8 Damp Penetration and Condensation

8.1 Description

Damp penetration is one of the most damaging failures that can occur whether the building is old or of a modern type of construction (Massari & Massari, 1993; Burkinshaw & Parrett, 2003; Hetreed, 2008). It can damage brickwork by saturating it; cause decay and breaking up of mortar joints; fungal attack in timber and corrosion in iron and steel; and stained wall surfaces internally and externally (see Trotman *et al.*, 2004).

A considerable amount of water is used in the construction of a new building for mixing concrete, mortar and plaster and for wetting bricks. It is estimated that the average house will contain a tonne of water in the brickwork alone (Addleson & Rice, 1992). Some of this water evaporates before the building is occupied and some will be immobilised in the hydration of plaster and cement. However, much of the water used in the constructional process is retained and will dry out slowly. Not much can be done about this type of moisture, but good ventilation and low heating during the first 12 months will greatly assist the drying out.

The majority of building materials are porous and therefore can soak up moisture if the groundwater table is high (BRE Digest 245). Groundwater will be drawn up through the base of the walls by capillary action. This penetration can happen especially on a saturated site unless stopped by a damp-proof course (DPC). The amount of rainwater blowing on to a wall can be considerable. It is not unusual for rain or snow to penetrate a 342 mm or 457 mm thick solid brick or stone wall if it has the force of the wind behind it, and if the brickwork is of a porous nature. The southwest aspect of a building is the most likely position for this type of dampness in view of the fact that the prevailing wind blows upon this face.

The common causes of rising damp from the ground and penetrating through walls are all considered in Sections 8.4 to 8.14.

8.2 Damp courses

The most common damp course that the surveyor will encounter will be a layer of bitumen impregnated felt or felt with a lead core. They are completely impervious

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and are obtainable in long lengths. Metallic damp courses are occasionally found consisting of sheet lead or copper. Both are pliable and easily laid; due to their smooth surfaces they tend to encourage 'slip' but at the same time will accommodate a great deal of movement. Mastic asphalt has been used in older buildings, but is rarely adopted in modern construction. The work was usually carried out by specialist firms and can be expensive. The material is durable but in warm weather tends to extrude under load and bleed through on to the external face of the wall. This is also a problem with bituminous felt damp courses.

Before the Public Health Act of 1875 it was not compulsory to provide a damp course at the base of a wall. The majority of buildings erected before this date will usually have damp problems. During the early years of the new act DPCs were often badly laid or have become defective with age. The early type of damp course usually consisted of two courses of slate laid breaking joint or two courses of hard engineering bricks. Slate provides excellent protection but tends to fracture if stressed by any unequal settlement of the wall. The weakness in using engineering bricks lies in the number of joints, and any settlement can cause cracking in the mortar joints, providing a path for damp to penetrate by capillary action.

8.3 Diagnosis

When investigating a damp problem it is most essential for the surveyor to understand the construction of the building and be certain as to the cause before attempting a remedy (Burkinshaw & Parrett, 2003; Douglas & Ransom, 2007). Some damp problems are straightforward and fairly easy to diagnose, whereas others are more complex and may consist of several damp areas in a more complicated pattern, often at a point some distance from the original source of the trouble. It is well to remember that moisture can travel a considerable distance before revealing itself inside the building (Oliver, 1997).

Damp problems in a building are not always new and are often due to long-standing defects, and in some cases several temporary repairs may have been carried out over many years. The occupier of the building will no doubt point out certain defects caused by damp penetration, but on some occasions the surveyor will consider it necessary to look at the structure as a whole especially if dealing with an old building.

It is worth bearing in mind that old buildings (built before 1880) were constructed of solid brick or stone walls, and no damp course or roofing felt were provided although a few had boarding beneath the slates or tiles.

One of the most common forms of damp penetration occurs through defective roof coverings or worn flashings and damp courses to chimney stacks. The surveyor will usually notice damp stains on the top floor ceiling or top of the chimney breasts no doubt due to defects in the roof. (These defects will be considered in Chapters 10 and 11.)

As already mentioned in Chapter 2 a moisture meter can be of great assistance in determining the moisture content of building materials or tracing the extent of the damp penetration. However, care must be taken where the moisture meter is being used internally. If the wall plaster has been lined with an impervious damp-proof lining under the wallpaper or other covering it will be necessary to remove a small portion of the surface covering, possibly in some inconspicuous part of the room, to enable the meter probes to be pressed into the damp area of the plaster. In the following paragraphs the identification of the causes of damp penetration will be dealt with. They can be divided into three categories as follows:

- Rising damp from the ground – though see Howell (2008), who posits the view of a growing number of building professionals that 'true/direct' rising damp is extremely rare, and that the usual cause of such dampness is bridging (i.e. 'indirect' rising) damp.
- Penetrating damp through walls.
- Extraneous causes.

