Before an Independent Hearings Panel
Appointed by Christchurch City Council

under: the Resource Management Act 1991

in the matter of: proposed Plan Change 14 to the Christchurch District Plan

and: **Daresbury Limited**
(Submitter 874)

Statement of evidence of Brett Andrew Gilmore for Daresbury Limited (Structural Engineering)

Dated: 20 September 2023

Reference: Jo Appleyard (jo.appleyard@chapmantripp.com)
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STATEMENT OF EVIDENCE OF BRETT GILMORE FOR DARESBURY LIMITED

INTRODUCTION

1 My full name is Brett Andrew Gilmore.

2 I am the Joint Managing Director and a Senior Structural Engineer with Quoin Structural Consultants (*Quoin*), and formerly known as Structex Metro Ltd (*Structex*). I have held this position since 2006.

3 I have been engaged by Daresbury Limited (Submitter #874) to provide evidence on structural engineering issues in relation to the proposed Plan Change 14 to the Christchurch District Plan. I have also given evidence on behalf of Submitter #1092 in relation to the Harley Chambers building on this same topic.

4 I first became involved with the review of this property in 2011 when working for Structex. I was engaged by Cunningham Lindsay Loss Adjustors to inspect and assess the earthquake damage caused to the house and complete a report that outlined the general scope of repairs required to reinstate the house back to its pre-earthquake condition. The report was used by the Insurer and owner to establish a cost estimate for the repairs and help assess whether the repairs would be economically viable or not.

5 In 2015, the property was sold. I assisted with the supervision of various people into the House (sales agents, photographer, prospective purchasers) as part of ensuring safe access for those people.

6 In 2016, I updated the assessment information from 2011-2012 for the new Owner to establish a cost estimate for the repair of the building and for the Owner to assess if it was economically viable to repair the building or not.

7 In 2018, the property was purchased by Daresbury Limited. I was engaged by Milne Construction Ltd to complete a more detailed structural assessment to estimate the earthquake strength of the building as a percentage of the New Building Standard (*% x NBS*), plus assist with supervision of detailed investigations of the building's construction, and provide a detailed scope of recommendations to repair the building back to its pre-earthquake condition and to a minimum earthquake strength of 67% x NBS. This review is summarised in my Quoin Structural Assessment Report dated 17 May 2019 (*the Quoin Report*).

QUALIFICATIONS AND EXPERIENCE

8 I received a Bachelor of Engineering (Civil) (Hons) in 1989. I am a member of Engineering New Zealand (ENZ); and am a Chartered Professional Engineer (Reg #139988).

9 I am a member of the Structural Engineering Society New Zealand (SESOC), Timber Design Society and Canterbury Structural Group.

10 I have over 30 years' experience in the structural engineering design industry, both in New Zealand and overseas. This includes:

10.1 Holmes Consulting Group, Christchurch (1992-1999 and 2003-2006).

10.2 Thornton Tomasetti Engineers, New York (1999-2003).

10.3 Structex Metro Ltd (now Quoin Structural Consultants), Christchurch (2006-present).

11 I have significant expertise in the structural assessment of structural earthquake damaged buildings following the 2010-2011 Canterbury Earthquake Sequence (*CES*) and developing scopes of repairs for these buildings.

CODE OF CONDUCT

12 While this is not an Environment Court hearing, I note that in preparing my evidence I have reviewed the Code of Conduct for Expert Witnesses contained in Part 9 of the Environment Court Practice Note 2023. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where I state that I am relying on the opinion or evidence of other witnesses. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

13 My evidence will address the structural engineering matters for this building, which includes review of the earthquake damage caused to the building and the building's current condition, and strategies for repairing the building to a safe and useable condition.

14 In preparing this evidence I have:

14.1 Reviewed the submission by Daresbury Limited.

14.2 Referred to my Structural Assessment Report of the building dated 17 May 2019 (*the Quoin Report*), which is attached as **Appendix 1** to my evidence.

14.3 Reviewed the relevant structural related Council section 42A reports and evidence completed by Stephen Hogg from Aurecon, dated 11 August 2023, and that includes the Structural Inspection Report by Win Clark dated 13 July 2012. The sections of Stephen Hogg's evidence that specifically

relate to Submission #874 Daresbury Homestead includes pages 12-20 and a copy of Win Clark's report in Appendix F.

14.4 My evidence will summarise the earthquake damage caused to the building and my recommendations for repairing and strengthening the building to 67% x NBS.

14.5 My evidence will discuss the conclusions reached in the Quoin Report as they relate to Daresbury Limited's submission. It will consider the difference in approaches between the Quoin Report and the Aurecon Report, where there are any.

SUMMARY OF EVIDENCE

15 The building suffered significant damage as a result of the CES:

15.1 The building will require extensive repair works to reinstate the building back to its pre-earthquake condition and to a safe minimum earthquake strength of 67% x NBS.

15.2 I have recommended a repair strategy that focuses on reinstating the appearance of the building's aesthetics and features, but that needs to be widely intrusive across the footprint of the building, at all levels, to achieve this and meet a minimum level of earthquake strength.

15.3 The damage caused to the building is significant and widespread across the footprint. While aiming to be sensitive to the heritage nature of the building when considering the structural repairs and strengthening of the building to a safe level, it is unavoidable, in my opinion, that such repairs are intrusive across a significant portion of the building's structure and features, that includes the walls, floors, roofs, chimneys and foundations.

15.4 The Structural Technical Advice provided by Mr Hogg concurs with all of the major structural issues and is in general agreement with myself on the repair and strengthening works required.

15.5 For the alternative options noted by My Hogg I agree that these are structurally feasible, but I have provided comments noting where these might affect the internal spaces and how these may compare with and affect my proposed repair methodology.

STRUCTURAL DAMAGE AND BUILDING CONDITION

16 The earthquake damage caused to the building from the CES is as generally summarised in the Quoin Report. I have referred to rooms as per the floor plans in Appendix 8.4 of the Quoin Report (pages

83-85 of 101). A summary of the structural related damage includes:

16.1 The exterior brick walls are extensively cracked to all sides of the building. This includes various vertical, horizontal, and diagonal cracks in the mortar courses and many of the cracks pass through individual bricks.

16.2 Various sections of the exterior brick walls have laterally displaced approximately 10-20mm in the plane of the wall and some sections 10-20mm out of plane. These failed walls are considered to be in a dangerous condition that could result in partial collapse of sections of the building under a moderate to large earthquake. These walls include:

(a) West wall to Dining Hall.

(b) West wall and west ends of the south and north walls to the Lounge.

(c) North wall at north-west corner of Family Room.

16.3 The foundations have differentially settled in some areas of the residence. These differential slopes in the ground floor/foundations include the following where the slope exceeds the suggested acceptable limits of 0.5% per the MBIE Residential Guidance for Repairing and rebuilding houses affected by the Canterbury earthquakes:

(a) Lounge:

(i) 48mm fall (1.0%) from middle of floor to south-west corner.

(ii) 24mm-32mm (0.7% - 0.8%) fall from middle of floor to the east wall to the Family Room that includes the heavy chimney stack (CH2).

(iii) 28mm fall (0.8%) over south end of west exterior wall.

(b) Family Room:

(i) 32mm-36mm (0.7% - 0.9%) falls from the middle of the room to the west interior wall to the Lounge and to the exterior north and east walls.

(ii) 26mm (0.7%) fall across the north bay window.

(iii) 26mm (0.9%) fall from north bay window towards west.

(c) Office/Kitchen

(i) Approximately 15mm-20mm settlement of Chimney (CH4) foundation between the Office and Kitchen, but floor slopes remain acceptable at 0.5% or less.

(d) Library:

(i) 14mm-22mm (0.6%) falls from middle of room towards west exterior wall.

16.4 The first floor to the main north 3-storey section of the building is out of level over its relative area. This has likely occurred as a result of a combination of creep deflection in the floor framing and the differential ground settlements noted above.

16.5 All of the brick chimneys partially collapsed and were removed down to roof level following the main earthquake.

16.6 There are a large number of cracks in the walls and ceilings to the interior of the building at all of the floor levels. Most of the cracks have penetrated the GIB board and lath and plaster, where visible, especially at the first floor level.

16.7 Severe damage was observed to the finishes, that includes failure of the sheet material. This was observed in a large number of the rooms.

16.8 The exterior cladding above the first-floor level, that comprises of pebble dash decorative plaster over brick infill, has suffered some significant and widespread damage. This includes:

(a) Significant cracking of the plaster and movement gaps between the plaster/bricks and the timber studs/transoms, to the west exterior wall of Bed 7, Bed 8, and the adjacent stairs, plus the north-west corner of Bed 8, and to parts of the west walls to the Dining Hall.

(b) Cracking and/or tearing of the plaster, and smaller movement gaps in the walls noted in (a) above, to the remainder of the wall elevations of the building.

(c) The damage noted above has compromised the weather-tightness of the cladding system, plus the

brick infill has loosened between the timber stud and transom framing.

16.9 Damage to roof tiles due to the collapse (full or partial) of the chimneys.

16.10 Slippage movement of the roof tiles. Subject to a more detailed assessment, damage was observed to the roofs to the Dining Hall, Bed 6/7, east entry, Bed 7 east end, and Bed 5/Ens 5.

16.11 Other damage to elements and finishes include, but are not limited to:

(a) Bent and cracked lead framed window to Family room.

(b) Cracks and movement gaps to internal fireplace surrounds.

(c) Ceiling damage due to post-earthquake water damage and broken windows to middle stairwell.

(d) Movement gaps to fixed joinery.

(e) Ceiling damage due to swinging light in Bed 7.

17 The buiding is currently in a very poor structural condition, with some sections susceptible to collapse. This includes:

17.1 The 3-storey north section of the building is in a very dangerous condition and could suffer a significant collapse if another moderate-large earthquake were to occur. This is due to the failed loadbearing brick walls as noted in (16.2) above, and the extensive cracking that has occurred to other loadbearing brick walls in this section of the building as noted in (16.1) above.

17.2 All sections of the brick construction that are cracked are currently in a much more weakened condition than before the earthquakes, when those sections of brickwork were uncracked.

17.3 Other parts of the building could also suffer further significant damage and pose a risk to life safety. These mainly include the other areas of heavy brick wall construction, whether currently cracked or uncracked.

17.4 The exterior roof and wall claddings of the building have suffered damage that has affected the weather tightness of the building in a number of areas, and that results in ongoing degradation of those systems. This includes areas of the slate

tile roof cladding, exterior brick walls, and exterior plastered brick wall cladding.

ASSESSED EARTHQUAKE STRENGTH OF THE BUILDING

18 The preliminary assessment by Quoin confirmed that the building would be considered to be earthquake prone with an assessed undamaged strength of 13% x NBS, not taking into account that some of the walls have failed and would have a lower % x NBS.

19 The main purpose of this assessment was to assess whether the building, in its undamaged pre-earthquake condition, was earthquake prone or not, and determine the weaker sections of the building for which strengthening would likely be required as part of the repairs. It was noted that the failed brick walls would need to be replaced as part of any repair, so this assessment focused on assessing the strength of the less damaged walls.

20 It is noted that the earthquake prone limits of 33% x NBS that are commonly used for commercial and public buildings do not normally apply to a single residential building. However, given the very large scale and size of the building, and that the building comprises of extensive unreinforced brick walls that have suffered significant damage, then the approach of assessing % x NBS was considered appropriate for this building.

21 It is also noted that for any repairs, then a Building Consent would be required, and I understand that the Christchurch City Council would likely require strengthening to a minimum target level of 67% x NBS for this type and size of building and for the large extent of repairs required.

22 The assessed % x NBS for the main structural elements include:

22.1 Ground floor north-south brick walls in-plane strength: 39% x NBS average.

22.2 Ground floor east-west brick walls in-plane strength: 29% x NBS average.

22.3 First floor north-south timber framed sheet braced walls: 23% x NBS average.

22.4 First floor east-west timber framed sheet braced walls: 30% x NBS average.

22.5 Second floor east-west timber framed sheet braced walls at north end of Entertainment: 13% x NBS.

22.6 Second floor north-south timber framed sheet braced walls: 36% x NBS average.

22.7 Second floor east-west timber framed sheet braced walls: 37% x NBS average.

22.8 South chimney to Dining Hall: 20% x NBS out-of-plane in north-south direction.

OPTIONS FOR REPAIR (BRETT GILMORE)

23 The following is a summary of my recommendations for the structural repairs required to reinstate the building back to its pre-earthquake structural condition, and to satisfy a minimum strength of 67% x NBS. Additional information and explanation of my assessment of these repairs is provided in the Quoin Report.

23.1 Remove the damaged exterior brick walls, and replace with timber framed walls with an exterior brick veneer to reinstate the architectural aesthetic. The extent of these walls includes all of the brick walls to the two and three storey sections of the residence and to the large height Dining Hall.

This repair strategy has the benefit of reducing the overall seismic mass of the building and allows the building's earthquake strength to be increased above 33% x NBS with the use of lighter weight GIB sheet bracing walls, supplemented by steel frames where required.

23.2 For the exterior brick walls that do not appear to be significantly damaged, I recommend that the exterior wythe to these walls be retained and repaired with Helifix bars and dryfix ties. These include the single storey lower height walls to Office 2 at the south-west corner and the Library and Hall 3 to the west side (middle).

23.3 All of the chimney stacks be removed down to ground level and reconstructed as lighter weight structures. This will have the benefit of reducing the seismic mass of the building and allows the building's earthquake strength to be increased, as noted in 23.1 above.

Given that the brick chimney stacks form an important part of the architectural aesthetic, I recommend to reinstate all of the sections of the chimneys that are exposed with brick veneer.

I recommend to laterally support the tall chimney stacks with internal steel trussed frames that are commonly used for such tall chimney construction. It may be possible, subject to review by an experienced contractor, to re-use parts of the existing chimney stacks that collapsed and/or have been removed and stored on site.

23.4 I recommend to remove and replace the existing unreinforced foundations beneath the exterior ground floor walls that are to be reconstructed.

23.5 For the existing unreinforced chimney pads, I recommend that these be removed and replaced with reinforced foundation pads that are sized to support the new steel trussed frames for the reconstructed chimneys. These steel frames form part of the lateral resisting systems for the building, together with the sheet braced walls (refer 23.7) and steel portal frames (refer 23.8).

23.6 I recommend to remove and replace all of the plastered brick infill to the external walls and replace with a compliant weather tight cladding system. This both repairs the damaged infill sections and reduces the seismic mass of the building to a level where the building can be earthquake strengthened to a minimum of 67% x NBS. This strategy also allows for the ground level brick walls to be more easily removed and replaced with a lesser amount of temporary propping required.

These repairs will likely involve the installation of a new compliant cladding system, with cavity, and detailed/finished with timber and decorative plaster to match the existing exterior aesthetic. To support the new cladding and internal additional wall finishes and sheet bracing, I recommend to allow to install additional timber studs and dwang framing to provide a compliant wall construction.

23.7 I recommend to remove all of the interior lath and plaster and Gib wall finishes, and reinstate with new Gib Braceline sheet braced walls, including standard hold down straps and bolts.

This both repairs the damaged wall finishes and reinstates the walls as stronger bracing elements that can achieve the target 67% x NBS strengthening.

23.8 Further to the new sheet braced walls and steel trussed chimney frames, Quoin assessed that supplementary steel frames would be required for the building to achieve an assessed earthquake strength of 67% x NBS. These supplementary frames include the following and require new foundations to achieve adequate strength and stiffness:

(a) Portal frame PF1 to Lounge with new north-south foundations across the width of the Lounge.

(b) Portal frame PF2 to north wall of Lounge, supported on new exterior foundation.

(c) Portal frame PF3 to east exterior wall of Family, supported on new exterior foundation.

(d) Portal frame PF4 to east exterior wall of kitchen, supported on new exterior foundation.

(e) Portal frame PF5 to north wall of Bed 1, supported on first floor exterior wall.

(f) Cantilever steel columns to the east and west exterior side walls of the Dining Hall with new transverse east-west 'finger' beams to provide a rigid base to the columns.

I have proposed the installation of these steel columns, together with proposed steel wall transoms and roof bracing, to provide a structural solution that takes into account the architectural features of the timber framed roof by minimising the extent of visible steelwork. This includes the steel columns to be built into the walls and the roof bracing to be installed on top of the timber roof sarking, so that the main steel elements are not visible in the repaired building. This assumes that the roof tiles will be replaced as part of the repairs.

(g) New tie beam foundations are recommended to be installed to the north side entry canopy posts and the west side first floor balcony posts to mitigate against possible lateral spreading of the foundations as noted in the geotechnical report.

23.9 I recommend allowance to remove all of the ceiling finishes throughout the building, and replace with new 13mm Gib, fixed in accordance with NZS 3604 and the Gib installation guidelines. This does not include the timber feature ceiling to the Dining.

23.10 I recommend that the areas of the floors and foundations summarised in (16.3) be relevelled to within the 0.5% slope criteria recommended in the MBIE Guidelines. This includes:

(a) Lounge, Family & Library: The central areas of the floor to be lowered by 10mm-20mm. I recommend to replace the interior piles, as is standard practice, rather than notching existing bearers. The sections around the perimeter will be relevelled as part of the foundation replacement repairs where recommended for the Lounge and Family Rooms.

(b) Office/Kitchen: The foundation between the Office and Kitchen will be relevelled as part of the foundation replacement repairs.

23.11 There are large areas of the first floor that have floor slopes that exceed the MBIE Guidelines. It is likely that the dislevelment is caused by a combination of creep deflection in the floor framing and some differential settlements of the main foundations. I recommend that the floor levelness be reviewed following completion of the foundation repairs and the relevelling.

23.12 The scope and extent of the non-structural repairs is to be reviewed and assessed by a licensed building practitioner. This may include, but may not be limited to the following:

(a) Cracks, lateral displacement, and/or bows in windows and doors.

(b) Displacement of decorative timber joinery and reveals to internal doors.

(c) Damage to floor finishes.

(d) Damage to joinery and fixtures.

(e) Damage to fireplace surrounds.

(f) Damage to spouting and downpipes.

(g) Damage to plumbing and services.

(h) Consequential effects of undertaking the main structural repairs and strengthening, such as removal of bathroom and kitchen finishes and fixtures, and temporary propping/bracing of the building structure during the repairs.

24 The impact on the heritage fabric caused by the scope of the structural repairs will be addressed by the evidence of other experts.

25 I note that my proposed repair methodology focuses on reinstating the appearance of the building's aesthetics and features (exposed brickwork chimneys and walls, and exposed feature timber roof structure in the Dining) whilst also aiming to achieve a strengthening system that works with the existing layout of walls throughout the building at all levels, and that can achieve seismic strengthening to 67% x NBS. Further comments as follows:

25.1 I have recommended a structural repair methodology that aims to retain brickwork that is undamaged or minimally damaged, where practical to do so.

25.2 The current proposed methodology utilises all of the available light weight walls as sheet braced walls and that requires supplementary steel frames to the chimneys and ground floor walls.

25.3 To achieve a strengthening target of 67% x NBS, it is my opinion that the seismic weight of the building needs to be reduced as much as possible, otherwise a practical solution per (25.2) is not possible. In this regard, a large portion of the brickwork to the chimneys and walls in the 2-3 story section of the building needs to be removed, and reinstated in a light-weight form to reinstate the aesthetic.

25.4 The damage caused to the building is significant and widespread across the footprint.

While aiming to be sensitive to the heritage nature of the building when considering the structural repairs and strengthening of the building to a safe level, it is unavoidable, in my opinion, that such repairs are intrusive across a significant portion of the building's structure and features, that includes the walls, floors, roofs, chimneys and foundations.

25.5 The intrusiveness of my recommended scope of repairs includes:

(a) Removal of damaged brick walls and replacement with lighter weight construction, with brick veneer, as noted in (23.1) above.

(b) Remove all of the brick chimney stacks down to ground level and reconstruct as lighter weight steel trussed structures, with new brick veneer to replicate previously exposed brickwork, as noted in per (23.3) above.

(c) Remove all plastered brickwork to external walls and reinstate with new light-weight compliant cladding system and associated framing, as per (23.6) above.

(d) Remove all interior wall finishes (lath and plaster, and Gib), throughout the building and replace with new Gib wall sheet bracing elements, as noted in (23.7) above.

(e) Remove all of the ceiling finishes throughout the building and replace with new compliant Gib ceilings, as noted in (23.9) above.

(f) Cut back existing brick walls to the Dining Hall so that steel columns can be installed, as noted in (23.8)(vi) above.

(g) Add exposed steel eaves transoms to top of the walls in the Dining Hall, or alternatively cut back top of existing brick walls to hide steel or concrete transoms, as noted in (23.8)(vi) above.

(h) Remove all of the roof cladding over the Dining hall, and other areas of damaged roof cladding, and replace with new, as noted in (23.8)(vi) and as related to chimney reconstructions and other areas of damaged roof cladding.

(i) Remove areas of the ground flooring where required for re-levelling and installation of new foundations, as related to (23.4), (23.5), (23.8), and (23.10) above.

25.6 Refer to my comments in (29) regarding alternative repair options.

RESPONSE TO COUNCIL SECTION 42A REPORTS AND EVIDENCE, INCLUDING ALTERNATIVE OPTIONS FOR STRUCTURAL REPAIRS

26 I have read the Section 42A structural related reports and associated Appendices that includes evidence from Mr Hogg of Aurecon and that includes a copy of the Structural Inspection Report by Win Clark dated 13 July 2012.

27 I note that the Structural Technical Advice provided by Mr Hogg concurs with all of the major structural issues and is in general agreement with myself on the repair and strengthening works required.

28 Mr Hogg also provides comments on Mr Clark's Report. I have reviewed Mr Clark's Report and I concur with Mr Hogg's comments where Mr Clark's opinion differs from Mr Hogg's and myself.

