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$M_k = 150 \text{ kN.m}$
 $f_{ck} = 20 \text{ MPa}$
 $\alpha = 50$

$b = 20 \text{ cm}$
 $h = 50 \text{ cm}$
 $d = 47 \text{ cm}$
 $d' = 3 \text{ cm}$

DIM

$M_d = 1,4 \cdot 15000 \Rightarrow M_d = 21000 \text{ kN cm}$

$\mu_d = \frac{21000}{1,429 \cdot 20 \cdot 47^2} \Rightarrow \mu_d = 0,333$

$\mu_{dlim} = 0,32$

$K_{xlim} = 0,6283$

$\mu_d > \mu_{dlim} \Rightarrow \Delta \mu_d = 0,013$

$w = w_{lim} + \Delta w$

$w = 0,85 \cdot \sqrt{0,7225 - 1,7 \mu_{dlim}} + \frac{\Delta \mu_d}{(1 - d'/d)} \Rightarrow$

$w = 0,85 \cdot \sqrt{0,7225 - 1,7 \cdot 0,32} + \frac{0,013}{(1 - 3/47)} \Rightarrow$

$w = 0,428 + 0,014 \Rightarrow w = 0,442$

$A_s = \frac{0,442 \cdot 20 \cdot 47 \cdot 1,429}{43,478} \Rightarrow A_s = 13,633 \text{ cm}^2$

$w' = \frac{\Delta \mu_d}{\frac{\sigma'_{sd}}{f_{yd}} (1 - d'/d)}$

$\epsilon'_{sd} = \left(1 - \frac{d'/d}{K_{xlim}}\right) \cdot 3,5\%$

$\epsilon'_{sd} = \left(1 - \frac{3/47}{0,6283}\right) \cdot 3,5 \Rightarrow \epsilon'_{sd} = 3,144 \quad \epsilon_{yd} = 2,07\%$

$\epsilon'_{sd} > \epsilon_{yd} \Rightarrow f_{yd} = \sigma'_{sd}$

$w' = \frac{0,013}{(1 - 3/47)} \Rightarrow w' = 0,014$

$A'_s = \frac{0,014 \cdot 20 \cdot 47 \cdot 1,429}{43,478} \Rightarrow A'_s = 0,429 \text{ cm}^2$