Research, Building Science and Architecture

Questions + Answers from the May 7, 2012 Webinar

Q: When utilizing closed cell spray on insulation on the underside of the roof deck is venting unnecessary i.e. ridge and soffit venting? [Brock Hesselsweet]

A: Spray-foam insulation is a rather compelling way to insulate a roof assembly. I did my first one in around 1990. And ventilation is not really compatible with spray foam. In particular, vent slots can, in the life of a building, have fire move through them, and I hate lining the pathway with combustibles. But doing unvented assemblies is outside the comfort zone of many. There is a whole complex of relationships—from inspectors to warranties to concerns for product performance and more—that keeps the industry in a vented-attic mindset, when we should be exploring other, often better, ways of doing attics. Incidentally, the 1990 roof worked very well and the client was very pleased and the building inspector trusted our judgment and the Amish contractors really liked it. The asphalt shingles were replaced after 20 years with some composite product. [Bill Rose]

Q: Can you give examples of known ordered versus known unordered? [Eric Faulkner]

A: In the webinar I tried to distinguish how building science research results are "catalogued" in the ASHRAE Handbooks, while they remain accessible but unordered in architectural journals. Cataloguing involves selecting among research results, keeping those which fill in the holes and not recognizing much of the other research. The NRCA Roofing and Waterproofing Handbook had a section called HARK, the Handbook of Accepted Roofing Knowledge. I like that. I imagined what it would be like to have HAAK, the Handbook of Accepted Architectural Knowledge. To some Extent Graphic Standards fills that role (and the most recent version is a real improvement over previous—perhaps I reach that conclusion because it cites my work). It has begun to cite research results. Neufert in Europe perhaps filled that role, though it did not lend itself to upgrading. We've had masterspec and other ordering of design decisions for specification; but that's not really ordering what we know—it's ordering what we have. [Bill Rose]

Q: Did you propose a hypothesis for white roof wet roof? What was your hypothesis and how did you decide where to start collecting information? [Eric Faulkner]

A: Caught me on this one. In the presentation, and also in the dealing with the client, I did not make the hypothesis explicit. That did come out though as I dug deeper. I began wondering if sky radiation could play such a large role, only to discover that it does. The hypothesis is the product of the "I wonder..." part. [Bill Rose]

Q: BUR? Built-up roof? Picture looks like a modified with white acrylic surface. [Alfred Johnson]

A: I see what you mean—the joints appear to have spacing like a modified bitumen, and are more pronounced than we'd expect with built-up roof. This was the description that was provided to me, and I went with it. [Bill Rose]

Q: Spray foam roof system or spray foam insulation under roof deck? [Alfred Johnson]

A: Spray foam under the roof decks in this instance would, I expect, have worked just fine. The client considered all foam use to be too expensive so that option was not taken. On the one hand, I recognize how

foam solves the thermal, moisture and airflow problems in one fell swoop. On the other hand, I always like to take even the most serviceable product as not necessarily essential. Plus, foam and fire don't mix. [Bill Rose]

Q: Have you done research on the validity of code required attic ventilation? [Alfred Johnson]

A: Tons. Attic ventilation as a design requirement has mythic status. Mythbusting comes down to looking at the historical background, which is laughably paltry in this case—one lousy data point in one rather poorly-done research project. My book "Water in Buildings" has a chapter on that history. I suggest that people interested in the topic try to answer this question: how many of the roofs out there have attic ventilation, and how many do not? Fifty-fifty? We get to the point of not even knowing whether a particular attic is ventilated or not, so how much significance can there be to this requirement? [Bill Rose]

Q: Does LEED change the compliance notion and now require a performance expectation? [Eric Faulkner]

A: I can't speak for LEED. I can speak to the difficulties of injecting a performance requirement in a building delivery system predicated on compliance. It's hard. I think it is becoming more and more necessary. Just take airtightness—what is the course of action if an airtight spec is included and the building, at test time, fails to meet the target? Many designers have solved this problem, others have not. It's a good problem, in any case. [Bill Rose]

Q: Please say again how a building may radiate more heat than it takes in and so go below the ambient temperature. [Bailey Pope]

A: Sorry if I was brief on that important point. I'd say study the first graphs that show W/m2—with the quantities upwelling and downwelling, both solar and infrared. Perhaps it's helpful to think of the earth hurtling through space that is at absolute zero, and imagining all the heat loss from the planet to outer space. This helps, since we do tend to focus on heat gain from the sun. I didn't discuss (infrared) emissivity which is about 0.9 for a white roof. I did discuss the role of (solar) absorptivity, but briefly. The ground at the SURFRAD sites is about 80% absorptive, so upwelling solar is only about 20% of downwelling. A white roof may be only 10% absorptive, so upwelling solar may be 90% of downwelling. I hope this helps a little. Really, the matter does take some study. [Bill Rose]

Q: Do you think it is important that buildings should perform, not just comply with codes & standards? [Jack Romigh]

A: Yep. [Bill Rose]

Q: Shouldn't research be applied at the beginning of a project, not the end? Similar to trying to obtain LEED certification after the building is complete - very difficult to do. [Carolinn Kuebler]

A: Yes. Any decent design process involves research at the beginning. Much as I criticize architecture education, I think the studios do make this important point, of doing analysis before jumping into the design. But then the design and construction process carries its own lessons that get put into the front end of the next project. And on and on. That analysis (research) is important, but it's hard to spend a lot of time on it with fee structures. We researchers are paid to do that part. You designers might ask yourselves what my research agenda ought to be. What do you want me to study for your benefit? [Bill Rose]

