

Introduction

This guide aims to provide owners, consultants and contractors with sufficient information to understand what causes salt attack and rising damp (and also falling and penetrating damp) and to diagnose and identify appropriate repairs for cases commonly seen in Australia. While emphasis is given to buildings of heritage value, the principles apply to all older buildings.

Salt attack and rising damp are two separate but interrelated processes; both must be understood if damage is to be minimised and if corrective measures are to be successful. While the term rising damp has been commonly used to cover both aspects, it tends to overlook the role of salt, an issue that will become increasingly important as our buildings get older and as our soils become more saline.

Salt damp is a term widely used in South Australia to refer to high salt concentrations associated with rising damp. The term is quite apt, as it combines the two concepts of salt attack and rising damp. Though less an issue in some parts, the problem of high salt concentrations affects buildings across much of Australia, and so the term salt damp has begun to be used in other States. Salt damp is used throughout this guide to mean the combination of salt attack and rising damp.

This guide is divided into two parts: Part One (Sections 1–9) covers some background and provides an understanding of how salt attack and rising damp damage buildings, while Part Two (Sections 10–25) deals with diagnosis, maintenance and repair.

Those with insufficient time should at least read the next section (The Basics) which includes a summary of the Seven Key Steps needed to manage a salt damp problem. It also has some common Questions and Answers and important Dos and Don'ts.

Technical terms are explained in a glossary at the rear and there is a bibliography for further reading. Boxes containing illustrations or discussion of particular issues are distributed through the guide.

The approach recommended by this guide is to treat a salt damp problem as one requiring thorough understanding of the causes, as well as ongoing attention if it is to be managed successfully. Approaching salt damp as a simple question of which damp-proofing technique should be employed, is neither the right question, nor is it likely to lead to a good outcome. There are many buildings with mild cases of salt damp which need attention, but which do not warrant insertion of a damp-proof course (DPC), at least in the short to medium term. This guide outlines a structured approach to salt damp problems so that appropriate methods and level of repair can be identified. This often enables retention of original fabric to be maximised and therefore heritage value to be retained.



Figure 1 The dense bluestone base courses of this Melbourne building help reduce upward movement of moisture. Dense stones such as bluestones and granites are commonly seen as base courses around Australia.



Figure 2 Typical salt damp damage in Adelaide, with decay of the bricks extending from about 0.5 to 1.2 metres above ground. There are no obvious signs of salt because it has been washed off by rain. Paler (underfired) bricks are more susceptible to salt attack than the darker, more well-fired ones.

Rising damp is caused by capillary suction of the fine pores or voids that occur in all masonry materials. The capillaries draw water from the soils beneath a building against the force of gravity, leading to damp zones at the base of walls. Many traditional buildings were constructed on footings of dense stone which helped reduce the upward passage of water (Figure 1). In modern construction rising damp is prevented by the insertion of a damp-proof course (DPC) which is generally a 0.5 mm thick sheet of polyethylene (plastic). Because many nineteenth century buildings were constructed without DPCs and because some DPCs have failed, been bridged, or damaged, there are now common problems of dampness at the base of walls. In most cases that dampness will have salt associated with it.

Salt attack is the decay of masonry materials such as stone, brick and mortar by soluble salts forming crystals within the pores of the masonry. As the salt crystals grow the masonry is disrupted and decays by fretting and loss of surface skins. The salt commonly comes from the soils beneath and is carried up into walls by rising damp. When the dampness evaporates from the walls the salts are left behind, slowly accumulating to the point where there are sufficient to cause damage. Repeated wetting and drying with seasonal changes leads to the cyclic precipitation of salts and the progressive decay of the masonry.

One of the difficulties for the casual observer is that salts are not always apparent, and so their role is often not appreciated (Figure 2).

