

EXTERNAL TIMBER CONDITION INVESTIGATION

1 RADSTOCK COTTAGE

JOB NO. 159-77



HELEN WINTER

13 OCTOBER 2023

Prepared by:	Technical review by:	Administration by:
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1 INTRODUCTION

1.1 AUTHORITY AND REFERENCE

Hutton+Rostron Environmental Investigations Limited carried out a preliminary timber decay and damp survey at 1 Radstock Cottage, RG6 5UN on 13 October 2023 in accordance with instructions received from Helen Winter by email dated 13 September 2023. Reference was made to drawings supplied by SFK Consulting, for the identification of structures. For the purpose of orientation in this report, the building was taken as facing west

1.2 AIM

The aim of this investigation was to investigate the condition of externally exposed structural timbers and the later repair elements and remedial capping pieces that had been applied to them

1.3 LIMITATIONS

This survey was confined to the accessible structures. Concealed timbers and cavities have been investigated where necessary by the use of high-powered fibre optics. The condition of concealed timbers may be deduced from the general condition and moisture content of the adjacent structure. Only demolition or exposure work can enable the condition of timber to be determined with certainty, and this destroys what it is intended to preserve. Specialist investigative techniques are therefore employed as aids to the surveyor. No such technique can be 100 per cent reliable, but their use allows deductions to be made about the most probable condition of materials at the time of examination. Structures were not examined in detail except as described in this report, and no liability can be accepted for defects that may exist in other parts of the building. We have not inspected any parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect or in the event that such part of the property is not free from defect it will not contaminate and/or affect any other part of the property. Any design work carried out in conjunction with this report has taken account of available pre-construction or construction phase information to assist in the management of health and safety risks. The sample remedial details and other recommendations in this report are included to advise and inform the design team appointed by the client. The contents of this report do not imply the adoption of the role of Principal Designer by H+R for the purposes of the Construction (Design and Management) (CDM) Regulations 2015. No formal investigation of moisture distribution was made

1.4 H+R STAFF ON SITE

Patrick Hughes

1.5 PERSONNEL CONTACTED

Helen Winter – property owner

2 EXECUTIVE SUMMARY

2.1 OBSERVATIONS AND RECOMMENDATIONS

2.1.1 External roof finishes

The condition of external roof finishes was not investigated in detail at the time of survey. Generally, roof tiles appeared to be in moderate condition. No obvious defects were identified

No immediate action required. Consideration should be made for H+R to conduct a survey of all materials forming the external roof coverings in the future. H+R can provide further advice if instructed

2.1.2 Rainwater drainage systems

The condition of rainwater drainage systems was not investigated in detail at the time of survey. Preliminary visual assessment deemed them to be metal and finished with a film-forming paint. Due to their constant exposure to the elements, it was considered likely that they had been subjected to excessive corrosion and a build-up of plant debris which may cause blockages

All eaves gutters, downpipes and ground drainage inlets, as well as any additional elements and mechanical fixings should be investigated to assess their suitability for continued use. Allowances should be made for the possible removal and replacement of defective members. H+R can provide further advice if instructed

2.1.3 Moisture penetration providing conditions for decay

It was clear that moisture penetration affecting the external structural timbers had been caused by constant exposure to inclement weather. Moisture issues had likely been exacerbated in some areas due to the use of impermeable materials in contact with timbers, leading to moisture pooling and decay

The full protection of external timbers from the affects of moisture was not deemed to be possible, however, to retain the use of and prolong the life of the individual elements all impermeable materials should be removed from their surfaces or from being in contact with them. Remedial capping timbers as well as the historical elements should be assessed and repaired as necessary to allow for increased protection and rainwater drainage systems should be maintained to prevent moisture cascading down the elevations

2.1.4 Timber decay

Initial investigations noted that significant remedial works had been undertaken in the past to tackle chronic decay issues, by fitting capping timbers over decayed and vulnerable members. Physical investigations using deep drilling and probing techniques were used to ascertain the presence and severity of decay to the historical timbers and the contemporary remedial capping timbers, with several areas of decay being detected (see plans in Attachment B)

