

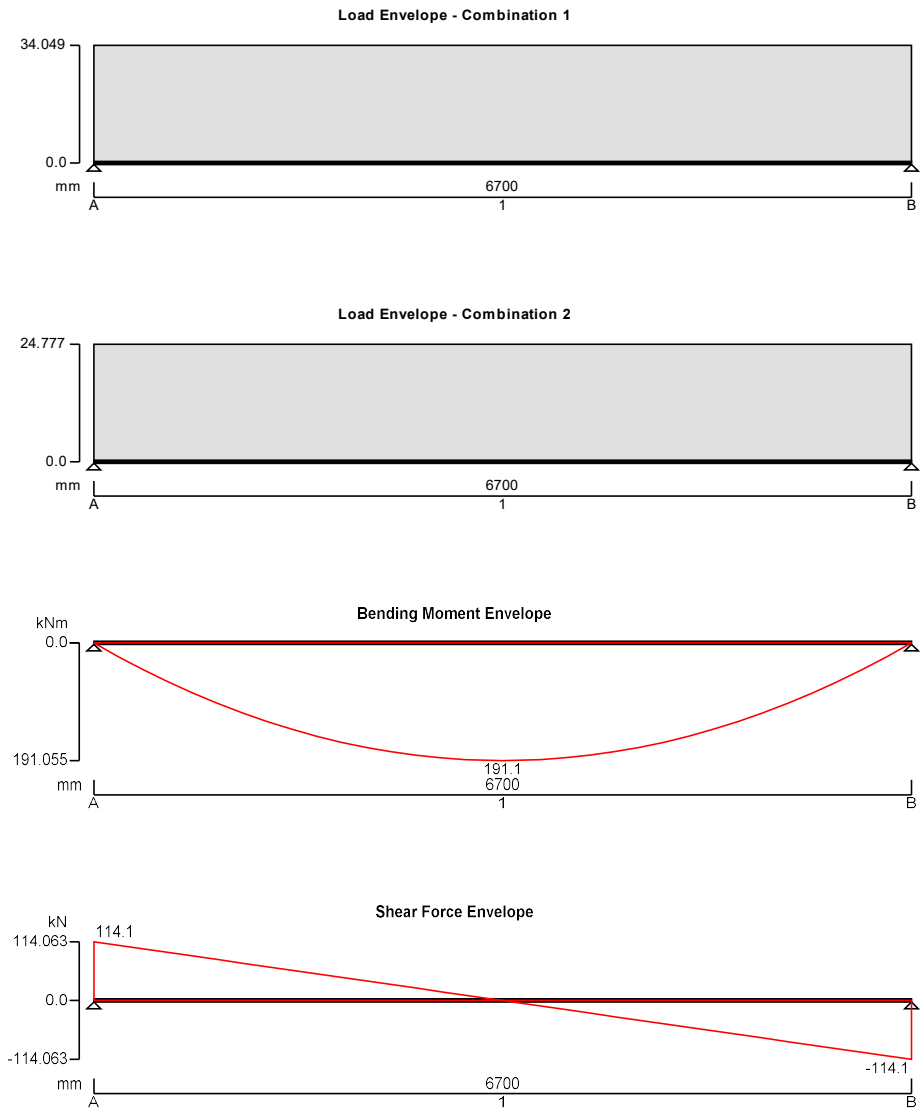
HARVIR DHANJAL	Project				Job Ref.	
	20 Lancaster Close Reading RG1 5HB				ASB4	
	Section				Sheet no./rev.	
	Floor Beams				1	
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1.0 GROUND STEEL BEAM ANALYSIS & DESIGN (EN1993)

STEEL BEAM ANALYSIS & DESIGN (EN1993-1-1:2005)

In accordance with EN1993-1-1:2005 incorporating Corrigenda February 2006 and April 2009 and the UK national annex

TEDDS calculation version 3.0.13



Support conditions

- Support A
- Support B
- Vertically restrained
- Rotationally free
- Vertically restrained
- Rotationally free

Applied loading

- Beam loads
- Permanent self weight of beam × 1
- Wall above - Permanent full UDL 11.5 kN/m

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Roof - Permanent full UDL 3.4 kN/m
Roof - Variable full UDL 2.5 kN/m
Floor - Permanent full UDL 3.66 kN/m
Floor - Variable full UDL 1.5 kN/m
Conc encasement - Permanent full UDL 1.5 kN/m

Load combinations

Load combination 1	Support A	Permanent $\times$ 1.35 Variable $\times$ 1.50
	Span 1	Permanent $\times$ 1.35 Variable $\times$ 1.50
	Support B	Permanent $\times$ 1.35 Variable $\times$ 1.50
Load combination 2	Support A	Permanent $\times$ 1.00 Variable $\times$ 1.00
	Span 1	Permanent $\times$ 1.00 Variable $\times$ 1.00
	Support B	Permanent $\times$ 1.00 Variable $\times$ 1.00