As well as the quality of building materials, and of construction and subsequent maintenance, climate and soil conditions are strong determinants of the severity of salt damp problems. Across Australia the wide range of climate and soil types leads to a great diversity in the degree and extent of salt damp. Adelaide is well known for its bad salt damp; this is because it has hot drying summers and very salty soils, whereas in Sydney the more humid climate and lower salt levels means the decay rates are slower. Age is another important factor; many buildings that have only a mild damp problem at present may, with time, accumulate sufficient salts to cause major decay.

Once salt concentrations are high enough to cause damage repairs will only be successful if they include treatment of both the damp and the salt.

The next three pages contain important information: some common Questions and Answers, a summary of the Seven Key Steps needed to manage a salt damp problem and some fundamental Dos and Don'ts.

2.1 Question and answers

Q My house has bad damp and there is salt bursting through the interior paintwork. Which of the damp-proofing treatments should I use?

A Wrong question. You first should make sure that the source of dampness is minimised and carry out other basic housekeeping measures. Work through the Seven Keys Steps to deal with the problem. Depending on the circumstances, you may need to use a combination of several methods. Be aware that many damp-proofing contractors specialise in one treatment method only, so seek independent advice.

► See the Seven Key Steps on the next page and also Part 2 of this guide.

Q Unlike the first enquiry, my house seems to have dampness in some places but no signs of salt. Does it need a damp-proofing treatment?

A Not necessarily. The problem may be eliminated or minimised to an acceptable degree by basic housekeeping measures, such as attention to plumbing and drainage. Check these first and make any repairs needed before considering damp-proofing.

► See Section 12: *Good housekeeping*

Q There is mould on the timber inside the built-in cupboard in the corner of the living room. What should I do?

A Mould is due to high humidity, the source of which should first be identified. If it's because of damp walls, the problem may be solved simply by ensuring that the existing underfloor ventilation is working properly. Clean out vent grilles and monitor air flow. More vents may be needed if changes to the house have blocked previous air passages.

► See Section 12.3: *Underfloor ventilation*.

Q Our school chapel has damp patches in the wood blocks of the parquet floor. Years ago there was some damp treatment to the walls at one end. Could they be related?

A Yes. When we inspected the outside we found that the ground had been built up over the damp-proof course, which was the reason for the previous (unnecessary) treatment. It is very likely that the underfloor spaces are too damp because of moisture penetrating through the walls from the built-up ground. Lower ground levels to expose the DPC, check underfloor ventilation and make sure all gutters, downpipes and drains work properly. Monitor for a year before making further changes.

► See Sections 11: *Diagnosis* and 12: *Good housekeeping*

Q I'm having split-system air conditioning installed in my old stone house and the contractor wants to put the external fan unit against the side wall. Could that be a problem?

A Yes, it could. As well as detracting from the aesthetic qualities of your house, the fan blowing warm air against the wall will encourage evaporation and focus salt damage on the area behind the unit. Site the fan unit, and the condensate drain, well away from valuable old walls.

► See Section 6: *Salt attack*.

Q We had our historic presbytery treated for damp with chemicals, yet the mortar is still eroding from between the bricks. Have the chemicals failed and should we have it done again?

A Not necessarily — the water-repellent zone formed by the chemicals may be working OK as a damp-proof course. The problem may be salts remaining in the walls above. Remove the salts and monitor before considering any further damp-proofing treatment.

► See Sections 6, 13, 14 and 16.3 and also Figure 43.

2.2 Seven Key Steps to dealing with salt damp

This is a summary of the Seven Key Steps to successfully dealing with salt damp. These steps are explained in detail in Part 2 of this guide beginning with Section 10: *Approach*.

1. Accurate diagnosis of the cause

- is it rising damp? or is it falling damp? or a combination? or
- is the damp penetrating sideways from a localised source, or
- is it condensation on internal surfaces?
- is there an existing DPC that is buried or otherwise bridged?
- how bad is the problem — does it really need major works?
- is there a lot of salt? what is its source?

