



Vinci Building Ltd

Prestwich Multi-Storey Car Park Piling Risk Assessment

2066VIN-PRA v1

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Contaminated Land, Brownfield & Environmental Contracting



REPORT TITLE: Piling Risk Assessment

REPORT NUMBER: 2066VIN-PRA v1

CLIENT NAME: Vinci Construction Ltd

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1.0 Introduction

1.1 Background

- 1.1.1 Vertase FLI Ltd (VertaseFLI) was employed by Vinci Building Ltd ('the Client') to prepare a remediation strategy for a car park located on Fairfax Road, Prestwich, M25 1BT ('the Site'), which forms part of a larger area of land intended for redevelopment for a mixed use in accordance with a hybrid planning application submitted to Bury Council (planning reference 70449). A site plan is shown in Drawing D4900_01 (Appendix A).
- 1.1.2 The Site is referred to as the "northern car park" in previous site investigation reports, which have been provided to VertaseFLI by the Client (see Section 1.3 for details about the reports). The Site shall be redeveloped to construct a multi-storey car park.

1.2 Remediation Strategy

- 1.2.1 The final revision of the options appraisal and remediation strategy prepared for the Site by VertaseFLI (Revision C) was dated November 2024.
- 1.2.2 Piled foundations are proposed to support the multi-storey car park (continuous flight auger bored piles). The design details for these piles are provided in Appendix A. The remediation strategy therefore recommended that, in addition to a remediation verification report, a piling risk assessment shall be prepared and submitted to the Local Authority to provide reassurance that a piled foundation solution shall not create a contaminant linkage and unacceptable risks to sensitive receptors.

1.3 Previous Investigations

- 1.3.1 Previous site investigation reports have been prepared by Geotechnical and Environmental Associates Ltd (GEA). These reports are listed below:
- GEA Ltd (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Desk Study. The Prestwich Regeneration LLP. January 2024. J23254. Rev 3

- GEA Ltd (2024). Prestwich North Car Park, Prestwich, Manchester, M25 1BT. Supplementary Ground Investigation. The Prestwich Regeneration LLP. September 2024. Rev 1
- GEA Ltd (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. October 2024. J23254. Rev 2

1.3.2 In combination, these site investigation reports provide information (desk study, preliminary assessment of risk, intrusive site investigation information and a quantitative assessment of risk) relevant to the entire area of land intended for redevelopment, including the northern car park.

1.4 Document Purpose

1.4.1 The purpose of this document is to assess the risk posed by the proposed piling foundation solution.

2.0 Pre-Remediation Ground Conditions

2.1 Ground Conditions

- 2.1.1 The ground conditions beneath the Site comprise a moderate thickness of Made Ground underlain by alluvium. The alluvium is in-turn underlain by Hummocky Glacial Deposits. Beneath the superficial deposits, the Pennine Upper Coal Measures Formation is present. The Made Ground and superficial deposits are described in Table 2-1.
- 2.1.2 According to the GEA Ltd (2024) ground investigation report, the alluvium, hummocky glacial deposits and Pennine Upper Coal Measures Formation are classified by the Environment Agency as Secondary A Aquifers.

Table 2-1. Summary of ground conditions beneath the Site

Material	Description
Made Ground	Comprising tarmacadam underlain by subbase (comprising sandy silty gravel with fragments of brick, concrete, asphalt and sandstone) ranging in thickness from 3m in BH101 in the northern portion of the site to 1.1m in BH09 at the southern portion of the site. Obstructions comprising concrete substructures and brick footings (some of archaeological interest) are present in the Made Ground at various depths and locations Perched groundwater was present in the Made Ground at depths of 0.28m to 1m.
Alluvium	The alluvium includes some very soft dark grey and brown pseudo-fibrous peat over very soft grey slightly gravelly clay with rare pockets of brown peat to a maximum depth of 2.5m in BH02.
Hummocky Glacial Deposits	The hummocky glacial deposits were reported to be highly variable comprising interbedded granular and cohesive deposits, underlain by stiff cohesive deposits, underlain by dense and very dense granular deposits

Notes:

Summary of ground conditions is taken from GEA (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. August 2024. J23254. Rev 0

2.2 Groundwater Levels

2.2.1 Groundwater was encountered during the various phases of site investigation. GEA recorded groundwater to generally be present in the as perched water in the made ground and within the underlying alluvium/glacial deposits at depths of between c. 1mbgl and 7mbgl.

2.3 Contaminants

2.3.1 Contaminants identified to be present within the Made Ground and shallow groundwater beneath the Site are summarised in Table 2-2.

Table 2-2. Summary of contaminants identified in the Made Ground

Contaminant	Description
Asbestos	Detected in BH08A at 0.5m bgl in Made Ground (chrysotile fibre bundles at <0.001%)
Petroleum Hydrocarbons	Hydrocarbon odours were detected in the Made Ground at the north of the Site
Polycyclic Aromatic Hydrocarbons (PAHs)	Hydrocarbon odours were detected in the Made Ground and natural ground at the north of the Site (BH01). Elevated concentrations of total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs) were detected in groundwater from BH02.
Sulphide	Detected at elevated levels in BH01
Notes: Summary of contamination identified is taken from GEA (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. August 2024. J23254. Rev 0	

2.4 Receptors

2.4.1 Potential receptors identified in previous site investigations by GEA Ltd include:

- Future users of the proposed multi-storey car park.
- Groundwater present in the underlying Secondary A aquifer.
- Buried services and building materials (concrete) in direct contact with contaminants in Made Ground.

2.5 Potential Pathways

- 2.5.1 Upon completion of the development, potential pathways for contaminants may include the inhalation of vapours by future site users and the downward migration of contaminants through the unsaturated zone into groundwater in the underlying Secondary A aquifer.
- 2.5.2 Pathways relating to ingestion and direct contact by future site users are unlikely due to the end use being a car park with a physical pathway break (i.e. hardstanding). However, direct contact of underground services and building materials (e.g. concrete) with contaminants is likely.

2.6 Contaminant Linkages

- 2.6.1 An assessment of the risk posed by chemical contaminants to the receptors was undertaken by GEA Ltd in their reported dated August 2024. The outcome of the assessment is summarised in Table 2-3.
- 2.6.2 The assessment did not identify any contaminant linkages posing unacceptable risks to current or future receptors in the context of the proposed development.

Table 2-3. Summary of GEA assessment of risk posed by contaminants

Receptor	Summary of GEA Assessment of Risk
Human health (future users or multi-story car park)	Elevated concentrations of PAHs present in Made Ground in the northern part of the Site (thought to be derived from coal tar) were present at concentrations exceeding generic assessment criteria for a commercial land use exposure scenario in some samples of Made Ground from the north of the Site. The commercial land use exposure scenario is very conservative for a car park.
Human health (construction workers)	Made Ground containing elevated concentrations of PAHs and some positive detections of asbestos fibres may pose risks to construction workers which should be managed via appropriate PPE and working in accordance with appropriate guidelines in relation to asbestos
Groundwater in Secondary A Aquifer	It was not considered likely that the redevelopment of the site would pose a risk to groundwater
Building materials (concrete)	Concentrations of soluble sulphates measured in the Made Ground were generally low except for some elevated concentrations in the northern part of the Site corresponding with an ACEC (Aggressive Chemical Environment for Concrete) class of AC-3 for mobile water conditions

Notes:

Summary of contamination risk assessment is taken from GEA (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. August 2024. J23254. Rev 0

3.0 Remediation Works – Summary

3.1 Summary

- 3.1.1 The site was re-graded to form suitable development platform for the multi-story car park and granular working platform.
- 3.1.2 All earthworks were carried out in accordance with SHW Series 600. All reinstated material met the validation criteria as specified in the Vertase FLI Earthworks Specification:
- Material classification in accordance with 'Series 600 Earthworks and Highways Specification' (SHW Series 600). Acceptable material classes for general earthworks are 1A, 2A/2B, 2C and 6F5
 - Compaction in accordance with SHW Series 600;
 - Undrained shear strength of reinstated materials and cut levels of ≥ 50 kPa for reinstated materials;
 - Moisture content upper limit corresponding with 95% or greater of the maximum dry density and a lower limit corresponding with 5% or less air voids;
 - Areas of formation to achieve a minimum deflection plate load results of 8mm using a 450mm diameter plate applying a maximum test pressure of 150kPa;
 - Piling mat areas to achieve a minimum deflection plate load results of 8mm using a 600mm diameter plate applying a maximum test pressure of 338kPa.
- 3.1.3 Made Ground materials with elevated concentrations of PAHs have been reinstated on-site in accordance with the approved Remediation Strategy. The material does not represent an unacceptable risk to human health or the environment in the context of the proposed future land use (underneath the multi-story car park).

3.2 Post-Remediation Considerations

- 3.2.1 It is possible that follow on trades may encounter the made ground material. If follow on trades encounter this material, they should follow good hygiene practice. It is advised that they wear appropriate personal protective equipment (PPE) when handling the material. If

they are working with this material, they should wash their hands thoroughly before eating, drinking, operating a mobile phone or smoking.

- 3.2.1 If made ground as described above is present in any arisings that result from follow on trades, this material should wherever practical be reinstated back into its place of origin. If this is not possible then materials should be exported to a suitable licensed facility. The chemical testing provided in this report can support this disposal.

4.0 Piling Risk Assessment

4.1 General

- 4.1.1 The following risk assessment has been undertaken to address the additional potential risks with respect to the proposed installation of concrete piles, with steel reinforcement, using Continuous Flight Auger (CFA) methods.
- 4.1.2 The piling design and associated calculations have been set out in the Cohesion Piling Company Ltd document attached at Appendix A. Pile lengths are between 11.6m and 20m.

4.2 Potential Penetrative Work Hazards

- 4.2.1 The CL:AIRE/Environment Agency document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention' lists the following key hazards with respect to piling on contaminated sites:
- 1) Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer;
 - 2) The driving of solid contaminants down into an aquifer during pile driving;
 - 3) Contamination of groundwater and, subsequently, surface waters by turbidity, support fluids, concrete, cement paste or grout;
 - 4) Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration);
 - 5) Creation of preferential pathways, including through a low permeability layer, to allow upward migration of landfill gas, soil gas, mine gas or contaminant vapours (e.g. Volatile Organic Compounds (VOCs)) to the surface;
 - 6) Causing off-site migration of ground gas or increased vertical emissions as a result of vibration or other effects from the pile installation process; and

- 7) Direct contact of site workers and others with contaminated soil arisings which have been brought to the surface.

4.3 Hazard Assessment

Creation of Preferential Pathways - Groundwater

- 4.3.1 During construction there may be a temporary creation of preferential pathways between marginally contaminated shallow groundwater and deeper groundwater.
- 4.3.2 Both the shallow and deeper aquifers that the piles will intercept are classified as Secondary A Aquifers and the overall risk to groundwater from contamination at the site has been assessed as low. The length of piles and their construction will not allow vertical transmission of contamination into deeper more sensitive aquifers.
- 4.3.3 The potential risk to sensitive receptors from the creation of vertical flow paths through piling is considered to be **low**.

Driving of Contaminants into an Aquifer

- 4.3.4 The piles will not be driven and will be completed using the CFA method. Therefore, contaminants present in the made ground will not be driven into the aquifer.
- 4.3.5 Risks are considered to be **negligible**.

Contamination of Groundwater – Concrete etc.

- 4.3.6 As concrete is being poured into the ground, below the groundwater table, there is the potential for concrete to contaminate groundwater. However, the likely viscosity of the concrete at the point of pouring (entry into groundwater) and the nature of the underlying ground conditions, highly variable and likely low transmissivity, will prevent the spread of concrete beyond it's intended area of use and the immediate vicinity.
- 4.3.7 Provided that the installation of the piles is to be carried out by appropriately skilled and trained piling installation engineers the risk to groundwater from concrete contamination is considered to be **very low**.

Direct contact of the piles or engineered structures with contaminated soil or leachate – degradation

- 4.3.8 The potential for chemical attack on the piles has been considered based on the results of the site investigation.
- 4.3.9 A revised BRE SD1 Assessment is included as Appendix F of the Cohesion pile design document. The assessment recommends a design sulphate class for the concrete of DS-3.
- 4.3.10 Therefore, provided the recommended concrete class is used within the piling degradation risks should be mitigated and the risk is considered **very low**.

Creation of Preferential Pathways - Gas and Vapours

- 4.3.11 Based on the site investigation data the piles will primarily be installed beneath the groundwater table. In addition, vapour analysis using a Photo-Ionisation Detector (PID) on samples from the made ground during the investigation indicated negligible volatile contamination.
- 4.3.12 Therefore, considering the saturated ground, low volatile content of the made ground and the pile construction the potential risk of the creation of preferential pathways for ground gas and vapours is **very low**.

Off-site Migration of Ground Gas

- 4.3.13 Due to the same reasons stated above the potential risk of off-site migration of ground gas and vapours is considered **negligible**.

Direct Contact with Contaminated Arisings

- 4.3.14 There may be potential for direct contact with contaminated arisings for construction workers. However, contamination within arisings does not represent an acute risk to construction workers.
- 4.3.15 Potential risks to site workers (drilling contractors) from arisings are considered to be **low** provided, appropriate PPE such as gloves, overalls and potentially RPE are worn and a high standard of hygiene and good housekeeping is maintained. Health and safety considerations for dealing with any arisings should be included as part of the appropriate risk assessments and method statements for the piling works.

- 4.3.16 All arisings will be placed in suitable areas of the site, located away from the site boundary and local watercourses and, if necessary, covered to prevent dust and minimise risks to other receptors.

5.0 Conclusions

5.1.1 The risk assessment has been undertaken to assess potential environmental impact from piling. Based upon the current ground conditions the overall risks from the installation of CFA piles is considered to be **low** provided the following conditions are met:

- Installation is undertaken by trained and competent staff in accordance with approved risk assessments and method statements;
- No significant soil contamination, beyond that which is already known, is observed during installation;
- Operatives undertaking pile installation work who may come in to contact with contaminated arisings where appropriate PPE (gloves, overalls, RPE if required) and maintain a high level of hygiene and good housekeeping; and
- All arisings from pile installation works and any temporary stockpiles should be placed in suitable areas of the site, away from the site boundary and local watercourses, and, if necessary, covered to prevent dust and to minimise risks to other receptors.

Appendix A

Cohesion Piling Company Ltd Pile Design Calculations



Piled Foundations & Underpinning

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PILE DESIGN CALCULATIONS CONTINUOUS FLIGHT AUGER BORED PILING

Fairfax Street, Prestwich for VINCI building

Project No.: 15107

Revision: C02

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Date prepared: 02/05/2025

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Date approved: 02/05/2025

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22/04/2025	C01	DM	First Issue
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Documentation

Civic Engineers:

- 17300-CIV-P1-XX-D-S-500000 Rev C01 – Piling GA
- 17300-CIV-P1-XX-D-S-500001 Rev C01 – Piling Schedule
- 17300-CIV-P1-XX-D-S-500002 Rev C01 – Foundation GA
- 17300-CIC-P1-XX-T-S-000003 Rev C01 – Piling Specification

Taylor Woodrow

- VB01605-TWTS-0140-XX-DR-Y-000301 Rev C02 – Two Tier Piling Platform – General Details

Geotechnical & Environmental Associates Limited (GEA):

- J23254 Rev 0 – Ground Investigation – Prestwich Village, Prestwich – January 2024
- J23254A - Ground Investigation Preliminary findings -Prestwich North Car Park – June 2024

Institution of Civil Engineers

- Specification for Piling and Embedded Retaining Walls (SPERWall), 3rd Edition, 2016

Scope

To install approximately 90 No. CFA bored piles of 450mm diameter to support a new Multi-Storey Car Park.

Ground investigation

The above mentioned ground investigations consisted of 2 No Cable Percussive boreholes and 15 No window sample boreholes on the proposed site to depths of up to 20.39 metres, denoted as BH01 to BH02, BH08-BH09, BH101 – BH110.

In situ testing (Standard Penetration Test) was carried out in all boreholes to assess the relative consistency of the soils. Geotechnical and chemical laboratory testing was undertaken on samples retrieved from the boreholes. The soil/leachate aggressive environment for concrete was assessed with a suite of tests for pH and water-soluble sulphate.

The investigation results showed variable amount of Made Ground was encountered in all boreholes, with some bands of organic clay and peat noted within or below this. This was underlayed by Glacial deposits comprised of loose to very dense very silty gravelly fine to medium SAND and soft to very stiff slightly sandy slightly gravelly silty CLAY.

Groundwater

Groundwater was encountered at depths between 1.00m and 7.20m bgl during the investigation.

Pile design

Piling levels

Top of Borehole levels have been provided by on the borehole logs.

Piling Platform Levels (PPL) have been proposed, as 95.700m OD for GL 8 to 15 and 94.400m OD for gridlines 1 to 7.

Pile Cut-Off Levels vary between 92.050m and 95.225m AOD.

The top of steel reinforcement will be left at PPL, which we assume provides sufficient length of steel to be tied into the foundations.

Anchorage length into the pile cap is to be designed by others.

We will install debonding foam from piling platform level down to 200mm above the pile cut off level.

