Building defects – what are the rest of the world's problems?

Chris Mahoney reports from a recent symposium on building pathology

The CIB Second International Symposium on Building Pathology, Durability and Rehabilitation was held in Portugal in November 2003. More than 15 countries from around the world participated in order to meet and disseminate knowledge about building defects and recent developments in technology. Members were invited to sit, listen and debate the latest thinking in building failures, methods of detection and remedies. With the exception of perhaps defects relating to climate, one point became increasingly clear – the problems we face are replicated around the world.

Justin Henshell, an American architect was one of the first to take the stand and split the conference into various topics, starting with an introduction to building pathology from America. One point he made is the recent interest that American lawyers have taken in building pathology. Now that asbestos claims have just about been exhausted, what could the lawyers turn to next? How about mould? 500 million years in the making, it's now got the attention of the lawyers, creating additional avenues of work for environmentalists and building pathologists. Our American architect wants us to remember that 'mould is gold'. This is good if you only undertake pathology work, and not so good if you have to earn a living undertaking surveys and inspections. Although the results of the RICS study into the possible dangers of mould and spores has yet to be published (note my avoidance of the word toxic), the initial results suggest that the experience of the American market will not be repeated.

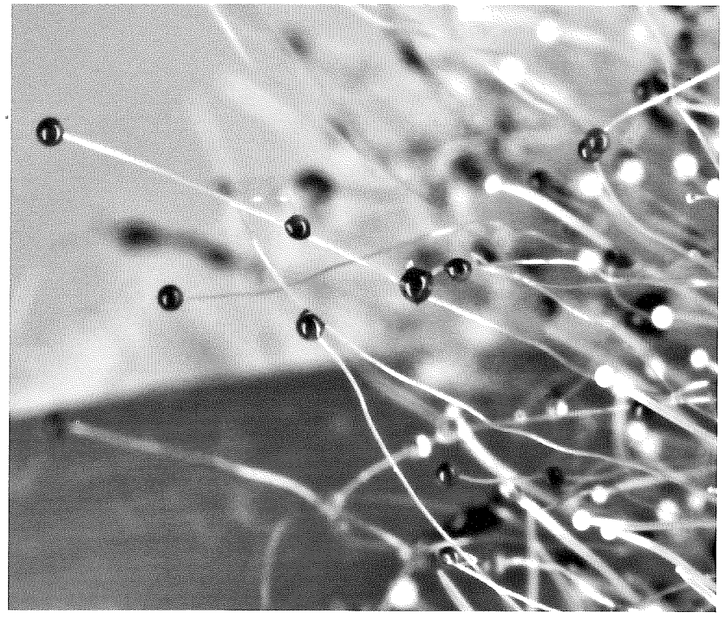
The following two case studies are from America and Finland and both have relevance to spores.

External algae growth on buildings

External algae growth on buildings is a problem that is likely to increase as we continue to add additional insulation to the outside walls of buildings. A seminar by Roland Buchli of the Swiss Federal Laboratories pinpointed the causes of the problem.

Algae growth on the external face of buildings is not only unpleasant to look at but can cause additional staining and lead to increased maintenance costs. In order to survive, the algae requires several ingredients – energy in the form of sunlight, minerals in the form of dirt, and water. The spores of the algae are microscopically small and dispersed through the air, landing on the building façade before growing on the face of the material. As the algae has no roots, it is dependent on rainwater or dew.

To understand why algae does so well, a case study showing a block of flats split into two halves was shown. One side was insulated, the other side not and the side which was insulated, was covered in algae. Roland Buchli concluded that the reason was because, overnight, the surface temperature of the insulated façade fell below the dew point of the outside air. In other words the side which had been insulated, now prevented heat loss from the building, so much so that water in the form of dew, was now able to condense on its surface. This is the same principle that causes a car to become covered in dew overnight. Interestingly a regular pattern of 'algae free' dots appeared on the building, which coincided with the positions of the mechanical fixings for the insulation: the fixings were allowing internal heat to bridge the insulation thus preventing algae from forming.



Further studies revealed that the problem was also being experienced with ventilated curtain walling systems, but less so with constructions offering a thermal mass, like brickwork and stone. Algae growth directly above windows was also observed, and the conclusion was reached that the moisture was coming from the inside of the building when the window was opened for ventilation.

The other factors influencing the potential growth of algae include the orientation of the facade, the exposure of the building, the location of trees and such things as weather protection.

With the knowledge that even more focus is about to be applied to energy conservation, this unwelcome side effect will probably increase. This is an issue then that requires a great deal of thought at design stage, and possibly further research, including identifying which external finishes are less prone to algae growth.

Timber defects

Despite 76% of its surface being covered by forest, and being a world leader in timber construction, you would be mistaken if you thought the Finns had succeeded in timber frame construction. As Jari Heikkila of the University of Oulu pointed out, the Finns have a real problem on their hands.

What they have come to realise is that although their wood is an excellent natural material, it can be susceptible to shrinkage, expansion, mould, decay and combustibility. In order to use it, particular attention must be paid to its protection.

The Finnish study found that when moisture levels in the timbers exceeded 20% over a long period of time, it started to decay and if the relative humidity was above 70%, mould also started to grow. Timber frame buildings that have survived the test of time have generally had some form of protection to the wood, and have managed to keep moisture levels below 20%. From the 1950s the design philosophy also changed in Finland and basements were no longer constructed, saunas and bathrooms became popular within the home and roofs became flat. This led to a number of moisture-related problems including decay at ground level and around wet areas. Flat roof construction caused so many problems that pitched roof construction became popular again in the 1980s and flat roofs converted into pitched.

The findings of studies into timber framed buildings in Finland showed that 82% of single family homes built since the 1950s have some form of moisture damage, most of which occurs in houses built in the earlier period. These problems include decay in timber because of:

- close contact with the ground
- poor protection to the timber façades
- poor overhang at eaves level
- poor provision for movement within the timber
- inadequate prevention of leaks to water services/wastes
- insufficient ventilation.

What is interesting is that half the problems were created in construction. In the last decade, the Finnish construction industry has put this down to shortened construction programmes and a skills shortage.

Despite the information now available to designers and the construction industry, the Finns still have a problem, particularly where timber meets the ground, or the external wall, or within wet areas – a problem they are trying to eliminate.

What lessons can we learn from the two studies? First, that in order to understand the cause of the defect, you have to understand the construction. Once you understand the construction, you should know what problems to look for and their causes and remedies.

The case of the external algae is all about heat retention in well-insulated buildings and dew point. I think this is a problem that may increase.

The decay of timber in buildings is about identifying the form of construction first, then understanding how timber reacts if it is not protected. The Finns predict that 50% of the problems lie in construction, a sobering thought for those undertaking stage inspections.

For those of you with an appetite for more, you will find a copy of all the papers bound into one volume in the RICS library entitled *CIB/W086 Second International Symposium on Building Pathology, Durability and Rehabilitation*, Lisbon, 6-8 November 2003.

Also available to download from the Faculty website, is *Building Pathology & Environmental Monitoring; The Development of Holistic Sustainable Conservation Solutions – an over view* by Dr Jagjit Singh, Director, Environmental Building Solutions Ltd, UK, adapted from his presentation at the building conservation annual symposium.

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Case studies:

Microbiological Growth on Facades, Roland Buchli, Swiss Federal Laboratories for Materials Testing and Research, Switzerland.

Learning from Defects of Timber Buildings in Finland, Jari Heikkila, University of Oulu, Finland.