CampbellReith
consulting engineers

47 Doughty Street, London, WC1N 2LW

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12336-40
Revision: D2

March 2017

Campbell Reith Hill LLP
Friars Bridge Court
41-45 Blackfriars Road
London
SE1 8NZ

T:+44 (0)20 7340 1700
F:+44 (0)20 7340 1777
E:london@campbellreith.com
W:www.campbellreith.com

Document History and Status

Revision	Date	Purpose/Status	File Ref	Author	Check	Review
D1	03/05/2016	Comment	AGfd12336-40-030516-47 Doughty Street-D1.doc	A Gleeson	F Drammeh/A Marlow	A Marlow
D2	17/03/2017	Comment	AGfd12336-40-030516-47 Doughty Street-D2.doc	A Gleeson	Graham Kite	Graham Kite

Document Details

Last saved	20/03/2017 09:38
Path	AGfd12336-40-030516-47 Doughty Street-D2.doc
Author	A Gleeson BEng
Project Partner	E M Brown, BSc MSc CGeol FGS
Project Number	12336-40
Project Name	47 Doughty Street
Planning Reference	2016/1027/P & 2016/1183/L

Contents

Appendix

1.0 NON-TECHNICAL SUMMARY

1.1. CampbellReith was instructed by London Borough of Camden, (LBC) ON 3 March 2016 to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 47 Doughty Street, WC1N 2LW (Camden Planning reference 2016/1027/P and 2016/1183/L). 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. The qualifications of the authors of the BIA are in compliance with the requirements of CPG4.

1.5. The majority of properties on Doughty Street are Grade II listed, including 47 Doughty Street. 48-49 Doughty Street which has a party wall with 47 Doughty Street is Grade I listed and houses the 'Dickens House Museum'.

1.6. A ground investigation (GI) has been undertaken by AP Geotechnics; which comprise of a single borehole to the rear garden and a number of trial pits to investigate the party wall foundations.

1.7. Based on the GI, it is accepted that groundwater is not expected to be encountered during excavations.

1.8. Given that an extended thickness of Made Ground has been confirmed it is recommended that the proposed underpinning is reconsidered. It is understood from the site investigations that an extended thickness of Made Ground up to 10m deep is anticipated. The proposal to provide a wall bearing directly on to the made ground is not accepted. Even with a very robust structural monitoring plan, the nature of the ground conditions and the proposed shallow foundation provides no assurance that suitable support could be provided to halt or slow down movements and damage impacts.

1.9. A proposed monitoring scheme for potentially impacted neighbouring properties has been provided. However, the scheme proposed is not considered adequate.

1.10. A construction management plan is included and details should be agreed with the Council. A works programme has been provided as part of the CMP.

1.11. Queries and requests for further information are discussed in Section 4 and summarised in Appendix 2. Until the additional information requested is provided, the BIA does not meet 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 47 Doughty Street, WC1N 2LW (Camden Planning reference 2016/1027/P & 2016/1183/L).

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

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; and,

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 *"Replacement of 3 storey rear extension (following demolition of existing rear closet wing); single story rear extension at ground floor level (following demolition of existing structure); lowering of floor level in front vaults; construction of basement below rear garden; internal alterations."*

2.6. The Audit Instruction also confirmed that 47 Doughty Street involved, or was a neighbour to, listed buildings. The Design & Access Statement identifies that the property is located in the

Bloomsbury Conservation Area and is Grade II listed. 48-49 Doughty Street which has a party wall with 47 Doughty Street is Grade I listed and houses the 'Dickens House Museum'

2.7. CampbellReith accessed LBC's Planning Portal on 31/03/2016 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment Report (BIA): Eastwood and Partners, dated March 2016
- Planning Application Drawings consisting of

  Location Plan dated February 2016

  Existing Plans dated February 2016

  Proposed Plans dated February 2016
- Design & Access Statement dated February 2016
- Construction Management Plan dated February 2016
- Consultation comments and response dated 31/03/2016 & 15/04/2015

2.8. CampbellReith received the following additional information on 13 October 2016:

- TG Studio drawings including proposed plans, sections and elevations revised to suit reduced sized basement extension dated October 2016.

2.9. Following CampbellReith's email requesting further information, the following additional information was received on 18 January 2017:

- Revised Basement Impact Assessment, Rev. 7, dated December 2016.

2.10. The following additional information was received on 16 February 2017:

- Basement Impact Assessment – reply to CampbellReith audit 150217.

