STRUCTURAL INSPECTION REPORT

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for

Pine Cone Cottage
Glenborradale
Acharacle
PH36 4JP

September 2021

Contents

Prepared by:

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1.0 INTRODUCTION

1.1 Scope of Instructions

We were instructed by the below-named client to undertake a survey of the non-traditional elements of the building so as to provide a written report on our opinion on their structural condition. This report is intended to form an addendum to the subsequent Home Report.

1.2 Disclosure

We can confirm we have no known conflicts of interest and are acting impartially.

1.3 Property address

Pine Cone Cottage
Glenborradale
Acharacle
PH36 4JP

1.4 Client name

Mr D & Mrs J Garnett

1.5 Date of Survey and Surveyor

An inspection of the property was undertaken by Ewan Stewart C. Build E. MRICS, Chartered Building Surveyor and Engineer on 24th September 2021.

1.6 Weather

The weather was dry at the time of inspecting, with heavy and prolonged spells of rain in the days preceding.

1.7 Limitations of inspection

This survey is concerned with the structural elements of the Dorran construction part of the property only. No comment is made on the condition of other elements or parts of the building such as the later, traditionally constructed extension; windows and doors; roof coverings, finishes and decorations or services. This report must be read in conjunction with the Home Report, or any other suitable condition survey, in order to gain an overall impression of the condition of the property.

The general terms of reference / appointment as issued are set out in Appendix 1 below.

1.8 Report references

All references to right and left are made as if looking on to the front of the property from outside. The front of the property faces south.

1.9 Information obtained or relied upon as part of this report

- Home Report, prepared by Allied Surveyors

2.0 DESCRIPTION OF THE PROPERTY

2.1 Type, history and age

Understood to have been built circa 1966, the original part of the property is a single storey detached dwelling manufactured by Dorran, of non-traditional construction, with the walls formed using Precast Reinforced Concrete walls. The property has been extended west at some point, with a small conservatory also added. This extension is of traditional construction. For the avoidance of doubt, this report is solely concerned with the non traditional Dorran walls and roof. No other part of the property was inspected.

The roof is gabled and has a tile-clad roof supported with prefabricated timber fink trusses. The floor is of suspended timber construction.

Accommodation within the Dorran part of the property comprises three bedrooms, bathroom, kitchen and sitting room. The extension provides a dining room.

The layout has slight differences from the typical Dorran layout.

The Dorran has been rendered externally at some point. Internally it is understood the walls have been lined with rigid board insulation to improve thermal performance.

2.2 Site and surrounding areas

The site is sloping, with an elevated position. The ground has bedrock relatively close to the surface.

3.0 BACKGROUND AND CONSTRUCTION

3.1 Construction principles of Dorrans

Dorrans were constructed using what is defined as non-traditional methods and comprise a concrete strip foundation with brickwork underbuilding and a precast concrete kerb for receiving the main wall panels. While there are some minor variations in how they are constructed, they are generally as follows:

The main walls comprise thin section (35-40mm approx.) Precast Reinforced Concrete panels, 400mm in width, cast on to a timber frame, comprising 25 x 38mm timber studs, set at 380mm intervals, and similar sized dwangs set at 400mm vertical centres, with a protective bituminous felt provided between to prevent water penetration. These panels are bolted together using galvanised 8mm steel bolts, 20mm washers and wing nuts through the timber frame at about 400mm intervals. The vertical joints are then filled with a mastic before finished in a cement pointing externally.

Lintels to window and door openings are of similar construction. They do not have any bearing at either end, and instead rely on the shear capacity of the wing nut bolts and nailing transmitting the loads to the adjacent wall panels.

The corners typically comprise a mild steel square hollow section post, with the concrete cast onto this, with the adjoining wall panels bolted into the post in the same manner described above.

At the eaves, the roof structure is secured to the wall panels via hooked steel restraint straps and clips, with a 75x50mm timber head binder forming the wall-plate.

As such, the timber frame, in addition to the concrete panels, fulfils a structural function and indeed is the main structural element, in addition to the bolts and roof structure, that provides overall rigidity to the structure in response to horizontal wind loading.

In most of these walls, at manufacture, there was usually about 10-25mm of polystyrene or glass wool insulation provided. The floor is of suspended timber construction with sleeper walls provided to give midspan support. The internal partitions, wall and ceiling linings are plasterboard. The roof structure is a prefabricated timber truss type and is of light section.

3.2 Background

Dorran Construction Limited, based in Perth, was formed either as a subsidiary or offshoot from R.G. Tarran of Hull. Non-traditional construction methods for housing were adopted by many housebuilders to address the post-war housing shortage and resulting boom. As with most other forms of non-traditional construction, the aim was to have most of the elements prefabricated before being delivered to site, which allowed houses to be erected quickly and economically. The majority of Dorrans were manufactured in the 1950s and 60s, with problems inherent to this type of construction starting to be observed in the 1970s. Some Dorrans were continuing to be erected into the 1970s.

3.3 Defects highlighted by the Building Research Establishment (BRE) Report

In 1984 the Building Research Establishment (BRE) identified problems with Prefabricated Precast Concrete (PRC) dwellings. This led to the Dorran being listed under the Housing Defects Act 1984 and then consolidated under the later Housing Act 1985. While there were problems such as severe condensation to the internal accommodation and corrosion to some of the panel bolts, the main issue identified by the BRE was the limited concrete cover to the steel reinforcement in the concrete:

Steel reinforcement is normally protected from corrosion by the high alkalinity of the concrete. However, the alkalinity can be lowered by a chemical process known as carbonation which in turn increases the risk of the steel corroding. The limited cover to the steel means that the carbonation process, which is a reaction between the concrete and the atmosphere, reaches the concrete immediately surrounding the steel, reducing the corrosion protection.

Another mechanism of deterioration for PRC wall panels, again by corroding the reinforcement, is because of an elevated chloride ion content. This occurs either due to chloride contaminated aggregates used in the concrete during manufacture or introduced from the surrounding environment after the dwelling has been erected.

Both these processes cause the reinforcement to corrode and expand, causing the concrete to break off or spall. This then allows water to enter the reinforcement causing further deterioration. This deterioration causes a loss in structural strength and can ultimately result in structural failure. It is worth noting however that this is both a very slow deterioration process that occurs over decades and the symptoms are readily visible long before such failure might occur.

Repairs to the affected concrete are possible but are awkward due to the relatively thin section of the concrete panel. Cladding the wall in an insulated structural cladding is the best option and allows the property to be considered as being of traditional construction. Typical costs for this work are in the order of £50-70,000 plus VAT. A Building Warrant is required for these works.

