APPENDIX G

DFS Pile Design Report

Job No: DFS221011 Design Engineer: AR Date: 13 December 2023

Job Name: BROXWOOD VIEW, 29 ST. EDMUND'S TERRACE LONDON NW8 7QH

Calc Title: Detailed Designs – ∅450 Secant Pile Retaining Wall, ∅600 Contiguous Pile Retaining Wall & ∅300 Bearing Piles Rev. 04

BROXWOOD VIEW, 29. ST. EDMUND'S TERRACE

LONDON NW8 7QH

Detailed Designs for ∅450 Perimeter Secant Pile Retaining Wall, ∅600 Perimeter Contiguous Pile Retaining Wall & ∅300 Bearing Piles

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DESIGN STATUS & ISSUE RECORD

Revision	Status	Description	Design		Check	
			Engineer	Date	Engineer	Date
/	For Review	Detailed designs for secant pile retaining wall & bearing piles	Dr. Azeez Rotimi	14/10/22	Dr. Abid Adekunte	14/10/22
Rev. 01	For Review	Design for bearing piles updated on the basis of Project Structural Engineer's latest loading information for minipiles. Bearing pile size reduced from 350mm to 300mm.	Dr. Azeez Rotimi	26/10/22	Dr. Abid Adekunte	26/10/22
Rev. 02	For Review	Design for bearing piles updated on the basis of Project Structural Engineer's latest pile load schedule for minipiles. Pile wall redesigned as contiguous pile wall of ∅600 & ∅450 diameters.	Dr. Azeez Rotimi	30/11/22	Dr. Abid Adekunte	30/11/22
Rev. 03	For Review	Design report and drawings updated to account for comments & recommendations provided by checking engineers/party wall surveyors.	Dr. Azeez Rotimi	13/12/22	Dr. Abid Adekunte	13/12/22
Rev. 04	Construction	Pile wall design section B-B is changed from ∅450 contiguous pile retaining wall system to a ∅450 secant pile wall system. Design report, pile wall schedule and construction drawings updated accordingly.	Dr. Azeez Rotimi	14/02/23	Dr. Abid Adekunte	14/02/23

BROXWOOD VIEW, 29. ST. EDMUND'S TERRACE LONDON NW8 7QH

DETAILED DESIGNS FOR ∅450 PERIMETER SECANT PILE RETAINING WALL, ∅600 PERIMETER CONTIGUOUS PILE RETAINING WALL & ∅300 BEARING PILES

1.0 INTRODUCTION

Deep Foundations Specialists (DFS) Limited have been appointed by Broxwood View Limited to carry out the detailed designs for the permanent perimeter pile retaining walls, associated temporary works and bearing piles for the proposed residential development on the above site in Northwest London.

The wider project is centred on the redevelopment of the site; this involves the complete demolition of the pre-existing 2 storey Porter's Lodge building on the site and the subsequent construction of a new 4 storey-extension adjacent to the northern wall of the existing Barrie House multi-storey block of residential apartments on the site, with an underlying single level-basement. The new 4 storey-structure would accommodate 9 No. residential apartments.

The approximate National Grid Reference for the approximately square-shaped 0.18 ha-site is 527495E, 183575N, while existing site topography generally slopes downwards from the northern boundary to the south, with an approximate gradient of 1:8. The site's reduced levels vary between (+48.600m OD) – (+42.000m OD). It is proposed to chiefly support the new structure on a 950mm thick reinforced concrete raft at basement floor level, while a number of bearing piles are also required outside the proposed basement area to support some sections of the proposed development.

A combination of secant bored pile retaining wall and contiguous bored pile retaining wall are required to support the deep excavation for the proposed subterranean components of the building, Maximum retained height is < 4.85m. The pile retaining walls would also function as permanent components of the new basement structure. In addition to lateral earth/groundwater retention, the bored pile retaining walls are also designed to support service vertical compressive loading of up to 500 kN/m run and nominal service vertical tension loading of -20 kN/m run of wall, as specified by the Project Structural Engineer.

The detailed design package for the temporary works that are required to provide lateral restraint to the bored pile walls at construction stage would be prepared and issued by DFS or others under separate cover.

This particular report chiefly focuses on the detailed designs for the ∅450 perimeter secant pile retaining wall, ∅600 perimeter contiguous pile retaining wall and the ∅300 bearing piles. The perimeter secant pile retaining wall shall comprise of 450mm dia. male and female piles, with male piles spaced @ 550mm c/c intervals. The perimeter contiguous pile retaining wall shall comprise of 600mm dia. piles @ 700mm c/c. The bearing piles are subject to service vertical compression, tension and horizontal loading of up to 250 KN/pile, -25 KN/pile and 10 KN/pile respectively.

The design report is presented under the following headings:

- INPUT DATA
- OUTLINE OF DESIGN
- TYPICAL SECTIONS CONSIDERED IN PILE WALL ANALYSIS & DESIGN
- GROUND CONDITIONS
- BORED PILE RETAINING WALL DESIGNS
  - Geotechnical Design
  - Structural Design
- BEARING PILE DESIGN
  - Geotechnical Design
  - Structural Design
- REFERENCES
- APPENDICES

2.0 INPUT DATA

Design is based on the following site-specific refence documents:

(i) Email Correspondence between Andrea Carbogno (Carbogno Ceneda Architects) and Dr. Abid Adekunte (Deep Foundations Specialists Limited) and others on 13/02/2023 @ 09:49 – RE: Broxwood View Secant Piled Wall.

(ii) PARMARBROOK's Document No. 1805 of May 2018 – Basement Impact Assessment: Barrie House, 29 St. Edmunds Terrace.

(iii) Card Geotechnics Limited's Geotechnical Report No. CG/28408 Rev. 2 of May 2018 – Barrie House Basement Impact Assessment Revision 2.

(iv) Soil Consultants Limited's Geotechnical Report No. 9241/OT/JRCB of 07 November 2012 – Ground Investigation Report for Proposed Construction at Barrie House, 29 St. Edmund's Terrace, London NW8 7QH.

(v) Richard Tant Associates' Drawing No. 5295-S01G – Notes.

(vi) Richard Tant Associates' Drawing No. 5295-S02D – Proposed Basement Floor Sheet 1/2.

(vii) Richard Tant Associates' Drawing No. 5295-S03A – Proposed Basement Floor Sheet 2/2.

(viii) Richard Tant Associates' Drawing No. 5295-S04B – Proposed Ground Floor Sheet 1/2.

(ix) Richard Tant Associates' Drawing No. 5295-S05A – Proposed Ground Floor Sheet 2/2.

(x) Richard Tant Associates' Drawing No. 5295-S10D – Section 1-1.

(xi) Richard Tant Associates' Drawing No. 5295-S11D – Section 2-2.

(xii) Richard Tant Associates' Drawing No. 5295-S12C – Sections 3-3 & 4-4.

(xiii) Richard Tant Associates' Drawing No. 5295-S13D – Section 5-5.

(xiv) Richard Tant Associates' Drawing No. 5295-S14D – Sections 6-6 & 7-7.

(xv) Richard Tant Associates' Drawing No. 5295-S15C – Sections 8-8 & 9-9.

(xvi) Richard Tant Associates' Drawing No. 5295-S16C – Sections 10-10, 11-11 & 12-12.

(xvii) Richard Tant Associates' Drawing No. 5295-S17C – Section 13-13.

(xviii) Richard Tant Associates' Drawing No. 5295-S18C – Section 14-14.

(xix) Richard Tant Associates' Drawing No. 5295-S19C – Section 15-15.

(xx) Richard Tant Associates' Drawing No. 5295-S20A – Section 16-16.

(xxi) Richard Tant Associates' Drawing No. 5295-S21A – Section 17-17.

(xxii) Richard Tant Associates' Drawing No. 5295-S22B – Section 18-18.

(xxiii) Richard Tant Associates' Drawing No. 5295-S23A – Section 19-19.

(xxiv) Richard Tant Associates' Drawing No. 5295-S24 – Section 20-20.

(xxv) Richard Tant Associates' Drawing No. 5295-S25 – Sections 21-21 & 22-22.

(xxvi) Richard Tant Associates' Drawing No. 5295-PM01C – Movement Monitoring 1/3.

(xxvii) Richard Tant Associates' Drawing No. 5295-PM02C – Movement Monitoring 2/3.

(xxviii) Richard Tant Associates' Drawing No. 5295-PM03A – Movement Monitoring 3/3.

3.0 OUTLINE OF DESIGN

- Design calculations for the pile retaining walls and bearing piles have been carried out in accordance with the recommendations of the ICE SPERW (2016), BS 8002 (1994), BS 8004 (1986), BS8102 (2009), BS5975 (2008), CIRIA Report No. C760 (2017), London District Surveyors' Association's (LDSA) Guidance Note No. 1 for the Design of Straight Shafted Bored Piles in London Clay (2018) and the BS 8110 (1997).
- Proposed development comprises of a 4 storey-block of residential apartments, with an underlying basement, as an extension adjacent to the northern wall of the existing Barrie House multi-storey block of residential flats.
- The new structure is proposed to be chiefly supported on reinforced concrete raft at lower ground floor level. However, a number of bearing piles are also required outside the proposed basement area to support a number of sections of the proposed building.
- The proposed earth/groundwater retention system for the deep excavation for the new basement on the site shall comprise of a combination of ∅450 perimeter secant pile retaining wall; 450mm dia. Interlocking male and female piles, with male piles spaced @ 550mm c/c intervals and ∅600 contiguous pile retaining wall; 600mm dia. piles @ 700mm c/c intervals.
- **An existing Thames Water underground asset/trunk runs outside the northern boundary of the site at off-set distances of between 4.1m – 5.0m from the centreline of the nearest run of pile retaining wall. Therefore, the serviceability of the adjacent underground trunk has had to be carefully accounted for in the choices of the ground engineering methodologies and construction sequencing on which the detailed designs for the pile retaining walls and bearing piles presented in this report are based.**
- Approx. 73 lm total run of proposed perimeter bored pile retaining walls; this comprises of 13.5 lm of ∅600 contiguous pile retaining wall and 59.5 lm of ∅450 secant pile retaining wall.
- **For serviceability reasons, the pile retaining walls shall be temporarily restrained with temporary structural steel props prior to the commencement of bulk excavation for the new basement. The temporary props can be removed once the permanent floor slabs achieve sufficient structural strength. However, it is imperative that the Project Structural Engineer designs the reinforced**

concrete capping beam to safely span across openings at ground floor level in the permanent condition i.e. 8m minimum span length under 160 kN/m service horizontal loading.

