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KILN PLACE
GEOTECHNICAL DESIGN REPORT

RAMBOLL

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1. INTRODUCTION

Ramboll UK Limited (Ramboll) has been appointed by EC Harris on behalf of Camden Borough Council to provide a Geotechnical Design Report for the proposed re-development of Maitland Park.

1.1 Scope and Objectives of Report

The scope of this report includes the determination of geotechnical aspects of the proposed works with respect to foundation design and analysis. The report is based on Rambolls interpretation of the 2014 ground investigation results.

The report has been written to satisfy the following objectives:

- To summarise the findings of the ground investigation.
- To explain the basis of interpretation of the ground conditions.
- To provide recommendations for the selection of ground models and characteristic values of geotechnical parameters for design based on the available factual information.

1.2 Description of the Project

The site is located in Gospel Oak, Camden, London. The site is centred at National Grid reference TQ 28331 85485 (post code NW5 4AJ) and covers an area of approximately 15,300 square metres (1.53 ha).

The site is currently occupied by residential dwellings, car parking and green, open communal areas which includes a play area. Surrounding land includes residential dwellings, industrial land and a railway. The site is accessed via Lamble Street.

The site is bound to the south by a railway, to the west by Grafton Road, to the north by Lamble Street and to the east by Meru Close.

It is proposed to construct two and three storey residential dwellings in both stand-alone blocks and by the infilling of space between existing buildings. Private gardens are proposed for one row of dwellings in the north of the site. Landscaping is likely to remain unchanged from what is currently on site.

1.3 Report Limitations

The information presented within this report is based on data and information within the Ramboll Ground Investigation Report ref. 61031879-KP-GE-RPT-002.

This report is limited to the preliminary design of foundations.

2. GROUND CONDITIONS AND SOIL PARAMETERS

2.1 Design Ground Profile

The ground profile presented in Table 2.1. has been used for this design report, based on the available information for the site;

Stratum		Depth to Base of Stratum	
		mbgl	mAOD
Made Ground	Granular	3.0	38.0
	Cohesive	7.0	34.5
London Clay Formation	Weathered	13.0	29.5
	Unweathered	>15.0 (base unproven)	<26.5 (base unproven)

Table 2.1 Ground profile for design purposes

The existing ground levels at site vary from 40.83 mAOD (WS1) to 45.24 mAOD (WS4). The depth to base in mAOD has taken the deepest occurrence of the soil horizon.

2.2 Groundwater

During the ground investigation groundwater was encountered in both exploratory boreholes and in three of the seven windowless sample holes.

Groundwater monitoring undertaken after the ground investigation measured groundwater levels from 1.52 mbgl (BH2) to 5.37 mbgl (WS2). There was one significant rainfall event (>10mm) of 14.5mm during the period of observation, on the 1st May 2014.

A worst case design groundwater level of between 1.0 mbgl and 2.0 mbgl could be taken for this site, with the changes in depth dependant on seasonal variations.

Groundwater levels for ULS design are those that represent the most unfavourable conditions which could realistically occur during the design lifetime of the structure. For SLS, where there are less severe consequences, design values shall be the most unfavourable values which could occur in normal circumstances. This follows clause 2.4.6.1 (6) Eurocode 7 (CEN, 2004).

2.3 Parameters

Based on the stratigraphy encountered, the characteristic values of the geotechnical parameters properties derived from the testing are presented in Table 2.2.

Stratum		Unit Weight kN/m³	Φ´ °	Undrained Shear Strength kPa	E_v' MN/m²	E_u MN/m²	Modulus of Compressibility m_v
Made Ground	Granular	18	32	N/A	6	N/A	N/A
	Cohesive	19	26	17	3	6	0.45
LCF	Weathered	19	22	4+(7.75z)	1625+(1525z)	3250+(3150z)	0.15
	Unweathered	19	22	154	31	62	0.10

Table 2.2 Geotechnical characteristic parameters

Where z is the depth below ground level.

3. GEOTECHNICAL FOUNDATION DESIGN

3.1 Foundation Analysis and Design

3.1.1 Shallow Foundation Solution

The Made Ground is not considered a suitable medium in which to directly place shallow foundations due to its variability in composition. Due to the depth of Made Ground at site it is

recommended that shallow footing designs are not adopted for any buildings proposed at the site. Large differential settlements due to ongoing consolidation of the Made Ground would likely occur, leading to deformation and cracking in any structure founded in the material.

Conventional mechanical backhoe excavators should prove suitable for excavation through the materials encountered at the site.

3.1.2 Piled Foundation Solution

Any buildings proposed for the site in its current state should be founded on a piled foundation solution. Either continuous flight auger (CFA), cased bored or steel driven piles embedded into the London Clay Formation could be adopted.

Due to the overlying unconsolidated Made Ground, negative skin friction will develop on the shaft of the pile. This will increase the loading on the pile. This has been applied to the pile design as an unfactored load.

Using the typical ground profile and assuming a pile cap depth of 1.0 metres, preliminary calculations of safe working loads based on bored piles with a factor of safety of 2.6(following guidance presented in LDSA No.1 2009) are presented in Table 3.1.

Estimated safe working loads for pile lengths exceeding 15 metres below ground level have been calculated using an inferred C_u value from LCF at 15 mbgl. This is due to no soil strength test data available below 15 metres.

