Common defects surveyors encounter in Victorian and Edwardian properties

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Abstract

The case study chosen to illustrate this paper provides a clear example of the complexities involved in accurately assessing the causes of defects in buildings of the Victorian and Edwardian period. At a time when the surveying profession is evolving to make best use of IT tools, there is a danger that our understanding of survey fundamentals becomes overshadowed by the adoption of seductive technologies and widespread 'surveying by app' and use of pre-programmed text. There is a consequent danger that over-simplistic assessment will result in poor quality advice with increased potential for disputes and claims. This paper proposes that practitioners may benefit from the adoption of a simple 'root cause' system, both as an aid to identifying the true causes of defects and to enhance client communication.

Key words: Victorian houses, defects, conservation, damp, movement

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INTRODUCTION

Victorian and Edwardian properties account for the vast majority of the UK's pre-1919 'traditional' housing stock. In many towns and cities entire suburbs date from this era and comprise the bulk of local surveyors' workload. A good understanding of common defects found in properties of this age and type is essential for practitioners, not least because they account for a disproportionate level of PII claims.

In recent years the residential surveying profession has been subjected to increasing criticism for alleged misdiagnosis of defects, particularly those relating to damp and timber treatment.[1] Incorrect diagnosis will inevitably result in poor quality advice and misleading recommendations for remedial work, which at best will be wasteful and at worst damaging to the building.[2]

Failure to identify the true cause of defects can result in undue alarm and expense, worrying homeowners unnecessarily where, for example, an inactive historic outbreak of wood beetle is flagged up as in need of urgent treatment.[3]

As can be seen in the case study below, the insurance industry has also come in for criticism when assessing claims, with a tendency to attribute a single cause to complex defects, which can sometimes prove over-simplistic.

In sum, in order to accurately define defects and hence prescribe appropriate solutions it is important to draw distinctions between different root causes. Attempting to fully analyse all the main defects found in 18th and early 19th-century properties would be an overly ambitious task for a paper of this scope. Rather, this paper puts forward the proposition that it would be instructive for practitioners to consider defects in relation to five basic 'root cause' categories:

(1) Inherent defects
(2) Alterations
(3) Environmental and lifestyle changes
(4) Ageing/'wear and tear'
(5) Lack of maintenance

The task of identifying and categorising defects is made more difficult because there are frequently two or more causes working in combination and it can sometimes be debatable which one is dominant. An extreme example might be where an inherent defect dating from the time of construction is compounded by gradual erosion of materials over time, long-term neglect of maintenance and subsequent structural alterations, given extra impetus by a sudden extreme weather event. The case study provides an example of how a range of disparate factors can converge with potentially fatal consequences. Before, however, we identify issues commonly found when surveying Victorian properties and consider how each might best be attributed to one of the above 'root causes', it may prove instructive to revisit first principles and look at how buildings of this age and type were designed to cope with

Box 1: Case Study

On the evening of 22nd May, 2012, a 20m section of rooftop parapet wall on a Victorian terrace in Stockwell, South London collapsed, crashing four storeys down to the ground. Miraculously no one was killed or injured. Structural engineers advised that the collapse was likely to be a result of 'diurnal drift' — rapid expansion and contraction due to the change in temperature over the preceding 24 hours. On the day of the collapse, the capital had experienced the hottest temperatures of the year to date, reaching 17 degrees higher than the lowest temperature on the preceding day.

The insurers of the four townhouses affected rejected the claim, however, attributing the cause to 'gradual deterioration and wear and tear'. Only after considerable media exposure and threats of legal action from high-profile owners (including the Solicitor General and two national newspaper columnists) was the claim eventually settled.

Many insurance policies now specifically exclude damage caused by wear and tear and some also exclude damage caused by 'gradually operating causes'. So there appeared to be some difference of opinion between the structural engineers and the insurers. To quote structural engineer Richard Salmon:

> 'Diurnal drift is something that occurs on a daily basis and well maintained roofs can quite easily cope with this movement as timber structures are inherently flexible. The main problem occurs when you introduce masonry (ie gable walls or parapets). In my opinion, the primary issue with the Stockwell case was the parapet wall [not being] securely tied back into the roof structure and therefore got pushed over when the roof 'expanded' in the warmer temperatures. This lack of strapping of masonry elements back into roofs is very common.'[4]

No evidence was found to support a contributory lack of maintenance to flashings or pointing, and residents reported no ingress of damp or signs of cracking presaging this event. Other possible contributory causes mooted in the media included possible wall movement to the base of the parapet, recladding original slate roofs in heavier tiles, and loft insulation blocking ventilation and resulting in dampness to roof timbers. Ultimately, however, three main causes were identified: an inherent defect (parapets not being effectively strapped to party walls), wear and tear over time, and environmental change (the sudden heatwave).