- Maximum retained height of pile walls is < 4.85m.
- 5 No. ∅300 bearing piles are required outside the proposed basement area to support a number of sections of the proposed development.
- The bearing piles are subject to service vertical compressive, tension and horizontal loading of up to 250 KN/pile, -25 KN/pile and 10 KN/pile respectively. In addition, the design for the bearing piles accounts for load eccentricity-induced overturning moment of up to 19 kNm/pile. A copy of DFS' bearing pile construction schedule, which provides detailed information on individual pile loads, required pile lengths and required steel reinforcement is attached to the appendices of this report.
- Shaft resistance and passive resistance within the top 5m of every bearing pile have been ignored in pile axial capacity calculations and lateral analysis, in order to account for potential bulk excavation-induced stress relief in the ground within the site.
- Piling platform level(s) are unconfirmed at this stage. However, for design purpose, the piling mat level for both the perimeter pile walls and the bearing piles is generally taken to be the proposed ground floor level; +44.600m OD. **Nonetheless, the Principal Contractor must confirm actual piling platform level(s) prior to the commencement of piling works on the site, so that the pile wall construction schedule and bearing pile construction schedule may be amended accordingly.**
- The perimeter pile walls and bearing piles shall be installed by Continuous Flight Auger (CFA) drilling technique, with heavy duty augers.
- **It is imperative that a temporary guide wall be put in-place prior to the commencement of the installation of the secant pile wall.**
- In addition to lateral earth/groundwater retention, the pile retaining wall has also been designed to support service vertical compressive and tension loading of up to +500 kN/m and -20 kN/m respectively.
- The secant pile wall design accounts for 1:100 verticality tolerance (with heavy duty augers), 25mm horizontal positional tolerance (with a temporary guide wall in-place) and 30mm over-break in accordance with the recommendations of the ICE Specification for Piling & Embedded Retaining Walls (ICE SPERW, 2015). Based on these, there are potentials for piles in the secant wall to encroach into

the basement area by magnitudes of up to 105mm. **It is imperative that the Architect, Project Structural Engineer and Principal Contractor make allowance for this.**

- The secant pile wall is designed to provide earth/groundwater retention in both temporary and permanent conditions. Pile wall design accounts for full hydrostatic pressure behind the wall in the long term, in accordance with the recommendations of the BS8102 (2009).
- Estimation of pile wall and bearing pile vertical capacities in compression are based on a global factor of safety of 2.6, with a minimum partial factor of safety of 1.2 on shaft friction resistance only. This is based on the assumption that no pile load tests would be carried out on the site (after LDSA, 2018).
- Estimation of pile wall and bearing pile vertical capacities in tension are based on a minimum factor of safety of 3.0 on shaft friction resistance only. This is also based on the assumption that no pile load tests would be carried out on the site (after LDSA, 2018).
- Estimation of pile wall axial capacities are based on 100% pile group efficiency for closely spaced perimeter pile groups, following the recommendations of Kezdi (1957), Broms (2007), Rose & Taylor (2010), Rose (2012) and Rose et al. (2013).
- Maximum pile settlement of 5mm under service vertical loading.
- Estimated pile wall lateral deflection in both temporary and permanent conditions is < 10mm.
- Concrete grade DS-4-FND4-C32/40 for male/hard piles, as specified by the Project Structural Engineer.
- 10 N/mm^2 56 day-strength concrete for female piles in secant pile wall for permanent groundwater cut-off.
- 50mm cover to pile reinforcement.

4.0 TYPICAL SECTIONS CONSIDERED IN PILE WALL ANALYSIS & DESIGN

Typical pile wall sections considered in numerical analysis and design are described below. Also, see DFS' construction drawings No's DFS221011-01, DFS221011-02 & DFS221011-03 attached to the appendices of this report for the numbered pile wall layout and illustration of typical design sections respectively.

PILE WALL SECTION A - A (∅600 PERIMETER CONTIGUOUS PILE WALL, DOUBLY PROPPED, ADJACENT TO EXISTING HEAVILY LOADED PAD FOOTINGS UNDERNEATH BARRIE HOUSE BUILDING): Piling Platform Level = Proposed Ground Floor Level = +44.600m OD. Basement Formation Level ≈ -+39.770m OD. Maximum Pile Wall Retained Height < 4.85m (Measured from Piling Platform Level). Wall Section is Designed to be Temporarily Restrained with 2 No. Rows of Structural Steel Props at Capping Beam Level and 2.5m Depth (i.e. +42.100) in the Temporary Condition. In the Permanent Condition, the Pile Wall shall be Restrained by the Basement Raft/Basement Floor Slab and the Ground Floor Slab. 270 kPa Structural Surcharge Loading from Adjacent/Existing Pad Footings and 10 kPa Nominal Traffic & Services Surcharge are Accounted for in Wall Analysis & Design. In Addition to Lateral Retention, Pile Wall Design Accounts for Service Vertical Compressive and Tension Loading of up to 500 kN/m & -20 kN/m Run of Wall Respectively.

Proposed Sequence of Construction:

1. Install ∅600 piles @ 700mm c/c intervals from piling platform level (+44.600) to depths specified by DFS to form contiguous pile wall; see DFS' pile wall construction schedule for more detailed information.
2. Break down piles to 75mm above proposed soffit level of RC capping beam.
3. Construct RC capping beam on pile wall.
4. Install 1st row of temporary props at capping beam level.
5. Carry out initial bulk excavation down to 3m depth.
6. Install 2nd row of temporary props and associated structural steel waling beam at 2.5m depth (+42.100).
7. Complete bulk excavation down to basement formation level; +39.770.
8. Place blinding of 50mm minimum thickness at formation level.
9. Construct 950mm thick reinforced concrete raft/basement floor slab with water-proof concrete and dowel into pile retaining wall.

10. Commence the construction of RC liner wall with water-proof concrete, in front of pile retaining wall, from basement level, up to 3m depth.
11. Remove 2nd row of temporary props and associated structural steel waling beam at 2.5m depth (+42.100).
12. Complete the construction of RC liner wall up to capping beam soffit level and connect same to capping beam.
13. Construct ground floor slab and connect same to capping beam.
14. Remove temporary props at capping beam level.
15. Construct superstructure.

PILE WALL SECTION B - B (∅450 PERIMETER SECANT PILE WALL, SINGLY PROPPED, OTHER AREAS OF PROPOSED BASEMENT, EXCLUDING THE PROPOSED UNDERPINNING AREA): Piling Platform Level = Proposed Ground Floor Level = +44.600m OD. Basement Formation Level ≈ -+39.770m OD. Maximum Pile Wall Retained Height < 4.85m (Measured from Piling Platform Level). Wall Section is Designed to be Temporarily Restrained with 1 No. Row of Structural Steel Props at Capping Beam Level. In the Permanent Condition, the Pile Wall shall be Restrained by the Basement Raft/Basement Floor Slab and the Ground Floor Slab. 25 kN/m Estimated Additional Horizontal Loading from Proposed RC Garden Retaining Wall Supporting Higher Ground behind Pile Wall, 50 kPa Estimated Potential Surcharge from Emergency Fire Engines/Appliances and 10 kPa Nominal Traffic & Services Surcharge are Accounted for in Wall Analysis & Design. In Addition to Lateral Retention, Pile Wall Design Accounts for Service Vertical Compressive and Tension Loading of up to 70 kN/m & -20 kN/m Run of Wall Respectively.

Proposed Sequence of Construction:

1. Install temporary guide wall prior to the commencement of secant pile wall construction.
2. Install ∅450 interlocking male and female piles, with male piles spaced @ 550mm c/c intervals from piling platform level (+44.600) to depths specified by DFS to form secant pile wall; see DFS' pile wall construction schedule for more detailed information.
3. Break down piles to 75mm above proposed soffit level of RC capping beam.
4. Construct RC capping beam on pile wall.
5. Install temporary props at capping beam level.
6. Complete bulk excavation down to basement formation level; +39.770.

7. Place blinding of 50mm minimum thickness at formation level.
8. Construct 950mm thick reinforced concrete raft/basement floor slab with water-proof concrete and dowel into pile retaining wall.
9. Commence the construction of RC liner wall with water-proof concrete, in front of pile retaining wall, from basement level, up to capping beam soffit level and connect same to capping beam.
10. Construct ground floor slab and connect same to capping beam.
11. Remove temporary props at capping beam level.
12. Construct superstructure.

5.0 GROUND CONDITIONS

Site stratigraphy at Broxwood View, 29 St. Edmund's Terrace London NW8 7QH may be generalised as shown in table 1 below:

DEPTH (m bgl)	DESCRIPTION	Representative N_{spt} Value
0.0 – 2.5	Made Ground	-
Below 2.5m bgl	Soft to Firm to Stiff to Very Stiff London Clay	6 - 16

Table 1 – Generalised Site Stratigraphy

Soil parameters used in design are presented in table 2 overleaf. In table 2;

ϕ' values for the cohesionless layers/made ground have been deduced from N_{spt} values (after Peck, Hanson & Thorburn (1974)).

ϕ' values for the cohesive layers are deduced from plasticity indices (after CIRIA Report No. 104, 1984 & CIRIA Report No. C580, 2003).

E' values for cohesionless materials/made ground are estimated with the correlation: $E' = 2000 – 3000 * N_{spt}$ in kPa (after CIRIA Report No. 143, 1995 & CIRIA Report No. C580, 2003).

E' values for cohesive layers are deduced from the expression $E' = 0.8 * E_u$, where $E_u = 800 * C_u$. (after Borin, 2012).

SOIL LAYER	N_{spt}	γ (kN/m^3)	ϕ' (°)	C' (kPa)	C_u (kPa)	E_u	E' (kPa)
Made Ground	-	18.0	28.0	0.0	-	-	15000
Soft to Firm to Stiff to Very Stiff London Clay	6 - 16	19.0	23.0	5.0	30 + 12z	24000 + 9600z	19200 + 7680z

Table 2 – Input soil parameters

6.0 PILE RETAINING WALL DESIGNS

(i) Geotechnical Design

The geotechnical design involves four stages, which are outlined below;

(i) *Ultimate Limit State (ULS) Analysis* – This involves the use of factored soil parameters to estimate the required embedment of the wall below proposed excavation level, for overall stability to be maintained in both the temporary condition and the permanent condition. This analysis has been carried out with the 'CADS PWS 6.09' geostructural modelling programme for embedded retaining walls. Analysis also provides information on estimated ultimate bending moments and shear forces in the wall.

Factors of safety adopted in the ULS analysis are based on the recommendations of the CIRIA Report No. C580 (2003) and CIRIA Report No. C760 (2017) for moderately conservative parameters. These are outlined below:

Factor of safety on undrained shear strength C_u = 1.5

Factor of safety on drained shear strength C' = 1.2

Factor of safety on drained angle of shearing resistance ϕ' = 1.2

See copies of the CADS PWS 6.09 ULS analysis output files attached to the appendices of this report.

(ii) *Serviceability Limit State (SLS) Analysis* – This involves the use of unfactored soil parameters to estimate the lateral displacement of the wall, as well as service bending moments, shear forces and service loads on the struts/permanent slabs. The analysis has been carried out with the 'CADS PWS 6.09' geostructural modelling programme. See copies of the CADS PWS 6.09 SLS analysis output files attached to the appendices of this report.

(iii) *Pile Wall Capacities under Vertical Axial Loading* – This is based on the traditional bearing capacity approach for axially loaded piles. 100% pile group efficiency has been adopted, based on the

recommendations of Rose & Taylor (2010), Rose et al. (2011 & 2012), Kezdi (1957) & Broms (2007) for perimeter pile groups embedded in clay or sand.

However, the wall is assumed to act as a continuous deep strip footing below basement formation level, surrounded by a block of soil, with the assumption of a block type failure mechanism in the ultimate limit state. In addition, the bearing capacity factor N_c in the London clay is reduced with a reduction factor f, in order to account for the existence of gaps in-between the piles within the wall.

The reduction factor f is expressed as;

$$f = \frac{\pi D}{4S} \qquad \text{---------- [1]}$$

Where D = pile diameter and S = pile centre to centre spacing. This approach produces an estimate of the axial capacities of the wall per metre run. See Adekunte (2014) for more detailed information on this methodology.

Separate MS Excel spreadsheet showing pile wall axial capacities in compression and tension are attached to the appendices of this report.

(iv) *Assessment of At-Rest Lateral Earth Pressures Around Pile Wall in the Permanent Condition* –

The numerical modelling/analysis of all pile wall sections for the permanent conditions are based on drained/effective stress parameters ϕ′, c′ & E′ presented in table 2 of section 5.0 of this report. However, as the pile retaining wall would be restrained by permanent floor slabs in the permanent condition, such that potential wall lateral displacement could be limited, there could be potentials for lateral earth pressures around the retaining wall to be higher than the active pressures or lower than the passive resistances computed by the CADS PWS 6.09 programme that had been based on active and passive pressure coefficients K_a & K_p respectively.

Therefore, this report considers it prudent to investigate the potential influence of at-rest-lateral earth pressures on the overall stability of the pile wall in the permanent condition. Lateral effective earth pressure at rest σ'_r is given by the equation;

$$\sigma'_r = \sigma'_z * K_o \quad \text{---------- [2]}$$

In equation 2, K_o is coefficient of earth pressure at rest and σ'_z is effective vertical pressure (including overburden pressure).

