

BETONSKE KONSTRUKCIJE 1

HVE PŽA

Vežba br. 5

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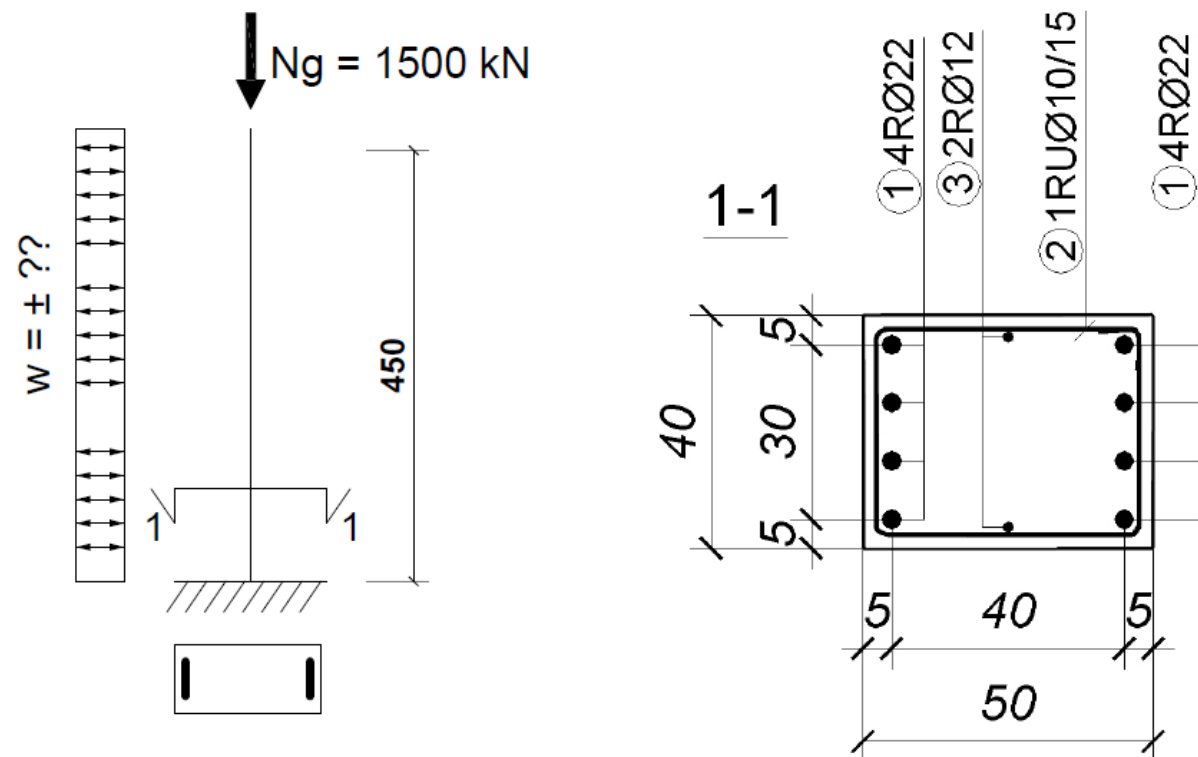
Semestar: V

ESPb: 6

Pismeni ispit 22.01.2014.; 2. zadatak

Stub konstatnog poprečnog preseka, armiran prema skici, centrično je napregnut silom pritiska $N_g = 1500\text{kN}$ usled stalnog opterećenja. Sračunati koliko jednako raspodeljeno opterećenje vetrom w može prihvatiti stub posmatrajući graničnu nosivost prema **momentima savijanja** i **transverzalnim silama**.

MB 30
RA 400/500



Odabir dijagrama interakcije

$MB\ 30 \Rightarrow f_B = 2.05\text{ kN/cm}^2$

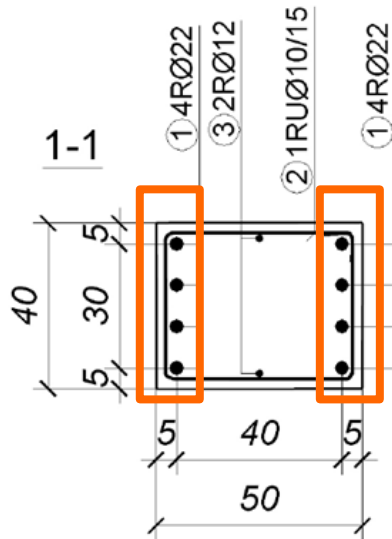
$RA\ 400/500 \Rightarrow \sigma_v = 40\text{ kN/cm}^2$

