3.1 Beton

$\gamma_c := 1.5$

$$fck(c) := \begin{cases} \left(\text{round}\left(\frac{0.8c}{5}\right)\cdot 5\right) & \text{if } c \neq 35 \\ (c\cdot 0.8) & \text{otherwise} \end{cases}$$

$$fctm(c) := \begin{cases} .3\cdot c^{\left(\frac{2}{3}\right)} & \text{if } c \leq 50 \\ 2.12\cdot \ln\left(1 + \frac{c+8}{10}\right) & \text{otherwise} \end{cases}$$

$$fcd(c) := \frac{c}{\gamma_c}$$

3.1.2 Cementklasse

Klasse S, N of R
CEM32.5N; klasse S
CEM32.5R,42.5N (N)
CEM42.5R,52,5N/R (R)

$$Ecm(c) := 22000\left[\frac{(c+8)}{10}\right]^{0.3}$$

Element	**Opstort**	**Ontspannen**	Tabel 3.1

$f_{ck.cube_0} := 37$ $\quad f_{ck.cube_1} := 25$ $\quad f_{ck.cube.t} := 0$

$cem_0 := \text{"R"}$ $\quad cem_1 := \text{"N"}$

$f_{ck.t} := fck\left(f_{ck.cube.t}\right)$ $\quad f_{ck.t} = 0$

$f_{ck} := fck\left(f_{ck.cube}\right)$ $\quad f_{ck} = \begin{pmatrix} 30 \\ 20 \end{pmatrix}$

$j := 0..1$

$fcm\left(f_{ck}\right) := f_{ck} + 8$ $\quad fcm\left(f_{ck}\right) = \begin{pmatrix} 38 \\ 28 \end{pmatrix}$

$f_{ctm_j} := fctm\left(f_{ck_j}\right)$ $\quad f_{ctd} := f_{ctm}\cdot\frac{0.7}{\gamma_c}$ $\quad f_{ctm} = \begin{pmatrix} 2.896 \\ 2.21 \end{pmatrix}$

$f_{cd_j} := fcd\left(f_{ck_j}\right)$ $\quad f_{ctd} = \begin{pmatrix} 1.352 \\ 1.032 \end{pmatrix}$ $\quad f_{cd} = \begin{pmatrix} 20 \\ 13.333 \end{pmatrix}$

$E_{cm} := Ecm\left(f_{ck}\right)$ $\quad E_{cm} = \begin{pmatrix} 3.284 \times 10^4 \\ 2.996 \times 10^4 \end{pmatrix}$

$$\varepsilon_{c3_j} := \begin{cases} 1.75 & \text{if } f_{ck_j} < 55 \\ 1.75 + 0.55\cdot\left[\frac{\left(f_{ck_j} - 50\right)}{40}\right] & \text{otherwise} \end{cases} \qquad \varepsilon_{c3} = \begin{pmatrix} 1.75 \\ 1.75 \end{pmatrix}$$

$$\varepsilon_{cu3_j} := \begin{cases} 3.5 & \text{if } f_{ck_j} < 55 \\ 2.6 + 35\left[\frac{\left(90 - f_{ck_j}\right)}{100}\right]^4 & \text{otherwise} \end{cases} \qquad \varepsilon_{cu3} = \begin{pmatrix} 3.5 \\ 3.5 \end{pmatrix}$$

Verbindingswapening tralie:

$d := 175$ $B := 1000$ $M_v := 56.4 \cdot 10^6$

$z := 161.4$ $x_u := (d - z) \cdot \frac{18}{7}$ $M_{Rd} := f_{cd_1} \cdot 0.75 \cdot B \cdot x_u \cdot z$ $M_{Rd} = 5.644 \times 10^7$

$V_{Ed} := 94.0 \cdot 10^3$

TRALIE $dia_{trl} := 5$ $H_{trl} := 140$ $B_{trl} := 70$ $steek := 200$ $f_{ctd_1} = 1.032$

$c := 0.4$ $\mu := 0.7$ $\sigma_n := 0$ $c \cdot f_{ctd_1} = 0.413$

$$\alpha := \operatorname{atan}\left(\frac{H_{trl}}{\frac{steek}{2} - 14}\right)$$ $\sin(\alpha) = 0.852$ $\sin(\pi - \alpha) = 0.852$ $\alpha = 1.02$

Aantal staven per steek: 4st diagonaal $A_{sw} := \frac{dia_{trl}^2 \cdot \pi}{2}$ $A_{sw} = 39.27$

$v_{Edi} := \frac{V_{Ed}}{z \cdot B}$ $v_{Edi} = 0.582$

NEN-EN 13747:2005+A1:2008(E), Annex D2

$$v_{Rwd} := \frac{A_{sw} \cdot 435 \cdot (2 \cdot \mu \cdot \sin(\alpha) + \cos(\alpha))}{steek \cdot B}$$ $v_{Rwd} = 0.147$

$$n_{Trl} := \frac{\left(v_{Edi} - c \cdot f_{ctd_1}\right)}{v_{Rwd}}$$ $n_{Trl} = 1.158$

$$v_{Rdi} := c \cdot f_{ctd_1} + \frac{n_{Trl} \cdot A_{sw} \cdot 435 \cdot (2 \cdot \mu \cdot \sin(\alpha) + \cos(\alpha))}{steek \cdot B}$$ $v_{Rdi} = 0.582$

Verbindingswapening beugels:

$d := 153$ $B := 1000$ $M_v := 45.56 \cdot 10^6$

$z := 140.37$ $x_u := (d - z) \cdot \frac{18}{7}$ $M_{Rd} := f_{cd_1} \cdot 0.75 \cdot B \cdot x_u \cdot z$ $M_{Rd} = 4.559 \times 10^7$

$V_{Ed} := 75.9 \cdot 10^3$

BEUGEL $dia_b := 8$ $f_{ctd_1} = 1.032$

$c := 0.4$ $\mu := 0.7$ $\sigma_n := 0$ $c \cdot f_{ctd_1} = 0.413$

$\alpha := \frac{\pi}{2}$ $\sin(\alpha) = 1$ $\alpha = 1.571$

Aantal staven per snede: 2st

$$A_{sw} := \frac{dia_b^{\,2} \cdot \pi}{2} \qquad A_{sw} = 100.531$$

$$v_{Edi} := \frac{V_{Ed}}{z \cdot B} \qquad v_{Edi} = 0.541$$

NEN-EN 1992-1-1:2011

$$v_{Rwd} := \frac{A_{sw} \cdot 435 \cdot (\mu \cdot \sin(\alpha) + \cos(\alpha))}{1000 \cdot B} \qquad v_{Rwd} = 0.031$$

$$n_{stf} := \frac{\left(v_{Edi} - c \cdot f_{ctd_1}\right)}{v_{Rwd}} \qquad n_{stf} = 4.185$$

$$v_{Rdi} := c \cdot f_{ctd_1} + \frac{n_{stf} \cdot A_{sw} \cdot 435 \cdot (\mu \cdot \sin(\alpha) + \cos(\alpha))}{1000 \cdot B} \qquad v_{Rdi} = 0.541$$

Eerste afstand: aantal beugels:

$$As_{bgl} := n_{stf} \cdot A_{sw} \qquad As_{bgl} = 421$$

WOR 2018.11.2