2.11. This information listed in 2.8-2.10 reflects the revised scheme for a significantly reduced basement size. The BIA and drawings noted in 2.7 are now superseded. This report relates to the BIA and drawings listed in 2.8-2.10 only.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	See Audit paragraph 4.1.
Is data required by Cl.233 of the GSD presented?	Yes	
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	
Are suitable plan/maps included?	Yes	
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	
Is a conceptual model presented?	Yes	
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	
Is factual ground investigation data provided?	Yes	
Is monitoring data presented?	Yes	
Is the ground investigation informed by a desk study?	Yes	
Has a site walkover been undertaken?	Yes	
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	
Is a geotechnical interpretation presented?	Yes	
Does the geotechnical interpretation include information on retaining wall design?	Yes	
Are reports on other investigations required by screening and scoping presented?	No	
Are the baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	Yes	
Is an Impact Assessment provided?	Yes	BIA Section 7.
Are estimates of ground movement and structural impact presented?	Yes	However, information provided not deemed adequate. Refer to comments in Section 4.

Item	Yes/No/NA	Comment
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	Considered, however, as all the potential impacts of the proposed basement have not been identified, this is considered inadequate (see Section 4).
Has the need for monitoring during construction been considered?	Yes	However information provided not deemed adequate. Refer to comments in Section 4.
Have the residual (after mitigation) impacts been clearly identified?	No	Not possible to determine if these are needed as all the potential impacts have not been considered.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	See Audit Section 4
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	However, supporting analysis not considered accurate and proposed construction method require reconsideration.
Are non-technical summaries provided?	Yes	

4.0 DISCUSSION

4.1. The BIA has been carried out by Eastwood & Partners Consulting Engineers. The qualifications of the authors of the BIA are in compliance with the requirements of CPG4.

4.2. The LBC Instruction to proceed with the audit identified that the basement proposal either involved a listed building or was adjacent to listed buildings but gave no details. The Design & Access Statement identified that 47 Doughty Street is located in the Bloomsbury Conservation Area and is Grade II listed. The majority of properties on Doughty Street are Grade II listed. 48-49 Doughty Street, which shares a party wall with 47 Doughty Street, is Grade I listed and houses the 'Dickens House Museum'.

4.3. 47 Doughty Street is a mid-terrace house of 5 storeys including a basement. The property dates from the early 19th Century and is constructed from traditional load bearing brick walls and timber floors. At the rear of the property there is a closet wing, which includes a basement and to the front there are large basement vaults beneath the pavement.

4.4. The proposal is to extend the existing basement to the rear of the property by less than 1m on plan. The depth of the extension is to match the depth of the existing basement, approximately 2.1m bgl. The wall is to act as a foundation for the steelwork above. It is not proposed to develop the basement under any part of the original listed building. The proposal also involves demolition of the existing conservatory and part of the existing closet wing and to replace it with a light weight extension which will be supported by the new basement structure. The proposed basement consists of an area with a retained height of approximately 2.10m adjacent to the rear of the house. It is also proposed to lower the floor levels to the vaults at the front of the property, however this has previously been approved in a separate planning application and no information has been provided in the BIA.

4.5. Ground investigation in the form of foundation investigation pits have been carried out to a maximum depth of 3.00m. The BIA states that Made Ground was encountered in all pits to full depth. It is stated that this is in line with local Geological maps and British Geological Survey boreholes records for the area. The BIA states that BGS boreholes in the area record Made Ground to approximately 3.50m, over sand and gravel to 11m underlain by Clay. Additional ground investigations, carried out May 2016 by AP Geotechnics, consisted of a borehole drilled to a depth of 18m to the rear of the property. The borehole confirmed that there is a substantial depth of Made Ground to a depth of 10.8m below ground level. The made ground overlays sands and gravels to the full depth of the borehole.

4.6. Neither the trial pits nor the borehole encountered any groundwater. Groundwater monitoring was undertaken and it is accepted that the water table is well below the proposed foundation depth.

4.7. It is proposed to construct the retaining wall so that is spans horizontally between the Party Walls and the central wall, therefore it is proposed that it doesn't require propping at the top. The calculations provided make an allowance for both the wall spanning horizontally and alternatively acting as an unpropped cantilever. For the wall to span horizontal bi-axial loading should be considered to allow for the axial force from the proposed structure above ground. It should also consider the shear force at the connections to the existing structure due to the loading from the structure above ground and the impact of the increased loading on the existing Party Walls. Therefore, based on the current proposals, it is most likely that the wall will act as an unpropped cantilever bearing onto the made ground.

