

GOOD BUT POTENTIALLY MISLEADING GUIDELINES

I want to thank Mr. Desjarlais and his three coauthors for their excellent article, “Practical Application of Hygrothermal Modeling of West Coast Wood Deck Systems” [in the March 2014 issue of *Interface*.] It makes a valuable contribution to our understanding of why some roofs installed over wood decks with batt insulation below experience decay due to excessive amounts of condensation and some do not.

The article persuasively shows that although roof reflectance plays an important role, it is not an overwhelmingly dominant one, at least not alone. The article points to interior relative humidity and exterior climate as dominant factors, especially in combination. And the article provides useful information about how much insulation needs to be installed over wood roof decks in selected cities to limit yearly accumulations of water to acceptable levels.

However, I need to mention, in my opinion, the article’s “practical guidelines” risk misleading roof professionals who don’t immediately recognize the implications of one of the research’s critical assumptions—namely, that the roof assemblies are “airtight.”

Where roof assemblies are subject to modest amounts of air intrusion from below, the R-value recommendations could prove nonconservative, with potentially quite unfavorable results—at least in spots. My concern here is that, in my experience, the majority of roof assemblies over wood decks with insulation below are simply not airtight.

I have personal experience on several West Coast wood deck projects (with insulation below) where hygrothermal analysis (WUFI) indicated “no decay,” yet field investigations found decay—in spots. The excessive water accumulation did not occur everywhere; it occurred in patterns mirroring locations where warm, humid air could slowly intrude up from below.

In those cases, the slow intrusion of humid air deposited large amounts of water vapor directly onto the “cold” bottom surfaces of the wood decks where it con-

densed, accumulated, and fueled decay. The amount of water accumulation associated with water vapor transported on a current of air far exceeds that which is predicted by WUFI when airtight construction is assumed (see document #1, referenced below). By the way, none of the examples I’m referring to had interior humidity conditions that exceeded ASHRAE 160 levels.

It is usually reasonable, as part of a WUFI analysis, to assume “compact” roof assemblies (or portions thereof) are airtight. See document #4, below, for limitations of this assumption.

However, I suggest roof professionals consider carefully when applying an “airtight” assumption to noncompact roof assemblies where all or most of the thermal resistance is provided in the form of batt insulation below the deck. Ceilings of noncompact roof assemblies routinely have many modest openings for the slow intrusion of air (e.g., around light fixtures, alarms, and vents). See document #3, below, for definitions of “compact” and “noncompact” roof assemblies.

The exception, of course, would be a roof assembly that is specifically designed and installed to provide a functioning air barrier (e.g., polyethylene sheeting above gypsum ceiling boards with sealed joints).

I also want to point out that the water contents and surface relative humidity levels needed for establishment and growth of wood decay fungi are often higher than those needed for other types of fungi. This can be important. Roof professionals are directed to ASHRAE Standard 160 for conservative design guidelines.

Bottom line: Roof assemblies (including wood decks with insulation below) are often not airtight. As Hartwig Kunzel notes, warm, humid air usually finds a “slow and tortuous” pathway to meander up into non-vented air spaces and condense on “cold” surfaces. And if the occupancy is fairly humid, the article’s guidelines could prove nonconservative—at least in spots.

For more information about air intrusion and condensation in roofs and walls, see:

1. 1989 *ASHRAE Fundamentals*, Chapter 21, pages 4 and 5.

2. Philip D. Dregger, “Air Infiltration—The Enemy of Wind Resistance and Condensation Control,” *Interface*, June 2002.
3. Wayne Tobiasson, 2009 *ASTM Manual 18*, Chapter 16, “Roofs.”
4. Bas Baskaran, “Air Intrusion and Its Effect on Moisture Transport in Mechanically Attached Roof Systems,” 2011 International Roofing Symposium.
5. Hartwig M. Kunzel, 2012 BEST 3 Conference, “Modeling Air Leakage in Hygrothermal Envelope Simulation.”

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RESPONSE

We want to thank Mr. Dregger for his comments on our article. He brings up a valid point that air leakage is not included in the analysis provided, and that it may impact the conclusions drawn from our study. Sources of air leakage can be construction-related (for example, penetrations that are not sealed) or bad practice (bathroom vents discharging into the airspace above the insulation layer). Including air leakage into the analysis is possible in that WUFI has the capability of including that reality into the calculation. It is difficult because little is known about the flow rates and the psychometric properties of the air being introduced into the compact roof system. Supplied with this sort of data (even the range would help), the analysis can be improved. Until this data is available, we would simply be guessing at what the input values to the model should be. This study was meant to continue the dialogue about hygrothermal moisture movement, and the addition of air leakage would be another continuation of that dialogue.

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