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To: Chuck Hector, RSI; Mark Conover, RSI

From: Sean Maxwell, Steven Winter Associates

Subject: Haddonview Ventilation Retrofit – Trash Room Exhaust Results

On February 15th, and April 4th, 2011, Sean Maxwell and Casey Otis from Steven Winter Associates visited the Haddonview Building to perform pre- and post-retrofit testing of duct sealing and balancing measures. Among the shafts tested, the trash room exhaust on each floor was sealed with mastic and balanced using constant airflow regulator (CAR) dampers. The results of the retrofit show a significant improvement of the overall balance and performance of the system.

Duct Tightness Tests

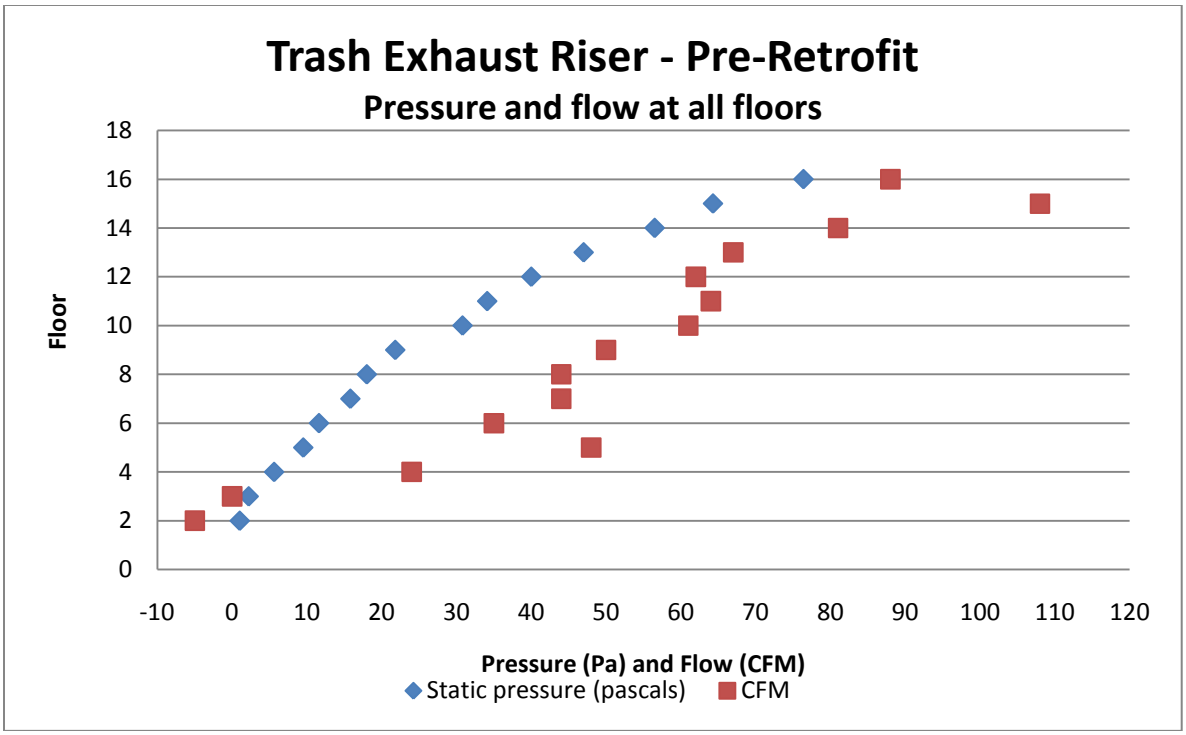
The ducts were tested using a duct blaster at 7 points of measurement, and a regression was made to 25 Pa. The ducts before the testing were measured at 320 CFM25, an average of 21.3 CFM per exhaust grill. After sealing with spray mastic, the ducts were tested at 128 CFM25, or 8.5 CFM per grill. This represents a 60% reduction in leakage. The results are shown in table format below.