RISING DAMP FROM THE GROUND

8.4 Solid walls with DPC absent or defective

As mentioned in Section 8.1 the ground around the foundations is often damp; moisture rises into the brick or stonework by capillary attraction and unless a DPC is provided above ground level the moisture can rise, causing considerable dampness to walls and floors. It is, therefore, important that the surveyor makes a careful examination of the base of the wall to ascertain the existence or absence of a DPC. If there is no damp course, dampness will show along the bottom of both external and internal faces causing discoloration, mildew and peeling decorations. The damp will rise in a wall or partition to a height at which there is a balance between the rate of evaporation and the rate which the damp can be drawn up by capillary attraction. The line of dampness due to the absence of DPC is usually continuous and fairly horizontal and in severe cases can reach a height in excess of 1 m (see BRE Digest 245). Figure 8.1a shows a typical early nineteenth century external wall construction with no DPC and no foundation concrete.

Care must be exercised when checking for rising damp due to a defective DPC. The cracks usually pass through the horizontal joint with a semicircular damp patch internally spreading up from the line of the DPC. The damp course line should be checked for continuity especially where it is stepped due to changes in floor levels or external pavings. At the same time the condition of the pointing to the damp course should be noted.

Another factor the surveyor must consider is that the ground water usually contains dissolved salts (such as nitrates and chlorides) which form a fine deposit on the wall surface during evaporation of the water. Some of these salts are hygroscopic and absorb moisture from the air. In such cases the plasterwork becomes contaminated with salts and usually requires replacement (with salt retardant 'renovating' plaster (e.g. Tremco Limelite) not gypsum plaster) to at least 300 mm above tide mark.

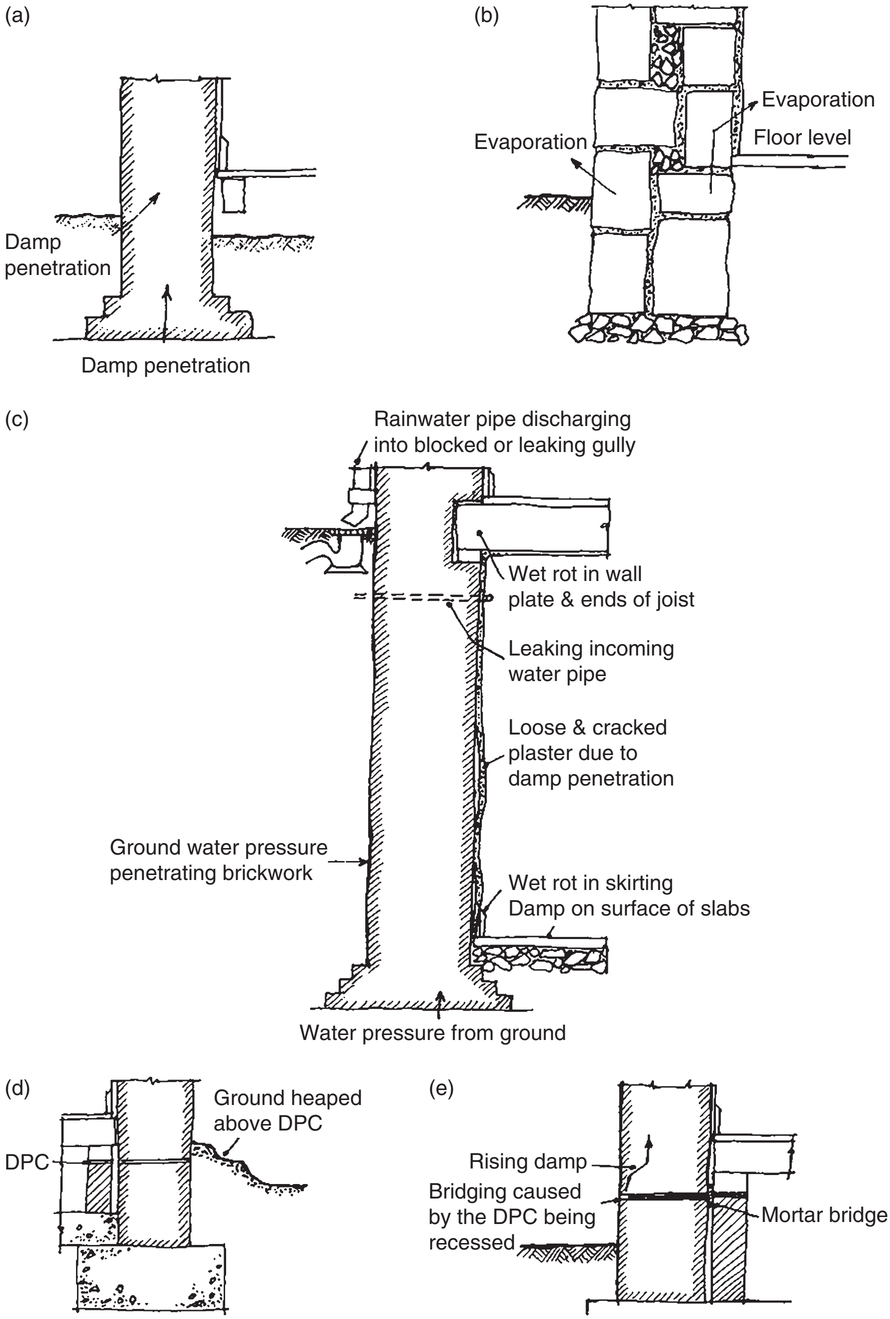

Figure 8.1 (a) Typical early nineteenth century external wall construction with no DPC. (b) Traditional solid stone wall. No DPC. (c) Typical damp problems in old basement walls. (d) DPC covered by earth. (e) Defects caused by bridging DPC

8.5 Stone walls in older buildings

Older buildings with solid masonry walls built before the nineteenth century have no damp course and are usually of stone throughout, though the interior may be inferior to the facing material. The type of construction is not necessarily unsound and, in fact, is often quite effective in repelling rising damp. Usually any water drawn up from the ground will be dissipated by evaporation through the porous masonry walls and lime mortar joints. In most cases the damp does not rise more than about 300 mm above ground level. The masonry also relies on its thickness to prevent damp reaching the inner face of the wall before evaporating.

