Controlling Air Leakage in Schools
for Improved Air Quality and Energy Savings

You've heard it all before: one classroom is too hot, another too cold; odors from the pool permeate the halls; or noise from the cafeteria disrupts classes in adjacent rooms. Odor, noise and thermal comfort complaints can easily be solved by controlling air movement. This is done by sealing the gaps, cracks and holes in your building envelope that are allowing air to leak. Air sealing measures can be accomplished with minimal cost and disruption to students and staff with the added bonus of energy savings.

Pathways for Odor, Noise and Unconditioned Air

In order for odors, noise and drafts to travel through a building, they must have a path and the motivation to use it. The path can be a gap under a door,

a plumbing or electrical penetration, floor- or ceiling-to wall joints, poorly sealed windows, stairwells, garbage chutes or the result of a renovation gone badly, to name just a few.

The motivation for air to travel is an air pressure difference between two locations. For instance, the corridors of multi-story buildings are pressurized by fan systems. The pressure difference between the corridor and each room helps keep odors, noise and conditioned air where they belong; inside that room. If that pressure ratio is altered – manually or by a failure in the building's Heat Ventilation and Air Conditioning (HVAC) system – then odors, noise or unconditioned air escape freely into the hallways and gleefully creep into any available area.

The transfer of noise, odor and unconditioned air can actually signal a serious flaw in a building's construction, indicating that the fire protection built into separate areas of the building has failed. Often, penetrations into separate areas are sealed with a fire-retardant material to restrict the spread of smoke and fire. Noise, odors and air may be leaking through those penetrations if the fire separation is missing or damaged.

"The biggest culprits are where roof and wall meet," says Construction Manager Ken MacDowell of Canam Building Envelope Specialists Inc. Often cracks and gaps will be large enough that you can see daylight coming through where the roof and wall joints meet. Gaps, cracks, leaks and holes in buildings are opportunities for many kinds of annoyances to move into occupied spaces. "I have found countless

nests right above ceiling tiles," says MacDowell. "I've seen birds, bees, tiny insects and other animals. Air sealing these entry and transfer points can remedy the problem, as well as reduce energy costs."

Diagnosing the Problem

Since noise or odor transfer can be the signal of a greater problem, the involvement of school personnel is key for diagnosis. Their first step will likely be to investigate the situation or to call in a consultant or specialist contractor.

Air barrier specialists typically begin the process with interviews of school administrative and maintenance personnel to find out exactly what issues are present. Then a visual inspection is conducted to identify any obvious pathways or maintenance issues. Then depending on the findings, several different options are available.

Those options usually mean using tools, such as an air leakage detector,

blower door test or thermal imaging, to pinpoint exactly where air is entering the building. The air leakage detector is a hand-held device that emits smoke when squeezed. It works by visually showing how air is moving in the space – where the smoke moves, air is

moving too. The blower door is a large fan that depressurizes the building, sucking air into the unit from exterior sources. And thermal imaging, which maps surface temperatures, may reveal the locations of conductive or convective heat loss/gain often related to excessive air leakage.

"Bringing in experts with tools such as these helps find sources that are not apparent to the naked eye," says Jim Bunting, senior client advisor with Canam Building Envelope Specialists Inc. "Once the open pathway is identified, the solution is fairly simple: seal it. If air can't travel, neither can the noise, odors and vapors it carries." His company often works on repairing or installing fire separations and can work with school administrators to investigate whole-building solutions to the problem, such as properly sealing the building envelope, or outer shell, which helps manage air flow and HVAC function.

Typical Air Sealing Measures

Typical air sealing measures include weatherstripping of windows and doors, sealing roof/wall intersections, sealing interior soffit openings, caulking interior wall cracks, sealing perimeters and joints in rooftop exhaust ducts and compartmentalizing by sealing shafts, stairwells, pipes and conduits.

The air sealing of individual areas, known as compartmentalizing or decoupling, can be just as important as sealing the building envelope. "High schools or vocational schools often have technical or agricultural wings with fans in place; but the exhaust fans often aren't enough to prevent the transfer of noise or odor," says MacDowell. "If we decouple these rooms, we can greatly reduce the transfer of odor and noise to the rest of the building."

According to MacDowell, other areas in schools that typically benefit from decoupling are boiler rooms and pools. "Often there is no air barrier between indoor pools and the rest of the building, allowing odor and moisture into conditioned spaces," says MacDowell. "Indoor pools should be under slightly negative pressure, so as to exhaust chemical laden air from the area and control humidity, not the other way around. You shouldn't be able to locate the pool in a building by its smell." Decoupling the pool from the conditioned space also promotes higher efficiency within the pool itself.

Optimizing HVAC for Energy Savings

The all too common complaints about thermal comfort are an indicator that your HVAC system is not functioning as it should. During the winter, leaky buildings often feature low humidity levels. One study shows that airborne bacteria, viruses and fungi all become more evident when relative humidity remains outside the 40 to 60% range for extended periods of time.

Energy efficiency savings are achieved because leaky buildings force HVAC systems to work harder as they compensate for the loss of conditioned air. The system begins using more energy than is necessary and can contribute to higher energy costs. A properly sealed building also leads to increased occupant comfort as drafts are controlled, temperatures are better regulated and the infiltration of allergens, dust and dirt are reduced.

"Control air movement and you can reduce the danger of smoke spread during a fire, reduce energy bills, and reduce complaints about occupant comfort," Bunting says. "It can also help reduce the spread of irritants such as noise, pests, flies, dust and dirt." MacDowell adds, "By creating a more efficient and continuous air barrier within your building envelope the energy dollars saved most often pay for the remediation within 10 years."

About Canam Building Envelope Specialists Inc.

Canam Building Envelope Specialists Inc. is an affiliate of the Tremco Roofing & Building Maintenance Division of Tremco Incorporated. Canam offers a comprehensive range of environment and energy related services in all types of buildings. These include insulation, ventilation, air leakage control, air tightness and window testing, auditing and total tune-ups.