This case raises an important question as to how we diagnose and define multiple causes of building defects in Britain's four million Victorian and Edwardian properties.

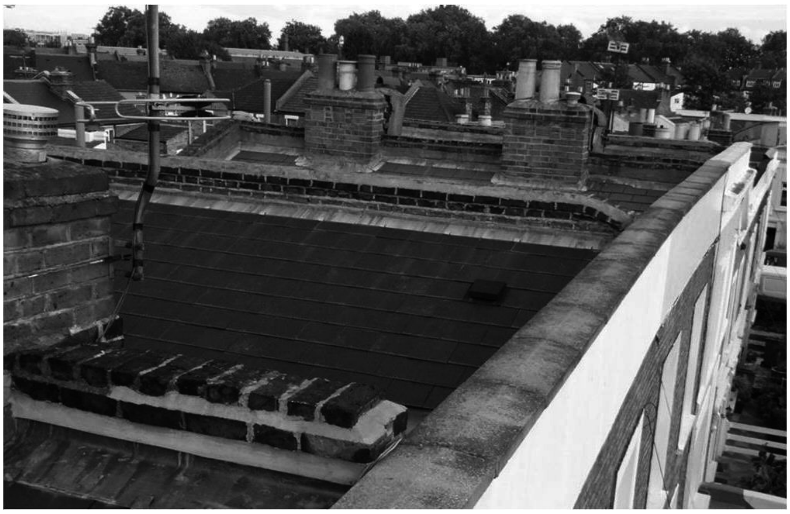

Figure 1: Parapet wall on a early Victorian 'butterfly' roof (aka 'London' roofs)

potentially damaging threats. Most defects, regardless of their origin, if subjected to a prolonged period of neglect will ultimately develop into more serious problems which manifest themselves in various forms of damp and structural movement.

HOW VICTORIAN HOUSES WORK

Building surveyors will be familiar with the natural 'breathing cycle' in traditional solid walled buildings and the importance of traditional lime-based solutions. It's worth noting, however, that the advice dispensed by our profession until relatively recently took little account of the now broadly accepted conservation-led approach. Furthermore, as a profession we still have a major role to play in enlightening homeowners, builders, mortgage lenders, valuers (and even some fellow surveyors) who remain unaware of how traditional buildings function, briefly summarised below.

Walls: Solid brick or stone walls were built with naturally porous materials bonded together with relatively weak mortars. In wet weather a certain amount of moisture is temporarily absorbed into the external surface, drying out and evaporating later, aided by the effects of sun and wind. The conduit for the transmission of moisture is via the mortar joints rather than the masonry and over a long period of time these can eventually start to erode (hence the term 'sacrificial mortar'). In exposed locations rendering was used to improve the performance of solid 9in thick brick walls which could otherwise be at risk of water saturation.

Floors: Suspended timber floors were built with a through flow of ventilation to facilitate the removal of moisture. Solid floors had naturally porous joints between tiles or flagstones through which any damp could naturally wick out.

Roofs: Lofts spaces similarly relied upon a good flow of air to expel damaging moisture. Ventilation depended on small gaps between slates or tiles and an absence of underlay, sometimes with additional vents to fascias and gable end walls.

Interiors: Indoor air circulation aided by active fireplaces helped disperse internal moisture.

Foundations: Relatively shallow footings meant that superstructures needed to be flexible enough to accommodate a certain amount of movement.

Problems tend to arise where modern materials are applied to old buildings. For example, replacing timber sash windows with sealed double glazed units without any compensating ventilation from trickle vents is likely to create a more humid internal environment with potential for mould growth and condensation.

Cement-based mortars, renders and impermeable modern paints are still widely applied with the intention of sealing surfaces to prevent moisture from entering, in effect making Victorian houses function like modern buildings. But cement mortar pointing or renders have the effect of inhibiting evaporation, potentially putting the ends of floor joists at risk of becoming rotten.[5] Repointing mortar joints in this way prevents them from breathing, forcing the moisture to evaporate via the surrounding brick or stonework, where the effects of frost action and crystallisation of salts can cause severe spalling and erosion of the wall surface. Furthermore, the inflexible, brittle nature of hard modern cement-based mortars and renders means they are ill equipped to accommodate movement without cracking. Moisture will then penetrate via small cracks and become trapped. Sealing up the inside of the walls with modern gypsum plasters or renders compounds the problem by blocking any escape route for moisture internally.

