Webb Yates Engineers

23-24 Smithfield Street
London. EC1A 9LF
T: 020 7489 0900

www.webbyates.co.uk
info@webbyates.co.uk

Basement Stability Report

J714 Templewood Avenue, Hampstead

Revision: X2

GENERAL NOTES

Only construction status documentation is to be constructed from. If you do not have a construction issue document and you are about to build something, please contact Webb Yates Engineers. Ensure that you have the latest revision prior to construction.

REVISION HISTORY

Revisions indicated with line in margin.

Revision status: P = Preliminary, T = Tender, C = Construction, X = For Information

Revision	Date	Author	Reviewer	Description
X1	31-08-10	MRF	SW	Planning Issue
X2	29-07-11	MRF	SW	Revised Planning Issue

1 INTRODUCTION

The project at Templewood Avenue is a refurbishment project to a masonry and timber dwelling in Hampstead. The proposal is to rebuild the internal structure of the house whilst retaining the facade. The accommodation is to be increased with a basement box, housing a swimming pool and plant area.

Webb Yates Engineers (WYE) is a London based engineering consultancy with extensive experience of the design of basements for residential dwellings. WYE is appointed to undertake the structural design of the basement and superstructure, and has been active in the design and specification of the building fabric from the commencement of the project.

2 SITE GEOLOGY

The relevant 1:50,000 scale British Geological Survey map sheet (256, North London) indicates that the site is underlain by the Clay-gate Beds, which overlie the London Clay Formation. The Bag-shot Formation caps the high ground of Hampstead Heath to the north of the site area. Two boreholes were undertaken on site and the findings are:-

- GL to 0.5m (BGL) Made Ground
- 0.5m to 13m (BGL) Silty sandy Clay
- 13m to 20m (BGL) Stiff silty Clay (London Clay)

A full and comprehensive Phase 2 site investigation has been undertaken by a geotechnical consultant, Constructive Evaluation. This is to be used through the detailed design process for the design of below ground structure.

3 EXISTING HOUSE

The existing house building is formed of traditional load bearing masonry walls, with timber flooring and rafters. The masonry to the perimeter appears in good condition, with no significant signs of settlement or cracking and thus can be retained in its existing state where required. Similarly, the exposed floor timbers appear in good condition, however it is unlikely that these will be retained due to the proposed layout and required floor specification.

The foundations (where proven) are corbelled masonry, of three tiers, bearing onto concrete strip foundations into the Clay-gate Beds ground formation. The concrete footings project by approximately 150mm and are 250mm deep. Existing footings are approximately 1m below the lower basement level.

4 PROPOSED SCHEME

4.1 BASEMENT

The proposed basement layout indicates a basement between 4-7.5m below the ground floor level. External ground levels vary across the site leaving a maximum retained height of around 7.5m to the pool plant and pool base. The basement is to be formed within a reinforced concrete (RC) box and the design is proposed as the following:-

- A section to the neighbouring party wall line of 250mm thick underpin type reinforced concrete (RC) construction;
- Secant (hard/soft) RC piled wall adjacent to the main street boundary; and
- A traditional RC wall constructed to the main garden, formed using battered earthworks

The basement slab is to act as raft foundation providing the permanent support the building above.

4.2 WATER-PROOFING

Waterproofing shall be provided to give a Grade 4 basement condition, suitable for a high spec residential space with control of both vapour and water ingress. This will be achieved using a combination of Type A (tanking) and Type C (drained cavity) with Type B (integral construction) protection.

Tanking shall be applied to the external ground floor slab area and is recommended to be a Polyurea based spray applied product. This is extremely durable and unlike membranes is resistant to puncturing. A drained cavity membrane should be applied to the basement floor and internal walls. The RC construction of the basement structure will provide the Type B protection throughout.

4.3 GROUND FLOOR SLAB

The ground floor slab and external podium is to be formed of a 325mm thick RC construction. This is to be built in two distinct phases, first - within the building footprint with ‘jigsaw’ edges into pockets made in the masonry; second – outside of the existing footprint following the construction of the perimeter basement walls.

In the temporary state the slab (& masonry shell above) shall be supported of cast-in place mini-piles allowing free excavation below. These piles shall be broken back and replaced in the final condition with discreet load bearing masonry walls and steel columns formed off the basement raft.

4.4 SUPER STRUCTURE

As part of the energy efficiency uplift of the refurbished building the internal masonry shell is to be lined with an insulated timber construction compromising of:-

- Timber stud and ply walls with finishes; With

- Engineered timber floor structure of screed, acoustic board, plywood decking, timber joists and integrated services;

The timber structure will be tied laterally into the masonry shell and provide cross-wall stability following the removal of the main contractors temporary works.

