

HYGROTHERMAL PERFORMANCE OF HIGHLY INSULATED WOOD FRAME WALLS WITH AIR  
LEAKAGE: FIELD MEASUREMENTS AND SIMULATIONS

By

Michael John Fox

Master of Applied Science in Building Science, 2014

Ryerson University, Toronto

ABSTRACT

This thesis examines the hygrothermal performance of six types of high thermal resistance (High RSI) wall assemblies during environmental exposure and an air leakage (exfiltration) simulation test. These walls were installed in the Building Engineering Group's test facility (BEG Hut) located at the University of Waterloo. The High-RSI wood-frame walls were assessed by analyzing condensation, mould, and decay risks using the moisture content, temperature, relative humidity and heat flux data collected during the field test. These field-measured data were also used to calibrate one-dimensional WUFI® simulation models for each of the High-RSI assembly for use in future durability assessments using a range of North American climates. Methods were investigated to improve the predictive capacity of these simulation models as well as to increase their utility as a research tool. The design, construction and instrumentation details of the High-RSI study were also documented.