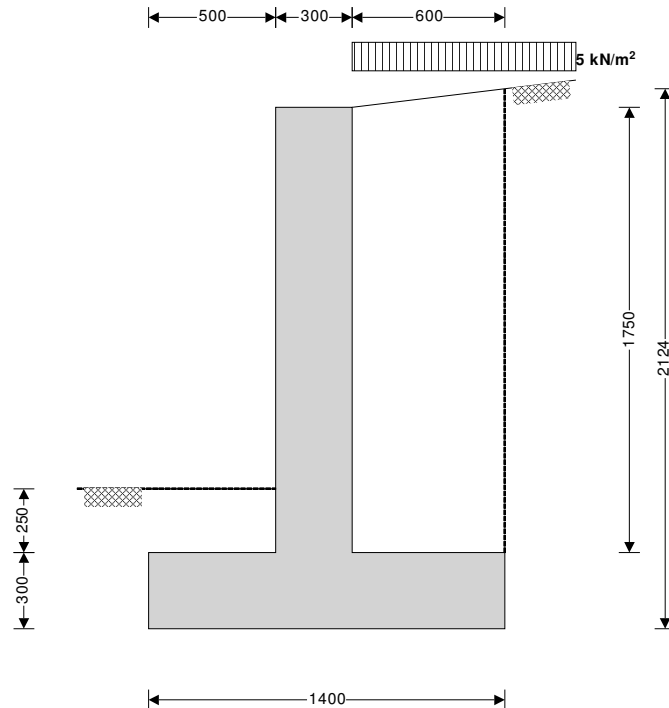


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RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.08



