CampbellReith
consulting engineers

13 Kylemore Road
London, NW6 2PS

Basement Impact Assessment
Audit

For

London Borough of Camden

Project Number: 12336-79
Revision: F1

October 2017

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Project Name	13 Kylemore Road
Planning Reference	2015/6424/P

Contents

Appendix

1.0 NON-TECHNICAL SUMMARY

1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 13 Kylemore Road, NW6 2PT (Camden Planning reference 2015/6424/P). The basement is considered to fall within Category B as defined by the Terms of Reference.

1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.

1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.

1.4. A new BIA undertaken by Card Geotechnics Limited (CGL) was submitted in response to the queries on the original BIA prepared by MW Consulting. This audit only relates to the current BIA. However, the query tracker in Appendix 2 includes the queries from the previous BIA.

1.5. The qualifications of the individuals involved in the current BIA and supporting documents meet CPG4 requirements.

1.6. The proposal includes increasing the depth of an existing semi basement and excavation of the front garden to basement level to create a lightwell and secondary access to the basement by underpinning.

1.7. It is stated the underpins will be extended to bear in the London Clay. An outline retaining wall design is included in the revised submission.

1.8. The revised BIA concludes the risk of flooding is minor. Mitigation measures are included in the Structural Report.

1.9. Queries relating to the 'lost' River have now been adequately addressed in the BIA.

1.10. An outline drainage strategy has been provided for the proposed lightwell. It is accepted that this solution should not adversely affect neighbours or the wider environment.

1.11. It is accepted the damage to the neighbouring properties is unlikely to exceed Category 1 (very slight) damage.

1.12. The updated Structural Report indicates condition surveys are to be undertaken prior to construction which is considered prudent.

1.13. An outline monitoring proposal has been provided as requested. The trigger levels should be agreed with the relevant Party Wall surveyors prior to construction.

1.14. An outline works programme has now been provided.

1.15. It is accepted that there are no slope stability concerns or any other groundwater and surface water considerations regarding the proposed development.

1.16. It is considered that with the supplementary information provided, the BIA meets the requirements of CPG4.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 13 Kylemore Road, NW6 2PS (Camden Planning reference 2015/6424/P).

2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.

2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Camden Planning Guidance (CPG) 4: Basements and Lightwells.
- Camden Development Policy (DP) 27: Basements and Lightwells.
- Camden Development Policy (DP) 23: Water.
- The Local Plan (A5 Basements) 2017.

2.4. The BIA should demonstrate that schemes:

a) maintain the structural stability of the building and neighbouring properties;

b) avoid adversely affecting drainage and run off or causing other damage to the water environment;

c) avoid cumulative impacts upon structural stability or the water environment in the local area, and;

evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as *"Proposed loft conversion including installation of a rear dormer, raising the roof level parapet wall over rear extension creating an upper floor roof terrace and installation of obscure glazed balustrade. Erection of a single storey rear extension and alterations to fenestration at rear. Excavation at basement level lowering the floor level and creation of front lightwell, including installing additional railings."*

2.6. The Audit Instruction also confirmed 13 Kylemore Road is not listed, nor is it a neighbour to a listed building.

2.7. CampbellReith accessed LBC's Planning Portal on 20 July 2016 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA): MW Design & Consulting Limited, dated August 2015
- Structural Inspection Report Design: MW Design & Consulting Limited, dated August 2014
- MW Design & Consulting Limited Planning Application Drawings consisting of

  Location Plan

  Existing Plans

  Proposed Plans

  Existing Section

  Proposed Section

  Existing Elevations

  Proposed Elevations

  3 No consultation responses

2.8. Following the initial audit, a new BIA by Card Geotechnics Limited (CGL) dated December 2016 was received by email on 3 March 2017. A Structural Report by Entuitive dated January 2017 was also included as part of the appendices.

2.9. Further information was received between June and October 2017 in response to the queries raised in the second audit. The latest revisions of the reports are as follows:

- Structural Report: Entuitive, Issue 2, dated September 2017.
- Basement Impact Assessment (BIA): CGL, Revision 3, dated September 2017
- Construction Sequence Sketches: Entuitive S-P-SK01, S-P-SK02 and S-P-SK03.
- Structural Calculations: Entuitive, dated May 2017
- Email response from Entuitive dated 27 June 2017

2.10. Due to file size the BIA and Structural Report are not included in Appendix 3. However, these can be accessed on LBC's planning portal. The remaining documents together with an email from the applicant relating to minimising disruption during construction, received on 29 August 2017, are included in Appendix 3.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	See Audit paragraph 4.2.
Is data required by Cl.233 of the GSD presented?	Yes	Included in the BIA and Structural Report. Indicative works programme now included.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	Revised BIA and Structural Report.
Are suitable plan/maps included?	Yes	A number of maps with the site location indicated now provided in structural report.
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	As above.
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Justification not provided for any of the 'No' responses. However, responses are correct.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Justification not provided for two of the 'No' responses. However, responses are correct.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Justification not provided for two of the 'No' responses and response to Q6 not accepted although this has subsequently been addressed in the latter sections of the report (see Audit paragraph 4.7).

Item	Yes/No/NA	Comment
Is a conceptual model presented?	Yes	Section 6 of the BIA and Figures 5, 6 and 7 although the elevation to the base of the Made Ground given in the BIA text does not consider the extended thickness encountered in one of the trial pits.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	Section 4 which the BIA described as 'Scoping' is not in accordance with the Arup GSD, however, Section 3.5 provides a summary of the issues identified and recommends further investigation.
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	As above.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	As above. Response to screening Q6 is incorrect although this has now been addressed in latter sections of the report (see Audit paragraph 4.7).
Is factual ground investigation data provided?	Yes	Appendix C of the CGL BIA.
Is monitoring data presented?	Yes	Section 6.4 and Appendix E of the BIA.
Is the ground investigation informed by a desk study?	Yes	Section 2 of the BIA.
Has a site walkover been undertaken?	Yes	Assumed yes. Not explicitly stated but Section 2.2 of the BIA makes reference to 'visual observations' of the neighbouring properties.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	Section 2.2 of the BIA states the lower ground floor levels of the adjoining properties are similar to the site.
Is a geotechnical interpretation presented?	Yes	Section 6 and Section 9 of the BIA.
Does the geotechnical interpretation include information on retaining wall design?	Yes	Geotechnical design parameters are given in Section 6 of the BIA although the stiffness values of the Made Ground are not considered to be conservative.

Item	Yes/No/NA	Comment
Are reports on other investigations required by screening and scoping presented?	Yes	Structural report comprises details not included in the BIA such as the drainage proposal.
Are the baseline conditions described, based on the GSD?	Yes	Description of current drainage and building defects referenced in Structural Inspection Report (see Audit paragraph 4.19) now included in Structural Report.
Do the base line conditions consider adjacent or nearby basements?	Yes	Section 2.2 of the BIA states that surrounding lower ground floor levels are similar to the site.
Is an Impact Assessment provided?	Yes	Section 10 of the BIA.
Are estimates of ground movement and structural impact presented?	Yes	Although there are queries on the assumptions and methodology.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	Revised BIA and Structural Report
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	Revised BIA and Structural Report
Has the need for monitoring during construction been considered?	Yes	Outline proposals in Section 12 of revised BIA (see Audit paragraph 4.21).
Have the residual (after mitigation) impacts been clearly identified?	N/A	None identified.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	Based on the assumptions made. There are queries on the ground movement assessment, however, these are not considered to have a significant effect on the damage category (see Audit paragraphs 4.15 to 4.18).
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Revised BIA and Structural Report (see Audit paragraph 4.8).

Item	Yes/No/NA	Comment
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	As above.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Maximum Category 1 damage indicated in Section 10 of the BIA.
Are non-technical summaries provided?	Yes	Provided in revised BIA.

4.0 DISCUSSION

4.1. A Basement Impact Assessment (BIA) prepared by MW Design and Consulting Engineers was previously audited. However, several queries relating to the author's qualifications, BIA format, hydrogeology, hydrology and stability of the proposed structure and neighbouring properties were raised. A new BIA undertaken by Card Geotechnics Limited (CGL) was submitted in response to the queries raised in the initial audit. This audit only relates to the current BIA although the query tracker in Appendix 2 includes the queries from the previous BIA.

4.2. The individuals involved in the preparation of the CGL BIA have CEng MICE and CGeol qualifications. A Structural Report was prepared by Entuitive and the author has a CEng MIStructE qualification.

4.3. The site currently comprises a residential building with two above ground storeys over a single storey basement which is indicated to be of reduced height. The proposal includes increasing the depth of the existing basement by 0.60m with a 2.30m excavation in the front garden to create a lightwell and secondary access to the basement. The new basement level is indicated to be c.41.65m AOD and is to be constructed by underpinning. The structural report included an underpinning bay sequence and sketches to illustrate the construction sequence however outline calculations were not originally included.

4.4. In the revised submissions, outline calculations are now provided in response to the queries raised following the second audit and although there are queries on the assumptions and approach, these are not considered to be significant due to the modest nature of the proposals.

4.5. It is stated in Section 2.2 of the BIA that the neighbouring properties comprise lower ground/basement levels similar to the subject site, No.13 Kylemore Road.

4.6. Following the second audit, it was observed the BIA could be improved by including the relevant maps extracts from the Arup GSD, Camden SFRA and the Environment Agency (EA) identifying the site location. It was noted these would help to support statements made in the BIA screening process for which no justification was given to several of the 'No' responses. A number of maps have now been included in both the updated structural report by Entuitive and the revised CGL BIA. For the remaining screening questions, where maps or justification is not provided, the responses have been checked and are valid.

4.7. A 'No' response was given to Question 6 of the hydrology screening which relates to whether or not the site is in an area at risk from flooding. Figure 5b of the Camden SFRA indicates the site is in an area at risk from external sewer flooding. Additionally, one of the consultation comments made reference to groundwater flooding and drainage problems along Kylemore

Road. Reference to Figure 4e of the Camden SFRA indicates the Environment Agency (EA) recorded groundwater flood incidents along Kylemore Road. The revised BIA concludes the risk of flooding is minor and although this issue is not considered to be appropriately addressed, the Structural Report proposes non-return valves which would mitigate the risk of sewer flooding.

4.8. It was initially stated in the structural report that there will be no increase in hardstanding. This was contradictory to the BIA screening which gave a 'Yes' response to Questions 3 and 4 of the hydrology and hydrogeology screening questions relating to whether or not there will be an increase to the area of hardstanding. Section 3.4 of the BIA stated that drainage issues will be '*addressed by others'*, however, this was not addressed any further. The revised structural report comprises a drainage strategy which proposes permeable paving on crushed stone within the new lightwell. The London Clay has low permeability and is not suitable for soakaway drainage. However, the proposed lightwell area is modest and any adverse effects of this drainage strategy would not impact neighbours or the wider environment.

4.9. The BIA screening and Figure 11 of the Arup GSD indicates a tributary of the 'lost' River Westbourne runs in the vicinity of the site to the east. The scoping section of the BIA indicates this required further investigation, although there does not appear to have been a specifically targeted investigation. Following the second audit, it was requested that although these 'lost' rivers are now culverted and form part of the sewer network, the item should be closed out. The revised BIA now concludes that due to the distance to the 'lost' river, this issue is not considered to be significant and therefore further investigation is not required.

4.10. A ground investigation, which includes two window sampler holes to a maximum depth of 8.45m below ground level and four trial pits to investigate the foundations of the existing building and party wall with No 11 Kylemore Road, was undertaken. Made Ground to a maximum depth of 1.50m over London Clay described as soft up to c.4.50m with relatively low SPT 'N' values was encountered in BH1 and BH2. TP1, which was undertaken on the party wall with No. 11 Kylemore Road, revealed brick foundations extending to c.3.25m bgl (c.40.70m bgl) founded in Made Ground, the depth of which was not proven. A trial pit was not undertaken along the party wall with No 15. Subsequent correspondence with Entuitive (see email response dated 27 May 2017 in Appendix 3) indicates a trial pit will be undertaken prior to construction and this is considered prudent.

4.11. Groundwater was monitored at 2.30m bgl (40.88m AOD) in BH2. It is stated in Section 10.2 of the BIA that this is anticipated to be perched water which could be dealt with by sump pumping. As noted above, groundwater flooding issues are indicated along Kylemore Road. The BIA concludes that due to the impermeable nature of the underlying geology, this is not considered

to be an issue. Recommendations on water proofing in the permanent case are given in the structural report.

