RISING DAMP IN GHANAIAN BUILDINGS: AN ISSUE WORTH ADDRESSING

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Introduction

Buildings, being composites of different materials and forms of construction, perform different functions. All old and modern types of construction are prone to natural and man-made mechanisms of deterioration. Research has shown that of all the defects associated with buildings, moisture is the most frequent and dangerous, and it contributes more than 50% of all known building failures. When moisture, which should not be present in a building, finds its way into that building, dampness is said to be present. Dampness, one of the most serious structural problems in walls of buildings occurs when structural elements are wetted through the action of moisture.

For several years, the problem of dampness has assumed alarming dimensions in many public and private buildings in Ghana. This problem is normally associated with symptoms such as hygroscopic salts or surface efflorescence, decayed skirting, mold growth, etc. Dampness, if left unattended, will create adverse health effects to the occupants of buildings.

What is dampness?

For several years now much attention have been paid to the investigation of dampness in all sort of buildings. Dampness occurs when water penetrates the walls and certain elements of buildings. Dampness is therefore an excessive moisture contained within building materials and components. It is associated with several

physical, chemical and health effects. Among the physical effects are timber rot, water staining, cyclic wetting/drying and electricity made unsafe. The chemical effects include surface efflorescence on walls, corrosion of ferrous metals, chemical attacks and loss of cohesion between steel and concrete. Health effects associated with dampness include mold and fungal growth on walls of buildings, skin diseases such as eczema, asthma, lung cancer, among others.

Sources of dampness in buildings

The sources that create dampness in buildings can be grouped into geological, climatic conditions and structural causes. Under the geological and climatic conditions, the sources of dampness include rain penetration, ground moisture rise, condensation in buildings due to moisture in the atmosphere, drainage of the site and orientation of the buildings. The structural sources of dampness include water used during construction and defective construction. Other researchers have classified the sources of dampness to include rising dampness, penetrating dampness, condensation and pipe leakages(Burkinshaw and Parrett, 2004; Hollis, 2000). Studies have shown that of all the sources of dampness, rising damp is the commonest in buildings around the world and plays a major role in the decay of all masonry buildings.

What is rising damp?

It is the most frequently encountered cause of damage to masonry walls. It results from the capillary flow of moisture from the ground. When ground water reaches the foot of a wall, it tends to rise in the walling material. It continues to rise in the walls due to capillary action to varying degrees of intensity.

A number of published articles have been dedicated to defining the phenomenon of rising damp in addition to the provision of an in-depth understanding of the mechanisms involved. Rising damp results from the capillary flow of water from the ground (Oxley and Gobert, 2011). Melville and Gordon (1998) described rising damp as 'ground water that reaches the foot of a wall and which tends to rise in the walling material and continues to do so due to capillary action, to varying degrees of intensity'. Burkinshaw and Parrett (2004) defined rising damp more comprehensively as 'moisture that travels upwards through the pore structure or through small fissures or cracks, or as water vapour against the forces of gravity, typically up a wall or through a floor from a source below the ground'. Trotman et al. (2004) defined rising damp as 'the upward transfer of moisture in a porous material due to capillary action'. Alfano et al. (2006) also defined rising damp as 'the upward vertical flow of water through a permeable wall structure'. In the British Research Establishment (BRE) Digest (2007), the issue of rising damp was not defined but it was demonstrated as walls that stand in water or saturated soils. This infers that a low level penetration damp could also be rising damp. In summary, rising damp can be defined as water that rises in porous masonry materials by capillary action and which has the potential to cause extensive decay in those materials because of the chemical constituents of the transported water.

The mechanism of rising damp

Majority of construction materials are porous. Because they are embedded in, or in contact with the ground, they will encourage the migration of water from the ground by capillary action.

