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PILEDESIGNS

EARL SHILTON - 223 STATION ROAD

BEARING PILE DESIGN CALCULATIONS

27582-BP

Document Control

Project:	Earl Shilton - 223 Station Road		
Site Address:	223 Station Road, Earl Shilton, Leicestershire, LE9 7GG		
Document Title:	Bearing Pile Design Calculations		
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1.0 Introduction

These calculations are for the design of the bearing piled foundations at 223 Station Road, Earl Shilton in Leicestershire. It is understood that the proposed development will consist of a new residential dwelling consisting of three plots including private gardens which will be founded on a piled foundation solution.

The proposed development is located on Station Road which is situated on the western boundary. The site is mainly set within a residential area and is bounded by other residential buildings to the north / south, Station Road to the west and by vegetation to the east. It is understood localised site levels are generally flat. See Figure 1 for Site Location Plan.

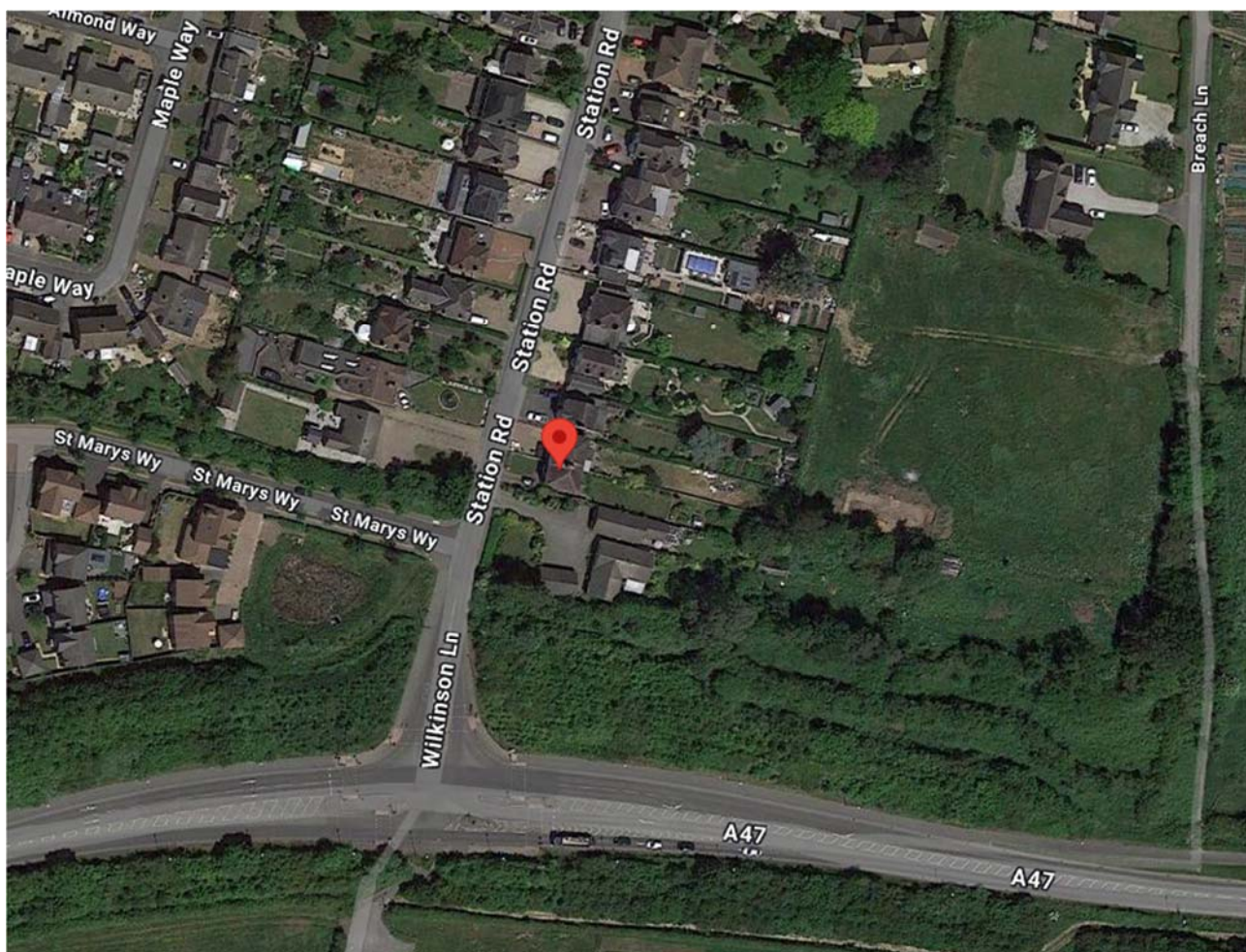


Figure 1 - Site Location Plan

Pile loadings have been provided on drawings provided from JC Structural Solutions Ltd. The drawings show pile locations and axial loads. These loads have been taken at cut off level.

The design has been carried out in general accordance with BS EN 1997 and other relevant documents. All loads have been converted into Eurocode design actions and a pile design is based upon these actions.

Piledesigns Limited (PDL) has been appointed by Midland Piling Ltd to undertake the detailed 'element' design for the bearing pile foundations.

2.0 Information Provided

The main documents that have been consulted in preparing these calculations are summarised below. Any subsequent revisions to these documents should be forwarded for review.

