Specification for Piling and Embedded Retaining Walls

Bedford Passage Development

RIBA Stage 4

Project reference: 60516144
MHA-ACM-XX-SP-SE-0009

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Quality information

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	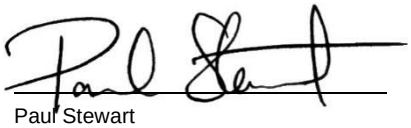	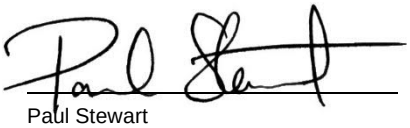
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
01	12/10/2018	First Issue	PAS	Paul Stewart	Regional Director
02	16/04/2020	Second Issue	BO	Baran Ozsoy	Technical Director
03	15/06/2020	Third Issue	BO	Baran Ozsoy	Technical Director
04	23/10/2020	Fourth Issue	DW	Dan Wallington	Project Manager

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1. Specification for Piling

1.1 Tender Requirement

The Trade Contractor is required to design, supply, deliver, install, and test piles for the re-development at the site.

The bearing piles shall be 600mm in diameter and constructed using bored or continuous flight auger techniques.

A ground investigation was undertaken by Concept Engineering Consultants Ltd in April to May 2018 comprising three cable percussion boreholes to 35m below ground level and twenty-seven observation pits to a maximum depth of 1.6m for structural purposes. The exploratory holes encountered a variable thickness of Made Ground overlying the Lynch Hill Gravel Member overlying the London Clay Formation overlying the Lambeth Group.

A supplementary ground investigation was carried out by the same company in January 2020. The new GI comprised two Cable Percussion Boreholes (BH) drilled to depths of 35.0mbgl, four Dynamic Sampling Boreholes (WS) drilled to a maximum depth of 8.0m, in-situ geotechnical testing, geotechnical and geo-environmental sampling and laboratory testing, and groundwater and gas monitoring.

The exploratory holes from both ground investigations encountered a variable thickness of Made Ground (maximum thickness of 5.50m) overlying Lynch Hill Gravel (maximum thickness of 2.50m) over London Clay Formation (maximum thickness of 18.60m) which in turn overlay Lambeth Group deposits (full thickness not proven, >10m proven).

It is anticipated that further intrusive works will be undertaken by the Museum of London Archaeology (MOLA). The Trade Contractor should ascertain the findings of these works prior to commencement of piling.

The site is located in an urban environment with adjacent structures present. The Trade Contractor should consider the site in detail before selecting equipment and procedures to undertake the works.

The Main Contractor will be responsible for supplying design information to the Contract Administrator for submission to gain Building Regulations approval for the pile design.

1.2 Specification

The piling work is to be carried out in accordance with the Institution of Civil Engineers Specification for Piling and Embedded Retaining Walls (SPERW) dated 2017, third edition. The following sections of this document are applicable to the Contract:

- Section B1 General Requirements for Piling Work
- Section B3 Bored cast-in-place concrete piles
- Section B4 Piles constructed using continuous flight augers or displacement augers
- Section B9 Secant pile walls
- Section B13 Integrity testing
- Section B15 Static load testing of piles
- Section B21 General requirements for concrete, mortar, structural grout and steel reinforcement

Additions, amendments, deletions and particular specifications relating to Sections B1, B3, B4, B9, B13, and B15 are listed in the following Sections, which shall take precedence over the original clauses where there is a conflict.

2. B1 Project Specification for Piling and Embedded Retaining Walls

a) Role of the Engineer

For the purposes of this Contract all references to the Engineer in the Piling Specification shall be deemed to mean Contract Administrator, (CA).

b) Location and Description of the Site

The site is located within the London Borough of Camden. It is centred on National Grid Reference 529262, 181811. The site is located on Cleveland Street, approximately 250m west of the Goodge Street London Underground Station. The site boundary encloses an area of approximately 0.32ha.

The site consists of North House located in the northwest corner of the site; South House located in the southwest corner of the site; and the Grade II listed Middlesex Hospital Annexe (the Union Work House) located in the centre of the site with two wing buildings at the rear.

The site is bounded by buildings with basements which vary in depth from single to double storey. A below ground tunnel associated with the Union Work House building appears to connect with tunnels along Cleveland Street. Beyond the site the tunnel is assumed to be disused as the tunnel stops before the site boundary.