Taking the shallow made ground layer on the site to be normally consolidated material, whilst taking the underlying London clay stratum to be overconsolidated in line with established geotechnical practice;

$K_{o(NC)}$ for the made ground layer may be estimated with Jaky's (1944 & 1948) equation;

$$K_{o(NC)} = 1 - \text{Sin } \phi' \quad \text{---------- [3]}$$

In equation 3, ϕ' is effective angle of shearing resistance.

$K_{o(OC)}$ for the London clay stratum may be estimated with Schmertmann's (1985) equation;

$$K_{o(OC)} = 0.5 * (OCR)^{0.5} \quad \text{---------- [4]}$$

where OCR is overconsolidation ratio, which can be estimated with Mayne & Mitchell's (1987) equation;

$$OCR = 4.31 * (C_u/\sigma'_z)^{0.5} \quad \text{---------- [5]}$$

where C_u = undrained shear strength and σ'_z is effective vertical stress (including overburden pressure).

However, with references to the CIRIA Report No. 104 (1984), CIRIA Report No. C580 (2003) and the CIRIA Report No. C760 (2017), at-rest-earth pressures/conditions are inapplicable to embedded

retaining walls due to the effects of wall installation by boring technique and the subsequent bulk excavation in front of the retaining wall, which essentially result in significant stress relief around the embedded retaining wall, such that horizontal effective stresses close to the wall are considerably reduced to values below their in-situ value e.g. see section 4.1.2 of the CIRIA Report No. C580 (2003).

Furthermore, section 4.5 of the CIRIA Report No. 104 (1984) recommends that coefficients of at-rest-pressures "should not in general be thought of as a fundamental property of the soil" in embedded retaining wall analysis and design, as at-rest-conditions no longer apply if the ground has strained horizontally" e.g. due to drilling-induced/bulk excavation-induced reduction in horizontal stress. In addition, movements of most propped/unpropped embedded retaining walls inevitably lower K_o values behind the wall from its value just after installation to a value close to the coefficient of active pressure Ka (after CIRIA Report No. 104, 1984).

In addition, while the CIRIA Report No. 104 (1984) acknowledges that in some circumstances, rigid structures may experience higher than active pressures, any structure partially or wholly relying on passive pressure of the soil in front of the wall to maintain overall stability should not be designed for pressures higher than active values behind the wall (see page 76, section 8.1.2 of the CIRIA Report No. 104, 1984).

On the basis of the above, CIRIA Reports No's 104 (1984), C580 (2003) & C760 (2017) generally do consider coefficients of at-rest-earth pressures not to be particularly applicable to the design of embedded retaining walls in both temporary and permanent conditions, while the use of active and passive pressure coefficients K_a and K_p are encouraged by all the documents. These recommendations essentially form the basis of the retaining wall design calculations presented in this report.

The results of the wall analysis and design are presented in table 3 overleaf. A copy of the pile wall construction schedule is also attached to the appendices of this report.

PILE WALL SECTION	Maximum Retained Height (m)	Required Male Pile Length/Female Pile Length (m)	Theoretically Estimated & Expected Maximum Pile Wall Lateral Deflection (mm)	Temporary Prop Load/Permanent Horizontal Loading on RC Floor Slabs (kN/m)	Required Steel Reinforcement in Piles
Section A - A (∅600 Contiguous Pile Wall, Doubly Propped @ Capping Beam Level & 2.5m Depth)	4.85	16.0	20.0 (< 10.0 expected, based on DFS' experience with the CADS PWS 6.09 programme & parallel field instrumentation & monitoring).	300.0 (1st Row of Temporary Props @ Capping Beam Level) 550.0 (2nd Row of Temporary Props @ 2.5m Depth; +42.100) 550.0 (Basement Raft/Basement Floor Slab) 160.0 (Ground Floor Slab)	12–B40s x 13m & B16 links @ 150mm c/c
Section B - B (∅450 Secant Pile Wall, Singly Propped @ Capping Beam Level)	4.85	8.0/6.0	8.0 (< 10.0 expected, based on DFS' experience with the CADS PWS 6.09 programme & parallel field instrumentation & monitoring).	40.0 (Temporary Props @ Capping Beam Level) 220.0 (Basement Raft/Basement Floor Slab) 90.0 (Ground Floor Slab)	5–B20s x 7m & B8 links @ 175mm c/c

- The hard pile lengths recommended in the above table are adequate to support service vertical compressive and tension loading of up to +500 kN/m and -20 kN/m run of wall respectively, as required by the Project Structural Engineer.
- Copies of CADS PWS 6.09 computer output files for pile lateral stability analysis are attached to the appendices of this report.
- Separate MS-Excel spreadsheet for pile wall axial capacities in compression and tension are also attached to the appendices of this report.

Table 3 – Summary of Pile Retaining Wall Design

(ii) Structural Design

The 'CADS PWS 6.09' geostructural modelling programme has also been used to design the reinforcement bars in the piles within the contiguous pile wall. Copies of relevant computer output files are attached to the appendices of this report.

7.0 BEARING PILE DESIGN

(i) Geotechnical Design

The geotechnical design for the bearing piles to support service vertical compressive loading, tension loading, horizontal loading and overturning moments involves three stages, which are outlined below;

- *Estimation of Pile Capacities under Vertical Axial Compressive/Tension Loading.*
- *Pile Settlement Analysis*
- *Assessment of Pile Behaviour under Combined Lateral Loading/Tension/Overturning Moments*

Pile Capacities under Vertical Axial Loading

Design is generally based on the traditional bearing capacity approach.

In cohesionless layers, ultimate shaft friction capacity Q_s is given by the equation:

$$Q_s = k_s \cdot \overline{\sigma'_{vo}} \cdot tan(\delta) \cdot A_s \quad \text{---------- (6)}$$

And ultimate end bearing capacity is given by the equation:

$$Q_b = N_q \cdot \sigma'_{v1} \cdot A_b \quad \text{---------- (7)}$$

where

$k_s =$ Coefficient of lateral earth pressure.

$\overline{\sigma'_{vo}} =$ Average effective overburden pressure along shaft. (kPa)

$\delta =$ Angle of friction between pile and soil.

$\sigma'_{v1} =$ Effective overburden pressure at toe level. (kPa)

$N_q =$ Bearing capacity factor (after Berezanstev et al., 1961).

In cohesive layers, ultimate shaft friction capacity is given by the equation:

$Q_s = \alpha * C_u * A_s$ ---------- (8)

Ultimate end bearing capacity is given by the equation:

$Q_b = N_c * C_u$ ---------- (9)

Where

α = adhesion factor. This has been taken to be 0.5-0.6 in the clay strata on the current site (after Martin et al., 2016).

C_u = undrained shear strength

A_s = pile shaft surface area

N_c = bearing capacity factor accounting for cohesion. This is taken to be 9 in clay.

Separate MS Excel spreadsheet for pile axial capacities in tension and compression are attached to the appendices of this report. Bearing pile construction schedule showing pile lengths and reinforcement details is also attached to the appendices.

Analysis of Pile Settlement under 250 KN Maximum SWL (∅300 Pile)

Maximum pile settlement under a given applied load is given by the sum of the initial shaft movement required to mobilise the skin friction around the pile shaft, elastic settlement of the pile shaft and the elasto-plastic deformation of soil beneath the pile toe. This can be expressed as:

$$\varepsilon = \frac{(W_s + 2W_b)\,L}{2\,A_s\,E_p} + \frac{\pi * W_b}{4A_b} * \frac{B\,(1 - \nu^2)\,I_p}{E_b} + \Delta_y \qquad \text{---------- (10)}$$

(after Tomlinson, 2001 and Mokwa & Duncan, 2003).

In equation 10, Δ_y is the initial movement required to mobilise skin friction resistance around the pile shaft. It is generally considered to be smaller than the movement required to mobilise the end-bearing resistance at pile toe level, while it is generally independent of pile diameter and soil type (after Kulhawy, 1984).

Δ_y typically ranges between 2.5mm – 8mm (after Davisson (1975), Gardner (1975) & Kulhawy (1984)). However, for the purpose of the current settlement calculations, Δ_y = 3mm is considered to be reasonable (after Mokwa & Duncan, 2003).

Ultimate skin friction capacity = 558 KN (please see copy of DFS' pile axial capacity calculation spreadsheet attached to the appendices of this report)

Adopting a factor of safety of 1.5 on shaft friction resistance only;

$Q_{allowable}$ in skin friction = 558/1.5 = 372 KN; this shall be limited to the maximum service load on the pile (250 KN).

∴ Load on Pile Shaft W_s = 250 KN

∴Total Load Transferred to pile base W_b = (250 – 250) KN = 0.0 (this essentially points to the likelihood of the service loading on the pile being wholly supported in shaft friction only, with negligible or no-load transfer to the pile base).

L = Shaft Length = 15.0m

B = Pile diameter = 0.3m

A_s = Shaft Area = π * B * L = π * 0.3 * 15.0 = 14.14m^2

A_b = Pile Base Area = π * B^2 / 4 = π * 0.3^2 / 4 = 0.07 m^2

E_p = Elastic Modulus of Pile Material (concrete) = 30 GPa. However, conservatively adopt 15 GPa.

ν = Poisson's ratio of soil beneath pile base. Pile is end-bearing in stiff to very stiff clay. Use ν = 0.15.

I_p = Influence factor. For ν = 0.0 – 0.25 and L/B > 5, I_p = 0.5 (after Tomlinson, 2001).

E_b = Deformation modulus of soil beneath the pile. This can be expressed as:

E_b = 2 - 3 * N_{spt} in MPa (after CIRIA Report No. 143, 1995, CIRIA Report No. C580, 2003 and CIRIA Report No. C760, 2017)

N_{spt} at pile toe level > 35

∴ E_b = 2 * 35 = 70 MPa or 70,000 kPa

∴ ε = [8.84 x 10^{-3}] + [0.0] + [3.0] mm

∴ ε ≈ 3.1mm.

Hence, based on site-specific design parameters, estimated worst-case pile head settlement under service vertical compressive loading of up to 250 KN is < 5mm (O.K.).

Also, a copy of the pile settlement analysis spreadsheet is attached to the appendices of this report.

(ii) Structural Design

1. Compression Reinforcement in Bearing Piles:

∅300 Section

Capacity of concrete section under axial compressive loading is given by:

$$Compressive\ SWL \leq \frac{0.4 \times f_{cu} \times A_c}{\gamma_f} \quad \text{---------- (11)}$$

$\gamma_f =$ 1.5

$f_{cu} =$ 40N/mm^2

$A_c =$ 70718 mm^2

$$SWL \leq \frac{0.4 \times 40 \times 70718}{1.5}$$

$SWL \leq$ 754 KN (O.K.).

Maximum service vertical compressive loading of 250 KN/pile is less than 754 KN, therefore Grade C32/40 concrete O.K. Compression reinforcement is not required.

∴ Provide nominal compression reinforcement.

2. Bending/Tension/Shear Reinforcement in Bearing Piles:

Please see copies of bearing pile lateral analysis spreadsheet attached to the appendices of this report.

Essentially, the 4-B25 x 8m steel reinforcement cage and R6 links @ 120mm c/c in each bearing pile is designed to support a combination of tension loading, bending moments and shear forces. Therefore, no additional central tendons are required in these piles.

REFERENCES

Adekunte, Sheppard & Rotimi (2020), "Experience-Based Value Engineering of Foundations & Deep Excavation Support Systems". *Proceedings of the Deep Foundations Institute's 46th Annual International Conference on Deep Foundations*, Las Vegas, Nevada USA, October 13-16, 2021.