4.0 SURVEY AND INSPECTION

4.1 Methodology and limitations of inspection

The survey comprised a visual inspection of the building from ground level and a visual inspection of the roof void, sub-floor void and internal accommodation.

Wool insulation has been laid over the ceiling joists in the loft. This restricts a full inspection of the roof structure. Some of the insulation was lifted in random areas to inspect the underlying structure.

The construction of the floor void meant its whole inspection was not possible. In particular polystyrene insulation boards have been fitted between the floor joists to part of the floor structure, which limited inspection of the timbers and the connections.

The property has had its original Dorran external walls are mainly finished in a dry dash render which has been painted.

The render prevents a good range of carbonation testing being undertaken across the panels. However, some tests were undertaken within the roof and floor voids. Tests for the depth of carbonation were undertaken using a cold chisel. A 1% Phenolphthalein solution was used as a pH indicator. No other tests were made.

5.0 VISUAL INSPECTION

5.1 Exterior

The underbuilding comprises a single leaf of concrete blockwork, which has been finished in render. Regular air bricks have been provided to ventilate the sub floor void.

A visual inspection of the exterior of the building revealed the following:

Roof:

5.1.1.1 No signs of structural movement.

Front Elevation:

5.1.1.2 Wall panels in alignment.

5.1.1.3 0.5mm vertical crack, below threshold to main door.

5.1.1.4 Hairline cracking, vertical, either side of lintel over main door.

5.1.1.5 No signs of structural movement to terrace / veranda.

Right elevation:

5.1.1.6 Wall panels in alignment

Left elevation

5.1.1.7 Wall panels in alignment, where visible / not covered by extension

5.1.1.8 Minor cracks to render, since repaired, above entrance door.

Rear elevation

5.1.1.9 Wall panels in alignment

5.1.1.10 Hairline vertical crack, approximately 150mm left of right corner, along with some signs of repaired render here.

Other comments:

The monoblock and concrete paving at the rear is too high, risking the damp proof course being bridged, resulting in damp timbers. This should be lowered by about 100mm.

Slight restricted airflow to subfloor due to veranda structure.

5.2 Roof void

The roof structure comprises prefabricated timber fink trusses with galvanised nail plates to the joints, supporting particleboard sarking. The spandrel panels are unlined, revealing the original PRC panels, timbers and bolts. A visual inspection of the roof void revealed the following:

5.2.1.1 No signs of structural distress or structural defects to roof structure.

5.2.1.2 No excessive deflection where ceiling joists' splices are unsupported below in living room.

5.2.1.3 Structural timbers in acceptable order. Some sagging of sarking but this is not structurally relevant. Some typical decay to bridling at chimney due to leaking flashing but not excessive.

5.2.1.4 Steel restraint straps and bolts in acceptable order.

5.2.1.5 No signs of any significant woodworm or recent activity on timbers inspected.

5.3 Sub floor void

An inspection revealed the following:

5.3.1.1 No signs of structural movement to underbuilding and sleeper walls.

5.3.1.2 Solum reasonably dry, some ponding of water at small depression acting as a sump. Not significant.

5.3.1.3 Timbers inspected to floor structure in good order.

5.3.1.4 Floor joists have been "lintelled" using timbers on joist hangers where they span across sleeper wall crawl spaces.

5.3.1.5 Damp proof courses present.

5.4 Internal accommodation

An inspection revealed the following:

5.4.1.1 No signs of structural distress.

5.4.1.2 No untoward deflection to floor joists.

6.0 CARBONATION TEST RESULTS

Position	Depth (mm)
Internally, in floor void, right elevation, at kerb	< 8
Internally, in floor void, front elevation, at kerb	< 8
Internally, in roof void, left gable, at spandrel	< 15
Internally, in roof void, left gable, at spandrel	< 15
Internally, in roof void, left gable, at spandrel	< 16
Internally, in roof void, right gable, at spandrel	< 16
Internally, in roof void, right gable, at spandrel	< 16
Internally, in roof void, right gable, at spandrel	>16

7.0 DISCUSSION AND CONCLUSION

7.1 Discussion

The testing shows some significant depths of carbonation have been reached on some of the panels. While the carbonation depth is rather high in these areas, it is unlikely to progress much further, as the rate of carbonation drops as the depth increases.

A key preventive measure in slowing the rate of carbonation is preventing water ingress via hairline cracking. Therefore, ensuring cracks are sealed as soon as possible is important maintenance. Improving ventilation to the roof void is also recommended, as this will help to mange condensation, which also contributes to carbonation. This is normally required in any roof that has a cold void above the insulation.

There are no signs of any structural defects to the panels – generally spalling of the render is the first clear indication that the steel reinforcement is beginning to corrode. The cracking noted above is due to normal shrinkage movement at the underlying panel joins and is not structurally significant.

The roof and floor structures are all in acceptable structural condition and no repairs are considered necessary.

7.2 Conclusion

In summary, the property is structurally sound and its condition looks to be above average when compared with other Dorrans. The shrinkage cracks should ideally be filled to prevent water ingress and ventilation added to the roof void. As noted above, the ground level at the rear should be lowered slightly to preserve the function of the damp proof course.

For longer term protection of the wall panels, not to mention the clear benefits in terms of energy efficiency, the installation of a proprietary external wall insulation system should be considered in the coming years.

Provided the above works are undertaken, and the property is otherwise properly maintained, then we would expect the property to be in an acceptable structural condition for the foreseeable future.

