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NESEA BE12: From Past to Future: The Green Mill Renovation

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Building Science Corporation

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Learning Objectives

- Summarize major green characteristics of mill redevelopment
- Explain interior retrofit insulation concerns and strategies
- Describe ventilation constraints, objectives, solutions for multifamily
- Implement unit compartmentalization strategies

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Overview: Inside or Outside Insulation?

- Insulating on exterior always preferable (masonry durability, condensation risks)
- Interior insulation → historic preservation reasons
- Interior → potential durability risks
- Energy efficiency, preserve exterior, museum-level durability: choose 2 of 3

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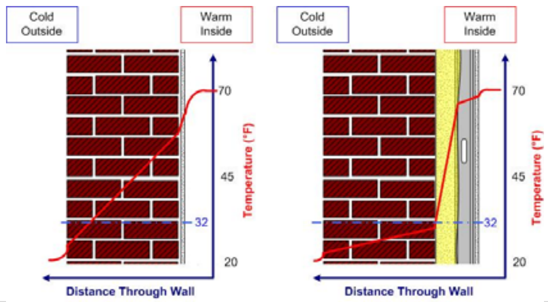
Cold Climate Risks

1. Freeze-thaw (reduced drying)
2. Air leakage condensation on interior face of masonry
3. Rot / corrosion of embedded elements



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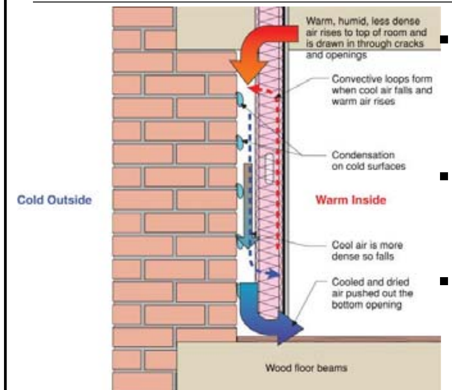
Cold Climate Risks: Condensation



- Requires perfect workmanship at air barrier—around penetrations, etc.
- Made worse by air gap behind insulation
- **NOT RECOMMENDED**

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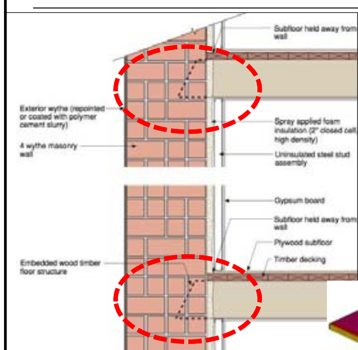
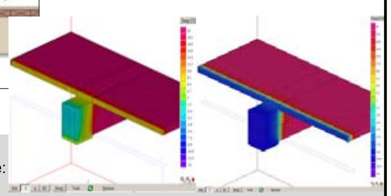
Embedded Wood Member Risks





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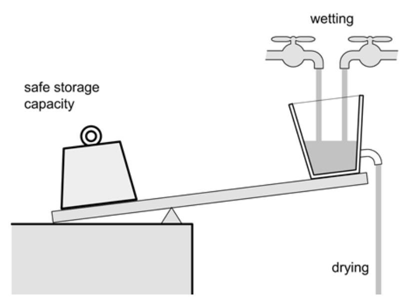
The Moisture Balance



- Large storage capacity (mass wall)
- Drying decreases with insulation
- Design should reduce/control wetting to compensate

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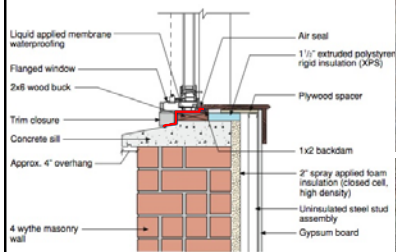
Windows (Potential Rain Entry Point)



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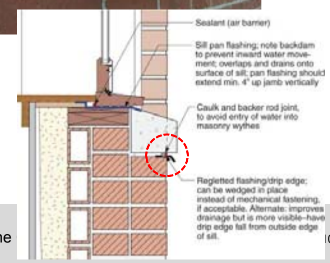
Windows (Water Concentration)



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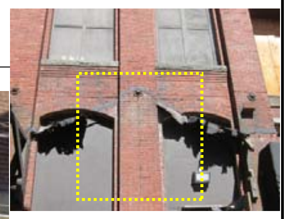
Water Concentrations