Adekunte, Greentree, Brunger & Munteanu (2018), "Non-Conventional Practice: Recent Case Histories of the use of Vertical Buttress Piles in Deep Excavation Support". *Paper Verbally Presented and Published in the Proceedings of the Deep Foundations Institute's 43rd Annual International Conference on Deep Foundations*, Anaheim California, USA, October 24-27, 2018.

Adekunte, Hilton & Greentree (2016), "An Alternative Approach for Estimating the Vertical Capacity of L-Shaped Segmental Underpinning Systems in Urban Basement Construction". *Proceedings of the Deep Foundations Institute's International Conference on Deep Foundations, Seepage Control and Remediation*, New York, USA, October 12-15, 2016.

Adekunte (2015), "Collaborative Development of Sustainable & Economical Solutions for Underground Structures". *Proceedings of the Deep Foundations Institute's 40th Annual International Conference on Deep Foundations*, Oakland California, USA, October 12-15, 2015.

Adekunte (2014), "Dealing with Complexities Associated with the Application of Bored Pile Retaining Walls in Urban Developments". *Proceedings of the Deep Foundations Institute's 39th Annual Conference on Deep Foundations*, Atlanta Georgia, USA, October 21-24, 2014.

Adekunte (2014), "An Investigation into the Vertical Axial Capacities & Groundwater Cut-off Capabilities of Secant Pile Walls". *Proceedings of the International Society for Soil Mechanics & Geotechnical Engineering (ISSMGE)'s TC207 International Conference on Soil-Structure Interaction – Underground Structures & Retaining Walls*, St. Petersburg, Russia, June 16-18, 2014.

Borin (2012), "The use of WALLAP in the context of Eurocode 7 (EN 1997-1, Eurocode 7: Geotechnical Design)". Geosolve, UK.

British Standards Institution (1986), "BS 8004 - Code of Practice for Foundations".

British Standards Institution (1997), "BS 8110 - Code of Practice for the Structural Use of Concrete".

British Standards Institution (1999), "BS 5930:1999+A2:2010 - Code of Practice for Site Investigations".

British Standards Institution (2004), "BS EN 1997-1:2004 Eurocode 7 – Geotechnical Design. General Rules (+A1:2013)".

British Standards Institution (2004), "BS EN 1992-1-1:2004+A1:2014 Eurocode 2 – Design of Concrete Structures – General Rules and Rules for Buildings".

British Standards Institution (2006), "PD 6687: 2006 – Background Paper to the UK National Annexes to BS EN 1992-1".

Broms (1964a), "Lateral Resistance of Piles in Cohesionless Soils". *Journal of Soil Mechanics & Foundations Division.* Proceedings of the American Society of Civil Engineers, Vol. 90, pp. 123-156.

Broms (1964b), "Lateral Resistance of Piles in Cohesive Soils". *Journal of Soil Mechanics & Foundations Division.* Proceedings of the American Society of Civil Engineers, Vol. 90, No. SM2, pp. 27-63.

Chin (1970), "Estimation of the Ultimate Load of Piles not carried to Failure". *Proceedings of the 2nd Southeastern Asian Conference on Soil Engineering*, pp. 81-90.

Chin (1971), "Discussion, "Pile Tests. Arkansas River Project". *Journal of the American Society of Civil Engineers*, SMFD, Vol. 97, SM6, pp. 930-932.

CIRIA (1984), "Report No. 104; Design of Retaining Walls Embedded in Stiff Clay".

CIRIA (1999), "Report No. 181; Piled Foundations in Weak Rock".

CIRIA (2003), "Report No. C580; Embedded Retaining Walls - Guidance for Economic Design".

CIRIA (2017), "Report No. C760; Guidance on Embedded Retaining Wall Design".

CIRIA (1995), "Report No. 143 – The Standard Penetration Test (SPT): Methods and Use".

Davisson (1975), "Pile Load Capacity". *Design, Construction and Performance of Deep Foundations*, American Society of Civil Engineers, University of California, Berkeley, California, pp. 1-49.

Federation of Piling Specialists UK (2006), "Handbook on Pile Load Testing".

Fellenius (1980), "The Analysis of Results from Routine Pile Load Tests". *Ground Engineering*, London, Vol. 13(6) pp 19-31.

Gardner (1975), "Considerations in the Design of Drilled Piers". *Design, Construction and Performance of Deep Foundations*, San Francisco, pp. 1-32.

Hassani, Whittaker & Scoble (1980), "Application of the Point Load Index Test to Strength Determination of Rock, Proposals for a New Size Correlation Chart". *Proceedings of the 21st U.S Symposium on Rock Mechanics.* Rolla, MO, 1980.

Institution of Civil Engineers (2016), "ICE Specification for Piling and Embedded Retaining Walls". 2nd Ed.

International Society for Rock Mechanics (1985), "Suggested Methods for Determining Point Load Strength". International Journal of Rock Mechanics & Mining Sciences, Vol. 22, pp 51-60.

Kondner (1963), "Hyperbolic Stress-Strain Response of Cohesive Soils". *Journal of the American Society of Civil Engineers*, SMFD, Vol. 89, SM1, pp. 115-143.

Kulhawy (1984), "Limiting Tip and Side Resistance". *Analysis and Design of Pile Foundations,* ASCE National Convention, American Society of Civil Engineers, New York, pp. 80-98.

Leonards & Lovell (1978), "Interpretation of Load Test on High-Capacity Driven Piles". *ASTM Symposium on Behaviour of Deep Foundations,* Special Technical Publication STP 670, pp 388-415.

Martin, Budden & Norman (2016), "Pile Tests to Justify Higher Adhesion Factors in London Clay". *Proceedings of the Institution of Civil Engineers,* Geotechnical Engineering 169, April 2016, Issue G2.

Mokwa & Duncan (2003), "Rotational Restraint of Pile Caps during Lateral Loading". *Journal of Geotechnical and Geoenvironmental Engineering,* American Society of Civil Engineers, September 2003.

O' Rourke (1988), "Rock Index Properties for Geoengineering Design in Underground Development. SME Preprint 88-48, 1988, 5 pp.

Peck, Hanson & Thorburn (1974), "Foundation Engineering". 2nd Ed.

Rowe & Armitage (1987a), "Theoretical Solutions for Axial Deformation of Drilled Shafts in Rock". *Canadian Geotechnical Journal.* Vol. 24(1).

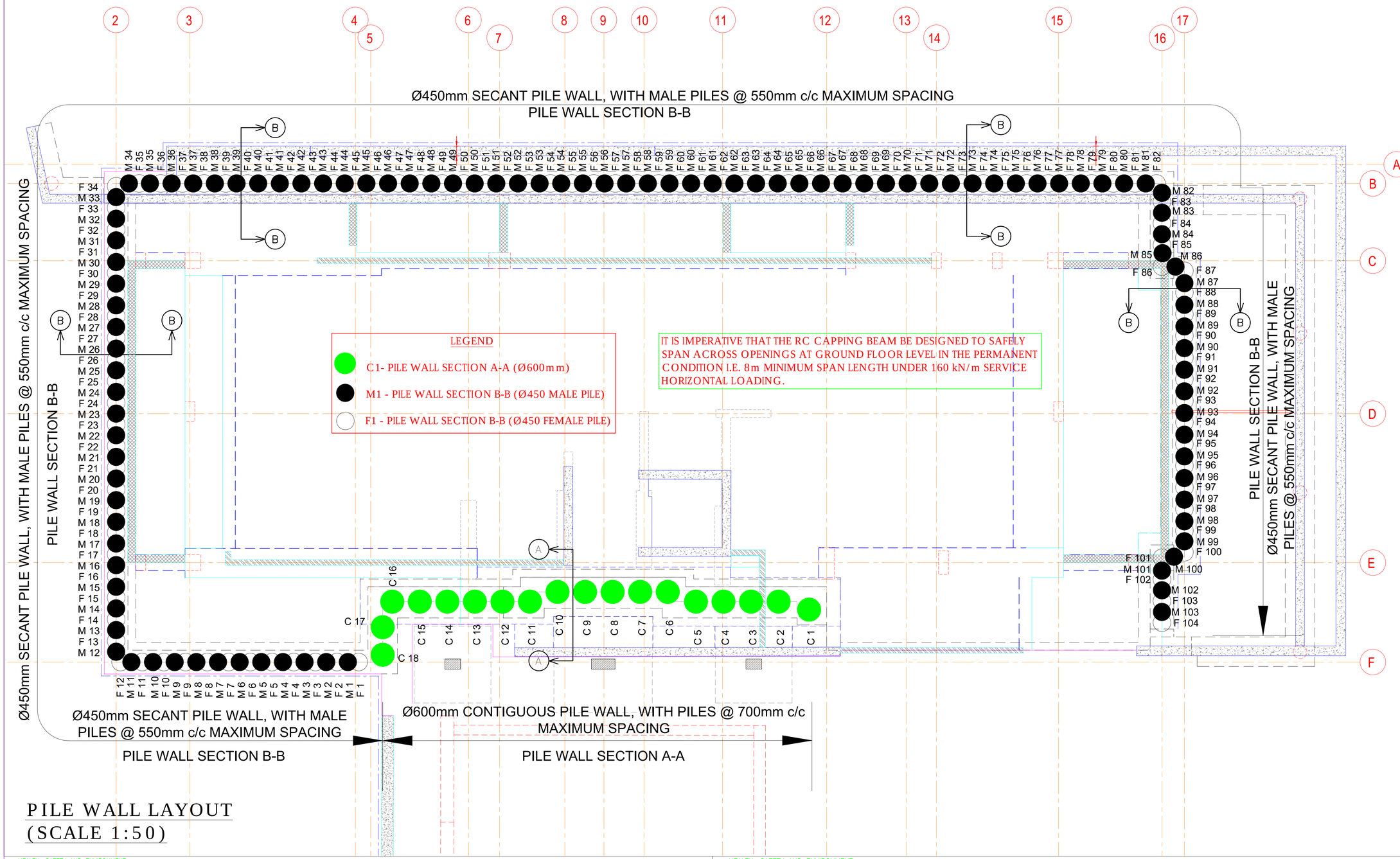
Rowe & Armitage (1987b), "A Design Method for Drilled Piers in Soft Rock". *Canadian Geotechnical Journal.* Vol. 24(1).

Taylor, Rose & Gorasia (2013), "Pile and pile group capacity; some findings from centrifuge tests". *International Journal of Geo-Engineering*, 2013, 5(2), pp. 5-15.

Tomlinson (2001), "Foundation Design & Construction". 7th Ed. Pearson Education Limited, 2001.

APPENDICES

DFS' Pile Wall Construction Drawings



PILE WALL LAYOUT
(SCALE 1:50)

IMPORTANT CONSTRUCTION NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, AND SPECIALISTS LATEST DRAWINGS AND SPECIFICATIONS. ANY DISCREPANCIES MUST BE REPORTED TO DFS, ENGINEER AND ARCHITECT IMMEDIATELY.
4. ONLY FIGURED DIMENSIONS ARE TO BE USED. ANY QUERIES MUST BE REFERRED TO DFS.
5. 50mm COVER TO PILE REINFORCEMENT.
6. STRICT SUPERVISION OF BULK EARTH WORKS IS REQUIRED TO ENSURE THAT EXCAVATIONS DO NOT EXCEED THE DESIGN DEPTH SHOWN IN THESE DRAWINGS (4.83m).
7. SECANT & CONTIGUOUS PILE WALLS SHALL BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE ICE SPECIFICATIONS FOR PILING AND EMBEDDED RETAINING WALLS (ICESPERW, 2016).
8. THE SECANT & CONTIGUOUS PILE WALLS ARE DESIGNED FOR BOTH TEMPORARY AND PERMANENT USE.
9. THE SECANT & CONTIGUOUS PILE WALLS ARE DESIGNED TO SUPPORT FULL HYDROSTATIC PRESSURE IN THE LONG-TERM, ONCE FACED WITH A PERMANENT RC LINER WALL, IN ACCORDANCE WITH THE RECOMMENDATION OF THE BS8102 (2009).

