APPENDIX C:
ROBERT BIRD GROUP, HERITAGE BUILDING STRUCTURAL WORKS FOR TEA HOUSE

C

Robert Bird Group

Heritage Building Structural Works for

Tea House

Issue: F – For Authority Approval

26 May 2022

Prepared For: Clarendon Tea House Pty Ltd

Project No.: 20220M

Document No.: 20220M-RBG-ZZ-XX-RP-ST-00002-220526

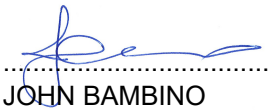
Report Amendment Register

Issue Ref	Amended Section(s)	Issue / Amendment Details	Author(s)	Reviewer	Date
A	All	Draft	Ben Howie	Justin Hettinga	18/12/20
B	Section 3, Appendices	For Authority Approval	Ben Howie	Justin Hettinga	22/02/21
C	Minor Updates	For Authority Approval	Ben Howie	Justin Hettinga	25/02/21
D	Minor Updates	For Authority Approval	Ben Howie	Justin Hettinga	23/06/21
E	Minor Updates	For Authority Approval	Ben Howie	Justin Hettinga	28/06/21
F	Minor Updates	For Authority Approval	Bridget Scanlan	John Bambino	26/05/2022

REVISION/ISSUE AUTHOR:

.....
BRIDGET SCANLAN
Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 26 May 2022

REVIEWER:



.....
JOHN BAMBINO
Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 26 May 2022

Executive Summary

The heritage Tea House building located at 28-34 Clarendon Street, Southbank, Victoria is proposed to be refurbished as part of the greater development planned for the site. This report sets out the structural works for the Robur Tea House Building to make it fit for purpose in accordance with the design proposed by Snohetta and the requirements set out by the building surveyor PLP. Certain testing, investigations and surveys are still pending, therefore the works set out in this report are preliminary and subject to these results. This report provides preliminary design propositions for discussion purposes.

Table of Contents

APPENDICES

1 Introduction

The Tea House Project is located at 28-34 Clarendon Street, Southbank, Victoria, and includes a 25-storey hotel, residential and office building located adjacent to the heritage Tea House building. The heritage building is proposed to be refurbished and minor modifications are proposed such that it is brought into compliance with Australian Standards as set out by the building surveyor. The heritage building is proposed to connect to the new building with two bridges and have a new internal stair core as per the architectural drawings by Snohetta dated 12 May 2021.

2 Investigations and Testing on the Heritage Building

No drawings or documentation on the existing structure have been located. Therefore, to determine the geometry, material properties and condition of the building, RBG have provided a Testing and Investigations Brief (refer to Appendix A).

Some of the required investigations, surveys and material testing have not yet been completed; therefore, this report is in preliminary draft format and based on the limited information available.

3 Seismic Upgrades

3.1 Compliance with Australian Standards and General Strategy

The requirements for compliance with the NCC and Australian Standards have been determined with the project building surveyor Frank Isgro from PLP Building Surveyors. Certification of the building structure is not required as compliance requirements for new buildings are not applicable, and the construction and material properties of the existing building cannot be determined to a sufficient degree of confidence to enable it.

It is required that the structure be brought into compliance with Australian Standard 3826 for seismic requirements. For this to be achieved, rectification and strengthening works are of the building are required as described below.

3.2 Connection of floor and roof framing to masonry external walls

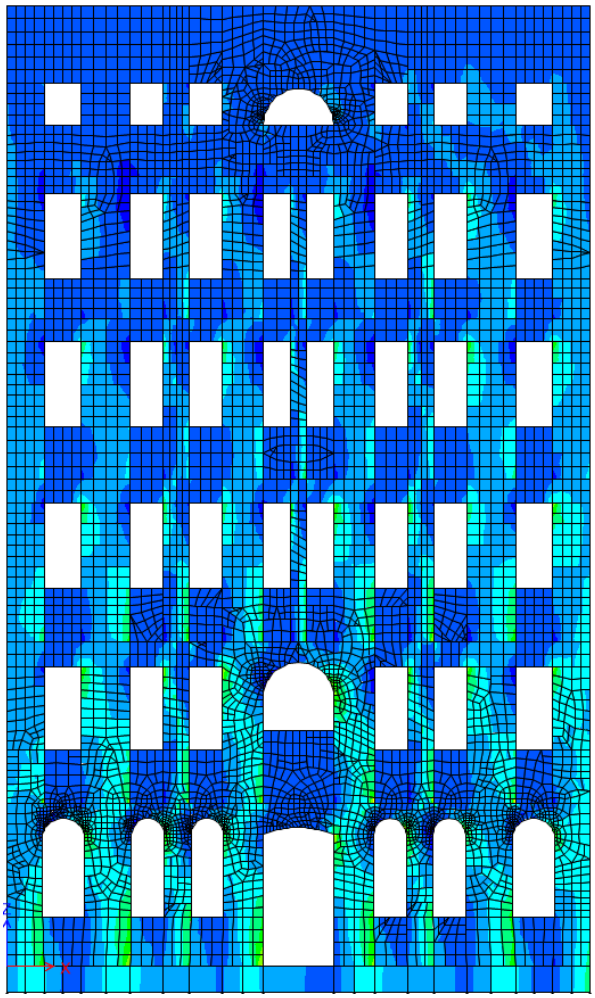
To ensure sufficient connectivity between the timber roof and floor diaphragm framing and the external masonry walls in an earthquake, strengthening of the connections between the two is required. Appendix B provides preliminary designs of the floor-masonry wall and roof-masonry wall connections. The floor-wall interface of every floor and roof will require this.

3.3 Masonry external walls

The primary direction of concern when considering the lateral seismic load on the heritage structure is that acting in the North-South direction. The lateral load in this direction is proposed to be taken by portal frame action in the East (Front) and West (Back) walls of the Tea House, as utilising the existing structure minimises the extent of large-scale structural works within the footprint of the structure.

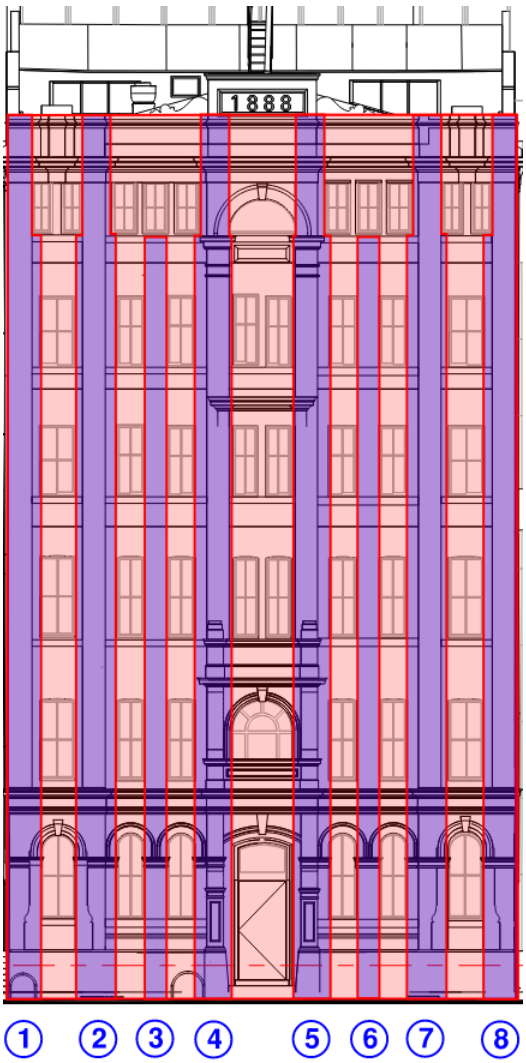
A finite element analysis of the Tea House façade has been completed to determine the regions where tensile stresses in the masonry exceed 0.2MPa (value to be verified via testing, as specified elsewhere in this report), at which point the masonry is deemed to have cracked and no longer contributes to the lateral resistance of the structure. These regions have either been assumed to be cracked and removed from the analysis or will require strengthening with steel plates to resists the tensile force once the masonry has cracked. The image below shows a preliminary stress plot

from the finite element analysis, where regions shaded dark blue exceed the 0.2MPa tension threshold. It can be noted that the most significant regions of high tensile load occur towards the top of the structure, where the precompression caused by the self-weight of the masonry is much lower.



Stress Plot of Front Façade Under Seismic Loads

Upon inspection of the heritage façade, there are eight masonry piers forming the primary load path for gravitational loads. The windows, with the exception of the uppermost level, generally sit aligned between the piers so as not to interrupt the vertical load path of the façade. The piers are numbered and indicated in purple in the below image.



Load Bearing Masonry Piers

The piers are joined via thin (generally 2 courses thick) masonry spandrels sitting vertically between the windows. These elements form the 'beams' of the portal frame system, however as they are much thinner than, and thus don't sit flush with the adjacent masonry piers, we consider that attempting to strengthen these elements would be both complex and inefficient. Our methodology for assessing the seismic load capacity of the structure has therefore focussed on strengthening the primary piers, whilst allowing the infill masonry spandrels to crack and shed load back to the strengthened piers.

To achieve compliance with AS3826, we therefore propose to strengthen piers 1, 2, 4, 5, 7 and 8 via the application of two vertical tension bars to either side of the pier up the full height of the building. A PFC running horizontally located on the underside of the joists on each level provides portal frame action in combination with these rods, and SHS frames on the lowest two levels provide the additional stiffness and strength needed to withstand the design seismic loadings. The proposed strengthenings are shown indicatively in Appendix C. Final strengthening arrangement, member sizes, plate sizes, bolt centres and transition details at steps in the masonry are subject to further detailed design at a later stage.

Initial analysis indicates that strengthening of the connection of the wall to the footing is not required.

3.4 Foundations

The heritage consultant Lovell Chen believe that the building is supported by timber piles which have been driven down to a suitable founding material. Due to the Coode Island Silt in the area, it is highly unlikely that the building is founded on shallow foundations.

