79 AVENUE ROAD, St JOHNS WOOD, LONDON, NW8 6JD

CONSTRUCTION METHOD STATEMENT FOR PLANNING

Job No: 193219

Date: January 2020

Prepared by: Rob Markovits C.Eng. M.I. Struct.E

Revision: P1

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Preamble

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ABOUT FORM SD

Form has undertaken over 300 projects involving subterranean development, both new build and retrospective, using numerous techniques and sequences of construction. This extensive design, site and local geology/hydrology experience has positioned the practice as one of London's leading subterranean engineering design consultants.

Many of our subterranean projects are in the London Boroughs of RBKC, Westminster, Camden, Hammersmith & Fulham and Wandsworth, making us familiar with the most recent requirements of subterranean development.

Form has designed multi-level basements using techniques including open dig, underpinning (mass and 'L' shaped R.C. special foundations), temporary and permanent steel sheet piling, temporary and permanent concrete piled retaining walls, top down construction and tunnelling.

TERMS OF REFERENCE

We were appointed in July 2019 by the property owner occupier in collaboration with MIRA A Architecture & Engineering, to prepare a supporting Structural Design Statement in support of a Planning Submission for demolishment and development of 79 Avenue Road, NW8 6JD, London.

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Contents

Introduction

1.1 Purpose of Report

This report has been prepared as a supporting document to the planning application for the redevelopment of the site currently known as 79 Avenue Road, which currently consists of a three-storey detached residential dwelling. The proposals involve the demolition of the existing post war building and the construction of a new three storey house incorporating a new basement. This report presents an outline structural scheme for the construction of the new basement and also touches on the construction of the superstructure.

This report and the structural information produced to date are based on a visual inspection of the existing building and review of the proposed architectural plans. Trial pit investigations have been undertaken to investigate the existing foundation details along the boundaries, the details of which recorded within the site investigation report and are incorporated into our structural drawings.

It should be read in conjunction with all other Consultants reports, specifications, and drawings. This document is confidential. It may not be assigned to or relied upon by a third party without the agreement of FORM Structural Design (FSD) Limited in writing. FSD retains all copyright and other intellectual property rights in the document and its contents unless transferred by written agreement between FSD and the Client. The findings and opinions expressed are based on the conditions encountered and/or the information reasonably available at the date of issue of this document and shall be applicable only to the circumstances envisaged herein.

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1.2 Health and Safety

The consideration of Health and Safety, including all necessary risk assessments, will conform to the requirements of the Health and Safety Act 1974 and the Construction (Design and Management) Regulations 2015. The Planning Supervisor will be made aware of any consequences of the design to Health and Safety through risk assessments. The CDM risk register will be continuously updated during the project and at key stages such package tenders and the issue of construction status information. In-house quality assurance, calculation and drawing checking procedures, as well as our responsibility under the CDM regulations are set out in the FORM's Operational Procedures and ensure compliance with our ISO 9001:2015 & ISO 14001:2015 accreditation.

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2 Planning Policy

The table below provides a non-technical executive summary covering key aspects of the London Borough of Camden's planning requirements for Basements and Lightwells GPG4 and DP27, which also ties in with Camden's preferred policy DP20. The key aspects have been divided into specific headings to ensure all requested information has been provided for the planning application.

