TECHNICAL ARTICLE

PARADISE NEEDS AIR BARRIERS MORE THAN THE ARCTIC

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When you are sitting on the beach with a refreshment in your hand, watching the waves roll in and feeling the breeze on your face, the last thing you think about is an air barrier in your hotel building. If you happen to think about all the poor souls back home in the freezing cold, you may even think that its good that they have an air barrier in their home as they will be warmer.

You pick up a magazine and you read that the most important location to make sure you have a properly installed air barrier system is right where you are. How can that be? The IECC 2018 Section C402.5.1 Exception states "Air barriers are not required in buildings located in Climate Zone 2B". ASHRAE 90.1 2016 narrows the exception down more where it states in Clause 5.4.3.1 Exceptions "Single wythe concrete masonry buildings in Climate Zone 2B".

ABAA commissioned the National Institute of Standards and Technology (NIST) and Oak Ridge National Laboratory (ORNL) to develop a calculator which would be easy to use but would use real weather files for different cites rather than an arbitrary average value that is used for every building in every location for all weather conditions.

The first version of the calculator only dealt with energy savings. NIST developed COMTAM files for 52 cities across the national. These files were then used with Energy Plus to do the calculation of the energy saved by comparing the energy used in a leaky building verses a tight building.

The selection of cities was based on a reasonable distribution of major metropolitan areas throughout the US; therefore, not every state is represented. If the specific city for which you are interested in obtaining results does not appear on the list, the selection of a city that has similar meteorological conditions (wind, temperature, solar radiation, and rain) is recommended. This is not always the city geographically closest to your target city.

In 2018, the calculator was updated to add moisture movement by air leakage. If we know the air leakage rate of the building, we know from the weather files what the atmosphere is outside, the interior atmosphere is basically set for buildings, so we can calculate how much moisture is transported along with the air that is leaking through the building enclosure.

The Air Saving and Moisture Transport Calculator
The updated calculator still gives you the energy savings that an air barrier provides for a building. Now it also tells you move much moisture is carried by that air leakage. To keep it simple and easy to use, it simply calculates how much moisture moves through the holes and cracks. That moisture flow can be going in or out of the building envelope. The calculator also does not try to determine whether any of that water vapor will condense within the building enclosure. If you understand how much moisture is being transported, you will take the proper precautions to manage the moisture.

The online energy savings and moisture transport calculator for commercial buildings (http://www.airbarrier.org/technical-information/energy-savings-and-moisture-transport-calculator/) is described in Figure 1. The calculator includes seven (7) of the sixteen (16) DOE archetypes that are used in Code development.

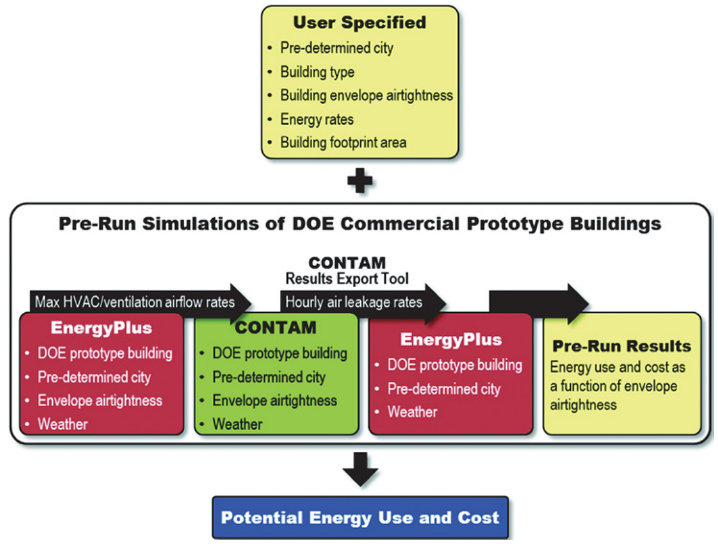

Figure 1: *General procedure to estimate potential energy costs for different levels of envelope airtightness in DOE commercial prototype buildings.*

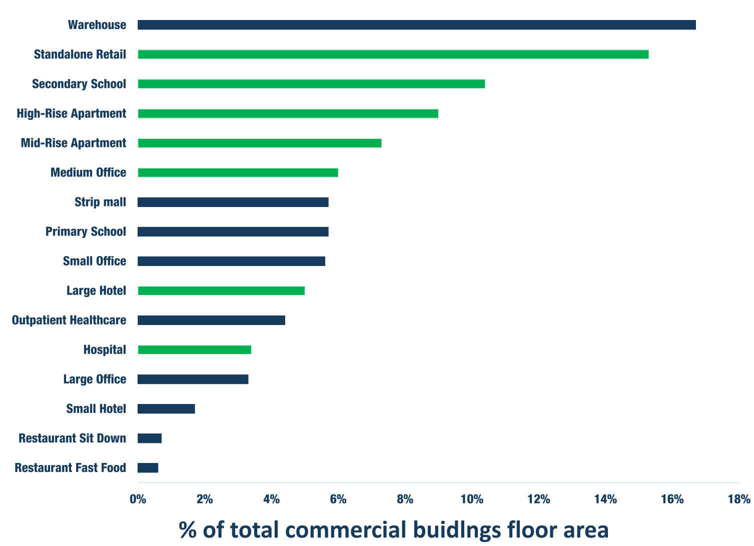

Figure 2: *Prototype buildings as a percentage of total US commercial building floorspace.*

These represent 80% of US commercial building floor area. Figure 2 shows the prototype buildings as a percentage of total US commercial building floorspace. These are depicted in Figure 2 by a solid green-colored bar and represent over 55 percent of US commercial floorspace and represent building types that would typically be temperature-conditioned and benefit from an air barrier system.

