CampbellReith
consulting engineers

109 Gloucester Avenue
London, NW1 8LB

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12336-77

Revision: F1

December 2016

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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 109 Gloucester Avenue, NW1 8LB (Camden Planning reference 2016/2216/P). On the basis of the BIA, the basement was considered to fall within Category A as defined by the Terms of Reference, however, a review of the proposals identified potential impacts on surrounding structures and infrastructure and risk of flooding.

1.2. The basement is now considered to fall within Category B as defined by the Terms of Reference.

1.3. 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.

1.4. 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.

1.5. The BIA was undertaken by Cambridge Architectural Research (CAR) and the qualifications of the individuals involved are considered suitable in this instance.

1.6. The proposal is for the extension of existing vaults beneath the front garden both in plan and depth.

1.7. Sketches to indicate the construction sequence together with retaining wall calculations have been provided in the revised submissions.

1.8. A ground investigation has been undertaken. The location plan of the neighbouring property foundations that have been investigated has been presented in the revised submissions.

1.9. Further investigation to determine the depth of the other party wall foundation as well as a sufficient investigation to derive geotechnical parameters for detailed design should be undertaken prior to construction. These parameters should inform the final GMA.

1.10. Measures to deal with any perched water which were not considered in the BIA have now been proposed. Permanent waterproofing proposals have been clarified in the revised submissions.

1.11. The potential flood risk has been addressed in the revised submissions with mitigation measures proposed as discussed in Audit paragraph 4.8.

1.12. The revised BIA states that both neighbouring properties on either side of No 109 have lower ground floors and vaults under the front garden.

1.13. The queries raised on the ground movement assessment have been adequately addressed in the revised submissions.

1.14. The predicted damage Category 1 requires mitigation measures to be proposed, as stated in CPG4. The mitigation relies upon good workmanship, stiff propping and appropriate hit and miss sequencing.

1.15. An outline monitoring proposal has been provided. Details and trigger levels should be agreed as part of the Party Wall award.

1.16. An outline works programme is included and it is accepted a detailed programme should be prepared by the appointed Contractor in due course.

1.17. It is accepted that there are no slope stability concerns, wider hydrogeological issues or any other surface water considerations regarding the proposed development.

1.18. With the additional information provided in the revised submissions, the Criteria of CPG4 and DP27 have been met. Queries and requests for further information are discussed in Section 4 and summarised in Appendix 2.

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 109 Gloucester Avenue, NW1 8LB (Camden Planning Reference 2016/2216/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.

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 *"To front: excavation of basement level extension under front garden and associated rooflight; replacement of metal steps to front lightwell with stone stairs; erection of storage area and planter. To rear: erection of glazed rear infill extension at upper ground floor level; relocation of terrace with privacy screen to first floor level; replacement of doors to existing lower ground extension".*

2.6. The Audit Instruction also confirmed 109 Gloucester Avenue is not listed, nor is it a neighbour to a listed building.

2.7. CampbellReith accessed LBC's Planning Portal on 14 July 2016 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA): Cambridge Architectural Research (CAR), undated
- Design, Access and Heritage statement: Manica Architecture, dated April 2016
- Manica Architecture Planning Application Drawings consisting of

  Location Plan

  Existing Plans

  Proposed Plans

  Existing Sections

  Proposed Sections

  Existing Elevations

  Proposed Elevations

2.8. Following the initial audit, a revised BIA (Rev B, September 2016) was received by email from CAR Ltd. This document is not included as an appendix due to file size.

2.9. Further queries on the revised document were raised and the responses to these queries, which were received via email on 24 and 31 October, and 14 November 2016, are included in Appendix 3, with the exception of the proposed waterproofing brochure. This document is not included due to its generic (non site specific) nature and file size.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	See Audit paragraphs 4.1 and 4.2.
Is data required by Cl.233 of the GSD presented?	Yes	Revised BIA and supporting documents (see Audit paragraph 4.4).
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	As above (see Audit paragraph 4.5).
Are suitable plan/maps included?	Yes	Revised BIA and supporting documents.
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	Revised BIA and supporting documents.
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Section 2.03 of the revised BIA, however, response to Q5 is incorrect but has no adverse effects on the proposal (see Audit paragraph 4.9).
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Section 2.02 of the revised BIA although the response to Q1b ignores the potential for perched water in the Made Ground. This issue has now been addressed (see Audit paragraphs 4.6 and 4.7).
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Section 2.04 of the revised BIA.
Is a conceptual model presented?	Yes	Section 4.1 and 4.2 of the ground investigation report (GIR).
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 3.02 of the revised BIA although Q5 should have been carried forward from the screening.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	No	No issues identified although one issue should have been carried forward from screening (see Audit paragraph 4.6).
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	No	Not provided but states a flood risk assessment (FRA) is required. The FRA is included in the later chapters of the BIA.
Is factual ground investigation data provided?	Yes	Included as part of the appendices to the revised BIA.
Is monitoring data presented?	No	It is stated groundwater was not encountered in the investigation, however, groundwater monitoring was not undertaken.
Is the ground investigation informed by a desk study?	Yes	Desk study information included in the ground investigation report although the site history lacks detail.
Has a site walkover been undertaken?	Yes	Section 2 of the BIA states a visual survey of the property and '*brief visual overview of the terrace also undertaken*'.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	Section 2 of the BIA (see Audit paragraph 4.10).
Is a geotechnical interpretation presented?	Yes	Some interpretation presented in the revised submissions.
Does the geotechnical interpretation include information on retaining wall design?	Yes	Presented in the revised submissions.
Are reports on other investigations required by screening and scoping presented?	Yes	Site specific ground investigation report provided.
Are the baseline conditions described, based on the GSD?	Yes	Revised BIA and supporting documents.
Do the base line conditions consider adjacent or nearby basements?	Yes	Section 2 of the revised BIA.
Is an Impact Assessment provided?	Yes	Section 5 of the revised BIA.

Item	Yes/No/NA	Comment
Are estimates of ground movement and structural impact presented?	Yes	Presented in the revised submissions.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	Updated in the revised submissions.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	BIA Sections 5 and 6.
Has the need for monitoring during construction been considered?	Yes	Section 5 of the revised BIA although it was requested the trigger values be reconsidered (see Audit paragraph 4.18).
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	Presented in the revised submission.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Revised BIA Section 5.01.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	Presented in the revised submission.
Does the report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Contradictory damage categories given in revised submission. Email states Category 1.
Are non-technical summaries provided?	Yes	BIA Section 2, only after the screening.

4.0 DISCUSSION

4.1. The Basement Impact Assessment (BIA) was undertaken by Cambridge Architectural Research (CAR) Ltd and the author has a CEng MIStructE qualification. Although the input of a Chartered Hydrologist or Chartered Civil Engineer specialising in flood risk management and surface water and an individual with a CGeol qualification with respect to groundwater appraisal is required in the production of a BIA, it was considered that due to the modest proposal this could be undertaken by another professional in this instance once clarification on two issues relating to the groundwater level and flooding was received. Proof of the author's expertise in engineering geology was however requested.

4.2. The revised BIA states that the author has several years' experience in subterranean developments and additionally the report has now been reviewed by an individual with a CGeol qualification.

4.3. The site comprises a five storey building which includes a lower ground floor and loft. The lower ground floor comprises a flat which is accessed from a front light well. The lightwell also provides access to existing brick vaults beneath the front garden which extend to the back of the pavement. Details are provided in the architect's drawings.