Wall details

Retaining wall type

Height of wall stem

Length of toe

Overall length of base

Height of retaining wall

Depth of downstand

Position of downstand

Depth of cover in front of wall

Height of ground water

Density of wall construction

Angle of soil surface

Mobilisation factor

Moist density

Design shear strength

Design shear strength

Moist density

Cantilever

$h_{\text{stem}} = 1750$ mm

$l_{\text{toe}} = 500$ mm

$l_{\text{base}} = 1400$ mm

$h_{\text{wall}} = 2050$ mm

$d_{\text{ds}} = 0$ mm

$l_{\text{ds}} = 900$ mm

$d_{\text{cover}} = 250$ mm

$h_{\text{water}} = 0$ mm

$\gamma_{\text{wall}} = 23.6$ kN/m³

$\beta = 7.0$ deg

$M = 1.5$

$\gamma_m = 18.0$ kN/m³

$\phi' = 35.0$ deg

$\phi'_b = 35.0$ deg

$\gamma_{mb} = 18.0$ kN/m³

Wall stem thickness

Length of heel

Base thickness

Thickness of downstand

Unplanned excavation depth

Density of water

Density of base construction

Effective height at back of wall

Saturated density

Angle of wall friction

Design base friction

Allowable bearing

$t_{\text{wall}} = 300$ mm

$l_{\text{heel}} = 600$ mm

$t_{\text{base}} = 300$ mm

$t_{\text{ds}} = 300$ mm

$d_{\text{exc}} = 0$ mm

$\gamma_{\text{water}} = 9.81$ kN/m³

$\gamma_{\text{base}} = 23.6$ kN/m³

$h_{\text{eff}} = 2124$ mm

$\gamma_s = 21.0$ kN/m³

$\delta = 0.0$ deg

$\delta_b = 18.6$ deg

$P_{\text{bearing}} = 50$ kN/m²

Using Coulomb theory

Active pressure

At-rest pressure

$K_a = 0.290$

$K_0 = 0.426$

Passive pressure

$K_p = 7.759$

Loading details

Surcharge load

Vertical dead load

Horizontal dead load

Surcharge = **5.0** kN/m²

$W_{\text{dead}} = 0.0$ kN/m

$F_{\text{dead}} = 0.0$ kN/m

Vertical live load

Horizontal live load

$W_{\text{live}} = 0.0$ kN/m

$F_{\text{live}} = 0.0$ kN/m

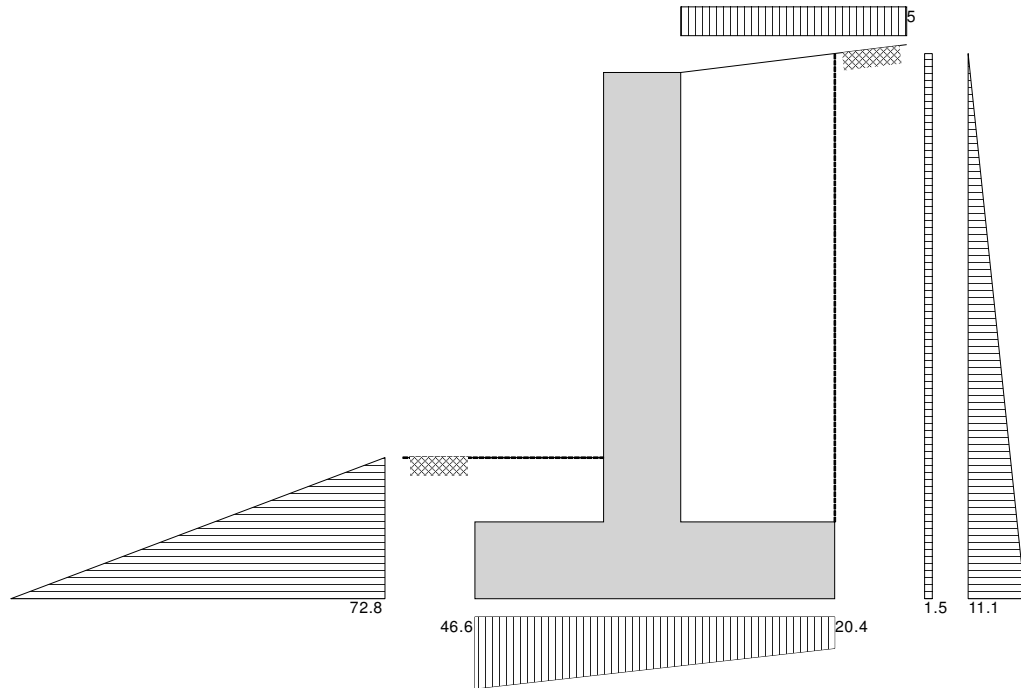
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Position of vertical load

$l_{load} = 0 \text{ mm}$

Height of horizontal load

$h_{load} = 0 \text{ mm}$



Loads shown in kN/m, pressures shown in kN/m²

Check stability against sliding

Total horizontal load on wall $F_{total} = 14.9 \text{ kN/m}$

Resistance to sliding $F_{res} = 34.0 \text{ kN/m}$

PASS - Resistance force is greater than sliding force

Check stability against overturning

Overturning moment $M_{ot} = 11.6 \text{ kNm/m}$

Restoring moment $M_{rest} = 36.3 \text{ kNm/m}$

PASS - Restoring moment is greater than overturning moment

Check bearing pressure

Total vertical reaction $R = 46.8 \text{ kN/m}$

Distance to reaction $x_{bar} = 609 \text{ mm}$

Eccentricity of reaction $e = 91 \text{ mm}$

Reaction acts within middle third of base

Bearing pressure at toe $p_{toe} = 46.6 \text{ kN/m}^2$

Bearing pressure at heel $p_{heel} = 20.4 \text{ kN/m}^2$

PASS - Maximum bearing pressure is less than allowable bearing pressure

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RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.08

Ultimate limit state load factors

Dead load factor $\gamma_{f_d} = 1.4$

Live load factor $\gamma_{f_l} = 1.6$

Earth pressure factor $\gamma_{f_e} = 1.4$

Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

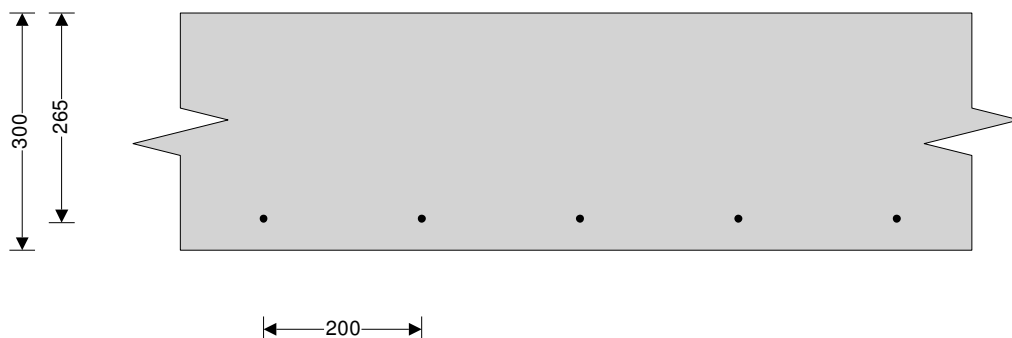
Strength of concrete $f_{cu} = 35 \text{ N/mm}^2$