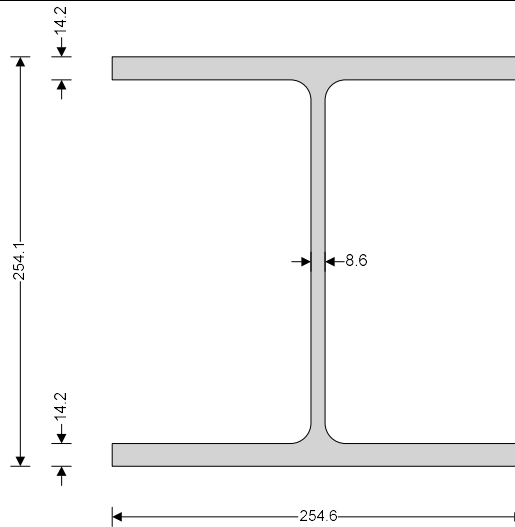
Analysis results

Maximum moment	$M_{\max} = 191.1$ kNm	$M_{\min} = 0$ kNm
Maximum shear	$V_{\max} = 114.1$ kN	$V_{\min} = -114.1$ kN
Deflection	$\delta_{\max} = 4.4$ mm	$\delta_{\min} = 0$ mm
Maximum reaction at support A	$R_{A_{\max}} = 114.1$ kN	$R_{A_{\min}} = 83$ kN
Unfactored permanent load reaction at support A	$R_{A_{\text{Permanent}}} = 69.6$ kN	
Unfactored variable load reaction at support A	$R_{A_{\text{Variable}}} = 13.4$ kN	
Maximum reaction at support B	$R_{B_{\max}} = 114.1$ kN	$R_{B_{\min}} = 83$ kN
Unfactored permanent load reaction at support B	$R_{B_{\text{Permanent}}} = 69.6$ kN	
Unfactored variable load reaction at support B	$R_{B_{\text{Variable}}} = 13.4$ kN	

Section details

Section type	UKC 254x254x73 (Tata Steel Advance)
Steel grade	S275
EN 10025-2:2004 - Hot rolled products of structural steels	
Nominal thickness of element	$t = \max(t_f, t_w) = 14.2$ mm
Nominal yield strength	$f_y = 275$ N/mm ²
Nominal ultimate tensile strength	$f_u = 410$ N/mm ²
Modulus of elasticity	$E = 210000$ N/mm ²

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Partial factors - Section 6.1

Resistance of cross-sections	$\gamma_{M0} = 1.00$
Resistance of members to instability	$\gamma_{M1} = 1.00$
Resistance of tensile members to fracture	$\gamma_{M2} = 1.10$

Lateral restraint

Span 1 has full lateral restraint

Effective length factors

Effective length factor in major axis	$K_y = 1.000$
Effective length factor in minor axis	$K_z = 1.000$
Effective length factor for torsion	$K_{LT,A} = 1.000$ $K_{LT,B} = 1.000$

Classification of cross sections - Section 5.5

$$\varepsilon = \sqrt{235 \text{ N/mm}^2 / f_y} = 0.92$$

Internal compression parts subject to bending - Table 5.2 (sheet 1 of 3)

Width of section	$c = d = 200.3 \text{ mm}$	
	$c / t_w = 25.2 \times \varepsilon \leq 72 \times \varepsilon$	Class 1

Outstand flanges - Table 5.2 (sheet 2 of 3)

Width of section	$c = (b - t_w - 2 \times r) / 2 = 110.3 \text{ mm}$	
	$c / t_f = 8.4 \times \varepsilon \leq 9 \times \varepsilon$	Class 1

Section is class 1

Check shear - Section 6.2.6

Height of web	$h_w = h - 2 \times t_f = 225.7 \text{ mm}$
Shear area factor	$\eta = 1.000$ $h_w / t_w < 72 \times \varepsilon / \eta$

Shear buckling resistance can be ignored

Design shear force	$V_{Ed} = \max(\text{abs}(V_{\max}), \text{abs}(V_{\min})) = 114.1 \text{ kN}$
Shear area - cl 6.2.6(3)	$A_v = \max(A - 2 \times b \times t_f + (t_w + 2 \times r) \times t_f, \eta \times h_w \times t_w) = 2562 \text{ mm}^2$
Design shear resistance - cl 6.2.6(2)	$V_{c,Rd} = V_{pl,Rd} = A_v \times (f_y / \sqrt{3}) / \gamma_{M0} = 406.8 \text{ kN}$

PASS - Design shear resistance exceeds design shear force

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Check bending moment major (y-y) axis - Section 6.2.5

Design bending moment $M_{Ed} = \max(\text{abs}(M_{s1_max}), \text{abs}(M_{s1_min})) = 191.1 \text{ kNm}$

Design bending resistance moment - eq 6.13 $M_{c,Rd} = M_{pl,Rd} = W_{pl,y} \times f_y / \gamma_{M0} = 272.8 \text{ kNm}$

PASS - Design bending resistance moment exceeds design bending moment

Check vertical deflection - Section 7.2.1

Consider deflection due to variable loads

Limiting deflection $\delta_{lim} = L_{s1} / 360 = 18.6 \text{ mm}$

Maximum deflection span 1 $\delta = \max(\text{abs}(\delta_{max}), \text{abs}(\delta_{min})) = 4.381 \text{ mm}$

