The effect of indoor environments on objects and building interiors

Part 1 – degradation of objects and building interiors

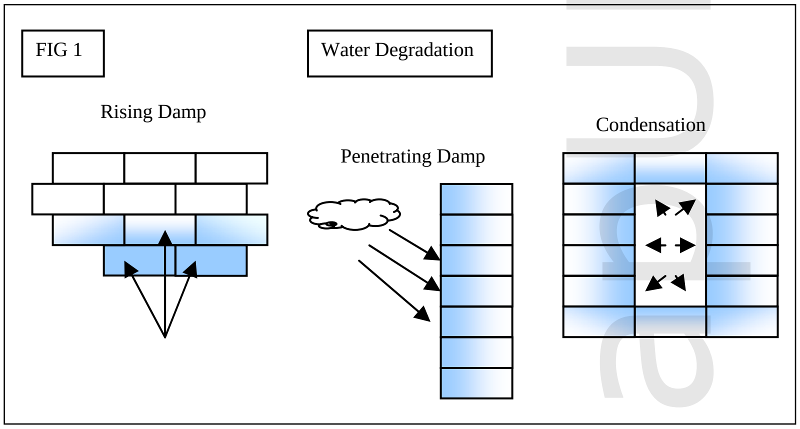
As with all conservation the key to the longevity of an objects life is in the early detection of problems and appropriate action. This goes for both indoor and outside environments as both can suffer greatly from the sometimes devastating effect of climatic or environmental change.

One of the most devastating environmental problems for objects within buildings is that of relative humidity (RH). RH simply is the evaporated water within the air, measured on a percentage scale it ranges from 1-100% these values represent the amount of water the air can hold without it condensing (e.g. RH 50% = half of all water air can hold). Normally in the environment it would cause few problems but when confined, objects within or the building itself can suffer. Organic objects are the most easily affected and can react in many different ways, cracking; staining, biological growths (e.g. algae's), corrosion and structural disintegration could all be caused by it (Gilroy & Godfrey 1998). The only protection against this is to lower the RH to a sustainable level and keep it as near to this as possible all the time, if done the objects and the building itself will stabilise and less damage will occur. The recommended range for indoor environments is between 50-65% as this is low enough to stop 'dampness' but high enough to be sustainable for a prolonged period of time (National Trust). Keeping this humidity stable requires constant monitoring and minute changes in heating to compensate for the natural changes in temperature and moisture. If areas have to higher RH de-humidifiers could be used, these though are expensive and often ineffective for larger rooms.

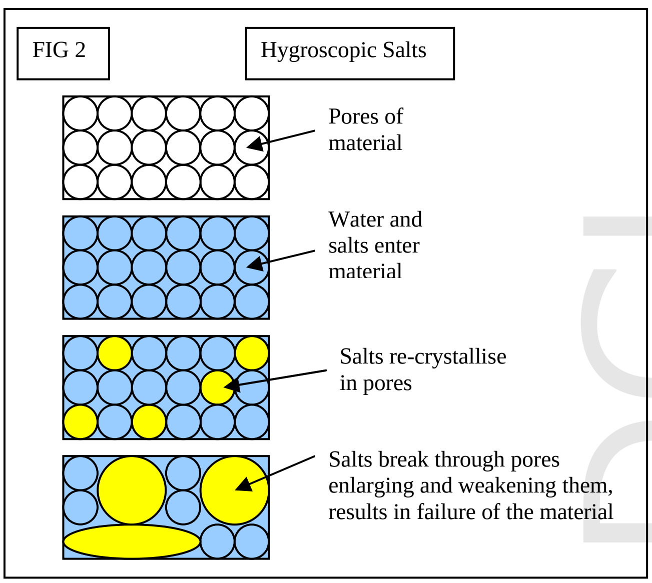
Temperature can also cause problems in buildings, thermal expansion occurs when materials absorb heat direct from the suns radiation this can cause rapid expansion or contraction. The amount of overall damage that is done depends largely on the objects elasticity, restraint, moisture content and its general capacity to 'creep' (Fielden 2003). Wooden object and fabrics tend to show less damage from this process than brick, stone, plaster and masonry which will show cracking and splitting as they move through three stages of damage. The first damage is to a part of an item or wall, this then affects the stability of a larger area which then can cause the whole object to crack, break or move, often in an irreparable manner (Fielden 2003).