4.4. It is understood from the drawings that the proposal includes the extension of the existing vaults both in plan and depth by mass concrete underpinning/construction of reinforced concrete walls. A construction sequence was not included. An underpinning bay sequence was provided together with structural sections indicating the underpinning. The sketches were considered inadequate as they only showed the final stage of the construction. The revised BIA contains a construction methodology and sequence sketches indicating each stage of the excavation and construction. Retaining wall calculations have also been provided and these are considered to be adequate.

4.5. Further to a request after the initial BIA, the screening in the revised BIA now provides justification for all the 'No' responses together with the relevant map extracts with the site location indicated.

4.6. The 'No' response given to Question 1b of the hydrogeology screening which relates to whether or not the basement will extend beneath the water table was queried in the initial audit report given that a ground investigation was not undertaken to establish the groundwater table. Whilst a ground investigation has now been undertaken, this did not include groundwater monitoring. It is stated that the basement will not extend beneath the water table due to groundwater not being encountered in the investigation. It should be noted that not encountering groundwater during excavation/drilling does not indicate its absence, rather it is likely due to the groundwater level not reaching equilibrium conditions. As previously noted, the response

ignores the potential for perched water to exist in the Made Ground which would require temporary dewatering measures.

4.7. It was requested by email on 20 October 2016 that temporary dewatering measures be considered in case perched water be encountered, despite not encountering groundwater in the investigation. An email response from CAR Ltd (Appendix 3) states temporary measures to deal with any perched water will be allowed for by the Contractor. Although it was not originally explicitly stated in the BIA, the revised submissions indicate the basement will be waterproofed in the permanent case.

4.8. 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. Gloucester Avenue is indicated to have flooded in 1975 on Figure 3ii of the Camden SFRA and Figure 15 of the Arup GSD. This issue has now been considered with mitigation measures proposed. This includes providing upstands around any rooflights, raising the roof level above the adjacent pavement level and drainage channel in the road and installing fittings on the drainage connections to the main sewers to avoid flooding due to sewer surcharge.

4.9. A 'No' response is given to Question 5 of the revised BIA which relates to whether or not London Clay is the shallowest strata. This is incorrect as the ground investigation revealed the shallowest stratum to be London Clay. The Made Ground is not considered to be a stratum in this context.

4.10. Although one of the Architects' plans indicates lightwells for the properties on either side of the site, it was not stated in the BIA text whether these properties contain basements or not. The revised BIA states that the properties along the same side of 109 Gloucester Terrace have vaults under the front garden and that the properties on either side have lower ground floors as well.

4.11. A ground investigation informed by a desk study has now been undertaken following a request after the initial audit. The desk study has not been undertaken in accordance with Arup GSD requirements. The investigation comprised two foundation inspection pits (one within the existing lightwell and the other at one of the party walls and a single borehole (hand augered through the base of one of the foundation inspection pits). The exploratory hole plan has been updated in the revised submissions to clarify hole locations.

4.12. The investigation encountered Made Ground to 1.30m and it is indicated strength testing (hand shear vanes) were undertaken. It is unclear how these were undertaken in a hand augered hole. Additionally, only one of the neighbouring property foundations was investigated. Clarification on the depth of underpinning was requested from CAR by email as it is stated in the revised

BIA that an excavation of approximately 1.20m is required. The email response included in Appendix 3 states the underpinning will extend into the London Clay.

4.13. Limited interpretation is included in the ground investigation report, which did not include retaining wall parameters. These were requested via email and CAR's response, which is included in Appendix 3, indicates the parameters provided are based on experience rather than site specific analysis. Stiffness values (Young's Modulus) are not included. As described above, the factual data presented indicates hand shear vane testing was undertaken, although it is unclear how this was undertaken in a hand augered hole. Further ground investigation to enable the derivation of appropriate geotechnical parameters should be undertaken for detailed design.

4.14. It was stated in the initial BIA that Category 0 (Negligible) damage was anticipated, however no justification was presented. The scoping stated that the proposed extension is sufficiently remote from neighbouring properties to prevent structural damage. This was not demonstrated and the property is part of a terrace. In the revised submissions, ground movements have been re-calculated and a Damage Impact if Category 1 (Very Slight) has been assessed for the party vault walls. Mitigation measures to reduce damage impact are reliant on good workmanship, stiff propping, and an appropriate hit and miss construction sequence, in short excavations.

4.15. Movement resulting from underpinning within stiff clay is controlled by workmanship and it may be possible to limit damage to nearby structures to acceptable limits provided the works are properly controlled and the affected structures are in sound condition. This needs to be demonstrated in the BIA. It was requested that anticipated vertical and horizontal movements (settlements) from the underpinning and excavation together with heave movements from the excavation should be considered and any resultant damage clearly assessed. It was also noted that the stiffness of the London Clay on site has not been established, and larger movements would be expected in soft to firm clay. Due to the relatively small excavations on site, the preliminary ground movement assessment provided in the revised submissions is considered appropriate.

4.16. The proposed development extends to the back of the pavement, however, the impacts to the pavement and any utilities running beneath it were not originally considered. The construction sequence methodology in the revised BIA now considers temporary support to the highway.

4.17. Movement monitoring of the neighbouring properties is considered in the revised BIA as requested following the initial audit, however, there were queries on the trigger levels. These have been revised and provided in an email (Appendix 3).

4.18. An outline works duration is provided. A detailed works programme should be prepared by the appointed Contractor in due course.

4.19. It is stated in the BIA that there will be no increase in impermeable area therefore the surface water flow regime and volume will be unchanged.

4.20. It is accepted that there are no slope stability concerns, wider hydrogeological issues or any other surface water considerations regarding the proposed development.

5.0 CONCLUSIONS

5.1. The BIA was undertaken by Cambridge Architectural Research (CAR) and despite no input from an individual with CWEM or CEng MICE qualifications with respect to hydrology, it is considered this issue has been appropriately assessed.

5.2. The proposal is for the extension of existing vaults beneath the front garden both in plan and depth.

5.3. An underpinning bay sequence is provided together with structural sections indicating the construction sequence. Retaining wall calculations have also been provided and these are considered to be adequate.

5.4. A ground investigation has now been undertaken. The location plan of the neighbouring property foundations that have been investigated has been presented in the revised submissions.

5.5. Further investigation to determine the depth of the other party wall foundation and sufficient investigation to derive geotechnical parameters for detailed design should be undertaken prior to construction. These parameters should inform the final GMA.

5.6. Measures to deal with any perched water which were not considered in the BIA have now been proposed. Permanent waterproofing proposals have been clarified in the revised submissions.

5.7. The potential flood risk has now been addressed with mitigation measures proposed as discussed in Audit paragraph 4.8.

5.8. The revised BIA states that both neighbouring properties on either side of No 109 have lower ground floors and vaults under the front garden.

5.9. The queries raised on the ground movement assessment have been adequately addressed in the revised submissions.

5.10. The predicted damage category requires mitigation measure as stated in CPG4. The mitigation relies upon good workmanship, stiff propping and appropriate hit and miss sequencing.

5.11. An outline monitoring proposal has been provided. Details and trigger levels should be agreed as part of the Party Wall award.

5.12. An outline works programme is included and it is accepted a detailed programme should be prepared by the appointed Contractor in due course.

5.13. It is accepted that there are no slope stability concerns, wider hydrogeological issues or any other surface water considerations regarding the proposed development.

5.14. With the additional information provided in the revised submissions, the Criteria of CPG4 and DP27 have been met. Queries and requests for further information are summarised in Appendix 2.