4.12. Stiffness parameters are given in Table 8 of the BIA for both the Made Ground and London Clay. These are not considered to be reasonably conservative, given the results of the ground investigation, as required by Camden's Terms of Reference. However, due to the modest nature of the proposals, this is not considered to be significant.

4.13. A ground movement assessment (GMA) is included in Section 10 of the BIA. The depth of the underpinning along the party walls was not explicitly stated in the initial BIA although it appeared a c.1m excavation had been assumed along the party walls and 2.30m for the front garden. It is stated in the Structural Report that the perimeter walls to the basement will be formed by reinforced concrete underpins '*in excess of 1m'* whilst the underpins to the lightwell will be 3m high. Whilst there is some apparent discrepancy, it is considered this will not significantly affect the GMA. The revised BIA indicates underpinning beneath the house will extend to c.1.20m and 2.30 to 2.40m for the lightwell.

4.14. One of the comments following the second audit was that the base of the Made Ground was not proven in the vicinity of the foundations which could have a bearing on the depth of the underpins and, consequently, the ground movement assessment. As described above, TP1 which was undertaken on the party wall with No 11 revealed a brick foundation extending to c.40.75m AOD founded on Made Ground, the depth of which was not proven. This is below the proposed basement depth of 41.65m AOD. It is recommended that the underpin foundations must bear on the London Clay.

4.15. Correspondence with Entuitive has indicated they consider the extended thickness of the Made Ground in the trial pit undertaken to be an '*isolated*' case and it is stated in both the revised BIA and structural report that the underpinning will be extended to bear into the London Clay.

4.16. Oasys Vdisp was used to predict vertical movements as a result of the net loading due to underpinning and excavation. A total displacement of 4.5mm is indicated from the analysis for No. 11 with 6mm predicted for No.15 Kylemore Road. It was stated '*the programme assumes perfect workmanship and does not allow for settlement of the dry pack between the existing footings and new concrete'*. It is further stated that '*with good construction practice, actual settlements would not exceed 5mm per lift'.* On this basis, a total vertical settlement of 9.5mm was indicated for No 11 Kylemore Road with 11mm for No. 15. The tabular input and output from the programme were not included.

4.17. On the basis of the anticipated vertical movement, '*limiting horizontal movements'* were estimated to restrict damage to Category 0 (11 Kylemore Road) and Category 1 (15 Kylemore

Road). These were 2.3 and 1.5mm respectively. It was considered that these limiting movements would be hard to achieve and monitor. Furthermore, ground movements will be greater if it is necessary to deepen the underpins significantly to bear on a competent natural stratum. Justification was requested for the predicted movements, including the statement that long term deflection is considered to be negligible.

4.18. The revised BIA now includes the requested input and output from the Vdisp analysis. The results indicates maximum vertical deflections of 1.8 and 2.3mm for No. 11 and 15 Kylemore Road respectively with 1.8 and 3mm '*limiting horizontal movements*'. Although there are comments on the difficulty in achieving and monitoring these movements, given the modest scale of the proposals it is accepted, as stated in the conclusions, that damage is unlikely to exceed Category 1.

4.19. The initial submission included a Structural Inspection Report which identified a number of defects within the property mainly relating to damp, evidence of subsidence and cracking. There was no mention of the extent of the damage beyond the subject site. There was no reference to this report in the initial CGL BIA or the Entuitive Structural Report although the BIA recommended condition surveys to be undertaken.

4.20. The building damage assessment relies on the assumption of good workmanship and properties which are in sound condition. A condition survey of the host and neighbouring properties should be undertaken prior to construction to determine the extent of any damage and the need for any remedial works. Entuitive's updated report indicates this will be undertaken prior to construction.

4.21. The initial BIA recommended movement monitoring of the neighbouring properties although no outline proposals were presented. These have now been provided however there are comments on the trigger values which are considered to be difficult to achieve. The monitoring strategy should be agreed with the relevant Party Wall surveyors prior to construction.

4.22. A works programme was not originally submitted as required by Cl.233 of the GSD. Entuitive have now provided an outline works duration.

4.23. It is accepted that there are no slope stability concerns or any other groundwater and surface water considerations regarding the proposed development.

5.0 CONCLUSIONS

5.1. A new BIA undertaken by Card Geotechnics Limited (CGL) was submitted in response to the queries on the original BIA prepared by MW Consulting. This audit only relates to the current BIA. However, the query tracker in Appendix 2 includes the queries on the previous BIA.

5.2. The qualifications of the individuals involved in the current BIA undertaken by CGL meet CPG4 requirements.

5.3. The proposal includes increasing the depth of an existing basement and excavation of the front garden to basement level to create a lightwell and secondary access to the basement by underpinning.

5.4. In the revised submissions, it is now stated that underpins will be extended to bear in the London Clay. An outline retaining wall design is included.

5.5. The revised BIA proposes non-return valves which would mitigate the risk of sewer flooding.

5.6. Queries relating to the 'lost' River have now been adequately addressed in the BIA.

5.7. An outline drainage strategy has been provided, as requested, which is not considered to adversely impact neighbours or the wider environment.

5.8. 'Negligible' and 'Very Slight' damage are predicted for No. 11 and 15 Kylemore Road respectively. It is accepted the damage to the neighbouring properties is unlikely to exceed Category 1 (Very Slight) damage.

5.9. The updated Structural Report now makes reference to the defects identified in the Structural Inspection Report and indicates condition surveys are to be undertaken prior to construction.

5.10. An outline monitoring proposal has been provided as requested. The trigger levels are considered to be difficult to achieve. However, this can be agreed with the relevant Party Wall Surveyors.

5.11. An outline works programme has now been provided.

5.12. It is accepted that there are no slope stability concerns or any other groundwater and surface water considerations regarding the proposed development.

5.13. Considering the revised submissions, the BIA meets the requirements of the BIA.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Shaughnessy (on behalf of the local residents association)	20 Kylemore Road London NW6 2PT	undated	BIA incomplete (no scoping and site investigation) and drawings unclear Properties on Kylemore Road subject to groundwater flooding and drainage problems	New BIA provided (see Audit paragraph 4.1) See Audit paragraph 4.11
Pallis	Not provided	undated	Disruption of water table Proposal will lead to localised flooding Stability of neighbouring buildings and party walls	See Audit paragraphs 4.11. Site Audit paragraph 4.7., 4.8 and 4.9. See Audit paragraphs 4.13 to 4.18.
Lewis (owner of 15 Kylemore Road)	71 Edgwarebury Lane Edgware Middlesex HA8 8LU	01/01/16	'*Threat*' to stability of No 15	See Audit paragraphs 4.13 to 4.18.

Appendix 2: Audit Query Tracker

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Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	BIA format	BIA author qualifications not in accordance with CPG4	Closed – See Audit paragraphs 4.1 and 4.2.	31/03/17
2	BIA format	BIA not undertaken in accordance with ARUP GSD and CPG4 requirements.	Closed – new BIA undertaken broadly in accordance with requirements.	31/03/17
3	BIA format	Works programme not included	Closed – outline duration provided in revised Structural Report. Detailed programme submitted at a later date by appointed Contractor.	13/09/17
4	BIA format/ Stability/Hydrogeology	No site specific ground investigation to confirm sequence of strata and groundwater level.	Closed – site specific ground investigation undertaken.	31/03/17
5	Hydrogeology	Potential groundwater flood risk. No investigation of 'lost river' as noted to be required in BIA.	Closed – See Audit paragraph 4.9.	03/10/17
6	Hydrology	Screening did not identify that the site is located in an area at risk from sewer flooding and area of hard standing is increased.	Closed – See Audit paragraph 4.7	03/10/17

7	Stability	Presence or absence of basement beneath neighbouring properties not discussed in BIA and foundations depths not determined. Ground investigation to determine depth and nature of party wall foundations to be undertaken. Depth of foundations to party wall with No 15 not determined	Closed – New BIA confirms the presence of basements beneath neighbouring properties. New BIA includes ground investigation To be undertaken prior to construction. See Audit paragraph 4.10 and email response (270617)	31/03/17 N/A
8	Stability	Proposed construction methodology not sufficiently detailed. No construction sequence sketches, temporary works proposal or retaining wall calculations. Clarification requested on the depth of the underpinning beneath the party walls as base of Made Ground not proven	Closed – Revised BIA documents contains requested information (see Appendix 3)	03/10/17
9	Stability	Ground movement assessment (GMA) not provided. GMA undertaken in new BIA however there are queries on this as discussed in Section 4	New BIA includes GMA. Closed – Damage category in conclusions considered acceptable.	 03/10/17
10	Stability	Neighbouring properties condition survey to be undertaken.	To be undertaken as part of a condition of planning.	N/A
11	Stability	Movement monitoring proposal not provided.	Outline proposal provided with trigger levels. There are comments on this (See Audit paragraphs 4.17, 4.18 and 4.21) to be agreed with the relevant Party Wall Surveyors.	N/A

Appendix 3: Supplementary Supporting Documents

Entuitive Construction Sequence Sketches (S-P-SK01, S-P-SK02 and S-P-SK03)

Entuitive Structural Calculations dated May 2017

Email response from Entuitive dated 27 June 2017

Email from Applicant dated 29 August 2017

SLAB POUR 4 | SLAB POUR 2 | SLAB POUR 3 | SLAB POUR 1

No.11

ALL SEQUENCE 'A' UNDERPINS TO BE 450mm THICK RC FULL HEIGHT WALLS.

450mm DEEP RC EXTERNAL BASEMENT SLAB

INSTALL SHEET PILE BETWEEN BOUNDARY WITH no, 15 AND LIGHTWELL UNDERPIN

No.15

SHORT LENGTH TEMPORARY HORIZ. WALERS.

TEMPORARY CROSS PROPS TO FACILITATE THE CASTING OF THE BASEMENT SLAB.

SACRIFICAL PROPS AS REQUIRED FOR SEQUENCE 6 PINS

≈350mm DEEP RC BASEMENT SLAB.

P1

No.13

ASSUMED PARTY WALL LINE,

No.15

EXISTING GRD. FLR.

EXISTING PARTY WALL.

TEMPORARY LATERAL SUPPORTS TO CONTRACTORS DETAILS.

CAVITY DRAINAGE SYSTEM TO SPECIALIST DETAILS

FFL OF EXISTING BASEMENT.

EXISTING BASEMENT SLAB

75mm THICK DRY PACK

NEW FFL ≈ 0.53m LOWER THAN ORIGINAL FLOOR

RIGID INSULATION BOARD OR SIMILAR.

250mm THICK RC UNDERPINNING WALL CAST IN HIT & MISS SEQUENCE.

≈350mm DEEP RC BASEMENT SLAB

SECTION 1-1 (SCALE 1:20).

BASEMENT PLAN (SCALE 1:50)

No.15

No.11

ASSUMED PARTY WALL LINE

EXISTING GRD. FLR

MIN. 250mm THICK RC WALLS CAST IN HIT & MISS SEQUENCE. UNDERPINS TO BE ≈1.15m DEEP.

EXISTING PARTY WALL.

CAVITY DRAINAGE SYSTEM TO SPECIALIST DETAILS

FFL OF EXISTING BASEMENT.

EXISTING BASEMENT SLAB

75mm THICK DRY PACK

NEW FFL ≈ 0.53m LOWER THAN ORIGINAL FLOOR

RIGID INSULATION BOARD OR SIMILAR.

50mm MIN BLINDING

250mm THICK RC UNDERPINNING WALL CAST IN HIT & MISS SEQUENCE.

≈350mm DEEP RC BASEMENT SLAB.

SECTION 2-2 (SCALE 1:20)

NOTES:

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FOR GENERAL NOTES SEE GN-01 & GN-02

Rev.	Date	Amendment	By
A	Aug '17	As Clouded	JM

Status: PLANNING

Project Title:
13 Kylemore Road, NW6

Drawing Title:
Basement Plan & SECTIONS.

