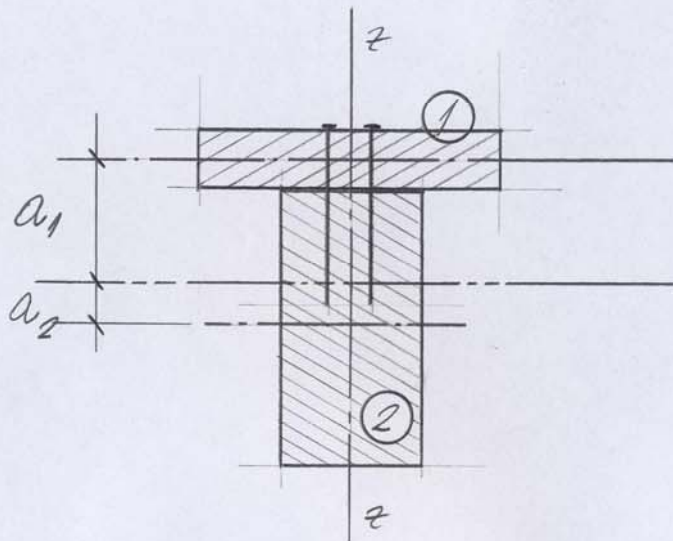


# SPREGNUTE KONSTRUKCIJE

## SASTAVLJENA DRVENA GREBA



$$b_1/h_1 = 22/4 \text{ cm}$$

$$b_2/h_2 = 10/20 \text{ cm}$$

ČAVLI Na 60/120

(BUŠENI,  $a = 72 \text{ mm}$ ,  
SVA REBA)

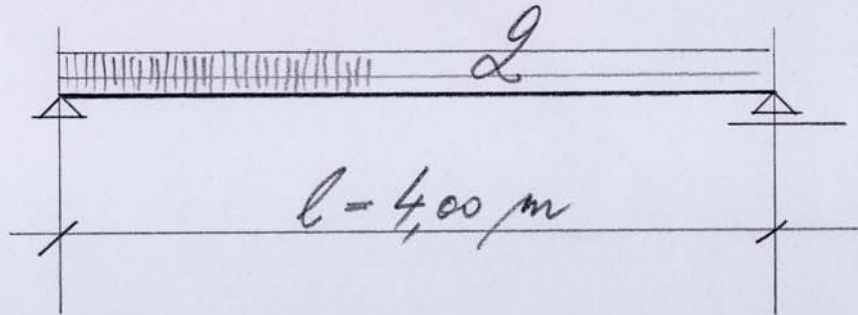
PUNO DRVO ČETINARA

MATERIJAL KLASE ČVRSTOĆE C 24

KLASA UPORABLJIVOSTI: 1 ( $V = 5-15\%$ )

OPTEREC'ENJA:

2.



$$q_{G,k} = 0,70 \text{ kN/m} \text{ (STALNO)}$$

$$q_{Q,k} = 2,45 \text{ kN/m} \text{ (PROMJENJIVO - SPENJETAJNO)}$$

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(1) SIN 1052: 2004-08

DESIGN OF TIMBER STRUCTURES  
GENERAL RULES AND RULES FOR BUILDINGS

$$E_d = E \left( \sum_{j \geq 1} \gamma_{G,j} \cdot G_{k,j} \oplus \gamma_{Q,1} \cdot Q_{k,1} \oplus \sum_{i \geq 1} \gamma_{Q,i} \cdot \psi_{Q,i} \cdot Q_{k,i} \right) \quad 3$$

$$\gamma_{G,j} = 1,35 \quad \gamma_{Q,1} = 1,5$$

$$Q_{G,d} = \gamma_G \cdot Q_{G,k} = 1,35 \cdot 0,70 = 0,95 \text{ kN/m'}$$

$$Q_{Q,d} = \gamma_Q \cdot Q_{Q,k} = 1,5 \cdot 2,45 = 3,68 \text{ kN/m'}$$

---

$$Q_d = 4,63 \text{ kN/m'}$$

$$M_{y,d} = \frac{4,63 \cdot 4,0^2}{8} = 9,30 \text{ kNm}$$

$$V_{z,d} = \frac{4,63 \cdot 4,0}{2} = 9,30 \text{ kN}$$

## GEOMETRIJSKE KARAKTERISTIKE PRESJECA

4.

$$A_1 = 22 \cdot 4 = 88 \text{ cm}^2$$

$$J_{y1} = \frac{22 \cdot 4^3}{12} = 117 \text{ cm}^4$$

$$W_{y1} = \frac{22 \cdot 4^2}{6} = 58,7 \text{ cm}^3$$

$$A_2 = 10 \cdot 20 = 200 \text{ cm}^2$$

$$J_{y2} = \frac{10 \cdot 20^3}{12} = 6667 \text{ cm}^4$$

$$W_{y2} = \frac{10 \cdot 20^2}{6} = 667 \text{ cm}^3$$

$$A_{\text{tot}} = 88 + 200 = 288 \text{ cm}^2$$

## C24 - KARAKTERISTIČNE VRIJEDNOSTI

5.