29 Some alternative options for the repair of various parts of the building are noted by Mr Hogg. My comments on these alternatives are as follows below, with Mr Hogg's comments shown in *italics*:

29.1 For areas of damaged brick walls that are not displaced out of alignment a feasible alternative repair option can be achieved by leaving the exterior walls "as is"; removing all internal

linings; and applying a shotcrete spray of a 100mm layer of reinforced concrete over the interior face of all exterior brick walls. New foundations would need to be incorporated with the shotcrete walls.

The application of a 100mm thick shotcrete skin increases the thickness of the wall and decreases the size of the internal space, so this may affect the appearance of some of the internal finishes and features, especially where the length of wall between a corner and window is small. It also affects the appearance and aesthetic of the windows due to the added wall thickness.

The additional shotcrete adds some weight to the structure and also means that the seismic weight of the brick wall is also not reduced as is currently intended by my recommended methodology. If such skin walls are installed at the lower level only then the additional seismic weight will require proportionate increases in the wall-floor diaphragm fixings and steel frames sizes, and likely require added bracing walls/frames above first floor to supplement the current light-weight Gib type wall bracing elements.

29.2 *Strengthening with composite fibre overlay on the interior face is also a possibility to strengthen brickwork but I have no experience in using this system on solid brick bracing walls.*

I agree this is an alternative option, but I also have no experience in using this on solid brick walls. I have used this on concrete buildings and found that there is a significant amount of preparation work required to the concrete substrate, and that it is often a more expensive method of strengthening a wall or floor element when compared with using equivalent steel plates. But fibre overlays do have the benefit of being thinner than steel plates and shotcrete skins.

The retention of the thicker heavy brick will result in a higher seismic weight at the lower level than currently allowed for in my strengthening methodology, but the increase is less than for the shotcrete skin system. Some proportionate increases in the wall-floor diaphragm fixings and steel frames sizes, and likely require added bracing walls/frames above first floor to supplement the current light-weight Gib type wall bracing elements.

Brett Andrew Gilmore

20 September 2023

Appendix 1

Structural Assessment Report

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quoin.co.nz

Client	**Milne Construction Limited**
Address	**67 Fendalton Road (9 Daresbury Lane), Fendalton, Christchurch**
Date	**17 May 2019**
Ref	**12316**

Integrity in Design

Quoin

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17 May 2019

James Milne
Milne Construction Limited
PO Box 232
Christchurch 8140

By Email: james@milneconstruction.co.nz

Dear James

Property at 67 Fendalton Road (9 Daresbury Lane), Fendalton, Christchurch Outline Scope of Works for Structural Repairs

1. Introduction

As requested, Quoin Structural Consultants Limited (Quoin) have completed a structural assessment of the main residence at 67 Fendalton Road (9 Daresbury Lane), Fendalton, Christchurch.

The aim of this assessment is to review the earthquake damage to the residence, assess the earthquake strength of the building and provide an outline scope of works for the structural repairs to reinstate the building to its pre-earthquake condition. This should allow for a preliminary budget estimate to be completed by Milne Construction Limited or an experienced quantity surveyor.

2. Limitations of Report

Findings presented as part of this report are for the sole use of use of Milne Construction limited. The findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses.

The structural assessment includes a walkover inspection of the residence and investigations to determine the construction of the main walls and some parts of the floors, ceilings and foundations. Structure that is hidden behind or beneath the remaining wall, ceiling and floor finishes and the ground level sub-floor have not been undertaken, and the assessment of the vertical alignment of the walls has not been assessed in any detail. A survey of the floor levels and a search of Christchurch City Council records has been undertaken.

Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.

3. General Background Information

3.1. Surveys, Reports, Investigations & Documentation

The following summarises the various surveys, reports, investigations and documentation used by Quoin as part of the structural assessment of this building.

(a) Floor Plan Layout Drawings. Refer to Appendices.

(b) East Elevation Drawing by Trengrove & Blunt, dated 1992. Refer to Appendices.

(c) Studio 21 – Endel Lust Drawings for Foundation Underpinning, dated 1 October 2003. Refer to Appendices.

(d) Floor level survey completed by Quoin (previously Structex Metro Limited) on 1 November 2011. Refer to Appendices.

(e) Structex Outline Scope of Works for Structural Repair, dated 24 August 2011.

(f) Skytech Geotechnical Report, dated 11 October 2013.

(g) Investigations of construction of main walls by Milne Construction and supervised by Quoin, dated July 2018. Refer to Appendices.

3.2. Standard of Structural Repairs

Quoin have been instructed that the standard of the structural repairs and works shall satisfy the requirements of the NZ Building Act 2004, and the NZ Building Code where required by the Act, and the Christchurch City Council for Building Consent. This includes:

(a) Building work is regulated under the Building Act 2004 and required to meet the statutory performance standards. Section 17 requires all building work to comply with the Building Code to the extent required by this Act, whether or not consent is required in respect of that building work. "Building work" includes both a rebuild and a repair. It is the responsibility of the designer to ensure plans, specifications or advice is sufficient to result in building work complying with performance-based requirements of the Code.

(b) Repair the damage such that the building will continue to comply with the NZ Building Code at least to the same extent as it did before the earthquake damage occurred (Section S112 of the NZ Building Act 2004).

(c) After the repair, there should be no reduction in:

  (i) Serviceability;

  (ii) Seismic performance;

  (iii) Size, capacity, durability and soundness.

(d) Include work that involves demolition, damage/destruction, removal and subsequent repair and reinstatement of otherwise undamaged necessary to comply with any law which is necessary to enable reinstatement of the earthquake damaged portions.

(e) Repair the damaged portions using currently equivalent building materials.

(f) As a matter of common sense, a "portion" might include an area larger than the damaged area.

3.3. Building Form & Construction

The residence includes a mixture of 1, 2 and 3 storeys and comprises the following:

(a) Category 1 Heritage Building.

(b) Designed by Samuel Hurst Seager and built between 1897 and 1901 in the English Domestic Revival style.

(c) Double and/or triple brick exterior load bearing walls 200mm to 360mm thick to the ground floor, with perimeter unreinforced concrete footings. The walls are typically strapped on the inside face with 75mm thick timber framing. Refer to the wall investigations summary.

(d) The exterior walls above the first floor typically comprise of 20mm decorative pebble dash plaster over 100mm thick brick infill between exposed timber stud/transom framing, with lath and plaster or GIB interior finishes. Refer to the wall investigations summary.

(e) Internal walls are typically timber framed and lined with a mixture of GIB board and lath and plaster. Refer to the wall investigations summary.

(f) Timber framed ground, first, and second floors.

(g) Tile roof over timber battens/purlins and rafters/trusses. The roof framing to the south-west Dining Hall is exposed and forms an architectural feature of this space.

(h) Lath and plaster ceilings throughout both the ground, first and second floor spaces. Some of the rooms have decorative and ornate timber finishes to the ceilings.

(i) Several large brick chimney stacks.

(j) The exterior load bearing brick walls are supported on unreinforced concrete strip footings and the ground floor framing is supported on concrete intermediate piles (assumed).

(k) The interior section of the ground floor to the Dining Hall was re-piled in 2003 with 125 x 125 timber piles cast into shallow strip footings.

(l) The south wall to the Lounge was underpinned in 2003 with new concrete pads and new sub-floor bearers.

3.4. Geotechnical Report & Site Soil conditions

The Skytec Geotechnical Report dated 11 October 2013 includes assessment of the site and soil conditions as follows:

(a) The property is a large section located in Fendalton with the Waimairi River running through the north-eastern part of the section and flowing in a north-west to south-east direction. The terrain is mainly level from the driveway to the rear apron and then slopes on a gentle gradient down to the riverbank. An internal trafficable bridge connects the two banks of the Waimairi River within the property.

(b) Soil profile typically comprises of shallow topsoil over mixtures of sand, silt, clay and gravel to a depth of 2.15m to 4.7m below ground level.

(c) Firm bearing of Ultimate Bearing Capacity (UBC) = 300 kPa available from 2.0m below ground level in 10 of 12 scala penetrometer tests (SPTs) and at a shallower depth of 1.1m below ground level in 2 of 12 SPTs.

(d) Moderate bearing of UBC=200 kPa available at varying depths between 0.6m to 1.0m below ground level.

(e) Water table measured at 1.9m below ground level.

(f) Aerial photographs taken of the area following the 24 February 2011 aftershock indicate pockets of grey ejecta along the roads around the neighbourhood. However, within the property, the aerial photographs did not conclusively indicate grey ejecta on the property.

(g) Based on the computed settlement due to liquefaction from CPT 1 to 3, the land on this property would be similar in performance to a TC1 property as per MBIE (2012). However, from the results of CPT 4, the performance would be classified as TC2 as per MBIE (2012).

(h) For a new building, shallow foundations may be used for this property for low rise buildings up to three storeys high but would require specific design to mitigate settlement from liquefaction and lateral spreading risks. This could be in the form of a thick RC raft foundation as per MBIE (2012).

4. Earthquake Damage to Residence

A brief summary of the damage caused to the residence due to the Canterbury Earthquake Sequence (CES) is as follows. Refer to the Appendices and the existing floor plans for the wall and room locations, and to the referenced photographs.

(a) The exterior brick walls are extensively cracked to all sides of the house. This includes various vertical, horizontal and diagonal cracks in the mortar courses and many of the cracks pass through individual bricks.

The cracks are likely to extend through the full thickness of the double/triple brick in many locations. Refer to the photographs as follows:

(i) Photographs 27-31 of west wall to Chiller, Laundry, Tech/Data.

(ii) Photographs 36-58 of south and west walls to Dining Hall.

(iii) Photographs 69-81 of south, west and north walls to Lounge.

(iv) Photographs 82-85 and 89-94 of north and east walls to Family.

(v) Photographs 96-98 of north and south wing walls to east entry.

(vi) Photographs 99-105 of east wall to Kitchen.

(vii) Photographs 106-108 of east wall to Office 1.

(b) Further to (a) above, various sections of the exterior brick walls have laterally displaced approximately 10-20mm in the plane of the wall and some sections 10-20mm out of plane.

These failed walls are considered to be in a dangerous condition that could result in partial collapse of sections of the building under a moderate to large earthquake. These walls include:

(i) West wall to Dining Hall.

(ii) West wall and west ends of the south and north walls to the Lounge.

(iii) North wall at north-west corner of Family.

Refer to photographs 40, 42-44, 47-51 to the Dining Hall, and photographs 69-81 to the Lounge, and photographs 82-85 to the Family.

(c) The foundations have differentially settled in some areas of the residence. Refer to the Appendices for the floor level survey summary. These differential slopes in the ground floor/foundations include:

(i) Lounge:

- 48mm fall (1.0%) from middle of floor to south-west corner.
- 24mm-32mm (0.7% - 0.8%) fall from middle of floor to the east wall to the Family Room that includes the heavy chimney stack (CH2).
- 28mm fall (0.8%) over south end of west exterior wall.

(ii) Family:

- 32mm-36mm (0.7% - 0.9%) falls from the middle of the room to the west interior wall to the Lounge and to the exterior north and east walls.
- 26mm (0.7%) fall across the north bay window.
- 26mm (0.9%) fall from north bay window towards west.

(iii) Office/Kitchen

- Approximately 15mm-20mm settlement of Chimney (CH4) foundation between the Office and Kitchen, but floor slopes remain acceptable at 0.5% or less.

(iv) Library

- 14mm-22mm (0.6%) falls from middle of room towards west exterior wall.

(d) The first floor to the main north 3-storey section of the residence is out of level over its relative area as indicated on the level plans. This has likely occurred as a result of a combination of creep deflection in the floor framing and the differential ground settlements noted in (c) above.

(e) All of the brick chimneys partially collapsed and were removed down to roof level following the main earthquake. Refer to sketch SKE1 and photographs 7, 17-23, 35, 39, 59-63 and 110-111.

(f) There are a large number of cracks in the walls and ceilings to the interior of the residence at all of the floor levels. Most of the cracks have penetrated the GIB board and lath and plaster, where visible, especially at the first floor level.

Severe damage to the finishes, that includes failure of the sheet material was observed in the following rooms:

(i) Lounge south and west walls (photographs 118-121).

(ii) Office 1 south end ceiling and wall, and west wall (photographs 127 and 129).

(iii) Middle stairwell north wall (photograph 133).

(iv) Bed 5 east wall above door (photograph 135).

(v) Bed 5 west wall above door (photographs 138 and 139).

(vi) Bed 6 west and east walls (photographs 141-144).

(vii) Bed 3 west wall above door (photograph 148).

(viii) Bed 2 east wall at north end (photograph 155).

(ix) Bed 1 all walls and ceiling (photographs 156-170).

(x) Main stairwell walls (photographs 171-174).

(xi) Bed 8 east wall (photograph 175),

(xii) Dining Hall walls (photographs 193-197).

(xiii) Hall 2 over internal arched doorway (photograph 203).

The full extent of cracks to the interior face of the brick walls has not been assessed due to the walls being hidden behind non-structural finishes.

(g) The exterior cladding above the first-floor level that comprises of pebble dash decorative plaster over brick infill has suffered some significant and widespread damage. This includes:

(i) Significant cracking of the plaster and movement gaps between the plaster/bricks and the timber studs/transoms, to the west exterior wall of Bed 7, Bed 8, and the adjacent stairs, plus the north-west corner of Bed 8, and to parts of the west walls to the Dining Hall. Refer to photographs 39, 40, 64-68, 74-76.

(ii) Cracking and/or tearing of the plaster, and smaller movement gaps than the walls noted in (i) above, to the remainder of the wall elevations of the Residence.

The damage noted above has compromised the weather-tightness of the cladding system, plus the brick infill has loosened between the timber stud/ transom framing.

(h) Damage to roof tiles due to the collapse (full or partial) of the chimneys).

(i) Slippage movement of the roof tiles. Subject to a more detailed assessment, damage was observed to the roofs to the Dining Hall, Bed 6/7, east entry, Bed 7 east end, and Bed 5/Ens 5.

(j) Other damage to elements and finishes include, but not limited to:

(i) Bent and cracked lead framed window to Family (photograph 113).

(ii) Cracks and movement gaps to internal fireplace surrounds (photographs 115-117, 119 and 137).

(iii) Ceiling damage due to post-earthquake water damage and broken windows to middle stairwell (photograph 132).

(iv) Movement gaps to fixed joinery (photographs 152-153 and 79).

(v) Ceiling damage due to swinging light in Bed 7 (photograph 187).

5. Assessment of Earthquake Strength of the Building

Quoin have completed a preliminary assessment of the undamaged strength of the main lateral resisting walls to provide an estimate of the pre-earthquake strength of the building.

The main purpose of this assessment is to assess whether the building, in its undamaged pre-earthquake condition is earthquake prone or not and determine the weaker sections of the building for which strengthening will likely be required as part of the repairs. It is noted that the failed brick walls will need to be replaced as part of any repair, so this assessment focuses on assessing the strength of the less damaged walls.

It is noted that the earthquake prone limits of 33% x NBS (New Building Standard) that are commonly used for commercial and public buildings do not normally apply to a single residential building. However, given the very large scale and size of the building, and that the building comprises of extensive unreinforced brick walls that have suffered significant damage, then the approach of assessing % x NBS is considered appropriate for this building.

It is also noted that for any repairs, then a Building Consent would be required, and we understand that the Christchurch City Council would likely require strengthening to a minimum target level of 67% x NBS for this type and size of building and for the large extent of repairs required.

The assessment is based on the NZ Society of Earthquake Engineering Guidelines (NZSEE, June 2006) for the "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" together with the Detailed Engineering Evaluation Procedure (DEEP, July 2011) document (draft). The assessment uses AS/NZS 1170.5 to determine the applied loadings to the building and the NZSEE, June 2006 and February 2011, guidelines to assess the building capacity.

The strength of the connections between the diaphragms and the resisting elements have not been assessed at this preliminary stage.

A brief summary assessment of the existing building (in terms of % x New Building Standard (NBS)) is:

(a) Ground floor north-south brick walls in-plane strength: 39% x NBS average

(b) Ground floor east-west brick walls in-plane strength: 29% x NBS average

(c) First floor north-south timber framed sheet braced walls: 23% x NBS average

(d) First floor east-west timber framed sheet braced walls: 30% x NBS average

(e) Second floor east-west timber framed sheet braced walls at north end of Entertainment: 13% x NBS

(f) Second floor north-south timber framed sheet braced walls: 36% x NBS average

(g) Second floor east-west timber framed sheet braced walls: 37% x NBS average

(h) South chimney to Dining Hall: 20% x NBS out-of-plane in north-south direction

The preliminary assessment confirms that the building would be considered to be earthquake prone with an assessed undamaged strength of 13% x NBS, not taking into account that some of the walls have failed and would have a lower % x NBS.

6. Assessment & Recommendations for Structural Repairs

The following is a summary of Quoin's assessment of the earthquake damage summarised in section 4 and recommendations for the structural repairs required to reinstate the residence back to its pre-earthquake condition, and satisfy a minimum strength of 67% x NBS. This scope is preliminary. Refer to sketches SKR1 – SKR10 inclusive.

Quoin's assessment of the repairs required for the earthquake damage as summarised in Section 4 recommendations for repair are as follows.

(a) Exterior Brick Loadbearing Walls

The exterior loadbearing walls to all sides of the residence have suffered extensive and widespread damage.

The brick walls to the west side and north-west/south-west corners of the ground floor Lounge beneath the 3-storey section of the residence have failed, and this corner of the residence is in danger of collapse. Other areas of the residence that have failed and/or severely damaged walls include the west wall to the Chiller/Laundry/Tech-Data, south and west walls of the Dining, part of the north wall to the Family, and north/south wing walls to the Main Entry. There is no option but to remove and replace these failed walls.

Elsewhere, the damage to the brick walls includes extensive cracking and gaps in the brickwork. It is likely that the cracks have extended through the thickness of the brick walls in most areas.

Quoin have assessed the walls in their undamaged condition to have an earthquake strength of less than 33% x NBS in most areas and, as such, the building would be considered to be earthquake prone if it were a commercial building.

It is Quoin's opinion that any repair strategy requires the exterior wythe of bricks to be removed and replaced. If this were undertaken, and if the inner wythe could be repaired, the walls would still have a strength of less than 33% x NBS.

Quoin recommends that the damaged ground level exterior brick walls be removed, and replaced with timber framed walls with an exterior brick veneer to reinstate the architectural aesthetic. The extent of these walls includes all of the brick walls to the two and three storey sections of the residence and to the large height Dining Hall as indicated on sketches SKR1, SKR3 and SKR4.

This repair strategy has the benefit of reducing the overall seismic mass of the building and allows the building's earthquake strength to be increased above 33% x NBS with the use of lighter weight GIB sheet bracing walls, supplemented by steel frames where required.

There are some exterior brick walls that do not appear to be significantly damaged. These include the single storey lower height walls to Office 2 at the south-west corner and the Library and Hall 3 to the west side (middle). Quoin recommends that the exterior wythe to these walls be retained and repaired with Helifix bars and dryfix ties Quoin recommends to allow to install 20 x 1000mm long stainless steel Helibars and 200 ties 245mm long. Refer to sketch SKR4 for the extent of these walls. Following repair, these particular walls will have a strength of 67% x NBS or more.

(b) All of the brick chimneys have collapsed and been removed to roof level.

The chimney stacks include the following, at locations shown on sketches SKE1, SKE2 and SKE3.

(i) 2+ storey high stack (CH1) to south walls of the Lounge, Bed 1, Bed 8. The remaining section of thick stack hidden behind finishes.

(ii) 3+ storey high stack (CH2) between the Family/Lounge, Bed 2/Bath, and Bed 8/Entertainment rooms. This stack is internal and hidden behind finishes.

(iii) 2+ storey high stack (CH3) between the Kitchen/Office 1 and Bed 4/ Ens 5. This stack is internal and hidden behind finishes.

(iv) 1+ storey high stack (CH4) to south wall of Office 1. This stack removed down to eaves level.

(v) 3+ storey high stack (CH5) above the Tech Data Room and between Bed 6/Stairs and to the south-west corner of Bed 7.

(vi) 2+ storey high stack (CH6) between the Dining Hall/Library that forms part of the high gable wall. This stack is extensively damaged above the flat roof of the Library.

(vii) 2+ storey high stack (CH7) to the south wall of the Dining Hall and that forms part of the high gable end wall. This stack removed down to eaves level and the remaining lower section has cracking damage.

Quoin recommends that all of the chimney stacks be removed down to ground level and reconstructed as lighter weight structures.

This will have the benefit of reducing the seismic mass of the building and allows the building's earthquake strength to be increased, as noted in (a) above.

Given the historic category of the building and that the brick chimney stacks form an important part of the architectural aesthetic, Quoin recommends to reinstate all of the sections of the chimneys that are exposed with brick veneer.

Quoin recommends to laterally support the tall chimney stacks with internal steel trussed frames that are commonly used for such tall chimney construction. It may be possible, subject to review by an experienced contractor, to re-use parts of the existing chimney stacks that collapsed and/or have been removed and stored on site. If the chimney(s) is not to remain in a working condition, then the middle of the re-used section would be filled with a steel pipe grouted inside of the bricks and fixed onto the top of the new steel support frame. Refer to sketches SKR7 and SKR8 for indicative details.

(c) Foundations

(i) Exterior Foundations for New Wall Construction

Quoin recommends to remove and replace the existing unreinforced foundations beneath the exterior ground floor walls that are to be reconstructed. Refer to sketches SKR1 and SKR2 that highlights these foundations as 'blue' and 'green' strip footings and SKR9 for typical details.

It is important that the new timber framed walls, that include exterior brick veneer (or brickslip cladding) and new sheet bracing are fixed well into reinforced foundations that can support the imposed gravity and wall bracing loads.

It is Quoin's opinion that the existing unreinforced foundations are not suitable for reuse for the new wall construction.

(ii) Chimney Bases

Quoin recommends that the existing unreinforced chimney pads be removed and replaced with reinforced foundation pads that are sized to support the new steel trussed frames for the reconstructed chimneys. The steel frames form part of the lateral resisting systems for the building, together with the sheet braced walls and steel portal frames, and require enlarged pads at some locations. Refer to sketch SKR2 that highlights the new foundation pads in 'blue'.

