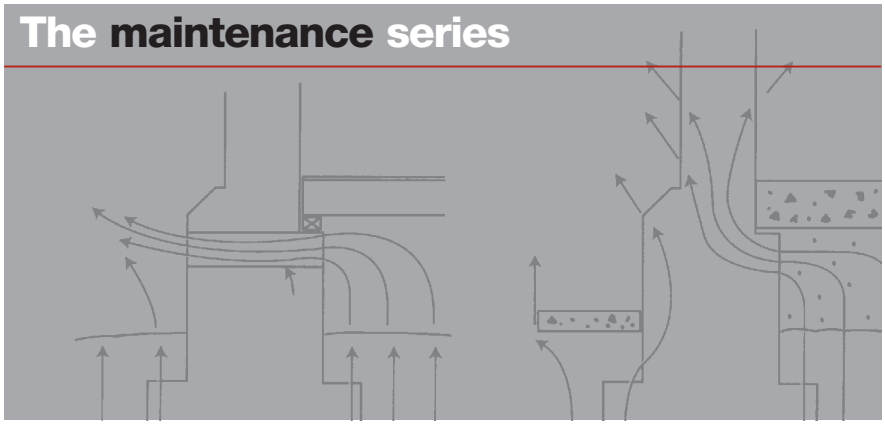
The maintenance series



Information sheet

2.1

NSW Heritage Office

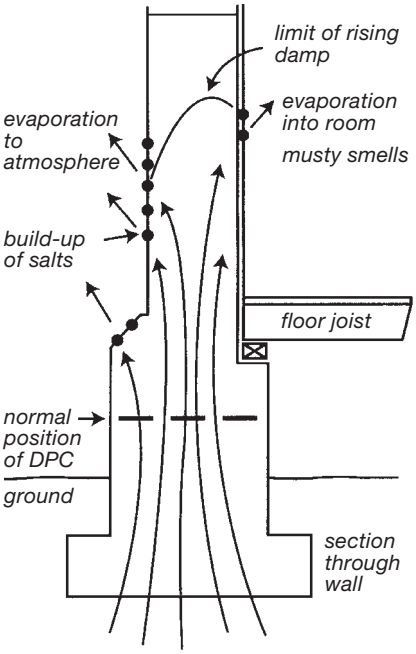
Rising damp

Introduction

Rising damp, a worldwide phenomenon, is a major cause of decay to masonry materials such as stone, brick and mortar. Even when mild it can cause unsightly crumbling of exterior masonry and staining of internal finishes. It may also cause musty smells in poorly ventilated rooms.

This Information Sheet provides a brief introduction to rising damp, its control and treatment, for the owner or manager of buildings of heritage value. A short bibliography of more detailed works on the subject is included for interested readers.

Rising damp



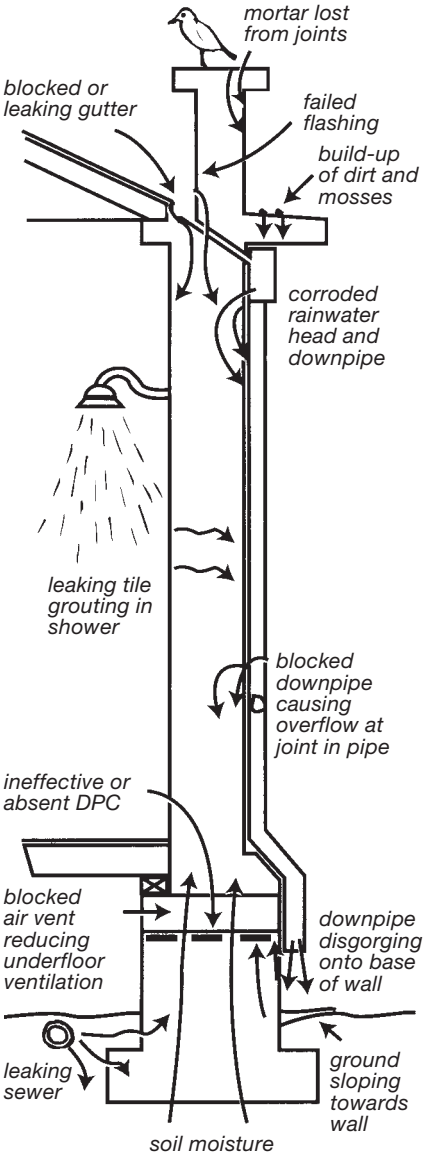
soil moisture drawn into wall by capillary suction

What is rising damp?

