MHBA HOUSING FORUM WEBINAR SERIES

Manitoba Home Builders' Association

Integrating Air Tightness to Performance Path Modelling

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Manitoba Home Builders' Association

Today's Context

- NECB (part 9.36) came into effect in November 2016 in Alberta
- Upcoming code changes in winter 2021 (Manitoba intent to adopt)
- What can we anticipate in the years to come:
  - Mandatory air leakage targets-max ACH
  - Prescriptive thermal performance values increased
  - Performance targets increased?
  - Minimum renewable energy installed on site?
  - Comfort calculations-room by room?

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Where are the Codes going?

Performance or Prescriptive?

Which Code to Use?

NECB (Default)

- All paths allowed
  - Part 3 buildings
  - Part 9 buildings of residential occupancy greater than 600 m2 footprint and 3 Stories
  - Part 9 buildings of non –residential occupancy greater than 300 m2
- Prescriptive path challenges
  - Window to wall ratio

Part 9 Buildings:

- Part 9.36 (Exception)

- Prescriptive or Trade-Off Paths
  - Residential occupancy
  - Buildings < 20% common areas / 100% dwelling
  - Non-residential occupancy less than 300 m2

- Performance Path
  - Houses: A-9.36.1.3-3
  - Buildings < 20% common areas and100% dwelling

Lesson: not all Part 9 Buildings are Part 9.36 Energy Code!

Compliance Paths?

- **Prescriptive**
  - Follow building code requirements for all the different components of the building: roof, walls, windows, basement, above grade foundation, below grade etc.
  - Provide all calculations to prove compliance
- **Trade-Off**
  - Above grade opaque assemblies (Part 9.36)
  - Windows (Part 9.36)
- **Performance**
  - Total Annual energy consumption of the building we want to build is equal or less in energy use than the same building built to the prescriptive requirements.
  - Energy model comparison, no minimum envelope or HVAC requirements per prescriptive path (other than HRV)

Prescriptive

- is an all or nothing scenario.
- Current code has relaxed effective RSI values due to Manitoba Code Amendments. Values likely go up once Manitoba adopts new code in 2021
- Mandatory grey water heat recovery
- No accounting of air tightness or building as a system approach

Performance

- allows for more flexibility in design and targeted upgrades if the building is not compliant.
- No minimum requirements for HVAC and envelope
- grey water heat recovery not required if compliance is achieved within performance path
- Includes energy savings due to air leakage
- Includes energy savings of the HRV.

Making energy conservation part of our building codes is a good way to push an industry forward…

But it has to be done wisely, just like any changes to the building codes.

Changes to the building code should be “integrated” to the current code, rather than “added” to the building code.

If not carefully “integrated” to the building codes, energy efficiency measures will potentially create more issues than good…

If the different sections and parts of the buildings are not integrated, we can anticipate an entire building stock that:

- Will not be buildable in our current developments
- Will potentially have structural issues
- Will potentially have greater indoor air quality issues and mold growth
- Will potentially have major envelope failures

An entire Net-Zero Energy building stock that no-one will be willing or able to live in…

To have a successful transition to the Pan-Canadian Framework targets of Net-Zero Energy Ready by 2030:

- Performance modelling at design stage.
- Assume trade-off and prescriptive paths will disappear in the future as no load can be calculated.

How do we get to higher performance targets with:

- Less risk of envelope failure?
- Better comfort for the occupants (less call backs)?
- More cost-effectively?

Air tightness in energy modelling!

This is easy as Manitoba already has GREAT air tightness practices, due to the R2000 program that had a lot of traction in your region.