Cement renders tend to be very dense and highly resistant to vapour transfer. Coupled with multiple layers of masonry paint over the years, this means the permeability of the finish decreases and the risk of water entrapment and interstitial condensation rises. Such water retention can be very harmful to a building, particularly if the masonry is constructed from lime mortar; this will deteriorate, and the effects of freezing and thawing can result in delamination and cracking.[6]

Damp walls can also significantly reduce the energy efficiency of Victorian properties.[5] Research has indicated that RdSAP is inaccurate where older buildings are concerned, as it normally underestimates their energy efficiency; neither does it take account of the condition of the building. This is important, because building fabric that is damp could be 30 per cent less energy efficient than dry building fabric. The control of moisture is therefore key and getting an older building into good repair in a way that maintains or reinstates vapour permeability should be prioritised over energy efficiency measures (*pace* BS7913:2013 Guide to the Conservation of Historic Buildings).

CAUSES OF DAMP

There are a number of possible causes of damp and accurate diagnosis is an essential skill for residential surveyors. The main threat in properties of this age relates to dampness affecting structural timbers, which can become attractive to wood-boring insect activity where moisture content exceeds 15–20 per cent and at risk of fungal decay between 20–25 per cent. Reducing dampness is therefore key to an effective solution to treating outbreaks of rot and beetle attack. The five main causes are:

1. Penetrating damp

Water soaking through walls from the outside is commonly the result of leaks from blocked, corroded or cracked guttering and downpipes or from eroded sills, often combined with defective pointing. But where damp penetrates near the base of a wall (for example due to high ground levels and rain splashing) it is sometimes misdiagnosed as rising damp. Defective flashings to roof and stack junctions are another common cause of leaks. Tracing the source of the leak is not always obvious, however, as water may have travelled some distance along ceilings etc. Penetrating damp is sometimes also encountered around old fireplaces due to rain entering unprotected pots, running down flues and soaking into the soot and debris.

2. Condensation

Normal living activities all generate moisture. A person sleeping will produce around 40g per hour, rising to 300g per hour when undertaking moderate manual work. Drying clothes indoors can produce about 1,500g per day and cooking with gas about 3000g per day. All of this vapour can be accommodated by warm indoor air until a state of equilibrium is reached. When heating is turned off or the air enters a cold room, as the temperature drops relative humidity (RH) increases. Generally the RH in a room will be about 10 per cent lower than the RH close to the surface of an outside wall. After a few days mould growth can develop (before condensation occurs). Once mould spores are established, they can continue to grow at RH levels below 80 per cent.[7]

Indoor humidity levels can also be heightened as a result of water ingress from other causes such as internal pipe leaks etc. As with penetrating damp, where condensing water runs down cold internal wall surfaces and soaks into low-level masonry over a period of time it may give the appearance of rising damp.

3. Internal plumbing leaks

There are numerous potential sources of damp from internal leaks, common examples being defective seals around baths and shower trays, leaking hidden pipe joints (eg behind kitchen units) and frozen unlagged pipes in cold lofts etc.

In Victorian and Edwardian houses incoming lead water supply pipes are often run under suspended timber floors from the isolation valve outside the curtilage. Persistent hidden leaks here can saturate the oversite, soaking into walls, fire hearths and chimney breast masonry. Underground drainage pipes running beneath Victorian floors can be similarly problematic.

4. Salt contamination

Formerly damp plasterwork can retain a residue of natural salts such as chlorides, nitrates and sulphates carried within the water. The dilution of deliquescent salts (which liquefy) and hygroscopic salts (which absorb moisture) can be very troublesome, with damp patches often persisting after the defects have been repaired.[6] Moisture absorbed from humid air in the room can make affected wall surfaces temporarily appear damp.

Figure 2: Damp — but not necessarily 'rising'

5. Rising Damp

True 'rising damp' due to a defective or missing DPC is extremely rare.[8] The two main sources of moisture to lower walls are high external ground levels or excessively wet ground. Earth banked up against a wall or a raised concrete path can force moisture into the wall. Marshy ground can result from a variety of causes such as persistent gutter leaks, a low-lying site, high water table or defective underground branch drains allowing water to seep into the ground, causing low-level dampness to persist unseen under suspended floors.

