AIR BARRIER

The indoor environment consists of conditioned air, and everything else encapsulated by the building envelope. It is therefore a high priority to keep the conditioned air on the inside, and not let unconditioned outdoor air infiltrate to the inside. Thus, having a relatively airtight home is a key feature of an energy efficient house. Avoiding air infiltration is also important when it comes to designing moisture durable walls and other envelope components.
The best way to control air movement is to install an air barrier. Few materials are solely designed to prevent air leakage. Instead, common building materials will reduce, if not block, air flow through the building envelope. Such materials are drywall, OSB, rigid foam insulation, or a water resistive barrier (housewrap).

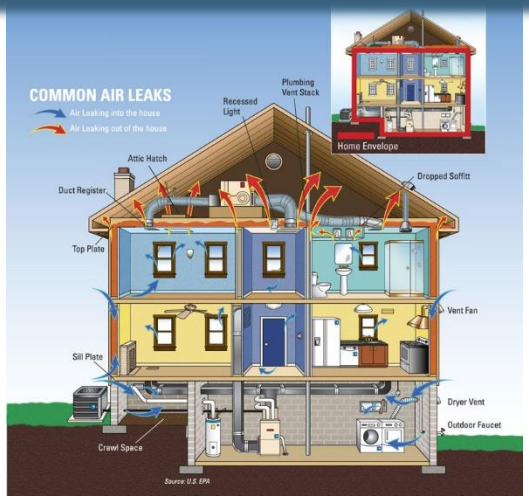

Figure 1: *Moisture enters a wall in many shapes and most be allowed to dry out.*

Cause and Effect

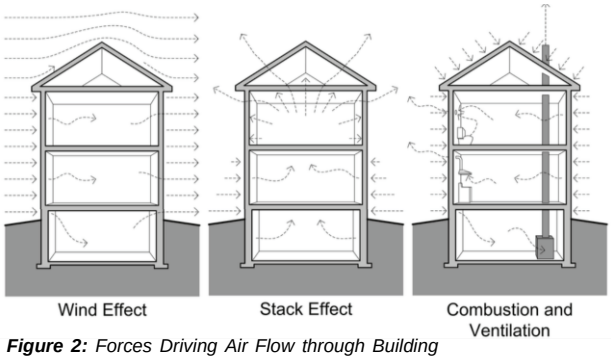

Figure 2: *Forces Driving Air Flow through Building Enclosure*

Air flow depends on two things: an air pressure gradient over the building caused by wind, stack affect or mechanical equipment (Figure 2); and an air permeable building envelope. Air flow will not exist if any of the two is missing. The air pressure gradient is difficult to control and, thus, the best approach is to make the envelope more airtight.
As discussed, reducing air leakage typically means saving energy. However, air leakage is very hazardous when it comes to moisture performance. It is much faster than regular vapor transportation (diffusion) since it can carry humid air and deposit moisture in materials it flows through and around. It may also bring moist air to cold surfaces inside the envelope, which increases the risk of condensation.

Preventive Actions

The airtightness of a building is defined by how many times the air inside the building is exchanged (Air Changes per Hour) if put at a 50 Pascal air pressure difference, ACH50. Most recent building codes (2015/2018 IECC) require an air exchange rate equal to or below 3 ACH50 for climate zone 3 to 8, and 5 ACH50 for climate zone 1 to 2.

It is also important to ensure that the air barrier around the building is properly detailed and continuous at penetrations, intersections and envelope transitions. Figure 3 shows detailing for a housewrap as air barrier.

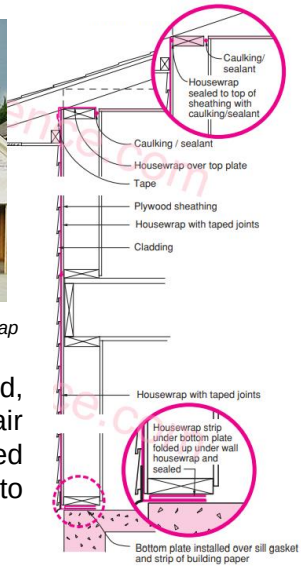

Figure 3: *Exterior Air Barrier Using Housewrap*

Depending on the climate, other approaches and materials for air barriers can be used, such as properly detailed continuous insulation or exterior insulation. Polyethylene air barrier systems can also be used in climate zones 6 and higher, and for non-air conditioned buildings. Always ensure proper mechanical ventilation when required according to ASHRAE Standard 62.2 to help ensure comfort and air quality inside the building.

References and Further Reading

BSI-084: Forty Years of Air Barriers
BSD-014: Air Flow Control in Buildings
RR-0403: Air Barriers
Continuous Air Barrier in Exterior Walls
BSI-037: Mold in Alligator Alley