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An Approach to Assessing the Long-term Performance of Wall Assemblies – Durability of Low-rise Wood-frame walls

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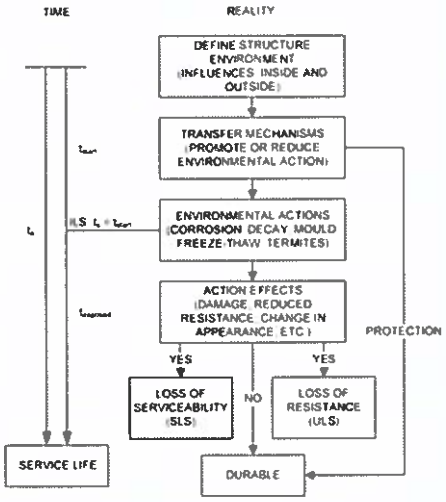
Abstract.
Given the importance of moisture to bring about deterioration in building materials over time, very generally, the long-term performance of building components depends on the hygrothermal response of the component when subjected to interior environmental and exterior climatic loads. In respect to the durability of components having a wood frame structure, this depends on whether the wood components remain dry and if not, the time over which they are exposed to conditions that generate temperatures and elevated levels of moisture content suitable for the onset of the formation of wood damaging fungi. Critical factors in estimating the longevity of wood frame structures include assessing conditions suitable for the onset, growth, and propagation of damage to occur, more specifically, the temperature range, wood moisture content and time of exposure.

In ISO 13823 [ISO 2008] recommendations are made on the use of different methods for the design and verification of structures for durability. For example, verifying a component of a structure for durability can be done by applying service-life formats such as: (i) the factor method, or; (ii) the limit-states format. When employing the factor method the design life is specified and the predicted service life is thereafter determined for the component or structure based on sets of factors that relate service life as determined from field studies to the expected life of a component for a similar use and subjected to a like environmental load. Whereas the limit-states format consists in checking the performance of a component or structure against a performance criterion, or a given performance limit state.

Different approaches to assessing the vulnerability of wood frame structures to deterioration have been developed in recent years. Some of these approaches suggest applying a limit-states design approach to the performance assessment of the wood frame assembly. For example, a generalized limit states method was presented by Bomberg and Allen [1996] as a systematic framework for limit state design in respect to the durability of building envelopes. Isaksen et al. [2010] presented a performance based model employing a dose-response function to predict the onset of mould growth, which was used as a limit state. The moisture management within wood frame structures has been investigated by hygrothermal simulation where the temperature, relative humidity and moisture content of wood-based components over time are extracted from the results of simulation.



Limit states method for durability as provided in ISO 13823 [ISO 2008]