DAMP SOLUTIONS

Having identified the true causes, problems can usually be rectified by a determined programme of maintenance: clearing blockages and replacing or repairing defective rainwater

Figure 3: High ground levels are a common cause of low level damp

Figure 4: Extreme example of eroded sills resulting in damp to lower walls and floor structure

Figure 5: Repointing in traditional lime mortar

fittings, damaged drains, eroded sills, cracked pipes etc. High ground levels should be reduced to at least 200mm below internal floor levels and concrete paths replaced with shallow gravel-filled 'French drains' excavated around the lower walls to facilitate evaporation of moisture from the base of the wall. Condensation may be initially reduced with dehumidifiers and heating, but an effective programme requires improved air extraction, a good flow of ventilation and upgraded insulation to cold surfaces as well as a reduction in moisture emissions.

Having remedied the cause(s) of the problem, consideration must be given to how residual damp can escape. To assist the drying out process any external vegetation engulfing the walls should be cleared. As noted above, however, the misguided use of cement-based mortars, renders and impermeable modern paints will interfere with the natural evaporation process. Materials which do not effectively breathe relative to host materials will almost certainly increase the risk of latent building defects.[9] These should be replaced with suitable traditional lime-based materials. The optimum specification will depend on several factors, but natural hydraulic limes (NHL) are often a good compromise for Victorian walls, a mid-range choice being NHL 3.5. NHL mortars can sometimes reach strengths of over $10N/mm^2$ [10] and are stronger than non-hydraulic lime putty.

Rendering systems must also be designed to be vapour permeable and need to follow the principle of a stronger backing coat and weaker external coats, never the reverse. A flexible, breathable coating should be the goal.[6]

Before replastering internally (using a suitable breathable hair lime plaster mix rather than modern gypsum) the masonry must be allowed sufficient time to dry out (the well-known rule of thumb being a month to dry out for each inch of masonry wall, depending on location, equating to roughly nine months in a typical Victorian house). Salt contamination can be brushed or vacuumed off, but not washed, as this salts back into solution.

It's worth pointing out that the standard mortgage lender solution to damp — injecting chemical DPCs — is now regarded by many practitioners as ineffective and potentially damaging.[11] In theory, pumping silicone-based fluid into a wall forms a horizontal barrier to block any damp rising up. But in practice, most DPCs are injected at far too high a level to protect vulnerable floor timbers. Also, the fluid is commonly injected into the brick or stonework rather than the mortar joints, which means moisture can often work its way past the injected bricks. The 'guarantee' which mortgage lenders put so much store by is dependent upon the application of render tanking to the internal face of the wall, which has the effect of masking residual dampness and further hindering breathability while the critical hidden portion of sub-floor wall remains damp.

COMMON TYPES OF MOVEMENT

Victorian footings, being relatively shallow (almost invariably less than half a metre), transmit ground movement to the main walls. In order to accommodate such movement, structures need to be more flexible than in rigid modern buildings. Lime mortars have an inherent 'plasticity' which allows walls to react to minor seasonal stresses by subtly distorting, sharing the movement over a larger expanse of masonry, leading to localised deformation rather than cracking. Lime also has an inherent ability to 'self-seal' any fine cracks that develop because incoming rainwater can dissolve tiny particles which later coagulate as the water evaporates out.

Lime has its limitations, however, and in more severe cases surveyors need to be able to assess cracking in order to arrive at an informed opinion of the causes of movement. A useful guide to assessing crack widths is BRE Digest 251 (Assessment Of Damage In Low-Rise Buildings).

Nonetheless, this is rarely a straightforward task, hence the requirement by insurers assessing claims for monitoring over a period of time to collect data. According to Dickinson and Thornton: 'It is estimated that surveyors and engineers make more mistakes interpreting the significance of cracking in buildings than anything else.'[12]

There are numerous possible causes of cracking,[13] including:

- Foundation subsidence or settlement
- Structural instability
- Incompatibility of building materials
- Chemical reaction of materials
- Thermal movement
- Changes in moisture content

Once the cause of movement has been identified and rectified, the cracking can be repaired with due consideration for the aesthetics of Victorian buildings as well their stability. Cracks can be stitched to stabilise masonry with stainless 'helibars' bedded into horizontal mortar beds either side of the crack bonded in polyester resin to bind it together, or inserted vertically from underneath. Once pointed up, such repairs should be invisible.

