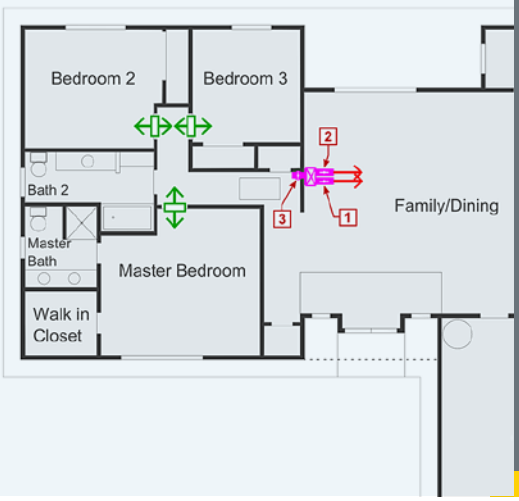

Building America Case Study

Whole-House Solutions for Existing Homes

Passive Room-to-Room Air Transfer

Fresno, California

PROJECT INFORMATION

Construction: Retrofit

Type: Single-family

Builder: GreenEarthEquities (retrofit); *http://greenearthequities.com/*

Size: 1,621 ft²

Price range: About $140,000

Date completed: 2011

Climate zone: Mixed-dry

PERFORMANCE DATA

HERS index: Not available

Builder standard practice: Not available

Case study house: 1,621 ft²

With renewables: Not applicable

Without renewables: 50.1%

Projected annual energy cost savings: Not available

Incremental cost of energy efficiency measures: Not available

Incremental annual mortgage: Not available

Annual cash flow: Not available

Billing data: Not available

Building America SM U.S. Department of Energy

Cutting-edge builders are installing single-point space conditioning systems in low-load houses with no means of providing conditioned air to bedrooms except via open doors. In this project, IBACOS, a U.S. Department of Energy Building America team, assessed a strategy for providing conditioned air to bedrooms when the bedroom doors are closed and measured potential thermal discomfort that occupants may experience when this strategy is used. Builders can use this information to discuss space conditioning options for low-load houses with their clients to determine acceptable comfort levels for occupants in these cost-optimized, energy-efficient houses.

In a retrofit unoccupied test house in Fresno, California, IBACOS evaluated the performance of high- and low-transfer grilles with respect to Air Conditioning Contractors of America (ACCA) Manual RS and ASHRAE Standard 55-2010 Section 5.2.5. The results showed that the system was effective at meeting the ASHRAE standard with almost 100% success because no rapid shifts in temperature occurred in the areas of concern—the bedrooms. However, the system failed the ACCA requirements because a slow change in temperature did occur in the bedrooms and resulted in their temperatures being greater than ±2°F different from the temperature at the thermostat 100% of the time in heating mode and ±3°F different from the temperature at the thermostat 50% of the time in cooling mode.

The retrofit unoccupied test house in Fresno, California, used automated doors and other equipment to facilitate testing of the high- and low-transfer grille strategy.

Key Energy Efficiency Measures

HVAC

- Whole-house loads of 16,680 Btu/h in heating mode and 15,934 Btu/h in cooling mode
- Three conditioned air-distribution strategies for test purposes
- Single-point energy recovery ventilator in the living room
- Kitchen and bath fans vented to outside

ENVELOPE

- Light-colored shingle roof
- R-60 blown ceiling insulation in the vented attic
- R-13 grade blown cellulose insulation in 2x4 frame walls
- Double-pane, low-E, vinyl windows; U = 0.30, SHGC = 0.30
- Tightly sealed house, ACH50 = 1.59

LIGHTING, APPLIANCES, AND WATER HEATING

- Not applicable—unoccupied test facility

For more information, see the Building America report, *Simplified Space Conditioning in Low-Load Homes: Results from Fresno, California, Retrofit Unoccupied Test House,* at *www.buildingamerica.gov*

Image credit: All images were created by the IBACOS team.

The retrofit unoccupied test house faced west, had well-shaded windows, and was a single story with slab-on-grade construction.

Lessons Learned

The following advantages and drawbacks were learned from this project:

Pros:

- The transfer grille assemblies were straightforward for the retrofit contractor to install above the bedroom doors and at the bottoms of the bedroom doors.
- Using transfer grilles to allow heating and cooling energy to reach the bedrooms in lieu of ductwork eliminates ductwork materials, labor, and associated bulkhead costs to bring the ductwork into conditioned space.
- Based on the results of this study, in the future the predicted load conditions in each bedroom could be used to determine if a transfer grille might be applicable.
- Opening bedroom doors improves thermal uniformity.

Cons:

- Building interior geometry reduces the success of HVAC systems in uniformly distributing air from a single source.
- The transfer grilles enabled less heat flow between the bedrooms and hallway than anticipated.
- The inability of the system to meet ACCA standards will prevent adoption of the system by builders or retrofitters who are risk averse or who are required to meet the ACCA standards.

U.S. DEPARTMENT OF ENERGY
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