Extract Descriptions of Key Aspects from Camden Development Policies Basements and Lightwells GPG4 and DP27:	Reference Location within this Report	Compliance to GPG4/ DP27 Policy
A. The **Desk Study** information and an analysis of the findings in relation to the proposals. A thorough desk study has been completed and presented in the Construction Method Statement main text, it includes:		
a. The site history;	Section 3.2	
b. The age of the property;	Section 3.2	
c. The site survey;	Section 3.3.1	
d. The geology and ground conditions –from the site investigation and British Geological Society borehole logs;	Section 3.3, 3.4 and 3.5	
e. Historic River Courses;	Section 3.4	✓
f. Underground Infrastructure;	Section 3.7	
i. Services;		
ii. Drains;		
iii. Tunnels;		
iv. Nearby basement developments in the area have been considered.	Section 3.9	
B. An appraisal of the **existing building structural arrangement** including previous alterations and any obvious defects, asses the condition and location of **adjoining buildings.**	Section 3 and 3.9	✓
C. Assessment of a **site investigation** which is demonstrated to be relevant to the site together with **trial pits** showing existing foundations and the material they are founded on, for all walls which may be impacted by the proposed scheme. If **groundwater** is present, levels are to be monitored for a period of time.	Section 3.3 and Appendix B	✓
D. Details of the engineering design which is advanced to detailed proposal stage a. Ground conditions and ground water; b. Existing trees and infrastructure; c. Drainage; d. Flooding; e. Vertical and horizontal loading; f. Structural engineering general arrangement and details; drawing showing underpinning, piled walls etc	Section 4	✓
E. An analysis of the **upper aquifer** (when it exists) and how the basement may impact any groundwater flow.	Section 3.5	✓
F. Details of **flood risk, surface water flooding, critical drainage areas** and how these have been addressed in the design. A full flood report assessment to represent areas determined to be at risk.	Section 3.4	✓
G. An Assessment of **movement** expected and the effect of adjoining or adjacent properties, covering both short term and long term effects. Design and construction to limit damage to all buildings to a maximum of Category 2 as set out in CIRA Report 580	Refer to BIA Report	✓

3 Site Information

3.1 The Site, Location, and Existing Building

The site is currently occupied by a post war single detached house located on Avenue Road (Figure 1). The property is not listed, and the site is not within a conservation area. The existing building consist of three storeys and is constructed from solid London stock brick walls. Figure 2 shows the front view of the house from Avenue road.

Figure 1: *Site Location Map*

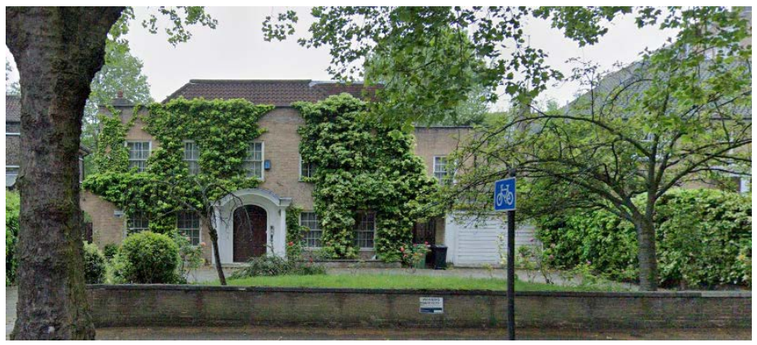

Figure 2*: Front View of Site*

3.2 Site History

Looking at the historic OS maps there is a record of a building on the site on the map for between 1893-1895 as shown in Figure 3. The latest Historic map ranging from 1944-1967 (Figure 4) shows buildings of a different shape to that currently on site indicating that the original property on site has been either partly demolished and extended or completely demolished and rebuilt after 1944-1967.

Figure 3: 1893-1895

Figure 4: 1944-1967

As can be seen from the bomb map in Figure 5, no bombs were dropped on the site during WW2. However, bombs did drop very near the site down Avenue Road. As seen by the map. The London County Council Bomb Damage Maps 1939-1945 (Figure 6) shows that there was blast damage – minor in nature to the property and the neighbouring properties.