Bearing pile geotechnical design

PPL – 95.700m

Soil	Level (m OD)	γ_b (kN/m ³)	C_u (kPa)	SPT N Value	ϕ°	USF (kPa)	UEB (kPa)
Made Ground	PPL – 94.40	18	0	-	27	Ignored	Ignored
Peat	94.40 – 92.80	15	5	-	-	Ignored	Ignored
Loose Granular TILL	92.80 – 91.00	18	-	10	30	11-18	Ignored
Firm Cohesive TILL	91.00 – 88.40	19	60.0	-	-	60	540
Medium Dense Granular TILL	88.40 – 85.40	20	-	25	34	35-51	3210 - 4660
Stiff Cohesive TILL	85.40 – 80.00	21	125.0	-	-	78	1125
Very Dense Granular TILL	80.00 +	21	-	50	41	110	10000

PPL – 94.400m

Soil	Level (m OD)	γ_b (kN/m ³)	C_u (kPa)	SPT N Value	ϕ°	USF (kPa)	UEB (kPa)
Peat	PPL – 92.80	15	5	-	-	Ignored	Ignored
Loose Granular TILL	92.80 – 91.00	18	-	10	30	4-10	Ignored
Firm Cohesive TILL	91.00 – 88.40	19	60.0	-	-	60	540
Medium Dense Granular TILL	88.40 – 85.40	20	-	25	34	26-42	2340 - 3790
Stiff Cohesive TILL	85.40 – 80.00	21	125.0	-	-	78	1125
Very Dense Granular TILL	80.00 +	21	-	50	41	94-110	10000

Made Ground & Peat

Contribution to skin friction and end-bearing has been ignored in the made ground and peat due to its inherent variability and low strength.

For resistance to horizontal loads, the made ground has been modelled as a loose granular material and the peat as a very soft cohesive material.

Conservatively, an allowance for Negative Skin Friction (NSF) has been allowed for the peat and made ground above as there is potential for NSF or down-drag to occur as the organic material degrades and compresses over time.

The calculation of NSF follows the Mayerhof method (effective stress) presented in Tomlinson, i.e. $\tau_{s \text{ neg}} = \beta \sigma'_v$, where $\beta = 0.3$.

Granular Till

The predominantly granular Glacial Deposit soils have been modelled as a saturated granular material with a SPT 'N' Value as indicated in the above tables, See Appendices for SPT soil plot. The Phi value has been derived from its correlation between the SPT value in the graph below, figure 1.

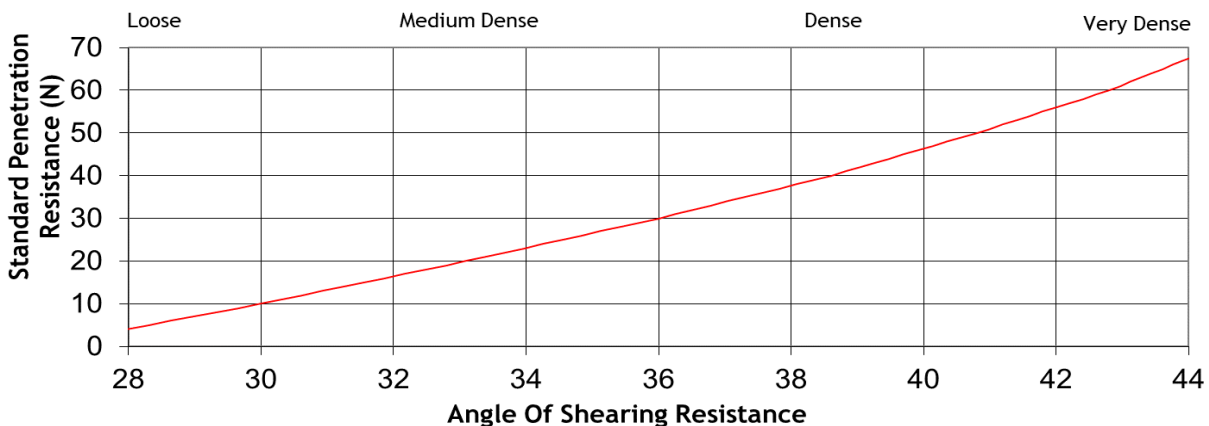


Figure 1: Angle of Shear Resistance and SPT

We have used a value of 0.8 for the earth pressure coefficient (K_s) for fine sands in accordance with BS 8004: 2015 clause 6.4.1.2.2 Table 8 for replacement (CFA) piles.

Cohesive Till

The predominantly cohesive Glacial Deposit soils have been modelled using total stress parameters, C_u and α .

C_u , the undrained cohesion, has calculated from the correlated results of in situ SPTs and Triaxial Compression Tests, included as part of the above-mentioned Site Investigation report. See Appendix A for SPT soil plot.

C_u can be estimated from SPT 'N' results using the correlation suggested by Stroud, 1974, $C_u = f_1 \times \text{SPT 'N}_{60}$ '. f_1 has been taken as 5.0 for Glacial Till.

Alpha values for relating undrained cohesion to unit skin friction have been taken from BS EN 8004: 2015 - Code of practice for foundations, using K1 & K2 values for replacement piles in glacial tills. Values are summarised in Figure 2.

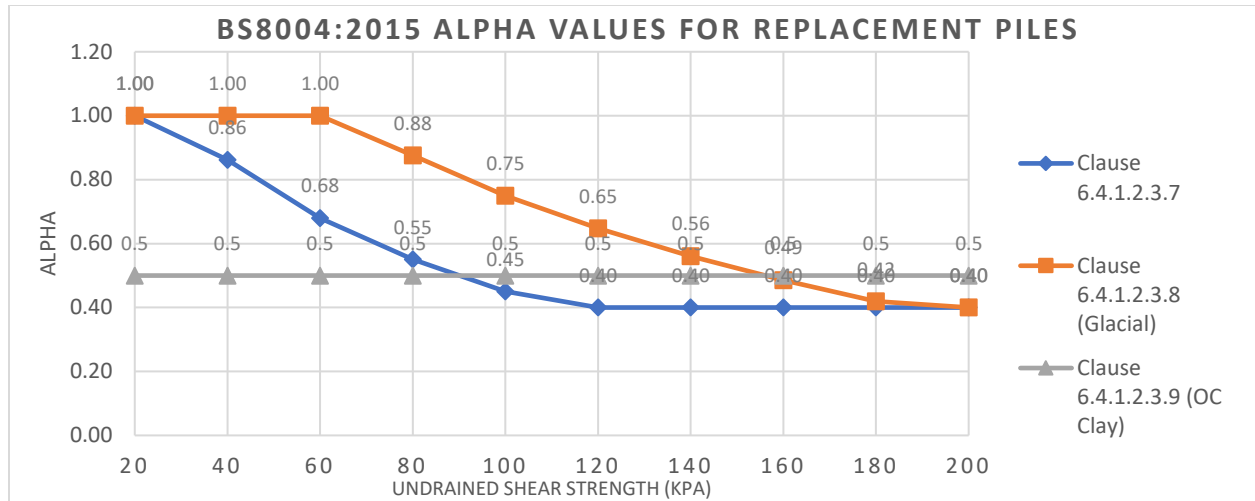


Figure 2: Alpha Values for Glacial Till

Design data

450mm diameter Continuous Flight Auger (CFA) piles are proposed, where:

As, surface Area = 1.099m² (per metre length)

Ab, base area = 0.096m²

The geotechnical design is carried out to Eurocode standards in accordance with BS EN 1997-1 (2004) and the UK National Annex. The pile design has been based on the assumption that no pile load testing will be carried out and therefore the appropriate (higher) set of R4 factors have been selected. An enhanced model factor of 1.4 is used.

Geotechnical Category 2 Structure:

BS EN 1997-1: Clause 2.1, sub-clause 18

Design Approach 1:

BS EN 1997-1: Clause 2.4.7.3.4.2

Combination 1: A1 + M1 + R1

Combination 2: A2 + M1 + R4

A, M & R are the action, material and resistance partial factors respectively.

N.B. For combinations 1 & 2, M1 = 1.0

In the absence of static load test results, design in accordance with NA to BS EN 1997-1 (2004): Clause A.3.3.2 using Equation 7.9 & 7.18 (design by calculation).

$$R_d > F_d$$

Axial Design Resistances > Axial Design Actions

Design actions

$$F_d = \gamma_f F_{Rep}$$

Where:

F_d = Design Action

γ_f = Partial safety factor on actions

F_{Rep} = Representative value of characteristic actions = ψF_k

Partial Factors on Actions - Table NA.A1.2(B)				
Action		Symbol	Set	
			A1	A2
Permanent	Unfavourable	γ_G	1.35	1.00
	Favourable		1.00	1.00
Variable	Unfavourable	γ_Q	1.50	1.30
	Favourable		0.00	0.00

Combination factors for variable actions:

- ψ = 1.0 where only one variable action is present
 $\psi_0 Q_k$ = Combination value of a variable action
 $\psi_1 Q_k$ = Frequent value of a variable action
 $\psi_2 Q_k$ = Quasi-permanent value of a variable action

Table NA.A1.1 UK National Annex of BS EN 1990:			
Action	ψ_0	ψ_1	ψ_2
Imposed loads in buildings:			
Category A: domestic, residential	0.7	0.5	0.3
Category B: office areas	0.7	0.5	0.3
Category C: congregation areas	0.7	0.7	0.6
Category D: shopping areas	0.7	0.7	0.6
Category E: storage areas	1.0	0.9	0.8
Category F: traffic area, < 30kN	0.7	0.7	0.6
Category G: traffic area, 30 - 160kN	0.7	0.5	0.3
Category H: roofs	0.7	0.0	0.0
Snow load: H ≤ 1000 m a.s.l.	0.5	0.2	0.0
Wind loads on buildings	0.5	0.2	0.0

For each critical load case, design values of the effects of actions are determined by combining the effects of actions that are considered to act simultaneously:

$$\Sigma \gamma_{G,j} G_{k,j} + \gamma_{Q,1} Q_{k,1} + \Sigma \gamma_{Q,i} \psi_{0,i} Q_{k,i}$$

BS EN 1990 Exp. (6.10) & Table A1.2 (B)

Where:

- G_k = Characteristic value of a permanent action
 $Q_{k,1}$ = Characteristic value of the leading variable action
 $Q_{k,i}$ = Characteristic value of accompanying variable action 'i'

Serviceability Limit State (SLS):

BS EN 1990 (6.5.3)

$$G_{k,j} + Q_{k,1} + \Sigma \psi_{0,i} Q_{k,i}$$

(characteristic combination)

- γ_G = 1.00
 γ_Q = 1.00

Design resistances

$$R_d = \left(\frac{R_{bk}}{\gamma_b} + \frac{R_{sk}}{\gamma_s} \right) / \gamma_{RD}$$

Where:

$$R_{bk} = A_b q_{bk}$$

$$R_{sk} = \sum_i A_{s,i} q_{sk,i}$$

Partial Factors on resistances for CFA Piles			
Resistance	Symbol	Set	
		R1	R4 (without verification)
Base	γ_b	1.00	2.00
Shaft (compression)	γ_s	1.00	1.60
Shaft (tension)	γ_s	1.00	2.00
Model	γ_{RD}	1.40	1.40

In addition to the above EC7 design cases, all piles are designed to have a minimum factor of safety of 1.5 when considering shaft resistance only and ignoring base resistance.

Concrete design

Strength class

$$f_{cd} = \frac{\alpha_{cc} f_{ck}}{\gamma_c}$$

α_{cc}	Coefficient of long-term effect – recommended – 0.85 (NA-1992-1-1)
f_{ck}	Characteristic compressive cylinder strength of concrete at 28 days
γ_c	Partial Factor of safety – recommended 1.65 (1.5 x 1.1)

For C28/35 concrete on a 450mm diameter pile ($d_{nom} = 427.5\text{mm}$)

$$\frac{0.85 \times 28}{1.65} \times \pi \times 0.2138^2 = 2070\text{kN}$$

Maximum Combination 1 (STR) load case – **1549kN < 2070kN**

Pile concrete shall be grade C28/35, S4 slump class with a 20mm maximum aggregate size.

Concrete aggressivity assessment

The chemical testing results indicate a Design Sulphate class of DS-2 and an Aggressive Chemical Environment for Concrete class of AC-3z. Therefore, concrete Design Chemical Class DC-3z is recommended by BRE SD1 (2005).

Lateral action resistance

The specified lateral loads will induce a bending moment and shear force in the pile. For this analysis, the piles are assumed to have a fixed-headed connection to the pile cap, meaning that restraint against rotation is provided by the pile cap/foundation element in which the piles are terminated.

Analysis of the lateral load effects has been carried out using a Broms analysis. The shear force, bending moment and lateral soil resistance is calculated at 100mm intervals along the pile length. This outputs the maximum shear and bending moment, and depth at which they reduce to approximately zero, which can then be used for the design of the pile reinforcement cage.

The Broms analysis is undertaken using SLS loads, resulting in an SLS output. A structural load factor of 1.5 is then applied to give the design load effects.

The simplified stratigraphy used in the Broms calculation assumes the Cut-Off Levels noted below, which is the worst case for each load case.

The Broms design cases are summarised below:

Platform Level (m OD)	Horizontal Shear (kN)	Pile Cut off Level (m OD)	Assumed head detail	Max. Induced Moment (kNm) Characteristic	Max. Induced Shear (kN) Characteristic	Depth at which moment & shear are negligible (m bcol)
95.70	Up to 25kN	95.225	Fixed	24.7	31.1	4.5
94.40	Up to 30kN	93.325	Fixed	25.2	48.6	3.6
95.70	Up to 50kN	95.060	Fixed	65.3	77.8	5.8
94.40	Up to 50kN	93.075	Fixed	46.2	64.8	4.0

Full analyses in appendices.

Pile reinforcement for lateral loads

The load effects from the Broms analyses detailed above are factored by a structural load safety factor of 1.5 to determine the design load effects, which are then used to calculate the pile reinforcement.

For the induced moments, an excel programme ShortcolEC2 for the design of reinforced concrete columns has been used to calculate the required area of steel reinforcement.

The pile shear reinforcement is calculated to EC2 using an in-house design sheet (appendices)

The length of steel required is equal to PPL - COL + the depth at which moment and shear are negligible.

Diameter (mm)	Applied Horizontal Shear (up to) (kN)	Design Bending Moment (kNm)	Design Shear (kN)	Min. Combination 1 (STR) axial Load (kN)	Max. Combination 1 (STR) axial Load (kN)	Longitudinal reinforcement	Helical reinforcement	Length of cage (from PPL) (m)
450	25	37.1	46.7	328	1443	6 B16	B8 @ 200mm	6.0
450	30	37.8	72.9	410	1499	6 B16	B8 @ 200mm	6.0
450	50	98.0	116.7	268	1548	8 B16	B8 @ 110mm	6.5
450	50	69.3	97.2	0*	1499	8 B16	B8 @ 110mm	6.5

*Tension load taken by central bar designed below

In accordance with ICE SPERW, minimum concrete cover to pile reinforcement is 75mm. The pile cage bars shall be Grade B500, ductility class B.

Pile reinforcement for tension loads

One case of net tension load has been considered:

Depth taken from CFA design sheet using the worst-case GEO load combination.

The area of steel required to resist the design tension load is calculated as:

$$A_s = \frac{E_{d \min, C1} \gamma_m}{f_y}$$

$E_{d \min, C1}$ = Combination 1 design tension action

$\gamma_m = 1.15$

$f_y = 500 \text{ N/mm}^2$ (DSI Prestressed Bar)

Combination 1 ULS Tension ($E_{d \min, C1}$) (kN)	Combination 2 ULS Tension ($E_{d \min, C2}$) (kN)	Diameter (mm)	$A_{s, \text{req.}}$ Tension Loads (mm^2)	Central Bar	$A_{s, \text{prov.}}$ (mm^2)	Depth of embedment required (from PPL) (m)
243	144	450	558.9	1 B32	804.2	9.5

Design notes and summary

1. Geotechnical design carried out to EC7 using the higher R4 partial factors and enhanced model factor on the basis that no pile load testing will be carried out. Pile lengths have been increased to give all piles are designed to have a minimum factor of safety of 1.5 when considering shaft resistance only and ignoring base resistance.
2. Integrity testing is required to 100% of piles.
3. Concrete identity cube testing is required at a rate of 4 cubes per day of concreting.
4. Piles design for an industry standard settlement of 10mm at working load.
5. An allowance has been made for negative pile shaft friction (NSF) in the made ground and peat when calculating the compressive pile length.
6. Piles will be installed to designed length or practical rig refusal, whichever occurs first.
7. No allowance is deemed necessary or allowed for heave.