2. Good housekeeping is fundamental

- ensure gutters and downpipes are working
- ensure rainwater is carried well away from base of walls
- ensure site is well drained — no ponding against walls
- minimise splash from hard pavements into walls
- maintain about 200 mm between DPCs and ground level
- check for and fix any plumbing leaks, including sewers
- check for fungal rot, borers and termites in damp floor timbers
- ensure adequate (but not too much) underfloor ventilation
- monitor changes, for these may be sufficient.

3. Treat mild damp sacrificially

- use weak mortars in eroding joints, or
- weak plasters and renders to control damage
- monitor changes before considering further treatment
- ongoing sacrificial treatments may be sufficient.

4. Remove excessive salts

- remove surface salt deposits by dry vacuuming, then
- use captive-head washing for near-surface salts
- use poultices of absorbent clay and/or paper pulp
- use sacrificial plasters, renders and mortars.
- monitor effectiveness — re-treat if necessary
- periodic maintenance treatments as required.

5. Review results before proceeding

- allow at least one year of monitoring
- account for unusual events — storms, floods, drought, etc
- routine maintenance activities may be sufficient.

6. Inserting damp-proof courses

- undersetting with mechanical DPC, and/or
- slot sawing with mechanical DPC, and/or
- impregnation of chemical DPC, and/or
- active electro-osmotic damp-proofing.
- install DPCs at a level that will also protect floor timbers
- monitor for 'leaks'.

7. Desalinating walls

- when salts abound, do not just insert DPC
- also remove excessive salts from above DPC
- use poulticing, captive-head washing and sacrificial treatments
- monitor annually for further salt attack
- re-treat if necessary until salts are reduced to a less harmful level.

2.3 The Dos & Don'ts of damp

Dos:

Do go out in the rain (the heavier the better) and check gutters and downpipes for blockages, leaks and overflows. Also check around the base of the building for water lying against walls. Fix leaks and make any improvements needed to site drainage.

Do check for the presence of a DPC — and ensure that it is continuous, and not 'bridged' by built up paving and garden beds.

Do remember that damp walls increase the risks of fungal rot and termite attack to floor timbers — always check beneath timber floors.

Do consider the possibility that your old building may have had previous treatments for rising damp, and that these may be obscuring the extent of the problem. Thorough investigation before commissioning works will be important to defining the nature, scope and likely costs of any repairs.

Do clean out existing air vents regularly — and monitor results before deciding to add new ones.

Do consider the possibility of salt attack decay into wall cavities — always inspect cavities for accumulation of debris (and corrosion of ties).

Do consider the implications of drying out the soils beneath your building. If it is founded on reactive (expansive) clay soils excessive drying could lead to structural cracking as a result of differential settlement. On reactive soils the challenge is to strike a balance between limiting cracking and minimising rising damp. The unhappy medium might be a bit of each.

Do get independent advice — that way there should be no pressure to use a particular product or system. Check your adviser's credentials.

Don'ts:

Don't use hard cement mortar to repoint failed lime mortar joints — that will just drive the damp further up the wall and may also damage the bricks.

Don't even think about sealing walls with water-repellent coatings.

Don't mulch your walls. Move garden beds away from the base of walls and remove irrigation to prevent spray and ponding against walls.

Don't dismiss the old tar and sand DPC — reduce the damp 'stress' on the walls, repair the DPC, use sacrificial mortars in the joints if necessary, and monitor results before considering an expensive new DPC.

Don't undertake insertion of any form of DPC until all the basic housekeeping measures have been completed and their effectiveness assessed over a period of time (at least a year).

Don't accept the cheapest quote for chemical dampcoursing without checking the contractor's references and the details of the proposed works such as drill hole spacing and depth, and how the contractor will determine when sufficient fluid has been impregnated.

Don't try to get away with using less chemicals and then locking in the inevitable damp with waterproof plasters — your client has read this too!