Solution – Design Example V1 – Clay Brick

Equation 3.1 of Eurocode 6 and Table NA.4 of UK National Annex (NA)

$f_k = Kf_b^{\alpha}f_m^{\beta} = 0{,}50 \times 42{,}5^{0,7} \times 4^{0,3} = 10{,}46\ N/mm^2$

Checking Capacity:

Effective height, $h_{ef} = \rho_n h = 0{,}75 \times 3000 = 2250$ mm

Effective thickness, $t_{ef} = t = 102{,}5$ mm

$\therefore$ Slenderness ratio = 2250 / 102,5 = 22.0 < 27 limiting value

(Therefore the effects of creep may be ignored, NA.2.14 of UK NA)

Hence eccentricity of design vertical load, $e_i = (M_{id} / N_{id}) + e_{he} \pm e_{init} \geq 0{,}05t$

Therefore $e_i = 0 + 0 + 5{,}0 = 5{,}0$ mm (i.e. 0,049t)

where $M_{id}/N_{id} = 0$

$e_{he} = 0$ *(horizontal loads effect)*

$e_{init} = h_{ef}/450 = (3000 \times 0{,}75) / 450 = 5{,}0$ *mm*

e_i is 0,05 t at top and bottom of the wall which are the minimum eccentricity design values to be used

Therefore $\phi_i = 1 - 2(e_i / t) = 1 - 2(0{,}05t / t) = 0{,}9$

And eccentricity of design vertical load, $e_m = (M_{md} / N_{md}) + e_{hm} \pm e_{init} \geq 0{,}05t$

Therefore $e_{mk} = e_m + e_k = 0 + 0 + 5{,}0 = 5{,}0$ mm (i.e 0,049t)

where $M_{md}/N_{md} = 0$

$e_{hm} = 0$ *(horizontal loads effect)*

$e_{init} = h_{ef}/450 = (3000 \times 0{,}75) / 450 = 5{,}0$ *mm*

$e_k = 0$ *(creep effect)*

e_{mk} is 0,05 t at mid-height of the wall which is the minimum eccentricity design value to be used

Hence for E = $1000f_k$ (10460 N/mm^2) Part 1.1 Annex G equations or Figure G1 gives:

Φ_m = 0,58 governs design

Class 2 execution control $\therefore$ γ_m = 3,0

Design resistance per unit length $N_{Rd} = \Phi\ t\ f_d$ from Table NA.1 of UK NA

Where design strength, $f_d = \frac{f_k}{\gamma_m}$ for vertical load on the units in the -

- normal direction of loading

N_{Rd} = 0,58 x 102,5 x 10,46 / 3,0 = 207 kN/m run > 180 kN/m

This is greater than the design load and therefore the clay brick masonry units and mortar specified are adequate.

Solution – Design Example V1 – Concrete Block

Equation 3.1 of Eurocode 6 and Table NA.4 of UK National Annex (NA)

$f_k = Kf_b^{\alpha} f_m^{\beta} = 0{,}75 \times 20^{0,7} \times 4^{0,3} = 9{,}26\ N/mm^2$

Checking Capacity:

Effective height, $h_{ef} = \rho_n h = 0{,}75 \times 3000 = 2250$ mm

Effective thickness, $t_{ef} = t = 140$ mm

$\therefore$ Slenderness ratio = 2250 / 140 = 16,1 < 27 limiting value

(Therefore the effects of creep may be ignored, NA.2.14 of UK NA)

Hence eccentricity of design vertical load, $e_i = (M_{id} / N_{id}) + e_{he} \pm e_{init} \geq 0{,}05t$
Therefore $e_i = 0 + 0 + 5{,}0 = 5{,}0$ mm (i.e. 0,036t)

where $M_{id}/N_{id} = 0$

$e_{he} = 0$ *(horizontal loads effect)*

$e_{init} = h_{ef}/450 = (3000 \times 0{,}75) / 450 = 5{,}0$ *mm*

e_i is 0,05 t at top and bottom of the wall which are the minimum eccentricity design values to be used

Therefore $\phi_i = 1 - 2(e_i / t) = 1 - 2(0{,}05t / t) = 0{,}9$

And eccentricity of design vertical load, $e_m = (M_{md} / N_{md}) + e_{hm} \pm e_{init} \geq 0{,}05t$

Therefore $e_{mk} = e_m + e_k = 0 + 0 + 5{,}0 = 5{,}0$ mm (i.e 0,036t)

where $M_{md}/N_{md} = 0$

$e_{hm} = 0$ *(horizontal loads effect)*

$e_{init} = h_{ef}/450 = (3000 \times 0{,}75) / 450 = 5{,}0$ *mm*

$e_k = 0$ *(creep effect)*

e_{mk} is 0,05 t at mid-height of the wall which is the minimum eccentricity design value to be used

Hence for E = 1000f_k (6790 N/mm^2) Part 1.1 Annex G equations or Figure G1 gives:

Φ_m = 0,72 governs design

Class 2 execution control $\therefore$ γ_m = 3,0

Design resistance per unit length $N_{Rd} = \Phi\ t\ f_d$ from Table NA.1 of UK NA

Where design strength, $f_d = \frac{f_k}{\gamma_m}$ for vertical load on the units in the -

- normal direction of loading

N_{Rd} = 0,72 x 140 x 9,26 / 3,0 = 311 kN/m run > 180 kN/m

This is greater than the design load and therefore the concrete block masonry units and general purpose mortar specified are adequate.