The important point for the surveyor to remember is that any treatment which prevents evaporation such as waterproof rendering internally or externally, will only cause the damp to rise higher before it can evaporate, causing more problems (Massari & Massari, 1993)! Any treatment recommended (Burkinshaw, 2009) is a matter requiring careful judgment (see Figure 8.1b).

When undertaking an examination the surveyor must closely inspect the walling material internally and externally making full use of the moisture meter. Water is drawn through fine fissures by capillary attraction particularly in stone with a coarse grain which contains open pores into which rainwater may be drawn. Fine fissures are often found between mortar and stone forming paths for moisture. Examine the joints cutting away some of the pointing if necessary.

8.6 Basement walls and floors

The conditions under which walls and floors below ground level are exposed to damp penetration are very different from those occurring above ground level. Rooms which are partially or fully below ground level can be affected by penetrating damp, where there is a high water table. As the depth increases so does the water pressure in ground with a high water table, and so the outside faces of basement walls may remain permanently damp. Ground water penetration can be seasonal depending on the relative height of the water table.

In modern buildings it has become common practice to protect basements by external or internal waterproof coatings. By this means the basements can be as dry as the rooms in the superstructure. Provided this tanking is efficient and the rooms are adequately ventilated the surveyor should have no problems. However, the exact cause of a 'damp patch' may be difficult to discover. Damp patches on walls or floors could emanate from an intermittently leaking water pipe or may be caused by condensation given off by a washing machine or drying appliance in an unventilated basement.

A common defect is the jointing of the damp-proof membrane at the internal angle of wall and floor. The slightest leakage at this junction will result in gradual percolation of moisture and a head of water may build up between the two leaves of brickwork or concrete walling. If the water pressure is strong below the floor it can cause actual flooding of the basement.

As far as the surveyor is concerned, older buildings (those built before the twentieth century) are usually easier to diagnose. They are usually damp throughout and no doubt have been prone to damp problems from the day they were built. The walls are usually constructed of fair-faced solid brickwork or stone set in lime-based mortar and it is unlikely that any damp proofing will be located.

Flag stones or brick floors were usually laid on the bare earth and moisture rising from the ground is common. The surveyor will often find an impervious finish has been laid over the solid floor which has become very wet underneath, and probably affected by rot. Figure 8.1c shows typical problems in an old basement wall.

8.7 Heaped earth or paving against walls and bridging of rendering

A common defect is where the horizontal DPC is placed nearer the ground than the 150 mm clearance required by the Building Regulations, and becomes ineffective through being bridged by earth or paving slabs laid at a higher level (Howell, 2008). In wet weather moisture may be drawn into the wall from the soil above the DPC. Where dampness appears on the interior face near the floor, the ground level in relation to the DPC should be examined (see Figure 8.1d).

Rendered plinths were common during the early part of the twentieth century, often in speculative built houses. In many cases the plinths were applied to buildings with solid walls and they invariably bridged the DPC causing rising damp to penetrate through to the wall plaster and skirtings. Bridging can also be caused by the DPC being slightly recessed and the joint filled with pointing mortar as shown in Figure 8.1e.

Defects due to 'bridging' are relatively easy to diagnose, but where the elevations have been rendered, it must definitely be established that the wall is solid. Damp patches internally at skirting level cannot be properly diagnosed until this is known.

8.8 Internal partitions

Another common defect found in domestic property is a partition wall with a solid floor on one side and a joist floor on the other. If the DPC is a few millimetres below the concrete floor then damp can rise through the unprotected gap (see Figure 8.2a).

8.9 Rising damp in ground floors

The surveyor will often find that the ground floors of properties built prior to about 1860 usually consisted of boarding secured to timber joists either laid directly on the earth or separated from it by a few millimetres, the joists being secured to timber plates on brick sleeper walls. No DPC or ventilation was provided. These conditions beneath timber floor joists are the main cause of dry rot outbreaks and will be dealt with in detail in Chapter 9. After about 1880 the principles of construction improved and the floor joists were laid on honeycomb pattern sleeper walls with ventilators at the base of the external wall.

The ventilators were often small and insufficient in number, but they did allow a certain amount of air to circulate around the joists. DPCs consisting of slates are likely to be found below the wall plates of sleeper walls during this period. In both the above categories very few will be found to have been provided with site concrete (see Figure 8.2b).

During the examination the surveyor will usually find the floor boarding to be in sound condition, but after removing a few floor boards the joists may well be found to be rotted or saturated with wet rot on their undersides.