Rising damp occurs as a result of capillary suction of moisture from the ground into porous masonry building materials such as stone, brick, earth and mortar. The moisture evaporates from either face of the wall (inside or outside), allowing more to be drawn from below. The height to which the moisture will rise is determined by the evaporation rate and the nature of the wall. The normal limit for rising damp ranges from 0.5 to 1.5 metres above ground level.

Rising damp may show as a high-tide-like stain on wallpaper and other interior finishes, and, when more severe, as blistering of paint and loss of plaster. Damp walls encourage the growth of moulds, which, with the high humidity, can lead to health problems for occupants. Externally, a damp zone may be evident at the base of walls, with associated fretting and crumbling of the masonry.

Sources of damp in walls



The DPC

To prevent rising damp it is normal practice to build-in an impermeable barrier at the base of the wall just above ground level. This is known as the damp-proof course (DPC) or sometimes as the damp course. Modern DPCs are generally 0.5mm thick black polyethylene sheeting. Early DPCs included overlapping roofing slates, lead sheets, glazed ceramic tiles (made for the purpose) and various bitumen-based materials, including tar–sand mixes which were laid hot.

Unfortunately, many 19th-century buildings in Australia were built without DPCs, and some early DPCs have proved ineffective. As a result, a substantial proportion of our historic buildings have inadequate damp-proofing.

The role of salts

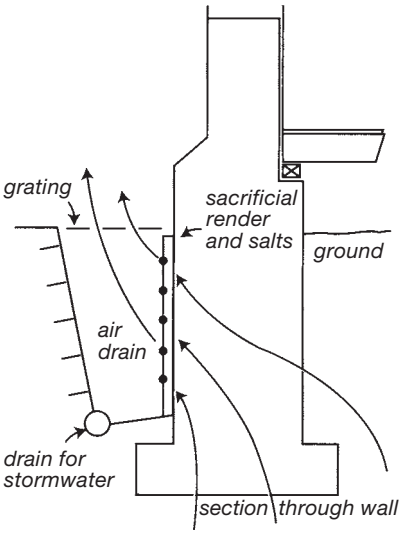
On its own, rising damp can make buildings unsightly and unpleasant to occupy. The situation is made much worse if there are appreciable quantities of soluble salts present, for the rising damp will carry salts up into the masonry to where the damp evaporates. There the salts are left behind and can often be seen as a white efflorescence on the wall surface. When these salts grow as crystals within the pores of the masonry they can disrupt even the strongest material, leading to fretting and crumbling of the surface. This process is known as salt attack, and, when severe, can lead to the slow but complete loss of stones and bricks in a wall.

Diagnosis

Rising damp is often caused by bridging of the DPC. This happens when external renders or internal plasters provide a moisture pathway around the DPC. Build-up of garden beds against walls can also bridge the DPC. But not all dampness in buildings is due to rising damp. Leaking water pipes or failed roofs and gutters may be the cause: some of these other forms of damp are discussed below.

Accurate diagnosis of the cause and extent of the damp problem is very important. Specialist advice should be sought. There are various electrical methods which allow moisture levels to be measured with convenient hand-held meters. Some of these can not distinguish between relatively dry but salty walls and those that are wet but free of salt, so great care is needed in interpreting their results.

Air drains: a control measure



By lowering the zone of evaporation, rising damp can be controlled to less visible parts of the wall. Valuable internal plaster can be protected and the risk of fungal rot decaying timber floors reduced.

Other forms of damp

Falling damp

Blocked or leaking gutters, failed flashings, joints that have lost their mortar, and general build-up of dirt and mosses on upper surfaces of stone or brickwork can all lead to water penetration into porous masonry, and percolation down walls as falling damp. Fallen leaves, bird manure, mosses and dirt contain weak acids and salts, which, if carried by water into masonry, can promote decay.