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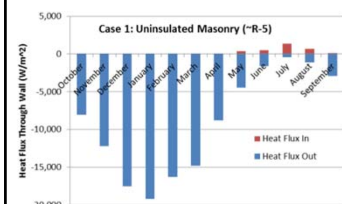
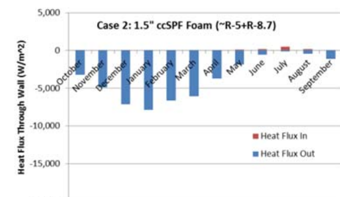
Do We Need to Insulate Mass Walls?

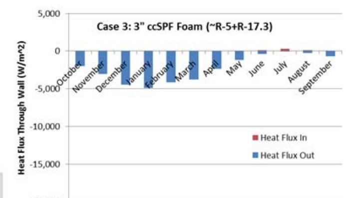


Climate: Burlington, VT

Case 2 (add 1.5" ccSPF, R-8.7) ≈ 60% reduction in heat flow through walls vs. uninsulated case

Case 3 (add 3" ccSPF, R-17.3) ≈ 75% reduction in heat flow through walls vs. uninsulated case





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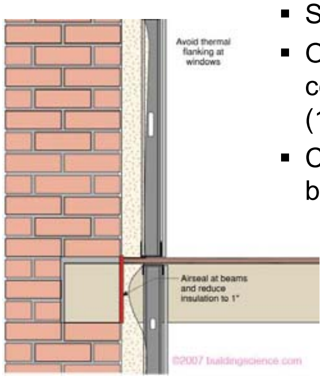
Recommended Approaches



- Spray foam against masonry
- Open cell (0.5 PCF)? Closed cell (2.0 PCF)? Intermediate (1.0 PCF)?
- Condensation risks within beam pocket: air seal

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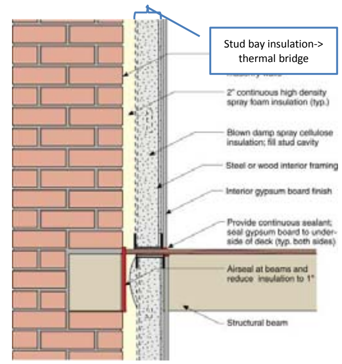
Hybrid Wall Insulation Assembly



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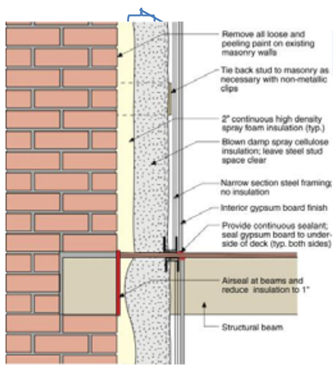
Hybrid Wall Insulation Assembly



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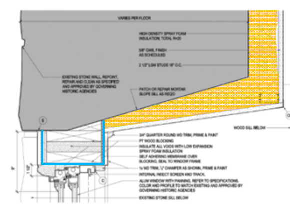
Tapered Window Openings



Minimum ~R-5 for thermal comfort (radiant surface temperatures)

Leverage spray foam for air barrier continuity to window opening

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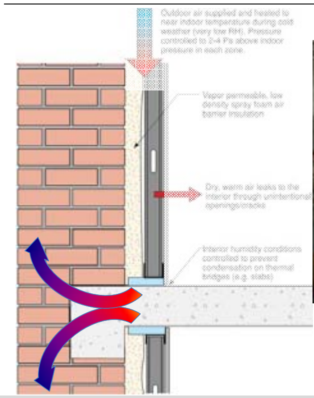
Thermal Bridging at Slab Floors



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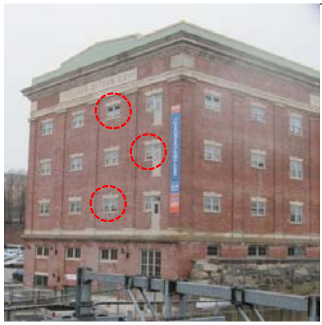
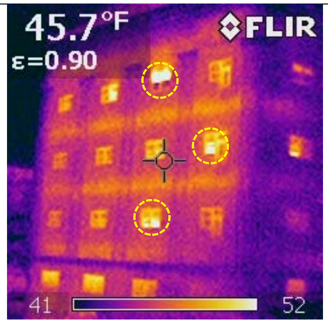
Thermal Bridging at Slab Floors