$$f_{c,0,k} = 21,0 \text{ N/mm}^2$$

$$f_{t,0,k} = 14,0 \text{ N/mm}^2$$

$$f_{m,k} = 24,0 \text{ N/mm}^2$$

(1) TAB. F.5

$$f_{v,k} = 2,7 \text{ N/mm}^2$$

$$E_{0,MEAN} = 11\,000 \text{ N/mm}^2$$

$$E_{0,05} = \frac{2}{3} \cdot 11\,000 = 7333 \text{ N/mm}^2$$

PROČUNSKÉ VRIJEDNOSTI :  $f_d = k_{mod} \cdot \frac{f_k}{\gamma_M}$

$$k_{mod} = 0,8 \quad (1. \text{ KLASA UPORABLJIVOSTI / SREDNJE PRAVNO}) \quad (1) \text{ TAB. F.1}$$

$$\gamma_M = 1,3 \quad (1) \text{ TAB. 1}$$

C 24 / 1. KL. UPORABLJIVOSTI : PRORAČUNSKE VRIJEDNOSTI

6.

$$f_{c,d} = 0,8 \cdot \frac{21}{1,3} = 12,9 \text{ N/mm}^2$$

$$f_{t,d} = 0,8 \cdot \frac{14}{1,3} = 8,6 \text{ N/mm}^2$$

$$f_{m,d} = 0,8 \cdot \frac{24}{1,3} = 14,8 \text{ N/mm}^2$$

$$f_{v,d} = 0,8 \cdot \frac{2,7}{1,3} = 1,66 \text{ N/mm}^2$$

DOKAZ ZA POČETNO STANJE :

$$(E \cdot J)_{ef,y} = \sum_{i=1}^2 E_i \cdot J_i + \sum_i^l E_i \cdot A_i \cdot a_i^2$$

(1) (25)

$$E_1 = E_2 = E \longrightarrow J_{ef,y} = \sum_{i=1}^2 J_i + \sum_i^l A_i \cdot a_i^2$$

KOEFICIENT POPUSTLIVOSTI

7.

$$\beta_1 = \frac{1}{1 + \frac{\pi^2 \cdot E_1 \cdot A_1 \cdot s_1}{k_1 \cdot l^2}}$$

(1)(29)

RAZMAK ČAVLA SVEŘENO NA TĚŽANĚ PŘES

$$s_1 = \frac{72}{2} = 36 \text{ mm}$$

MODUL KLIZANŇA

(1)(4)

$$k_1 = \frac{k_{M, \text{MEAN}}}{\beta_M}$$

$$k_{M, \text{MEAN}} = \frac{2}{3} k_{SER}$$

(1)(5)

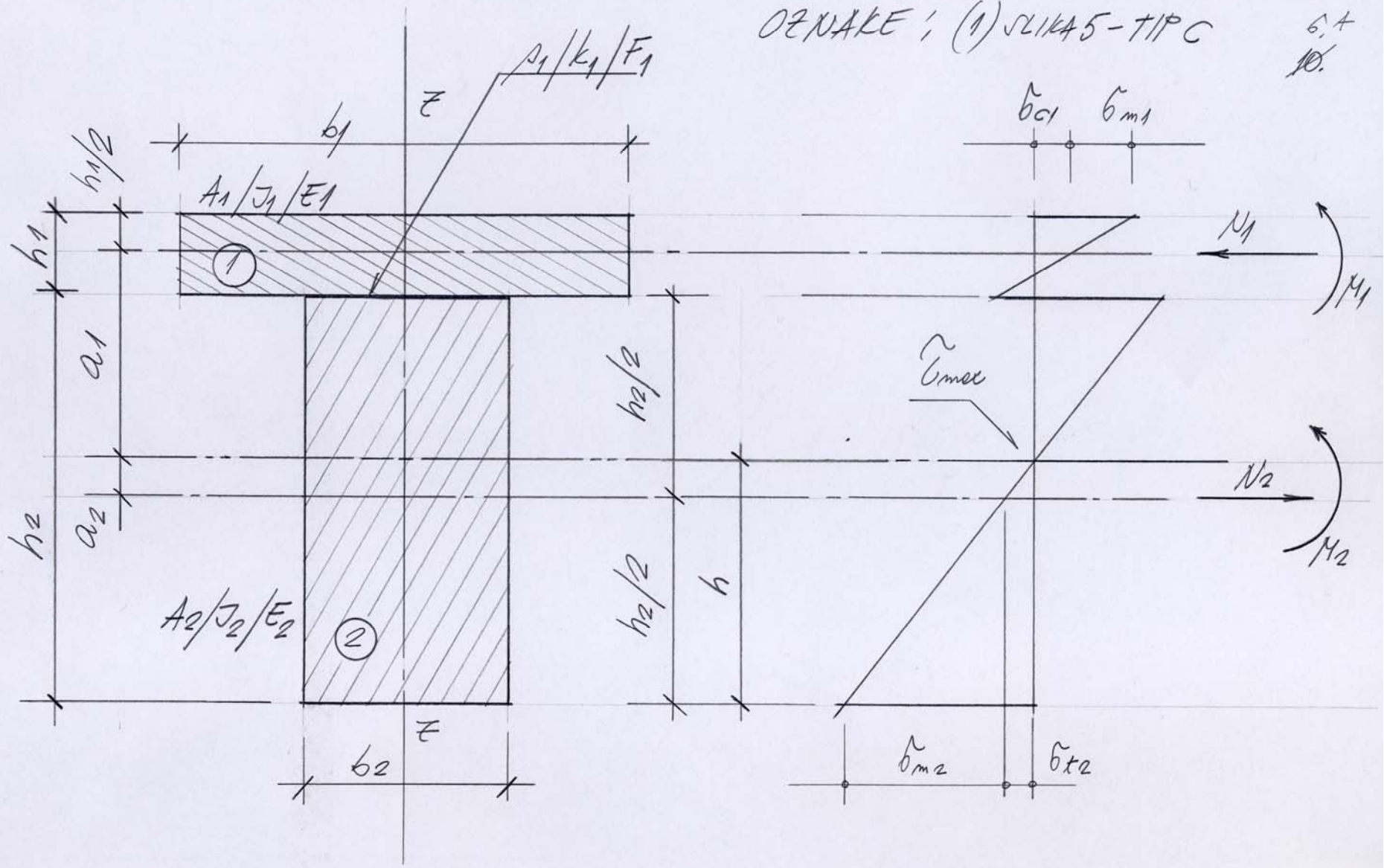
$$\text{MODUL KLIZANŇA ZA ROŠEJNÉ ČAVLE } k_{SER} = \frac{\rho_k^{1,5} \cdot d}{20}$$