Penetrating damp

Horizontal or penetrating damp can be due to leaking water supply or waste pipes, or failure of tile grouts in shower alcoves and other wet areas. Drips from air-conditioning or hot water system overflows can also be a problem. These sources tend to produce small, localised patches of dampness and decay, whereas rising damp may affect the base of a whole building.

Control and treatment

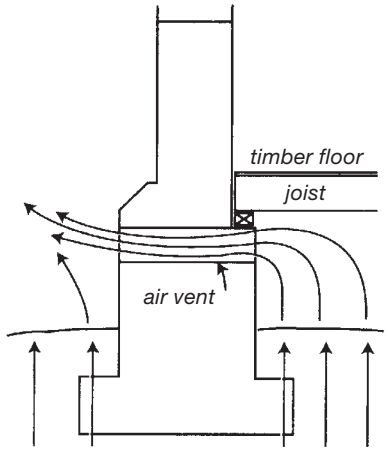
Having diagnosed the cause of the damp problem, the obvious response is to prevent it recurring by fixing leaks, by removing bridges, or by inserting a new DPC. Good housekeeping measures should be undertaken as well. These will help prevent further damp problems and may reduce the severity of an existing problem to an extent that major works are not necessary. These measures include regular maintenance of plumbing and roof and guttering systems, and attention to site drainage and to underfloor ventilation.

Site drainage

It is important that water does not lie against the base of walls; surrounding paths and ground levels should be sloped so as to drain water away from walls. Make sure that downpipes don't disgorge stormwater onto lower walls or plinths. Stormwater should be carried well away by large, regularly cleaned drains. Ground levels may need to be lowered to expose a buried DPC. In cases where there is no DPC, lowering of ground levels may be needed to encourage drying of capillary moisture to occur at lower levels, thus limiting damage. This practice is extended in the technique known as air drains, a method for controlling damp by encouraging evaporation to occur at the lowest possible level.

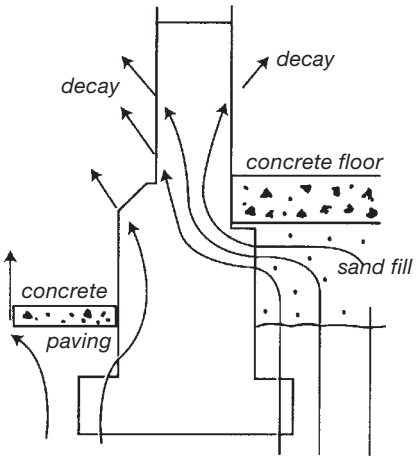
A word of caution here: where buildings are founded on reactive clay soils and subsoils, rearranging site drainage may upset a pre-existing balance and lead to structural cracking of walls. Often the correct treatment will be a compromise between controlling damp and controlling cracking. Geotechnical advice should be sought if clay soils are a problem.

Why concrete-on-fill floors can cause rising damp



Before

Well-ventilated underfloor space allows soil moisture to evaporate to the open air



After

Concrete slabs prevent evaporation, so soil moisture is forced up the wall

One of the worst mistakes of renovators is to remove a ventilated timber floor and replace it with a concrete slab poured on sand or fill.

Ventilation

Maintaining underfloor ventilation is an important part of controlling damp, as it allows soil moisture to evaporate beneath the floor and to pass out through the vents in the lower walls. Without this ventilation the moisture 'stress' on the walls would be much greater. One of the worst mistakes of renovators is to remove a ventilated timber floor and replace it with a concrete slab poured on sand or fill. The concrete prevents evaporation and all the soil moisture rising beneath the building is now focused on the walls. Rising damp problems are almost guaranteed, whereas before there may have been no significant damp, even though the walls may have lacked effective DPCs.

Sacrificial treatments

Sacrificial treatments can be useful ways of controlling mild damp. Particularly when coupled with the housekeeping measures of attention to ventilation and site drainage, they may limit the damp to such an extent that it becomes a manageable problem that can be lived with, without the need for expensive and invasive major works. In sacrificial treatments, deliberately weak mortars and renders are used to encourage any salt attack to decay the new mortar and render and not the original masonry. Formulation of appropriate mortar mixes requires expert advice. As they are designed to crumble, sacrificial mortars and renders need ongoing maintenance, and their decay products may be aesthetically unacceptable.

