MARSH DESIGN LIMITED

STRUCTURAL DESIGN CONSULTANTS & SURVEY REPORTS

STRUCTURAL CALCULATIONS

FOR

CHECK OF LOAD BEARING CAPACITY OF EXISTING FOUNDATION

FOR

MRS. EMILY ASKEY
GRAVEL FARM BUNGALOW
GRAVEL FARM
SHEFFIELD
S36 9AW

OUR REF: MDL – 10280

REV.03: Issued for Building Control Approval Only
17th July 2024

Structural Notes:

These calculations are issued for building control approval only. Any structural construction works undertaken prior to approval being obtained are done so at risk by the client / contractor.

If any queries arise on site or if there are any doubts, then ask the structural engineer immediately for further guidance.

All CDM requirements are the responsibility of the client and principal contractor. We have not been engaged to undertake the role of principal designer.

The sketches and marked up drawings contained within these structural calculations are NOT setting out or construction drawings, and they must NOT be used for setting out of steelwork or foundations.

All setting out and positioning of steel beams is the full responsibility of the building contractor responsible for the works.

All stated dimensions are clear dimensions for calculation purposes only.

The builder must confirm the lengths of all beams, columns and other structural elements from his own site measurements allowing a minimum of 100mm end bearing at both ends of the beam.

The builder is responsible for all temporary propping works, for both internal and external works.

All beams must be supported on reinforced concrete padstones unless noted otherwise in the calculations.

Structural integrity and stability of all retained masonry piers or walls is to be confirmed after all openings have been broken out. This is generally undertaken by the building control inspector, but in certain instances approval by the appointed structural engineer may be necessary.

Upon commencement of the works, when the retained walls supporting the steelwork have been exposed, new masonry piers or steel columns maybe required to support the steel beams.

All steel work must be minimum grade BS EN 10025 S355.

Strengthening or underpinning of the existing foundations maybe required due to increased point loadings on the walls. Foundations must be exposed and checked on site prior to installations of the beams.

**All new foundation sizes to be confirmed after excavations have started and underlying sub strata exposed.**

All ground conditions to approval of building inspector.

Foundations to be built on firm sub-strata with a minimum ground bearing pressure of 100 kN/m^2, to be confirmed on site by the building control inspector.

Depth of foundations to be confirmed on site considering any cellars, drains or trees which may be present.

Any temporary shoring works required to retain exposed earth are the full responsibility of the main contractor.

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	Calcs by **MF**	Calcs date **21/06/2024**	Checked by **DSH**	Checked date	Approved by	Approved date