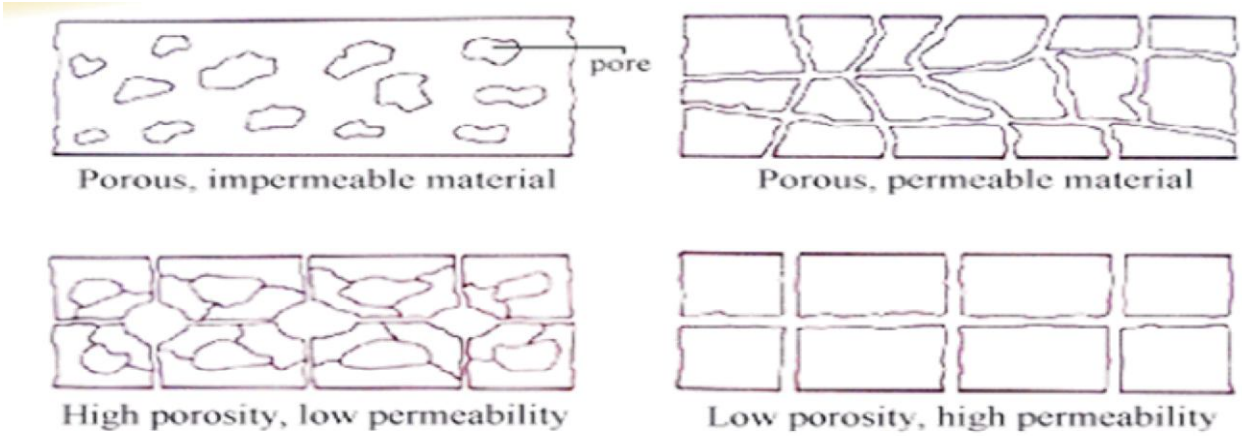


FIGURE 1.0: Flow of moisture in building materials (Source: Riley and Cotgrave, 2005)

For water to rise up in a wall, a supply must be available at the base of the wall. If the ground surrounding the wall is saturated, this condition is achieved. However if the ground is not saturated, the soil will exert a suction that will oppose the upward capillary pull on the water in the wall. If the water table of the surrounding area falls, the height of the moisture in the wall will drop to a new level provided there is sufficient time for equilibrium to become established. Each period of heavy rain on the ground at the base of the wall will produce a temporary condition of saturation and the water level in the wall will begin to rise again. The Extent to which a wall is affected by rising damp differs and it is dependent on:

1. The level of moisture in the ground;
2. The features of the wall enabling or restricting evaporation from its surface;
3. The porosity of the material; and
4. The chemical composition of the migrating water.

How does rising damp damage buildings?

In masonry that is affected by rising damp, moisture is continuously transported upward through the capillaries. After a given period of time when the moisture reaches the surface of the wall, it evaporates and more moisture follows. This process leads to an increase in the concentration of salts on the surface of the building. When this happens, most of the evaporation takes place in the area between the dry (top) and the damp (bottom) part of the wall

