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consulting engineers

Great Hall, Library & Under Treasurers House, Lincolns Inn, London, WC2 3TL

Basement Construction Plan Review

For

London Borough of Camden

Project Number: 12366-01

Revision D3

May 2016

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Document History and Status

Revision	Date	Purpose/Status	File Ref	Author	Check	Review
D1	18/02/16	Draft	SLGjvw12366-01-240216-Lincolns Inn-BCPReview.doc	SLG	SLG	LB
D2	29/02/16	Final	SLGjvw12366-01-290216-Lincolns Inn-BCPReview D3.doc	SLG	SLG	LB
D3	09/05/16	Updated	SLGjvw12366-01-100516-Lincolns Inn-BCPReview D3.doc	SLG	SLG	LB

Document Details

Last saved	10/05/2016 09:07
Path	SLGjvw12366-01-100516-Lincolns Inn-BCPReview D3.doc
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Project Number	12366-01
Project Name	Great Hall, Library & Under Treasurers House, Lincolns Inn, London,WC2 3TL BCP-Review

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1.0 INTRODUCTION

1.1. CampbellReith was instructed by London Borough of Camden (LBC) to undertake a review of the two Basement Construction Plans submitted by Eckersley O'Callaghan (EOC) following an audit of the Basement Impact Assessments (BIA) submitted as part of the Planning Submission documentation for the Great Hall, Library & Under Treasurers House, Lincolns Inn, Planning References 2015/440P & 2015/4408/P.

1.2. A meeting was held on 6th January 2016 with EOC and LBC to agree the scope of the BCP in accordance with Camden Planning Guidance requirements set out in CPG4 below:

3.37 A basement construction plan should contain:

- *a method statement detailing the proposed method of ensuring the safety and stability of neighbouring properties throughout the construction phase including temporary works sequence drawings,*
- *appropriate monitoring including details of risk assessment thresholds and contingency measures,*
- *detail demonstrating that the basement has been designed using evidence of local factors including ground conditions, the local water environment and the structural condition of neighbouring properties, in order to minimise the impact on them.*
- *provision to retain at the property throughout the construction phase a suitably qualified engineer from a recognised relevant professional body to monitor, inspect, and approve the permanent and temporary basement construction works.*
- *measures to ensure the ongoing maintenance and upkeep of the basement.*

3.38 The basement construction plan should ensure that:

- *a suitably qualified and experienced engineer has agreed the design,*
- *the modelling of ground conditions and water environment is appropriately conservative; and*
- *best endeavours are undertaken to prevent any impact on the structural integrity of the neighbouring properties.*

3.39 Prior to final submission to the Council for approval, basement construction plans need to be certified by a suitably qualified and experienced engineer who is independent of the design team. The certification will need to be funded by the applicant.

1.3. The two BCPs were required to address the queries raised by CampbellReith in their BIA audit of October 2015, namely:

Query No	Subject	Query	Status	Date closed out
1	Stability	Further details of construction methodology to be provided including programme, detailed design of underpins and piles, temporary works arrangements and proposals for monitoring and construction surveys.	To be provided in Basement Construction Plan	N/A
2	Stability	Ground Movement Assessment to be reviewed for final construction methodology.	To be provided in BCP	N/A

1.4 In addition, CampbellReith requested by e-mail dated 1st February 2016 that the BCPs should provide 'confirmation of results of ongoing water level monitoring and trial excavations, and assessment of likelihood/potential impact of ground water inflows. Proposals for excluding water from excavations (including underpins) and any necessary mitigation measures '

1.5 This report covers our review of the final BCPs for the East Terrace and Library basements submitted by EOC on 15th February 2016 in accordance with LBC's requirements. The documents reviewed are as follows:

- East Terrace BCP – 12 Feb 2016, incl Appendix 1 – Drawings
- Library BCP – 12 Feb 2016, incl Appendix 1 – Drawings
- Appendix 2 – Ground Movement Assessment Report by GEA – Final – 10 Feb 2016

1.6 It should be noted that following discussions with EOC revised BCPs were issued on 26th February 2016 which have addressed the queries raised in our review.

2.0 BASEMENT CONSTRUCTION PLAN REVIEW CHECKLIST

2.1. Eckersley O'Callaghan submitted on 15th February 2016 the two Basement Construction Plans required by LBC and as agreed with CampbellReith. The following checklist shows the status of our review of the documents for the Library and East Terrace basements :

✓ **Denotes information has been submitted, reviewed and meets LBC's requirements for the BCP**

