ARUP

Our ref DCP
27 June 2012

13 Fitzroy Street
London
W1T 4BQ
United Kingdom

t +44 20 7636 1531
d +44 20 7755 3548
f +44 20 775 2121

dinesh.patel@arup.com
arup.com

Planning and Public Protection
Culture and Environment
London Borough of Camden
5th Floor
Town Hall Extension (Environment)
Argyle Street
London
WC1H 8EQ

For the attention of Charles Thuaire

Dear Sir,

16A Lyndhurst Gardens- Audit of Revised Basement Impact Assessment June 2012

In May 2012 we were asked to comment on a series of BIA documents for 16A Lyndhurst Gardens which raised questions which we addressed in our letter to you of 29th May 2012.

Subsequent to that letter we received a revised Basement Impact Assessment by email from Mr Baliti on 18 June 2012.

This letter reports the findings of our review of the revised BIA report, dated June 2012, and its appendices A to K.

Conclusions of review of revised BIA documents (dated June 2012)

We find that the revised document is sufficient to satisfy the requirements for the grant of planning permission in accordance with DP27, in respect of:

- maintaining the structural stability of the building and any neighbouring properties
- avoiding adversely affecting drainage and run-off or causing other damage to the water environment and
- avoiding cumulative impacts on structural stability or the water environment in the local area

Note that this finding relates only to the basement configuration and construction sequence proposed. If there are significant changes to these during detailed design then another review would need to be conducted.

Significantly more work will be required at detailed design stage **after Planning Permission.** Aspects arising from our review which will need to be addressed more fully in later stages are described below. We recommend that a condition of Planning Approval

should be to review the further work required below prior to construction proceeding. We would be happy to assist in any further review.

Details of findings and related further work required prior to construction.

In our letter to you of 29th May 2012 we summarised the information outstanding prior to Planning Permission in points numbered 1 to 13. In the following, we list each of our points in turn, discuss to what extent the applicant has fulfilled the requirements and provide recommendations/ considerations for the further work required prior to construction.

1. A desk study should be provided.

A desk study has now been provided in Appendix A. The desk study (together with the main BIA report and the GroundSure Review in Appendix B) addresses the information for which clarity was required as follows:

- It follows the recommended topics of Appendix G1 of the Arup report "Camden geological, hydrogeological and hydrological study – Guidance for subterranean development".

- It acknowledges the potential proximity of the site to the outcrop of the Claygate Beds and the coarse grain size content at the top of Division D of the London Clay.

- It considers current slopes of both the hillside and the site and provides historical drawings which show that the current slope of the hillside has not been changed since its natural slope prior to the residential development. These drawings indicate that the relatively steep slope local to the site is as a result of the terracing constructed in Made Ground and not of potential instability in the natural geology.

- The historical drawings show that the terracing and buildings were constructed between 1879 and 1896. The main BIA report at the front of the revised document contains further information on the nature of the adjacent buildings. They are traditional load bearing masonry buildings; No. 18 is 3 storeys in height and No. 16 is five storeys high with a half basement at the front next to the road, and with the lowest floor level with the garden at the rear.

- The main BIA report states that the foundations of No.s 16 and 18 have been assumed to be relatively shallow during the initial stages of the design and that trial pits are required to establish the depths for detailed design.

- The main BIA report states that condition surveys have been carried out of the adjacent structures and they have been found to be in good condition.

- The GroundSure environmental review of the site includes considerations of contamination

2. A factual report and subsequent interpretative report for the ground investigation should be provided. This should also include any recommendations for further site investigations.

There is now a report which combines factual data and interpretation in Appendix C. There is also an assessment of ground related risks in Appendix J.

Although no levels have been taken on the borehole logs, approximate ground levels are known from a site survey.

Laboratory test data is now provided. There are no grading curves but the laboratory descriptions describe rare sand and fine gravel, indicating that the partings of silt and fine sand may be a representative description. The Atterberg limits show high to very high plasticity clay, indicating that granular material was not dominating the behaviour of these samples.

The standpipes were read again on 7/6/12 following heavy rain. Ground water was found in BH2 and BH3. The appendix states that the boreholes below the standpipes were backfilled with "low permeability material". This does not clarify what the holes were backfilled with so that the question over whether water could leak away remains, but nevertheless, the water encountered indicates that there is the potential for water flow through the Made Ground and shallow London Clay, as acknowledged by the report.

Additional trial pits are recommended to investigate the foundations of the adjacent properties.

It is reported that following discussions with the piling contractor, one or two more boreholes may be required to confirm the assumed engineering properties of the London Clay. This seems reasonable since the hydrological assessment in Appendix G says that a subsurface drainage pathway is proposed to be constructed behind the walls before excavation and the risk assessment in Appendix J recommends that the gaps in the wall be plugged if there is any leakage through the walls. Therefore the remaining risk (provided the back of wall drainage is maintained) is to the piles during construction.