4.5 ROOF

The existing roof finishes and construction is to be replaced with a plywood stressed skin construction, simulation and external tiles to match the existing. The structural form of the roof will provide a more rigid braced, elegant and efficient design.

5 BASEMENT CONSTRUCTION AND STABILITY

5.1 METHODOLOGY

The basement construction is to occur top-down in the following main phases:-

- Removal of the existing internal floors, partitions and rafters.
- Install contractor designed temporary works to stiffen the masonry.
- Pile within the limits of the house.
- Cast the ground floor slab construction.
- Secant pile (hard/soft) to external perimeter.
- Propped underpinning and retention to the garden wall at the rear of the existing building.
- Excavate the basement introducing steel whalers in the double height sections.
- Form new basement floors.
- Cast RC walls adjacent to batters.

5.2 TEMPORARY WORKS

The main temporary works are likely to comprise of steel whalers and cross strutting to the heads of the retaining structure. This is to be designed by the Main Contractor in accordance with the WYE outline design statement. To ensure the detailed design of the works is compatible with the design of the permanent structure WYE will review all contractor proposals prior to site commencement. During the works WYE will monitor the implementation and check for conformity between the contractor's design method statement and the actual on site works. This shall limit the risk of unstable excavation and subsequent settlements.

5.3 PARTY WALLS

The rear elevation and garden wall (adjacent to No 2 Templewood Avenue) is a party wall structure. This is to be retained during the works using a RC under-pinned construction. The house beyond sits within 5m of this boundary line as is the only nearby building requiring a party wall notice to be served. Deflections to the

head of the retained wall shall be controlled by introducing permanent props back to the main ground floor slab.

To the street side the permanent piled secant wall shall be designed for a notional 20kPA surcharge. Deflections at surface level shall be controlled by the retaining structure propped at floor levels.

5.4 PILED CONSTRUCTION

There shall be a secant piled embedded retaining wall to two sides of the basement volume. The piles will typically be 450mm diameter, with a hard-soft configuration. The bentonite piles shall extend to a level approximately 1m below the basement slab level. This shall limit the ingress of sub-surface run-off and rising ground water into the excavation, but not form an impermeable barrier below the basement. All piles will be designed to comply with the CIRIA document 580 “Embedded retaining walls –guidance for economic design”

5.5 UNDER-PINNING/RETAINING STRUCTURE

The retaining wall structure to the boundary of the adjoining property (No. 2 Templewood Avenue) is to be formed using the traditional method of underpinning and of reinforced concrete construction. It should be noted that the proposed height of retained ground reduces substantially along the line of wall, as the ground level reduces from approximately 97.5m to 96.0m.

The following method of construction is envisaged:-

- Complete adjacent secant pile and capping past the corner of the house.
- Complete new the new ground floor reinforced concrete slab.
- Under-dig wall for the first section of retaining, 900mm long to a maximum depth of 1.5m BGL.
- Insert temporary shoring to sides of excavation as digging down (IE normal to wall line)
- Cast section of wall and prop back to the slab at ground floor level.
- Complete for successive lengths of wall along the wall line.
- Batter the ground-line down from 1.5m BGL to new basement level.
- Complete the basement slab-up to the line of the current ground batter.
- Repeat in strips until the required excavation level has been reached.
- Cast the wall base, key and toe of the retaining wall.
- Complete the basement level slab.

5.6 DEFLECTIONS AND GROUND MOVEMENTS

Lateral deflections for the embedded retaining walls have been calculated using the FREW software analysis software and have been found to be approximately 12mm (propped condition). With reference to the CIRIA guide 580, the vertical displacement at grade, above the retained soil mass can be expected to be

approximately half this value so therefore 6mm. In the context of the proximity to neighbouring structures (roadway, houses etc) this is considered nominal.

Lateral deflections for the boundary wall retaining wall structure (astride No.2 Templewood Avenue) are in the order of 6-8mm and thus can be expected to result in comparable vertical values of 3-4mm to the rear of wall. Relative vertical settlements reduce in value with both depth below retained level; and distance from the retained surface. Therefore given that the foundations for No.2 are approximately 5m in horizontal distance and 1m below the retained level (conservatively assumed given the findings of its contemporary, No. 4), the vertical settlements at the horizon of the foundations of No.2 and are attributable to the construction of retaining wall, shall be close to zero.

