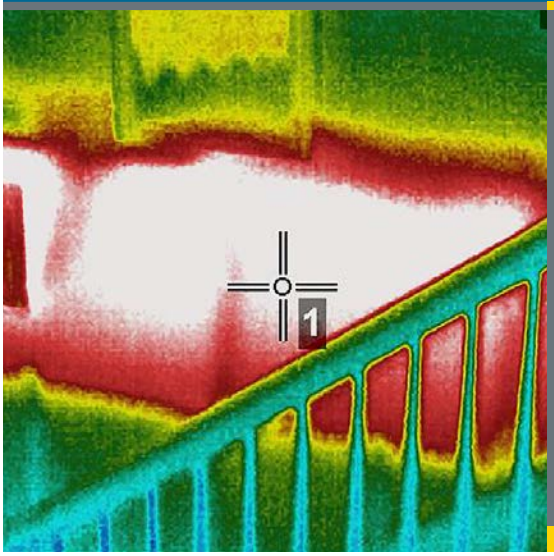

Building America Case Study

Investigating Solutions to Wind Washing Issues in Two-Story Florida Homes: Phase 2

Southeastern United States

PROJECT INFORMATION

Project Name: Investigating Solutions to Wind Washing Issues in Two-Story Florida Homes: Phase 2

Location: Central and north Florida

Partners:

Florida Power & Light, *fpl.com*

Building America Partnership for Improved Residential Construction, *ba-pirc.org*

Building Component: Attic-floor cavity intersections

Application: Retrofit, single-family

Years Tested: 2011–2014

Climate Zones: All

PERFORMANCE ESTIMATES

Estimated cost of energy-efficiency measures: Average $350 (range $100–$1,200/house)

Projected annual electricity energy savings: 3.6 million Btu/year per house (or 12.1 million Btu/year in source energy)

Projected annual energy cost savings: $121 per house

In many two-story homes, there are attic spaces above first-floor portions of the home that border portions of the second-story conditioned space. (See Figure 1.) These spaces have breaches of the air and thermal boundaries, creating a phenomenon known as *wind washing*. This can cause:

- Attic air above the first-floor space to be driven into the cavity between the first and second floors by wind, thermal buoyancy forces, or mechanical driving forces (duct leaks, unbalanced return air, unbalanced exhaust air, etc.)
- Circulation of hot attic air against the wallboard because of gaps between insulation batts installed on knee walls and the gypsum wallboard.

In this project, the U.S. Department of Energy team Building America Partnership for Improved Residential Construction (BA-PIRC) investigated wind washing in 56 homes. The goals were to identify the failure mechanisms that lead to wind washing, characterize the pathways for air and heat to enter the house, and evaluate the seasonal energy savings and peak demand reduction that can result from repairing these wind washing problems. Based on this research, the team developed recommendations for cost-effective retrofit solutions and information that can help avoid these problems in new construction. The extent of wind washing occurrence depends on wind speed, direction, the size of the floor cavity openings, the size of the area of insulation exposed to air movement, and the presence of complementary air leakage pathways. Air will move more readily through a floor cavity that has openings to the outdoors on both sides than through only one pathway.

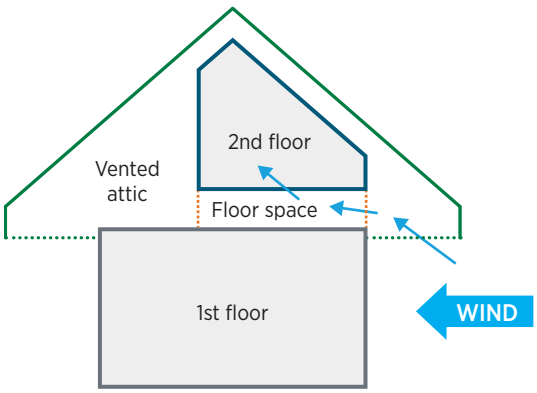

Figure 1. Wind washing is caused by air movement into the soffit, then into the attic, and finally into the floor space. Wind-driven attic air is pushed into the space between floors, bypassing house air and thermal boundaries.

Building America U.S. Department of Energy

WIND WASHING RESEARCH

This image shows a floor cavity that is open to a vented attic on one end and has conditioned space above and below.

IR scans show temperature variations and reveal the operation of the wind washing phenomenon. As shown in the images above, thermal anomalies are occurring where hot attic air has penetrated into the floor cavity that lies behind the stairwell wall. The wall surface temperature was 83°F compared to 78°F room temperature.

For more information, see the Building America report *Investigating Solutions to Wind Washing Issues in Two-Story Florida Homes: Phase 2* at *buildingamerica.gov*.

Image credit: All images were created by the BA-PIRC team.

Figure 2. Visual inspection is important to determine the existence of wind washing, the resulting problems, repair strategies, and the potential benefit of the repair. The image on the left shows poorly installed batts and a pathway in a floor cavity open to the attic. Field tests can also be useful. These tests include infrared (IR) scans of house surfaces (see sidebar), house and duct leakage tests, and pressure mapping.

Lessons Learned

- Breaches of the air and thermal boundaries of the house can lead to significant sensible heat penetrating into the house and in some cases substantial latent heat (water vapor) penetrating into the structure. This penetration increases space cooling loads in the summer and heating loads in the winter.
- In some homes, significant levels of duct leakage occur within the floor cavity between the first and second floors of the house. Wind washing repair can potentially eliminate a large portion of the duct leakage energy waste by containing much of that leakage within newly created air and thermal boundaries of the floor cavity.
- Wind washing is affected by the size and locations of floor cavity pathways, attic conditions, and driving forces across floor cavity pathways.

Looking Ahead

Wind washing affects energy use, peak demand, comfort, potential for moisture damage, and elevated humidity in some two-story homes in hot and humid climates. This phenomenon can cause water pipes to freeze in cold climates. Because wind washing retrofits also reduce peak electrical demand, it is likely that electric utilities will see the benefit of providing repair incentives to customers, which could further enhance retrofit cost-effectiveness from the customer perspective. Building codes should be examined and code enforcement practices evaluated in order to eliminate wind washing.

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

For more information, visit
buildingamerica.gov

The U.S. Department of Energy's Building America program is engineering the American home for energy performance, durability, quality, affordability, and comfort.

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