$a = 5\text{ cm}$

$a/d = 0.1$

$A_a = 8 \times 3.8 = 30.4\text{ cm}^2$

$\bar{\mu} = 30.4 \times 40 / (40 \times 50 \times 2.05) = 0.297 \approx 0.3$

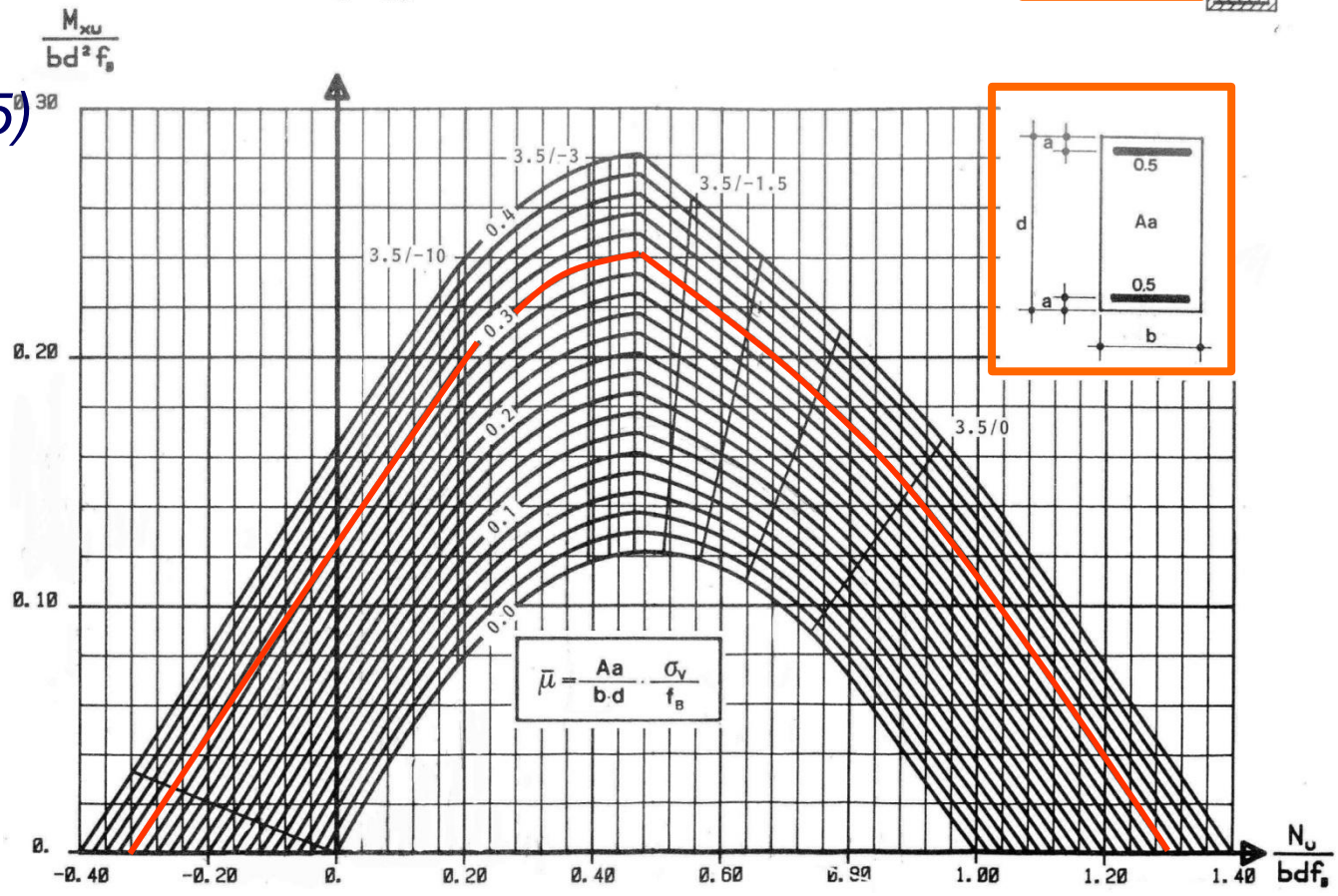


115. Dijagram za dimenzionisanje M_{xu}, N_u
GF - IMK

$\sigma_v = 40.0\text{ kN/cm}^2$
 $\bar{\mu}_{max} = 0.4$

$\frac{m_y}{m_x} = \frac{M_y/b}{M_x/d} = 0.0$

