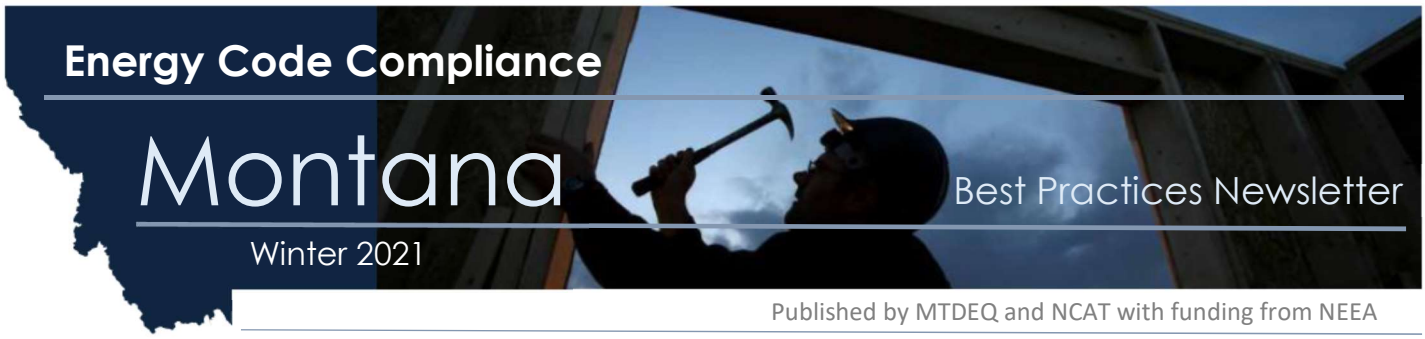

Energy Code Compliance Montana Best Practices Newsletter

Winter 2021

Published by MTDEQ and NCAT with funding from NEEA

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Update on 2021 Code Adoption

Montana Building Codes Council met on December 8, 2021, to present and consider proposed administrative rule amendments for adoption of new versions of the building codes. The council considered a number of new codes, including the 2021 International Energy Conservation Code (IECC). The meeting allowed public comments to consider changes to the proposed amendments to the various codes. The amendments can be found at bsd.dli.mt.gov/building-codes-permits/DraftARM_BCC12-8-21.pdf.

Most public comments offered to the council regarding the 2021 IECC centered on Appendix RC, which covers residential zero energy. If adopted as an appendix, certain municipalities could adopt the appendix as part of the local adoption process. A number of comments were offered that can be summarized this way: generally, the building industry opposed the appendix because of cost concerns, with some municipalities and environmental interests in support of adoption. A council member moved to adopt Appendix RC, but there was no second. Therefore, at this point in the process, the appendix is not included as part of the 2021 IECC for Montana. Final adoption of the codes is set for late winter of 2022.

A Second Look at Double-Stud Walls

Back when I was in high school, one of my dad's friends, Jack, hired me for a summer to help him build a house. Like my dad, Jack was a railroader. He had recently become a widower, and since his own daughter was grown and lived on her own, Jack wanted a smaller house. This was the mid-1970s and the energy crisis was at its peak. Jack—like all of us in Terre Haute, Indiana, at the time—disliked the power company. Jack's idea was to build a small, energy-efficient house on a plot of land out in the country and pay as little as possible to heat and cool the place. A wood stove was to be a central feature of the house. Jack, being a railroader in a recession, had the time and skills to build his own house. If memory serves me correctly, Jack ordered a set of plans and then hired me to be a gopher, lifter of all things heavy, and occasional hammer wielder. I didn't think too much about the design of the house at the time; I was just a high-school kid happy to be making a few bucks before going off to college. I did note, however, that Jack's house had double-thick (double-stud) exterior walls, which caused a bit of head scratching when it came time to frame windows and doors. I also noticed that Jack used a bunch of polyethylene sheeting on these walls, both inside and out. Again, I didn't think too much about this, since there was a factory in town that made the stuff and I just figured he had an inside track to get the stuff cheap. Eventually, we got the framing and sheathing up in time for me to head back to school in the fall. I don't think I ever saw the finished house.

