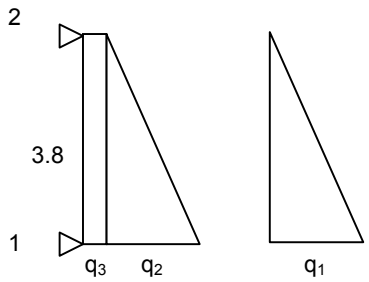
APPENDIX 20

STRUCTURAL CALCULATION OF CLEAN WATER RESERVOIR

- Belasting op dek max 0.5 m grond
- Veranderlijk 4.0 kN/m^2 (NEN 7602)
- Max waterstand NAP +4.60
- Aangehouden tot o.k. dek NAP +4.80
- HGS onder bodem kelder

Kelderwand



Inwendig

q_1 water = 3.55 x 10.0 = 35.5 kN/m'

qd = 42.6 kN/m'

Uitwendig

q_2 grond = 3.55 x 20.0 x 0.5 = 35.5 kN/m'

q_3 b.b = (0.5 x 20.0 + 4.0) x 0.5 = 7 kN/m'

1

q_2d = 1.35 x 35.5 = 47.925 kN/m'

q_3d = 1.35 x 0.5 x 20.0 x 0.5 = 6.75 kN/m'

resp

q_2d = 1.2 x 35.5 = 42.6 kN/m'

q_3d = (1.2 x 0.5 x 20.0 + 1.5 x 4.0)x 0.5 = 9 kN/m'

Mv bij vrij opgelegd

t.g.v. q_1

Md = 1/27 x $3^{1/2}$ x 42.6 x 3.8^2 = 39.46 kNm

t.g.v. q_2,q_3

Md = 1/27 x $3^{1/2}$ x 47.925 x 3.8^2 + 1/8 x 6.75 x 3.8^2 = 56.58 kNm

t.q.v. resp

Md = 1/27 x $3^{1/2}$ x 42.6 x 3.8^2 + 1/8 x 9 x 3.8^2 = 55.71 kNm

1

V_1d = 2/3 x 1/2 x 3.8 x 47.925 + 0.5 x 3.8 x 6.75 = 73.53 kN/m'

V_2d = 1/3 x 1/2 x 3.8 x 47.925 + 0.5 x 3.8 x 6.75 = 43.18 kN/m'

resp

V_1d = 2/3 x 1/2 x 3.8 x 42.6+ 0.5 x 3.8 x 9 = 71.06 kN/m'

V_2d = 1/3 x 1/2 x 3.8 x 42.6 + 0.5 x 3.8 x 9 = 44.08 kN/m'

h = 250m d = 200mm

τd = 73.53/200 = 0.37 N/mm^2 < τ_1 (= 0.56 N/mm^2)

Max Md = 56.58 kNm/m'

bxd = 1.0 x 0.2 Md/bd^2 = 1414.5

ω_0 = 0.337

A = 674 mm^2 → ϕ12-165

Bij volledige inklemming in bodem en dek

t.g.v. q_1

Md = 1/20 x 42.6 x 3.8^2 = 30.76 kNm

t.g.v. q_2,q_3

Md = 1/20 x 47.925 x 3.8^2 + 1/12 x 6.75 x 3.8^2 = 42.72 kNm

t.q.v. resp

Md = 1/20 x 42.6 x 3.8^2 + 1/12 x 9 x 3.8^2 = 41.59 kNm

Max Md = 42.72 kNm/m'

bxd = 1.0 x 0.2 Md/bd^2 = 1068

ω_0 = 0.252

A = 505 mm^2 → ϕ12-220

Ivm. Scheurwijdte beperking in milieuklasse 5

Bij ϕ12 ω_0 = 0.33 → ϕ12-125

Kelder dek h = 250 mm

Belasting permanent

- Eigen gewicht 0.25 x 25 = 6.25 KN/m²
- Isolatie + dakbed = 0.75 KN/m²
- Grond 0.5 x 20 = 10 KN/m²

= 17 KN/m²

Veranderlijk = 4 KN/m²

BC 1 Pd = 1.2 x 17.0 + 1.5 x 4.0 = 26.4 KN/m²

Kolom afstand 3.35 x 3.35

Kolom afmeting ϕ 300

Fd = 3.35 x 3.35 x 26.4 = 296.3 KN

Belasting op ponscirkel met diameter D = 300 + 2 x 200 = 700 mm

Q = ¼ π x 0.7² x 26.4 = 10.2 KN

τd = (296.274 -10.16)/ {π x 0.2 (200+300)} = 0.91 N/mm²

V_{1d} = 1/3 x ½ x 3.8 x 35.5 x 1.2 = 27 KN/m

Wapening $\rightarrow$ ϕ12-150 = 754 mm²/m σs = 27000/754 = 35.8 N/mm²

τ_1 = 0.8 fb – σs / 4 fs = 1.12 – 35.8 / (4x435) = 1.1 N/mm² > 0.91 N/mm² (τd)

Wapening kelderdek

Maximale momenten NEN 6720

Middenveld (tabel 19) M = 0.132 x 26.4 x 3.35² = 39.11 KNm

Randveld (tabel 23) M = 0.178 x 26.4 x 3.35² = 52.74 KNm

Hoekveld (tabel 25) M = 0.19 x 26.4 x 3.35² = 56.29 KNm

$\rightarrow$ Max : M = 56.29 KNm

Md/bd² = 1407 ω_0 = 0.335

A = ω_0 x b x d = 670 mm² min = ϕ12-150 = 754 mm²

Ronde kolom N'd/Ab = 296.274/(1/4 x π x 0.3²) = 4191.42 KN/m² = 4.19 N/mm²

e_t = $(e_o + e_c)\ \xi$

ψ = 1.31, ρ = 1, lc =3550, e_0 = 0

e_c = 3 [1.5h + e_o (4ψ - 3)] x (ρ lc/100h)²

= 3 x 450 x 0.014 = 18.9

ξ = 0.5 (1+ e_1 / e_0) = 0.5

e_t = $(e_o + e_c)\ \xi$

= 18.9 x 0.5 = 9.45

$\rightarrow e_{t =}$ 0.1 x 300 = 30 mm

B35 $\rightarrow$ f'b= 21, ß = 1.4

N'd/(f'b x Ab) = 4.19 / 21 = 0.2

N'd x e_t /(f'b x Ab x h) = 0.2 x 30 / 300 = 0.02

$\rightarrow$ r = 0 ω_0 = 0

Amin = 0.3 x Ab = 212 mm² $\rightarrow$ 5ϕ12 = (565 mm²)

Kelder bodem als dek ϕ12-150