4.8. The BIA states that 'aesthetic cracking' only is expected to the garden wall. The proposed basement extension does not undermine the foundations to neighbouring properties. Given that an extended thickness of Made Ground is anticipated the proposed underpinning should be reconsidered. It is understood from the site investigations that an extended thickness of Made Ground over 10m deep is anticipated, and the insitu testing indicates this be loose. The proposal to provide a wall bearing directly on to the Made Ground is not accepted. It is noted on the proposal that the wall is to span horizontally, however the design provided does not support this fully. The proposed foundation on to loose Made Ground is not advisable considering the sensitivity of the structure and the surrounding listed structures. The predicted settlements of ~20mm have not been properly assessed in terms of damage impacts. Even with a very robust structural monitoring plan, the nature of the ground conditions and the proposed shallow foundation provides no comfort that suitable support could be provided to halt or slow down movements and damage impacts. This is particularly important given that 47 Doughty Street and the adjacent properties are all listed buildings.

4.9. A movement monitoring proposal has been provided. However, the scheme proposed is not considered adequate for the current proposal.

4.10. The BIA has shown that although the development is close to a culverted tributary of the River Fleet, it will not impact any other watercourses, springs or the Hampstead Heath Pond chain catchment area.

4.11. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.

4.12. A construction management plan is included and details should be agreed with the Council.

4.13. It is noted that a works programme has now been submitted in the revised submissions.

5.0 CONCLUSIONS

5.1. The qualifications of the authors of the BIA are in compliance with the requirements of CPG4.

5.2. The majority of properties on Doughty Street are Grade II listed, including 47 Doughty Street. 48-49 Doughty Street which has a party wall with 47 Doughty Street is Grade I listed and houses the 'Dickens House Museum'.

5.3. Ground investigations which include foundation excavation pits and a single borehole have been undertaken. Groundwater monitoring has been carried out and it is accepted that the basement is unlikely to encounter groundwater.

5.4. The depth and nature of the neighbouring property foundations have been determined. The additional information received confirms that the proposed basement extension does not undermine the existing basement to 47 Doughty Street or the neighbouring properties.

5.5. A temporary works proposal and proposed construction scheme has been included as part of the additional information requested. The proposed underpinning with foundations on loose Made Ground are not considered a viable solution.

5.6. It is recommended that the impact from the basement excavation and construction on the neighbouring properties be assessed in further detail, in particular the property at 48 Doughty Street which shares a party wall with the proposed construction and is Grade 1 listed. The vertical and horizontal movements from the underpinning, resulting estimated movement and damage category for the neighbouring properties, in particular No 48, have not been properly assessed.

5.7. An outline movement monitoring proposal has been provided. However, this would need to be updated to reflect any accepted structural scheme. The current scheme is not accepted.

5.8. A works programme has been provided as part of the CMP.

5.9. A construction management plan is included and details should be agreed with the Council.

5.10. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.

5.11. Queries and requests for further information are summarised in Appendix 2. Until the additional information requested is provided, the BIA does not meet the requirements of CPG4.

Appendix 1: Residents Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Sughrue	48 Doughty Street,WC1N 2LX	30/03/2016	Excavations	5.4 – 5.7

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	BIA format	Qualifications of individuals involved not in accordance with CPG4 requirements.	Input of a Chartered Geologist (C.Geol) required.	Closed – Feb 2017
2	BIA format	Works programme not included	Outline programme to be provided.	Closed – Feb 2017
3	BIA format/ Stability	No site specific ground investigation to confirm sequence of strata	Site specific ground investigation to be undertaken.	Closed – Feb 2017
4	Hydrogeology	Groundwater level not established	To be established as part of the recommended ground investigation.	Closed – Feb 2017
5	Stability	Neighbouring property foundations not determined	To be investigated or maximum differential depth assumed.	Closed – Feb. 2017
6	Stability	Proposed construction method not sufficiently detailed and may need reconsideration. No temporary works proposal or construction sequence drawings	Open – Construction method to be reconsidered following ground investigation and construction sequence drawings together with any temporary works proposal to be provided.	Open – Structural solution not considered viable
7	Stability	Contradictory damage category for neighbouring properties and no supporting analysis. No consideration of impact on roadway and sewer beneath	Open – Anticipated movements from all construction activities to be provided once method is established together with damage category for neighbouring properties and the property itself. Impact on roadway and any utilities running beneath to be considered.	Open – Structural solution not considered viable. Assessment incomplete.
8	Stability	Movement monitoring proposal not provided	Open - Outline proposal to be provided. Details and trigger levels to be agreed as part of Party Wall awards.	Open – Structural solution not considered viable. Proposal incomplete.