2.1 Engineering Documentation

The following engineering documentation relevant for the design have been produced and utilised for the project:

Table 1 – Design Documents

Reference	Rev	Title
Author: JC Structural Solutions Ltd.		
T-7-19484 - SK01	-	Plot 1 Pile & Ground Beam Layout
T-7-19484 - SK02	-	Plot 1 Pile Loads
T-7-19484 - SK05	-	Garage to Plot 1, 2 & 3 Pile & Ground Beam Layout
T-7-19484 - SK07	-	Plots 2 & 3 Pile & Ground Beam Layout
T-7-19484 - SK08	-	Plot 2 & 3 Pile Loads

2.2 Specification Documentation

The design has been undertaken in general accordance with the project specification received, presented in table 2.

Table 2 – Specification Report

Reference	Rev	Title	Date
None Provided			

Where no specific project specification has been provided, reference has been made to the Institute of Civil Engineers publication, ICE Specification for Piling and Embedded Retaining Walls, SPERW, Third Edition published 2017. This is an administrative document for good working practice of piling works and the design has been carried out in general accordance with this document.

2.3 Ground Investigation

Table 3 - Ground Investigation Report

Author	Reference	Rev	Title	Date
GeoDyne	43207/BP	-	Station Road, Earl Shilton (Cable Percussion Works)	1st August 2024

2.4 Design Scope & Further Information

The design herein is for the bearing piles to the loads provided within the documents referenced above.

- It is proposed to use 300mm diameter auger piles.
- The design has been carried out to EC7.
- Loads have been provided by engineer as an unfactored total load therefore we have assumed an 80/ 20% dead / live split to calculate EC7 design actions for vertical component. The Vertical/Axial load FY, has been taken as a compression load only, therefore there has been no allowance made for structural tension and lateral loads. This should be checked prior to construction.
- No piling commencement levels have been given; therefore, a single Piling Platform Level (PPL) has been assumed which is 1.0m above pile cut off level and coincident with borehole commencement level. Piling levels to be confirmed by the principle contractor.
- Pile loads have been taken as acting at cut off level.
- No cut-off levels (COL) have been provided, for design purposes COL's have been assumed as 1.0mBGL, which should be checked prior to construction.
- All pile positions have been taken as tied within the pile cap. Such piles have been taken as fixed, and effectively restrained in two directions by the above structure.
- Design only considers the element design of the bored augured piles/ continuous flight auger piles based on the specified loads.

3.0 Ground Conditions

This section describes ground conditions, based upon the available ground information, and provides a ground model for use within the design and comments on the geotechnical parameters taken.

3.1 Ground Investigation

Information on ground conditions have been based on a geotechnical investigation data provided by GeoDyne which included only borehole log for dates refer to Table 3. This contained the following information:

- Single cable percussive borehole taken to a maximum depth of 9.5mBGL (metres below ground level).

No borehole commencement levels were provided for the boreholes and it has been assumed they were carried out from approximately existing ground / piling level.

These records show that the site is underlain by made ground overlying Bosworth Clay Member to depth. Reference was also made to the British Geological Website's 1:50 000 Map series, which shows that the site is underlain by made ground overlying Bosworth Clay Member and Edwalton Member at depth, which wasn't encountered in the boreholes.

The soil profile and assumed parameters must be checked on site during initial piling operations.

3.2 Geotechnical Assessment

This section details the derivation of geotechnical properties from field and/or laboratory test data, empirical correlation, theoretical conversions and or reference to design codes. The following soil descriptions below have been taken from the site investigation reports and our previous experience in the area.

3.2.1 Made Ground

Made Ground was recorded in all exploratory holes from surface (minimum depth encountered) to a maximum base depth of 2.1mBGL. The Made Ground was generally comprised of medium dense silty gravelly Clay with gravel and cobbles of brick, concrete, tile and with rare plastic sheeting

This should be checked on site during piling operations, the top 3m have been discounted for positive skin friction if encountered deeper then the designer must be notified for review. These deposits have been discounted for positive skin friction.

3.2.2 Bosworth Clay Member

Beneath the Made Ground strata is material identified as Bosworth Clay Member and were encountered in all exploratory holes to a maximum base depth of 9.5mBGL (maximum depth of the investigation). The Bosworth Clay Member was recorded as a Stiff to very stiff red-brown occasionally locally mottled green grey silty clay.

3.2.3 Ground Water

Ground water strike was encountered during the investigation at 6.0mBGL, rising to 4.00mBGL over a period of 20 minutes. Groundwater levels are subject to variations caused by changes in drainage conditions and seasonal climatic changes.

For design purposes the ground water has been modelled at 4.0mBGL. It is understood that this is likely to represent a perched water level.

3.3 Ground Model

The geotechnical design data has been analysed and is presented within the appendices. The following table presents the various profiles that have been used within the design.

Table 4 - Ground Profile

Depth (mBGL)			Soil
PPL	-	3.0	Made Ground and potentially desiccated Clay
3.0	-	--	Bosworth Clay Member

For design purposes the ground water has been modelled at 4.0mBGL.

3.4 Design Parameters

From the above the following design parameters will be adopted.

Table 5 - Design Properties

Soil	γ (kN/m ³)	SPT (N)	Cu (kN/m ²)	ϕ' (°)
Discounted Soils	19	2-8	n/a	n/a
Bosworth Clay Member	20	17-50+	80 + 24.29z ^[1]	n/a

[1] z refers to the depth in metres below the top of the Bosworth Clay Member.

[2] Bulk unit weights are based on material descriptions and bulk density testing.

The figures are Service Limit State (SLS) values and have not had any partial factors applied. Please note where no direct testing has been undertaken to determine the specific design value(s) quoted in Table 5, the value has been based upon published correlations, engineering descriptions and engineering judgment.

Should ground conditions differ to that of the ground model and parameters be found during the piling works this should be relayed back to the designers.