$\frac{a}{d} = 0.100$



1. Kombinacija sa MINIMALNOM silom pritiska

$$N_u = 1.0 \times N_g = 1.0 \times 1500 = 1500 \text{ kN}$$

$$n_u = N_u / (bdf_b) = 1500 / (40 \times 50 \times 2.05) = 0.366$$

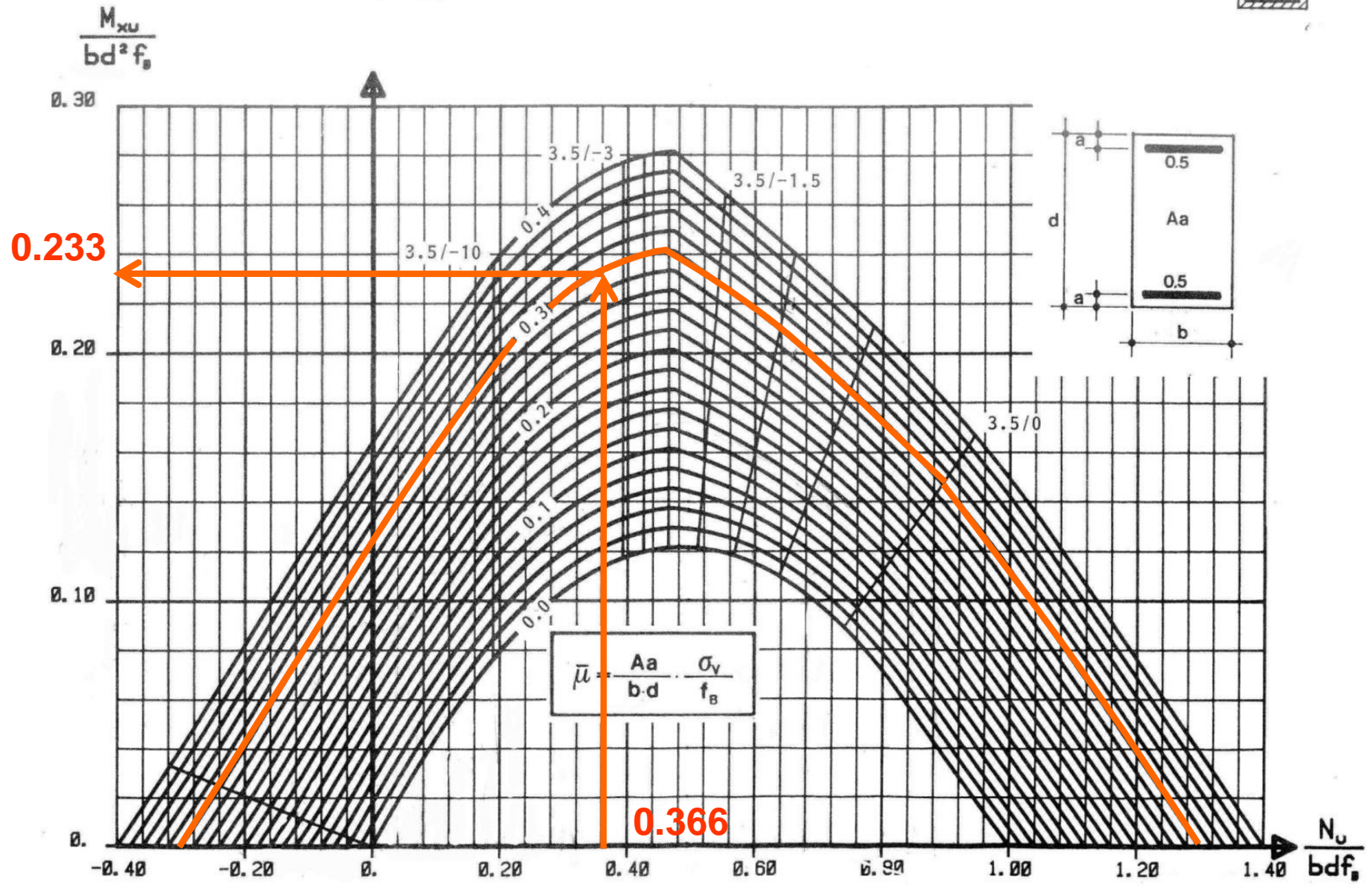
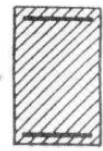
115. Di jagram za
dimenzionisanje M_{xu}, N_u
CF - IMK