Appendix 3: Supplementary Supporting Documents

Eastwood & Partners Letter, 15th February 2017

Eastwood & Partners
CONSULTING ENGINEERS

E&P

Centaur House, Ancells Business Park, Ancells Road, Fleet, Hampshire GU51 2UJ
Tel: 01252 360580 Fax: 0114 255 4330 mail@eastwoodandpartners.com www.eastwoodandpartners.com

Drew Planning & Development Ltd
86 Calbourne Road
London
SW12 8LR

SDP/JP/01/39053

15 February 2017

For the attention of Jonathan Drew

Dear Jonathan,

47 Doughty Street, London - Basement Impact Assessment Audit

We write in response to the comments on the latest issue of the BIA made by Campbell Reith in their e-mail of 27 January at 17.21. The relevant points are as follows, in italics:-

1) As noted previously, detailed GMA needs to be provided to accurately predict ground movements - the information provided in 'Section 6.3.5.6 Ground Settlements' is not acceptable. This is particularly important considering these are listed buildings.

It was agreed in a telephone discussion with Aoife Gleeson of Campbell Reith on 31 January 2017 that hand calculations would be acceptable, and these are enclosed in Appendix A. The calculations show that the settlement during construction of the granular made ground will be in the region of 10mm, and the long term consolidation settlement will be around 8mm. These figures are based on applying the maximum line load of 72kN/m as a new line load. In fact, the existing rear wall has a load of 22kN/m over half its length and 65kN/m over the other half (average 44kN/m), and this wall is only around 1m away from the new wall. The bulbs of pressure will overlap at depth, so the soil will not be reacting to a new load of 72kN/m, but to an additional load of 28kN/m, so the settlement will be significantly less than the simple hand calculation shows.

2) Please provide calculations for the design of the new retaining wall, including proposed connection details to both the Party Walls and all associated temporary works proposals and construction sequencing drawings.

Calculation pages BW 1-4 are attached in Appendix B together with a copy of SK 16 which provides structural details of the basement junctions. More detailed CAD drawings will be produced in due course. We have also attached a copy of our Temporary Works Proposal

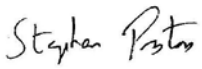
and Construction Sequence Document. This will be developed with sketches and drawings as appropriate in due course.

3) The report states that the proposed basement does not go any lower than the current basement. It is assumed from this that the proposed basement is not deeper than the foundations/basements to the neighbouring properties. Please confirm.

Apart from the first couple of hundred millimetres of the garden party wall No.47/48, the proposed basement extension does not go any lower than the foundations of the basements to the adjoining properties.

The proposed basement extension has a FFL of 47.47m and will have foundations founded at approximately the same depth as the underside of the existing adjacent footings to the basements in no.48 and 46. That is approximately 46.6m (refer to TP 1 logs in BIA). The very short length of the party garden wall referred to above will be underpinned to the same depth as the adjacent foundation to the basement of No.48.