PASS - Maximum deflection does not exceed deflection limit

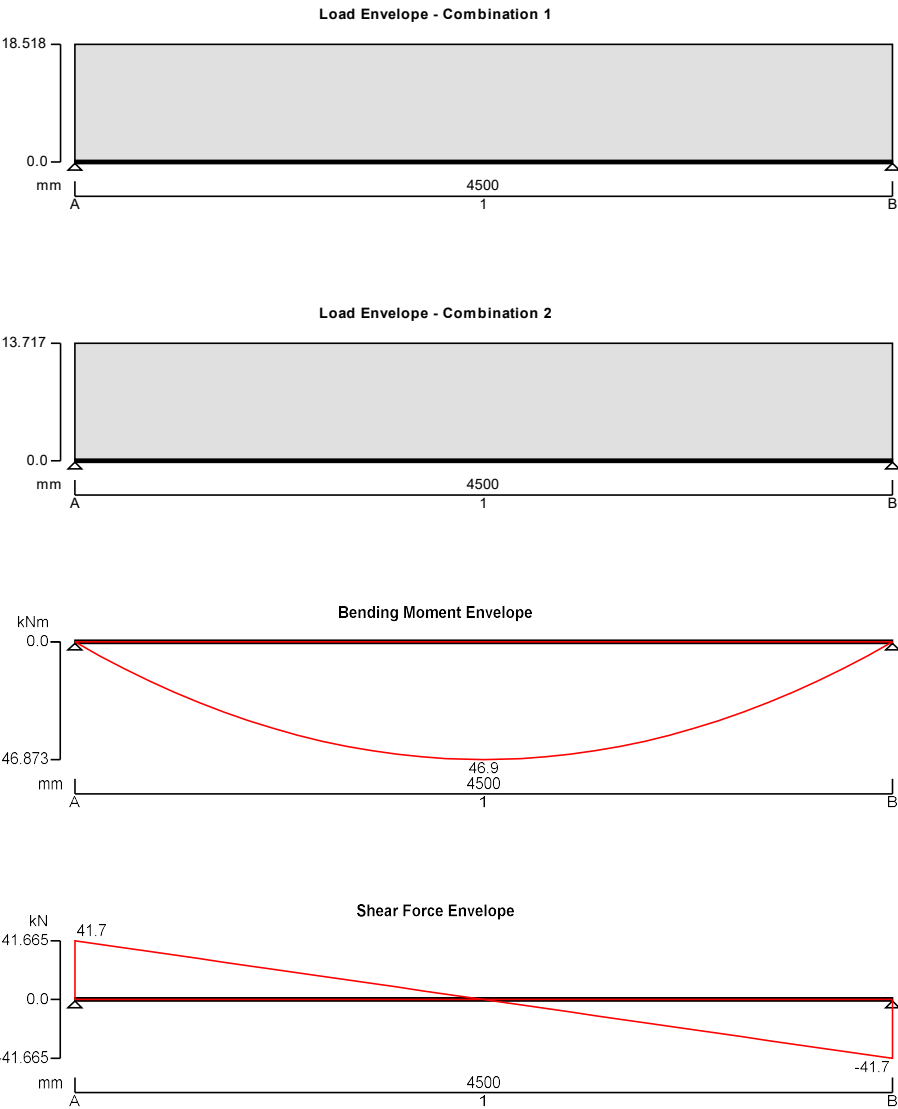
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	D	24/05/2022				

1.1 STEEL GROUND BEAM ANALYSIS & DESIGN (EN1993)

STEEL BEAM ANALYSIS & DESIGN (EN1993-1-1:2005)

In accordance with EN1993-1-1:2005 incorporating Corrigenda February 2006 and April 2009 and the UK national annex

TEDDS calculation version 3.0.13



Support conditions

Support A

Vertically restrained

Rotationally free

Support B

Vertically restrained

Rotationally free

Applied loading

Beam loads

Permanent self weight of beam × 1

Wall - Permanent full UDL 11.5 kN/m

Conc encasement - Permanent full UDL 1.5 kN/m

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Load combinations

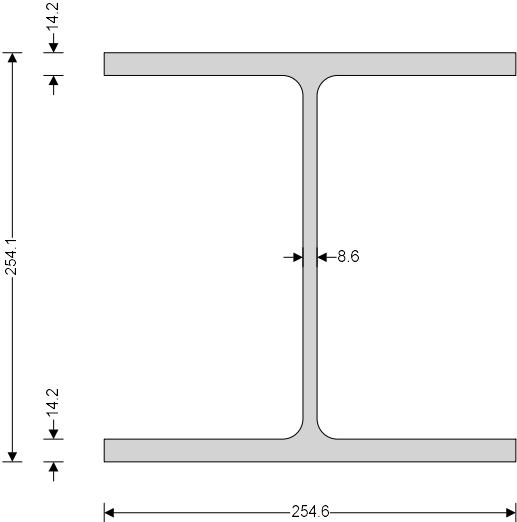
Load combination 1	Support A	Permanent × 1.35 Variable × 1.50
	Span 1	Permanent × 1.35 Variable × 1.50
	Support B	Permanent × 1.35 Variable × 1.50
Load combination 2	Support A	Permanent × 1.00 Variable × 1.00
	Span 1	Permanent × 1.00 Variable × 1.00
	Support B	Permanent × 1.00 Variable × 1.00