Test pits have been completed to expose the footings. The findings of these investigative works are attached in Appendix D.

Due to the tops of the piles being located below the water table, there is a low probability of degradation of the piles.

4 Framing under gravity loads

The floor framing cannot currently be inspected due to the existing ceilings still being in place. Once these are removed, surveys, investigation and testing can be done to determine the timber framing sizes, spans, gradings and damages. Structural strengthening and repair work for the floors and roof will be determined once this is done.

5 Modifications and additions to the Tea House Structure

5.1 Framing around new lift and stair core

In order to minimise impact on the existing floor members, the new stair core will utilise only the footings of the existing structure and be otherwise self-supporting. The proposed framing will consist of steel columns and floor beams, shown indicatively in Figure 1.

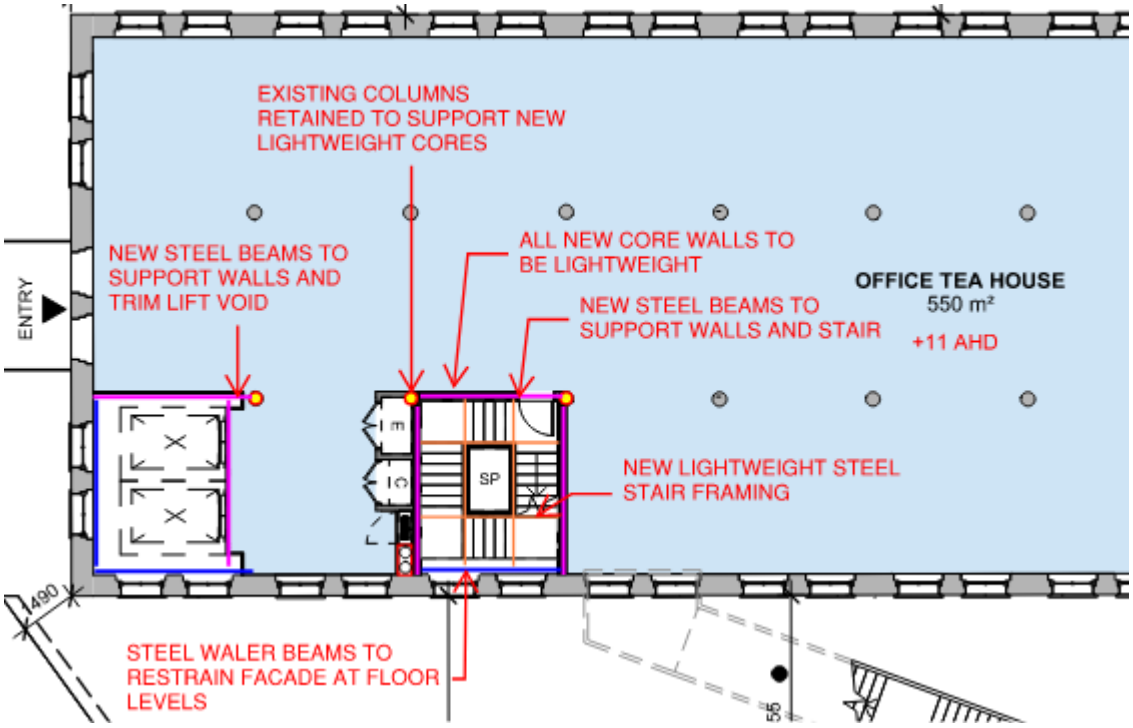


Figure 1: Lift and Stair Core Framing

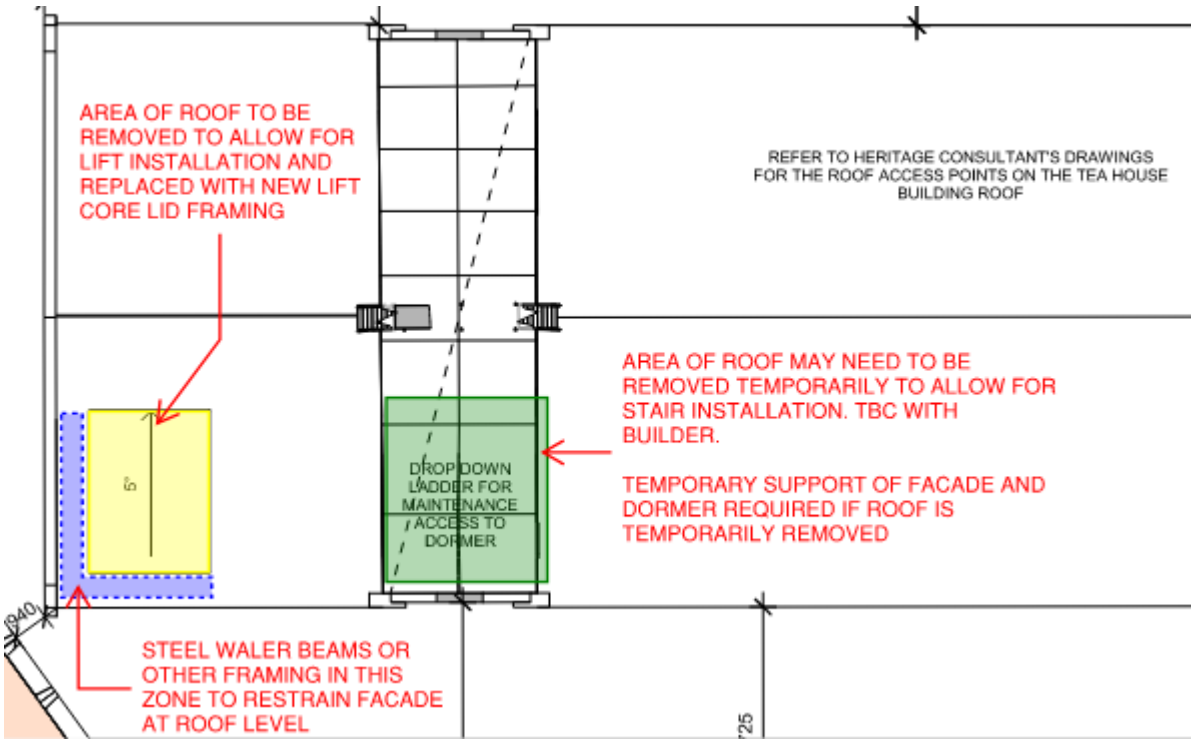


Figure 2: Lift and stair roof modifications

Installation of the proposed lifts and stairs will require partial demolition of existing framing. The anticipated extent is shown in yellow and green shading in the above figure, which shall be confirmed with the builder, once appointed.

Further modifications will be required within the crawl-space – and to a minor extent on ground floor – to connect the new framing to the existing footings. It is proposed that the framing, which may be steel or reinforced concrete beams, span between the existing footings as shown in Figure 3.

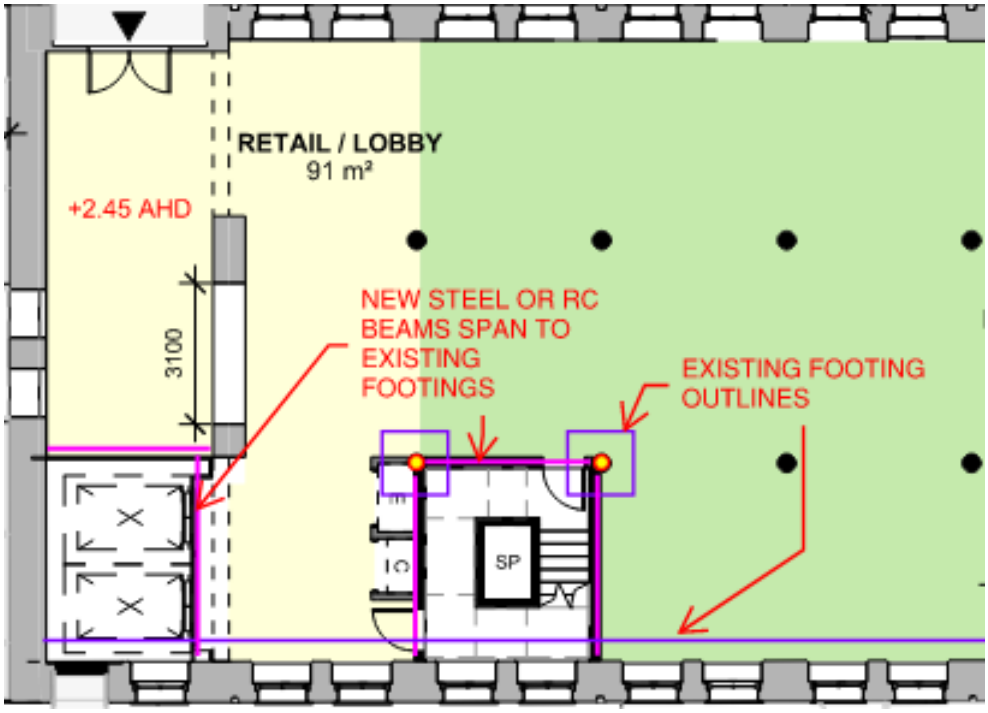


Figure 3: Lift and Stair Core Footing Concepts

For both the steel and RC beam options, the beams can simply rest on top of the bluestone load-spreader, with drill and epoxy reinforcing bars from the beam into the existing footing.