Appendix 1: Residents' Consultation Comments

None

Appendix 2: Audit Query Tracker

Audit Query Tracker*

Query No	Subject	Query	Status	Date closed out
1	BIA format	BIA author qualifications	Closed – see Audit paragraphs 4.1 and 4.2.	08/11/2016
2	BIA format/ Stability/Hydrogeology	No site specific ground investigation to confirm sequence of strata and groundwater level.	Ground investigation now undertaken, however, further investigation to be undertaken prior to detailed design to confirm in situ strength of the London Clay. This should be reviewed as part of the Party Wall award.	N/A
3	Hydrogeology/Stability	Temporary dewatering measures not considered.	Closed – groundwater control measures proposed in email response (see Appendix 3).	08/11/2016
4	Hydrology	Screening did not identify that the site is located in an area which previously flooded.	Closed – considered and mitigated in revised BIA.	08/11/2016
5	Stability	Presence or absence of basement beneath neighbouring properties not discussed in BIA text and foundations depths not determined.	Closed – Presence of lower ground floors and/or vaults beneath the neighbouring properties confirmed.	08/11/2016
6	Stability	Proposed construction methodology not sufficiently detailed. No construction sequence, inadequate sketches and no temporary works proposal.	Closed – Construction sequence sketches together with structural calculations provided.	08/11/2016
7	Stability	Ground movement assessment (GMA) insufficient.	Closed – GMA provided	14/11/2016
8	Stability	Movement monitoring proposal not provided.	Open – Outline proposal provided. Details and trigger levels to be agreed as part of Party Wall award.	08/11/2016 N/A
9	BIA format/ Stability	Location plan does not clearly indicate which neighbouring property foundation was investigated. Direction of North arrow contradicts scheme drawings to be	Closed – revised drawings provided	14/11/2016

		confirmed.		
10	Hydrogeology	Permanent waterproofing proposals not included in the text.	Closed – confirmed via email.	14/11/2016

* Please provide clear and complete responses to the above queries. If the BIA and/or supporting documents are amended, please provide a covering email/letter to indicate the amended sections.

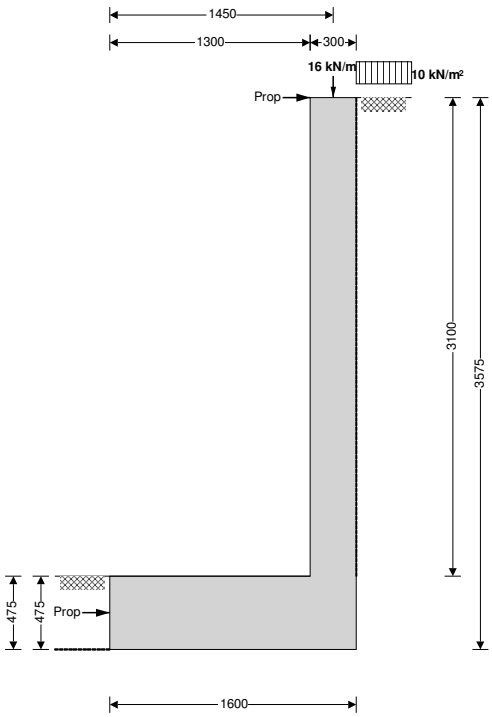
Appendix 3: Supplementary Supporting Documents

CAR email responses (received 24/10/2016, 31/10/2016, 14/11/2016)
Retaining Wall Calculation
Damage Impact Assessment
Trial Pits & Borehole Location Plan

Tekla Tedds CAR Ltd Unit 6, 25 Gwydir Street Cambridge CB1 2LG	Project 109 Gloucester Avenue, London			Job no. 2812	
	Calcs for Front retaining wall			Start page no./Revision RW 2 A	
	Calcs by TB	Calcs date 31/10/2016	Checked by	Checked date	Approved by	Approved date

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever propped at both**
Height of retaining wall stem	h_{stem} = **3100** mm
Thickness of wall stem	t_{wall} = **300** mm
Length of toe	l_{toe} = **1300** mm
Length of heel	l_{heel} = **0** mm
Overall length of base	$l_{base} = l_{toe} + l_{heel} + t_{wall}$ = **1600** mm
Thickness of base	t_{base} = **475** mm
Depth of downstand	d_{ds} = **0** mm
Position of downstand	l_{ds} = **1125** mm
Thickness of downstand	t_{ds} = **475** mm
Height of retaining wall	$h_{wall} = h_{stem} + t_{base} + d_{ds}$ = **3575** mm
Depth of cover in front of wall	d_{cover} = **0** mm
Depth of unplanned excavation	d_{exc} = **475** 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/m^3
Density of base construction	γ_{base} = **23.6** kN/m^3
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	$h_{eff} = h_{wall} + l_{heel} \times \tan(\beta)$ = **3575** mm

Retained material details

Mobilisation factor	M = **1.5**
Moist density of retained material	γ_m = **15.0** kN/m^3

Saturated density of retained material γ_s = **19.5** kN/m^3

Design shear strength ϕ' = **18.0** deg

Angle of wall friction δ = **18.6** deg

Base material details

Firm clay

Moist density γ_{mb} = **18.0** kN/m^3

Design shear strength ϕ'_b = **21.0** deg

Design base friction δ_b = **18.6** deg

Allowable bearing pressure $P_{bearing}$ = **120** kN/m^2

Using Coulomb theory

Active pressure coefficient for retained material

$$K_a = \sin(\alpha + \phi')^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta) \times [1 + \sqrt{(\sin(\phi' + \delta) \times \sin(\phi' - \beta) / (\sin(\alpha - \delta) \times \sin(\alpha + \beta)))}]^2) = \mathbf{0.460}$$

Passive pressure coefficient for base material

$$K_p = \sin(90 - \phi'_b)^2 / (\sin(90 - \delta_b) \times [1 - \sqrt{(\sin(\phi'_b + \delta_b) \times \sin(\phi'_b) / (\sin(90 + \delta_b)))}]^2) = \mathbf{3.549}$$

At-rest pressure

At-rest pressure for retained material $K_0 = 1 - \sin(\phi') = \mathbf{0.691}$

Loading details

Surcharge load on plan Surcharge = **10.0** kN/m^2

Applied vertical dead load on wall W_{dead} = **12.0** kN/m

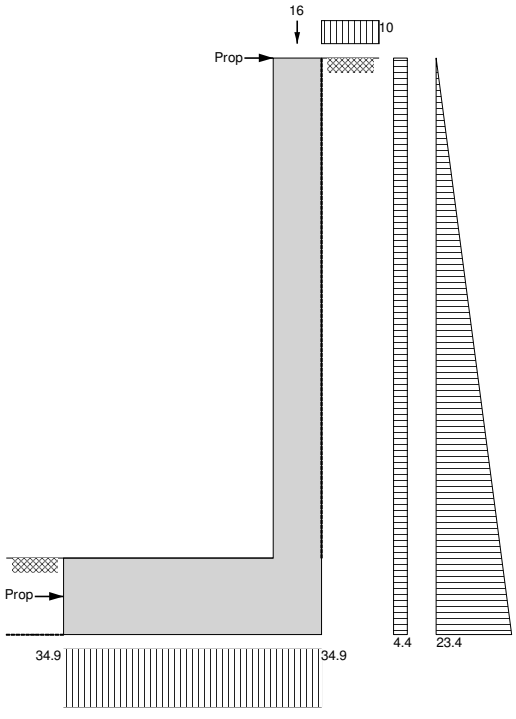
Applied vertical live load on wall W_{live} = **4.0** kN/m