Analysis results

Maximum moment	$M_{max} = 46.9 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 41.7 \text{ kN}$	$V_{min} = -41.7 \text{ kN}$
Deflection	$\delta_{max} = 0 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_{max}} = 41.7 \text{ kN}$	$R_{A_{min}} = 30.9 \text{ kN}$
Unfactored permanent load reaction at support A	$R_{A_{Permanent}} = 30.9 \text{ kN}$	
Maximum reaction at support B	$R_{B_{max}} = 41.7 \text{ kN}$	$R_{B_{min}} = 30.9 \text{ kN}$
Unfactored permanent load reaction at support B	$R_{B_{Permanent}} = 30.9 \text{ kN}$	

Section details

Section type	UKC 254x254x73 (Tata Steel Advance)
Steel grade	S275
EN 10025-2:2004 - Hot rolled products of structural steels	
Nominal thickness of element	$t = \max(t_r, t_w) = 14.2 \text{ mm}$
Nominal yield strength	$f_y = 275 \text{ N/mm}^2$
Nominal ultimate tensile strength	$f_u = 410 \text{ N/mm}^2$
Modulus of elasticity	$E = 210000 \text{ N/mm}^2$



Partial factors - Section 6.1

Resistance of cross-sections	$\gamma_{M0} = 1.00$
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Resistance of members to instability $\gamma_{M1} = 1.00$

Resistance of tensile members to fracture $\gamma_{M2} = 1.10$

Lateral restraint

Span 1 has full lateral restraint

Effective length factors

Effective length factor in major axis $K_y = 1.000$

Effective length factor in minor axis $K_z = 1.000$

Effective length factor for torsion $K_{LT,A} = 1.000$

$K_{LT,B} = 1.000$

Classification of cross sections - Section 5.5

$\varepsilon = \sqrt{[235 \text{ N/mm}^2 / f_y]} = 0.92$

Internal compression parts subject to bending - Table 5.2 (sheet 1 of 3)

Width of section $c = d = 200.3 \text{ mm}$

$c / t_w = 25.2 \times \varepsilon \leq 72 \times \varepsilon$ Class 1

Outstand flanges - Table 5.2 (sheet 2 of 3)

Width of section $c = (b - t_w - 2 \times r) / 2 = 110.3 \text{ mm}$

$c / t_f = 8.4 \times \varepsilon \leq 9 \times \varepsilon$ Class 1

Section is class 1

Check shear - Section 6.2.6

Height of web $h_w = h - 2 \times t_f = 225.7 \text{ mm}$

Shear area factor $\eta = 1.000$

$h_w / t_w < 72 \times \varepsilon / \eta$

Shear buckling resistance can be ignored

Design shear force $V_{Ed} = \max(\text{abs}(V_{\max}), \text{abs}(V_{\min})) = 41.7 \text{ kN}$

Shear area - cl 6.2.6(3) $A_v = \max(A - 2 \times b \times t_f + (t_w + 2 \times r) \times t_f, \eta \times h_w \times t_w) = 2562 \text{ mm}^2$

Design shear resistance - cl 6.2.6(2) $V_{c,Rd} = V_{pl,Rd} = A_v \times (f_y / \sqrt{3}) / \gamma_{M0} = 406.8 \text{ kN}$

PASS - Design shear resistance exceeds design shear force

Check bending moment major (y-y) axis - Section 6.2.5

Design bending moment $M_{Ed} = \max(\text{abs}(M_{s1_max}), \text{abs}(M_{s1_min})) = 46.9 \text{ kNm}$

Design bending resistance moment - eq 6.13 $M_{c,Rd} = M_{pl,Rd} = W_{pl,y} \times f_y / \gamma_{M0} = 272.8 \text{ kNm}$

PASS - Design bending resistance moment exceeds design bending moment

Check vertical deflection - Section 7.2.1

Consider deflection due to variable loads

Limiting deflection $\delta_{lim} = L_{s1} / 360 = 12.5 \text{ mm}$

Maximum deflection span 1 $\delta = \max(\text{abs}(\delta_{\max}), \text{abs}(\delta_{\min})) = 0 \text{ mm}$