HEALTH, SAFETY AND ENVIRONMENT

1. THIS GEO-STRUCTURAL DESIGN HAS BEEN CARRIED OUT AND REVIEWED IN ACCORDANCE WITH THE CONSTRUCTION, DESIGN & MANAGEMENT (CDM) REGULATIONS 2015 AND DOES NOT INCLUDE ANY ABNORMAL RISK ITEM THAT A COMPETENT CONTRACTOR WOULD NOT BE AWARE OF WHEN UNDERTAKING CONSTRUCTION WORKS SHOWN.
2. THE SECANT PILE WALL DESIGN ACCOUNTS FOR 1:100 VERTICALITY TOLERANCE (WITH HEAVY DUTY AUGERS), 25mm HORIZONTAL POSITIONAL TOLERANCE (WITH A TEMPORARY GUIDE WALL IN-PLACE) AND 30mm OVER-BREAK IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE ICE SPECIFICATION FOR PILING & EMBEDDED RETAINING WALLS (ICE SPERW, 2015). BASED ON THESE, THERE ARE POTENTIALS FOR PILES IN THE SECANT WALL TO ENCROACH INTO THE BASEMENT AREA BY MAGNITUDES OF UP TO 105MM. IT IS IMPERATIVE THAT THE ARCHITECT, PROJECT STRUCTURAL ENGINEER AND PRINCIPAL CONTRACTOR MAKE ALLOWANCE FOR THIS.
3. THE CONTIGUOUS PILE WALL DESIGN ACCOUNTS FOR 1:75 VERTICALITY TOLERANCE, 75mm HORIZONTAL POSITIONAL TOLERANCE AND 30MM OVER-BREAK IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE ICE SPECIFICATION FOR PILING & EMBEDDED RETAINING WALLS (ICE SPERW, 2015). BASED ON THESE, THERE ARE POTENTIALS FOR PILES IN THE PILE WALL TO ENCROACH INTO THE BASEMENT AREA BY MAGNITUDES OF UP TO 170mm. IT IS IMPERATIVE THAT THE ARCHITECT, PROJECT STRUCTURAL ENGINEER AND PRINCIPAL CONTRACTOR MAKE ALLOWANCE FOR THIS.
4. THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB-CONTRACTORS MUST CARRY OUT INDEPENDENT RISK ASSESSMENTS THAT ARE APPLICABLE TO THEIR WORKS AND FULLY COMPLY WITH THE ABOVE STATED REGULATION.
5. THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB-CONTRACTORS MUST REVIEW THE SITE-SPECIFIC AND HISTORICAL BOREHOLE LOGS OF THE SITE TO HAVE ADEQUATE KNOWLEDGE OF GROUND CONDITIONS ON THE SITE, PRIOR TO COMMENCEMENT OF WORKS.
6. DURING SITE OPERATIONS, IF OBSERVED GROUND CONDITIONS DIFFER FROM THE GENERALISED STRATIGRAPHY SHOWN IN THIS SET OF DRAWINGS, DFS MUST BE INFORMED IMMEDIATELY.
7. IT IS THE RESPONSIBILITY OF THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB-CONTRACTORS TO ENSURE THAT SITE OPERATIVES ARE COMPETENT AND EXPERIENCED IN THE AREA OF WORKS TO BE UNDERTAKEN.

HEALTH, SAFETY AND ENVIRONMENT

8 IN ADDITION TO THE RISK/HAZARD TYPICALLY ASSOCIATED WITH THE GROUND ENGINEERING WORKS DETAILED IN THIS DRAWING, ADDITIONAL SITE/WORK-SPECIFIC HAZARDS HAVE BEEN IDENTIFIED THROUGH DESIGN RISK ASSESSMENT. THESE ARE OUTLINED IN 8.1 – 8.3 BELOW. ALL SITE OPERATIONS MUST ACCOUNT FOR ALL USUAL AND SITE/WORK-SPECIFIC HAZARDS.

8.1 PILING PLATFORM LEVEL IS UNCONFIRMED AT THIS STAGE. HOWEVER, FOR DESIGN PURPOSE, THE PILING MAT LEVEL FOR THE PERIMETER CONTIGUOUS PILE WALL AND BEARING PILES IS GENERALLY TAKEN TO BE THE PROPOSED GROUND FLOOR LEVEL; APPROX. +44.600M OD. NONETHELESS, THE PRINCIPAL CONTRACTOR MUST CONFIRM ACTUAL PILING PLATFORM LEVEL(S) PRIOR TO THE COMMENCEMENT OF PILING WORKS ON THE SITE, SO THAT THE PILE WALL SCHEDULE & BEARING PILE SCHEDULE MAY BE AMENDED ACCORDINGLY.

8.2 A REINFORCED CONCRETE CAPPING BEAM MUST BE CONSTRUCTED ON THE PILE WALL, WHILE TEMPORARY PROPS MUST BE INSTALLED AT LEVELS SPECIFIED BY DFS PRIOR TO THE COMMENCEMENT OF BULK EXCAVATION FOR THE NEW BASEMENT.

8.3 IN ADDITION, IT IS IMPERATIVE THAT THE CONCRETE MIX DESIGN FOR THE PILES IN THE CONTIGUOUS WALL ACCOUNTS FOR 10MM MAXIMUM AGGREGATE SIZE AND SET-RETARDING ADMIXTURES IN ORDER TO EASE THE INSTALLATION OF REINFORCEMENT CAGES INTO CONCRETED DRILLHOLES. REINFORCEMENT CAGE VIBRATORS MAY ALSO BE REQUIRED TO FORCE THE STEEL CAGES DOWN TO THE DESIGN DEPTHS.

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JOB TITLE: BROXWOOD VIEW, 29 ST. EDMUND'S TERRACE LONDON NW8 7QH

DRAWING TITLE: PILE WALL LAYOUT

DATE	DRAWN	CHECKED
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HEALTH, SAFETY AND ENVIRONMENT

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4. THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB–CONTRACTORS MUST CARRY OUT INDEPENDENT RISK ASSESSMENTS THAT ARE APPLICABLE TO THEIR WORKS AND FULLY COMPLY WITH THE ABOVE STATED REGULATION.

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7. IT IS THE RESPONSIBILITY OF THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB–CONTRACTORS TO ENSURE THAT SITE OPERATIVES ARE COMPETENT AND EXPERIENCED IN THE AREA OF WORKS TO BE UNDERTAKEN.

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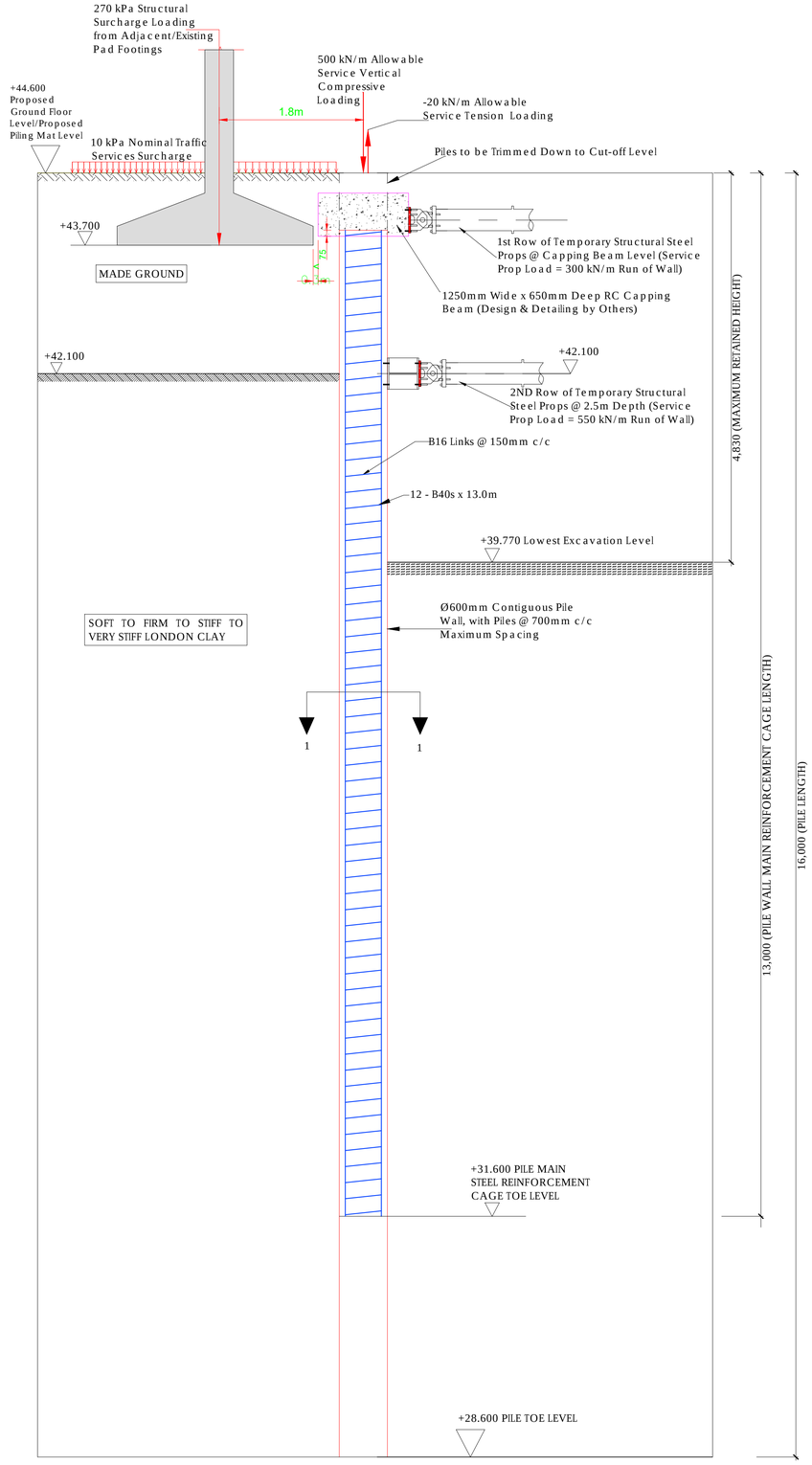
8.2. A REINFORCED CONCRETE CAPPING BEAM MUST BE CONSTRUCTED ON THE PILE WALL, WHILE TEMPORARY PROPS MUST BE INSTALLED AT LEVELS SPECIFIED BY DFS PRIOR TO THE COMMENCEMENT OF BULK EXCAVATION FOR THE NEW BASEMENT.

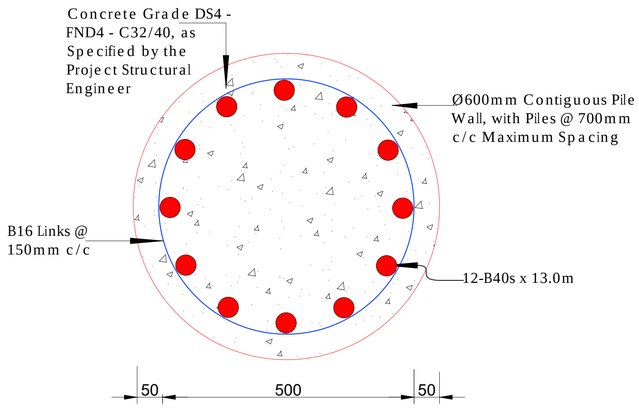
8.3. IN ADDITION, IT IS IMPERATIVE THAT THE CONCRETE MIX DESIGN FOR THE PILES IN THE SECANT & CONTIGUOUS WALL ACCOUNTS FOR 10MM MAXIMUM AGGREGATE SIZE AND SET–RETARDING ADMIXTURES IN ORDER TO EASE THE INSTALLATION OF REINFORCEMENT CAGES INTO CONCRETED DRILLHOLES. REINFORCEMENT CAGE VIBRATORS MAY ALSO BE REQUIRED TO FORCE THE STEEL CAGES DOWN TO THE DESIGN DEPTHS.