Relevant features immediately surrounding the site are summarised in Table 1.

Table 1. Features Surrounding the Site

Direction	Summary
North	The Sainsbury Wellcome Centre with Howland Street and the BT Tower beyond
South	Middlesex House, the former Tottenham Mews Resources Centre, Days Hospital
East	Astor College with Charlotte Street beyond
West	Cleveland Street with commercial units beyond

The Trade Contractor shall be deemed to have visited the site and shall be wholly responsible for acquainting himself with the nature and the position of the site, access to the site, service locations, groundwater levels, soil conditions, obstructions, temporary works, the full extent of the works and all other information relevant to the execution of the works.

c) Nature of the Works

The work consists of the design supply, delivery, installation and testing of the permanent piles indicated on the drawings to carry the proposed loading of the new building. The Trade Contractor shall design the piles in order that the serviceability and ultimate limit states are met.

The Trade Contractor shall produce survey records and as-built drawings of the contract piles.

d) Working Area

Working areas shall be as agreed with the Main Contractor.

e) Sequence of the Works and Other Works Proceeding at the Same Time

The planned sequence for the piling works shall be provided with the Tender and agreed with the Main Contractor prior to commencement of the works.

f) Contract Drawings

Pile locations, design loads, cut-off levels etc are indicated on the drawings.

- MHA-ACM-00-B2-DR-SE-01000 - NEW BUILD GENERAL ARRANGEMENT BASEMENT B2
- MHA-ACM-00-B1-DR-SE-01001 - NEW BUILD GENERAL ARRANGEMENT BASEMENT B1
- MHA-ACM-BW.2-XX-DR-S-1001 – PROPOSED SECANT PILE WALL LAYOUT TO BOUNDARY WALLS
- MHA-ACM-BW.2-XX-DE-S-1002 - SOUTH BOUNDARY WALL WITH MIDDLESEX HOUSE SECTION 2-2
- MHA-ACM-BW.2-XX-DE-S-1003 – EAST GABLE WALL TO THE SOUTH HOUSE SECTION 3-3
- MHA-ACM-BW.2-XX-DE-S-1005 – EAST BOUNDARY WALL TO ASTOR COLLEGE SECTION 5-5
- MHA-ACM-BW.2-XX-DE-S-1006 - EAST BOUNDARY WALL TO ASTOR COLLEGE SECTION 6-6
- MHA-ACM-XX-P1-DR-S-1001 - NEW BUILD SECANT PILED WALL SURCHARGE LOADING PLAN
- MHA-ACM-00-GF-DR-SE-01106 – NEW BUILD SECANT PILING
- MHA-ACM-00-XX-DR-SE-00050 – NEW BUILD SECANT PILE WALL LOADING LEVEL 00, B1 AND B2
- MHA-ACM-00-B1-DR-SE-01012 – NEW BUILD PILE LAYOUT
- MHA-ACM-00-XX-DR-SE-01014 – NEW BUILD PILE SCHEDULE

g) Office and Other Facilities for the Engineer

Not required.

h) Submission of Information (in addition to Table B1.1)

Information shall be submitted in accordance with Table B1.1. The Trade Contractor will be responsible for providing information on the design and construction of the piling for the purpose of obtaining Building Regulations Approval. The designs shall be presented to AECOM for comment prior to the designs being submitted to Building Control.

i) Responsibility for Design, Including Any Division of this Responsibility

Foundation Piles

The Foundation Piles shall be designed using 'Option 2 – Contractor Design of Piles'. The Trade Contractor shall be responsible for the design, construction and testing of piles. The Trade Contractor shall be responsible for the sufficiency of the design and the execution of the piling works. A design warranty is required.

Retaining Wall Piles

The Retaining Wall Piles shall be designed using 'Option 3 – Contractor Design of Wall Elements'. The Trade Contractor shall be responsible for the design and construction of pile walls. The Trade Contractor shall be responsible for the sufficiency of the design and the execution of the piling works. A design warranty is required. The Trade Contractor shall provide a Wall Manual with the tender highlighting any divergences from the proposed temporary propping arrangement shown in the tender drawings.

j) Design Standards and Criteria for Piles or Walls Including Design Life

The design shall be carried out using all relevant design standards. The standards proposed shall be stated in the design and any deviation from the standards shall be clearly identified.