PASS - Maximum deflection does not exceed deflection limit

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NHBC EXAMPLE

BUILDING NEAR TREES

In accordance with Appendix C of NHBC Part 4: Foundations - Chapter 4.2

Tedds calculation version 2.0.00

Site Details

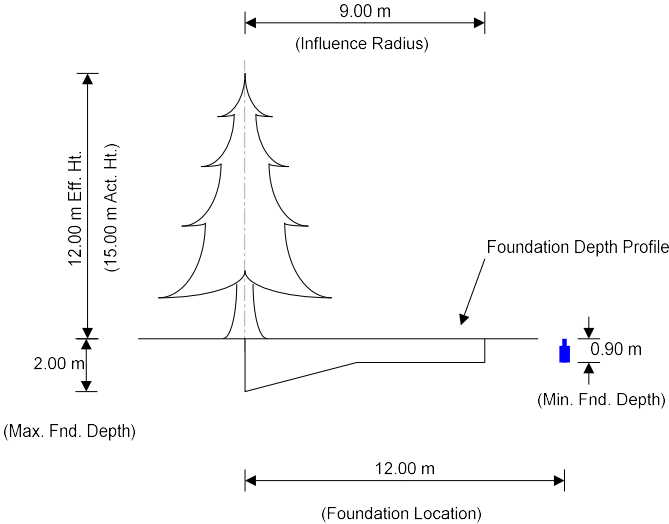
Site location Reading
Reduction depth due to climate variations - Fig. 13 Zc = 0.00 m

Soil Details

Plasticity index from lab tests Ip = 36 %
Percentage of particles < 425 µm p425 = 100 %
Modified plasticity index - cl. D5(b) I'p = Ip × p425 / 100 % = 36 %
Volume change potential - Table 1 Medium

Details for Tree - 1

Species of tree Conifer - Yew
The tree is to remain at the site, with no further planting allowed.
Water demand of tree - Table 12 Moderate
Mature height of tree - Table 12 Hm1 = 12.00 m
Influence radius - Table 2 rinf1 = 0.75 × Hm1 = 9.00 m
Measured height of tree Hact1 = 15.00 m
Distance from centre of tree to face of foundations D1 = 12.00 m
Effective height of tree - Fig. 1 Heff1 = 12.00 m



Minimum foundation depth - Table 5 Zmin = 0.90 m
Look up value for foundation depth - NHBC-Table 18 Coniferous trees ZLookup1 = 0.90 m
Required foundation depth Zreq1 = ZLookup1 - Zc = 0.90 m

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Summary Table

Tree	Name	Distance (m)	Measured Height (m)	Effective Height (m)	Tree to be removed?	Required Foundation Depth (m)
1	Yew	12.0	15.0	12.0	No	0.90

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FOUNDATION ANALYSIS & DESIGN (EN1992/EN1997)

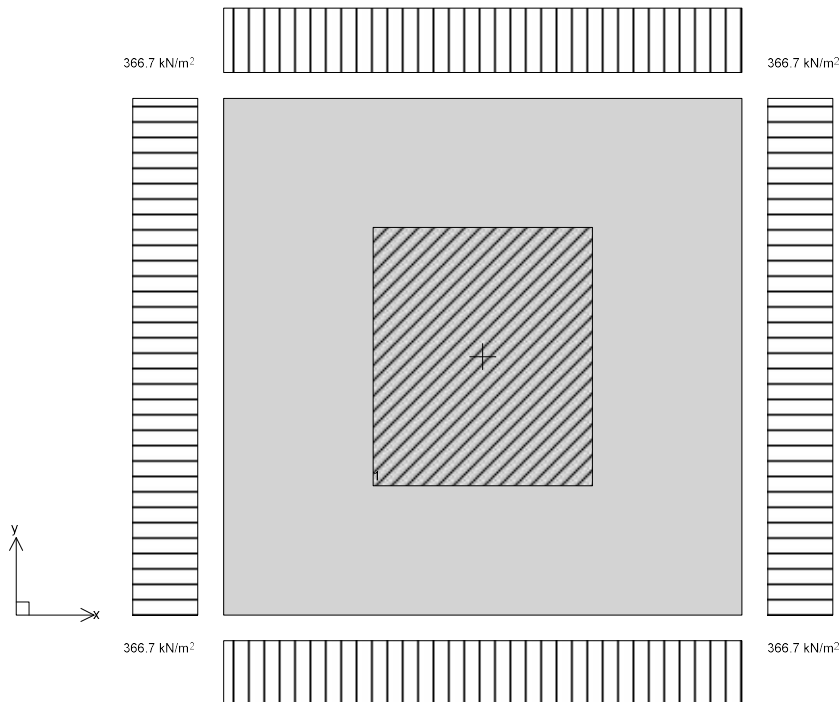
FOUNDATION ANALYSIS (EN1997-1:2004)

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

TEDDS calculation version 3.2.02

Pad foundation details

Length of foundation	$L_x = 600 \text{ mm}$
Width of foundation	$L_y = 600 \text{ mm}$
Foundation area	$A = L_x \times L_y = 0.360 \text{ m}^2$
Depth of foundation	$h = 1000 \text{ mm}$
Depth of soil over foundation	$h_{\text{soil}} = 600 \text{ mm}$
Level of water	$h_{\text{water}} = 0 \text{ mm}$
Density of water	$\gamma_{\text{water}} = 9.8 \text{ kN/m}^3$
Density of concrete	$\gamma_{\text{conc}} = 24.0 \text{ kN/m}^3$



Column no.1 details

Length of column	$l_{x1} = 254 \text{ mm}$
Width of column	$l_{y1} = 300 \text{ mm}$
position in x-axis	$x_1 = 300 \text{ mm}$
position in y-axis	$y_1 = 300 \text{ mm}$

