Fact Sheet

TECH15 03/2009

SLAB EDGE DAMPNESS SALT ATTACK

The Basics

Common building materials such as brick, concrete blocks, concrete and mortar are all permeable to some extent or other. Any permeable building material, if placed in contact with water, will draw water up by capillary action.

Capillary action is the tendency of water in a fine conduit to be drawn up above the surrounding water reservoir level by surface tension effects.

When capillary rise occurs in a closed tube, the water will rise to an equilibrium height and then stop. However, when it occurs in a permeable building material that is exposed to the air, the moisture is lost from the exposed parts through evaporation.

Apart from capillary flow, there is a second way in which building materials can transfer moisture and that is by vapour transport. Instead of flowing as a liquid, the water is carried as a vapour in the air in the material pores. This is a much slower process.

A second aspect of the problem is that water can carry dissolved salts, but water vapour cannot. Consequently, when capillary water evaporates, the salt is left behind either on the surface or in the pores of the material near to the surface.

The resultant build-up of salt in the pores and the expansion as it crystallises can eventually cause mechanical disruption of the building material that manifests as fretting and disintegration.

The severity of the effect varies with the type of salt. Sulphate salts are the most aggressive common salt.

The salt may originate in the building material itself. However, because there is only a finite amount in the material, salt from that source is usually not a problem except cosmetically such as in efflorescence deposits.

The most common source of the salt in significant cases of salt attack is from the soil in contact with the building material.

Whilst on the subject of soils, it should be appreciated that soils, depending on the type, may contain a lot of water.

Unfortunately, much of that water is tightly bound up in the soil. Nevertheless, that still leaves a lot that can be drawn up into porous building materials and structures made from them.

Generally speaking, damp and salt attack problems are more likely or more severe on clayey soil sites rather than free draining sand sites.

Based on what has been said so far, it should be clear that whenever any of our common building materials are placed in contact with the soil, there is the prospect that water will be drawn up into them together with whatever salts are dissolved in the water

The general nature of these problems has been recognised and understood for generations and various building practices have developed to overcome them.

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Definition of Terms

- **Rising Damp**
  Refers to the general problem of the capillary rise of moisture with or without salt. The term is most commonly used in connection with walls, but not exclusively so.
- **Salt Attack**
  Refers to fretting and disintegration caused by the build-up of salt in the building material that may be brick, mortar or concrete. Salt, particularly sulphate, can also chemically attack mortar, concrete and other cement based materials.
- **Slab Edge**
  Refers to the appearance of dampness with or without salt deposits.
- **Dampness**
  The top surface at the edge of a slab-on-ground or raft slab. The dampness can cause deterioration of walling, furnishings and floor finishes.
- **Slab Edge Salting**
  Refers to the accumulation of salt on the top surface at the edges of a slab-on-ground. The salt aggravates the effects of the accompanying dampness. The accumulation of salt can cause lifting of tiles, damage to the slab and floor fin¬ishes, as well as being a general nuisance. Parquetry and timber strip flooring is particularly sensitive to slab dampness.

In relation to walling, recognition of these problems has lead to the

following strategies to overcome them. A damp proof course (DPC) is installed to block the rise of moisture in the walling. In the distant past, a damp proof course was often just that, a course of very well baked and vitrified bricks – hence the name.

Now the DPC usually takes the form of a sheet membrane barrier built into a bed joint. Below the DPC, the bricks and mortar are exposed to salt and moisture from the soil and must have adequate resistance to salt attack.

Above the DPC, the brickwork is expected to be protected from that severe exposure and therefore can be of less resistant materials.

The DPC still serves to limit the rise of dampness and salt into the higher parts of the wall. Even if the bricks and mortar are resistant, the dampness and salt can be unsightly so it is desirable to limit the problem to the lower few courses by having an effective DPC.

Salt and dampness will usually impact upon applied finishes such as paint or render.

To be effective, the DPC must be continuous and must extend across the full width of the wall. This means it must extend right out to the face of the brickwork and if there is any applied finish, it must extend out to the face of that.

The common practice of setting the DPC membrane back from the face of the wall is definitely not satisfactory. A set back of as little as 5mm is more than enough to allow salt attack and damp to extend several courses above the DPC level.

We now turn to the slab edge dampness problem.

Two features of conventional construction help to prevent the rise of dampness in slab-on-ground construction. These are a polythene membrane and a layer of granular material placed under the slab.

The polythene is commonly described as a vapour barrier, but more importantly it also functions as a barrier to capillary rise of liquid water. It is not intended to be a waterproof tanking that will hold back hydrostatic water pressure.

This requirement is most conveniently achieved by providing direct concrete-to-concrete contact together with suitable reinforcement between the two elements. Consequently, it is not generally appropriate to continue the membrane through the joint between the footing beam and slab.

This has lead to the practice of stopping the membrane short at the inside edge of the footing beam.

The Residential Slabs and Footings Standard AS2870 – 1996 allows where justified by satisfactory local experience, a vapour barrier may be terminated at the internal face of external beams.

There are other factors that contribute to the risk of slab-edge-dampness.

Poor surface drainage and finishing of the footing beam with a lip at the edges can allow water to pond on the footing beam and gain access to the slab edge. The problem is particularly aggravated if the slab level is set too low on a flat site.

Slab edge damp and salting and salt damage are more likely with poor quality concrete.

