times l_i^2/d = 0.1 \times 4.44 \times 10^{-5} \times 2000^2/50 = 0.355$

Ukupan bezdimenzionalni ekscentricitet

$e/d = e_I/d + e_2/d = 0.134 + 0.355 = 0.489$

Potreban moment unutrašnjih sila preseka

potr $m_r = n_r \times e/d = 0.1 \times 0.489 = 0.049$

potr $m_r \times 10^3 = 49$ (pomnoženo sa 10^3 radi korišćenja tablica)

Tablice se nalaze u knjizi Beton i armirani beton prema BAB 87, knjiga 2, Prilog 2.7.2. U tablicama tražimo mehanički koeficijent armiranja $\overline{\mu}$:

Za n=0.1, k=2 i za $m_r \times 10^3 = 49$, $\overline{\mu}$ se nalazi između 0.00 i 0.10. Potrebno je izvršiti interpolaciju tabulisanih vrednosti $m_r \times 10^3 = 39$ i $m_r \times 10^3 = 62$:

$$potr.\overline{\mu} = 0.0 + \frac{0.10 - 0.0}{62 - 39} \times (49 - 39) = 0.04$$

$$\mu = \overline{\mu} \times \frac{f_B}{\sigma_v} = 0.04 \times \frac{2.05}{40} \times 100\% = 0.205\%$$

$$A_a = 0.205 \times \frac{50 \times 40}{100} = 4.1 cm^2$$

Proračun minimalne armature po Pravilniku BAB 87

(proračun se sprovodi po teoriji dopuštenih napona)

Dopušteni napon:

$$\sigma_i = 1.4 \times \sigma_s - 0.4 - (\sigma_s - 1) \times \frac{\lambda}{125} \quad ; \quad \sigma_s \, u[MPa]$$

, iz Tabele 21 u Pravilniku BAB

$$\sigma_i = 1.4 \times 8 - 0.4 - (8 - 1) \times \frac{139}{125} = 3.02\,MPa$$

minimalni procenat armiranja:

$$\mu_{\min} = \frac{139}{50} - 0.4 = 2.38\%$$

$$\mu_{\min} = \frac{\lambda}{50} - 0.4 \geq 0.6\%$$

potrebna površina betonskog preseka:

$$A_{b,potr.} = \frac{N}{\sigma_i \times (1 + n \times \mu_{\min})} = \frac{200}{0.302 \times (1 + 10 \times 2.38 \times 10^{-2})} = 534.9\,cm^2$$

$$A_{a,\min.} = \mu_{\min} \times A_{b,potr.} = 2.38 \times 10^{-2} \times 534.9 = 12.73\,cm^2 > 4.1\,cm^2$$

Sračunatu minimalnu armaturu potrebno je rasporediti po čitavom obimu poprečnog preseka. Konačno usvajanje armature u preseku se sprovodi nakon dimenzionisanja gornjeg pojasa prema M_u i N_u sračunatim za ukupno opterećenje q_u.