X Denotes information has not been submitted and is outstanding

Condition Surveys • Plan drawing showing extent of condition survey to be provided. • Photographic and descriptive record of existing condition to be provided. • Condition Survey to be carried out by third party independent of the design and contractor team to be carried out prior to commencement of works.	✓ ✓ ✓
Final GMA report based on detailed design RIBA stage 4 & general temporary works arrangements. 1. GEA will be carrying out WALLAP Analysis based on detailed Stage 4 structural information and agreed propping sequence taking on board the following information. • Surcharge loadings • Vertical pile loadings • Vertical location of props/walers during excavation works • Confirmation of embedment length • Consideration of pre-loading of flying shores to minimise horizontal movement 2. Several sections will be analysed to confirm more detailed understanding of predicted movements. 3. The target will be to reduce the predicted settlements and ground movements within the previous report. 4. This will result in a reduction of the damage category assessment to a level 1 Burland throughout the site.	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Movement Monitoring Proposals including drawings & specification to include: • The trigger and action levels for horizontal and vertical movements will be supplied. • Monitoring targets will be indicated on the Elevations drawings for the Great Hall and Library Boundary walls as required. • The monitoring frequency will be included – suggested weekly intervals with a report to be supplied to the Engineer within 24hrs of monitoring.	✓ ✓ ✓

Outline Temporary works proposals including • Plans indicating propping arrangements. • Programme indicating timing of basement installation works. • Excavation & propping sequence. • Sectional Detailing of temporary works propping.	 ✓ ✓ ✓ ✓
• GEA are supplying the retaining wall calcs. • EOC have provided detailed design of underpins	✓ ✓

2.2. The BCP must be certified by a suitably qualified and experienced engineer who is independent of the design team. EOC have stated that this has been undertaken by:

Robert Rock BEng (Hons) CEng MIStructE

`An Associate level Chartered Structural Engineer with many years of experience in basement construction and design `

3.0 DISCUSSION

3.1. The following comments apply to the BCPs for both the East Terrace and Library basements:

3.2. The condition surveys of the existing buildings, within the zone of influence of the basement excavations, are to be carried out before works commence.

3.3. The GMA report by GEA has been updated and generally addresses the requirements of the BCP's. Two sections for each basement have been analysed for ground movements using WALLAP and a reduction to Burland Damage Category 1 has been achieved.

3.4. The building monitoring proposals are acceptable although we believe it would be prudent to set the limits of vertical movement warning to lesser values of 8mm for amber warnings and 12mm for red warnings. This has been discussed with EOC and they have agreed and revised their report accordingly.

3.5 We have reviewed the underpinning drawings and find the construction methods, sequencing and temporary propping to be acceptable assuming that the pins are founded in the gravel strata and settlements are limited to a max of 5mm. The underpinning calculations and justification of the max 5mm settlement have been discussed with EOC and the following further information has now been received:

Ref: E-mail 26th Feb 2016 from Martin Cooper GEA to EOC

Duncan

Further to the request for justification of the settlement of less than 5 mm our first response is that it is generally accepted that settlements will be typically between 2 mm and 5 mm provided that the underpinning is carried out by a reputable and experienced contractor and in accordance with ASUC Guidance.

However we have also calculated the potential long term settlements using the Pips software and the ground model that was used in the heave calculations within our Ground Movement Analysis. For the settlement of underpinned foundations we have looked at the settlement of a 10 m length of the foundations represented by Section No 1 on EO'C Drawing S3.1. We have modelled the following two conditions, with the lowest existing load and highest proposed loading in order to model the greatest load difference.

The first represents the existing loading of 100 ken/m^2 bearing at 16.77 m OD on a foundation of 1.66 m width. The total maximum settlement is calculated as 3 mm.

The second represents the proposed loading, also of 100 ken/m2 bearing at 14.1 m OD on a foundation of 2.40 m width. The total maximum settlement is calculated to be 7 mm.

Since the underpinning simply takes the current loading to a deeper level the settlement induced by the foundations bearing at a lower level will be the difference between the two cases which is less than 5 mm quoted in our report.

Calculation sheets and contour plots are attached.

Regards

Martin

3.5. The proposals for the temporary propping of the basement retaining walls, using preloaded flying shores, are generally acceptable although we have not undertaken any independent design checks.

3.6. It should be noted that the BCP proposals are not final. Design and construction options for the temporary works are available to the contractor i.e. the contractor can decide to adopt an alternative methodology for excavation, temporary propping and sequencing of the works as currently set out in the BCPs. However he must work within the specification requirements of the BCP for controlling ground movements. This has been discussed with EOC and they have updated their report to state (Ref Clause 7.5) 'Any contractor proposals which fundamentally change the proposed temporary works, sequencing and basement construction methods contained within this report will require resubmission to Camden for approval.'

4.0 CONCLUSIONS

4.1. The proposals for the preconstruction condition surveys, the updated ground movement assessments and the methodology for excavation and temporary propping of the secant and contiguous piled retaining walls are acceptable. The groundwater monitoring information is satisfactory. The sequencing and indicative programme of the works appear to be satisfactory.

4.2. The movement monitoring proposals are acceptable and slightly lower values have now been set for the amber and red warnings for vertical settlement to minimise the risk of damage to the listed buildings.

4.3. The justification of the underpin settlements has been received and is satisfactory. The final pile design will be provided by the contractor.

4.4. Should the contractor change the methodology for the basement construction then a revised BCP will be required.

4.5. We are generally satisfied that the detailed information provided to us for review complies with the requirements of CPG4.

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