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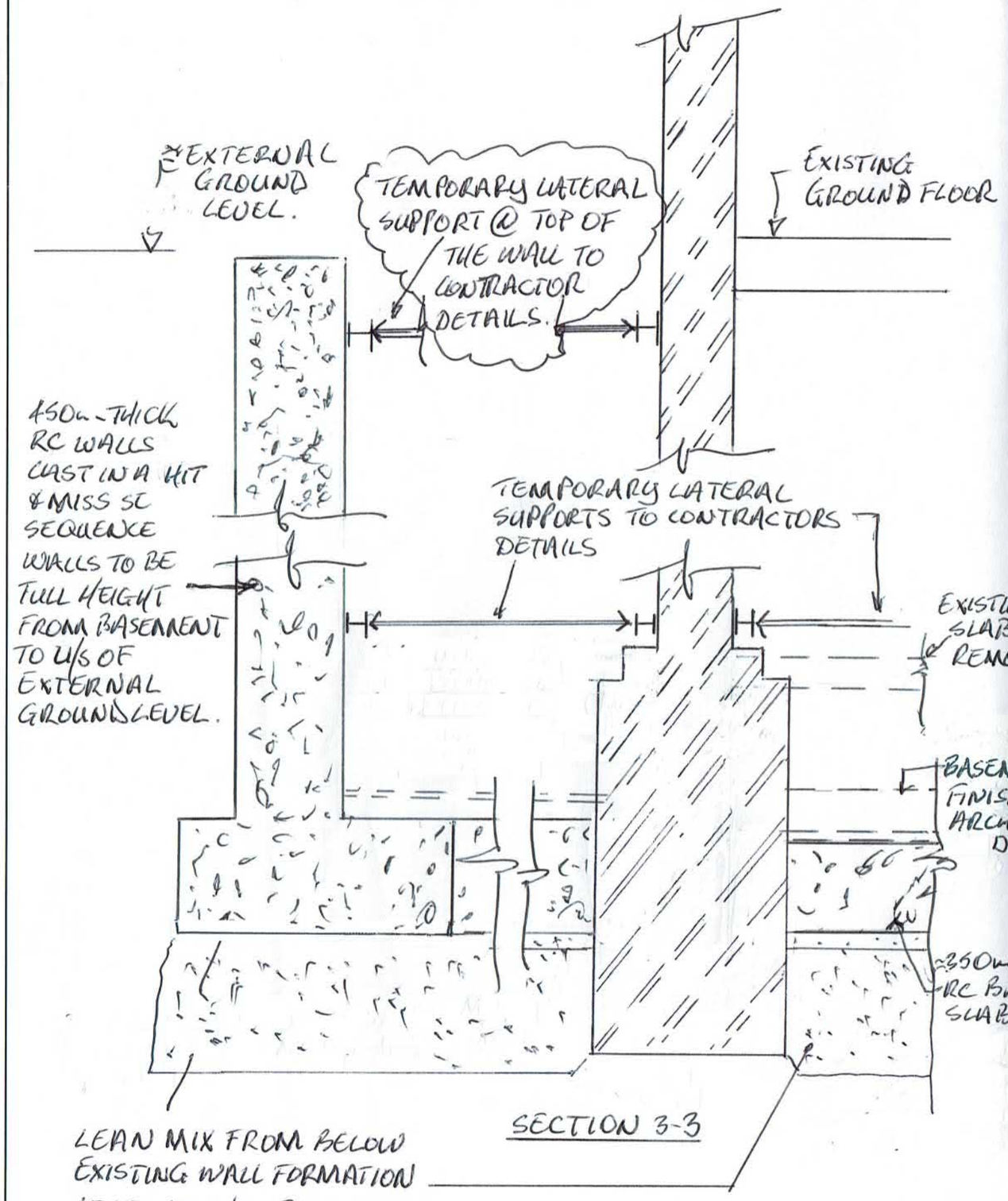
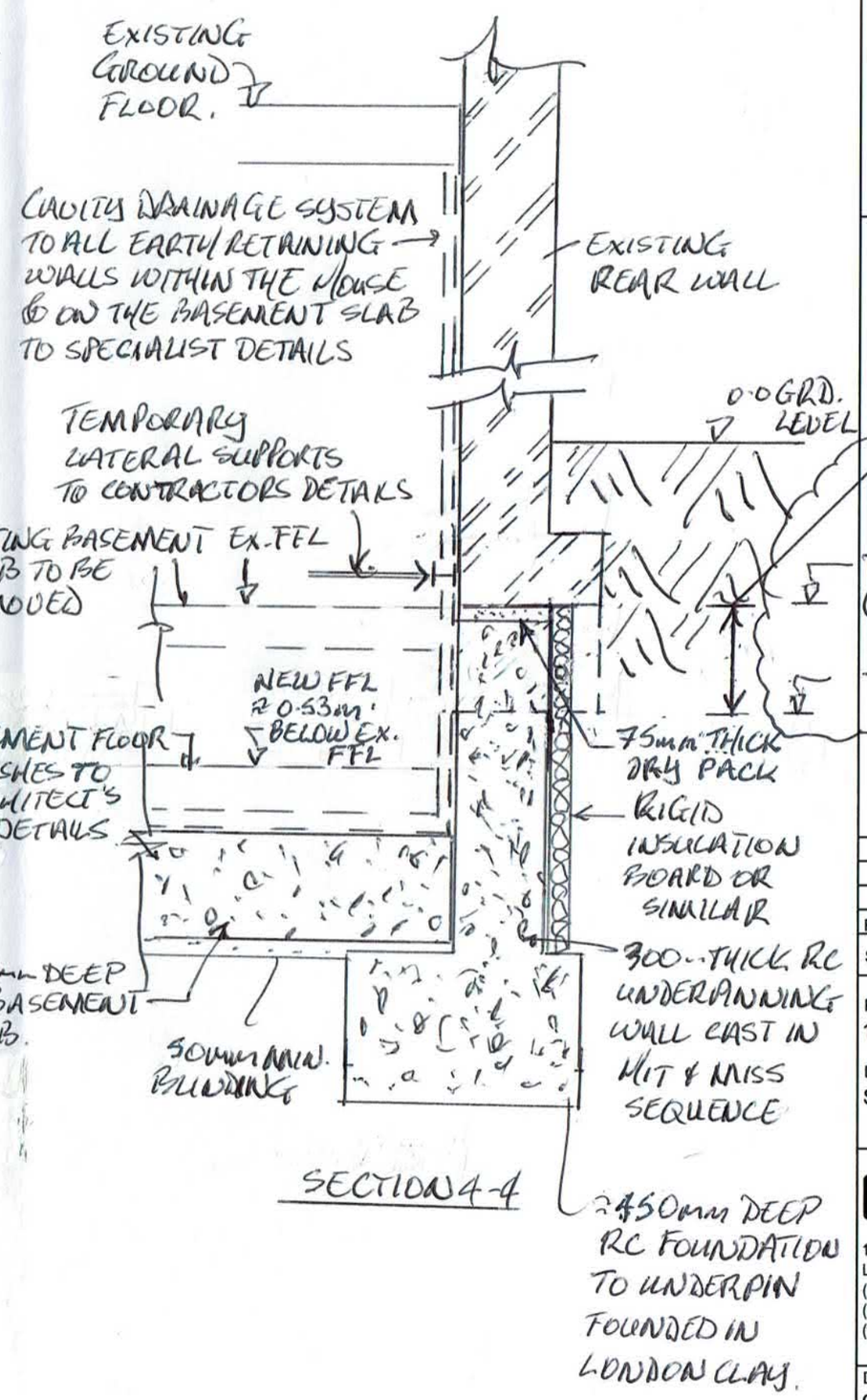
Date:	Scale:	Drawn:
01-2017	AS NOTED	JM

Project No.:	Drwg No.:	Rev.:
4249	S- P- SK01	A





EXTENT OF EXISTING FOUNDATION TO BE CUT BACK.

TOP OF RC UNDERPIN @ -0·56m BGL

-0·76m B.G.L TO U/S OF BRICK FOUNDATION

FOR GENERAL NOTES SEE GN-01 & GN-02

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Rev.	Date	Amendment	By
A	APR.17	As issued	JM

Status: PLANNING

Project Title:
13 Kylemore Road, NW6

Drawing Title:
Section Sheet 1

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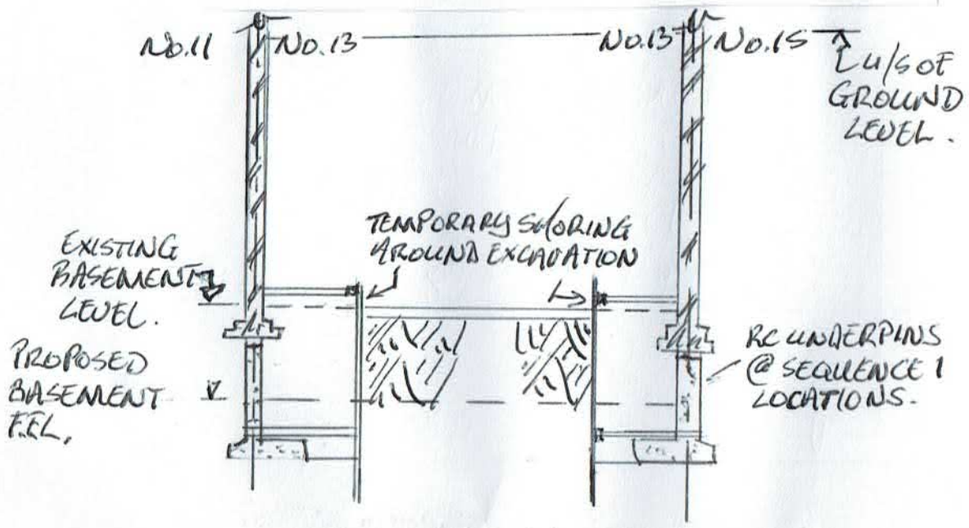
Date:	Scale:	Drawn:
01-2017	1:20 AT A3	JM

Project No.:	Drwg No.:	Rev.:
4249	S- P- SK02	A

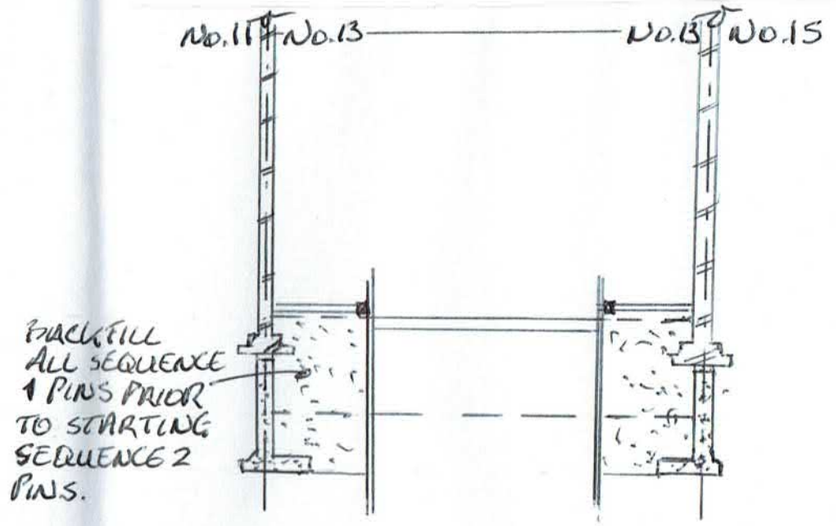
Stage 1 Underpinning works to number 1 pins

1.1 Following the sequence outlined on the plan carefully excavate all pin numbered 1.
1.2 With adequate temporary shoring in place cast the reinforced concrete pin below the existing wall.
1.3 Insert dry packing and back fill hole with well compacted arisings.