(1) TAB. G.1

C24 - KAR. GUSTOŤA  $\rho_k = 350 \text{ kg/m}^3$ ;  $d$  - PRŮMĚR ČAVLA (mm)

ОЗНАЧЕ: (1) СЛИКА 5-ТИП С

6,4  
10.





$$k_{OER} = \frac{350^{1,5} \cdot 6}{20} = 1964 \text{ N/mm}$$

8.

$$k_{M, MEAN} = \frac{2}{3} \cdot 1964 = 1309 \text{ N/mm}$$

$$j_M^2 = 1,3$$

$$k_1 = \frac{k_{M, MEAN}}{j_M} = \frac{1309}{1,3} = 1007 \text{ N/mm}$$

$$\frac{k_1}{s_1} = \frac{1007}{36} = 28,0 \text{ N/mm}^2$$

$$E_1 = E_2 = \frac{E_{O, MEAN}}{j_M} = \frac{11000}{1,3}$$

(1) 8.2(2)

$$E_1 = E_2 = 8462 \text{ N/mm}^2$$

$$j_1^e = \frac{1}{1 + \frac{\pi^2 \cdot 8462 \cdot 88 \cdot 10^2 \cdot 36}{1007 \cdot (40 \cdot 10^3)^2}} = 0,378$$

9.

$$j_2^e = 1,0$$

(1) (28)

$$a_2 = \frac{1}{2} \cdot \frac{j_1^e \cdot E_1 \cdot A_1 \cdot (h_1 + h_2)}{(j_1^e \cdot E_1 \cdot A_1 + j_2^e \cdot E_2 \cdot A_2)}$$

(1) (30)

$$a_2 = \frac{1}{2} \cdot \frac{0,378 \cdot 8462 \cdot 88 \cdot 10^2 \cdot (40 + 200) \cdot 10}{(0,378 \cdot 8462 \cdot 88 \cdot 10^2 + 1,0 \cdot 8462 \cdot 200 \cdot 10^2)}$$

$$a_2 = 17,1 \text{ mm}$$

$$a_1 = \frac{(h_1 + h_2)}{2} - a_2 = \frac{(40 + 200)}{2} - 17,1$$

$$a_1 = 102,9 \text{ mm}$$

$$J_{ef,y} = J_{y1} + J_{y2} + J_1^2 \cdot A_1 \cdot a_1^2 + J_2^2 \cdot A_2 \cdot a_2^2 \quad 11.$$

$$J_{ef,y} = 117 + 6667 + 0,378 \cdot 88 \cdot 10,29^2 + 1,0 \cdot 200 \cdot 1,71^2$$

$$J_{ef,y} = 10891 \text{ cm}^4$$

$$(E \cdot J)_{ef,y} = 8462 \cdot 10891 \cdot 10^4 = 9,22 \cdot 10^{11} \text{ Nmm}^2$$

ELEMENT ①

$$N_{1,d} = \frac{M_{y1,d}}{(E \cdot J)_{ef,d}} \cdot J_1^2 \cdot a_1 \cdot E_1 \cdot A_1 \quad (1) \quad (31)$$

$$N_{1,d} = \frac{93 \cdot 10^6}{9,22 \cdot 10^{11}} \cdot 0,378 \cdot 102,9 \cdot 8462 \cdot 88 \cdot 10^2 = 29216 \text{ N}$$

$$M_{y1,d} = \frac{M_{y1,d}}{(E \cdot J)_{ef,y}} \cdot E_1 \cdot J_{y1} \quad (1) \quad (32)$$

$$M_{1y,d} = \frac{93 \cdot 10^6}{9,22 \cdot 10^{11}} \cdot 8462 \cdot 117 \cdot 10^4 = 99864 \text{ Nmm}$$

12.

