WELCOME

Building Envelope Problems

OPTIMIZE
Envelope Engineering Ltd.

AGENDA

- WHY IMPORTANT
- CONDENSATION
- STONE
- WINDOWS
- MOISTURE BARRIER
- EIFS/STUCCO
- RECAP

WHY IMPORTANT

IMPORTANT

- Nobody is perfect
- Calgary is a tough climate
- Accept that some problems will happen
- Where are they most likely to occur, and how to identify issues
- Problems will cost you
  - Time
  - Money
  - Reputation

IMPORTANT

- Don’t ignore them
- Properly identify them
- May be more than one cause

IMPORTANT

- Get a second opinion
- Get a third opinion

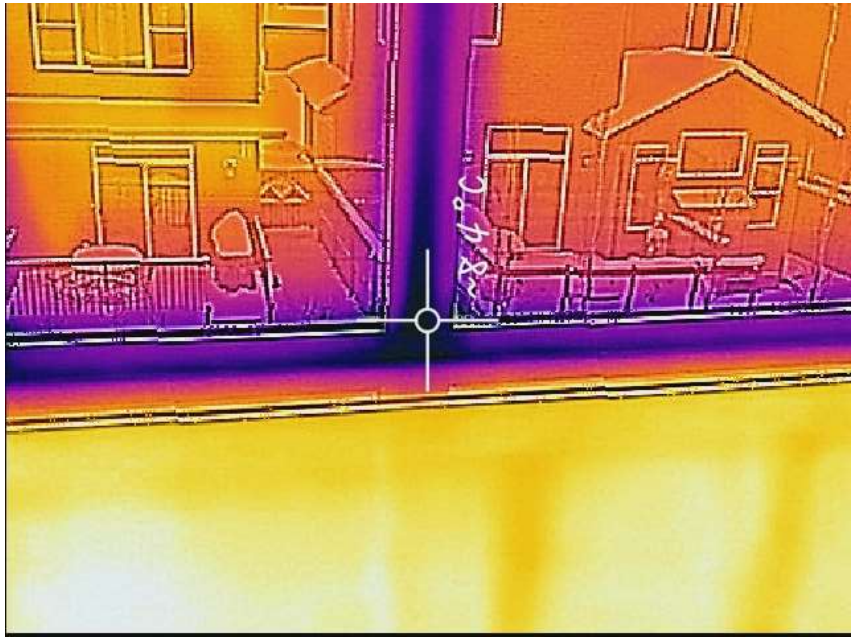
CONDENSATION

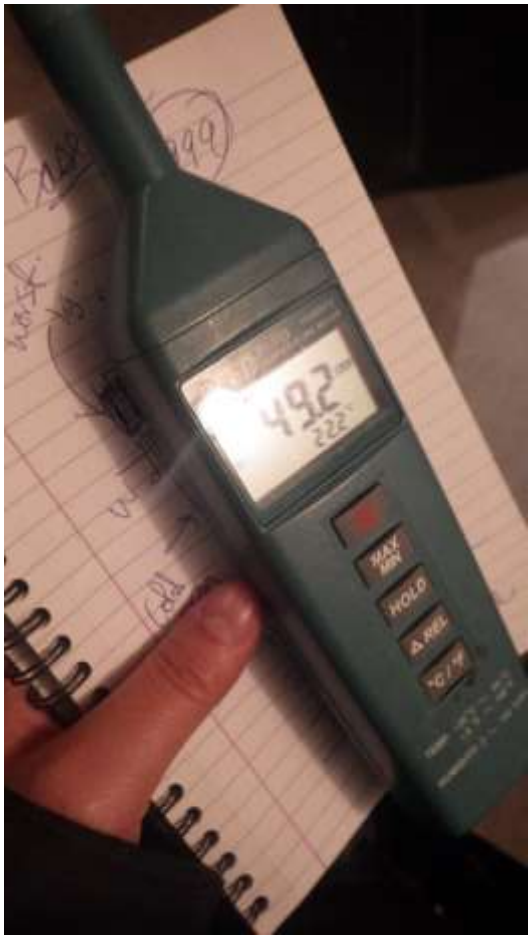
CONDENSATION

- “Water that collects as droplets on a cold surface when humid air is in contact with it”
- Most common locations
  - Attic/ceiling
  - Bathrooms
  - Windows/doors

CONDENSATION

- Humidity too high
- Inadequate ventilation/airflow
- Inadequate air/vapour control

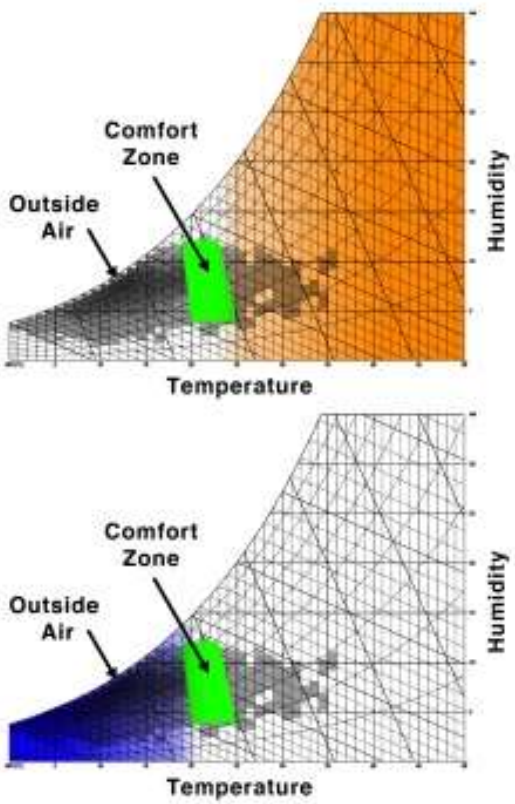




CONDENSATION

- Psychrometric Chart
  - 22°C, 50% RH = dewpoint at 11°C
  - 22°C, 40% RH = dewpoint at 8°C
  - 20°C, 25% RH = dewpoint at -1°C