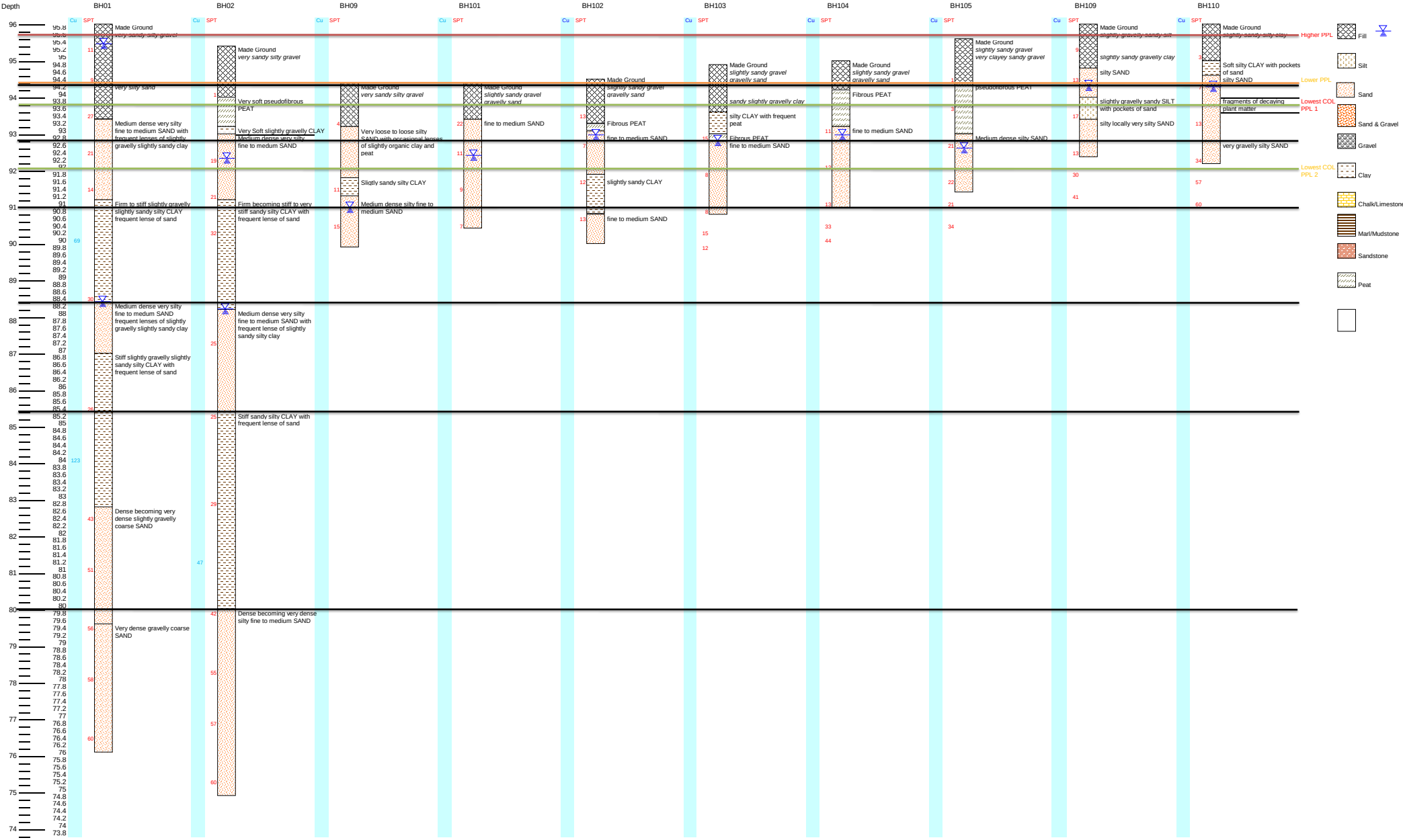
Appendices

Appendix A: Soil Profile and Plot

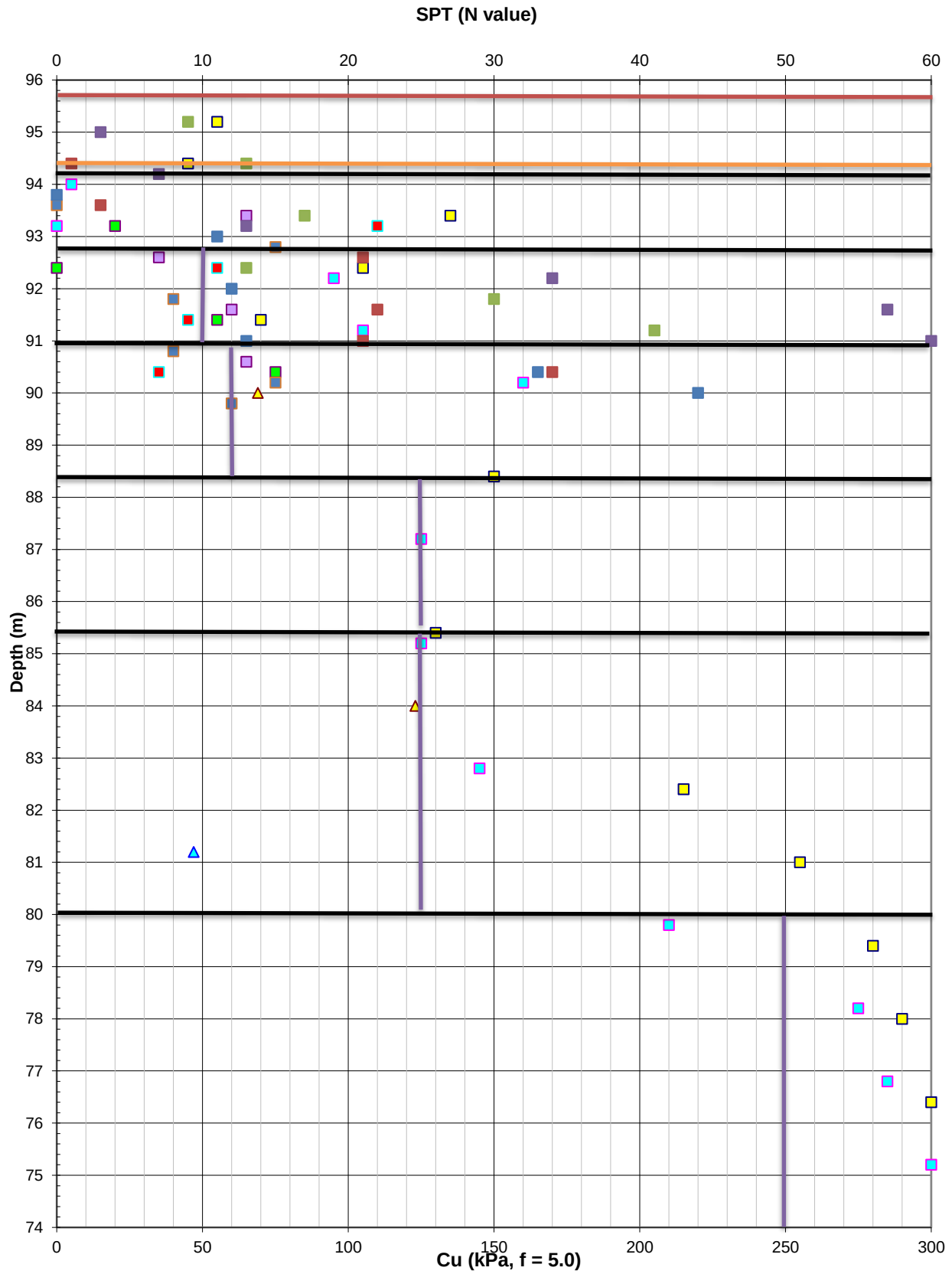
Project Title :	Fairfax Street, Prestwich - MSCP		
Job No :	15107	Date:	17/04/2025
Client :	VINCI Building	Calcs by :	DAM
SI Reference:	J23254	Page :	



Piled Foundations & Underpinning



SPT vs Depth Plot - Prestwich



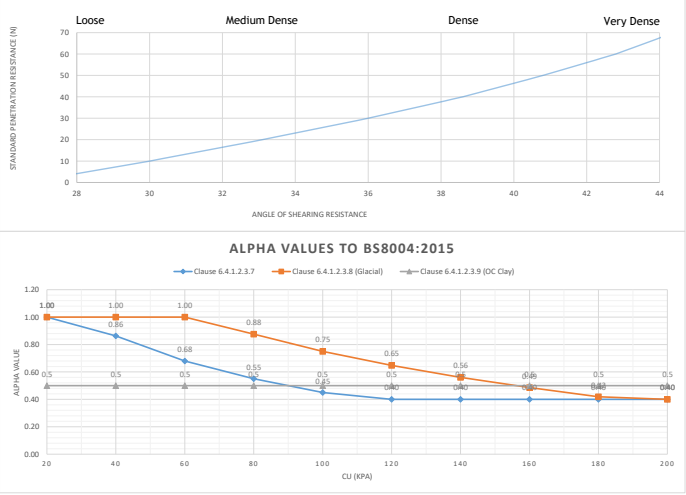
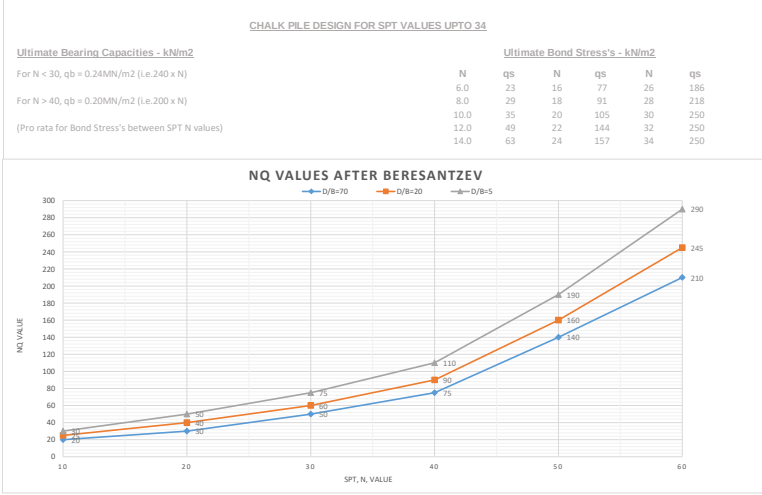
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BH109 SPT	BH110 SPT	SPT	SPT	SPT	SPT	SPT	SPT
BH01 Cu	BH02 Cu	BH09 Cu	BH101 Cu	BH102 Cu	BH103 Cu	BH104 Cu	BH105 Cu
BH109 Cu	BH110 Cu	Cu	Cu	Cu	Cu	Cu	Cu

Appendix B: CFA Design Sheets



Contract Name: Fairfax Street, Prestwich - PPL - 95.70m
Contract Ref: 15107
Engineer: DAM
Date: 17/04/2025
Revision: C01

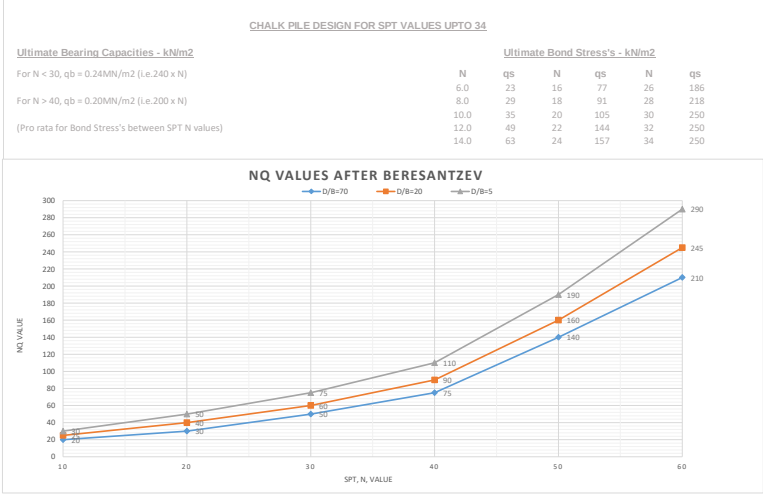
Depth	Reduced Level	Soil Description	Bulk Unit Weight γ kN/m³	Submerged Unit Weight γ' kN/m³	N.S.F Beta Value β	Cohesive soil input parameters		Granular soils input parameters					Chalk input parameters			Effective o'burden pressure kN/m²	Unit Skin Friction kN/m²	Unit Base Resistance kN/m²									Shaft only FOS = 1.50 kN
													sPT	PG6 Method q _s	PR 86 Method β												
								N Value	K _s	tan δ	D/B Ratio	N _q								Ult. Shaft kN	Ult. Base kN	Ult N.S.F. kN	DA1 C1 kN Comp.	DA1 C2 kN Comp.	DA1 C1 kN Tens.	DA1 C2 kN Tens.	
0.0	- 0.5	95.7 - 95.2	18		0.3											9	0	0	0	0	1	-1	-1	0	0	-1	
0.5	- 1.0	95.2 - 94.7		8	0.3											0.000	2										-4
1.0	- 1.5	94.7 - 94.2		5	0.3											0.000	3										-8
1.5	- 2.0	94.2 - 93.7		5	0.3											0.000	4										-12
2.0	- 2.5	93.7 - 93.2		5	0.3											0.000	6										-17
2.5	- 3.0	93.2 - 92.7		8				10	0.8	0.577	7					26	12	0	2	0	21	-14	-14	1	1	-20	
3.0	- 3.5	92.7 - 92.2		8				10	0.8	0.577	8					30	14	0	11	0	21	-7	-10	8	4	-13	
3.5	- 4.0	92.2 - 91.7		8				10	0.8	0.577	9					34	16	0	22	0	21	1	-5	15	8	-6	
4.0	- 4.5	91.7 - 91.2		8				10	0.8	0.577	10					38	18	0	34	0	21	9	0	24	12	2	
4.5	- 5.0	91.2 - 90.7		9		60.0	1.00									43	60	540	64	86	21	92	45	46	23	22	
5.0	- 5.5	90.7 - 90.2		9		60.0	1.00									47	60	540	107	86	21	123	63	76	38	50	
5.5	- 6.0	90.2 - 89.7		9		60.0	1.00									52	60	540	149	86	21	153	82	106	53	79	
6.0	- 6.5	89.7 - 89.2		9		60.0	1.00									56	60	540	191	86	21	183	101	137	68	107	
6.5	- 7.0	89.2 - 88.7		9		60.0	1.00									61	60	540	234	86	21	214	120	167	84	135	
7.0	- 7.5	88.7 - 88.2		10				25	0.8	0.688	17	50				65	36	3260	269	518	21	548	291	192	96	159	
7.5	- 8.0	88.2 - 87.7		10				25	0.8	0.688	18	50				70	39	3510	296	558	21	595	317	211	106	177	
8.0	- 8.5	87.7 - 87.2		10				25	0.8	0.688	19	50				75	41	3760	324	598	21	644	344	232	116	196	
8.5	- 9.0	87.2 - 86.7		10				25	0.8	0.688	20	50				80	44	4010	355	638	21	694	371	253	127	216	
9.0	- 9.5	86.7 - 86.2		10				25	0.8	0.688	21	50				85	47	4260	387	678	21	746	400	277	138	237	
9.5	- 10.0	86.2 - 85.7		10				25	0.8	0.688	22	50				90	50	4510	422	717	21	799	430	301	151	260	
10.0	- 10.5	85.7 - 85.2		11		125.0	0.62									95	78	1125	465	179	21	445	257	332	166	289	
10.5	- 11.0	85.2 - 84.7		11		125.0	0.62									101	78	1125	520	179	21	485	281	372	186	326	
11.0	- 11.5	84.7 - 84.2		11		125.0	0.62									106	78	1125	576	179	21	524	306	411	206	363	
11.5	- 12.0	84.2 - 83.7		11		125.0	0.62									112	78	1125	631	179	21	564	331	451	225	400	
12.0	- 12.5	83.7 - 83.2		11		125.0	0.62									117	78	1125	686	179	21	603	355	490	245	437	
12.5	- 13.0	83.2 - 82.7		11		125.0	0.62									123	78	1125	741	179	21	642	380	529	265	473	
13.0	- 13.5	82.7 - 82.2		11		125.0	0.62									128	78	1125	796	179	21	682	405	569	284	510	
13.5	- 14.0	82.2 - 81.7		11		125.0	0.62									134	78	1125	851	179	21	721	429	608	304	547	
14.0	- 14.5	81.7 - 81.2		11		125.0	0.62									139	78	1125	907	179	21	761	454	648	324	584	
14.5	- 15.0	81.2 - 80.7		11		125.0	0.62									145	78	1125	962	179	21	800	478	687	344	620	
15.0	- 15.5	80.7 - 80.2		11		125.0	0.62									150	78	1125	1017	179	21	839	503	726	363	657	
15.5	- 16.0	80.2 - 79.7		11				50	0.8	0.863	36					156	108	0	1084	0	21	760	469	775	387	702	
16.0	- 16.5	79.7 - 79.2		11				50	0.8	0.863	37					161	110	0	1162	0	21	815	504	830	415	754	
16.5	- 17.0	79.2 - 78.7		11				50	0.8	0.863	38	145				167	110	10000	1240	1590	21	2007	1107	885	443	806	
17.0	- 17.5	78.7 - 78.2		11				50	0.8	0.863	39	145				172	110	10000	1317	1590	21	2062	1141	941	470	857	
17.5	- 18.0	78.2 - 77.7		11				50	0.8	0.863	40	145				178	110	10000	1395	1590	21	2118	1176	996	498	909	
18.0	- 18.5	77.7 - 77.2		11				50	0.8	0.863	41	145				183	110	10000	1473	1590	21	2173	1211	1052	526	961	
18.5	- 19.0	77.2 - 76.7		11				50	0.8	0.863	42	145				189	110	10000	1551	1590	21	2229	1245	1108	554	1013	
19.0	- 19.5	76.7 - 76.2		11				50	0.8	0.863	43	145				194	110	10000	1628	1590	21	2284	1280	1163	582	1065	
19.5	- 20.0	76.2 - 75.7		11				50	0.8	0.863	44	145				200	110	10000	1706	1590	21	2340	1315	1219	609	1117	
20.0	- 20.5	75.7 - 75.2		11				50	0.8	0.863	46	145				205	110	10000	1784	1590	21	2395	1350	1274	637	1168	
20.5	- 21.0	75.2 - 74.7																									
21.0	- 21.5	74.7 - 74.2																									
21.5	- 22.0	74.2 - 73.7																									
22.0	- 22.5	73.7 - 73.2																									
22.5	- 23.0	73.2 - 72.7																									
23.0	- 23.5	72.7 - 72.2																									
23.5	- 24.0	72.2 - 71.7																									
24.0	- 24.5	71.7 - 71.2																									
24.5	- 25.0	71.2 - 70.7																									
25.0	- 25.5	70.7 - 70.2																									
25.5	- 26.0	70.2 - 69.7																									
26.0	- 26.5	69.7 - 69.2																									
26.5	- 27.0	69.2 - 68.7																									
27.0	- 27.5	68.7 - 68.2																									
27.5	- 28.0	68.2 - 67.7																									
28.0	- 28.5	67.7 - 67.2																									
28.5	- 29.0	67.2 - 66.7																									
29.0	- 29.5	66.7 - 66.2																									
29.5	- 30.0	66.2 - 65.7																									