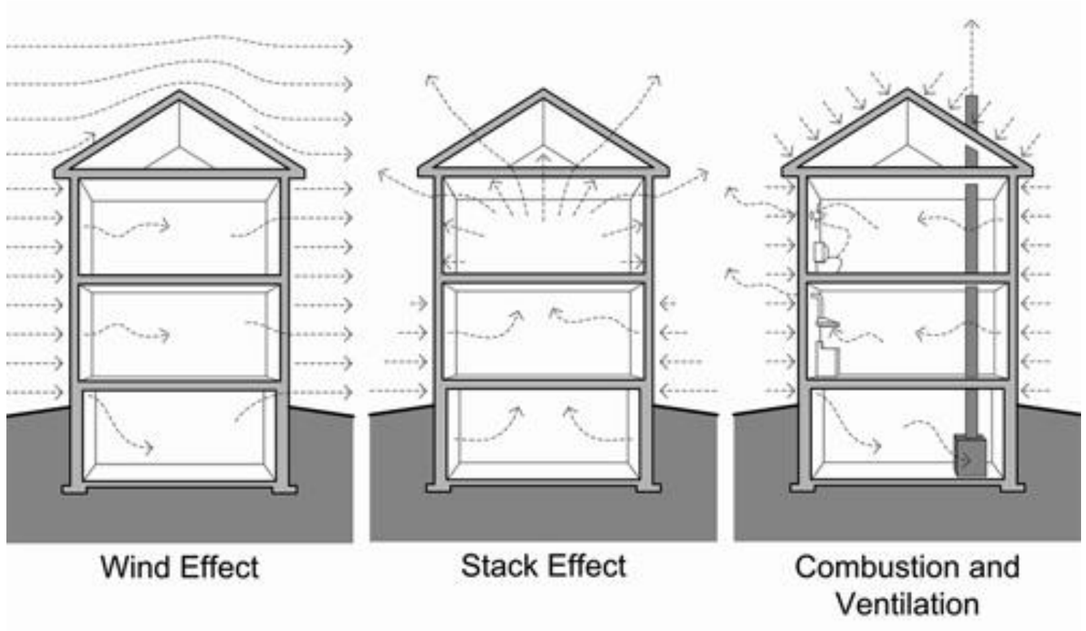
Might as well use all this hard work to your advantage!

Air tightness…Recap

- What is its intention? Primary air barrier?
- Where should it be located?
- What materials can we use and how?
- Air tightness challenges
- Air tightness benefits
- Air tightness detailing
- Caution around air tightness
- Can we guarantee the air leakage target? How do we do that?
- Air tightness and performance modelling: Code, ERS, Net-Zero Energy etc

What is its intention?

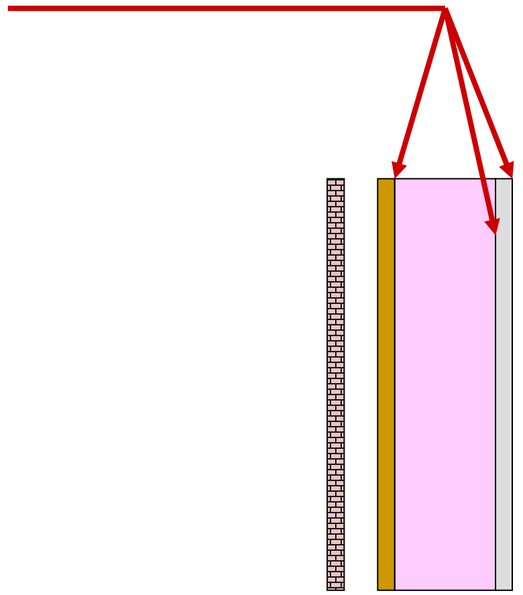
- An air barrier is a system built of different materials that mitigate uncontrolled air flow through the building envelope.



- Air flow is mainly triggered by pressure difference between inside and outside the house:
  - Stack effect
  - Mechanical flue effect
  - Window effects- positive, negative and neutral pressure planes

Location in the envelope system?