Solar radiation though can also cause fading, embrittlement and loss of structure within objects. The only control is to limit the amount of light falling on the object and possibly the use of ultra violet restrictive glazing. Light levels between 50 and 150 lux are generally suitable for light sensitive objects, this is normally maintained using curtains or blinds which can be altered at different times of the day to account for any changes (National Trust). Moisture and dampness within buildings can come from many sources (fig1), often it is due to poor maintenance of the outside that can transmit the problems indoors. Visible drips, damp patches, bowing of plaster, wet rot, pests and insects, hygroscopic salts and corrosion are just some of the possible indicators of a damp environment. Damp only damages the materials through expansion and their becoming wet this can do some damage but its effects are minimal, its damps ability

to speed up almost every kind of physical and biological degradation that makes it such a large problem. As with RH regular monitoring is required to stop dampness not only inside but also on the outside of a building. One badly positioned birds nest blocking a gutter or a simple cracked tile could cause thousands of pounds of damage inside. If tiles, gutters, windows, doors and chimneys are checked regularly the problems could be prevented before they occur. Hygroscopic salts (fig2) though are often harder to remove, these salts enter the wall when in 'solution' (dissolved in water) and then precipitate out. This can then leave many layers of thick encrustation on the brick or stonework. Some salts are easy to remove and do little damage such as sodium (Fielden 2003) but salts of potassium, magnesium and calcium can cause disintegration, failure of cohesion or hard crusts in walls. In turn these can then destroy plaster, wall paper, paint and speed up corrosion in metal objects (Weaver 1993).



Another problem occurring especially in regularly open buildings with many visitors is the damage caused by particulate matter in the air, this comes from almost all living and non-living things and apart from creating glass cabinets or installing air-conditioning filters little can be done. The most damaging particulate is soot from fuels, cigarette smoke, fires etc: as this will stick to surfaces leaving a dark residue requiring expensive cleaning. But sand, dust and other small fragments can be 'wafted' creating gentle abrasive effects which over time can degrade delicate objects. Biological pests have as much impact inside as they do out, especially when combined with a damp environment, rodents, insects, fungi, and beetles all cause their own forms of degradation from simple droppings to the now notorious dry rot. The only real way to combat these problems is to treat surfaces against them, kill them or put them off with a strictly controlled environmental regime.



But degradation can also occur from human causes as well, the hurried moving of a table could scratch a floor, high healed shoes can damage rugs and carpets, even the over cleaning of an object can remove delicate paint work, the list is quite possibly endless.

Degradation comes from many sources, in all places, in every environment, there is no escaping it. What can be done though is to limit its effect on the human environment, our treasured artefacts and buildings. This should be done by the controlling of the environment and the upkeep of buildings themselves, but also the general education of people into the damage that can be done by such simple means as over cleaning and placement within a room. By doing this degradation will not be stopped but hopefully some of its harmful effects can be limited and our heritage preserved for a while longer.

Part 2 – Elvaston Castle (full photographic record provided at end)