Yours sincerely,



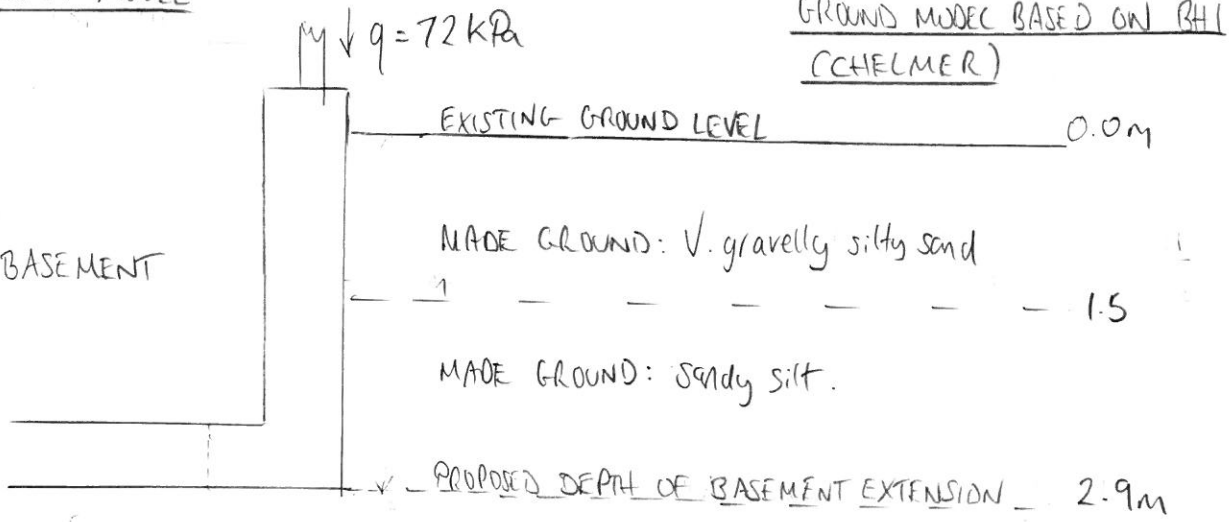
S D Preston
Director

Enc.

APPENDIX A

PROJECT : 47 DOUGHTY STREET	Job No. 39053	Date 09/02/17
SUBJECT : SETTLEMENT ANALYSIS	Prepared RW	Checked SDP

GROUND MODEL



GROUND MODEL BASED ON BH1 (CHELMER)

MADE GROUND: Silty Sand. (Assumed formation material) or gravelly silty clay

CHARACTERISTIC VALUES USED IN ANALYSIS

- STRENGTH PARAMETERS BASED ON MACPROBE TESTING IN THE MADE GROUND
- TYPICAL M-VALUE (No. OF BLOWS PER 100mm) = 18
- CORRESPONDS WITH AN UNDRAINED SHEAR STRENGTH, Cu OF
  - = 2.5M (A.FAKER et al, 2006)
  - = 2.5 x 18
  - = 45 kPa (FOR A CLAY SOIL)
- FOR A GRANULAR SOIL,
  - USE THE APPROXIMATE RELATIONSHIP

$$SPT\,'N' = \frac{3M}{10}$$

$$= \frac{3 \times 18}{10}$$

$$= 5.4$$

PROJECT : 47 DOUGHTY STREET	Job No. 39053	Date 09/02/17
SUBJECT : SETTLEMENT ANALYSIS	Prepared RW	Checked SDP

SETTLEMENT OF THE GRANULAR MADE GROUND

USING GUIDANCE IN CIRIA REPORT 143

ASSUME LOOSE SOILS (i.e. N < 10)

APPLIED FOUNDATION PRESSURE, $q = 72 kPa$ (EASTWOOD + PARTNERS)

ASSUME FOOTING WIDTH, B, = 0.60m

SETTLEMENT IS LIKELY TO BE IMMEDIATE UPON LOADING.

$$\rho_{MAX} = q(0.32B^{0.3})$$

$$= 72(0.32 \times 0.6^{0.3})$$

$$= 72(0.32 \times 0.86)$$

$$= 72 \times 0.28$$

$$= 19mm$$

N.B. THE PROBABLE SETTLEMENT WILL BE ABOUT ONE-HALF OF ρ_{max} i.e. $\approx$ 10MM

SETTLEMENT OF THE COHESIVE MADE GROUND

- TO CALCULATE THE CO-EFFICIENT OF VOLUME COMPRESSIBILITY, M_v

PLASTICITY INDEX, $I_{PAV} = 12\%$ (CHELMER LABORATORY TESTING)

$\therefore f_2 = 0.75$ (TOMLINSON, fig 4, p10).

- TO ESTIMATE LIKELY SPT 'N' VALUE OF THE COHESIVE SOILS

$$\text{SPT N} = \frac{C_u \text{ (OBTAINED FROM THE RELATIONSHIP } C_u = 2.5M)}{5}$$

$$= \frac{45}{5}$$

$$= 9$$

$$M_v = \frac{1}{f_2 N}$$

$$= \frac{1}{0.75 \times 9}$$

$$= 0.15 m^2/MN$$ (i.e. APPROXIMATELY CORRESPONDING WITH A 'FIRM' CLAY (BARNES, TABLE 9.3))

PROJECT : 47 DOUGHTY STREET	Job No. 39053	Date 09/02/17
SUBJECT : SETTLEMENT ANALYSIS	Prepared RW	Checked SDP

PREDICTED CONSOLIDATION SETTLEMENT

$$s = M_v \Delta\sigma_v H$$

WHERE M_v IS COEFFICENT OF VOLUME COMPRESSIBLITY
$\Delta\sigma_v$ IS CHANGE IN VERTICAL STRESS
H IS THICKNESS OF THE SOIL LAYER