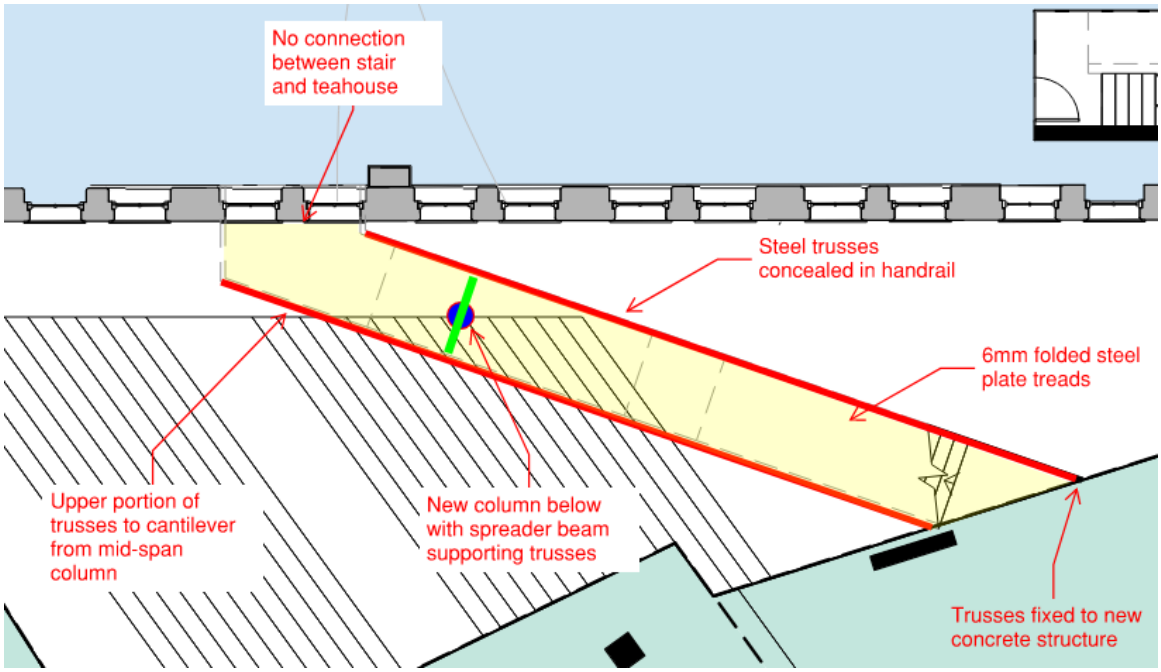
To install the RC beams, reinforcement and formwork can be delivered through the access door on the northern wall and assembled in place. The concrete would then be poured from above, requiring localised holes in ground floor.

If the steel beam option is used, the beam will need to be notched at each end to allow the beam to fit within the cavity between the top of the existing footing and the underside of the ground floor structure.

The construction of the new stair core is assumed to be possible by transporting posts and beams in through the building by hand. Craning in members or materials is assumed not to be required and shall be confirmed with the contractor once they are appointed. This will limit the area of roof requiring temporary demolition to the extent required for the new lifts.

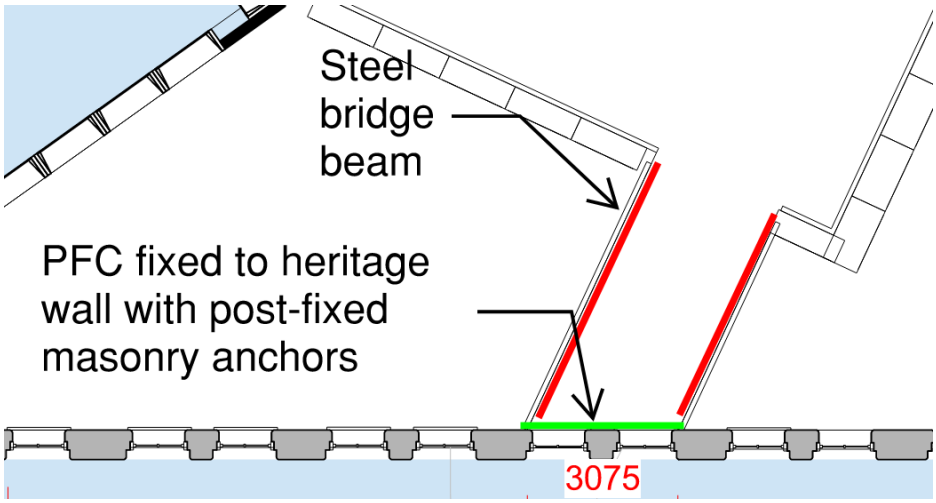
5.2 Connection of the new bridges to the heritage building

The new bridge connection to the southern side of the Tea House is proposed to be supported by the new concrete retail structure at its eastern end and by a single new column near to its western end. This structural arrangement does not rely on support from the Tea House itself and thus fixings to the heritage masonry will be kept to a minimum. The proposed arrangement is shown in the image below.



Proposed Southern Link Bridge Structural Arrangement

The bridge proposed to link to the northern face of the Tea House is intended to be constructed from two primary UB stringers fixing to a PFC positioned flush against the heritage wall. The PFC will be fixed to the façade via post-fixed masonry anchors through its web. The proposed arrangement is indicatively shown in the image below.



Proposed Northern Link Bridge Structural Arrangement

APPENDICES

Appendix A Investigations and Testings Brief

Appendix B Preliminary Connections from Floors and Roof to External Masonry Walls

Appendix C Preliminary Strengthening Details for Eastern & Western Walls

Appendix D Geotechnical Report on Test Pits Exposing Existing Footings

Appendix A Investigations and Testings Brief

Robert Bird Group

Investigations and Testing Brief

Tea House Redevelopment

Issue: D (Draft)

26 May 2022

Prepared For: Clarendon Tea House Pty Ltd

Project No.: 20220M

Document No.: 20220M-RBG-ZZ-XX-RP-ST-00001-220526

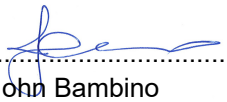
Report Amendment Register

Issue Ref	Amended Section(s)	Issue / Amendment Details	Author(s)	Reviewer	Date
Draft	All	Draft	Justin Hettinga	John Bambino	26/10/20
B-Draft	All	Minor updates	Justin Hettinga	John Bambino	5/11/20
C-Draft	All	Minor updates	Ben Howie	Justin Hettinga	25/02/21
D-Draft	2	Minor updates	Bridget Scanlan	John Bambino	26/05/22

REVISION/ISSUE AUTHOR:

.....
Bridget Scanlan
Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 26 May 2022

REVIEWER:



.....
John Bambino
Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 26 May 2022

Table of Contents

1 Introduction

This report sets out the testing and investigations on the heritage Tea House building located at 28-34 Clarendon Street, Southbank. The purpose of these works is to determine the structural geometry, member sizes, and general condition of the existing structure. As existing drawings have not been located for the building, the investigations are intended to provide sufficient information such that structural analysis can be performed.

Further investigations and testing may be required in addition to those described in this report, as the results from the first round of investigations may uncover areas requiring further investigations. Portions of the existing structure are currently not visible, for example the floor framing is covered by ceiling linings and the timber piles cannot be inspected without local excavation.

All testing, investigations and surveys are to be organized by the project manager.

2 Investigation of the existing foundations

The existing foundations, which are understood to be timber piles, shall be investigated to determine if there is any damage or deterioration. The following scope is proposed for their investigation:

- Excavate locally to expose the tops of the timber piles under a pile cap. The pile cap shall not be undermined, both RBG and Golders shall be on site during excavation works. A timber specialist shall also be in attendance when the tops of the timber piles are exposed.
- Measure the dimensions of the existing pile cap including height, length and depth
- Determine the construction of the existing pile cap: construction material and dimensions. Determine the condition and map any deterioration observed
- Do integrity testing on the pile to determine its approximate length
- Determine the timber grade and species of the pile, and drill a core sample of the pile to determine any deterioration across its section – to be done by the timber specialist

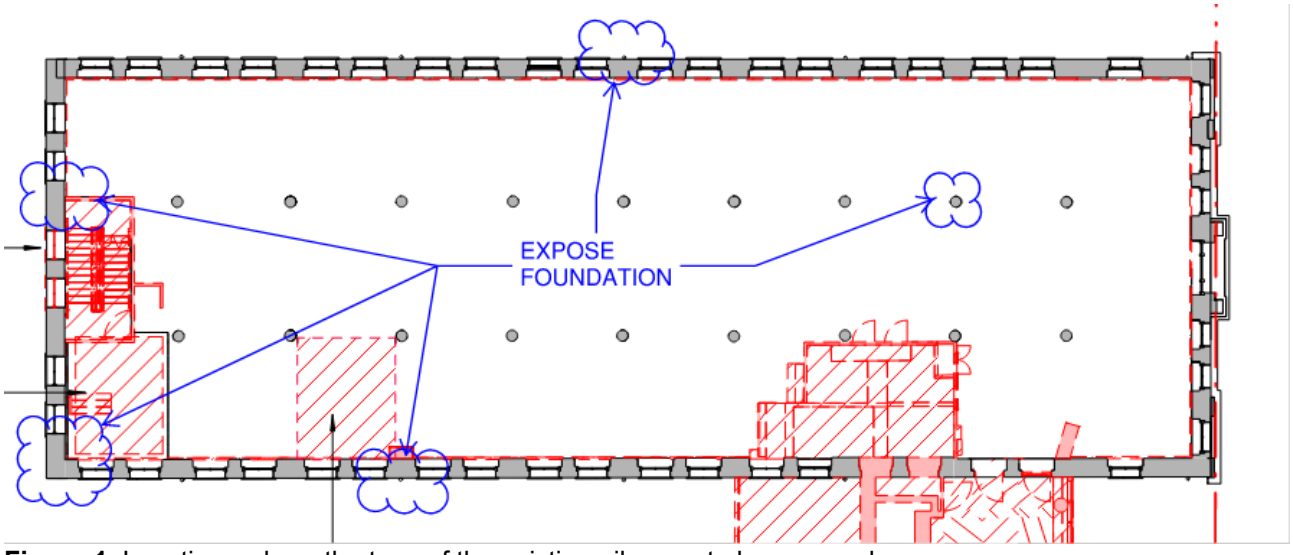


Figure 1: Locations where the tops of the existing piles are to be exposed.