No chemical remedial treatments are required or recommended. All timber members in direct contact with or close proximity to damp affected masonry or other materials should be isolated using a damp-proof membrane and through ventilated air gap. Structurally decayed and/or defective timber elements (including all previous remedial capping elements) should be either replaced, partnered using suitable timber and mechanical fixings, or cut back to sound timber and repaired using a suitable scarf joint detail in air dried timber of a similar species. All new timber repairs should be secured using mechanical fixings such as stainless steel coach screws/bolts and timberloks, which should then be covered using timber grain pellets. Any failed jointing should be repaired and secured using traditional means such as draw-bored and pegged mortise and tenon joints. H+R can provide further advice if instructed

2.1.5 Fungal decay infection

Widespread evidence of fungal decay infection was identified during the survey, these were preliminarily identified as being a 'wet' rot species, likely *Coniophora puteana* and/or *Donkioporia expansa*. Deep moisture readings of various external elements throughout the elevations of the property were above the threshold for the onset and growth of fungal decay organisms therefore these instances of fungal decay could remain active

No chemical remedial treatments are required or recommended with regard to fungal decay infection. All timber elements that have been structurally decayed by fungal decay infection should follow recommendations set out in section 2.1.5 above. H+R can provide further advice if instructed

2.1.6 Wood-boring beetle infestation

Death Watch beetle (*Xestobium rufovillosum*) infestation was observed in localised areas of various structural timber elements. No evidence of an active infestation were identified, however deep moisture readings of various external elements throughout the elevations of the property were above the threshold required for a wood-boring beetle infestation to remain active, therefore it was possible that one remained active or dormant within certain structural and remedial timber elements

No chemical remedial treatments are required or recommended in relation to wood-boring beetle infestation. All timber elements that have been decayed by wood-boring beetle should follow recommendations set out in section 2.1.7 above. H+R can provide further advice with regards to all remedial details if instructed

2.1.7 Impermeable materials

A number of building elements were seen to be comprised of materials that would likely prevent the evaporation of moisture, these would include the render over the infill panels and the cill wall, as well as the paint over both the masonry and the timbers

The use of impermeable materials in contact with the timbers would likely prevent any saturated moisture from evaporating, instead allowing it pool and raise the moisture levels of the timbers which would significantly increase their likelihood of infection/infestation by biological decay organisms. Consideration should be made for all impermeable materials to be removed and replaced with breathable, lime-based alternatives such as mineral paints and lime mortar/render. H+R can provide further advice if instructed

2.1.8 Restricted access

Access to investigate all structural timbers of the external elevations was not possible due to the height. In the cases where timbers could not be reached, visual assessments of their condition were made

No immediate action required. Consideration should be made for H+R to return and conduct further investigations of these timbers when full, safe access is available. H+R can provide further advice if instructed

3 OBSERVATIONS AND RECOMMENDATIONS

3.1 CONSTRUCTION

3.1.1 History

The property was a boxed timber frame structure with exposed structural timber elements visible at the north and west elevations, that was given a grade two listed status in 1989 (list entry no. 1136320). The property was originally built in the early seventeenth century with a twentieth century extension adjoining the north elevation

3.1.2 Structural arrangement

The property was box-framed and formed of structural timbers that were connected using draw-bored and pegged mortise and tenon joints to form a small-panel framed longwall and gable cross-frame. The timber frame was supported by a short cill wall that was formed of brickwork with what appeared to be a cementitious render. Infill panels appeared to feature a likely cementitious skim over the exterior faces, and both the infill panels and the timbers had been finished in an impermeable, film-forming paint. The north-west gable elevation featured a large chimneybreast and stack that had been built over the structural timber elements at this location, this was considered to possibly be a later addition to the property

3.1.3 Relevant dimensions

North elevation	
Central post	~170 x NA mm
Primary rails	~220 x NA mm
Secondary rails	~85 x NA mm
Corner post	~230 x 195 mm
Cill beam	~150 x 110 mm
Contemporary capping pieces	~40-45mm
West elevation	
Studs	~100 x NA mm
Rails	~170 x NA mm
Cill beams	~150 x 110 mm
Contemporary capping pieces	~15-20mm, ~25-30mm, ~60-55mm, ~60-80mm

