Detailing for Durability

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Research in Practice | Greening Housing Research

Researching Resiliency | Affordable Housing Research

Healthy Homes Research

Paul Fisette
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Submit a question to the moderator via the Chat box. They will be answered as time allows.

Stephen Schreiber, FAIA
Professor and Architecture+Design Program Director
Department of Art, Architecture, and Art History
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Moderator

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Course Description

Controlling moisture, rain and ground water are the most important factors in the design and construction of durable buildings. The shell of a house serves as the first line of defense between the occupants and the outdoor environment. Walls function as a weather barrier, nail base for finish materials and an energy conserving boundary. A sensible wall system is durable. And this requires all components in a wall assembly to be compatible for the long haul. Siding, siding finishes, housewraps, insulation and wall frames must work together while achieving distinctive goals.

This webinar will discuss the detailing of houses as part of an overall strategy to control moisture. These strategies will reduce maintenance and lengthen the working life of structural components in wood-frame structures. The webinar will focus on moisture transport mechanisms, relative threats, primary actions, prevention and control.

Learning Objectives

1. Learn about strategies for designing durable, sustainable wall systems.
2. Identify how architects can play a leadership role in design and constructing the building enclosure to control moisture.
3. Learn about strategies for improving sustainable living including human comfort, low energy consumption, improved occupant health, durability.
4. Gain an understanding of moisture transport mechanisms, relative threats, primary actions, prevention and control.

Detailing for Durability

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Discussion

- Moisture Transport Mechanisms
- Relative Threats
- Primary Actions
- Prevention and Control

Why We Care

- Human Comfort
- Energy Consumption
- Occupant Health
- Maintenance
- Durability

Four Moisture Transport Mechanisms

- Vapor Diffusion (lowest threat)
- Air Transport
- Capillarity
- Bulk Transport (highest threat)

Vapor Diffusion

- Primary Action
  - moves in or out
- Requirements
  - permeance
  - driving force
  - time
  - surface area
  - source

Diffusion Control

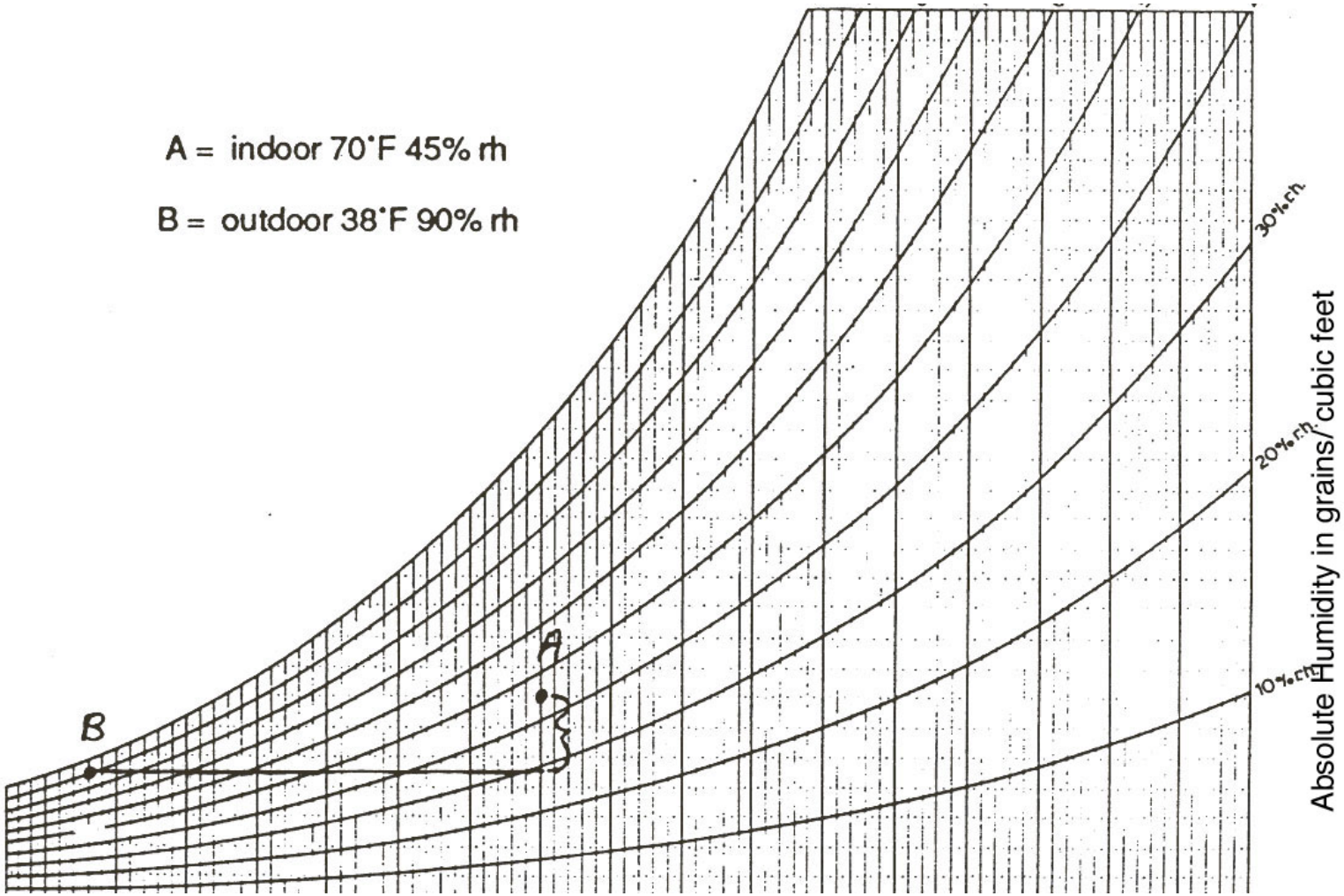
- Easiest to control permeance of materials
- Examples of vapor barriers
  - foil
  - polyethylene
  - Kraft facing
  - vapor barrier paint
- Install on warm side