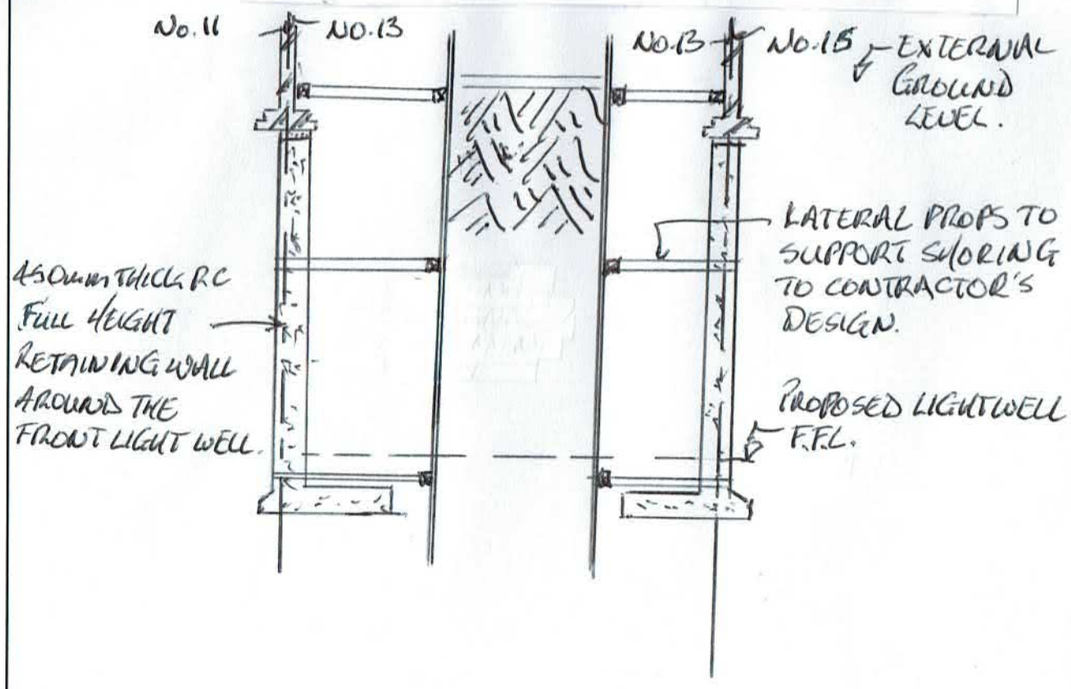
Stage 2 Underpinning works to number 2-6 pins

2.1 Following the completion of all number 1 pins commence works to number 2 pins and so on following the numbered sequence on the basement plan.
2.2 Allow for sacrificial props as required for sequence 6 pins.



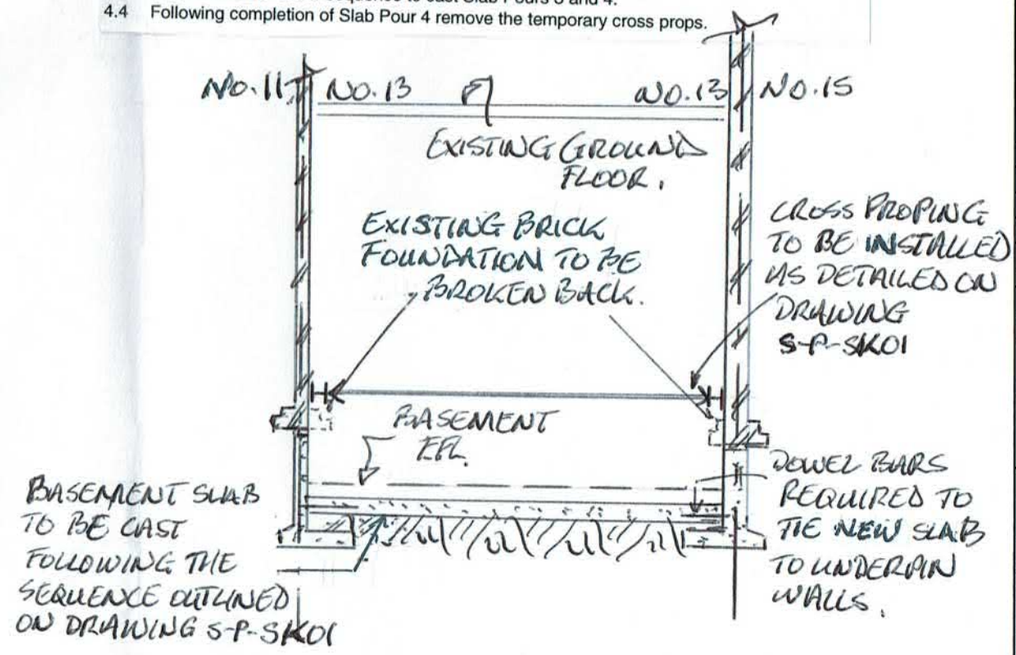
Stage 3 Retaining wall works to form the front lightwell

3.1 Following the sequence outlined on the plan carefully excavate all the wall sections numbered 1a to form the front lightwell.
3.2 With adequate, full height, temporary shoring in place cast the reinforced concrete retaining walls.
3.3 Following completion of all the 1a wall sections backfill with well compacted arisings.
3.4 Following the completion of all number 1a wall sections commence works to number 2a wall sections and so on following the numbered sequence on the basement plan.



Stage 4 Casting the basement slab

4.1 Install the temporary horizontal wailers and cross props as noted on the basement plan.
4.2 Once the temporary cross props are in place dig out completely to the formation level of Slab Pour 1 as noted on the basement plan.
4.3 Following completion of Slab Pour 1 dig out completely to the formation level of Slab Pour 2 and continue to follow sequence to cast Slab Pours 3 and 4.
4.4 Following completion of Slab Pour 4 remove the temporary cross props.



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FOR GENERAL NOTES SEE GN-01 & GN-02

Rev.	Date	Amendment	By

Status: PLANNING

Project Title:
13 Kylemore Road, NW6

Drawing Title:
Outline Sequence

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Project No.:	Drwg No.:	Rev.:
4249	S- P SK03	-

Robert Hume

13 Kylemore Road, NW6

Structural Planning Calculations

ENTUITIVE

Robert Hume

13 Kylemore Road, NW6

Structural Planning Calculations

May 2017

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Project Number: 4249

INTRODUCTION

The full address is:

13 Kylemore Road
London
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The house is a terraced building over three storeys, including a single below ground storey of reduced head height. There is also a three storey rear addition to the back of the main house. The external walls are loadbearing masonry walls and the floors are of timber construction as is the roof. The foundations are traditional stepped brick.

SCOPE OF WORK

The proposed alterations involve the formation of a basement extension below the main house that would include a lightwell to the front of the property.

The proposed work involves, forming a new basement extension directly below the footprint of the building with reinforced concrete underpins directly below the existing stepped brick foundations, including a lightwell to the front of the property, to transfer the vertical dead and live loads into the soil below. The lateral forces from the retained soil and surcharges will be transferred into the cantilevered reinforced concrete underpins that will be supported at the base via the basement slab.

We propose that this work be undertaken via the formation of the reinforced concrete underpins constructed in a hit and miss sequence. Likewise the basement slab will be cast according to an agreed sequence.

The lateral stability of the house should not be affected as the extension works will not change the current stability framing

The attached calculation pages A00-A06 confirm the outline structural calculations required to achieve the above work. Drawings 4249/S- P- SK-01, 02 rev A & 03 show the required structural intervention to construct the works.

Sincerely,
Entuitive

John Maguire
Senior Engineer
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	Project No.: 4249	Made by: JM	Checked:	Date: April 2017	Revision:

CONTENTS

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	Project No.: 4249	Made by: JM	Checked:	Date: Nov '16	Revision:

Outline design of the RC underpins to the House

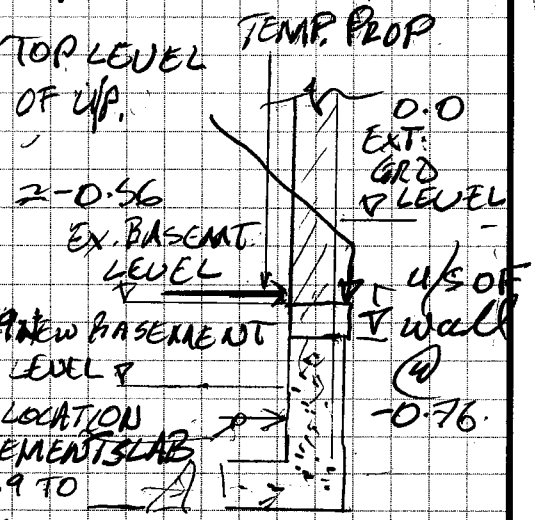
Horizontal loads on walls

- made ground ≈ 3.2m dp.
- unit weight = 19 kN/m³
- θ ≈ 24°

$K_{and\,gd.} = 0.289$

$P_{s1} = 0.289 \times 19 \times 1.86^2/2 = 9.5$

$P_{sur} = 0.289 \times 2.5 = 0.723$



The worse case RC underpin walls to the house will be at the rear and will require ≈1.6m deep RC underpin that will be continuous over over the new RC basement slab in the permanent condition.

From a review of the Tedds analysis in the permanent condit. we expect that there would be sufficient passive pressure on the toe of the u/p to withstand the lateral force at the base of the underpin.

Outline design of the RC underpins to the lightwell

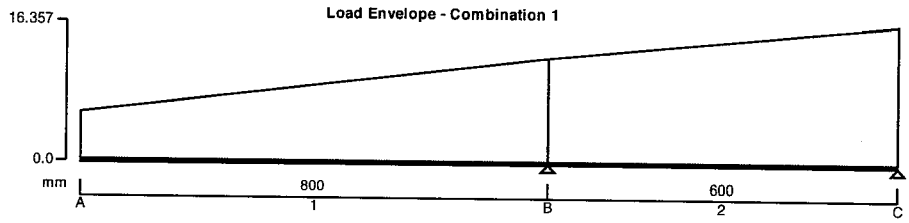
Lateral loads on the RC underpin sections will be the same as above

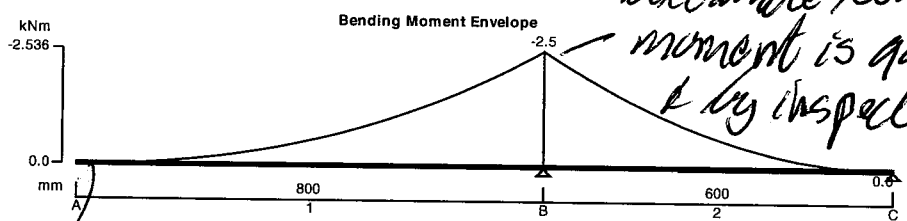
$P_{s1} = .289 \times 19 \times 2.6^2/2 = 18.6\,kN/m$

CSC ▶ TEDDS	Project				Job Ref.	
Entuitive	13 Kylemore, NW6				4249	
143 Cownstone Road London SW2 1NB	Section Retaining wall underpin				Sheet no./rev. 402	
	Calc. by JM	Date	Chk'd by	Date	App'd by	Date

RC BEAM ANALYSIS & DESIGN BS8110

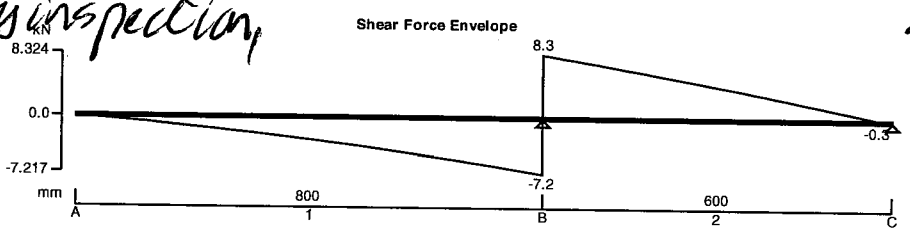
TEDDS calculation version 2.0.01





Ultimate bending moment is quite small & by inspection min. steel reinforcement in the wall will be sufficient for bending + shear.

Deflection @ top of wall will be, by inspection, minimal.