3 Investigation of retaining wall footing along western site boundary

The retaining wall on the neighbouring site along the site boundary to the west and north may result in surcharge loading on the proposed site retention. The drawings for this retaining wall shall be provided to RBG for consideration in the structural design. In addition, a test is proposed within the boundary of the Tea House site to determine if the footing from the neighbouring retaining wall is protruding into the site. The trench shall

be narrow and localised, and dug under the supervision of RBG and a geotechnical engineer. The location is proposed in the following figure:

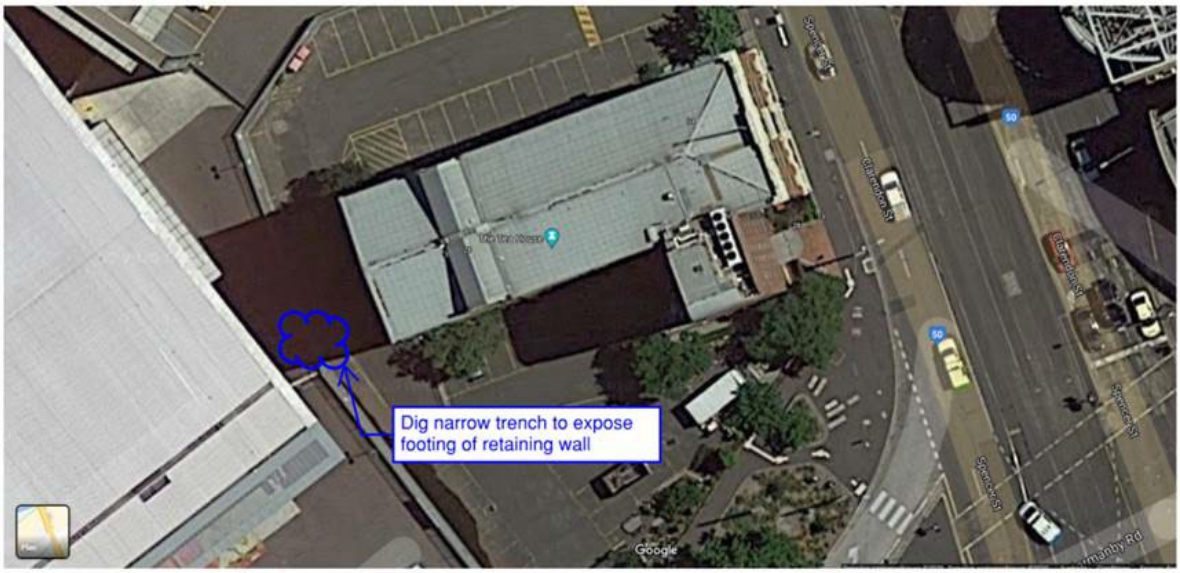


Figure 2: Location of narrow test pit along site boundary to investigate the footing of the retaining wall on the neighbouring site

4 Brickwork survey

In order for RBG to complete structural analysis of the existing building, the geometry and thicknesses of the existing masonry walls shall be determined, as per the following scope:

- Determine the thickness of the brickwork for all walls and note the internal geometry of the wall (i.e. number of wythes).
- Provide elevations of all brick walls with thicknesses marked on an elevation drawing of the wall. Provide a part plan referencing the location of each elevated wall.
- Determine if masonry walls are rubble filled or solid masonry.

The brickwork survey shall be done via non-destructive methods such as visual surveys.

5 Masonry testing

In order for RBG to determine the structural capacity of the existing masonry, testing of masonry samples shall be completed, as per the following:

- Perform 2 minimum tests of the following:
    - Test representative masonry prisms in accordance with AS 3700 Appendix C and AS 3826-1998 clause 3.3.2 (b) to determine Characteristic compressive strength of the masonry
    - Perform bond wrench tests to determine Characteristic flexural tensile strength of the masonry in accordance with AS 3700 Appendix D and AS 3826-1998 clause 3.3.3.

The contractor shall make good with bricks similar to those removed for the test, and with mortar of similar composition to that of the existing shall be used. The proposed bricks and mortar shall be reviewed and approved by RBG and Lovell Chen prior to use.

Note: If this test is not performed, AS 3826-1998 stipulates that the characteristic flexural tensile strength of masonry shall be taken as zero in the absence of in situ test data. Note that not testing and using a flexural tensile strength of zero will likely result in a significant increase in the extent of strengthening works required.

RBG therefore recommend that this test be undertaken, as the damage to the heritage fabric by this test will be relatively minor in comparison with the strengthening works likely required should the test not be performed.

RBG recommend the masonry tests be done in the crawl space beneath the ground floor slab to minimize their visual impact. The condition and type of the masonry in this location is assumed to be representative of all masonry in the building.

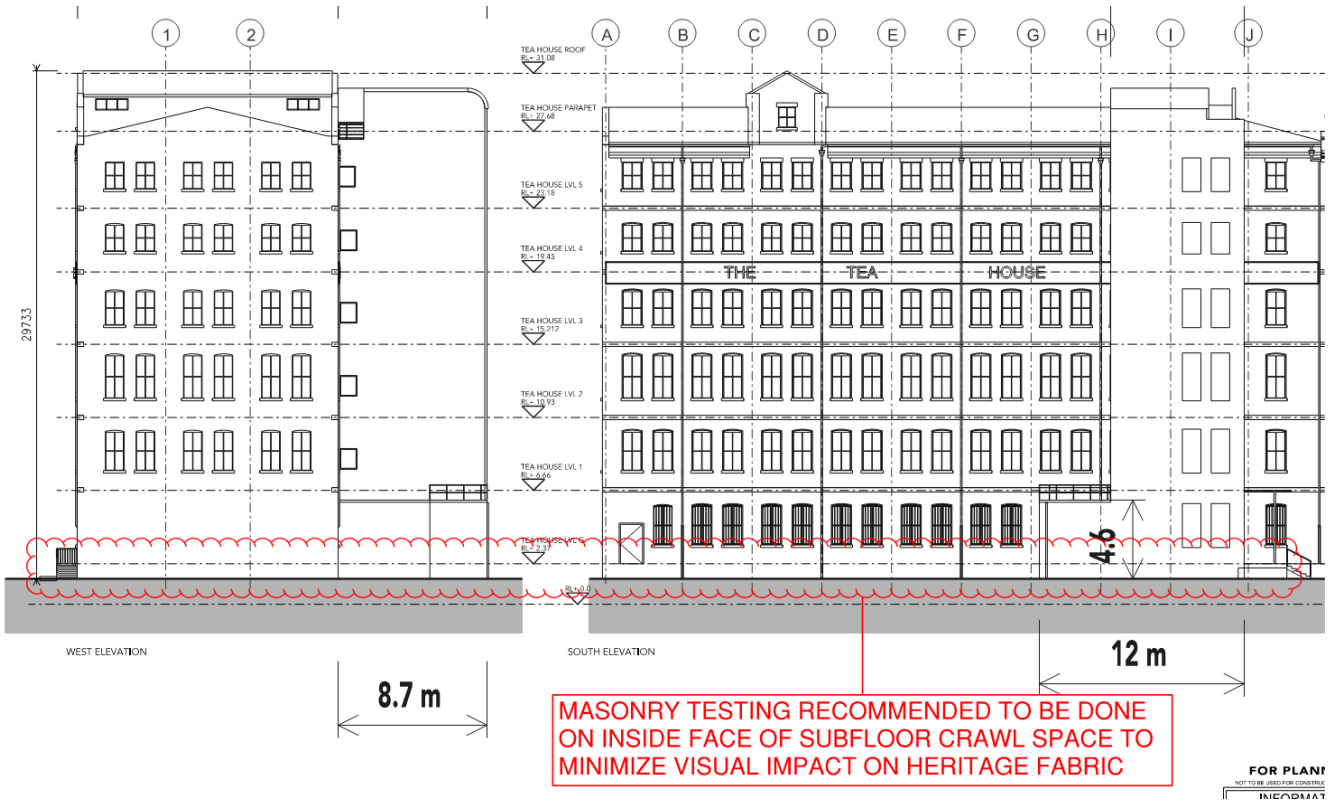


Figure 3: General location proposed for masonry sampling

6 Framing surveys, timber grading and species determination

A framing survey shall be done following the removal of the existing ceiling linings such that the existing framing is visible.

The framing surveys shall include the following:

- Provide structural sizes of floor framing members and materiality as follows:
  - Timber decking: thickness, species and grade
  - Joists: size, spacing, span length, species and grade
  - Beams: size, span, member type or member dimensions, and material grade

- Connection details:
  - Provide dimensions and details of connections, including number, size and grade of connectors (bolts, nails, screws) from:
    - Decking to joists
    - Joists to beams
    - Beams to columns

Columns:

- As the plan layout of columns is regular, all columns are anticipated to be the similar, however they may differ from one floor to another. A column in the same location shall be measured on each floor, including in the crawl space under the ground floor. The fire rating will need to be removed from the column to take the measurement.

- The dimensions of the column investigated shall include its wall thickness and material grade. A hole (max 8mm diameter) shall be drilled through the column in order to ascertain its wall thickness.
- Provide dimensions and details of the connection from one column to the next, including the geometry and detailing showing the interface of the floor framing with the column

Roof framing survey:

- Provide structural sizes of roof framing members and materiality as follows:
  - Roof members: thickness, species and grade
- Connection details:
  - Provide dimensions and details of connections, including number, size and grade of connectors (bolts, nails, screws) between roof members
- The point cloud survey (refer to Section 8) will likely be the easiest way to determine the member sizes and geometry of the roof framing

Timber members shall be graded, timber species identified, and degradation shall be mapped by a timber specialist.

7 Dilapidation Report

A dilapidation report is recommended to determine the existing condition of the structure. RBG are happy to provide a brief for a dilapidation study.

8 Point Cloud Survey

A point cloud survey shall be completed, and a 3D model created from it such that member sizes, member spans and structural geometry can be verified. The ceiling shall be stripped out of the existing building prior to the point cloud survey being completed such that the structure is captured in the survey.

