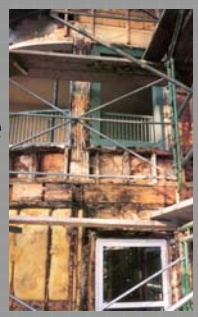
RDH Building Sciences Inc.

Construction Claims Task Force

Building Enclosure Performance Problems



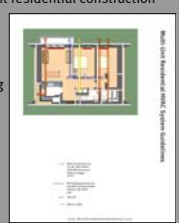
Dave Ricketts, M.Sc., P.Eng.

Overview

- RDH background and role in addressing building enclosure problems
- Why do building enclosures fail?
- Why not older buildings?
- What are elements of the solution that have been used in British Columbia and Washington State
  - *Technical*
  - *Process*
- Our perspective on the state of the industry in Oregon

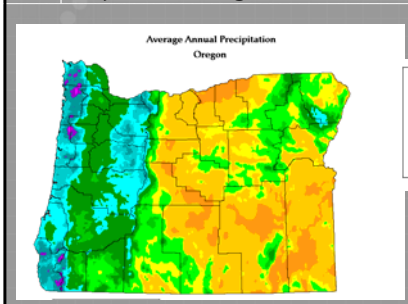
RDH Overview

- Authors
  - *Survey of Building Envelope Failures in Coastal BC*
  - *Best Practice Guide – Wood Frame Building Envelopes*
  - *Study of High-Rise Envelope Performance*
  - *Guide to Cost Effective Rehabilitation*
- Recently completed HVAC guideline for multi-unit residential construction for Washington and Oregon
- Currently preparing Best Practice Guide for Windows
- Member of Washington State Committee looking at Building Enclosure Performance problems
- Member of BC Provincial Advisory Council for Residential Construction
- Engineers, Architects, & Construction Managers



RDH Building Sciences Inc.
Portland: 503-245-6222
Seattle: 206-324-2272

Why Do Building Enclosures Fail – Rainfall?

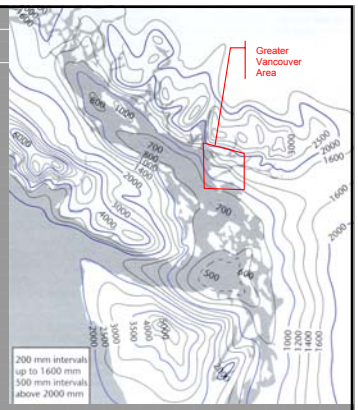


RDH Building Sciences Inc.

www.rdhbe.com

Rainfall

- Rainfall quantity varies from 800mm (28") to 2500mm (100")
- Moisture problems found throughout
- Amount of rainfall is not the dominant variable
- Drainage and drying capability and/or features of the building that provide protection are more dominant variables



RDH Building Sciences Inc.

www.rdhbe.com

Why Do Building Enclosure Fail?

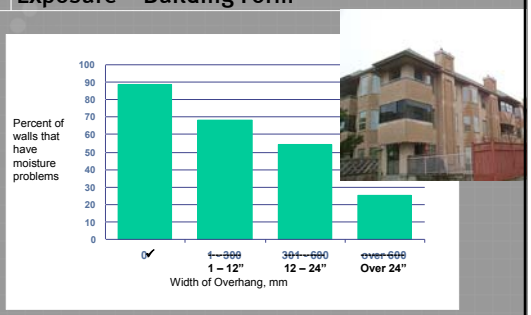
- Climate?
  - *Rain*
  - *Wind*
  - *Drying potential*
- Something about the building as well as the climate?
  - *Lack of overhangs*
  - *Sensitive wall assemblies*
  - *Poor details*

RDH Building Sciences Inc.

www.rdhbe.com

RDH Building Sciences Inc.
Portland: 503-245-6222
Seattle: 206-324-2272

Exposure – Building Form



RDH Building Sciences Inc.

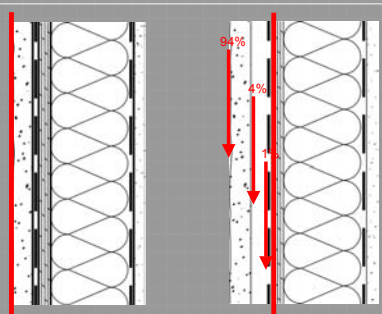
www.rdhbe.com

Exposure and Details

RDH Building Sciences Inc.

www.rdhbe.com

Sensitive Wall Assemblies



RDH Building Sciences Inc.

