4 The Grove, Highgate

Visual Structural Inspection

23 February, 2016

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Visual Structural Inspection

This report describes the findings of the Visual Structural Inspection conducted at 4 The Grove, Highgate on behalf of Jamie Oliver Holdings Limited

Quality information

Document name	Ref	Prepared for	Prepared by	Date	Reviewed by
Visual Structural Inspection	GRO-ACM-XX-XX-DOC-SE-00001	Jamie Oliver Holdings	A.McEwan	23.02.16	D.Brown

Revision history

Revision	Revision date	Details	Name	Position
00	23.02.16	First Issue	A.McEwan	Senior Structural Engineer

Contents

Introduction

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01 Introduction

01.01 Client Brief

AECOM were instructed by Jamie Oliver Holdings Limited to undertake a full visual structural inspection of the Grade II* listed residential property at 4 The Grove, Highgate, London, N6 6JU.

The aim of this report is to describe the observations made by AECOM Structural Engineers Clive Richardson BSc (Hons), CEng, FICE, FIStructE, IHBC and Alex McEwan MEng (Hons) CEng MIStructE on Thursday 4th February 2016. The format of the report utilises a Defects Analysis Table to tabulate the observations by the visible symptom of distress, the probable cause, discuss if any further investigation is required, recommend the principal of repair and state the likely consequence of non-repair. The final chapter of this report summarises our recommendations and conclusions in to essential desirable repairs.

The inspection was taken from all readily available and safe vantage points. Only exposures that were consented by the planning authorities to inform the proposed structural alterations to the property were inspected and as such there is the possibility that more defects may be uncovered as the building structure is opened-up and exposed. Please note that the engineers took all reasonable care and attention to record all defects observed through previously removed finishes or those which had made themselves visible through the finishes.

01.02 Definition

A Visual Structural Inspection comprises of a visual inspection, with the naked eye and binoculars, of those parts of the structure that can be seen from safe, readily accessible vantage points. External roof surfaces, chimneys, eaves and other features at high level were viewed from the ground, upper storey windows and the roof valley gutter. Some areas of the building were inaccessible for inspection and we therefore cannot confirm that these parts are free from defects. We have not carried out any tests or made enquiries concerning particular materials or re-appraised the original design. This report was prepared as a record of where concern exists regarding specific parts of, or defects in, the property.

The report is confined to an inspection of the visible load-bearing structural elements of the building only. The “Structure” of a building is defined as those parts of the fabric of the building which significantly contribute to its strength, stability and integrity such as roof carcassing, floors, walls, frameworks and foundations. This report will not address such items as finishes, coverings, fixtures and fittings, fenestration, doors and windows, water pipes / plumbing, gas pipes, electrical services, mechanical installations, decorations, plasterwork, non-structural timber, claddings, woodwork or any form of infestation, moisture penetration, damp, waterproofing, etc. or external works, boundary fences or compliance with local/national legislation.

01.03 Limitations

Due to the Grade II* listing of the property, we will not inspect woodwork or any inaccessible, covered or unexposed part of the building. We will therefore not be able to report on the structural condition of such areas or that such areas are free of rot, insect infestation or other defects.

Our report is based on the available visual evidence together with our previous experience of similar buildings and their problems. We have only reported on structural defects that may materially affect the stability of the building and that were reasonably detectable and visible at the time of our inspection.

It must be appreciated that deterioration may occur to some areas in the future due to the potentially detrimental effects arising from the existence of Asbestos, High Alumina Cement, concrete carbonation, corrosion of reinforcement or other items of covered steel, etc, even where no obvious evidence of distress is visible at the time of our inspection, particularly where circumstances change subsequent to our inspection. We do note that the property was cleared of Asbestos in January 2016.

AECOM cannot offer any guarantees that the building will be free from future defects or that existing ones, which are non-structural and hence outside the scope of this report and/or beyond the limitations and exclusions of this report, will not deteriorate in the future, and hence lead to problems with the structure.

The report is confidential and non-assignable and is intended for the sole use of the client. Unless specifically stated, it will not constitute a statement of fact, which might be used in resolution of disputes or litigation. AECOM takes no responsibility for any action by third parties, resulting from the contents of their report. Copyright is held by AECOM hence reproduction of additional copies of the report is prohibited without prior agreement.

Where trial pits were excavated to inform the proposed structural alterations and described in the report, it must be understood that any comment on the ground conditions beneath the foundations can only relate to the exposed soil at the place of the excavation and does not necessarily mean that those conditions are consistent across the whole of the site. Whilst local trial pits usually provide a reasonable representation of the foundations and ground conditions, these cannot be determined with complete certainty.

Figure 1 – Front Elevation of 4 The Grove, Highgate

Figure 2 – Rear Elevation of 4 The Grove, Highgate

Existing Structure

02

02 Existing Structure

02.01 Structural Arrangement

The Grade II* listed residential property was built in 1688 over four levels from lower ground, upper ground, first and second floors. The site lies on a quiet residential road at the top of a hill which slopes down away from the rear of the property. The front of the property is accessed at upper ground floor level with rear access to the garden at lower ground floor. The rear garden has been levelled with a substantial masonry retaining wall at the end of the garden with steps down approximately 6m to the lower area at the end of the garden.

The existing structure is predominantly formed in timber with the external facades constructed in brick. Appendix A contains annotated existing measured survey drawings depicting the existing structural arrangement of the building along with observations and notes made on the defects found during the inspection.

02.01.01 Roof Level

The roof is formed with two principal trusses supporting the purlins which provide support to the rafters on the front and rear pitches and a valley beam in the centre of the roof. The base of the rafters are built-up from the parapet of the front and rear facades.

02.01.02 Second Floor

Timber floor joists span East-West on to bressummers running North-South at third points. The bressummers span from the external masonry walls to the central East-West timber spine wall. Although the central joists span between the two bressummers, through the central North-South timber spine wall, it appears the wall is load-bearing down to the masonry wall at lower ground floor.

02.01.03 First Floor

Timber floor joists span East-West on to bressummers running North-South at third points. The bressummers span from the external masonry walls to the central East-West timber spine wall. Although the central joists span between the two bressummers, through the central North-South timber spine wall, it appears the wall is load-bearing down to the masonry wall at lower ground floor.

02.01.03 Upper Ground Floor

Timber floor joists span North-South on to bressummers running East-West at quarter points. The bressummers span from the external masonry front and rear elevations on to the North-South masonry wall below.

The eastern half of the East-West central spine wall and stair enclosure do not continue down to lower ground floor and are carried on the floor joists at upper ground floor level.

02.01.04 Lower Ground Floor

West half of the stair enclosure continues down to lower ground floor along with the West half of the central East-West spine wall. North-South central wall formed in masonry from upper to lower ground floor level. Floor constructed as a concrete ground-bearing slab.

02.02 Ground Conditions

Following a desktop study of the local surface geology, we found the property to be located on the Bagshot Formation over the London Clay horizon.

However, nearby borehole logs available online show the London Clay to be present at a higher level, directly beneath any surface made ground. This was confirmed whilst inspecting some shallow trial pits dug in the lower ground floor of the property to inform some proposed alterations to the lower ground floor. Stiff clay was encountered immediately below the ground bearing slab with only some moisture on the northern boundary allowing some indentation when pinched by hand. The clay appeared well consolidated and with no sign of differential settlement in the external façade, we don't anticipate any issues with the bearing strata with the exception of any heave or shrinkage due to nearby trees.