Types of movement commonly found in Victorian houses include:

Bowing

Flank walls were commonly built with floor joists running parallel to them, hence very little lateral restraint was provided. Over time these unrestrained expanses of masonry have a tendency to bulge out, eventually requiring remedial work in the form of ties fixed through the wall to floor joists (assuming the wall is still stable). Similar problems can occur where the main front elevation walls on some terraces were not effectively tied to the party walls. Similarly, some apparently solid external walls were cheaply built as twin

Figure 6: Traditional method restraint applied to bowing walls

adjoining single skins tied together with little more than a few 'bonding timbers', which were inevitably prone to decay, leaving the facing 'leaf' unrestrained.

Roof thrust

Where the connections between wall plates and ceiling joists or collars fail over time (often due to nail corrosion, timber decay, or structural alterations), the force exerted on the upper walls by the unrestrained rafters will tend to push them out. Once the roof slope spreads it is likely to sag as the supporting purlins deflect, potentially causing cracking to gable end walls in which they are bedded. This is sometimes accompanied by horizontal cracks on the leaning wall appearing a few courses down from the eaves.

Arch spread

Arches channel vertical loadings into horizontal thrust, so arched door or window openings adjacent to end walls need to be carefully inspected. Arch construction was also used for underground coal stores and shared tunnel passageways built into some terraces. Where there's a wall above an arch (eg a party wall) it may rely on internal walls and fireplaces in the houses either side to buttress it at right angles. Removal of these fireplaces or internal walls can cause the arch to start spreading.[14]

Deflection

Deflection of structures is common in older buildings, although such movement is not always 'progressive'. One potentially serious example can be seen in some Victorian flat-roofed bays where ponding water soaking into the adjoining front wall over time can result in fungal decay to large 'bressummer' timber beams spanning the bay opening. Replacement of bressummers is a major structural undertaking. Similarly decay to floor joists, or movement to sub-floor piers or sleeper walls may result in deflection to floors. Sloping floors are, however, often a result of longstanding settlement to supporting internal walls originally built with little in the way of foundations, and in many cases a state of stability will have been achieved over time as the ground has been compressed (although clearly this is far from ideal).[8]

Differential movement

Houses with shallower footings to bays and sometimes to rear additions can be prone to differential movement due to varying foundation depths. Similarly, where part of the ground floor footprint comprises a relatively deep cellar or basement alongside conventional footings elsewhere, this can be another potential source of differential movement, in some cases exacerbated where the movement damages adjacent drain runs resulting in marshy ground yielding further.

Where home extensions have been built onto Victorian houses, stresses often develop at the junction between the two structures because of the different foundation depths and it is not unusual for restitched brickwork where cracking previously existed to open up again as movement recurs, hence the importance of providing movement joints.

Subsidence

The majority of subsidence claims submitted to insurers are tree-related.[15] In many Victorian terraces with drainage systems concentrated to the rear, however, the most common factor causing subsidence is leaking drains (although moisture-seeking tree roots are a particular threat to traditional vitrified salt-glazed clay underground pipes disturbing drainage and altering its alignment, and hence an indirect cause of subsidence).[14]

Having identified and addressed the reason behind the loss of support to subsided structures, remedial work can be undertaken. Conservationists tend to question the appropriateness of pumping large quantities of concrete to underpin old buildings as there is a danger this can set up new differential movement stresses, preferring the less aggressive technique of 'underbuilding' to reinstate lost support.

CATEGORISING DEFECTS

Earlier in this paper it was proposed that it may be instructive for practitioners to consider defects in relation to five 'root cause' categories — always bearing in mind that in many cases two or more will apply. This is by no means an exhaustive list, but a brief summary might be as follows:

1. Inherent defects

Flaws dating back to the original design and construction tend to be more prevalent in cheaper terraced houses. Common examples include:

- Shallow foundations
- Missing firebreak walls in lofts

Figure 7: Embedded cast iron downpipe — an inherent defect dating from the time of constuction

- Unrestrained main walls, gables and parapets
- Thin walls (single width '4.5in' brick rear additions and bays)
- Under-structured floors
- Joist ends embedded in solid masonry walls
- Timber inner lintels embedded in porous walls
- Cast iron downpipes embedded in walls or inaccessible for painting
- Hidden valley and parapet gutters and hoppers
- Lack of DPCs to stacks, parapets and to some pre-1875 main walls
- Lack of inspection chambers for accessing underground drain runs

