New Air and Vapor Barrier Technologies

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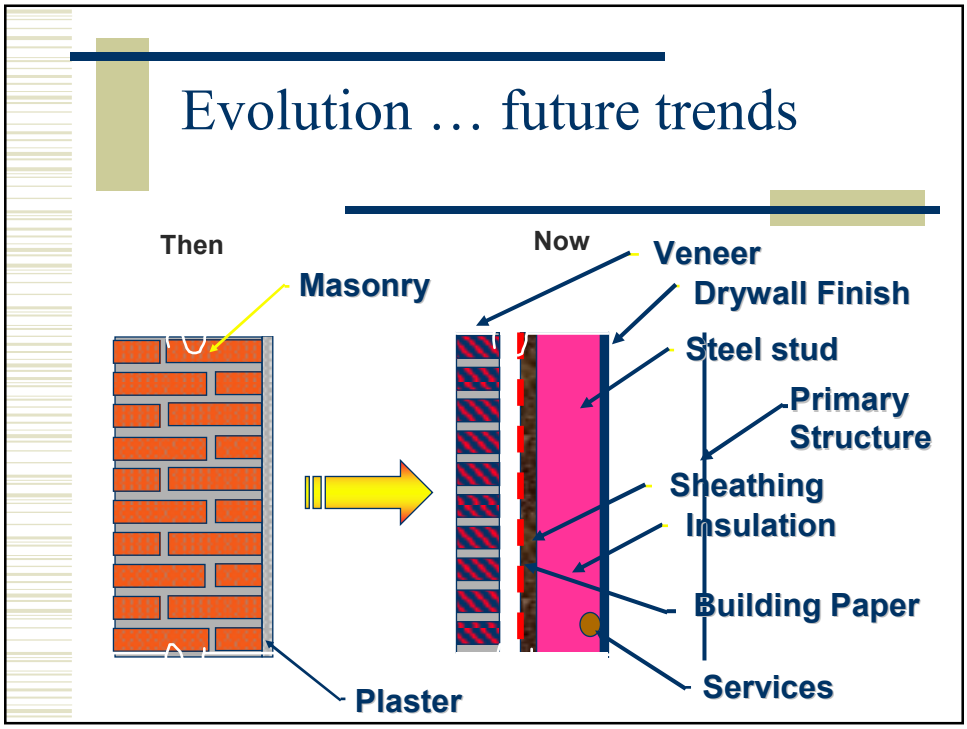
BEG
Building Engineering Group

Overview

- Air gaps
- Drainage and ventilation review
- Combined drainage plane, air and vapor barriers
- New technologies


Evolution … future trends
Then
Masonry
Plaster
Now
Veneer
Drywall Finish
Steel stud
Primary Structure
Sheathing
Insulation
Building Paper
Services