R-20 for 10 foot wall
R-3 for 1 foot floor slab
R-13 overall R value

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Interior Brick Exposed to Exterior

Reference: Canadian Building Digests 138:
On Using Old Bricks in New Buildings

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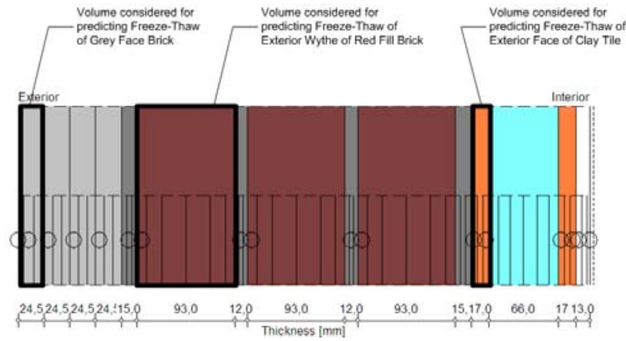
Hygrothermal Simulations



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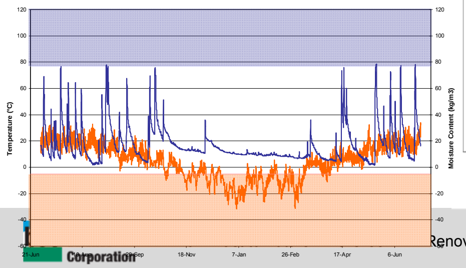
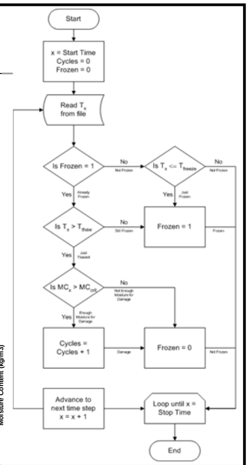
Assessment

- Freeze Thaw Event
  - Brick must have higher moisture than Critical Degree of Saturation
  - Brick must freeze/thaw (<23 F and >32 F)





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Air Barrier Issues

Can't rely on masonry alone to be an air barrier

13" brick wall, 100 sf = 3.1 sq. in. leakage EqLA

Same with 3 coat plaster = 0.054 sq. in. EqLA

Source: CBD-23. Air Leakage in Buildings

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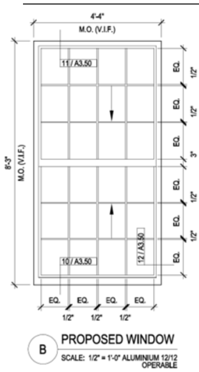
Window Heat Loss in Context



- Large windows (4' x 8'), high glass %
- Can't change frame profile (historic)
- Aluminum, double, low E: U≈0.5 (center of glass U-0.30)
- R-2 holes in R-20 walls

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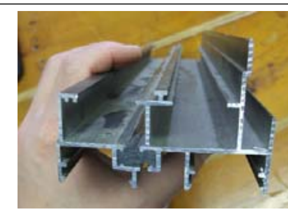
Window Heat Loss in Context

- Improved thermal breaks available
- Improved edge spacers available
- Improved center-of glass (triple, films, etc.)
- All add cost; not typical construction
- Alternate frame materials?



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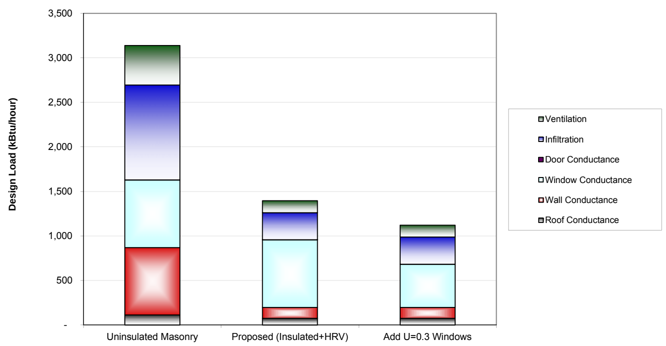
Wintertime Heat Loads by Component



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Thank you for your time!
Any Questions?

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