2. Alterations

Much harm is caused as a result of inappropriate alterations and modernisation work, as well as poor quality repairs. Many claims against surveyors relate to failure to spot structural alterations carried out without Building Regulations consent, for example:

- Chimney breasts removed but masonry above left unsupported
- Load-bearing internal walls removed with little or no support provided
- Illegal basement conversions
- Illegal loft conversions
- Roofs reclad with inappropriate coverings, eg unsupported heavier materials, or laid to an inappropriate lap or gauge

Repair and modernisation work commonly carried out to a poor standard include:

- Repointing masonry with inappropriate cement-based materials
- DIY electrical work and plumbing
- Floor joists cut excessively and structurally weakened
- 'Miracle cures' such as spray foam applied to internal roof timbers and 'never paint again' renders
- Unnecessary damp treatments and DIY sealants
- Poor quality replacement windows, doors, fascias, guttering etc
- Extensions, conservatories or raised patios blocking air flow to timber floors
- Short-life taped flashings
- Poor quality insulation causing cold spots and blocking ventilation

3. Environmental and lifestyle changes

Warmer wetter weather is likely to result in higher levels of ambient relative humidity,[16] leading to condensation, mould growth and associated problems.

Significant environmental changes since Victorian houses were built include:

- Traffic vibration and spray and fumes
- Climate conditions creating habits for alien species of woodbeetle/termites
- Warmer wetter weather with resulting flooding
- Trees and shrubs planted in close proximity to walls and drains
- Arrival of non-native invasive species such as Japanese knotweed
- Coastal erosion and sinkholes
- Increased prevalence of land prone to potentially toxic gases such as radon and methane
- Nearby excavations and new developments affecting ground stability

Significant lifestyle changes since Victorian houses were built include:

- Central heating/disused boarded-up fireplaces
- Replacement double glazing and increased air tightness
- Wet rooms, interior bathroom suites and plumbing/pipework
- Installation of electrical cable runs as well as those for IT and sound systems etc
- Solar roof panels
- Car parking to paved-over front gardens

4. Ageing/'wear and tear'

Many materials used in Victorian houses, such as natural slate and naturally seasoned timber, were of significantly better quality than their modern equivalents, and good traditional detailing to walls, roofs, copings and sills to expel rainwater was also superior to that found on many modern buildings. Nonetheless, all building materials have a useful lifespan, and will eventually suffer from the 'effects of ageing'. Longevity will depend on the quality of the original material as well as its exposure to the local climate. Lack of maintenance (point 5) can also be a factor, as can lifestyle changes and alterations.

This category has a special significance because many insurance policies now specifically exclude 'wear and tear' and 'gradually operating causes' (see case study).

Common defects on Victorian houses caused by 'gradual deterioration' include:

- Slipped roof coverings due to corroded fixing nails
- Erosion of mortar pointing
- Erosion of sills and detailing designed to disperse rainwater
- Rusted cast iron guttering and downpipes
- Rusted iron cramps set within stonework
- Loss of key to lath and plaster ceilings

5. Lack of maintenance

In many properties this is the predominant cause of more serious defects such as damp, timber decay and structural movement (compounded by inherent defects and ageing over time). Common areas where neglected maintenance can often cause problems on Victorian houses include:

- Blocked, leaking or corroded gutters and downpipes
- Blocked, leaking or damaged drains
- Eroded pointing to walls, stacks and parapets
- Leaking flashings

Figure 8: Example of long term neglect — a common cause of defects

- Exterior timber joinery, windows and doors at risk of damp and decay
- Unrestrained shrub and tree growth

CONCLUSION

This paper has endeavoured to illustrate some of the more common defects found in Victorian and Edwardian properties. Clearly it is impossible to prescribe appropriate solutions without being able to accurately identify and define the causes of defects, a task frequently made more challenging by the existence of one or more contributory causes. But the role of the surveyor is not limited purely to achieving technical competence. There is a related aspect of our profession which is rarely given much consideration: the ability to communicate findings and advice clearly to clients. This is also a fundamental skill, since poor communication will result in mistakes and poor outcomes just as surely as misdiagnosing problems in the first place. This paper therefore proposes that as an aid both to analysis and communication it may be useful to define defects according to five root cause categories. With further research it may be possible to develop a more sophisticated model with weightings applied to improve the way multiple subsidiary causes of defects are appraised, thereby refining the approach to surveying properties of the Victorian and Edwardian period.

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