4.0 Geotechnical Design Methodology

The design has been carried out in general in accordance with Eurocode (BS EN 1997-1:2004+A1:2013) with reference made to the UK National Annex and Execution Codes. This is an ultimate limit state design approach with partial factors applied to actions (A), materials (M) and resistances (R).

The main approach is to satisfy that the Design Effect of Actions, E_d is less than the Design Resistance, R_d . The Design Effect of Actions is a combination of actions (A) and or materials (M). Whereas the Design Resistance, R_d , is a combination of resistances (R) and or materials (M). Furthermore, elements will need to satisfy Serviceability Limit State (SLS) requirements which relates to settlements at working conditions.

Reference to typical actions (A), materials (M) & resistances (R) arrangements related to specific elements are presented below. Individual partial factors are presented in the table below, which have been taken from the UK National Annex.

Table 6 - Partial factor for GEO/STR Design Situations

Element	Design Approach 1	A1	A2	M1	M2	R1	R4
Axial Design	Combination 1	•		•		•	
	Combination 2		•	•			•
Lateral Design	Combination 1	•		•		•	
	Combination 2		•		•	•	

Table 7 - Partial factors on actions for the structural (STR) and geotechnical (GEO) limit states

Actions (A) [table NA.A1.2(B) in the NA to BS EN 1990]	Notation	A1	A2
Permanent Action (Unfavourable)	$G_{k,unfav}$	1.35	1.00
Permanent Action (Favourable)	$G_{k,fav}$	1.00	1.00
Variable Action (Unfavourable)*	$Q_{k,unfav}$	1.50	1.30
Variable Action (Favourable)	$Q_{k,fav}$	0.00	0.00

* Secondary variable actions are combined with an accompanying variable partial factor, taken from table NA.A1.1

Table 8 - Partial factors for soil parameters for the STR and GEO limit states

Soil factors (M) [table A.NA.4 in the NA to BS EN 1997]	Notation	M1	M2
Effective angle of shearing resistance	$\tan \phi'$	1.00	1.25
Effective cohesion	c'	1.00	1.25
Undrained shear strength	C_u	1.00	1.40

Table 9 - Partial factors for design resistance for the STR and GEO limit states

Resistances (R) [table A.NA.7 and A.NA.8 in the NA to BS EN 1997]	Notation	R1	R4 without explicit verification of SLS	R4 with explicit verification of SLS
Pile Base	γ_{bRe}	1.00	2.0	1.7
Pile Shaft (compression)	γ_{sRe}	1.00	1.6	1.4
Pile Shaft (tension)	γ_{tRe}	1.00	2.0	2.0
Model Factor	Notation	R1	R4 without explicit verification of ULS	R4 with explicit verification of ULS
Model Factor	γ_{mod}	n/a	1.4	1.2

4.1 Design Actions

From section 2 the piles are to be designed for axial compressive and lateral loads. Loads have been provided by engineer as an unfactored total load taken to be the representative action, F_{rep} . We have assumed a permanent / variable split to calculate EC7 design actions for vertical component. Design actions for the SLS & ULS (STR/GEO) vertical conditions are detailed below.

- Permanent Action, G_k = $F_{rep} \times 80\%$
- Variable Action, Q_k = $F_{rep} \times 20\%$
- $F_{rep.min}$ = $G_k \times 1.0$ $F_{rep.max}$ = $[G_k \times 1.0] + [Q_{k.imp} \times 1.0]$
- DA1-1min = $G_k \times 0.9$ DA1-1max = $[G_k \times 1.35] + [Q_{k.imp} \times 1.5]$
- DA1-2min = $G_k \times 1.0$ DA1-2max = $[G_k \times 1.0] + [Q_{k.imp} \times 1.3]$

4.2 Axial Design Philosophy

Pile lengths have been determined from the appropriate partial factors as detailed within Tables A.NA.3, A.NA.4 and A.NA.8. For this the combination summary detailed below.

- Combination 1 (DA1-1): $A1 + M1 + R1$
- Combination 2 (DA1-2): $A2 + M1 + R4$

5.0 Geotechnical Design

Design for bearing piles to BS EN 1997. The bearing piles are detailed are within the drawings by JC Structural Solutions Ltd. referenced within Table 1. The design has been carried out to EC7. Loads have been provided by the engineer as unfactored total loads (Safe Working Load -SWL) and to which we have assumed a 80 / 20 % dead / live split to calculate EC7 design actions for vertical component.

During the design process if it proposed to utilise 300mm diameter piles and the design herein is based upon this. For design purposes we have assumed the bearing piles will be installed from approximately existing ground / borehole level.

5.1 Axial Pile Load

The ultimate design resistance of a bearing pile is calculated from the sum of resistance gained on the pile shaft and the base, as detailed in Section 4.

For this site it is understood that neither preliminary nor working tests are proposed. Therefore, the piles have been designed to factors that do not require validation by testing. These calculations consider a model factor of 1.4 and partial factors of 1.6 and 2.0 applied to shaft and base resistances respectively.