Support conditions

Support A	Vertically free
	Rotationally free
Support B	Vertically restrained
	Rotationally free
Support C	Vertically restrained
	Rotationally free

Applied loading

Span 1 loads	Imposed VDL 2.860 kN/m at 0 mm to 6.970 kN/m at 800 mm
	Imposed UDL 0.723 kN/m from 0 mm to 800 mm
Span 2 loads	Imposed VDL 6.970 kN/m at 0 mm to 9.500 kN/m at 600 mm
	Imposed UDL 0.723 kN/m from 0 mm to 600 mm

Load combinations

Load combination 1	Support A	Dead × 1.40
		Imposed × 1.60
	Span 1	Dead × 1.40

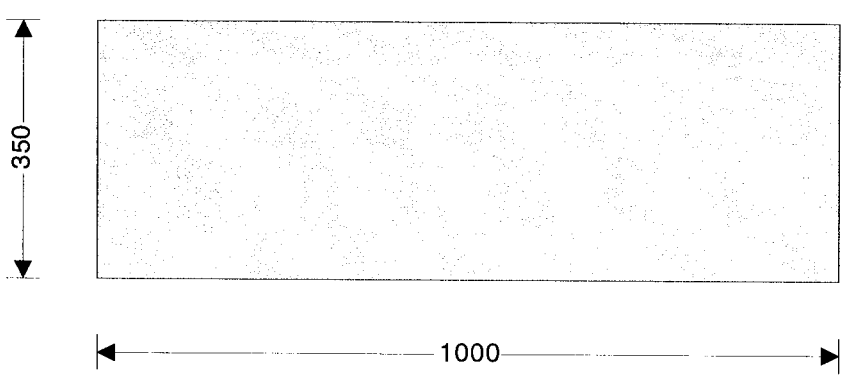
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60
	Span 2	Dead × 1.40
		Imposed × 1.60
	Support C	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment support A	M_{A_max} = **0** kNm	M_{A_red} = **0** kNm
Maximum moment span 1 at 0 mm	M_{s1_max} = **0** kNm	M_{s1_red} = **0** kNm
Maximum moment support B	M_{B_max} = **-3** kNm	M_{B_red} = **-3** kNm
Maximum moment span 2 at 583 mm	M_{s2_max} = **0** kNm	M_{s2_red} = **0** kNm
Maximum moment support C	M_{C_max} = **0** kNm	M_{C_red} = **0** kNm
Maximum shear support A	V_{A_max} = **0** kN	V_{A_red} = **-3** kN
Maximum shear support A span 1 at 300 mm	$V_{A\_s1\_max}$ = **0** kN	$V_{A\_s1\_red}$ = **-5** kN
Maximum shear support B	V_{B_max} = **8** kN	V_{B_red} = **5** kN
Maximum shear support B span 1 at 500 mm	$V_{B\_s1\_max}$ = **-4** kN	$V_{B\_s1\_red}$ = **-0** kN
Maximum shear support B span 2 at 300 mm	$V_{B\_s2\_max}$ = **4** kN	$V_{B\_s2\_red}$ = **1** kN
Maximum shear support C	V_{C_max} = **-0** kN	V_{C_red} = **4** kN
Maximum shear support C span 2 at 300 mm	$V_{C\_s2\_max}$ = **0** kN	$V_{C\_s2\_red}$ = **-8** kN
Maximum reaction at support A	R_A = **0** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **0** kN	
Maximum reaction at support B	R_B = **16** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **10** kN	
Maximum reaction at support C	R_C = **0** kN	
Unfactored imposed load reaction at support C	$R_{C\_Imposed}$ = **0** kN	

Rectangular section details

Section width	b = **1000** mm
Section depth	h = **350** mm



Concrete details

Concrete strength class	**C40/50**
Characteristic compressive cube strength	f_{cu} = **50** N/mm^2
Modulus of elasticity of concrete	E_c = 20kN/mm^2 + 200 × f_{cu} = **30000** N/mm^2
Maximum aggregate size	h_{agg} = **20** mm

Reinforcement details

Characteristic yield strength of reinforcement f_y = **500** N/mm^2

Characteristic yield strength of shear reinforcement f_{yv} = **500** N/mm^2

Nominal cover to reinforcement

Nominal cover to top reinforcement c_{nom_t} = **35** mm

Nominal cover to bottom reinforcement c_{nom_b} = **50** mm

Nominal cover to side reinforcement c_{nom_s} = **35** mm

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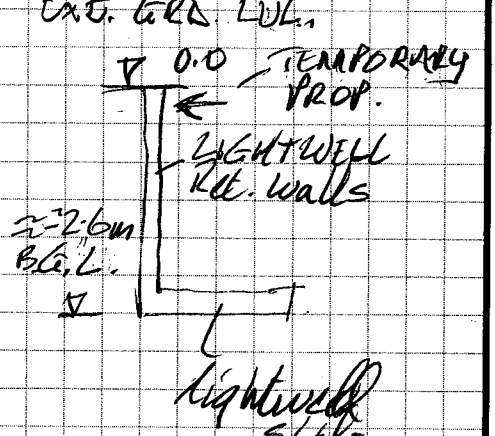
	Project No.: 4249	Made by: JM	Checked:	Date: Nov '16	Revision:

$P_{water} = 9.81 \times 1.3^2/2 = 8.36 kN/m^2$

$P_{soil} = 0.72 kN/m^2$



The worst case condition for the lightwell walls is the permanent condition which is calculated in the Tedds analysis over.

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143 Crownstone Road	Section				Sheet no./rev.	
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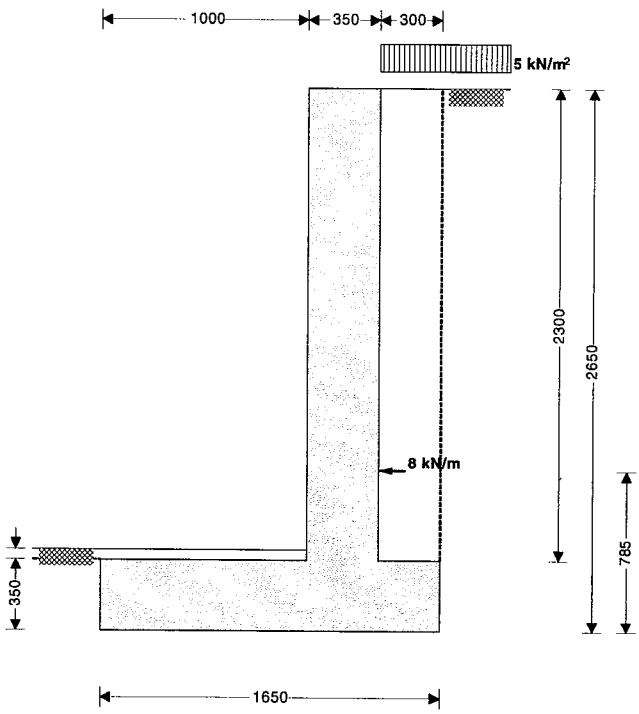
SW2 1NB	Calc. by	Date	Chk'd by	Date	App'd by	Date
	JM					

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.02



Wall details

Retaining wall type	**Unpropped cantilever**
Height of retaining wall stem	h_{stem} = **2300** mm
Thickness of wall stem	t_{wall} = **350** mm
Length of toe	l_{toe} = **1000** mm
Length of heel	l_{heel} = **300** mm
Overall length of base	$l_{base} = l_{toe} + l_{heel} + t_{wall}$ = **1650** mm
Thickness of base	t_{base} = **350** mm
Depth of downstand	d_{ds} = **0** mm
Position of downstand	l_{ds} = **1300** mm
Thickness of downstand	t_{ds} = **350** mm
Height of retaining wall	$h_{wall} = h_{stem} + t_{base} + d_{ds}$ = **2650** mm
Depth of cover in front of wall	d_{cover} = **50** mm
Depth of unplanned excavation	d_{exc} = **50** mm
Height of ground water behind wall	h_{water} = **0** mm
Height of saturated fill above base	$h_{sat} = \max(h_{water} - t_{base} - d_{ds}, 0\ mm)$ = **0** mm
Density of wall construction	γ_{wall} = **23.6** kN/m³
Density of base construction	γ_{base} = **23.6** kN/m³
Angle of rear face of wall	α = **90.0** deg
Angle of soil surface behind wall	β = **0.0** deg
Effective height at virtual back of wall	$h_{eff} = h_{wall} + l_{heel} \times \tan(\beta)$ = **2650** mm

Retained material details

Mobilisation factor	M = **1.5**

Moist density of retained material	γ_m = **18.0** kN/m^3
Saturated density of retained material	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg
Angle of wall friction	δ = **18.6** deg

Base material details

Peat (very variable)	
Moist density	γ_{mb} = **18.0** kN/m^3
Design shear strength	ϕ'_b = **24.2** deg
Design base friction	δ_b = **18.6** deg
Allowable bearing pressure	$P_{bearing}$ = **100** kN/m^2

Using Coulomb theory

Active pressure coefficient for retained material

$$K_a = \sin(\alpha + \phi')^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta) \times [1 + \sqrt{(\sin(\phi' + \delta) \times \sin(\phi' - \beta) / (\sin(\alpha - \delta) \times \sin(\alpha + \beta)))}]^2) = \mathbf{0.369}$$

Passive pressure coefficient for base material

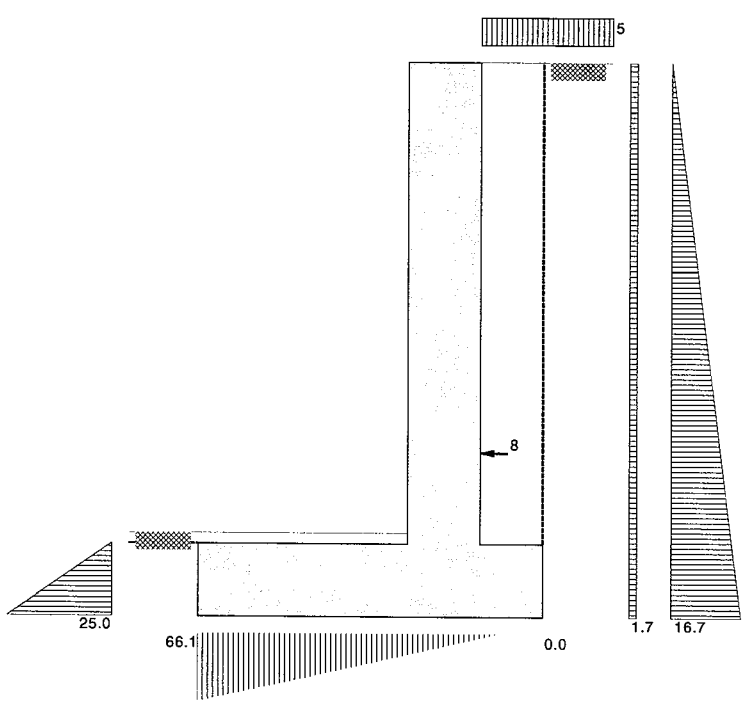
$$K_p = \sin(90 - \phi'_b)^2 / (\sin(90 - \delta_b) \times [1 - \sqrt{(\sin(\phi'_b + \delta_b) \times \sin(\phi'_b) / (\sin(90 + \delta_b)))}]^2) = \mathbf{4.187}$$

At-rest pressure

At-rest pressure for retained material	$K_0 = 1 - \sin(\phi')$ = **0.590**

Loading details

Surcharge load on plan	Surcharge = **5.0** kN/m^2
Applied vertical dead load on wall	W_{dead} = **0.0** kN/m
Applied vertical live load on wall	W_{live} = **0.0** kN/m
Position of applied vertical load on wall	l_{load} = **0** mm
Applied horizontal dead load on wall	F_{dead} = **8.3** kN/m
Applied horizontal live load on wall	F_{live} = **0.0** kN/m
Height of applied horizontal load on wall	h_{load} = **785** mm



Loads shown in kN/m, pressures shown in kN/m²

Vertical forces on wall

Wall stem — $w_{wall} = h_{stem} \times t_{wall} \times \gamma_{wall}$ = **19** kN/m

Wall base — $w_{base} = l_{base} \times t_{base} \times \gamma_{base}$ = **13.6** kN/m

Surcharge — $w_{sur} = \text{Surcharge} \times l_{heel}$ = **1.5** kN/m

Moist backfill to top of wall — $w_{m\_w} = l_{heel} \times (h_{stem} - h_{sat}) \times \gamma_m$ = **12.4** kN/m

Soil in front of wall — $w_p = l_{toe} \times d_{cover} \times \gamma_{mb}$ = **0.9** kN/m

Total vertical load — $W_{total} = w_{wall} + w_{base} + w_{sur} + w_{m\_w} + w_p$ = **47.4** kN/m

Horizontal forces on wall

Surcharge — $F_{sur} = K_a \times \cos(90 - \alpha + \delta) \times \text{Surcharge} \times h_{eff}$ = **4.6** kN/m

Moist backfill above water table — $F_{m\_a} = 0.5 \times K_a \times \cos(90 - \alpha + \delta) \times \gamma_m \times (h_{eff} - h_{water})^2$ = **22.1** kN/m

Applied horizontal load — $F_h = F_{dead} + F_{live}$ = **8.3** kN/m

Total horizontal load — $F_{total} = F_{sur} + F_{m\_a} + F_h$ = **35** kN/m

Calculate stability against sliding

Passive resistance of soil in front of wall — $F_p = 0.5 \times K_p \times \cos(\delta_b) \times (d_{cover} + t_{base} + d_{ds} - d_{exc})^2 \times \gamma_{mb}$ = **4.4** kN/m

