

# VENTING AND THE LEED PROTOCOL

There is no denying that the US Green Building Council, LEED protocol is getting to be more and more popular in large building constructions around the country. As it is the case with any new approach that challenges the *status quo*, the actual degree of acceptance of this conceptual design greatly varies from State to State but an ever growing number of engineering firms are displaying the USGBC plaque in their offices and the request for LEED consultants is on the rise; some of the larger firms have their own, in-house, LEED consultant.

The protocol, often seen as having an environmental only focus, actually addresses a variety of economic issues as well. Such issues vary from supporting local businesses to reducing maintenance, up-keep and running costs of the buildings. This in turn, can even have an affect on things like loans and insurance as well as make the building more attractive for occupancy.

As to be expected in any relatively new things, time and a closer inspection/analysis usually reveals more opportunities than those identified at earlier stages. This is certainly the case when the venting system of large buildings is looked at from a LEED prospective.

There are three basic areas of the LEED protocol that could potentially be satisfied by abandoning conventional venting designs and opting for, well proven yet innovative, solutions. The three areas are:

1. Innovation & Design Process (Credit 1 / 1-4 Points)
2. Indoor Chemical & Pollutant Source Control (Credit 5 / 1 Point)
3. Heat Island Effect: Roof (Credit 7.2 / 1 point)

Let's take a look at each individually and see how the adoption of an advanced venting design fits in each category and can help us rack-up some LEED points.

## INNOVATION & DESIGN PROCESS

Grouped under this heading there are two basic areas that can be addressed by non conventional venting designs: (i) material reduction and (ii) decrease in the waste water volume that the building is directly responsible for.

### (i) **Materials**

The protocol addresses in great details the use of construction materials utilizing different percentages of recycled content. The primary objective is to reduce as much as possible the use of virgin (new) materials. Although not directly defined in LEED, the very same concept (reducing the volume of virgin material used in a project) extends to a substantial *overall* reduction of material being used. Such a result would perfectly fit the intent of the *Innovation in Design* chapter as shown in Fig.1.

SS	WE	EA	MR	EQ	ID	<h1>Innovation &amp; Design Process</h1>
<b>Credit 1</b>						
1-4 Points						<b>Innovation in Design</b>
						<b>Intent</b>
						To provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by the LEED Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED Green Building Rating System.
						<b>Requirements</b>
Credit 1.1 (1 point)						In writing, identify the <b>intent</b> of the proposed innovation credit, the proposed <b>requirement</b> for compliance, the proposed <b>submittals</b> to demonstrate compliance, and the <b>design approach</b> (strategies) that might be used to meet the requirements.
Credit 1.2 (1 point)						Same as Credit 1.1
Credit 1.3 (1 point)						Same as Credit 1.1
Credit 1.4 (1 point)						Same as Credit 1.1
						<b>Submittals</b>
						<input type="checkbox"/> Provide the proposal(s) within the LEED Letter Template (including intent, requirement, submittals and possible strategies) and relevant evidence of performance achieved.
						<b>Potential Technologies &amp; Strategies</b>
						Substantially exceed a LEED performance credit such as energy performance or water efficiency. Apply strategies or measures that are not covered by LEED such as acoustic performance, education of occupants, community development or lifecycle analysis of material choices.

Fig.1

Switching from a conventional venting design to a full AAV venting system (for less than 5 stories constructions) or to an Active Pressure Control (APC) system\* (in mid and high rise constructions) has the potential, depending on layout, to ***very significantly reduce the amount of pipe needed***. System layout and routing will also determine if a reduced usage of other (non piping) materials (e.g. fire stopping devices, roof flashings, etc.) can be achieved as well. Fig. 2 compares the layout of a real job designed first conventionally and then using AAVs (for a less than 5 stories building); Fig. 3 shows a job designed conventionally and then redesigned with an APC system (for a six stories construction). Clear in both figures is the streamlining of the design and the reduction in material when AAV or APC are utilized as the primary venting source.