Position of applied vertical load on wall l_{load} = **1450** mm

Applied horizontal dead load on wall F_{dead} = **0.0** kN/m

Applied horizontal live load on wall F_{live} = **0.0** kN/m

Height of applied horizontal load on wall h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m^2

Vertical forces on wall

Wall stem $w_{wall} = h_{stem} \times t_{wall} \times \gamma_{wall} = \mathbf{21.9}$ kN/m

Wall base $w_{base} = l_{base} \times t_{base} \times \gamma_{base} = \mathbf{17.9}$ kN/m

Applied vertical load $W_v = W_{dead} + W_{live} = \mathbf{16}$ kN/m

Total vertical load $W_{total} = w_{wall} + w_{base} + W_v = \mathbf{55.9}$ kN/m

Horizontal forces on wall

Surcharge $F_{sur} = K_a \times \cos(90 - \alpha + \delta) \times \text{Surcharge} \times h_{eff} = \mathbf{15.6}$ kN/m

Moist backfill above water table $F_{m\_a} = 0.5 \times K_a \times \cos(90 - \alpha + \delta) \times \gamma_m \times (h_{eff} - h_{water})^2 = \mathbf{41.8}$ kN/m

Total horizontal load $F_{total} = F_{sur} + F_{m\_a} = \mathbf{57.3}$ kN/m

Calculate total propping force

Propping force $F_{prop} = \max(F_{total} - (W_{total} - W_{live}) \times \tan(\delta_b), 0 \text{ kN/m})$

$F_{prop} = \mathbf{39.9}$ kN/m

Overturning moments

Surcharge $M_{sur} = F_{sur} \times (h_{eff} - 2 \times d_{ds}) / 2 = \mathbf{27.8}$ kNm/m

Moist backfill above water table $M_{m\_a} = F_{m\_a} \times (h_{eff} + 2 \times h_{water} - 3 \times d_{ds}) / 3 = \mathbf{49.8}$ kNm/m

Total overturning moment $M_{ot} = M_{sur} + M_{m\_a} = \mathbf{77.6}$ kNm/m

Restoring moments

Wall stem $M_{wall} = w_{wall} \times (l_{toe} + t_{wall} / 2) = \mathbf{31.8}$ kNm/m

Wall base $M_{base} = w_{base} \times l_{base} / 2 = \mathbf{14.3}$ kNm/m

Design vertical dead load $M_{dead} = W_{dead} \times l_{load} = \mathbf{17.4}$ kNm/m

Total restoring moment $M_{rest} = M_{wall} + M_{base} + M_{dead} = \mathbf{63.6}$ kNm/m

Check bearing pressure

Total vertical reaction $R = W_{total} = \mathbf{55.9}$ kN/m

Distance to reaction $x_{bar} = l_{base} / 2 = \mathbf{800}$ mm

Eccentricity of reaction $e = \text{abs}((l_{base} / 2) - x_{bar}) = \mathbf{0}$ mm

Reaction acts within middle third of base

Bearing pressure at toe $p_{toe} = (R / l_{base}) - (6 \times R \times e / l_{base}^2) = \mathbf{34.9}$ kN/m^2

Bearing pressure at heel $p_{heel} = (R / l_{base}) + (6 \times R \times e / l_{base}^2) = \mathbf{34.9}$ kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

Calculate propping forces to top and base of wall

Propping force to top of wall

$F_{prop\_top} = (M_{ot} - M_{rest} + R \times l_{base} / 2 - F_{prop} \times t_{base} / 2) / (h_{stem} + t_{base} / 2) = \mathbf{14.762}$ kN/m

Propping force to base of wall $F_{prop\_base} = F_{prop} - F_{prop\_top} = \mathbf{25.112}$ kN/m

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

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 $w_{wall\_f} = \gamma_{f\_d} \times h_{stem} \times t_{wall} \times \gamma_{wall} = \mathbf{30.7}$ kN/m

Wall base $w_{base\_f} = \gamma_{f\_d} \times l_{base} \times t_{base} \times \gamma_{base} = \mathbf{25.1}$ kN/m

Applied vertical load $W_{v\_f} = \gamma_{f\_d} \times W_{dead} + \gamma_{f\_l} \times W_{live} = \mathbf{23.2}$ kN/m

Total vertical load $W_{total\_f} = w_{wall\_f} + w_{base\_f} + W_{v\_f} = \mathbf{79}$ kN/m

Factored horizontal at-rest forces on wall

Surcharge $F_{sur\_f} = \gamma_{f\_l} \times K_0 \times \text{Surcharge} \times h_{eff} = \mathbf{39.5}$ kN/m

Moist backfill above water table $F_{m\_a\_f} = \gamma_{f\_e} \times 0.5 \times K_0 \times \gamma_m \times (h_{eff} - h_{water})^2 = \mathbf{92.7}$ kN/m

Total horizontal load $F_{total\_f} = F_{sur\_f} + F_{m\_a\_f} = \mathbf{132.3}$ kN/m

Calculate total propping force

Propping force $F_{prop\_f} = \max(F_{total\_f} - (W_{total\_f} - \gamma_{f\_l} \times W_{live}) \times \tan(\delta_b), 0 \text{ kN/m})$

$F_{prop\_f} = \mathbf{107.8}$ kN/m

Factored overturning moments

Surcharge $M_{sur\_f} = F_{sur\_f} \times (h_{eff} - 2 \times d_{ds}) / 2 = \mathbf{70.6}$ kNm/m

Moist backfill above water table $M_{m\_a\_f} = F_{m\_a\_f} \times (h_{eff} + 2 \times h_{water} - 3 \times d_{ds}) / 3 = \mathbf{110.5}$ kNm/m

Total overturning moment $M_{ot\_f} = M_{sur\_f} + M_{m\_a\_f} = \mathbf{181.1}$ kNm/m

Restoring moments

Wall stem $M_{wall\_f} = w_{wall\_f} \times (l_{toe} + t_{wall} / 2) = \mathbf{44.6}$ kNm/m

Wall base $M_{base\_f} = w_{base\_f} \times l_{base} / 2 = \mathbf{20.1}$ kNm/m

Design vertical load $M_{v\_f} = W_{v\_f} \times l_{load} = \mathbf{33.6}$ kNm/m

Total restoring moment $M_{rest\_f} = M_{wall\_f} + M_{base\_f} + M_{v\_f} = \mathbf{98.3}$ kNm/m

Factored bearing pressure

Total vertical reaction $R_f = W_{total\_f} = \mathbf{79.0}$ kN/m

Distance to reaction $x_{bar\_f} = l_{base} / 2 = \mathbf{800}$ mm

Eccentricity of reaction $e_f = \text{abs}((l_{base} / 2) - x_{bar\_f}) = \mathbf{0}$ mm

Reaction acts within middle third of base

Bearing pressure at toe $p_{toe\_f} = (R_f / l_{base}) - (6 \times R_f \times e_f / l_{base}^2) = \mathbf{49.4}$ kN/m^2

Bearing pressure at heel $p_{heel\_f} = (R_f / l_{base}) + (6 \times R_f \times e_f / l_{base}^2) = \mathbf{49.4}$ kN/m^2

Rate of change of base reaction $\text{rate} = (p_{toe\_f} - p_{heel\_f}) / l_{base} = \mathbf{0.00}$ kN/m^2/m

Bearing pressure at stem / toe $p_{stem\_toe\_f} = \max(p_{toe\_f} - (\text{rate} \times l_{toe}), 0 \text{ kN/m}^2) = \mathbf{49.4}$ kN/m^2