TRIAL HOLE

TRIAL HOLE

7000

BUNGALOW BOUNDARY

9500

TRIAL HOLE

EXISTING FOUNDATION
SCALE 1:50
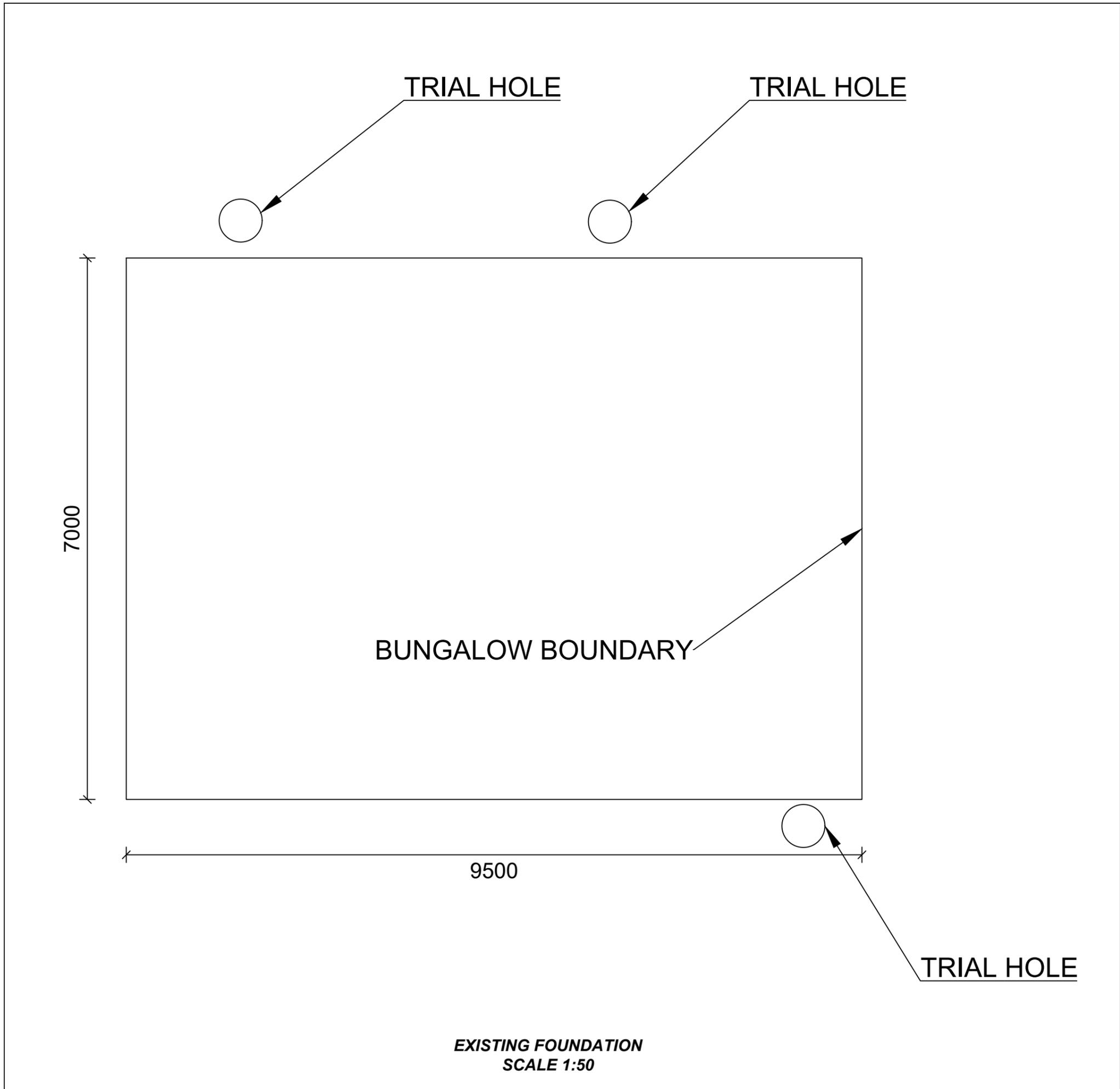
Structural Element	Details	DESCRIPTION

NOTE: LENGTH OF ALL BEAMS TO BE CONFIRMED BY BUILDERS
ALLOWING MINIMUM 100mm END BEARING AT EACH END OF THE BEAM

	Project	**Gravel Farm, Sheffield**		Job no. **10280**	
![Marsh Design Ltd logo] **MarshDesign**Ltd STRUCTURAL ENGINEERS www.marshdesign.co.uk	Calcs for	**Existing Foundation Check**		Start page no./Revision **SK-02**	
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150