Contract Name: **Fairfax Street, Prestwich - PPL - 94.400m**
Contract Ref: **15107**
Engineer: **DAM**
Date: **17/04/2025**
Revision: **C01**

Depth	Reduced Level	Soil Description	Bulk Unit Weight γ kN/m ³	Submerged Unit Weight γ' kN/m ³	N.S.F Beta Value β	Cohesive soil input parameters		Granular soils input parameters					Chalk input parameters			Effective o'burden pressure kN/m ²	Unit Skin Friction kN/m ²	Unit Base Resistance kN/m ²	DAI								Shaft only FOS = 1.50 kN	
						Cu kN/m ²	Alpha α	N Value	Ks	tan δ	D/B Ratio	Nq	sPT	PG6 Method q _s	PR 86 Method β				Ult. Shaft kN	Ult. Base kN	Ult N.S.F. kN	DA1 C1 kN Comp.	DA1 C2 kN Comp.	DA1 C1 kN Tens.	DA1 C2 kN Tens.			
0.0	- 0.5	94.4	- 93.9	PEAT	5	0.3					0.000	1				3	0	0	0	0	0	0	0	0	0	0	0	0
0.5	- 1.0	93.9	- 93.4	PEAT	5	0.3					0.000	2				5	0	0	0	0	1	-1	-1	0	0	0	0	-1
1.0	- 1.5	93.4	- 92.9	PEAT	5	0.3					0.000	3				8	0	0	0	0	3	-2	-2	0	0	0	0	-3
1.5	- 2.0	92.9	- 92.4	Loose Granular TILL	8				10	0.8	0.577	4				11	5	0	3	0	3	0	-1	2	1	1	1	-1
2.0	- 2.5	92.4	- 91.9	Loose Granular TILL	8				10	0.8	0.577	6				15	7	0	7	0	3	3	1	5	3	2		
2.5	- 3.0	91.9	- 91.4	Loose Granular TILL	8				10	0.8	0.577	7				19	9	0	13	0	3	7	4	9	5	6		
3.0	- 3.5	91.4	- 90.9	Firm Cohesive TILL	9		60.0	1.00			0.000	8				23	60	540	27	86	3	78	41	19	10	15		
3.5	- 4.0	90.9	- 90.4	Firm Cohesive TILL	9		60.0	1.00			0.000	9				28	60	540	69	86	3	109	60	49	25	43		
4.0	- 4.5	90.4	- 89.9	Firm Cohesive TILL	9		60.0	1.00			0.000	10				32	60	540	112	86	3	139	78	80	40	72		
4.5	- 5.0	89.9	- 89.4	Firm Cohesive TILL	9		60.0	1.00			0.000	11				37	60	540	154	86	3	169	97	110	55	100		
5.0	- 5.5	89.4	- 88.9	Firm Cohesive TILL	9		60.0	1.00			0.000	12				41	60	540	196	86	3	200	116	140	70	128		
5.5	- 6.0	88.9	- 88.4	Firm Cohesive TILL	9		60.0	1.00			0.000	13				46	60	540	239	86	3	230	135	171	85	156		
6.0	- 6.5	88.4	- 87.9	Medium Dense Granular TILL	10				25	0.8	0.688	14	50			51	28	2540	258	404	3	471	257	184	92	169		
6.5	- 7.0	87.9	- 87.4	Medium Dense Granular TILL	10				25	0.8	0.688	16	50			56	31	2790	279	444	3	514	281	199	100	183		
7.0	- 7.5	87.4	- 86.9	Medium Dense Granular TILL	10				25	0.8	0.688	17	50			61	33	3040	302	483	3	559	305	216	108	198		
7.5	- 8.0	86.9	- 86.4	Medium Dense Granular TILL	10				25	0.8	0.688	18	50			66	36	3290	327	523	3	605	331	233	117	215		
8.0	- 8.5	86.4	- 85.9	Medium Dense Granular TILL	10				25	0.8	0.688	19	50			71	39	3540	353	563	3	652	357	252	126	233		
8.5	- 9.0	85.9	- 85.4	Medium Dense Granular TILL	10				25	0.8	0.688	20	50			76	42	3790	382	603	3	701	384	273	136	252		
9.0	- 9.5	85.4	- 84.9	Stiff Cohesive TILL	11		125.0	0.62			0.000	21				81	78	1125	437	179	3	438	257	312	156	289		
9.5	- 10.0	84.9	- 84.4	Stiff Cohesive TILL	11		125.0	0.62			0.000	22				87	78	1125	492	179	3	477	282	352	176	325		
10.0	- 10.5	84.4	- 83.9	Stiff Cohesive TILL	11		125.0	0.62			0.000	23				92	78	1125	548	179	3	517	306	391	196	362		
10.5	- 11.0	83.9	- 83.4	Stiff Cohesive TILL	11		125.0	0.62			0.000	24				98	78	1125	603	179	3	556	331	431	215	399		
11.0	- 11.5	83.4	- 82.9	Stiff Cohesive TILL	11		125.0	0.62			0.000	26				103	78	1125	658	179	3	596	356	470	235	436		
11.5	- 12.0	82.9	- 82.4	Stiff Cohesive TILL	11		125.0	0.62			0.000	27				109	78	1125	713	179	3	635	380	509	255	473		
12.0	- 12.5	82.4	- 81.9	Stiff Cohesive TILL	11		125.0	0.62			0.000	28				114	78	1125	768	179	3	675	405	549	274	509		
12.5	- 13.0	81.9	- 81.4	Stiff Cohesive TILL	11		125.0	0.62			0.000	29				120	78	1125	823	179	3	714	429	588	294	546		
13.0	- 13.5	81.4	- 80.9	Stiff Cohesive TILL	11		125.0	0.62			0.000	30				125	78	1125	879	179	3	753	454	628	314	583		
13.5	- 14.0	80.9	- 80.4	Stiff Cohesive TILL	11		125.0	0.62			0.000	31				131	78	1125	934	179	3	793	479	667	334	620		
14.0	- 14.5	80.4	- 79.9	Very Dense Granular TILL	11				50	0.8	0.863	32				136	94	0	991	0	3	706	440	708	354	658		
14.5	- 15.0	79.9	- 79.4	Very Dense Granular TILL	11				50	0.8	0.863	33				142	98	0	1059	0	3	755	471	757	378	703		
15.0	- 15.5	79.4	- 78.9	Very Dense Granular TILL	11				50	0.8	0.863	34	145			147	100	10000	1130	1590	3	1941	1070	807	404	750		
15.5	- 16.0	78.9	- 78.4	Very Dense Granular TILL	11				50	0.8	0.863	36	145			153	105	10000	1202	1590	3	1993	1103	859	429	799		
16.0	- 16.5	78.4	- 77.9	Very Dense Granular TILL	11				50	0.8	0.863	37	145			158	109	10000	1279	1590	3	2047	1137	913	457	850		
16.5	- 17.0	77.9	- 77.4	Very Dense Granular TILL	11				50	0.8	0.863	38	145			164	110	10000	1356	1590	3	2103	1171	969	484	901		
17.0	- 17.5	77.4	- 76.9	Very Dense Granular TILL	11				50	0.8	0.863	39	145			169	110	10000	1434	1590	3	2158	1206	1024	512	953		
17.5	- 18.0	76.9	- 76.4	Very Dense Granular TILL	11				50	0.8	0.863	40	145			175	110	10000	1512	1590	3	2214	1241	1080	540	1005		
18.0	- 18.5	76.4	- 75.9	Very Dense Granular TILL	11				50	0.8	0.863	41	145			180	110	10000	1590	1590	3	2269	1276	1135	568	1057		
18.5	- 19.0	75.9	- 75.4	Very Dense Granular TILL	11				50	0.8	0.863	42	145			186	110	10000	1667	1590	3	2325	1310	1191	596	1109		
19.0	- 19.5	75.4	- 74.9																									
19.5	- 20.0	74.9	- 74.4																									
20.0	- 20.5	74.4	- 73.9																									
20.5	- 21.0	73.9	- 73.4																									
21.0	- 21.5	73.4	- 72.9																									
21.5	- 22.0	72.9	- 72.4																									
22.0	- 22.5	72.4	- 71.9																									
22.5	- 23.0	71.9	- 71.4																									
23.0	- 23.5	71.4	- 70.9																									
23.5	- 24.0	70.9	- 70.4																									
24.0	- 24.5	70.4	- 69.9																									
24.5	- 25.0	69.9	- 69.4																									
25.0	- 25.5	69.4	- 68.9																									
25.5	- 26.0	68.9	- 68.4																									
26.0	- 26.5	68.4	- 67.9																									
26.5	- 27.0	67.9	- 67.4																									
27.0	- 27.5	67.4	- 66.9																									
27.5	- 28.0	66.9	- 66.4																									
28.0	- 28.5	66.4	- 65.9																									
28.5	- 29.0	65.9	- 65.4																									
29.0	- 29.5	65.4	- 64.9																									
29.5	- 30.0	64.9	- 64.4																									



Appendix C: Pile Schedule

EC7 Vertical Actions																																				
Reference		Pile Geometry			Permanent		Variable				Nett Tension						EC7 Horizontal Actions					Pile Design														
Pile Ref	Loading Ref	Cut-off Level (mOD)	Piling Platform Level (mOD)	Pile Diameter (mm)	G _{k,max} (kN)	G _{k,min} (kN)	Q _{k,i,max} (kN)	Q _{k,i,min} (kN)	Q _{k,wind,max} (kN)	Q _{k,wind,min} (kN)	T _k (kN)	DA1 Comb1 (ULS-STR) E _{d,max} (kN)	DA1 Comb1 (ULS-STR) E _{d,min} (kN)	DA1 Comb2 (ULS-GEO) E _{d,max} (kN)	DA1 Comb2 (ULS-GEO) E _{d,min} (kN)	G _k (kN)	Q _{k,i} (kN)	Q _{k,wind} (kN)	DA1 Comb1 (ULS-STR) E _{d,max} (kN)	DA1 Comb2 (ULS-GEO) E _{d,max} (kN)	Pile Toe Level (mOD)	Pile Length from PPL (m)	Min Steel Projection above COL (m)	Top of Steel Level (mOD)	No of Main Bars	Main Bar Diameter (mm)	Main Bar Length (m)	Shear Bar Diameter (mm)	Shear Pitch (mm)	Shear Type (Helical/Link)	No of Tension Bars	Tension Bar Diameter (mm)	Tension Bar Length (m)			
P01	17300-CIV-P1-XX-D-S-500001 Rev C01	95.060	95.700	450	685	685	110		0	0	0	1090	685	828	685		25		38	33	78.800	16.9	0.640	95.700	6	16	6.0	8	200	Helical						
P02	17300-CIV-P1-XX-D-S-500001 Rev C01	95.060	95.700	450	790	790	120		75	-140	0	1305	580	997	608		50		75	65	77.300	18.4	0.640	95.700	8	16	6.5	8	110	Helical						
P03	17300-CIV-P1-XX-D-S-500001 Rev C01	95.060	95.700	450	745	745	215		170	-175	0	1487	483	1162	518		50		75	65	76.100	19.6	0.640	95.700	8	16	6.5	8	110	Helical						
P04	17300-CIV-P1-XX-D-S-500001 Rev C01	95.060	95.700	450	825	825	130		110	-120	0	1416	645	1087	669		50		75	65	76.500	19.2	0.640	95.700	8	16	6.5	8	110	Helical						
P05	17300-CIV-P1-XX-D-S-500001 Rev C01	95.060	95.700	450	710	710	240		225	-295	0	1548	268	1221	327		50		75	65	75.800	19.9	0.640	95.700	8	16	6.5	8	110	Helical						
P06	17300-CIV-P1-XX-D-S-500001 Rev C01	95.060	95.700	450	835	835	165		90	-200	0	1443	535	1108	575		25		38	33	76.300	19.4	0.640	95.700	6	16	6.0	8	200	Helical						
P07	17300-CIV-P1-XX-D-S-500001 Rev C01	95.050	95.700	450	740	740	240		0	0	0	1359	740	1052	740		0		0	0	77.000	18.7	0.650	95.700	6	16	4.5	8	200	Helical						
P08	17300-CIV-P1-XX-D-S-500001 Rev C01	95.050	95.700	450	740	740	240		0	0	0	1359	740	1052	740		0		0	0	77.000	18.7	0.650	95.700	6	16	4.5	8	200	Helical						
P09	17300-CIV-P1-XX-D-S-500001 Rev C01	95.050	95.700	450	720	720	245		0	0	0	1340	720	1039	720		0		0	0	77.100	18.6	0.650	95.700	6	16	4.5	8	200	Helical						
P10	17300-CIV-P1-XX-D-S-500001 Rev C01	95.050	95.700	450	720	720	245		0	0	0	1340	720	1039	720		0		0	0	77.100	18.6	0.650	95.700	6	16	4.5	8	200	Helical						
P11	17300-CIV-P1-XX-D-S-500001 Rev C01	95.050	95.700	450	715	715	200		0	0	0	1266	715	975	715		0		0	0	77.600	18.1	0.650	95.700	6	16	4.5	8	200	Helical						
P12	17300-CIV-P1-XX-D-S-500001 Rev C01	95.050	95.700	450	715	715	200		0	0	0	1266	715	975	715		0		0	0	77.600	18.1	0.650	95.700	6	16	4.5	8	200	Helical						
P13	17300-CIV-P1-XX-D-S-500001 Rev C01	95.225	95.700	450	350	350	50		20	-15	0	563	328	428	331		25		38	33	81.700	14.0	0.475	95.700	6	16	6.0	8	200	Helical						
P14	17300-CIV-P1-XX-D-S-500001 Rev C01	94.825	95.700	450	590	590	220		0	0	0	1127	590	876	590		0		0	0	78.600	17.1	0.875	95.700	6	16	4.5	8	200	Helical						
P15	17300-CIV-P1-XX-D-S-500001 Rev C01	94.825	95.700	450	590	590	220		0	0	0	1127	590	876	590		0		0	0	78.600	17.1	0.875	95.700	6	16	4.5	8	200	Helical						
P16	17300-CIV-P1-XX-D-S-500001 Rev C01	94.825	95.700	450	575	575	230		0	0	0	1122	575	874	575		0		0	0	78.700	17.0	0.875	95.700	6	16	4.5	8	200	Helical						
P17	17300-CIV-P1-XX-D-S-500001 Rev C01	94.825	95.700	450	575	575	230		0	0	0	1122	575	874	575		0		0	0	78.700	17.0	0.875	95.700	6	16	4.5	8	200	Helical						
P18	17300-CIV-P1-XX-D-S-500001 Rev C01	94.825	95.700	450	575	575	230		0	0	0	1122	575	874	575		0		0	0	78.700	17.0	0.875	95.700	6	16	4.5	8	200	Helical						
P19	17300-CIV-P1-XX-D-S-500001 Rev C01	95.075	95.700	450	225	225	65		0	0	0	402	225	310	225		0		0	0	84.100	11.6	0.625	95.700	6	16	4.5	8	200	Helical						
P20	17300-CIV-P1-XX-D-S-500001 Rev C01	94.650	95.700	450	630	630	195		10	-10	0	1151	615	890	617		25		38	33	78.400	17.3	1.050	95.700	6	16	6.0	8	200	Helical						
P21	17300-CIV-P1-XX-D-S-500001 Rev C01	94.650	95.700	450	630	630	195		10	-10	0	1151	615	890	617		25		38	33	78.400	17.3	1.050	95.700	6	16	6.0	8	200	Helical						
P22	17300-CIV-P1-XX-D-S-500001 Rev C01	94.325	95.700	450	575	575	220		0	0	0	1107	575	861	575		0		0	0	78.800	16.9	1.375	95.700	6	16	4.5	8	200	Helical						
P23	17300-CIV-P1-XX-D-S-500001 Rev C01	94.325	95.700	450	575	575	220		0	0	0	1107	575	861	575		0		0	0	78.800	16.9	1.375	95.700	6	16	4.5	8	200	Helical						
P24	17300-CIV-P1-XX-D-S-500001 Rev C01	94.325	95.700	450	775	775	335		0	0	0	1549	775	1211	775		0		0	0	75.700	20.0	1.375	95.700	6	16	4.5	8	200	Helical						
P25	17300-CIV-P1-XX-D-S-500001 Rev C01	94.325	95.700	450	775	775	335		0	0	0	1549	775	1211	775		0		0	0	75.700	20.0	1.375	95.700	6	16	4.5	8	200	Helical						
P26	17300-CIV-P1-XX-D-S-500001 Rev C01	94.575	95.700	450	645	645	230		0	0	0	1216	645	944	645		0		0	0	78.000	17.7	1.125	95.700	6	16	4.5	8	200	Helical						