Evolution … specialization

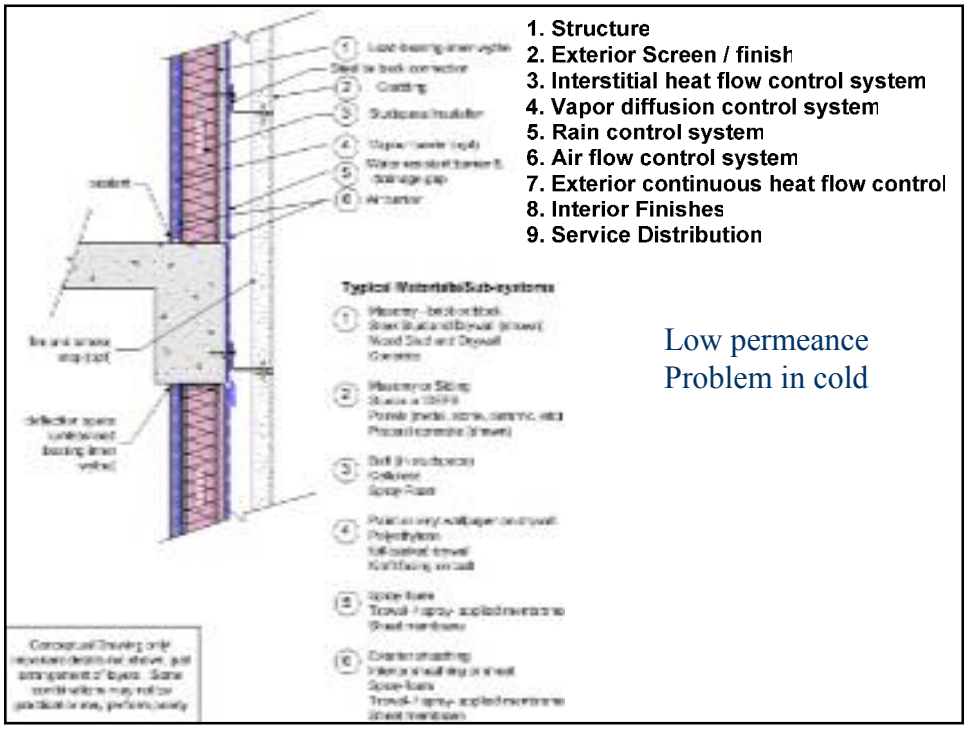
- Individual layers with well defined functional requirements
  - Insulation
  - Air control
  - Rain control
  - Vapor
  - Fire

Really important!

- Don't miss interactions

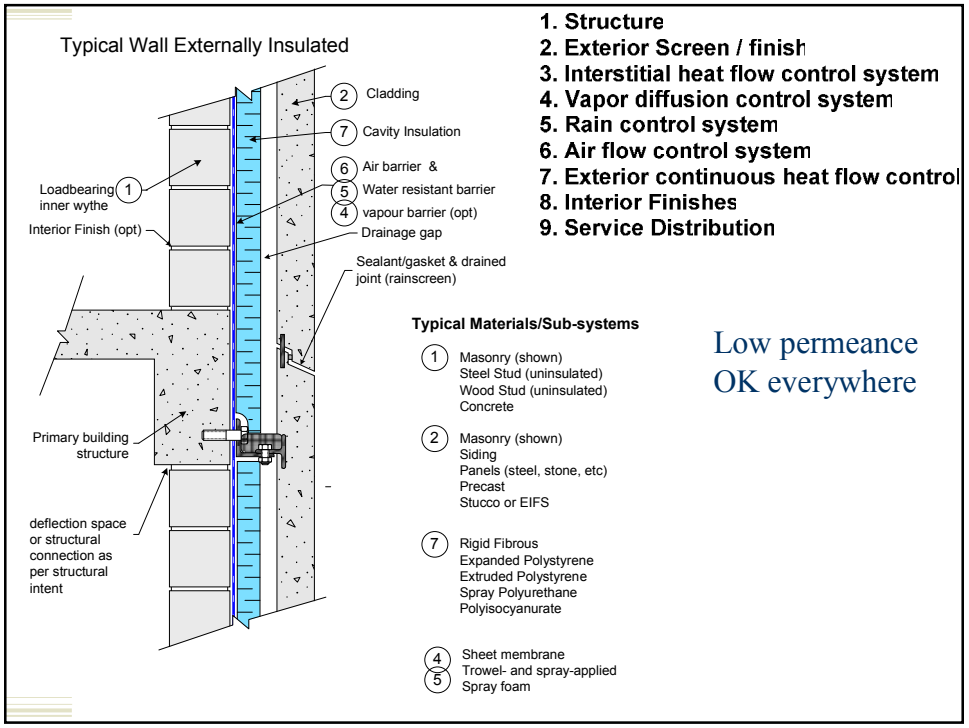
The ideal enclosure

- Structure
- Air Barrier
- Insulation
- Rain Control
- Finish



1. Structure
2. Exterior Screen / finish
3. Interstitial heat flow control system
4. Vapor diffusion control system
5. Rain control system
6. Air flow control system
7. Exterior continuous heat flow control
8. Interior Finishes
9. Service Distribution