PROVAČUNSKA VRIJEDNOSTI NAPREŽANJA:

$$\sigma_{c,0,d} = \frac{N_{1,d}}{A_1} = \frac{29216}{88 \cdot 10^2} = 3,32 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{1y,d}}{W_{y1}} = \frac{99864}{58,7 \cdot 10^3} = 1,70 \text{ N/mm}^2$$

DOKAZ ZA ELEMENT ①

$$\left( \frac{\sigma_{c,0,d}}{f_{c,0,d}} \right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} =$$

(1) (57)

$$= \left( \frac{3,32}{12,9} \right)^2 + \frac{1,7}{14,8} = 0,18 < 1,0$$

## ELEMENT ②

B.

$$N_{2,d} = \frac{M_{y,d}}{(E \cdot J)_{ef,y}} \cdot \rho_2 \cdot A_2 \cdot E_2 \cdot A_2$$

(1) (31)

$$N_{2,d} = \frac{93 \cdot 10^6}{922 \cdot 10^{11}} \cdot 1,0 \cdot 17,1 \cdot 8462 \cdot 200 \cdot 10^2 = 29\,191 \text{ N}$$

$$M_{zy,d} = \frac{M_{y,d}}{(E \cdot J)_{ef,y}} \cdot E_2 \cdot J_{y2}$$

(1) (32)

$$M_{zy,d} = \frac{93 \cdot 10^6}{922 \cdot 10^{11}} \cdot 8462 \cdot 6667 \cdot 10^4 = 5\,690\,567 \text{ Nmm}$$

PROVAČUNSKE VRIJEDNOSTI NAPREŽANJA:

$$\sigma_{t,o,d} = \frac{N_{2,d}}{A_2} = \frac{29\,191}{200 \cdot 10^2} = 1,46 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{zy,d}}{W_{y2}} = \frac{5\,690\,567}{667 \cdot 10^3} = 8,53 \text{ N/mm}^2$$

## DOKAZ ZA ELEMENT (2)

14.

$$\frac{\tilde{\sigma}_{t,0,d}}{f_{t,0,d}} + \frac{\tilde{\sigma}_{m,y,d}}{f_{m,y,d}} = \frac{1,46}{8,6} + \frac{8,53}{14,8} = 0,75 < 1,0 \quad (1)(55)$$

## POSNIK OS POPREČNE SILE (ELEMENT 2)

$$\tilde{\sigma}_{2,max,d} = \frac{V_{max,d} \cdot 0,5 \cdot E_2 \cdot b_2 \cdot h^2}{(E \cdot J)_{ef,y} \cdot b_2} \quad (1)(33)$$

$$h = \frac{h_2}{2} + a_2 = \frac{200}{2} + 17,1 = 117,1 \text{ mm}$$

$$\tilde{\sigma}_{2,max,d} = \frac{93 \cdot 10^3 \cdot 0,5 \cdot 8462 \cdot 100 \cdot 117,1^2}{9,22 \cdot 10^{11} \cdot 100} = 0,59 \text{ N/mm}^2$$

DOKAZ:

$$\frac{\tilde{\sigma}_{2,max,d}}{f_{v,d}} = \frac{0,59}{1,66} = 0,36 < 1 \quad (1)(59)$$

## SOKAZ ZA KONACNO STANJE;

15.

### MODUL KUZANJA

$$k_1 = \frac{k_{m, \text{MEAN}}}{f_M \cdot (1 + k_{\text{def}})}$$

(1) 8.3(2)

(1) (4)

$$k_{\text{def}} = 0,6 \quad \leftarrow \quad \begin{array}{l} \text{PUNO DRVO} \\ \text{I. KL. UPORABLJIVOSTI} \end{array}$$

(1) TAB. F.2

$$k_1 = \frac{1309}{1,3(1+0,6)} = 629 \text{ N/mm}$$

$$\frac{k_1}{A_1} = \frac{629}{36} = 17,5 \text{ N/mm}^2$$

$$f_1 = \frac{1}{1 + \frac{\pi^2 \cdot E_1 \cdot A_1 \cdot s_1}{k_1 \cdot L^2}} = \frac{1}{1 + \frac{\pi^2 \cdot 8462 \cdot 88 \cdot 10^2 \cdot 36}{629 \cdot (40 \cdot 10^3)^2}} = 0,276$$

$$f_2 = 1,0$$

$$a_2 = \frac{1}{2} \frac{\rho_1 \cdot E_1 \cdot A_1 \cdot (h_1 + h_2)}{(\rho_1 \cdot E_1 \cdot A_1 + \rho_2 \cdot E_2 \cdot A_2)}$$