8.0 PHOTOGRAPHS

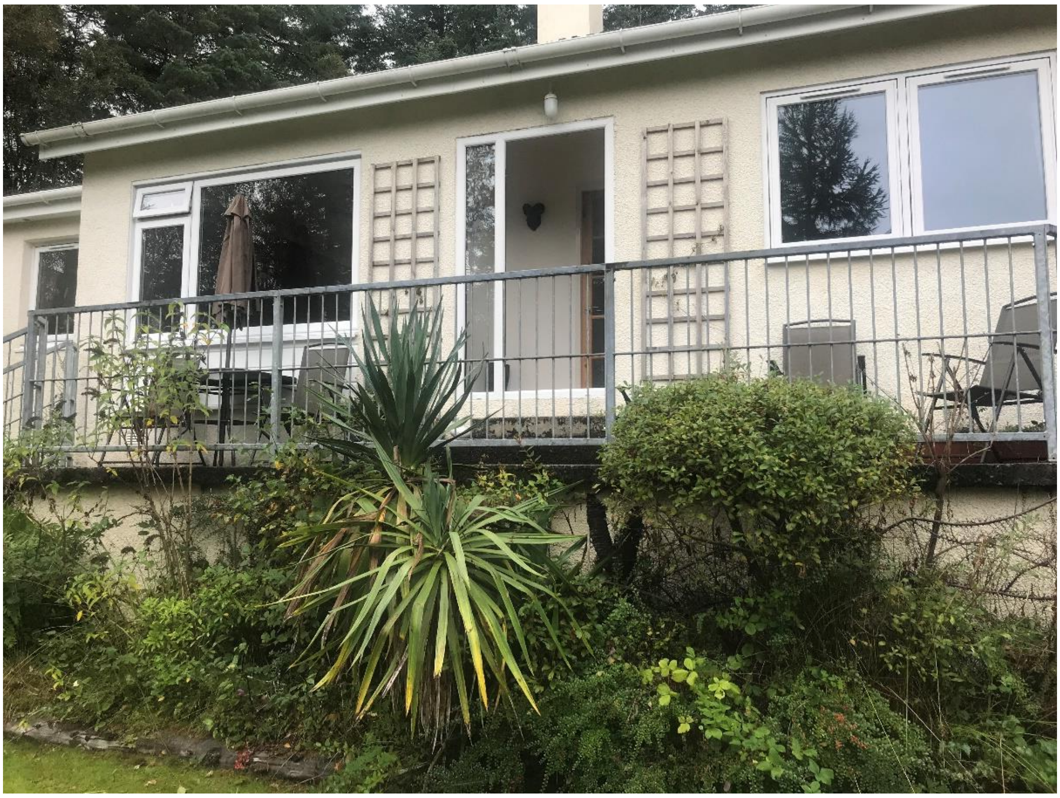

Figure 1 Front elevation

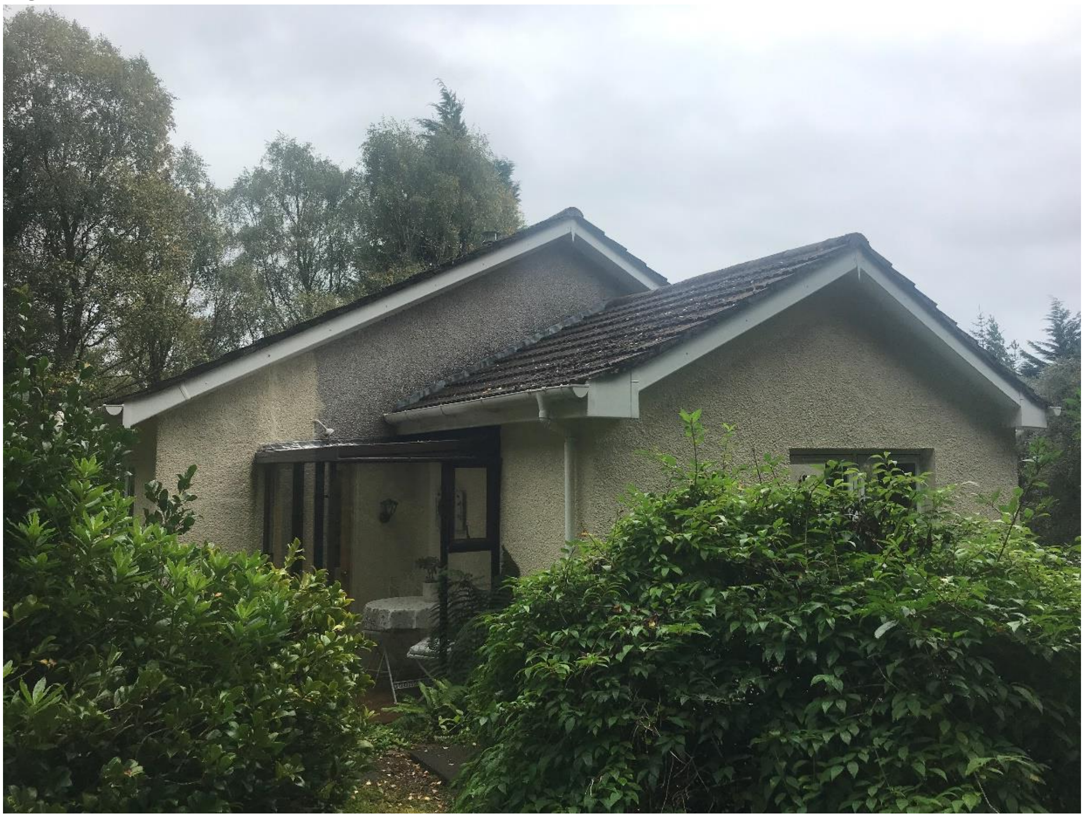

Figure 2 Left elevation