Reference		Pile Geometry			Permanent		Variable				Nett Tension					EC7 Horizontal Actions					Pile Design													
Pile Ref	Loading Ref	Cut-off Level (mOD)	Piling Platform Level (mOD)	Pile Diameter (mm)	G _{k,max} (kN)	G _{k,min} (kN)	Q _{k,l,max} (kN)	Q _{k,l,min} (kN)	Q _{k,wind,max} (kN)	Q _{k,wind,min} (kN)	T _k (kN)	DA1 Comb1 (ULS-STR) E _{d,max} (kN)	DA1 Comb1 (ULS-STR) E _{d,min} (kN)	DA1 Comb2 (ULS-GEO) E _{d,max} (kN)	DA1 Comb2 (ULS-GEO) E _{d,min} (kN)	G _k (kN)	Q _{k,l} (kN)	Q _{k,wind} (kN)	DA1 Comb1 (ULS-STR) E _{d,max} (kN)	DA1 Comb2 (ULS-GEO) E _{d,max} (kN)	Pile Toe Level (mOD)	Pile Length from PPL (m)	Min Steel Projection above COL (m)	Top of Steel Level (mOD)	No of Main Bars	Main Bar Diameter (mm)	Main Bar Length (m)	Shear Bar Diameter (mm)	Shear Pitch (mm)	Shear Type (Helical/Link)	No of Tension Bars	Tension Bar Diameter (mm)	Tension Bar Length (m)	
P57	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	575	575	220		0	0	0	1107	575	861	575		0		0	0	78.400	16.0	1.575	94.400	6	16	5.0	8	200	Helical				
P58	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	575	575	220		0	0	0	1107	575	861	575		0		0	0	78.400	16.0	1.575	94.400	6	16	5.0	8	200	Helical				
P59	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	805	805	290		0	0	0	1522	805	1182	805		0		0	0	75.500	18.9	1.575	94.400	6	16	5.0	8	200	Helical				
P60	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	805	805	290		0	0	0	1522	805	1182	805		0		0	0	75.500	18.9	1.575	94.400	6	16	5.0	8	200	Helical				
P61	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	770	770	185		0	0	0	1317	770	1011	770		0		0	0	76.800	17.6	1.575	94.400	6	16	5.0	8	200	Helical				
P62	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	770	770	185		0	0	0	1317	770	1011	770		0		0	0	76.800	17.6	1.575	94.400	6	16	5.0	8	200	Helical				
P63	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	575	575	220		0	0	0	1107	575	861	575		0		0	0	78.400	16.0	1.575	94.400	6	16	5.0	8	200	Helical				
P64	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	575	575	220		0	0	0	1107	575	861	575		0		0	0	78.400	16.0	1.575	94.400	6	16	5.0	8	200	Helical				
P65	17300-CIV-P1-XX-D-S-500001 Rev C01	92.050	94.400	450	610	610	210		0	0	0	1139	610	883	610		0		0	0	78.100	16.3	2.350	94.400	6	16	5.0	8	200	Helical				
P66	17300-CIV-P1-XX-D-S-500001 Rev C01	92.050	94.400	450	610	610	210		0	0	0	1139	610	883	610		0		0	0	78.100	16.3	2.350	94.400	6	16	5.0	8	200	Helical				
P67	17300-CIV-P1-XX-D-S-500001 Rev C01	92.050	94.400	450	610	610	210		0	0	0	1139	610	883	610		0		0	0	78.100	16.3	2.350	94.400	6	16	5.0	8	200	Helical				
P68	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	785	785	185		0	0	0	1338	785	1026	785		0		0	0	76.700	17.7	1.575	94.400	6	16	5.0	8	200	Helical				
P69	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	785	785	185		0	0	0	1338	785	1026	785		0		0	0	76.700	17.7	1.575	94.400	6	16	5.0	8	200	Helical				
P70	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	610	610	220		0	0	0	1154	610	896	610		0		0	0	78.000	16.4	2.025	94.400	6	16	5.0	8	200	Helical				
P71	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	610	610	220		0	0	0	1154	610	896	610		0		0	0	78.000	16.4	2.025	94.400	6	16	5.0	8	200	Helical				
P72	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	795	795	290		0	0	0	1509	795	1172	795		0		0	0	75.600	18.8	2.025	94.400	6	16	5.0	8	200	Helical				
P73	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	795	795	290		0	0	0	1509	795	1172	795		0		0	0	75.600	18.8	2.025	94.400	6	16	5.0	8	200	Helical				
P74	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	675	675	165		0	0	0	1159	675	890	675		0		0	0	77.900	16.5	2.025	94.400	6	16	5.0	8	200	Helical				
P75	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	675	675	165		0	0	0	1159	675	890	675		0		0	0	77.900	16.5	2.025	94.400	6	16	5.0	8	200	Helical				
P76	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	735	735	285		0	0	0	1420	735	1106	735		0		0	0	76.200	18.2	1.575	94.400	6	16	5.0	8	200	Helical				
P77	17300-CIV-P1-XX-D-S-500001 Rev C01	92.825	94.400	450	735	735	285		0	0	0	1420	735	1106	735		0		0	0	76.200	18.2	1.575	94.400	6	16	5.0	8	200	Helical				
P78	17300-CIV-P1-XX-D-S-500001 Rev C01	93.075	94.400	450	780	780	275		10	-10	0	1473	765	1144	767		25		38	33	75.800	18.6	1.325	94.400	6	16	6.0	8	200	Helical				
P79	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	585	585	80		275	-230	0	1287	240	1016	286		50		75	65	77.200	17.2	2.025	94.400	8	16	6.5	8	110	Helical				
P80	17300-CIV-P1-XX-D-S-500001 Rev C01	93.075	94.400	450	690	690	190		245	-145	0	1499	473	1182	502		50		75	65	75.700	18.7	1.325	94.400	8	16	6.5	8	110	Helical				
P81	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	635	635	70		140	-360	0	1141	95	881	167		50		75	65	78.100	16.3	2.025	94.400	8	16	6.5	8	110	Helical				
P82	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	735	735	275		125	-5	0	1499	728	1174	729		30		45	39	75.700	18.7	2.025	94.400	6	16	6.0	8	200	Helical				
P83	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	525	525	140		340	-300	0	1366	75	1095	135		50		75	65	76.800	17.6	2.025	94.400	8	16	6.5	8	110	Helical				
P84	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	735	735	275		125	-5	0	1499	728	1174	729		30		45	39	75.700	18.7	2.025	94.400	6	16	6.0	8	200	Helical				
P85	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	500	500	50		255	-495	0	1110	-243	877	-144		50		75	65	78.400	16.0	2.025	94.400	8	16	6.5	8	110	Helical	1	32	9.5	
P86	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	650	650	165		155	-185	0	1284	373	1002	410		50		75	65	77.200	17.2	2.025	94.400	8	16	6.5	8	110	Helical				
P87	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	520	520	135		0	0	0	905	520	696	520		25		38	33	78.900	15.5	2.025	94.400	6	16	6.0	8	200	Helical				
P87A	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	520	520	135		0	0	0	905	520	696	520		25		38	33	78.900	15.5	2.025	94.400	6	16	6.0	8	200	Helical				
P88	17300-CIV-P1-XX-D-S-500001 Rev C01	92.625	94.400	450	410	410	90		0	0	0	689	410	527	410		25		38	33	78.900	15.5	1.775	94.400	6	16	6.0	8	200	Helical				
P89	17300-CIV-P1-XX-D-S-500001 Rev C01	92.375	94.400	450	775	775	130		155	-295	0	1416	333	1095	392		50		75	65	76.200	18.2	2.025	94.400	8	16	6.5	8	110	Helical				

Appendix D: Broms Analyses

Project : Fairfax Street, PrestwichProject No : 1510725kN LateralRevision : COL - 95.225m**BROMS ANALYSIS**Input by : DAMRevised By : Approved For
Construction : Date : 17-Apr-25Date : Date :

LAYER	LEVEL OF TOP OF STRATUM BELOW CUT-OFF (m)	SOIL DESCRIPTION	BULK UNIT WEIGHT (kN/m ³)	Cu (kN/m ²)	Phi (^o)
1	0.0	Made Ground	18		27
2	-0.8	PEAT	15	5	
3	-2.4	Loose TILL	18		30
4	-4.2	Firm TILL	19	60	

Water Level :- 0.0 mPile Size :- 450 mmUnfactored Lateral Load at Top :- 25 kNUnfactored Moment Applied to Top :- 0 kNm NOT CONSIDERED DUE TO FIXED HEAD CONDITIONSOverburden Pressure on Ground at Top of Pile Level :- 0.0 kN/m²F.O.S. on Lateral Pressure :- 3Summary

Level of max moment below cut off level. (m)	Level of bottom of reinforcement below cut off level. (m)	Maximum shear load in pile. (kN)	Unfactored max. moment in pile assuming <u>FIXED</u> head conditions. (kNm)
-2.9	-4.5	31.127	24.706

Level (m)	Factored Lateral Resisting Pressure (kN/m ²)	Shear in Pile (kN)	Moment in Pile (kNm)
0.0	0.000	25.000	-24.706
-0.1	2.182	24.951	-22.207
-0.2	4.364	24.804	-19.719
-0.3	6.545	24.558	-17.250
-0.4	8.727	24.215	-14.810
-0.5	10.909	23.773	-12.410
-0.6	13.091	23.233	-10.059
-0.7	15.273	22.595	-7.767
-0.8	10.247	22.020	-5.538
-0.9	11.111	21.540	-3.360
-1.0	11.975	21.020	-1.231
-1.1	12.840	20.462	0.843
-1.2	13.704	19.865	2.860
-1.3	14.568	19.229	4.815
-1.4	15.000	18.563	6.704
-1.5	15.000	17.888	8.527
-1.6	15.000	17.213	10.282
-1.7	15.000	16.538	11.970
-1.8	15.000	15.863	13.590
-1.9	15.000	15.188	15.142
-2.0	15.000	14.513	16.627
-2.1	15.000	13.838	18.045
-2.2	15.000	13.163	19.395
-2.3	15.000	12.488	20.678
-2.4	44.592	11.148	21.871
-2.5	47.050	9.086	22.883
-2.6	49.508	6.913	23.684
-2.7	51.966	4.630	24.262
-2.8	54.424	2.236	24.606
-2.9	56.882	0.000	24.706
-3.0	59.340	-2.615	24.576
-3.1	61.798	-5.341	24.179

Project : Fairfax Street, Prestwich

Project No : 15107

File : 25kN Lateral

Revision :

Based On : COL - 95.225m

BROMS ANALYSIS (CONTINUED)



Piled Foundations & Underpinning

-3.2	64.256	-8.177	23.504
-3.3	66.714	-11.124	22.540
-3.4	69.172	-14.181	21.276
-3.5	71.630	-17.349	19.700
-3.6	74.088	-20.628	17.802
-3.7	76.546	-24.017	15.571
-3.8	79.004	-27.517	12.995
-3.9	81.462	-31.127	10.064
-4.0	83.920	-27.406	7.136
-4.1	86.378	-23.574	4.586
-4.2	180.000	-17.581	2.493
-4.3	180.000	-9.481	1.140
-4.4	180.000	-1.381	0.597
-4.5	180.000	6.719	0.864

Project : Fairfax Street, PrestwichProject No : 1510750kN LateralRevision : COL - 95.060m**BROMS ANALYSIS**Input by : DAMRevised By : Approved For
Construction : Date : 17-Apr-25Date : Date :

LAYER	LEVEL OF TOP OF STRATUM BELOW CUT-OFF (m)	SOIL DESCRIPTION	BULK UNIT WEIGHT (kN/m ³)	Cu (kN/m ²)	Phi (^o)
1	0.0	Made Ground	18		27
2	-0.6	PEAT	15	5	
3	-2.2	Loose TILL	18		30
4	-4.0	Firm TILL	19	60	

Water Level :- 0.0 mPile Size :- 450 mmUnfactored Lateral Load at Top :- 50 kNUnfactored Moment Applied to Top :- 0 kNm NOT CONSIDERED DUE TO FIXED HEAD CONDITIONSOverburden Pressure on Ground at Top of Pile Level :- 0.0 kN/m²F.O.S. on Lateral Pressure :- 3Summary

Level of max moment below cut off level. (m)	Level of bottom of reinforcement below cut off level. (m)	Maximum shear load in pile. (kN)	Unfactored max. moment in pile assuming FIXED head conditions. (kNm)
-3.7	-5.8	77.793	65.310

Level (m)	Factored Lateral Resisting Pressure (kN/m ²)	Shear in Pile (kN)	Moment in Pile (kNm)
0.0	0.000	50.000	-65.310
-0.1	2.182	49.951	-60.312
-0.2	4.364	49.804	-55.323
-0.3	6.545	49.558	-50.354
-0.4	8.727	49.215	-45.415
-0.5	10.909	48.773	-40.515
-0.6	8.519	48.336	-35.660
-0.7	9.383	47.933	-30.846
-0.8	10.247	47.491	-26.075
-0.9	11.111	47.011	-21.349
-1.0	11.975	46.491	-16.674
-1.1	12.840	45.933	-12.052
-1.2	13.704	45.336	-7.489
-1.3	14.568	44.699	-2.987
-1.4	15.000	44.034	1.450
-1.5	15.000	43.359	5.820
-1.6	15.000	42.684	10.122
-1.7	15.000	42.009	14.357
-1.8	15.000	41.334	18.524
-1.9	15.000	40.659	22.624
-2.0	15.000	39.984	26.656
-2.1	15.000	39.309	30.620
-2.2	39.676	38.079	34.499
-2.3	42.134	36.238	38.216
-2.4	44.592	34.287	41.743
-2.5	47.050	32.225	45.070
-2.6	49.508	30.052	48.184
-2.7	51.966	27.769	51.076
-2.8	54.424	25.376	53.735
-2.9	56.882	22.871	56.148
-3.0	59.340	20.256	58.305
-3.1	61.798	17.531	60.195

Project : Fairfax Street, Prestwich

Project No : 15107

File : 50kN Lateral

Revision :

Based On : COL - 95.060m

BROMS ANALYSIS (CONTINUED)



Piled Foundations & Underpinning

-3.2	64.256	14.694	61.808
-3.3	66.714	11.748	63.131
-3.4	69.172	8.690	64.153
-3.5	71.630	5.522	64.865
-3.6	74.088	2.244	65.254
-3.7	76.546	0.000	65.310
-3.8	79.004	-3.500	65.136
-3.9	81.462	-7.110	64.606
-4.0	180.000	-12.993	63.638
-4.1	180.000	-21.093	61.934
-4.2	180.000	-29.193	59.419
-4.3	180.000	-37.293	56.095
-4.4	180.000	-45.393	51.961
-4.5	180.000	-53.493	47.017
-4.6	180.000	-61.593	41.262
-4.7	180.000	-69.693	34.698
-4.8	180.000	-77.793	27.324
-4.9	180.000	-69.693	19.949
-5.0	180.000	-61.593	13.385
-5.1	180.000	-53.493	7.631
-5.2	180.000	-45.393	2.686
-5.3	180.000	-37.293	-1.448
-5.4	180.000	-29.193	-4.772
-5.5	180.000	-21.093	-7.287
-5.6	180.000	-12.993	-8.991
-5.7	180.000	-4.893	-9.885
-5.8	180.000	3.207	-9.970

Project : Fairfax Street, PrestwichProject No : 1510730kN LateralRevision : COL - 93.325m**BROMS ANALYSIS**Input by : DAMRevised By : Approved For
Construction : Date : 22-Apr-25Date : Date :

LAYER	LEVEL OF TOP OF STRATUM BELOW CUT-OFF (m)	SOIL DESCRIPTION	BULK UNIT WEIGHT (kN/m ³)	Cu (kN/m ²)	Phi (^o)
1	0.0	PEAT	15	5	30
2	-0.6	Loose TILL	18		
3	-2.4	Firm TILL	19	60	
4					

Water Level :- 0.0 m
Pile Size :- 450 mm
Unfactored Lateral Load at Top :- 30 kN
Unfactored Moment Applied to Top :- 0 kNm NOT CONSIDERED DUE TO FIXED HEAD CONDITIONS
Overburden Pressure on Ground at Top of Pile Level :- 0.0 kN/m²
F.O.S. on Lateral Pressure :- 3

Summary

Level of max moment below cut off level. (m)	Level of bottom of reinforcement below cut off level. (m)	Maximum shear load in pile. (kN)	Unfactored max. moment in pile assuming FIXED head conditions. (kNm)
-2.4	-3.6	48.600	25.161

