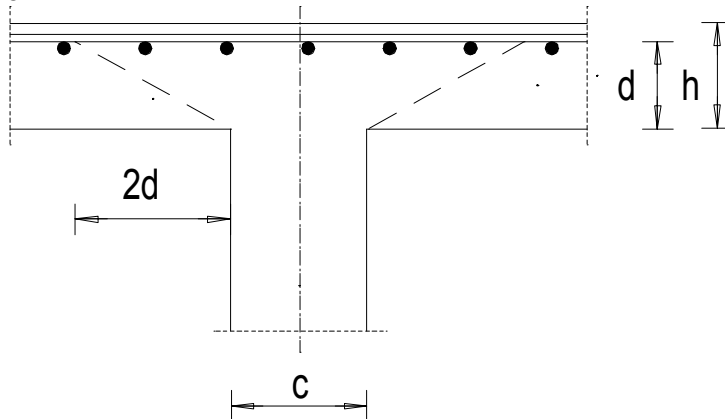


Ponsberekening rechthoekige middenkolom
NEN-EN 1992-1-1 artikel 6.4 geen excentriciteiten

Geometrie:



Hoogte h =	250 mm
Ø hoofwapening in x richting $d_{\text{hoofd},x}$ =	12 mm
Ø hoofwapening in y richting $d_{\text{hoofd},y}$ =	12 mm
Dekking c_{nom} =	30 mm
Breedte kolom c_1 =	290 mm
Dikte kolom c_2 =	290 mm
Wapening in x richting ρ_{1x} =	0,020
Wapening in y richting ρ_{1y} =	0,020

$$d_x = h - c_{\text{nom}} - 0,5 * d_{\text{hoofd},x} = 214 \text{ mm}$$

$$d_y = h - c_{\text{nom}} - d_{\text{hoofd},x} - 0,5 * d_{\text{hoofd},y} = 202 \text{ mm}$$

$$d_{\text{eff}} = (d_x + d_y) / 2 = 208 \text{ mm}$$

Materialen en veiligheidsfactoren

Beton	=	C20/25
f_{ck}	=	20 N/mm ²
$f_{\text{cd}} = f_{\text{ck}} / 1,5$	=	13 N/mm ²
$f_{\text{ywd}} = 500 / 1,15$	=	435 N/mm ²

Belastingen

$$V_{\text{Ed}} = 550 \text{ kN}$$

Controle schuifspanning direct naast de kolom

$$\text{Middenkolom } \beta = 1,15$$

$$u_0 = \frac{2 * c_1 + 2 * c_2}{\beta} = 1160 \text{ mm}$$

$$V_{\text{Rdmax}} = 0,5 * 0,6 * \left(1 - \frac{f_{\text{ck}}}{250}\right) * f_{\text{cd}} = 3,59 \text{ N/mm}^2$$

$$V_{\text{Ed,max}} = \frac{\beta * V_{\text{Ed}}}{u_0 * d_{\text{eff}}} * 10^3 = \frac{1,15 * 550}{1160 * 208} * 10^3 = 2,62 \text{ N/mm}^2 < V_{\text{Rdmax}}$$

Controle schuifspanning eerste controledoorsnede

$$\begin{aligned}
 u_1 &= 2 * \pi * 2 * d_{\text{eff}} + u_0 &= 3774 \text{ mm} \\
 k &= \text{MIN}\left(1 + \sqrt{\frac{200}{d_{\text{eff}}}}; 2\right) &= 1,98 \\
 \rho &= \text{MIN}\left(\sqrt{\rho_{1x} * \rho_{1y}}; 0,02\right) &= 0,02 \\
 C_{\text{Rd,c}} &= &0,12 \\
 v_{\text{min}} &= 0,035 * k^{2/3} * f_{\text{ck}}^{1/2} = 0,035 * 1,98^{2/3} * 20^{1/2} &= 0,25 \text{ N/mm}^2 \\
 v_{\text{Rd,c}} &= C_{\text{Rd,c}} * k * (100 * \rho * f_{\text{ck}})^{1/3} &= 0,81 \text{ N/mm}^2 \\
 v_{\text{Rd,c}} &= \text{MAX}(v_{\text{Rd,c}}; v_{\text{min}}) &= 0,81 \text{ N/mm}^2 \\
 v_{\text{Ed,max}} &= \frac{\beta * V_{\text{Ed}}}{u_1 * d_{\text{eff}}} * 10^3 = \frac{1,15 * 550}{3774 * 208} * 10^3 &= 0,81 \text{ N/mm}^2
 \end{aligned}$$

Bepaling vereiste hoeveelheid ponswapening (artikel 6.4.5)

$$\begin{aligned}
 f_{\text{ywd,ef}} &= \text{MIN}(250 + 0,25 * d_{\text{eff}}; f_{\text{ywd}}) &= 302 \text{ N/mm}^2 \\
 s_r &= &100 \text{ mm} \\
 \alpha &= &90^\circ \\
 A_{\text{sw}} &= \frac{(v_{\text{Ed,max}} - 0,75 * v_{\text{Rd,c}})}{1,5 * (d_{\text{eff}} / s_r) * f_{\text{ywd,ef}} * \frac{1}{u_1 * d_{\text{eff}}} * \sin(\alpha)} &= 169 \text{ mm}^2
 \end{aligned}$$

Bepaling van de controle-omtrek waarvoor geen ponswapening meer is vereist

$$\begin{aligned}
 u_{\text{out,ef}} &= \beta * V_{\text{Ed}} / (v_{\text{Rd,c}} * d_{\text{eff}}) * 10^3 &= 3754 \text{ mm} \\
 r_{\text{out,ef}} &= (u_{\text{out,ef}} - u_0) / (2 * \pi) &= 413 \text{ mm}
 \end{aligned}$$