$$\sigma_v = 40.0 \text{ KN/cm}^2$$

$$\bar{\mu}_{\max} = 0.4$$

$$\frac{m_y}{m_x} = \frac{M_y/b}{M_x/d} = 0.0$$

$$\frac{a}{d} = 0.100$$



2. Kombinacija sa MAKSIMALNOM silom pritiska

5

$$N_u = 1.9 \times N_g = 1.9 \times 1500 = 2850 \text{ kN}$$

$$n_u = N_u / (b d f_b) = 2850 / (40 \times 50 \times 2.05) = 0.695$$

115. Di jagram za
dimenzionisanje M_{xu}, N_u

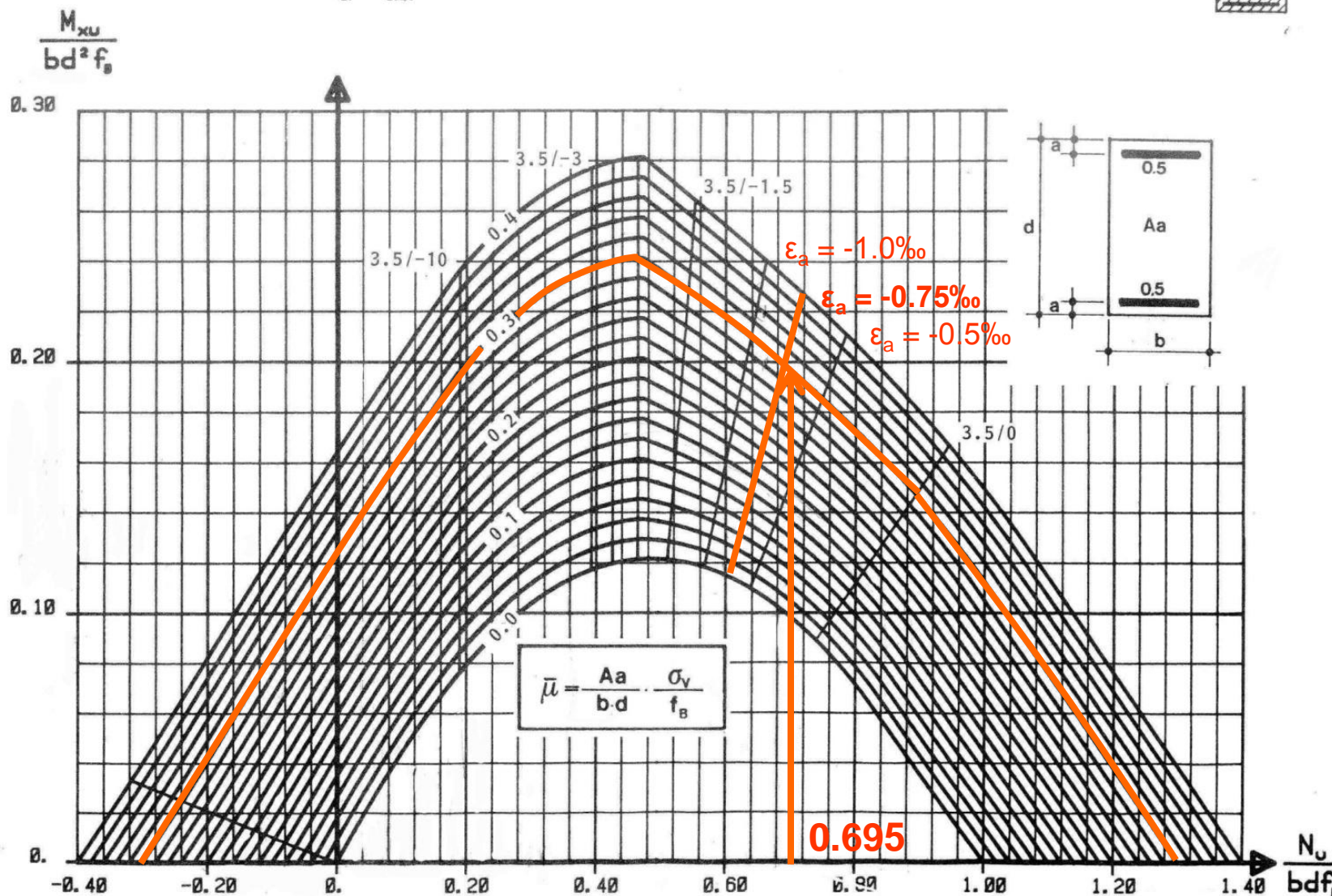
CF - IMK

$$\sigma_v = 40.0 \text{ KN/cm}^2$$

$$\bar{\mu}_{\max} = 0.4$$

$$\frac{m_y}{m_x} = \frac{M_y/b}{M_x/d} = 0.0$$

$$\frac{a}{d} = 0.100$$