16.  
(1)(30)

$$a_2 = \frac{1}{2} \frac{0,276 \cdot 8462 \cdot 88 \cdot 10^2 (40 + 200) \cdot 10}{(0,276 \cdot 8462 \cdot 88 \cdot 10^2 + 1,0 \cdot 8462 \cdot 200 \cdot 10^2)}$$

$$a_2 = 130 \text{ mm}$$

$$a_1 = \frac{(h_1 + h_2)}{2} - a_2 = \frac{(40 + 200)}{2} - 130$$

$$a_1 = 107,0 \text{ mm}$$

$$J_{ef,y} = J_{y1} + J_{y2} + \rho_1 \cdot A_1 \cdot a_1^2 + \rho_2 \cdot A_2 \cdot a_2^2$$

$$J_{ef,y} = 117 + 6667 + 0,276 \cdot 88 \cdot 107^2 + 1,0 \cdot 200 \cdot 13^2 = 9903 \text{ cm}^4$$

$$(E \cdot J)_{ef,y} = 8462 \cdot 9903 \cdot 10^4 = 8,4 \cdot 10^{11} \text{ Nmm}$$



ELEMENT ①

17.

$$N_{1,d} = \frac{M_{y,d}}{(E \cdot J)_{ef,y}} \cdot \rho_1 \cdot a_1 \cdot E_1 \cdot A_1$$

(1)(31)

$$N_{1,d} = \frac{93 \cdot 10^6}{84 \cdot 10^{11}} \cdot 0,276 \cdot 107,0 \cdot 8462 \cdot 88 \cdot 10^2$$

$$N_{1,d} = 24347 \text{ N}$$

$$M_{1y,d} = \frac{M_{y,d}}{(E \cdot J)_{ef,y}} \cdot E_1 \cdot J_{y1}$$

(1)(32)

$$M_{1y,d} = \frac{93 \cdot 10^6}{84 \cdot 10^{11}} \cdot 8462 \cdot 117 \cdot 10^4$$

$$M_{1y,d} = 109613 \text{ Nmm}$$

PROVAČUNSKÉ VRIJEDNOSTI NAPREŽANJA:

18.

$$\sigma_{c,d} = \frac{N_{1,d}}{A_1} = \frac{24\,347}{88 \cdot 10^2} = 2,77 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{1,y,d}}{W_{y1}} = \frac{109\,613}{58,7 \cdot 10^3} = 1,87 \text{ N/mm}^2$$

DOKAZ ZA ELEMENT ①

$$\left( \frac{\sigma_{c,d}}{f_{c,d}} \right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} =$$

(1)(57)

$$= \left( \frac{2,77}{12,9} \right)^2 + \frac{1,87}{14,8} = 0,17 < 1,0$$

ELEMENT 2

$$N_{2,d} = \frac{M_{y,d}}{(E \cdot J)_{ef,y}} \cdot J_2^e \cdot a_2 \cdot E_2 \cdot A_2 \quad (1)(31)$$

$$N_{2,d} = \frac{93 \cdot 10^6}{8,4 \cdot 10^{11}} \cdot 10 \cdot 13,0 \cdot 8462 \cdot 200 \cdot 10^2 = 24\,358 \text{ N}$$

$$M_{2y,d} = \frac{M_{y,d}}{(E \cdot J)_{ef,y}} \cdot E_2 \cdot J_{y2} \quad (1)(32)$$

$$M_{2y,d} = \frac{93 \cdot 10^6}{8,4 \cdot 10^{11}} \cdot 8462 \cdot 6667 \cdot 10^4 = 6\,246\,074 \text{ Nmm}$$

PRORAČUNSKÉ VRIJEDNOSTI NAPREŽANJA:

$$\tilde{\sigma}_{x,d} = \frac{N_{2,d}}{A_2} = \frac{24\,358}{200 \cdot 10^2} = 1,22 \text{ N/mm}^2$$

$$\tilde{\sigma}_{m,y,d} = \frac{M_{2y,d}}{W_{y2}} = \frac{6\,246\,074}{667 \cdot 10^3} = 9,36 \text{ N/mm}^2$$

SOKAZ ZA ELEMENT (2)

20.

$$\frac{\tilde{\sigma}_{t,d}}{f_{t,d}} + \frac{\tilde{\sigma}_{m,y,d}}{f_{m,y,d}} = \frac{1,22}{8,6} + \frac{9,36}{14,8} = 0,77 < 1,0 \quad (1)(55)$$

POSNIK OD POPREČNE SILE (ELEMENT (2))