(d) Exterior Plaster Clad Walls Above First Floor Level & to Dining Hall

It is Quoin's opinion that the plaster and brick infill to the significantly damaged areas noted in Section 4(g)(i) needs to be entirely removed and replaced with a compliant weather tight cladding system, and that repairs the wall bracing strength to a minimum of 67% x NBS.

For the remaining areas that are damaged, but to a lesser extent, Quoin recommends the same removal and reinstatement repair strategy so that the seismic mass of the building is reduced to a level where the building can be earthquake strengthened to a minimum of 67% x NBS.

This strategy will also allow for the ground level brick walls to be more easily removed and replaced with a lesser amount of temporary propping required.

The repairs will likely involve the installation of a new compliant cladding system, with cavity, and detailed/finished with timber and decorative plaster to match the existing exterior aesthetic. To support the new cladding and internal additional wall finishes and sheet bracing, Quoin recommends to allow to install additional timber studs and dwang framing to provide a compliant wall construction.

(e) Interior Wall Finishes

As summarised in section 4 (f), the extent of the damage to the interior wall and ceiling finishes throughout the residence is extensive.

All of the failed lath and plaster and gib finishes need to be replaced as part of any repair.

Given the large extent of finishes and heavy brick walls and chimneys to be replaced, Quoin assessed whether the building could be repaired and strengthened with lighter weight sheet wall bracing elements, together with the reconstructed chimneys with steel trussed frames. This type of strengthening, that utilises the reduction in the seismic mass of the building, works well with the type and extent of new walls, steel frames, and roof/floor

bracing that might otherwise be required if the heavy brick walls, chimneys, and wall infills were to be reconstructed and/or retained where possible within the building.

Quoin assessed that the building can be strengthened to a minimum of 67% x NBS as follows:

(i) Remove all heavy brick walls, chimneys, and infills, and reinstate with lighter weight construction as noted in 6 (a), (b) and (d) above.

(ii) Remove all interior lath and plaster and Gib wall finishes, and reinstate with new Gib Braceline, including standard hold down straps and bolts.

(iii) Include supplementary steel frames as noted in 6 (f).

(f) Earthquake Strengthening & Steel Frames

Further to the new sheet braced walls and steel trussed chimney frames, Quoin have assessed that supplementary steel frames are required for the building to achieve an assessed earthquake strength of 67% x NBS or more. These supplementary frames include the following as indicated on sketches SKR3 – SKR5 and that require new foundations as highlighted 'blue', 'pink' or 'orange hatched' on SKR2 and that comprise of strip footings to ensure adequate strength and stiffness.

(i) Portal frame PF1 to Lounge with new north-south foundations across the width of the Lounge.

(ii) Portal frame PF2 to north wall of Lounge, supported on new exterior foundation.

(iii) Portal frame PF3 to east exterior wall of Family, supported on new exterior foundation.

(iv) Portal frame PF4 to east exterior wall of kitchen, supported on new exterior foundation.

(v) Portal frame PF5 to north wall of Bed 1, supported on first floor exterior wall.

(vi) Cantilever steel columns to the east and west exterior side walls of the Dining Hall with new transverse east-west 'finger' beams to provide a rigid base to the columns.

Quoin have proposed the installation of these steel columns, together with proposed roof bracing, to provide a structural solution that takes into account the architectural features of the timber framed roof by minimising the extent of visible steelwork. The sketches indicate the steel columns to be built into the walls and the roof bracing to be installed on top of the timber roof sarking, so that the main steel elements are not visible in the repaired building. This assumes that the roof tiles will be replaced as part of the repairs.

(vii) New tie beam foundations are recommended to be installed to the north side entry canopy posts and the west side first floor balcony posts to mitigate against possible lateral spreading of the foundations as noted in the geotechnical report.

(g) Interior Ceiling Finishes

The extent of the works to repair and replace the wall linings and the chimney stacks and install the steel frames will affect the ceiling linings adjacent to the walls, chimneys and frames.

The replacement of the exterior brick walls will require propping to be installed beneath the first floor adjacent to and set back approximately 0.5 – 1.0 m from the exterior walls. This will require the removal of the ceilings in these areas so that the floor framing can be inspected and suitable propping installed.

The ceilings to the single storey sections and to the roofs of the 2/3 storey sections typically act as diaphragms within the main building structure and will need to be replaced as part of the strengthening works.

Taking into account the above, together with the repairs required to the damaged ceilings, Quoin recommends that allow to remove all of the ceiling finishes throughout the residence, and replace with new 13mm Gib, fixed in accordance with NZS 3604 and the Gib installation guidelines. This does not include the timber feature ceiling to the Dining.

(h) Ground Floor & Foundation Relevelling

Quoin recommends that the areas of the floors and foundations summarised in 4(c)(i) – (iv) be relevelled to within the 0.5% slope criteria recommended in the MBIE Guidelines. This includes:

(i) Lounge, Family & Library

The central area of the floor to be lowered by 10mm-20mm. Quoin recommends to replace the interior piles, as is standard practice, rather than notching existing bearers.

The sections around the perimeter will be relevelled as part of the foundation replacement repairs, where recommended for the Lounge and Family Rooms.

(ii) Office/Kitchen

The foundation between the Office and Kitchen will be relevelled as part of the foundation replacement repairs.

(i) First Floor Relevelling

There are large areas of the first floor that have floor slopes that exceed the MBIE Guidelines.

It is likely that the dislevelment is caused by a combination of creep deflection in the floor framing and some differential settlements of the main foundations.

Quoin recommends that the floor levelness be reviewed following completion of the foundation repair and the relevelling.

Typical details are indicated on Sketch SKR10 for localised relevelling of the first floor.

(j) Non-Structural Elements and Fixtures

The scope and extent of the non-structural repairs is to be reviewed and assessed by a licensed building practitioner such as Milne Construction Ltd. They may include, but may not be limited to the following:

(i) Cracks, lateral displacement, and/or bows in windows and doors.

(ii) Displacement of decorative timber joinery and reveals to internal doors.

(iii) Damage to floor finishes.

(iv) Damage to joinery and fixtures.

(v) Damage to fireplace surrounds.

(vi) Damage to spouting and downpipes.

(vii) Damage to plumbing and services.

(viii) Consequential effects of undertaking the main structural repairs and strengthening , such as removal of bathroom and kitchen finishes and fixtures, and temporary propping/bracing of the building structure during the repairs.

7. Conclusion

The residence has suffered significant and widespread earthquake damage.

Some sections of the building have loadbearing brick walls that have failed and are at risk of partial collapse due to future moderate/large earthquakes.

The building has been assessed as being earthquake prone with an earthquake strength of 13% x NBS for some of the less damaged walls, and less than the earthquake prone limit of 33% x NBS for commercial, public, and multi-unit residential buildings.

Quoin recommends that the repairs to the building include strengthening to a minimum of 67% x NBS.

The report summarises the earthquake damage and recommendations for the structural repairs and strengthening.

If you have any queries, regarding this Outline Scope, or require any further assistance, please do not hesitate to contact the undersigned.

Yours sincerely
Quoin Structural Consultants Limited

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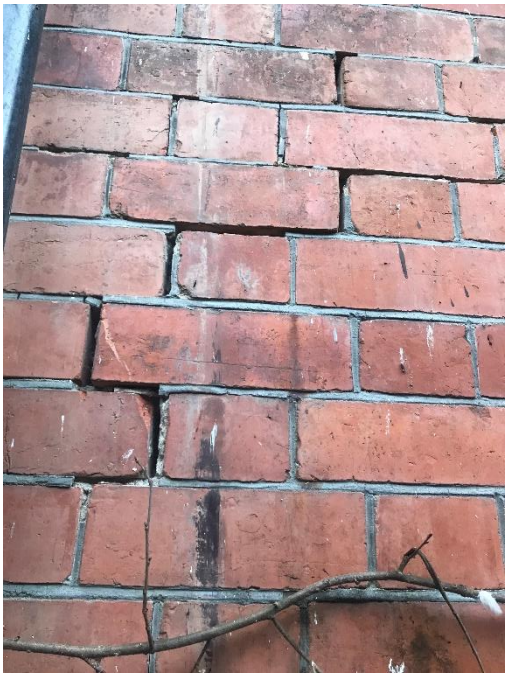
29.	Cracks and slippage gaps in west brick wall to Laundry	
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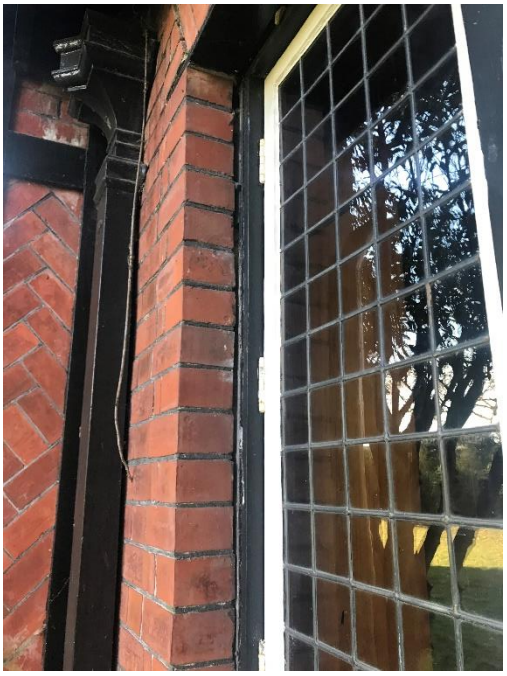
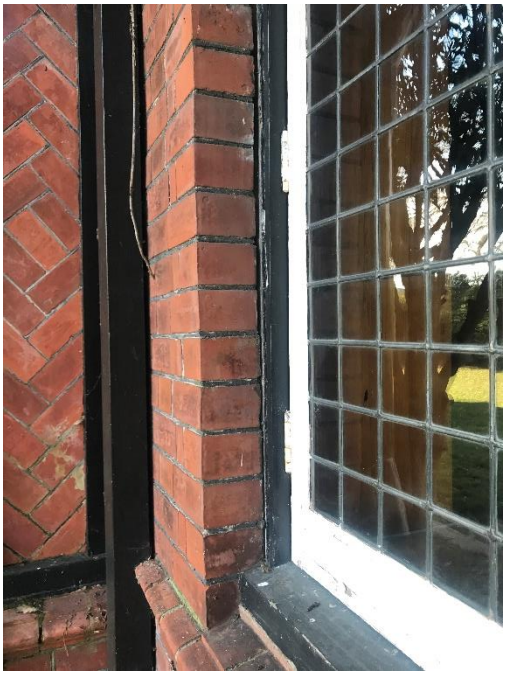
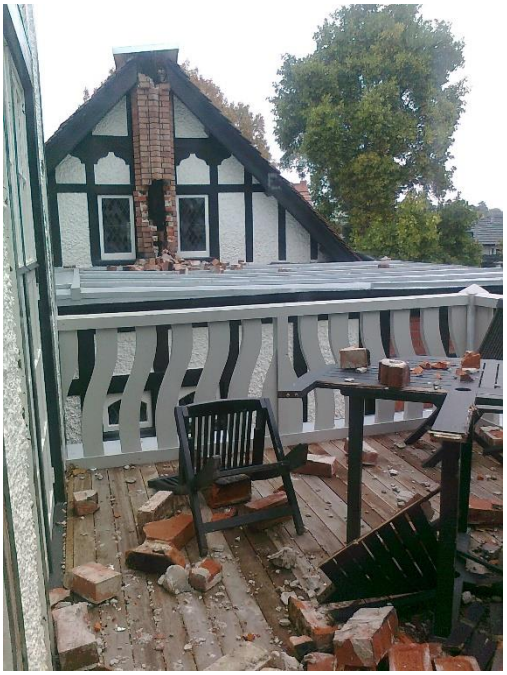
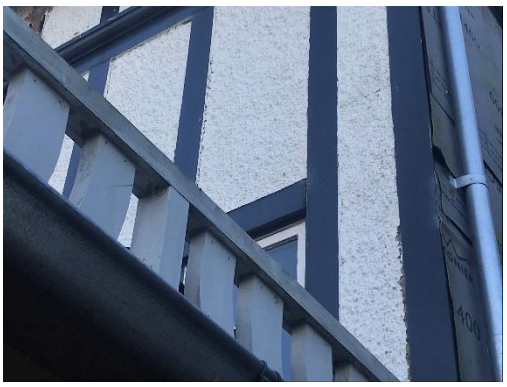
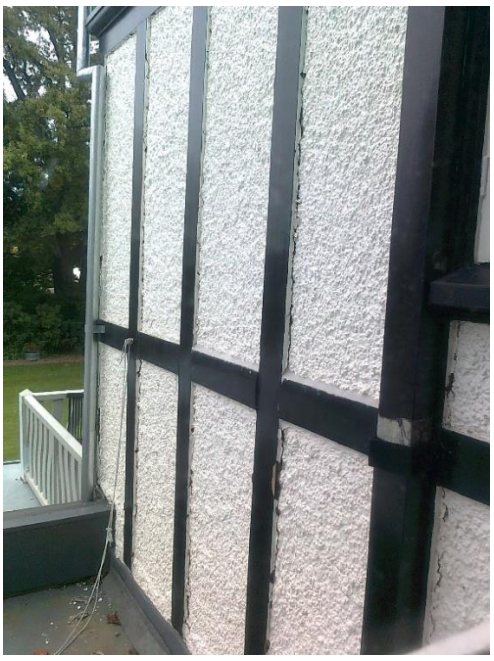
53.	Large 10mm movement of west brick wall to Dining Hall, adjacent to door	

54.	Large 15 – 25mm movement of west brick wall at window to Dining Hall	
55.	Large 15 – 25mm movement of west brick wall at window to Dining Hall	

56.	Large 15 – 25mm movement of west brick wall at window to Dining Hall	
57.	Large 15 – 25mm movement of west brick wall at window to Dining Hall	
58.	Cracks and slippage gaps in brick wall above west side windows to Dining Hall	

59.	Collapse and failure of brick chimney to north end of Dining Hall, above flat roof to Library, plus movement damage to tile roofing	
60.	Collapse and failure of brick chimney to north end of Dining Hall, above flat roof to Library, plus movement damage to tile roofing	
61.	Collapse of brick chimney to south-west corner of Bed 8 plus movement damage to tile roofing	

62.	Collapse of brick chimney to south-west corner of Bed 8 plus movement damage to tile roofing	
63.	Collapse of brick chimney to south-west corner of Bed 8 plus movement damage to tile roofing	
64.	Cracks in plaster/brick infill, and movement gaps/tearing between plaster and timber studs/transoms to west wall of stairs, Bed 1, Bed 6, and Bed 8	

65.	Cracks in plaster/brick infill, and movement gaps/tearing between plaster and timber studs/transoms to west wall of stairs, Bed 1, Bed 6, and Bed 8	
66.	Cracks in plaster/brick infill, and movement gaps/tearing between plaster and timber studs/transoms to west wall of stairs, Bed 1, Bed 6, and Bed 8	
67.	Cracks in plaster/brick infill, and movement gaps/tearing between plaster and timber studs/transoms to west wall of stairs, Bed 1, Bed 6, and Bed 8	
68.	Cracks and tearing in decorative plaster to south wall of main north-west Stairwell	

69.	Failure of south side brick wall to Lounge, at south-west corner	
70.	Failure of west side back wall to Lounge – south end	
71.	Failure of west side brick wall to Lounge – north end	
72.	Failure of west side brick wall to Lounge – north end	

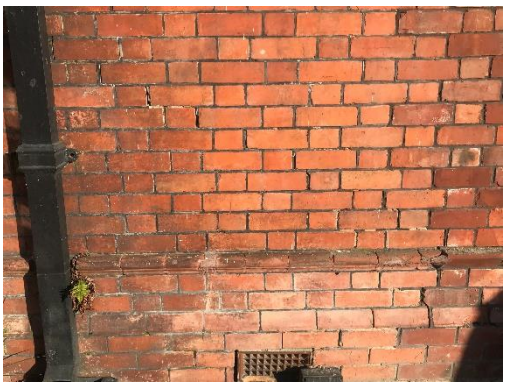
73.	Failure of west side brick wall to Lounge – north end	
74.	Failure of west side brick wall to Lounge – north end, plus damage to plaster and brick infill above	
75.	Failure of west side brick wall to Lounge – north end, plus damage to plaster and brick infill above	
76.	Failure of west side brick wall to Lounge – north end, plus damage to plaster and brick infill above	

77.	Failure of north brick wall to Lounge, at north-west corner	
78.	Failure of north brick wall to Lounge, at north-west corner	
79.	Cracks in brick walls to north wall of Lounge, plus large movement gaps between timber framing elements	

80.	Localised failure in north brick wall to Lounge, adjacent to window	
81.	Cracks in north brick wall to Lounge, including slippage gaps	
82.	Cracks in north brick wall to Lounge, including slippage gaps	
83.	Cracks and localised failure of north brick wall to Family Room	

84.	Cracks and localised failure of north brick wall to Family Room	
85.	Cracks and localised failure of north brick wall to Family Room	
86.	Cracks and localised failure of north brick wall to Family Room	
87.	Large movement gap in timber wall framing at base of north wall at terrace	

88.	Large movement gap in timber wall framing at base of north wall at terrace	
89.	Movement gaps between plaster and timber studs/transoms to north wall	
90.	Cracks and movement gaps in brick wall beneath north bay window to Family	
91.	Cracks and slippage gaps in east brick wall to Family	

92.	Cracks and slippage gaps in east brick wall to Family	
93.	Cracks and slippage gaps in east brick wall to Family	
94.	Cracks and slippage gaps in east brick wall to Family	
95.	Cracks and slippage gaps in east brick wall to Family beneath bay window	

96.	Damaged roof tiles to east entry roof	
97.	Cracked brick north wing wall to east entry	
98.	Cracked brick north wing wall to east entry	
99.	Failed brick south wing wall to east entry	

100.	Cracks and slippage gaps in east brick wall to Kitchen	
101.	Cracks in east brick wall to Kitchen	
102.	Cracks and slippage gaps in east brick wall to Kitchen	
103.	Cracks and slippage gaps in east brick wall to Kitchen	

104.	Cracks and slippage gaps in east brick wall to Kitchen	
105.	Cracks and slippage gaps in east brick wall to Kitchen	
106.	Cracks and slippage gaps in east brick wall to Kitchen	
107.	Cracks in east brick wall to Office 1	

108.	Cracks in east brick wall to Office 1	
109.	Cracks in east brick wall to Office 1	
110.	Collapsed chimney to south wall of Office 1	

111.	Collapsed chimney to south wall of Office 1	

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Photographs of Earthquake Damage to Interior

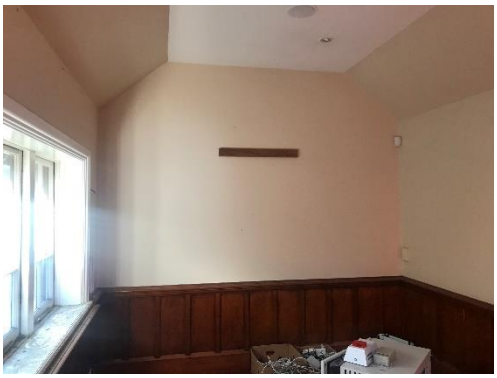
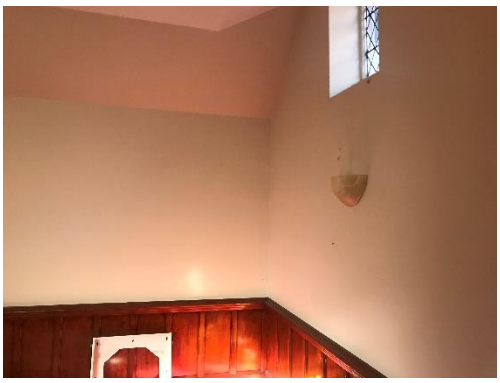
112.	Chimney fireplace in Family (west wall) looking west	
113.	Deformed and broken lead framed window to Family	
114.	Movement of roof tiles to Dining Hall	

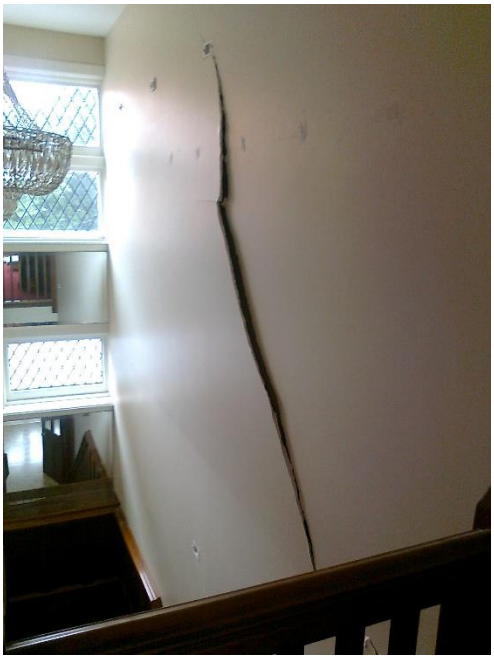
115.	Chimney fireplace in Lounge (east wall) looking east, with cracks/ gaps in bricks	
116.	Chimney fireplace in Lounge (east wall) looking east, with cracks/ gaps in bricks	
117.	Crack/gap in concrete lintel above east fireplace in Lounge	

118.	Large cracks/gaps in wall finishes at north-west corner of Lounge	
119.	Chimney fireplace in Lounge (south-west) looking south, with extensive damage to wall and ceiling finishes and cracks/gaps in brick walls	
120.	Chimney fireplace in Lounge (south-west) looking south, with extensive damage to wall and ceiling finishes and cracks/gaps in brick walls	
121.	Racking damage to south wall of Lounge	

122.	Crack/gap in wall finishes in Entry Hall	
123.	General view of Entry Hall, looking west	
124.	General view of Kitchen, looking north	