Soil properties

Density of soil	$\gamma_{\text{soil}} = 18.0 \text{ kN/m}^3$
Characteristic cohesion	$c'_k = 0 \text{ kN/m}^2$
Characteristic effective shear resistance angle	$\phi'_k = 30 \text{ deg}$
Characteristic friction angle	$\delta_k = 20 \text{ deg}$

Foundation loads

Self weight	$F_{\text{swt}} = h \times \gamma_{\text{conc}} = 24.0 \text{ kN/m}^2$
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Soil weight

$$F_{\text{soil}} = h_{\text{soil}} \times \gamma_{\text{soil}} = \mathbf{10.8 \text{ kN/m}^2}$$

Column no.1 loads

Permanent load in z

$$F_{Gz1} = \mathbf{100.0 \text{ kN}}$$

Variable load in z

$$F_{Qz1} = \mathbf{15.0 \text{ kN}}$$

Partial factors on actions - Combination1

Permanent unfavourable action - Table A.3

$$\gamma_G = \mathbf{1.35}$$

Permanent favourable action - Table A.3

$$\gamma_{Gf} = \mathbf{1.00}$$

Variable unfavourable action - Table A.3

$$\gamma_Q = \mathbf{1.50}$$

Variable favourable action - Table A.3

$$\gamma_{Qf} = \mathbf{0.00}$$

Partial factors for soil parameters - Combination1

Angle of shearing resistance - Table A.4

$$\gamma_{\phi'} = \mathbf{1.00}$$

Effective cohesion - Table A.4

$$\gamma_{c'} = \mathbf{1.00}$$

Weight density - Table A.4

$$\gamma_{\gamma} = \mathbf{1.00}$$

Partial factors for spread foundations - Combination1

Bearing - Table A.5

$$\gamma_{R,v} = \mathbf{1.00}$$

Sliding - Table A.5

$$\gamma_{R,h} = \mathbf{1.00}$$

Bearing resistance (Section 6.5.2)

Forces on foundation

Force in z-axis

$$F_{dz} = \gamma_G \times (A \times (F_{\text{swt}} + F_{\text{soil}}) + F_{Gz1}) + \gamma_Q \times F_{Qz1} = \mathbf{174.4 \text{ kN}}$$

Moments on foundation

Moment in x-axis

$$M_{dx} = \gamma_G \times (A \times (F_{\text{swt}} + F_{\text{soil}}) \times L_x / 2 + F_{Gz1} \times x_1) + \gamma_Q \times F_{Qz1} \times x_1 = \mathbf{52.3 \text{ kNm}}$$

Moment in y-axis

$$M_{dy} = \gamma_G \times (A \times (F_{\text{swt}} + F_{\text{soil}}) \times L_y / 2 + F_{Gz1} \times y_1) + \gamma_Q \times F_{Qz1} \times y_1 = \mathbf{52.3 \text{ kNm}}$$

Eccentricity of base reaction

Eccentricity of base reaction in x-axis

$$e_x = M_{dx} / F_{dz} - L_x / 2 = \mathbf{0 \text{ mm}}$$

Eccentricity of base reaction in y-axis

$$e_y = M_{dy} / F_{dz} - L_y / 2 = \mathbf{0 \text{ mm}}$$

Effective area of base

Effective length

$$L'_x = L_x - 2 \times e_x = \mathbf{600 \text{ mm}}$$

Effective width

$$L'_y = L_y - 2 \times e_y = \mathbf{600 \text{ mm}}$$

Effective area

$$A' = L'_x \times L'_y = \mathbf{0.360 \text{ m}^2}$$

Pad base pressure

Design base pressure

$$f_{dz} = F_{dz} / A' = \mathbf{484.5 \text{ kN/m}^2}$$

Net ultimate bearing capacity under drained conditions (Annex D.4)

Design angle of shearing resistance

$$\phi'_d = \text{atan}(\tan(\phi'_k) / \gamma_{\phi'}) = \mathbf{30.000 \text{ deg}}$$

Design effective cohesion

$$c'_d = c'_k / \gamma_{c'} = \mathbf{0.000 \text{ kN/m}^2}$$

Effective overburden pressure

$$q = (h + h_{\text{soil}}) \times \gamma_{\text{soil}} - h_{\text{water}} \times \gamma_{\text{water}} = \mathbf{28.800 \text{ kN/m}^2}$$

Design effective overburden pressure

$$q' = q / \gamma_{\gamma} = \mathbf{28.800 \text{ kN/m}^2}$$

Bearing resistance factors

$$N_q = \text{Exp}(\pi \times \tan(\phi'_d)) \times (\tan(45 \text{ deg} + \phi'_d / 2))^2 = \mathbf{18.401}$$

