Solution - Design Example V1 - Clay Brick

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

\[ f_k = Kf_{u,m} = 0.50 \times 42.5^{0.7} \times 4^{0.3} = 10.46 \text{ N/mm}^2 \]

Checking Capacity:

Effective height, \( h_{ef} = \rho_n h = 0.75 \times 3000 = 2250 \text{ mm} \)

Effective thickness, \( t_{ef} = t = 102.5 \text{ mm} \)

\[ \therefore \text{Slenderness ratio} = \frac{2250}{102.5} = 22.0 < 27 \text{ limiting value} \]

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

Hence eccentricity of design vertical load, \( e_t = \left( \frac{M_{ld}}{N_{ld}} \right) + e_{he} + e_{init} \geq 0.05t \)

Therefore \( e_t = 0 + 0 + 5.0 = 5.0 \text{ mm (i.e. 0.049t)} \)

\[ \text{where } M_{ld}/N_{ld} = 0 \]

\[ e_{he} = 0 \text{ (horizontal loads effect)} \]

\[ e_{init} = h_{ef}/450 = (3000 \times 0.75) / 450 = 5.0 \text{ mm} \]

\( e_t \) is 0.05 t at top and bottom of the wall which are the minimum eccentricity design values to be used

Therefore \( \phi_i = 1 - 2(e_t / t) = 1 - 2(0.05t / t) = 0.9 \)

And eccentricity of design vertical load, \( e_m = \left( \frac{M_{md}}{N_{md}} \right) + e_{hm} + e_{init} \geq 0.05t \)

Therefore \( e_{mk} = e_{m} + e_{k} = 0 + 0 + 5.0 = 5.0 \text{ mm (i.e 0.049t)} \)

\[ \text{where } M_{md}/N_{md} = 0 \]

\[ e_{hm} = 0 \text{ (horizontal loads effect)} \]

\[ e_{init} = h_{ef}/450 = (3000 \times 0.75) / 450 = 5.0 \text{ mm} \]

\[ e_{k} = 0 \text{ (creep effect)} \]

\( e_{mk} \) is 0.05 t at mid-height of the wall which is the minimum eccentricity design value to be used

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

$\Phi_m = 0.58$ governs design

Class 2 execution control $\therefore \gamma_m = 3.0$

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

$N_{Rd} = 0.58 \times 102.5 \times 10.46 / 3.0 = 207$ 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)

\[ f_k = K_{k_1} f_m = 0.75 \times 20^{0.7} \times 4^{0.3} = 9.26 \text{ N/mm}^2 \]

Checking Capacity:

Effective height, \( h_{ef} = \rho_n h = 0.75 \times 3000 = 2250 \text{ mm} \)

Effective thickness, \( t_{ef} = t = 140 \text{ mm} \)

\( \therefore \) Slenderness ratio = \( \frac{2250}{140} = 16.1 < 27 \) 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 \( e_i = 0 + 0 + 5.0 = 5.0 \text{ mm} \) (i.e. 0.036t)

\[ \text{where } M_{id}/N_{id} = 0 \]

\[ e_{he} = 0 \text{ (horizontal loads effect)} \]

\[ e_{init} = h_{ef}/450 = (3000 \times 0.75) / 450 = 5.0 \text{ mm} \]

\( e_i \) 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 \( e_{mk} = e_m + e_k = 0 + 0 + 5.0 = 5.0 \text{ mm} \) (i.e 0.036t)

\[ \text{where } M_{md}/N_{md} = 0 \]

\[ e_{hm} = 0 \text{ (horizontal loads effect)} \]

\[ e_{init} = h_{ef}/450 = (3000 \times 0.75) / 450 = 5.0 \text{ mm} \]

\[ e_k = 0 \text{ (creep effect)} \]

\( e_{mk} \) is 0.05 t at mid-height of the wall which is the minimum eccentricity design value to be used

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

$\Phi_m = 0.72$ governs design

Class 2 execution control $\therefore \gamma_m = 3.0$

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

$N_{Rd} = 0.72 \times 140 \times 9.26 / 3.0 = 311$ 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.