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Rousseau, M. Z.; Maref, W.; Leroux, P.; Armstrong, M. M.

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**EFFECTS OF EXTERIOR INSULATION RETROFIT ON
MOISTURE ACCUMULATION IN WOOD-FRAME EXTERIOR WALLS**

Background

Energy retrofitting the building envelope of the existing housing stock can result in higher energy efficiency and thermal comfort, and lower operation costs. Adding thermal insulation on the exterior of existing walls is one option available to building owners. The effect of the heat, air and vapour flow control properties of the thermal insulation on moisture accumulation in the wall cavity due to wintertime condensation is a topic of interest warranting research.

Objective

Compare and assess the hygrothermal response of 3 different wood-frame wall assemblies, two of which integrate a different energy retrofit measure using exterior thermal insulation with different hygrothermal properties (i.e. vapour and air permeance), exposed to challenging climate conditions.

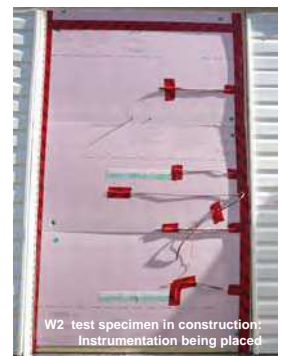
Methodology

- Three wall tests specimens with different heat, air and moisture control properties were built side-by-side in NRC-IRC Field Exposure of Walls Facility (FEWF).
- The test specimens are exposed to natural outdoor weather, and to a series of challenging levels of air pressure and relative humidity indoors over the course of the seasons.
- An opening in the air barrier system (the polyethylene membrane) of the specimens is introduced during the monitoring period, to examine the effect of air leakage on the wetting and drying of the elements.
- The test specimens are instrumented and monitored continuously to characterize the profiles of temperature, relative humidity, air pressure, moisture deposition, and moisture content in locations of interest within the assemblies.
- The study started in Fall 2007 and will continue through Winter 2009.



Test Specimens

- W1 (reference wall) is a typical 38 mm X140 mm (2X6 nominal) wood-frame wall construction for low-rise housing, including RSI3.52 (R20) glass fibre insulation in the stud cavity.
- W2 is an energy-retrofitted specimen. It consists of W1 construction *plus* 50 mm (2 in.) rigid-board extruded polystyrene insulation (XPS) on the exterior of the existing wood sheathing & sheathing membrane.
- W3 is an energy-retrofitted specimen. It consists of W1 construction *plus* 62.5 mm (2.5 in.) semi-rigid mineral fibre insulation on the exterior of the existing wood sheathing & sheathing membrane.
- All 3 specimens include a PVC horizontal exterior lap siding, and a polyethylene air/vapour barrier behind the interior drywall finish.



Expected Outcomes

- Better understanding of critical elements affecting the wetting and drying of such wall assemblies.
- Benchmarking NRC-IRC hygroIRC 2D numerical model for predicting hygrothermal response of wall assemblies.

Partners

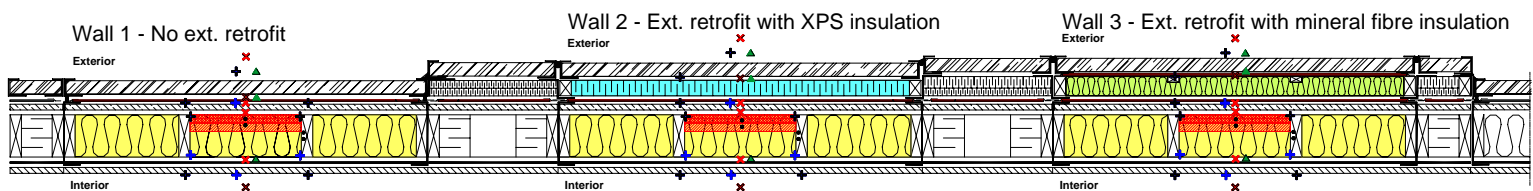
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Contacts

Dr. Wahid Maref
(613) 993-5709
wahid.maref@nrc.gc.ca

Madeleine Rousseau
(613) 993-3938
madeleine.rousseau@nrc.gc.ca

website http://irc.nrc-cnrc.gc.ca/bes/hmpe/fieldfewf/index_e.html



Horizontal cross-section of the 3 test wall assemblies

Instrumentation - Plan View
 * RH and T sensors
 * T sensors
 * Air Pressure sensor
 * Moisture Pins
 * Moisture Detection Tape