- CONSIDER THE COHESIVE SOIL IS INFLUENCED BY THE FOUNDATION PRESSURE TO A DEPTH OF 3B, i.e. $3 \times 0.6 = 1.8$m. (CRAIG, FIG 5.8, p.167)

- CONSIDER THE COHESIVE SOIL UNDERGOES A REDUCTION IN FOUNDATION PRESSURE IN ACCORDANCE WITH THE INFLUENCE CHART IN CRAIG (FIG 5.8, p167)

STRESS AT FRACTION OF 'B'	THICKNESS OF LAYER, H (m)	PREDICTED SETTLEMENT $M_v \Delta\sigma_v H$ = (mm)
$0.25B = 0.9q = 0.9 \times 72 = 64.8$	0.15	$0.15 \times 64.8 \times 0.15 = 1.5$
$0.50B = 0.7q = 0.7 \times 72 = 50.4$	0.15	$0.15 \times 50.4 \times 0.15 = 1.13$
$1.00B = 0.55q = 0.55 \times 72 = 39.6$	0.30	$0.15 \times 39.6 \times 0.30 = 1.8$
$1.50B = 0.4q = 0.4 \times 72 = 29.8$	0.30	$0.15 \times 29.8 \times 0.30 = 1.35$
$2.00B = 0.3q = 0.3 \times 72 = 21.6$	0.30	$0.15 \times 21.6 \times 0.30 = 1.0$
$2.50B = 0.25q = 0.25 \times 72 = 18.0$	0.30	$0.15 \times 18.0 \times 0.30 = 0.8$
$3.00B = 0.2q = 0.2 \times 72 = 14.4$	0.30	$0.15 \times 14.4 \times 0.30 = 0.65$

TOTAL PREDICTED SETTLEMENT = 8MM

NOTE: THE ANTICIPATED APPLIED FOUNDATION PRESSURE USED IN THESE CALCULATIONS IS 72kPa. THE IMMEDIATELY ADJACENT EXISTING BASEMENT WALL (APPROXIMATELY 1OM AWAY) HAS STRESSED THE UNDERLYING SOILS WITH A PRESSURE OF AROUND 50KPa, AND CAN BE CONSIDERED TO HAVE INFLUENCED THE ADJACENT SOILS UNDERLYING THE PROPOSED WALL. AS SUCH IT CAN BE CONSIDERED THAT THE NET FOUNDATION PRESSURE OF THE PROPOSED WALL WILL BE LESS THAN 72KPa, AND THEREFORE SETTLEMENTS ARE LIKELY TO BE LESS.

APPENDIX B

PROJECT : Doughty Street	Job No. 39053	Date Jan '17
SUBJECT : New Basement Ret Wall	Prepared JM	Checked SDP

Wall is R.C. 250 wide

adopt $\gamma_{soil} = 20$

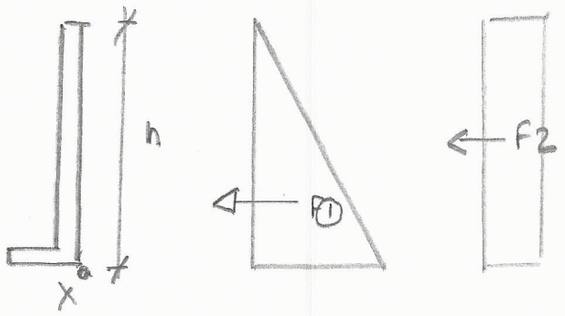
angle of friction (made ground found to be reasonable stable when excavated)

$\phi' = 25°$ $\quad K_a = \frac{1 - \sin 25°}{1 + \sin 25°} = 0.41$

design for L.L. surcharge in garden area behind new wall

$q_f = 5 kN/m^2$

new wall is ~ 2.15m below adjacent foundations. Design for height of 3.15m $\quad h = 3.15m$



$F_1 = \frac{20}{\gamma_{soil}} \times K_1 \times \frac{h^2}{2} = 20 \times 0.41 \times 3.15^2/2 = 40.7 kN$

$F_2 = \frac{5}{\gamma_{soil}} \times K_a \times h = 5 \times 0.41 \times 3.15 = 6.5 kN$

PROJECT : Dorgarty Street	Job No. 39053	Date Jan'17
SUBJECT : New Basement Ret. Wall	Prepared fm	Checked SDC

BM(max) moment in conc wall

as a vertical cantilever

BM about $X = \left(F_1 \times \frac{h}{3}\right) 1.4 + \left(F_2 \times \frac{h}{2}\right) 1.6$