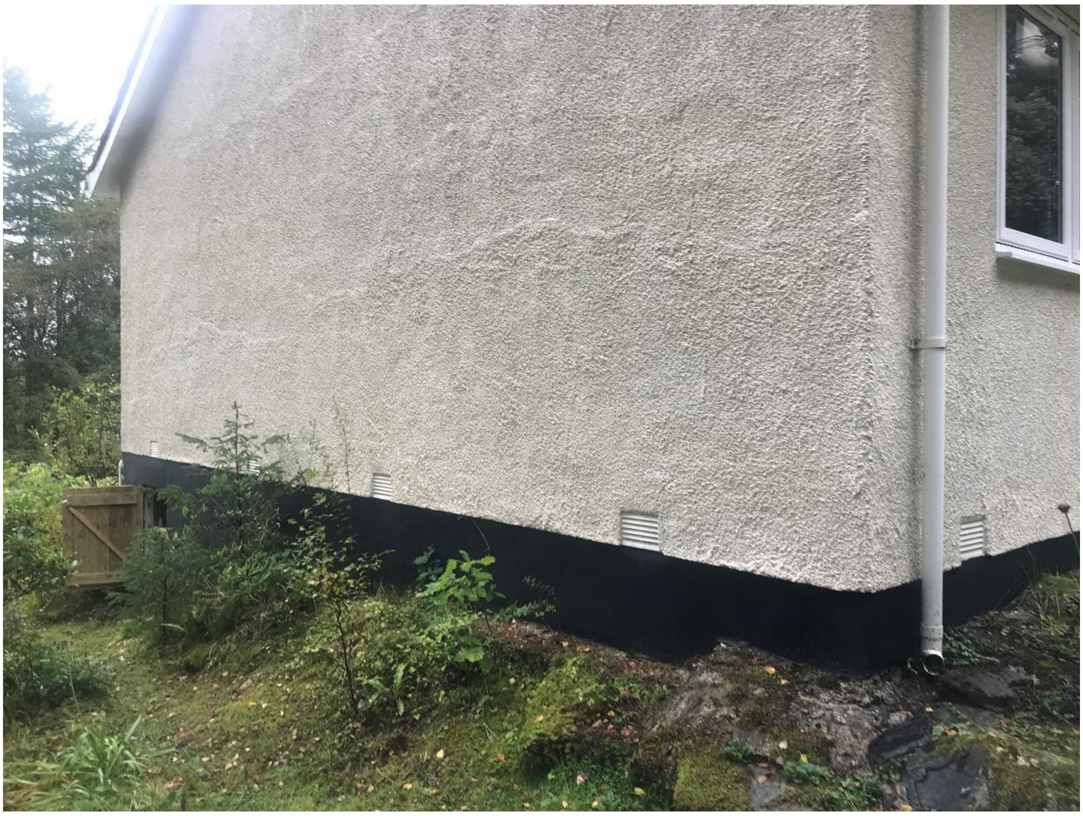

Figure 3 Right elevation

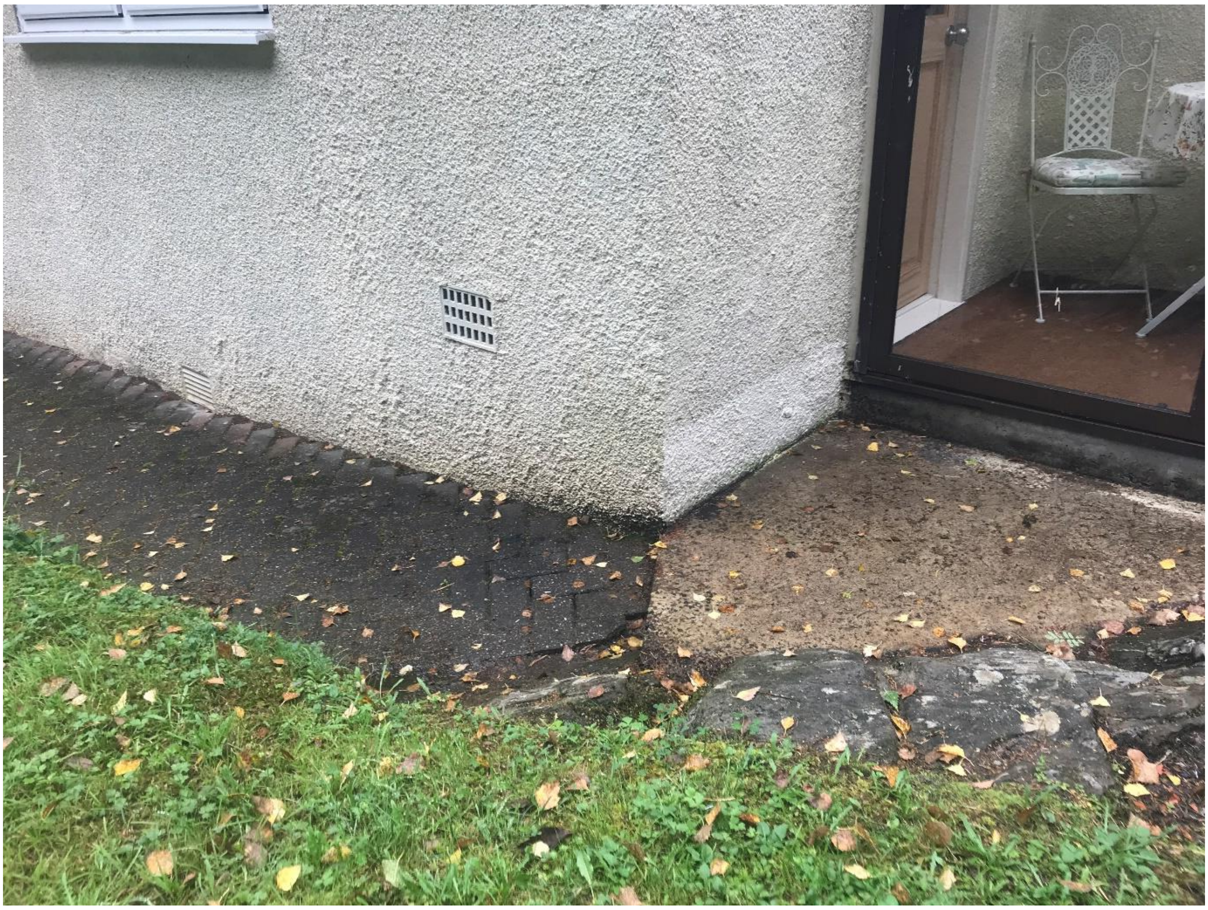

Figure 4 High external ground level at rear. This should be lowered.

