



The Eco-\$mart Library

Structural Insulated Panels SIP Insulation Performance



Expanded Polystyrene was first utilized in the cold room industry. When it was originally introduced, the costs were relatively high. For this reason, it was not considered for use in home construction. In time, the price decreased considerably. Recognizing its excellent thermal resistance properties, manufacturers of home construction materials began to incorporate it into many different products.

The Structural Insulated Panel (SIP) emerged as a unique alternative building technology for building envelope construction that was comprised of two skins of the same or different materials laminated to either side of an expanded polystyrene foam core. Tests were conducted by Jeffrey Christian, director of the U.S. Department of Energy's Buildings Technology Center of Excellence at Oak Ridge Laboratory, and Jan Kosny, a research engineer at the University of Tennessee. The structural insulated panel or SIP provided a 58 percent higher thermal whole-wall performance than a building envelope constructed of conventional wood frame 2" x 6".

TESTS PROVE SIPS TOPS IN THERMAL PERFORMANCE

Compared to a building envelope constructed of conventional wood frame 2" x 6", the use of structural insulated panels or SIPs can result in a shell that has a 58% better thermal performance overall, according to recent tests performed by the University of Tennessee and the U.S. Department of Energy's Oak Ridge National Laboratory.

The study tested and compared 18 wall systems - calculating standard R-values - but also calculating how well heat flows through various wall materials (structure and insulation) and how well the walls connect to other walls, flooring, roof, doors and windows - called "whole-wall R-values." Traditionally a wall's R-value is calculated by determining the insulation performance of only structural and insulation materials called clear-wall R-value. The new study weighed the performance of the entire building envelope or shell, comparing whole-wall R-value performance for concrete, wood, metal, Larson truss walls and SIPs.

SIPs had a whole-wall R-value of 21.6, which is 88% of its clear-wall R-value of 24.7, which means the material creates one of the tightest building envelopes in construction.

Wall System	Clear-Wall R-Value	Whole-Wall R-Value	% Difference
2 x 4 wood stud wall in 16" o.c., R-1 batt insulation	10.6	9.6	91%
2 x 6 wood stud wall in 24" o.c., R-19 batt insulation	16.4	13.7	84%
Structural insulated panel (SIP), 6" thick foam core + 2-1/2" oriented strand boards	24.7	21.6	88%
4" – metal stud wall 24" o.c. R-11 batt insulation, 1" EPS Sheathing + 1/2" wood siding	14.8	10.9	74%
3-1/2" metal stud wall 16" o.c., R-11 batt insulation, 1/2" wood siding	7.4	6.1	83%

(Each system includes 1/2" plywood exterior and 1/2" gypsum board interior.)