Bearing pressure at mid stem $p_{stem\_mid\_f} = \max(p_{toe\_f} - (\text{rate} \times (l_{toe} + t_{wall} / 2)), 0 \text{ kN/m}^2) = \mathbf{49.4}$ kN/m^2

Bearing pressure at stem / heel $p_{stem\_heel\_f} = \max(p_{toe\_f} - (\text{rate} \times (l_{toe} + t_{wall})), 0 \text{ kN/m}^2) = \mathbf{49.4}$ kN/m^2

Calculate propping forces to top and base of wall

Propping force to top of wall

$F_{prop\_top\_f} = (M_{ot\_f} - M_{rest\_f} + R_f \times l_{base} / 2 - F_{prop\_f} \times t_{base} / 2) / (h_{stem} + t_{base} / 2) = \mathbf{36.103}$ kN/m

Propping force to base of wall $F_{prop\_base\_f} = F_{prop\_f} - F_{prop\_top\_f} = \mathbf{71.704}$ kN/m

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

Material properties

Characteristic strength of concrete f_{cu} = **40** 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} = **74** mm

Calculate shear for toe design

Shear from bearing pressure $V_{toe\_bear} = (p_{toe\_f} + p_{stem\_toe\_f}) \times l_{toe} / 2$ = **64.2** kN/m

Shear from weight of base $V_{toe\_wt\_base} = \gamma_{f\_d} \times \gamma_{base} \times l_{toe} \times t_{base}$ = **20.4** kN/m

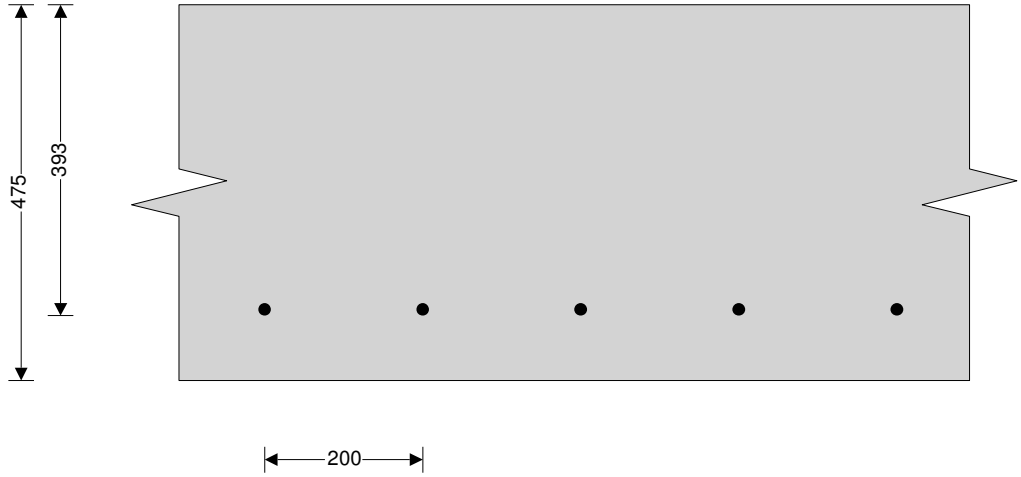
Total shear for toe design $V_{toe} = V_{toe\_bear} - V_{toe\_wt\_base}$ = **43.8** kN/m

Calculate moment for toe design

Moment from bearing pressure $M_{toe\_bear} = (2 \times p_{toe\_f} + p_{stem\_mid\_f}) \times (l_{toe} + t_{wall} / 2)^2 / 6$ = **51.9** kNm/m

Moment from weight of base $M_{toe\_wt\_base} = (\gamma_{f\_d} \times \gamma_{base} \times t_{base} \times (l_{toe} + t_{wall} / 2)^2 / 2)$ = **16.5** kNm/m

Total moment for toe design $M_{toe} = M_{toe\_bear} - M_{toe\_wt\_base}$ = **35.4** kNm/m



Check toe in bending

Width of toe b = **1000** mm/m

Depth of reinforcement $d_{toe} = t_{base} - c_{toe} - (\phi_{toe} / 2)$ = **393.0** mm

Constant $K_{toe} = M_{toe} / (b \times d_{toe}^2 \times f_{cu})$ = **0.006**

Compression reinforcement is not required

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

z_{toe} = **373** mm

Area of tension reinforcement required $A_{s\_toe\_des} = M_{toe} / (0.87 \times f_y \times z_{toe})$ = **218** mm²/m

Minimum area of tension reinforcement $A_{s\_toe\_min} = k \times b \times t_{base}$ = **618** mm²/m

Area of tension reinforcement required $A_{s\_toe\_req} = \max(A_{s\_toe\_des}, A_{s\_toe\_min})$ = **618** mm²/m

Reinforcement provided **16 mm dia.bars @ 200 mm centres**

Area of reinforcement provided $A_{s\_toe\_prov}$ = **1005** mm²/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress $v_{toe} = V_{toe} / (b \times d_{toe})$ = **0.111** N/mm²

Allowable shear stress $v_{adm} = \min(0.8 \times \sqrt{}(f_{cu} / 1\ \text{N/mm}^2), 5) \times 1\ \text{N/mm}^2$ = **5.000** 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} = **0.471** N/mm²

v_{toe} < v_{c_toe} - No shear reinforcement required

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

Material properties

Characteristic strength of concrete f_{cu} = **40** N/mm²

Characteristic strength of reinforcement f_y = **500** N/mm²

Wall details

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

Cover to reinforcement in stem c_{stem} = **75** mm

Cover to reinforcement in wall c_{wall} = **75** mm

Factored horizontal at-rest forces on stem

Surcharge $F_{s\_sur\_f} = \gamma_{f\_l} \times K_0 \times \text{Surcharge} \times (h_{eff} - t_{base} - d_{ds})$ = **34.3** kN/m

Moist backfill above water table $F_{s\_m\_a\_f} = 0.5 \times \gamma_{f\_e} \times K_0 \times \gamma_m \times (h_{eff} - t_{base} - d_{ds} - h_{sat})^2$ = **69.7** kN/m

Calculate shear for stem design

Surcharge $V_{s\_sur\_f} = 5 \times F_{s\_sur\_f} / 8$ = **21.4** kN/m

Moist backfill above water table $V_{s\_m\_a\_f} = F_{s\_m\_a\_f} \times b_l \times ((5 \times L^2) - b_l^2) / (5 \times L^3)$ = **53.6** kN/m

Total shear for stem design $V_{stem} = V_{s\_sur\_f} + V_{s\_m\_a\_f}$ = **75** kN/m

Calculate moment for stem design

Surcharge $M_{s\_sur} = F_{s\_sur\_f} \times L / 8$ = **14.3** kNm/m

Moist backfill above water table $M_{s\_m\_a} = F_{s\_m\_a\_f} \times b_l \times ((5 \times L^2) - (3 \times b_l^2)) / (15 \times L^2)$ = **34.8** kNm/m

