Interstitial Cavities—Pathways to the Unknown in Your Retrofit

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Our Definition of Interstitial Cavity - As there is none

Pathways or spaces between the inside and the outside of the building that allow unconditioned air to bypass your insulation.

- Chimney Chases
- Building cavities (floors, walls and roofs)
- Strapped ceilings
- Gaps between multiple layers of siding, or roofs
Interstitial Cavities

Are more likely to occur when you have multiple layers of building components.

- Built up roofs
- Multiple layers of siding
- Above drop ceilings
- In retrofits where new layers have been built over the original structure
  - Additions, modular homes, renovations
Why are they Problematic?

These air leakage highways bypass your insulation layer and create:

- Poor insulation performance
- Drafts/Decreased comfort
- Condensation & durability issues
- Pathways for vermin, odor, sound, and fire
- Liability concerns
- Unhappy customers
How Do You Locate Them?

- Infrared Scans
- Blower Door
- Manometer Pressure Mapping
- Smoke Pencil
- Theatrical smoke machines
- Investigation
- Dirty insulation
How Do They Connect?

Before treating, you need to understand how this space connects to the exterior:

Does the leakage occur at a single point?
- End of a drop soffit or plumbing chase

Along a line?
- The wall / floor connection in a balloon frame building, interior wall to exterior wall connection, along the exterior run of a soffit or chase

Or is this connection allowing diffusional air leakage along its entire area?
- Leaky exterior sheathing such as boards or unsealed joints in plywood or OSB
Go with the Flow

• Does the plumbing go to the attic?
• Does the plenum stop at the band joist?
• How will the home/furnace react to weatherization?
Investigation

- Noticing two different ceiling layers (sheetrock over lath and plaster)
  - A ¾" gap is difficult to find under insulation
- Moving fiberglass to find plastic
- Moving drop ceiling tiles
- Following duct work in attics
  - Disconnected plenum, chase ways
IR Camera and Blower Door

- Highlight the effect of interstitial cavities with air leakage
Zonal Diagnostics and Smoke Pencil

- Determine how drafty an interstitial cavity truly is
- With zonal diagnostics we begin to understand the versatility of interstitial cavities (distance traveled, pathways taken, chasing the roadrunner)
- Zonal diagnostics help us determine where the thermal and pressure boundaries are aligned or not aligned
  - Check before insulating in new construction
Convective Air Movement Within Walls

- Cyclical air movement within wall cavities
- Aren’t these interstitial cavities?
- Understanding the energy swap
- Air movement is around batt insulation not within
  - When does fiberglass actually take up the entire cavity
Wall Interstitial Cavities

- Fiberglass, chopped fiberglass, rock wool
  - Vulnerable due to improper install
  - Plastic over fiberglass
    - Allows clear visual of convective loops
Wall Interstitial Cavities
More issues with fiberglass

- What’s really going on here?
- Convection from outside
- Excessive moisture in the home
- Diffusional moisture
  - Moisture getting into penetrations, working through insulation

Borate is anti-microbial
Wall Interstitial Cavities

Cellulose
- Problematic when not installed properly
- What happens when a leak on the outside is lined up with a leak on the inside?
- Is there an interstitial cavity towards the outside, how air tight is the cavity? (diffusional moisture should be vented)

- Continuous density is key
- Is an air attenuator
- Has enough to slow the air and heat transfer
Wall Interstitial Cavities

Foam

- Not filling entire wall cavities with foam
  - Creates interstitial cavity
  - Cannot allow cold air from outside to infiltrate
    - Caulk all remaining pathways
  - Air space on inside needs to be completely dead
    - Cracks from home shifting will allow cold air in, meets warm air, condenses
Wall Interstitial Cavities

Interior Walls

- With no insulation, interior walls that are very connected to a band joist or attic diminish performance

Colder at the top
Wall Interstitial Cavities

Building Connections
- Large voids typically found empty
- Fire walls between multi family dwellings
  - Drill into concrete blocks at attic plane, inject foam, mortar over holes
  - With sheetrock, dense pack cellulose, comply with code
Wall Interstitial Cavities

Multiple wall cavities
- Curve balls
- Air seal and insulate interior cavity with dense pack cellulose
- How air tight is the exterior cavity?
Attic Interstitial Cavities

- If the attic is not properly air sealed from the home isn’t that an interstitial cavity?
Attic Interstitial Cavities

Dormers

- Don’t let the problem spread
- Moisture from inside of home moving up slopes and into attic and causing durability issues
Attic Interstitial Cavities

Chimney Chase

- Understanding impact
- Air seal connection to attic with flashing and high temp caulk
Attic Interstitial Cavities

Plastic air barriers

- Air movement between vapor barrier and interior drywall and/or insulation.
- Don’t let problems hide
Attic Interstitial Cavities

Gap between fiberglass and sheetrock

- Cutting insulation off at the knees
- Pull fiberglass and blow cellulose in direct contact with the air barrier of the interior drywall
Attic Interstitial Cavities