Several years later when I was home visiting from college, my dad told me that Jack had been in the hospital. To make a long story short, someone determined that Jack built his house too tight, it "needed to breathe"[1] and it was making him sick. Jack remedied the situation by keeping some windows open year-round, pretty much thwarting his plan to "stick it to the power company."

Fast forward some 35 years later, and I find myself working for the National Center for Appropriate Technology (NCAT), when I happen to find an incomplete set of house plans in a forgotten storage area in the office. The plans, developed by NCAT during the energy crises to help people deal with high energy costs, included double-stud walls and polyethylene. I wondered if these were the plans Jack purchased for his house. I'll never know, but the plans and my foggy memory of Jack's house sure would point to that being the case.

My impression of double-stud walls from my teenage years until my time building my own homes has been to dismiss them as dangerous and not worth the effort to make them safe. That is, until recently. What has made me take a second look is that a number of building scientist and architects I follow have revived the idea, and using sound building science principles and the proper building materials have shown these wall assemblies to be safe, affordable, and energy-efficient.

Some Common (Mis) Perceptions

One common belief about double-stud walls is that, because of their thickness, they will become wet, especially the exterior sheathing, and never dry out, leading to rot or worse. Perhaps it is the stories like Jack's and the way that some of these houses were built in the 1970s and 1980s that have caused this perception, but builder Ben Bogie concludes in a May 2021 article for Green Building Advisor:

> "This 'yeti' is the idea that double-stud walls are going to have dangerous levels of moisture accumulation throughout the winter months that will result in anything from mold growth to catastrophic rot and failure. The joke here is that it's a yeti because it's often talked about but rarely, if ever, seen."

He reaches this conclusion after studying three years of data from 12" double-stud walls he constructed in Maine. The data shows typical seasonal levels of wetting and drying; however, the peaks and valleys of the wetting and drying cycles are reduced over time, indicating the walls drying out after construction with typically wetted construction materials. Granted, Bogie has constructed these wall assemblies properly and, as with all wall assemblies, the details matter.

His observations are bolstered by a 2015 Building America Case Study, *Monitoring of Double-Stud Wall Moisture Conditions in the Northeast.* While warning readers that these wall assemblies have a higher risk of moisture problems than exterior insulated sheathing, and double-stud walls monitored showing moisture content in the dangerous ranges, the study concludes:

> "…in all walls, during each summer after a winter of wetting, moisture levels fell well into the safe range. When the walls were disassembled at the conclusion of the experiment, the sheathing and framing showed remarkably little evidence of wetting damage or mold growth. No visible mold growth, staining, or water rundown was found. The damage was limited to some grain raise of the interior surface of the oriented strand board at the cellulose wall, and slight corrosion of fasteners and staples."

The good news for Montana builders is that the cold, wet Northeast climate is a worst-case scenario for Montana's mostly cold, dry climate. Our climate should allow a double-stud wall assembly to dry out and stay dry throughout the year.

A second misperception about double-stud walls is that they are too complicated and time- consuming to construct. Granted, they are a bit more complicated than a typical 2x6 wall, but with increasingly stringent energy codes and the push for continuous insulation to minimize thermal bridging, designers and builders will be looking for alternatives that a competent carpenter can incorporate into the build without acquiring new skills. A double-stud wall may be just the ticket when it comes to simplicity in the build.

[1] Houses don't breathe, the people inside of them breathe. Houses need to be built tight and ventilated properly. I'm sure Jack only built tight as ventilation wasn't seen as important at the time.