Perm Ratings of Common Building Materials (Source: ASHRAE)

- Built up Roofing……...0.00

- 0.35-mil Aluminum Foil……..……0.05
- 6-mil Polyethylene……..……0.06
- 1/2-inch Exterior Plywood……0.35
- 3 Coats of Oil-based Paint……0.65
- Kraft Paper……..……..……..…1.0
- 1-inch Expanded Polyurethane……..1.0
- 15-lb asphalt felt……..……1.0
- 1-inch Extruded Polystyrene……..……1.2
- 1-inch Molded Expanded Polystyrene…..……...3.9
- 3/8-inch Gypsum Wallboard ……...……50

Vapor Pressure vs.. Temperature

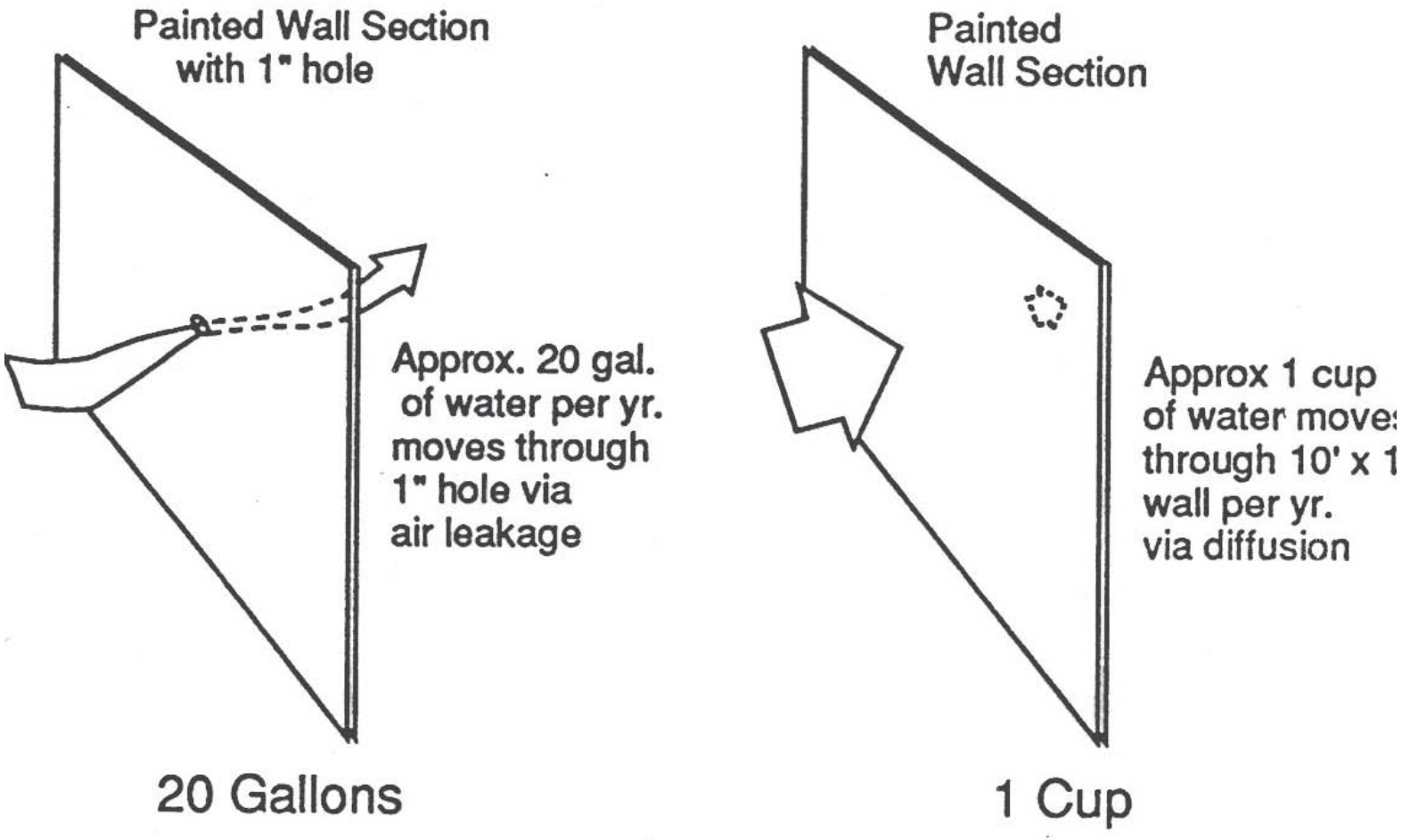


Vapor & Capillary Control

Air Transport

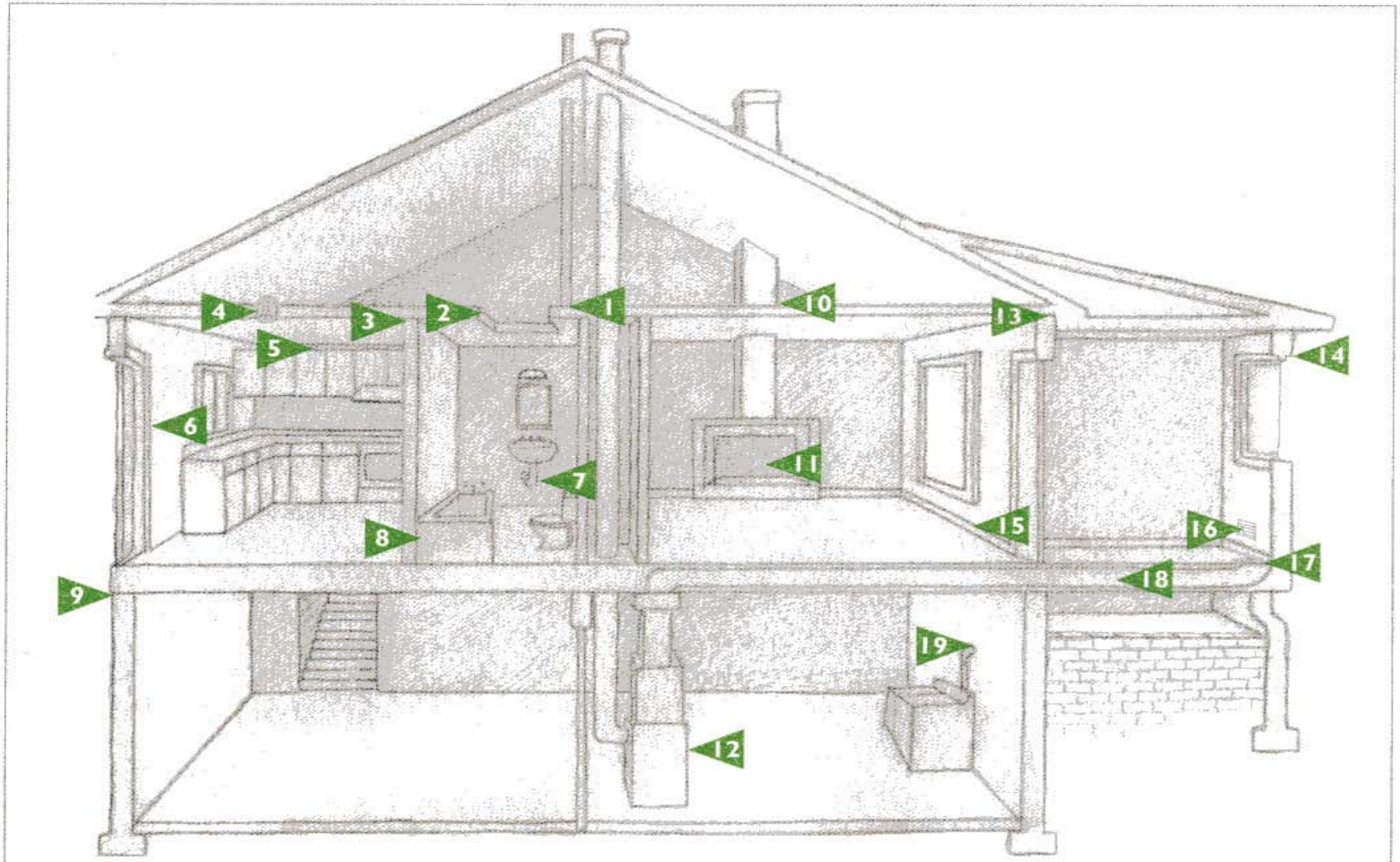
- Primary Action
  - moves moisture in or out as vapor
  - second most dominant force ~ capillary drive
- Requirements
  - source of moisture
  - holes or pathway
  - pressure differential

