A Short Paper on the Conventions and Standards that govern the understanding of moisture risk in traditional buildings.

Moisture

Standards BS 5250:2011, BS EN 13788:2002 & BS EN 15026:2007

At present the Standard BS 5250:2011 is used almost exclusively as the sole test of moisture risk for buildings. This Standard is titled *Code of Practice for the Control of Condensation* and provides advice on the avoidance of internal surface and interstitial condensation caused by the movement of water vapour by diffusion through the building envelop from the interior to the exterior. BS 5250:2011 refers to BS EN 13788:2002 as the means by which this risk should be calculated using a method commonly known as the Glaser Method which uses vapour pressure differential and monthly averaged external temperature conditions to predict occurrences of condensation occurring either within or on the interior surface of building fabric. BS EN 13788:2002 is clear about its limitations and states "This standard deals with critical surface humidity and interstitial condensation, and does not cover other aspects of moisture, e.g. ground water, precipitation, built-in moisture and moisture convection, which can be considered in the design of a building component" (p. 3). And BS 5250:2011 is clear that designers need to also consider "the much greater risk of condensation occurring as a result of air leakage, which transports water vapour through gaps, joints and cracks in the building fabric" (p. 5) as well as the effects of exposure to sunlight, clear night skies, wind and driving rain, particularly in exposed positions subject to high wind speeds.

In solid wall buildings made of permeable fabric constructed without a damp proof course (dpc) phenomena such as driving rain and ground water will have a significant impact on the moisture behaviour of the building envelope. At present BS 5250:2011 is used almost universally as *the* test of moisture performance of buildings and building components when even the standard itself states, in relation to the calculation methodology given in BS EN ISO 13788:2002 that, "it does not provide an accurate prediction of moisture conditions within the structure under service conditions". Whilst this statement must, to some extent, be pertinent to all buildings it must be particularly significant with regard to pre-1919 moisture permeable, solid wall buildings. Furthermore, it is understood that an important aspect of the proper functioning of a solid wall building is that in conditions such as severe driving rain the moisture load will be such that the wall will occasionally need to dry to the interior. Because BS 5250 & BS EN 13788 only assess the movement of water (as vapour) in one direction, from the interior to the exterior, the use of this standard to assess retrofit solutions commonly advises the use of a vapour control layer in combination with insulation to limit and slow the quantity of vapour from the internal space that can be admitted into the building fabric. This solution prevents excess moisture accumulating within a building element and thus causing condensation and is created by the use of the Glaser Method. However, in some instances, when the moisture load is heaviest from the exterior side (in both liquid and vapour forms) a vapour control layer will block the transport of moisture to the interior and may cause exterior borne moisture to accumulate within the wall.

There is an alternative standard available to assess moisture risk in buildings, BS EN 15026:2007 *Hygrothermal performance of building components and building elements. Assessment of moisture transfer by numerical simulation.* Unlike BS 13788:2002 this method does not assume a dry building operating in a steady-state but promotes the use of dynamic modelling which is able to take into account the affects of specific material properties and the local environment on a building over time. These models use a more detailed description of the characteristics of moisture behaviour within individual building materials and therefore are able to model the behaviour of water both as a liquid and a vapour, including the phenomena of wind driven rain within a building enclosure. Because this Standard is able to account for more of the factors that impinge upon moisture behaviour in a building enclosure it is a more appropriate means by which to assess moisture risk in pre-1919, moisture

permeable, solid wall buildings. It is however rarely used and due to limited weather and material properties data for modelling UK buildings as well as the complexity of solid wall forms its use requires a high degree of expertise.

BS 5250:2011 (and the calculations given in *BS EN ISO 13788:2002) should not be used as the sole form of moisture calculation risk for traditional buildings.* The use of BS 5250:2011 is insufficient for solid wall buildings where driven rain and other sources of fabric moisture are present. This makes it inadequate as a means to assess all risks posed by moisture to the building fabric and occupants of traditional buildings. In particular, for all Internal Wall Insulation applications to solid walls, numerical modelling according to BS EN 15026:2007 should be used, with substantial safety margins built in due to the lack of data and research. The same applies to all EWI applications where construction moisture is likely to exist, due to previous weathering, lack of damp proof courses etc.

Additionally as identified in Hooper et al (2012), in regard to External Wall Insulation, the site practice of application of external insulation to solid wall buildings is often different from the designed details due either to incomplete design details sufficient to deal with all variations of building type and form, and/or also due to incorrect or a poor standards of site practice. The consequence of these factors in all applications (both IWI and EWI) is that in order to provide safe treatments, it is strongly recommended that modelling should incorporate safety factors to deal with liquid moisture presence or ingress. This can only be done through the use of numerical modelling with agreed safety factors. Such a methodology has been developed by the Fraunhofer Institute using WUFI modelling (to BS EN 15026:2007) for applications of EWI to new build timber frames in North America, and there is no reason why a similar approach should not be adopted for “as built” performance of retrofit solutions to traditional (and possibly all existing) buildings in the UK.

Consequences:

The use of BS 5250:2011 as the only method of assessing the moisture content of traditional buildings and of such buildings where retrofit insulation is applied, could lead to considerable fabric decay and risks to human health, as well as waste of material and financial resources. Furthermore problems resulting from incorrect assessment may occur and become apparent only after some time (sometimes several years). This means that policies for retrofit run the risk of incurring significant long term liabilities unless adjusted in the near future.

Conclusion:

In general *where sufficient weather and material properties data exist the use of* BS EN 15026:2007 as a method of calculating moisture risks should be encouraged. In the short term the limitations of BS 5250:2011 need to be clearly noted in standards and certifications and should not be permitted to form the sole basis for moisture risk assessment in traditional buildings. Ultimately, the current practice within the building industry of only a partial test of moisture risk via the use of BS 5250:2011 needs to be corrected by the development of a new standard that assesses all moisture risks arising within all buildings.

References

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