Strength of reinforcement $f_y = 500 \text{ N/mm}^2$

Base details

Minimum reinforcement $k = 0.13 \%$

Cover in toe $c_{toe} = 30 \text{ mm}$



Design of retaining wall toe

Shear at heel $V_{toe} = 29.7 \text{ kN/m}$

Moment at heel $M_{toe} = 13.0 \text{ kNm/m}$

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **A393 mesh**

Area required $A_{s_toe_req} = 390.0 \text{ mm}^2/\text{m}$

Area provided $A_{s_toe_prov} = 393 \text{ mm}^2/\text{m}$

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress $v_{toe} = 0.112 \text{ N/mm}^2$

Allowable shear stress $v_{adm} = 4.733 \text{ N/mm}^2$

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress $v_{c_toe} = 0.415 \text{ N/mm}^2$

$v_{toe} < v_{c_toe}$ - No shear reinforcement required

Design of reinforced concrete retaining wall heel (BS 8002:1994)

Material properties

Strength of concrete $f_{cu} = 35 \text{ N/mm}^2$

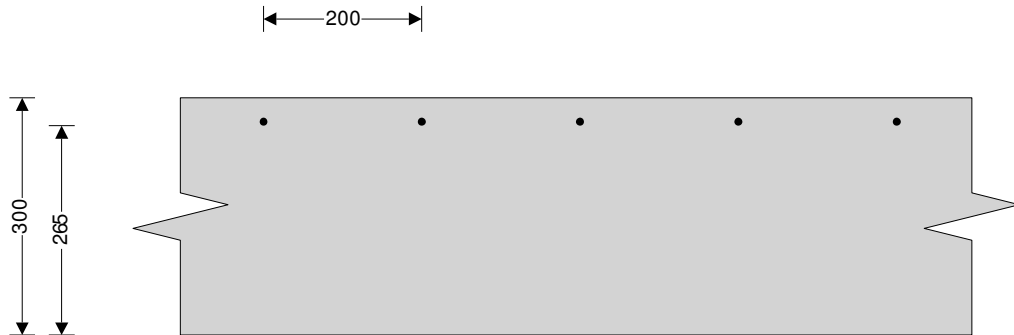
Strength of reinforcement $f_y = 500 \text{ N/mm}^2$

Base details

Minimum reinforcement $k = 0.13 \%$

Cover in heel $c_{heel} = 30 \text{ mm}$

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Design of retaining wall heel

Shear at heel $V_{\text{heel}} = 24.5 \text{ kN/m}$

Moment at heel $M_{\text{heel}} = 11.8 \text{ kNm/m}$

Compression reinforcement is not required

Check heel in bending

Reinforcement provided **A393 mesh**

Area required

$A_{s_heel_req} = 390.0 \text{ mm}^2/\text{m}$

Area provided

$A_{s_heel_prov} = 393 \text{ mm}^2/\text{m}$

PASS - Reinforcement provided at the retaining wall heel is adequate

Check shear resistance at heel

Design shear stress $V_{\text{heel}} = 0.092 \text{ N/mm}^2$

Allowable shear stress

$V_{\text{adm}} = 4.733 \text{ N/mm}^2$

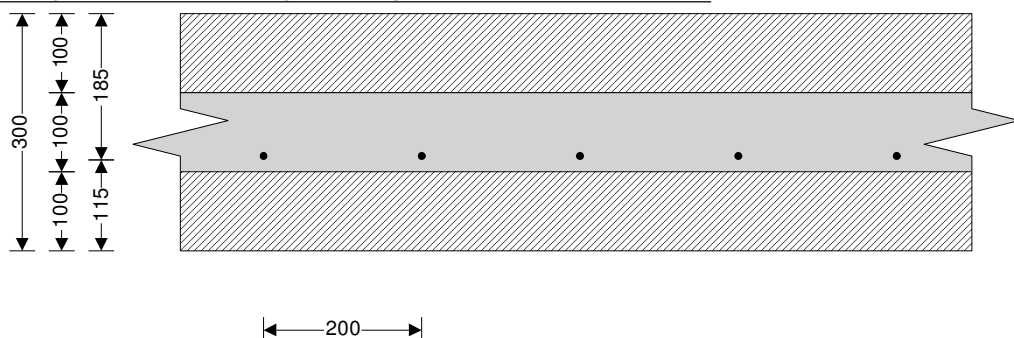
PASS - Design shear stress is less than maximum shear stress