150

GROUND LEVEL

180

200

600
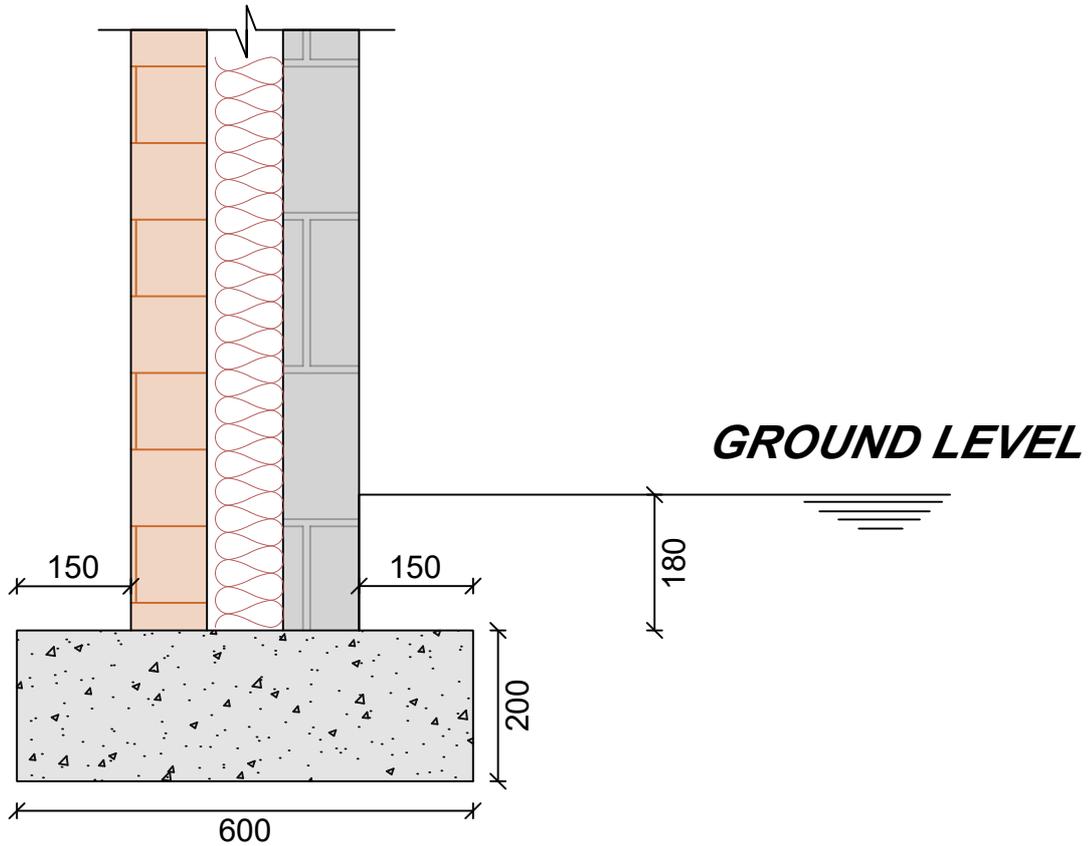
EXISTING FOUNDATION
SCALE 1:10

Structural Element	Details	DESCRIPTION
EXISTING FOUNDATION IS SATISFACTORY FOR INCREASED LOADS		

NOTE: LENGTH OF ALL BEAMS TO BE CONFIRMED BY BUILDERS
ALLOWING MINIMUM 100mm END BEARING AT EACH END OF THE BEAM

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SUMMARY:

Load Bearing Capacity

This report evaluates the load-bearing capacity of the existing foundation to determine its adequacy for supporting the additional load from a new storey to be added to the existing building. All calculations are based on a soil load-bearing capacity of 100 kN/m².

Based on the calculated load per unit area and the soil bearing capacity, the existing foundation is adequate to support the additional load from the proposed new storey. No further foundation reinforcement or enhancement is necessary.

For detailed calculations see page 2.

Minimum Foundation Depth

According to Approved Document A guidelines, except where strip foundations are founded on rock, the strip foundations should have minimum depth of 450 mm to their underside of to avoid the action of frost. This depth, however, will commonly need to be increased in areas subject to long periods of frost or in order to transfer the load onto satisfactory ground.

Based on our structural survey, the existing foundation depth is 380 mm to its underside but there is not any structural concern regarding the depth because this wall has previously been exposed to historical external ground temperature changes through prolonged winter periods. As such, we do not consider that frost will affect the foundations in the coming months and years.

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CHECK OF EXISTING FOUNDATION:

DEAD AND IMPOSED LOADS ON FOUNDATION:

W_{D1} = 1/2 * 3.5 m * 1.5 kN/m² = 2.625 kN/m   *FROM ROOF*

W_{D2} = 1/2 * 4.0 m * 0.5 kN/m² = 1.000 kN/m   *FROM FLOOR*

W_{D3} = 1/2 * 4.0 m * 0.5 kN/m² = 1.000 kN/m   *FROM FLOOR*

W_{D3} = 0.1 m * 5.0 m * 21.0 kN/m³ = 10.500 kN/m   *FROM WALL*

W_{D4} = 0.1 m * 5.0 m * 20.0 kN/m³ = 10.000 kN/m   *FROM WALL*

W_D = 25.125 kN/m

W_{L1} = 1/2 * 3.5 m * 0.8 kN/m² = 1.400 kN/m   *FROM ROOF*

W_{L2} = 1/2 * 4.0 m * 1.5 kN/m² = 3.000 kN/m   *FROM FLOOR*

W_{L3} = 1/2 * 4.0 m * 1.5 kN/m² = 3.000 kN/m   *FROM FLOOR*

W_L = 7.4 kN/m

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CALCULATIONS:

FOUNDATION ANALYSIS

In accordance with EN1997-1:2004 + A1:2013 incorporating corrigendum February 2009 and the UK National Annex incorporating corrigendum No.1

Tedds calculation version 3.3.05

Summary table

Description	Unit	Allowable	Actual	Utilisation	Result
Base pressure	kN/m^2	100	64.6	0.646	Pass
Concrete projection	**mm**	**341**	**150**	**0.439**	**Pass**