The design life of the piles shall be a minimum of 50 years.

k) Constraints on Design

The design is carried out in accordance with BS EN 1990:2002, BS EN 1992-1-1:2004, BS EN 1997-1:2004 and the associated UK National Annexes. Characteristic shaft resistance of bearing piles shall follow the guidance of London District Surveyors 'Design of Straight Shafted Bored Piles in London Clay', third edition.

The design life of the piles shall be a minimum of 50 years.

l) Working Platform and Commencing Level

The commencing surface for piles shall be as agreed with the Contract Administrator and Main Contractor. The Trade Contractor shall be responsible for piling platform design and approval.

m) Schedule of Specified Working Loads or Representative Actions

Refer to contract drawings.

n) Pile or Wall Element Dimensions

Refer to contract drawings.

o) Preliminary Piles and Trial Bores/drives/panels

To be determined by Trade Contractor.

p) Performance Criteria for the Structure to be Supported on the Piles or by the Wall

Piles shall be designed and constructed such that differential movement between adjacent piles and pile caps shall not exceed 1 in 500.

Piles shall be designed and constructed such that settlement at working load for individual or groups of CFA/BCIP piles shall not exceed 20mm.

q) Performance Criteria for Piles Under Test (see Table B1.2)

Static load testing shall be undertaken in accordance with Table B1.2. Preliminary pile testing is required if the design diverges from the constraints highlighted in clause k). Working pile tests required on a minimum of 1% of working bearing piles.

Pile Ref.	Permitted Types – Performance Specification Section No.	Specified Working Load (kN)	Pile Designation	Design Verification Load DVL (kN)	Permitted Settlement at DVL (mm)	Permitted Settlement at DVL + 0.5SWL (mm)	Minimum Pile Diameter (mm)
Working Bearing Pile Testing							
WT01	BCIP/CFA	Refer to pile schedule	Base	SWL	6	10	600
WT02	BCIP/CFA	Refer to pile schedule	Base	SWL	6	10	600

r) Sampling and Testing of Materials (other than concrete)

Not required.

s) Permissible Damage Criteria for Existing Critical Structures or Services

The Trade Contractor shall confirm the presence of all underground services, ducts, tunnels, foundations or other underground structures affected by the works prior to the commencement of piling.

The Trade Contractor shall have the responsibility of ensuring that no damage is caused by the pile installation, or subsequent in service settlements, to existing structures and services. These are to include:

- Surrounding buildings
- Existing tunnels
- Service/utility infrastructure
- Highway infrastructure

- Other surrounding structures or features

Ground movements should be controlled to avoid/limit damage to the adjacent buildings. Damage category to be as defined by Burland et al (1977). The Trade Contractor shall design the temporary works to limit damage to Category 1 or less, based on the final proposed pile size and final propping arrangement. The Trade Contractor shall liaise with the temporary works designer to develop the final propping arrangement. Pile design to take account of any resultant eccentricity of load.

If the Trade Contractor is of the opinion that the below ground structures or neighbouring properties may be damaged, this shall be stated in the returned tender documents and the extent and nature of the necessary protective or other temporary works described therein.

The Trade Contractor shall take all reasonable measures to control noise, vibration, dust, and traffic movements throughout the contract period. Attention is drawn to adjacent occupied buildings.

t) Additional Temporary Works Plant and Duration of Loading for Which Working Platform Should be Designed

Refer to Main Contractor– TBC.

u) Site Datum and Grid

Refer to Main Contractor– TBC.

v) Restrictions on Permissible Working Hours

Refer to Main Contractor– TBC.

w) Restrictions on Noise and Vibration Levels

Restrictions on noise and vibration are to be confirmed during tender period. Adjacent buildings and utility infrastructure may be sensitive to vibration. The proposed piling technique shall be designed to minimise disturbance. Provide the following information as part of the tender:

- Proposed limits on vibration during the work and justification for these limits.
- Proposed method for monitoring vibration should this be required.

x) Site Investigation Including Geotechnical and Geo-environmental Information, and the Need for Further Site Investigation

The following reports are available:

- AECOM, Basement Impact Assessment, Ref. 60516144/BIA/004 (Refer to the latest revision)
- AECOM Ground Movement Assessment Report, Ref. 60516144/GEO/GMA/002 Rev 02, 24/4/2020.
- AECOM Geotechnical and Geo-environmental Ground Condition Report, Ref. 60516144/MH-ACM-XX-XX-RP-GE-01 Rev P01, 15/4/2020.
- Concept Engineering Consultants Ltd, Site Investigation Report, Ref. 18/3104-FR01, July 2018.
- Concept Engineering Consultants Ltd, Site Investigation Report, Ref. 19/3355-FR01, April 2020.