EXPECTED MAXIMUM WALL LATERAL DEFLECTION < 10mm

STRICT SUPERVISION OF BULK EXCAVATION BY MAIN CONTRACTOR IS REQUIRED, SO AS TO ENSURE THAT BULK EXCAVATION DOES NOT PROGRESS BELOW THE DIG DEPTH SHOWN IN THIS DRAWING



CONTIGUOUS PILE WALL SECTION A-A



SECTION 1-1 (SCALE 1:6)

PROPOSED SEQUENCE OF CONSTRUCTION:

PILE WALL SECTION A-A (Ø600 PERIMETER CONTIGUOUS PILE WALL, DOUBLY PROPPED, ADJACENT TO EXISTING HEAVILY LOADED PAD FOOTINGS UNDERNEATH BARRIE HOUSE BUILDING)

A. INSTALL Ø600 PILES @ 700mm C/C INTERVALS FROM PILING PLATFORM LEVEL (+44.600) TO DEPTHS SPECIFIED BY DFS TO FORM CONTIGUOUS PILE WALL; SEE DFS' PILE WALL CONSTRUCTION SCHEDULE FOR MORE DETAILED INFORMATION.
B. BREAK DOWN PILES TO 75mm ABOVE PROPOSED SOFFIT LEVEL OF RC CAPPING BEAM.
C. CONSTRUCT RC CAPPING BEAM ON PILE WALL.
D. INSTALL 1ST ROW OF TEMPORARY PROPS AT CAPPING BEAM LEVEL.
E. CARRY OUT INITIAL BULK EXCAVATION DOWN TO 3M DEPTH.
F. INSTALL 2ND ROW OF TEMPORARY PROPS AND ASSOCIATED STRUCTURAL STEEL WALING BEAM AT 2.5M DEPTH (+42.100).
G. COMPLETE BULK EXCAVATION DOWN TO BASEMENT FORMATION LEVEL; +39.770.
H. PLACE BLINDING OF 50mm MINIMUM THICKNESS AT FORMATION LEVEL.
I. CONSTRUCT 950mm THICK REINFORCED CONCRETE RAFT/BASEMENT FLOOR SLAB WITH WATER-PROOF CONCRETE AND DOWEL INTO PILE RETAINING WALL.
J. COMMENCE THE CONSTRUCTION OF RC LINER WALL WITH WATER-PROOF CONCRETE, IN FRONT OF PILE RETAINING WALL, FROM BASEMENT LEVEL, UP TO 3M DEPTH (+41.600).
K. REMOVE 2ND ROW OF TEMPORARY PROPS AND ASSOCIATED STRUCTURAL STEEL WALING BEAM AT 2.5M DEPTH (+42.100).
L. COMPLETE THE CONSTRUCTION OF RC LINER WALL UP TO CAPPING BEAM SOFFIT LEVEL AND CONNECT SAME TO CAPPING BEAM.
M. CONSTRUCT GROUND FLOOR SLAB AND CONNECT SAME TO CAPPING BEAM.
N. REMOVE TEMPORARY PROPS AT CAPPING BEAM LEVEL.
O. CONSTRUCT SUPERSTRUCTURE.

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DRAWING TITLE: CONTIGUOUS PILE WALL SECTION A-A

DATE	DRAWN	CHECKED
14 FEB 2023	AR	AA

DRAWING No.	REV	SCALE
DFS221011-02	04	SCALE IS AS SHOWN @ A1

HEALTH, SAFETY AND ENVIRONMENT

1. THIS GEO–STRUCTURAL DESIGN HAS BEEN CARRIED OUT AND REVIEWED IN ACCORDANCE WITH THE CONSTRUCTION, DESIGN & MANAGEMENT (CDM) REGULATIONS 2015 AND DOES NOT INCLUDE ANY ABNORMAL RISK ITEM THAT A COMPETENT CONTRACTOR WOULD NOT BE AWARE OF WHEN UNDERTAKING CONSTRUCTION WORKS SHOWN.
2. THE SECANT PILE WALL DESIGN ACCOUNTS FOR 1:100 VERTICALITY TOLERANCE (WITH HEAVY DUTY AUGERS), 25mm HORIZONTAL POSITIONAL TOLERANCE (WITH A TEMPORARY GUIDE WALL IN–PLACE) AND 30mm OVER–BREAK IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE ICE SPECIFICATION FOR PILING & EMBEDDED RETAINING WALLS (ICE SPERW, 2015). BASED ON THESE, THERE ARE POTENTIALS FOR PILES IN THE SECANT WALL TO ENCROACH INTO THE BASEMENT AREA BY MAGNITUDES OF UP TO 105MM. IT IS IMPERATIVE THAT THE ARCHITECT, PROJECT STRUCTURAL ENGINEER AND PRINCIPAL CONTRACTOR MAKE ALLOWANCE FOR THIS.
3. THE CONTIGUOUS PILE WALL DESIGN ACCOUNTS FOR 1:75 VERTICALITY TOLERANCE, 75mm HORIZONTAL POSITIONAL TOLERANCE AND 30mm OVER–BREAK IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE ICE SPECIFICATION FOR PILING & EMBEDDED RETAINING WALLS (ICE SPERW, 2015). BASED ON THESE, THERE ARE POTENTIALS FOR PILES IN THE PILE WALL TO ENCROACH INTO THE BASEMENT AREA BY MAGNITUDES OF UP TO 170MM. IT IS IMPERATIVE THAT THE ARCHITECT, PROJECT STRUCTURAL ENGINEER AND PRINCIPAL CONTRACTOR MAKE ALLOWANCE FOR THIS.
4. THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB–CONTRACTORS MUST CARRY OUT INDEPENDENT RISK ASSESSMENTS THAT ARE APPLICABLE TO THEIR WORKS AND FULLY COMPLY WITH THE ABOVE STATED REGULATION.
5. THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB–CONTRACTORS MUST REVIEW THE SITE–SPECIFIC AND HISTORICAL BOREHOLE LOGS OF THE SITE TO HAVE ADEQUATE KNOWLEDGE OF GROUND CONDITIONS ON THE SITE, PRIOR TO COMMENCEMENT OF WORKS.
6. DURING SITE OPERATIONS, IF OBSERVED GROUND CONDITIONS DIFFER FROM THE GENERALISED STRATIGRAPHY SHOWN IN THIS SET OF DRAWINGS, DFS MUST BE INFORMED IMMEDIATELY.
7. IT IS THE RESPONSIBILITY OF THE PRINCIPAL CONTRACTOR AND ASSOCIATED SUB–CONTRACTORS TO ENSURE THAT SITE OPERATIVES ARE COMPETENT AND EXPERIENCED IN THE AREA OF WORKS TO BE UNDERTAKEN.
8. IN ADDITION TO THE RISK/HAZARD TYPICALLY ASSOCIATED WITH THE GROUND ENGINEERING WORKS DETAILED IN THIS DRAWING, ADDITIONAL SITE/WORK–SPECIFIC HAZARDS HAVE BEEN IDENTIFIED THROUGH DESIGN RISK ASSESSMENT. THESE ARE OUTLINED IN 8.1 – 8.3 BELOW. ALL SITE OPERATIONS MUST ACCOUNT FOR ALL USUAL AND SITE/WORK–SPECIFIC HAZARDS.

8.1. PILING PLATFORM LEVEL IS UNCONFIRMED AT THIS STAGE. HOWEVER, FOR DESIGN PURPOSE, THE PILING MAT LEVEL FOR THE PERIMETER CONTIGUOUS PILE WALL AND BEARING PILES IS GENERALLY TAKEN TO BE THE PROPOSED GROUND LEVEL; APPROX. +44.600M OD. NONETHELESS, THE PRINCIPAL CONTRACTOR MUST CONFIRM ACTUAL PILING PLATFORM LEVEL(S) PRIOR TO THE COMMENCEMENT OF PILING WORKS ON THE SITE, SO THAT THE PILE WALL SCHEDULE & BEARING PILE SCHEDULE MAY BE AMENDED ACCORDINGLY.

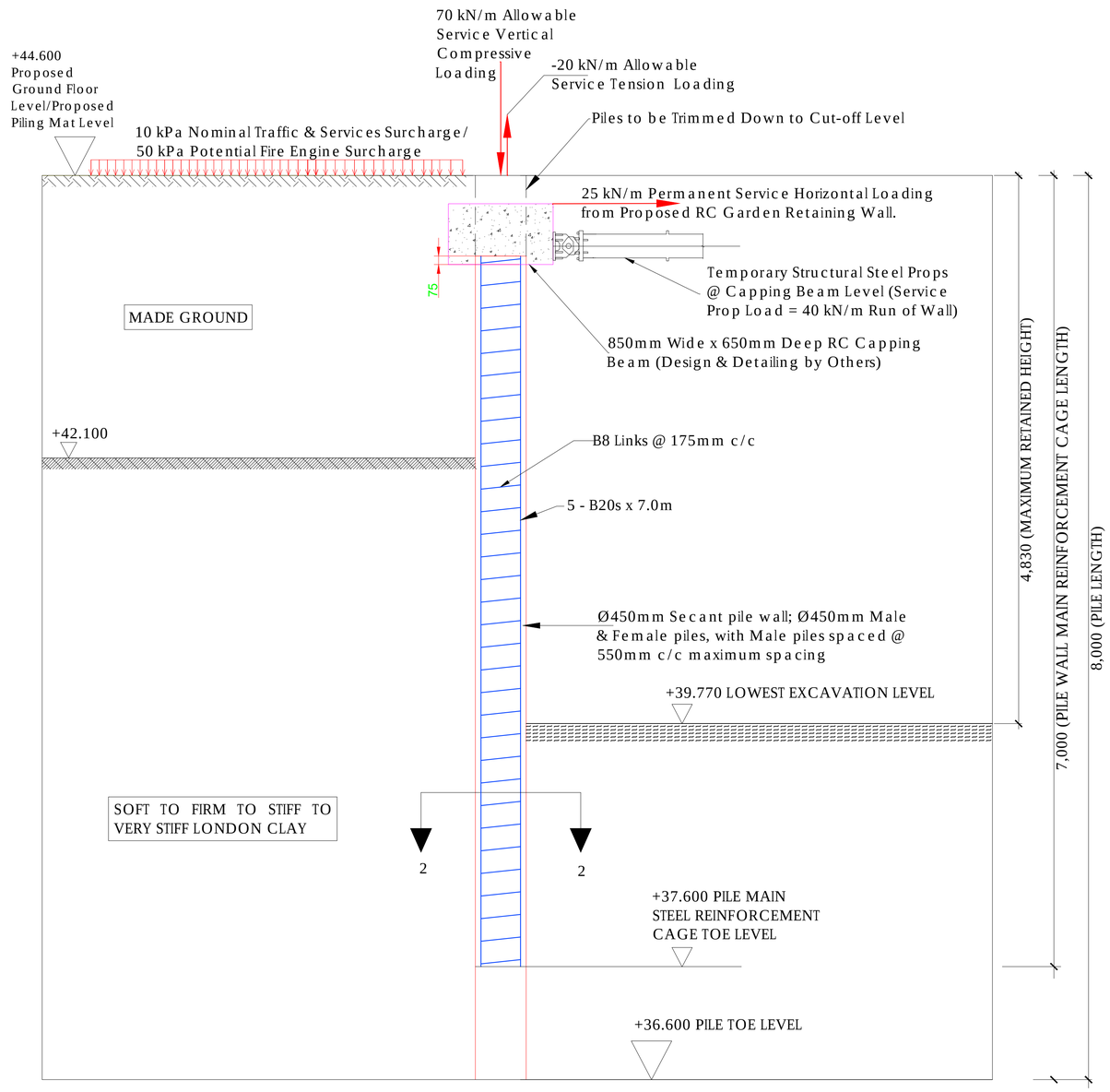
8.2. A REINFORCED CONCRETE CAPPING BEAM MUST BE CONSTRUCTED ON THE PILE WALL, WHILE TEMPORARY PROPS MUST BE INSTALLED AT LEVELS SPECIFIED BY DFS PRIOR TO THE COMMENCEMENT OF BULK EXCAVATION FOR THE NEW BASEMENT.