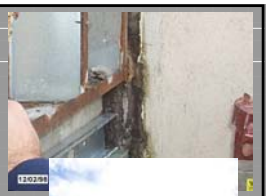
www.rdhbe.com

RDH Building Sciences Inc.
Portland: 503-245-6222
Seattle: 206-324-2272

High-Rise Failures

Water migrates through exterior wall without reaching interior, mould

Severe corrosion of stud only on exterior portion

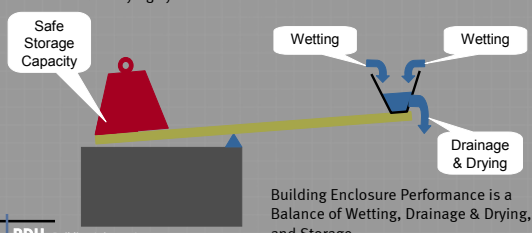


RDH Building Sciences Inc.

www.rdhbe.com

Building Enclosure Design Strategy

- Assess exposure conditions - wetting
- Provide enough drainage and drying to accommodate wetting
- Provide enough storage to accommodate fluctuations in wetting and drying cycles



Building Enclosure Performance is a Balance of Wetting, Drainage & Drying, and Storage

RDH Building Sciences Inc.

Graphic Courtesy of University of Waterloo www.rdhbe.com

Why Not Older Buildings?

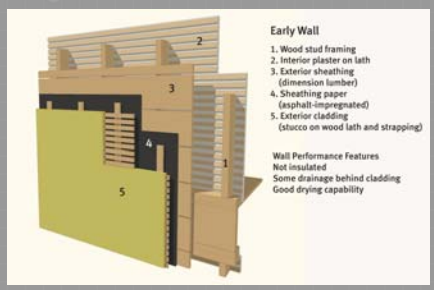
- Why fewer failures in older building?
  - *Quantity of insulation*
  - *Quality of detailing*
  - *Exposure conditions (macro and micro)*
  - *Complexity of building form (more details)*
  - *Wall assemblies more tolerant of moisture*

RDH Building Sciences Inc.

www.rdhbe.com

RDH Building Sciences Inc.
Portland: 503-245-6222
Seattle: 206-324-2272

Why Not Older Buildings?



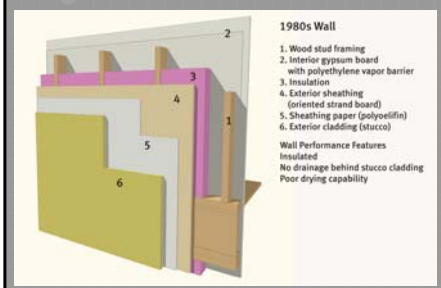
Early Wall

1. Wood stud framing
2. Interior plaster on lath
3. Exterior sheathing (dimension lumber)
4. Sheathing paper (asphalt-impregnated)
5. Exterior cladding (stucco on wood lath and strapping)

Wall Performance Features
Not insulated
Some drainage behind cladding
Good drying capability

RDH Building Sciences Inc.
www.rdhbe.com

Why Not Older Buildings?



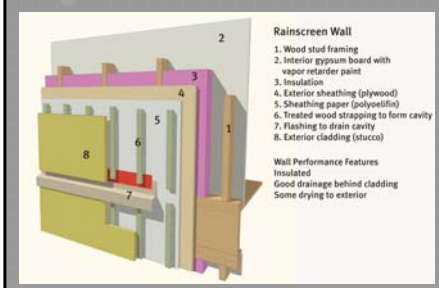
1980s Wall

1. Wood stud framing
2. Interior gypsum board with polyethylene vapor barrier
3. Insulation
4. Exterior sheathing (oriented strand board)
5. Sheathing paper (polyoelifin)
6. Exterior cladding (stucco)

Wall Performance Features
Insulated
No drainage behind stucco cladding
Poor drying capability

RDH Building Sciences Inc.
www.rdhbe.com

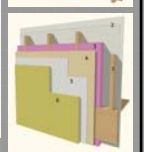
Why Not Older Buildings?