Double-Stud Walls and the 2021 IECC

With Montana set to adopt the 2021 IECC in early 2022, it would be wise to take a look at how double- stud walls will comply. The un-amended 2021 IECC Table R402.1.3, Insulation Minimum R-Values, will require continuous insulation to comply with this prescriptive part of the code. The proposed Montana amendments, however, retain the previous R-21 cavity requirement without continuous insulation. Strictly speaking, double-stud wall cavities would not meet the continuous insulation requirement because the footnotes describe the location of the continuous insulation as, "on the exterior or interior surface of the wall." Even though double-stud walls are designed to fix the problem of thermal bridging that the IECC is aiming at with continuous insulation, the insulation is still in the cavity. However, Table R4.1.2, Maximum Assembly U-Factors, offers another compliance path requiring the wall assembly to have a U-Factor of 0.045 for zone 6, which is equivalent to an R-Value of a little over R-22. An 8-inch double-stud wall cavity with cellulose or fiberglass batts would meet this requirement with the insulation alone, not taking into account any other assembly components.

Constructing the Double-Stud Wall

Perhaps the most complicated part of the double-stud wall is choosing how to build it. A quick internet search will demonstrate that there are numerous ways to build these wall assemblies, and also numerous debates about which way is best. The most popular approach is two walls—an outside load-bearing wall and an inside parallel wall.

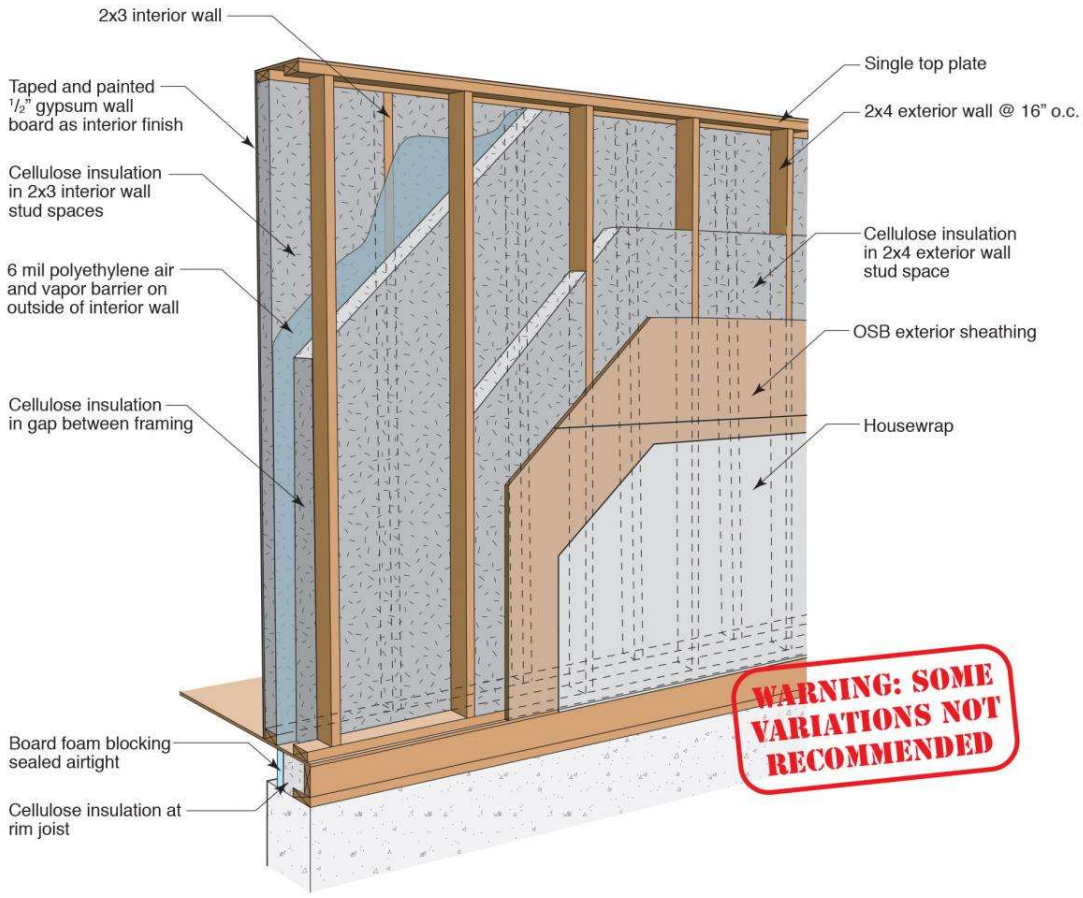

Illustration courtesy of U.S. Department of Energy Building America Solution Center

Less common methods include using 2x8 or larger top and bottom plates and staggering the studs on both sides of the plate.