Low permeance
Problem in cold



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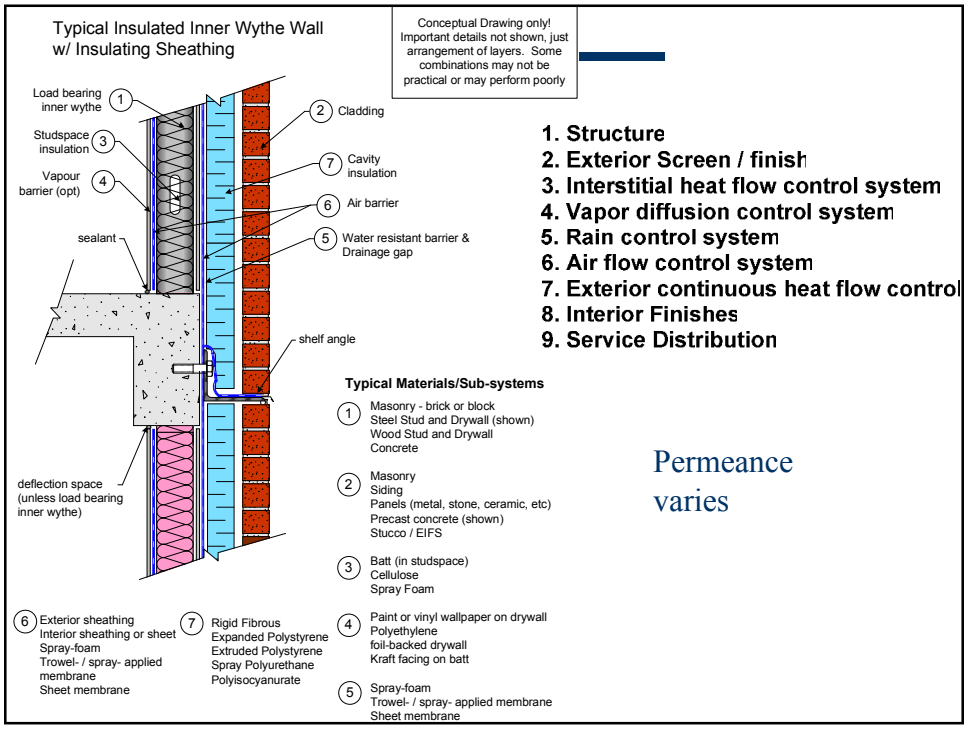
Low permeance
OK everywhere



Air gaps, drainage, ventilation

- Why gaps?
  - 1. Drainage
  - 2. Ventilation DRYING IS IMPORTANT
- BEG has been asking: How do they work?
  - Began pressure equalization research 1992
    - CMHC and industry (Owens-Corning, Dow, etc)
  - Began ventilation research 1994
    - CMHC concepts, ASHRAE experimental
  - Began serious drainage research 2000
    - Building Science Corp, Dupont, industry

Drainage

- Gap avoids hydrostatic pressure
  - drains away
- Reduces time of wetness on housewrap sheathing membrane
- *May* prevent bridging if >3-6 mm
  - Practically, water crosses gap
- BEG has developed test methods and conducted drainage tests on dozens of walls