After World War I solid ground floors appeared both in domestic and commercial properties. However, it was soon realised that a concrete slab was not sufficiently impermeable to prevent moisture penetration. Many failures were reported in the timber fillets and boarding as a result of moisture penetration and thus a clause was added to the Model By-laws of 1937 requiring that timber in contact with a concrete base must be protected by a damp-proof membrane consisting of 3 mm thick bitumen or coal tar pitch. The floors of a building erected before this date are therefore suspect and the surveyor will be wise to remove a few floorboards and examine the base concrete. Rising damp in solid floors is easily seen on the surface of the floor finishing. Timber strip flooring or wood block will often have a water mark on the surface and in some cases will be loose and easily lifted.

A number of damp-proofing materials have been developed over the past 60 years providing a completely impervious membrane over the solid floors. Any failures that may occur in the damp-proof membrane are usually due to inadequate jointing with the external wall damp course. It is essential that the damp-proof membrane is continuous with the DPC in the external wall. It is under such circumstances as these that the moisture meter is of great assistance, and in order to determine accurately the cause of the defect it will probably be necessary for the surveyor to obtain the owner's permission to remove a portion of the skirting and expose the internal face of the wall. If moisture can be found to have affected the walling behind the skirting the cause can only be due to inadequate jointing between the floor membrane and the DPC in the external wall (Figure 8.2c). An important point to check is the air space and ventilation to the ground floor. This space must be properly ventilated to protect the joists and wall plates against dry rot. Air is induced from outside by the insertion of air vents at frequent intervals immediately under the damp course level (giving at least 1500 mm^2 fresh air inlet per lineal metre of external wall). The air vents are usually constructed of cast-iron or terracotta (size 230 mm × 75 mm) although tile slips are often used in good quality work. It is not unusual to find that the air vents have been covered with perforated zinc or even solid metal plates in order to discourage insects or mice. When carrying out the examination it is important to ensure that the air vents are free from obstruction. If close to garden planting or shrubs the apertures are often found to be filled with earth.