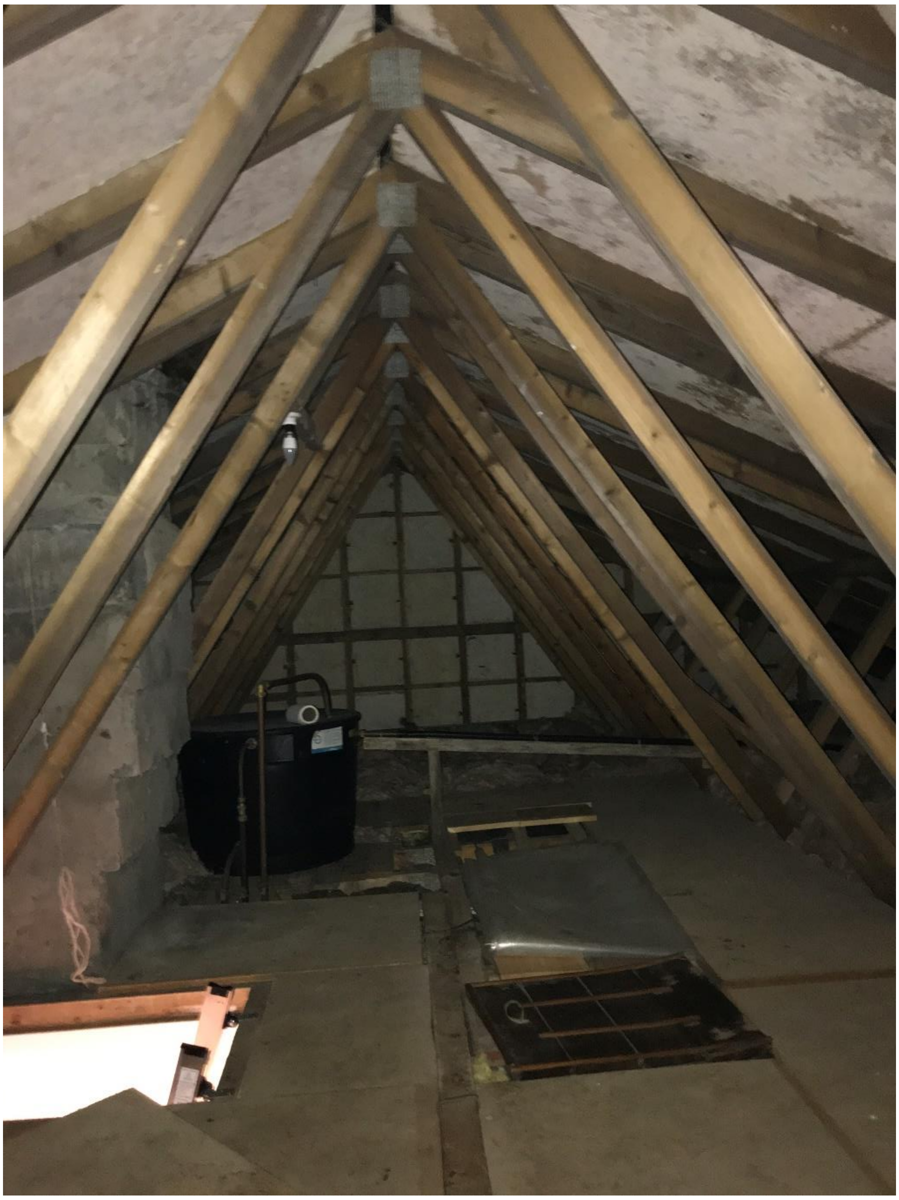

Figure 5 General view of roof void, with fink trusses and exposed gable spandrel panels

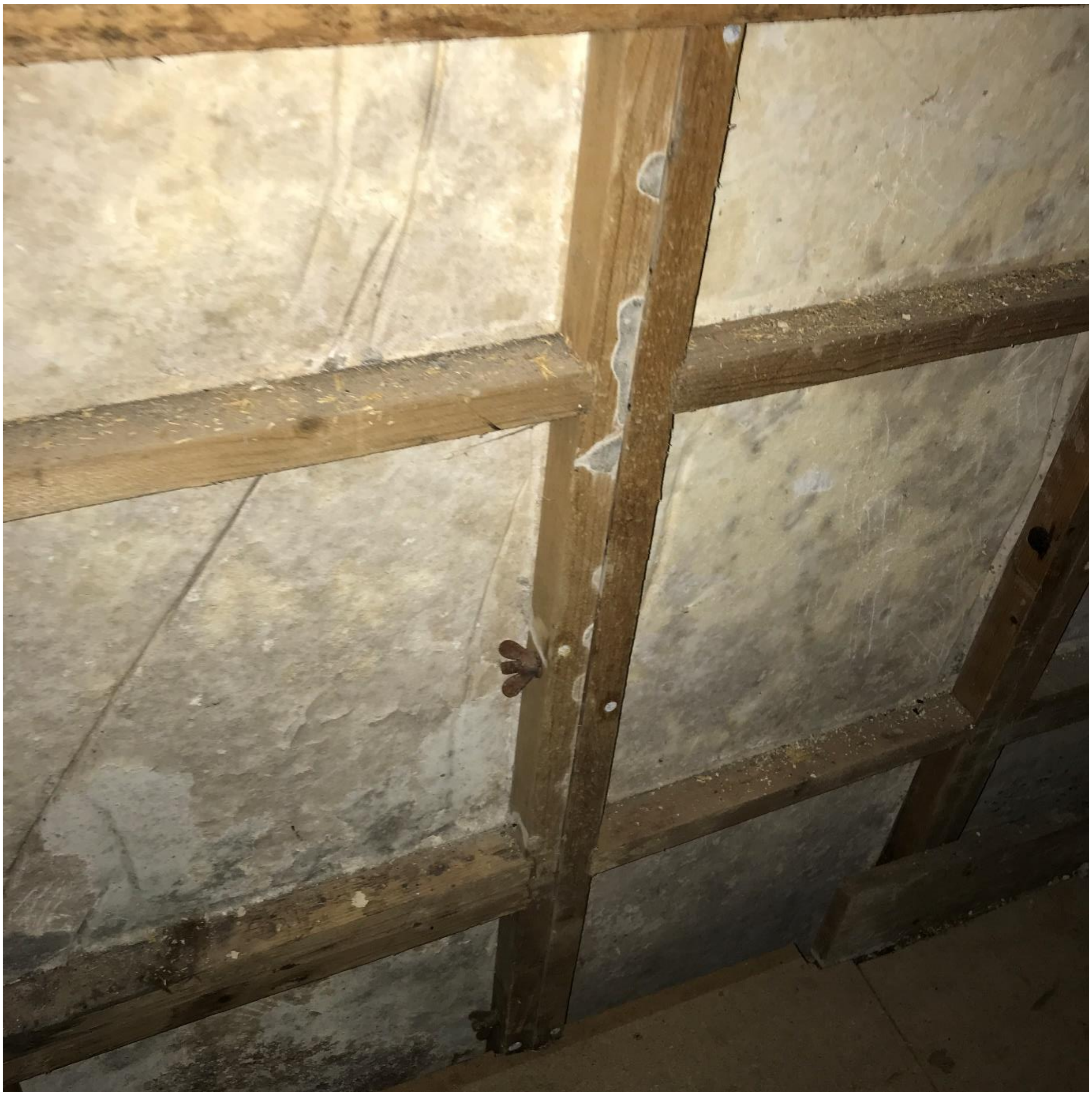

Figure 6 Close up of spandrel panel showing timbers and bolting arrangement.