Figure 3 below is an extract from the British Geological Survey's surface geology map and highlights the properties approximate location.

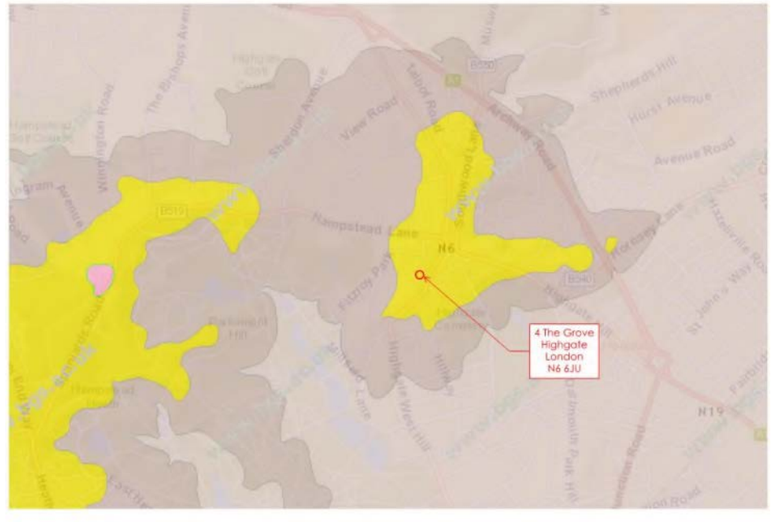

Figure 3 – Extract from British Geology Survey surface geology map

Defects Analysis

03

03 Defects Analysis

Reference	Visible Symptom of Distress	Possible Cause(s)	Further Investigation Required	Principal of Repair	Likely Consequence of Not Repair	Photo References
ROOF LEVEL						
R-1	Vertical cracking in face of stack	Thermal fluctuations	None	Rake-out bed joint of every 4th course and insert 6mm diameter stainless steel Helibar placed in helibond grout as bonding agent. For cracks up to 6mm, use Nitokit TH by Fosroc. For cracks over 6mm, ram in tight 1:2 dry pack with non-shrink additive. All as per manufacturers recommendations.	Progressive increase in crack width and potential destabilization of stack over time.	1 / 2 / 3
R-2	Blown brick faces	Crypto florescence. Hidden salt crystallisation occurring within the pores below the masonry surface. Fine pores cannot accommodate the increasing accumulations of salts and are eventually broken apart by the expansive forces of the crystal growth, causing the surface to decay.	None	Loss of section minimal. No repair presently required.	-	3
R-3	Pointing missing to parapet	Freeze thaw action	None	Rake out any loose pointing encountered and re-point.	Further loss of pointing in adjacent beds.	4
R-4	Bowing rafters to interior roof pitches	Non-original concrete tiles on interior pitches	None	Replace heavy concrete tiles with traditional clay tiles to match front and rear pitches. Install collar strut to act as compression member and prevent further deflection.	Rafters remain overloaded and cause rafters to deflect further overstress purlins and potentially exacerbate roof spread at 2nd floor level.	5
R-5	Hatch enclosure timbers rotten	Poor flashing detail allowing water ingress	None	Reconstruct roof access hatch and enclosure in timber carcassing and improve waterproofing detail using lead work to Architects details and recommendation.	Continued decay of enclosure timbers and water ingress to roof space.	6
R-6	Fractured hatch timber	Inadequate design and detailing of trimming timbers during historic modification	None	Remove roof access enclosure and rebuild with doubled-up trimming rafters either side of opening to avoid overstressing of individual rafters.	Potential collapse of roof access hatch enclosure.	7 / 8 / 9
R-7	Minor ridge sagging	Overloading of interior pitches and historical creep	None	Reduce load by replacing heavy concrete tiles with traditional clay tiles to match front and rear pitches. Improve connectivity of 2nd floor joists with rafter feet to prevent further roof spread.	Continued distortion of roof structure and potentially exacerbate roof spread at 2nd floor level.	10
R-8	Silting in valley gutter	Insufficient fall in valley gutter	None	Increase fall of valley gutter.	Continued build-up of sediment preventing water from draining. Encouraging ponding and water ingress to roof structure.	11
R-9	Major fracture in purlin	Overloading and rotation of purlin causing failure of tenon connection	None	Horizontal through bolting of purlin with resin infill to reform section modulus. Steel brackets to improve connection of purlin in to principal truss.	Partial collapse of roof possible should the connection fail entirely.	12
R-10	Vent pipe stay missing	Stay fixing failed	None	Replace pipe stay.	Cracking of pipe due to oscillation in wind.	-
R-11	Flaking chimney pot	Freeze thaw	None	None currently required.	Surface of pot may continue to erode.	13
R-12	Deflected purlins	Overloading and roof spread	None	Reduce load by replacing heavy concrete tiles with traditional clay tiles to match front and rear pitches. Install compression members between purlins to prevent any further deflection. Improve connectivity of 2nd floor joists with rafter feet to prevent further roof spread.	Partial collapse of roof possible should the deflection cause the tenon connections to fail and the rafters become unsupported.	14 / 15
R-13	Insect bores in timber	Insect attack	Specialist timber survey may be beneficial to mitigate risk. No insect bore dust or frass visible so insect attack may be historical.	Timber specialist to advise of appropriate cause and treatment. As a precaution, we would recommend having the roof sprayed with insecticide as a matter of course.	If active, insect attack could reduce the capacity of individual elements and cause them to fail in extreme circumstances.	16 / 17
R-14	Missing pointing from inside face of North gable wall within roof space	Historical water ingress washing out mortar	None	Repoint with lime based mortar.	Continued loss of mortar could make the gable wall unstable.	18
R-15	Modern diagonal prop to interior pitch within front roof space	Attempt to prevent further rafter deflection. Props down to ceiling joist binder which is structurally inadequate to prop against.	None	Replace heavy concrete tiles with traditional clay tiles to match front and rear pitches. Install collar strut to act as compression member and prevent further deflection.	Rafters remain overloaded and cause rafters to deflect further overstress 2nd floor ceiling joists.	19