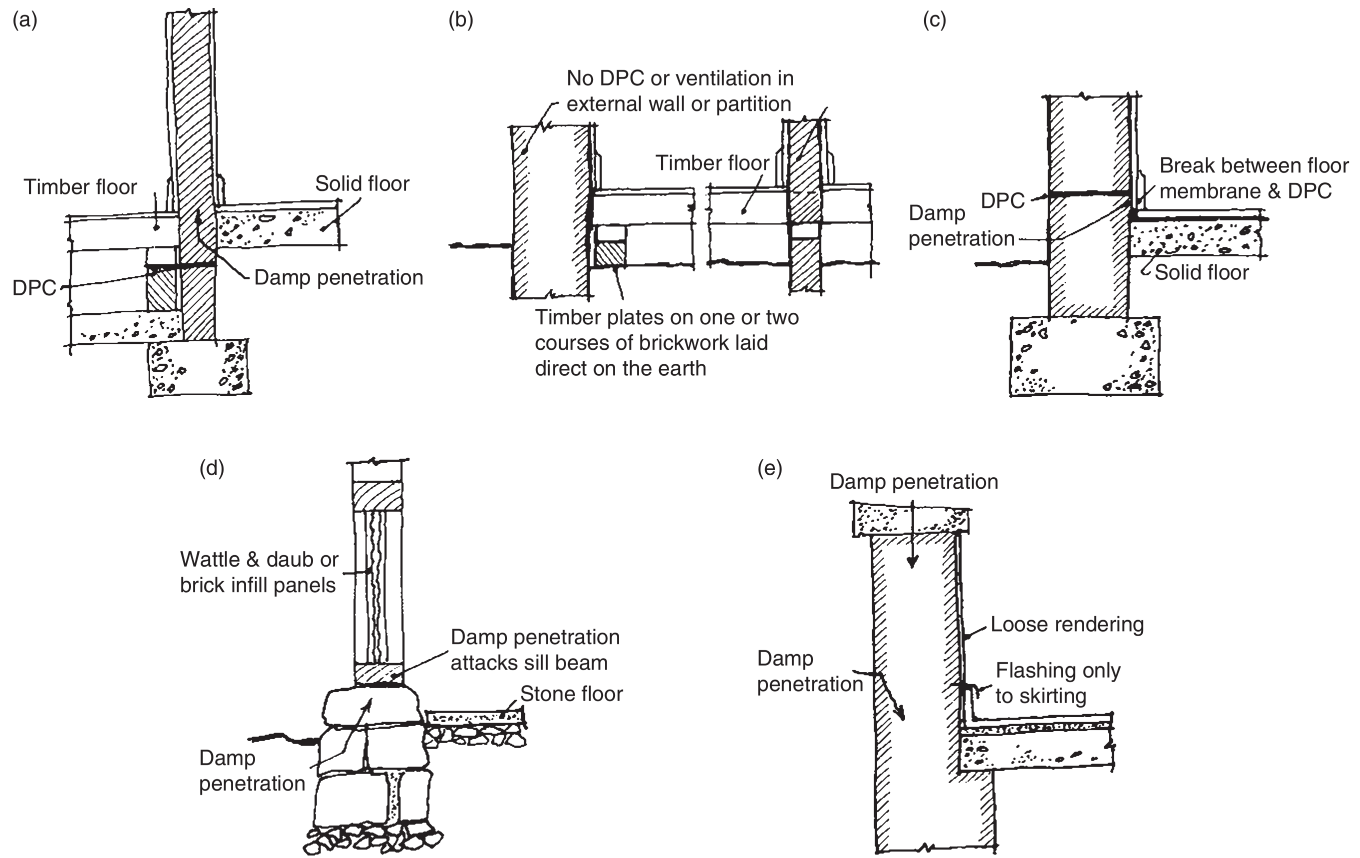

Figure 8.2 **(a) Incorrect DPC insertion in partition wall. (b) Typical early nineteenth century timber floor construction. (c) Inadequate jointing between floor membrane and DPC. (d) Typical base detail of timber framed building. (e) Defects caused by the absence of DPCs in parapet wall**

8.10 Rising damp in old timber-framed buildings

Early timber-framed buildings usually had their main oak posts dug into the ground, but those that have survived were supported on a horizontal member or sill beam into which the vertical posts were jointed (Swindells & Hutchings, 1991). The sill beam was laid on a brick or stone dwarf wall to keep the timber away from the damp ground. With no damp course, reliance was placed on the dwarf wall to keep rising damp to a reasonable level. However, this wall was not sufficient protection, and rainwater and rising damp from the ground gradually attacked the timbers by a combination of wind pressure and capillary action producing wet rot in the sill and the base of the vertical posts (Figure 8.2d). This defect can often lead to undue stress being thrown upon other members of the frame. It is therefore advisable to examine all the framing thoroughly, however sound the timbers may appear externally.

Damp penetration in framed buildings also occurs at the joints between the panel infilling and the timber framing. The systems usually consist of cracks between the frame and the panel infilling allowing rainwater to penetrate. Distortion of the frame is also a common defect resulting from twisting and warping of the timber over many years. Figure 8.3 shows the effects of rising damp and woodworm at the foot of a timber post in a timber framed building.

PENETRATING DAMP THROUGH WALLS

8.11 Locating damp penetration

It is quite possible for rainwater to penetrate a 343 mm solid brick wall if the bricks are of a porous nature and the force of the wind is behind it. In the past various forms of overhang have been used to protect walls from rain penetration, but during the past 60 years their use has declined. The overhangs mainly consisted of canopies, projecting eaves, string courses and cornices. On modern properties it is quite probable that the external walls are much wetter for long periods now that these overhangs are absent. If overhangs do exist they should have sufficient fall to throw rainwater off and preferably be covered with some sort of protective flashing. In old buildings many cornices and string courses have been covered with cement fillets. These fillets will often be found to have shrunk and cracked at the junction with the wall and thus form a trap for water.

In most parts of England the prevailing wind blows from the southwest so this aspect of a building is the most likely position for this type of penetrating damp. Water is drawn through fine fissures by capillary attraction, and it is often assisted by internal warmth which tends to draw the moisture inside where it can evaporate easily. Fine cracks and fissures are evidence of poor quality bricks, and stonework with a coarse grain also contains open pores into which rainwater may be drawn.

If the walling material appears to be sound and not excessively absorbent, the joints should be examined and if necessary some of the pointing should be