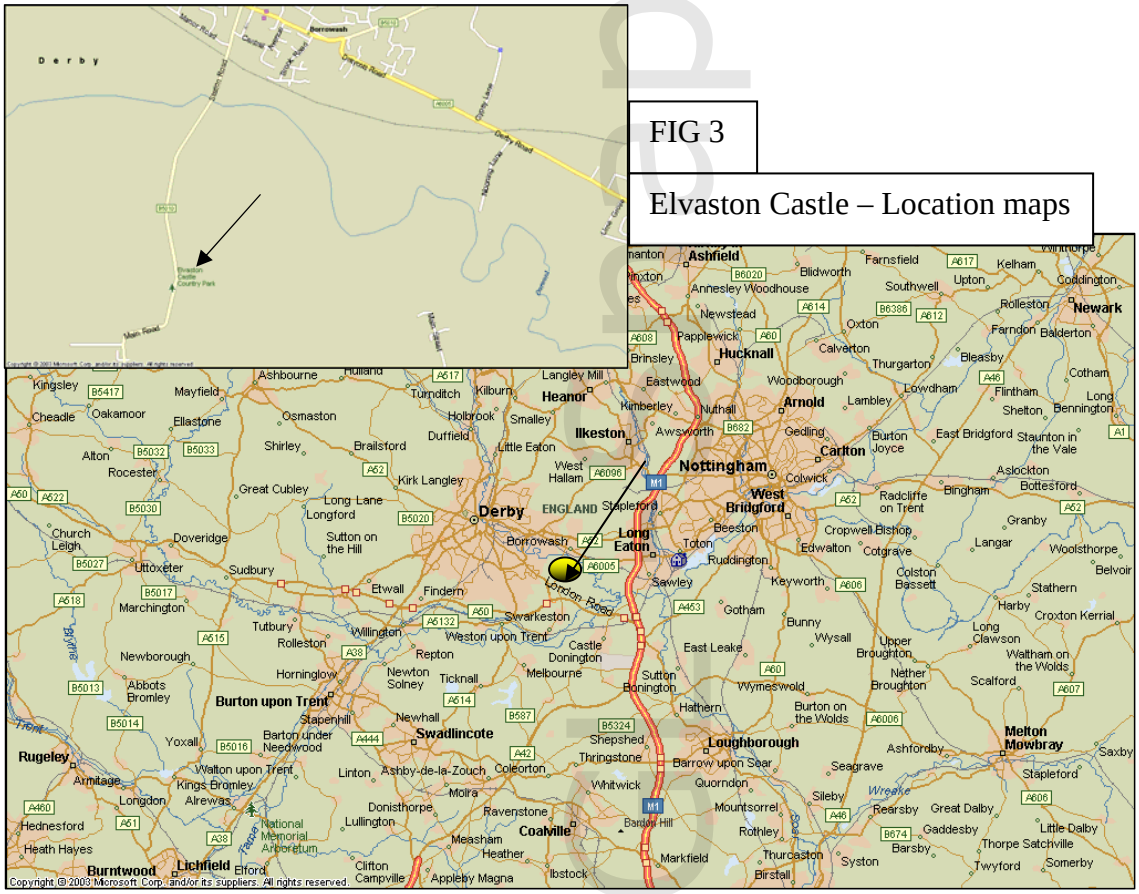


FIG 3

Elvaston Castle – Location maps

Elvaston Castle is a ninth century manor house situated around 7 miles from Derby (fig 3), extensively remodelled in the nineteenth century it now resembles a classical style castle. Once famous for its extensive gardens it now falls into a state of extreme degradation along with much of its former estate. The internal building is largely made up of brick structure, but extensive wooden joisting can be seen within the roof spaces (fig4) which now suffers from the effects of dry rot (personal communication). Very little of the original decoration still exists due to a 1940s conversion into a teacher training school and later a museum, but where it has survived such as Lord Stanhope's Dressing room (fig 5) the long term effects of neglect are being seen. This problem occurs throughout the building in

Fig 4

Fig 5

all the areas not regularly seen by visitors, the cost of the renovation and time needed for maintenance has bewildered the local council into doing practically nothing at all.

Fig 6

Water damage is one of the most prominent problems occurring throughout the building, Fig 6 shows just how bad some areas have become. These pictures are just one example of the many seen and possibly not the worst, they show Lady Stanhope's Dressing room with a huge drip coming from the ceiling, and when looked at closely plaster and wall masonry damage can also be identified. To put the problem in context the water in the metal bath placed under the drip was from just 2 days of scattered showers, as can be seen the problem is much worse than just some surface damage. Many examples of wallpaper coming off, plaster cracking, wattle and daub destruction, rotting timber, and salts (fig 7) can be seen wherever you look in almost every room and when asked about how they are combating this (personal communication) the simple answer was "we're not, there's no money".

Fig 7

The amount of damage from water though was even more extensive than I had expected considering the outside of the property is largely intact, I found out that at some period (possibly during the 1940's renovation) water storage tanks had been installed in the roof space (fig 8) these then at some point have overflowed and saturated much of the wood, and plaster around it, combined with a high RH due to no real heating, overflowing drainpipes and leaky roofing it has been disastrous.

Fig 8

The effect of insects and infestations is actually not seen although I have been informed that cases have been known, it may be that due to greater water damage all evidence has been removed. One room though has given clues to the causes of the many 'salt' and dirt deposits visible on most of the surfaces (fig 9). The sign in the picture reads

Fig 9

"Derby bat conservation group - this room is used as a bat roost, please do not enter unless necessary…." As with many animals bats faeces is a good possible cause of degradation, chemicals which it contains are harmful to the delicate plasterwork and wall papers in the rooms. They also create large areas of powder like residue which stick to many of the exposed surfaces and slowly penetrate the old worn brickwork. Unfortunately due to the bat

protection scheme even if the damage is extreme the bats cannot be removed and methods of controlling them are highly limited.

Little evidence can be seen within the house of light damage except for in the orchid room (fig 10), here the large ‘green house’ style roof lets vast quantities in originally for the growing of rare plants, fruits and flowers. Here apart from the salt and water damage, bleaching and structural disintegration to the original wooden flooring can be seen. Also the loss of paint is visible on the central pole, iron work and wooden hand rails. In some places on the glass roof and glass floor panels a slight crizzling effect can be seen, this will be caused by the UV radiation and rapid changes in temperature that this room will endure. To stop this effect a UV repellent shielding could be put on the windows, this would be a cheap method of control and should limit light damage to the remaining materials.

Fig 10

On the central staircase of the building a cast iron painted handrail support (fig 11) can be seen, if looked at carefully corrosion can now be seen in the corners where it joins the wall, the only possible reasons that this could have occurred is if the wall is wet or containing a corrosive chemical. With the other evidence around the building the dampness would be the obvious cause.

Fig 11

Vandalism to the outside of the building is extensive and unfortunately the windows tend to suffer, in the Lords dressing room (fig 5) one of the only original stained glass windows has been vandalised (fig 12) and due to its age and the cost of renovation its replacement is not an option.

Fig 12

Luckily for the owners though most of the damage internally is only cosmetic, with care and money restoration at present would be possible. If left any longer though more wet rot, dry rot, and loss of structural strength and adhesion could make this impossible. Already structural joists are being put in to hold the building together (fig 13). This extensive damage though could have all been avoided with some simple maintenance and constant monitoring and adaptation of conservation strategies. Through neglect over a period of 60+ years

the castle and estate as a whole has gone from being one of the grandest in the UK to a bedraggled remnants of its former glory. The only possible hope for the castle in the future is to be purchased by an owner who will care for the building in the way it deserves and have a vision of its long term future, a process underway at this moment.

Fig 13

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Note: ALL photographs and diagrams by Author

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