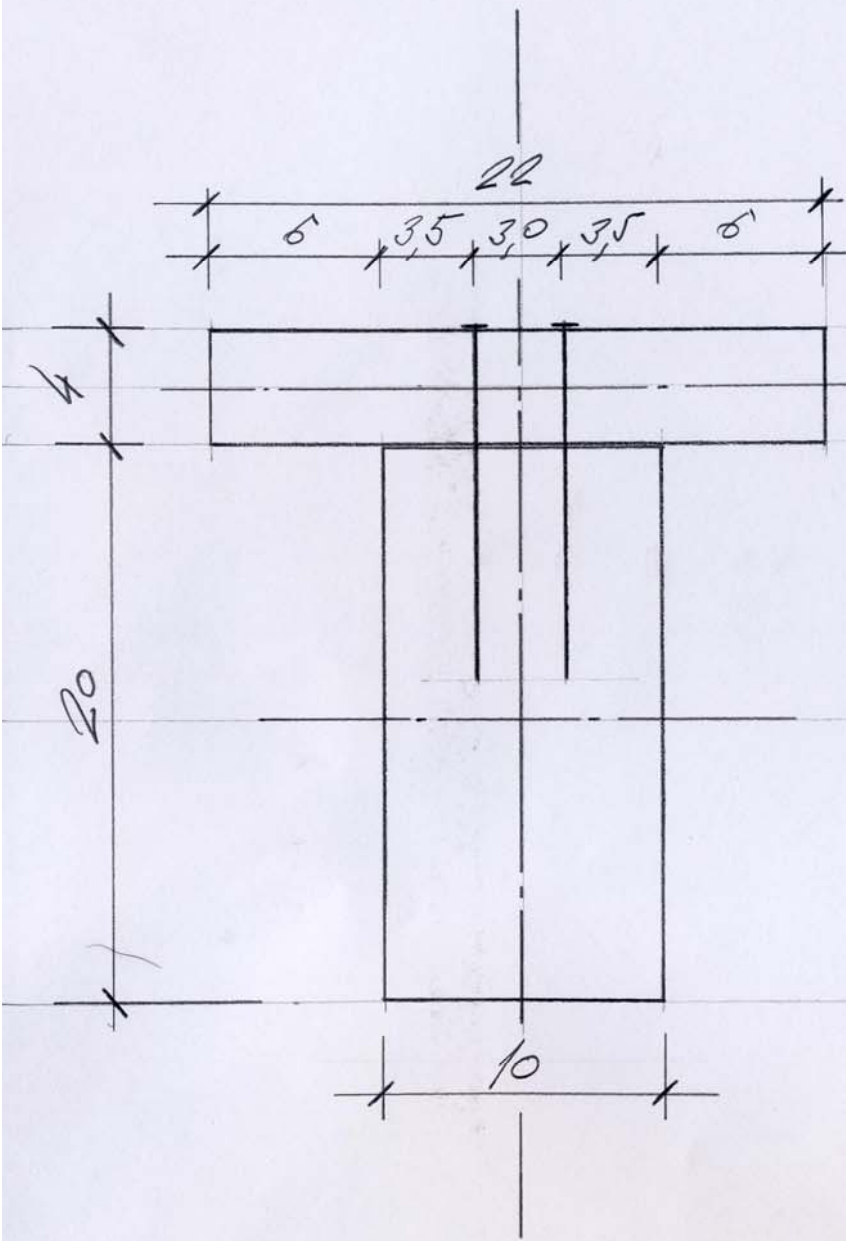
$$\tilde{\sigma}_{2,max,d} = \frac{V_{max,d} \cdot 0,5 \cdot E_2 \cdot b_2 \cdot h^2}{(E \cdot J)_{ef,y} \cdot b_2} \quad (1)(33)$$