3.2 CONDITION

3.2.2 Timber decay

- 1 Overview: It was clear upon initial investigation that the external structural timbers had been subjected to chronic decay issues over centuries. Deep moisture readings of certain timbers were consistently elevated and this was clearly due to their constant exposure to wind driven rain and the fluctuating humidities of the external environment. These issues were exacerbated by the presence of impermeable materials used to form elements of the building that were in close contact and proximity to the timbers, such as the infill panels and cill wall, the chimneystack that had been built over the

timbers of the north-west elevation and the presence of impermeable paints over both timbers and masonry. In addition to this the remedial capping timbers had also become decayed in certain areas and a number had separated from the historical timbers due to dimension changes, resulting in cavities that would allow moisture to pool in contact with both new and old timber

- 2 Upon investigation the following decayed elements and areas of concern were identified:

North-west elevation

The collar, tie beam and 1 no. truss stud that were in contact and close proximity to the chimneystack were visually identified as being at significant risk and likely decayed

1 no. section of the central cross-frame post was visually identified as being likely decayed

2 no. sections of historical rail to the left-hand side of the chimneystack were found to be decayed for their entire lengths

1 no. section of historical mid rail to the left-hand side of the chimneystack was decayed for ~250mm

The central cross-frame post was decayed at its lower section for ~1.8m

1 no. historical stud adjacent to the right-hand side of the chimneystack was partially decayed for ~1850mm

The historical down brace on the right-hand side of the chimneystack was decayed at its lower mortise and tenon joint

The historical upper rail on the right-hand side of the chimneystack, below the down brace was decayed at its mortise and tenon joint connecting it to the main corner post

The historical mid rail on the right-hand side of the chimneystack was decayed for ~900mm and a section visible on the left-hand side of the chimneystack was decayed for ~150mm, with the remedial capping also decayed for ~150mm

Partial decay was identified to the foot of the corner post, beneath the remedial capping timber

The historical cill section on the right-hand side of the chimneybreast was decayed for ~400mm and the remedial capping was decayed for ~950mm

South-west elevation

Possible decay was identified to 1 no. historical mid-rail, beneath the remedial capping timber

1 no. lower historical rail was decayed for ~340mm

Partial decay to bottom edge of cill remedial capping ~1230mm historical timber appears to be decayed beneath

1 no. section of remedial capping to the cill was decayed for ~520mm

Partial decay to bottom edge of remedial cill capping and the historical timber beneath

1 no. section of remedial cill capping and historical timber beneath was decayed for ~150mm

1 no. section of the historical cill was decayed for ~2m

Further partial decay to bottom edge of remedial capping and historical timber beneath was identified

1 no. historical post and remedial capping were decayed at the bottom end for ~270mm

1 no. historical post was decayed at its bottom end for ~350mm

1 no. section of remedial capping on an upper mid rail was significantly bowed

1 no. butt joint between remedial capping pieces on a main longwall post was seen to be open and decay for ~80mm was identified

1 no. section of partial decay to a historical mid rail mortise and tenon joint was identified, beneath remedial capping

1 no. mortise and tenon joint connecting an upper mid rail to a main longwall post was considered to be inadequate

No chemical remedial treatments are required or recommended. All timber members in direct contact with or close proximity to damp affected masonry or other materials should be isolated using a damp-proof membrane and through ventilated air gap. Structurally decayed and/or defective timber elements (including all previous remedial capping elements) should be either replaced, partnered using suitable timber and mechanical fixings, or cut back to sound timber and repaired using a suitable scarf joint detail in air dried timber of a similar species. All new timber repairs should be secured using mechanical fixings such as stainless steel coach screws/bolts and timberloks, which should then be covered using timber grain pellets. Any failed jointing should be repaired and secured using traditional means such as draw-bored and pegged mortise and tenon joints

Consideration should be made for all impermeable paints to be removed from exposed timbers and masonry, to be replaced with breathable, mineral based alternatives. All cementitious materials should be removed and replaced with lime-based alternatives to ensure all trapped moisture can escape

Efforts should be made to protect those structural timbers that are encapsulated beneath the chimneystack and breast at the north-west elevation

Any structural repairs should be carried out following guidance from a Structural Engineer. H+R can provide further advice with regards to all remedial details if instructed

4 GENERAL RECOMMENDATIONS

All new and refurbishment detailing should be assessed for its effect on environmental and structural health. General principles are set out below. Special care is required when introducing new materials, moisture sources or heating and ventilation systems, for example air conditioning