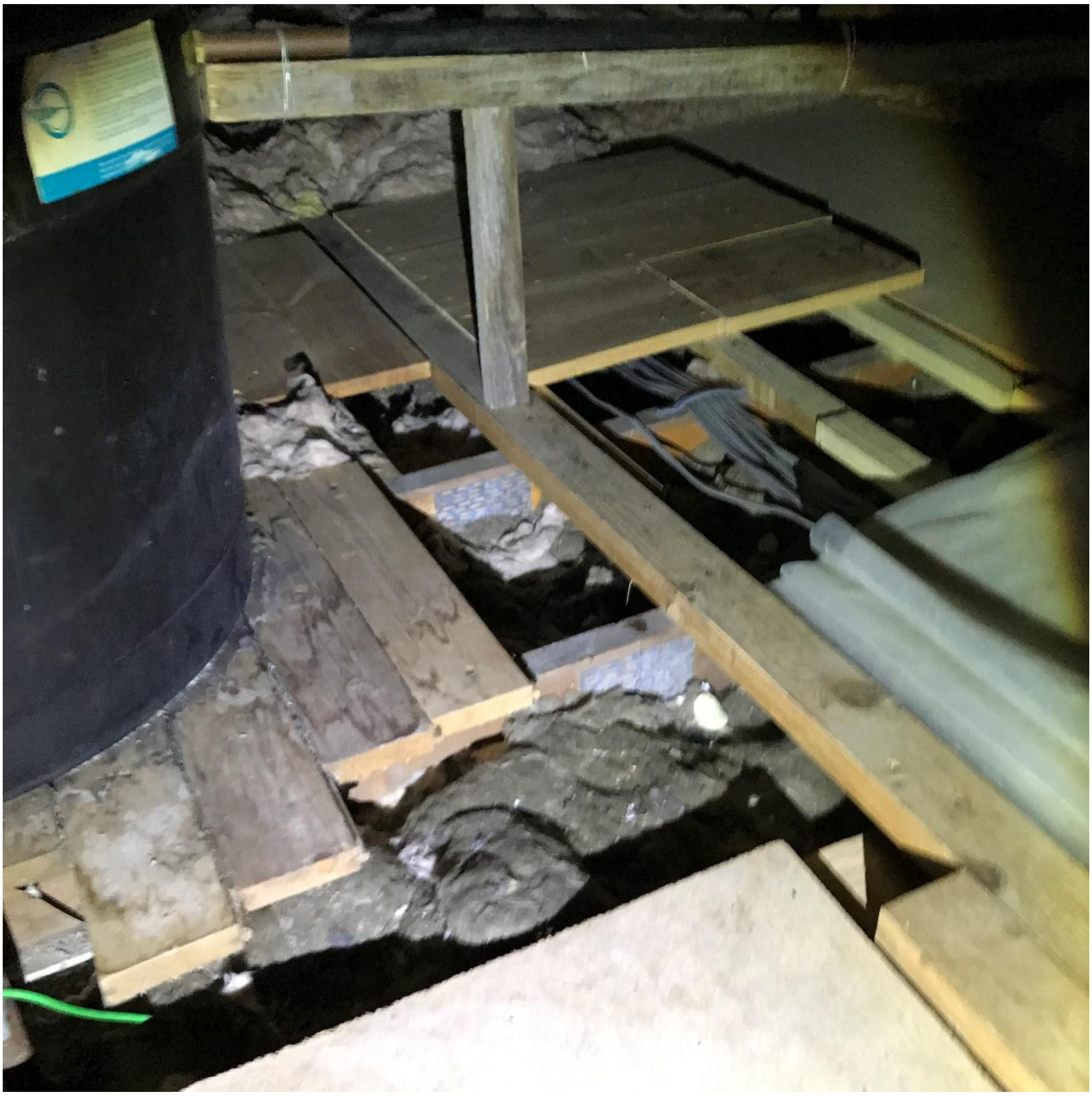

Figure 7 Spliced ceiling joists in acceptable condition.

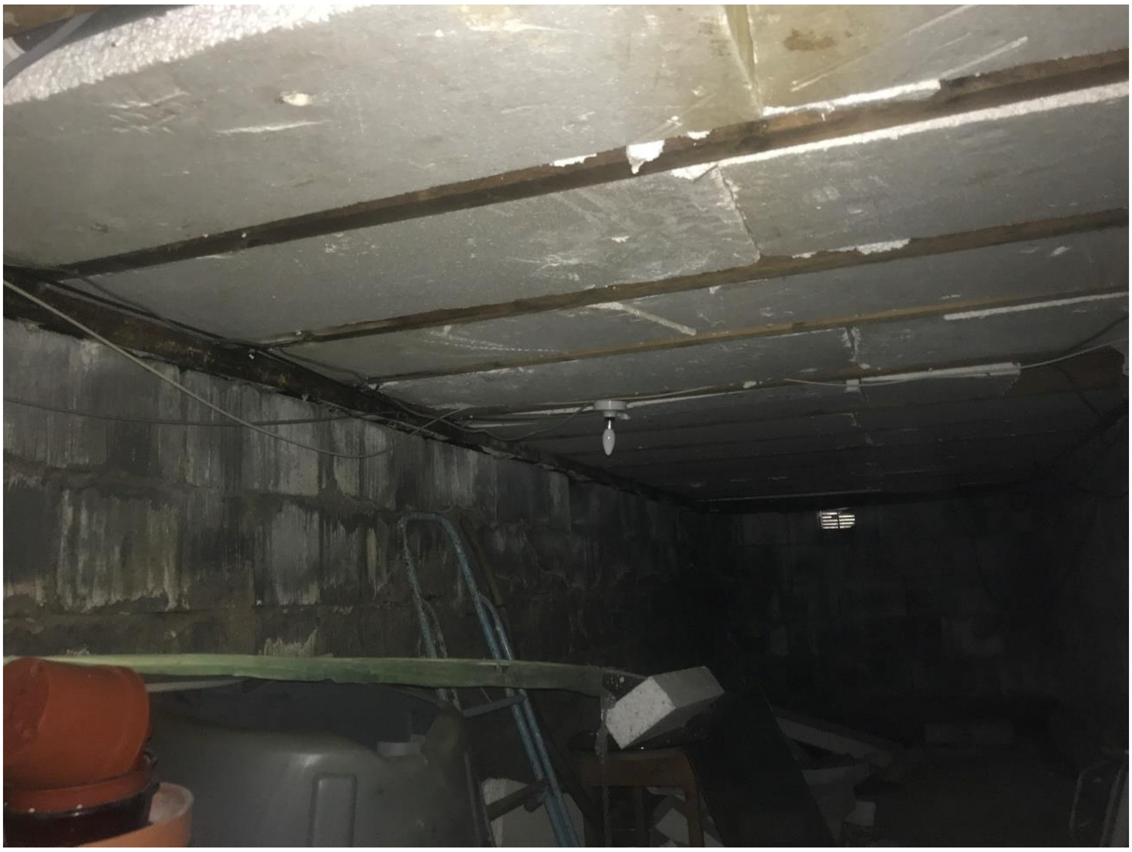

Figure 8 Typical view of floor void, with polystyrene insulation fitted between floor joists.