125.	General view of Kitchen, looking south towards fireplace, with significant ceiling damage	
126.	General view of Office 1, looking north towards fireplace	
127.	Ceiling and wall damage in Office 1	
128.	Wall damage in Office 1	

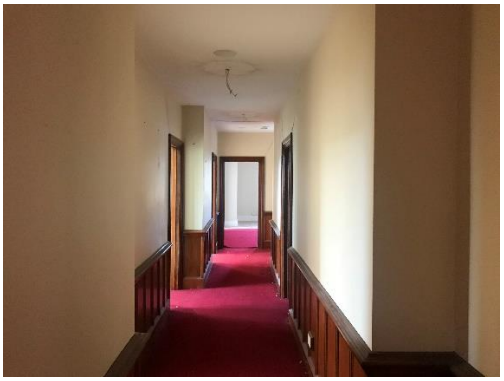
129.	Wall damage in Office 1	
130.	General view of Office 2, looking east	
131.	South-west corner of Office 2	
132.	Ceiling to middle Stairwell	

133.	Failure of wall finishes to middle Stairwell	
134.	Cracked wall and ceiling finishes to north-west of Bed 5	
135.	Cracked wall finishes to Bed 5 above door to Ens 5	
136.	Crack in wall finishes in south-west wardrobe	

137.	Cracks in fireplace surround and wall finishes to Bed 4	
138.	Significant cracks in wall finishes to Bed 4	
139.	Significant cracks in wall finishes to Bed 4	
140.	General view of Bath 4/6	

141.	Significant cracks in wall finishes to Bed 6	
142.	Significant cracks in wall finishes to Bed 6	
143.	Significant cracks in wall finishes to Bed 6	
144.	Significant cracks in wall finishes to Bed 6	

145.	General view of Bath 3	
146.	Bath 3 large movement gap in wall finishes at north-east corner	
147.	Cracks in wall finishes to Bed 3	

148.	Cracks in wall finishes to Bed 3	
149.	Cracks in wall finishes to First Floor Hall	
150.	General view of Foyer, looking west	
151.	Cracks in wall finishes in Foyer above door to Bed 2	

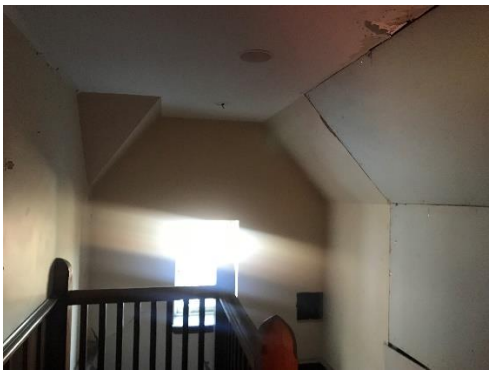
152.	Bed 2, looking west towards fireplace, with cracks in wall finishes and movement gaps in fixed joinery	
153.	Bed 2, looking west towards fireplace, with cracks in wall finishes and movement gaps in fixed joinery	
154.	Cracks in wall finishes to Bed 2 including large movement gaps at window frame	
155.	Cracks in wall finishes to Bed 2 including large movement gaps at window frame	

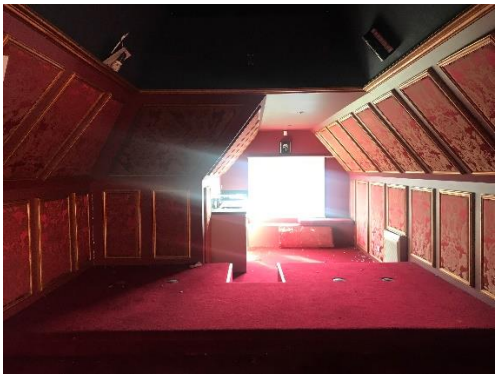
156.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
157.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
158.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
159.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	

160.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
161.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
162.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
163.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	

164.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
165.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
166.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
167.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	

168.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
169.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
170.	Bed 1 extensive and severe cracking damage to wall and ceiling finishes	
171.	Extensive cracks in wall finishes to main north Stairwell	

172.	Extensive cracks in wall finishes to main north Stairwell	
173.	Extensive cracks in wall finishes to main north Stairwell	
174.	Cracks in wall and ceiling finishes to main north Stairwell, including temporary replacement of some linings	
175.	Cracks in wall finishes to Bed 8	

176.	Cracks in wall finishes to Bed 8	
177.	Cracks in wall finishes to Second Level Hall	
178.	General view of Entertainment Room, looking north	
179.	General view of Entertainment Room looking south, including cracks and movement gaps to wall/ceiling finishes	

180.	Movement in wall finishes to Entertainment Room	
181.	General view of Bed 7	
182.	General view of Bed 7	
183.	General view of Bed 7	

184.	Cracks in wall finishes to Bed 7	
185.	Cracks in wall finishes to Bed 7	
186.	Cracks in wall finishes to Bed 7	
187.	Ceiling damage to Bed 7 from swinging light	

188.	General view of Dining Hall looking south	
189.	General view of Dining Hall looking north	
190.	General view of Dining Hall roof framing	
191.	General view of Dining Hall roof framing	

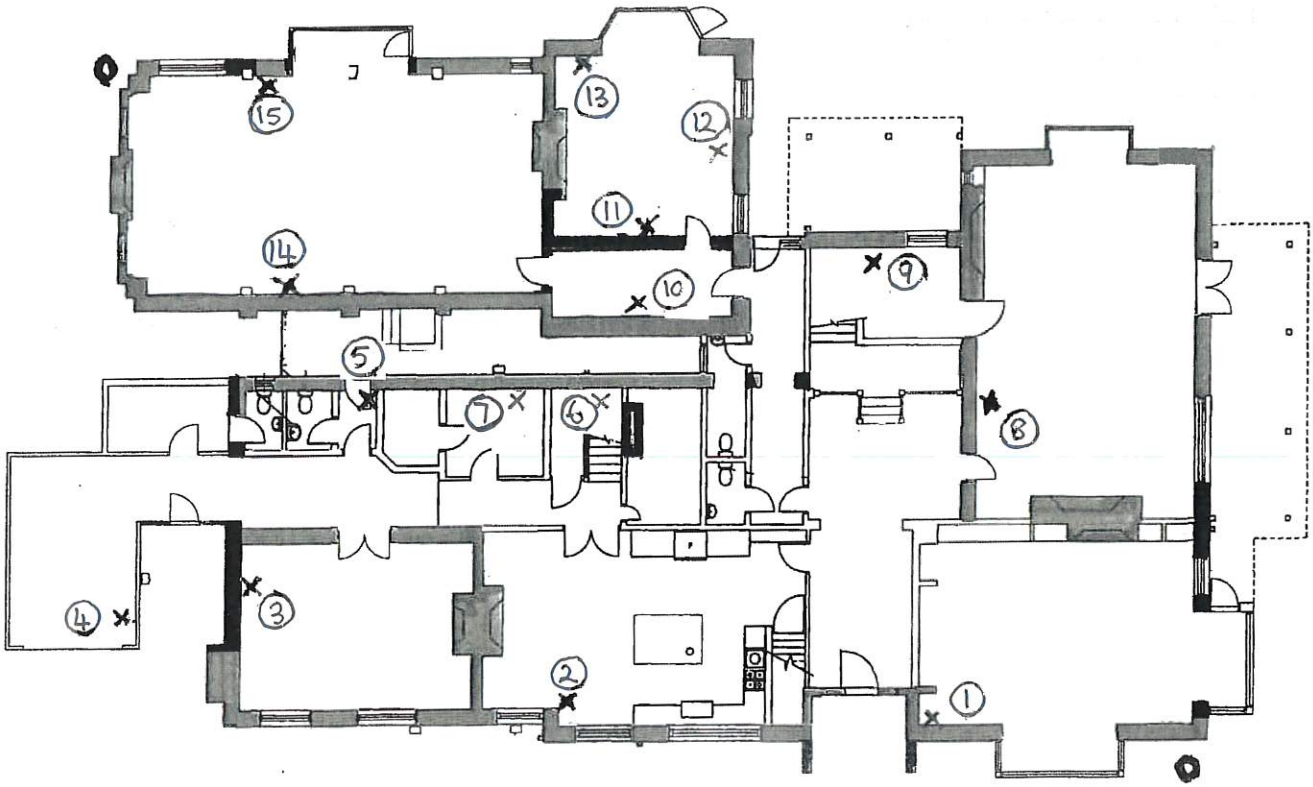
192.	General view of Dining Hall roof framing	
193.	Cracks in wall finishes to Dining Hall	
194.	Cracks in wall finishes to Dining Hall	
195.	Cracks in wall finishes to Dining Hall	

196.	Cracks in wall finishes to Dining Hall	
197.	Cracks in wall finishes to Dining Hall	
198.	General view of Hall 3, looking north	
199.	General view of Library, looking west	

200.	Cracks to wall finishes to Library	
201.	Cracks to wall finishes to Library	
202.	Cracks to wall finishes to Library	
203.	Cracks in wall to Hall 2, looking east	

Quoin

Project	67 Fenaltan Rd		
Reference	12316		
Date	July 2018	Author	BAG



GROUND FLOOR WALL AND FOUNDATION INVESTIGATIONS

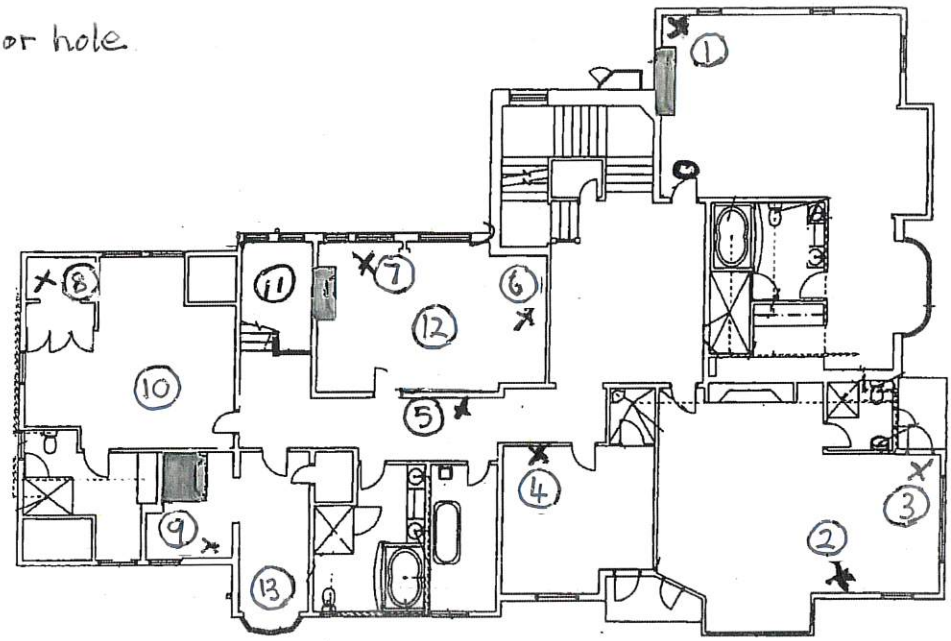
x cutout or hole in wall

o excavate at foundation

Quoin

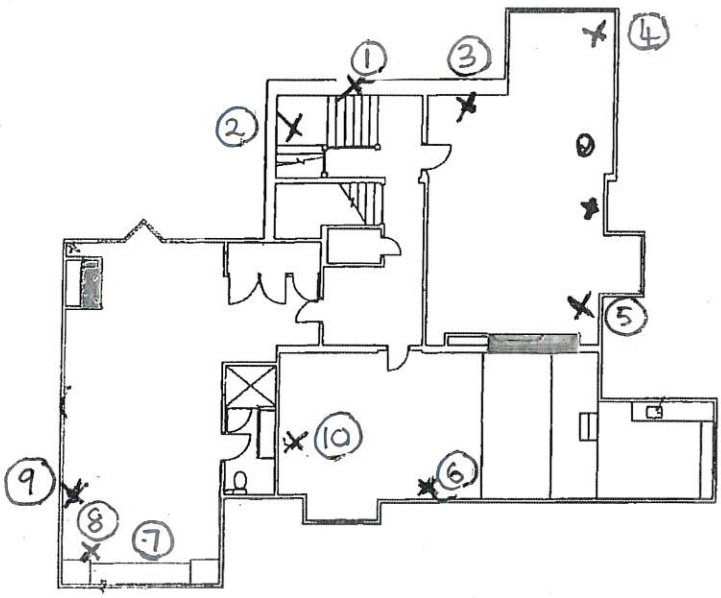
Project	67 Fendalton Rd		
Reference	12316		
Date	July 2018	Author	BAG

x cutout or hole



FIRST FLOOR WALL/FLOOR/CEILING INVESTIGATIONS

x cutout or hole



SECOND FLOOR WALL/FLOOR INVESTIGATIONS

67 Fendalton Road - Residence Wall Investigations
(July 2018)

	Ground Floor Wall/Floor Investigations
1	Brick 350mm thick and 75 timber strapped
2	Brick 350mm thick and 75 timber strapped
3	Brick 360mm thick (20mm plaster on face) 2 x 10mm Gib, 20mm batten & panelling
4	Brick 305mm thick and 50mm timber strap, poly, 10mm Gib
5	Note: Bathroom tiled unable to view
6	Brick 350mm thick and 75 timber strap, lath & plaster
7	Joists 300x50, 470 centres
8	Internal wall 75mm stud, lath & plaster one side and TG&V on other
9	Brick 360mm thick and 75mm timber on lath & plaster
10	Brick 230mm thick
11	Internal wall 100mm framing, lath & plaster both sides
12	Brick 120mm thick, decorative exterior plaster 10-20mm thick
13	Brick 200mm thick, decorative brick pattern
14	Brick 350mm thick
15	Brick 470mm thick

Holes and cutouts formed by Milne Construction Ltd and supervised by Quoin

67 Fendalton Road - Residence Wall Investigations
(July 2018)

	First Floor Wall/Floor/Ceiling Investigations
1	Brick 120mm thick including decorative plaster 20mm batten, lath & plaster and Gib
2	Brick 130mm thick including plaster in between timber 100x100mm and Strapped 75mm timber, lath & plaster and Gib
3	Brick 120mm thick and 20mm batten lath & plaster
4	100mm studs, lath & plaster and Gib both sides
5	100mm studs, lath & plaster and Gib both sides
6	100mm studs, lath & plaster and Gib both sides
7	Brick 130mm thick including exterior plaster
8	Brick 120mm thick and 20mm battens, lath & plaster
9	Rafters 150x45, 400 centres
10	Ceiling runners 150x45 - strong back 2/300x50
11	300x50 ceiling runners, 150x50 rafters
12	300x50 ceiling runners
13	Floor hole 300x100, joist cantilevered to support overhang of first and second storey

Holes and cutouts formed by Milne Construction Ltd and supervised by Quoin

67 Fendalton Road - Residence Wall Investigations
(July 2018)

	Second Floor Wall/Floor Investigations
1	Void and brick 120mm Thick
2	Brick 120mm thick including plaster - big void, 100mm framing, lath & plaster
3	100mm timber wall on TG&V 20mm batten, lath & plaster, rafters 150x50
4	Brick 120mm thick, 100mm posts, TG&V, lath & plaster
5	100x50 timber wall into roof space on Gib
6	2/300x45 timber joists 450 centres
7	300x45 timber joist on 100x100 studs with 150x50 top plate supporting joists for cantilevered overhang
8	Brick 130mm thick on decorative plaster on 20mm batten with TG&V 50mm strap, poly and Gib
9	100x50 Timber Wall on Lath & Plaster
10	115 Timber Wall, Lath & Plaster and 13mm Gib, TG&V on Bathroom Side

Holes and cutouts formed by Milne Construction Ltd and supervised by Quoin

Preliminary
16.05.2019

Drawing List
(A3 originals)

STRUCTURAL

existing drawings

SKE1	existing ground floor plan
SKE2	existing first floor plan
SKE3	existing second floor plan and roof deck
SKE4	east elevation (Trengrove & Blunt Architects)
SKE5	underpinning and foundations (Studio 21-Endel Lust)
SKE6	underpinning and foundations (Studio 21-Endel Lust)
SKE7	typical existing exterior wall foundation

floor level plans

SKL1	existing ground floor level plan
SKL2	existing first floor level plan
SKL3	existing second floor level plan

repairs drawings

SKR1	foundation types / new walls and steel frames
SKR2	foundation plan repairs
SKR3	ground floor plan repairs - wall, roof, and chimney repairs and new steel frames
SKR4	ground floor plan repairs - wall, roof, and chimney repairs and new steel frames
SKR5	first floor plan repairs
SKR6	second floor plan repairs and roof deck plan
SKR7	typical chimney details
SKR8	typical chimney base support details
SKR9	typical foundation details
SKR10	floor packing details

ACENZ

Quoin

Quoin Structural Consultants

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Christchurch 8013
PO Box 25 438
Christchurch 8144

03 968 4925
quoin.co.nz

STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE)

for

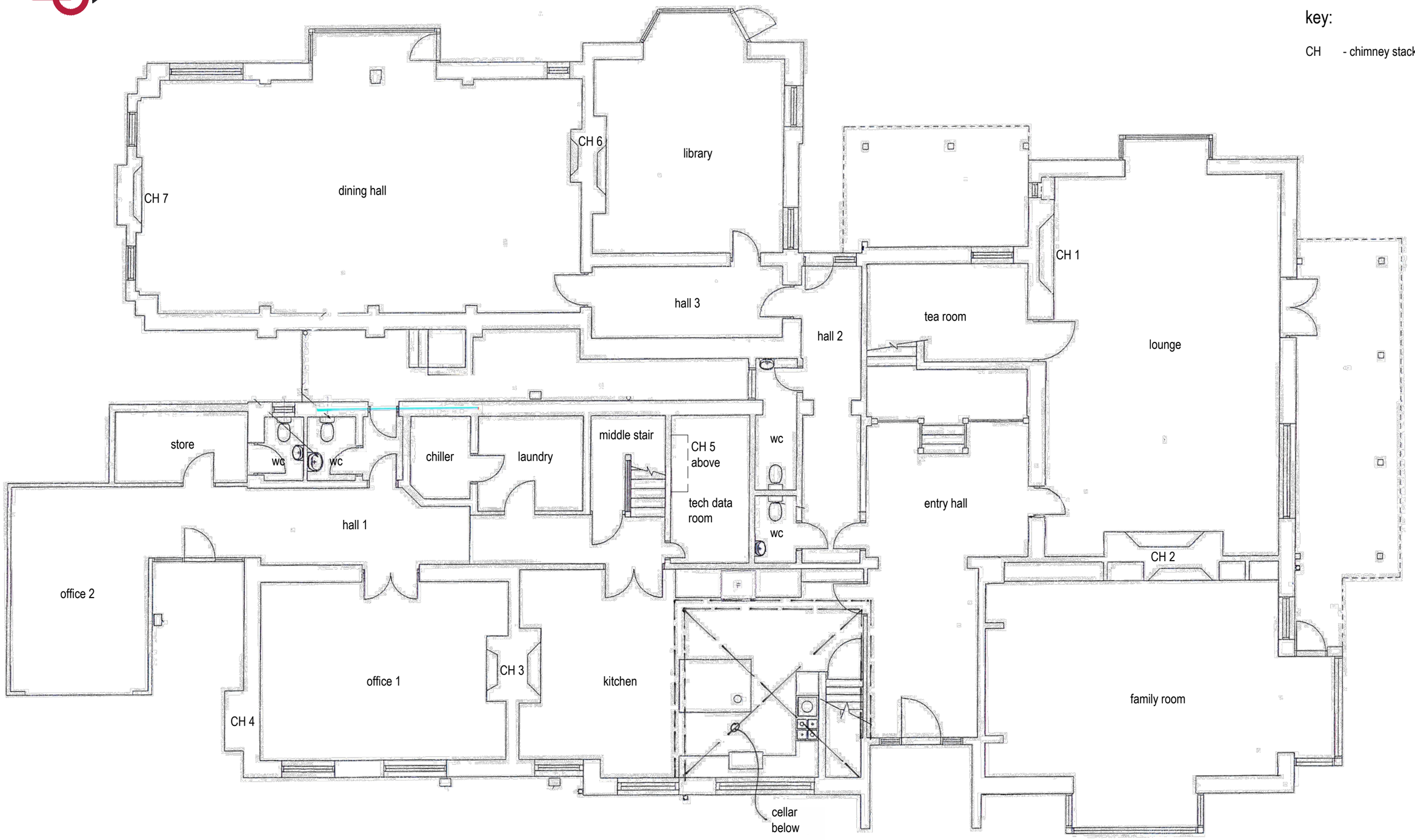
J Milne

Integrity in Design

12316

key:

CH - chimney stack



existing ground floor plan

note:
existing PDF drawings has been used, take care of scaling

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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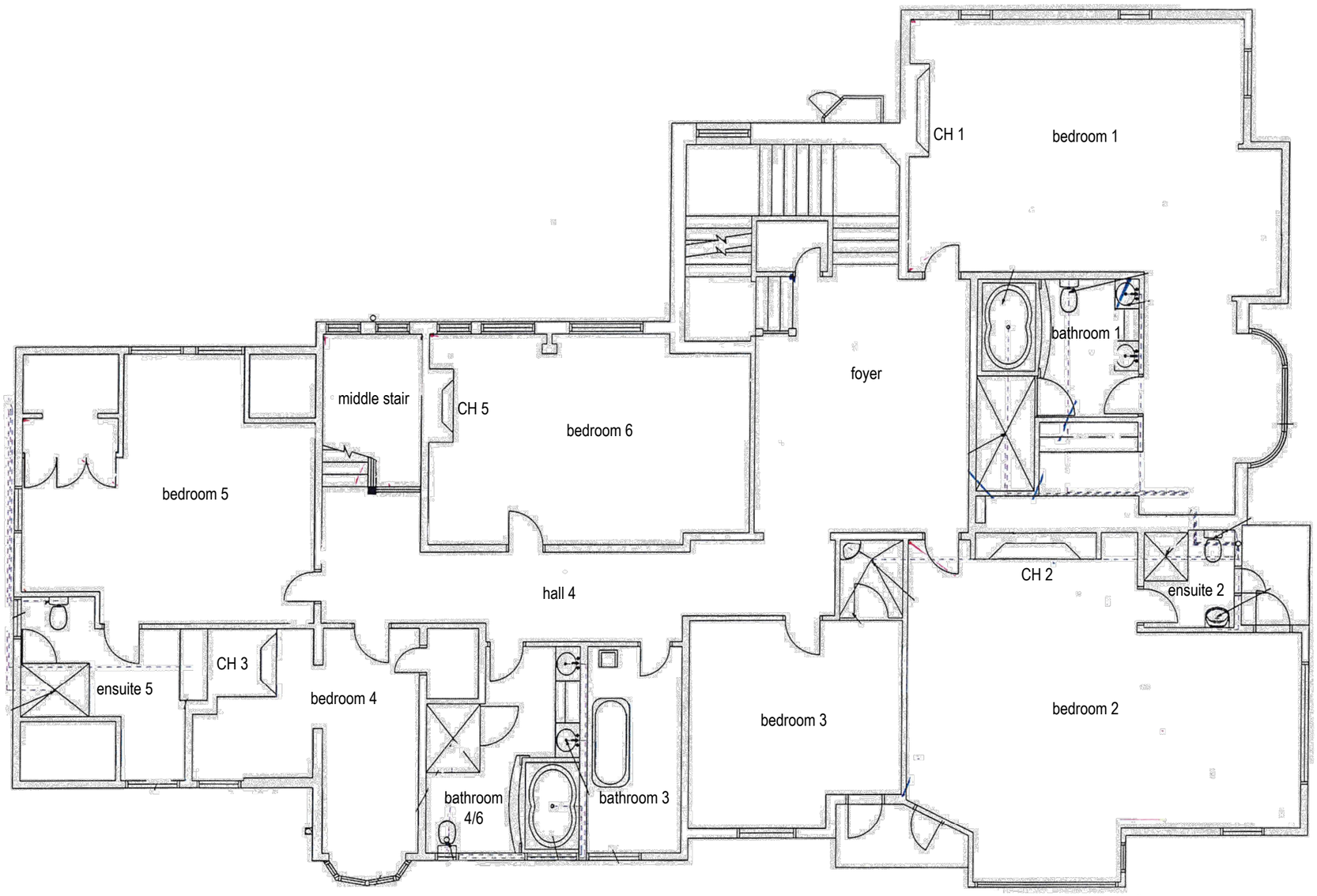
Integrity in Design

Quoin

project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	existing ground floor plan	12316	SKE1	A

key:

CH - chimney stack



existing first floor plan

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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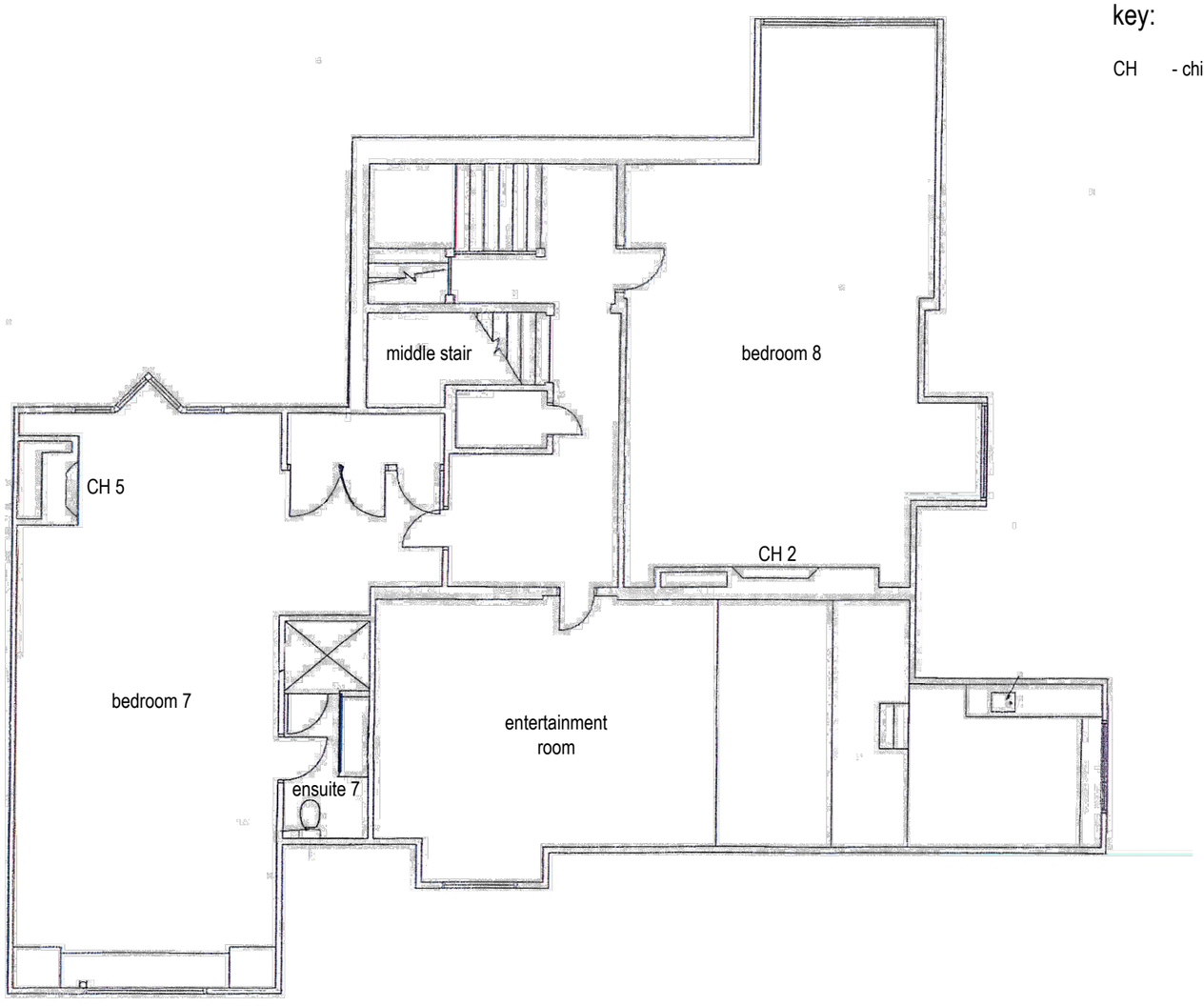
Integrity in Design

Quoin

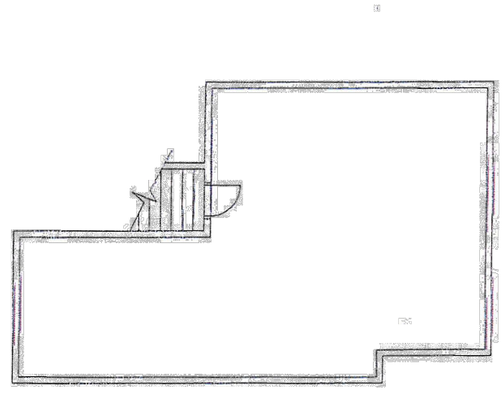
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	existing first floor plan	12316	SKE2	A

key:

CH - chimney stack



existing second floor plan



existing roof deck plan

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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Integrity in Design

Quoin

project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	existing second floor and roof deck plans	12316	SKE3	A

CONTRACTORS MUST VERIFY ALL DIMENSIONS ON THE SITE BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS

No.	REVISIONS	DATE

existing east elevation
(NTS)

PROPOSED ALTERATIONS - DARESBURY
for Mr & Mrs MALCOLM NORTH

ARCHITECTS TRENGROVE & BLUNT
80 OXFORD TERRACE
CHRISTCHURCH N.Z.

ELEVATION AS EXISTING | DRAWING A3 | SHEET
SCALES 1:100 | 6:5:92

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
NTS
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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Level 2, 138 Victoria Street
Christchurch 8013
03 968 4925
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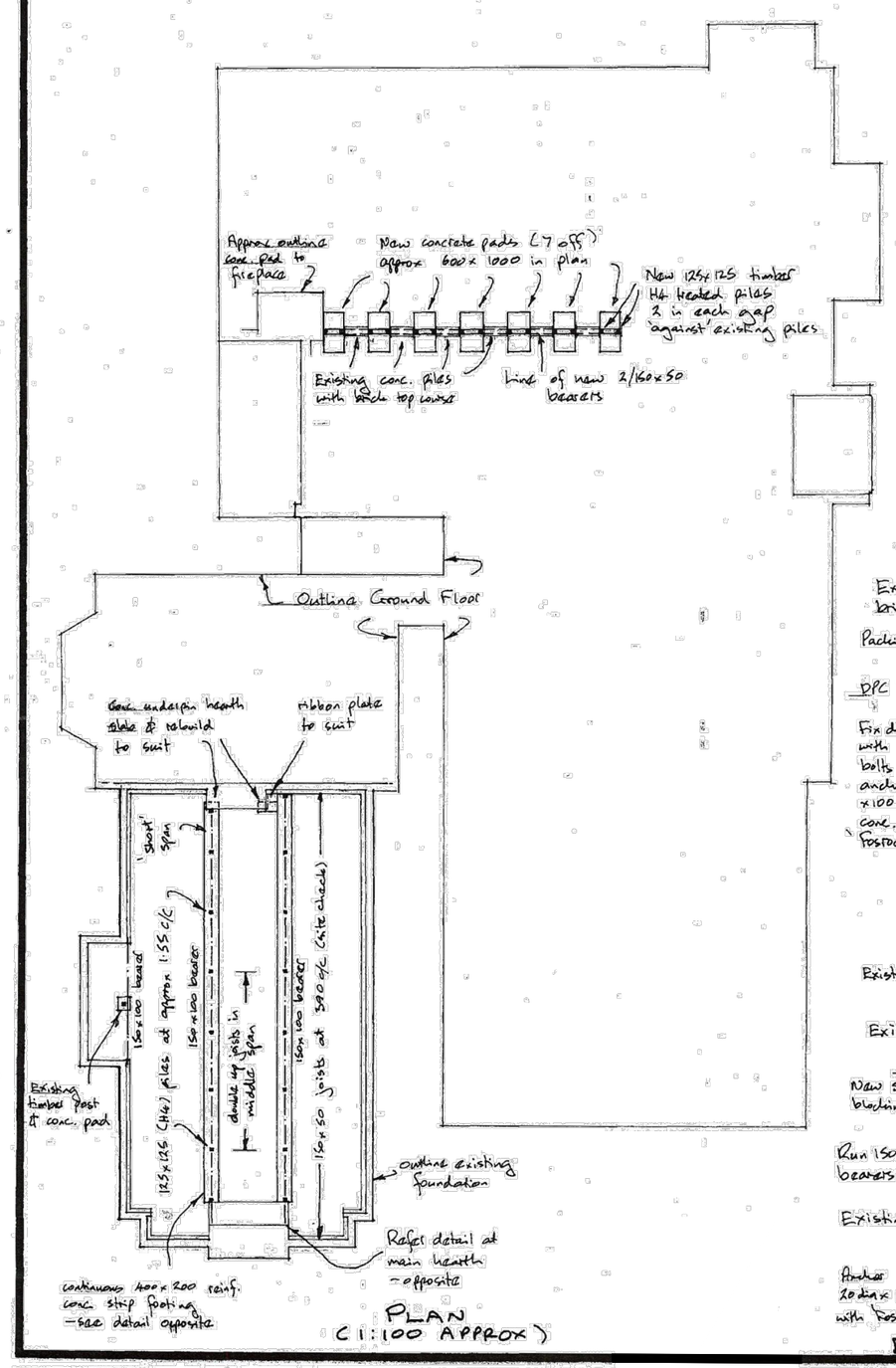
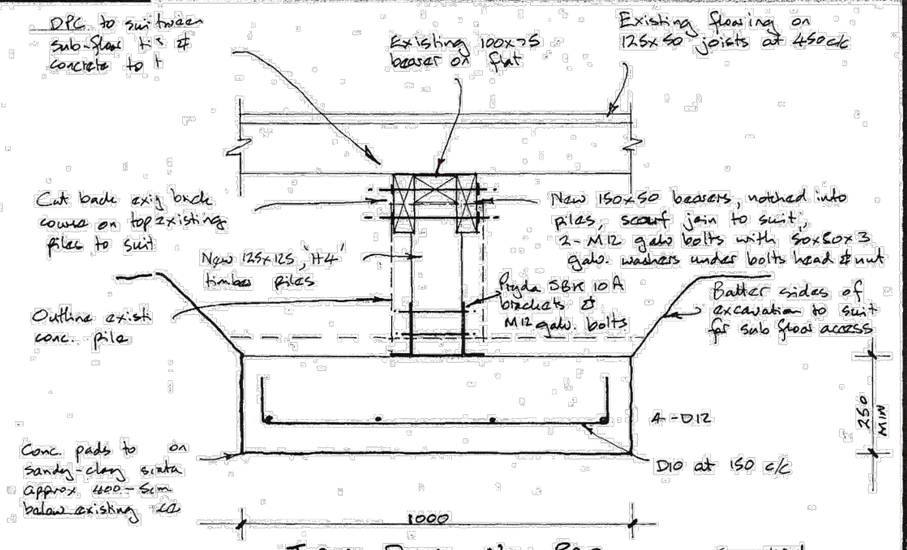
Integrity in Design

Quoin

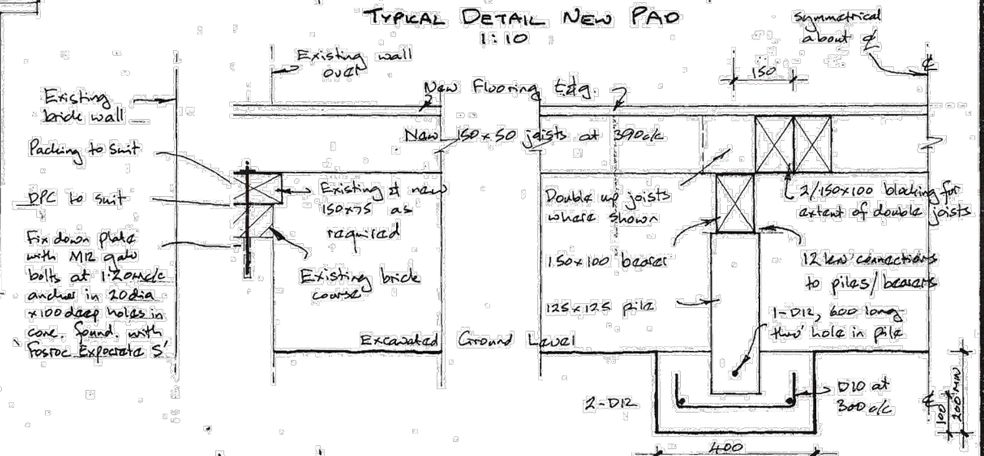
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	existing east elevation	12316	SKE4	A



PLAN
(1:100 APPROX)

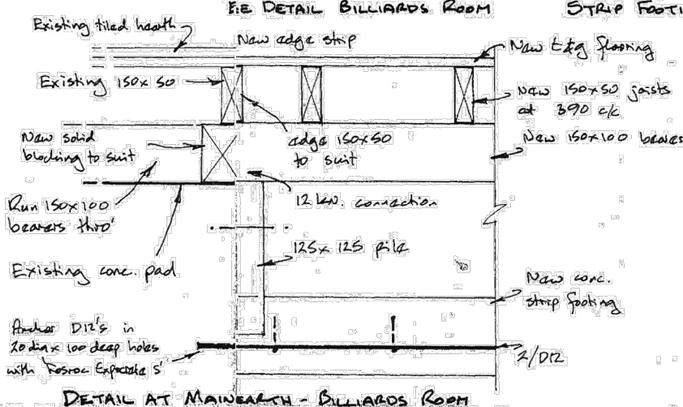


TYPICAL DETAIL NEW PAD
1:10



'E/E DETAIL' BILLIARDS ROOM

STRIP FOOTING DETAIL BILLIARDS ROOM



DETAIL AT MAINEARTH - BILLIARDS ROOM

VERIFY ALL DIMENSIONS ON SITE BEFORE WORK IS COMMENCED

NOTES

1. All work to be in accordance with Local Territorial Authority By-Laws & New Zealand Building Code as applicable.
2. Excavate for pads down to sandy-clay substrata at approx 400-500 mm depth.
3. Reinforcing steel to be 'mild' Grade 300 E) deformed steel bars to NZS/AS 4671.
4. Concrete Strength : 17.5 MPa.
5. Where not specified otherwise timber construction and connections to be in accordance with NZS 3604 : 'Timber Frame Buildings'.
6. Galv bolts, washers or brackets that will be in contact with treated timber to receive one good coat of 'Epiglass Rustguard' or similar epoxy primed paint before installation.
7. Excavate down to firm original sandy-clay for continuous footing
8. All sub-floor structural timbers to be H4 treated.
9. Floor joists should be H3 treated.
10. Where not shown connections to be in accordance with NZS 3604 'Timber Frame Buildings'
11. Epoxy to be mixed and applied strictly in accordance with manufacturers specifications.
12. No concrete to be placed until Engineer has inspected and approved bearing substrate, sub floor timbers and reinforcing as applicable
13. Floor generally designed for 3.0 kPa Live Load.
14. Doubled up joists & double blocking to accommodate full size billiards table. If position of billiards table is to change then sub-floor structure will require some modification.

STUDIO 21	ENDEL LUST REGISTERED CIVIL ENGINEER P.O. BOX 21121, CHRISTCHURCH	DARESBURY

CONTENTS:	SCALES:	DATE:
UNDERPINNING & FOUNDATIONS	1:100, 10	1/10/2003 DRAWN: E.L.

PRELIMINARY

underpinning and foundations
(NTS)

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original NTS scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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Integrity in Design

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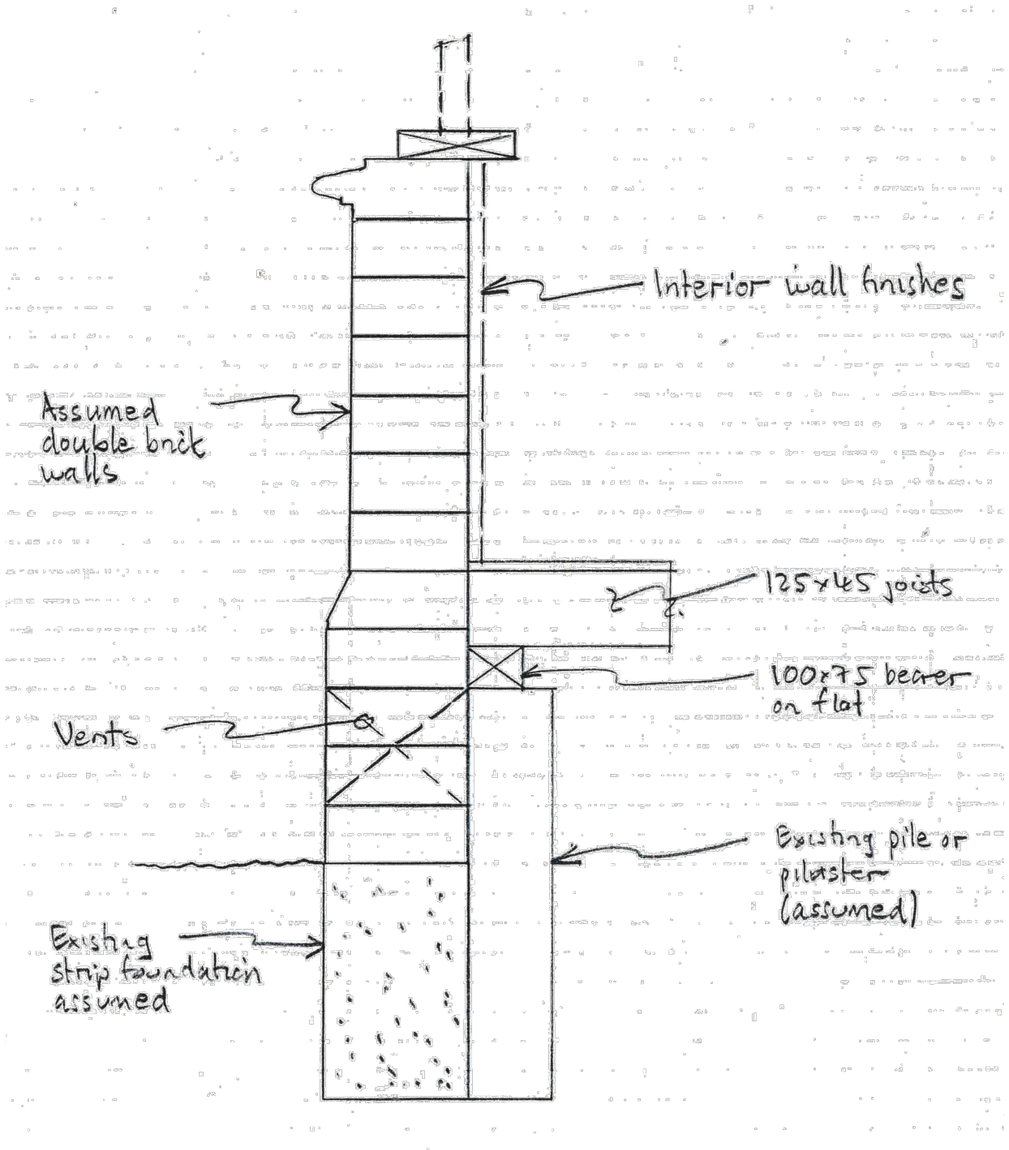
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	underpinning and foundations	12316	SKE5	A