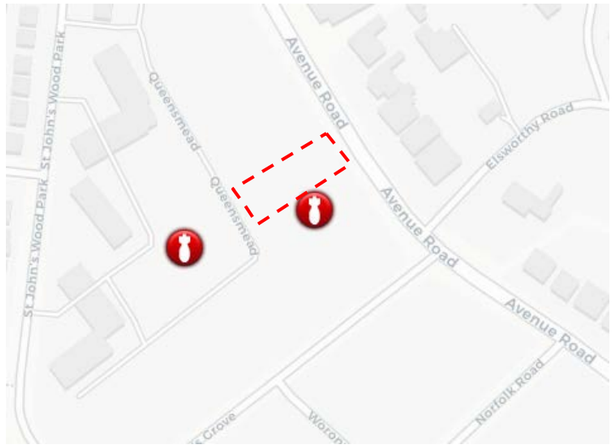

Figure 5: World War 2 Bomb Map

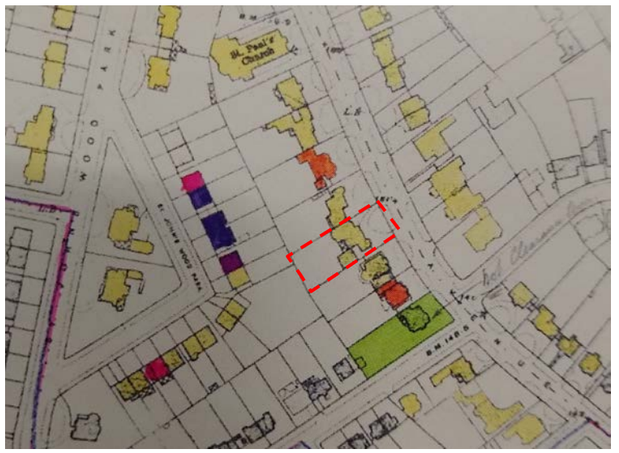

Figure 6: London County Council Bomb Damage Maps 1939-1945

3 Site Information

3.3 Ground Conditions/Geology

With reference to British Geological Survey website (BGS) the site is underlain by London clay bedrock – Clay, Silt and Sand (Figure 7). The BGS website has no superficial deposits recorded at the site location.

A desk study found that the nearest existing borehole to site is approximately 200m to the South-west of the site along St Johns wood park. The results of the borehole are summarised as Made Ground 0m – 0.3m, and London Clay 0.3m-9.14m bgl.

A site- specific investigation in the form of a Borehole, a Window sample and four trial holes was carried out to establish the profile and depth of the existing foundations and the soil conditions. The locations and results of which can be found in the appendix of this document. **Table 1** Shows a summary of the soil conditions found.

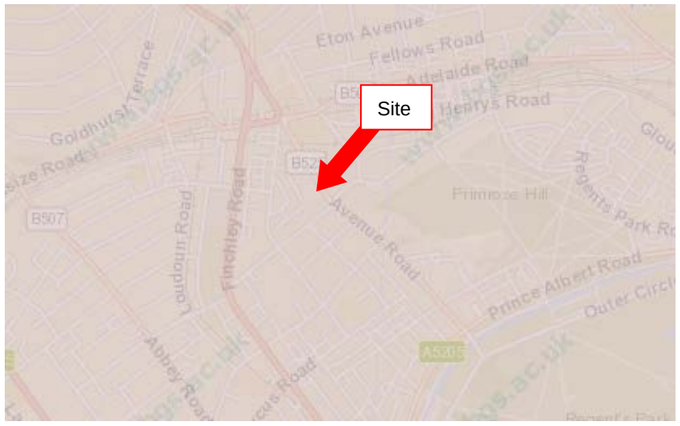

Figure 7: Bedrock Geology Underlying the Site

No groundwater was encountered during the site investigation carried out by CGL. However, during a monitoring visit ground water was found in both the monitoring well WS1 and BH1 at 4.16m and 2.22m below ground level respectively. This indicates that the stratum is likely to be of very low permeability (seepage). To control any seepage sump pumps during construction can be used.

Table 1: *Summary of Soil condition logs*

Description of strata, datum	Depth
MADE GROUND Paving Stones over fill	0.00m – 0.40m
HEAD DEPOSITS Brown silty Clay	0.40m – 3.00m
WEATHERED LONDON CLAY FORMATION Mottles brown and grey clay	0.30m – 8.70m
LONDON CLAY FORMATION Dark brown fissured clay with a few gypsum crystals	8.70m – 15.00m (end of BS1)

The construction methods proposed within this report and associated structural proposals are appropriate for the geology and are capable for supporting the structural loads of the subterranean development, the techniques that will be used for the construction are well established in the industry. Refer to Appendix A for the proposed sequence of works.

3.3.1 Slope Stability

A Topological survey of the site has been conducted by Laser Surveys. The site is considered to be generally level and not cut into the side of hills or valleys. Therefore, slope stability is not considered to be a problem. Refer to the Site Survey Report.

3.4 Hydrology

A desk top study of “The Lost Rivers of London” indicates that the River Tyburn is thought to run across the front of the site boundary with Avenue Road. The Tyburn originates on Hampstead heath to the North of the site. The river is situated within an underground conduit. As the proposed basement works will be carried out away from the front of the site the conduit will not be disturbed.

