Eastwood & Partners
CONSULTING ENGINEERS

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

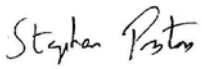
and Construction Sequence Document. This will be developed with sketches and drawings as appropriate in due course.

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,



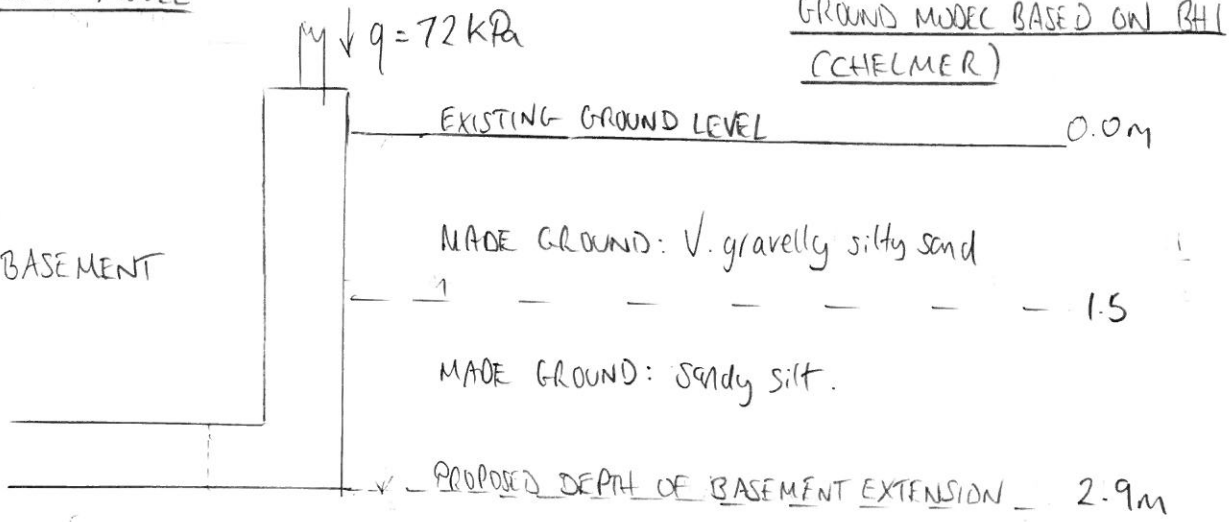
S D Preston
Director

Enc.

APPENDIX A

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

GROUND MODEL



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

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

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

$$= 5.4$$

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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 14, 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 (BALNES, TABLE 9.3))

PROJECT : 47 DOUGHTY STREET	Job No. 39053	Date 09/02/17
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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 $\gamma_{soil} = 20$

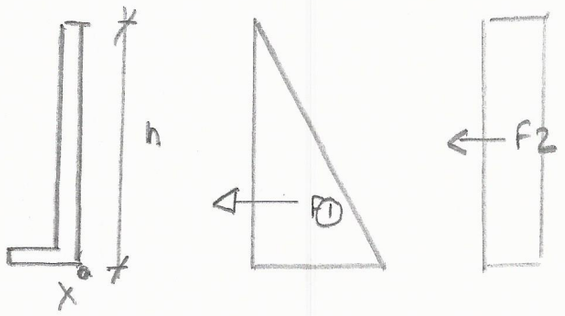
angle of friction (made ground found to be reasonable stable when excavated)

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

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

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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

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

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

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

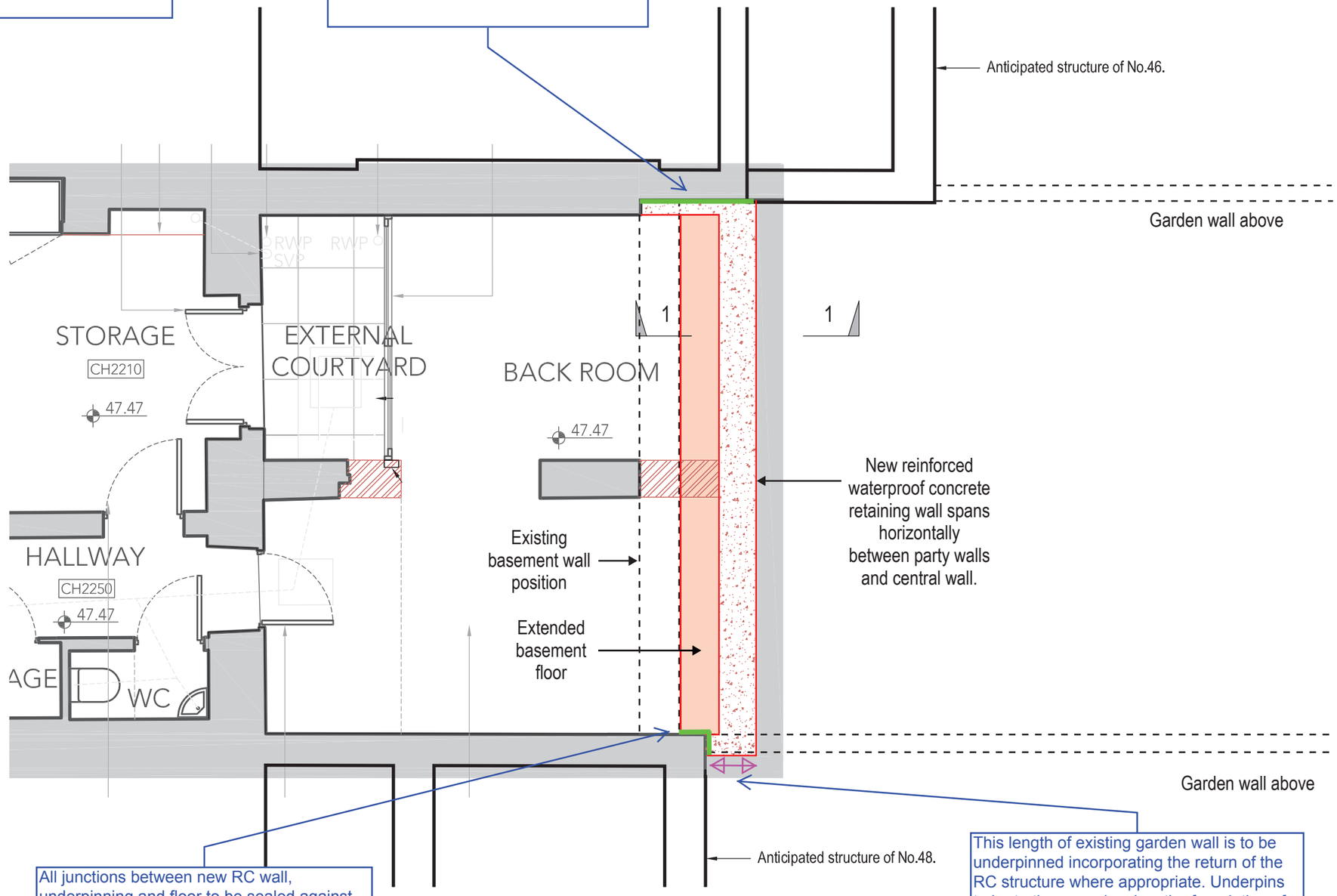
$A_{s req} = \frac{K \times f_{cu} \times b \times d^2}{0.87 \times f_y \times z} = \frac{76 \times 10^6}{0.87 f_y \times z} = 959 mm^2/m$

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.