typical existing exterior wall foundation

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:10
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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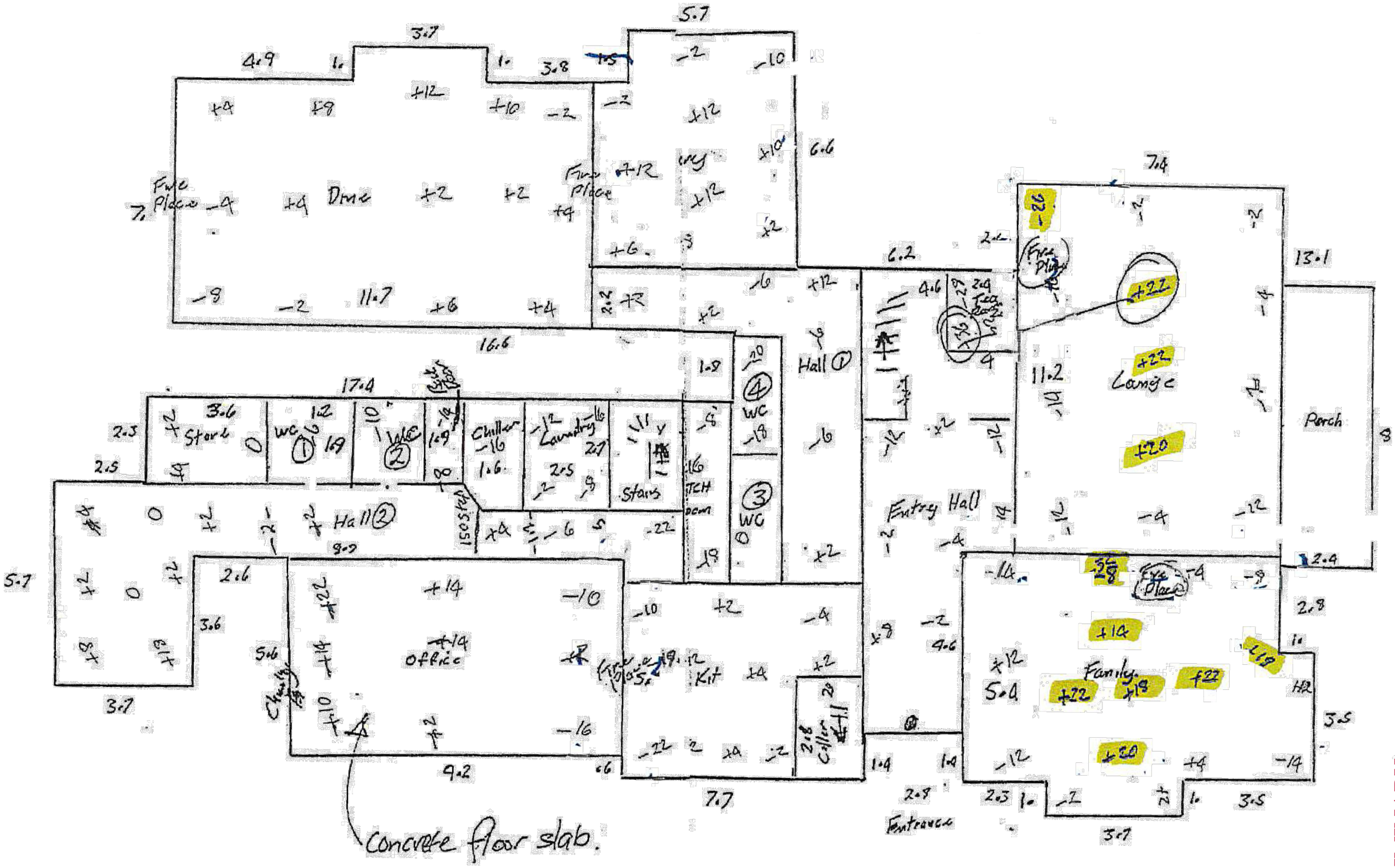
project and client
STRUCTURAL REPAIRS TO RESIDENCE
AT 67 FENDALTON ROAD
(9 DARESBURY LANE) for J Milne

drawing title
typical existing exterior wall foundation

project no.	drawing no.	issue
12316	SKE6	A



existing ground floor level plan

note:
existing PDF drawings has been used, take care of scaling

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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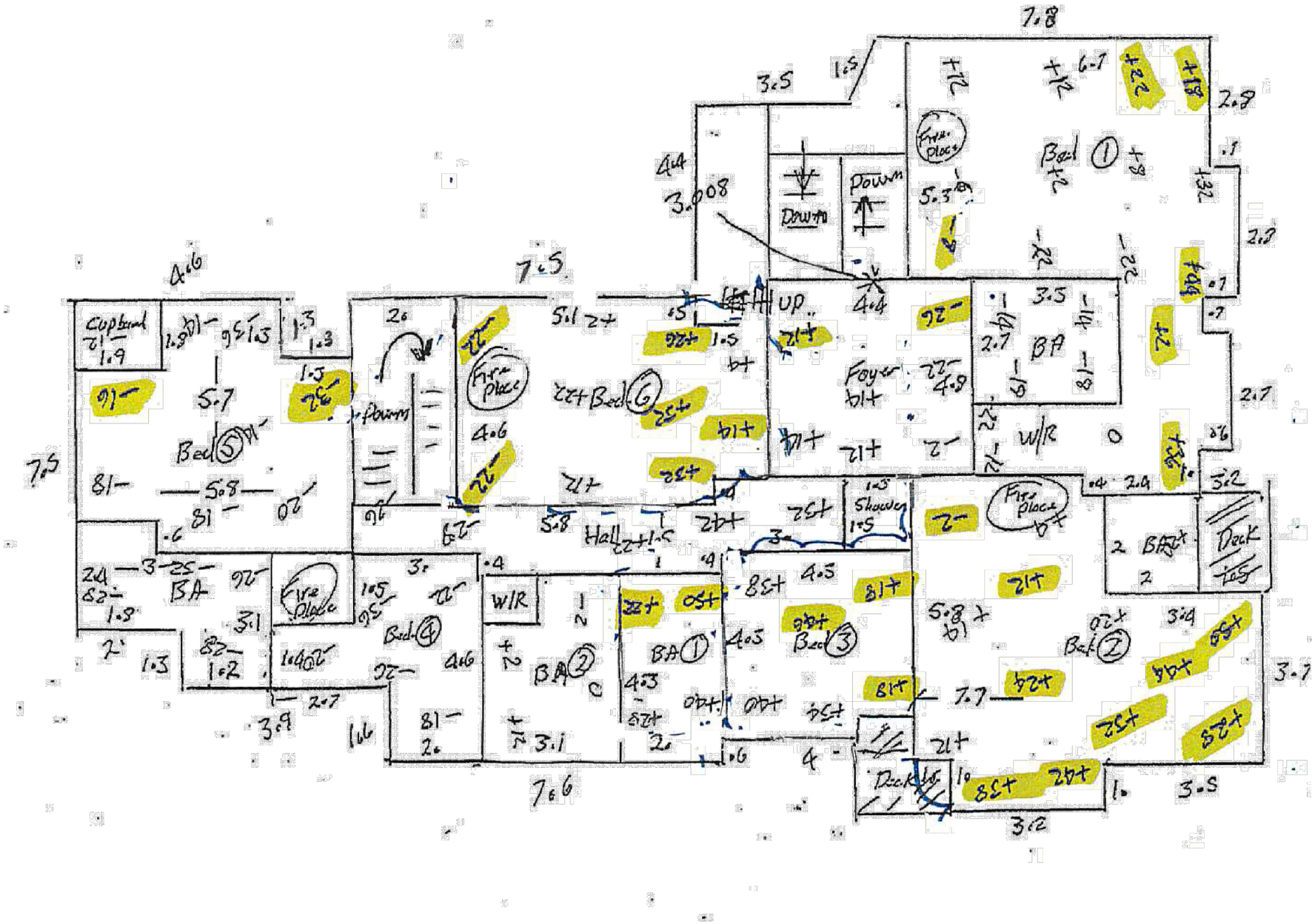
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	existing ground floor leveling plan	12316	SKL1	A



existing first floor level plan

note:
existing PDF drawings has been used, take care of scaling

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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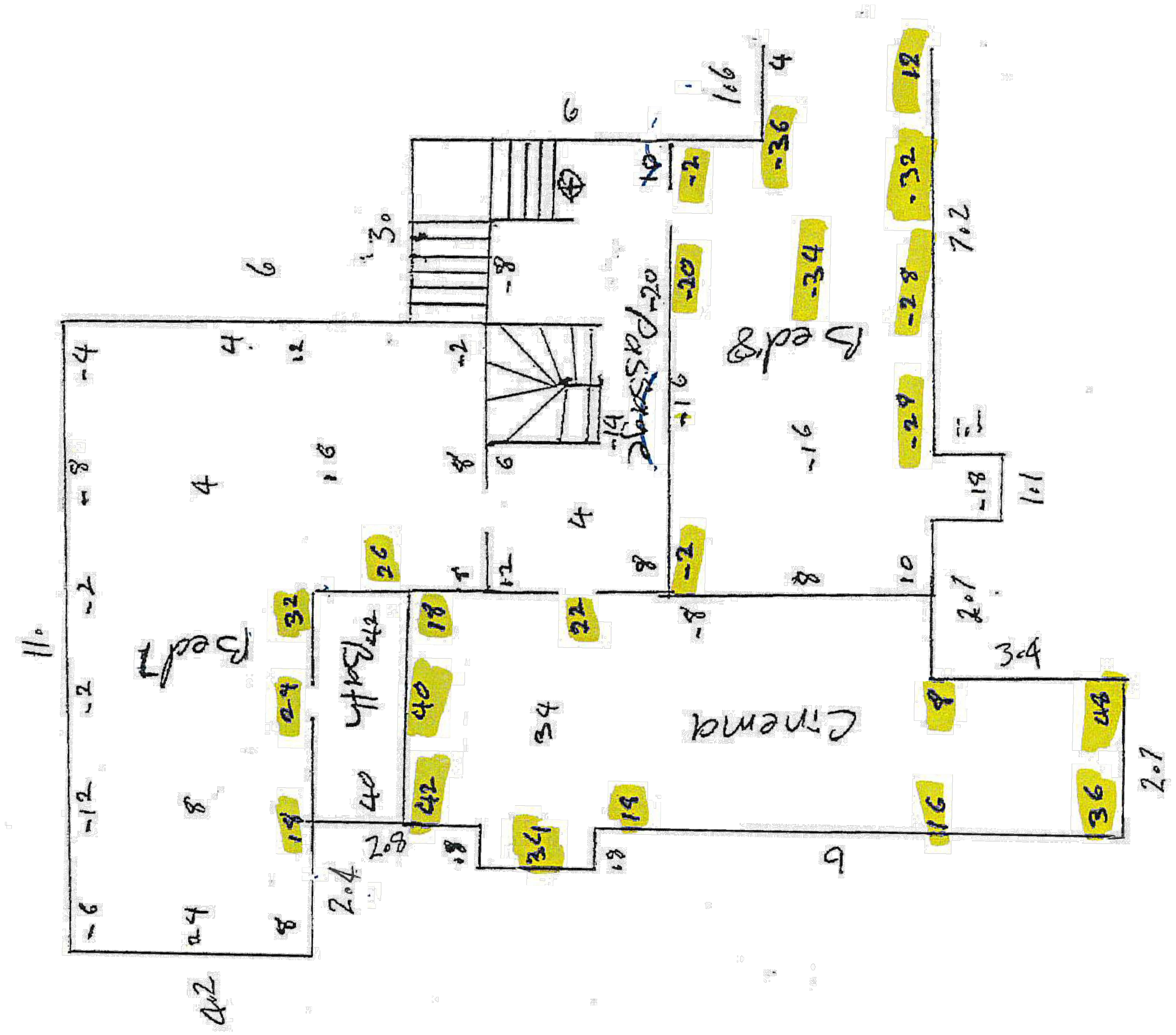
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	existing ground floor leveling plan	12316	SKL2	A



existing second floor level plan

note:
existing PDF drawings has been used, take care of scaling

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original 1:100 scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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project and client: STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne

drawing title: existing ground floor leveling plan

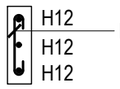
project no.	drawing no.	issue
12316	SKL3	A

note:
existing PDF drawings has been used, take care of scaling

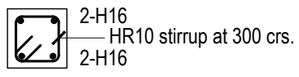
foundation types

1. new 450 w x 550 d + 150 w upstand — Refer SKR 9 for details
2. new 330 w x 550 d + 150 w upstand — Refer SKR 9 for details
3. new 500 w x 500 d

4. new 150 w x 500 d



5. new 400 w x 400 d



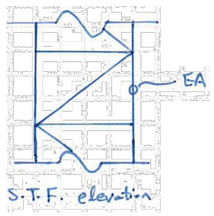
6. new 500 d RC pad — Reinforcement: H16 @ 300 e.w., T. & B.
7. new 450 w x 550 d without upstand — Reinforcement similar to foundation Type 1 & Type 2
8. existing footing/pad to remain

new walls and steel frames (refer SKR3 - SKR6)

9. a) existing thick lower level exterior brick walls.
   - remove the thick brick walls, reinstate the walls as exterior brick veneer laterally support by inner timber framed walls.

   b) existing upper level brick infill between timber framing exterior walls.
   - remove brick infill, add timber framing as required, reinstate lining and fixing, re-plaster to match existing.

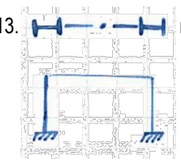
   c) existing timber frame interior walls.
   - remove lining, add supplementary dwangs if required, reinstate lining and fixing.
10. existing brick chimney to be removed, including foundations. reinstate chimney including brick veneer where currently exposed to view.
11. existing timber frame walls, lining to be removed and replaced with new lining and fixing. add supplementary dwangs if required
12. new steel truss frame (S.T.F.1 - 7): truss frame both directions, refer SKR7 and SKR8 for further details



Type 1: S.T.F. 1 - 2, S.T.F. 3, S.T.F. 5

Type2: S.T.F. 4, S.T.F. 6 - 7

13. new portal frame (P.F.1 - 3): 250UC89 column and beam



14. new portal frame (P.F.4 - 5): 300PFC column and beam

PRELIMINARY

issue	reason	issuer	approved	date	A3 original	scales at A3
A	Preliminary	TVW	BG	16.05.19	NTS	

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draughtsman	engineer/s	director
TVW	KA	BG

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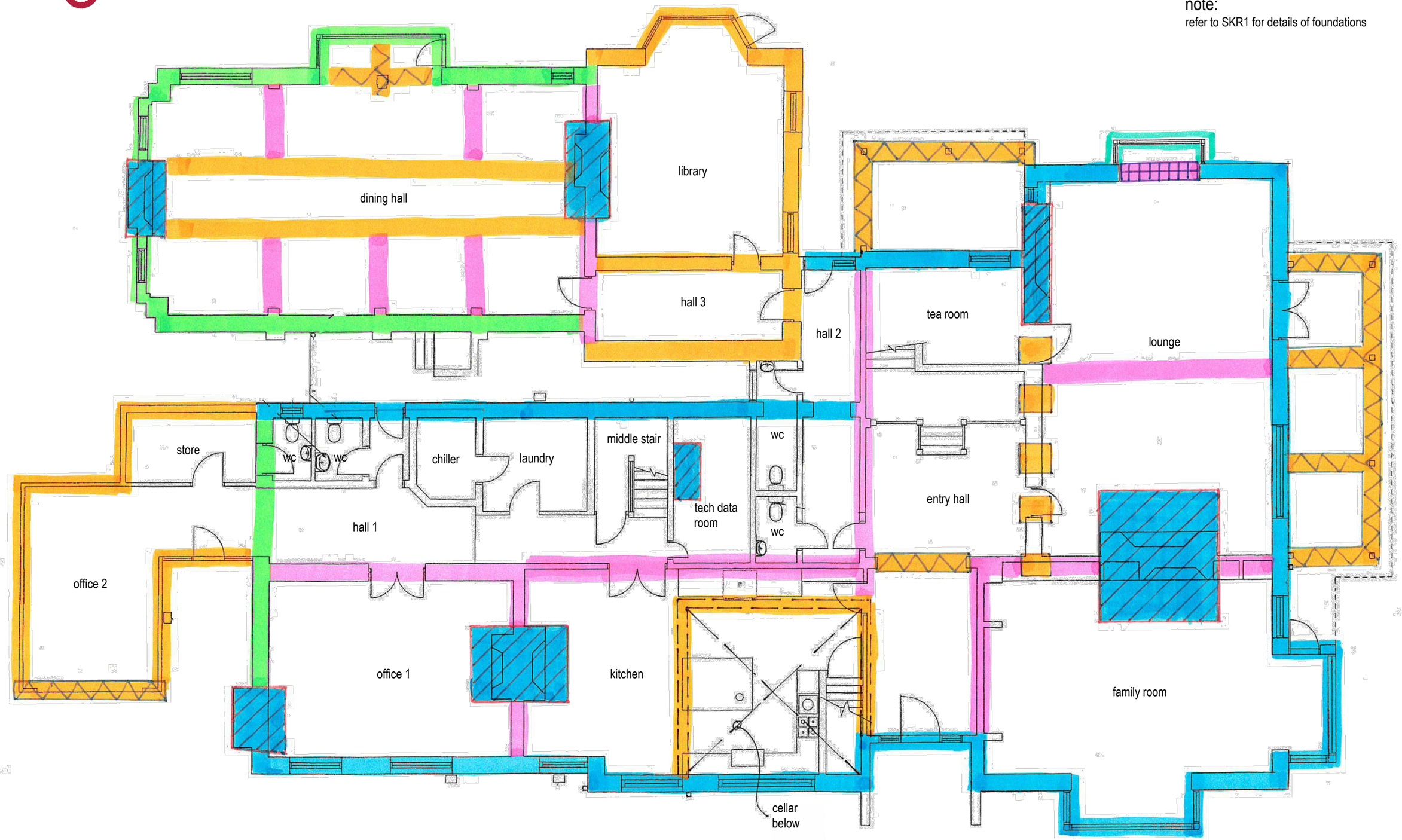
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	foundation types / new walls and steel frames	12316	SKR1	A

note:
refer to SKR1 for details of foundations



foundation plan repairs

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	foundation plan repairs	12316	SKR2	A

notes:

chimney, refer note 2, SKR1

wall, total length: along 55m and across 64m, refer note 1, SKR1

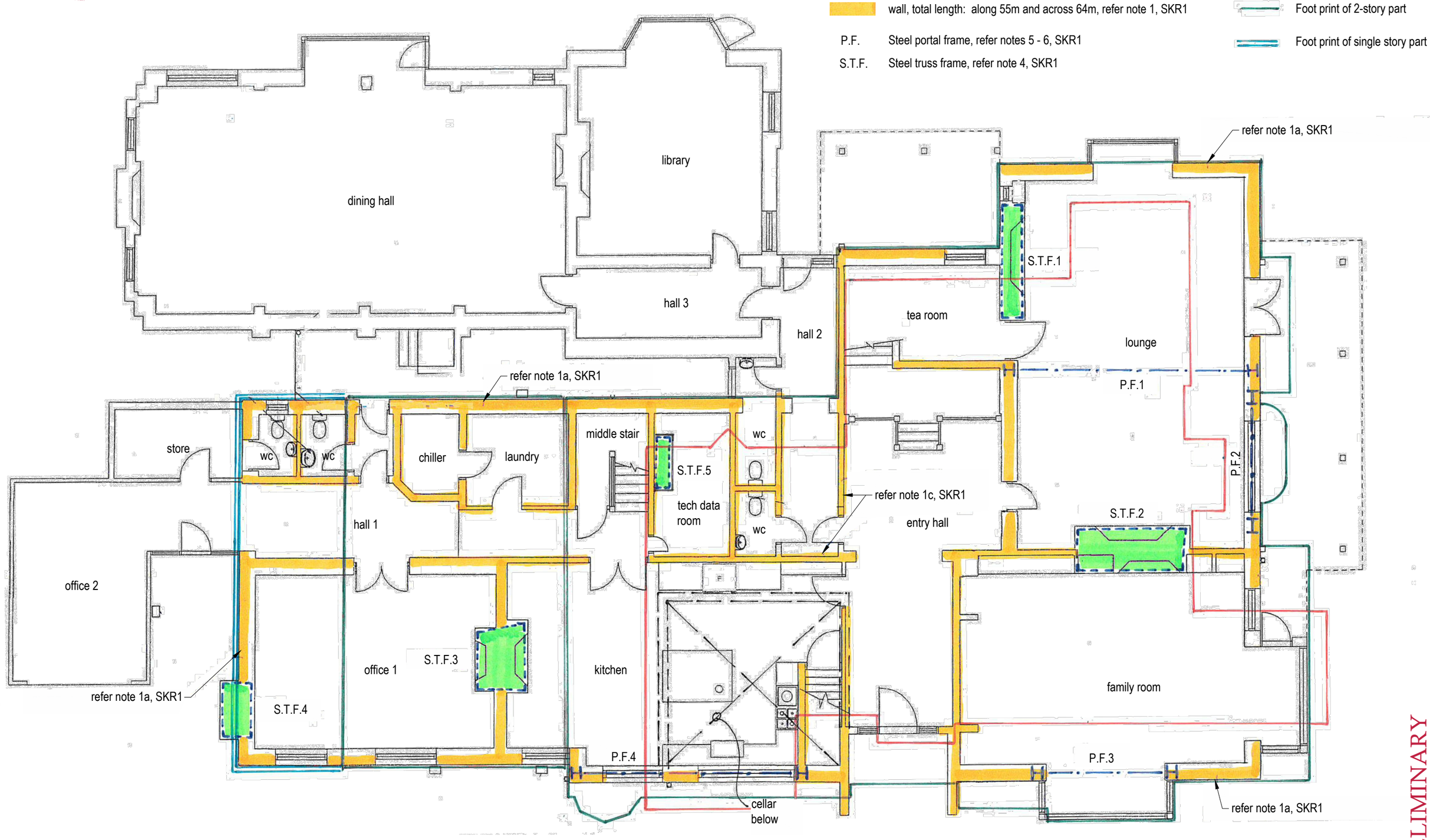
P.F. Steel portal frame, refer notes 5 - 6, SKR1