*\*APC systems combine the AAVs effectiveness in balancing negative pressure, with the ability of Positive Pressure Attenuators do absorb and dissipate the energy of positive transients generated in free falling, tall stacks.*

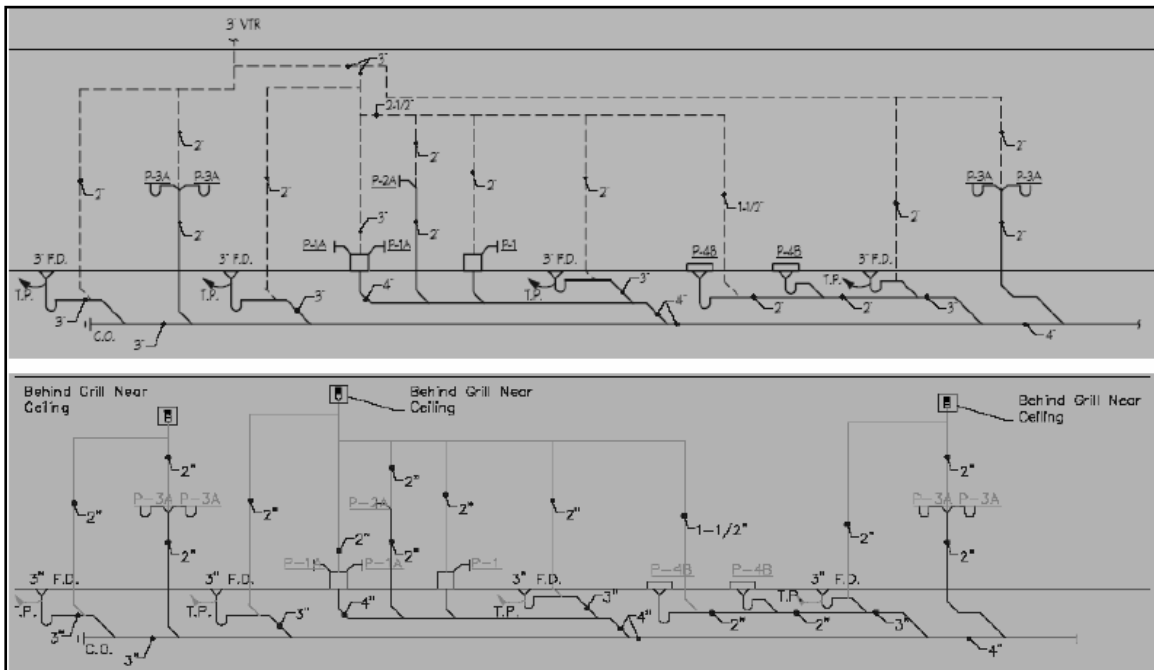


Fig.2 Conventional (top) Vs. AAV (bottom)