The ultimate design resistance of a bearing pile is calculated from the sum of resistance gained on the pile shaft and the base, as detailed below;

Design Compression Resistance, $R_{d,vert}$;

$$R_{d,vert} = \frac{R_{sk}}{\gamma_s \cdot \gamma_{mod}} + \frac{R_{bk}}{\gamma_b \cdot \gamma_{mod}}$$

5.1.1 Ultimate Shaft Adhesion, R_{sk}

The shaft resistance contribution from the made ground have been ignored, furthermore material above pile cut off level has also been discounted. The characteristic shaft resistance for the relevant strata's has been calculated as follows;

In Cohesive Material;

$$R_{sk} = C_{u,ave} * \alpha * A_s$$

where, $C_{u,ave}$ = shear strength along the length of the pile as shown in table 4

α = adhesion factor taken as 0.5

A_s = Area of pile shaft

5.1.2 Ultimate End Bearing, R.bk

All piles will found in the Bosworth Clay Member therefore the base resistance for the Made Ground has been ignored. The characteristic base resistance for the relevant strata's has been calculated as follows;

In Cohesive Material;

$$R.bk = C_{u.base} * Nc * Ab$$

where, $C_{u.base}$ = Shear strength at pile base as shown in table 4

Nc = Bearing capacity factor, taken as 9 for circular piles in clay

Ab = Area of pile base

5.1.3 Desiccation

From the site investigation report the near surface soils are noted as having high volume change potential. Calculate the potential uplift force from this material based upon an affective depth of 3.0m, therefore pile length due to possible desiccation (3.0m – 1.0m =) 2.0m.

$$Tk.heave.pile = 45kN/m^2 * \phi\pi * 2.0m$$

$$Tk.heave.pile = 85kN$$

Plus an allowance for voidformer, $Tk.heave.voidformer$, assumed as 20kN. Therefore, the total heave force, $Tk.heave.total$ is calculated as follows.

$$Tk.heave.total = Tk.heave.pile + Tk.heave.voidformer$$

$$Tk.heave.total = 85kN + 20kN = 105kN$$

Review required anchorage resistance for $Tk.heave.design$. From calculations above for vertical pile capacity - ultimate skin friction for a 7m reinforced pile length is 242kN. Therefore, safety factor on possible heave on pile element only is (242 / 105 =) >1.5 which is considered satisfactory.

5.1.4 Pile Length

The above calculations have been carried out using the OASYS Pile program, version 19.7 which allows the appropriate partial factors to be applied to the soil parameters. The results are given in the appendices which includes a summary table of the design resistances calculated.

6.0 Structural Analysis

Pile section design has been carried out on the basis of the reinforced concrete design code BS EN 1992-1-1:2004 (Eurocode 2) using the following parameters.

Pile Diameter, d_{nom}	=	300mm
Design Concrete strength, f_{ck}	=	28N/mm ² { f_{cu} = 35N/mm ² (C28/35)}
Steel f_{yk}	=	500 N/mm ² [high yield] (BS EN 1992-1-1:2004)
Design Concrete Cover	=	75mm

6.1 Axial Structural Analysis

The axial compressive stress of concrete has been checked in accordance with BS EN 1992-1-1:2004 where the value of design compressive strength, f_{cd} , of concrete is defined as:

$$f_{cd} = (\alpha_{cc} \cdot f_{ck}) / (\gamma_c \cdot k_f)$$

Where, α_{cc} = 0.6 for unreinforced section

$$\gamma_c = 1.5$$

$$k_f = 1.1$$

Considering C28/35 grade concrete, and axial compressive resistance of 720kN for 300mm diameter piles has been calculated. This is greater than the maximum STR on the associated pile diameters.

6.2 Primary Pile Reinforcement

For piles under vertical actions only supply nominal reinforcement, taken as 0.5% of pile area. The cages will be installed in a nominal helical binder, as detailed below.

- 300mm Dia, 0.5% A_{st} = 4B12/B8@150 x 7m.

6.2.1 Pile Heave (Tension) Reinforcement

From section 5.1.4 pile to be designed for tensile actions due to heave forces. For design purposes a partial factor of 1.5 is applied to this and the calculated required area of steel, A_{st} , is as follows.

$$A_{st} = (T_{k.heave.total} \times 1.5) / (f_{yk} / \gamma_s)$$

$$A_{st} = (105 \times 10^3 \cdot 1.5) / (500 / 1.15)$$

$$A_{st} = 362\text{mm}^2$$

From main reinforcement cage 4B12 total area of steel is 452mm² which is > 328mm² required, therefore, 4B12 sufficient to cater for tensile forces due to heave.

6.3 Pile Reinforcement Projection

The radial cage has been designed to cater for all loadings at cut off level, the Basic Anchorage Length has been calculated in accordance with EC2 cl. 8.4.3. This generates a design tension anchorage, l_{bd} , of 350mm for 12mm diameter reinforcement. This is the minimum anchorage that is to be supplied for the radial cages.

6.4 Buried Concrete Requirements

C28/35 concrete has been used in the structural analysis and is sufficient for the pile actions. In the absence of relevant testing sulphate conditions are unknown.

For the design allow for C28/35, with 75mm cover.

7.0 Summary

The design herein is for the bearing pile element only, issued for approval from the professional team and relevant third-party bodies.

If any works proceed on site prior to receiving approval from any warranty provider, approved inspector or insurance provider (e.g. NHBC, Premier Guarantee, LABC) that may impact the final design and/or details the contractor/client are proceeding at their own risk.

- All piles to be constructed in accordance with the piling schedule issued separately.
- Design in general accordance with Eurocode (EC7)
- Piles have been designed to the loads given in the relevant drawings.
- Ground profile to be checked on site during initial piling.
- No allowance has been made for structural tension and lateral loads.
- C28/35 concrete and 75mm cover to all bearing piles.

APPENDIX A

DESIGNERS RISK ASSESSMENT



STATEMENT ON CDM REGULATIONS (2015) AND RESIDUAL RISKS

CDM Regulations (2015)

The Client and Designer for this project are subject to certain duties under the CDM (2015) Regulations. It is the duty of the Designer to ensure that the client is aware of these duties prior to commencing the design. Piledesigns Ltd are responsible for an 'elemental' part of the design only and are not the 'overall' scheme designer. This 'elemental' design has been undertaken on the premise that this duty has been carried out by the scheme designer, and that no separate approach, in respect of this elemental design, by Piledesigns Ltd is required.