The Trade Contractor shall satisfy himself as to the adequacy of the information provided and carry out any further investigation that is deemed necessary.

y) Disposal of Excavated Material and Trimmed Excess Pile and Wall Materials

Off site to appropriate licensed landfill site, with agreement of Contract Administrator and Main Contractor.

z) Other Particular Technical Requirements

The Trade Contractor shall submit a Method Statement and Programme for the works with the tender return.

Pile installation records shall be made available to the CA where requested.

In addition to clause B1.10.3, all bored cast-in-place piles installed from a working platform above cut-off level are to be overcast to the required cut off level, capped with a ply lid to prevent contamination and the remaining hole shall be backfilled with loose material. Identification markers to be agreed with Main Contractor.

In addition to clause B1.17, rebar above the required cut off level should have debonding sleeved covers to reduce break out works.

aa) Water Retention Function and Degree of Retention for Retaining Wall in Both Temporary and Permanent Conditions

The wall shall be designed to be ‘watertight’ in accordance with Clause B1.9 in both the temporary and permanent conditions.

3. B3 Project Specification for Bored Cast-in-place Piles

a) Support Fluid

Not required unless considered necessary by Trade Contractor.

b) Base or Shaft Grouting

Not required.

c) Pile Shaft and Base Inspection by CCTV and / or Sampling Probing

Not required.

d) Details of Permanent Casings

Permanent casings not required.

For rotary bored cast-in-place piles temporary casings will be required through the Made Ground and Drift Deposits. Temporary casings shall be in accordance with B3.3.2.

e) Inspection of Underreams

Not applicable.

f) Other Particular Technical Requirements

No further technical requirements.

4. B4 Project Specification for Piles Constructed Using Continuous Flight Augers

a) Permitted Pile Types

Piles shall be continuous flight auger (CFA) piles. Displacement piles are not permitted.

b) Splitting of Augers

Not permitted.

c) Control of Concrete Supply

The piles shall be concreted using Method 2 – oversupply of concrete.

d) Detailed Requirements for Monitoring

Additional records to be kept in accordance with Table 12 of BS EN 1536:2000 with the following additional requirements:

- Volume of actual concrete consumption against volume of theoretical concrete consumption
- Rate of concrete flow over rate of auger extraction
- Variation of auger torque with depth

e) Other Particular Technical Requirements

No further technical requirements.

5. B9 Project Specification for Secant Piled Walls

a) Construction Tolerances

Tolerance	Embedded Retaining Wall Constructed with a Guide Wall
Plan position for piles/walls with cut-off level below commencing surface	25mm + 1 in 200 below cut-off level

b) Performance Criteria for Movement Under Vertical Load

Wall elements shall be designed to support vertical loading. The Trade Contractor shall assess the potential load sharing provided by the capping beam and state the extent of load sharing considered. Vertical movements from the application of vertical load shall not exceed 10mm with rotation of the capping beam to not exceed 1:500.

c) Support Fluid

Not permitted.

d) Additional Overbreak Tolerance

Tolerances shall be in accordance with (a) above. The structural design includes an allowance for the total tolerance in the basement wall build-up for variance in plan position/verticality/overbreak of pile during concreting, as identified in section (5a). Any additional out of tolerance/oversizing that occurs that takes the pile outside this will need to be broken back.

e) Requirements for Low Strength Concrete

Trade Contractor to specify mix for secant wall. Details to be confirmed with Contract Administrator.

f) Pile Diameters

The Trade Contractor shall be responsible for the final design, but the preliminary design is based upon a nominal pile diameter of 600mm, using hard-firm piling techniques.

g) Pile Spacing and Overlap at Commencing Level

Preliminary design is based on 600mm diameter hard-firm piles. Spacing for hard piles will need to be confirmed in the Trade Contractor's detailed design, taking into account the findings from the ground investigation and also keeping a sufficient overlap in between primary and secondary piles for water tightness.

h) Depth to Which Pile Interlock Must be Maintained

All secondary piles shall extend at least 1m below the basement formation level or 1.0m into the London clay, whichever is deeper.

i) Instrumentation

2No.inclinometer tubes shall be installed to full pile depth along centre line of wall, at locations to be defined. Monitoring to be carried out in accordance with the AECOM Movement and Tolerances Specification (MHA-ACM-XX-SP-SE-0007). The rest of the wall sections shall be monitored regularly on daily basis by means of precise optical surveying methods. For this purpose, certain benchmark locations at top, middle and bottom section of the exposed surface of the secant piles will be chosen in every 5m on the plan in order to cover the area not being monitored by inclinometers.