$$N_c = (N_q - 1) \times \cot(\phi'_d) = \mathbf{30.140}$$

$$N_{\gamma} = 2 \times (N_q - 1) \times \tan(\phi'_d) = \mathbf{20.093}$$

Foundation shape factors

$$s_q = 1 + (L'_y / L'_x) \times \sin(\phi'_d) = \mathbf{1.500}$$

$$s_{\gamma} = 1 - 0.3 \times (L'_y / L'_x) = \mathbf{0.700}$$

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Load inclination factors

$$s_c = (s_q \times N_q - 1) / (N_q - 1) = \mathbf{1.529}$$

$$H = \mathbf{0.0 \text{ kN}}$$

$$m_y = [2 + (L'_y / L'_x)] / [1 + (L'_y / L'_x)] = \mathbf{1.500}$$

$$m_x = [2 + (L'_x / L'_y)] / [1 + (L'_x / L'_y)] = \mathbf{1.500}$$

$$m = m_x = \mathbf{1.500}$$

$$i_q = [1 - H / (F_{dz} + A' \times c'_d \times \cot(\phi'_d))]^m = \mathbf{1.000}$$

$$i_\gamma = [1 - H / (F_{dz} + A' \times c'_d \times \cot(\phi'_d))]^{m+1} = \mathbf{1.000}$$

$$i_c = i_q - (1 - i_q) / (N_c \times \tan(\phi'_d)) = \mathbf{1.000}$$

Net ultimate bearing capacity

$$n_f = c'_d \times N_c \times s_c \times i_c + q' \times N_q \times s_q \times i_q + 0.5 \times \gamma_{soil} \times L'_y \times N_\gamma \times s_\gamma \times i_\gamma = \mathbf{870.9 \text{ kN/m}^2}$$

PASS - Net ultimate bearing capacity exceeds design base pressure

Partial factors on actions - Combination2

Permanent unfavourable action - Table A.3 $\gamma_G = \mathbf{1.00}$

Permanent favourable action - Table A.3 $\gamma_{Gf} = \mathbf{1.00}$

Variable unfavourable action - Table A.3 $\gamma_Q = \mathbf{1.30}$

Variable favourable action - Table A.3 $\gamma_{Qf} = \mathbf{0.00}$

Partial factors for soil parameters - Combination2

Angle of shearing resistance - Table A.4 $\gamma_\psi = \mathbf{1.25}$

Effective cohesion - Table A.4 $\gamma_{c'} = \mathbf{1.25}$

Weight density - Table A.4 $\gamma_\gamma = \mathbf{1.00}$

Partial factors for spread foundations - Combination2

Bearing - Table A.5 $\gamma_{R,v} = \mathbf{1.00}$

Sliding - Table A.5 $\gamma_{R,h} = \mathbf{1.00}$

Bearing resistance (Section 6.5.2)

Forces on foundation

Force in z-axis $F_{dz} = \gamma_G \times (A \times (F_{swt} + F_{soil}) + F_{Gz1}) + \gamma_Q \times F_{Qz1} = \mathbf{132.0 \text{ kN}}$

Moments on foundation

Moment in x-axis $M_{dx} = \gamma_G \times (A \times (F_{swt} + F_{soil}) \times L_x / 2 + F_{Gz1} \times x_1) + \gamma_Q \times F_{Qz1} \times x_1 = \mathbf{39.6 \text{ kNm}}$

Moment in y-axis $M_{dy} = \gamma_G \times (A \times (F_{swt} + F_{soil}) \times L_y / 2 + F_{Gz1} \times y_1) + \gamma_Q \times F_{Qz1} \times y_1 = \mathbf{39.6 \text{ kNm}}$

Eccentricity of base reaction

Eccentricity of base reaction in x-axis $e_x = M_{dx} / F_{dz} - L_x / 2 = \mathbf{0 \text{ mm}}$

Eccentricity of base reaction in y-axis $e_y = M_{dy} / F_{dz} - L_y / 2 = \mathbf{0 \text{ mm}}$

Effective area of base

Effective length $L'_x = L_x - 2 \times e_x = \mathbf{600 \text{ mm}}$

Effective width $L'_y = L_y - 2 \times e_y = \mathbf{600 \text{ mm}}$

Effective area $A' = L'_x \times L'_y = \mathbf{0.360 \text{ m}^2}$

Pad base pressure

Design base pressure $f_{dz} = F_{dz} / A' = \mathbf{366.7 \text{ kN/m}^2}$

Net ultimate bearing capacity under drained conditions (Annex D.4)

Design angle of shearing resistance $\phi'_d = \text{atan}(\tan(\phi'_k) / \gamma_\psi) = \mathbf{24.791 \text{ deg}}$

Design effective cohesion $c'_d = c'_k / \gamma_{c'} = \mathbf{0.000 \text{ kN/m}^2}$

Effective overburden pressure $q = (h + h_{soil}) \times \gamma_{soil} - h_{water} \times \gamma_{water} = \mathbf{28.800 \text{ kN/m}^2}$