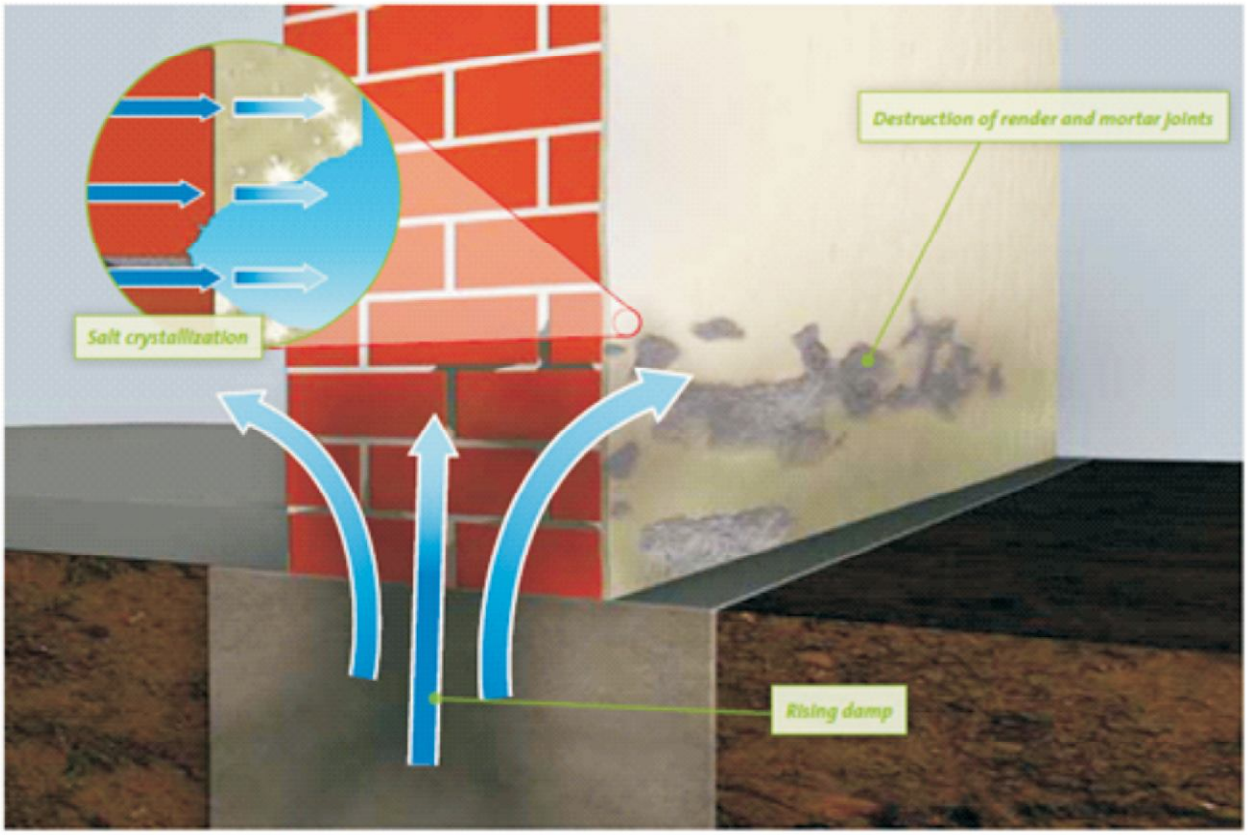


FIGURE 2.0: Evaporation takes place between the top and bottom part of the wall
(Source: Koster Waterproofing Systems, n.d)

Symptoms associated with rising damp

Rising damp in buildings is associated with several symptoms. It may show as a high-tide-like stain on wall paper and other interior finishes, and, when it is severe, as blistering of paint and loss of plaster. Damp walls encourage the growth of mould which in conjunction with high humidity, can lead to health problems among occupants

FIGURE 3.0: Symptoms associated with rising dampness

Salts in Masonry materials

Rising damp cannot be mentioned without making mention of salts. Salts in buildings are either present in the masonry during construction or are absorbed from the atmosphere or ground water during the life of the building. Salt deposits in buildings are usually associated with efflorescence. Efflorescence is a deposit of soluble salts which usually appears as fine, white crystalline powder on the surface of masonry as the internal water evaporates.

How does salt cause deterioration in buildings?

The water transported into and through a wall contains salt. These salts can have different sources. The salts can be dissolved in ground water or ground moisture and can then be transported with the ground water into the wall. Salts can also be present in the building materials and can be dissolved by the risen water in the masonry.

Before deterioration occurs in buildings, water with salt in solution travels in porous materials through capillary flow to the surface where evaporation occurs. Salt is left behind as water evaporates. The process leads to an ever-increasing concentration of salts as evaporation continues. Water then rushes to dilute the concentration of salt leading to potentially huge hydrostatic pressures. When this happens the surface breaks apart and flakes when the hydrostatic pressure due to osmosis exceeds the cohesive strength of the material under attack.