4.1 ROOF AND SURFACE DRAINAGE

4.1.1 Maintenance

All guttering, hopperheads and outlets should be regularly checked and cleared to keep them free of debris, especially during the autumn months

4.1.2 Protection

Hopperheads, gutter outlets and ground gullies should be protected with metal mesh cages so as to prevent blockage and overflow. These should extend higher than the expected water level to reduce the tendency to block and should be easily removable to allow cleaning and maintenance

4.1.3 Overflows

Hopperheads, parapet gutter outlets and valley gutter outlets should be fitted with overflow pipes to drain water clear of the structure in case of blockage. These should be at a level below that at which water would overflow the roof flashings

4.1.4 Roof drainage calculations

Roof drainage calculations should be made to check the adequacy of gutters, drains and downpipes so that their capacities may be increased if necessary during refurbishment. H+R can carry out these calculations if required

4.1.5 Monitoring

The installation of an automatic monitoring and alarm system should be considered to give warning of blockage or overflow in the roof drainage system

4.1.6 Access

Safe and convenient access ladders, safety points and walkboards should be installed to all roof areas to allow proper inspection and maintenance

4.1.7 Pigeons

Feral pigeons should be controlled. H+R can give advice on this if necessary

4.2 VENTILATION

4.2.1 Structural voids

All structural voids within the building should be provided with adequate through ventilation so as to prevent moisture build-up. This must be done with regard to the applicable fire regulations

4.2.2 Chimneys

All chimneys not in use should be capped so as to minimise water ingress but so as to allow maximum ventilation of the flues. Flues should be cleared and cleaned to remove blockages. Fireplaces and chimney breasts should be opened or vented to allow through-ventilation of the flues. This prevents moisture build-up in the flues and helps interior ventilation by the stack effect

4.2.3 Bathrooms and kitchens

All bathrooms and kitchens should be fitted with adequate extractor fan systems. These should run for at least fifteen minutes after occupancy to prevent condensation. The installation of floor drains should be considered in these rooms in case of overflow

4.2.4 Roof spaces

All roof spaces, including flat roof areas and gutter soles, should be provided with adequate through-ventilation. This may occur via the gaps between slates in unsarked pitched roofs. However, flat roofs and pitched roofs with sarking or insulation will require the installation of vents through the roof surfaces or at the eaves and ridges. Insulation material in roof spaces should be kept clear of external walls, gutter soles or timbers in contact with damp or potentially damp masonry

4.2.5 Windows

Windows should be refurbished so as to allow easy and convenient opening and closing by occupants in order to encourage proper ventilation of the building. This is important both for environmental and structural health. Windows should be fitted with security locks so as to allow secure locking in a partially opened position

4.3 STRUCTURAL DETAILING

4.3.1 New timbers

New timbers should be isolated from any damp or potentially damp masonry with a damp proof material or ventilated air gap

4.3.2 Timber repairs

Structurally decayed timbers should be removed or cut back to sound timber unless required for aesthetic reasons. Timbers should then be partnered or spliced as in section 4.3.1 above. If steel plates or hangers are used, they should be detailed so as to allow sufficient ventilated air gaps and drainage to prevent moisture build-up due to condensation. No timber preservation or remedial treatments should be required

4.3.3 Paint finishes

Moisture vapour permeable or 'microporous' paint finishes should be preferred for internal and external surfaces and woodwork. This is especially important on window timbers. To take advantage of the properties of such paints, the complete removal of old alkyd paint systems is recommended. Health and Safety: Special precautions should be taken during surface preparation of pre 1960's paint surfaces as they may contain harmful lead or other toxic materials

Appendix A



Fig 1:

External, west elevation; showing a general view of the historical south-west elevation



Fig 2:

Internal; showing a general view of the structural timber cross-frame within the master bedroom



1 Radstock Cottage

Photographs
13 October 2023
Not to scale

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Fig 3:

Internal; showing a general view of the structural timbers forming the first floor, from ground floor level



Fig 4:

Internal; showing a general view of the structural timbers forming the first floor, from ground floor level. Note that joists were embedded at their bearing ends into the masonry, however this was an internal dividing wall between ground floor rooms, therefore the risk of moisture saturation was less than any timbers embedded into external masonry