Resistance to sliding — $F_{res} = F_p + (W_{total} - w_{sur} - w_p) \times \tan(\delta_b)$ = **19.5** kN/m

FAIL - Sliding force is greater than resisting force

Overturning moments

Surcharge — $M_{sur} = F_{sur} \times (h_{eff} - 2 \times d_{ds}) / 2$ = **6.1** kNm/m

Moist backfill above water table — $M_{m\_a} = F_{m\_a} \times (h_{eff} + 2 \times h_{water} - 3 \times d_{ds}) / 3$ = **19.5** kNm/m

Applied horizontal load — $M_{hor} = F_h \times h_{load}$ = **6.5** kNm/m

Total overturning moment — $M_{ot} = M_{sur} + M_{m\_a} + M_{hor}$ = **32.2** kNm/m

Restoring moments

Wall stem — $M_{wall} = w_{wall} \times (l_{toe} + t_{wall} / 2)$ = **22.3** kNm/m

Wall base — $M_{base} = w_{base} \times l_{base} / 2$ = **11.2** kNm/m

Moist backfill — $M_{m\_r} = (w_{m\_w} \times (l_{base} - l_{heel} / 2) + w_{m\_s} \times (l_{base} - l_{heel} / 3))$ = **18.6** kNm/m

Total restoring moment — $M_{rest} = M_{wall} + M_{base} + M_{m\_r}$ = **52.2** kNm/m

Check stability against overturning

Total overturning moment — M_{ot} = **32.2** kNm/m

Total restoring moment — M_{rest} = **52.2** kNm/m

PASS - Restoring moment is greater than overturning moment

Check bearing pressure

Surcharge — $M_{sur\_r} = w_{sur} \times (l_{base} - l_{heel} / 2)$ = **2.3** kNm/m

Soil in front of wall — $M_{p\_r} = w_p \times l_{toe} / 2$ = **0.5** kNm/m

Total moment for bearing — $M_{total} = M_{rest} - M_{ot} + M_{sur\_r} + M_{p\_r}$ = **22.7** kNm/m

Total vertical reaction — $R = W_{total}$ = **47.4** kN/m

Distance to reaction — $x_{bar} = M_{total} / R$ = **479** mm

Eccentricity of reaction — $e = \text{abs}((l_{base} / 2) - x_{bar})$ = **346** mm

Reaction acts outside middle third of base

Bearing pressure at toe — $p_{toe} = R / (1.5 \times x_{bar})$ = **66.1** kN/m²

Bearing pressure at heel — p_{heel} = 0 kN/m² = **0** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure

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SW2 1NB	Calc. by	Date	Chk'd by	Date	App'd by	Date
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RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.02

Ultimate limit state load factors

Dead load factor — $\gamma_{f\_d} = \mathbf{1.4}$

Live load factor — $\gamma_{f\_l} = \mathbf{1.6}$

Earth and water pressure factor — $\gamma_{f\_e} = \mathbf{1.4}$

Factored vertical forces on wall

Wall stem — $w_{wall\_f} = \gamma_{f\_d} \times h_{stem} \times t_{wall} \times \gamma_{wall} = \mathbf{26.6}$ kN/m

Wall base — $w_{base\_f} = \gamma_{f\_d} \times l_{base} \times t_{base} \times \gamma_{base} = \mathbf{19.1}$ kN/m

Surcharge — $w_{sur\_f} = \gamma_{f\_l} \times \text{Surcharge} \times l_{heel} = \mathbf{2.4}$ kN/m

Moist backfill to top of wall — $w_{m\_w\_f} = \gamma_{f\_d} \times l_{heel} \times (h_{stem} - h_{sat}) \times \gamma_m = \mathbf{17.4}$ kN/m

Soil in front of wall — $w_{p\_f} = \gamma_{f\_d} \times l_{toe} \times d_{cover} \times \gamma_{mb} = \mathbf{1.3}$ kN/m

Total vertical load — $W_{total\_f} = w_{wall\_f} + w_{base\_f} + w_{sur\_f} + w_{m\_w\_f} + w_{p\_f} = \mathbf{66.7}$ kN/m

Factored horizontal at-rest forces on wall

Surcharge — $F_{sur\_f} = \gamma_{f\_l} \times K_0 \times \text{Surcharge} \times h_{eff} = \mathbf{12.5}$ kN/m

Moist backfill above water table — $F_{m\_a\_f} = \gamma_{f\_e} \times 0.5 \times K_0 \times \gamma_m \times (h_{eff} - h_{water})^2 = \mathbf{52.2}$ kN/m

Applied horizontal load — $F_{h\_f} = \gamma_{f\_e} \times F_{dead} + \gamma_{f\_l} \times F_{live} = \mathbf{11.6}$ kN/m

Total horizontal load — $F_{total\_f} = F_{sur\_f} + F_{m\_a\_f} + F_{h\_f} = \mathbf{76.3}$ kN/m

Passive resistance of soil in front of wall kN/m — $F_{p\_f} = \gamma_{f\_e} \times 0.5 \times K_p \times \cos(\delta_b) \times (d_{cover} + t_{base} + d_{ds} - d_{exc})^2 \times \gamma_{mb} = \mathbf{6.1}$

Factored overturning moments

Surcharge — $M_{sur\_f} = F_{sur\_f} \times (h_{eff} - 2 \times d_{ds}) / 2 = \mathbf{16.6}$ kNm/m

Moist backfill above water table — $M_{m\_a\_f} = F_{m\_a\_f} \times (h_{eff} + 2 \times h_{water} - 3 \times d_{ds}) / 3 = \mathbf{46.1}$ kNm/m

Applied horizontal load — $M_{hor\_f} = F_{h\_f} \times h_{load} = \mathbf{9.1}$ kNm/m

Total overturning moment — $M_{ot\_f} = M_{sur\_f} + M_{m\_a\_f} + M_{hor\_f} = \mathbf{71.8}$ kNm/m

Restoring moments

Wall stem — $M_{wall\_f} = w_{wall\_f} \times (l_{toe} + t_{wall} / 2) = \mathbf{31.3}$ kNm/m

Wall base — $M_{base\_f} = w_{base\_f} \times l_{base} / 2 = \mathbf{15.7}$ kNm/m

Surcharge — $M_{sur\_r\_f} = w_{sur\_f} \times (l_{base} - l_{heel} / 2) = \mathbf{3.6}$ kNm/m

Moist backfill — $M_{m\_r\_f} = (w_{m\_w\_f} \times (l_{base} - l_{heel} / 2) + w_{m\_s\_f} \times (l_{base} - l_{heel} / 3)) = \mathbf{26.1}$ kNm/m

Soil in front of wall — $M_{p\_r\_f} = w_{p\_f} \times l_{toe} / 2 = \mathbf{0.6}$ kNm/m

Total restoring moment — $M_{rest\_f} = M_{wall\_f} + M_{base\_f} + M_{sur\_r\_f} + M_{m\_r\_f} + M_{p\_r\_f} = \mathbf{77.3}$ kNm/m

Check stability against overturning

Total overturning moment — $M_{ot} = \mathbf{32.2}$ kNm/m

Total restoring moment — $M_{rest} = \mathbf{52.2}$ kNm/m

PASS - Restoring moment is greater than overturning moment

Factored bearing pressure

Total moment for bearing — $M_{total\_f} = M_{rest\_f} - M_{ot\_f} = \mathbf{5.5}$ kNm/m

Total vertical reaction — $R_f = W_{total\_f} = \mathbf{66.7}$ kN/m

Distance to reaction — $x_{bar\_f} = M_{total\_f} / R_f = \mathbf{82}$ mm

Eccentricity of reaction — $e_f = \text{abs}((l_{base} / 2) - x_{bar\_f}) = \mathbf{743}$ mm

Reaction acts outside middle third of base

Bearing pressure at toe — $p_{toe\_f} = R_f / (1.5 \times x_{bar\_f}) = \mathbf{540.9}$ kN/m²

Bearing pressure at heel — $p_{heel\_f} = 0$ kN/m² $= \mathbf{0}$ kN/m²

Rate of change of base reaction	rate = p_{toe_f} / (3 × x_{bar_f}) = **2192.34** kN/m²/m
Bearing pressure at stem / toe	$p_{stem\_toe\_f}$ = max(p_{toe_f} - (rate × l_{toe}), 0 kN/m²) = **0** kN/m²
Bearing pressure at mid stem	$p_{stem\_mid\_f}$ = max(p_{toe_f} - (rate × (l_{toe} + t_{wall} / 2)), 0 kN/m²) = **0** kN/m²
Bearing pressure at stem / heel	$p_{stem\_heel\_f}$ = max(p_{toe_f} - (rate × (l_{toe} + t_{wall})), 0 kN/m²) = **0** kN/m²

Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Characteristic strength of concrete	f_{cu} = **35** N/mm²
Characteristic strength of reinforcement	f_y = **500** N/mm²

Base details

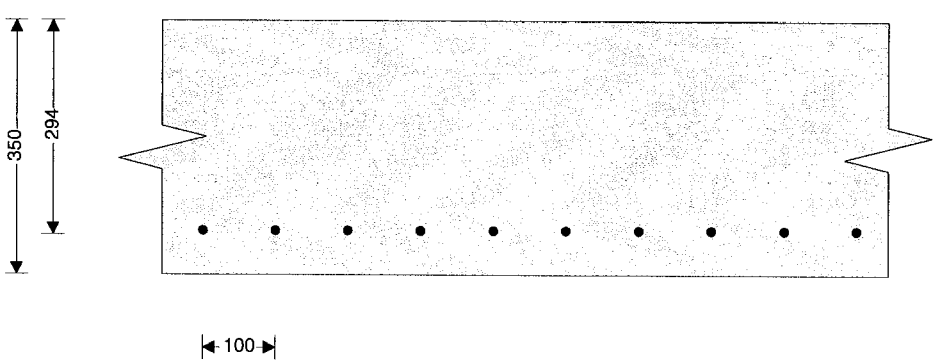
Minimum area of reinforcement	k = **0.13** %
Cover to reinforcement in toe	c_{toe} = **50** mm

Calculate shear for toe design

Shear from bearing pressure	V_{toe_bear} = 3 × p_{toe_f} × x_{bar_f} / 2 = **66.7** kN/m
Shear from weight of base	$V_{toe\_wt\_base}$ = γ_{f_d} × γ_{base} × l_{toe} × t_{base} = **11.6** kN/m
Total shear for toe design	V_{toe} = V_{toe_bear} - $V_{toe\_wt\_base}$ = **55.2** kN/m

Calculate moment for toe design

Moment from bearing pressure	M_{toe_bear} = 3 × p_{toe_f} × x_{bar_f} × (l_{toe} - x_{bar_f} + t_{wall} / 2) / 2 = **72.9** kNm/m
Moment from weight of base	$M_{toe\_wt\_base}$ = (γ_{f_d} × γ_{base} × t_{base} × (l_{toe} + t_{wall} / 2)² / 2) = **8** kNm/m
Total moment for toe design	M_{toe} = M_{toe_bear} - $M_{toe\_wt\_base}$ = **64.9** kNm/m



Check toe in bending

Width of toe	b = **1000** mm/m
Depth of reinforcement	d_{toe} = t_{base} − c_{toe} − (ϕ_{toe} / 2) = **294.0** mm
Constant	K_{toe} = M_{toe} / (b × d_{toe}^2 × f_{cu}) = **0.021**
	Compression reinforcement is not required
Lever arm	z_{toe} = min(0.5 + √(0.25 - (min(K_{toe}, 0.225) / 0.9)),0.95) × d_{toe}
	z_{toe} = **279** mm
Area of tension reinforcement required	$A_{s\_toe\_des}$ = M_{toe} / (0.87 × f_y × z_{toe}) = **534** mm²/m
Minimum area of tension reinforcement	$A_{s\_toe\_min}$ = k × b × t_{base} = **455** mm²/m
Area of tension reinforcement required	$A_{s\_toe\_req}$ = Max($A_{s\_toe\_des}$, $A_{s\_toe\_min}$) = **534** mm²/m
Reinforcement provided	**B1131 mesh**
Area of reinforcement provided	$A_{s\_toe\_prov}$ = **1131** mm²/m
	PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress $v_{toe} = V_{toe} / (b \times d_{toe}) = \mathbf{0.188}$ N/mm²

Allowable shear stress $v_{adm} = \min(0.8 \times \sqrt{(f_{cu} / 1\ \text{N/mm}^2)}, 5) \times 1\ \text{N/mm}^2 = \mathbf{4.733}$ N/mm²

