

IMPACTS OF THE AIR BARRIER ON BUILDING PERFORMANCE

by Mr. Laverne Dalgleish

Air leakage in buildings has serious consequences and we are just beginning to understand their extent. Air leakage in buildings impacts almost every aspect of the building's performance. All the following building envelope issues are positively impacted using a single set of air barrier materials.

MOISTURE

Moisture in buildings is at the top of the list for causing moisture problems. It is one of the predominant problems that result in insurance payouts. Moisture causes premature building failures, increased maintenance costs and too-early replacement of the building.

Moisture can result from liquid moisture getting into the building due to the water not being shed from the building with the use of roofing materials, water resistive barriers, flashings, and waterproofing. Moisture caused by standard construction methods – materials stored outdoors, moisture from paint and adhesives as they dry - can leave building materials with high moisture content which can lead to problems.

We now understand that water damage in buildings may not be caused by liquid water coming from the outside but rather water vapor infiltrating the building assemblies and then condensing. When the damage is discovered, the water is in a liquid state and one may not immediately think of air leakage being the cause. The most common reaction is to think that the water is a result of vapor transmission through the material.

It may be water vapor, but a vapor barrier does not solve the problem as, in most cases, it is the air leakage that carried the water vapor to the area where the vapor condensed into its liquid state.



This brings to mind the person who calls the roofing company in late winter, after having had no rain for four months and with no snow melting on the roof and demands that the company come to fix the "roof leak". One roofing company got so fed up with being blamed for shoddy workmanship, when they had done a nearly perfect installation of the roofing materials that they refused to start installing shingles until all air leakage into the attic was corrected.

When the outside temperature is colder than the interior temperature, warm moist air from the inside can leak through the holes and cracks to the area where the first plane of condensation is found, and the vapor turns to liquid. When the inside temperature is colder than the exterior temperature, warm moist air from the outside can leak through the holes and cracks to the area where the first plane of condensation is found, and the vapor turns to liquid. It does not matter where you live, in the north or in the south, you will typically see both warm and cold atmospheres every year.



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Use of an air barrier system in a building reduces moisture problems where the climate is hot and humid. The amount of moisture transport by air leakage is greater in hot and humid climates than in cold and dry climates.

Moisture in buildings causes mold growth, decay, rot, and corrosion that lead to structural problems,

durability issues, increased maintenance costs, building devaluation, health problems of the occupants and the list goes on.

A complete air barrier system in a building goes a long way for managing moisture problems in a building. Many air barrier materials and accessories can also be a water resistive barrier to provide additional protection.

Building Component	Residential (quads)		Commercial (quads)	
	Heating	Cooling	Heating	Cooling
Roofs	1.00	0.49	0.88	0.05
Walls	1.54	0.34	1.48	-0.03
Foundation	1.17	-0.22	0.79	-0.21
Infiltration	2.26	0.59	1.29	-0.15
Window (conduction)	2.06	0.03	1.60	-0.30
Window (solar heat gain)	-0.66	1.14	-0.97	1.38

ENERGY USE

We don't always want the indoor environment to be the same as the outdoor environment. To make ourselves comfortable, we add or subtract heat and we add or subtract moisture from the air inside the building. When this conditioned air exits from the building, the air has to be made up by bringing in outside air which then needs to be conditioned. To condition the air, we use energy to add or subtract heat or to add or subtract water from the outside air. The more air leakage in a building, the more air we need to condition and therefore, the more energy we use.

The National Institute of Standards and Technology reports that the added energy to heat and cool buildings due to infiltration and exfiltration of air can be anywhere from 10% in cooling climates to 42% in heating climates ([NISTIR 7238](#)).

The Building Technologies Office Multi-Year Program Plan in 2010 showed that air infiltration in buildings results in primary energy consumption of 2.26 quads for heating and 0.59 quads for cooling for residential buildings. For commercial buildings, infiltration results in primary energy consumption of 1.29 quads for heating and -0.15 quads for cooling. Reducing air leakage rates in buildings has a great impact on reducing energy use. Currently the highest impact on reducing energy use as double digits whereas almost all other energy saving measures results in single digit savings.

air barrier
abaa
 association of
 america