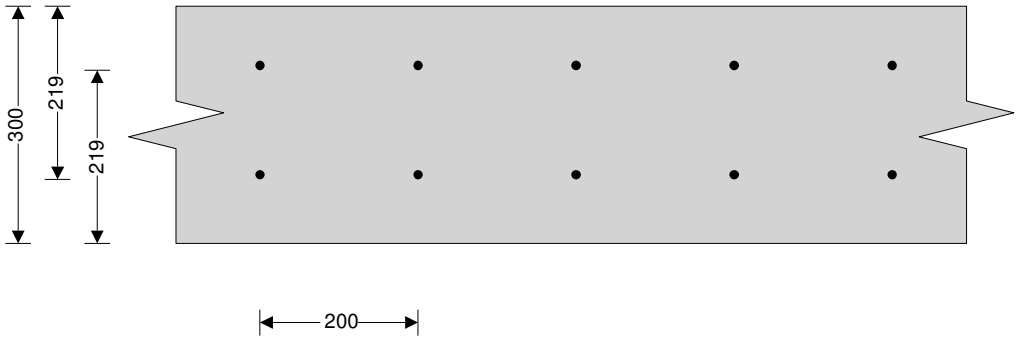
Total moment for stem design $M_{stem} = M_{s\_sur} + M_{s\_m\_a}$ = **49.1** kNm/m

Calculate moment for wall design

Surcharge $M_{w\_sur} = 9 \times F_{s\_sur\_f} \times L / 128$ = **8** kNm/m

Moist backfill above water table $M_{w\_m\_a} = F_{s\_m\_a\_f} \times 0.577 \times b_l \times [(b_l^3 + 5 \times a_l \times L^2) / (5 \times L^3) - 0.577^2 / 3]$ = **15** kNm/m

Total moment for wall design $M_{wall} = M_{w\_sur} + M_{w\_m\_a}$ = **23.1** kNm/m



Check wall stem in bending

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

Depth of reinforcement $d_{stem} = t_{wall} - c_{stem} - (\phi_{stem} / 2)$ = **219.0** mm

Constant $K_{stem} = M_{stem} / (b \times d_{stem}^2 \times f_{cu}) = \mathbf{0.026}$

Compression reinforcement is not required

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

$z_{stem} = \mathbf{208}$ mm

Area of tension reinforcement required $A_{s\_stem\_des} = M_{stem} / (0.87 \times f_y \times z_{stem}) = \mathbf{542}$ mm²/m

Minimum area of tension reinforcement $A_{s\_stem\_min} = k \times b \times t_{wall} = \mathbf{390}$ mm²/m

Area of tension reinforcement required $A_{s\_stem\_req} = \max(A_{s\_stem\_des}, A_{s\_stem\_min}) = \mathbf{542}$ mm²/m

Reinforcement provided **12 mm dia.bars @ 200 mm centres**

Area of reinforcement provided $A_{s\_stem\_prov} = \mathbf{565}$ mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress $v_{stem} = V_{stem} / (b \times d_{stem}) = \mathbf{0.343}$ N/mm²

Allowable shear stress $v_{adm} = \min(0.8 \times \sqrt{}(f_{cu} / 1\ \text{N/mm}^2), 5) \times 1\ \text{N/mm}^2 = \mathbf{5.000}$ N/mm²

PASS - Design shear stress is less than maximum shear stress

From BS8110:Part 1:1997 – Table 3.8

Design concrete shear stress $v_{c\_stem} = \mathbf{0.547}$ N/mm²

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

Check mid height of wall in bending

Depth of reinforcement $d_{wall} = t_{wall} - c_{wall} - (\phi_{wall} / 2) = \mathbf{219.0}$ mm

Constant $K_{wall} = M_{wall} / (b \times d_{wall}^2 \times f_{cu}) = \mathbf{0.012}$

Compression reinforcement is not required

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

$z_{wall} = \mathbf{208}$ mm

Area of tension reinforcement required $A_{s\_wall\_des} = M_{wall} / (0.87 \times f_y \times z_{wall}) = \mathbf{255}$ mm²/m

Minimum area of tension reinforcement $A_{s\_wall\_min} = k \times b \times t_{wall} = \mathbf{390}$ mm²/m

Area of tension reinforcement required $A_{s\_wall\_req} = \max(A_{s\_wall\_des}, A_{s\_wall\_min}) = \mathbf{390}$ mm²/m

Reinforcement provided **12 mm dia.bars @ 200 mm centres**

Area of reinforcement provided $A_{s\_wall\_prov} = \mathbf{565}$ mm²/m

PASS - Reinforcement provided to the retaining wall at mid height is adequate

Check retaining wall deflection

Basic span/effective depth ratio $\text{ratio}_{bas} = \mathbf{20}$

Design service stress $f_s = 2 \times f_y \times A_{s\_stem\_req} / (3 \times A_{s\_stem\_prov}) = \mathbf{319.5}$ N/mm²

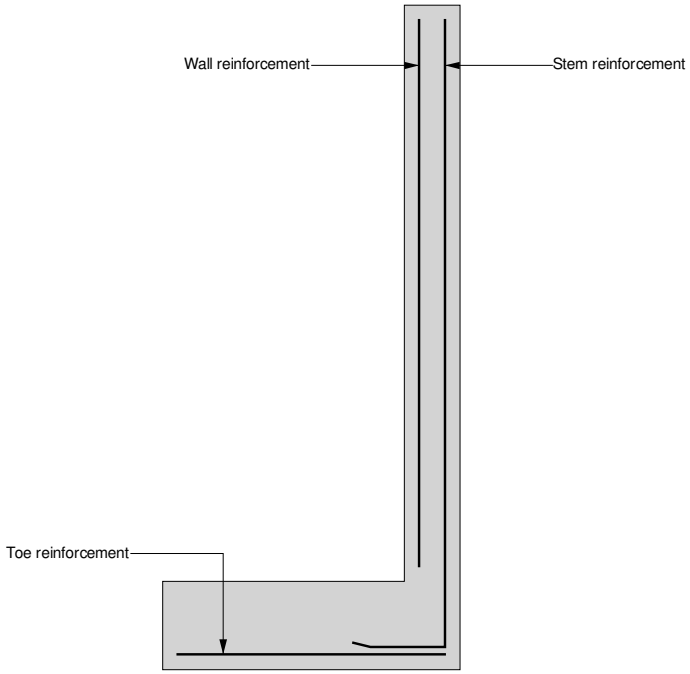
Modification factor $\text{factor}_{tens} = \min(0.55 + (477\ \text{N/mm}^2 - f_s)/(120 \times (0.9\ \text{N/mm}^2 + (M_{stem}/(b \times d_{stem}^2)))),2) = \mathbf{1.23}$

Maximum span/effective depth ratio $\text{ratio}_{max} = \text{ratio}_{bas} \times \text{factor}_{tens} = \mathbf{24.65}$

Actual span/effective depth ratio $\text{ratio}_{act} = h_{stem} / d_{stem} = \mathbf{14.16}$

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 16 mm dia.@ 200 mm centres - (1005 mm^2/m)
Wall bars - 12 mm dia.@ 200 mm centres - (565 mm^2/m)
Stem bars - 12 mm dia.@ 200 mm centres - (565 mm^2/m)

RE: FW: BIA 12336-77 109 Gloucester Avenue
Tyrone Bowen
to:
camdenaudit@campbellreith.com
14/11/2016 12:11
Cc:
"Aaron Fletcher (afletcher@manicaarchitecture.com)", "FatimaDrammeh@campbellreith.com", "Smith, Kristina"
Hide Details
From: Tyrone Bowen <Tyrone.Bowen@carltd.com>
To: "camdenaudit@campbellreith.com" <camdenaudit@campbellreith.com>
Cc: "Aaron Fletcher (afletcher@manicaarchitecture.com)" <afletcher@manicaarchitecture.com>, "FatimaDrammeh@campbellreith.com" <FatimaDrammeh@campbellreith.com>, "Smith, Kristina" <Kristina.Smith@camden.gov.uk>

3 Attachments

Pages from 2812_109 Gloucester Avenue London NW1 8LB - Basement Impact A....pdf DELTA-System-500-brochure-17-05-16.pdf

Damage Category Assessment rev A.pdf

Hi Graham

We refer to your email below and Kristina Smith's email of 09.11.16 with reference to the outstanding items in Appendix 2 of the BIA Audit.