S.T.F. Steel truss frame, refer note 4, SKR1

Foot print of 3-story part

Foot print of 2-story part

Foot print of single story part



ground floor plan - wall, roof, and chimney repairs and new steel frames

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100 scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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Integrity in Design

Quoin

project and client
STRUCTURAL REPAIRS TO RESIDENCE
AT 67 FENDALTON ROAD
(9 DARESBURY LANE) for J Milne

drawing title
ground floor plan
wall, roof, and chimney repairs
and new steel frames

project no.	drawing no.	issue
12316	SKR3	A

notes:

2 / 200 PFC cantilever posts, cast into new foundation and extends to eaves level. fix into existing timber column and new walls

50 x 1mm Lumberlok Multibrace over top of roof purlin

SHS 125x6 at eaves level

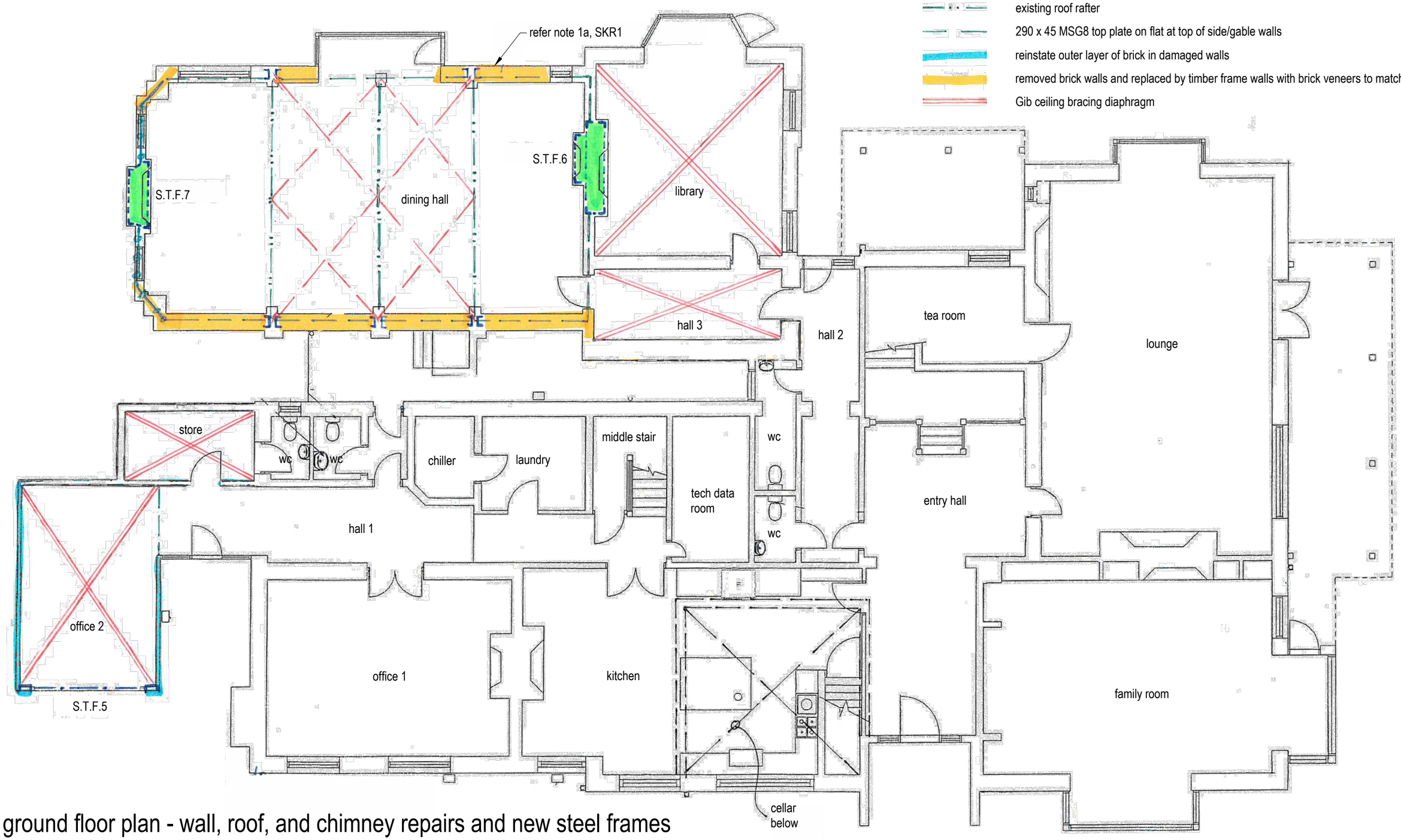
existing roof rafter

290 x 45 MSG8 top plate on flat at top of side/gable walls

reinstate outer layer of brick in damaged walls

removed brick walls and replaced by timber frame walls with brick veneers to match existing

Gib ceiling bracing diaphragm



ground floor plan - wall, roof, and chimney repairs and new steel frames

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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project and client
STRUCTURAL REPAIRS TO RESIDENCE
AT 67 FENDALTON ROAD
(9 DARESBURY LANE) for J Milne

drawing title
ground floor plan
wall, roof, and chimney repairs
and new steel frames

project no.	drawing no.	issue
12316	SKR4	A

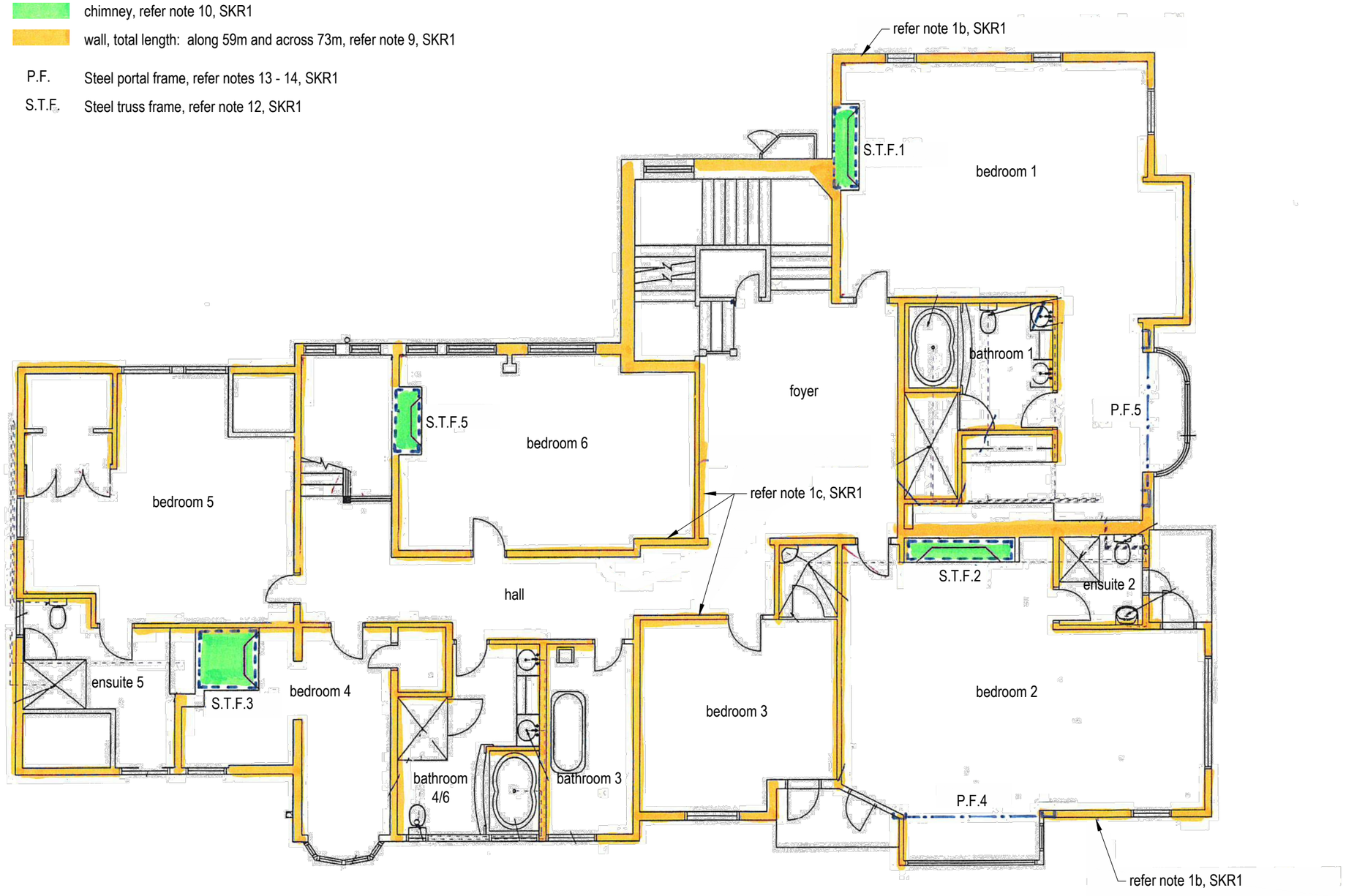
notes:

chimney, refer note 10, SKR1

wall, total length: along 59m and across 73m, refer note 9, SKR1

P.F. Steel portal frame, refer notes 13 - 14, SKR1

S.T.F. Steel truss frame, refer note 12, SKR1



first floor plan repairs

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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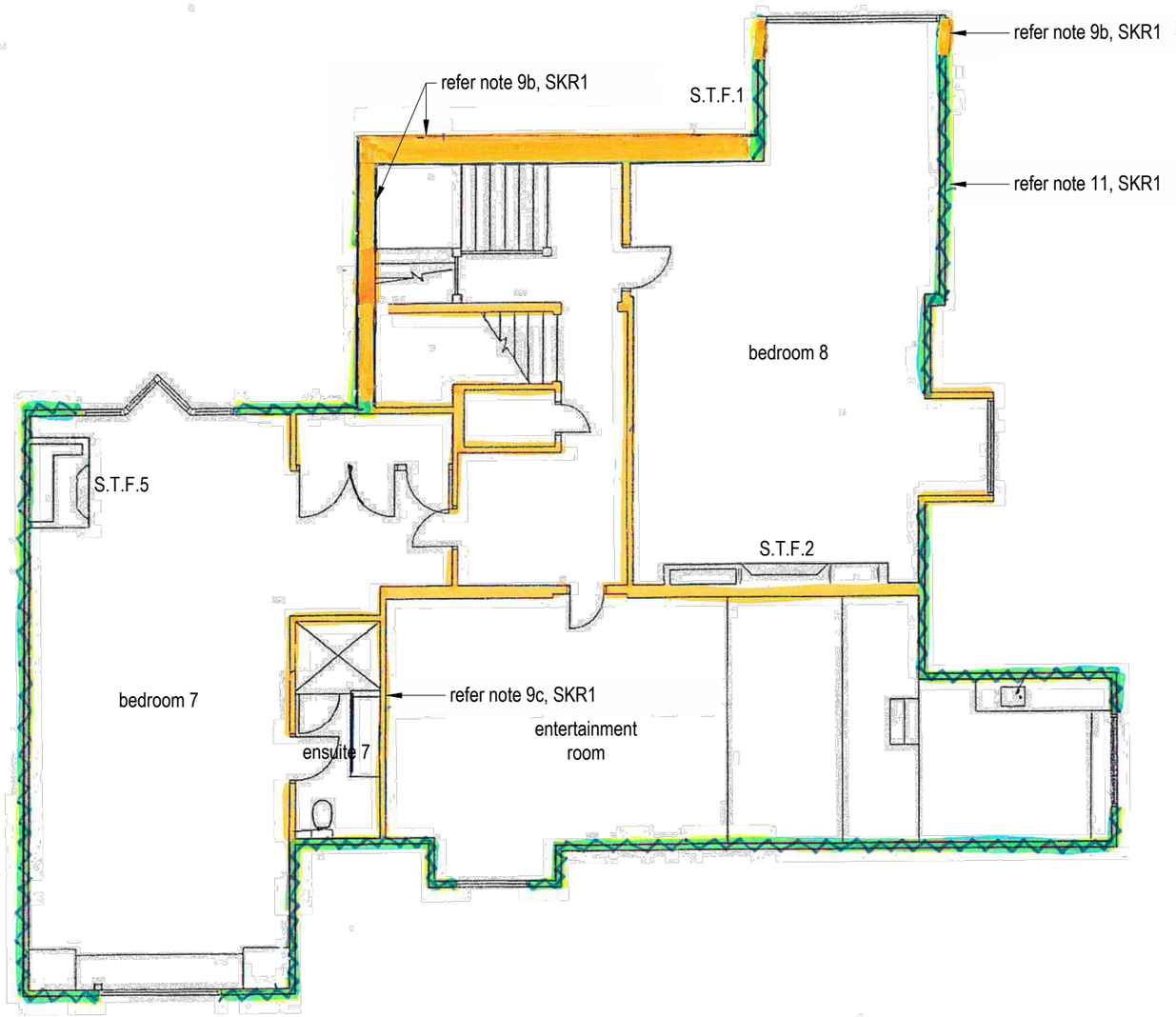
project and client: STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne

drawing title: first floor plan repairs

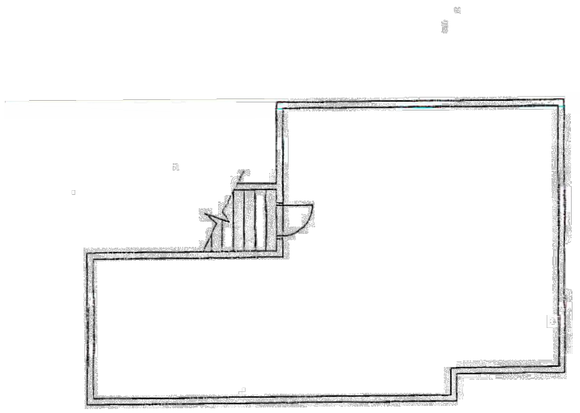
project no.	drawing no.	issue
12316	SKR5	A



note:

timber frame wall with h ≤ 2.4m, length along: 26m, length across: 27m

timber frame wall with $h_{ave.}$ = 3.0m, length along: 18m, length across: 17m



second floor plan repairs

roof deck plan

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:100
scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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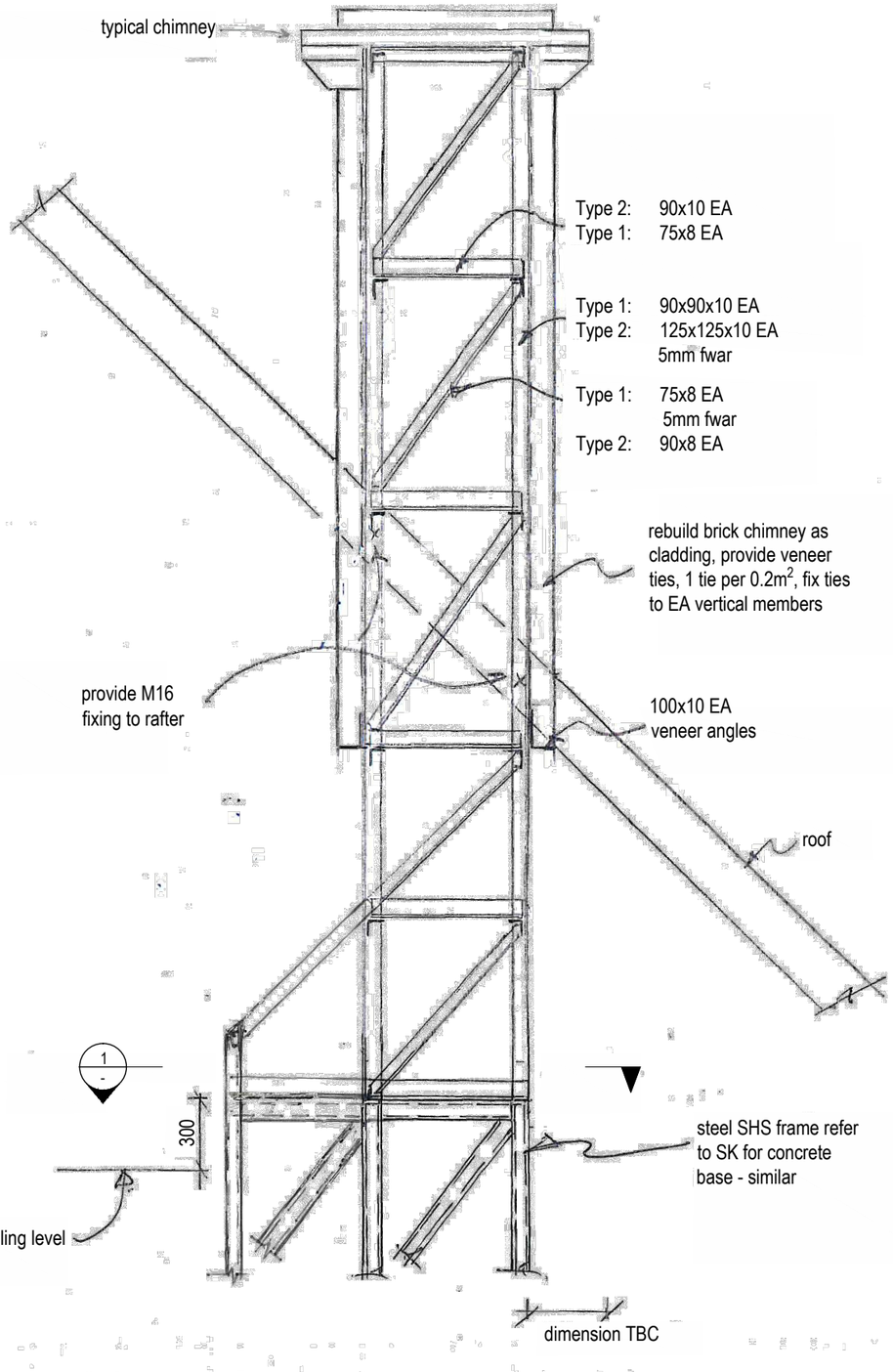
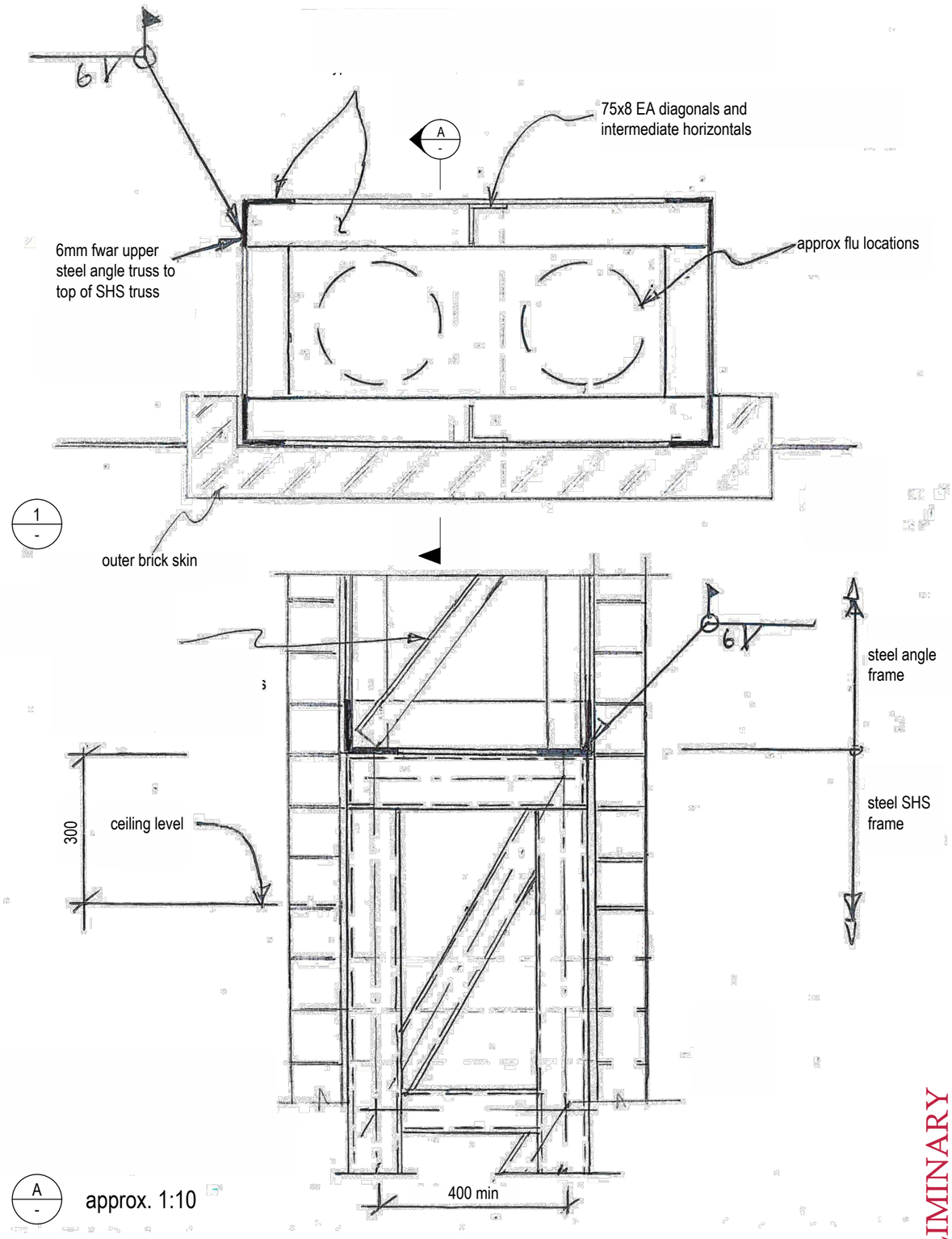
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	second floor plan repairs and roof deck plan	12316	SKR6	A



NTS



approx. 1:10

typical chimney details

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:10
NTS
scales at A3

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draughtsman	engineer/s	director
TVW	KA	BG

