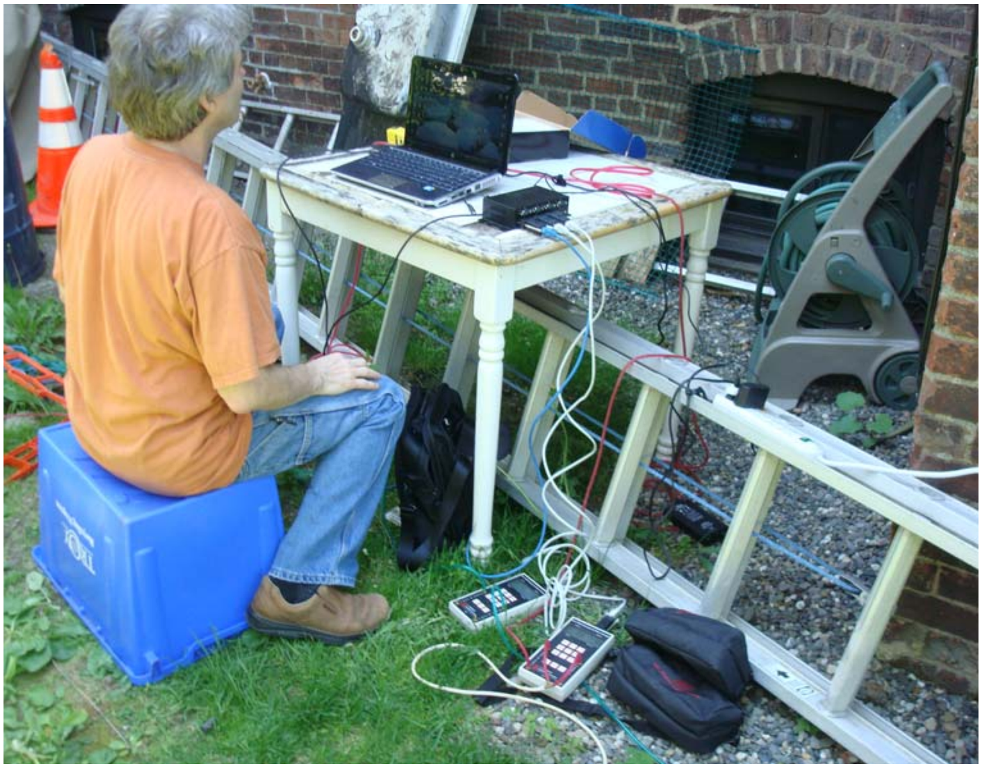
Fan Pressure Test at 111 and 109 Madison Street

111 Madison Street is right-half of an existing brick building that was fully gutted and rehabbed in 2010. The other half of the building, 109 Madison Street, was renovated in 2007. Each side of the building contains two apartments and a full basement. 111 Madison St was redesigned as part of the NYSERDA Residential Performance Challenge Project.

On May 21, 2010 we conducted a blower door test that simultaneously pressurized both sides of the building in order to separately measure the leakage from each building relative to outdoors. The test conducted by Terry Brennan, Hugh Henderson, and Jeff Cosgrove.

Two fan doors were setup on the two sides of the building, each blower door used to depressurize both apartments along with the basement and front and rear stairwells. The test was simultaneously conducted on both sides of the building. The fan flows were varied while the maintaining the pressure difference between two sides at zero. In this way a fan pressure test was conducted for each side of the building, excluding building-to-building air leaks. During the test pressure difference between the two sides and the flows through the fans were continuously recorded in one second intervals (See Figure 2 for a timeline of the data).



Test Setup for Side-by-Side Blower Door Test with Multiple Pressure and flow readings recorded simultaneously