Recessed light fixtures
- Leaving messes everywhere
- Paying extra for less comfort
Attic Interstitial Cavities

Multiple roof layers

- Evaluate the information
Sloped Ceiling Cavities

- Air leakage doesn’t care about intentions
- Need to separate ventilation air from insulation
- Why was proper venting needed?
- With a continuous dense pack, is proper venting needed?
- Vented roof decks can be warmer than unvented roof decks
Soffit Interstitial Cavities

- Overhangs with soffit venting
- The venting of an attic can increase air leakage
  - Increases draft from already leaky top plates
Soffit Interstitial Cavities

- Exterior walls that are open to soffits
- With no encapsulation for the fiberglass how well can the walls perform?
Band Joist Interstitial Cavities

Standard band joist

Did air leakage exacerbate the problem?

Wood joints expand and contract with the seasons, allowing air to enter and exit at will.

Batts don’t fit snugly around wall penetrations or against uneven surfaces, and they get stuffed behind floor registers.

Condensation occurs on cold water plumbing and cold metal duct bands.

Because the rim joist is cool, water vapor condenses on the interior surface and puddles.
Band Joist

Perimeter of floor system

- If cold air is infiltrating on gable ends of home, treat these, run zonal diagnostic tests
Cantilever Interstitial Cavities

Cantilevered Floors
- Frozen Pipes
- Venting addresses symptom but not the cause
Knee Wall Interstitial Cavities

Connection to knee walls

Large insulation bypass, with vented slopes from the attic the convective loop can occur.
Knee Wall Interstitial Cavities
Hidden wall cavities

What’s happening behind the shelves?

Insulation bypass
Floor Interstitial Cavities

Trailer belly
- Duct work in unconditioned space
- Numerous penetrations to any attempt at an air barrier, cable, plumber etc.
- Multiple layers of insulation making interstitial cavities
- Insulate skirting and try to insulate ground
Floor Interstitial Cavities

Garage Ceiling

- Safety - Air seal to prevent CO from entering living area
- Encapsulate perimeter, air seal penetrations, loose fill cellulose (Larsen truss system with very deep cavities), top off with dense pack
Basement Interstitial Cavities

Sills
- Understanding what you see
- Often covered up by drop ceiling

Air seal and insulate the correct surface
Basement Interstitial Cavities

Brick over granite

- Frozen pipes, rot and extremely uncomfortable
Basement Interstitial Cavities

Flooring over exposed soil

- Fieldstone air leakage below grade
  - Moisture and cold air infiltration both effect this area
Basement Interstitial Cavities

Chimney

CO, Stack Effect
Basement Interstitial Cavities

Within concrete block foundation
- Be careful not to force an interstitial cavity
- Only treating above grade portion, leaving crack below
- Leaving leakage pathways from outside into cavity
Crawl Space Interstitial Cavities

Perfect for duct work!

- Capillary action of water through concrete pores can drive moisture up foundation and effect band sill behind closed cell foam
- During construction, install a capillary break on top of foundation wall
Crawl Space Interstitial Cavities

Duct Work

- How much control do we really have?
- Open supply will pressurize crawlspace and can drive air and moisture into living area
Chase Interstitial Cavities

- Drop soffit above kitchen cabinets

Connection to exterior wall
Chase Interstitial Cavities

Duct work chase in basement
  - Exterior walls and sills open to chase
Drop Ceiling Tiles

Uncovering the trifecta nightmare

- Drop Ceiling, perforated fiber board with a fiberglass batt above
Pathway Treatment Options

Direct Connections
- Expose area and air seal connection(s) to exterior with rigid board and/or spray foam
- Improved bag and blow method at exterior with dense pack cellulose

Diffuse Connection (board sheathing)
- Treat (seal leakage) or fill the entire cavity with dense pack cellulose
- Demo interior surface and air seal exterior bypass with closed cell spray foam, dense packing interior cavity will likely improve performance
Are Other Things in My Way?

- Cost
- Comfort
- Health and safety first
- How many opportunities do we really have?
- Ambition/Motivation of customers
  - Do multiple homeowners want to achieve the same goal?
  - Are homeowners just looking to sell?
  - Are customers buying home?
Avoiding Interstitial Cavities in New Construction

- Avoid constructing building assemblies with more layers than necessary for thermal and moisture control.
  - KISS Principle: Interior wall, insulation, exterior sheathing (air sealed), back vented rain screen, siding
- Avoid gaps between your insulation and your interior wall unless you can be certain that they cannot communicate to the outside.
Quality Control Process

- If you exposed and air sealed, check effectiveness with blower door and smoke or theatrical fog before your work is covered back up (lath and plaster on ceiling before loose filling again)
- If you filled the entire cavity, then check work with blower door and infrared camera
Mistakes Made During Construction

- Assuming you’re in control
- Interstitial cavities towards inside pose thermal problems
- Cavities toward outside pose durability problems
Thank You