Questions + Answers from the Detailing for Durability Webinar held March 5, 2012

Hello everyone. Wow this is a lot of questions and they are uniformly excellent. I simply don't have the time to provide long thoughtful answers to these great questions. However, I did try to provide some guidance on each and every question. I hope this is useful.

Paul Fisette

Q: Hi Paul, I have quoted you in posts on my website and note that you and I share a preference for 15# asphaltic building paper as a residential wood frame sheathing water resistive barrier rather than materials like TyVek, due to the perm rating characteristics. I have a heck of a time trying to convince builders of this. Any comments to reinforce your position on this issue? [Rand Soellner]

> A: My attraction to #15 felt is related to cost and it's ability to sense changing moisture conditions. That is as humidity rises, the material becomes more permeable to vapor, promoting a greater drying potential in wall cavities. I think there are many non-perforated wraps available these days that have appropriate permeance that repel liquid water and allow the passage of vapor (like Gortex does.) I simply don't think that housewraps provide very good air barrier systems as promoted.

Q: Why is a non-woven building wrap more effective at dealing with bulk moisture than a perforated wrap? [Kevin Harkins]

> A: Perforated wraps have holes in them that leak water when they are under an air pressure differential.

Q: Here's another: there are some buiding panel materials on the market these days that are supposed to have integral vapor resistance, by a coating, which I believe, but they rely on tapes at their joints, and this makes me very concerned! Won't the adhesion of such tapes let go some year? How about in 10 years? 20? I wonder if this approach (without a formal water barrier membrane like tar paper) will be experiencing failures over the coming years? Any feedback on that? [Rand Soellner]

> A: I think you are talking about Huber's Zip system. The coating is permeable, so it is not a vapor barrier, but it is resistant to liquid water so it functions as a weather barrier beneath the siding. The tape is used to complete the continuity and to help make the system airtight. You are instructed to use a roller to apply the tape onto the panels. The pressure you apply when rolling the tape onto the panels is an important aspect. You ask a great question--- What will the adhesion be like in 10 or 20 years? Time will tell. I have inspected 3 and 4 year old applications and the tape is still holding fast. Frankly I like this system.

Q: What do you mean by warm side. Warm side changes according to the season. [Tarit Chaudhuri]

> A: Warm side is defined by the length of time that dominates. For example, Massachusetts is a heating dominated climate, so the warm side would be the interior surface closest to the living space.

Q: We always specify to tape the joints of the extruded poly in a masonry wall assembly but it' nearly impossible to get it to happen. How critical is this and what do you suggest to ensure that it occurs. or is there an alternate method of insulating masonry walls that you prefer? [Christina Schessler]

> A: Yes this is a great point. Foam can be difficult to seal. If the seal is a critical aspect of your design the permanence of the taped joints is even more important. I recommend that you use the tape product recommended by the foam manufacturer. For example, if you use Dow foam, use Dow tape. I have had good luck with this approach. The other option is to make your air barrier at another point in the assembly, but it would be a better idea to try and seal the foam since you have already invested in this

installation, why not take the next steps to seal the panels.

Q: Do you choke the fist size stone with smaller stone? [Christina Schessler]

A: Not on the stone at the bottom of the excavation. The idea here is to allow unimpeded communication of water under the slab area so that it can travel to perimeter drainage that is buried around the outside of the footing. You can choke the stone above the perimeter drains to keep fines out or use filter fabric that is integrated with the drainage mates on the outside.

Q: SHouldn't a vapor barrier/plastic underneath the footing be important or an alternative to fist sized stones to eliminate capillary action? [Patrick A'Hearn]

A: You could go that way. I think dumping stone an easier way to go. The stone is self-compacting, promotes drainage and addresses capillary forces.

Q: Wouldn't adding foam in the attic be a problem, creating a barrier to stop the exfiltration of moisture, driving moisture back down into a house and causing increased condensation / moisture? [Jonathan Siegel]

A: No. Looking at the SOURCE moisture which you describe as interior air let’s plug in some numbers. Let’s say the interior air was 70 degrees F and 50% RH. The dewpoint temperature of that air is approximately 50 degrees. So this means that if this indoor air reaches a surface 50 degrees or lower, it will become saturated (100% RH) and condense on the cooler surfaces. So you don’t want to let interior air reach the attic when this could result. It is best to decouple the unconditioned attic space from the conditioned living space for reasons related energy and durability performance. Cold air has less moisture-holding capacity than warm air. The reverse would be true when looking at a cooling climate where warm exterior air is allowed to migrate into cooler interior surfaces.