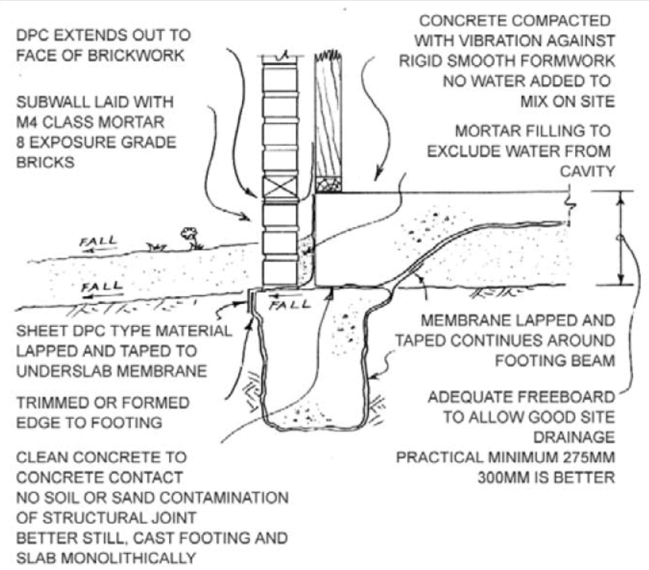
Good dense smooth formed surfaces with well compacted (read properly vibrated) concrete are more resistant than rough poorly compacted concrete that has been degraded by the addition of water to the mix on site.

In situations where the slab is fully enclosed by a membrane and not exposed to the weather, there is no indication that 20Mpa concrete is unsatisfactory in house slabs. However, where those conditions cannot be met, there is a case for increasing the specified strength to 25 or even 32Mpa in order to obtain a higher cement content and hence, higher durability.

Identification of Sites Posing Risk of Damp and Salt Attack

Ordinary site investigations for residential footing design purposes do not test the salt content of the soils. Tests to determine the content of various salt types can be carried out. The local authority will hold a register of acid sulfate areas.

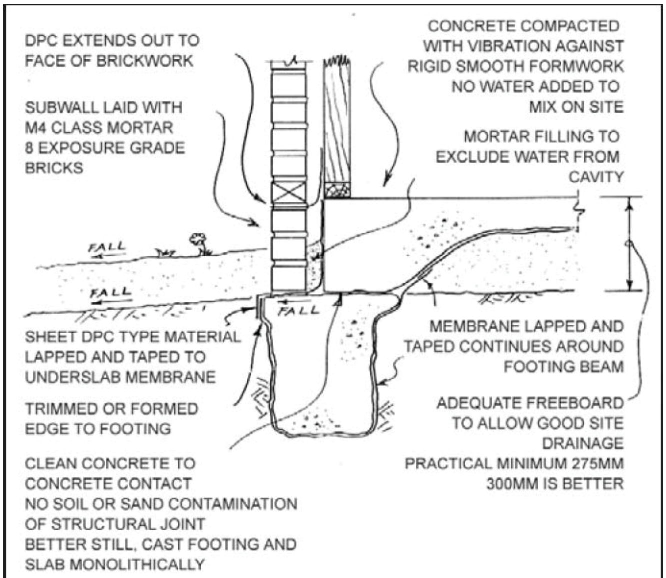
Salty sites can occur in coastal areas and canal estates but also in inland areas where soil salinity is a problem due to rising water tables caused by land clearing and agricultural practices.



Typical Slab Edge Detail

Apects of Good Practice

in Respect to Damp and Salt Attack



Typical Slab Edge Detail

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FIGURE 2

Building Practices

The first line of defence against damp and salt attack problems is to adopt proper building practices. If that were done it would overcome most of the problems or else reduce them to insignificance.

Some important requirements that are often overlooked in relation to masonry are:

- AS 3700 requires that masonry below damp proof course or in contact with aggressive soils must be laid using exposure grade masonry units and an M4 class of mortar (ie 1 : 0.5 : 4.5 cement : lime : sand or equal). Refer to Masonry Structures Standard AS3700 for full details.
- Masonry in severe marine environments (ie up to 100m from a non-surf coast and up to 1km from a surf coast) must be laid with exposure grade masonry units and an M4 class mortar.
- Masonry above DPC level subject to non-saline wetting and drying must be laid with a Class M3 or better (ie 1 : 1 : 6 Portland cement : lime : sand or equivalent, refer to AS3700 for full details)
- Lime is an important component in mortar mixes. It significantly improves durability as well as facilitating autogenous healing of fine cracks.
- Ironed joints improve durability over raked joints due to the compaction of the mortar and the better shedding of water.

In relation to slab edge dampness, consideration should be given to the following points:

- The underslab membrane should totally envelope the slab and edge beams unless the site is known to present a low hazard of dampness or salt attack problems.
- On sites of known hazard from dampness or aggressive salt conditions, consideration should be given to using higher grades of concrete to obtain better durability and less permeable concrete. Alternatively, a higher grade of concrete could be used in the exposed parts of the slab such as the garage door threshold.
- Ensure that there is no opportunity for ponding of water on buried surfaces associated with the slab edge such as the surface of the footing beam and the surface of the building platform before placement of top soil etc. Correcting the unsatisfactory surface falls by placing permeable fill may only make the problem worse.
- Set the slab at an appropriate height to allow proper surface falls away from the building. This is particularly critical on low-lying level sites where there is very little that can be done to correct the

situation if the slab is set too low.

- Do not degrade the concrete by adding water to the mix on site.
- Compact the concrete in the footing beams and in the slab by using vibrators.
- Cure the slab.
- Prevent the possibility of water accumulating in the subwall cavity by filling the cavity with sound mortar or concrete.

Figure 1 *– Shows some typical slab edge detail practices that are prone to problems*

Figure 2 *– Shows how modified details offering much greater protection*