Results

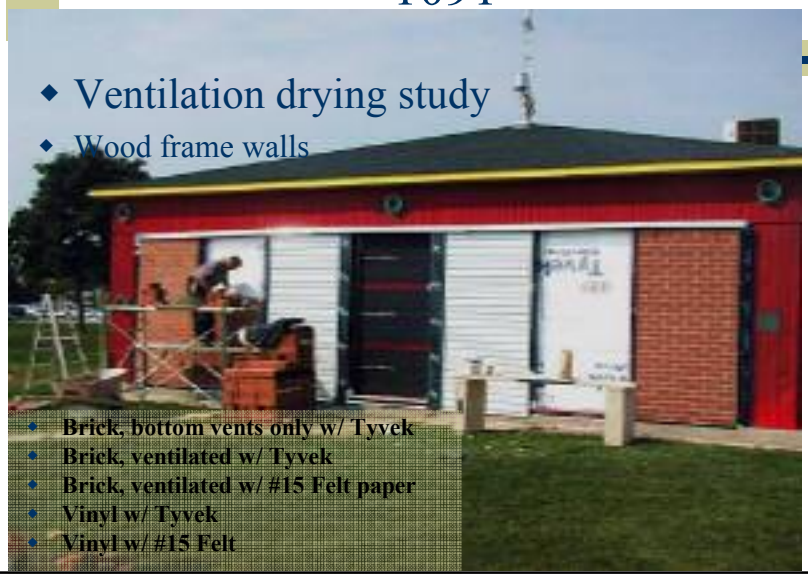
- Drainage is excellent provided
  - A clear gap exists
  - Size – maybe one mm
  - Need to build this though
- Drainage stops leaving stored moisture
  - This needs to be removed by ventilation or diffusion
- Large gaps
  - are useful for ventilation
  - But, when do you need it?

Ventilation

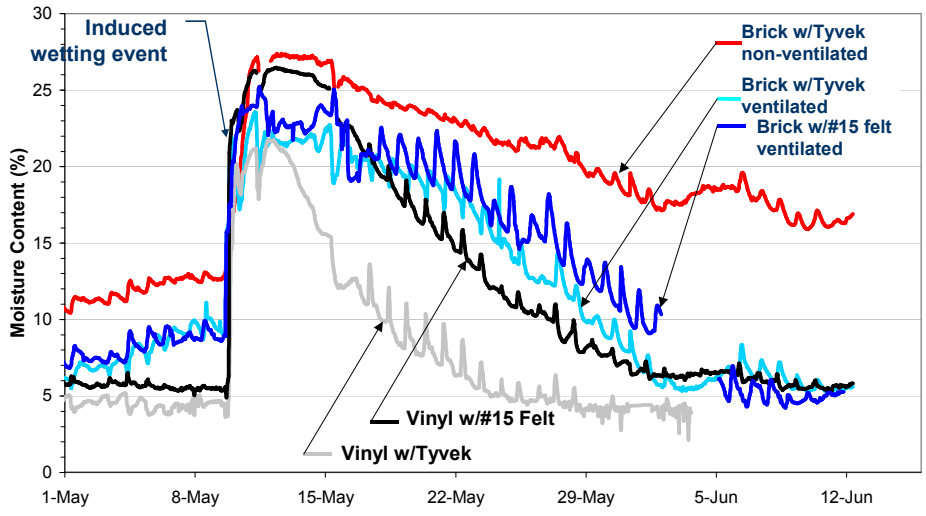
- Intentional airflow behind cladding bypasses vapor resistance of cladding
- Allows faster drying
- Controls damaging inward diffusion
- Not sure how big of a gap is needed
  - 6? to 25? mm
  - Even smaller may help