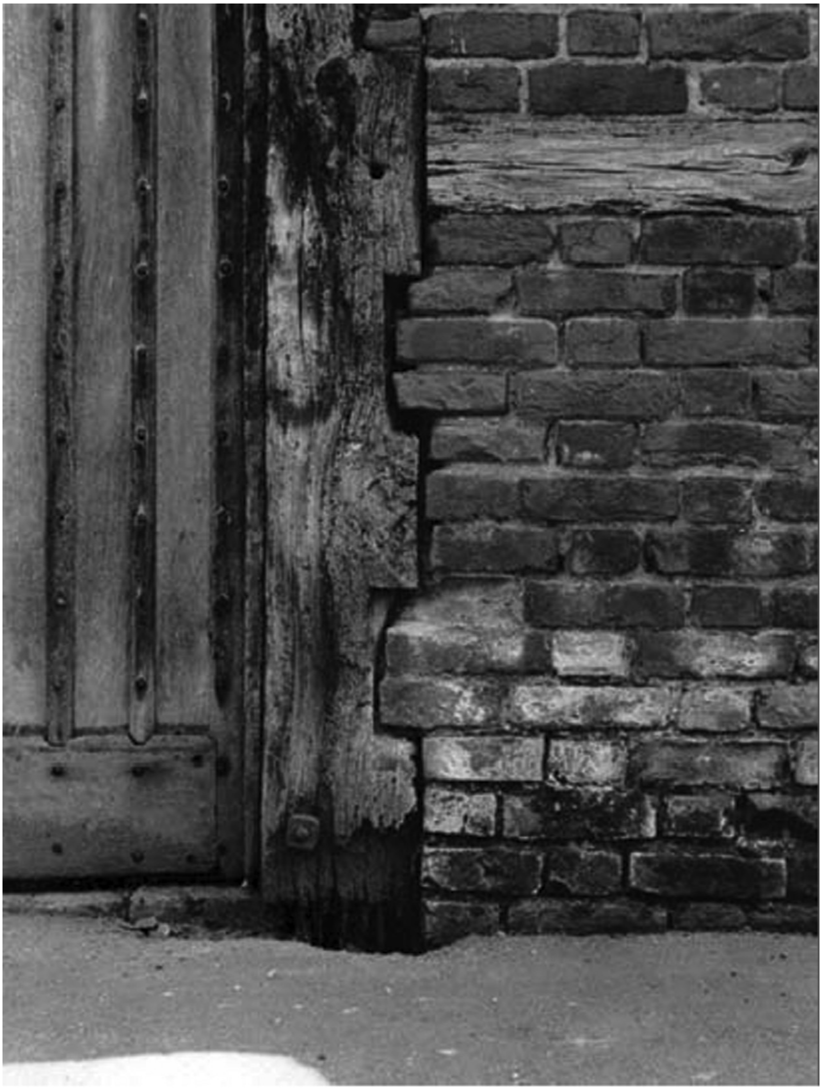

Figure 8.3 Effects of rising damp and woodworm in a timber-framed building

removed. If the mortar is of poor quality the risk of damp penetration is increased. Dampness is often caused by using strong cement mortars which tend to shrink. In such cases water is drawn in through the fine fissures between mortar and brick. Window and door openings in solid walls are often a source of trouble and should be carefully examined. In old or modern buildings the wood frames are often flush with the external face of the wall. If the joint between the frame and the masonry is defective allowing moisture to penetrate then the timber is prone to wet rot.

8.12 Parapet walls

Parapets are undoubtedly the most vulnerable part of a building as far as damp is concerned especially as they are exposed to the weather on three sides (Oliver, 1997). The majority of parapet walls are of one brick thickness, and it is common to find that the inner face has been rendered to prevent damp penetration. Whether the parapet is solid or of cavity construction can easily be checked by measurement at coping level. When the type of construction has been established the surveyor should examine the coping. Copings of natural or artificial stone should always have sufficient fall to throw the water off the upper surfaces and a good throating should always be provided on the underside so that water draining from the top will not run round the underside to the wall beneath. Copings should also prevent the downward penetration of rainwater, but being broken by joints they may be defective causing the parapet beneath to become very damp. Brick copings are particularly susceptible to penetration by driving rain through the mortar joints and do not provide a good weathering surface.

The external faces of the parapet should be carefully examined. If the bricks show signs of decay or surface flaking this will indicate that the wall is saturated and frost damage or sulphate attack has occurred. Cracks or bulging of any rendering either on the internal or external faces will also indicate severe damp penetration. These defects are usually caused by the absence of a DPC below the coping (see Figure 8.2e).

The next point to investigate is the provision of a DPC under the coping and in the parapet wall at the top of the skirting to the roof. If these DPCs are missing or ineffective then damp will penetrate through the main fabric of the structure. A common defect found in a number of parapet DPCs has been to stop the DPC short of the internal brick face and not turn it down. On a flat roof the DPC should be taken right through to the internal face of the parapet to form a cover flashing over the skirting as shown in Figure 8.4a. On the external face, the DPC should extend to form a small projecting drip on the face of the brickwork. If the wall is rendered externally the DPC should pass through the thickness of the rendering and be turned down to prevent 'bridging' of the damp course by the rendered face.

If the precautions described above are not taken then failure is almost certain. Cavity parapets are the best solution and if designed in accordance with the current Code of Practice no problems should ensue.

8.13 Cavity walls

A common problem in cavity wall construction is bridging of the cavity wall by excessive mortar droppings at the bottom of the wall or on the wall ties (Hollis, 1990). Moisture will then be absorbed by the inner wall and irregular damp patches will appear adjacent to the mortar droppings or near the floor. Inclined wall ties which slope downwards from outer to inner leaf also allow water to penetrate. This

