MOISTURE INTRUSION

Simply explained…

Moisture migration

After three hurricanes and buckets of rain, many of us in central Florida may have personal experience with moisture intrusion through the walls of our homes and aren't lookin' to repeat. With Charley, we had a quick storm blow through and not a lot of rain. With Frances, we had a lot of rain but not a lot of wind. With Jeanne, we got it all. Hard driving winds and rain that was relentless for hours.

So how does water get in? Answer, science. 1. Gravity is pretty reliable, up to down. 2. Greater pressure to lower pressure. 3. Temperature, warmer to cooler. 4. More to less, higher concentration to lower concentration, more relaxing. Now there is always the human factor (poor construction) but there's not much you and I can do with regards to an existing house, so….

If I can "slip" my business cards in the cracks, how hard do you think it is for water to "slip" in?

Let's look at a typical block wall. There are some interesting dynamics here. Different materials all put together that breath, that shrink, that move…hello cracks. Now ask this system to perform like a submarine and you get just as silly an answer…hello moisture intrusion. Let's get to the bottom of this. OK, foundation settlement can cause cracks however this source is not the most prevalent and not the focus of this article. Most cracks in block walls come from the materials and application of these materials in the wall.

A recent UCF Constructability Lab study focused on block wall performance with regards to moisture intrusion right here in central Florida! I read through all 77 pages of the UCF study and can paraphrase the points most applicable to us…block leaks like a sieve…stucco provides the majority of the "water proofing"…paint just helps. If building codes and ASTM Standards were followed to a T, we could reduce settling and moisture intrusion issues almost entirely. What are the chances of that occurring every time?

Paint quality in question?

Most of our homes have a stucco type veneer whether it's on wood frame or concrete block. Stucco is made up largely of Portland cement and is porous by nature. When stucco is applied it "cures". As part of the curing process, stucco gives up moisture to the atmosphere. As it dries, it cracks kinda like our skin. There is an ASTM C926 Standard that requires multiple applications, thicknesses and curing times, but according to the UCF study, proper application is rare.

A minimum thickness of 4/8-7/8" is required for block and frame construction respectively per FBCR703.11. Instead, an average of 3/8-5/8" is what is commonly found in the field. Secondly, if stucco were installed in a 2 or 3 coat process with proper curing time in between, we simply would not have the moisture intrusion issues we currently encounter. The science thing takes over from here…gravity, pressure and temperature gradients, capillary action.

How thick is this "stucco"?

So here we have a porous material with cracks subjected to wind driven rain, what'll ya think will happen? Picture a napkin dipped in water. The water races right up the napkin via capillary action. According to Dr. Joe Lstiburek, the theoretical limit of capillary rise in concrete is about 6 miles! In wood it is about 400'. Common sense (and physics mentioned above) says the more paths provided and the longer those paths are exposed to inclement weather, the more vulnerable a wall system (or anything else) is to moisture intrusion and subsequent adverse ramifications…Duh. Now during our normal 15 minute Florida thunderstorms, we just don't have the quantity of rain and Jeanne type winds and thus we just don't experience the moisture intrusion problems we had with the hurricanes. However the UCF study found that cracks don't need to be wide to allow moisture penetration. Cracks .39mm or 1/64" allowed moisture penetration and accumulation at the base of test walls.

Old mortar joints, moisture related.

Besides the stucco shrinkage and cracking, Forcon International Corp 1992 TEK 10-1A 2001, Gulde 2006 determined another common cause of shrinkage cracks in masonry walls comes from using 'wet' or uncured concrete block. When uncured blocks are used to construct a masonry wall, they continue to cure and experience a significant amount of shrinkage. Typical shrinkage in a 50 foot masonry wall range from 3.1 to 6.9 mm. The older the masonry is, the moisture loss decreases as compared with the loss in the beginning of it's life but I read a stat somewhere that concrete will continue to shrink over it's entire lifetime while a brick will continue to expand over it's lifetime. Interesting huh?