Figure 8: Location of Lost River Tyburn Relative to the Site

A check on the Environment Agency website has shown that the site is within Flood Zone 1. This indicates that the site is considered to be at low risk of tidal and fluvial flooding.

An FRA report has been carried out and has been included in the planning application. The report demonstrates that the proposed development is at a low risk of flooding.

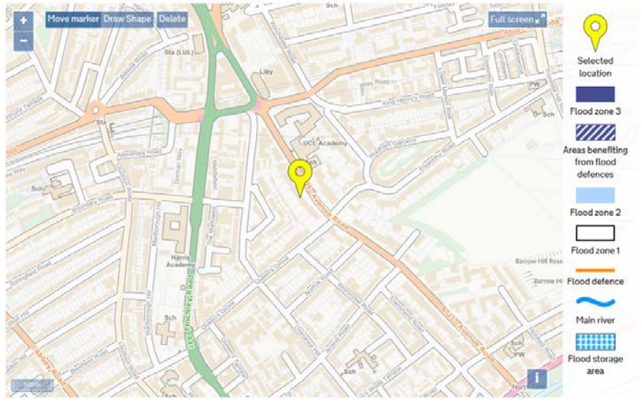

Figure 9: Environment Agency Flood Zone Map

3 Site Information

3.5 Hydrogeology

The site hydrogeology can be summarised as follows:

- The Environment Agency has produced an aquifer designation system consistent with the requirements for the Water Framework Directive. The designations have been set out for superficial and bedrock geology and are based on the importance of aquifers for potable water supply, and their role in supporting surface water bodies and wetland ecosystems.

- The London Clay Formation has been classified as a non-productive stratum (formerly non-aquifers). It comprises of rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

- The Environment Agency website indicates the site is not located within an Environment Agency Source Protection Zone (SPZ)

- There are no recorded surface water abstractions within 2km of the site.

3.6 Arboriculture

An arboriculture report has been prepared by Cantia Arboricultural Services and will be submitted as part of this planning application. The report shows that the site is surrounded by a number of high quality trees including four Category A trees. It is proposed to retain and avoid damage to the category A and B tress with the removal of one Category C tree.

The report outlines precautionary and protective measures which should be adhered to during works in order to have no affect upon individual trees

3 Site Information

3.7 Existing Utilities

3.7.1 Mains Water

A Thames Water Asset Search has been carried out to locate the mains water and drainage routes within the site and near the site. The full results can be found in Appendix D which shows that there is not main water route running through the site (Figure 10) and therefore Thames Water will not need to be consulted.

Figure 10: Thames Water Mains Water Route Relevant to Site Location

3.7.2 Underground Drainage

The Thames Water Asset Search confirms that there is no combined sewer routes that run through the property as shown in Figure 11. Therefore, Thames Water will not need to be consulted.

Figure 11: Thames Water Combined Sewer Route Relevant to Site Location

3.7.3 Gas and Electrical

A Utility Survey has been carried out by Laser Surveys see Appendix C. This has been conducted to determine the location of the existing services to ensure the proposal does not affect the existing utilities and to determine if any require re-directing on the site. Any services that require to be diverted will be replaced by modern day standards where necessary as determined by the Mechanical and Electric Engineer for the project. All services that are required to pass through the new structure will be sleeved and articulated accordingly to allow for future movements and settlements of the surrounding structure.

3.8 Underground Structures

3.8.1 London Underground

It can be seen from the map in that the Overground line from the London Underground Tube system runs approximately 275m to the North of the site. It can Also be Seen from the map in figure. that the Jubilee and Metropolitan lines run approximately 240m from the West of the site. Due to the distance, it will not be necessary to inform the London Underground Asset Protection department to check alignments, as agreed works will not affect any existing tunnels or access shafts.

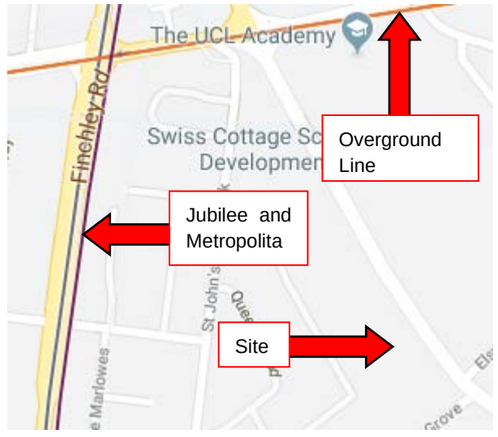

Figure 12: Map showing Site Location Relevant to London Underground Structures

3.8.2 Crossrail 1

As can be seen from the map in Figure 13, the site is approximately 1.8km away from the nearest Crossrail 1 Tunnel. Due to the large distance, Transport for London will not need.