Significance Air vs. Diffusion



Air Transport Control

- Control each - 1 at a time or all together
- Easiest to control source or pressure
- Control temperature vs. dew point



Common air leakage sites in a home

Home Energy Magazine

Air & Bulk Moisture Control

Methods of Control

- Dehumidification
- Dilution - air changes in heating climates
- Depressurization in heating climates
- Controlled ventilation
- Point source ventilation
- Raise surface temperatures
- Control of #holes very difficult

Heat Recovery Ventilation

Air, Diffusion and Surface Temp

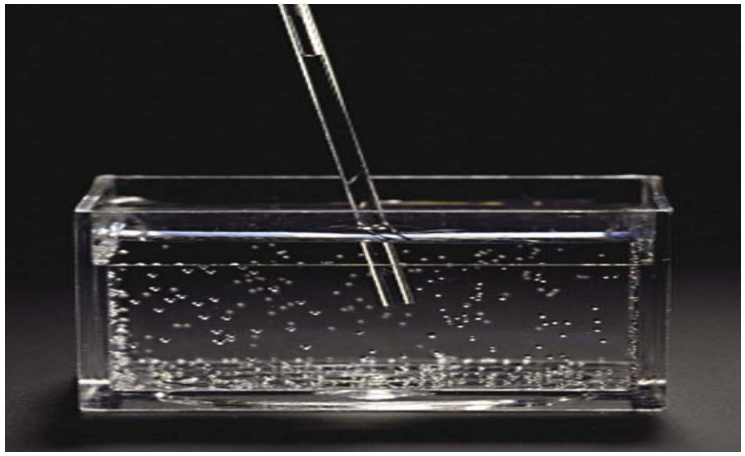
Capillary Movement
Second Most Serious Threat

- Primary Action
  - Moves moisture from outside into envelope
- Requirements
  - Surface tension
  - Pore size
  - Source of moisture

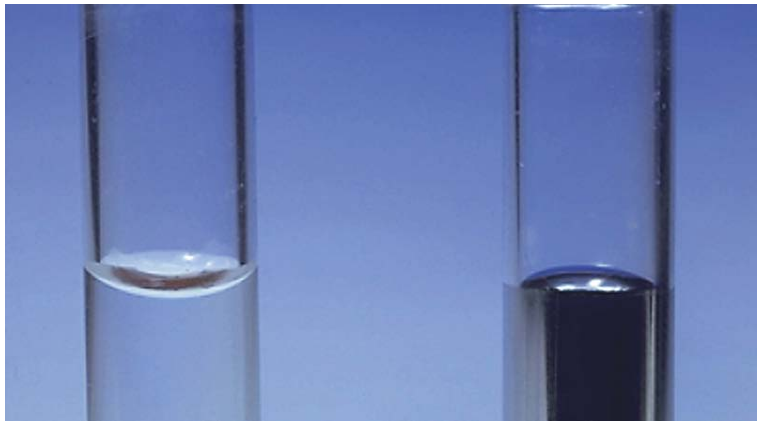
Surface Tension

- Water spreads into thin film on clean glass left.
- Water beads (cohesion of water-to-water) on oil-coated surface on right.