Reference	Visible Symptom of Distress	Possible Cause(s)	Further Investigation Required	Principal of Repair	Likely Consequence of Not Repair	Photo References
SECOND FLOOR						
2-1	Roof spread	Overloading of interior pitches causing excessive purlin deflection and resultant outward force through rafter feet. Cut bottom chord and lack of connectivity between rafter ends and 2nd floor joists resulting in no floor restraint and parapet able to push out.	Remove dwarf stud walls and clear eaves to enable engineers to inspect wall plate and rafter end relationship with second floor joists. Also open-up joist to bressummer connection within 2nd floor plate.	Insert timber rafter collar and purlin struts to prevent further deflection. Replace lost connectivity between rafter ends and 2nd floor joists. Tie joists over supporting bressummers to ensure 2nd floor can act as a diaphragm in tension.	Ultimately, collapse of rear elevation and associated structure. It is essential this is repaired immediately.	20 / 21 / 25
2-2	Leaning dwarf stud walls	Overloading of interior pitches causing excessive purlin deflection and resultant outward force through rafter feet. Cut bottom chord and lack of connectivity between rafter ends and 2nd floor joists resulting in no floor restraint and parapet able to push out.	Remove dwarf stud walls and clear eaves to enable engineers to inspect wall plate and rafter end relationship with second floor joists. Also open-up joist to bressummer connection within 2nd floor plate.	Insert timber rafter collar and purlin struts to prevent further deflection. Replace lost connectivity between rafter ends and 2nd floor joists. Tie joists over supporting bressummers to ensure 2nd floor can act as a diaphragm in tension.	Ultimately, collapse of rear elevation and associated structure. It is essential this is repaired immediately.	22
2-3	New joists installed to level sloping floor	An poor attempt to control roof spread and correct the level of the floor	None	In addition to recommendations made in '2-1'. Replace lost connectivity between rafter ends and 2nd floor joists. Tie joists over supporting bressummers to ensure 2nd floor can act as a diaphragm in tension. Ensure boards are suitably screwed down into new joists to maintain diaphragm action of 2nd floor plate.	-	23
2-4	Water staining on timbers	Water ingress through failed box gutter	Remove dwarf stud walls and clear eaves to enable engineers to inspect damage to wall plate and rafter ends. Specialist timber survey may be beneficial to mitigate risk.	Replace/strengthen elements of decayed timber. Rot survey to establish full extent of decay.	Decayed timber may be structurally inadequate.	24
FIRST FLOOR						
1-1	Sloping floors and lozenge doors	Overloading of central East-West timber spine wall	None	Relieve load wherever possible. Replace concrete roof tiles with clay alternatives. Avoid areas of heavy storage. No dense modern materials.	Continued overstressing of spine wall will lead to further cracking and rotation of door openings.	26 / 27
1-2	Sloping floor and deflection of bressummers	Heavy modern concrete block partition supported on single joist. Non-original timber trussed walls under.	None	Remove existing blockwork wall and reconstruct using timber stud on doubled-up joist below.	Continued overstressing of floor plate and potential for further movement.	28
UPPER GROUND FLOOR						
UGF-1	Sloping floor to East-West spine wall	Also, large non-original opening in East-West spine wall severing ties in timber trussed walls. East half of central East-West and stair enclosure do not continue down to LGF and therefore transfer load directly on to UGF joists causing them to be overstressed.	None	Add additional floor joists between existing under transferred walls to stiffen floor and prevent further deflection. Reduce loading wherever possible.	Continued over stressing of floor plate and potential for further movement.	29
LOWER GROUND FLOOR						
LGF-1	Shallow footing level	Floor previously lowered to below originally intended.	Compete remaining trial pits	Ensure any lowering of the existing lower ground floor does not undermine the existing footing.	None, assuming that the footing is not undermined.	30
LGF-2	High moisture readings in walls	Rising damp due to no visible DPC.	None	Injected DPC could be installed following consultation with Architect.	Continued high moisture readings and damage to finishes.	-

Recommendations & Conclusions

04

04 Recommendations & Conclusions

04.01 Essential Repairs

Due to the sensitive nature of the property we recommend the following items are addressed as a minimum to ensure the structural integrity is maintained, the building remains dry and no further damage occurs to the structure.

04.01.01 Roof Spread

As we hope is clear from the Defects Analysis, Survey Notes and corresponding photographs; the work required to address the multiple roof defects should be conducted as a matter of urgency to mitigate further roof spread.

Heavily deflected rafters and purlins due to installation of concrete roof tiles have been exacerbated by the damaging alterations at 2nd floor level which have led to severing of the 2nd floor joists from the rafter ends and allowed the roof to spread, pushing the head of the rear wall out.

There is evidence that modern strengthening details have attempted to prevent further spread of the roof but these have been poorly detailed and are having little to no benefit.

Defects R-4 / R-7 / R-12 / R-15 / 2-1 / 2-2 / 2-3 can all be addressed through the installation of collar struts and compression members between purlins used in conjunction with a tying details at the interface of the second floor joists with the rafter ends and the supporting bressummers.

This suite of roof strengthening details should, if detailed correctly, prevent any further roof spread occuring.

04.01.02 Fractured Roof Purlin

The North-East purlin was found to have a major fracture at its tenon connection with the northern principal truss. We recommend horizontal through bolting of purlin with resin infill to reform the section modulus. Steel brackets should then be installed to improve connection of the purlin in to the principal truss.

04.01.03 Investigate Extent of Water Damage

As noted in the Defects Analysis, historical water staining was observed in the rear roof eaves behind the dwarf walls at second floor level. We recommend this is investigated further to determine the extent of water ingress and if any of the structural timbers have decayed to an extent that may necessitate replacement.

Should we find extensive timber decay, we would recommend procuring a specialist timber survey to confirm the extent. We have a strong relationship with Exova BM Trada who would be happy to assist with this regard. We could also request they advise on treatment of the insect attack observed.

04.02 Desirable Repairs

All other defects observed and detailed in the Defects Analysis are desirable and do not necessarily required immediate action. However, these defect may become more severe with time and whilst the building refurbishment is undertaken we would encourage the repair of all defects as a matter of course and best practice.

We would highlight the following actions to mitigate the defects observed:

- Stitching of vertical cracking in face of chimney stack
- Replace hatch enclosure and trimming timbers
- Increase fall of valley gutter
- Re-point parapet and inside face of gable wall within roof space
- Replace Bedroom 6 blockwork with stud partition on doubled-up joists
- Insert additional joists under central spine wall in ground floor reception

We would be happy to assist with the preparation of repair details for the defects listed above.