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Design effective overburden pressure

$$q' = q / \gamma_f = \mathbf{28.800 \text{ kN/m}^2}$$

Bearing resistance factors

$$N_q = \text{Exp}(\pi \times \tan(\phi'_d)) \times (\tan(45 \text{ deg} + \phi'_d / 2))^2 = \mathbf{10.431}$$

$$N_c = (N_q - 1) \times \cot(\phi'_d) = \mathbf{20.418}$$

$$N_\gamma = 2 \times (N_q - 1) \times \tan(\phi'_d) = \mathbf{8.712}$$

Foundation shape factors

$$s_q = 1 + (L'_y / L'_x) \times \sin(\phi'_d) = \mathbf{1.419}$$

$$s_\gamma = 1 - 0.3 \times (L'_y / L'_x) = \mathbf{0.700}$$

$$s_c = (s_q \times N_q - 1) / (N_q - 1) = \mathbf{1.464}$$

Load inclination factors

$$H = \mathbf{0.0 \text{ kN}}$$

$$m_y = [2 + (L'_y / L'_x)] / [1 + (L'_y / L'_x)] = \mathbf{1.500}$$

$$m_x = [2 + (L'_x / L'_y)] / [1 + (L'_x / L'_y)] = \mathbf{1.500}$$

$$m = m_x = \mathbf{1.500}$$

$$i_q = [1 - H / (F_{dz} + A' \times c'_d \times \cot(\phi'_d))]^m = \mathbf{1.000}$$

$$i_\gamma = [1 - H / (F_{dz} + A' \times c'_d \times \cot(\phi'_d))]^{m+1} = \mathbf{1.000}$$

$$i_c = i_q - (1 - i_q) / (N_c \times \tan(\phi'_d)) = \mathbf{1.000}$$

Net ultimate bearing capacity

$$n_f = c'_d \times N_c \times s_c \times i_c + q' \times N_q \times s_q \times i_q + 0.5 \times \gamma_{\text{soil}} \times L'_y \times N_\gamma \times s_\gamma \times i_\gamma = \mathbf{459.3 \text{ kN/m}^2}$$

PASS - Net ultimate bearing capacity exceeds design base pressure

FOUNDATION DESIGN (EN1992-1-1:2004)

In accordance with EN1992-1-1:2004 incorporating Corrigendum dated January 2008 and the UK National Annex incorporating National Amendment No.1

TEDDS calculation version 3.2.02

Concrete details (Table 3.1 - Strength and deformation characteristics for concrete)

Concrete strength class

C30/37

Characteristic compressive cylinder strength

$$f_{ck} = \mathbf{30 \text{ N/mm}^2}$$

Characteristic compressive cube strength

$$f_{ck, \text{cube}} = \mathbf{37 \text{ N/mm}^2}$$

Mean value of compressive cylinder strength

$$f_{cm} = f_{ck} + 8 \text{ N/mm}^2 = \mathbf{38 \text{ N/mm}^2}$$

Mean value of axial tensile strength

$$f_{ctm} = 0.3 \text{ N/mm}^2 \times (f_{ck} / 1 \text{ N/mm}^2)^{2/3} = \mathbf{2.9 \text{ N/mm}^2}$$

5% fractile of axial tensile strength

$$f_{ctk, 0.05} = 0.7 \times f_{ctm} = \mathbf{2.0 \text{ N/mm}^2}$$

Secant modulus of elasticity of concrete

$$E_{cm} = 22 \text{ kN/mm}^2 \times [f_{cm} / 10 \text{ N/mm}^2]^{0.3} = \mathbf{32837 \text{ N/mm}^2}$$

Partial factor for concrete (Table 2.1N)

$$\gamma_c = \mathbf{1.50}$$

Compressive strength coefficient (cl.3.1.6(1))

$$\alpha_{cc} = \mathbf{0.85}$$

Design compressive concrete strength (exp.3.15)

$$f_{cd} = \alpha_{cc} \times f_{ck} / \gamma_c = \mathbf{17.0 \text{ N/mm}^2}$$

Tens.strength coeff.for plain concrete (cl.12.3.1(1))

$$\alpha_{ct, pl} = \mathbf{0.80}$$

Des.tens.strength for plain concrete (exp.12.1)

$$f_{ctd, pl} = \alpha_{ct, pl} \times f_{ctk, 0.05} / \gamma_c = \mathbf{1.1 \text{ N/mm}^2}$$

Maximum aggregate size

$$h_{agg} = \mathbf{20 \text{ mm}}$$

Reinforcement details

Characteristic yield strength of reinforcement

$$f_{yk} = \mathbf{500 \text{ N/mm}^2}$$

Modulus of elasticity of reinforcement

$$E_s = \mathbf{210000 \text{ N/mm}^2}$$

Partial factor for reinforcing steel (Table 2.1N)

$$\gamma_s = \mathbf{1.15}$$

Design yield strength of reinforcement

$$f_{yd} = f_{yk} / \gamma_s = \mathbf{435 \text{ N/mm}^2}$$

Nominal cover to reinforcement

$$c_{nom} = \mathbf{30 \text{ mm}}$$

Strip and pad footings (Section 12.9.3)

Design base pressure

$$f_{dz} = \mathbf{484.5 \text{ kN/m}^2}$$

Projection from column face

$$a = \mathbf{173 \text{ mm}}$$

Maximum projection from column face - (exp.12.13) $a_{max} = 0.85 \times h / \sqrt{[3 \times f_{dz} / f_{ctd, pl}]} = \mathbf{733 \text{ mm}}$

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PASS - Projection from the column face doesn't exceed permissible limit for plain concrete