Q: So, based on your best research, in the New England area, with a 2x6 stud framed insulated wall; and R-5 rigid continuous sheathing on the exterior; where would you put the vapor barrier, and what type, and

where would you put the air barrier, and what type?[Paul Brown]

A: R-5 continuous sheathing is a vapor barrier. In fact, I've probably never seen a wall or roof assembly that did not have a vapor barrier in it somewhere—that is a material or assembly with low vapor permeance. So we already have vapor barriers in our walls. Next question is—do our walls work? ASHRAE Standard 160 was designed to answer that question. (I was one of the originators of that Standard.) Please look it up. The GSA now requires its use in all building projects. ASHRAE Standard 160 doesn't tell you if your wall needs a vapor barrier or not. It tells you if your wall performs. So try it with a vapor barrier and without. Try it with a membrane here or there or not at all. Try it with smart vapor barriers or dumb ones or whatever. Cut to the chase: New England, 2x6 wood studs, normal humidity load, R-5 sheathing I'd say its borderline. I'd push you for more foam on the exterior then it's not borderline any more—skip the poly. [Bill Rose]

Q: BUT more and more people are wanting spray foam in wood frame house roofs and eaves etc. Still no ventilation? [Daphne Petri]

A: Roofs have modes of failure. Roofing products have modes of failure. In order to avoid these forms of failure, the products and the design have to be thought through. “Ventilation” is not a key to avoiding failure. In fact it has its own ways of inviting a few other little forms of failure, like hurricane damage. No silver bullet. There are some really good roofs out there that have ventilation. There are really good roofs out there that have no ventilation. You need to find out how to do really good roofs. It takes observation, experience, tracking, asking around, learning the tradeoffs, sticking your neck out here and there, and, hate to say this, luck. [Bill Rose]

Q: Did they rebuild / move the Farnsworth House? [Nancy Harper]

A: No. Cowan just got his facts wrong. I didn't really make the point I wanted to make at that part of the presentation, namely, that some people, when they grandstand, they may tend to slip from scientific rigor and get their facts wrong. He sure did. [Bill Rose]

Q: Do you differentiate between research from elsewhere applied to architecture and research done in the process of designing or the building? [Matthias Richter]

A: Ooh, good question. Simple answer is—what is the subject population? Research from elsewhere may seek to address results regarding a wide population of buildings—that's the “degree of freedom” problem I referred to in the presentation. Research as a preliminary to design really only seeks answers about one future building. The methods may be the same (avoid error, or mistakes, or embarrassment, by any means possible). “Research from elsewhere” also has the advantage of having existing buildings that can be probed and measured and photographed. [Bill Rose]

Q: Did your study on white roofs take into account dirt on the roof and to cost to have your roof periodically cleaned? [Mark Johnson]

A; You are correct to note that material properties at one point in time can change. In this case, dirt on the roof would have warmed it, and reduced the sub-cooling that occurred, and might have helped. [Bill Rose]

Q: What is the best way to find the latest research related to a design detail question? [Margot Fehrenbacher]

A: Good question. Chances are, your particular detail will not appear in any literature, so you'd have to sneak

up on an answer for your particular case. One way this is resolved is through court cases. I don't go there. (I am paid by the generous citizens of Illinois, and I'm not about to use my knowledge and skills to clobber any other citizen—of Illinois or not.) I'd start with the ASHRAE Handbooks. I'd do 2-dimensional thermal modeling, and one-dimensional hygrothermal modeling. We just completed a great research project at ASHRAE RP-1365, which provides a catalogue of several details associated with several building types and does 3-D cataloguing of thermal bridges. I'd go to the Canadian literature, in particular the CMHC Best Practice Guides. I'd join a Building Enclosure Council and chat up the detail with people there who seem knowledgeable. Most important, you must realize that "design details" are almost never the product of government-funded research. [Bill Rose]

Q: Doesn't the location and type of vapor barrier make a huge difference in moisture problems in buildings more than the insulation type? [Tom Hurd]

A: Check ASHRAE Standard 160 "Criteria for Moisture Design Analysis in Buildings". You use either design or default inputs, run a transient simulation for your design and its possible variants, and apply the criteria provided in the standard. Bingo, you have your answer about what works and what doesn't from a moisture point of view. [Bill Rose]

Q: Is building commissioning a scientific discipline, or an example of blatant profit motive? [Kyle Staley]

A: I don't know. I don't deal with commissioning, much. If the purpose of commissioning is to squeeze good performance out of a design done for compliance, well, I'd rather see the designer having performance in mind in the course of the design. If I did design (I don't) I sure wouldn't want anybody thinking they could improve my work. [Bill Rose]

Q: MEP system today are operating in silos with waste from one system thrown away when they could be directed to next system as raw material. e.g. chiller produces cooled air but generate waste heat and water (condensate). We used power to generate heat and water. ..What could be done to bridge this gap between the various silos? Is an integrated closed loop MEP system viable at all or is it in the horizon among the research community? [Geokser Lee]

A: You've captured one of the honored traditions in building research—integration of processes. This kind of thinking goes way back. You've also noted that there is a clear social aspect to the question—the technical part of the question may be even smaller than the social part. District heating? Grey water use? Rainwater capture? An air-permeable wall which recovers conductive heat loss? Heat pump water heaters that provide free dehumidification for basements? Energy wheels for ventilation? The list goes on. We make some progress, for example with heat pipes obviating the need for reheat. We abandon wonderful technology such as district distribution. We have a few feedback surprises such as how more heating fuel is needed in furnaces where the blower motor is ECM. Everybody has their pet integration. Mine is providing for dryness in basements thereby improving the thermal resistance through the soil. I need a beer for this kind of discussion. [Bill Rose]