Melbourne Office

Robert Bird Group Pty Ltd
ABN 67 010 580 248 ACN 010 580 248

Tower 4, Collins Square
Level 19, 727 Collins Street
Melbourne VIC 3000
PO Box 472
Collins Street West
Melbourne VIC 8007
Australia

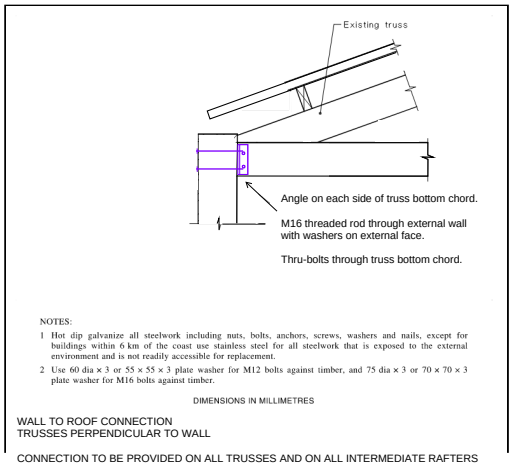
P: +61 (0) 3 8677 7555
F: +61 (0) 3 8677 7566

www.robertbird.com

Appendix B Preliminary Connections from Floors and Roof to External Masonry Walls

APPENDIX B: PRELIMINARY CONNECTIONS FROM FLOORS AND ROOF TO EXTERNAL MASONRY WALLS

ROOF TO EXTERNAL MASONRY WALL CONNECTIONS:



NOTES:

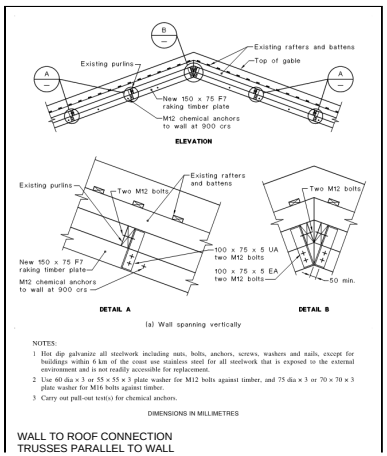
1 Hot dip galvanize all steelwork including nuts, bolts, anchors, screws, washers and nails, except for buildings within 6 km of the coast use stainless steel for all steelwork that is exposed to the external environment and is not readily accessible for replacement.

2 Use 60 dia × 3 or 55 × 55 × 3 plate washer for M12 bolts against timber, and 75 dia × 3 or 70 × 70 × 3 plate washer for M16 bolts against timber.

DIMENSIONS IN MILLIMETRES

WALL TO ROOF CONNECTION
TRUSSES PERPENDICULAR TO WALL

CONNECTION TO BE PROVIDED ON ALL TRUSSES AND ON ALL INTERMEDIATE RAFTERS WHICH OCCUR BETWEEN TRUSSES



(a) Wall spanning vertically

NOTES:

1 Hot dip galvanize all steelwork including nuts, bolts, anchors, screws, washers and nails, except for buildings within 6 km of the coast use stainless steel for all steelwork that is exposed to the external environment and is not readily accessible for replacement.

2 Use 60 dia × 3 or 55 × 55 × 3 plate washer for M12 bolts against timber, and 75 dia × 3 or 70 × 70 × 3 plate washer for M16 bolts against timber.

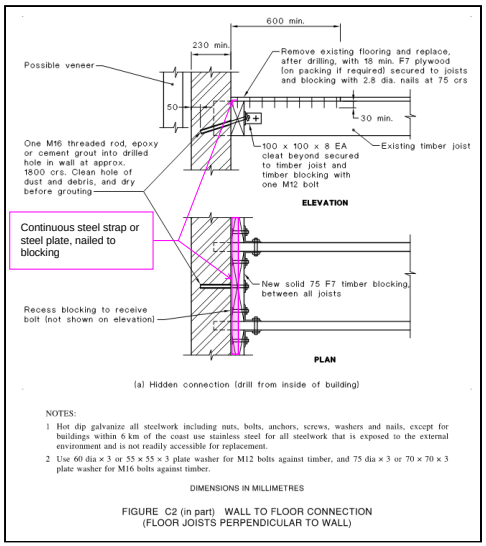
3 Carry out pull-out test(s) for chemical anchors.

DIMENSIONS IN MILLIMETRES

WALL TO ROOF CONNECTION
TRUSSES PARALLEL TO WALL

CONNECTION TO BE PROVIDED FOR EAST AND WEST END WALL, AND ALSO FOR NORTH AND SOUTH END WALLS OF LANTERN

FLOOR TO EXTERNAL MASONRY WALL CONNECTIONS:



(a) Hidden connection (drill from inside of building)

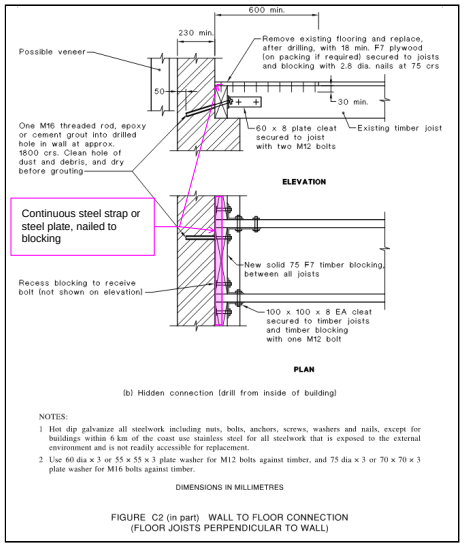
NOTES:

1 Hot dip galvanize all steelwork including nuts, bolts, anchors, screws, washers and nails, except for buildings within 6 km of the coast use stainless steel for all steelwork that is exposed to the external environment and is not readily accessible for replacement.

2 Use 60 dia × 3 or 55 × 55 × 3 plate washer for M12 bolts against timber, and 75 dia × 3 or 70 × 70 × 3 plate washer for M16 bolts against timber.

DIMENSIONS IN MILLIMETRES

FIGURE C2 (in part) WALL TO FLOOR CONNECTION
(FLOOR JOISTS PERPENDICULAR TO WALL)



(b) Hidden connection (drill from inside of building)

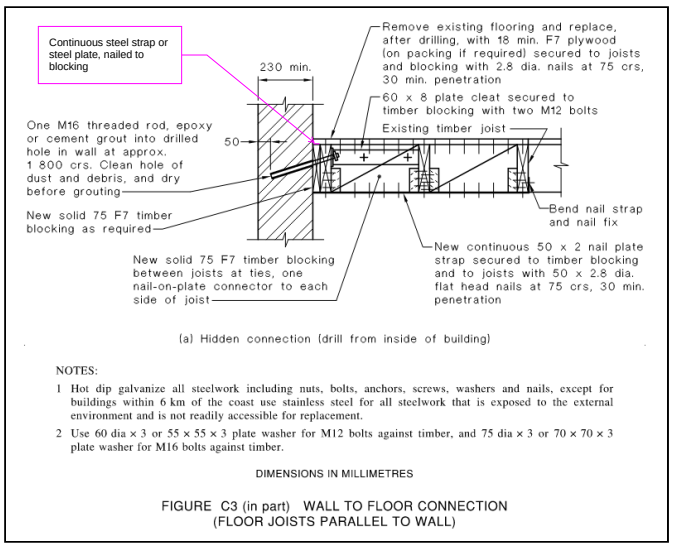
NOTES:

1 Hot dip galvanize all steelwork including nuts, bolts, anchors, screws, washers and nails, except for buildings within 6 km of the coast use stainless steel for all steelwork that is exposed to the external environment and is not readily accessible for replacement.

2 Use 60 dia × 3 or 55 × 55 × 3 plate washer for M12 bolts against timber, and 75 dia × 3 or 70 × 70 × 3 plate washer for M16 bolts against timber.

DIMENSIONS IN MILLIMETRES

FIGURE C2 (in part) WALL TO FLOOR CONNECTION
(FLOOR JOISTS PERPENDICULAR TO WALL)



(a) Hidden connection (drill from inside of building)

NOTES:

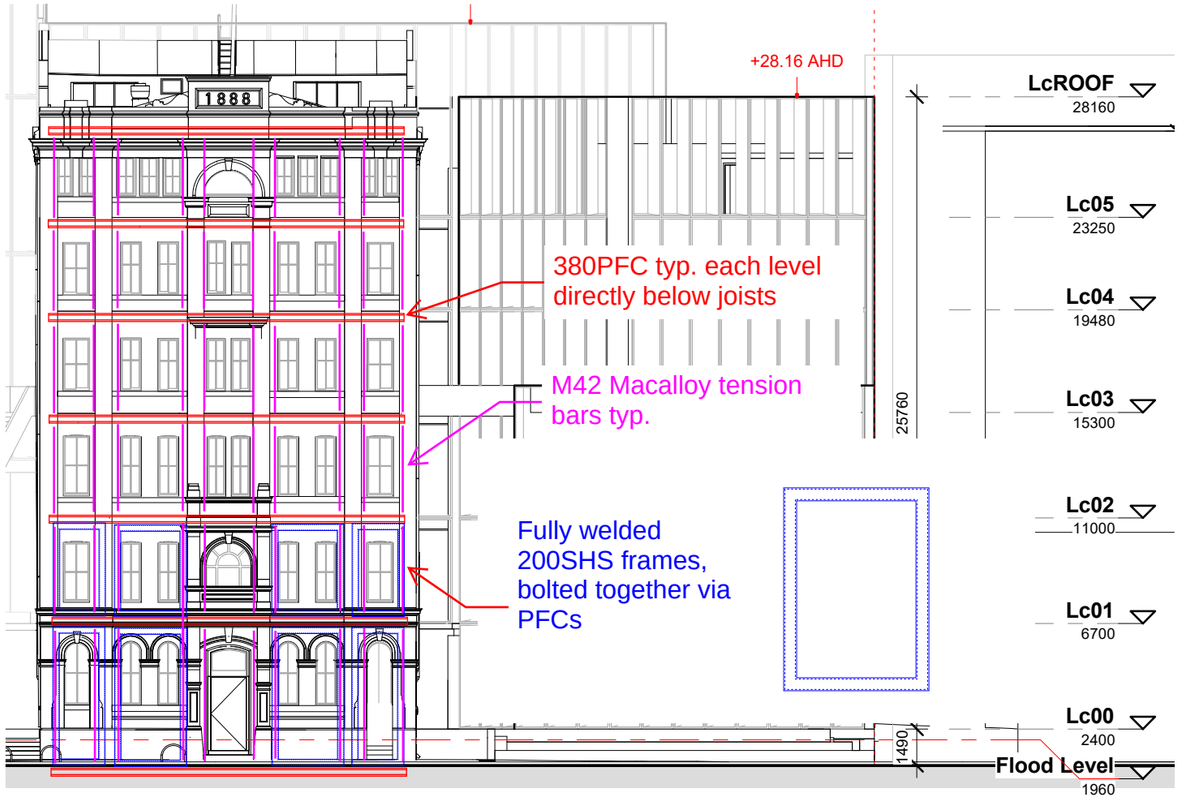
1 Hot dip galvanize all steelwork including nuts, bolts, anchors, screws, washers and nails, except for buildings within 6 km of the coast use stainless steel for all steelwork that is exposed to the external environment and is not readily accessible for replacement.