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Photographs
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Fig 5:

Internal; showing a general view of the structural timbers forming the first floor from ground floor living room. Note that the historical movement in the structure was observed however this was not deemed to be due to the current decay issues seen externally



Fig 6:

External, north elevation; showing a general view of the structural arrangement and condition of the gable cross-frame. Note the positioning of the chimneybreast and stack over the external structural timbers, leaving certain timbers at particular risk of elevated moisture contents and decay



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Photographs
13 October 2023
Not to scale



Fig 7:

External, north elevation; showing a general image of the structural timbers at this location. Note that several areas of decay were identified (see drawings in Attachment B for further details)



Fig 8:

External, north elevation; showing a general image of the structural timbers at this location. Note that several areas of decay were identified (see drawings in Attachment B for further details). Also note the visible cementitious render infill panel that had recently been installed



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13 October 2023
Not to scale



Fig 9:

External, north elevation; showing a focused view of the extent of decay to structural elements at this location. Urgent remedial works were deemed to be required



Fig 10:

External, north elevation; showing further decay to a mid rail at this location. Moisture pooling in the mortise or the joint had likely exacerbated decay issues over years



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13 October 2023
Not to scale



Fig 11:

External, north elevation; showing a contemporary remedial capping piece fitted over the cill beam at this location. Extensive decay was identified (see plans in Attachment B for further details)



Fig 12:

External, north elevation; showing a focused view of metal strapping tying a mid rail to the corner post that had undergone significant repair works in the recent past



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Photographs
13 October 2023
Not to scale



Fig 13:

External, west elevation; showing a general view of this section of the building. Note that all timbers had undergone significant remedial works in the recent past to combat chronic historical decay issues



Fig 14:

External, west elevation; showing a further image of an additional mid rail, connected to the main corner post using metal strapping



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Fig 15:

External, west elevation; showing gaps between historical and contemporary remedial timbers, which would allow moisture ingress during inclement weather



Fig 16:

External, west elevation; showing a focused view of the cill wall that had been rendered in cementitious materials and finished in film forming paints, this was inevitably exacerbating decay issues to the cill timbers and would continue to do so unless addressed



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Fig 17:

External, west elevation; showing a section of mid rail that a missing section of contemporary remedial capping. This should be addressed to prevent further moisture saturation of the main historical structural timber



Fig 18:

External, west elevation; showing a significant pocket of decay to a later rail element



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Fig 19:

External, west elevation; showing a general view of timbers at this location, as well as localised areas of repair to infill panels using a likely cementitious material



Fig 20:

External, west elevation; showing a focused view of the cill at this location. Note that decay was detected to the remedial capping piece and adjoining post (see plans in Attachment B for further details)



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Fig 21:

External, west elevation; showing a general view of timbers at this location, as well as localised areas of repair to infill panels using a likely cementitious material



Fig 22:

External, west elevation; showing a general view of structural timbers and associated building materials at this location. Note that several areas of decay were detected to the lower sections of vertical elements, as well as cill members (see plans in Attachment B for further details)



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Fig 23:

External, west elevation; showing a focused view of historical and contemporary capping pieces that were found to be decayed upon investigation



Fig 24:

External, west elevation; showing a capping timber that was projecting beyond the face of the elevation, resulting in a small shelf that was allowing moisture pool



1 Radstock Cottage

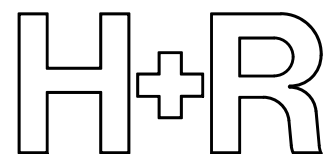
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Appendix B