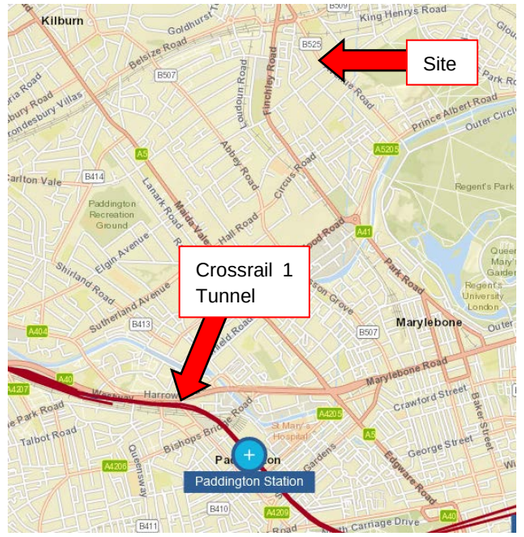

Figure 13: Map Showing Site Location Relevant to Cross Rail 1

3 Site Information

3.8.3 Crossrail 2

From the map in Figure 14 it can be seen that the site is approximately 2.5km away from the Crossrail 2 safeguarding zone. The safeguarding zone means the land within is protected for the future development of Crossrail 2. As the site is a significant distance from the safeguarding zone, TFL will not need to be notified and construction of the basement will not affect or be affected by Crossrail 2.

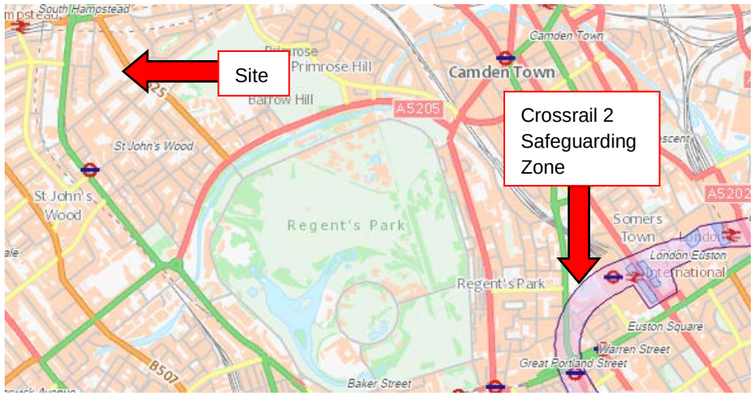

Figure 14:Map showing Site Location Relative to Cross Rail 2 Safeguarding Zone

3.9 Boundary Conditions

3.9.1 East Boundary – Front

- The east boundary is with the pavement of Avenue Road.
- A brick wall runs between the property and the walkway on Avenue Road. (Figure 15)

3.9.2 West Boundary – Back

The rear garden extends to the west bordered by garages along a private road which comes off St John Wood Park (Figure 16).

3.9.3 North Boundary – With No.81

- To the North of the site sits No.81 Avenue Road.
- Figure 17 shows the boundary between the two properties from the front. This photo shows a 215mm brick wall between the two properties. The condition of which could not be seen due to overgrown vegetation along the wall.
- A search on Camden Council planning application website shows that No.81 has planning permission for the erection of a 3 storey, single family dwelling house with accommodation in the roof space and a basement beneath the house and part of rear garden, following the demolition of the existing building. However, the works for this are yet to start and are likely to be carried out after the proposed development of No.79.

3.9.4 South Boundary – With No.77

- To the south of the site sits No.77 Avenue Road.
- Figure 18 shows the boundary between the two properties at the rear of the garden. At this point the boundary is a 215mm thick brick wall with timber fencing sat on top.
- A search on Camden Council planning application website shows that No.77 has planning permission for a new two-storey basement and the erection of a new three-storey single family dwelling house, following demolition of existing three-storey single house. However, the works for this are yet to start and are likely to be carried out after the proposed development of No.79.

