Side by Side Study Proves SIP Advantage

Brock University Study Quantifies Superior Thermal Performance of SIPs

By Emil Taraba

A recent study by Dr. Tony Shaw of Brock University involved a side by side evaluation of nearly identical residential buildings - one constructed with SIP exterior walls and one conventionally framed with studs and batt insulation. The two structures involved in the study were rental housing units, located immediately adjacent to one another. Both buildings were identical and had similar east-west orientations, ensuring the same exposure to outdoor temperature and wind conditions. Except for brief periods both houses were occupied throughout the course of the study, which took place over a 12-month period from February 2000 to January 2001. Both units were heated with a natural gas/forced air system.

One unit was constructed with 4.5" SIPs, while the other used 2x6 studs with batt insulation. Both homes were built to the Ontario/National Building Code of Canada. The same crew built the units, with no one being aware that scientific tests would be conducted afterwards. The study incorporated several test methods to analyze different determinants of energy efficiency: thermographic imaging, hourly temperature readings and air leakage measurement.

Thermographic Analysis

The deceiving nature of R-values was illustrated by infrared imaging on the two structures on a day in early March. Energy loss measured at the conventionally framed building, which used insulation rated at R-20, performed at an R-4 equivalent. By comparison the SIP home, performed at a true R-17 level. Thermographic analysis, at an outdoor temperature of 13.1 degrees Fahrenheit, also demonstrated that the stud home consumed nearly four times as many BTUs as the SIP home.

Furthermore, thermographic photographs provided visual confirmation of areas of thermal weakness in the 2x6 wall, where thermal bridging (i.e. conduction) is visible around each stud, along with pockets of air leakage.

Temperature Trends

This imaging evidence was supported by temperature data recorded hourly by a series of sensors located within the walls of each building. Temperatures recorded in the middle wall and inside the exterior wall surface of the stud construction showed the greatest fluctuation, corresponding closely to the variation in outdoor ambient temperatures, especially during the cold months of December, January and February. In comparison, the SIP wall sensors recorded significantly higher and more stable temperatures at those locations. The temperature of the middle wall sensor averaged 35.5 degrees Fahrenheit for the stud wall, while the SIP wall averaged 60.1 degrees Fahrenheit in the month of January.

These variances are key because, once again, heat will always move from the hotter body to the cooler one. The higher temperature at the middle wall sensor demonstrates that the SIP wall experienced less heat loss than the stud wall, and consequently, is more energy efficient.

Also of notable significance are the temperature differentials recorded between the inside interior wall surface and the inside exterior wall surface. Over the course of the year, lower differentials were recorded for the SIP wall (an average of 43.7 degrees Fahrenheit) as compared to 54.2 degrees Fahrenheit for the stud wall, further demonstrating its reduced susceptibility to heat loss.

Air Tightness Comparisons

The results of the air leakage tests showed the SIP house to be much tighter than the stud house. The SIP house had 1.55 air changes per hour (ACH) at a pressure differential of 50 Pa, while the framed wall house had 2.60 ACH at 50 Pa, or 68% more leakage. This means that, all other factors being equal, the SIP house would use less energy for heating, would be more comfortable, have better heat retention and be less drafty.

The following article appears courtesy of SIPA and is reprinted with permission.

Engineered Panel Designs, Inc 1245 South Cleveland-Massillon Rd Suite 210 Akron, OH 44321
(330) 668-1500
www.epdsips.com contactus@epdsips.com