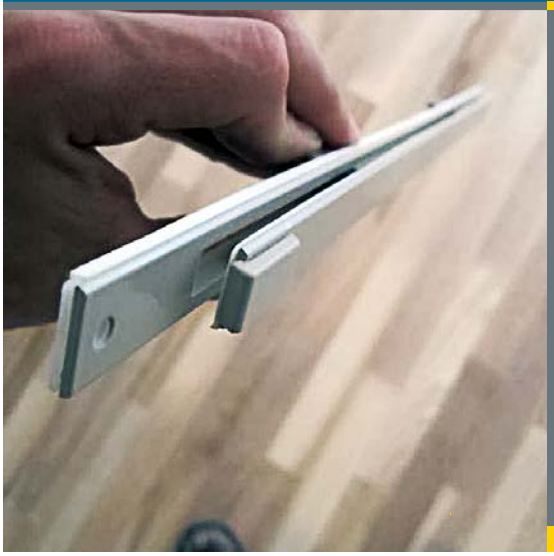

Building America Case Study

Evaluation of Passive Vents in New-Construction Multifamily Buildings

New York, New York

PROJECT INFORMATION

Construction: New dwelling units

Type: Multifamily

Topic: Passive ventilation performance

Date Completed: 2014

Climate Zone: Mixed-humid

PERFORMANCE DATA

The average airflow through the different passive vents evaluated ranged from 39 CFM at 5 Pascals. The typical operating pressures observed and the number and quality of the installed vents yielded 6–20 CFM of outdoor air per apartment. Typical apartments will need 20–45 CFM of outdoor air to meet ASHRAE 62.2-2010 whole-house ventilation rates.

Exhaust ventilation and corresponding outdoor air intake strategies are being implemented in high-performance new-construction multifamily buildings. This effort is aimed at meeting program or code requirements for improved indoor air quality, but a lack of clear design guidance is resulting in poor system performance despite the best intentions of the programs or standards.

Passive vents such as trickle vents and airlets rely on a pressure differential created by an exhaust system to provide outdoor air to apartments. Because passive vents incur lower first costs and operating costs than other outdoor intake air strategies, such vents are commonly used in multifamily buildings. However, not enough is known about how passive vents actually perform in real-world conditions or how to implement them effectively.

The Consortium for Advanced Residential Buildings (CARB), which is administered by the U.S. Department of Energy's Building America program, conducted research to gain more insight into this subject. Because passive vents are meant to operate in a general environment of negative apartment pressure, the research assessed whether these negative pressures prevail through a variety of environmental conditions. The data from the evaluation of three buildings showed that the passive vents did not perform as expected. The average airflow through the passive vents fell short of providing the ASHRAE 62.2-2010 whole-house ventilation requirements. A majority of the exhaust makeup air still came from unintentional sources—from leaks in the exterior envelope, neighboring apartments, or the corridor.

An airlet, one common type of passive vent, shown installed in a wall (left) and removed to expose the backside (right). The flaps on the back are designed to limit airflow as pressure increases.

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TRICKLE VENT INSTALLATION

A typical trickle vent, shown installed in a window frame (top) and with the cover removed (bottom).

The vent is installed by cutting holes in the window frame. The size of the holes directly affects the amount of air delivered. In this case, the two holes provide only 50% of the area specified by the trickle vent manufacturer, resulting in reduced airflow.

AIRTIGHTNESS

Apartment airtightness is critical in developing the pressure differential required for passive vents to operate properly. The tighter the apartment is, the greater the pressure created by the exhaust ventilation system. A greater pressure across the passive vent results in greater flow through the vent. In addition, a well-sealed apartment is less susceptible to changes in conditions in other parts of the building. An airtightness of less than 0.10 CFM50/ft^2 of enclosure is needed for passive vents to provide appropriate levels of outdoor air. This level of air sealing can be challenging to achieve and requires careful design and oversight.

For more information see the Building America technical report *Evaluation of Passive Vents in New Construction Multifamily Buildings* at *buildingamerica.gov*.

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

Apparatus for testing airflow through a trickle vent (left) and actual test in progress (right).

While this evaluation did not demonstrate that these systems performed as expected, it did identify the challenges and design criteria that affect performance.

Lessons Learned

- The average airflow through the passive vents was 6–20 CFM of outdoor air per apartment. These values fall short of the whole-house ventilation rates from ASHRAE 62.2-2010, which typically require a minimum of 20–45 CFM for most apartments. The amount of makeup air from the passive vents was 13%–36% of the total exhaust airflow.
- Certain exhaust flow rates are necessary to create the pressure differential needed to induce flow through the vents. However, in this study the exhaust flow rates often exceeded the continuous local exhaust rates required by ASHRAE 62.2-2010 by more than 50%. The excessive rate results in higher fan energy and a higher heating load.
- Airtightness—and more specifically compartmentalization—is critical in creating an environment for passive vents to work properly. The apartments that were highly sealed had greater pressure differentials and more airflow through the passive vents. In addition, these apartments were impacted less by conditions in adjacent units and other parts of the building.

Looking Ahead

CARB created a Measure Guideline for the proper design and installation of passive vents. Factors that have significant impact on performance include the size and number of passive vents, the exhaust flow rates, and the airtightness of the apartment and its entry door. Data collected from this research will be used to quantify the impact of these factors so as to create the design guidance needed. Best practice recommendations based on the quality of the passive vents and their installation will also be developed to further improve their performance. This guidance has the potential to significantly impact the building industry as it seeks to provide multifamily buildings with a reliable and low-cost source of dedicated outdoor air that works in practice.

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