Contrary to a vapor retarder, the air barrier system can be installed anywhere in the envelope assembly:



The Criteria of an air barrier is:

- IMPERMEABLE to air flow
- CONTINUOUS, by sealing all seams, edges, gaps, holes and tears (tie-ins)
- Not necessarily impermeable to moisture flow-can have drying potential
- Rigid and strong enough to withstand air-pressure differences
- DURABLE during construction and for the expected life of building

What Materials Can We Use?

In the science world, it would be any material that has less than 0.02 metric perms @ 75 pa of pressure differential…

In the construction world… almost anything that isn't a fiber material. These could be used as part of your "primary" air barrier system.

Aluminum Foil Vapour Barrier	Non-measurable
Modified Bituminous Torch-On Grade Membrane, 2.7 mm, Glass Fibre Matt	Non-measurable
Modified Bituminous Self-Adhesive Membrane, 1.3 mm	Non-measurable
Modified Bituminous Torch-On Grade Membrane, 2.7 mm, Polyester Reinforced Matt	Non-measurable
Plywood Sheathing, 9.5 mm	Non-measurable
Extruded Polystyrene, 38 mm	Non-measurable
Foil Back Urethane Insulation, 25.4 mm	Non-measurable
Phenolic Insulation Board, 24 mm	Non-measurable
Phenolic Insulation Board, 42 mm	Non-measurable
Cement Board, 12.7 mm	Non-measurable
Foil-Backed Gypsum Board, 12.7 mm	Non-measurable
Plywood Sheathing, 8 mm	0.0067
Flakewood Board, 16 mm	0.0069
Gypsum Board (M/R), 12.7 mm	0.0091
Flakewood Board, 11 mm	0.0108
Particleboard, 12.7 mm	0.0155
Reinforced Non-Perforated Polyolefin	0.0195
Gypsum Board, 12.7 mm	0.0196

What is your primary air barrier system?

This is the main material that has to be tied into everything else, sealed on all joints and sides.

Challenges of Building an Air Barrier System:

- No professional training available
- Management of trades on site
- Can be very labor intensive
- Takes time
- Not many understand it
- Who is responsible for them?

Cracks:

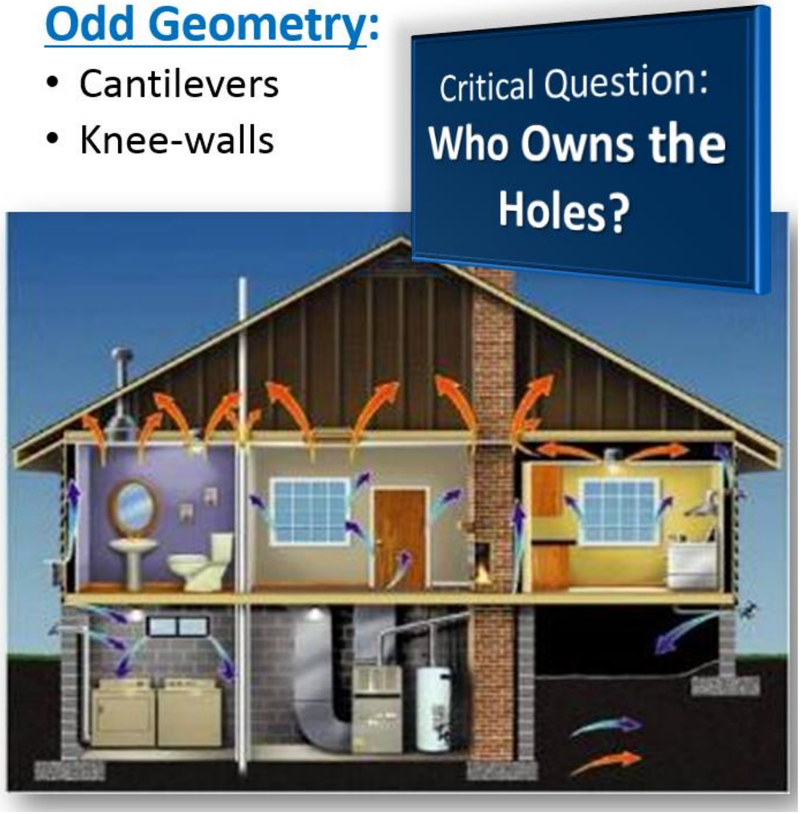
- Sill Plates
- Windows & Doors
- Drywall at Top Plate
- Access Panels
- Sheathing Joints
- Foundation/Framing

