01 INTRODUCTION

Historic buildings and structures not only form part of our built environment but also our heritage. Given that ‘sustainability’ is important for the construction industry, what better act of recycling is there than re-using our existing buildings and the materials therein?

Many of our existing buildings can still serve as valuable economic or housing function and can be the lynchpin in redeveloping our post-industrial age towns and cities.

Adherence to modern Building Codes, as required by Local Authority Building Control and/or insurers, may require extensive intervention. This can be more challenging if the building is listed as building consent will be required before work can start.

02 CHANGE OF USE OR REFURBISHMENT?

A condition survey of timber in a building is normally undertaken when the building is refurbished for either a change in use, or to continue in its current use. The building may have been empty for only a short period of time, or may have been unoccupied for much longer. Where listed or heritage buildings are to be refurbished, special conservation considerations can take precedence.

Changes of use can involve conversions of large residential buildings to offices, large offices or public building into apartments. Other refurbishments of buildings range from the vernacular and municipal to industrial mills, and include former schools, ecclesiastical buildings and grand stately homes.
When undertaking conversion or refurbishment of a timber building the developer needs to answer two questions:

• Are the original timbers in good condition?
• How strong are they?

On the face of it, these are straightforward questions but very often poor advice or a lack of knowledge can lead to unnecessary and expensive remedial and/or replacement works. Often, there is a perception that timber in older unused buildings is in poor condition and requires replacement. In many instances this is simply not the case and often timber may visually appear to be in worse condition than it actually is.

### 03 CONDITION SURVEY

A timber condition survey provides an assessment of the physical condition of timber within a building. It can evaluate the load-bearing properties of the structural timbers such as beams, joists, posts, rafters and purlins. It can also determine the condition of non-structural timber elements, such as floorboards, staircases, wood panelling, windows, doors, architrave and skirting.

A condition survey provides the project architect, engineer or contractor with confidence that the original timber elements will meet the specified performance and appearance for the completed project.

The extent of a condition survey can vary depending on the client’s needs. It may involve a preliminary inspection to assess the general condition of the timber and to identify whether there are significant defects. This is then usually followed by a more detailed survey.

The objective of the more detailed survey is to assess the condition and strength of the individual timber elements. This more detailed survey will identify and evaluate any damage which may have been caused by decay, fungi, wood destroying insects and other defects.

### 3.1 SURVEY TECHNIQUES

There are a number of techniques that can be employed. A visual inspection by someone with expertise to identify defects is important. This is combined with knowledge and understanding of the construction methods and materials used and the ability to make appropriate decisions based on evidence.

There are two complimentary techniques used to determine the condition of timbers, particularly in locations where timber are embedded into walls such as joists and beams. These are the areas which are the least accessible, and are where the condition and moisture content of the timber is most critical. The condition of timber in such areas can be determined by decay detection drilling using specialist probes and drills.

### 04 ASSESSING THE STRENGTH OF TIMBER

Where buildings undergo a change in use, floor loadings may change and structural timbers may need to be evaluated for their load bearing capacity. Having determined the condition of structural timbers, the next stage is to determine their strength, so how is this achieved? The timber needs to be strength graded.

#### 4.1 ‘CODES OF PRACTICE FOR THE STRUCTURAL USE OF TIMBER’

The first code of practice for the structural use of timber, CP112, was published in 1952 and it was titled, ‘The Code of Practice for the Structural Use of Timber’. This code presented the first formal grading system for structural timber where the strength properties of important commercial timbers were defined.

The rules also considered the structural function of a piece of timber. For example, was the piece to be used as a post, a beam, or a rafter? However, these rules did present marketing and supply challenges as the supplier had to decide on the final function of the structural timbers held in stock.


#### 4.2 VISUAL STRENGTH GRADING OF SOFTWOODS AND HARDWOODS

BS 4978 and BS 5756 both require that all six surfaces of a piece of timber need to be inspected before it can be
assigned a strength grade. This is rarely possible in an existing building or structure, and very often the surveyor will only be able to visually assess at most, three surfaces. In this instance it is possible to assign an indicative visual strength grade.

