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A practical comment on condensation

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Donald Balmer, *a surveyor based in West Bromwich, West Midlands, has much experience of the problem of condensation. He submitted this contribution in response to the paper 'Thermal upgrading, condensation and mould growth at a "no fines" estate' by Brian Hanway, which was published in* Structural Survey *Vol. 7 No. 1 (1988)*

To summarise my conclusions:

(1) The proper remedy for condensation is ventilation.
(2) In addition, heat may retard the formation of mould growth.
(3) Additional insulation of the exterior of buildings may not be cost-effective.
(4) More information must be given by authoritative sources if any of the above are to be accepted by occupiers.

Brian Hanway's excellent paper in *Structural Survey* gave much-needed technical information, backed by scientific tests.

One of the conclusions was 'that external insulation has to some extent succeeded in increasing internal wall temperatures . . . however, a significant number of dwellings still suffer . . . with insufficient and highly intermittent heating, wall temperatures will stay low'.

The survey was carried out on 'no fines' construction, but is it not reasonable to assume that the same conclusion would be drawn in the case of additional insulation added to solid brick walls?

If one applies my old geography master's teachings: 'air warms, air rises, air cools, air rains', it is safe to assume that, as the air is warmed by heat from within or as a result of additional insulation, the air will absorb more moisture and hold it in suspense until the warming source ceases, when moisture will condense on the colder surfaces.

Would not the occupiers of accommodation so warmed be breathing moisture-laden humid air and be more subject to a health hazard, compared with those breathing a less humid atmosphere?

Old-fashioned Fahrenheit thermometers used to show 'sick room temperature' as 60° F/15.5°C. I wonder whether those advocating increased heat should advocate a Government health warning where there is insufficient ventilation. When did one ever see recommendations for more ventilation in double-glazing advertisements?

If an occupier returns from work at say 6 pm and a cold room is then heated until 11.30 pm, the scenario is perfect for the air to warm and rise. The heat will draw moisture out of the wall plaster and wall and ceiling paper. When the heat is turned off, the wall and ceiling surfaces will cool. The air, having accepted the additional moisture from the breath of the occupant — 30 grammes per hour, per person, has been quoted — will also cool and thereafter no longer hold the moisture in suspense. The moisture will be deposited on to these cooler surfaces and the cycle will start again when the heat is turned on.

If the walls are gloss painted, the moisture will not be drawn from the plaster as the plaster will be sealed but, given the same circumstances, this condensation on to the surface will be greater. The water will run down the wall and be absorbed by the skirting boards, floor or carpet.

When the air is slow-moving in the corners of rooms, which are high heat-flow areas as Mr Hanway points out, there may be a lower heat penetration, as well as additional heat loss.

On walls behind cupboards, or sometimes behind beds, or behind working surfaces on outer walls in the kitchen, mould growth can often be found, especially if the doors of the rooms are not opened and closed frequently.

In some cases the mould will be found on clothes in wardrobes; in these cases there will have been no movement of air at all.

It is reasonable to suppose the underfloor heating or night storage heating will give a lower period of heat than do radiators switched on and off when residents return from work. This means that the fabric will be warmer, having soaked up the heat, and will lose heat during the day, but as the fabric is being kept at a certain level of heat, it is less likely that mould growth will form on these warmer surfaces.

In the early 1950s after building controls were lifted, I remember that houses were built without air bricks, because it was said that it had been realised that windows never had an air-tight fit and that there would always be plenty of ventilation to the room. What had not been appreciated, I suspect, was that houses or flats were then being built without open fire places and therefore that chimney flues were omitted. This must have had the greatest single effect upon the creation of condensation. Occupants fitted foam draught excluders to doors and windows and underdraught fires, in the case of coal burning fires, were the rage; with the addition of wall-to-wall carpeting, air could not come under the doors. The air changes per house were automatically reduced in frequency and condensation problems became the norm.

If there is provision for frequent air changes, the humid atmosphere within the room will cease. I have heard it said that, when it is raining, the air outside will be drier than the moisture within the building. By trial and error I have found, at any rate to my own satisfaction, that one or even two opening fans at the top of a window are not enough to dry out a room once condensation conditions exist. One must open a window — one small fan encasement will be enough — plus a door and the same in an adjoining room, so that air can circulate through these two rooms. This will clear the air and dry out the room between three days and a week or so and it will nearly always work under any conditions and in whichever direction the wind. It is not necessary to use dehumidifiers.

The smaller the room, the worse the condensation will be, given the same amount of extra moisture. Thus in poorer and older dwellings which are likely to be occupied by people on low incomes, one is more likely to find hand washing and drying of clothes, which are often boiled on the stove. Washing machines may not be permanently plumbed in, so that there is water spillage and, if tumble driers are not vented through the wall, the conditions exist for excessive condensation. The oft-suggested remedy of a mechanical fan will simply not be enough; two-room draught ventilation is the only really successful remedy.