Concrete shear stress

$V_{c_heel} = 0.415 \text{ N/mm}^2$

$V_{\text{heel}} < V_{c_heel}$ - No shear reinforcement required

Design of cavity reinforced masonry retaining wall stem - BS5628-2:2000



Wall details

Thickness of outer leaf of wall $t_{\text{outer}} = 100 \text{ mm}$

Thickness of inner leaf of wall $t_{\text{inner}} = 100 \text{ mm}$

Thickness of reinforced cavity $t_{\text{cavity}} = 100 \text{ mm}$

Masonry details

Masonry type
units

Aggregate concrete blocks no voids
 $p_{\text{unit}} = 10.0 \text{ N/mm}^2$

Compressive strength of

Mortar designation

ii

Char. compressive strength

$f_k = 8.1 \text{ N/mm}^2$

Manufacture control of units

Normal

Material strength safety factor

$\gamma_{\text{mm}} = 2.3$

Design of retaining wall stem

Shear at base of stem $V_{\text{stem}} = 24.1 \text{ kN/m}$

Moment at base of stem

$M_{\text{stem}} = 19.9 \text{ kNm/m}$

Check maximum design moment

Maximum design moment

$M_{d_stem} = 48 \text{ kNm/m}$

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PASS - Applied moment is less than maximum design moment

Check wall stem in bending

Reinforcement provided **A393 mesh**

Area required $A_{s_stem_req} = 390.0 \text{ mm}^2/\text{m}$ Area provided $A_{s_stem_prov} = 393 \text{ mm}^2/\text{m}$

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress $v_{stem} = 0.130 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 0.268 \text{ N/mm}^2$

PASS - Design shear stress is less than maximum shear stress

Check limiting dimensions

Limiting span/eff.depth ratio $ratio_{max} = 18.00$ Actual span/eff.depth ratio $ratio_{act} = 9.96$

PASS - Span to depth ratio is acceptable

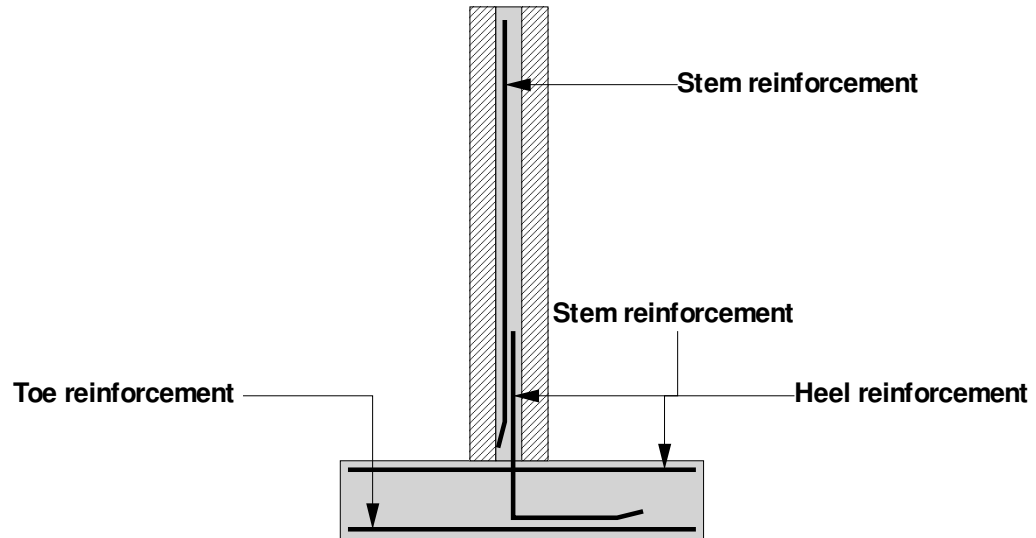
Axial load check

Factored axial load on wall $N_{wall} = 17.3 \text{ kN/m}$ Limiting axial load $N_{limit} = 244.3 \text{ kN/m}$

Applied axial load may be ignored - calculations valid

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Indicative retaining wall reinforcement diagram



Toe mesh - A393 - (393 mm²/m)
 Heel mesh - A393 - (393 mm²/m)
 Stem mesh - A393 - (393 mm²/m)