Q: Does it matter if it's open or closed cell spray foam? [Michael Fox]

A: Not if you are looking at controlling temperature and air leakage. Both work well. Open cell is more moisture absorptive.

Q: Is there a situation where spray foam and fiberglass can be combined, like in a floor system? [Allen Robinson]

A: Yes, this is an economical approach. Hybrid installations like this can take advantage of the airsealing of the foam layer and the economic advantage of the fiberglass or cellulose fiber for increased R.

Q: What are good resources for unbiased testing of rainscreen or other building product performance so we don't have to rely on mfg info? [Joshua Dourte]

A: I suppose National Labs like Oak Ridge National Labs or Lawrence Berkeley Labs as well as universities.

Q: Is there any research available for which materials perform best on each facade (based on direction/exposure to sunlight)? [John Price]

A: I don’t have a good recommendation for this.

Q: How important is a rain screen in dry climates? [Dennis Thompson]

A: Not important.

Q: Considering New England conditions, how much should we worry about summer conditions with air conditioning, where the warm side is on the outside? [Geoffrey Pingree]

A: Good point. I am not overly concerned about this, but I try to design structural systems so they have a mechanism to dry if wet. So by my way of thinking, this means don't use polyethylene as a vapor barrier. I would build systems the minimize moisture transport into cavities and then provide ways that in the unfortunate event that moisture collects in the cavities, it has a way to dry out. So having said this, I do not like the use of exterior foil-faced foam sheathing, especially when combined with an impermeable interior sheathing.

Q: Do you think that air barriers have negated the need for vapor barriers in "most" situations? [Brian Trimble]

A: Often they do. I did not install an interior vapor barrier in my own home that was built 4 years ago, but used dense pack cellulose in the walls and foam sandwich panels on the roof. So by virtue of the thickness, I do have a vapor barrier on the roof, but no cavity to collect moisture. I feel comfortable that the dense pack cellulose retards air transport and has the ability to store moisture and give it back when conditions dry.

Q: How do you deal with the dew point on foundation walls that are half buried and half exposed to air? [Allen E Neyman]

A: In my climate I like to install foam insulation that is adhered to the interior surface of the foundation wall. Sealing all joints and seams prevents interior warm air from reaching the cold concrete during the winter and colder than ambient concrete during the summer avoiding condensation. Of course this application requires that I cover the foam with paperless drywall for fire protection.

Q: Many clients want to add a layer of foam to the outside of an insulated, wood framed wall. There is concern, in our cold climate, that the layer of foam will create a condensation plane for any moisture driven into the wall. [Catherine Call]

A: I don't think this is a concern. In fact from a pure building science perspective this is a great thing to do. It provides you with an opportunity to create a continuous air barrier uninterrupted by framing members. It is a straight-forward system. Also, it is like putting a winter coat on your home keeping all building elements inside of that barrier warm and above the dewpoint temperature. So contrary to the thinking, it reduces the likelihood of condensation.

Q: How do your local building departments feel about pouring footings on a gravel base? My experience has been that the footings are to be poured on virgin, undisturbed soil. [Brian Schwieterman]

A: Large stones are self-compacting because of the weight. The code reads footings must be installed on undisturbed or compacted soil and the thick stone base achieves the intent of the regulation.

Q: I have done some expert witness investigations where Tyvek or equal has been expected to stop moisture penetration. Even though the Codes allow for that simple building wrap, is that enough over wood framed construction? [David Porter]

A: I don't think so. I think that we should be installing a drainage plane to prevent intrusion and to promote drying. As homes get more and more energy "tight", they often become less tolerant of moisture intrusion with less drying potential.

Q: You indicated the rainscreen detail at the base to allow air-flow; what about the top of rainscreen detail? Is the air relieved into the vented soffit? [Stanley Turner]

> A: Ideally, this would be a good detail to incorporate. Some code officials won't let you connect 2 stories with a continuous behind-the-siding cavity because they claim it provides an unobservable flame path between multiple floor levels. Having said this, this only happens on rare occasions (by my experience only once). Also, if you don't have venting on the top, the system still works fine, it just doesn't develop a stack force to drive air upward behind the siding.