Residual Risks – In accordance with the CDM Regulations (2015) any specific residual design risks and construction sequences relevant to this design are given below. As stated in the CDM Regulations (2015), whilst we have assessed the design risks for our works we have only listed the risks we consider significant to the design and which we consider are not likely to be obvious to a competent contractor or other designer. It does not constitute or remove the need for task related risk assessments for the activities carried out in the implementation of the design. Furthermore, it is the responsibility of the client and principal designer to ensure a competent principal contractor is appointed for these works.

The residual risks below should be added to any relevant construction drawing or method statements and copied to relevant designers and contractors on site.

Item No	Risk	Potential Effects	Risk Management / Mitigation
1	Unforeseen ground conditions	Pile performance could be compromised.	Ground conditions encountered during pile construction should be logged and checked against the assumed design profile and any variations from that assumed in the design must be reported immediately to the designer.
2	Services	Injury to site operatives / public and damage to equipment	No works should be carried out until a permit to work has been provided to the piling contractor by the Principle Contractor. Where it is necessary to carry out works close to any services the main contractor must positively locate (visually) the service, or divert and decommission the service prior to the commencement of any piling works.
3	Working Platform	Rig instability which could make unsafe working conditions for	Ensure working platform is designed, constructed and maintained in accordance with published guidance or other appropriate best practice. Construct platform

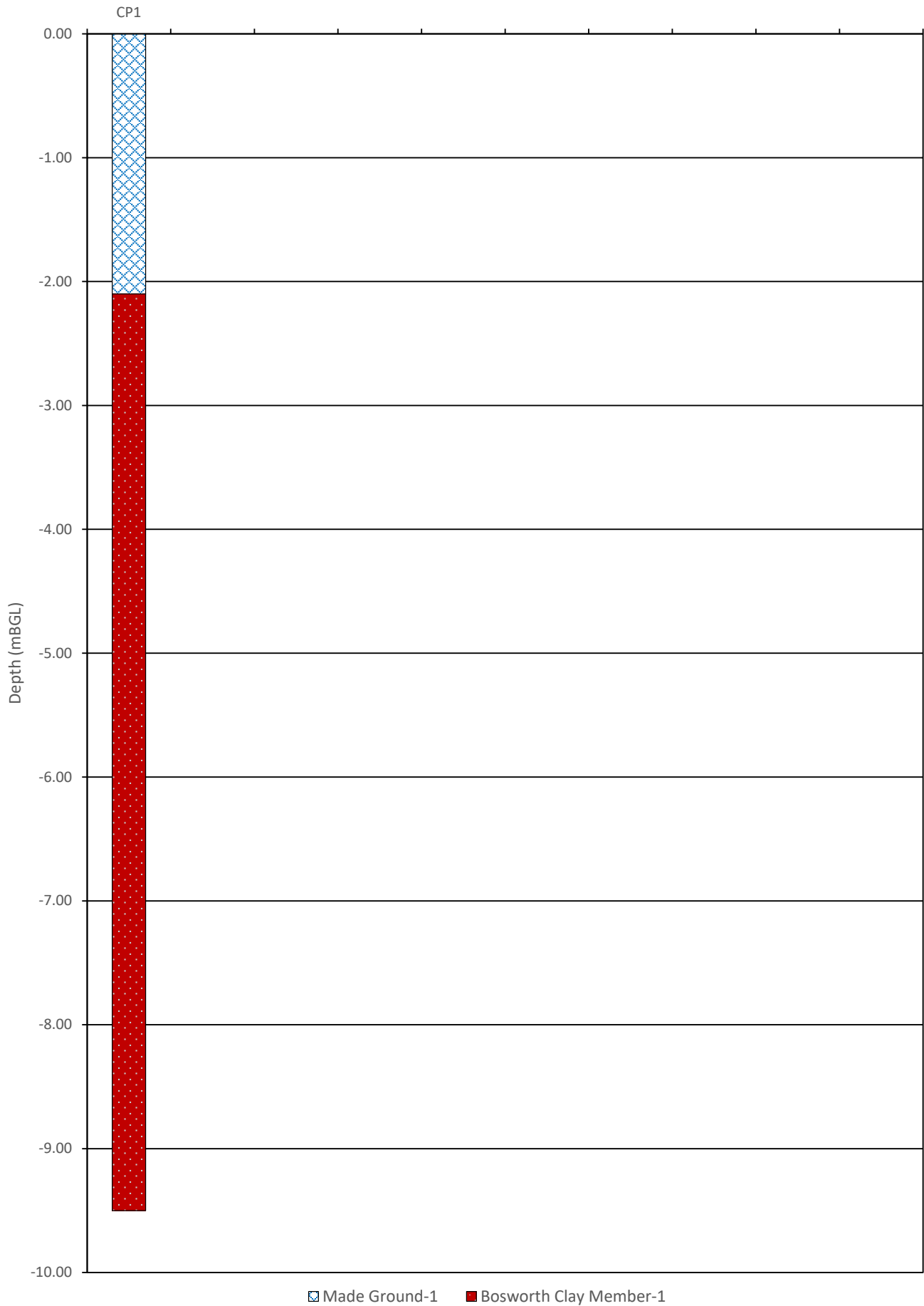
Item No	Risk	Potential Effects	Risk Management / Mitigation
		site personnel	according to specification, inspect regularly and maintain to original specification.
4	Obstructions	Unable to achieve proposed design lengths, damage to equipment.	Ensure all known existing obstructions are removed prior to piling works.
5	Unable to install reinforcement cages in CFA piles	Pile reinforcement does not achieve the required to level.	Reinforcement stated within the design is the minimum required. Reinforcement can be increased in bar diameter and number to increase cage stiffness for pile installation. to ensure adequate rigidity for temporary lifting and also provision of lifting etc.
6	Lifting reinforcement cages	Damage cages, injury to personnel	Ensure all lifting operations are carried out to an agreed method statement / lift plan. All reinforcement cages to have designed lifting points
7	Piling adjacent to neighbouring structures.	Damage to structures	Ensure all piling activities are agreed with the required third parties and the appropriate sign off have been completed before commencement.
8	Non-conformance of concrete	Compromised pile performance	Implement an agreed testing regime of concrete cubes and relay any non-conformances for checking at earliest opportunity
9	Risk of Cracking piles below pile cut off level during trimming	Compromised pile performance	Pile trimming to be undertaken carefully and de-bonding sleeves to be used. All piles should be subjected to integrity testing
10	Temporary exposed reinforcement from piles	Injury to site workers	Pile reinforcement to be terminated flush with piling platform level. Where reinforcement extends above piling platform level, these are to be clearly marked and mushroom caps will be required.

