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Key Hole Inspection in Historic Buildings

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Biography

Dr Jagjit Singh, Director of Environmental Building Solutions Ltd, is an independent consultant specialising in building health problems, heritage conservation and environmental issues. His current research focuses on interrelationships of building structures and materials with their environments and occupants.

Keyhole Inspection in Historic Buildings

Just like the physicians and surgeons use stethoscope and keyhole surgery to examine the internal organs and check their patients, the building pathologists can use a range of non-destructive instrumentation to check their buildings. This will save unnecessary exposure work and the destruction of the historic fabric. As pathology is the scientific study of the cause and effects of disease, similarly building pathology encompasses not only observation of the structural and functional changes of the performance of the building, but the elucidation of the factors, which cause it. For example the cure for Athlete Foot is not amputation, but drying out of the affected parts and localised targeted treatment with fungicide if necessary.

An initial assessment of the symptoms and causes of the problems in both modern and historic buildings can be made by the use of commonly available equipment such as Binoculars, small mirror and/or Surveyor mirror, screw driver, ladder, torches, compass, camera and moisture meters.

Building materials in historic buildings, churches and other structures is inherently susceptible to infestation and decay, if it is not kept dry and well ventilated. Once the infestation has started it will continue to propagate, if the conditions are favourable, until eventually the material can no longer sustain loads. It is therefore important that the building or structure is regularly evaluated for material decay and assessment to prevent failure or collapse, which could result in loss of use. Based on this information, environmental control measures can be put in place to prevent further advancement of the decay.

The Non-destructive Diagnostic Approach

The diagnostic approach involves carrying out regular inspections using a range of non-destructive investigation techniques. This approach enables a specific maintenance programme to be drawn up and ensuring the loss of historic fabric is kept to a minimum.

The total reliance on one method of inspection or isolation technique for decay organisms is not ideal. A combination of the use of instrumentation with common sense is the best way forward. For example a number of in-situ methods for timber decay assessment are available; however, these involve destructive techniques and have had varying degrees of success in detecting decay and predicting the residual strength of timber members.

The analysis of decay organisms with destructive sampling is neither sympathetic nor acceptable to the conservation of historic churches, castles, abbeys, monuments and other landmarks. Furthermore, remedial chemical treatments for woodworm, death-watch beetles, dry rot and wet rots are very expensive and often cause more damage to the health of building fabric and people than the infestation itself.

Non-destructive inspection techniques enable the condition of timbers to be ascertained without opening much of the building fabric; they are therefore especially valuable in buildings of historic and architectural interest.

Moisture Meters

The information given by moisture meters needs to be treated with care. They are most useful in spotting trends rather than giving absolute information on moisture levels. They can be very useful in determining the spread of moisture away from a building defect. Moisture meters can occasionally give misleading results, the most notorious being when used in areas with foil backed wall coverings, or when assessing moisture in timber treated with preservative salts. Used with sense they can be very informative

Endoscopes, Borescope or Fibre Optic Inspection

Interpreting information from fibre optic inspection requires practice on site. It can be easy, for example, to confuse spiders' webs with fungal mycelium. Borescopes are excellent at allowing an assessment of the distance that a dry rot outbreak has grown from its origin. They can avoid damage to precious wall coverings and avoid the necessity for wide scale lifting of timber to allow access to hidden areas.

Decay Detection Drill

The decay detection drill is used to detect the presence of decay cavities in wood and is useful in assessing potential damage to timbers close to, but not directly involved in, dry rot outbreak. The drill can identify changes in the density of wood and hence regions which may have been infected with fungus. Care is needed when using the drill to ensure that it goes through, rather than around, growth rings or false reading will result.

Resistograph Methodology

This methodology involves the use of a Resistograph drill, which drives a 3mm diameter drill bit up to 440mm into the timber. As the drill bit penetrates the wood the rotational resistance is shown on an LED display and recorded on a printout chart. This gives an immediate profile and permanent record of the internal condition of the timber.

Regions of sound wood are shown as high resistance to forward motion of the drill bit. As the drill bit enters a decayed region, the resistance to forward motion is reduced and a low signal level is recorded.

Dendrochronology

It is also possible to ascertain the dendrochronology of timber with the use of the Resistograph. The method works by detecting the width of the annual rings, since the ring itself is comprised of soft and hard sections corresponding to early and late wood respectively. This method is also well suited for one-sided or multi-layered timbers.

Ultrasound Techniques

These are based on the generation of high frequency sound waves within or through materials to test for differences, for instance for density. This technique has been used to detect voids in large dimensional timbers.

Stress Wave Velocity Measurement

This technique is used for measuring the speed of sound waves travelling through a wooden sample. The sensor can detect decayed sections in the timber structures.

Further Reading

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