2. Kombinacija sa MAKSIMALNOM silom pritiska

Interpolacija koeficijenata sigurnosti:

$$\varepsilon_a = -0.75\text{‰}$$

$$\gamma_{u,g} = 1.9 - \frac{1.9 - 1.6}{3 - 0} \times 0.75 = 1.825$$

$$\gamma_{u,p} = 2.1 - \frac{2.1 - 1.8}{3 - 0} \times 0.75 = 2.025$$

$$N_u = 1.825 \times N_g = 1.825 \times 1500 = 2737.5 \text{ kN}$$

$$n_u = N_u / (bdf_b) = 2737.5 / (40 \times 50 \times 2.05) = 0.668$$

2. Kombinacija sa MAKSIMALNOM silom pritiska

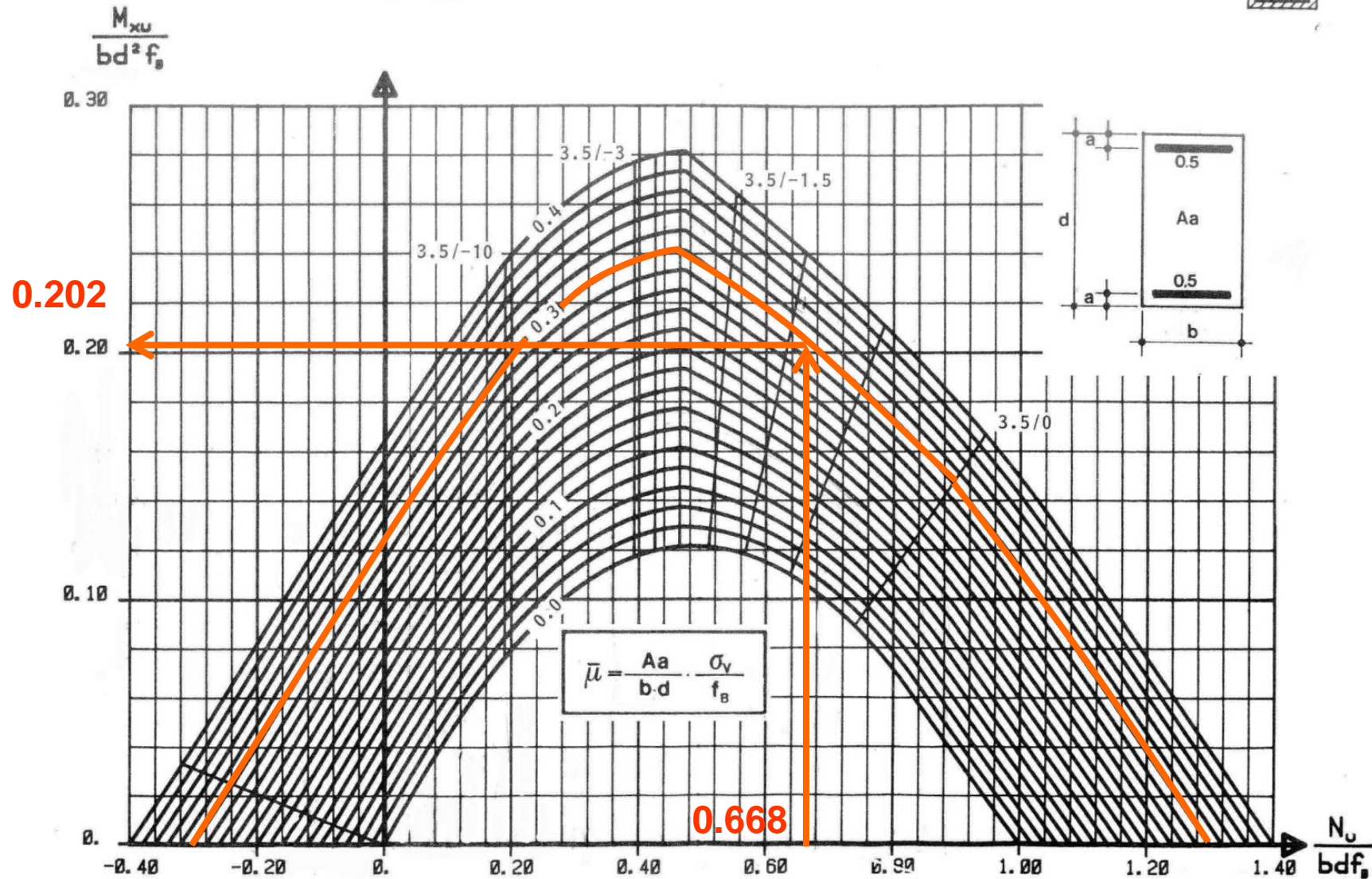
115. Di jagram za
dimenzionisanje M_{xu}, N_u
CF - IMK