Q: You spoke a bit about the significance of paint in terms of reducing vapor intrusion on an exterior wall. It sounded like this might be as important as or more important than a vapor barrier behind the exterior finish. Is this correct and additionally could you speak to the relative significance of paint as opposed to vapor barrier's significance in a mild climate like northern california? [MIchael Cobb]

> A: What I discussed was the ability of paint to block capillarity of wood. Painted wood doesn't soak up water.

Q: What is the most important redundant moisture control system? [John Donaghey]

> A: I am not sure I have a "winner", but I simply like redundant systems. Building bulletproof barrier systems is next to impossible to build in a way that are sustainable over time.

Q: How do you calculate the maximum amount of insulation in a wall without risking dew point in the wall? For instance in a cold climate region would there be a problem in using a high r-value SIP panel in addition to insulation in the furred out interior wall (that is directly attached to the SIP panel)? [Peter Eid]

AND a related question…

Q: Given the differential in indoor/outdoor RH and temperature, building material characteristics, etc. How do you determine the location of the dew point in an insulated wall to avoid condensation within the assembly? [Alexander Esposito]

> A: I don't think maximum R is a design issue/challenge. I think controlling the source of moisture and decoupling it from cold surfaces is the approach I would take. If you look at a wall system on a cold day (20 degrees) for example, the exterior of the wall is the exterior temperature and the interior surface of the wall is at the interior temperature, say 70 degrees. The temperature within the wall assembly is a linear drop from inside to outside based on degrees/R value. If the wall had an R30 or R15 the inside would still be 70 degrees and the outside would be 20 degrees. The temperature would drop 50 degrees/R30 or 50 degrees/R15 to calculate the drop on a per R basis. If you know the dewpoint temperature of the interior air, you can calculate where the condensation will collect and after running typical scenarios, you should be able to design a wall that minimizes the threat of condensation.

Q: What is your suggestion for insulation of a flat roof? Bat insulation inside or rigid insulation on top? [Kamran Charmsaz]

> A: Rigid

Q: Do you agree that dense pack cellulose in a wall cavity is more effective than fiberglass batts because it minimizes, if no eliminates, air transport within the wall cavity? [Jeremy Coleman]

> A: That has been my experience.

Q: Have you seen any research where closed cell insulation installed as a vapor barrier has pulled away from the drying studs creating leaks? [Kelli Wegscheid]

A: I have seen this far too often for my liking in the field. I think this is a problem that was not common 20 years ago. I started to notice this recently (last 5 years) and I am not sure if this is related to the reformulation of blowing agents to be more environmentally friendly or not. But I have seen foam pull away from framing members in some installations over time. I don't have any answers at this point, simply observations. I am not concerned about this from a vapor barrier (diffusion) aspect, but it does concern me if you are depending on this to create a continuous air barrier.

Q: Is it ok to use spray foam in a house that is 50 plus yrs old, one that has been breathing for a long time and suddenly is not due to the spray foam?[Donald Green]

A: This can work, but attention to detail is important. The simplistic answer is to clearly define SOURCE-PATH-DRIVING FORCES at play and control them appropriately. For example, you probably have to redesign the mechanical ventilation system in the building to handle interior loads. Also, you might want to look at assemblies to make sure you are not trapping moisture in cavities, etc.

Q: Do these procedures require outside air for health living? [Mark Robin]

A: Yes you need to assure that you have adequate and appropriate levels of fresh air delivered to the occupants.

Q: New energy code will require stopping thermal bridging, probably with foam board over sheathing. Discuss effect on moisture control: in cold, moderate, warm-humid climates. [Edward Acker]

A: This is a big topic and I think following the answers I have been able to provide in this forum provides some insights regarding moisture control, surface temperature control, dewpoint location control, etc.

Q: What was the OSB sheathing tape that we saw in the pictures? [Kelli Wegscheid]

A: This is the Huber Zip system with the Zip system tape provided by the manufacturer.

Q: There has been discussion that the air barrier provided by spray foam when applied with integrity is more important than the u value in insulation. Any comment? [Allen E Neyman]

A: I don't see this as an issue. R is R. When viewed from an energy standpoint, this is what you pay for. Moisture transport is an issue you need to analyze and detail for. So if you mix, that's fine, just be sure you understand what sources and forces are at play.