8.3. IN ADDITION, IT IS IMPERATIVE THAT THE CONCRETE MIX DESIGN FOR THE PILES IN THE SECANT & CONTIGUOUS WALL ACCOUNTS FOR 10MM MAXIMUM AGGREGATE SIZE AND SET–RETARDING ADMIXTURES IN ORDER TO EASE THE INSTALLATION OF REINFORCEMENT CAGES INTO CONCRETED DRILLHOLES. REINFORCEMENT CAGE VIBRATORS MAY ALSO BE REQUIRED TO FORCE THE STEEL CAGES DOWN TO THE DESIGN DEPTHS.

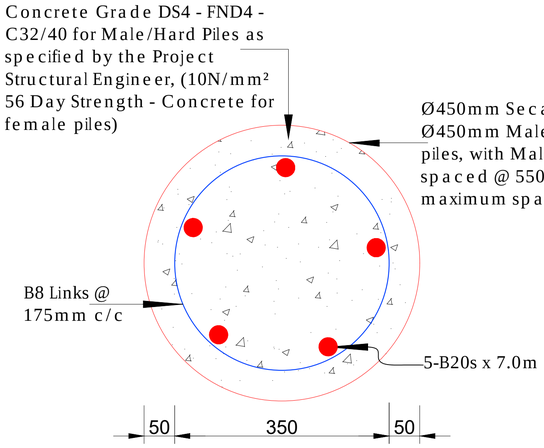
EXPECTED MAXIMUM WALL LATERAL DEFLECTION < 5mm

INSTALL FEMALE PILES TO 6.0m DEPTH ONLY

STRICT SUPERVISION OF BULK EXCAVATION BY MAIN CONTRACTOR IS REQUIRED, SO AS TO ENSURE THAT BULK EXCAVATION DOES NOT PROGRESS BELOW THE DIG DEPTH SHOWN IN THIS DRAWING



SECANT PILE WALL SECTION B-B (SCALE 1:25)



SECTION 2-2 (SCALE 1:5)

PROPOSED SEQUENCE OF CONSTRUCTION:

PILE WALL SECTION B - B (Ø450 PERIMETER SECANT PILE WALL, SINGLY PROPPED, OTHER AREAS OF PROPOSED BASEMENT, EXCLUDING THE PROPOSED UNDERPINNING AREA):

A. INSTALL TEMPORARY GUIDE WALL PRIOR TO THE COMMENCEMENT OF SECANT PILE WALL CONSTRUCTION.
B. INSTALL Ø450 INTERLOCKING MALE AND FEMALE PILES, WITH MALE PILES SPACED @ 550mm C/C INTERVALS FROM PILING PLATFORM LEVEL (+44.600) TO DEPTHS SPECIFIED BY DFS TO FORM SECANT PILE WALL; SEE DFS' PILE WALL CONSTRUCTION SCHEDULE FOR MORE DETAILED INFORMATION.
C. BREAK DOWN PILES TO 75MM ABOVE PROPOSED SOFFIT LEVEL OF RC CAPPING BEAM.
D. CONSTRUCT RC CAPPING BEAM ON PILE WALL.
E. INSTALL TEMPORARY PROPS AT CAPPING BEAM LEVEL.
F. COMPLETE BULK EXCAVATION DOWN TO BASEMENT FORMATION LEVEL; +39.770.
G. PLACE BLINDING OF 50MM MINIMUM THICKNESS AT FORMATION LEVEL.
H. CONSTRUCT 950MM THICK REINFORCED CONCRETE RAFT/BASEMENT FLOOR SLAB WITH WATER-PROOF CONCRETE AND DOWEL INTO PILE RETAINING WALL.
I. COMMENCE THE CONSTRUCTION OF RC LINER WALL WITH WATER-PROOF CONCRETE, IN FRONT OF PILE RETAINING WALL, FROM BASEMENT LEVEL, UP TO CAPPING BEAM SOFFIT LEVEL AND CONNECT SAME TO CAPPING BEAM.
J. CONSTRUCT GROUND FLOOR SLAB AND CONNECT SAME TO CAPPING BEAM.
K. REMOVE TEMPORARY PROPS AT CAPPING BEAM LEVEL.
L. CONSTRUCT SUPERSTRUCTURE.

IMPORTANT CONSTRUCTION NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, AND SPECIALISTS LATEST DRAWINGS AND SPECIFICATIONS. ANY DISCREPANCIES MUST BE REPORTED TO DFS, ENGINEER AND ARCHITECT IMMEDIATELY.
4. ONLY FIGURED DIMENSIONS ARE TO BE USED. ANY QUERIES MUST BE REFERRED TO DFS.
5. 50mm COVER TO PILE REINFORCEMENT.
6. STRICT SUPERVISION OF BULK EARTH WORKS IS REQUIRED TO ENSURE THAT EXCAVATIONS DO NOT EXCEED THE DESIGN DEPTH SHOWN IN THESE DRAWINGS (4.83m).
7. SECANT & CONTIGUOUS PILE WALLS SHALL BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE ICE SPECIFICATIONS FOR PILING AND EMBEDDED RETAINING WALLS (ICESPERW, 2016).
8. THE SECANT & CONTIGUOUS PILE WALLS ARE DESIGNED FOR BOTH TEMPORARY AND PERMANENT USE.
9. THE SECANT & CONTIGUOUS PILE WALLS ARE DESIGNED TO SUPPORT FULL HYDROSTATIC PRESSURE IN THE LONG–TERM, ONCE FACED WITH A PERMANENT RC LINER WALL, IN ACCORDANCE WITH THE RECOMMENDATION OF THE BS8102 (2009).

DEEP FOUNDATIONS SPECIALISTS LIMITED
2nd FLOOR, THE PORTER BUILDING 1 BRUNEL WAY
SLOUGH SL1 1FQ
TELEPHONE: 01753 396498

CLIENT: BROXWOOD VIEW LIMITED

JOB TITLE: BROXWOOD VIEW, 29 ST. EDMUND'S TERRACE LONDON NW8 7QH

DRAWING TITLE: SECANT PILE WALL SECTION B-B

DATE	DRAWN	CHECKED
14 FEB 2023	AR	AA

DRAWING No.	REV	SCALE
DFS221011-03	04	SCALE IS AS SHOWN @ A1

DFS' Pile Wall Construction Schedule

BROXWOOD VIEW, 29 ST. EDMUND'S TERRACE LONDON NW8 7QH
450mm Dia. Secant & 600mm Dia. Contiguous Pile Retaining Walls
Wall Schedule - 450mm Dia. Secant Male & Female Piles, with Male Piles Spaced @ 550mm c/c & 600mm Dia. Contiguous Piles Spaced @ 700mm c/c
Rev 04

SHEET NO.: of
ENQUIRY NO. JOB NO.:
CREATED BY: AR CHECKED BY: AA
DATE: **14/02/2023** DATE:14/02/23

Wall Section	Wall Type	Piling Technique	Temporary Condition	Permanent Condition	Wall Length	Asumed PPL	Lowest Excavation Level	Design Retained Level for Pile Wall	P/H	Min excavation level inc. Overdig	Retained Height	Pile Dia	Male Pile Spacing c/c	Required Male Pile Toe Level	Required Female Pile Toe Level	No. of Hard Piles Required	Bored/Concreted Male Pile Length	Bored/Concreted Female Pile Length	Estimated Maximum Pile Lateral Deflection	Anticipated Maximum Pile Lateral Deflection	Required Steel Reinforcement in Male Piles	Steel Top	Steel Reinforcement Cage Toe Level	Steel Reinforcement Cage Length
					(m run)	(mOD)	(mOD)	(mOD)		(mOD)	(m)	(mm)	(mm)	(mOD)	(mOD)		(m)	(m)	(mm)	(mm)		(mOD)	(mOD)	(m)
SECTION A - A	600mm Dia. Perimeter Contiguous Pile Wall	CFA Drilling with Heavy Duty Augers	Doubly Restrained with 2 No. Rows of Structural Steel Struts @ Capping Beam Level & 2.5m Depth (+42.100)	Restrained by the Basement Raft and the Ground Floor Slab	12.5	44.600	39.770	44.600	2.31	39.270	4.83	600	700	28.600	N/A	18	16.0	N/A	20	10	12 - B40 x 13m & B16 links @ 150mm c/c	44.600	31.600	13.0
SECTION B - B	450mm Dia. Perimeter Secant Pile Wall	CFA Drilling with Heavy Duty Augers	Singly Restrained with 1 No. Row of Structural Steel Struts @ Capping Beam Level	Restrained by the Basement Raft and the Ground Floor Slab	56.5	44.600	39.770	44.600	0.66	39.270	4.83	450	550	36.600	38.600	103	8.0	6.0	8	10	5 - B20 x 7m & B8 links @ 175mm c/c	44.600	37.600	7.0
					69.0 m run									Total		18								

18 No. 600mm Dia. Contiguous Piles
103 No. 450mm Dia. Male Secant Piles
104 No. 450mm Dia. Female Secant Piles

Design Notes:

RC Capping Beam
It is Imperative that the Project Structural Engineer Designs the RC Capping Beam on the Pile Wall to Safely Span over a Minimum Length of 8m under 160 kN/m Service Horizontal Loading Across Openings at Ground Floor Level in the Permanent Condition

Support to Vertical Axial Loading
Based on the Recommended Male/Hard Pile Lengths in the Above Table, the Pile Wall can Safely Support Service Vertical Compressive and Tension Loading of up to 500 kN/m & -20 kN/m Run of Wall Respectively, as Specified by the Project Structural Engineer.

Groundwater Cut-off
Install Female Piles to 6m Depth, as Specified in the Above Table; Minimum Embedment of 1m in the Stiff to Very Stiff London Clay Layer below Basement Formation Level is Required.

Concrete Grade DS4-FND4-C32/40 for Male/Hard Piles, as Specified by the Project Structural Engineer. For Female Piles, Provide 10 N/mm2 Concrete (56 day-strength) for Permanent Groundwater Cut-off.

50mm cover to pile reinforcement

Revision Notes: **Rev 04**

DFS' Bearing Pile Construction Schedule

Ref			
Made By	AR	Date	30/11/2022
Verified	AA	Date	30/11/2022
Page			Revision: 02

BROXWOOD VIEW, 29 ST. EDMUND'S TERRACE, LONDON NW8 7QH - 300mm Dia. Bearing Piles

Bearing Pile Schedule - No Pile Load Testing Requirements

Pile Indentification No.		No. of Piles	Shaft Diameter (mm)	Piling Technique	Piling Platform Level (m OD)	Estimated Lowest Pile Cut-Off Level (m OD)	Concreting/Steel Termination Level	Service Overturning Moment kNm	Service Horizontal Loading KN	Maximum Service Compression KN	Service Tension KN						Compression Toe Level (m OD)	Tension Toe Level (m OD)	Bore Length from PPL (m)	Main Reinforcement Cage: Concreted Length (m)	No. of Bars	Bar dia. mm	Links	Length (m)	Tension Reinforcement (CFA): Bar & No.	Length (m)
P1		1	300	CFA/SFA	44.600	TBC	44.600	19	10	250	-25							29.60	37.10	15.0	15.0	4	B25	R6 @ 120	8		
P2		1	300	CFA/SFA	44.600	TBC	44.600	19	10	250	-25							29.60	37.10	15.0	15.0	4	B25	R6 @ 120	8		
P3		1	300	CFA/SFA	44.600	TBC	44.600	19	10	250	-25							29.60	37.10	15.0	15.0	4	B25	R6 @ 120	8		
P4		1	300	CFA/SFA	44.600	TBC	44.600	19	10	250	-25							29.60	37.10	15.0	15.0	4	B25	R6 @ 120	8		
P5		1	300	CFA/SFA	44.600	TBC	44.600	19	10	100	-25							34.60	37.10	10.0	10.0	4	B25	R6 @ 120	8		
	TOTAL :	5																								

SUMMARY

No. of Piles	Pile Diameter (mm)	Max Service Compression (KN)	Lowest Toe Level (m OD)	Ave Bore Length (m)	Ave Concreted Length (m)	Main Reinforcement: No. of Bars	Dia (mm)	Type	Length (m)	Tension Reinforcement	Concrete Volume (m^3)					Bore Max Length (m)		Bore Min Length (m)
						300mm DIA. PERMANENT BEARING PILES												
5	300	+250/-25	29.600	14.0	14.0	4-B25 x 8m & R6 Links @ 120mm c/c x 5 No's					5.0					15.0		10.0

Project Structural Engineer's Drawings

NOTE:
ALL DIMENSIONS PROVIDED AND KEY DATUM TO BE CHECKED AND AGREED WITH ARCHITECT AND STRUCTURAL ENGINEER. ANY DISCREPANCY TO BE IMMEDIATELY NOTIFIED TO ARCHITECT.