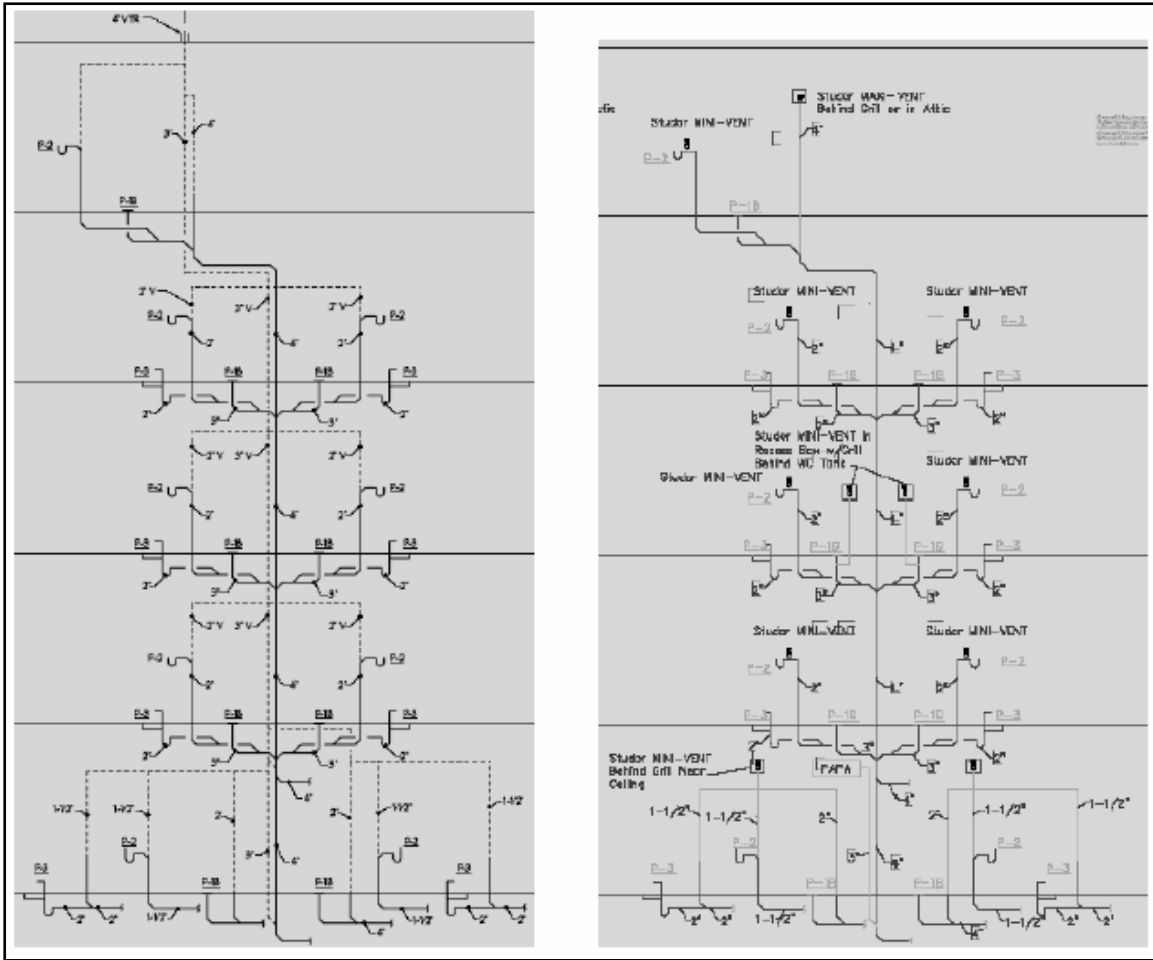


Fig. 3 Conventional (left) Vs. APC (right)

When it comes to mid or high rise constructions, it should be noticed that other systems, such as Sovent, have been offering material reductions over conventional designs for quite some time. However, a Sovent system may require larger than standard pipes (in order to provide the needed 75% of pipe ID for airflow), cannot be used on suds line (typically leading to the isolation of washing machines on separate stacks which then need to be conventionally vented) and requires a pressure relief line connecting the horizontal run of the stack back to the vertical section in order to bleed the constant build up of positive pressure. Because of all these factors, using an APC system in mid and high rise constructions will provide a further appreciable reduction of material above and beyond what can be achieved with the Sovent design.

**(ii) Wastewater reduction**

Although there is a section of the LEED protocol directly dealing with waste water reduction it concentrates on fixtures requiring high efficiency or dry fixtures in order to achieve different percentile reduction in the waste water volume contribution of the building. However the underline objective is to decrease the amount of water that needs to be treated. Overlooked by the current protocol, but certainly included in the spirit of the **Innovation & Design Process** section, is the contribution to the overall waste water volume that a building makes based on its DWV system design choice.

Conventional and Sovent systems alike all require each stack to terminate to the open air through the roof. In large commercial buildings it is not uncommon to have 20, 30, 40 or more such openings. Open stacks and vents through roofs contribute in a very substantial way to the collection of large amount of storm water most of which would not have otherwise entered the sewer system. The result is an increase in the waste water volume generated by the building and a consequent increased burden on the municipality's waste water treatment facility. By contrast AAV and APC systems dramatically reduce the number of overall roof openings thus also decreasing the amount of storm water that will enter the municipal sewer through the sanitary system of the building.

**HEAT ISLAND EFFECT: ROOF**

There are several provisions in the LEED protocol that deal with the effect that the building has on its immediate natural surroundings. One such provision is the **Heat Island Effect: Roof**.