$$\sigma_v = 40.0 \text{ KN/cm}^2$$

$$\bar{\mu}_{\max} = 0.4$$

$$\frac{m_y}{m_x} = \frac{M_y/b}{M_x/d} = 0.0$$

$$\frac{a}{d} = 0.100$$



Merodavno opterećenje vetrom prema M

Iz kombinacije sa MINIMALNOM silom pritiska:

$$m_u = 0.233$$

$$M_u = m_u \times b \times d^2 \times f_b = 0.233 \times 40 \times 50^2 \times 2.05 / 100 = 477.65 \text{ kNm}$$

$$M_w = M_u / 1.8 = 477.65 / 1.8 = 265.36 \text{ kNm}$$

$$M_w = w \times H^2 / 2 \Rightarrow w = 2 \times M_w / H^2$$

$$w' = 2 \times 265.36 / 4.5^2 = 26.21 \text{ kN/m}$$

Iz kombinacije sa MAKSIMALNOM silom pritiska

$$m_u = 0.202$$

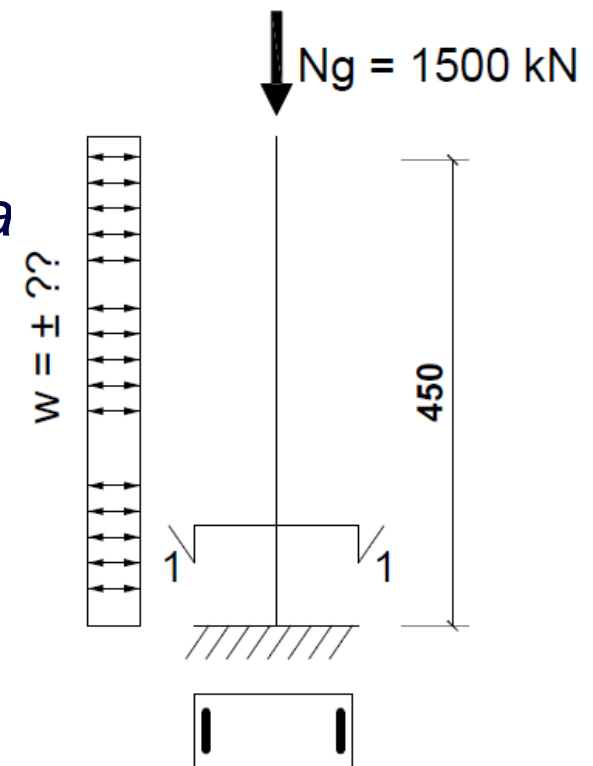
$$M_u = 0.202 \times 40 \times 50^2 \times 2.05 / 100 = 414.1 \text{ kNm}$$