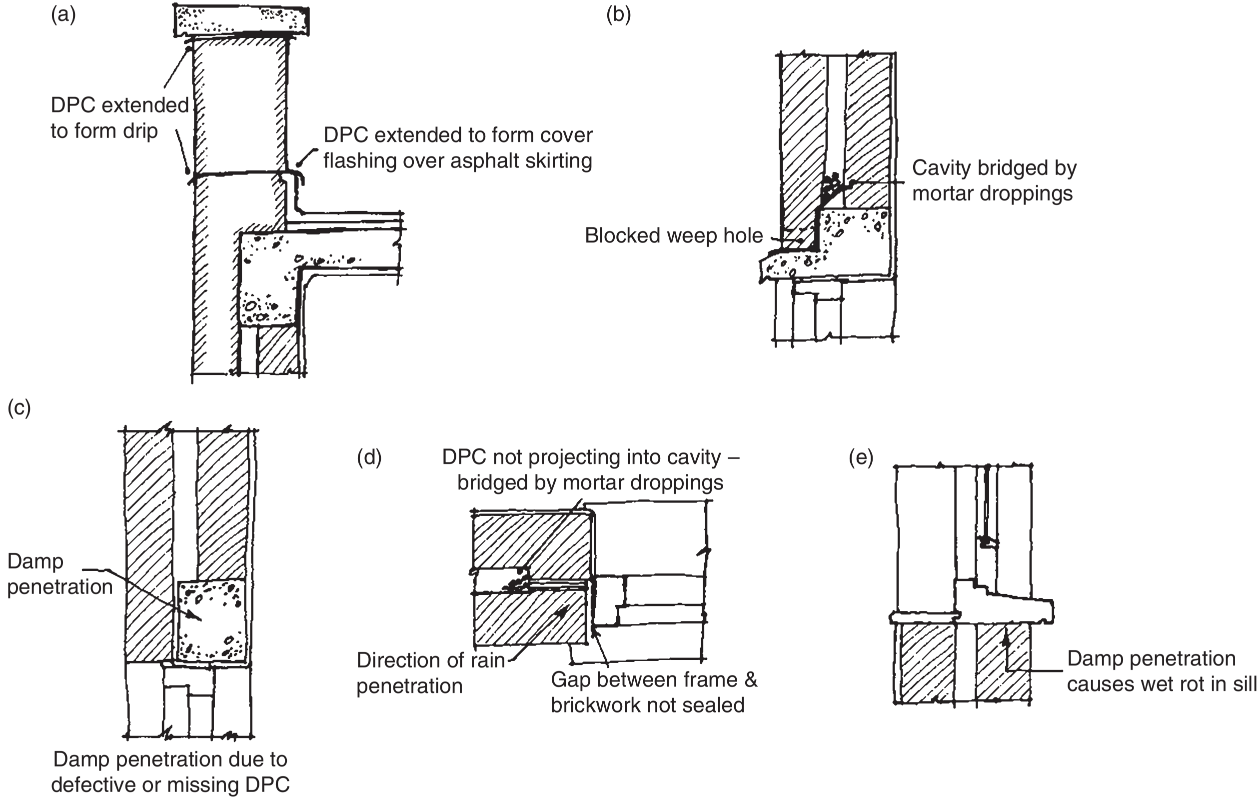

Figure 8.4 (a) Correct detail for DPCs in solid parapet wall. (b) Bridging of DPC over opening. (c) Damp penetration due to defective or missing DPC. (d) Damp penetration due to poor detailing of DPCs and jointing to reveal opening. (e) Damp penetration due to omission of DPC under sill

is also a common fault with DPCs over window and door openings as shown in Figures 8.4b and c where bridging of the cavity is caused by excessive mortar droppings building up off the DPC or due to a faulty or missing damp-proof tray. Damp patches on the plaster about 300 mm above the head of the window usually indicate mortar droppings collecting at the head of the damp-proof tray. The weep holes externally should also be examined to ensure that they are not blocked.

The reveal to a window opening seems the obvious place to expect the entry of water, particularly if the jointing between wall and frame is in poor condition. Rainwater penetration at this point is often due to poor detailing of the DPC. Semicircular damp patches at the junction of the window frame and plaster indicate a defective or missing vertical DPC which can also cause wet rot in the frame. The vertical DPC should project into the cavity to prevent 'bridging' by mortar droppings (see Figure 8.4d). Another common danger point is the sill. All sills should be provided with a DPC for their whole length and width, and turned up at the ends.

Where a flexible DPC crosses the cavity the underside should be supported on an asbestos or slate sheet. Figure 8.4e shows the line of damp penetration due to omission of the DPC under the sill. In recent years the cavities of cavity walls have often been filled with plastic foam to increase the thermal insulation value of the wall. The foam usually consists of urea-formaldehyde and is injected into the cavity by drilling holes through the mortar joints. In view of the fact that the main purpose of a cavity is to prevent damp penetration, a filling material, in principle, increases the risk.

There have been a few cases in the past where urea-formaldehyde foam has shrunk causing voids to form, allowing moisture to cross the cavity and penetrate the inner leaf. However, where the technique is correctly applied the original function of the wall is not greatly impaired.

Defects can also be caused by large amounts of driving rain against brickwork that has a high porosity. The visible signs of damp on the inner leaf take the form of damp patches which are often difficult to distinguish from damp penetration caused by mortar droppings on wall ties.

BS 5618 is a code of practice for the use of urea-formaldehyde and contains a local driving rain index value. This document may well give guidance to the surveyor when engaged on a particularly difficult problem concerning filled cavity walls.

Unfortunately, in cases of doubt with cavity wall problems it will often be necessary to cut away several bricks in the outer leaf in order to ascertain the extent of the defect.

EXTRANEOUS CAUSES

8.14 Leaks in plumbing systems

An extraneous cause of dampness which is sometimes overlooked is water that has become entrapped under impervious floor coverings laid on boarded floors. Water passes through the joints or cracks and spreads out underneath making evaporation almost impossible. This type of dampness is usually caused by leaks from plumbing systems or weeping joints in sanitary fittings.

Defective pipes buried in an external wall can sometimes give rise to damp patches on the wall surface similar to rainwater penetration. Prolonged dampness from this source has been known to cause wet rot in floorboards particularly in rooms containing sanitary fittings. Care must be taken not to confuse this problem with condensation which is similar in appearance.

