



INFILTRATION:

The Good, The Bad, and The Ugly

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June 8, 2022*

WHO AM I?

- Mechanical Engineer, NIST
 - Indoor air quality
 - Airflow and contaminant simulation
 - Energy modeling
- Member of: IBPSA-USA, ASHRAE
- Mentor

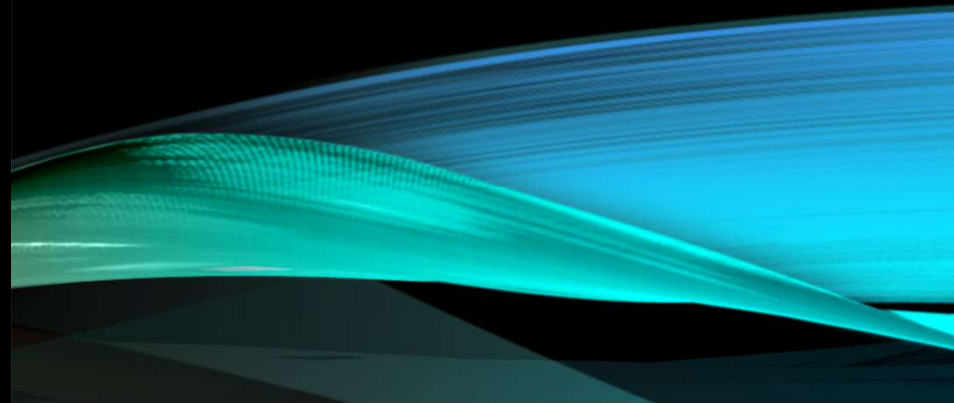


INFILTRATION – THE GOOD

- We are talking about it more



INFILTRATION – THE BAD



INFILTRATION – THE GOOD



- Understand it
<https://www.nist.gov/video/building-airflow-physics>



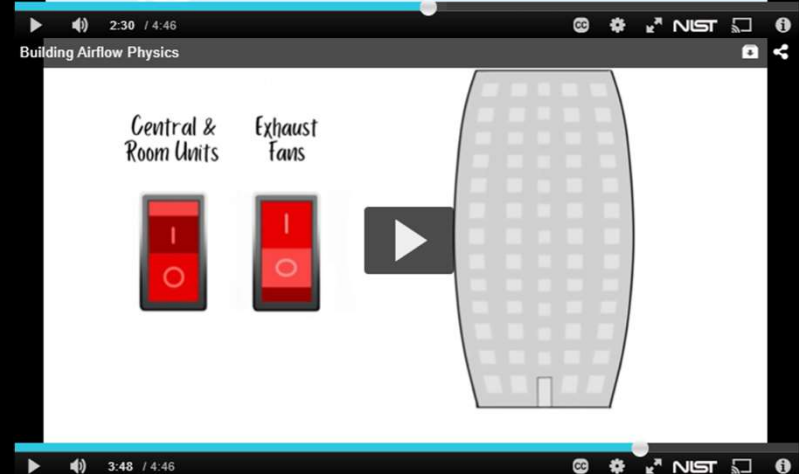
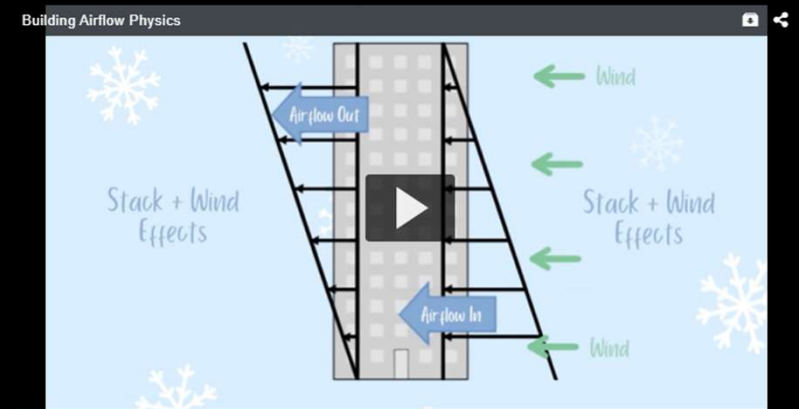
INFILTRATION – THE GOOD

1. Which direction does air flow?

- a) High temperature to low temperature
- b) Low temperature to high temperature

2. Can air infiltrate buildings that are pressurized?

- a) Yes
- b) No
- c) It depends!