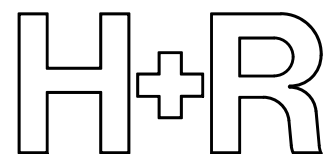
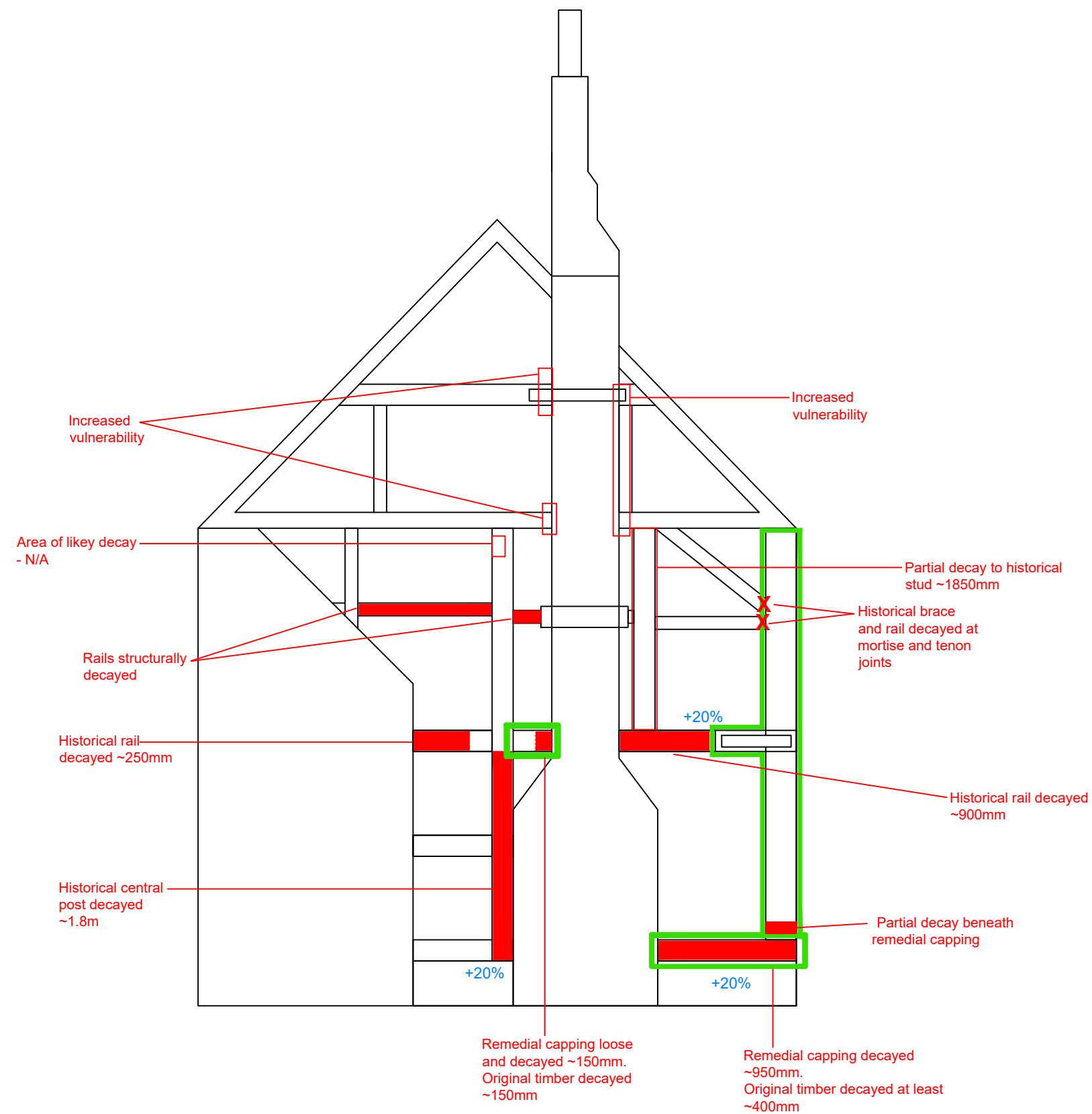


Key:

- Decayed timber element
- X Decayed bearing end
- Remedial capping element
- 10% Level of moisture content



1 Radstock Cottage, South-West Elevation
 External timber condition investigation
 October 2023



1 Radstock Cottage, North-West Elevation
 External timber investigation
 October 2023

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Key:

- Decayed timber element
- Decayed bearing end
- Remedial capping element
- 10% Level of moisture content