PASS - Design shear stress is less than maximum shear stress

From BS8110:Part 1:1997 – Table 3.8

Design concrete shear stress $v_{c\_toe} = \mathbf{0.555}$ N/mm²

$v_{toe} < v_{c\_toe}$ - No shear reinforcement required

Design of reinforced concrete retaining wall heel (BS 8002:1994)

Material properties

Characteristic strength of concrete $f_{cu} = \mathbf{35}$ N/mm²

Characteristic strength of reinforcement $f_y = \mathbf{500}$ N/mm²

Base details

Minimum area of reinforcement $k = \mathbf{0.13}$ %

Cover to reinforcement in heel $c_{heel} = \mathbf{50}$ mm

Calculate shear for heel design

Shear from weight of base $V_{heel\_wt\_base} = \gamma_{f\_d} \times \gamma_{base} \times l_{heel} \times t_{base} = \mathbf{3.5}$ kN/m

Shear from weight of moist backfill $V_{heel\_wt\_m} = w_{m\_w\_f} = \mathbf{17.4}$ kN/m

Shear from surcharge $V_{heel\_sur} = w_{sur\_f} = \mathbf{2.4}$ kN/m

Total shear for heel design $V_{heel} = V_{heel\_wt\_base} + V_{heel\_wt\_m} + V_{heel\_sur} = \mathbf{23.3}$ kN/m

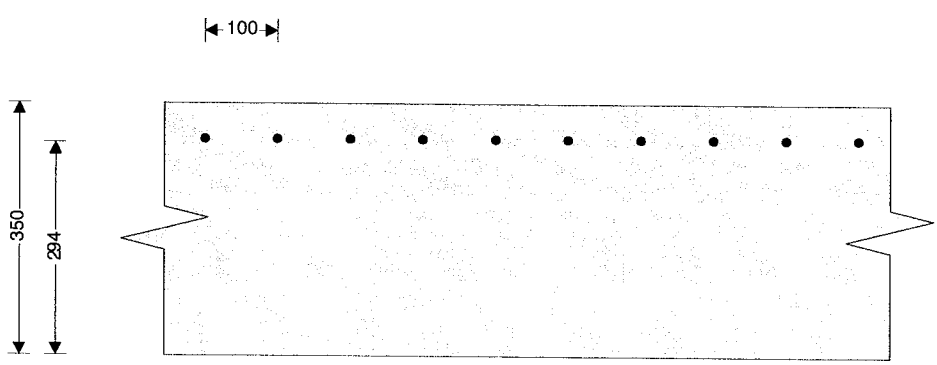
Calculate moment for heel design

Moment from weight of base $M_{heel\_wt\_base} = (\gamma_{f\_d} \times \gamma_{base} \times t_{base} \times (l_{heel} + t_{wall} / 2)^2 / 2) = \mathbf{1.3}$ kNm/m

Moment from weight of moist backfill $M_{heel\_wt\_m} = w_{m\_w\_f} \times (l_{heel} + t_{wall}) / 2 = \mathbf{5.7}$ kNm/m

Moment from surcharge $M_{heel\_sur} = w_{sur\_f} \times (l_{heel} + t_{wall}) / 2 = \mathbf{0.8}$ kNm/m

Total moment for heel design $M_{heel} = M_{heel\_wt\_base} + M_{heel\_wt\_m} + M_{heel\_sur} = \mathbf{7.7}$ kNm/m



Check heel in bending

Width of heel $b = \mathbf{1000}$ mm/m

Depth of reinforcement $d_{heel} = t_{base} - c_{heel} - (\phi_{heel} / 2) = \mathbf{294.0}$ mm

Constant $K_{heel} = M_{heel} / (b \times d_{heel}^2 \times f_{cu}) = \mathbf{0.003}$

Compression reinforcement is not required

Lever arm $z_{heel} = \min(0.5 + \sqrt{(0.25 - (\min(K_{heel}, 0.225) / 0.9))}, 0.95) \times d_{heel}$

$z_{heel} = \mathbf{279}$ mm

Area of tension reinforcement required $A_{s\_heel\_des} = M_{heel} / (0.87 \times f_y \times z_{heel}) = \mathbf{64}$ mm²/m

Minimum area of tension reinforcement $A_{s\_heel\_min} = k \times b \times t_{base} = \mathbf{455}$ mm²/m

Area of tension reinforcement required — $A_{s\_heel\_req} = \text{Max}(A_{s\_heel\_des}, A_{s\_heel\_min}) = \mathbf{455}$ mm²/m

Reinforcement provided — **B1131 mesh**

Area of reinforcement provided — $A_{s\_heel\_prov} = \mathbf{1131}$ mm²/m

PASS - Reinforcement provided at the retaining wall heel is adequate

Check shear resistance at heel

Design shear stress — $v_{heel} = V_{heel} / (b \times d_{heel}) = \mathbf{0.079}$ N/mm²

Allowable shear stress — $v_{adm} = \min(0.8 \times \sqrt{(f_{cu} / 1\ \text{N/mm}^2)}, 5) \times 1\ \text{N/mm}^2 = \mathbf{4.733}$ N/mm²

PASS - Design shear stress is less than maximum shear stress

From BS8110:Part 1:1997 – Table 3.8

Design concrete shear stress — $v_{c\_heel} = \mathbf{0.555}$ N/mm²

$v_{heel} < v_{c\_heel}$ - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

Material properties

Characteristic strength of concrete — $f_{cu} = \mathbf{35}$ N/mm²

Characteristic strength of reinforcement — $f_y = \mathbf{500}$ N/mm²

Wall details

Minimum area of reinforcement — k = **0.13** %

Cover to reinforcement in stem — $c_{stem} = \mathbf{50}$ mm

Cover to reinforcement in wall — $c_{wall} = \mathbf{50}$ mm

Factored horizontal at-rest forces on stem

Surcharge — $F_{s\_sur\_f} = \gamma_{f\_l} \times K_0 \times \text{Surcharge} \times (h_{eff} - t_{base} - d_{ds}) = \mathbf{10.9}$ kN/m

Moist backfill above water table — $F_{s\_m\_a\_f} = 0.5 \times \gamma_{f\_e} \times K_0 \times \gamma_m \times (h_{eff} - t_{base} - d_{ds} - h_{sat})^2 = \mathbf{39.3}$ kN/m

Applied horizontal load — $F_{s\_h\_f} = \gamma_{f\_d} \times F_{dead} + \gamma_{f\_l} \times F_{live} = \mathbf{11.6}$ kN/m

Calculate shear for stem design

Shear at base of stem — $V_{stem} = F_{s\_sur\_f} + F_{s\_m\_a\_f} + F_{s\_h\_f} = \mathbf{61.8}$ kN/m

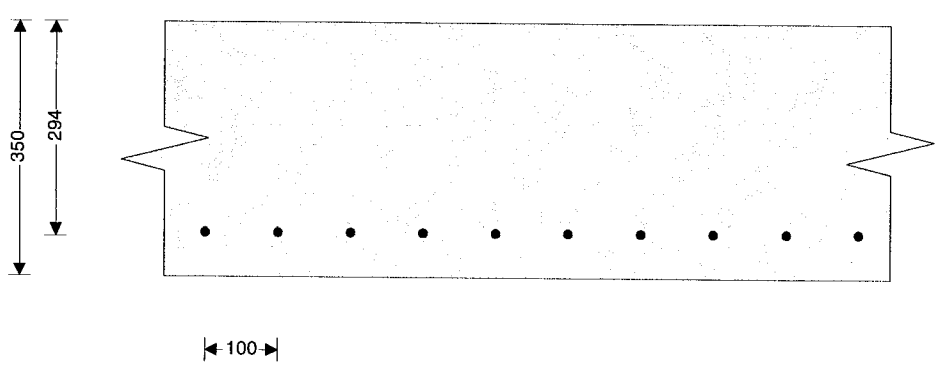
Calculate moment for stem design

Surcharge — $M_{s\_sur} = F_{s\_sur\_f} \times (h_{stem} + t_{base}) / 2 = \mathbf{14.4}$ kNm/m

Moist backfill above water table — $M_{s\_m\_a} = F_{s\_m\_a\_f} \times (2 \times h_{sat} + h_{eff} - d_{ds} + t_{base} / 2) / 3 = \mathbf{37}$ kNm/m

Applied horizontal load — $M_{s\_hor} = F_{s\_h\_f} \times (h_{load} - t_{base} / 2) = \mathbf{7.1}$ kNm/m

Total moment for stem design — $M_{stem} = M_{s\_sur} + M_{s\_m\_a} + M_{s\_hor} = \mathbf{58.5}$ kNm/m



Check wall stem in bending

Width of wall stem — b = **1000** mm/m

Depth of reinforcement — $d_{stem} = t_{wall} - c_{stem} - (\phi_{stem} / 2) = \mathbf{294.0}$ mm

Constant $K_{stem} = M_{stem} / (b \times d_{stem}^2 \times f_{cu}) = \mathbf{0.019}$

Compression reinforcement is not required

Lever arm $z_{stem} = \min(0.5 + \sqrt{(0.25 - (\min(K_{stem}, 0.225) / 0.9))}, 0.95) \times d_{stem}$

$z_{stem} = \mathbf{279}$ mm

Area of tension reinforcement required $A_{s\_stem\_des} = M_{stem} / (0.87 \times f_y \times z_{stem}) = \mathbf{482}$ mm²/m

Minimum area of tension reinforcement $A_{s\_stem\_min} = k \times b \times t_{wall} = \mathbf{455}$ mm²/m

Area of tension reinforcement required $A_{s\_stem\_req} = \text{Max}(A_{s\_stem\_des}, A_{s\_stem\_min}) = \mathbf{482}$ mm²/m

Reinforcement provided **B1131 mesh**

Area of reinforcement provided $A_{s\_stem\_prov} = \mathbf{1131}$ mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress $v_{stem} = V_{stem} / (b \times d_{stem}) = \mathbf{0.210}$ N/mm²

Allowable shear stress $v_{adm} = \min(0.8 \times \sqrt{(f_{cu} / 1\ \text{N/mm}^2)}, 5) \times 1\ \text{N/mm}^2 = \mathbf{4.733}$ N/mm²

PASS - Design shear stress is less than maximum shear stress

From BS8110:Part 1:1997 – Table 3.8

Design concrete shear stress $v_{c\_stem} = \mathbf{0.555}$ N/mm²

$v_{stem} < v_{c\_stem}$ - No shear reinforcement required

Check retaining wall deflection

Basic span/effective depth ratio $\text{ratio}_{bas} = \mathbf{7}$

Design service stress $f_s = 2 \times f_y \times A_{s\_stem\_req} / (3 \times A_{s\_stem\_prov}) = \mathbf{141.9}$ N/mm²

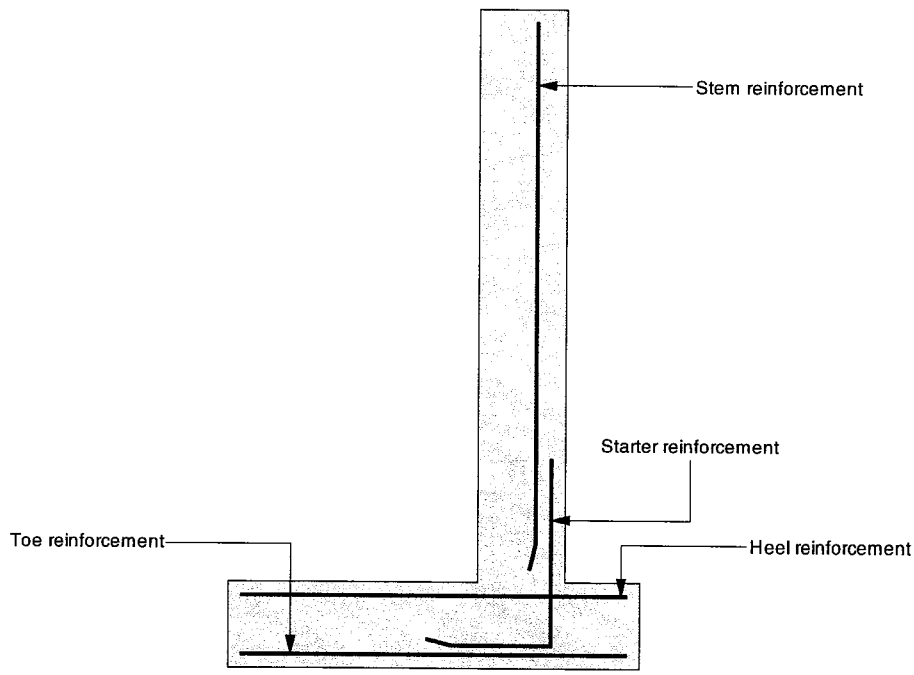
Modification factor $\text{factor}_{tens} = \min(0.55 + (477\ \text{N/mm}^2 - f_s)/(120 \times (0.9\ \text{N/mm}^2 + (M_{stem}/(b \times d_{stem}^2)))), 2) = \mathbf{2.00}$

Maximum span/effective depth ratio $\text{ratio}_{max} = \text{ratio}_{bas} \times \text{factor}_{tens} = \mathbf{14.00}$

Actual span/effective depth ratio $\text{ratio}_{act} = h_{stem} / d_{stem} = \mathbf{7.82}$

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe mesh - B1131 - (1131 mm²/m)
Heel mesh - B1131 - (1131 mm²/m)
Stem mesh - B1131 - (1131 mm²/m)

2015/6424/P - 13 Kylemore Road

Yeung, Raymond to: FatimaDrammeh@campbellreith.com 27/06/2017 11:25
Cc: "camdenaudit@campbellreith.com"

History: This message has been replied to.