Capillary Rise



- Examples
  - blotter paper
  - solder in plumbing
  - wood siding



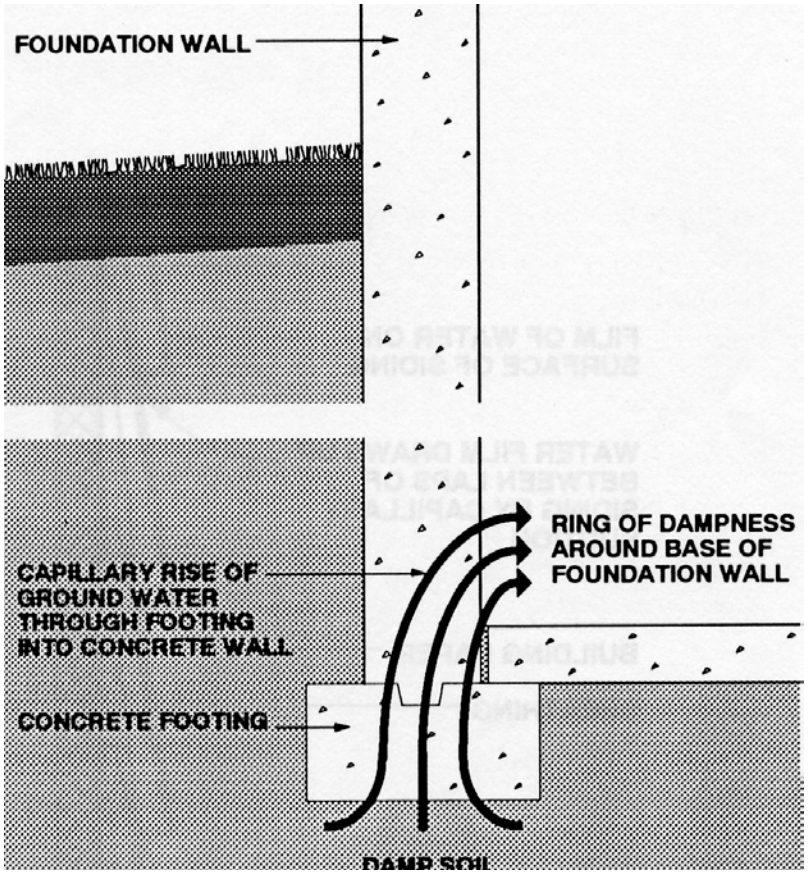
- Water wets glass (left) concave meniscus.
- Mercury doesn't wet glass convex meniscus.

Capillary Control

Pore Size: = 0 or >1/4”

Below Grade

- Stone base
- Polyethylene (sealed)
- Drainage mats
- Parging/coatings
- Good drainage



Capillary Control

Above Grade

- Paint
- Small joints = pores
- Space joined materials
- Good drainage
- Rain Screen