INFILTRATION – THE GOOD

3. In what climate is infiltration an important issue?

- a) Very cold
- b) Very hot
- c) It depends!

4. Infiltration is a constant value.

- a) True
- b) False



INFILTRATION – THE GOOD



- Solutions
 - Improve building envelope airtightness
 - Mechanical ventilation for indoor air quality
- Tools to evaluate its impact
 - NIST
 - Oak Ridge National Laboratory
 - Air Barrier Association of America





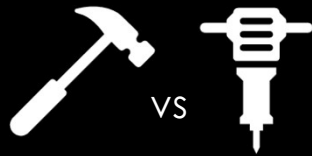
INFILTRATION – THE BAD



- How leaky is my building?
- Does infiltration even matter?
- How do I model infiltration?

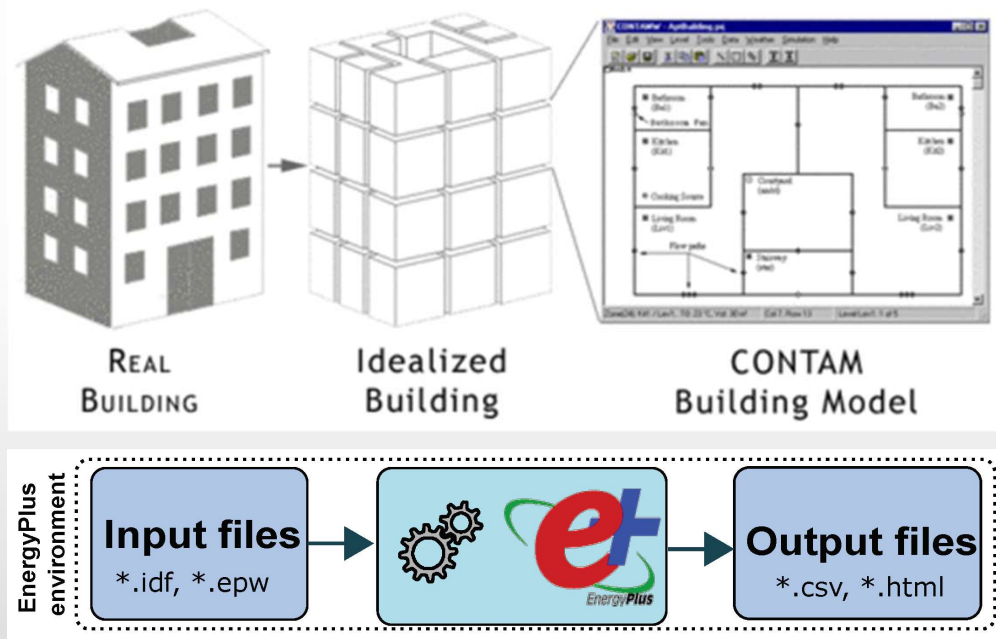
INFILTRATION – THE UGLY

- Assuming 0 or constant infiltration
- Not taking into account HVAC system operation or weather in simulations
- Not using available tools



TOOLS

NIST, Oak Ridge National Laboratory and Air Barrier Association of America




INFILTRATION CALCULATOR

<https://airleakage-calc.ornl.gov/#/>

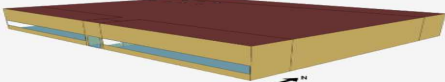
OAK RIDGE National Laboratory Energy Savings and Moisture Transport Calculator v1.0-020A Home Infiltration Account

Infiltration Calculator



Location: United States Illinois Chicago

Building Type: Standalone Retail Floor Area: 24695



Leakage Rates: $1/2\text{m}^2$

Base case: 5.4 Retrofitted building: 2

Electricity: (\$/kWh) 0.11 Energy Costs: Natural Gas: \$/1000 ft³ 11.03


Calculate

abaa air barrier association of america U.S. DEPARTMENT OF ENERGY Office of Science NIST National Institute of Standards and Technology U.S. Department of Commerce