Please see below our combined response to the relevant items for ease as requested:

- Query no. 7 – Please see attached calculation and sketch for the ground movement assessment as requested. We have added a plan to show anticipated movement contours and clarified the sketch section on pg M1A. Mitigation measures have been described in the original BIA text and an outline sequence of construction sketch included for clarity – see pg 33. The works are to be carried out in short hit and miss excavations with high and low level temporary propping to the existing walls during the works.

- Query no. 8 – Movement monitoring proposals are included in the original BIA document. The following trigger levels were also confirmed in our email to Campbell Reith dated 24.10.16. We understand that this item should have been recorded as closed.
  Green - up to 1mm movement
  Amber - between 2-5mm movement
  Red - greater than 5mm movement.

- Query no. 9 - The trial hole location plan with amendments is attached. North arrow and property numbers are marked up. The trial hole was adjacent to 111 Gloucester Avenue.

- Query no. 10 – A drained cavity system is to be provided to achieve a Grade 3 level of waterproofing. It is anticipated that a Delta Membrane system (DELTA® MS-500 cavity system) will be used – see attached.

regards

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Director – Structural Engineering
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From: GrahamKite@campbellreith.com [mailto:GrahamKite@campbellreith.com] On Behalf Of camdenaudit@campbellreith.com
Sent: 14 November 2016 10:21
To: Tyrone Bowen <Tyrone.Bowen@carltd.com>
Cc: Aaron Fletcher (afletcher@manicaarchitecture.com) <afletcher@manicaarchitecture.com>; camdenaudit@campbellreith.com;

RE: 109 Gloucester Avenue - 2016/2216/P

Tyrone Bowen to: FatimaDrammeh@campbellreith.com 24/10/2016 13:07

Cc: "Aaron Fletcher (afletcher@manicaarchitecture.com)" , "Smith, Kristina" , "camdenaudit@campbellreith.com" , Philip Miles

History: This message has been forwarded.

Dear Fatima

Thank you for your email. Please see below our response to the points raised.

1) The underpinning will extend into the Clay.
2) The report states that the Contractor is to allow for temporary dewatering to cope with any water ingress from rainfall etc. These measures will also be used to deal with any ground water inflows.
3) Retaining wall parameters to follow.
4) This was a typo in the report. It should read 'Category 1 - Very Slight'.
5) Anticipated ground movement statement to follow.
6) The revised trigger levels are as follows:

Green - up to 1mm movement
Amber - between 2-5mm movement
Red - greater than 5mm movement.

Regards

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-----Original Message-----
From: FatimaDrammeh@campbellreith.com [mailto:FatimaDrammeh@campbellreith.com]
Sent: 20 October 2016 12:04
To: Tyrone Bowen <Tyrone.Bowen@carltd.com>
Cc: Aaron Fletcher (afletcher@manicaarchitecture.com) <afletcher@manicaarchitecture.com>; Smith, Kristina <Kristina.Smith@camden.gov.uk>; camdenaudit@campbellreith.com
Subject: RE: 109 Gloucester Avenue - 2016/2216/P

Dear Tyrone,
We have looked through the revised report you sent across and have the following queries/comments:

The ground investigation encountered Made Ground to a maximum depth of 1.30m below the vaults. It is stated in the BIA that the required excavation depth is approx. 1.20m. Please clarify the depth of underpinning to confirm these will be founded in competent strata.
It is stated in non technical summary of the slope stability screening that 'groundwater was not encountered in the investigation, therefore

temporary dewatering measures are not required'. Groundwater monitoring was not undertaken. It should be noted that not encountering groundwater in the exploratory holes does not indicate its absence. The groundwater level is unlikely to have reached equilibrium conditions during excavation and drilling hence its absence. Although the anticipated flows are unlikely be significant, the presence of perched water in the Made Ground cannot be discounted, therefore temporary measures to deal with this should be considered.
Although some interpretation is provided in the ground investigation report, retaining wall parameters are not included. Please provide these.
It is stated in the conclusions that the anticipated damage is likely to be 'Category 1 (Negligible)'. Category 1 is 'very slight' damage whilst Negligible damage is Category 0. Please clarify. If Category 1 damage is anticipated, please refer to CPG4 (2015) paragraph 3.30 on the need for mitigation measures.
Additionally an indication of the vertical and horizontal movements as a result of the underpinning and excavation used to determine the damage category should be provided together with justification to support these or supporting analysis.
Please reconsider the Amber trigger levels given in the movement monitoring proposal. These would appear to be in excess of movements for Category 2 damage.

Kind regards
Fatima Drammeh
Geotechnical Engineer

(Embedded image moved to file: pic61579.jpg)

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41-45 Blackfriars Road,
London
SE1 8NZ

Tel +44 (0)20 7340 1700
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(Embedded image moved to file: pic10698.gif)

From: Tyrone Bowen <Tyrone.Bowen@carltd.com>
To: "Smith, Kristina" <Kristina.Smith@camden.gov.uk>, "FatimaDrammeh@campbellreith.com" <FatimaDrammeh@campbellreith.com>
Cc: "Aaron Fletcher (afletcher@manicaarchitecture.com)" <afletcher@manicaarchitecture.com>, "Cockrell, Nathan" <nathan.cockrell@lazard.com>, Dana Haimoff <dana.haimoff@btinternet.com>
Date: 23/09/2016 15:45
Subject: RE: 109 Gloucester Avenue - 2016/2216/P

Dear Kristina and Fatima

We have reviewed your comments on the BIA Audit tracker and have amended our report accordingly - please see attached.

If you have any further queries I would be happy to discuss with you.

Regards

Tyrone

Tyrone Bowen MEng CEng MIStructE
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[attachment "2812_109 Gloucester Avenue London NW1 8LB - Basement Impact Assessment R....pdf" deleted by Fatima Drammeh/CRH]

RE: 109 Gloucester Avenue - 2016/2216/P

Tyrone Bowen to: FatimaDrammeh@campbellreith.com 31/10/2016 10:50

Cc: "Aaron Fletcher (afletcher@manicaarchitecture.com)" , "Smith, Kristina" , "camdenaudit@campbellreith.com" , Philip Miles

1 attachment

2812_109 Gloucester Avenue - Front Retaining Wall Rev A.pdf

Dear Fatima

Further to our previous email please see below response to points 3 and 5.

3) Retaining wall parameters - please see information provided by Brown 2 Green based on their experience of the type of ground encountered. Retaining wall calculations attached.

As requested we have presented estimated values for earth pressure coefficients. These figures are based on our experience and the soil descriptions.

Soil Type	C' kN/m2	Ø°	ϒkN/m3
Made Ground	0	18	20
London Clay	0	21	20

The estimated heave will be less than 1mm.

Kind regards

Philip Miles
Director
Brown 2 Green Associates
Suite 1, Wenden Court
Station Road, Wendens Ambo
Nr. Saffron Walden
Essex, CB11 4LB
Tel: 01799 542473
Mobile: 07528 650733
Web site:
http://webdefence.global.blackspider.com/urlwrap/?q=AXicHcrBCgIhFAXQC7WIPkYHJaFWDcRsWwTtHZG0fDq9cZJW_XrR-pz1Ch8DbM4Ap7fWdzHzS5CNyZVcuSThCmHZX_unMZeuU0ppDLZGsie2RD4cnaVp9CmxjzX8e6h1OkjZWhMjl5bVjb3PPxLLQwLY7oAvx1UljA&Z

5) Brown 2 Green have anticipated heave will be less than 1mm.