$$h = \frac{h_2}{2} + a_2 = \frac{200}{2} + 13,0 = 113,0 \text{ mm}$$

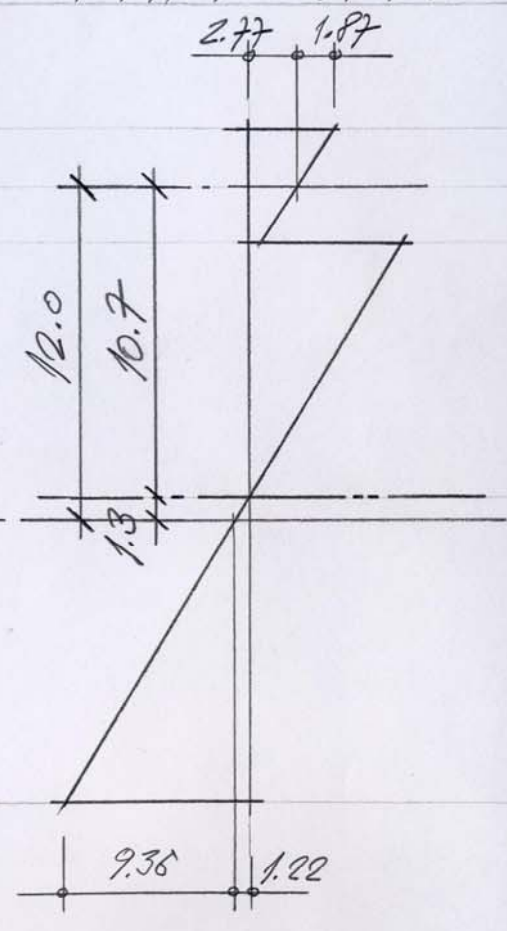
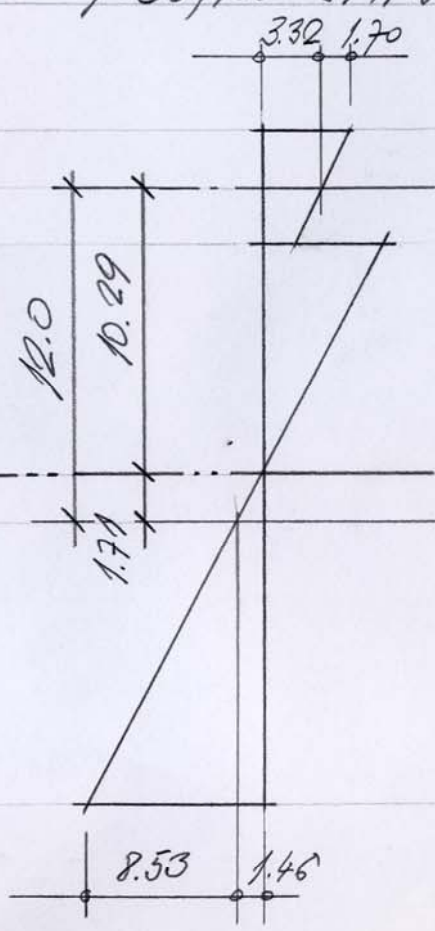
$$\tilde{\sigma}_{2,max,d} = \frac{9,3 \cdot 10^3 \cdot 0,5 \cdot 8462 \cdot 100 \cdot 113,0^2}{8,4 \cdot 10^{11} \cdot 100} = 0,60 \text{ N/mm}^2$$

SOKAZ:

$$\frac{\tilde{\sigma}_{2,max,d}}{f_{v,d}} = \frac{0,6}{1,66} = 0,36 < 1,0 \quad (1)(59)$$



POČETNO STANJE KONACNO STANJE <sup>20+</sup>



# SPAJALA - ČAVLI

20. #

PRORAČUNSKA SILA PO ČAVLU:

1. POČETNO STANJE

$$F_{1,d,inst.} = \frac{V_{max,d} \cdot f_1^2 \cdot E_1 \cdot A_1 \cdot a_1 \cdot s_1}{(E \cdot J)_{ef,y,inst.}} \quad (1)(34)$$

$$F_{1,d,inst.} = \frac{9,3 \cdot 10^3 \cdot 0,378 \cdot 8462 \cdot 88 \cdot 10^2 \cdot 102,9 \cdot 36}{9,22 \cdot 10^{11}} = 1052 \text{ N}$$

2. KONAČNO STANJE

$$F_{1,d,fin.} = \frac{V_{max,d} \cdot f_1^2 \cdot E_1 \cdot A_1 \cdot a_1 \cdot s_1}{(E \cdot J)_{ef,y,fin.}} \quad (1)(34)$$

$$F_{1,d,fin.} = \frac{9,3 \cdot 10^3 \cdot 0,276 \cdot 8462 \cdot 88 \cdot 10^2 \cdot 107,0 \cdot 36}{8,4 \cdot 10^{11}} = 877 \text{ N}$$

NOSIVOST ČAVLA - KARAKTERISTIČNA VRIJEDNOST /

4.

$$R_k = \sqrt{2 \cdot M_{y,k} \cdot f_{h,1,k} \cdot d} \quad (1) (216)$$

KARAKT. VRIJEDNOST TLAČNE ČVRSTOĆE PO PRASTU RUPE (BČ)

$$f_{h,1,k} = f_{h,2,k} = 0,082 \cdot (1 - 0,01 \cdot d) \cdot f_k \quad (1) (213)$$

KARAKT. VRIJEDNOST GUSTOĆE (C24):  $f_k = 350 \text{ kg/m}^3$   
 $d = 6 \text{ mm}$

$$f_{h,k} = 0,082 \cdot (1 - 0,01 \cdot 6) \cdot 350 = 27,0 \text{ N/mm}^2$$

KARAKT. VRIJEDNOST MOMENTA POPUŠTANJA ČAVLA

$$M_{y,k} = 0,3 \cdot f_{u,k} \cdot d^{2,6} \quad f_{u,k} = 600 \text{ N/mm}^2 \quad (1) (214)$$

$$M_{y,k} = 0,3 \cdot 600 \cdot 6^{2,6} = 18987 \text{ Nmm}$$

$$R_k = \sqrt{2 \cdot 18987 \cdot 27,0 \cdot 6} = 2480 \text{ N}$$

PROVJERA DEBLJINE PRVOG SRVA I KURINE ZABIJANJA  
U DRUGO SRVO:

$$t_{req} = 9 \cdot d = 9 \cdot 6 = 54 \text{ mm}$$

$$\text{PRVO SRVO } t_1 = h_1 = 40 \text{ mm}$$

$$t_{req} = 54 \text{ mm} > h_1 = 40 \text{ mm}$$

UVJET NIJE ISPUNJEN - SMANJENJE NOSIVOSTI:

$$R_{k, red} = R_k \cdot \frac{t_1}{t_{req}} = 2480 \cdot \frac{40}{54} = 1837 \text{ N} \quad (1) 12.2.2(2)$$

$$\text{DRUGO SRVO } t_2 = l_{NA} - h_1 = 120 - 40 = 80 \text{ mm}$$

$$t_{req} = 54 \text{ mm} < t_2 = 80 \text{ mm} \quad \checkmark$$

NOSIVOST ČAVLA - PRORAČUNSKA VRIJEDNOST:

$$R_d = k_{mod} \cdot \frac{R_{k, red}}{\gamma_M} \quad (1) (195)$$



$$R_d = 0,8 \cdot \frac{1837}{1,1} = 1336 \text{ N}$$

DOKAZ NADAVOSTI ČAVALA:

$$\frac{F_{1,d,inst}}{R_d} = \frac{1052}{1336} = 0,79 < 1,0$$

PROVĚRA RAZMĚRA ČAVALA (BČ)

(1) 12.5.2(16)

(1) TAB. 10

PARALELNO SA VLAKANCI MA:  $a_{1,req} = (3 + 2 \cdot \cos \alpha) \cdot d$

$$a_{1,req} = (3 + 2 \cdot \cos 0^\circ) \cdot 6 = 30 \text{ mm} < 72 \text{ mm} \checkmark$$

OKOMITO NA VLAKANCA:  $a_{2,req} = 3 \cdot d$

$$a_{2,req} = 3 \cdot 6 = 18 \text{ mm} < 30 \text{ mm} \checkmark$$

OKOMITO NA VLAKANCA - NEOPTEREČENI RUB:  $a_{2,r,req} = 3 \cdot d$

$$a_{2,r,req} = 3 \cdot 6 = 18 \text{ mm} < 35 \text{ mm} \checkmark$$

## KONTROLA PROGIBA

KARAKTERISTIČNA (RIJETKA) KOMBINACIJA:

$$E_d = \sum \left( \sum_{j \geq 1} G_{k,j} \oplus Q_{k,1} \oplus \sum_{i > 1} \psi_{0,i} \cdot Q_{k,i} \right)$$

$$w_{G,inst} = \frac{5 \cdot 2 G_k \cdot l^4}{384 \cdot (E \cdot J)_{ef,y,fin}} = \frac{5 \cdot 0,7 \cdot (40 \cdot 10^3)^4}{384 \cdot 8,4 \cdot 10^{11}}$$

$$w_{G,inst} = 2,8 \text{ mm}$$

$$w_{Q,inst} = \frac{5 \cdot 2 Q_k \cdot l^4}{384 \cdot (E \cdot J)_{ef,y,fin}} = \frac{5 \cdot 2,45 \cdot (40 \cdot 10^3)^4}{384 \cdot 8,4 \cdot 10^{11}}$$

$$w_{Q,inst} = 9,7 \text{ mm}$$

NASVIŠTENJE  $w_0 = \phi$

KONAČNI PROGIB OD STALNOG OPTEREĆENJA :

25.  
(1) 8.3(7)

$$w_{G,fin} = w_{G,inst} \cdot (1 + k_{def})$$

(1) (6)

$$w_{G,fin} = 2,8 \cdot (1 + 0,6) = 4,5 \text{ mm}$$

KONAČNI PROGIB OD PROMJENJIVOG OPTEREĆENJA :

(1) 8.3.(8)

$$w_{Q,fin} = w_{Q,inst} \cdot (1 + \psi_2 \cdot k_{def})$$

(1) (7)

ZGRADA, KATEGORIJA A  $\rightarrow \psi_2 = 0,3$

$$w_{Q,fin} = 9,7 \cdot (1 + 0,3 \cdot 0,6) = 11,4 \text{ mm}$$

UKUPNI KONAČNI PROGIB :

(1) 9.2.(3)

$$w_{fin} = w_{G,fin} + w_{Q,fin} + w_0$$

$$w_{fin} = 4,5 + 11,4 + \phi = 15,9 \text{ mm}$$

ШОКАЗ:

$$W_{Q, inst} \leq \frac{l}{300}$$

(1)(40)

$$W_{Q, inst} = 9,7 \text{ mm} < \frac{400}{300} = 13,3 \text{ mm} \quad \checkmark$$

$$W_{fin} - W_{G, inst} \leq \frac{l}{200}$$

(1)(41)

$$W_{fin} - W_{G, inst} = 15,9 - 2,8 = 13,1 \text{ mm} < \frac{400}{200} = 20 \text{ mm}$$

✓

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