$= \left(40.7 \times \frac{3.15}{3}\right) 1.4 + \left(6.5 \times \frac{3.15}{2}\right) 1.6$

$= 60 + 16 = 76$ kNm/m ULS

BM (max) for wall spanning horizontally (continuous with central support

width of rear of house < 6m

design span say 6/2 = 3m

worst case is lowest 1 metre of wall

F① across lowest 1m is average

of $20 \times 0.41 \times \frac{3.15^2}{2}$ and $20 \times 0.41 \times \frac{2.15^2}{2}$

$= \frac{40.7 + 18.9}{2} = 30$ kN unfactored

over 1m height.

PROJECT : Donaghy Street	Job No. 39053	Date Jan '17
SUBJECT : New Basement Ret. Wall	Prepared YP	Checked SDP

and f2 across 1m height

$= f \times 0.41 \times 1.0 = 5 \times 0.41 \times 1.0$

$= 2.0$ kN unfactored over 1m height

BM max spanning horizontally across 6m with central support will be "hogging" @ support. ($wl^2/8$)

$= \left(30 \times \frac{3.0^2}{8}\right) 1.4 + \left(2 \times \frac{3.0^2}{8}\right) 1.6$

$= 33.7 + 3.6$

$= 37.3$ kNm ULS over 1m height.

∴ Vertical spanning would be reinforced.

R.C. design (assuming T16's used)

$d = 250 - 50 - 8 = 192$ mm

EASTWOOD & PARTNERS
(Consulting Engineers) Ltd.

Sheet No. RW / 4

PROJECT :	Job No.	Date
Dovgate Street	39053	Jan '17
SUBJECT :	**Prepared**	**Checked**
New Basement Ret. Wall	TM	SDP

(BIA stated wall spans horizontally)

but ... design for BM_{max} of 76 kNm

$M/bd^2 = 10^6 \times 76 / 192^2 \times 1000 = 2.06 N/mm^2$

$K = \frac{M}{bd^2 f_{cu}} = \frac{2.06}{40} = 0.051$

$z = 0.95 \times d = 0.95 \times 192 = 182$

$A_{s req} = \frac{K \times f_{cu} \times b \times d^2}{0.87 \times f_y \times z} = \frac{76 \times 10^6}{0.87 f_y \times z} = 959 mm^2/m$