Penetrations:

- Plumbing
- Wiring
- Recessed Lights
- Vents
- HVAC Duct Boots

Odd Geometry:

- Cantilevers
- Knee-walls



Benefits of Building a Performing Air Barrier System:

Home owner/ Client:

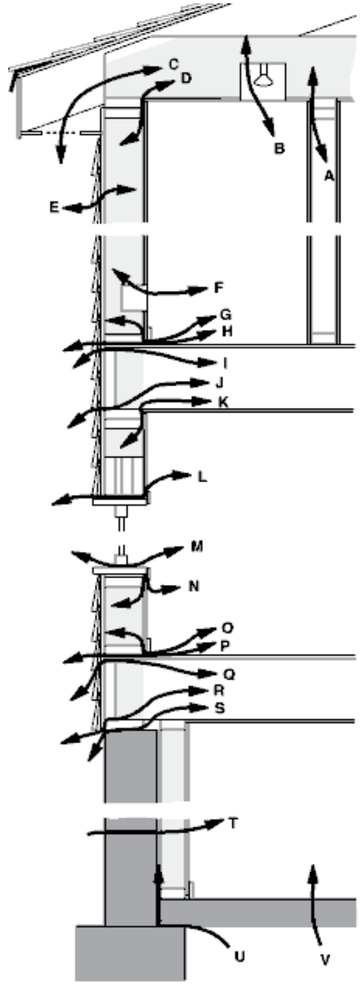
- Saves on operations costs over the life time of the building
- Allows for better control of indoor air quality. Can also promote better indoor air quality.
- Houses are quieter to exterior noise
- Pest Control
- Mitigates drafting within the house
- In attached units: mitigates odors from adjacent unit

Builder:

- Makes meeting energy performance requirements easier-code, ERS etc.
- Mitigates moisture issues within the envelope system-warranty
- Cost trade-off of air tightness for insulation and or HVAC-with performance modelling
- May reduce call backs from home owners in regards to their comfort or other concerns.

Air Barrier System: Lots of Detailing

- between wall top plates and drywall
- through cracks in recessed fixtures
- through gaps in siding and sheathing
- through holes in electrical boxes
- between bottom plate and drywall
- between bottom plate and subfloor
- between rim joist and subfloor
- between rim joist and top plate
- around window and door jambs
- leaky windows and doors
- between window framing and drywall
- between sill plate and foundation wall
- between floor and foundation wall
- through cracks in floor slab



Caution Around Air Tightness!!

What can air tightness trigger within the building?

- Promotes higher humidity levels
  - Condensation on windows
  - Indoor air quality
  - Potential for mold growth.

Typical response? “My house has to breath!”

Breath or Dry?

Luckily! Every house has a ventilation system! To DRY it.

WINDOWS!!

What would be recommended to install??

You know it! An HRV!

Again, Manitoba makes Heat Recovery Ventilators mandatory in all constructions!

Why? Because your air tightness practices are already very good!

So why not see if these units can fit within your budget rather than “added” to your budget?

Ventilation systems: Heat Recovery Ventilators

- As HRV's recover the heat from the exhaust rather than discard it, it saves energy as it preheats the incoming fresh air.
- The HRV allows for some energy savings in the code compliance as the reference house does not account for one.
- To get the full benefit of the HRV, the install should include a controller:
  - The HRV controller should NOT be located next to the furnace thermostat, but rather in the main living space of the house.
  - An HRV with no control becomes an expensive "glorified fresh air intake".