Founding Stratum	Pile Length (m)	Estimated Safe Working Load (kN) by pile diameter (mm)		
		300 mm	400 mm	600 mm
LCF (W)	10	48	81	171
LCF (U)	15	129	189	333
	20	269	375	613
	25	408	561	892
	30	548	747	1171

Table 3.1 Estimated Safe Working Loads for Bored Piles

Once a detailed design and layout has been finalised, it is recommended that the advice of a specialist piling contractor is sought regarding the design and installation, particularly in respect of the potential obstructions such as any remaining former footings, buried services or major inclusions within the Made Ground.

3.2 Buried Concrete

The chemical analysis results for pH and water soluble sulphate content (2:1 water extract as SO_4) of the soils have been assessed for the Made Ground and the London Clay Formation. The relative design sulphate class and ACEC class have been derived from the BRE Special Digest 1 – Concrete in Aggressive Ground (Third Edition 2005). They are presented in Table 3.2.

Stratum		Water Soluble Sulphate Content (2:1 Water Extract as SO_4) mg/l	Design Sulphate Class	pH	ACEC Class
Made Ground	Granular	1200	DS-2	8.0	AC-2
	Cohesive	1250	DS-2	7.5	AC-2
LCF	Weathered	1500	DS-3	7.6	AC-3
	Unweathered	690	DS-2	7.9	AC-2

Table 3.2 pH and Sulphate design class for location

4. SUMMARY OF RECOMMENDATIONS

Based upon the findings of the Harrison Group Ground Investigation Report (GL18084 GI) and the Ramboll Geotechnical Interpretive Report (61031879/KP/GE/RPT/002), the following recommendations have been made regarding development of the site:

- The depth of Made Ground at site is significant. Shallow foundations are not a viable option for the site in its current state.
- Structures will need to be supported on piled foundations.
- The groundwater data is limited. The results of the ground investigation indicate the groundwater is potentially mobile and susceptible to seasonal variations.
- The levels of water soluble sulphate are elevated and the design of any buried concrete structures should consider the relevant design class. Concrete in Made Ground and unweathered LCF should be designed to DS-2, AC-2, whereas concrete in weathered LCF should be designed to DS-3, AC-3.

The recommendations regarding geotechnical design made within this report have been developed to give guidance and assist in developing the preliminary design of structures at the site and are general in nature. A detailed geotechnical design should consider the ground profiles and existing ground levels relative to the finished floor levels to correctly assess foundation embedment depths founding strata.

5. REFERENCES

BRE Special Digest 1 (2005), Concrete in Aggressive Ground (Third Edition)

British Geological Survey 1:50,000 Solid and Drift Edition Sheet 256 – North London.

British Standards Institute (1999), Code of practice for site investigations. BS 5930:1999.

BS. EN ISO 14688-2:2004 – Geotechnical investigation and testing – Identification and classification of a soil - Part 2: Principles for a classification

BS. EN 1997-1 (2004), Eurocode 7 Geotechnical design – Part 1: General rules

BS. EN 1997 – 2:2007 – Geotechnical Design – Part 2: Ground investigation and testing

CIRIA (1995), The Standard Penetration Test (SPT): Methods and Use. CIRIA Report 143. C.R.I. Clayton.

Harrison Group Environmental Ltd (2014), Ground Investigation Report, Project No. GL18084 GI

LDSA No.1 2009 – Guidance notes for the design of straight shafted bored piles in London clay.

Ramboll, Ground Investigation Report 61031879-KP-GE-RPT-003.

R.B. Peck, W.E. Hanson and T.H. Thornburn (1953). Foundation Engineering, John Wiley, New York.

Stroud, M.A. and Butler, F.G. (1989). The Standard Penetration Test – its Application and Interpretation. Penetration Testing in the UK, Thomas Telford, 1989, pp. 29-49.

APPENDIX 1

CALCULATIONS

Job Name and Number Kiln Place, Camden

Pile Capacities

Diam= 0.6

STRUCTURE

Enter for: ALL | GRANULAR | COHESIVE

SHAFT FRICTION:

					granular		cohesive		weak rock						For varying cu - see sketch	
Ground Profile:	From	To	Level (maOD)	Stratum	delta	Ks	cu	alpha	UCS Mpa	τsf kPa	density	vert stress	capacity		m	C
1	1	7		Made Ground Cohesive							19	114	0			
2	7	13		London Clay Weathered				0.6			9	168	185		7.75	4
3	13	30		London Clay (Unweathered)			154	0.5			9	321	2467			
4												321	0			
5												321	0			
6												321	0			
7												321	0			
8												321	0			
9												321	0			
10												321	0			
												321	0			

BASE CAPACITY

Rs calc 2652 kN

ONLY ONE VALUE

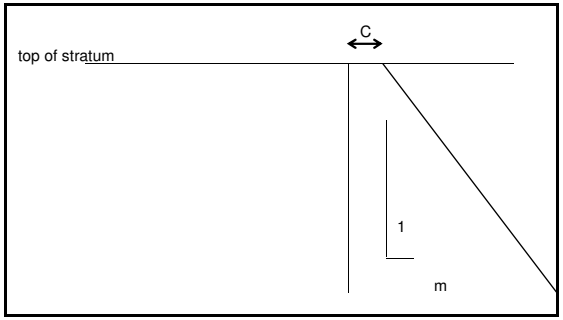
	Granular Nq	sigma	Cohesive cu	weak rock UCS base
Base	0	0	154	

R base calc 392 kN

* determine q_ult in F17 by inputting base vertical effective stress from m17

Ultimate 3044

Traditional factors of safety			
F=2.6	1171	kN	LDSA



Base cu