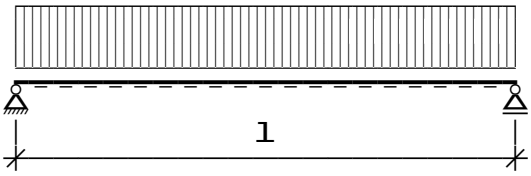
Berekening beton balk

Schema



De overspanning l = 4,50 m

Belastingen

$q_{pb,rep}$ = 32,0 kN/m
$q_{vb,rep}$ = 10,8 kN/m

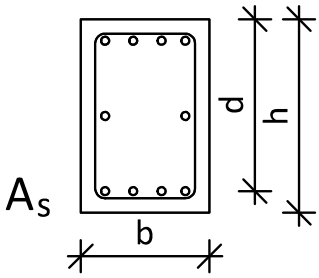
$q_d = 1,2 * q_{pb,rep} + 1,5 * q_{vb,rep}$ = 54,6 kN/m

Maatgevende snedekrachten

$M_{Ed} = \frac{1}{8} * q_d * l^2$ = 138,2 kNm

$V_{Ed} = \frac{1}{2} * q_d * l$ = 122,8 kN

Geometrie



Hoogte h = 600 mm
Breedte b = 400 mm
Diameterhoofdwapening d_{hoofd} = 16 mm
Dekking c_{nom} = 30 mm
Diameterbeugels $d_{beugels}$ = 8 mm
h.o.h afstand beugels s = 150 mm
b_w = b = 400 mm
d = $h - c_{nom} - d_{beugels} - 0,5 * d_{hoofd}$ = 554 mm
z = 0,9 * d = 499 mm
$A_{sw} = 2 * \pi * (1/2 * d_{beugels})^2$ = 101 mm²

Materiaaleigenschappen

Beton = C28/35
f_{ck} = 28 N/mm²
f_{ctm} = 2,80 N/mm²
f_{cd} = f_{ck} / 1,5 = 19 N/mm²
f_{ywd} = 435 / 1,15 = 378 N/mm²

Bepaling hoofdwapening

$d = h - c_{nom} - d_{beugels} - 0,5 * d_{hoofd} = 554$ mm

$K = \frac{M_{Ed} * 10^6}{b * d^2 * f_{cd}} = 0,059$

$z = \frac{d}{2} * (1 + \sqrt{1 - 112 * K / 54}) = 536$ mm

$x_u = \frac{18}{7} * (d - z) = 46$ mm

$A_s = \frac{M_{Ed} * 10^6}{435 * z} = 593$ mm²

Toegepaste wapening

Wapening = 4 ∅ 16

$A_{s,toe} = 804 > A_s$

Controle minumumwapening

$A_{s,min1} = \frac{0,26 * f_{ctm} * b * d}{500} = 323$ mm²

$A_{s,min2} = 0,0013 * b*d = 288$ mm²

$A_{s,min} = MAX(A_{s,min1};A_{s,min2}) = 323$ mm² < A_s

Controle hoogte van betondrukzone volgens artikel 5.5

Geen herverdeling δ = 1,00

k_1 = 0,44

$k_2 = 1,25 * \left(0,6 + \frac{0,0014}{0,0035}\right) = 1,25$

$k_1 + k_2 * \frac{x_u}{d} = 0,44 + 1,25 * \frac{46}{554} = 0,54 \leq \delta$

Berekening dwarskracht

$\nu = 0,6 * \left(1 - \frac{f_{ck}}{250}\right) = 0,53$

$\nu_1 = \nu = 0,53$

Θ = 45 °

$V_{Rd,s} = \frac{A_{sw}}{s} * z * f_{ywd} * \frac{1}{\tan(\Theta)} * 10^{-3} = 136$ kN

$V_{Rd,max} = \frac{1 * b_w * z * \nu_1 * f_{cd}}{1 / \tan(\Theta) + \tan(\Theta)} * 10^{-3} = 1080$ kN

$V_{Rd} = MIN(V_{Rd,max};V_{Rd,s}) = 136$ kN

$V_{Ed} = 123$ kN < V_{Rd}