Monitoring to be carried out by specialist contractor. The monitoring range should be displacement orientated and should be capable of measuring to the nearest 0.1mm.

The Trade Contractor shall be responsible for installation of inclinometer tubes suitable for use by the specialist monitoring contractor. Defective installations shall be repaired or replaced with a suitable alternative to the agreement of the Contract Administrator.

j) Temporary Backfill Material

Not applicable.

k) Integrity Testing

Not required for secant pile wall.

l) Other Particular Technical Requirements

No further technical requirements.

6. B13 Project Specification for Integrity Testing

a) Method of Test

This section does not apply to the secant pile walls. Integrity testing is to be carried out for all bored/CFA foundation piles by an approved independent firm authorised and trained by the licence holders of the system, and the method of test employed is to be the Low Strain Method.

b) Number, Type and Location of Elements to be Tested

Testing to be carried out for foundation piles only. Secant piles shall not be tested by this method. All foundations shall be tested by means of the low strain methods.

c) Stages in the Programme of Works When a Phase of Integrity Testing to be Carried Out

The testing shall be carried out at a time agreed with the Main Contractor and Contract Administrator.

d) Cross-hole Sonic Logging

Not required.

e) Time After Testing at Which the Test Results and Findings Shall be Available to the Engineer

As Clause B13.8

f) Number of Days to Elapse Between Casting and Integrity Testing

As recommended by the pile designer and test consultant.

g) Preparation of Concrete Surface of Test Element for Testing Using the Vibration Method

Test surface to be prepared to ensure a clean contact between test equipment and pile.

h) Other Particular Technical Requirements

None.

7. B15 Project Specification for Static Load Testing of Piles

a) Type of Pile

This section does not apply to the secant pile walls. Static Load Testing is to be carried out for foundation piles only. Piles constructed using continuous flight augers or rotary bored cast-in-place.

b) Type of Test

Multi-cyclic proof load test as clause B15.13.1.

c) Loads to be Applied and Procedure to be Adopted in Testing Preliminary Piles, Including Maximum Reaction Capacity

The method of load application shall ensure that only axial loads are applied. Loads shall be in accordance with Table B15.1.

d) Loads to be Applied and Procedure to be Adopted in Proof Testing Working Piles, Including Maximum Reaction Capacity

The method of load application shall ensure that only axial loads are applied. Loads shall be in accordance with Table B15.1. Extension of testing shall be in accordance with B15.13.3.

e) Whether Test is to be Compression or Tension and Number of Loading Cycles

Preliminary and proof load test is to be in compression and multi-cyclic.

f) Special Materials to be Used in Construction of Preliminary Test Piles Where Appropriate

No special requirement.

g) Special Construction Detail Requirements for Test Piles, Including Requirements for Additional Reinforcement, Increase Concrete Strength, Sampling or in situ Testing

No special construction measures required.

h) Special Requirements for Pile Testing Equipment and Arrangement, Including Requirement for any Pile Instrumentation

No special measures required.

i) Pile Installation Criteria

Test piles to be installed in similar manner to all working piles.

j) Time Interval Between Pile Installation and Testing

A minimum period of 7 days will be required between pile installation and testing.

k) Removal of Temporary Works

Removal of temporary works to be agreed with Contract Administrator.

l) Whether Interpretation is Required and Extent of Interpretation

Contractor to carry our interpretation of the test and provide results to the Contract Administrator within 7 days of completion of the test.

m) Additional Records or Information Required from the Load Test

No additional records required.

n) Displacement Transducer Stem Travel

Proposed displacement transducer stem travel to be provided.

o) Cut Off Level for Test

To be agreed with Contract Administrator.

p) Details of Work to be Carried out to the Test Pile Cap or Head at the Completion of a Test

Pile head to be prepared to enable pile cap construction. Any defects resulting from the pile test shall be notified to the Contract Administrator before further work is undertaken.

q) Special Requirements for the Application of a Lateral Load to a Pile Detailed in Accordance with the Expected Conditions of Loading

No special requirements.