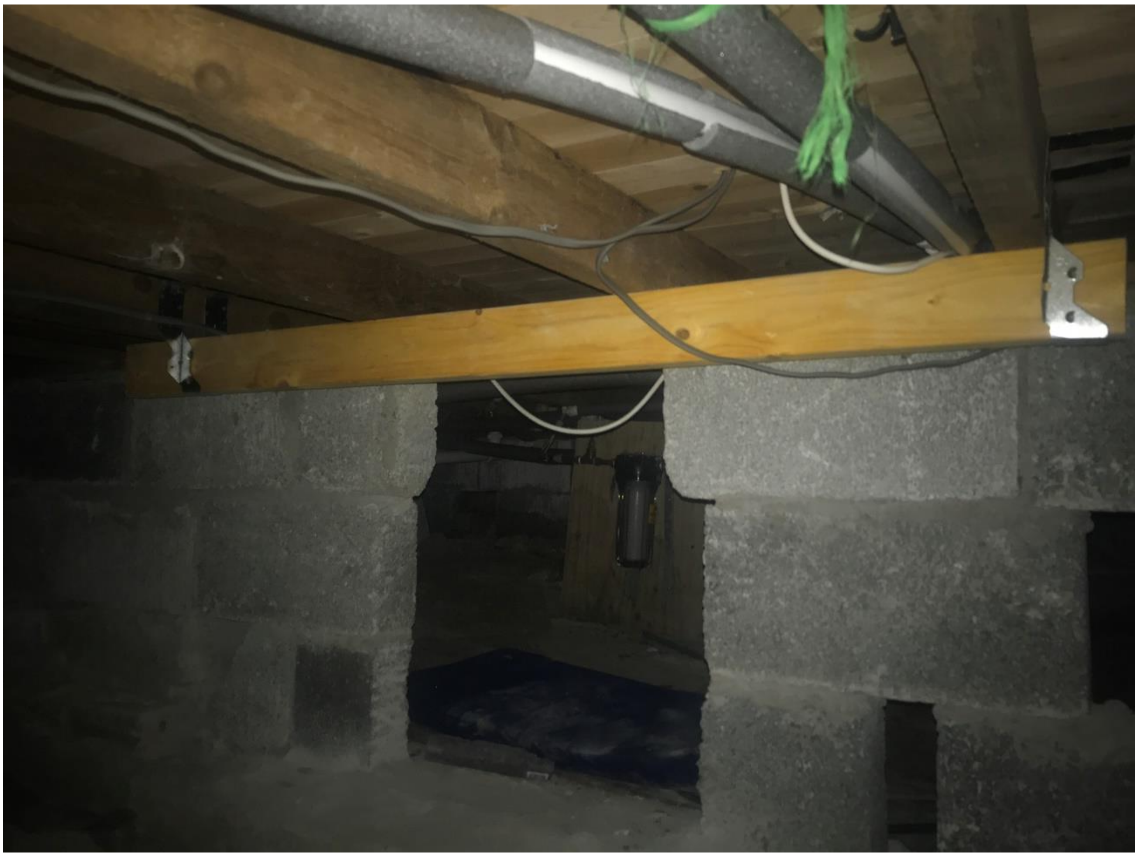

Figure 9 The original sleeper wall did not have concrete lintels installed. Instead, timbers have been used to lintel over. No excessive deflection was noted to the floor structure and this is considered acceptable.

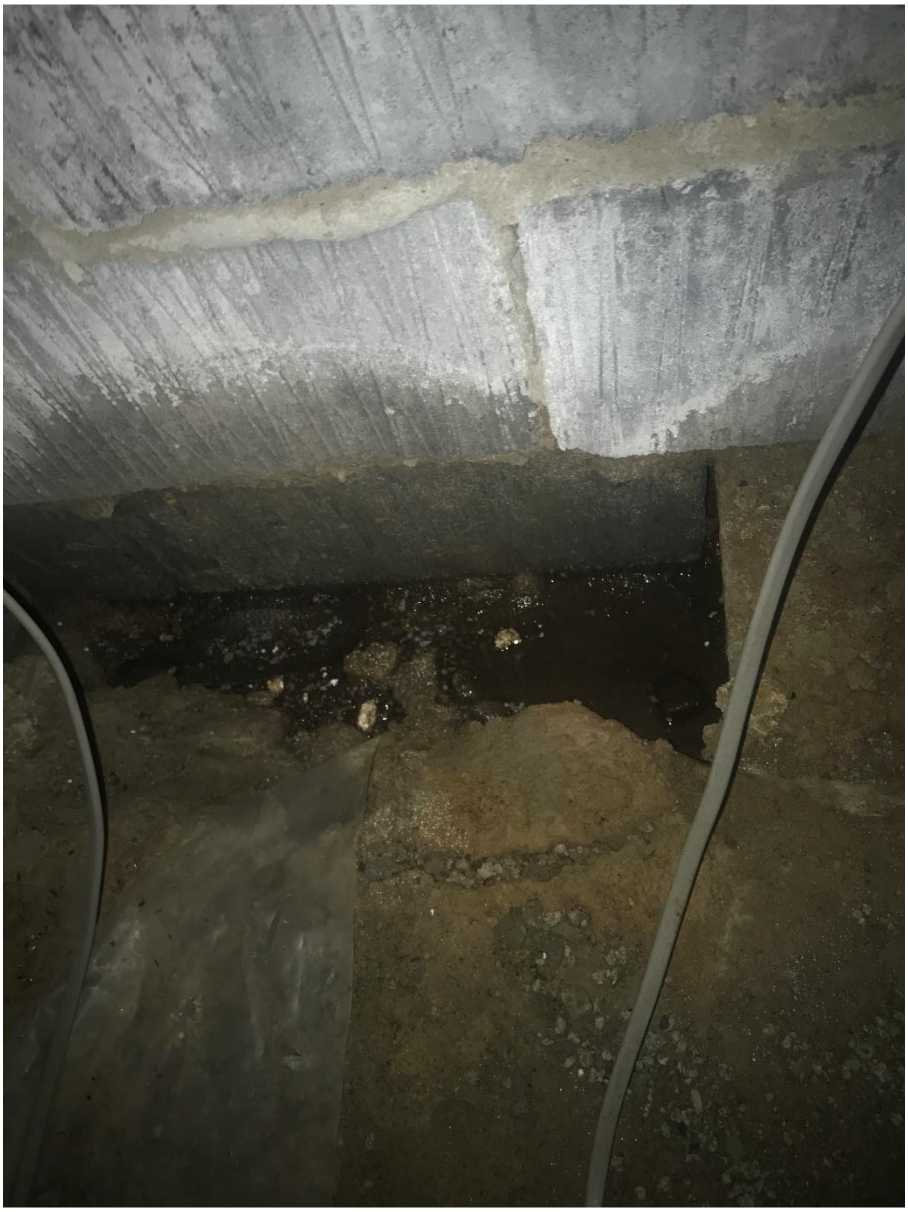

Figure 10 Small void acting as a sump, with a small amount of water noted.