Appendix C

COMMON DECAY ORGANISMS

1 DRY ROT

Dry rot (*Serpula lacrymans*) belongs to the same group of fungi as most of the common mushrooms and toadstools. Reproduction is by means of spores which are produced in enormous numbers by the fleshy pancake-shaped fruiting body. These fruiting bodies generally only appear when the fungus is stressed or dying off. A well established infestation may produce fruiting bodies more than one metre across and be accompanied by thick layers of rust-coloured spore dust. Each minute spore has an outer coat which affords it some protection against heat and desiccation, and germination has been achieved after a twenty-year latent period. Dry rot spores are ubiquitous and there is no domestic or natural environment entirely free of them. They can be found throughout the environment from high up in the jet stream to the middle of the countryside

Spores will germinate and grow in timber with a moisture content of between 20 and 30 per cent. The fine fungal thread (hypha) digests the cellulose and hemi cellulose fractions of the wood, but is unable to attack the structural linings. These remain as a brittle matrix which cracks into cubes under differential stresses. Cuboidal cracking is also a characteristic of many wet rots and does not automatically indicate the presence of dry rot

Fungal hyphae may clump together into a variety of structures known as mycelia which take various forms depending on the surrounding conditions. They may fill a humid cavity as a cotton wool-like mass, or grow across the surface of the timber, as a grey-white skin. Active dry rot has a fresh white or greyish appearance and smells strongly of mushrooms. Distinctive patches of lilac or canary yellow pigmentation are usually present

Some hyphae group together to form conducting strands. These have a fairly impervious outer layer rich in chitin, the major constituent of insect cuticle. The strands, which may reach a centimetre in thickness, are flexible when moist, becoming progressively more brittle as they dry out. Their main function is the conduction of nutrients, through or across inert non-nutrient materials (brickwork etc) to other timbers. Their relatively impervious outer layer, together with an unusual alkaline tolerance, allows them to survive in the mortar layers within masonry and walls. An infested area may be full of dry rot strands. The dry rot fungus may tolerate relatively lower moisture contents and, through this, and other quirks in its biology, is potentially capable of considerable destruction. Realisation of this potential, however, requires a narrow range of environmental conditions and, in practice, several factors restrict growth

Dry rot hyphae may attack timber with a moisture content of about 18 per cent; however, spores would not germinate under these conditions. This moisture content is still 5 to 10 per cent wetter than timber should be in a healthy domestic building, and indicates water penetration or, perhaps, faulty plumbing. There is no evidence that dry rot can 'wet up' timber to any appreciable extent under conditions expected in a healthy building, although this is often claimed. The fine attacking hyphae, unlike the coarse conducting strands, are susceptible to desiccation and dry wood may disperse moisture faster than it can be transported. This means they cannot move through dry masonry and wood or across ventilated cavities

The total breakdown of wood by fungus produces considerable quantities of water. It has been suggested that dry rot can sustain itself on this 'metabolic' water alone. However, in practice, external drying factors disperse the moisture so that favourable conditions can be maintained only in exceptional circumstances such as behind impermeable finishes or in sealed cavities

In order to thrive, dry rot requires a moisture content in timber in excess of 20 per cent, and a relative humidity above 95 per cent. Below these levels the fungus will cease to cause current decay problems. Temperature is also a strong regulating factor, and growth ceases at about 25°C, a temperature frequently exceeded in roof spaces, for example. Large radiators can be particularly lethal to dry rot and measurements of 30°C with 20 per cent relative humidity are not unusual in their immediate vicinity

Dry rot is attacked by many other decay organisms which cause particular damage when the fungus is under stress will eventually destroy it. However, under dry conditions, dead dry rot does not disappear. Strands may eventually darken and the fungal mats may lose their fresh appearance, becoming tinged with brown, and leathery or papery in texture. The decayed wood becomes powdery as it dries, shrinks and distorts, which can be the first sign of decay having occurred behind paint finishes

2 WET ROT

Wet rot is caused by a number of basidiomycete fungi of which the most important are *Coniophora puteana* (cellar fungus), *Poria fungi*; *Fibroporia vaillantii*, *Poria placenta*, *Amyloporia xantha*, *Geophyllum trabeum*, *Phellinus contiguus*, *Donkiporia expansa*, *Pleurotus ostreatus*, *Asterostroma* and *Paxillus panuoides*. They attack both softwoods and hardwoods causing a darkening of the timber (brown rot) or bleaching (white rot). Wet rot fungi usually occur in persistently damp conditions, needing an optimum moisture content of 50 to 60 per cent. Unlike dry rot, the conducting strands of wet rot fungi do not extend far from their nutrient wood, hence they cannot travel through masonry and brickwork. The fruiting bodies occur rarely in buildings. Wet rot has been known to hollow out giant beams. Wet rot *Coniophora puteana* is responsible for up to 90 per cent of wood decay within buildings but raises less concern than dry rot, possibly because it is more easily controlled by standard building techniques. Some wet rots are also called soft rots as they destroy both cellulose and lignin, leaving the colour of the wood largely unaltered, but producing a soft felty or spongy texture. Soft rot is caused by *Chaetomium globosum* and a number of other fungi also found growing on wet wood in buildings