$$M_w = M_u / 2.025 = 414.1 / 2.025 = 204.49 \text{ kNm}$$

$$M_w = w \times H^2 / 2 \Rightarrow w = 2 \times M_w / H^2$$

$$w'' = 2 \times 204.49 / 4.5^2 = 20.2 \text{ kN/m}$$

$$w = \min[w', w''] = 20.2 \text{ kN/m}$$



Merodavno opterećenje vetrom prema T

$$MB\ 30 \Rightarrow \tau_r = 0.11\ \text{kN/cm}^2$$

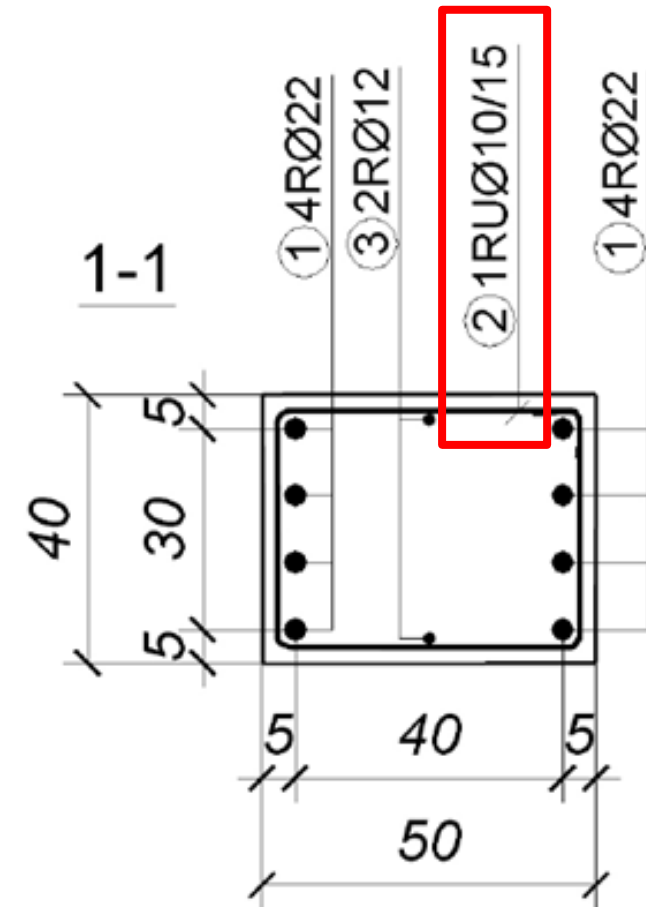
$$b = 40\ \text{cm} \quad h = 45\ \text{cm}$$

$$UR\ \emptyset\ 10/15 \Rightarrow m=2, \theta=45^\circ, \alpha=90^\circ$$

$$a_u^{(1)} = 0.785\ \text{cm}^2, e_u = 15\ \text{cm}$$

$$\tau_{u,usv} = \frac{m \cdot a_u^{(1)}}{b \cdot e_u} \cdot \sigma_v \cdot (\cos \alpha + \sin \alpha \cdot \text{ctg } \theta) =$$

$$= \frac{2 \cdot 0.785}{40 \cdot 15} \cdot 40 = 0.105\ \text{kN/cm}^2$$



Merodavno opterećenje vetrom prema T

$$\tau_{u,usv} = 0.105 \text{ kN/cm}^2 \begin{matrix} > \tau_r \\ < 3 \cdot \tau_r \end{matrix} \Rightarrow \tau_{u,usv} = \tau_{Ru} = \frac{3}{2} (\tau_n - \tau_r)$$

$$\Rightarrow \tau_n = \frac{2}{3} \tau_{u,usv} + \tau_r = \frac{2}{3} 0.105 + 0.11 = 0.18 \text{ kN/cm}^2$$

$$\tau_n = \frac{T_u}{b \cdot z} \Rightarrow T_u = \tau_n \cdot b \cdot 0.9 \cdot h = 0.18 \cdot 40 \cdot 0.9 \cdot 45 = 291.6 \text{ kN}$$

$$T_u = 1.8 \cdot T_w \Rightarrow T_w = 291.6 / 1.8 = 162 \text{ kN}$$

$$T_w = w \cdot H \Rightarrow w = 162 / 4.5 = 36 \text{ kN/m}$$

$$w = \min[w^M, w^T] = 20.2 \text{ kN/m}$$