Rainscreen Wall

1. Wood stud framing
2. Interior gypsum board with vapor retarder paint
3. Insulation
4. Exterior sheathing (plywood)
5. Sheathing paper (polyoelifin)
6. Treated wood strapping to form cavity
7. Flashing to drain cavity
8. Exterior cladding (stucco)

Wall Performance Features
Insulated
Good drainage behind cladding
Some drying to exterior



RDH Building Sciences Inc.
www.rdhbe.com

RDH Building Sciences Inc.
Portland: 503-245-6222
Seattle: 206-324-2272

Elements of Addressing the Problems - BC

- Technical
  - *Training – Improved understanding of technical issues*
  - *Guideline documents*
  - *Improved technology – overhangs, wall assemblies, details*
  - *Guidance to owners on maintenance and renewals*
  - *Mock-ups, field review and field testing*

RDH Building Sciences Inc.

www.rdhbe.com

Technical

- Training
  - *Architectural Institute of British Columbia mandatory building enclosure training*
  - *Architect and Engineering Associations provide Building Enclosure (Envelope) Professional program*
  - *British Columbia Building Envelope Council - Seminars*
  - *British Columbia Institute of Technology introduces building science technician program*
  - *Canadian Homebuilders and Homeowner Protection Office – Building enclosure training for builders*

RDH Building Sciences Inc.

www.rdhbe.com

Technical

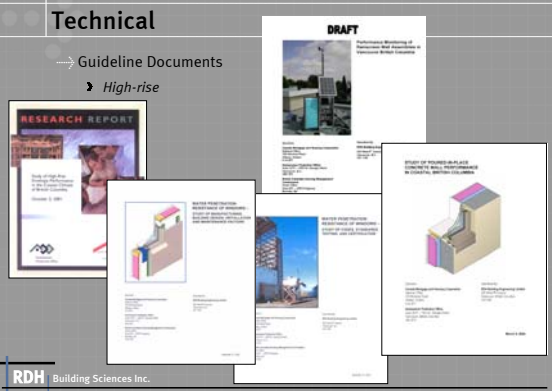
- Guideline documents - Helps to ensure consistency of approach
  - *Wood frame*

RDH Building Sciences Inc.

www.rdhbe.com

Technical

- Guideline Documents
  - *High-rise*

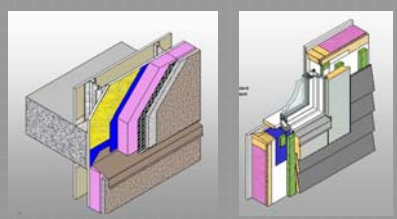


RDH Building Sciences Inc.

www.rdhbe.com

Technical

- Improved technology & consistent technology
- Rainscreen walls and improved detailing

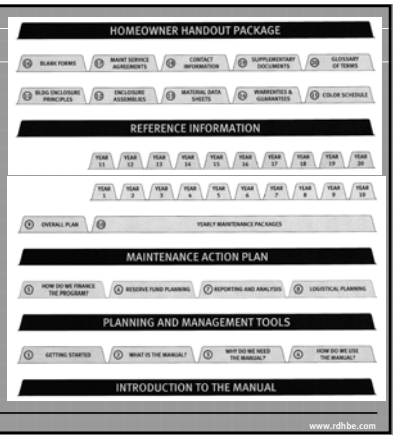


RDH Building Sciences Inc.

www.rdhbe.com

Technical

- Maintenance and Renewals Plans



RDH Building Sciences Inc.

www.rdhbe.com

RDH Building Sciences Inc.
Portland: 503-245-6222
Seattle: 206-324-2272

Mock-Ups, Field Review & Field Testing

RDH Building Sciences Inc.

www.rdhbe.com

Elements of Addressing Problems - BC

- Process & Motivation
- New government body - Homeowner Protection Office
  - *Licensing of builders*
  - *Mandatory Warranty Program*
    - 2 years labor and material
    - 5 years water penetration
    - 10 years structural
  - *Warranty programs and most municipalities require building enclosure consultant involvement in projects*

RDH Building Sciences Inc.

www.rdhbe.com

Washington State

- Borrowed from northern neighbors
  - *Technology*
  - *Consultants*
- Legislative requirements for condominiums - Bill 1848
  - *Clarifies design responsibility*
  - *Additional field review of construction*
- Non Mandatory warranty provisions
  - *Modeled on BC's program*
  - *Incentive to developers is the limits on remedies for HOA's*
- Issues
  - *Lack of consistency in technical advice and standards*
  - *Lack of availability of warranty providers*
    - Indemnity models not attractive to developers

RDH Building Sciences Inc.

www.rdhbe.com

Oregon?

- Contractors and Developers are the impetus for change
  - *Motivated by losses and ability to secure insurance at a reasonable cost*
- Improved technology and building practices are being used
- Maintenance and renewals plans are being developed
- Issues
  - *No mandated requirement for appropriate envelope technology, drawing detailing and specs*
  - *Parts of the industry are lagging behind*
  - *Lack of consistency in technical advice*
  - *Lack of accepted guideline documents*

RDH Building Sciences Inc.

www.rdhbe.com