2 Use 60 dia × 3 or 55 × 55 × 3 plate washer for M12 bolts against timber, and 75 dia × 3 or 70 × 70 × 3 plate washer for M16 bolts against timber.

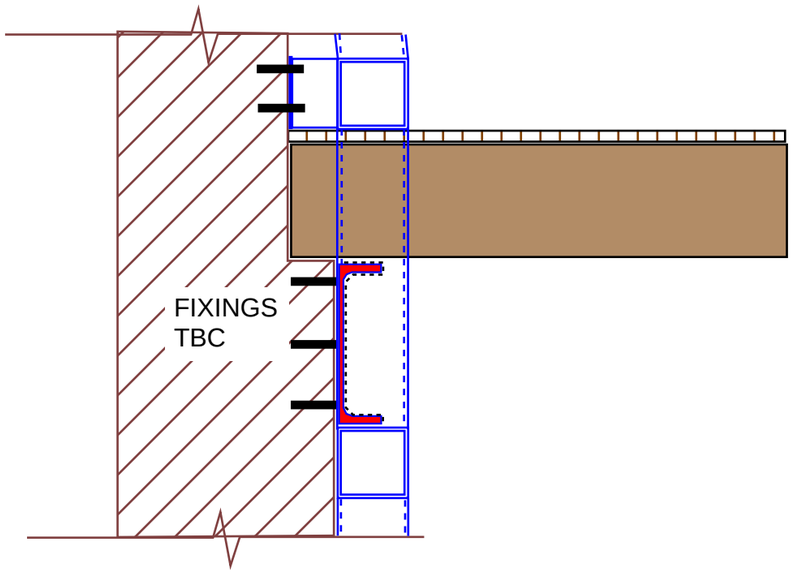
DIMENSIONS IN MILLIMETRES

FIGURE C3 (in part) WALL TO FLOOR CONNECTION
(FLOOR JOISTS PARALLEL TO WALL)

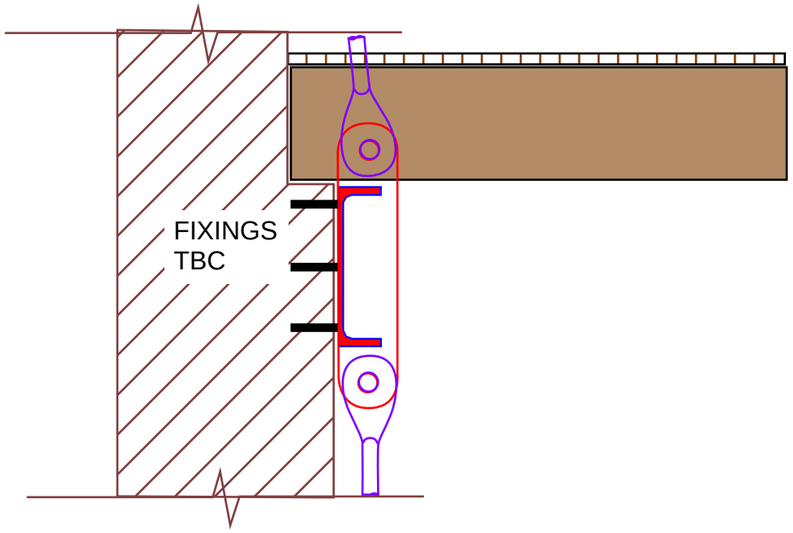
Appendix C Preliminary Strengthening Details for Eastern & Western Walls



ALL DETAILS ARE PRELIMINARY ONLY AND SUBJECT TO CHANGE AS THE DESIGN DEVELOPS AND FURTHER STRUCTURAL INVESTIGATIONS ARE UNDERTAKEN



DETAIL B



DETAIL A

HERITAGE FACADE STRENGTHENING
ELEVATIONS
TEAHOUSE REDEVELOPMENT
RBG SKETCH - 20220
17/02/2021 BH

Appendix D Geotechnical Report on Test Pits Exposing Existing Footings

22 December 2020 20144725-003-L-Rev0

Austin Giordano
CostaFox Developments Pty Ltd
Suite 102, 54 Davis Avenue
South Yarra VIC 3141

28 CLARENDON STREET, SOUTHBANK – PILE CAP EXPOSURES

Dear Austin,

Engagement

CostaFox has engaged Golder Associates Pty Ltd (Golder) to undertake a geotechnical investigation for the proposed redevelopment of the site at 28 to 34 Clarendon Street, Southbank.

Golder has completed the geotechnical investigation, with the results and findings of the investigation presented in our report dated 15 July 2020 (20144725-001-R-Rev0).

CostaFox has subsequently engaged Golder to undertake pile cap exposures and if possible pile integrity testing on timber piles beneath the existing heritage Tea House Building and excavate a test pit along the western boundary of the site to expose the footings of the perimeter retaining wall.

This letter summarises the finding of the pile cap exposures and our assessment into the feasibility of undertaking pile integrity testing.

Site conditions and proposed development

The site is located on the north west corner of the intersection of Clarendon Street and Normanby Road, Southbank. The site has plan dimensions of about 55 m (east west) by about 60 m (north south). The Robur Tea building, (a six level brick building) is located near the centre of the site with asphalt surfaced car parking and pavements to the north, west and south of the existing building.

Based on preliminary drawings and information provided by CostaFox we understand that the proposed redevelopment of the site will include the following key elements:

- Refurbishment of the existing heritage listed Tea House building for use as commercial offices;
- Podium structure (anticipated to be up to six levels) and mixed hotel and residential tower (approximately 20 levels) – the locations of the podium structure and tower are yet to be confirmed but are likely to extend across the majority of the site to the north, west and south of the existing Tea House building; and
- A half level basement car park is also possible with car stacker pits across part of the site.

Aims

The aims of the supplementary geotechnical investigation were as follows:

- Undertake footing exposures to assess the nature of the footings for the building currently occupying and adjacent to the site as directed by CostaFox and the structural engineer (Robert Bird Group Pty Ltd - RBG).
- Assess the condition of the exposed pile caps and document any deterioration and defects observed.
- Undertake pile integrity testing on a typical pile to assess its approximate length (if feasible).

Results of Geotechnical investigation (footing exposures)

A geotechnical engineer from Golder attended the site on 7, 16 and 18 December 2020 to undertake three footing exposures of pile caps and one footing exposure underneath the western perimeter wall of the site as directed by CostaFox with input from RGB. The location of pile cap/footing exposures are shown on Figure 1. Prior to undertaking excavation works a service locator was engaged to undertaken service clearance on 7 and 16 December 2020 to identify the location of underground services. The following information is relevant to the footing exposures:

- To minimise disturbance and reduce the risk of potentially undermining the existing pile caps and perimeter wall footing, excavation works were undertaken using non-destructive digging (NDD) techniques (high pressure water lance and vacuum) and hand methods (using a spade and crow bar) rather than mechanical excavation (an excavator).
- A geotechnical engineer from Golder described the materials encountered, and the depth and dimensions of the exposed pile caps and footings which are presented in Figures 2 to 6 along with photos of the footing exposures.
- There was variable inferred uncontrolled fill with bricks/concrete rubble observed from the surface of Footing Exposures 1 to 4 (refer Figure 2 to 6) to the base of pile caps/footings. There was a noticeable change in excavation resistance beneath the base of the pile caps which is inferred to be due to the presence of Coode Island Silt (soft clay). Similarly, there was a soft material inferred to be Coode Island Silt encountered below a depth of about 1.6 m at Footing Exposure 3.
- Elevations of the base of pile caps are approximated by measuring the depths relative to the asphalt carpark levels shown on a feature survey plan provided to Golder by CostaFox. Approximate depths and elevations of the base of piles/footings are provided below:
  - Footing Exposure 1 (western side of building): Base of pile cap 2.7 m below ground level (approximate RL = -1.3 m AHD) – refer to Figure 2
    - Concrete exposed in pile cap appears to be in reasonable condition with no obvious cracking/defects
  - Footing Exposure 2 (northern side of building): Base of pile cap 2.2 m below ground level (approximate RL = -0.9 m AHD) – refer to Figure 3
    - Concrete exposed in pile cap appears to be in reasonable condition with no obvious cracking/defects
  - Footing Exposure 3, western perimeter wall (refer Figure 4):

  - Base of inferred concrete strip footing at 0.9 m below ground level (approximate RL = 0.4 m AHD)
  - Inferred cement treated gravel/sand beneath the inferred concrete strip footing from 0.9 -1.6 m.
  - Aggregate exposed in concrete side of strip footing exposed but no major defects/cracking observed in concrete.
- Footing Exposure 4 (from the basement of building):
  - Base of pile cap 1.4 m below ground level (approximate RL = -0.25 m AHD)
  - Groundwater inflow to a depth of 0.8 m below ground level (approximate elevation RL = 0.35 m AHD)
  - Concrete exposed in pile cap appears to be in reasonable condition with no obvious cracking/defects

- Groundwater levels were previously measured in three standpipes installed as part of the geotechnical investigation for the proposed development. Groundwater levels were measured to range between about RL 0.2 m AHD to RL 0.3 m AHD.
- It was assessed that pile integrity testing was not feasible at the location of Footing Exposures 1 to 3 due to pile caps extending below the groundwater table and to significant depth making it not practical to safely expose the piles so to instrument them.
- Upon completion of the excavation works test pits were backfilled with crushed rock/gravel.