Figure 1. Fan door in old part of building

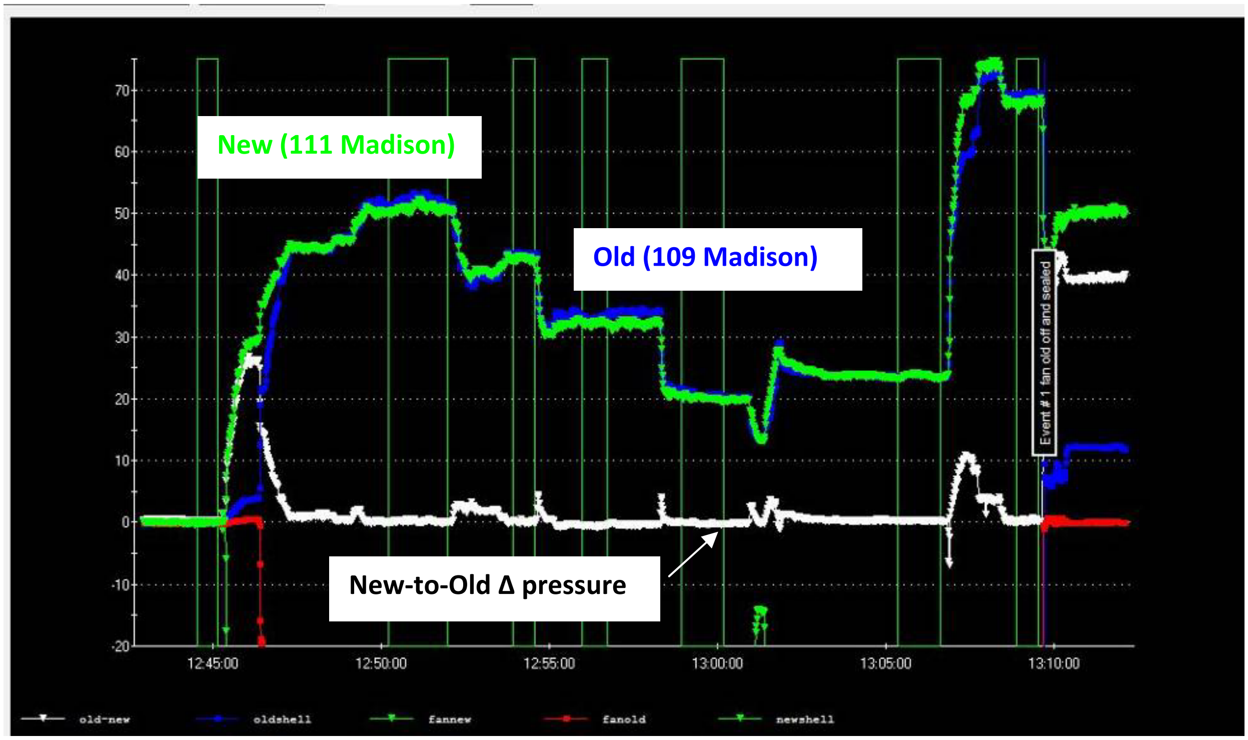
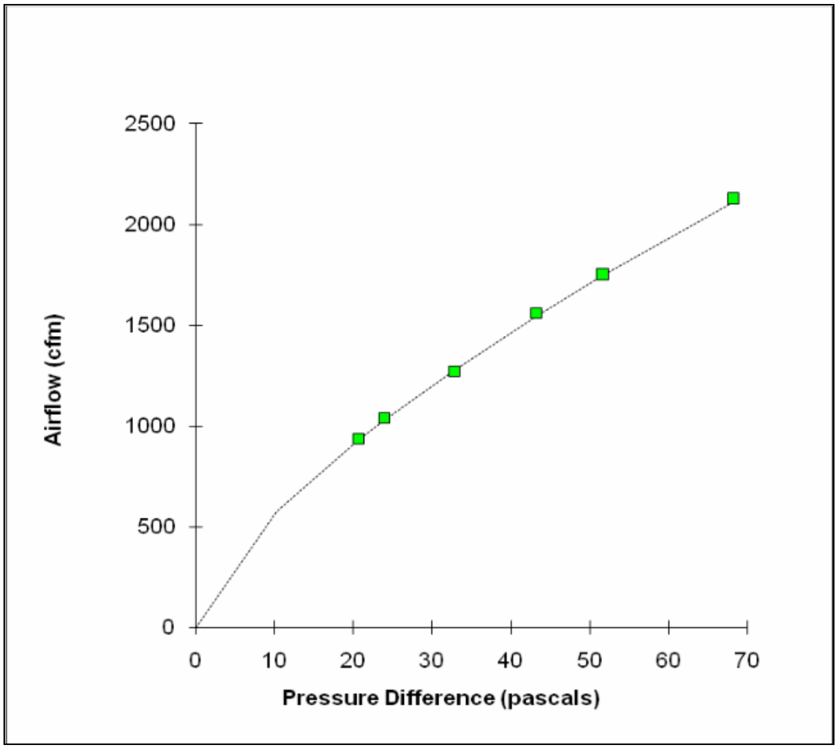


