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Development of performance-based standards for external timber cladding

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Abstract

This paper reviews the background to, and development of, new British Standards for external timber cladding. The standards are being produced because timber has become a widely used external cladding material in the UK and this has highlighted that existing standards on the topic are inadequate. When fully published, the BS 8605 series will offer performance-based specifications and guidance on the main issues affecting external timber cladding. The standards involve multi-compliant performance measures; several technical conflicts had to be addressed.

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1. Background

It used to be so easy. Technical standards used to follow a prescriptive ("do this, do that") type of format that was simple to write and to use. The prescriptive approach could be restrictive, however, and was a barrier to innovation and trade. Technical standards are, therefore, moving towards being performance-based where requirements are defined in terms of measurable user need, with the means of compliance left unspecified. Although this move is to be welcomed it does make technical standards more complex; so much so that that some are becoming unusable by parts of their audience, as well as being slower and more demanding to write. Three difficulties are particularly common.

Firstly, what happens when a technical standard spans several performance criteria some of which conflict? The fire safety of a facade, for example, might have to be integrated with criteria such as durability. Fire safety often

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requires that cavity ventilation is blocked but this can increase fungal decay risk. Life safety obviously over-rides other criteria but does this mean that second level issues have to be ignored?

Secondly, how can the performance approach be applied to durability? Performance requirements need to be stated as a limit state. Much research has been undertaken on the initial properties of structural components but, until recently, there has been little work on the equally important topic of degradation of component properties. This is especially the case with timber degradation. Performance models should be capable of evaluating the risk of degradation in performance capacity over time, with a coefficient of variation related to that capacity [1]. But existing data on timber durability cannot yet be generalized as a parametric model. Thelandersson *et al*. [2] give a state-of-the-art review.

Thirdly, what happens when a user need cannot be verified? Performance requirements must be verifiable – they must be readily falsifiable using established scientific or engineering principles – but some issues are untestable. The weathering characteristics of a facade, for example, are important for the building's designer and users, but are often impossible to predict from short term tests.

1.1. Growth in timber facades in the UK

These challenges have recently been highlighted in the UK. Timber-clad facades are widely used in North America and Scandinavia and in recent years have undergone a substantial revival in the UK and central Europe. Previously used mainly on low-rise housing, timber cladding is increasingly appearing as an external finish on medium-rise buildings, multiple occupancy housing and for non-domestic applications such as offices. So long as timber was only used to clad low-rise, single-occupancy dwellings on relatively sheltered sites it was simple to design and install; there were few technical risks. But the growing use of this cladding on large, complex buildings – and on exposed sites – has increased the associated risks, such as wind damage or fire spread. Timber now has to achieve equivalent performance standards to other, longer established, cladding materials. Suitable specifications and design recommendations are urgently needed for external timber cladding in the UK. But can the challenges of multi-compliance, parametric modelling and verifiability really be addressed for timber facades?

1.2. Timber as a facade material

Timber, as distinct from other cladding materials, is biogenic (derived from living organisms) and organic (carbon based with at least one C-H bond). Materials can be categorized by whether they originate, directly or indirectly, from living organisms or other sources: biogenic materials such as timber that originate directly from living organisms tend to be non-uniform, whereas transformed biogenic materials (e.g. coal, plastics) are more uniform. Organic compounds hold large amounts of energy in their chemical bonds, are thermodynamically unstable and, given the right conditions, revert to a more stable form, releasing energy during the process. Organic–biogenic materials share a further characteristic, moisture sensitivity. Timber, therefore, has three key characteristics as a facade material: non-uniformity, combustibility and moisture sensitivity [3].

None of these characteristics prevents timber being used externally – far from it. The differences between timber and other mainstream construction materials are, however, manifested through two distinct approaches to facade design. Thus, many published accounts of rainwater penetration through cladding focus on leakage through the joints between impermeable sheet materials but ignore moisture flow through the cladding itself; this is an important issue for timber-clad facades. Similarly, discussions of facade corrosion usually omit the effect of organic acids.

These differences between timber and more traditional cladding materials mean some existing performance criteria for facades are not directly transferable to timber. Facades are constantly exposed to fluctuating moisture conditions: the relationship between wood and water tends to dominate the design. Combustibility and non-uniformity have to be managed while not increasing moisture related deterioration. This is usually done through the use of what can be termed timber rainscreen cladding.

1.3. Timber rainscreen cladding

Screened walls – where the external cladding is separated from the wall structure using a cavity – are common in the UK. The cavity provides a capillarity break between the cladding and substrate and promotes evaporative drying