RIBA STAGE 3 (COORDINATION)

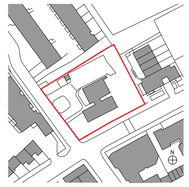
NOTES

No implied license exists. This drawing should not be used to calculate areas for the purposes of valuation. All dimensions to be checked on site by the contractor and such dimensions to be their responsibility.

This drawing is to be read in conjunction with all other contract documents and specifications and all other consultants drawings. All levels and dimensions should be checked on site

All work must comply with relevant British Standards and Building Regulations requirements Drawing errors and omissions to be reported to the architect

KEY PLAN



- Existing Structure / Earth
- Existing Structure not part of this application
- Area of backfill to be removed
- Assumed existing internal partitions and fittings
- Site Boundary

DRAFT ISSUE FOR SITE CHECK
FINAL SETTING OUTS TO BE ISSUED ONCE MAIN CONTRACTOR CONFIRMS DIMENSIONS AND POSSIBLE ISSUES

Project Ref. No.	2113
Client	BROXWOOD VIEW LIMITED
Date	MARCH 2022
Scale	1:100 @ A1
Project	BROXWOOD VIEW, 29 ST EDMUNDS TERRACE, LONDON NW8 7QH
Drawing Name	EXISTING TOPOGRAPHICAL SURVEY AND GROUND FLOOR DIMENSIONAL CHECK
Drawing No.	R001
Rev.	-
Drawn	CF
Approved	AC
Signed	

CARBOGNO CENEDA ARCHITECTS
48a ANTILL ROAD, LONDON N15 4BA
TEL 07890 586 884
INFO@CARBOGNOCENEDA.COM

01 GROUND FLOOR PLAN SETTING OUT CHECKS
SCALE 1:100 @ A1

5m 10m

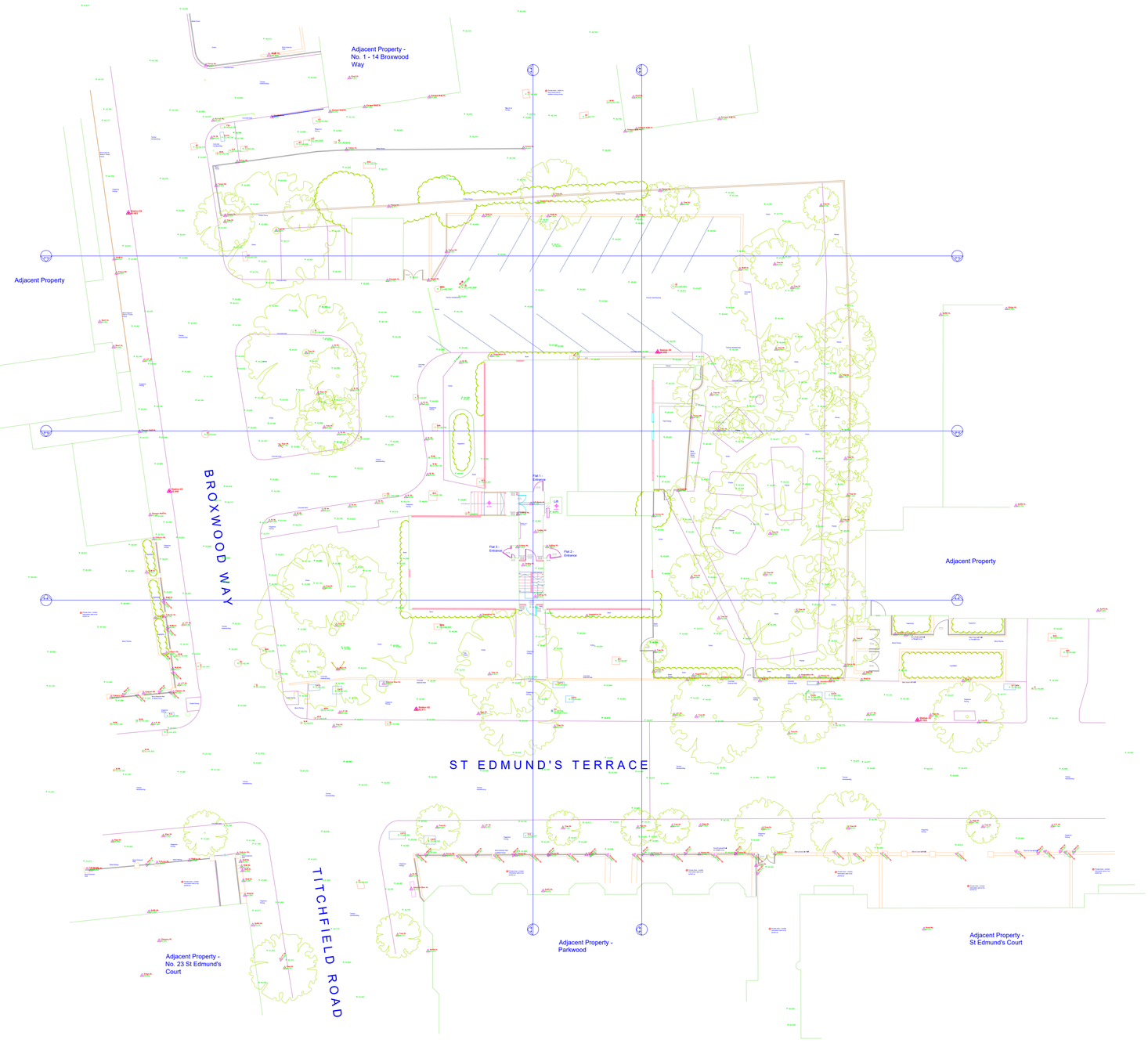
BROXWOOD WAY

No. 34 ST EDMUND'S TERRACE

NOT PART OF THIS APPLICATION

Existing Barrie House Entrance

SEE DWG 300



Site Plan / Ground Floor Plan

1:200 Scale

Note:
Areas drawn indicatively noted and indicated by grey dashed line as line below

Compass Note:
Geographical orientation indicated is for indicative purposes only.

Abbreviations Key:

I/C	-	Inspection Chamber	BT	-	British Telecoms
M/H	-	Manhole	GAS	-	Gas Supply
G	-	Drainage Gully	ES	-	Electrical Supply
CD	-	Channel Drain	PO	-	Post Office
RE	-	Rodding Eye	CATV	-	Community Antenna Television
RWP	-	Rain Water Pipe			
S+VP	-	Soil & Vent Pipe	TSSU	-	Traffic Light Signals
WM	-	Water Meter	T.P	-	Telegraph Pole
ST	-	Stop Tap	B.	-	Bollard
SV	-	Stop Valve	L.P.	-	Lamp Post
FH	-	Fire Hydrant	Ht	-	Height
IL	-	Invert Level			
CL	-	Cover Level			

Rev	Date	Amendments
B	2017.10.18	Window mullions added as per AI
A	2017.10.16	Windows on external wall added as per AI

Levels:
Levels co-ordinated to OS using GPS equipment, permanent stations shown on plan.

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London Office:
Kemp House
152 - 160 City Road
London
EC2V 2NX
020 3198 1197

Project:	Measured Building Survey
Address:	Barrie House, 29 St Edmund's Terrace, London, NW8 7QH
Drawing No:	2067 - 01
Drawing Title:	Site Plan / Ground Floor
Drawing Date:	September 2017
Drawing Size:	Scale as Shown @ A1
Drawn By: JH	Checked By: MW Issue B

NOTE:
ONLY SOFT STRIP OUT, SITE CLEARANCE AND FACILITIES PREPARATION CAN TAKE PLACE ON SITE. UNLESS OTHERWISE INSTRUCTED BY CARBOGNO CENEDA ARCHITECTS.
NO CONCRETE WORK, EXCAVATION, DEMOLITION OF PORTER'S LODGE, PILING CAN TAKE PLACE UNTIL WE ISSUE FURTHER INSTRUCTION.

CONTRACTOR TO CHECK EXISTING DRAINAGE RUNS AND CONFIRM THESE SERVE ONLY THE CARPARK AREA AND NOT BARRIE HOUSE.

NOTE:
SETTING OUT TO BASEMENT SHELL TO BE PROVIDED AT LATER STAGE ONCE FINAL STRUCTURAL DESIGN BECOMES AVAILABLE FROM RICHARD TANT ASSOCIATE (WHICH IS AWAITING CONFIRMATION OF CLT LOADINGS BY SPECIALIST CLT DESIGNERS)

KEY **GRID** SETTING OUT FROM BARRIE HOUSE N/W CORNER
GRID 1741 **GRID** 745

KEY **GRID** SETTING OUT FROM BARRIE HOUSE N/E CORNER
GRID 1096 **GRID** 1549

KEY **GRID** SETTING OUT FROM GROUND FLOOR REAR EXTENSION WALL
GRID 2397 **GRID** 709

NEW RC SHELL TO FORM STAIR TO PLANT ROOM

EXTENT OF BARRIE HOUSED FOOT PRINT TO FRONT

EXTENT BARRIE HOUSE FOOT PRINT FROM FIRST FLOOR LEVEL UP

EXTENT OF BARRIE HOUSE GROUND FLOOR FOOTPRINT (FLAT 1)

NOTE:
SETTING OUT TO BE PROVIDED AT LATER STAGE ONCE PARTY WALL AWARDS ARE IN PLACE AND ACCESS TO THIS AREA IS RESOLVED

CONTRACTOR TO CHECK PROXIMITY OF UNDERGROUND RUNS TO PILINGS

DIMENSIONAL CHECK 26571
DIMENSIONAL CHECK 12159
DIMENSIONAL CHECK 11245

DRAFT ISSUE FOR SITE CHECK
FINAL SETTING OUTS TO BE ISSUED ONCE MAIN CONTRACTOR CONFIRMS DIMENSIONS AND POSSIBLE ISSUES

RIBA STAGE 3 (COORDINATION)

NOTES

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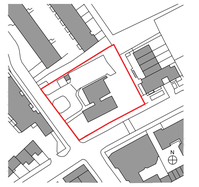
KEY PLAN



Existing Structure / Earth

Existing Structure not part of this application

Area of backfill to be removed

Assumed existing internal partitions and fittings

Site Boundary

Project Ref. No.	2113
Client	BROXWOOD VIEW LIMITED
Date	MARCH 2022
Scale	1:100 @ A1
Project	BROXWOOD VIEW, 29 ST EDMUNDS TERRACE, LONDON NW8 7QH
Drawing Name	SETTING OUT GRID AND PILES
Drawing No.	R101 Rev. -
Drawn CF	Approved AC Signed

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