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Whole House Air Infiltration Study

Technical Bulletin

Full-scale house study shows virtually no difference in air infiltration among insulation types

While laboratory studies of construction techniques have many scientific merits, there is nothing quite like testing full-scale construction in terms of generating believable, real-world results. In 1996, Gren K. Yuill, Ph.D., Professor of Architectural Engineering at Penn State University, performed air infiltration tests on two identical houses built at Owens Corning's Granville, Ohio, Science and Technology Center.

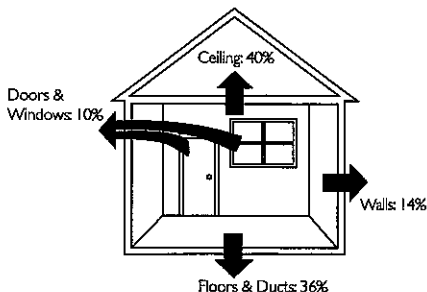
The tests conducted in the four-part study included:

- Effect of Wet-Blown Cellulose and Kraft-Faced Fiber Glass Insulation on Air Infiltration of a House
- Effect of Loosefill Fiber Glass and Kraft-Faced Fiber Glass Insulation on Air Infiltration of a House
- Effects of Various Wall System Air-tightening Materials and Techniques on Air Infiltration of a House
- Effects of Sealing House Components Against Air Infiltration

Component contributions

By successively isolating the air infiltration contribution of various construction components the study determined the contribution of each element: exterior walls, doors and windows, floor, interior partitions and ceiling. The overall results for each structural element are shown below:

Air Leakage by Component



Source: 1996 Whole House Air Infiltration Study by Dr. Gren Yuill, Penn State University.

"The results may surprise some people about where most air infiltration occurs in a house," said Dr. Yuill. "We found it was not the wall system, but the ceiling (40%) and floor (36%) that account for the majority of air leakage in a house. While it is still important to incorporate airtightening techniques in the wall system, the floor and ceiling should receive the most attention."

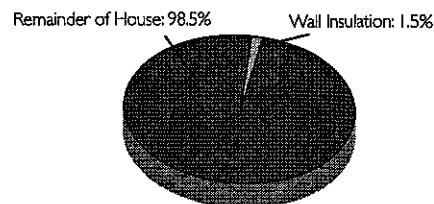
Insulation has very little effect on air infiltration

The study discovered that wall cavity insulation as an air infiltration barrier is insignificant when compared to the other components of a wall, and the air leakage through the walls is small compared to the overall leakage through the other components of a house. The majority of a house's air leakage occurs in the floors, ceiling and ducts. The complete removal of the wall cavity insulation would only result in a 1.5 percent increase in air leakage throughout the entire house.

Fiber glass insulation vs. cellulose insulation

Another part of the same test series investigated the effects of

Impact of Cavity Insulation on Whole House Air Infiltration

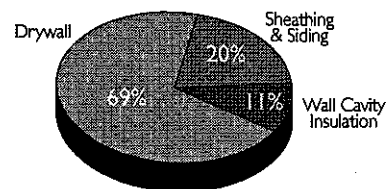


Source: 1996 Whole House Air Infiltration Study by Dr. Gren Yuill, Penn State University.

R-13 kraft-faced fiber glass insulation and wet-blown cellulose wall insulation on the air infiltration of a house. The wall system tested in this part of the study consisted of cavity insulation, drywall, siding and wood fiber sheathing. Caulk and sealant were not applied to the wall system.

"Based on the test data, we found the performance difference between the two insulation materials' ability to reduce air infiltration to be minimal," said Yuill. "Furthermore, we discovered that wall cavity insulation as an air infiltration barrier is insignificant when compared to the other components of a wall, and the air leakage through the walls is small compared to the overall leakage through the other components of a house."

Effect of Construction Materials in Resisting Exterior Wall Air Infiltration



Source: 1996 Whole House Air Infiltration Study by Dr. Gren Yuill, Penn State University.

Fiber glass batts vs. fiber