APPENDIX B

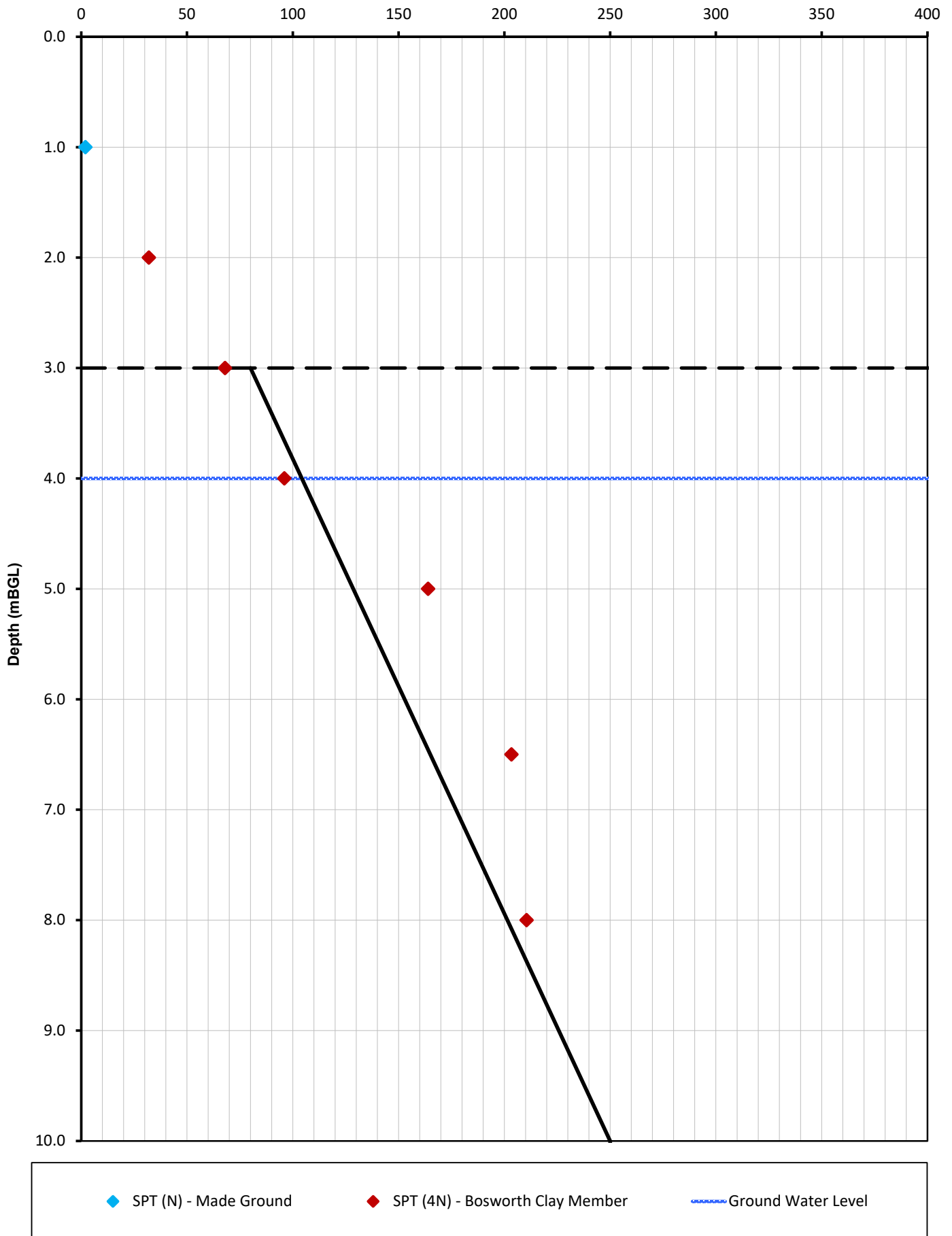
SOILS INFORMATION



Borehole Profile



All against depth for all boreholes



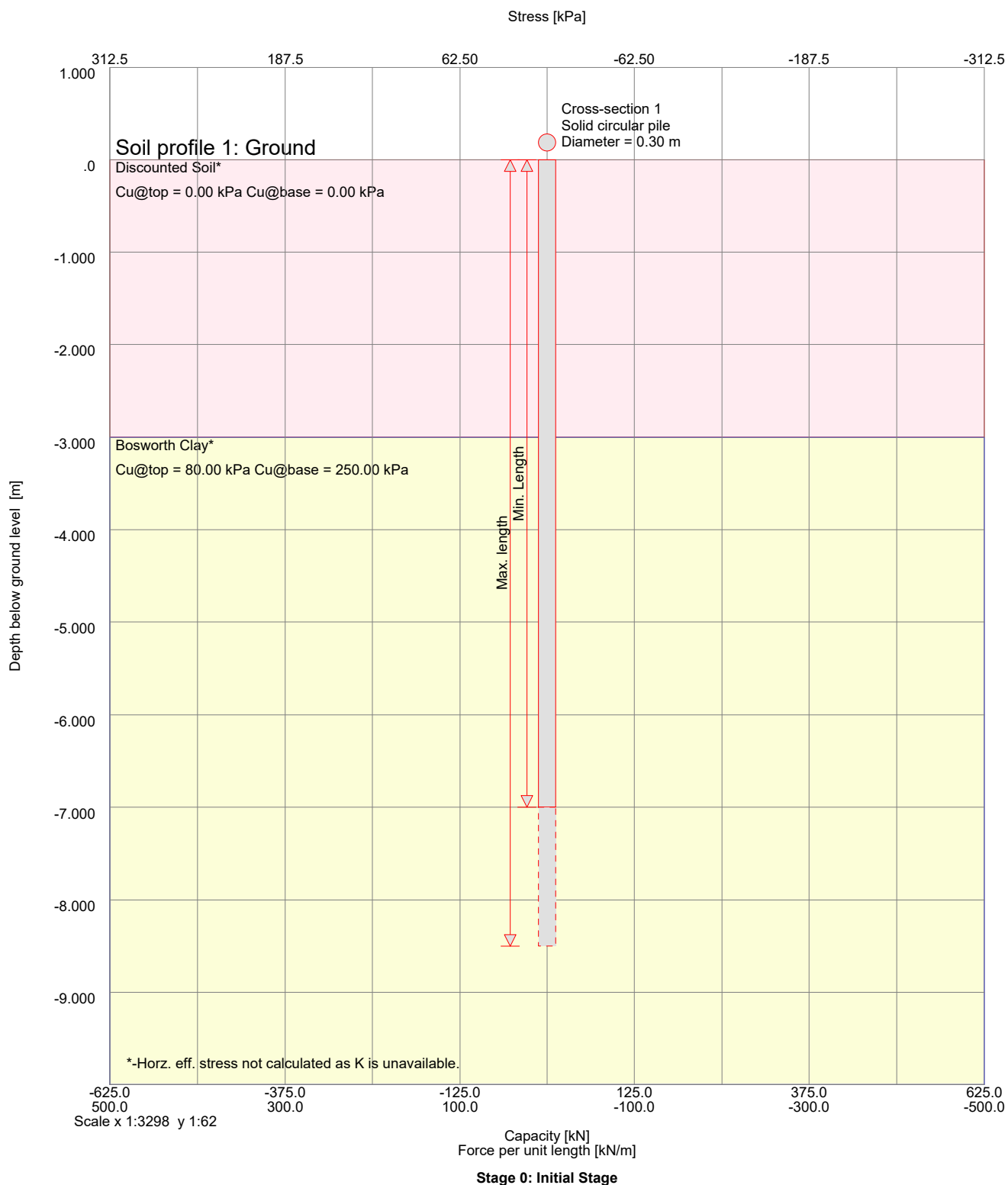
APPENDIX C

OASYS PILE



Earl Shilton - 223 Station Road
300mm diameter auger piles
Vertical Capacity- EC7 (No testing)

Job No.	Sheet No.	Rev.
27582		
Drg. Ref.		
Made by SA	Date	Checked



Analysis Options

Design approach:	DA1(C1 + C2)
Pile type:	CFA
Model factor:	1.40
Partial factor on negative skin friction - Set A1:	1.00
Partial factor on negative skin friction - Set A2:	1.00
Serviceability verified by load tests (preliminary/working)	No
carried out on more than 1% of constructed piles to loads not less than 1.5 times the representative load for which they are designed?	
Resistance verified by a maintained load test taken to the calculated, unfactored, ultimate resistance?	No
Is BS8004 SLS check enabled?	No
Datum type	Depth based
Effective stress profile	Calculated

Pile Properties

Pile type	Solid
Pile cross-section	Circular
Under-ream	No
Calculation profile	Range
Minimum pile length	7.0000 m