Further work required prior to construction

- Additional trial pits to investigate the foundations of the adjacent properties
- Further boreholes to investigate the ground conditions, depending on choice of piling method

3. A Flood Risk Assessment is required should heavy rainfall cause a run off of water in the more permeable Made Ground during basement excavation / construction

This has been addressed in the hydrological assessment in Appendix G. It is acknowledged that any potential seepages could be blocked and back up behind the walls. A subsurface drainage pathway is proposed to be constructed behind the walls before excavation.

Further work required prior to construction

- Design of drainage pathway behind walls and maintenance requirements
- Ensure that drainage behind the walls does not provide a pathway for water ingress through the piled wall.

4. The existing ground water conditions rely on an understanding of how the standpipes were installed and monitored and this needs further clarification.

This has been satisfactorily addressed, see response to 2. above, although clarification of the "low permeability material" for backfill would be preferable to help understand the groundwater level measured in June 2012.

5. The applicant should provide a clear summary of total areas of hard standing and permeable areas for: 1) the existing; 2) the existing + permitted and 3) the proposed development.

This has now been provided in Appendix H.

6. The method of top down construction has not been demonstrated as buildable as there are no construction sequence drawings.

The method of top down construction has now been carefully thought out and explained in detail in Appendix E. The wall will be propped at four levels as excavation proceeds downwards: ground floor, basement, sub-basement and an intermediate level of temporary props which has been introduced between the basement and sub-basement slabs. Support to the north wall through the ground floor slab will be provided by first constructing the south wall of the basement (see 7.).

Further work required prior to construction

Some details need to be clarified/ considered at later stages of design. These include:

- The design depth of excavation needs to be specified and clearly shown on the drawings. We are assuming that it will not be significantly deeper than the maximum 9.2m analysed in the preliminary wall movement calculations.
- Precise distances to neighbouring buildings need to be clearly shown on the drawings.
- Details of the propping to restrain the boundary wall with No. 16 need to be developed.
- Some main bearing piles are constructed initially prior to construction of the ground floor slab. These piles are shown extended to ground level to support the ground bearing slab during construction. No support method for the basement and sub-basement slabs is shown on the drawings. The calculations in Appendix F say that the basement and sub-basement slab are hung off the floors above. No mention is made of plunge columns. Attention needs to be given to how these slabs will be supported.
- As shown, the piles installed adjacent to the south boundary wall will need to be broken down at the stage when the underpinning and the sacrificial retaining wall are constructed. This needs some thought within the sequence. An alternative would be to install the piles from ground level and backfill the bore above pile cut-off, although this would preclude the use of CFA piles.

- Excavation below the basement slab to just below the temporary prop level will be carried out prior to construction of the remaining bearing piles. No level is given for the temporary prop. The wall movement calculations in Appendix F show the prop level 2.8m below the basement slab centreline. Therefore a piling mat and piles will need to be constructed in about 3m of headroom. This may be difficult and advice needs to be sought from piling contractors at detailed design stage. Again, an alternative would be to install the piles from ground level and backfill the bore above pile cut-off.
- The maximum depth of excavation needs to be clarified. It has been assumed in the wall movement calculation in Appendix F to be 9.2m. This appears to be an upper bound from the available drawings.
- The method of drainage of the cavity below the base slab needs to be specified.

7. An adequate support system to the excavation on the south side needs to be presented with supporting calculations to show that the underpinned brick wall will be stable for both building surcharge and earth pressures when the ground is excavated in front of this wall.

This has been carefully addressed in Appendix E. In summary, the wall will be supported whilst excavation is carried out down to the garden level of No. 16. At that stage investigation of the wall foundation will be carried out and the design of the underpinning reviewed. The adjacent bearing piles and contiguous piled wall for the basement will be installed. Following that, underpinning and lateral support to the underpinning using a sacrificial retaining wall constructed in bays is proposed. The permanent south basement wall will then be constructed inside the sacrificial wall.

Further work required prior to construction

- The dimensions of the sacrificial retaining wall have yet to be determined and may impact on the final design of the geometry of the permanent basement wall and basement slab shown on the drawings.

8. Calculations of movement of the contiguous piles wall are required to support the assertion of a stiff support and to help to validate predicted ground movements for different sections along the perimeter of the wall, allowing for building surcharge pressures.

Preliminary calculations of wall movement and required structural capacity of the wall have now been carried out and are included in the geotechnical assessment in Appendix F. The calculations have been carried out for the greatest depth of excavation adjacent to No. 18 and include surcharge from No.18. The calculations assume top-down construction and levels of propping consistent with the construction sequence given in Appendix E. SLS and ULS analyses have been carried out in accordance with the recommendations of the CIRIA C580 report.