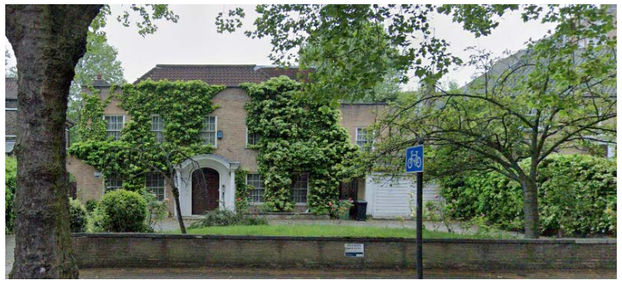

Figure 15: East Boundary

Figure 16: West Boundary

Figure 17: North Boundary

Figure 18: South Boundary

4 Development Proposals

4.1 The Proposal

It is proposed to demolish the existing property and construct a new three storey house with a basement below the footprint of the house and part of the rear garden. The Basement will house a swimming pool and plant room, along with a series of other rooms.

The following briefly summarises the sequence of works to achieve the proposals:

1) Demolish the existing property.

2) Underpin the garden party walls either side of property for the extent of the basement to facilitate construction of the capping beam for the contiguous pile wall.

3) Install two contiguous piled walls for both the upper and lower basement and the temporary piles which will be required to support the ground floor slab. This will enable a top-down construction.

4) Excavate basement down to capping beam level.

5) Install a capping beam at GF Level for each of the contiguous piled walls.

6) Install the ground floor slab leaving a void for the stair core and light wells. This is to enable the removal of spoil and provide access to the basement.

7) Excavate basement down to B1 level.

8) Cut down B2 contiguous piled wall to B1 level.

9) Install a capping beam to B2 level contiguous piled wall at B1 level.

10) Cross-prop B2 capping beam at B1 level.

11) Excavate to B2 level.

12) Install B2 slab.

13) Install verts from B2-B1.

14) Install B1 slab

15) Remove lateral props at B1 level.

16) Install verts from B1-GF level.

17) Cut down temporary GF support piles and infill B2 slab.

4.2 Substructure and Basement Construction Constraints

The structural proposals are described within the report and on the drawings contained within **Appendix A**. They have been developed by Form-SD in conjunction with the architects to address the specific site constraints and characteristics including:

- The ground conditions
- The stability of the neighbouring properties
- Health and Safety considerations
- The physical site constraints

During the site set up the contractor will insure that the main access route through the existing property is cleared.

To reduce the impact of the development during construction we have identified several simple general measures that the contractor will be expected to undertake:

Noise:

- For all operations identify working method that use equipment or modes of operation that produce less noise.
- Reduce the need for noisy assembly practices by assembling off site where possible.
- Keep noisy plant as far away as possible from the site boundaries.
- Adopt working hours to restrict noisy activities to certain periods of the day.
- Minimise the drop height into hoppers, lorries or other plant.

Dust:

- Reduce the amount of dust through, cutting, grinding, and sawing by assembling off site where possible.
- Equipment fitted with dust suppression or a dust collection facility should be used
- Stockpiles of sand or similar dust generating materials will be covered.

Vibration:

- For all operations identify working method that use equipment or modes of operation that do not vibrate.
- Reduce the need for assembly practices by assembling off site where possible.

Vibration and the monitoring there of is discussed further in Section below.

4.3 Sub Structure and Basement Construction Techniques

Due to the close adjacency of the neighbouring properties and the sensitivity of the site location within a residential area, the demolition, excavation, and piling works have been identified as particularly sensitive operations and the following precautions outlined below will be taken.

Prior to any of these operations commencing the site will be inspected by a Structural Engineer to ensure that procedures have been satisfactorily implicated. Further regular site inspections will be made by the Structural Engineer to supervise throughout the duration of these operations.

4.3.1 Excavation

The soil will be excavated and removed predominantly using excavators. During the underpinning excavation will be undertaken by the use of hand tools.

The site will be inspected by a Structural Engineer prior to the commencement of any excavation to ensure the following procedures have been implicated:

- All excavation shall be carried out by hand or utilising a micro excavator (maximum operating weight of 1.5 tonnes).
- Any compaction of hardcore shall only be carried out using non-vibrating methods.