Ventilation Research: ASHRAE 1091

- Ventilation drying study
- Wood frame walls



Example Field Results: ASHRAE RP1091



Ventilation

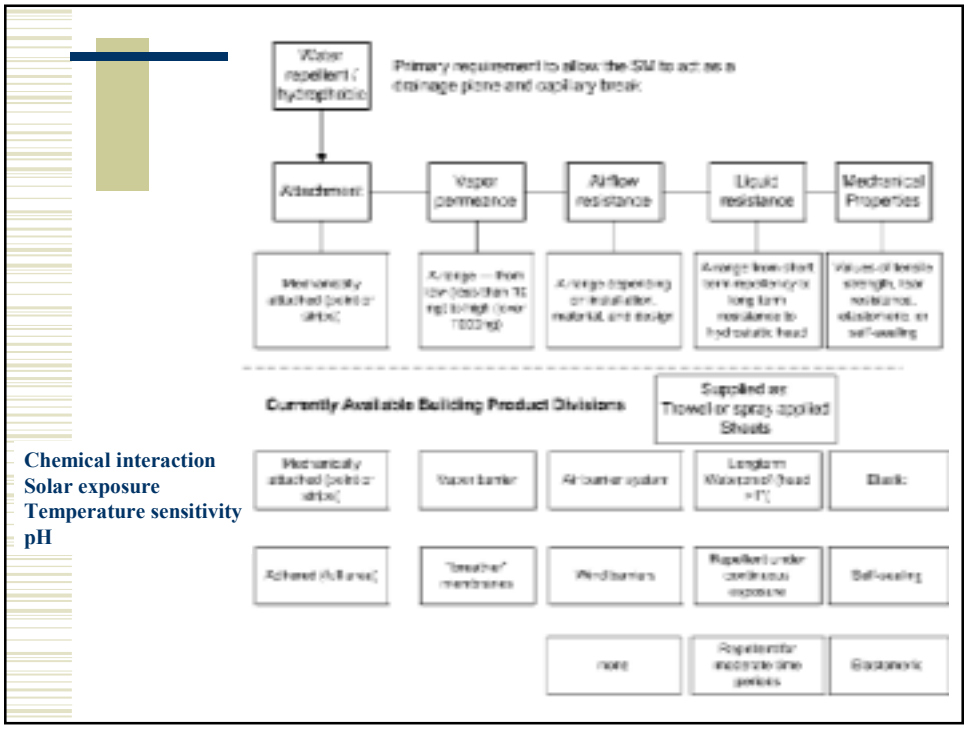
- Ventilation helps drying
- Ventilation controls inward drives
- Need vent openings top *and* bottom
- The more vapor tight the cladding, the more it helps
- Surprisingly small gaps allow ventilation

Summary of Research- We learned:

- We need gaps to provide drainage
- Flashing is the *real* practical requirement
- The required size of the drainage gap is very small (1 mm?)
- Larger gaps are needed for ventilation drying (3,6,9?)
- We don't always need ventilation drying
- Sheathing membrane is important!!

Sheathing Membranes

- Applied behind cladding
- May be in front of, behind, between insul.
- Perform numerous control functions
  - Must be capillary break / hydrophobic
  - May provide Air tightness
  - May provide vapor diffusion control
  - May provide Drainage gap


Water repellent / hydrophobic
Primary requirement to allow the SW to act as a drainage plane and capillary break
Attachment
Vapor permeance
Airflow resistance
Liquid resistance
Mechanical Properties
Currently Available Building Product Divisions
Supplied as Trowel or spray applied Sheets
Chemical interaction
Solar exposure
Temperature sensitivity
pH


Common Types
Format
Sprayed on
trowel applied
Sheet applied
Desirable Attributes
Self sealing
Fully adhered