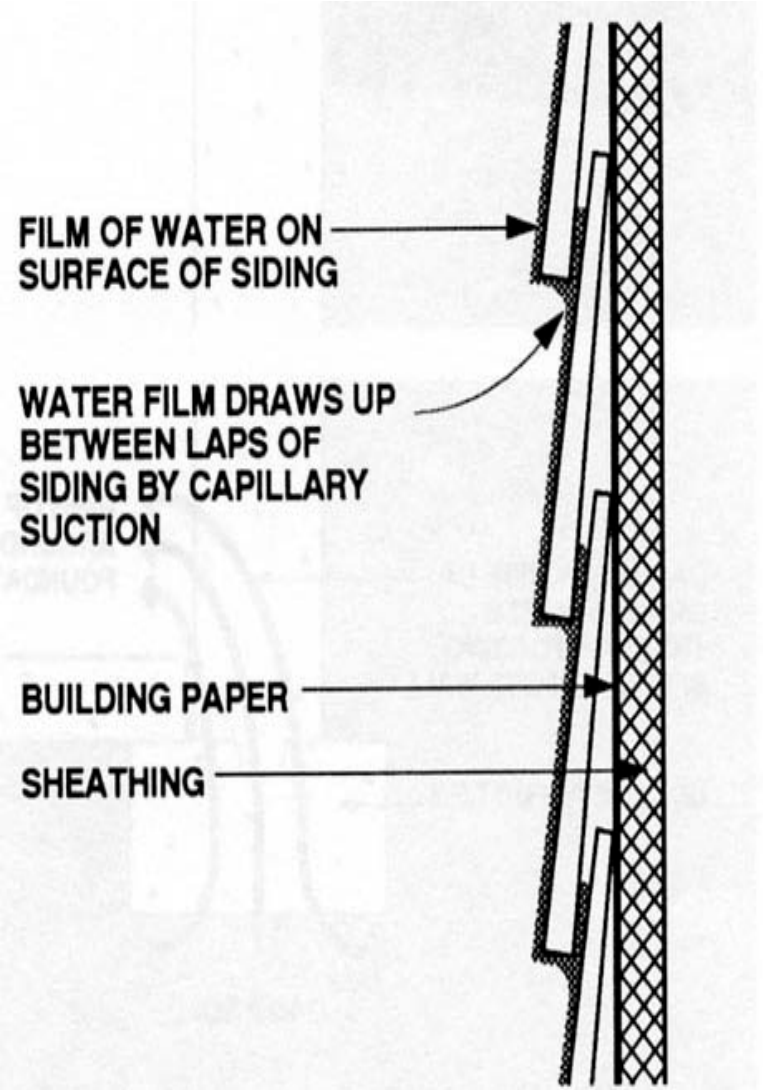
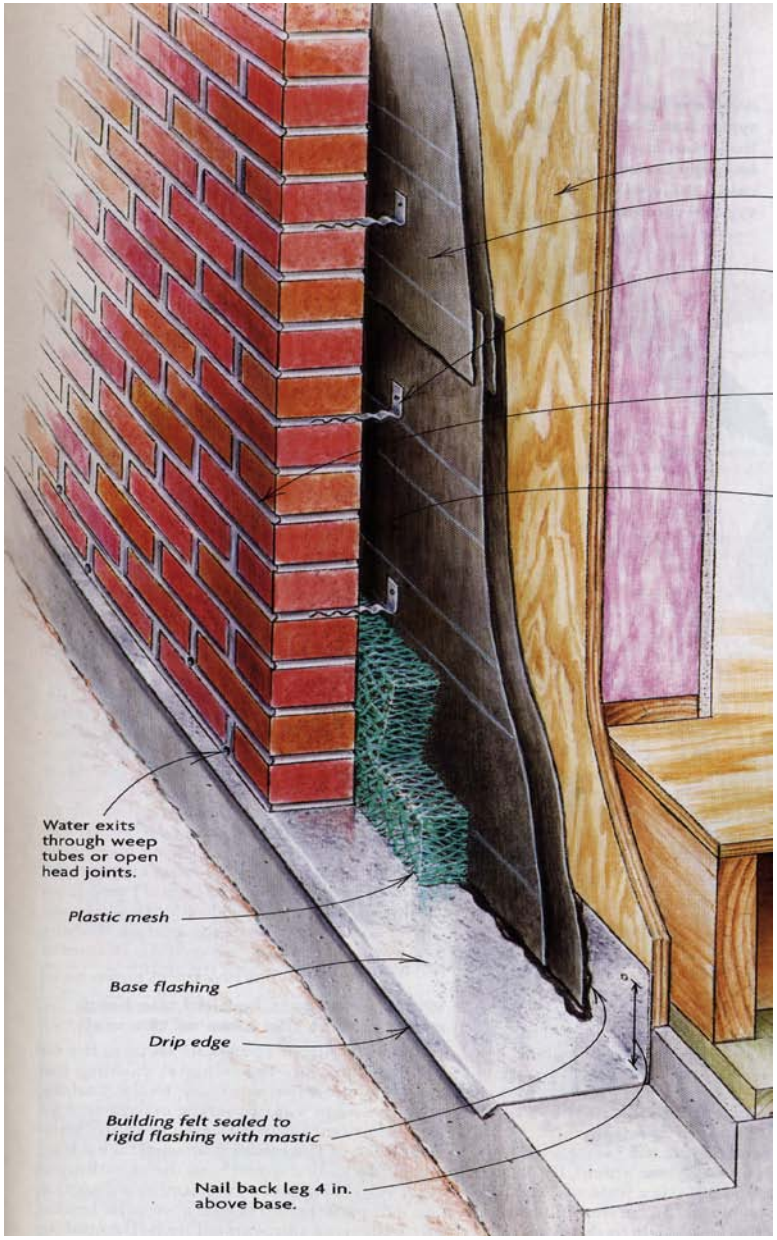