4.3.2 Piling

Contiguous piles will be used to form the basement box. These will retain the soil during the excavation and construction of the RC basement ‘box’.

The site will be inspected by a Structural Engineer prior to the commencement of any piling to ensure the following procedures have been implicated:

- An experienced piling contractor is appointed to undertake the works and pile design. All method statements, drawings and calculations will be submitted to the engineer for review. All precautions taken to ensure that the works are to be carried out in a manner which minimises any noise and vibration must be described.

Further weekly site inspections will be made by the Structural Engineer to supervise throughout the duration of the piling.

4 Development Proposals

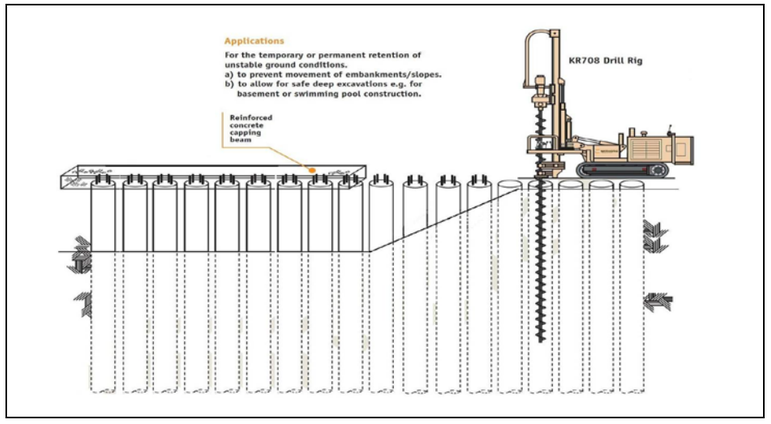

Figure 19: *Contiguous Piled Wall Method of Construction*

4.3.3 Underpinning

The Garden party walls either side of the property will be underpinned the extent of the basement to facilitate the construction of the pile capping beam.

The excavation of the underpin will be carried out by the use of hand tools.

Prior to the works commencing, all neighbouring occupiers will be consulted to ensure that the construction process results in minimal disruption/disturbance.

4.4 Potential Ground Movement and Monitoring of Adjoining Properties

The underpinning described may cause localised settlements to party walls. However, anticipated movements are expected to be minimal and suppressed due to the distance between the proposed works at the neighbouring structures.

The contiguous pile retaining wall will be designed to permit only very small movements during the excavation. The piles will be closely spaced to ensure that fine migration will be mitigated.

Monitoring of the neighbouring buildings will be carried out during the works to assess possible movements and the findings will be reported to the adjoining surveyors periodically. The details of the monitoring regime will be agreed with the adjoining owners' surveyors as part of the party wall approval process. Form will produce a monitoring specification which will form part of the party wall documentation. This will detail, amongst other things, the frequency of monitoring, tolerances and location of monitoring points. Monitoring points will be placed in multiple locations at high and low levels in order to monitor vertical and lateral movement of all structures within the zone of influence of the works. Trigger levels will be suggested and agreed with the adjoining owners' surveyors. These trigger levels will set out quantities of settlement at which the adjoining owners will be notified and works on site reviewed by the project engineer. The damage Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989, and Burland, 2001) has been used to predict the anticipated damage to the neighbouring structures. This has been discussed in the BIA (Appendix B) which gives a Category 0 'negligible' damage including hairline cracks of less than 0.1mm.

4.5 Waterproofing and Drainage systems

The reinforced concrete liner walls will be designed as a water retaining structure in accordance with BS 8007 and detailed with hydrophyllic strips at all concrete joints in order to prevent water ingress. An internal cavity drainage system will also be included. As the intended use of the basement is mixed including habitable space, a Grade 3 environment is required, complying with BS 8102.

Sump pumps and drainage will be required to remove any water ingress from the cavity drain system and these will be designed by an appointed M&E consultant.

4.6 Superstructure

The superstructure is still within its early development but is likely to be constructed from a reinforced concrete frame with masonry infill cladding and partition walls up to 2nd floor. The roof will be constructed from timber and steel.

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5 Site Management

This section of the report has been produced at planning stage and before the main Contractor has been fully appointed. It sets out the systems and procedures that the Contractor will utilise in controlling the construction operations on site, to ensure progress of the project in the most safe and efficient manner possible and to minimise impacts on the local environment and surrounding amenity.