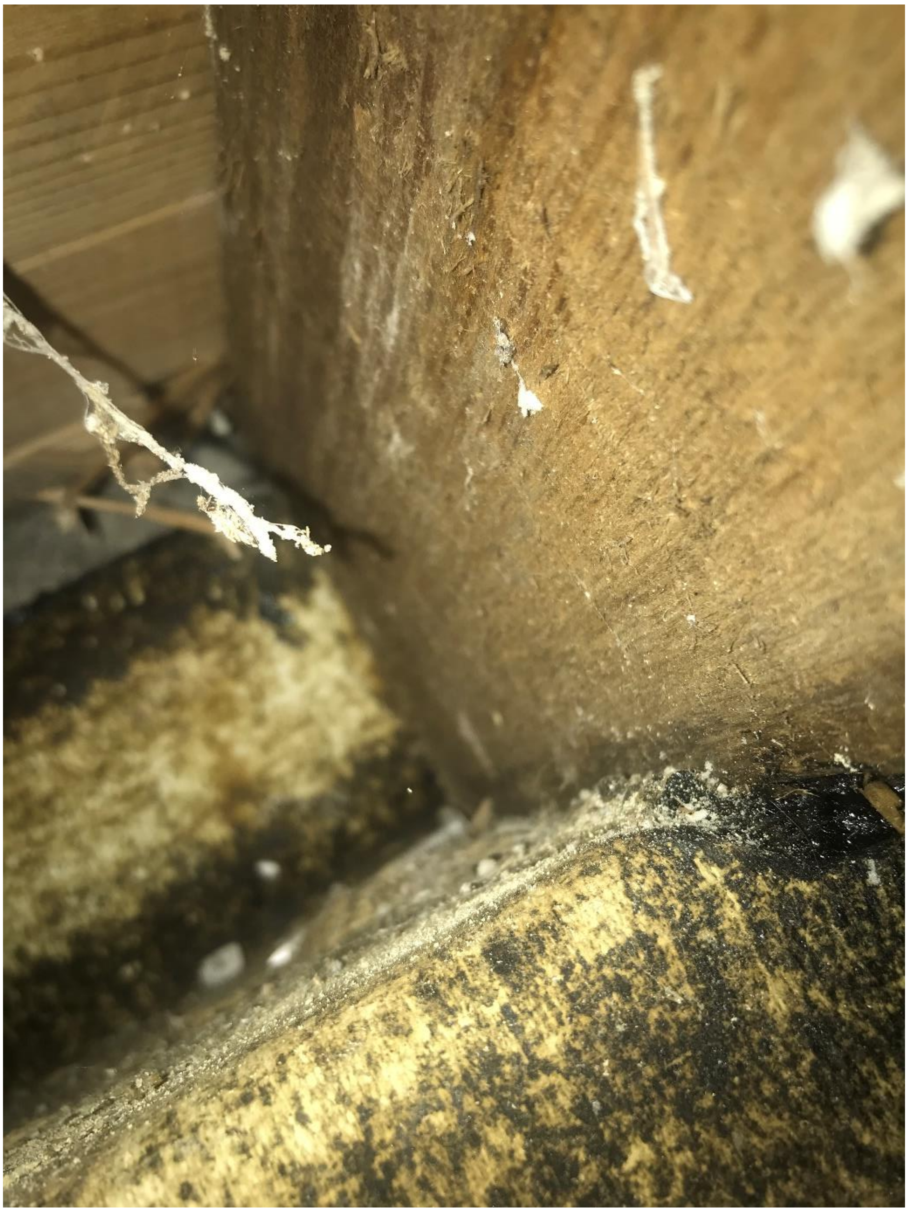
Figure 11 Bearing ends of timber floor joists in good order, with damp proof courses installed below.

9.0 APPENDIX 1:

CONDITIONS OF APPOINTMENT

Subject to express agreement to the contrary and any agreed amendments/additions, the terms on which the Surveyor will undertake the Survey are set out below:

9.1 The Report

Based on an inspection as defined below, the Surveyor will advise the Client by means of a written report as to their opinion of the visible structural condition and state of structural repair of the subject property. The report is concerned with the structural elements of the property only and no comment will be made on other parts of the property such as rainwater goods, roof coverings, windows and doors, joinery, fitments, services, fittings and finishes.

9.2 The Inspection

No openings or tests will be made except where explicitly mentioned or instructed. Some damp meter readings may be taken. Unless stated otherwise, we will not inspect woodwork or other parts of the structure that are covered, unexposed or inaccessible and are therefore unable to report that any such part of the structure is free from defect.

9.3 Accessibility and Voids

The Surveyor will inspect as much of the surface area of the structure as is practicable.

9.4 Floors

The Surveyor will lift accessible sample loose floorboards and trap doors, if any, which are not covered by heavy furniture, ply or hardboard, carpets or other floor coverings. The Surveyor will not attempt to raise fixed floorboards without permission from the owner.

9.5 Roofs

The Surveyor will inspect the roof spaces if they are available and accessible from within the property to be inspected or in the common areas of the building. The Surveyor will have a ladder of sufficient height to gain access to a roof hatch or to a single storey roof, not more than 3.0m (10'0') above the floor or adjacent ground. It might therefore not be possible to inspect roofs above this level; in such cases, pitched roofs will be inspected by binoculars.

9.6 Areas not inspected

The surveyor will identify any areas which would normally be inspected but which were unable to be inspected and indicate if access should be obtained or formed and advise on possible or probable defects based on evidence from what they have been able to see.

9.7 Boundaries, Grounds and Outbuildings

The inspection will not include boundaries, grounds and outbuildings unless instructed.

9.8 Services

The Surveyor will not inspect the services.

9.9 Deleterious and Hazardous Materials

The surveyor will assume that no deleterious or hazardous materials or techniques have been used in the construction of the property. However, the Surveyor will advise in the report if, in their view, there is a likelihood that high alumina cement (HAC) concrete has been used in the construction and that, in such cases, specific enquiries should be made or tests carried out by a specialist.

The Surveyor will not advise in the Report if the property is in an area where there is a risk of radon.

9.10 Contamination

The Surveyor will not comment on the existence of contamination as this can only be established by appropriate specialists. Where, from local knowledge or inspection, they consider that contamination might be a problem they will advise as to the importance of obtaining a report from an appropriate specialist.

9.11 Restrictions and obligations

The Surveyor will assume that the property is not subject to any unusual or especially onerous restrictions or obligations which apply to the structure or affect the reasonable enjoyment of the property.

9.12 Statutory Consents

The Surveyor will assume that all necessary statutory consents have been obtained. Although the Surveyor may comment upon them in the case of new buildings or alterations and extensions, the Surveyor will not verify whether such consents have been obtained. Any enquiries should be made by the Client or their legal advisers. Drawings and specifications will not be obtained by the Surveyor.

9.13 Repairs and approximate costs for repairs

The report will identify any repairs that are deemed necessary. The report will not provide a specification for any repairs. Costs for repair works are approximate and therefore not accurate. To obtain accurate quotations it is necessary to prepare suitable repair specification before inviting competitive quotations from suitable local contractors.