Insertion of a new DPC

In many severe cases of damp, the only effective solution is the insertion of a new DPC in the base of the walls. Provided this is done well, it can provide a permanent cure for rising damp, whereas the other treatments mentioned all involve ongoing maintenance. Even the permanent cure needs regular inspection to ensure that the efficacy of the new DPC is not being compromised by failure of guttering systems or bridging by build-up of garden soil.

New DPCs can be inserted by physical or chemical means.
The traditional physical means is the technique known as undersetting (not to be confused with underpinning, which is a treatment for cracking and footing failure). In undersetting, sections of the base of the wall are removed and progressively replaced with new materials and a DPC is inserted at the same time. This is the best method for eradicating severe damp associated with high salt concentrations (as commonly found in South Australia), because it disposes of any salt-laden masonry as well as inserting a new DPC. The disadvantage from a heritage conservation viewpoint is that it requires removal of original (and thus valuable) parts of the building.

Rising damp in brick and stone masonry. Note how the worst decay is at the base of the window opening. This is where most evaporation takes place and hence most decay due to salt attack.

Another physical method involves sawing a horizontal slot through the wall along a mortar joint, the insertion of a DPC membrane and the repacking of the joint. A system of grout-filled DPC envelopes is a neat version of this method, as it ensures tight packing of the joint. A shortcoming of any sawing technique is the inability to cut beneath an existing floor when working on internal walls. Thus, a line of damp bricks is left above floor level, which may lead to fungal rot in skirting boards and floor timbers. At the same time, the method has the advantage of reducing disruption to existing historic fabric. A potential disadvantage is that salt-laden masonry may be left in the wall above the new DPC. This salt can still cause decay due to its hygroscopic nature and changes in humidity, and should therefore be removed by clay poulticing or a sacrificial render treatment. Otherwise the method is best reserved for situations where salt concentrations are low.

Chemical treatments have become popular in recent years. They aim to create a chemical barrier in the wall by injecting water-repellent compounds into a series of pre-drilled holes along the base of the wall. Their advantage is minimal disruption, but, like the last physical method, any salts remaining in the wall above the new DPC must be dealt with. To be effective, the repellents must penetrate through the entire wall thickness. This may be difficult to ensure.

Old treatments

Over the years there have been many different treatments for rising damp, most of which have proved unsatisfactory. Some of the more common ones are: hard cement renders, damp-proof mortar additives, ceramic tubes inserted into walls as drying aids, and passive electro-osmotic damp proof systems. In the latter, copper strips were inserted into walls and simply earthed to the ground without the application of an active current. These methods should no longer be considered.

Over the years there have been many different treatments for rising damp, most of which have proved unsatisfactory.

FURTHER READING

Ashurst, J & Ashurst, N. 1988. *Practical building conservation*. English Heritage Technical Handbooks, 5 volumes, Gower Technical Press, Aldershot, Hants, UK. *Volume 1: Stone masonry. Volume 2: Brick, terracotta and earth.*

Graduate School of the Built Environment 1981. *Rising damp and salt attack: recent developments*. The University of New South Wales, Kensington.

Oliver, A.C. 1988. *Dampness in buildings*. BSP Professional books, Oxford.

Oxley, T.A. & Gobert, E.G. 1983. *Dampness in buildings: diagnosis, treatment, instruments.* 1989, revised reprint, Butterworths, London.

Torraca, G. 1998. *Porous building materials: materials science for architectural conservation.* 3rd edn, ICCROM, Rome.

Young, D.A. 1994. Rising damp and salt attack. *South Australia, Department of Environment and Natural Resources and the City of Adelaide. Heritage Conservation Technical Note.*

Text and drawings by David Young, Heritage Consultant, Canberra.

ISBN 1 876415 75 4
HO 04/06

NSW Heritage Office

March 1998, online edition 2004

Endorsed by the Heritage Council of NSW Technical Advisory Group