Appendix A – Survey Notes

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05 Survey Notes

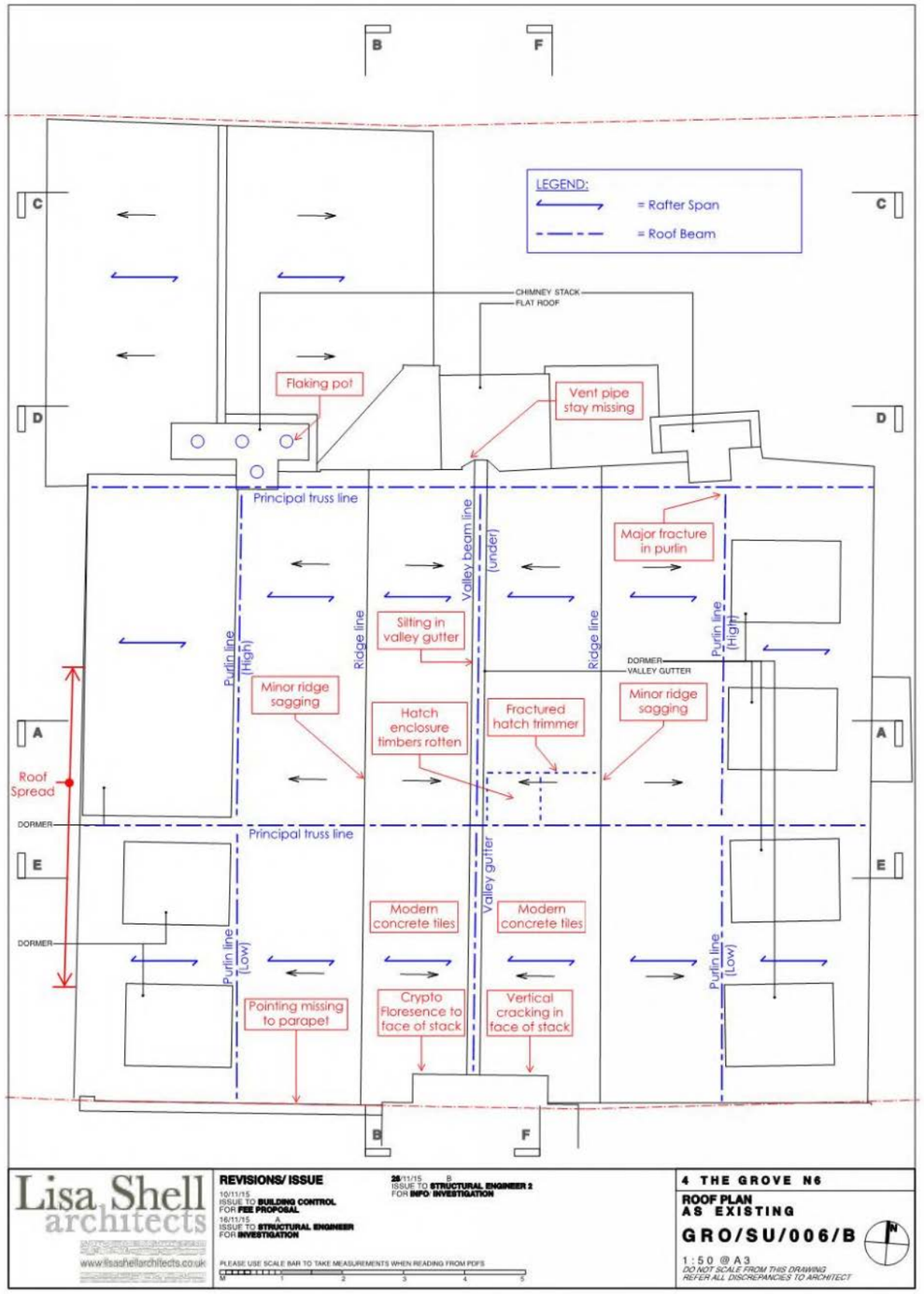

Figure 4 – Mark-up of Existing Roof Level

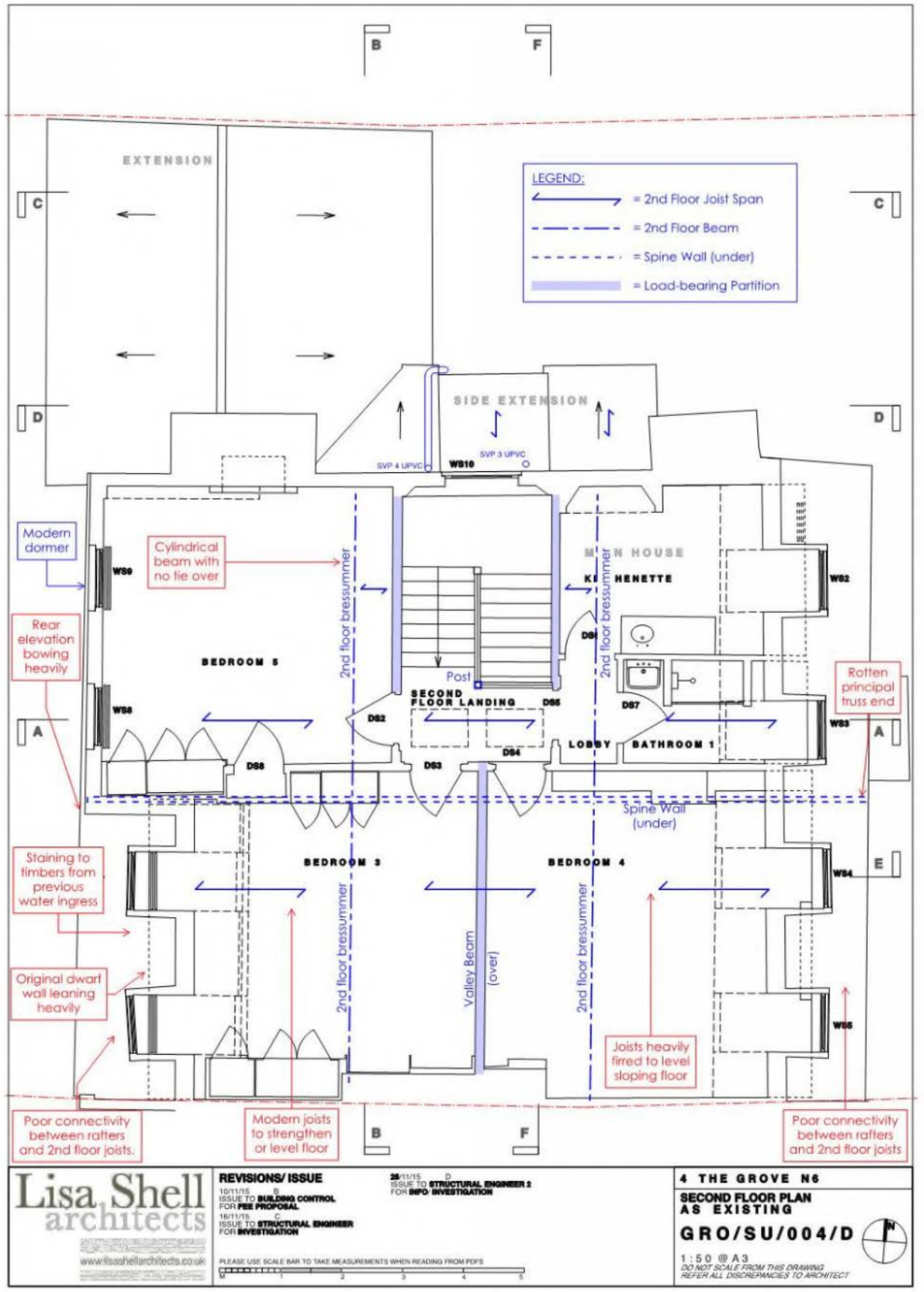

Figure 5 – Mark-up of Existing 2nd Floor Level

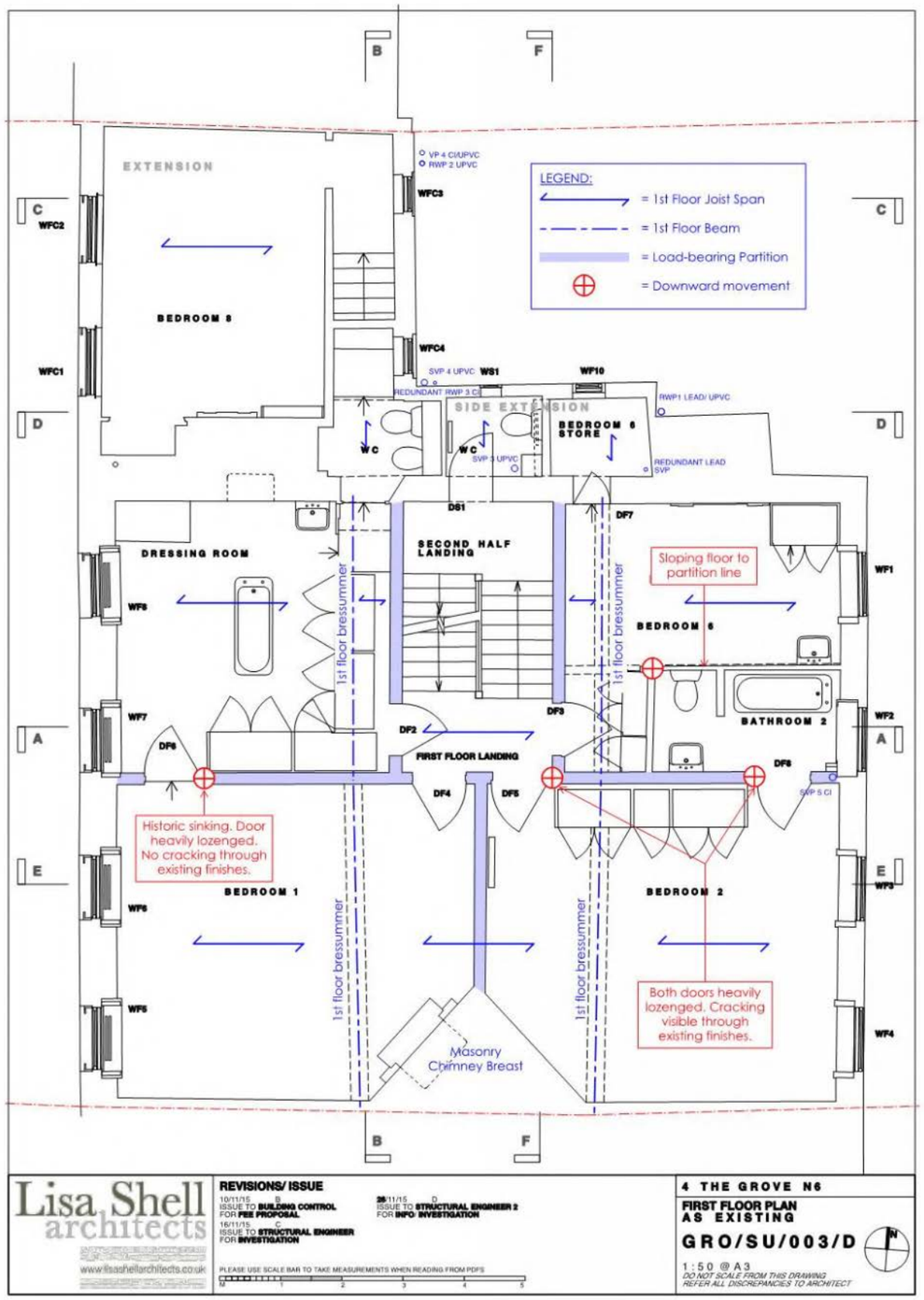