The same principles apply where foods are boiled for fairly long periods, but perhaps the advent of microwave ovens and convenience foods will mean that kitchens will become drier places in future.

In the case of houses, there may well be enough ventilation if one or two windows plus a door are left open in a first-floor room. The difference in levels with warm air rising from below will be sufficient, but the drying and clearing process will be far faster if another window and door of a ground-floor room connecting to the first floor, via the hall, are left open. Sash windows appear to give the best ventilation; an opening of 3/8 in at the top and bottom at all times is enough to keep an average bedroom ventilated and, if the walls have been warmed up, loss of heat through these small gaps is not noticeable — but try telling some people that!

If, once a flat has been dried out, top opening fans are left open to give a 3/8 in to 1/2 in gap along the bottom rail, by reasonably thoughtful use of the principle of opening two doors and two windows in

two rooms from time-to-time, ventilation will be adequate and no heat or extra heat will be required.

I have occasionally found that a flat or house will be so designed that air simply cannot be made to move in certain parts — even Heineken has failed! In these circumstances air bricks at high and low levels would have to be provided to the outer walls. A third air brick into another room will be the next experiment in these very rare cases where two air bricks fail.

A few years ago, if tenants of flats which had been built a few years earlier complained of condensation, some local authorities used to serve Public Health Act notices upon landlords to fix insulation boards on to the walls. After discussions, arrangements were sometimes made to provide air bricks instead. Of late, the environmental departments of the same authorities appear to be advising complainants that more ventilation is required. I fancy that the message is gradually being received, but a great deal more effort is required.

So often, one is met with the following after giving appropriate advice:

'What?' will be the cry, 'After I have paid for heat? You must be joking!' or
'Who's going to pay for the heat?'

OR this kind of dialogue takes place:

'Do you leave your window open?'
'Yes, always'
'What about at night in the bedroom?'
'Oh no, I close them. Do you expect me to freeze?'

Or alternatively,

'I always leave my window open' — One can return again and again to look at the flat from the outside. The windows will always be closed.

Is it a mental block or is it lack of knowledge? I do not know.

One must be very careful not to offend when trying to explain. One is, after all, pointing out that the occupier's domestic arrangements are at fault. A most personal part of an individual's existence is being questioned. Tact will be called for, but it is not enough. Many people will not accept the opinions of one adviser.

Papers such as Mr Hanway's are required to present evidence based upon research. It is hoped that such gems will be absorbed by all who have dealings with the problem; then perhaps commonsense can be incorporated into the advice given by local authorities and into discussions or interviews in the press and broadcasting.

Fort George rehabilitation — Case study on timber strengthening

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Summary

Fort George is a 200-year-old ancient monument and category 'A' listed building situated on a peninsula on the southern coast of the Moray Firth 14 miles east of Inverness, Scotland. Used by the Ministry of Defence as a barracks, it has recently been upgraded to provide facilities to suit the current requirements of the army.

This has involved major refurbishment works to most of the principal buildings within the fort ramparts.

In view of the requirements of the client to retain as much of the existing timber structure as possible, it was decided to review in detail the state of the art of strengthening aged timber structures.

In assessing the requirements for treating and strengthening the timber members, the following were considered:

- preservation and infestation treatment;
- consolidation of the existing structural timber elements which exhibited complex splits and shakes, by reforming the homogeneous section;
- strengthening by improving the load-bearing capacity of the existing structural timber elements;
- replacement of rotted beam and rafter ends.

Although many of the specialist proprietory systems were recognised as effective and economic solutions for this work, the novel strengthening details which were finally adopted utilised traditional materials and mechanical fixings which could be easily installed using conventional local skilled labour and avoid the import of specialist sub-contractors.

Epoxy resin was used extensively, both as a void filler and as a structural medium.

Introduction

Fort George, constructed between 1748 and 1769, is regarded as one of the best preserved artillery fortifications in Europe, and has the rare distinction of being an outstanding example of military architecture (Photo A).

The Fort, which is located 14 miles east of Inverness, is an ancient monument and category 'A' listed building.

Until recently, the Fort has at various times served as an Army barracks, and in 1964, it was opened to the public as an ancient monument. As such, the responsibility for the maintenance and preservation of Fort George is that of the Historic Buildings and Monuments Directorate (HBM), of the Scottish Development Department.

In the wake of the Army's forward Planning Programme in 1971, the Ministry of Defence (MoD) decided to re-establish the fort as a modern barracks and to upgrade the facilities to suit the current requirements of the Army.

Following the appointment of the design team, detailed scheme designs and costs were presented in 1980, including consideration of a completely new barracks complex. Approval by the MoD was given, in June 1982, to prepare documents for a total refurbishment within the existing fort, and construction of new