Figure 2. Pressure differences during fan test

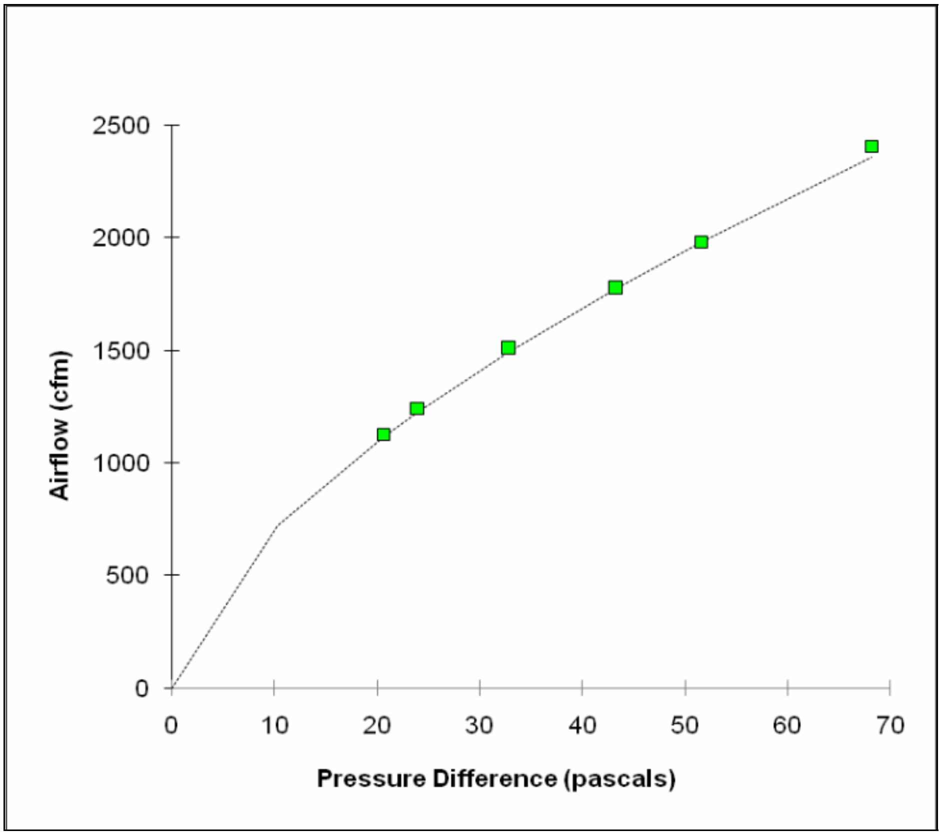
Results

The new side (111 Madison) had a measured flow of 1707 cfm to outdoors at 50 pascals. The old side (109 Madison) was 1943 cfm at 50 pascals. Curve fits of the data are shown in Figures 3, 4 and 5. Other measures of air tightness are included with the figures. The new side of the building is around 50% leakier than the Energy Efficient Builders Association standard for new buildings of 0.228 cfm per square foot of enclosure at 50 pascals. The old part of the house is 67% leakier than this standard.



	C		n	
Flow =	116.51	x ΔP^	0.686	CFM
R sq =	1.000			
ELA4 =	85.51	sq in.		
CFM50 =	1706.78			
ACH50pa =	3.29			
m3/hr.50/m2 enclosure =	6.08			
LPS75/m2 enclosure =	2.23			
CFM50/ft2 enclosure =	0.33			
in2ELA/100ft2 enclosure =	1.66			

Figure 3. Curve fit of the test for 111 Madison St (New Side)



	C		n	
Flow =	168.06	x ΔP^	0.626	CFM
R sq =	0.999			
ELA4 =	113.43	sq in.		
CFM50 =	1943.17			
ACH50pa =	3.75			
m3/hr.50/m2 enclosure =	6.92			
LPS75/m2 enclosure =	2.48			
CFM50/ft2 enclosure =	0.38			
in2ELA/100ft2 enclosure =	2.21			

Figure 4. Curve fit for test of 109 Madison St. (Old Side)