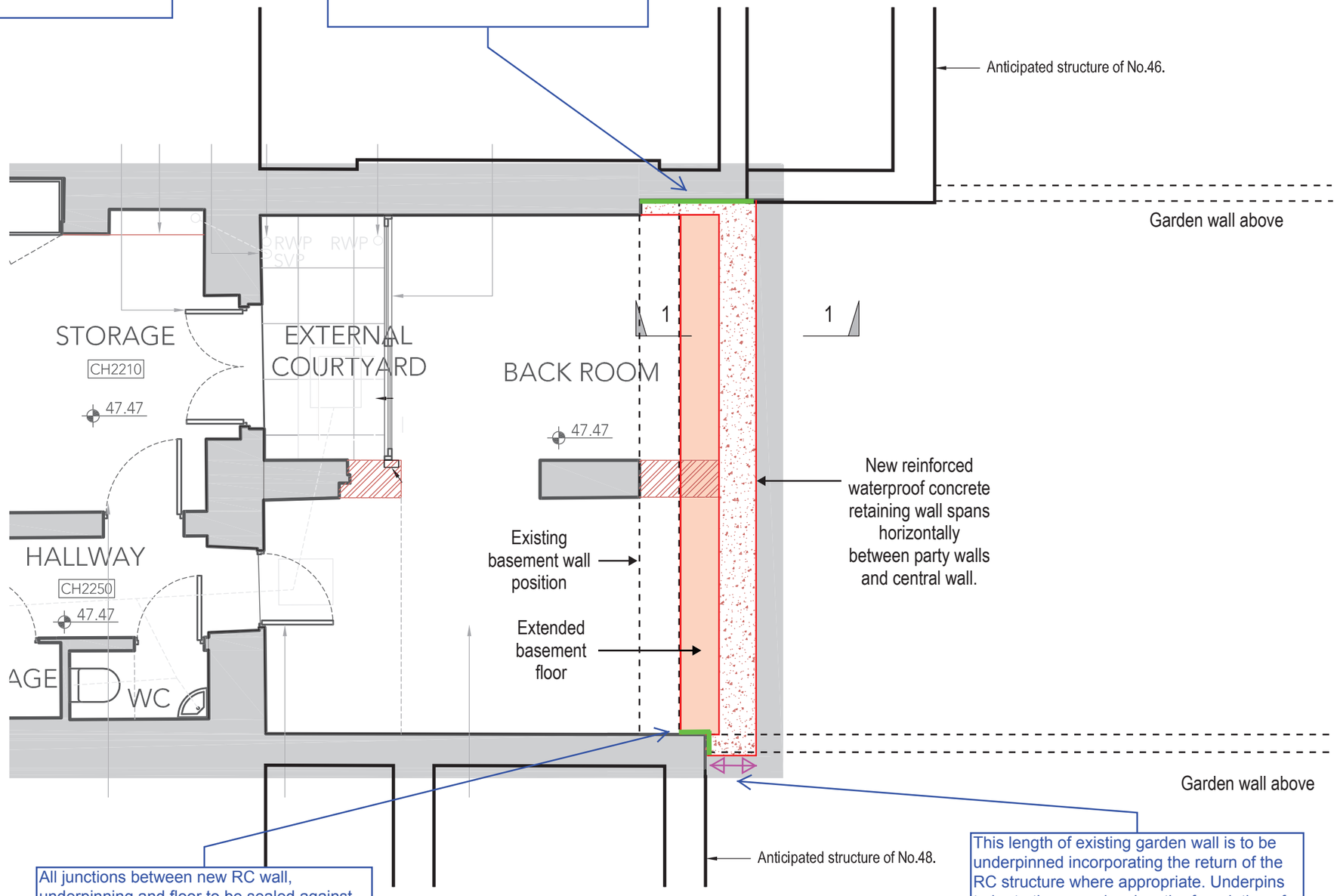
Provide 16 ϕ @ 200 c/c = 1010 mm^2

both directions & both faces

for wall to span horizontally or vertically.

E&P
SK16
Structural details of Basement Junctures
2017.02.15 JET

New RC wall and floor slab to be tied to adjacent structure along all lengths shown thus using 200mm long stainless steel helical ties resin fixed into existing structure and cast into wall. Ties to be set at 300mm horizontal and 300mm staggered vertical centres.



All junctions between new RC wall, underpinning and floor to be sealed against adjacent structure using suitable waterproof sealant prepared and installed in accordance with the manufacturers guidance.

This length of existing garden wall is to be underpinned incorporating the return of the RC structure where appropriate. Underpins to be to the same level as the foundation of the basement of No.48. Brickwork above ground to be made good locally as required.

Basement Plan showing basement structure

Temporary Works Proposal and Construction Sequence

1. Underpin the existing foundations to the short section of garden wall with No.48 which adjoins the new basement extension. Depth of underpin is to suit the adjacent existing foundations to No.48 basement. Retain the brickwork structure and make good any local damage.

2. Excavate for the new basement area in No.47 installing props between the existing basement walls and the earth face after every 1m width of excavation. Commence excavation adjacent to the new underpin on the Party wall with No.48 and progress towards No.46.

3. Shore up the excavation to create a safe working zone for constructing the new RC wall and floor slab.

4. Propping to the party walls with No.48 and No.46 will be provided at ground floor level during the works until the new ground floor structure in installed.

5. Drill and resin fix the horizontal ties into the existing adjacent structures.

6. Cast new RC floor slab and kicker.

7. Construct new masonry pier central to the extended basement.

8. Cast new RC wall.

9. Remove propping to rear face but retain party wall propping until ground floor structure is in place.

10. Seal all junctions between existing and new structure below ground.

London

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

T: +44 (0)20 7340 1700
E: london@campbellreith.com

Birmingham

Chantry House
High Street, Coleshill
Birmingham B46 3BP

T: +44 (0)1675 467 484
E: birmingham@campbellreith.com

Surrey

Raven House
29 Linkfield Lane, Redhill
Surrey RH1 1SS

T: +44 (0)1737 784 500
E: surrey@campbellreith.com

Manchester

No. 1 Marsden Street
Manchester
M2 1HW

T: +44 (0)161 819 3060
E: manchester@campbellreith.com

Bristol

Wessex House
Pixash Lane, Keynsham
Bristol BS31 1TP

T: +44 (0)117 916 1066
E: bristol@campbellreith.com

UAE

Office 705, Warsan Building
Hessa Street (East)
PO Box 28064, Dubai, UAE

T: +971 4 453 4735
E: uae@campbellreith.com