3 WOOD-BORING INSECTS

The common furniture beetle (*Anobium punctatum*) has a life cycle consisting of four stages - egg, larva (which causes all the damage), pupa and adult. The eggs are laid in end grain or in existing flight holes and hatch in 4 to 5 weeks and the new larvae bore directly into the wood. The larvae feed and grow within the wood creating a network of tunnels closely packed with frass (small ellipsoidal pellets). The larvae are whitish, curved, approximately 6mm in length and have well defined dark-brown jaws. When fully grown the larva excavates a small chamber and pupates producing a beetle after 6-8 weeks which bores through a thin layer of wood producing the characteristic emergence holes 1-2mm in diameter. Emergence usually occurs between May and August. The life cycle depends on the condition of the wood, the temperature and humidity. The life cycle usually takes a minimum of 3 years within buildings. Attack is usually confined to the sapwood of softwoods and hardwoods but may occur in the heartwood in timbers such as beech, birch, spruce or in timbers modified by fungal decay. As sapwood only makes up a small cross section of the majority of structural timbers in older buildings, attack is often of little or no structural importance. In most instances of suspected attack, the infestation has died out long ago due to unfavourable environmental conditions. Careful checking is therefore required to establish that living woodworm are present

In cases of active infestation the environmental conditions are often marginal allowing the life cycle to continue but at a very slow rate. Small changes in the environmental conditions can tip the balance against insects. Woodworm attack is often very localised to small areas of high humidity or especially 'palatable' timber and further spread is highly unlikely

In the British Isles, death watch beetle (*Xestobium rufovillosum*) infestations occur most commonly in oak, probably because this wood used to be extensively employed in construction, but infestation can also occur in elm, walnut, chestnut, elder and beech. The life cycle is similar to that of the common furniture beetle but can take many years to complete from one year under experimental conditions, to ten years or more in a building (Ref 11). The hatched larvae wander over the surface of the timber before burrowing into it. When it is fully grown it pupates and changes into the adult beetle which does not emerge until the spring of the following year producing a 3mm diameter hole

In old buildings severe damage can be caused under favourable environmental conditions. Softwoods are occasionally infested where they are in close proximity to damp infected hardwood. Infestation is confined to fungal decayed or damp affected timbers. Many existing cases probably arose from the reuse of infected timbers from demolished buildings and from the use of unseasoned timbers used in their construction. Attack is not confined to the sapwood and often the heartwood is entirely consumed causing severe structural damage. Damage is most severe where ventilation is poor and where timbers are in contact with damp masonry

Death watch beetles are not active fliers. A localised attack of death watch will not automatically spread to the whole house and infest every timber in the building. Lowering of moisture contents of the timber in conjunction with careful observation to determine the level and extent of activity should provide control of the insects. Some severe cases may merit the use of local insecticide treatments as a first aid measure. However, the chemical must be targeted properly or large quantities of toxic pesticides will be used to little effect

Woodworm and death watch beetle infestation will not flourish if the moisture content of timber is below about 14 to 15 per cent. The risk of infestation of insect attack is slight, in timbers with a moisture content at or below 14 per cent and the insect larvae will desiccate below about 12 per cent moisture content. The infestation will eventually die out if the timber moisture content is maintained below this. Healthy roof timbers should have a core moisture content of between 14 to 15 percent, while suspended floor timbers should be between about 11 and 14 per cent. Installation of a central heating system may reduce these moisture contents to about 9 per cent particularly in exposed timbers

It is absolutely necessary to recognise whether an insect infestation is 'active' or 'dead'. The presence of fresh frass (bore dust) in conjunction with damp timbers may be acceptable evidence of active infestation