Problems and Limits with Current Sheathing Membranes

Housewrap Problems: materials & installation

S

- Annoying details

Stick and peel

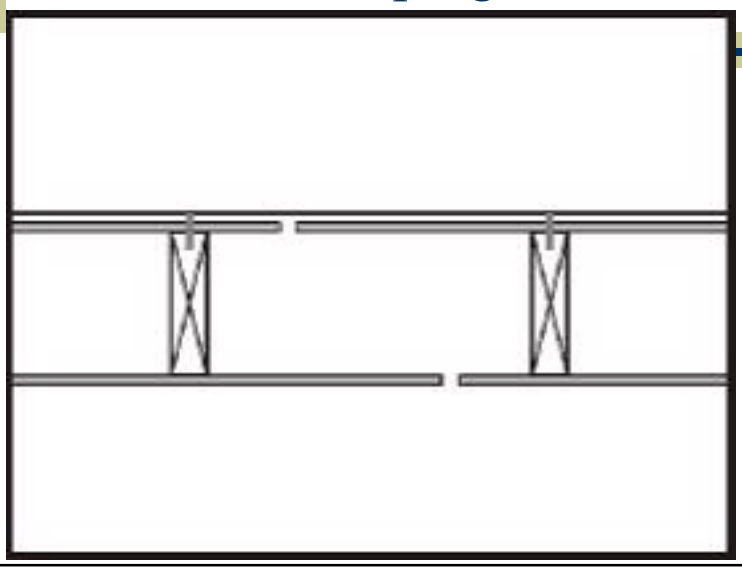
Vapor barrier on the exterior in cold climate

- Vapor permeable on the exterior in cold climate
- Not fully adhered

Pumping

- Unsupported sheathing membranes
  - housewraps
- Poly sheet between studs

Pumping



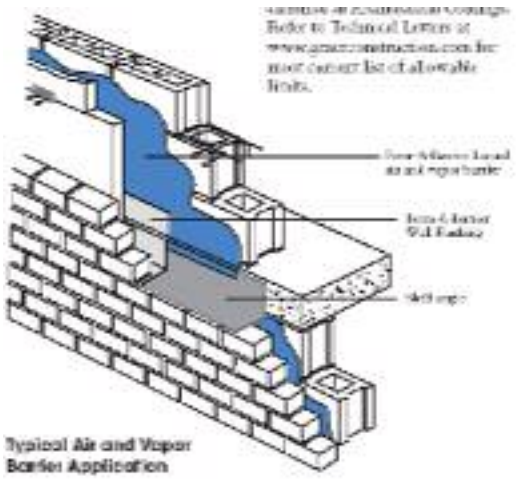
New Solutions

- Spray applied, trowel applied membranes
- Fully adhered, conforms to building details
- Can “dial in” the proper permeance for location in assembly and on planet