We hope this clarifies these items. If you have any queries please do not hesitate to contact me.

regards

Tyrone Bowen MEng CEng MIStructE
Director – Structural Engineering
CAR Ltd

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Unit 6, 25 Gwydir Street
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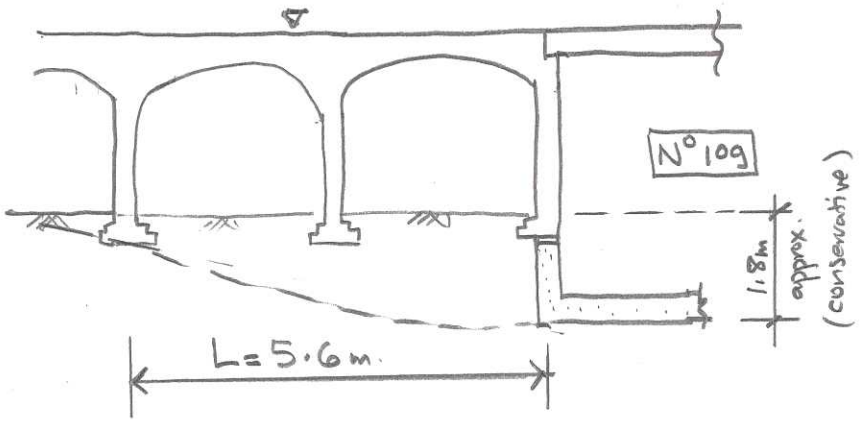
Tel: 01223 460475

Date	Job No	Sheet No	Rev
Nov-16	2182	M1	A
Eng: TB	Project: 109 Gloucester Avenue, London		

DAMAGE CATEGORY ASSESSMENT.

CIRIA C580



SECTION.

Table 2.4: Horiz. surface movement @ wall $= \frac{0.15}{100} \times 1800 = 2.7\text{mm}$.

Distance to negligible movement $= 4 \times 1800 = 7200\text{ mm}$.

Fig 2.11

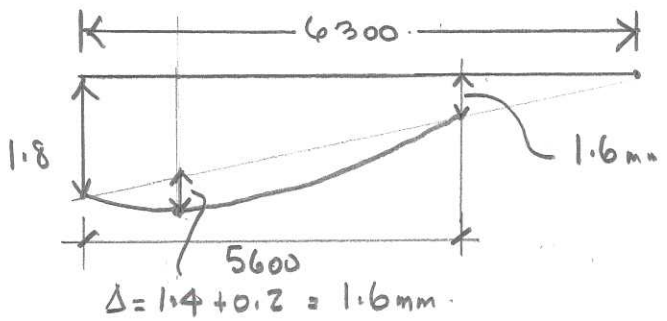
Vertical movements:- Distance from wall = 0 m

$\therefore$ Settlement/max excavation depth (%) = 0.04 %

@ Distance = 0.5m, ratio = 0.08 % (Settlement = 1.4mm)

Surface movement @ wall $= \frac{0.1}{100} \times 1800 = 1.8\text{mm}$.

Distance to negligible movement = $3.5 \times 1800 = 6300\text{mm}$.



CAR Ltd
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Date	Job No	Sheet No	Rev
Nov-16	2182	M2.	A

Eng	Project
TB	109 Gloucester Avenue, London

Δ/L ratio = $(1.6/5600) \times 100 = 0.029\%$

Horizontal strain = $(2.7/5600) \times 100 = 0.05\%$.

From figure 2.18 $\Rightarrow$ Damage Category 1 or better.

0mm/negligible

0.6mm

1.2mm

Nº 111

operty Boundary

1.8mm

Washer Dryer

UTILITY

1.2mm

1.8mm

0mm/
negligible

0.6mm

LIGHTWELL

Nº 103

SHOWER ROOM

GLOUCESTER AVENUE

only
this section of
Slab to be lowered.

1.8mm

Nº 107

1.2mm

N

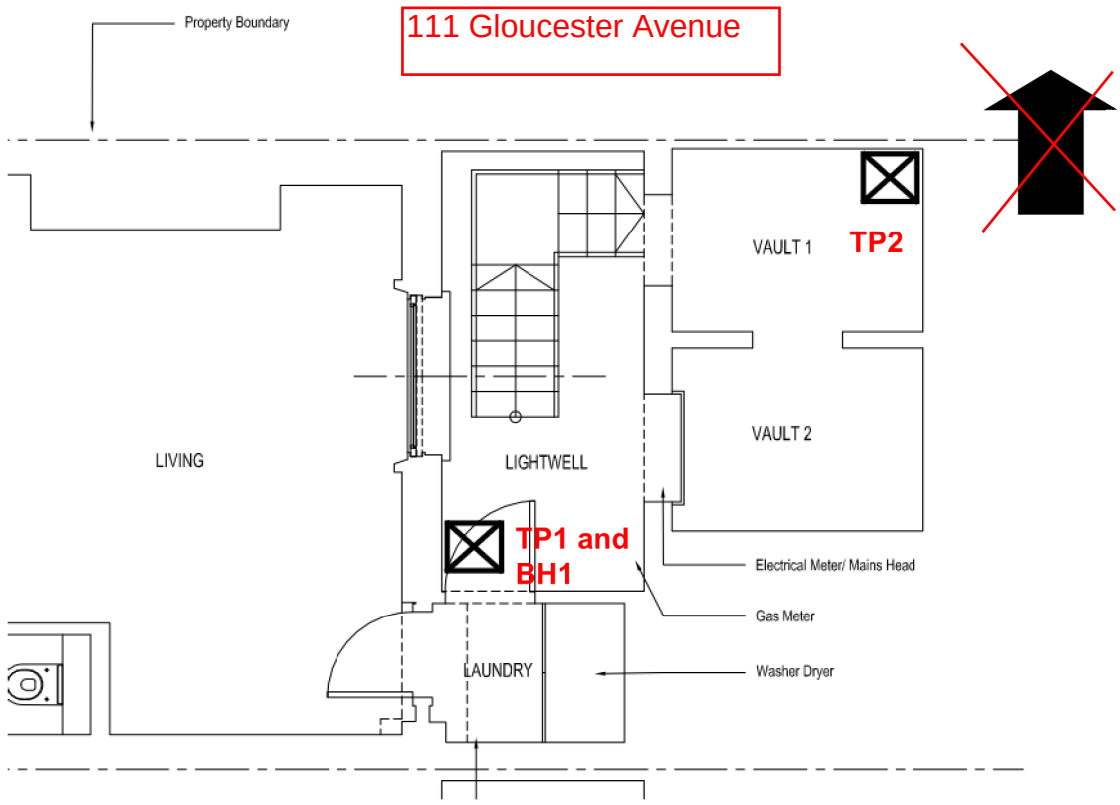
SCALE 1:50 @ A3.

(Movement @ 1m intervals
from excavation).

0.6mm

0mm/negligible.

PLAN ON FRONT VAULTS. (Ground Movement Assessment)



Project Number: 1699	Project: 109 Gloucester Avenue, London	Scale: NTS
Figure 3	**Trial Pits and Borehole Location Plan**	Brown 2 Green

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