Level (m)	Factored Lateral Resisting Pressure (kN/m ²)	Shear in Pile (kN)	Moment in Pile (kNm)
0.0	3.333	30.000	-25.161
-0.1	4.198	29.831	-22.169
-0.2	5.062	29.622	-19.196
-0.3	5.926	29.375	-16.246
-0.4	6.790	29.089	-13.323
-0.5	7.654	28.764	-10.430
-0.6	10.248	28.361	-7.573
-0.7	12.706	27.845	-4.761
-0.8	15.164	27.218	-2.007
-0.9	17.622	26.480	0.678
-1.0	20.080	25.632	3.285
-1.1	22.538	24.673	5.801
-1.2	24.996	23.603	8.216
-1.3	27.454	22.423	10.518
-1.4	29.912	21.132	12.697
-1.5	32.370	19.731	14.741
-1.6	34.828	18.219	16.639
-1.7	37.286	16.596	18.381
-1.8	39.744	14.863	19.955
-1.9	42.202	13.020	21.350
-2.0	44.660	11.065	22.555
-2.1	47.118	9.000	23.559
-2.2	49.576	6.825	24.351
-2.3	52.034	4.538	24.920
-2.4	180.000	0.000	25.161
-2.5	180.000	-8.100	24.756
-2.6	180.000	-16.200	23.541
-2.7	180.000	-24.300	21.516
-2.8	180.000	-32.400	18.681
-2.9	180.000	-40.500	15.036
-3.0	180.000	-48.600	10.581
-3.1	180.000	-40.500	6.126

Project :

Fairfax Street, Prestwich

Project No :

15107

File :

30kN Lateral

Revision :

Based On :

COL - 93.325m

BROMS ANALYSIS (CONTINUED)



Cohesion Piling Company Ltd

Piled Foundations & Underpinning

-3.2	180.000	-32.400	2.481
-3.3	180.000	-24.300	-0.354
-3.4	180.000	-16.200	-2.379
-3.5	180.000	-8.100	-3.594
-3.6	180.000	0.000	-3.999

Project : Fairfax Street, PrestwichProject No : 1510750kN LateralRevision : COL - 93.075m**BROMS ANALYSIS**Input by : DAMRevised By : Approved For
Construction : Date : 22-Apr-25Date : Date :

LAYER	LEVEL OF TOP OF STRATUM BELOW CUT-OFF (m)	SOIL DESCRIPTION	BULK UNIT WEIGHT (kN/m ³)	Cu (kN/m ²)	Phi (^o)
1	0.0	PEAT	15	5	30
2	-0.3	Loose TILL	18		
3	-2.1	Firm TILL	19	60	
4					

Water Level :- 0.0 mPile Size :- 450 mmUnfactored Lateral Load at Top :- 50 kNUnfactored Moment Applied to Top :- 0 kNm NOT CONSIDERED DUE TO FIXED HEAD CONDITIONSOverburden Pressure on Ground at Top of Pile Level :- 0.0 kN/m²F.O.S. on Lateral Pressure :- 3Summary

Level of max moment below cut off level. (m)	Level of bottom of reinforcement below cut off level. (m)	Maximum shear load in pile. (kN)	Unfactored max. moment in pile assuming <u>FIXED</u> head conditions. (kNm)
---	--	---	--

-2.4	-4.0	64.800	46.227
------	------	--------	--------

Level (m)	Factored Lateral Resisting Pressure (kN/m ²)	Shear in Pile (kN)	Moment in Pile (kNm)
0.0	3.333	50.000	-46.227
-0.1	4.198	49.831	-41.235
-0.2	5.062	49.622	-36.262
-0.3	5.574	49.383	-31.311
-0.4	8.032	49.077	-26.387
-0.5	10.490	48.660	-21.500
-0.6	12.948	48.133	-16.659
-0.7	15.406	47.495	-11.877
-0.8	17.864	46.746	-7.164
-0.9	20.322	45.887	-2.531
-1.0	22.780	44.917	2.010
-1.1	25.238	43.837	6.448
-1.2	27.696	42.646	10.774
-1.3	30.154	41.344	14.974
-1.4	32.612	39.932	19.039
-1.5	35.070	38.409	22.957
-1.6	37.528	36.776	26.717
-1.7	39.986	35.032	30.308
-1.8	42.444	33.177	33.719
-1.9	44.902	31.212	36.940
-2.0	47.360	29.136	39.958
-2.1	180.000	24.020	42.666
-2.2	180.000	15.920	44.663
-2.3	180.000	7.820	45.850
-2.4	180.000	0.000	46.227
-2.5	180.000	-8.100	45.822
-2.6	180.000	-16.200	44.607
-2.7	180.000	-24.300	42.582
-2.8	180.000	-32.400	39.747
-2.9	180.000	-40.500	36.102
-3.0	180.000	-48.600	31.647
-3.1	180.000	-56.700	26.382

Project : Fairfax Street, Prestwich

Project No : 15107

File : 50kN Lateral

Revision :

Based On : COL - 93.075m

BROMS ANALYSIS (CONTINUED)



Piled Foundations & Underpinning

-3.2	180.000	-64.800	20.307
-3.3	180.000	-56.700	14.232
-3.4	180.000	-48.600	8.967
-3.5	180.000	-40.500	4.512
-3.6	180.000	-32.400	0.867
-3.7	180.000	-24.300	-1.968
-3.8	180.000	-16.200	-3.993
-3.9	180.000	-8.100	-5.208
-4.0	180.000	0.000	-5.613

Appendix E: Structural Calculations

COPCO	Project: Fairfax Street, Prestwich	Engineer: DAM
ShortColEC2 Copyright © 2007	Subject: 450mm diameter CFA pile with 6 B16 Cage	Date: 2-May-25
		Checker:
		Date:

Reinforced concrete column capacity for axial force and bending about Y-axis

Eurocode 2, EN 1992-1-1 (2004)

Materials:

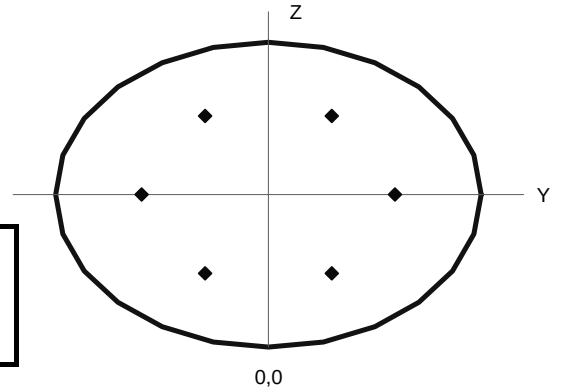
$f_{ck} =$	28 MPa	$E_{cm} =$	32.3 GPa
$f_{yk} =$	500 MPa	$E_s =$	200 GPa
$\gamma_c =$	1.65		
$\gamma_s =$	1.15		
$a_{cc} =$	0.85		

Section Properties:

Diameter = 450 mm

600

Concrete section	Transformed section
$A_c = 159043 \text{ mm}^2$	$A_T = 165302.7 \text{ mm}^2$
$I_c = 2E+09 \text{ mm}^4$	$I_T = 2.07E+09 \text{ mm}^4$
$Y_{bc} = 225 \text{ mm}$	$Y_{bT} = 225 \text{ mm}$

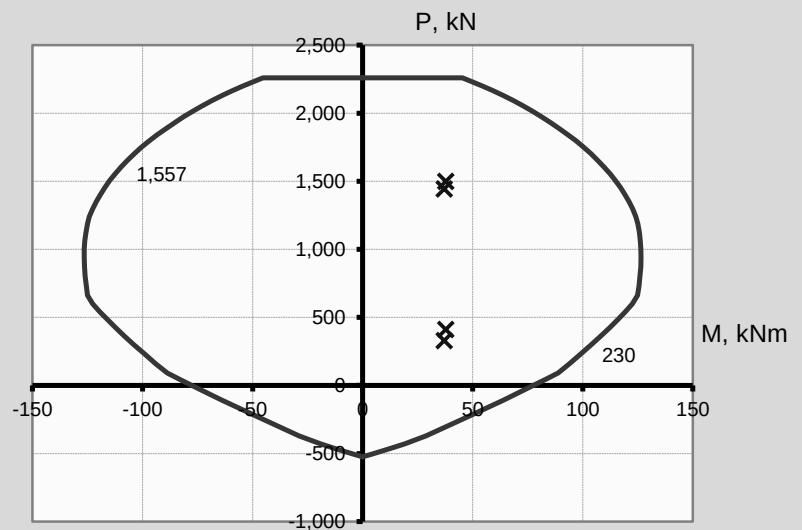


Reinforcing bars:

Bar Diameter =	16 mm
No. bars =	6 (< 300)
$\Sigma(A_s) =$	1206 mm ²
$\Sigma A_s/A_c =$	0.00758
Concrete cover =	75 mm
Spiral/Stirrup dia. =	8 mm

Reinforcing Bar No.	Area A_s mm ²	Coordinates, mm	
		Y (from ctr.)	Z (from bot.)
1	201	134.00	225.00
2	201	67.00	341.05
3	201	-67.00	341.05
4	201	-134.00	225.00
5	201	-67.00	108.95
6	201	67.00	108.95

Axial Force/Bending Moment Interaction Diagram Bending about horizontal axis



Positive moment corresponds to tension in bottom fibers of the section
Positive axial force is compressive force

Load Description	Factored Loads		Capacity	
	P_u kN	M_u kNm	M_{Rdy} kNm	M_u/M_{Rdy}
PPL 95.7m - 25kN Shear Max	1443	37.1	118	0.32
PPL 95.7m - 25kN Shear Min	328	37.1	106	0.35
PPL 94.4m - 30kN Shear Max	1499	37.8	115	0.33
PPL 94.4m - 30kN Shear Min	410	37.8	111	0.34

Project Title :		Fairfax Street, Prestwich - 25kN Shear PPL - 95.7m - Max	
Job No :		15107	Date: 22/04/2025
Client :		VINCI	Calcs by : DAM
		Checked :	



Cohesion Piling Company Ltd
Piled Foundations & Underpinning

EC2

Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ)

4.4.1.3(4)

Pile section

pile dia d_{nom}

=

450 mm

R

=

225 mm

Ac

=

159043 mm²

cover c_{nom}

=

75 mm

main bar dia

=

16 mm

no. main bars

=

6 no.

stirrup dia

=

8 mm

d

=

310 mm

f_{ck}

=

28 MPa

f_{yk}

=

500 MPa

V_{Ed}

=

46.7 kN

N_{Ed}

=

1443 kN

k_2

=

75 mm

As

=

1206.4 mm²

bw

=

236.97 mm

d= R(1+Sin α)

γ_c

=

1.65

α_{cc}

=

0.85 [NA.1 3.1.6 (1)]

γ_s

=

1.15

$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd}$

=

282.56 kN

OK

$v = 0.6 \cdot [1 - (f_{ck}/250)]$

=

0.5328

6.2.2

Check requirement for shear reinforcement

$V_{Rd,c}$

=

$[C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$

with minimum

=

$(v_{min} + k_1 \sigma_{cp}) b_w d$

v_{min}

=

$0.035 k^{3/2} f_{ck}^{1/2}$

0.44831

$V_{Rd,c}$

=

134 kN

Is $V_{Rd,c} > V_{Ed}$

=>

YES

Action: No shear links needed - provide nominal links as req'd

CRd,c

=

$0.18 / \gamma_s$

0.1091

k

=

$1 + (200/d)^{1/2}$

1.80 <=2.0

ρ_1

=

$A_s / b_w d$

0.0043 <=0.02

σ_{cp}

=

N_{ed} / A_c

3.3939 < 0.2 f_{cd}

k_1

=

0.15

[NA.1 6.2.2(1)]

6.2.3

Design Shear Reinforcement

Check concrete strut capacity at Cot $\theta = 2.5$:-
(Cot $\theta = 1.25$ if axial tension)

$V_{Rd,max}$

=

$\alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (Cot\theta + \tan\theta)$ (6.9)

$V_{Rd,max}$

=

142 kN

Is $V_{Rd,c} > V_{Ed}$

=>

NA

Action:

Calculation for strut inclination:-

θ

=

$0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$

θ

=

NA rad

cot θ

=

2.5

$\tan \theta$

=

0.4

α_{cw}

=

1

[NA.1 6.2.3(3)]

z

=

0.77d

238.94 mm

v_1

=

$0.6 (1 - (f_{ck}/250))$

0.5328 [6.6N]

cot $\theta = 2.5 > 1.0$

Calculate shear links spacing:-

$V_{Rd,s}$

=

$\lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} Cot\theta$

s

=

$\lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot Cot\theta / V_{Rd,s}$

=

NA mm

Check maximum shear link spacing:-

clause 9.5.3 is $s_{l,max} > 20\phi, d, 400$ YES

A_{sw}

=

100.53 mm²

f_{ywd}

=

435 MPa

λ_1

=

0.85

λ_2

=

0.9693

Provide 8 mm stirrups at nominal pitch 310 mm

Project Title :		Fairfax Street, Prestwich - 25kN Shear PPL - 95.7m - Min		 Filed Foundations & Underpinning	
Job No :		15107	Date:		22/04/2025
Client :		VINCI	Calcs by :		DAM
			Checked :		
EC2	Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ)				
4.4.1.3(4)	Pile section				
	pile dia d_{nom}	=	450 mm		
	R	=	225 mm		
	Ac	=	159043 mm ²		
	cover c_{nom}	=	75 mm	$k_2 = 75$ mm [NA.1 4.4.1.3 (4)]	
	main bar dia	=	16 mm	As = 1206.4 mm ²	
	no. main bars	=	6 no.		
	stirrup dia	=	8 mm	bw = 236.97 mm	
	d	=	310 mm	d= R(1+Sin α)	
	f_{ck}	=	28 MPa	$\gamma_c = 1.65$ $\alpha_{cc} = 0.85$ [NA.1 3.1.6 (1)]	
	f_{yk}	=	500 MPa	$\gamma_s = 1.15$	
	V_{Ed}	=	46.7 kN	$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd} = 282.56$ kN OK	
	N_{Ed}	=	328 kN	$v = 0.6 \cdot [1 - (f_{ck}/250)] = 0.5328$	
6.2.2	Check requirement for shear reinforcement				
6.2.3 (3) exp 6.9	$V_{Rd,c}$	=	$[C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$	$CR_{d,c} = 0.18 / \gamma_s = 0.1091$	
	with minimum	=	$(v_{min} + k_1 \sigma_{cp}) b_w d$	$k = 1 + (200/d)^{1/2} = 1.80 \leq 2.0$	
	v_{min}	=	$0.035 k^{3/2} f_{ck}^{1/2}$	$\rho_1 = A_s / b_w d = 0.0043 \leq 0.02$	
			0.44831	$\sigma_{cp} = N_{ed} / A_c = 2.0623 < 0.2 f_{cd}$	
	$V_{Rd,c}$	=	106 kN	$k_1 = 0.15$ [NA.1 6.2.2(1)]	
	Is $V_{Rd,c} > V_{Ed}$	=>	YES	Action: No shear links needed - provide nominal links as req'd	
	Design Shear Reinforcement				
	Check concrete strut capacity at Cot $\theta = 2.5$:- (Cot $\theta = 1.25$ if axial tension)			$\cot \theta = 2.5$ $\tan \theta = 0.4$	
	$V_{Rd,max}$	=	$\alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$ (6.9)	$\alpha_{cw} = 1$ [NA.1 6.2.3(3)]	
				$z = 0.77d = 238.94$ mm	
	$V_{Rd,max}$	=	142 kN	$v_1 = 0.6 (1 - (f_{ck}/250)) = 0.5328$ [6.6N]	
	Is $V_{Rd,c} > V_{Ed}$	=>	NA	Action:	
	Calculation for strut inclination:-				
θ	=	$0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$			
θ	=	NA rad	$\cot \theta = 2.5 > 1.0$		
Calculate shear links spacing:-					
$V_{Rd,s}$	=	$\lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$	$A_{sw} = 100.53$ mm ²		
s	=	$\lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$	$f_{ywd} = 435$ MPa		
	=	NA mm	$\lambda_1 = 0.85$		
Check maximum shear link spacing:-			$\lambda_2 = 0.9693$		
clause 9.5.3 is $s_{l,max}$	>	20 ϕ , d, 400	YES		
Provide 8 mm stirrups at nominal pitch 310 mm					

Project Title :		Fairfax Street, Prestwich - 30kN Shear PPL - 94.4m - Max	
Job No :		15107	Date: 02/05/2025
Client :		VINCI	Calcs by : DAM
		Checked :	