Strip foundation details - considering a one metre strip

Length of foundation	L_x = **1000** mm
Width of foundation	L_y = **600** mm
Foundation area	$A = L_x \times L_y$ = **0.600** m^2
Depth of foundation	h = **200** mm
Depth of soil over foundation	h_{soil} = **180** mm
Level of water	h_{water} = **0** mm
Density of water	γ_{water} = **9.8** kN/m^3
Density of concrete	γ_{conc} = **25.0** kN/m^3

64.6 kN/m^2 64.6 kN/m^2
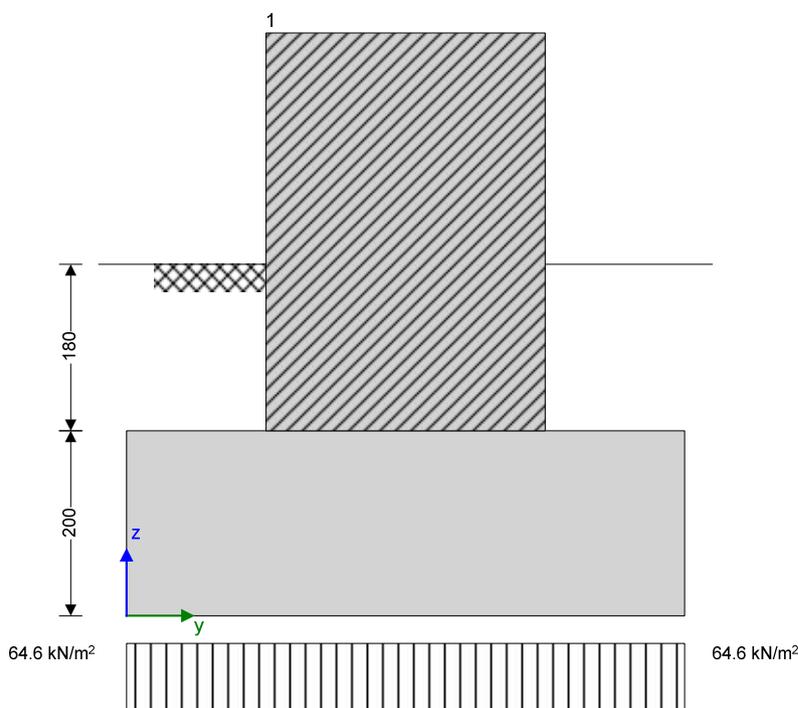
Wall no.1 details

Width of wall	l_{y1} = **300** mm
position in y-axis	y_1 = **300** mm

Soil properties

Density of soil	γ_{soil} = **18.0** kN/m^3
Characteristic cohesion	c'_k = **0** kN/m^2

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Characteristic effective shear resistance angle ϕ'_k = **30** deg

Characteristic friction angle δ_k = **20** deg

Foundation loads

Variable surcharge load F_{Qsur} = **1.5** kN/m^2

Self weight F_{swt} = h × γ_{conc} = **5.0** kN/m^2

Soil weight F_{soil} = h_{soil} × γ_{soil} = **3.2** kN/m^2

Wall no.1 loads per linear metre

Permanent axial load F_{Gz1} = **25.1** kN

Variable axial load F_{Qz1} = **7.8** kN

Bearing resistance (Section 6.5.2)

Forces on foundation per linear metre

Force in z-direction F_{dz} = A × (F_{swt} + F_{soil} + F_{Qsur}) + F_{Gz1} + F_{Qz1} = **38.8** kN

Moments on foundation per linear metre

Moment in y-direction M_{dy} = A × (F_{swt} + F_{soil} + F_{Qsur}) × L_y / 2 + F_{Gz1} × y_1 + F_{Qz1} × y_1 = **11.6** kNm