Maximum pile length	8.5000 m
Increment size	0.50000

Cross-section	Number of cross sections	Top Diameter [m]	Second Diameter location [m]	Second Diameter [m]	Third Diameter location [m]	Third Diameter [m]
Cross-section 1	1	0.30000				

Undrained Materials - General Data

No.	Material description	Bulk unit weight [kN/m³]	Cu material factor	Top Cu [kPa]	Base Cu [kPa]
1	Discounted Soil	19.000	NA	0.0	0.0
2	Bosworth Clay	20.000	NA	80.000	250.00
3	Bosworth Clay 2	20.000	NA	250.00	250.00

Undrained Materials - Skin Friction Data

No.	Material description	Skin friction computation	Alpha	qs Top [kPa]	qs Base [kPa]	qs, lim Spec. Value [kPa]
1	Discounted Soil	Alpha specified	0.0	NA	NA	No NA
2	Bosworth Clay	Alpha specified	0.50000	NA	NA	No NA
3	Bosworth Clay 2	Alpha specified	0.50000	NA	NA	No NA

Undrained Materials - End Bearing Data

No.	Material description	End bearing computation	Nc	qb Top [kPa]	qb Base [kPa]	qb, lim Spec. Value [kPa]
1	Discounted Soil	Nc specified	0.0	NA	NA	No NA
2	Bosworth Clay	Nc specified	9.0000	NA	NA	No NA
3	Bosworth Clay 2	Nc specified	9.0000	NA	NA	No NA