Many cold water pipes collect condensation on their surface and in severe cases water will run down the exterior of the pipe and on to the floor covering or boarding. This problem will be dealt with in more detail in the following section.

CONDENSATION

8.15 Description

Condensation and its effects has been one of the worst post-war building problems particularly in new housing and blocks of flats (Garratt & Nowak, 1991). Dampness together with mould growth caused by surface condensation or high humidity is not only difficult for the surveyor to diagnose, but can be very distressing for the occupiers of the building.

8.16 Causes

In order that the surveyor can discuss possible remedies for condensation it is necessary to understand how it occurs, and to be able to identify the defects. Condensation must not be confused with dampness due to water penetration from the outside nor with dampness caused by the normal drying out of a new building (Burkinshaw & Parrett, 2003). Moisture which condenses on internal surfaces is derived from the internal air and is generally produced by the occupant's activities. Air at all temperatures absorbs moisture, but the higher its temperature the more moisture it can retain. However, air at any temperature will ultimately reach a state when it cannot absorb any more and it will therefore have reached saturation point. Condensation will occur when the warm air is cooled to a temperature known as its 'dewpoint' temperature, either by being brought into contact with the cold surfaces of the structure or by passage into a cooler part of the building. Condensation will also occur on absorbent surfaces, but will not always show until the surface is very damp. In such cases mould growth will appear consisting of green or black patches which will cause deterioration of decorative finishings. This type of growth can also form on clothing etc. stored in unventilated and unheated built-in cupboards.

8.17 Diagnosis

Generally speaking, this type of dampness applies to all types and ages of buildings. However, a lot of present-day condensation problems have been aggravated by the use of modern materials which have a low thermal capacity (Trotman *et al.*, 2004).

When carrying out an examination of older type property the surveyor will probably not have to consider the various factors that have created condensation (Massari & Massari, 1993). The features built into these properties created the correct conditions to avoid condensation problems although they were probably not realised by the early builders. The materials they used had a high thermal capacity and included such features as air bricks, box windows and lime plaster on the walls and ceilings. The most important feature was the open fire which gave good ventilation to the room and chimney breasts while their warm flues passing through the building heated the internal wall surfaces. This method of heating the principal rooms of a house has ceased and has thus also done away with the natural ventilation from the flue. All these features played an important part in the removal of moisture-laden air. Gypsum plaster in lieu of lime plaster has been used considerably during the past 60 years. The gypsum plaster being denser and colder has not the power to absorb moisture. However, this problem has largely been overcome by the introduction of vapour check thermal boards and lightweight retarded hemihydrate plasters.

'Cold bridges' formed by cavity wall ties can produce small discoloured patches of mould on wall plaster. Openings in cavity walls sealed with slates in cement mortar can also cause a similar condition on the wall plaster. The use of steel or concrete lintels over door or window openings which completely bridge the cavity transfers a completely cold area from the outer face to the internal face of a building. Metal windows have a high thermal conductivity which can cause similar conditions when built direct to brick openings that provide a cold bridge between the exterior and interior. The appliances in domestic properties should be carefully noted. Washing machines, gas cookers and tumble driers are often the cause of condensation problems, particularly where some form of ventilation to the outside has not been provided.

A considerable amount of double glazing has been carried out during the past 25 years which no doubt reduces the risk of condensation, but does not entirely prevent it on the glass and frame. This will depend on the humidity and temperature in the building. Condensation can occur in pitched and flat roofs of modern buildings unless precautions are taken. One cause is due to the increased use of thermal insulation. Insulants are used up to 100 mm in thickness immediately above the ceiling level in order to prevent heat loss and pattern staining. Pitched roofs usually have an underlay of felt and the ceiling below lined with aluminium foil backed plasterboard. Both these methods tend to make the space above the insulation colder and the dewpoint is thus more easily reached. As previously mentioned chimneys are now either removed or not used. In such cases there will be no warmth from the flues to help raise the temperature in the roof space and so help reduce the risk of condensation.

Where condensation is noticeable on the roof timbers and metal fasteners it is no doubt due to the lack of ventilation especially if the insulation is packed tightly up to the eaves. The surveyor should carefully note this point and if necessary recommend that a gap of approximately 20 mm should be provided along the eaves and a few small holes drilled into the soffit board on two opposite sides of the building to provide adequate ventilation to the roof space. Natural ventilation is the cheapest form of remedial work and is nearly always beneficial in reducing condensation. The important factor is that moisture-laden air is extracted and a current of air promoted. Some severe cases of condensation require knowledge of many complex factors and the reader is recommended to study BS 5250 and Garratt and Nowak (1991) for further information.

8.18 Problems with flues

During examination of older type buildings the surveyor will occasionally find that the fireplace openings and flues have been sealed off, and that damp patches have appeared on the chimney breast. This defect is often mistaken for damp penetration or condensation, when the basic problem is due to the lack of ventilation. If this stagnant air is not released, a chemical corrosive process known as soot damp will commence which gradually eats into the brickwork and through to the plaster. The problem is easily overcome by installing a louvre vent at the bottom of the chimney breast thus ensuring a flow of air through the flue.