Eccentricity of base reaction

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

Pad base pressures

q_1 = F_{dz} × (1 - 6 × e_y / L_y) / (L_y × 1000 mm) = **64.6** kN/m^2

q_2 = F_{dz} × (1 + 6 × e_y / L_y) / (L_y × 1000 mm) = **64.6** kN/m^2

Minimum base pressure q_{min} = min(q_1, q_2) = **64.6** kN/m^2

Maximum base pressure q_{max} = max(q_1, q_2) = **64.6** kN/m^2

Presumed bearing capacity

Presumed bearing capacity $P_{bearing}$ = **100.0** kN/m^2

PASS - Presumed bearing capacity exceeds design base pressure

Design approach 1

Partial factors on actions - Combination1

Partial factor set   A1

Permanent unfavourable action - Table A.3 γ_G = **1.35**

Permanent favourable action - Table A.3 γ_{Gf} = **1.00**

Variable unfavourable action - Table A.3 γ_Q = **1.50**

Variable favourable action - Table A.3 γ_{Qf} = **0.00**

Partial factors for spread foundations - Combination1

Resistance factor set   R1

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

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

Forces on foundation per linear metre

Force in z-direction F_{dz} = γ_G × (A × (F_{swt} + F_{soil}) + F_{Gz1}) + γ_Q × (A × F_{Qsur} + F_{Qz1}) = **53.6** kN

Moments on foundation per linear metre

Moment in y-direction M_{dy} = γ_G × (A × (F_{swt} + F_{soil}) × L_y / 2 + F_{Gz1} × y_1) + γ_Q × (A × F_{Qsur} × L_y / 2 + F_{Qz1} × y_1) = **16.1** kNm

Eccentricity of base reaction

Eccentricity of base reaction in y-direction e_y = M_{dy} / F_{dz} - L_y / 2 = **0** mm

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Effective area of base per linear metre

Effective width $L'_y = L_y - 2 \times e_y = $ **600** mm

Effective length $L'_x = $ **1000** mm

Effective area $A' = L'_x \times L'_y = $ **0.600** m^2

Pad base pressure

Design base pressure $f_{dz} = F_{dz} / A' = $ **89.4** kN/m^2

Design approach 1

Partial factors on actions - Combination2

Partial factor set   A2

Permanent unfavourable action - Table A.3 $\gamma_G = $ **1.00**

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

Variable unfavourable action - Table A.3 $\gamma_Q = $ **1.30**

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

Partial factors for spread foundations - Combination2

Resistance factor set   R1

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

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

Forces on foundation per linear metre

Force in z-direction $F_{dz} = \gamma_G \times (A \times (F_{swt} + F_{soil}) + F_{Gz1}) + \gamma_Q \times (A \times F_{Qsur} + F_{Qz1}) = $ **41.4** kN

Moments on foundation per linear metre

Moment in y-direction $M_{dy} = \gamma_G \times (A \times (F_{swt} + F_{soil}) \times L_y / 2 + F_{Gz1} \times y_1) + \gamma_Q \times (A \times F_{Qsur} \times L_y / 2 + F_{Qz1} \times y_1) = $ **12.4** kNm

Eccentricity of base reaction

Eccentricity of base reaction in y-direction $e_y = M_{dy} / F_{dz} - L_y / 2 = $ **0** mm

Effective area of base per linear metre

Effective width $L'_y = L_y - 2 \times e_y = $ **600** mm

Effective length $L'_x = $ **1000** mm

Effective area $A' = L'_x \times L'_y = $ **0.600** m^2

Pad base pressure

Design base pressure $f_{dz} = F_{dz} / A' = $ **69** kN/m^2

<u>FOUNDATION DESIGN</u>

In accordance with EN1992-1-1:2004 + A1:2014 incorporating corrigenda January 2008, November 2010 and January 2014 and the UK National Annex incorporating National Amendment No.1 and No.2

Tedds calculation version 3.3.05

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

Concrete strength class   C30/37

Characteristic compressive cylinder strength $f_{ck} = $ **30** N/mm^2

Mean value of axial tensile strength $f_{ctm} = 0.3$ N/mm$^2 \times (f_{ck} / 1$ N/mm$^2)^{2/3} = $ **2.9** N/mm^2

5% fractile of axial tensile strength $f_{ctk,0.05} = 0.7 \times f_{ctm} = $ **2.0** N/mm^2

Partial factor for concrete (Table 2.1N) $\gamma_C = $ **1.50**

Tens.strength coeff.for plain concrete (cl.12.3.1(1)) $\alpha_{ct,pl} = $ **0.80**

Des.tens.strength for plain concrete (exp.12.1) $f_{ctd,pl} = \alpha_{ct,pl} \times f_{ctk,0.05} / \gamma_C = $ **1.1** N/mm^2

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Strip and pad footings (Section 12.9.3)

Design base pressure f_{dz} = **89.4** kN/m²

Projection from wall face   a = **150** mm

Max.projection from wall face - (exp.12.13) $a_{max} = 0.85 \times h / \sqrt{[3 \times f_{dz} / f_{ctd,pl}]}$ = **341** mm

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