 PILEDESIGNS GEOTECHNICAL EXPERTISE Earl Shilton - 223 Station Road 300mm diameter auger piles Vertical Capacity- EC7 (No testing)	Job No.		Sheet No.		Rev.	
	27582					
	Drg. Ref.					
	Made by SA		Date		Checked	

No.	Material description	End bearing computation	Nc	qb	qb, lim
				Top [kPa]	Base Spec. Value [kPa]
Undrained Materials - Material Factors (Code Based)					
No.	Material description	Qs factors	Nc factors	Qb factors	
		M1	M2	M1	M2
1	Discounted Soil	N.A.	N.A.	1.0000	N.A.
2	Bosworth Clay	N.A.	N.A.	1.0000	N.A.
3	Bosworth Clay 2	N.A.	N.A.	1.0000	N.A.

STAGE SPECIFIC DATA

Stage 0 : Initial Stage

Groundwater

No.	Level	Pressure	Unit weight of water
	[m]	[kPa]	[kN/m³]
1	4.0000	0.0	9.8100

Soil Profiles

Soil Profile 1: Ground

No.	Depth	Material description	Contributes to negative skin friction
	[m]		
1	0.0	Discounted Soil	No
2	3.0000	Bosworth Clay	No
3	10.000	Bosworth Clay 2	No

Soil Profile - Groundwater Map

No.	Soil Profile	Groundwater
1	Ground	Groundwater Profile 1

Stage specific warnings

1 - Stage 0 - The bottom most layer in Ground is assigned "Total stress" material. For this layer the cohesion is assumed to be constant at "Cu-Top", i.e cohesion specified at the top of this layer. The user specified value of cohesion at the bottom of this layer, "Cu-Bottom" is ignored. (Material Properties)

CAPACITY RESULTS

Partial Resistance Factors Used:

DA1 C1

Shaft resistance factor for set R1 (Compression): 1.00

Base resistance factor for set R1: 1.00

Shaft resistance factor for set R1 (Tension): 1.00

DA1 C2

Shaft resistance factor for set R4 (Compression): 1.60

Base resistance factor for set R4: 2.00

Shaft resistance factor for set R4 (Tension): 2.00

Model factor: 1.40

Stress Profiles



PILEDESIGNS
GEOTECHNICAL EXPERTISE

Earl Shilton - 223 Station Road
300mm diameter auger piles
Vertical Capacity- EC7 (No testing)

Job No.
Sheet No.
Rev.

27582

Drg. Ref.

Made by
SA
Date
Checked

No.	Soil Profile	Groundwater
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Soil Profile 1: Ground

Depth	Density	Undrained Cohesion	Nq	Total vertical stress	Porewater pressure	Effective vertical stress	Effective horizontal stress*	Cumulative skin friction per unit perimeter
[m]	[kN/m³]	[kPa]		[kPa]	[kPa]	[kPa]	[kPa]	[kN/m]
0.0	19.000	0.0	N.A.	0.0	0.0	0.0	NA	0.0
3.0000	19.000	0.0	N.A.	57.000	0.0	57.000	NA	0.0
3.0000	20.000	80.000	N.A.	57.000	0.0	57.000	NA	0.0
4.0000	20.000	104.29	N.A.	77.000	0.0	77.000	NA	46.071
7.0000	20.000	177.14	N.A.	137.00	29.430	107.57	NA	257.14
7.5000	20.000	189.29	N.A.	147.00	34.335	112.67	NA	302.95
8.0000	20.000	201.43	N.A.	157.00	39.240	117.76	NA	351.79
8.5000	20.000	213.57	N.A.	167.00	44.145	122.86	NA	403.66

* Effective horizontal stress not calculated for "Total Stress" materials and for Beta Method.

Cross-section 1 results:

Uniform pile with top shaft diameter = 0.30 m

Results - Compression

Soil Profile 1: Ground

Depth	Pile length	Ultimate base capacity (Q _b)	Cumulative external Friction (Q _s)	Negative skin friction (Q _{nsf})	Net ultimate resistance
[m]	[m]	[kN]	[kN]	[kN]	[kN]
7.0000	7.0000	112.69	242.35	0.0	355.04
7.5000	7.5000	120.42	285.52	0.0	405.94
8.0000	8.0000	128.14	331.55	0.0	459.69
8.5000	8.5000	135.87	380.44	0.0	516.31

Depth	Pile length	Design resistance	Combination with least resistance	Factored load*
[m]	[m]	DA1-C1 [kN]	DA1-C2 [kN]	DA1-C1 [kN] DA1-C2 [kN]
7.0000	7.0000	253.60	148.44	2 0.0(C) 0.0(C)
7.5000	7.5000	289.96	170.47	2 0.0(C) 0.0(C)
8.0000	8.0000	328.35	193.78	2 0.0(C) 0.0(C)
8.5000	8.5000	368.79	218.36	2 0.0(C) 0.0(C)

Limiting criteria :
1 : DA1 C1
2 : DA1 C2
*(C)-> Compression load, (T)-> Tension load
Note: Design resistance does not include any consideration of negative skin friction.

Nq Calculation Details

Soil Profile 1: Ground - Material Factor Set - 1

There are no pile toe levels in any drained material(with Berezantzev/Bolton option) in the given soil profile.

Soil Profile 1: Ground - Material Factor Set - 2

There are no pile toe levels in any drained material(with Berezantzev/Bolton option) in the given soil profile.

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END OF CALCULATIONS



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