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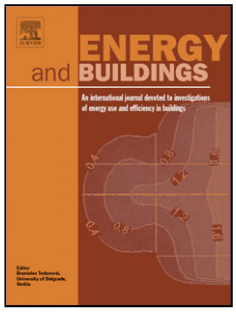

Title: Finite Element Thermal Modeling and Correlation of Various Building Wall Assembly Systems Journal paper in the Energy and Buildings Journal

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Abstract: The 2009 Energy codes IECC and ASHRAE 90.1-2007 contains significant insulation changes for steel stud wall constructions regarding thermal shorts introduced by steel studs. A better understanding of industry requirements regarding U-factor calculation procedures, modeling guides, and tools, establishes the foundation for building enclosure performance evaluation as well as for new building enclosure solution development. This study compares the thermal performance of three wall systems using several modeling methods and laboratory testing.
Literature suggests there are many challenges related to the thermal modeling of building walls, including proper representation of frame cavity and boundary condition. Although simple 2D Finite Element (FE) tool (THERM5.0) has been certified by NFRC, its limitations have not been well understood. In order to address industry challenges and to develop a better understanding of the limitations of 2D analysis, a 3D finite element analysis thermal modeling approach has been developed. This paper outlines findings from guarded hot box tests of three walls: a conventional wall, two continuous insulation walls one with spray polyurethane foam (SPF) and one without SPF; and compares the results of the testing with FEA modeling for the same three walls. The results show significantly increased performance of continuous insulation with SPF filled cavity vs. typical gypsum wall with fiberglass insulation.