Table 1. Duct Tightness Results, Trash Room Exhaust Riser

	Pre-Retrofit		Post-Retrofit		
	CFM25	**Leakage per Grill**	**CFM25**	**Leakage per Grill**	**Improvement**
Trash Room	320	21.3	128	8.5	60%

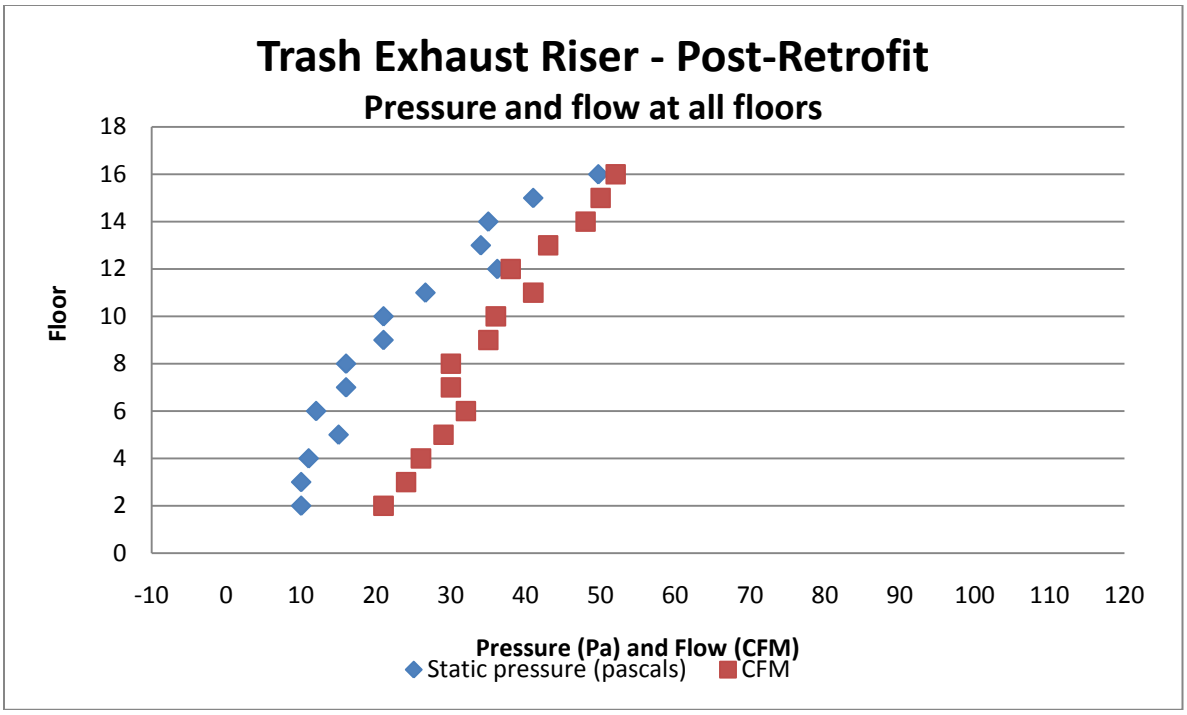
Flow and Static Pressure Measurements

The flow from registers in trash rooms was measured along with static pressure. The results are presented in a graph below. Along the vertical axis is displayed the floor on which the trash room exhaust measurement was taken. The horizontal axis displays both the static pressure in (Pascals) and flow (CFM). From the chart, it is easy to see a trend of much higher flows on higher floors. The uppermost floors are ventilated at dramatically higher rates, as much as 108 CFM on the 15th floor, while the bottom floors are almost not ventilated at all. In fact, on the first floor, flow is *negative*, or in the direction of supply, which is obviously not ideal for a trash room. This profile is typical of unsealed, unbalanced duct systems.



An improvement was made by sealing the trash riser exhaust duct with spray mastic, and replacing standard registers with CAR damper assemblies. The combination of the two had a dramatic effect of improving balance vertically in the shaft. The graph below shows pressure and flow measurements after the improvement was made. The profile is much more "vertical" from top to bottom floors. An ideal, perfectly-sealed shaft would be entirely the same from top to bottom, but in the built environment this does not practically exist.

The chart below shows the same criteria – floor level on the vertical axis and flow and static pressure on the horizontal axis. The effect of the sealing and balancing dampers is immediately noticeable. The maximum flows at the top floors are reduced to a maximum of 52 CFM, less than half of the previous rate and a more reasonable level. The flow at the bottom of the shaft was increased considerably, from a minimum of zero pre-retrofit to a minimum of 21 post-retrofit. Static pressure was also evened out between upper and lower floors, with a maximum at the top floor of close to 50 Pa.



The total flows measured from these register and post-retrofit were 771 CFM pre-retrofit and 535 CFM post-retrofit, or an average of 51 CFM per floor to 36 CFM, respectively. If the intended ventilation rate is 30 CFM per floor, the retrofit brings the duct much closer to the design and in fact reduces over-ventilation.

This example shows that the sealing and balancing process can have a dramatic positive effect on the performance of a ventilation system. In addition, where ventilation rates exceed current needs, the retrofit can mean significant energy savings by reducing ventilation to an acceptable level. The process can improve ventilation quality at all floors, mitigating over-ventilation and under-ventilation while generating energy savings.