6 OUTLINE STRUCTURAL SPECIFICATION

6.1 DESIGN STANDARDS

Structural and civil design to be undertaken in accordance with the following design standards:

6.1.1 UK APPROVED DOCUMENTS:

- Part A. Structure
- Part B. Fire safety
- Part C. Site preparation and resistance to contaminants and moisture
- Part H. Drainage and waste disposal

6.1.2 CODES OF PRACTICE:

- BS8102 - Code of Practice for Protection of Structures Below Ground Against Water
- EN 1990: (Eurocode 0) Basis of structural design
- EN 1991: (Eurocode 1) Actions on structures
- EN 1992: (Eurocode 2) Design of concrete structures
- EN 1993: (Eurocode 3) Design of steel structures
- EN 1994: (Eurocode 4) Design of composite steel and concrete structures
- EN 1995: (Eurocode 5) Design of timber structures
- EN 1996: (Eurocode 6) Design of masonry structures
- EN 1997: (Eurocode 7) Geotechnical design

6.2 DESIGN LOADING

To comply with requirements of EN 1991: (Eurocode 1) Actions on structures and finishes imposed loading allowance as denoted below:-

6.2.1 BASEMENT FLOORS

- 60mm screed - 1.20 kPa (2000 kg/m3)
- Solid board insulation - 0.10 kPa
- 25mm tiled finishes - 0.63 kPa (2500 kg/m3)
- Residential (A1) - 1.50 kPa
- Plant zones - 5.00 kPa

- Car parking (F < than 3000kg) - 2.50 kPa

6.2.2 ELEVATED FLOORS

- 56mm screed - 1.12 kPa (2000 kg/m3)
- Solid board insulation - 0.10 kPa
- 25mm tiled finishes - 0.55 kPa (2200 kg/m3)
- M&E Services - 0.25 kPa
- Ceiling - 0.25 kPa (2 layers of 12.5 kg/m2)
- Residential (A1) - 1.50 kPa
- Balconies (A5) - 2.50 kPa
- Plant zones - 5.00 kPa
- Car parking (F < than 3000kg) - 2.50 kPa

6.2.3 ROOFS

- Secondary timber framing - 0.10 kPa (2000 kg/m3)
- Imposed roof - 0.60 kPa
- Insulation - 0.10 kPa
- 15mm tiled slate - 0.42 kPa (2800 kg/m3)
- M&E Services - 0.25 kPa
- Ceiling - 0.25 kPa (2 layers of 12.5 kg/m2)

6.2.4 GROUND-FLOOR EXTERNAL PODIUM

- 60mm screed - 1.20 kPa (2000 kg/m3)
- Solid board insulation - 0.10 kPa
- 25mm tiled finishes - 0.63 kPa (2500 kg/m3)
- Residential (A1) - 1.50 kPa
- Balconies (A5) - 2.50 kPa
- Plant zones - 5.00 kPa
- Car parking (G < than 16500kg) - 5.00 kPa
- Fill (height < 900mm) - 18.0 kPa (2000 kg/m3)

6.3 BASEMENT WATERPROOFING

To comply with requirements of BS8102 - Code of Practice for Protection of Structures Below Ground Against Water:

- Environmental Grade: 4
- Internal protection:
  - Type A Tanked Protection: Polyurea sealant to basement garden roof
  - Type B Integrally Waterproof: Reinforced construction to EC2
  - Type C Drained Cavity Protection: Internal drained cavity membrane system to pumped sumps

6.4 GENERAL MATERIALS

To comply with requirements of above design standards as relevant:-

6.4.1 STRUCTURAL CONCRETE:

- RC40 to walls and slabs
- FND2 to below ground

- RC30 to composite floors

6.4.2 STRUCTURAL STEEL:

- S275 for rolled sections
- S355 for hollow section tubes

6.4.3 PERMANENT FORMWORK FOR COMPOSITE FLOORS:

- Kingspan MD80 1.0mm gauge deck

6.4.4 REINFORCEMENT ESTIMATES:

- 325mm Ground floor slab - 140 kg/m3
- 300 to 400mm Raft slab - 150 to 115 kg/m3
- 200mm Underpin wall - 170 kg/m3
- 250mm Retaining wall - 108 kg/m3

6.4.5 STRUCTURAL TIMBER:

- Finnforest FJI timber joists
- Grade C24 for studs and rafters
- Kerto-Q for timber trimmers
- Kerto C24 for timber rafters
- WBP birch plywood

6.4.6 STRUCTURAL MASONRY:

- 75mm 3.5 MPa liner block work
- 100/140mm 7.0 MPa load-bearing block
- All mortar minimum M6