Building Science Corporation recommends adding a vapor-control layer in the center of the assembly to reduce the risk of wetting to the cold outside sheathing. The following illustration shows this layer as taped ½-inch plywood. However, some designers and architects have had good results using polyethylene sheeting in this location, as shown in the previous illustration. While there is a cost savings to this approach, the disadvantage is maintaining the integrity of the vapor-control layer, as polyethylene is less durable than plywood. Hence, the warning label.

There is some debate about the need for this vapor-control layer in drier climates. If it is not used, then a vapor open assembly utilizing plywood sheathing; a vapor-open, weather-resistant barrier; and a drainage plane behind the cladding will help the sheathing to dry.

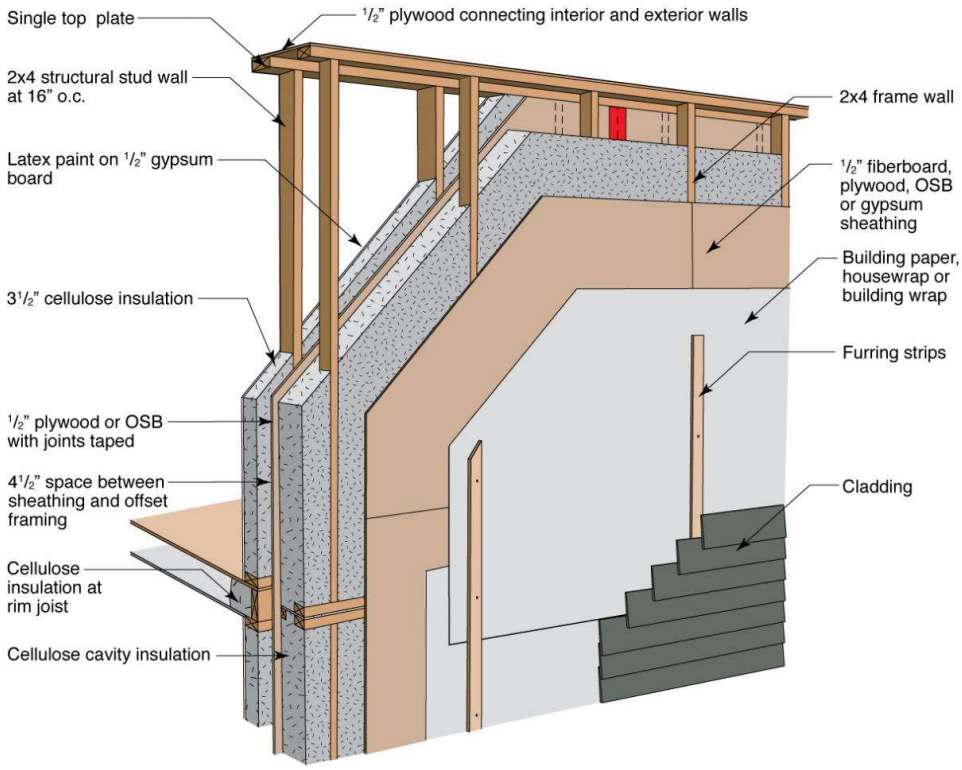

Illustration courtesy of U.S. Department of Energy Building America Solution Center

Conclusion

Double-stud walls deserve a second look. While these walls assemblies are above code, they will result in a very tight, energy-efficient house if constructed properly. They may be the most affordable above-code option. Remember, don't be like Jack and not provide the proper ventilation in homes constructed with double-stud walls.

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