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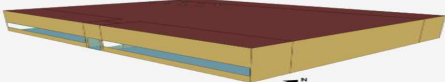
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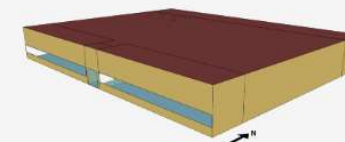
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INFILTRATION CALCULATOR

<https://airleakage-calc.ornl.gov/#/>

Infiltration Calculator Results

Building Type	Standalone Retail
Location	Chicago IL USA
Floor Area	24695 ft ²
Energy Price	Electricity 0.11\$/kWh, Natural Gas 11.03\$/1000 ft ³

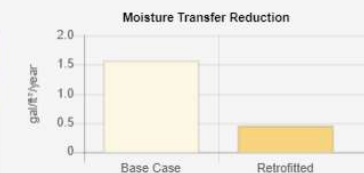


Leakage Rate		Equivalent Leakage Area	
Base Case	Retrofitted Building	Base Case	Retrofitted Building
5.40 L/s/m ² at 75 Pa	2.00 L/s/m ² at 75 Pa	11.65 ft ²	4.31 ft ²

Predicted Annual Savings	Electricity	Natural Gas
Energy	9,502 kWh	329.947 ft ³
Cost	\$ 1,045.26	\$ 3,639.32
Total Cost Savings	\$ 4,684.57	



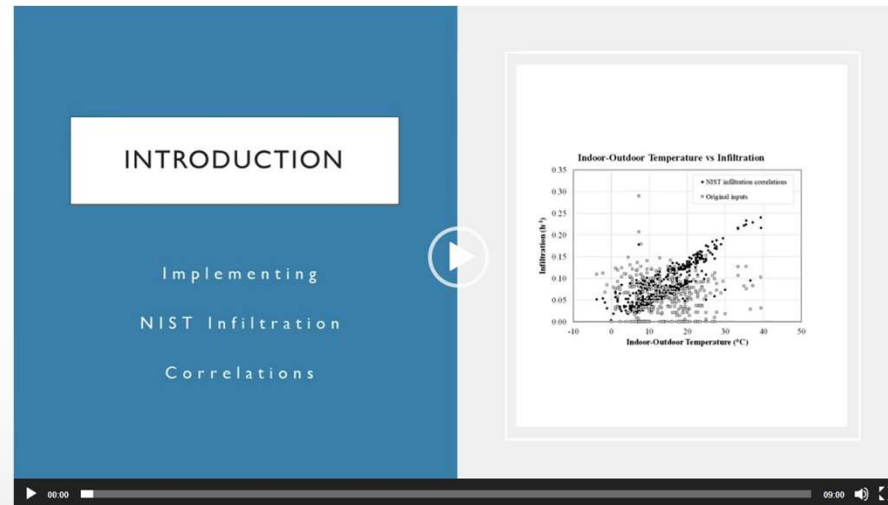
Moisture Transfer through the Wall Assembly due to Air Leakage		
Description	Base Case	Retrofitted Building
Total Moisture transfer	58,631 gal/year	17,286 gal/year
Moisture transfer per envelope area	1.57 gal/ft ² /year	0.46 gal/ft ² /year
Moisture transfer per effective leakage area (ELA)	34.96 gal/in ² /year	27.83 gal/in ² /year



$$\text{Infiltration} = I_{\text{design}} \cdot F_{\text{schedule}} [A + B|\Delta T| + C \cdot W_s + D \cdot W_s^2]$$

NIST INFILTRATION CORRELATIONS & HOW TO USE THEM

<https://www.airbarrier.org/nist-infiltration>



Video: <https://www.airbarrier.org/nist-infiltration/>

Written tutorial: <https://www.nist.gov/publications/implementing-nist-infiltration-correlations>

NIST infiltration correlations: <https://data.nist.gov/od/id/mds2-2598>

THANK YOU!

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Join our list serve: infiltration+subscribe@list.nist.gov

The background features a dark, almost black, gradient. Overlaid on this are several flowing, wavy bands of color. On the left side, there are vibrant red waves that curve upwards and then downwards. On the right side, there are bright cyan and blue waves that flow from the top right towards the bottom right. The waves have a soft, ethereal quality, with some internal texture or graininess, giving them a sense of movement and depth.