Cohesion Piling Company Ltd
Piled Foundations & Underpinning

EC2	Shear to EN 1992-1-1:2004 (EC2) <u>Circular Sections (Cast In-situ)</u> <u>Pile section</u> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">pile dia d_{nom} = 450 mm</td><td style="width: 50%;"></td></tr> <tr> <td>R = 225 mm</td><td></td></tr> <tr> <td>Ac = 159043 mm²</td><td></td></tr> <tr> <td>cover c_{nom} = 75 mm</td><td>k_2 = 75 mm [NA.1 4.4.1.3 (4)]</td></tr> <tr> <td>main bar dia = 16 mm</td><td>As = 1206.4 mm²</td></tr> <tr> <td>no. main bars = 6 no.</td><td></td></tr> <tr> <td>stirrup dia = 8 mm</td><td>bw = 236.97 mm</td></tr> <tr> <td>d = 310 mm</td><td>d= R(1+Sin α)</td></tr> <tr> <td>f_{ck} = 28 MPa</td><td>γ_c = 1.65 α_{cc} = 0.85 [NA.1 3.1.6 (1)]</td></tr> <tr> <td>f_{yk} = 500 MPa</td><td>γ_s = 1.15</td></tr> <tr> <td>V_{Ed} = 72.9 kN</td><td>$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd}$ = 282.56 kN OK</td></tr> <tr> <td>N_{Ed} = 1499 kN</td><td>$v = 0.6 \cdot [1 - (f_{ck}/250)]$ = 0.5328</td></tr> </table>	pile dia d_{nom} = 450 mm		R = 225 mm		Ac = 159043 mm ²		cover c_{nom} = 75 mm	k_2 = 75 mm [NA.1 4.4.1.3 (4)]	main bar dia = 16 mm	As = 1206.4 mm ²	no. main bars = 6 no.		stirrup dia = 8 mm	bw = 236.97 mm	d = 310 mm	d= R(1+Sin α)	f_{ck} = 28 MPa	γ_c = 1.65 α_{cc} = 0.85 [NA.1 3.1.6 (1)]	f_{yk} = 500 MPa	γ_s = 1.15	V_{Ed} = 72.9 kN	$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd}$ = 282.56 kN OK	N_{Ed} = 1499 kN	$v = 0.6 \cdot [1 - (f_{ck}/250)]$ = 0.5328
pile dia d_{nom} = 450 mm																									
R = 225 mm																									
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cover c_{nom} = 75 mm	k_2 = 75 mm [NA.1 4.4.1.3 (4)]																								
main bar dia = 16 mm	As = 1206.4 mm ²																								
no. main bars = 6 no.																									
stirrup dia = 8 mm	bw = 236.97 mm																								
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N_{Ed} = 1499 kN	$v = 0.6 \cdot [1 - (f_{ck}/250)]$ = 0.5328																								

4.4.1.3(4)	Check requirement for shear reinforcement <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> $V_{Rd,c} = [C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$ with minimum = $(v_{min} + k_1 \sigma_{cp}) b_w d$ </td><td style="width: 50%;"> $CR_{d,c} = 0.18 / \gamma_s$ 0.1091 $k = 1 + (200/d)^{1/2}$ 1.80 ≤ 2.0 $\rho_1 = A_s / b_w d$ 0.0043 ≤ 0.02 $\sigma_{cp} = N_{ed} / A_c$ 3.3939 $< 0.2 f_{cd}$ $k_1 = 0.15$ [NA.1 6.2.2(1)] </td></tr> </table> $V_{min} = 0.035 k^{3/2} f_{ck}^{1/2}$ 0.44831 $V_{Rd,c} = 134$ kN Is $V_{Rd,c} > V_{Ed}$ => YES Action: No shear links needed - provide nominal links as req'd	$V_{Rd,c} = [C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$ with minimum = $(v_{min} + k_1 \sigma_{cp}) b_w d$	$CR_{d,c} = 0.18 / \gamma_s$ 0.1091 $k = 1 + (200/d)^{1/2}$ 1.80 ≤ 2.0 $\rho_1 = A_s / b_w d$ 0.0043 ≤ 0.02 $\sigma_{cp} = N_{ed} / A_c$ 3.3939 $< 0.2 f_{cd}$ $k_1 = 0.15$ [NA.1 6.2.2(1)]
$V_{Rd,c} = [C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$ with minimum = $(v_{min} + k_1 \sigma_{cp}) b_w d$	$CR_{d,c} = 0.18 / \gamma_s$ 0.1091 $k = 1 + (200/d)^{1/2}$ 1.80 ≤ 2.0 $\rho_1 = A_s / b_w d$ 0.0043 ≤ 0.02 $\sigma_{cp} = N_{ed} / A_c$ 3.3939 $< 0.2 f_{cd}$ $k_1 = 0.15$ [NA.1 6.2.2(1)]		

6.2.2	Design Shear Reinforcement Check concrete strut capacity at $\cot \theta = 2.5$:- ($\cot \theta = 1.25$ if axial tension) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> $V_{Rd,max} = \alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$ (6.9) $V_{Rd,max} = 142$ kN </td><td style="width: 50%;"> $\cot \theta = 2.5$ $\tan \theta = 0.4$ $\alpha_{cw} = 1$ [NA.1 6.2.3(3)] $z = 0.77d$ 238.94 mm $v_1 = 0.6 (1 - (f_{ck}/250))$ 0.5328 [6.6N] </td></tr> </table> Is $V_{Rd,c} > V_{Ed}$ => NA Action: Calculation for strut inclination:- <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> $\theta = 0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$ $\theta = NA$ rad </td><td style="width: 50%;"> $\cot \theta = 2.5 > 1.0$ </td></tr> </table> Calculate shear links spacing:- <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> $V_{Rd,s} = \lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$ $s = \lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$ = NA mm </td><td style="width: 50%;"> $A_{sw} = 100.53$ mm² $f_{ywd} = 435$ MPa $\lambda_1 = 0.85$ $\lambda_2 = 0.9693$ </td></tr> </table> Check maximum shear link spacing:- clause 9.5.3 is $s_{l,max} > 20\phi, d, 400$ YES	$V_{Rd,max} = \alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$ (6.9) $V_{Rd,max} = 142$ kN	$\cot \theta = 2.5$ $\tan \theta = 0.4$ $\alpha_{cw} = 1$ [NA.1 6.2.3(3)] $z = 0.77d$ 238.94 mm $v_1 = 0.6 (1 - (f_{ck}/250))$ 0.5328 [6.6N]	$\theta = 0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$ $\theta = NA$ rad	$\cot \theta = 2.5 > 1.0$	$V_{Rd,s} = \lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$ $s = \lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$ = NA mm	$A_{sw} = 100.53$ mm ² $f_{ywd} = 435$ MPa $\lambda_1 = 0.85$ $\lambda_2 = 0.9693$
$V_{Rd,max} = \alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$ (6.9) $V_{Rd,max} = 142$ kN	$\cot \theta = 2.5$ $\tan \theta = 0.4$ $\alpha_{cw} = 1$ [NA.1 6.2.3(3)] $z = 0.77d$ 238.94 mm $v_1 = 0.6 (1 - (f_{ck}/250))$ 0.5328 [6.6N]						
$\theta = 0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$ $\theta = NA$ rad	$\cot \theta = 2.5 > 1.0$						
$V_{Rd,s} = \lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$ $s = \lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$ = NA mm	$A_{sw} = 100.53$ mm ² $f_{ywd} = 435$ MPa $\lambda_1 = 0.85$ $\lambda_2 = 0.9693$						

Provide	8 mm stirrups at nominal pitch	310 mm
---------	---------------------------------------	---------------

Project Title :		Fairfax Street, Prestwich - 30kN Shear PPL - 94.4m - Min	
Job No :	15107	Date:	22/04/2025
Client :	VINCI	Calcs by :	DAM
		Checked :	



Cohesion Piling Company Ltd
Piled Foundations & Underpinning

EC2

Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ)

4.4.1.3(4)

Pile section

pile dia d_{nom}

=

450 mm

R

=

225 mm

Ac

=

159043 mm²

cover c_{nom}

=

75 mm

main bar dia

=

16 mm

no. main bars

=

6 no.

stirrup dia

=

8 mm

d

=

310 mm

f_{ck}

=

28 MPa

f_{yk}

=

500 MPa

V_{Ed}

=

72.9 kN

N_{Ed}

=

410 kN

k_2

=

75 mm

As

=

1206.4 mm²

bw

=

236.97 mm

d= R(1+Sin α)

γ_c

=

1.65

α_{cc}

=

0.85 [NA.1 3.1.6 (1)]

γ_s

=

1.15

$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd}$

=

282.56 kN

$v = 0.6 \cdot [1 - (f_{ck}/250)]$

=

0.5328

OK

6.2.2

Check requirement for shear reinforcement

$V_{Rd,c}$

=

$[C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$

with minimum

=

$(v_{min} + k_1 \sigma_{cp}) b_w d$

v_{min}

=

$0.035 k^{3/2} f_{ck}^{1/2}$

0.44831

$CR_{d,c}$

=

$0.18 / \gamma_s$

0.1091

k

=

$1 + (200/d)^{1/2}$

1.80

ρ_1

=

$A_s / b_w d$

0.0043

σ_{cp}

=

N_{ed} / A_c

2.5779

k_1

=

0.15

[NA.1 6.2.2(1)]

$V_{Rd,c}$

=

117 kN

Is $V_{Rd,c} > V_{Ed}$

=>

YES

Action: No shear links needed - provide nominal links as req'd

6.2.3

Design Shear Reinforcement

Check concrete strut capacity at $\cot \theta = 2.5$:-
($\cot \theta = 1.25$ if axial tension)

$V_{Rd,max}$

=

$\alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$

(6.9)

α_{cw}

=

1

z

=

0.77d

238.94 mm

$V_{Rd,max}$

=

142 kN

v_1

=

$0.6 (1 - (f_{ck}/250))$

0.5328 [6.6N]

Is $V_{Rd,c} > V_{Ed}$

=>

NA

Action:

Calculation for strut inclination:-
 $\theta = 0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$
 $\theta =$ NA rad
 $\cot \theta = 2.5 > 1.0$

Calculate shear links spacing:-
 $V_{Rd,s} = \lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$
 $s = \lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$
 $s =$ NA mm
 $A_{sw} = 100.53$ mm²
 $f_{ywd} = 435$ MPa
 $\lambda_1 = 0.85$
 $\lambda_2 = 0.9693$

Check maximum shear link spacing:-
clause 9.5.3 is $s_{l,max} > 20\phi, d, 400$ YES

Provide

8 mm stirrups at nominal pitch

310 mm

COPCO	Project: Fairfax Street, Prestwich	Engineer: DAM
ShortColEC2 Copyright © 2007	Subject: 450mm diameter CFA pile with 8 B16 Cage	Date: 2-May-25
		Checker:
		Date:

Reinforced concrete column capacity for axial force and bending about Y-axis

Eurocode 2, EN 1992-1-1 (2004)

Materials:

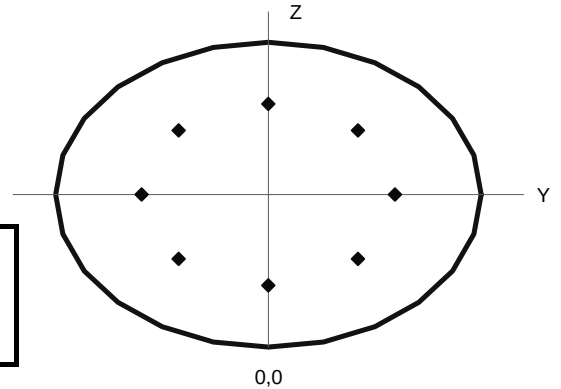
$f_{ck} =$	28 MPa	$E_{cm} =$	32.3 GPa
$f_{yk} =$	500 MPa	$E_s =$	200 GPa
$\gamma_c =$	1.65		
$\gamma_s =$	1.15		
$a_{cc} =$	0.85		

Section Properties:

Diameter = 450 mm

600

Concrete section	Transformed section
$A_c = 159043 \text{ mm}^2$	$A_T = 167389.2 \text{ mm}^2$
$I_c = 2E+09 \text{ mm}^4$	$I_T = 2.09E+09 \text{ mm}^4$
$Y_{bc} = 225 \text{ mm}$	$Y_{bT} = 225 \text{ mm}$

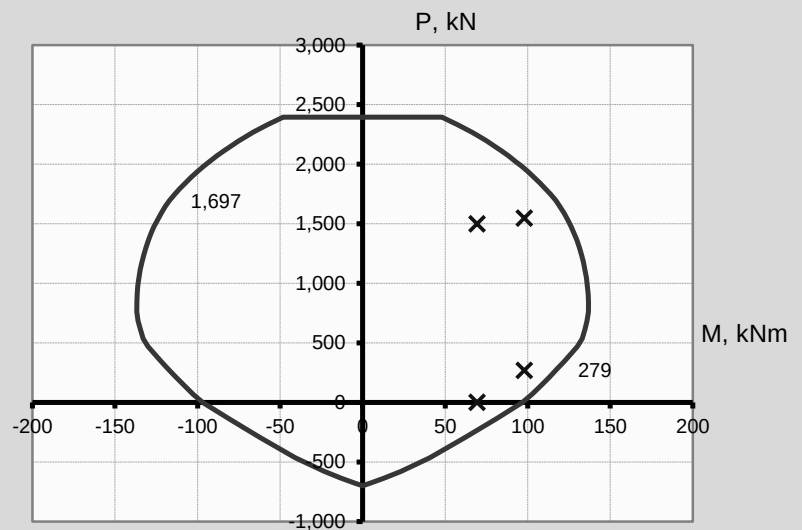


Reinforcing bars:

Bar Diameter =	16 mm
No. bars =	8 (< 300)
$\Sigma(A_s) =$	1608 mm ²
$\Sigma A_s/A_c =$	0.01011
Concrete cover =	75 mm
Spiral/Stirrup dia. =	8 mm

Reinforcing Bar No.	Area A_s mm ²	Coordinates, mm	
		Y (from ctr.)	Z (from bot.)
1	201	134.00	225.00
2	201	94.75	319.75
3	201	0.00	359.00
4	201	-94.75	319.75
5	201	-134.00	225.00
6	201	-94.75	130.25
7	201	0.00	91.00
8	201	94.75	130.25

Axial Force/Bending Moment Interaction Diagram Bending about horizontal axis



Positive moment corresponds to tension in bottom fibers of the section
Positive axial force is compressive force

Load Description	Factored Loads		Capacity	
	P_u kN	M_u kNm	M_{Rdy} kNm	M_u/M_{Rdy}
PPL 95.7m - 50kN Shear Max	1548	98	124	0.79
PPL 95.7m - 50kN Shear Min	268	98	117	0.84
PPL 94.4m - 50kN Shear Max	1499	69.3	126	0.55
PPL 94.4m - 50kN Shear Min	0	69.3	97	0.72

Project Title :		Fairfax Street, Prestwich - 50kN Shear PPL - 95.7m - Max	
Job No :		15107	Date: 02/05/2025
Client :		VINCI	Calcs by : DAM
		Checked :	



Cohesion Piling Company Ltd
Piled Foundations & Underpinning

EC2

Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ)

4.4.1.3(4)

Pile section

pile dia d_{nom}

=

450 mm

R

=

225 mm

Ac

=

159043 mm²

cover c_{nom}

=

75 mm

main bar dia

=

16 mm

no. main bars

=

8 no.

stirrup dia

=

8 mm

d

=

310 mm

f_{ck}

=

28 MPa

f_{yk}

=

500 MPa

V_{Ed}

=

116.7 kN

N_{Ed}

=

1499 kN

k_2

=

75 mm

As

=

1608.5 mm²

bw

=

236.97 mm

d= R(1+Sin α)

γ_c

=

1.65

α_{cc}

=

0.85 [NA.1 3.1.6 (1)]

γ_s

=

1.15

$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd}$

=

282.56 kN

OK

$v = 0.6 \cdot [1 - (f_{ck}/250)]$

=

0.5328

6.2.2

Check requirement for shear reinforcement

$V_{Rd,c}$

=

$[C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$

with minimum

=

$(v_{min} + k_1 \sigma_{cp}) b_w d$

v_{min}

=

$0.035 k^{3/2} f_{ck}^{1/2}$

0.44831

$V_{Rd,c}$

=

134 kN

$CR_{d,c}$

=

$0.18 / \gamma_s$

0.1091

k

=

$1 + (200/d)^{1/2}$

1.80

≤ 2.0

ρ_1

=

$A_{sl}/b_w d$

0.0058

≤ 0.02

σ_{cp}

=

N_{ed}/A_c

3.3939

$< 0.2 f_{cd}$

k_1

=

0.15

[NA.1 6.2.2(1)]

Is $V_{Rd,c} > V_{Ed}$

=>

YES

Action: No shear links needed - provide nominal links as req'd

6.2.3

Design Shear Reinforcement

Check concrete strut capacity at $\cot \theta = 2.5$:-
($\cot \theta = 1.25$ if axial tension)

$V_{Rd,max}$

=

$\alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$

(6.9)

$V_{Rd,max}$

=

142 kN

$\cot \theta$

=

2.5

$\tan \theta$

=

0.4

α_{cw}

=

1

[NA.1 6.2.3(3)]

z

=

0.77d

238.94 mm

v_1

=

$0.6 (1 - (f_{ck}/250))$

0.5328

[6.6N]

Is $V_{Rd,c} > V_{Ed}$

=>

NA

Action:

Calculation for strut inclination:-

θ

=

$0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$

θ

=

NA rad

$\cot \theta$

=

2.5

> 1.0

Calculate shear links spacing:-

$V_{Rd,s}$

=

$\lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$

s

=

$\lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$

NA mm

A_{sw}

=

100.53 mm²

f_{ywd}

=

435 MPa

λ_1

=

0.85

λ_2

=

0.9693

Check maximum shear link spacing:-

clause 9.5.3 is $s_{l,max} > 20\phi, d, 400$ YES

Provide

8 mm stirrups at nominal pitch

310 mm

Project Title :		Fairfax Street, Prestwich - 50kN Shear PPL - 95.7m - Min		 Cohesion Piling Company Ltd Piled Foundations & Underpinning		
Job No :		15107	Date:			02/05/2025
Client :		VINCI	Calcs by :			DAM
			Checked :			