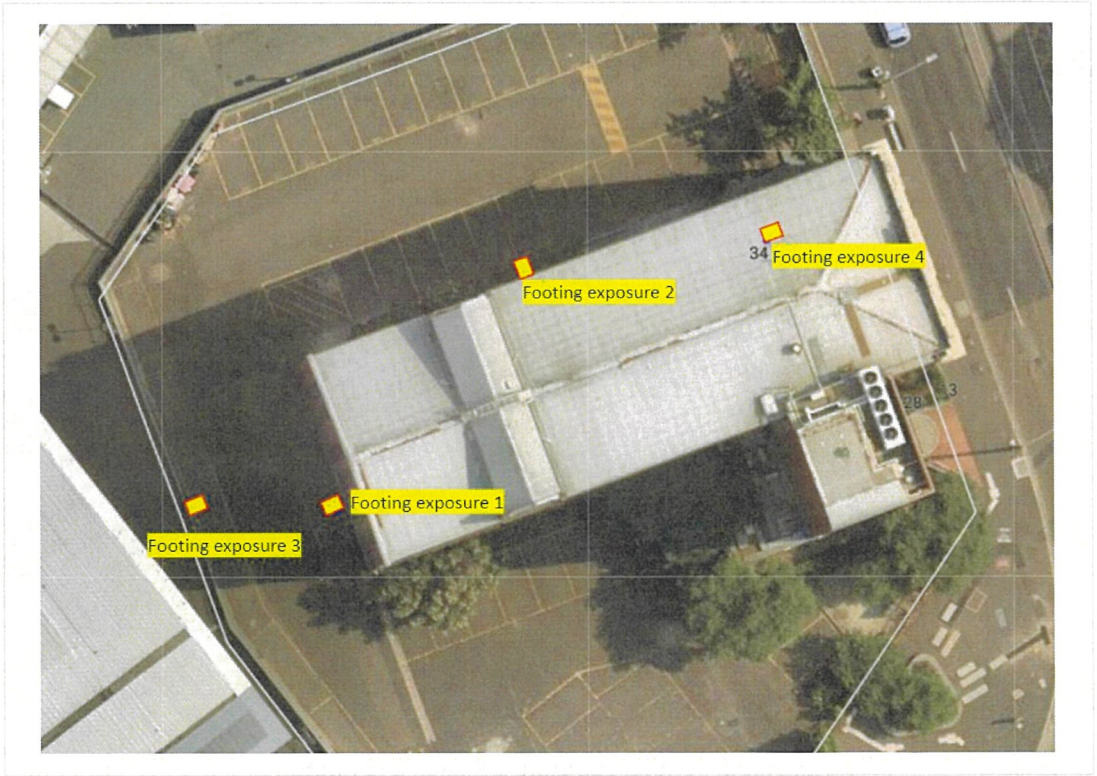


Figure 1: Investigation location plan

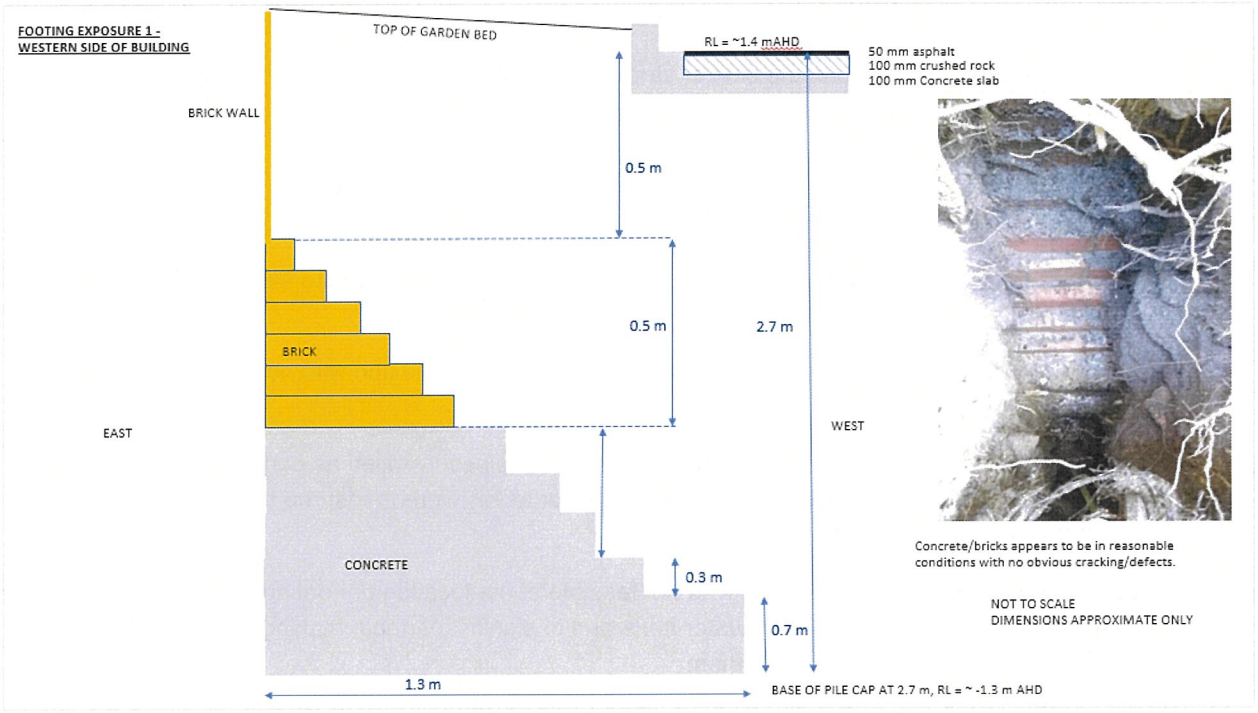


Figure 2: Footing Exposure 1 Sketch and Photo

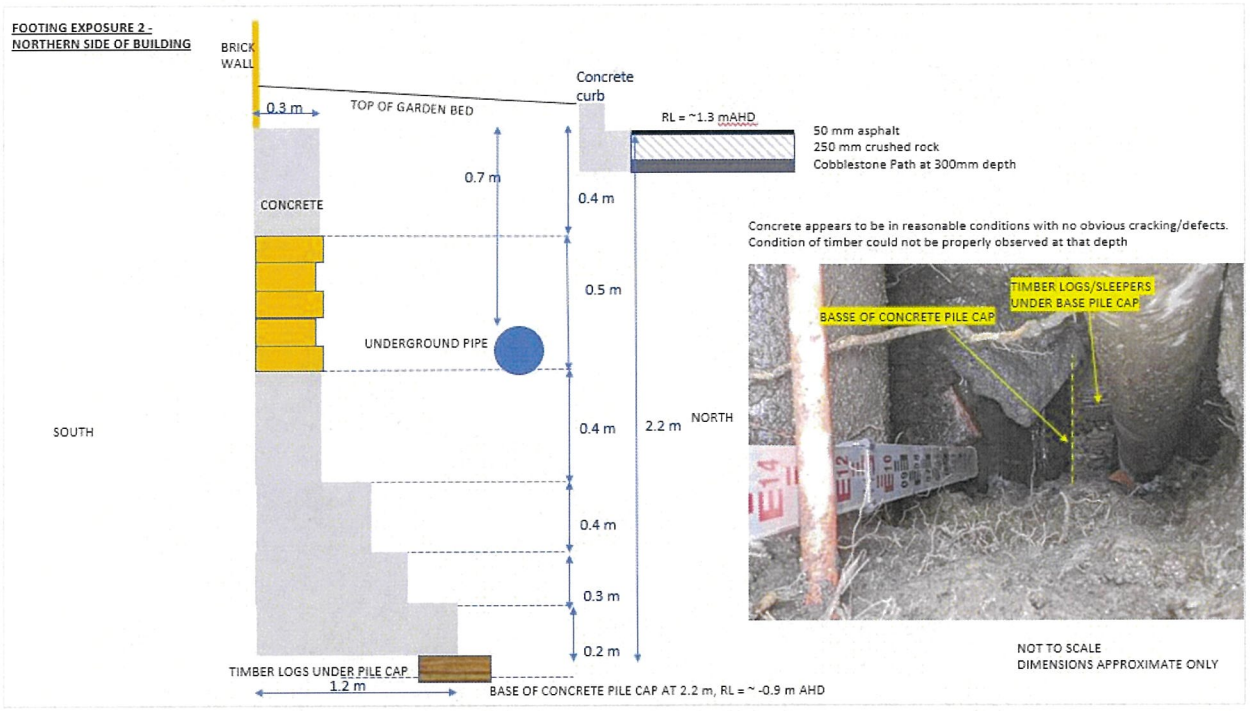


Figure 3: Footing Exposure 2 Sketch and Photo

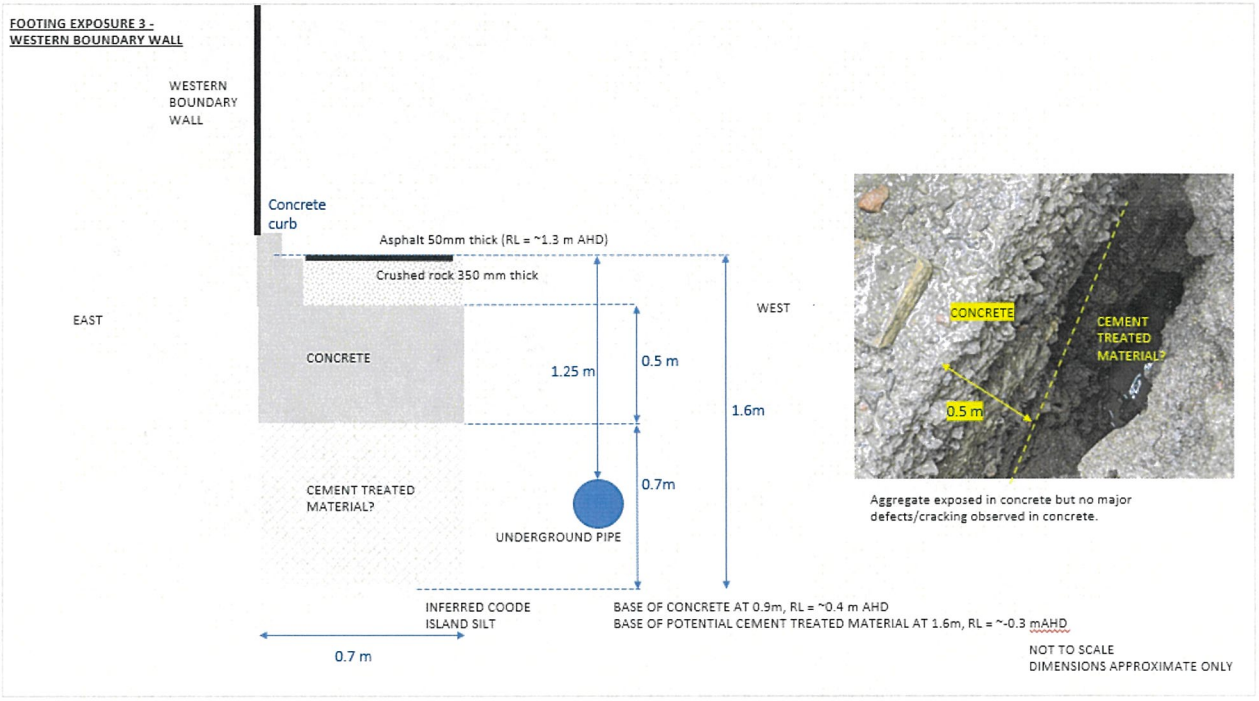


Figure 4: Footing Exposure 3 Sketch and Photo

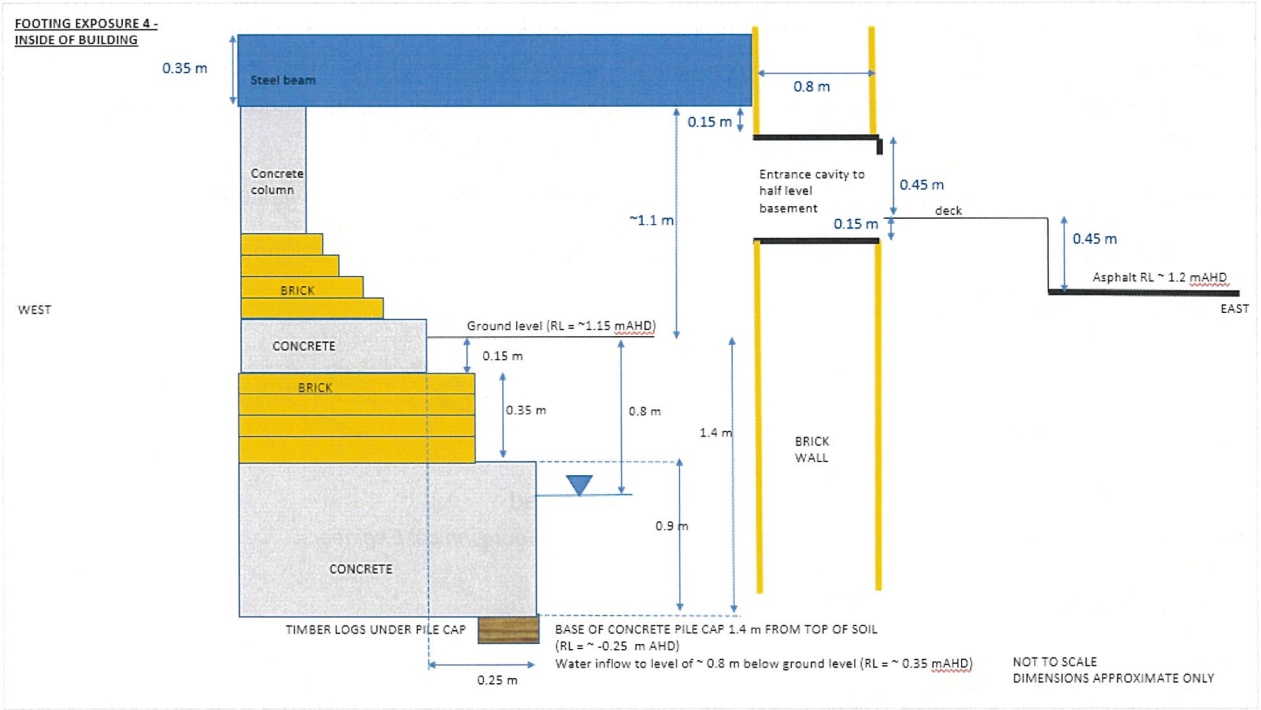


Figure 5: Footing Exposure 4 Sketch

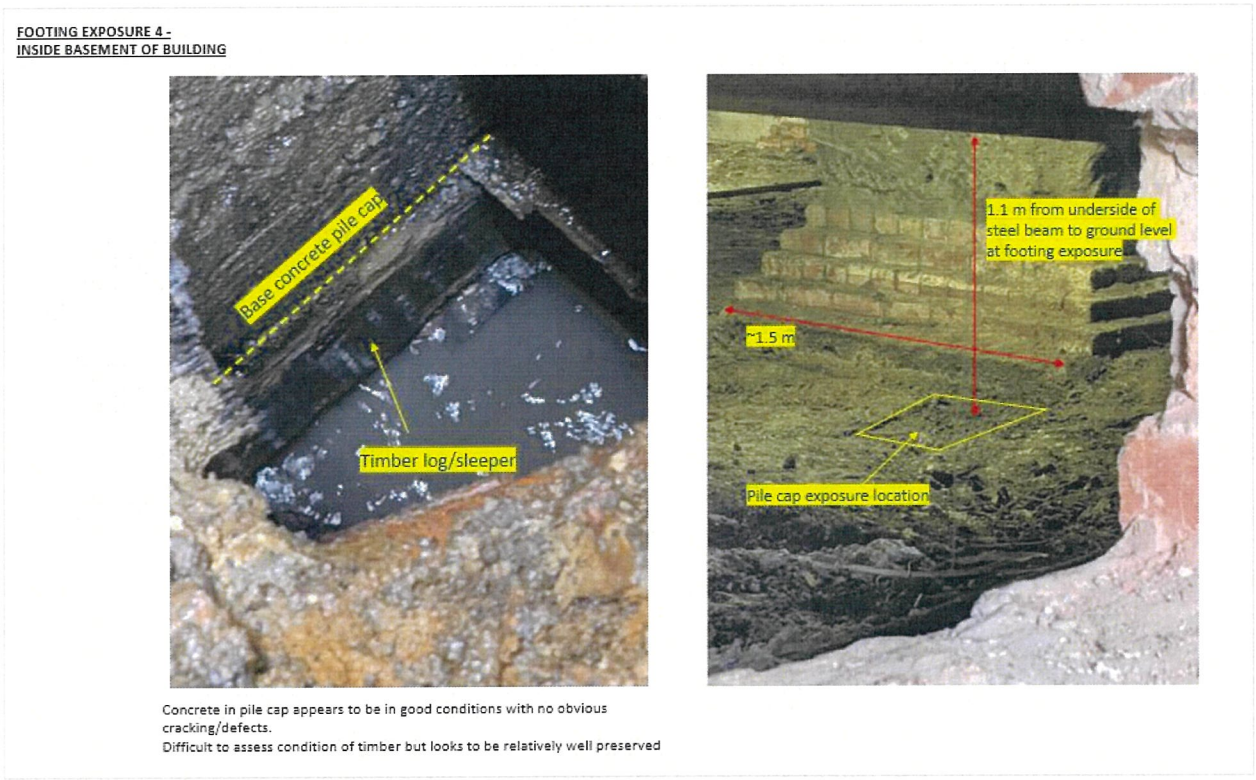


Figure 6: Footing Exposure 4 Photos

Limitations

Important information relating to this report is attached. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

We would be pleased to answer any questions the reader may have regarding these limitations.

Should you have any questions regarding this letter report please contact the undersigned.

Golder Associates Pty Ltd

Paul Strasser
Geotechnical Engineer

Doug Goad
Principal Geotechnical Engineer

PGS/DLG-EH/pgs

Attachments: Important Information

https://golderassociates.sharepoint.com/sites/127943/project files/6 deliverables/20144725-003-l-rev0.docx

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

Melbourne Office

Robert Bird Group Pty Ltd
ABN 67 010 580 248 ACN 010 580 248

Tower 4, Collins Square
Level 19, 727 Collins Street
Melbourne VIC 3000
PO Box 472
Collins Street West
Melbourne VIC 8007
Australia

P: +61 (0) 3 8677 7555
F: +61 (0) 3 8677 7566

www.robertbird.com