Q: How do you recommend treating crawl spaces? Vent/no vent? Vapor barrier sealed/unsealed? [Dennis Thompson]

A: I think if we evolved as a species that was 2-feet tall, the headroom we would build for basements would be 3-feet ceiling heights. Yet the laws of physics would not change. Moisture transport mechanisms to not change because of ceiling height. In fact, a case can be made that since you are excavating less with crawlspaces, the exposure to damp soil and water tables are less. Therefore, I build crawlspaces exactly as I build basements. I detail for good drainage, attention to capillary forces, and all the other things I do for good basement design. Stone is placed at the bottom of the excavation, polyethylene sheeting over the top of the stone on the interior, pour an interior slab for a floor, install drainage mats on the outside that are integrated with a thoughtful perimeter drainage system.

Q: You did not show any rigid insulation at foundation (4' at inside wall or under basement slab or 2'+2')...why not? [Louis Wasserman]

A: Sorry --- detail not included as part of the discussion, but as mentioned above, the entire interior surface of the foundation wall was covered with foam that was then covered with paperless drywall.

Q: In unheated structures is ventilation an adequate approach to control condensation on the underside of roof sheathing from the heating up of the roof surface. in cold climates...[Jeff Stetter]

A: If you have a condition whereby you have a roof surface with no condensation on the underside to start, warming by the sun will only work to dry it out more.

Q: Please mention what is your climate zone and that different climates require different responses. For Example: Here in Massachusetts we would want to add a layer of foam under the slab in addition to the stone and vapor barrier. Likewise some soil conditions may require a drain tile around the footing. Perhaps you can think of some other exceptions. [Eric Reinhard]

A: Yes, the University of Massachusetts is in Massachusetts with a heating climate with about 6500 HDD.

Q: Tyvek can degrade to powder when used against Cedar shingles due to the resins in the wood. What do you think of Delta Dri as opposed to rain slicker? [Anne Surchin]

A: Actually this finding was a result of the work we did at the University of Massachusetts (Building & Construction Technology program) in the 1990s. Tyvek and others did not degrade to powder when used against Cedar. What we found was that the water soluble extractives naturally found in cedar worked like soaps to change the surface chemistry so that these wraps could leak, much like when you put soapy water on them. Power washing vinyl siding had similar reactions. Since that time many manufacturers have reformulated their products to be resistant to this dynamic. I have moved on from there over the years to think it is best to incorporate a viable drainage plane behind the siding and not to rely on the wrap as a primary line of defense.

Q: I've heard that the building paper available today is made from cellulose rather than the cotton felt it used to be. Any comment? [Peter Vander Heide]

A: Not sure about this.

Q: what effect do 'French-drains' have on moisture in basement areas? [Raymond Donovan]

A: Dewatering wet sites with French drains has been an effective strategy. Perimeter drains are a good design tool to incorporate in moisture managements systems below grade.

Q: When I am trying to be "green" the tar paper isn't the best product. What is your suggestion for what is the greenest solution? [Judith Miller]

A: I doubt that asphalt impregnated paper is any less friendly than foam insulation, so you have to define your design goals first. If your goal is to use nothing but locally available resources, that are naturally grown / harvested, then you have a particular protocol you must follow. If the design guidelines focus on durability – the ability to last long periods of time without the infusion of new replacement materials and saving energy along the way (embodied as well as that used to condition spaces), then your approach will hinge differently.

Q: Thoughts on ice-and-water shield use. [John Donaghey]

A: I like this product for specific uses like roof edging and valleys. I also like it when it is used around the base of exterior walls where splash back is a threat.

Q: The city of Los Angeles now requires 1/2" or more aggregate under a vapor barrier instead of sand under a vapor barrier. Does this really make sense? [Don Gottfeld]

A: I am not familiar with this ordinance and not sure what they are trying to achieve. I will have to look into this before commenting.

Q: Has not the quality of 15# felt changed in the last 20 or 30 years? I have been told (by old-timers) that today's 15# felt paper is much thinner than it used to be. So should we use two layers of 15# felt or a "heavier" felt to achieve the same performance as the older 15# felt? [Sheree Dittmer]

A: Yes. #15 used to mean that a square (100 square feet of coverage) of the material weighed 15 pounds. Now #15 means number 15 and I think a square weighs 11 pounds. The decision regarding thickness depends on performance metrics. For example if permeance is a concern, you should look at the product specs to see what the perm rating of each layer is.