Figure 6 – Mark-up of Existing First Floor Level

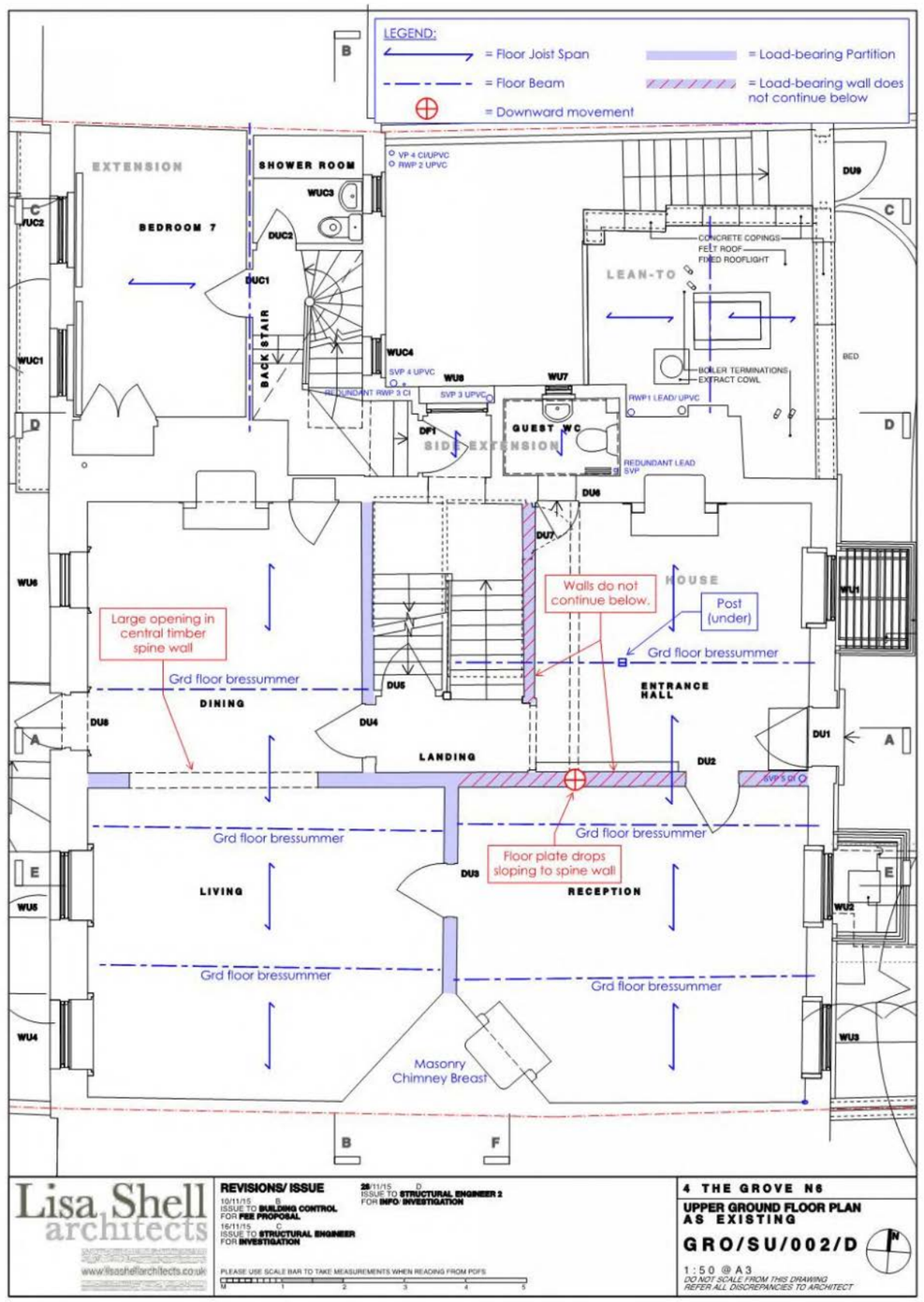

Figure 7 – Mark-up of Existing Upper Ground Floor Level

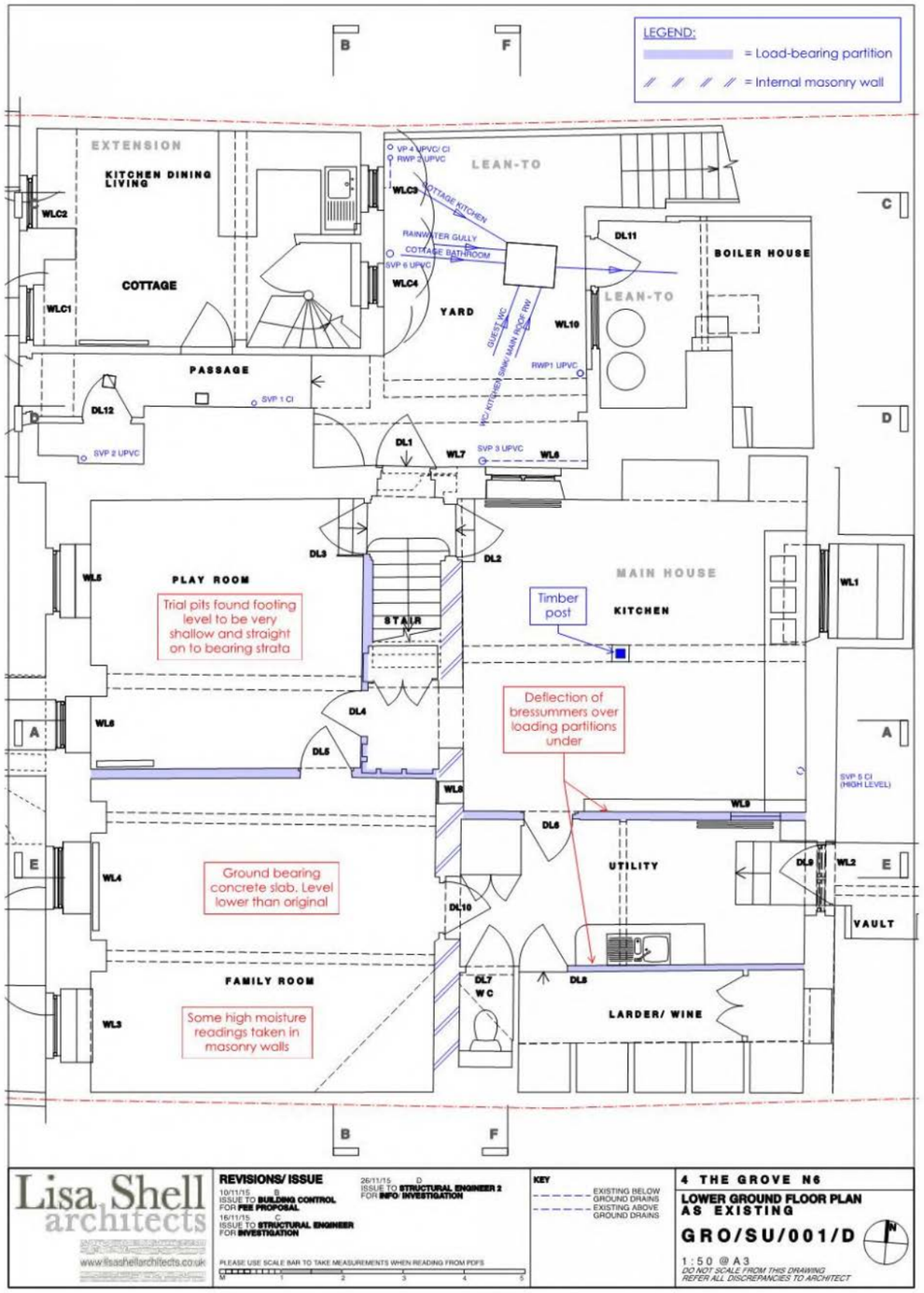

Figure 8 – Mark-up of Existing Lower Ground Level

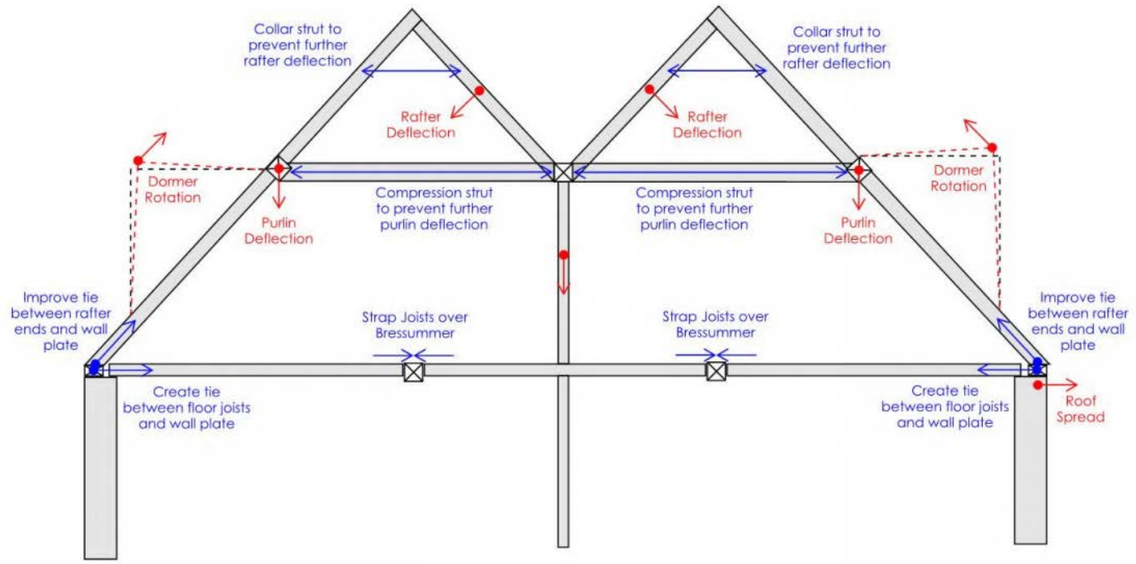

Figure 9 – Section through roof structure

Appendix B – Photographic Record Library

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06 Photographic Record Library

Photo 1 – Looking South to North elevation of southern chimney stack

Photo 2 – Vertical crack in face of southern stack

Photo 3 – Blown face of brickwork and vertical cracking to northern face of southern stack

