Appendix B: Dimensioning of new column

torsdag 25. mai 2023 19.56

Calculations are done in line with NS-EN 1992-1-1:2004+A1:2014+NA:2021

The calculations that are completed are only ment as an aproximation to what could occur in a realistic case.

Assuming outer dimensions of column to be 300 x 300 x 3500 mm. Column is exposed to a mostly dry climate, giving it exsposure class XC1. Durability class M60 is then necessary, giving a concrete class of B30 (NA.4.5N).

Concrete:	B30 M60
Reinforcement steel:	B500NC

Minimum amount of reinforcement is assumed. Calculated in line with section 9.5.

Minimum amount of longitudinal reinforcement for column:

$$A_c = 300\,mm \cdot 300\,mm = 90000\,mm^2$$

$$A_{s,min} = 0{,}01\,A_c = 900\,mm^2 \qquad (NA.9.12N)$$

Reinforcement is chosen to be 12 mm in diameter, giving:

$$\frac{900\,mm^2}{\pi \cdot 6^2\,mm} = 7{,}96 \rightarrow \underline{8\,\phi 12}$$

Minimum concrete cover with dimensioning lifespan of 50 years:

$$c_{nom} = c_{min} + \Delta c_{dev} \qquad (4.1)$$

$$c_{min} = \max \begin{cases} c_{min,b} = 12\,mm \\ c_{min,dur} + \Delta c_{dur,\gamma} - \Delta c_{dur,st} - \Delta c_{dur,add} = 15\,mm \\ 10\,mm \end{cases} \qquad (4.2)$$

$$c_{min} = 15\,mm$$

$$\Delta c_{dev} = 10\,mm \qquad (NA.4.4.1.3(1))$$

$$c_{nom} = 15\,mm + 10\,mm = \underline{25\,mm}$$

Maximum spacing of transverse rebar. Assuming equal diameter as for longitudinal:

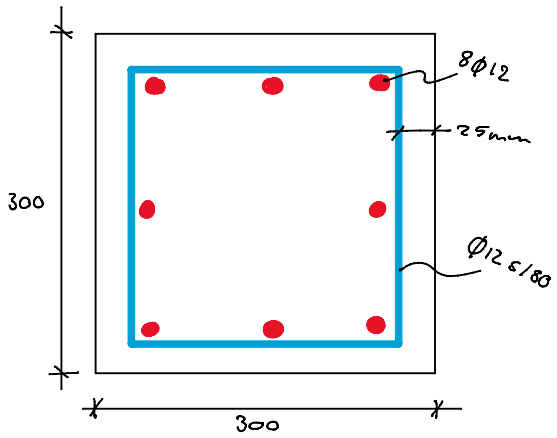
$$s_{cl,max} = \min \begin{cases} 15 \cdot \phi = 15 \cdot 12 = 180\,mm \\ \text{smallest dim. of column} = 300\,mm \\ 400\,mm \end{cases} \qquad (NA.9.5.3(3))$$

$$s_{cl,max} = 180\,mm$$

Number of transverse rebars:

$$\frac{3500\,mm - 2 \cdot 25\,mm}{180\,mm} = 19{,}4 \rightarrow 20 \text{ spacings} \rightarrow \underline{21\ \phi 12\ s180}$$

This gives the final layout of the column with following volumes:



$$V_s = 8 \cdot \pi \cdot 6^2 \cdot 3450 + \pi \cdot 6^2 \cdot 4 \cdot 250 \cdot 21$$

$$\approx 0{,}0053\,m^3$$

$$V_c = 300 \cdot 300 \cdot 3500 - V_s$$

$$\approx 0{,}3097\,m^3$$

To connect the column to its adjointing surfaces, reinforcement bars of 12 mm in diameter are used with an overlap of 50 times its diameter. Connecting bars are assumed to reach 275 mm into the adjointing surfaces before braking 90 degrees.

$$l_b = 50 \cdot \phi = 600\,mm$$

$$V_{s.b} = 16 \cdot \pi \cdot 6^2 \cdot (600 + 600 + 275) \approx 0{,}0031\,m^3$$

The weight of the steel and concrete is then:

$$m_s = (0{,}0031 + 0{,}0053) \cdot 7800 = \underline{65{,}33\,kg}$$

$$m_c = 0{,}3097 \cdot 2500 = \underline{774{,}25\,kg}$$