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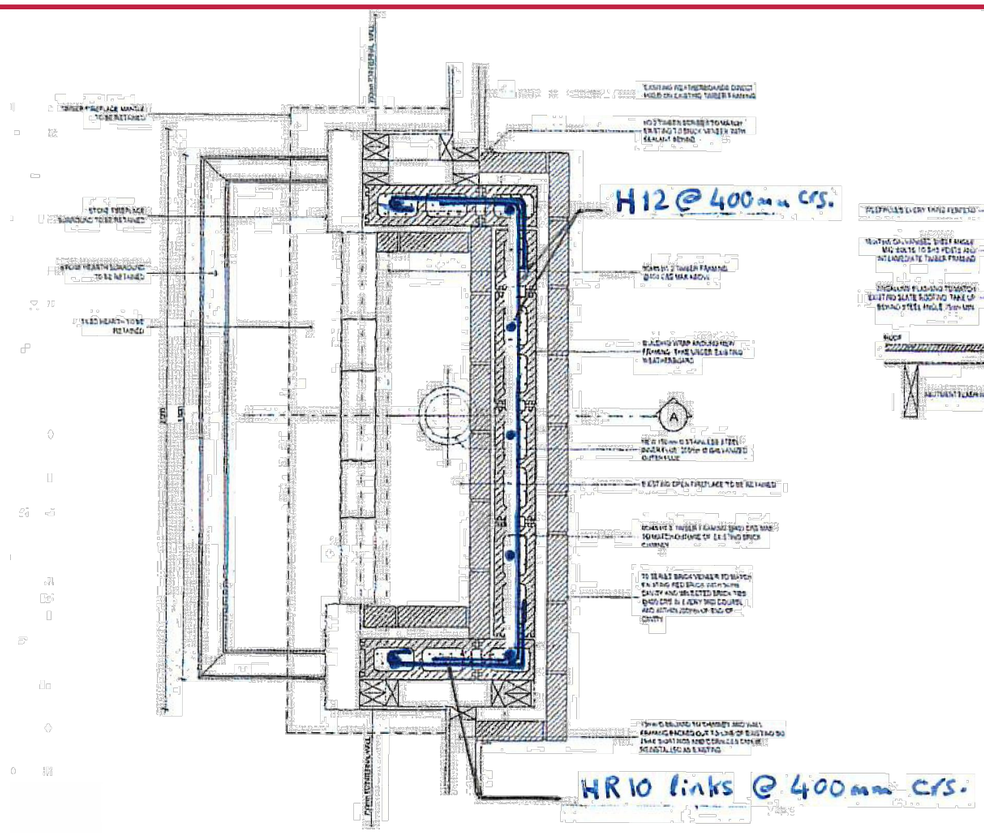
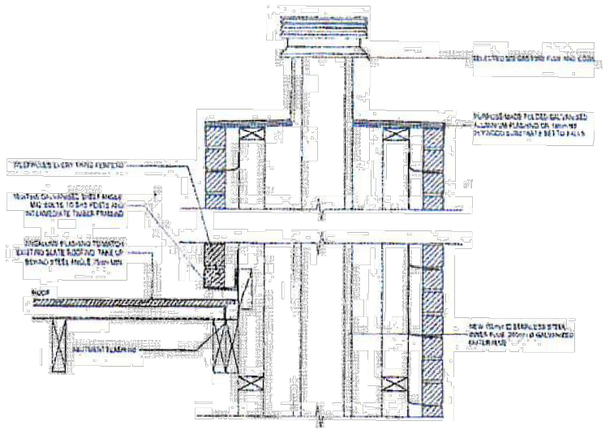
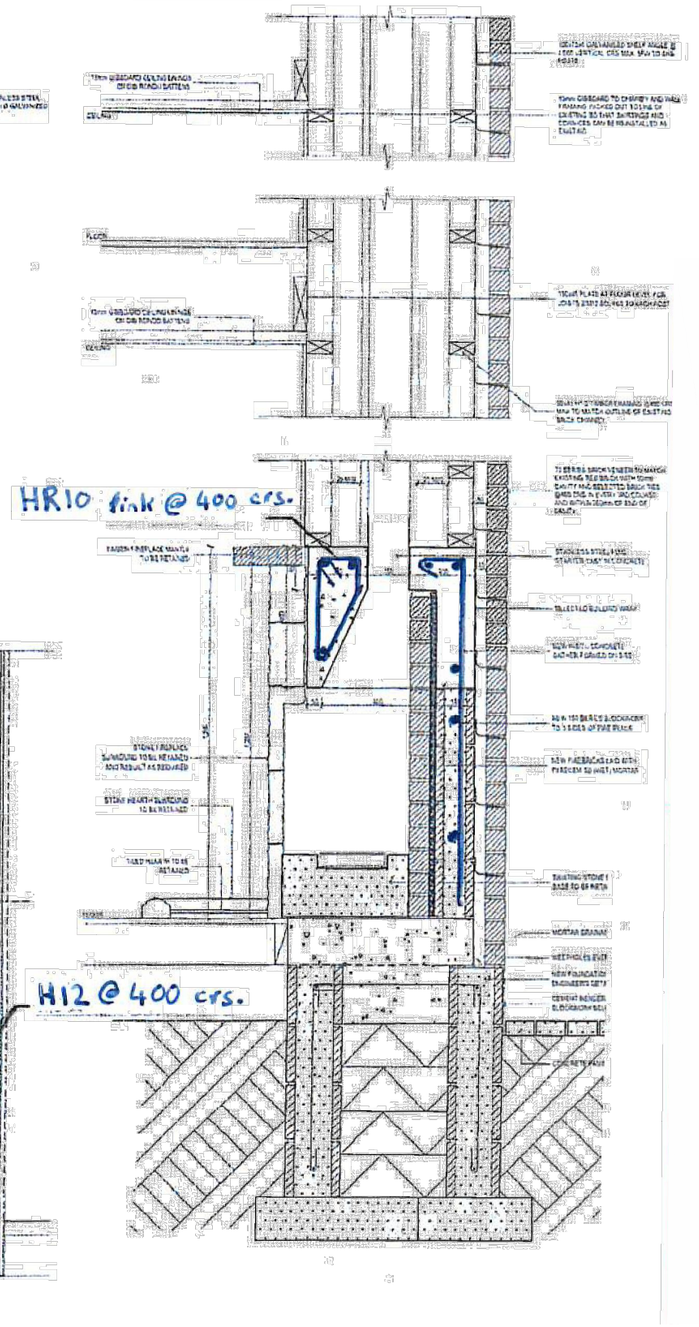
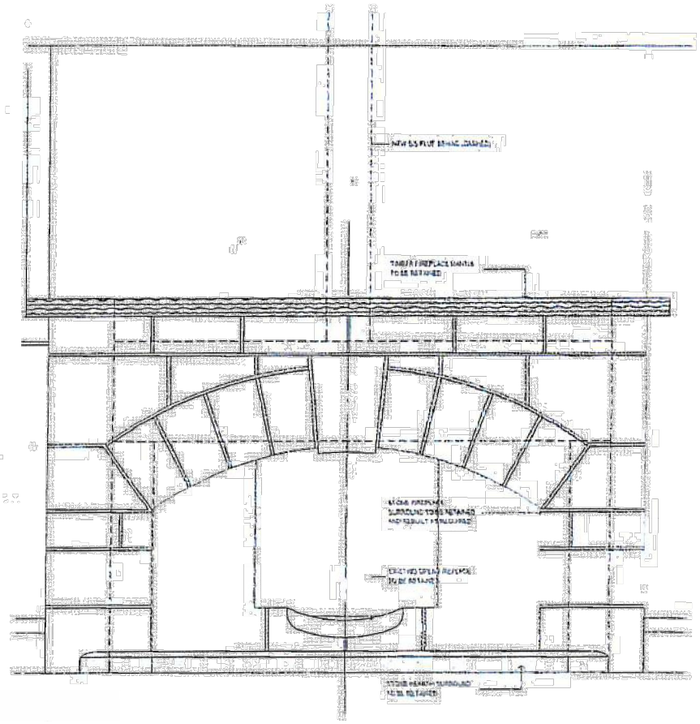
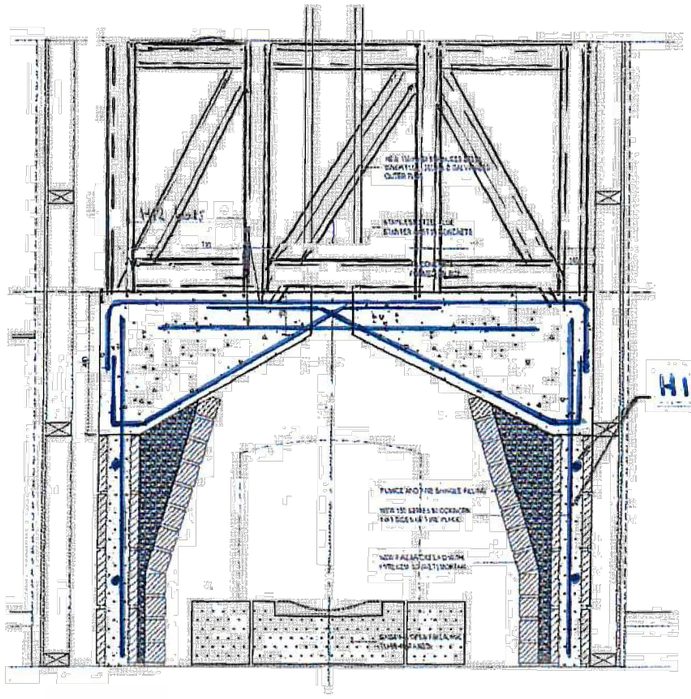
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	typical chimney details	12316	SKR7	A











typical chimney base support details

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original NTS scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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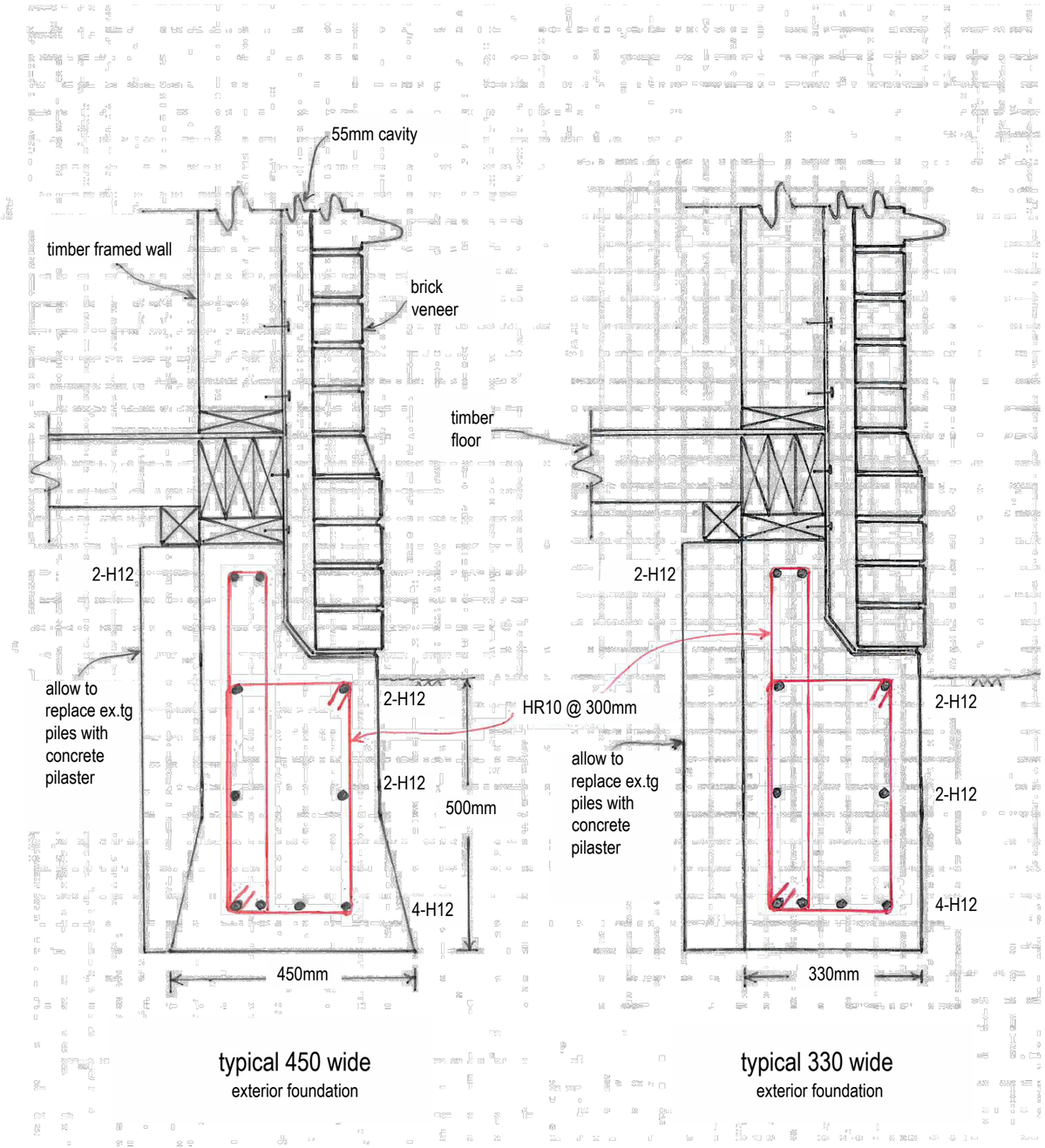
project and client: STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne

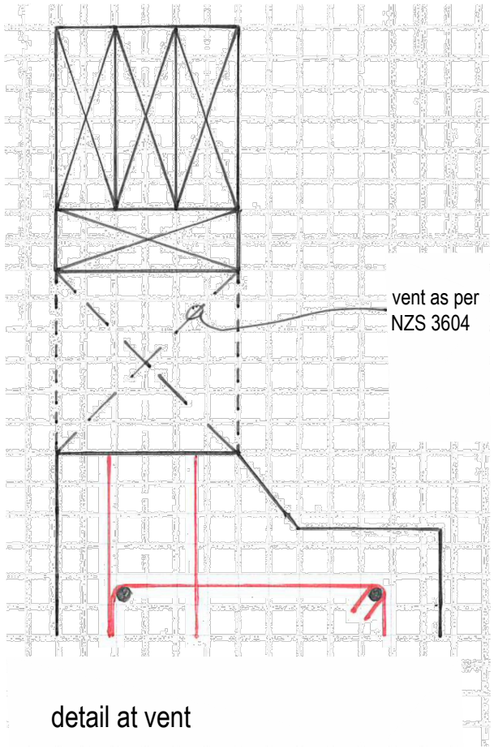
drawing title: typical chimney base support details

project no.	drawing no.	issue
12316	SKR8	A

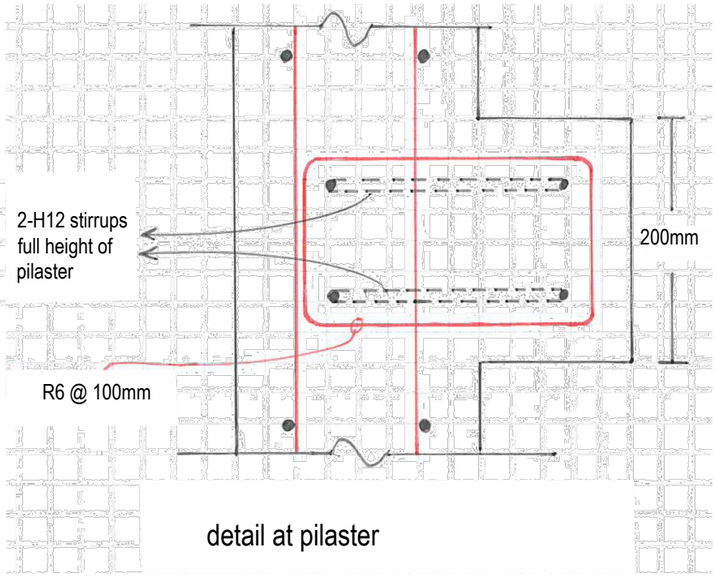


typical 450 wide exterior foundation

typical 330 wide exterior foundation



detail at vent



detail at pilaster

typical foundation details

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:10
1:5 scales at A3

this drawing is to be printed in colour

draughtsman	engineer/s	director
TVW	KA	BG

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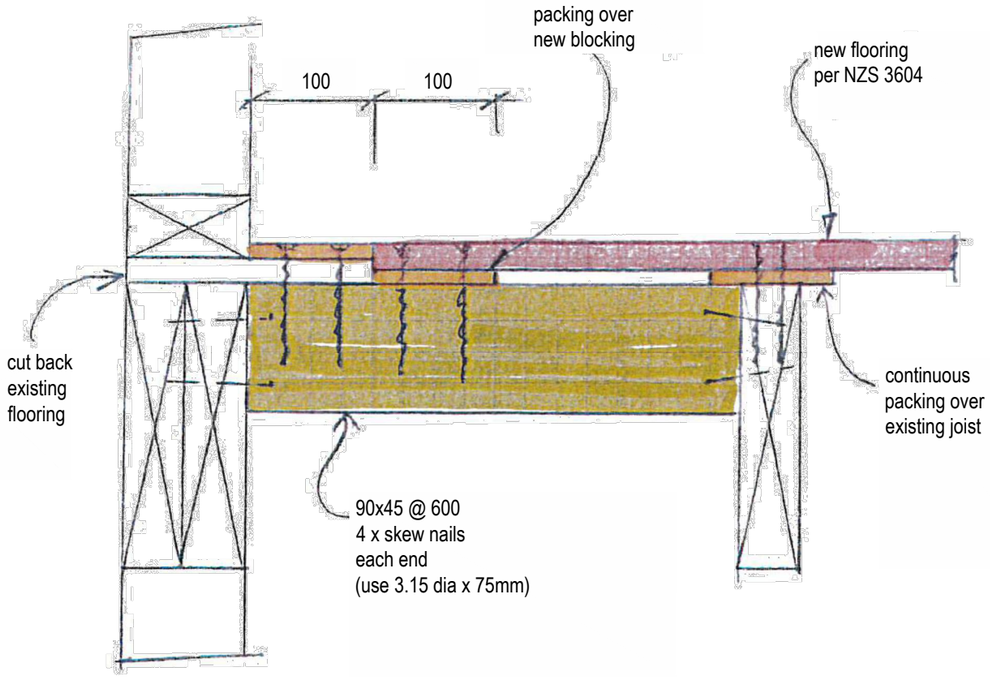
project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	typical foundation details	12316	SKR9	A

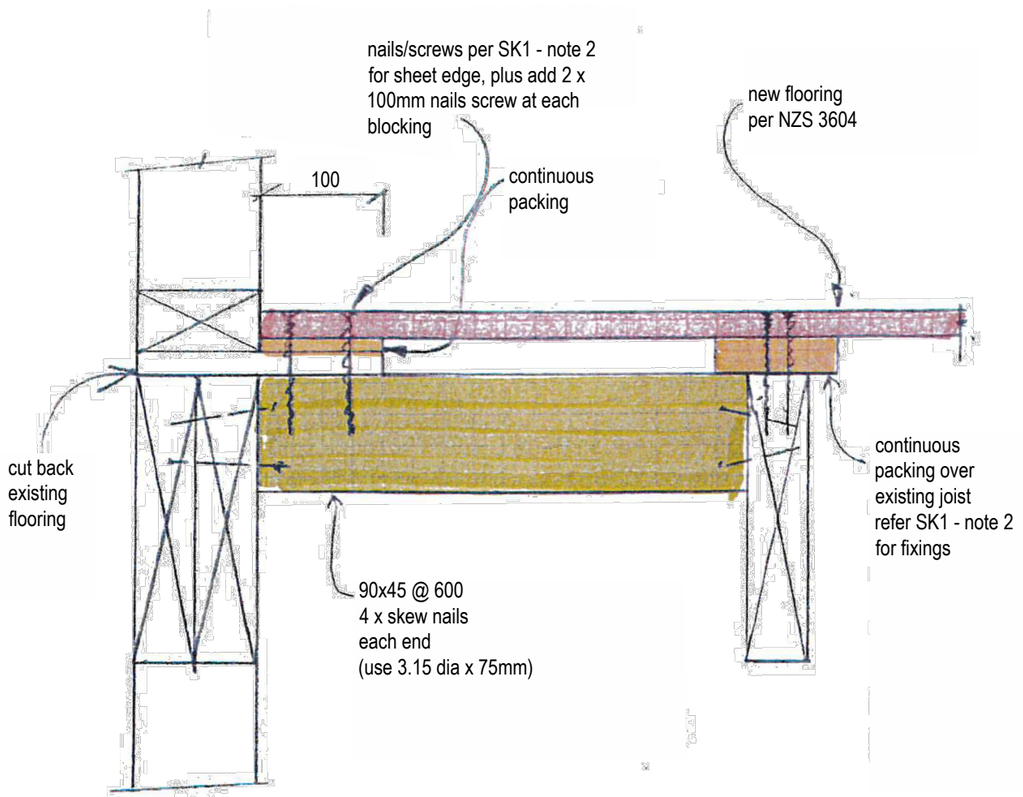


pack first floor up ≤ 200mm

notes:

1. packing provided as solid thickness or in layers to suit new flooring

2. all new flooring and solid packers to be fixed per flooring requirements in NZS3604, nails/screws to have minimum 40mm embedment into existing floor joists or new blocking, space at 150mm crs to sheet edges and 300mm crs to intermediate supports, or equivalent



pack first floor up ≥ 200mm

notes:

1. refer to SKF1 for notes

floor packing details

PRELIMINARY

issue	reason	issuer	approved	date
A	Preliminary	TVW	BG	16.05.19

A3 original
approx 1:5 scales at A3

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draughtsman	engineer/s	director
TVW	KA	BG

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Quoin

project and client	drawing title	project no.	drawing no.	issue
STRUCTURAL REPAIRS TO RESIDENCE AT 67 FENDALTON ROAD (9 DARESBURY LANE) for J Milne	floor packing details	12316	SKR10	A