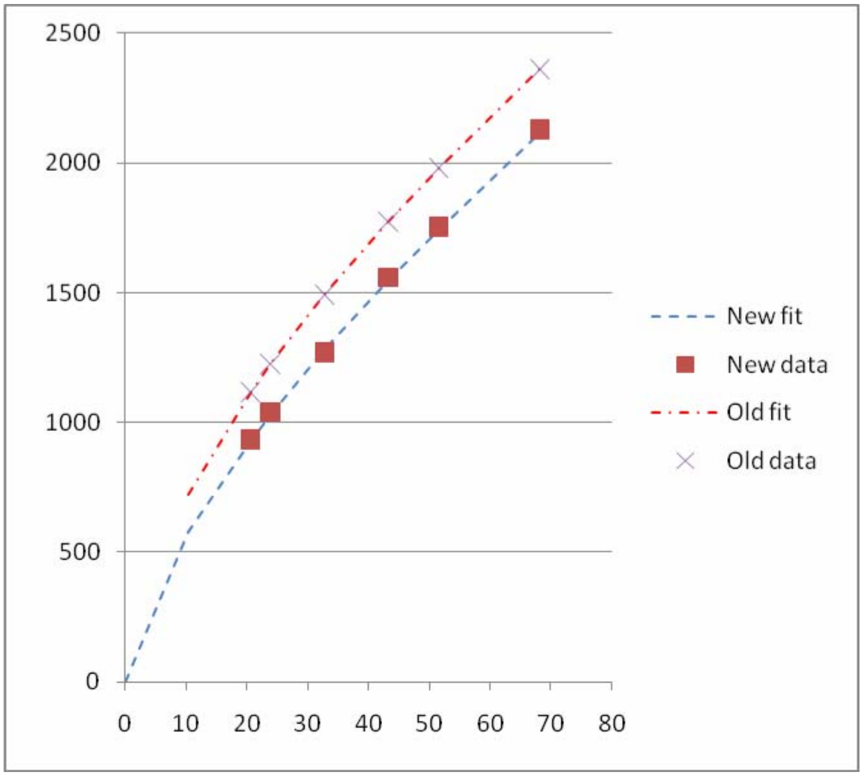


Figure 5. Both curves plotted on the same graph

	109 Madison St. (Old House)	111 Madison St (New House)
CFM50	1,943	1,707
ACH50	3.75	3.29
ELA (sq in) per 100 sq ft of enclosure	2.21	1.66

It was expected that the new portion of the building would be tighter than the old portion. However it is not as tight as we expected it would be. We were expecting something more like 1000 cfm at 50 pascals. Smoke bottles were used to identify air leaks in the building (see Figures 6, 7, 8 and 9). Identified leakage sites were:

- Crack at top of basement windows
- Beam pocket vents added to ensure floor joists could dry
- 2ns floor attic ceiling including

- Interior partitions at outlets and baseboards (through walls into attic)
- Ceiling fan and light fixtures

A significant portion of the air leakage in the new side is from the passive vents built around the wooden floor joists where they rest in pockets in the masonry. The original intention of the vents is to improve drying potential and reduce the chance of wood decaying fungi growth in the beam ends (which could cause structural damage). The actual implementation of this design detail was not completed exactly as intended. While this precautionary step was taken due to alleviate concerns that that closed cell foam around the beams would raise the moisture content of the bean in the masonry pocket. However it is not clear whether this precaution was fully necessary. To test this assumption, we plan to make periodic moisture content measurements of the wooden joists in the basement over the course of half a year. Then we will air seal half the joist vents and continue monitoring to determine whether the vents are needed and if needed effective. We will measure the leakage rate through the vents.

We also plan to conduct infrared scans of the building to identify air leakage sites when the weather becomes colder in the Fall of 2010

Figure 6. Air leak at top of window

Figure 7. Air leak at top of window

Figure 8. Air leak at ceiling fan

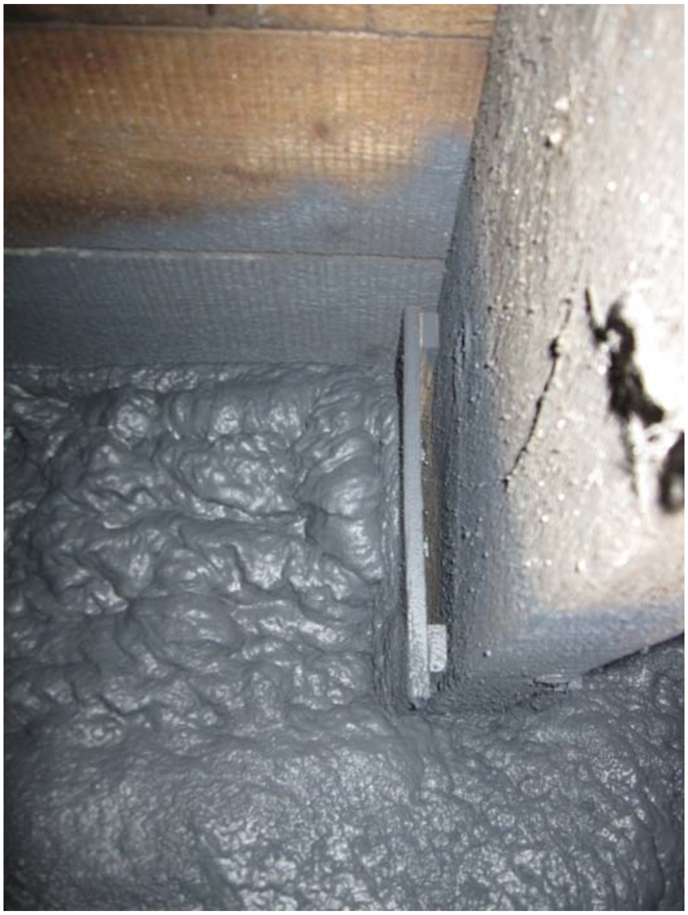


Figure 9. Air Leak at " beam pocket" vent