Tendering Contractors will be made aware of the contents below (alongside any planning conditions). Once planning permission is granted, the appointed contractor will be responsible for the submission of a Construction Traffic Management Plan prior to commencement of development.

The engineer will make a site visit at each of the points detailed in the sequence of construction. The ground worker will provide detailed method statements for the works and temporary propping to the basement for approval by the engineer prior to commencement of the works.

5.1 Excavation of Soil

The soil will be excavated and transferred to normal 7m skips kept within the site boundaries in the front garden. The excavation of the basement will be undertaken by small excavators which will then transfer the waste to the skip to the front of the site. The frequency of vehicle movement will be confirmed by the chosen contractor and approved by the council before works commence. The footpath and street adjacent to the site will be cleaned each evening. Further information on the management of site activities is detailed in the Construction Management Plan.

5.2 Local Environmental Considerations

All of the works, particularly the sub-structure, are to be carried out in a manner which minimises any noise, dust, and vibration that may affect the neighbouring properties.

We have identified a number of simple general measures that the contractor will be expected to undertake to minimise theses impacts including:

5.2.1 Demolition

The demolition works are to take place within the hoarded confines of the site. Any scaffolding on the site perimeter is to be clad with monoflex sheeting above the 6-foot plywood hoarding line to minimise any dust or debris from falling onto the neighbouring streets.

To minimise dust and dirt from demolition, the following measures shall be implemented:

- All brickwork and concrete demolition work is to be constantly watered to reduce any airborne dust.
- Demolished materials are to be removed to a skip placed in the front of the site within the site boundaries, which will be emptied daily.
- The pavement to the front of the property is to be washed and cleaned down each day.
- Any debris or dust / dirt falling on to the street and public highway will be cleared as it occurs by designated cleaners and washed down fully every night.

5.2.2 Noise

The following measures should be followed to minimise noise due to demolition or construction:

- For all operations identify working method that use equipment or modes of operation that produce less noise.
- Reduce the need for noisy assembly practices by assembling off site where possible.
- Keep noisy plant as far away as possible from the site boundaries.
- Adopt working hours to restrict noisy activities to certain periods of the day.
- Minimise the drop height into hoppers, lorries or other plant.

5.2.3 Dust

The following measures should be followed to minimise dust due to demolition or construction:

- Reduce the amount of dust through, cutting, grinding, and sawing by assembling off site where possible.
- Equipment fitted with dust suppression or a dust collection facility should be used
- Stockpiles of sand or similar dust generating materials will be covered.

5.2.4 Vibration

The following measures should be followed to minimise vibration due to demolition or construction:

- For all operations identify working method that use equipment or modes of operation that do not vibrate.
- Reduce the need for assembly practices by assembling off site where possible.

Building work which can be heard at the boundary of the site will not be carried out on Sundays and Bank Holidays and will be carried out within working hours as agreed with the council.

5.2.5 Rubbish Removal and Recycling:

An important part of the site management process involves site cleansing, rubbish removal, and recycling.

Materials such as stock-bricks, re-useable timbers, steel beams etc are to be recycled where possible.

To reduce and manage site waste:

- All material removed from site is to be taken to waste recycling stations and separated for recycling where possible. Records of the waste recycling will be provided by the recycling stations.
- Waste types to facilitate recycling activities.
- All Duty of Care and other legal requirements are complied with during the disposal of wastes.
- Suppliers are to be consulted to determine correct / appropriate disposal routes for waste products and containers.

It will be the responsibility of each contractor to keep the site area under his control safe from build-up of rubbish.

Appendix A - FORM SD PRELIMINARY STRUCTURAL DRAWINGS

Appendix B - CGL SITE INVESTIGATION REPORT

Form

Appendix C – UTILITY SURVEY

Form

Appendix D - THAMES WATER ASSET SEARCH

Appendix E - BUILDING DAMAGE CLASSIFICATION TABLE

Classification of visible damage to walls (after Burland et al, *1977, Boscardin and Cording, 1989; and Burland, 2001)*

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ε_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Notes

1. In assessing the degree of damage, account must be taken of its location in the building or structure.
2. Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

Appendix F – CALCULATIONS

Form

Appendix G - FRA