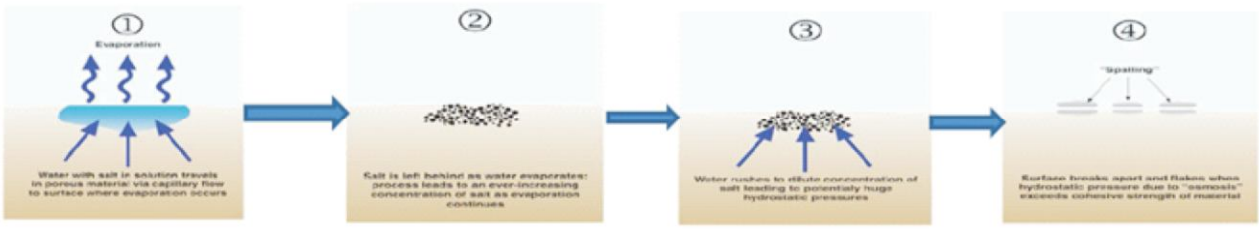
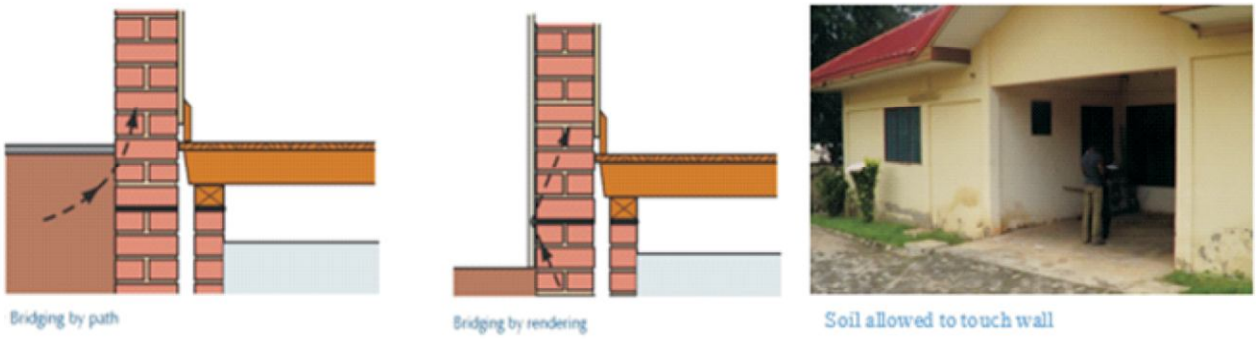


FIGURE 4.0: Processes involved in the deterioration of buildings (Lstiburek, 2014)

Causes of rising damp in buildings

Rising damp is mainly caused by bridging of existing damp proof courses and membranes installed in buildings. Bridging is caused when water by-passes damp proof courses which are installed in buildings. The most common form of bridging is:

1. When the ground level outside a solid wall becomes higher than the installed damp proof course;
2. Internal plastering and external rendering extending down over the damp proof course line;
3.
4. If soil or paths are allowed to touch the wall above the level of the damp proof course leading to the intrusion of groundwater into the walls of the building.



1.FIGURE 5.0: Bridging of damp proof courses

The problem of rising damp in Ghana

In a tropical region like Ghana characterized by high rainfall with relatively high and even temperatures, rising damp is a very common problem among many public and private buildings. Studies carried out in Ghana have shown that rising dampness has assumed an alarming dimension in many buildings. This is because one out of every ten buildings is affected by the problem, some of which are visible. Generally, the level of awareness of the problem among building occupants and construction professionals in Ghana is very high. This has led to the adoption of various methods such as tiling of wall bases, replastering, among others to control the problem. The significance of the problem is also reflected by the diversity of the products on the market. Owing to the scarce scientific information on the effectiveness of such methods, it has become very difficult for professionals working in the field to choose suitable intervention on sound basis. This issue has left the general public in Ghana in a state of shock as the problem of dampness keeps escalating with no sure ways to control it.

FIGURE 6.0: Ways in which rising damp is controlled in Ghana

Conclusion

The issue of rising damp is still an open area and researchers are called upon to conduct in-depth studies in this area. An open challenge is thrown to all stakeholders to come together to find a lasting solution to this problem. This is because unless more surveyors, engineers and architects learn how to diagnose and find suitable remedies to control the problem of rising dampness in buildings, contractors, masons, foremen, etc. out there in the industry will remain the actual source of advice to such problems. If this continues, the problem might get out of hands and its associated effects might increase.