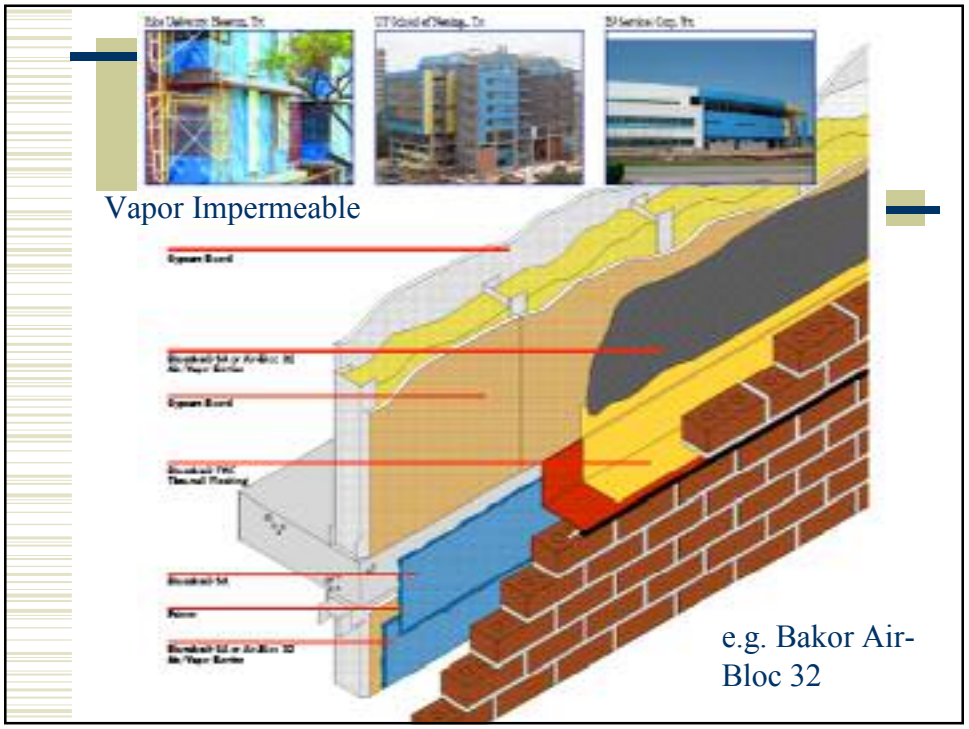
Spray Applied

- Low perm

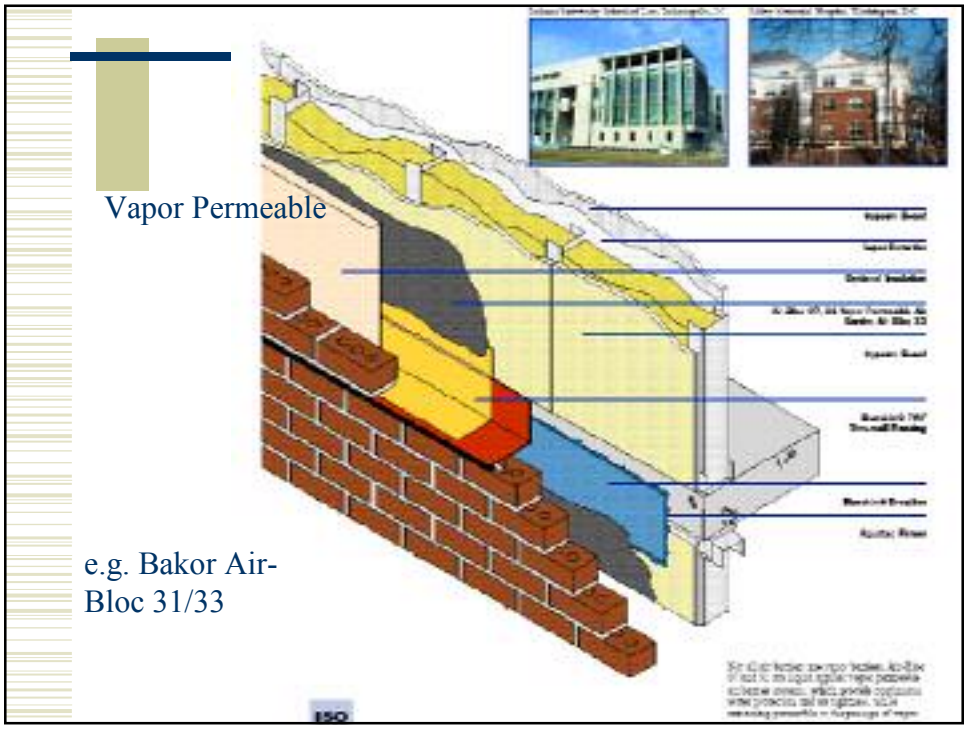
e.g. Grace
Perm-a-barrier



Spray Applied
Vapor Impermeable



Trowel Applied Vapor permeable



Waterproof

- Mid permeance (<4 US perms, 220 SI perms)
- Eg Sto Flexyl, Thoroseal (12 perms)

Spray Applied on wood

- Fully adhered
- Vapor permeable
- E.g Sto Gold Guard

Insulation, Air barrier, WRB

Self Sealing

- Self sealing used in critical locations on houses or commercial buildings
  - Sloped, high exposure
  - Need to reduce the flow of small amounts of moisture
- All existing products are vapor impermeable – this is a problem

Conclusions

- Drainage gaps and ventilation matter
- New spray and trowel applied sheathing membranes offer new choices
  - Benefits of fully adhered can be important
- Need more knowledge to apply
- Few have “self-sealing” characteristics
- Require more QC/QA on site!

Website

- University of Waterloo
  - **B**uilding
  - **E**ngineering
  - **G**roup
    - www.civil.uwaterloo.ca/beg
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