Besides the stucco shrinkage and besides the block shrinkage we also have to deal with shrinkage of the mortar joints themselves from imperfect mix proportions of sand, water and cement.

Besides the stucco shrinkage and besides the block shrinkage and besides the shrinkage of the mortar joints, other documented problems start with the initial installation of the vapor barrier between the framed second floor and concrete block first floor. Discontinuous membranes, under-lapped membranes and the lack Z flashing allow water to run behind the stucco veneer until it runs into an electrical outlet or your baseboard.

Crack along expansion joint.

Other common moisture intrusion areas are around poorly sealed windows and inconsistent/improper window installation, electrical/cable guy/dryer vent/bath vent/mechanical/plumbing/gas line and other decorative wall penetrations. The one I really love is when I find bare block around and behind electrical panels. Bare block sucks, water that is.

According to this UCF study and their researchers, waiting and loading strategies are advised if ya got the time. The Portland Cement Association apparently suggests waiting a full 28 days before applying any paint to new stucco. Happens lots huh?

Next, let's look at remedies and actions we should take to help minimize moisture intrusion for stucco veneered walls. I say minimize because some construction techniques already exist and may be vulnerable to moisture intrusion by nature. Remember, before you throw your builder under the bus, a house is a house. It's not a swimmin' pool, it's not a submarine and it's not a frog's butt. If you hold the house under water or subject it to conditions similar to…it'll eventually leak. So let's deal with what we've got. If you're building a custom home and have the luxury of dictating methods (or even if you're not), I encourage you to check out the below referenced web sites. The Dr. Joe (Building Science) article reads like a conversation, plain understandable language we can really identify with.

So what in the world do we do with our existing housing issues? A line I have coined is "the better we caulk/seal/paint, the better the house performs" works for me. We all agree that a good "breathable" elastomeric or acrylic paint be applied. This will help keep the water out while still allowing the wall to breathe and can be purchased from all major manufacturer's. In a two story home where the initial intrusion may be occurring at the block/frame transition, reflashing may be necessary which of course is more expensive. Just two token pieces of advice...1)don't buy cheap caulk or paint and 2)when you recaulk your windows, don't caulk the weep holes! Focus on the corners, not the little holes or areas that let water back out. I quote the UCF study…

Paint: Use a premium, high build, acrylic coating with the following characteristics:

- Meets Federal Specifications for resistance to wind driven rain (TT-C-555B).
- Allows water vapor transmission (high perm rating) permitting water to evaporate from the wall to the exterior.
- High flexibility/elongation to cover existing and new cracks.

Service: Near the end of the warranty period, repair all visible cracks and apply a second coat of paint. Cracks should be repaired with an elastomeric waterproof sealant patching compound. The method will depend on crack width and the sealant product, but might typically include:

- Less than 0.4 mm (1/64 inch) – apply a brush grade compound with a small brush.
- Between 0.4 mm (1/64 inch) and 0.8 mm (1/32 inch) – apply a knife grade compound.
- Between 0.8 mm (1/32 inch) and 6.4 mm (1/4 inch) – route out crack ¼ inch wide by ¼ inch deep; apply two coats of knife grade compound.

My personal experience…DO NOT GOOP CAULK on/in stucco cracks no matter how strong the urge and how careful you are. It "flashes", looks like caca and generates love letters and heckling from neighbors/HOA associations.

If you need to hire a contractor for repairs use common sense. You can check out licensed contractors at the Better Business Bureau or the National Home Builder's Association. Make sure the contractor has insurance or you could be liable. Get a written estimate and contract. If you get a guarantee, it should be in writing and state who is responsible for repairs and maintenance and for how long. And finally, don't give up your final payment until the work is complete and you have obtained all necessary release of liens. If a building contractor has not paid their subs and leaves with your money, you may be paying the subs again!

If you've got questions or suggestions, let me know. The ideas for new articles come from YOU! I can be contacted via email at jon@inspectagator.com. If we all stick together nobody gets burned!

References

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