Accurate predictions about grade and strength can be made if six surfaces are visible. One of the major challenges facing the timber surveyor when grading timber in-situ is access. You can only grade what can be seen, the more timber that’s on show, the more confident the recommendation will be.

### 4.3 Grading to Achieve a Higher Strength Class

Changes to the loads applied to a structure may result in some timber members requiring a higher strength class than is achievable using conventional standards. With the aid of other non-destructive techniques, a higher strength class can often be achieved in older buildings.

This can result in significant cost and time savings, rather than carrying out strengthening work which may not be required. Exova BM TRADA’s team of technical consultants have experience in-situ grading as well as grading timber above the British Standards.

Historically, fungal decay such as dry rot and insect attack caused by death watch beetle or common furniture beetle have been viewed as construction problems that have been overcome by solutions with little regard to the biology of the causal organisms. Understanding the biology and risks presented by these organisms can play a vital role in undertaking timber condition surveys, evaluating risks and specifying remedial treatment and/or timber repairs.

### 05 Biological Risks to Timber

Timber in buildings is inherently durable and resistant to most forms of biological attack provided they are not exposed to wetting and the timber moisture content does not rise above the decay threshold of 20% for prolonged periods. Prolonged exposure to damp and/or wetting increases the risk of decay and degradation of timber by wood destroying fungi and insects.

#### 5.1 Decay and Insect Attack

Fungi needs oxygen, food and most importantly moisture to survive. Provided internal timbers are kept dry and well ventilated, they cannot be affected by fungal decay and the risk of attack by wood destroying insects is also reduced.

All too often the perceived risks of wood destroying organisms far exceed the actual risk to timber because often the construction team do not have the necessary knowledge to accurately evaluate the risks to the timber.

This is particularly relevant in assessing the potential risks posed by wood destroying insects. Often, damage caused in the standing tree, such as pin-hole borer attack, can be misdiagnosed as active attack resulting in unnecessary treatments being applied. Or historic attack, sometimes centuries old, can be mistaken for active attack.

When we consider the refurbishment of older, particularly listed buildings, there has to be a balance between the environmental approach of controlling timber decay organisms and what is commercially realistic in terms of critical path and timescale management.

#### 5.2 Moisture Content

One of the most important factors affecting the performance and properties of wood in service is its moisture content. Moisture content affects its weight, strength, workability, susceptibility to biological attack and dimensional stability in a particular end use.
When assessing the condition of structural timbers it is important to assess the moisture of the timber by way of a moisture content survey. It is estimated that over 80% of the in-service problems associated with wood are in some way related to moisture content.

The importance of the interaction between water and wood cannot be understated and, if not properly understood and taken into consideration, can result in the need for expensive remedial measures.

When undertaking the moisture content survey it is essential to measure wood moisture at locations likely to be at most risk from wetting, e.g. the bearing ends in external walls.

When refurbishment and restoration projects, there has to be a balance between the 'environmental' approach of managing and controlling timber decay organisms and what is commercially realistic.

Understanding the biological requirements of decay organisms and wood-destroying insects will lead to less potentially destructive opening-up and less disruptive remedial/replacement works. The specification and application of preservative treatments if needed will be better targeted, with the result that there is greater control of the use of chemicals.

Timber condition surveys and in-situ strength assessments should not be carried out without considering the condition of other materials in contact with the timber. All potential sources of moisture and damp penetration must be identified and these areas thoroughly investigated.

Non-destructive surveys can use a range of techniques that cause minimal disruption and allow the inspection to proceed with the minimum of opening-up works during the preliminary phase of the building investigation. However, it must be borne in mind that these non-destructive techniques form the basis for justifying opening-up works when areas of decay are located or where it is established that there is a risk of fungal decay and further interventions may be necessary.

The appraisal of the condition and strength of historic timbers requires specialist knowledge. The extent and scope of any survey can be tailored to suit the needs of the client and in almost all cases, significant savings in construction time, materials and costs can be achieved. Moreover, obtaining good information early in the project can also reduce the developer’s exposure to risk pricing at the tender stage.