Photo 4 – Missing pointing on Party Wall parapet

Photo 5 – Significant firrings to correct sagging rafters

Photo 6 – Decaying timber surround to roof hatch

Photo 7 – Fracture to roof hatch trimming timber

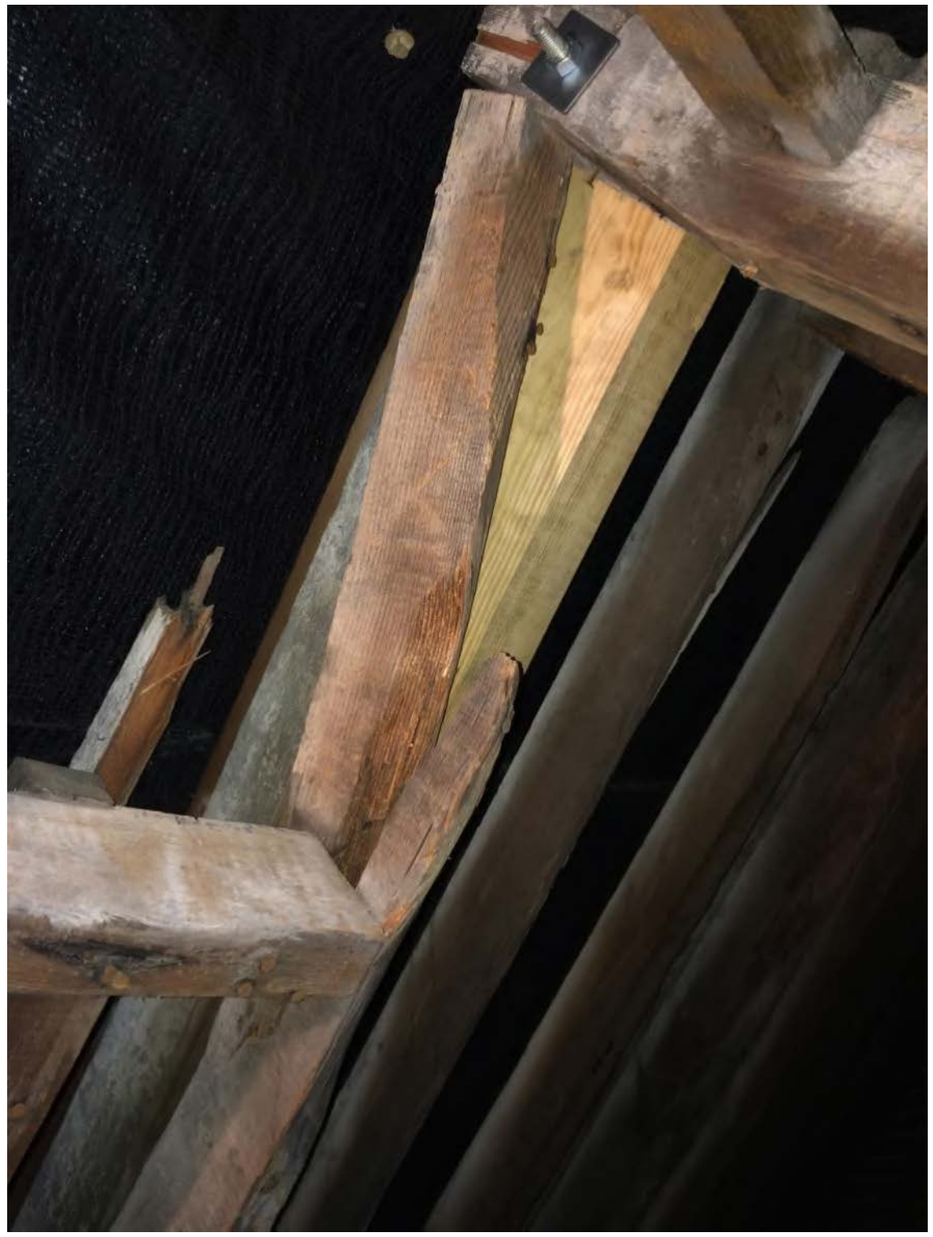

Photo 8 – Fracture to roof hatch trimming timber

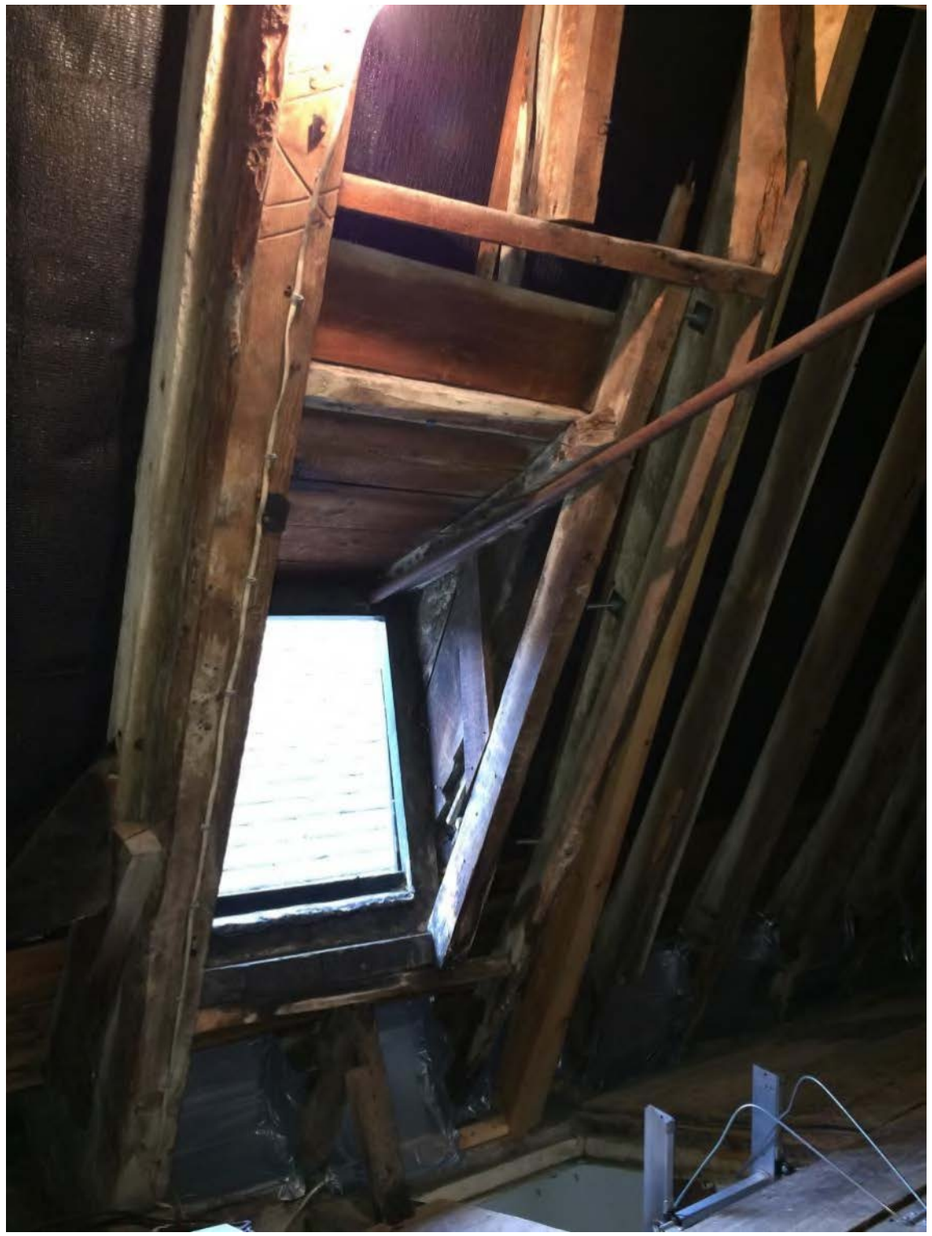

Photo 9 – Fracture to roof hatch trimming timber on right hand side

Photo 10 – Minor sagging of roof pitch

Photo 11 – Silting of valley gutter

Photo 12 – Fractured purlin at tenon connection with northern principal truss

Photo 13 – Flaking surface to clay pot

Photo 14 - Significant deflection of South-West purlin

Photo 15 - Significant deflection of North-East purlin

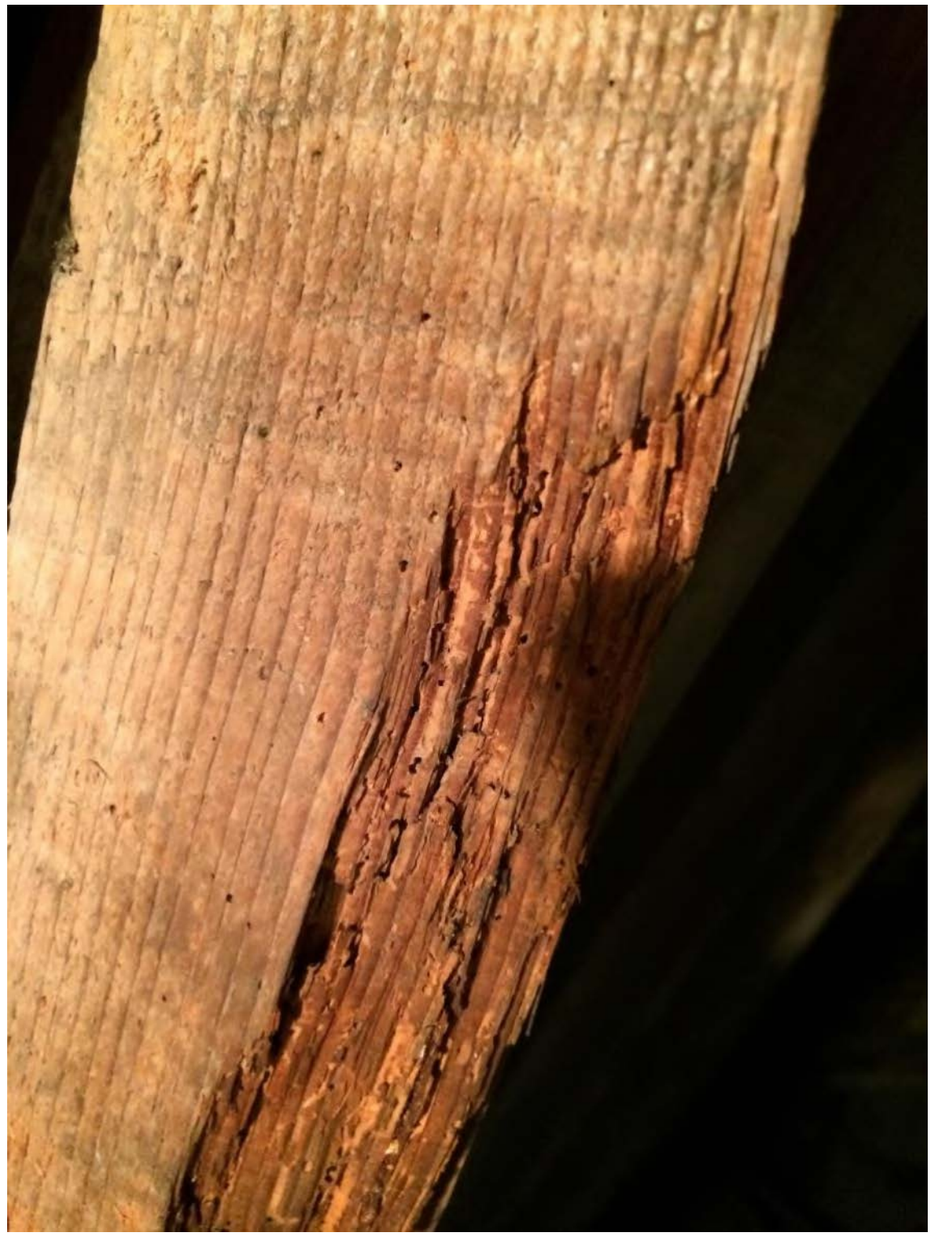

Photo 16 – Insect bores to timber rafter

Photo 17 – Insect bores to timber floor joist and heavy notching of battens

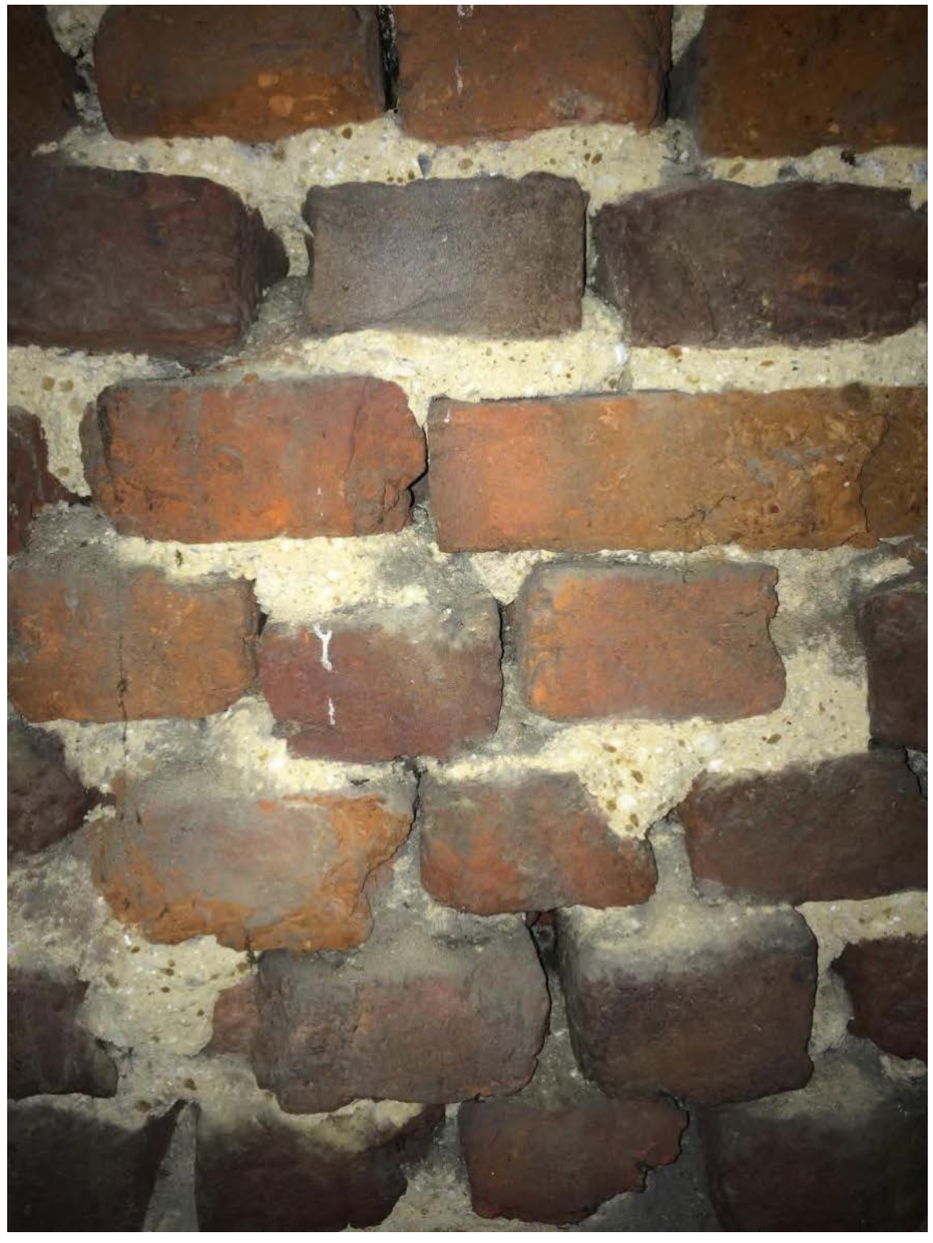

Photo 18 – Missing pointing to inside face of North gable wall within roof space

Photo 19 – Modern Repairs within roof space

Photo 20 – Bowing of rear elevation at mid-point of 2nd floor level

Photo 21 – Loss of connectivity between rafter ends and second floor joists. Existing joists appear to have been severed.

Photo 22 – Original dwarf stud walls leaning to rear elevation behind modern corrected wall line

Photo 23 – Supplementary modern timbers installed either side of existing joists and poor detail over bressummer

Photo 24 – Significant water staining to rafter ends within rear eaves. Cut truss chord.

Photo 25 – Poor connection of joists on to North-West 2nd floor bressummer

Photo 26 – Sloping floor and lozenging of doors in Bedroom 1 at 1st floor level

Photo 27 – Sloping floor and lozenging of doors in Bedroom 2 at 1st floor level

Photo 28 – Sloping floor to modern blockwork partition

Photo 29 – Sloping floor to East-West central spine wall at upper ground floor level

Photo 30 – Shallow foundations at lower ground floor level

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