Figure 2-15: Capillary Rise in Wood Siding

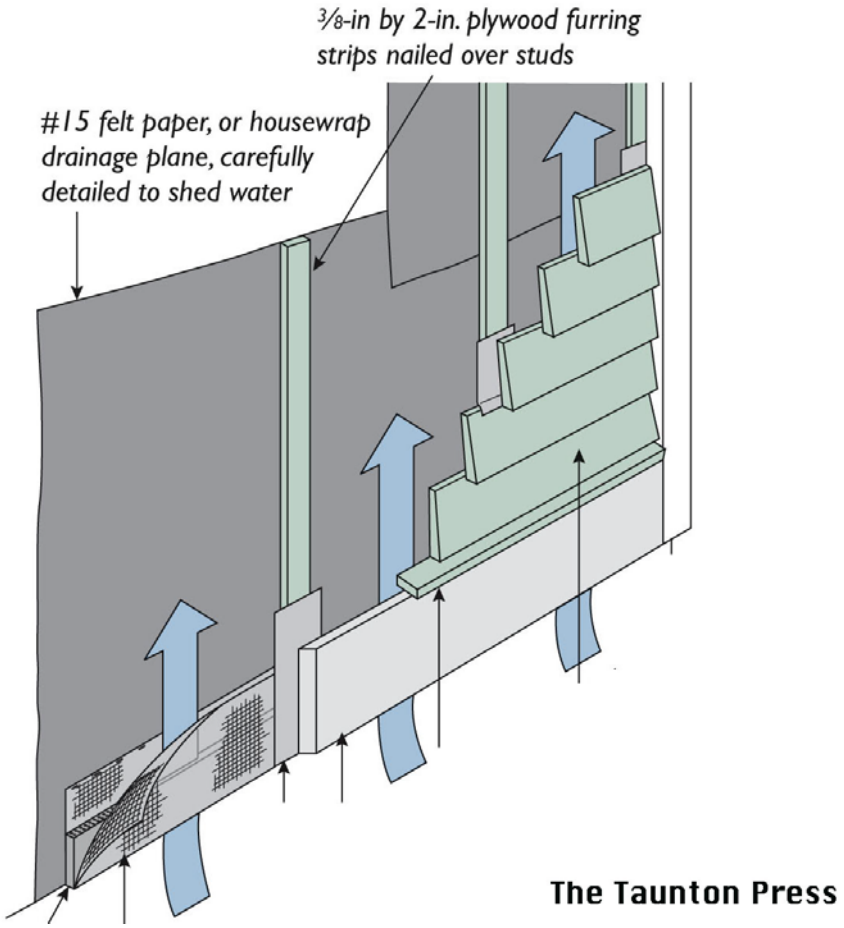


Bulk Movement
Most Significant Threat

- Primary Action
  - Moves from outside into envelope
  - Snow, rain, and ground water most significant
  - Moves most moisture in the least time
- Needed to Control
  - Bulk moisture (source)
  - Hole (pathway)
  - Driving force (pressure, gravity, etc.)

Above Grade Control

- Sheltered Location
- Rain Screen
- Caulking
- Flashing
- Redundancy
- Channel/Redirect



Above Grade Control

Below Grade Control

Below Grade Control

Structural Damage

- Peeling Paint
- Rotting Wood - 21% MC or 90% RH
- Mold - RH > 70%
- Condensation - cosmetic, health, & energy
- Corrosion
- Insects

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Thank you for joining us!

This concludes the AIA/CES Course #H12002.

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