SAFE, EFFECTIVE & AFFORDABLE RETROFITS FOR COLD CLIMATES

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EXTENDED ABSTRACT

In general, retrofitting walls with insulated cavities improves the condensation potential inside the cavity as well as the energy performance of the building envelope (Straube, 2011). Care needs to be taken in choosing the amount of exterior insulation so that the dew point does not fall within the cavity when exterior insulation is applied (Craven & Garber-Slaght, 2014). The colder the climate the more exterior insulation is necessary. The rule of thumb in Fairbanks, Alaska is that 2/3 of the wall R-value needs to be outside the structural sheathing to prevent condensation within the stud cavity. This amount of exterior insulation is usually cost prohibitive, leading to retrofits with less than optimal exterior insulation.

The 2/3 exterior insulation rule of thumb is based on an interior temperature of 21°C and 40% relative humidity. Lowering the inside humidity to 20% reduces the amount of exterior insulation needed to approximately ½ of the overall R-value. While 20% interior RH is certainly achievable in cold arid interior Alaska, it is not considered healthy (Sterling, Arundel, and Sterling, 1985). Additionally, designing a wall that relies on very low interior RH is a recipe for disaster. Ventilation systems get disabled on a regular basis because they introduce cold air into the living space or make the air too dry, causing people to humidify when the air is too uncomfortable. It is better to design a wall that is resilient despite user behavior.

Existing buildings in Alaska tend to have a leaky vapor/air retarder layer (usually 6 mil polyethylene sheeting) behind the gypsum board. 2x6 stud walls usually have RSI 3.3 (R-19) batts of fiberglass with exterior plywood sheathing. Traditional construction techniques have survived in Interior Alaska for two reasons: moisture accumulates on the sheathing in the winter when it is frozen and when it melts it dries to the outside very quickly. Slight changes to an existing wall can have huge impacts on moisture durability.

Adding rigid foam to the exterior of a house is a common energy retrofit in Alaska. This technique has the potential to improve a home's energy performance but it changes the moisture dynamics of the wall. This change in moisture movement can result in compromised indoor air quality and reduced durability of the structure due to moisture accumulation in the building envelope. This research used a literature search and hygrothermal modelling to study the effects of using a more vapor open exterior insulation. Eight potential retrofit walls were chosen to test further in the CCHRC mobile test lab.

All the test walls will start with a base of traditionally constructed wood framed walls. Each will get a different exterior insulation (see Table 1) that is vapor permeable, but is also more affordable than the excessive amount of exterior insulation required to keep the dew point outside of the stud. The study which will begin in October 2017, will evaluate the moisture and thermal performance of wall in-situ. It will also

study how frozen wall components affect the moisture performance of walls.

Table 1. Exterior Insulations

Wall Number	Exterior Insulation
1	3.8 cm (1.5 in) mineral wool
2	5 cm (2 in) unfaced EPS
3	5 cm (2 in) Biomaterial
4	7.6 cm (3 in) mineral wool
5	none
6	8.9 cm (3.5 in) cellulose
7	8.9 (3.5 in) cm fiberglass
8	10 cm (4 in) Biomaterial
9	10 cm (4 in) unfaced EPS

REFERENCES

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