EC2

4.4.1.3(4)

6.2.2

6.2.3

6.2.3 (3)
exp 6.9

Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ)

Pile section

pile dia d_{nom}

R

Ac

cover c_{nom}

main bar dia

no. main bars

stirrup dia

d

f_{ck}

f_{yk}

V_{Ed}

N_{Ed}

=

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Project Title :		Fairfax Street, Prestwich - 50kN Shear PPL - 94.4m - Max	
Job No :		15107	Date: 22/04/2025
Client :		VINCI	Calcs by : DAM
		Checked :	



Cohesion Piling Company Ltd
Piled Foundations & Underpinning

EC2

Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ)

4.4.1.3(4)

Pile section

pile dia d_{nom}

=

450 mm

R

=

225 mm

Ac

=

159043 mm²

cover c_{nom}

=

75 mm

main bar dia

=

16 mm

no. main bars

=

8 no.

stirrup dia

=

8 mm

d

=

310 mm

f_{ck}

=

28 MPa

f_{yk}

=

500 MPa

V_{Ed}

=

97.2 kN

N_{Ed}

=

1499 kN

k_2

=

75 mm

As

=

1608.5 mm²

bw

=

236.97 mm

d= R(1+Sin α)

γ_c

=

1.65

α_{cc}

=

0.85 [NA.1 3.1.6 (1)]

γ_s

=

1.15

$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd}$

=

282.56 kN

OK

$v = 0.6 \cdot [1 - (f_{ck}/250)]$

=

0.5328

6.2.2

Check requirement for shear reinforcement

$V_{Rd,c}$

=

$[C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$

with minimum

=

$(v_{min} + k_1 \sigma_{cp}) b_w d$

v_{min}

=

$0.035 k^{3/2} f_{ck}^{1/2}$

0.44831

$CR_{d,c}$

=

$0.18 / \gamma_s$

0.1091

k

=

$1 + (200/d)^{1/2}$

1.80

≤ 2.0

ρ_1

=

$A_s / b_w d$

0.0058

≤ 0.02

σ_{cp}

=

N_{ed} / A_c

3.3939

$< 0.2 f_{cd}$

k_1

=

0.15

[NA.1 6.2.2(1)]

$V_{Rd,c}$

=

134 kN

Is $V_{Rd,c} > V_{Ed}$

=>

YES

Action: No shear links needed - provide nominal links as req'd

6.2.3

Design Shear Reinforcement

Check concrete strut capacity at $\cot \theta = 2.5$:-
($\cot \theta = 1.25$ if axial tension)

$V_{Rd,max}$

=

$\alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$

(6.9)

α_{cw}

=

1

[NA.1 6.2.3(3)]

z

=

0.77d

238.94 mm

$V_{Rd,max}$

=

142 kN

v_1

=

$0.6 (1 - (f_{ck}/250))$

0.5328

[6.6N]

Is $V_{Rd,c} > V_{Ed}$

=>

NA

Action:

Calculation for strut inclination:-
 $\theta = 0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$
 $\theta =$ NA rad
 $\cot \theta = 2.5 > 1.0$

Calculate shear links spacing:-
 $V_{Rd,s} = \lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$
s = $\lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$
= NA mm
Check maximum shear link spacing:-
clause 9.5.3 is $s_{l,max} > 20\phi, d, 400$ YES

A_{sw}

=

100.53 mm²

f_{ywd}

=

435 MPa

λ_1

=

0.85

λ_2

=

0.9693

6.2.3 (3)

exp 6.9

Provide

8 mm stirrups at nominal pitch

310 mm

Project Title :		Fairfax Street, Prestwich - 50kN Shear PPL - 94.4m - Min	
Job No :	15107	Date:	02/05/2025
Client :	VINCI	Calcs by :	DAM
		Checked :	



Cohesion Piling Company Ltd
Piled Foundations & Underpinning

EC2

Shear to EN 1992-1-1:2004 (EC2) Circular Sections (Cast In-situ)

4.4.1.3(4)

Pile section

pile dia d_{nom}

=

450 mm

R

=

225 mm

Ac

=

159043 mm²

cover c_{nom}

=

75 mm

main bar dia

=

16 mm

no. main bars

=

8 no.

stirrup dia

=

8 mm

d

=

310 mm

f_{ck}

=

28 MPa

f_{yk}

=

500 MPa

V_{Ed}

=

97.2 kN

N_{Ed}

=

-243 kN

k_2

=

75 mm

As

=

1608.5 mm²

bw

=

236.97 mm

d= R(1+Sin α)

γ_c

=

1.65

α_{cc}

=

0.85 [NA.1 3.1.6 (1)]

γ_s

=

1.15

$V_{ed} \leq 0.5 \cdot b_w \cdot d \cdot v \cdot f_{cd}$

=

282.56 kN

OK

$v = 0.6 \cdot [1 - (f_{ck}/250)]$

=

0.5328

6.2.2

Check requirement for shear reinforcement

$V_{Rd,c}$

=

$[C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}] b_w d$

with minimum

=

$(v_{min} + k_1 \sigma_{cp}) b_w d$

v_{min}

=

$0.035 k^{3/2} f_{ck}^{1/2}$
0.44831

$V_{Rd,c}$

=

31 kN

$CR_{d,c}$

=

$0.18 / \gamma_s$
0.1091

k

=

$1 + (200/d)^{1/2}$
1.80 ≤ 2.0

ρ_1

=

$A_s / b_w d$
0.0058 ≤ 0.02

σ_{cp}

=

N_{ed} / A_c
-1.528 $< 0.2 f_{cd}$

k_1

=

0.15 [NA.1 6.2.2(1)]

Is $V_{Rd,c} > V_{Ed}$

=>

NO

Action: design shear reinforcement

6.2.3

Design Shear Reinforcement

Check concrete strut capacity at $\cot \theta = 2.5$:-
($\cot \theta = 1.25$ if axial tension)

$V_{Rd,max}$

=

$\alpha_{cw} \cdot b_w \cdot z \cdot v_1 \cdot f_{cd} / (\cot \theta + \tan \theta)$ (6.9)

$V_{Rd,max}$

=

202 kN

$\cot \theta$

=

1.25

$\tan \theta$

=

0.8

α_{cw}

=

1 [NA.1 6.2.3(3)]

z

=

0.77d
238.94 mm

v_1

=

$0.6 (1 - (f_{ck}/250))$
0.5328 [6.6N]

Is $V_{Rd,c} > V_{Ed}$

=>

YES

Action: Calculate link spacing

Calculation for strut inclination:-

θ

=

$0.5 \cdot \sin^{-1} [(6.54 \cdot V_{Ed}) / (b_w \cdot d \cdot (1 - f_{ck}/250) \cdot f_{ck})]$

θ

=

NA rad

$\cot \theta$

=

1.25 > 1.0

Calculate shear links spacing:-

$V_{Rd,s}$

=

$\lambda_1 \lambda_2 (A_{sw}/s) z f_{ywd} \cot \theta$

s

=

$\lambda_1 \lambda_2 A_{sw} \cdot z \cdot f_{ywd} \cdot \cot \theta / V_{Rd,s}$

=

111 mm

A_{sw}

=

100.53 mm²

f_{ywd}

=

435 MPa

λ_1

=

0.85

λ_2

=

0.9693

Check maximum shear link spacing:-

clause 9.5.3 is $s_{l,max} > 20\phi, d, 400$ NO

Provide

8 mm stirrups at nominal pitch

110 mm

Appendix F: BRE SD1 Assessment

Site History	Brownfield
Groundwater	Mobile
Exposed to Sulphate ions?	No
Design life of structure	At least 50 years

Soil Samples	
Sample Ref:	Water Soluble Sulphate (2:1 Extract) SO ₄ g/l
BH118 - 1m	1.170
BH119-1.1m	0.410
BH121 - 1.4m	0.138
BH128 - 0.93m	0.155
BH202 - 0.5m	0.435
BH204 - 0.4m	0.120
BH208 - 0.5m	0.261
BH211 - 0.3m	0.150
BH213 - 2.0m	0.009
BH214 - 0.82m	0.024
BH101 - 0.1m	0.028
BH104 - 0.22m	0.092
BH105 - 1.5m	0.228
BH107A - 0.8m	0.015
BH108 - 0.4m	0.163
BH110 - 1.0m	0.296
TS03 - 0.2m	0.067
TS06 - 0.25m	0.080
TS09 - 0.55m	0.508
TS11 - 0.8m	0.037

N = 20
Characteristic value = 0.631 g/l

Water Samples	
Sample Ref:	Sulphate SO ₄ g/l
	0.022

N = 1
Characteristic value = 0.022 g/l

pH	
Sample Ref:	pH pH units
BH118 - 1m	7.0
BH119-1.1m	7.1
BH121 - 1.4m	7.3
BH128 - 0.93m	5.3
BH202 - 0.5m	8.1
BH204 - 0.4m	8.0
BH208 - 0.5m	8.6
BH211 - 0.3m	8.0
BH213 - 2.0m	8.2
BH214 - 0.82m	7.5
BH101 - 0.1m	8.1
BH104 - 0.22m	7.6
BH107A - 0.8m	8.4
BH108 - 0.4m	9.4
BH110 - 1.0m	6.6
TS03 - 0.2m	8.1
TS06 - 0.25m	8.4
TS09 - 0.55m	6.4
TS11 - 0.8m	8.2
BH133 - .15m	7.4

N = 20
Characteristic value = 6.3

Sulphate class (soils) DS-2
Sulphate class (water) DS-1
Actual sulphate class DS-2
ACEC Class for site AC-3z
DC Class DC-3z

Appendix G: Designers Risk Assessment

Site Address: Fairfax Street, Prestwich			Designers Risk Assessment						 Piled Foundations & Underpinning																																																																														
Contract Number: 15107			Author: Dale Massey Revision: 0			Date: 22/04/2025			COHESION PILING COMPANY LTD																																																																														
Key to Risk Rating: <table><thead><tr><th colspan="2" rowspan="2"></th><th colspan="5">Severity (S)</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr></thead><tbody><tr><td rowspan="5">Likelihood (L)</td><td>1</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>2</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr><tr><td>3</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td></tr><tr><td>4</td><td>4</td><td>8</td><td>12</td><td>16</td><td>20</td></tr><tr><td>5</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td></tr></tbody></table> <table><thead><tr><th colspan="2" rowspan="2">Likelihood (L)</th><th colspan="3">Severity (S)</th></tr><tr><th colspan="2">Structure</th><th>Safety</th></tr></thead><tbody><tr><td>1</td><td>Very Unlikely</td><td>1</td><td>Acceptable</td><td>No injury</td></tr><tr><td>2</td><td>Unlikely</td><td>2</td><td>Distress</td><td>Minor Injury</td></tr><tr><td>3</td><td>Likely</td><td>3</td><td>Failure</td><td>Injury or Illness</td></tr><tr><td>4</td><td>Very Likely</td><td>4</td><td>Partial Collapse</td><td>Major Injury or illness</td></tr><tr><td>5</td><td>Certain</td><td>5</td><td>Major Collapse</td><td>Fatality</td></tr></tbody></table> Risk Rating (RR) = Likelihood (L) x Severity (S)														Severity (S)					1	2	3	4	5	Likelihood (L)	1	1	2	3	4	5	2	2	4	6	8	10	3	3	6	9	12	15	4	4	8	12	16	20	5	5	10	15	20	25	Likelihood (L)		Severity (S)			Structure		Safety	1	Very Unlikely	1	Acceptable	No injury	2	Unlikely	2	Distress	Minor Injury	3	Likely	3	Failure	Injury or Illness	4	Very Likely	4	Partial Collapse	Major Injury or illness	5	Certain	5	Major Collapse	Fatality
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5	Certain	5	Major Collapse	Fatality																																																																																			
Item	Stage	Hazard/Risk	Possible Consequences	Risk Rating			Design Action/ Control Measures	Residual Risk			Risk Owner																																																																												
				S	L	RR		S	L	RR																																																																													
1	Design	Designers not understanding their role as a designer under CDM	Incorrect methodology or design being proposed which could result in injury to person, damage to equipment or pile failure	3	3	9	Ensure all designers understand their role under CDM regulations as the pile designer and ensure piles are design using the appropriate methodology and designed fully to meeting the clients' requirements.	3	1	3	Cohesion Piling																																																																												
2	Design	Communication of design information	Miscommunication between designer and principle designer and/or principle contractor	3	3	9	Ensure all relevant design and safety information is submitted and communicated properly in line with the requirements for the Golden thread of information and BIM.	3	1	3	Cohesion Piling																																																																												
3	Design / Construction	Quality of works	Pile failure, structural damage, equipment damage or injury to person	3	3	9	Ensure all works are carried out in accordance with our design, RAMS documents and quality procedures and manual	3	1	3	Cohesion Piling																																																																												
4	Construction	Services in the ground	Striking live services will result in injury of person, damage to plant and distribution of services	3	3	9	No piling works to take place without being provided with a permit to dig on site.	1	2	2	Encountering uncharted services	Principle Contractor																																																																											
5	Construction	Rig Stability	Piling rig overturning, potentially causing injury and damage to plant and property	4	3	12	Adequate piling platform is design, constructed and maintained for the piling rig used on the job.	4	1	4	Design not adequate, construction, testing or maintenance not in accordance with best practise.	Principle Contractor																																																																											

Site Address: Fairfax Street, Prestwich			Designers Risk Assessment					 Piled Foundations & Underpinning COHESION PILING COMPANY LTD				
Contract Number: 15107			Author: Dale Massey Revision: 0			Date: 22/04/2025						

Key to Risk Rating:		Severity (S)					Likelihood (L)		Severity (S)				
		1	2	3	4	5			Structure			Safety	
Likelihood (L)	1	1	2	3	4	5	1	Very Unlikely	1	Acceptable		No injury	
	2	2	4	6	8	10	2	Unlikely	2	Distress		Minor Injury	
	3	3	6	9	12	15	3	Likely	3	Failure		Injury or Illness	
	4	4	8	12	16	20	4	Very Likely	4	Partial Collapse		Major Injury or illness	
	5	5	10	15	20	25	5	Certain	5	Major Collapse		Fatality	
Risk Rating (RR) = Likelihood (L) x Severity (S)													

Item	Stage	Hazard/Risk	Possible Consequences	Risk Rating			Design Action/ Control Measures	Residual Risk			Risk Owner	
				S	L	RR		S	L	RR		
6	Construction	Projecting Reinforcement Bars	Injury to persons and damage to constructed piles	3	3	9	Pile reinforcement bars terminate at or below piling platform level.	1	1	1		Principle Contractor
7	Construction	Breaking down of piles	Injury to persons and damage to constructed piles	3	3	9	Debonding foam to be provide along rebar within the breakdown section to aid in breakdown pile without damaging rebar. Contractor to	3	1	3	Safe method not followed	Principle Contractor
8	Design / Construction	Access to pile positions	Unable to install piles in a safe manner or in the correct position, potentially causing injury to person or damage to equipment and property as well as causing additional undesigned for loads which could cause failure of the pile or above substructure	3	3	9	Pile positions are decided by the substructure designer, Cohesion Piling will review the pile positions provided and ensure that we are able to access the pile positions safely and indicate any issues to the substructure designer so the pile positions can be reviewed and changed to safe appropriate position with all design changes involved being accounted for.	3	1	3		Cohesion Piling / Substructure designer

Site Address: Fairfax Street, Prestwich			Designers Risk Assessment						 Piled Foundations & Underpinning																																																																														
Contract Number: 15107			Author: Dale Massey Revision: 0				Date: 22/04/2025			COHESION PILING COMPANY LTD																																																																													
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5	Construction	Weaker Ground Conditions	Increased Pile Settlement	3	2	6	Parameters have been derived from information and testing provided in the J23254 Rev 0 – Ground Investigation January 2024. Site operatives are brief on ground conditions expected, and if any variations in the conditions are encountered this is to be reported to the pile designer immediately for review.	3	1	3	Cohesion Piling																																																																												
6	Construction / Design	Obstructions	Unable to progress the piles to their required design depth and therefore unable to provide the required working capacity needed for the structure	3	3	9	Ground Investigation information reviewed and doesn't indicate any obstructions within the boreholes, but still can't be ruled out.	3	1	3	Site teams are brief and if any are encountered this is to be reported to the design team immediately and redesign of the pile position to miss the obstruction will need to be carried out.	Cohesion Piling																																																																											
6	Construction	Lifting	Rig instability, load falls, injury to person, damage to equipment	5	2	10	Design to reflect rig capability manufacturers operation manual	5	1	5	Rig to be operated inside rig manufacturers operating parameters	Cohesion Piling																																																																											

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7	Construction	Lifting of equipment and reinforcement cages	Injury to person, damage to equipment	4	3	12	Safe lifting of reinforcement cage to detailed lift plan. Ensure ALL lifting equipment inspection as required under LOLER, PUWER & EWR before use Ensure ALL lifting accessories are inspected daily/weekly as required by LOLER, and any damages reported immediately for repair or discarding. Ensure all lifting equipment is within certificate date	4	1	4	Cohesion Piling /
8	Construction	Condition of work equipment	Damage to equipment, risk of injury and delays to programme.	4	3	12	Ensure all equipment is inspected weekly. Check equipment is in good working order. Check PAT testing is in date for electrical equipment. Pre use check to be completed prior to use, to be undertaken.	4	1	4	Cohesion Piling

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