Session VIII-A: Wall Systems III

Wednesday, December 8, 2004
8:30 a.m. to 10:00 a.m.
Grand Ballroom – Beach

Session Chair:

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8:30 a.m. to 8:40 a.m. Introduction
Anton Tenwolde

8:40 a.m. to 9:00 a.m. *"Airflow in the Ventilation Space Behind a Rain Screen Wall"*
Therese Stovall

9:00 a.m. to 9:20 a.m. *"Detection of Moisture Accumulation in Wall Assemblies Using Ultra-Wideband Radio Signals"*
Bill Healy

9:20 a.m. to 9:40 a.m. *"Condensation Risk within Loose Fill Insulation Due to Natural Convection in Vertical Cavities"*
Katrin Riesner

9:40 a.m. to 10:00 a.m. *"Designing and Testing a Structural Insulated Panel (SIP) with the Help of Hygrothermal Model"*
Oskar Pankratz

Airflow in the Ventilation Space Behind a Rain Screen Wall

Therese K. Stovall and Achilles Karagiozis – *Oak Ridge National Laboratory*

The inclusion of a ventilated airspace within a wall has been shown to improve the moisture transport of the wall assembly. Experimental data describing the airflow within such a cavity are available for a limited range of weather conditions and geometric configurations, but general relationships between the ventilation within the wall and external weather variables are not. Therefore, a series of steady-state numerical models was constructed to explore the influence of weather variables, including wind speed, insolation, and outdoor air temperature, for brick rain screen wall configurations. These configurations included multiple cavity depths and vent sizes. All models were based on a single-story building height with wind perpendicular to the wall. The results were used to develop a number of correlations intended to supplement the accuracy of transient hygrothermal models.

Detection of Moisture Accumulation in Wall Assemblies Using Ultra-Wideband Radio Signals

William M. Healy – *National Institute of Standards and Technology*

Eric van Doorn – *Intelligent Automation Inc.*

This paper discusses the use of ultra-wideband radio signals near 5 GHz to detect moisture problems within building assemblies. Ultra-wideband signals are made up of a large spectrum of electromagnetic waves, and hardware is available to temporarily resolve the signals to a time scale on the order of picoseconds. By emitting these signals toward a wall assembly and analyzing the reflected signal, information can be obtained on the wall. Most notably, because water reflects these waves more significantly than dry building materials, the magnitude of the reflections can be correlated to moisture levels. This principle has been incorporated into a synthetic aperture imaging technique to create images of the moisture state of building assemblies. The pictures can help identify locations of unwanted moisture intrusion in a nondestructive manner. Advantages of using ultra-wideband compared to conventional radio frequency techniques include the improved spatial resolution and the ability to penetrate a wide range of materials.

Condensation Risk within Loose Fill Insulation Due to Natural Convection in Vertical Cavities

Katrin Riesner and Georg-Wilhelm Mainka – *University of Rostock*

Carl-Eric Hagentoft – *Chalmers University of Technology*

The paper presents a case study about the influence of natural convection on condensation risks and on mold growth risks within loose fill insulation of a wood-framed wall under a yearly climate cycle. The investigations were carried out using the WINHAM2D model, a two-dimensional heat, air, and moisture transport program without liquid transport suitable for noncapillary insulations. The results of WINHAM2D are compared with the German standard to show differences between both models and their results. As the focal point, the results of location, time, period, and extent of local moisture accumulation are considered. The purpose of the study is to give a first recommendation to avoid damage due to convective moisture redistribution under the coupled conditions of air permeability of the insulation and water vapor diffusion resistances of the boundary layers. The analysis indicates that material properties and boundary conditions have a significant influence on the dynamic process of the moisture migration within insulation.

Designing and Testing a Structural Insulated Panel (SIP) with the Help of Hygrothermal Model

Oskar Pankratz

Andreas Holm – *Fraunhofer Institute of Biophysics*

When building component manufacturers design new component parts, it is still common in Germany and Austria to use the “Glaser diagram” (dew-point method) to predict the hygrothermal behavior. One reason is that during the design process, experimental investigations are expensive and of limited transferability. An alternative is the use of validated models. The main advantage of modeling is that modeling can predict the long-term hygrothermal performance of the system under different climatic conditions, changes in the interior conditions, or the effect of different system components in a fast and cost-effective way (e.g., with or without vapor retarder). One problem is that after the computer design process, only few new building components are actually tested and monitored in practice. This paper will show the successful use of a simulation program during the early designing process of structural insulated panels and how the calculated results influenced the final design of the structural insulated panel (SIP) system. The designed construction was monitored intensively at the outdoor testing field in Holzkirchen/Germany. The comparison of measurement and simulation with WUFI demonstrates good agreement. Based on the experiments and calculations under various climatic—including indoor—conditions, this SIP’s hygrothermal performance will be demonstrated.