Although not stated elsewhere in the submission, the maximum depth of excavation assumed in the calculations is 9.2m and the wall toe has been set 5m below this. This is deeper than the 2m described in the previous submission and dispels our previous concerns over slope stability and the effects outside the walls of heave movements inside.

The calculations predict a maximum wall movement of 14mm which is consistent with the assumption of a stiff support used in the geotechnical assessment to assess ground movements based on empirical guidance given in CIRIA C580. We agree that potential additional movement due to sway is likely to be small.

Further work required prior to construction

- In detailed design, calculations will need to be carried out for the final design depths of excavation and wall toe level and at different sections around the excavation, including the design of any temporary propping scheme.
- Consideration will need to be given to the effects of potential sway across the basement due to the higher ground level to the north, as noted in the geotechnical assessment report. The surcharge loadings from the adjacent buildings will also need to be confirmed for detailed design.

9. A design statement is required at the least to show that support to the existing slope and the difference in ground level across the basement has been/ will be taken into account (imbalance of forces).

The difference in ground level across the basement is acknowledged in the main BIA report and the construction sequence has now been designed to provide a stiff support to the north wall despite the difference in ground level. Calculations are provided in appendix E to show that the ground floor slab and piles have been checked for the effects of the imbalance of load.

The deeper toe level of approximately 5m below the excavation level, proposed and analysed in the geotechnical assessment in Appendix F, is reasonable from considerations of slope stability

10. Details of the main bearing foundation elements (top down piles?) proposed for the building is be provided.

No preliminary pile design has so far been carried out. Some details of construction sequence have been given in Appendix E.

The main BIA document states that a drainage void will be incorporated beneath the sub-basement slab so that there will be no heave or uplift pressure on the slab. Therefore the piles are not required to act in tension.

Some comments have been made in relation to the available pile information in 6. above.

The available information is considered satisfactory at this stage.

Further work required prior to construction

- Detailed pile design still needs to be carried out, including considerations of construction sequence (see 6.)

- The pile design will need to consider the effects of heave adjacent to the pile shafts.

11. Damage assessment of adjacent buildings should consider ground movements from both the short term and the long term movements.

The damage assessments for both No.s 16 and 18 find that the resultant degree of damage to the adjacent structures is classed as Category 1 (very slight) in accordance with the BRE Damage Classification. The wall movement calculations provided in Appendix F show that this is compatible with the predicted wall movements.

The geotechnical assessment in Appendix F has addressed the long term movements due to heave inside the walls. It is not clear how the excavation has been modelled and hence validity of the results cannot be assessed. However, our concerns over long term movements outside the walls due to heave inside the wall have been minimised through the apparent adoption of deeper walls.

Further work required prior to construction

- The predicted ground movements will need to be checked during detailed design with the final construction sequence of temporary/permanent propping.
- The distances of the adjacent buildings from the excavation will need to be shown clearly in order to fully understand where the buildings are positioned with regard to predicted ground movements and whether there is any significant curvature arising from their positions relative to the settlement trough behind the walls.
- The assessment of "damage" should be reviewed in regard to future condition surveys and surveys of the existing foundations, including investigation of the garden wall to No. 16.

12. Proposals are required for monitoring and planned contingency measures, should movements reach pre-defined trigger levels.

This has been satisfactorily addressed at this stage. The main BIA report proposes that a monitoring regime with predefined trigger levels is agreed with the owners of the neighbouring properties.

Further work required prior to construction

- A full monitoring specification with trigger levels and contingency measures will need to be developed during detailed design.
- A detailed method statement for the basement construction needs to be developed alongside the monitoring so that each element of activity can be assessed with respect to movements.

13. An initial ground related risk assessment is suggested that can be later evolved post planning. This should include the use of small minipile cfa rigs, using segmental augers.

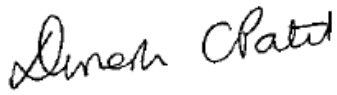
This has now been addressed in a satisfactory manner at this stage.

Further work required prior to construction

- We note that in relation to piles, it is advised that the piling contractor should allow for temporary casings if necessary to protect the sides of the bore and that he should ensure the bore is clean before filling with concrete. This is therefore worded with bored piles in mind. Although no rig details are given in this submission, the previous submission indicated that the proposed piling method would use a minipile Klemm 709 rig (essentially a segmental auger CFA method of piling). If a CFA rig is finally proposed then a statement needs to be made in regard to the risks of using cfa rigs next to buildings and the controls and mitigation measures to be put in place during construction to ensure installation of piles has no detrimental effects to buildings. Also, the cfa method also requires controls to avoid flighting, avoiding contaminating the concrete as short segmental casings (1-2m)are removed during concreting, and risks of plunging steel cages to the bottom of a slim 450mm diameter pile into fresh concrete from the ground surface.

I hope that this letter will assist you in reaching your decision.

Yours faithfully



Dinesh Patel
Director
BSc(Hons) MSc DIC CEng MICE RoGEP