<b>SS</b>	<b>WE</b>	<b>EA</b>	<b>MR</b>	<b>EQ</b>	<b>ID</b>
<b>Credit 7.2</b>					
1 Point		<b>Heat Island Effect: Roof</b>			
		<b>Intent</b>			
		Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.			

Similar to the ‘material reduction’ the effect of roof vents on the thermal gradient difference is also not currently addressed directly by the protocol in the *Requirement* section of the Heat Island paragraph. It is however easy to see how the warm, heavier than air sewer gasses expelled by roof vents will settle on the roof top thus increasing the thermal gradient difference on the roof between the developed and undeveloped areas and impacting the microclimate.

Innovative venting solutions (such as systems employing AAVs or APC) resulting in a very substantial reduction of roof vents will dramatically decrease the likelihood of such an occurrence. Once more, submittal of proposals, for LEED points adjudication, under the provision of the **Innovation & Design Process** section would be allowed since such designs would provide solutions specifically addressing the spirit and intent of this section of the protocol.

### **INDOOR CHEMICAL & POLLUTANT SOURCE CONTROL**

Recent studies conducted by Prof. John Swaffield, Dean of the School of Building Environment at Heriot Watt University, together with six other PhDs, have clearly documented how conventional venting in very large buildings featuring extensive and complex venting piping systems can easily lead to a very severe depletion of the traps further removed from the roof vent pipe inlet. This, combined with pressure changes in the system has actually been shown to produce bubbling of such traps. Sewer gasses can enter the living space via a bubbling trap and so can (and have) pathogens. The latter was demonstrated in a paper presented at the IAPMO sponsored SARS conference in February 2004 in Los Angeles. It should also be noted that correcting such problems in a conventionally vented system would be (if at all possible) very expensive and lengthy. For this reason little or nothing is, or can be, done and the depletion and/or bubbling of traps remain something that the building ‘lives with’ with the consequent adverse impact on the indoor air quality.

By contrast, extensive and complex DWV system utilizing AAV or APC designs have been shown both in testing and in real life to be able to balance pressure changes inside the system much more quickly and efficiently, thus avoiding the systematic depletion and consequent bubbling of the trap.

***As a result, the water seal inside the trap remains very substantial at all times thus affording greater protection against pollutants.***

	SS	WE	EA	MR	EQ	ID
	Credit 5					
<b>Indoor Chemical &amp; Pollutant Source Control</b>	1 Point					
<b>Intent</b>	Avoid exposure of building occupants to potentially hazardous chemicals that adversely impact air quality.					

A second and relatively common source of pollutant inside buildings is the actual vent pipe on the roof. Often enough, the proximity of the roof vent to the building's air handling equipment results in the forced entry of sewer gasses back into the building. Although codes all over the country regulate the minimum distance between roof vents and roof mounted air handling equipment, a combination of specific wind conditions and roof profiles (e.g. flat roofs, parapets, etc.) often results in what's commonly referred to as the *sick building syndrome*. A common solution to this problem is the retrofitting of AAVs on most of the roof vents while a carbon filter is used on those vent(s) /stack(s) that by code need to breathe both ways. Although there is no real cost difference between AAVs and filters the reason carbon filters are not used exclusively is simply because they are a maintenance item while ASSE compliant AAVs are not.

Finally, the one unavoidable constant in conventional or Sovent design is that every single stack has to penetrate the roof line in order to be able to draw air from the outside. It is a very well documented factor that, although great care may be taken to properly seal and isolate these openings, they are often a source of water infiltration and excessive humidity resulting in the formation of mold. Mold spores are a well know air pollutant which can cause a variety of respiratory and other related health problems. With one of the main features of dedicated AAV and/or APC systems being the very substantial reduction of roof penetrations, it can be clearly seen how such systems will in fact have a positive impact on the building's indoor air quality.

Ultimately a certified LEED consultant will have to decide what is or isn't appropriate. However once the decision has been made, for a given job, to pursue the LEED certification it is clear that enough data is now available to make it advisable to thoroughly research the possibility of utilizing some of the innovative venting technologies highlighted in this article as a source of additional credits.