HRV installation is it important:

- As the building gets more and more air tight due to the new energy code, the indoor air quality may be reduced and condensation risks may be increased.
- The HRV will assist with indoor pollutants, concentrations of chemicals and humidity levels.
  - And all that while saving energy!!

- Does this mean that if we have an HRV we won't have condensation in our windows?
  - It helps, but not entirely.

Air Tightness Quality Control?:

How do we know the air barrier was completed properly?

How do we know what we paid for?

How can we find out?

The lower the air exchange rate, the more benefits to you and the home owner!

Air leakage testing is the measuring tool

PHBI offers a series of theoretical and on-site training to help industry!

What is a good performing air tightness target?

Air Tightness “Guarantee”?:

After all this work, can we guarantee an air leakage rate to use it for code compliance and any other energy efficiency target?

As of recently, air tightness has been challenging to execute without any guarantee of execution. In all simulation modelling, we had to assume the leakage rate and “hope” we did it right on site.

A whole building air tightness solution is now available!

AEROBARRIER™

Breakthrough Envelope Sealing Technology

What are the Benefits of Guaranteeing an Air Leakage Rate?:

- Air tightness data can be used for code compliance and any energy efficiency target to optimize your house in the simulation model
- Trade-off air tightness for more relaxed thermal performance of house components and better sized HVAC systems.
- Allows for better or equal performing house for marginal cost increase.
- Makes Net-Zero Energy Ready simple and cost effective.

An example of Cost analysis when including air tightness to the energy model- Current NBC

Preliminary Analysis Shows (Customer homes):

- Most houses comply to the energy code with 2.5 ACH by about 5% with:
- R50 attics
- R20 2x6 16” OC walls
- 4” of 2 lb foam rim joists
- 4” of 2 lb foam in cantilevers
- R12 2X4 @ 24” OC basement walls
- No slab insulation-below frost non-radiant slab
- 96% furnaces
- HRV
- Typical gas hot water tank
- Double pane vinyl frame windows
- Approx. 13% FDWR

With the same specs but dropping the air tightness from 2.5 ACH to 1.5 ACH, we get compliances ranging from 10% to 20%.

What does this mean to you?

- As the energy codes get more stringent requirements, if air tightness is fairly low, construction assemblies won't have to change as much with performance modeling—buying time.

- With a lower air exchange rate, we can look at value engineering of current practices and possibly lower the cost of construction and materials—Today!

Moral of the story?

If Manitoba Builders are already very good at air barrier systems and are mandated by current codes to install Heat recovery ventilators, why not **use this to your advantage** in a performance modelling- which is also known as a “Full building trade off”?

In Summary: Guaranteed Air Tightness:

- Makes meeting energy performance requirements easier- Code Compliance, ERS etc
- Mitigates moisture issues within the envelope system-warranty
- Cost trade-off of air tightness for insulation and or HVAC-with performance modelling
- May reduce call backs from home owners in regards to their comfort or other concerns.
    - Give all the benefits at an equal or reduced cost!

Build Smarter, not Harder..

Programs in Manitoba

Efficiency Manitoba New Homes Program-Prescriptive or via Energuide Rating System

Prescriptive gets $1200

- Free of charge to builder/home owner

Performance offers $1500 to $12000 (20% or better)

- Small fee for the energy modelling
- Air leakage testing and labelling funded by Efficiency Manitoba
- 20% is fairly simple to achieve on most houses if good windows are installed and no north facing walkouts and at 1 ACH50

Programs in Manitoba

CMHC mortgage insurance rebates-single family and MURBs- Energuide Rating System or NECB/Part.36

Single family homes (Energuide):

EnerGuide GJ/Year Rating	Insurance Premium Refund
At least 15% lower than “A Typical New Home”	15%
At least 40% lower than “A Typical New Home”	25%

MURBs (i.e Row houses-plexes- NECB/Part 9.36):

Co-Investment fund
Co-investment fund Min. Environmental and Accessibility

For More Information

askphbi@phbi.ca

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