Case	Air Leakage Rate at 75 Pa (L/s·m2)	Air Leakage Rate at 75 Pa (CFM/ft2)
Baseline	5.4	1.06
1	2.0	0.39
2	1.25	0.25
3	0.25	0.05

***Table 1:** Assumed building envelope airtightness levels for a six-sided envelope (standalone retail building).*

Air leakage data for the four different airtightness levels were curve-fitted for each building type and geographical location. The calculator will interpolate between the baseline 6-sided air leakage and the tightest level of 0.25 L/s·m2 (0.05 CFM/ft2) at 75Pa. Extrapolation should not be used.

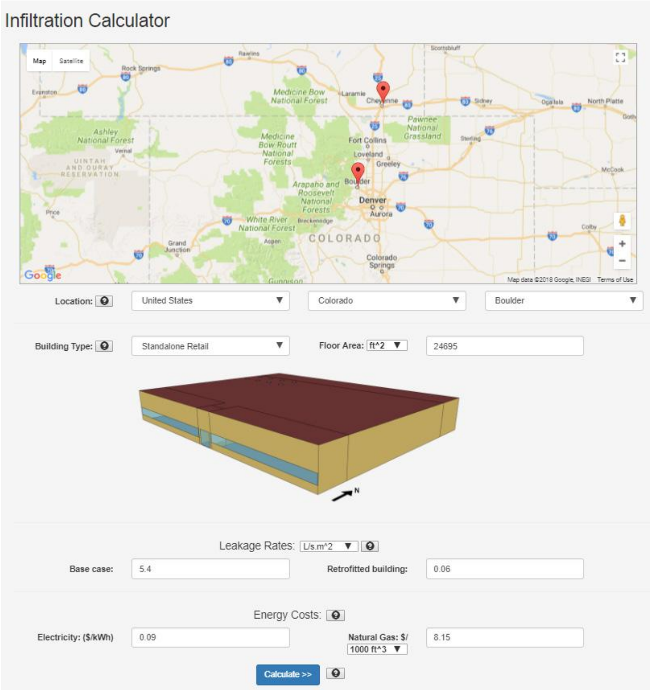

***Figure 3:** Input page for the Energy Savings and Moisture Transfer Calculator*

Figure 3 depicts the input page of the Energy Savings and Moisture Transfer Calculator.
The user;

1. Decide metric system or traditional IP
2. Select a geographical location - drop-down menus or map screen
3. Selects the commercial building type
4. Enter the footprint size
5. Input two levels of airtightness
6. Accept state energy costs or input your own values
7. Press "Calculate" and.....bingo

The output screen is shown in Figure 4. A summary of the user selections is posted at the top of the page. The calculator determines the Equivalent Leakage Area (ELA) for the baseline case and the improved airtight construction along with the amount of energy saved and the total savings in the appropriate currency. Finally, the calculator computes the total amount of moisture that would be transported through the wall for both the baseline and retrofit cases.

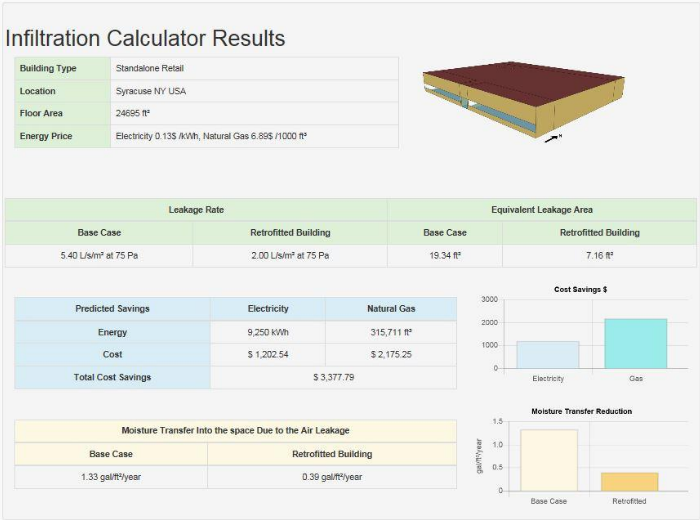

Figure 4: Output page for the Energy Savings and Moisture Transfer Calculator

Why We Did It

An online airtightness calculator was developed to estimate the energy reduction and dollar savings of an air barrier system along to its contribution to reducing the potential moisture load that a wall system must endure. This calculator is different from other common methods used in wall system analysis in that it uses hourly air leakage rates that are estimated by considering key variables such as building leakage rate, weather conditions, and HVAC operation. The calculator provides energy cost estimates as a function of building envelope airtightness for DOE commercial prototype buildings in cities in the United States. The calculator is a powerful, credible, and easy-to-use tool that designers and contractors can utilize to estimate the energy and financial savings that building owners could achieve by reducing the air leakage and the improved durability by reducing the potential. moisture load.