Dear Fatima,

Hope you are well.

In response to our email attached, please see the applicant's email below.

Hope this would address any outstanding issues before the final audit.

Thanks

Raymond

From: John Maguire [mailto:john.maguire@entuitive.com]
Sent: 27 June 2017 11:22
To: Yeung, Raymond <Raymond.Yeung@camden.gov.uk>
Cc: Robert Hume <robert.hume@virgin.net>
Subject: RE: 2015/6424/P - 13 Kylemore Road

Dear Raymond,

Following our discussion with Campbell Reith I've gone through the outstanding discussions points, raised within their discussion points and the audit tracker queries, in their report dated April 2017 and below we've outlined where the issues have been addressed by CGL and ourselves;

CGL and Entuitive responses to Campbell Reith section 4 - Discussion Points

4.3 Entuitive sent retaining wall calculations as a standalone document.

4.5 For Camden SFRA maps refer to CGL report Appendix C.

4.6 Refer to section 2.8 and Appendix C of CGL's report as a justification of the low risk of flooding on Kylemore Road.

4.7 Refer section 3.6 of Entuitive's report for the outline drainage strategy to align with CGL's report.

4.8 Refer to section 2.8 and Appendix C of CGL's report.

4.9 Refer section 4.2 and 4.3 of Entuitive's report for details on the basement construction.

4.10 Refer to section 2.8 and Appendix C of CGL's report as a justification of the low risk of flooding on Kylemore Road.

4.11 No action.

4.12 Refer to sections 10.6 to 10.8 of CGL's report and section 12 for the monitoring strategy.

4.13 Refer section 4.2 of Entuitive's report for details on the basement

construction.

4.14 During the next phase Entuitive and following a strip out of the internal finishes a thorough inspection of the internal condition of the building will be undertaken. We'd expect that visual inspections of the neighbouring properties will be undertaken as part to the Part Wall approval process.

4.15 Refer to sections 10.6 to 10.8 of CGL's report and section 12 for the monitoring strategy.

4.16 Refer section 4.5 of Entuitive's report.

4.17 Refer section 4.3 of Entuitive's report.

4.18 Refer to section 12 of CGL's report for the monitoring strategy.

4.19 Refer to Appendix C of Entuitve's report.

CGL and Entuitive responses to Campbell Reith - Audit Query Tracker within the Appendices

3. Refer to response to 4.19 above.
4. N/A
5. Refer to response to 4.8 above.
6. Refer to response to 4.6 above.
7. Due to access issues trial pits were not undertaken below the party wall with no.15 these works will be undertaken as part of the next phase of works refer to response to 4.17 above.
8. Refer to response to 4.13 above.
9. Refer to response to 4.12 and 4.15 above.
10. Refer to response to 4.17 above.
11. Refer to response to 4.18 above.

Should you have any queries please contact me to discuss.

Best regards
John

John Maguire CEng
Senior Engineer

Entuitive | Canada + United Kingdom + United States
143 Crownstone Road, London, SW2 1NB, UK | T. +44 (0)20.7733.6837

From: Robert Hume [mailto:robert.hume@virgin.net]
Sent: 23 June 2017 16:15
To: Yeung, Raymond <Raymond.Yeung@camden.gov.uk>
Cc: John Maguire <john.maguire@entuitive.com>
Subject: Re: 2015/6424/P - 13 Kylemore Road

Hello Raymond,
I will ask John Maguire at Entuitive engineers to get in contact directly to explain his discussions with Campbell Reith.
Regards,

Robert

On 23 Jun 2017, at 16:11, Yeung, Raymond <Raymond.Yeung@camden.gov.uk> wrote:

Dear Robert,

Hope this email finds you well.

Campbell Reith starting reviewing the supplementary documents for this BIA however it is not obvious in the documents (especially the CGL BIA) where their queries/comments have been addressed. In their last report (rev D2), we requested a covering email/letter to be provided to indicate the amended sections should the BIA or any of the supporting documents be amended to address our comments.

Could you please send this to me and I would forward it to them, this should hopefully speed up the audit process and hopefully close out their queries.

Thank you.

Regards

Raymond Yeung MRTPI
Planning Officer
Regeneration and Planning
Supporting Communities
London Borough of Camden

Telephone: 020 7974 4546
Web: camden.gov.uk

5 Pancras Square
London N1C 4AG

From: Robert Hume [mailto:robert.hume@virgin.net]
Sent: 01 June 2017 11:26
To: Yeung, Raymond <Raymond.Yeung@camden.gov.uk>
Subject: 2015/6424/P - 13 Kylemore Road

Hello Raymond,

I trust you are well. The geotechnical engineers CGL and the structural engineers Entuitive have finished their reports in response to Campbell Reith's comments.

- CGLs 18952 rev1 (attached)
- BIA - Structural report (attached)
- Structural calculations (attached)
- Drawings 4249 S-P- SK01, 02 & 03 (attached).

I hope this is all correct and if there is anything wanting please contact me to discuss.

Regards,
Robert

This e-mail may contain information which is confidential, legally privileged and/or copyright protected. This e- mail is intended for the addressee only. If you receive this in error, please contact the sender and delete the material from your computer.

----- Message from "FatimaDrammeh@campbellreith.com" <FatimaDrammeh@campbellreith.com> on Fri, 23 Jun 2017 15:05:54 +0000 -----

To: "Yeung, Raymond" <Raymond.Yeung@camden.gov.uk>

cc: "camdenaudit@campbellreith.com" <camdenaudit@campbellreith.com>

Subject: Re: FW: 2015/6424/P - 13 Kylemore Road

Hi Raymond,
We've starting reviewing the supplementary documents for this BIA however it is not obvious in the documents (especially the CGL BIA) where our queries/comments have been addressed. On our last report (rev D2), we requested a covering email/letter to be provided to indicate the amended sections should the BIA or any of the supporting documents be amended to address our comments.

Could you please request this on our behalf from the applicant/engineers? This would speed up the audit process and hopefully close out our queries.

Thank you.

Kind regards

Fatima Drammeh
Senior Geotechnical Engineer

CampbellReith
consulting engineers

Friars Bridge Court,
41-45 Blackfriars Road,
London
SE1 8NZ

Tel +44 (0)20 7340 1700
www.campbellreith.com

From: "Yeung, Raymond" <Raymond.Yeung@camden.gov.uk>
To: "GrahamKite@campbellreith.com" <GrahamKite@campbellreith.com>, "camdenaudit@campbellreith.com" <camdenaudit@campbellreith.com>
Cc: DC Mail <DCMail1@camden.gov.uk>
Date: 01/06/2017 11:33
Subject: FW: 2015/6424/P - 13 Kylemore Road

Dear Graham

Please find attached the revised and additional information to address the issues you've raised with the applicant for the above.

Please let me know the next steps.

Many thanks

Regards

Raymond Yeung MRTPI
Planning Officer
Regeneration and Planning
Supporting Communities
London Borough of Camden

Telephone: 020 7974 4546
Web: camden.gov.uk

5 Pancras Square
London N1C 4AG

From: Robert Hume [mailto:robert.hume@virgin.net]
Sent: 01 June 2017 11:26
To: Yeung, Raymond <Raymond.Yeung@camden.gov.uk>
Subject: 2015/6424/P - 13 Kylemore Road

Hello Raymond,

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- CGLs 18952 rev1 (attached)
- BIA - Structural report (attached)
- Structural calculations (attached)
- Drawings 4249 S-P- SK01, 02 & 03 (attached).

I hope this is all correct and if there is anything wanting please contact me to discuss.

Regards,
Robert

FW: 2015/6424/P - 13 Kylemore Road
Yeung, Raymond
to:
FatimaDrammeh@campbellreith.com
29/08/2017 14:06
Hide Details
From: "Yeung, Raymond" <Raymond.Yeung@camden.gov.uk>
To: "FatimaDrammeh@campbellreith.com" <FatimaDrammeh@campbellreith.com>
History: This message has been replied to.

Hi there.

Hope you had a good bank holiday.

Please see email below for supplementary information.

Thanks.

Regards

Raymond Yeung MRTPI
Planning Officer
Regeneration and Planning
Supporting Communities
London Borough of Camden

Telephone: 020 7974 4546
Web: camden.gov.uk

5 Pancras Square
London N1C 4AG

From: Robert Hume [mailto:robert.hume@virgin.net]
Sent: 29 August 2017 14:02
To: Yeung, Raymond <Raymond.Yeung@camden.gov.uk>
Subject: 2015/6424/P - 13 Kylemore Road

Hello Raymond,

I hope you are well. I thought it might be of service to the procedure of the application if I stated my objective to be as considerate to the neighbours as possible with my proposed renovation of 13 Kylemore in case this principle hadn't been sufficiently expounded in the BIA submission. I had thought the focus of the BIA would be the geotechnical and engineering material and the devising of a works scheme that respected the neighbours would be part of negotiating the part wall stage. However if the focus of the engineers on other areas does not lead them to present this in enough detail I am happy to declare my intentions here.

As the co-owner of the project and instigator of the renovation I would give great attention to selecting a considerate contractor. All demolition and construction works would be carried out by a competent and qualified contractor, required to accord with the Considerate Constructors Scheme. The contractor would take all necessary measures to minimise the short term disturbances caused by

noise, vibration and dust that might impact on the local environment and the neighbouring residents.

During all work the following measures would be implemented:

Noise
Neighbours would be notifiedfied in advance of potential noisy activity, in particular where these are on or near boundary structures. Where there is particular sensitivity, activity would be restricted to 09:00-17:00 Monday to Friday. Wherever possible, electrically operation tools would be used in preference to engine driven machinery.
The use of site radios would be considered carefully regarding location and volume levels, and if any neighbour complaints shall be received, a prohibition of their use will be enforced.

Vibration
While the use or percussive, powered machinery upon hard construction materials may give rise to inevitable vibration, wherever possible and in accordance with CCS Code, unnecessary vibration would be avoided and mitigated. This would take the form of careful planning and consideration of the hardness of the material being demolished and of the works planned. Neighbours potentially affected would be notified accordingly and the 09:00-17:00 working hours principle be observed.

Dust
Most of the works would be internal and thus can be relatively easily isolated from becoming airborne and dispersing to the neighbours and to the local environment. External activity would be contained efficiently using suitable hoardings and sheeting.
Any materials stored externally would be covered or contained to avoid wind and weather disturbance and translation to granular and particulate materials. Structural concrete would be mixed off-site and delivered, but where small quantities or mortar would be site mixed, this could be done in an enclosed area to limit cement dust from becoming airborne. The same consideration with plaster and other dust based materials.
Deliveries of materials would be covered where potential for dust is prevalent. Waste skips and excavated soils would be covered whenever practicable.
For activities that generate dust, surface wetting-down, and water misting would be used to suppress dusting. Rotary cutters would use water as a dust suppressant.

General Housekeeping
The pavement in front of the site will be regular swept, and should vehicles or neighbour's windows become soiled through the works, the contractor would arrange cleaning as the neighbour desires.

Regards,
Robert Hume
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