- Humidity on furnace ≠ actual humidity
- Check actual humidity
- Hardwood wants 40%+



Temperature (orange = too hot, blue = too cold)

CONDENSATION

- SOLUTIONS
- Don’t control the user
- Attack all three
  - Reduce humidity, max 25% winter
  - Ventilation, balanced, not necessarily increase
  - Air/vapour control
- Check blocked vents, restricted airflow
- More efficient windows/seal may help
- Thermal camera to identify air leakage
- Commercial windows - need commercial heating systems
- Design and occupant awareness

CONDENSATION

- SOLUTIONS
- Complicated designs
- Why unvented more popular

STONE

STONE

- Critical – safety issue
- Large consequences of failure or problems
- Expense and potential safety issues
- Very important to monitor during construction

STONE

Section 9.27. Cladding

9.27.1. Application

9.27.1.1. General

3) Where masonry serves as cladding on wood-frame or masonry walls exposed to precipitation, the cladding assembly shall comply with
a) Subsections 9.27.2. to 9.27.4., and Section 9.20., or
b) Part 5.

Specific rules for masonry in 9.20

Form A: Manufactured Stone and Brick Used in Exterior Wall Cladding Systems

PL 1189 (R2015-11)

"meets the intent of the Alberta Building Code 2014"

STONE

9.20.6.4. Masonry Veneer

1) Except for masonry veneer where each masonry unit is supported individually by the structural backing, masonry veneer shall be of solid units not less than 75 mm thick.

2) Veneer described in Sentence (1) over wood-frame walls shall have not less than a 25 mm air space behind the veneer.

3) Masonry veneer less than 90 mm thick shall have unraked joints.

4) Masonry veneer shall conform to Subsection 4.3.2., where the masonry units are required to be individually supported by the structural backing.

9.20.13.11. Caulking at Door and Window Frames

1) The junction of door and window frames with masonry shall be caulked in conformance with Subsection 9.27.4.

9.20.14.1. Laying Temperature of Mortar and Masonry

1) Mortar and masonry shall be maintained at a temperature not below 5°C during installation and for not less than 48 h after installation.

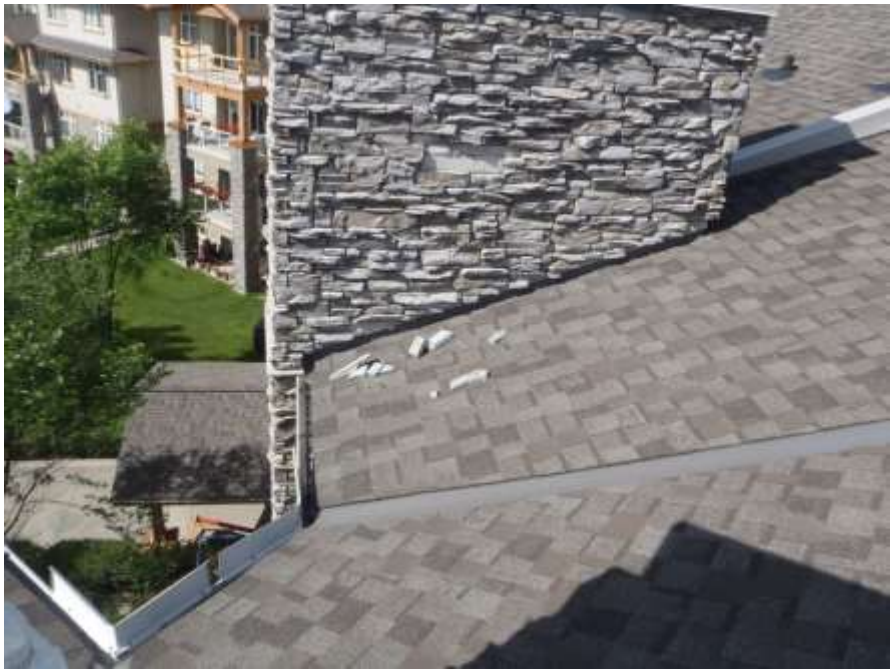
9.20.14.2. Protection from Weather

1) The top surface of uncompleted masonry exposed to the weather shall be completely covered with a waterproofing material when construction is not in progress.

If not Form A or Part 5

STONE

- Falling off
- Used in high applications



STONE

- Bonds failing for variety of reasons
- Some form of installation error
  - Curing temps/time
  - Wrong product, may need bonding agent
  - Inadequate application of product to back of stone

STONE

- Improper use of product or lack of protection
- Not necessarily builder/installation issue, but could be a design issue
- Could lead to other compromised areas
- Still may be warranty item

STONE

- Unsupported sill stones common
- Walk up and pull them right off
- Often at hip height
- In patio areas in contact with people and/or children
- High risk of failure
- Mortar joints unprotected
- Need support underneath

STONE

- Exterior columns
- Not technically part of envelope but need protection unless all P.T.
- Seen severe damage and costly repairs
- Require membranes on horizontal surfaces
- Involved in several litigations with poor column detailing involving stone tie-ins

STONE

STONE

- If standard masonry, ensure to 9.20
- Collect Form A documentation if required
- If veneer, mortar to be Type S, bonding agent may be required
  - Check some
- Check moisture barrier tie-ins
- **TEMPERATURES**
- Extra fasteners under sills
- Full bed needs 1” air space
- Safety issue

WINDOWS

WINDOWS

Because of this…

WINDOWS

Now we have this…

in the 2014 ABC.

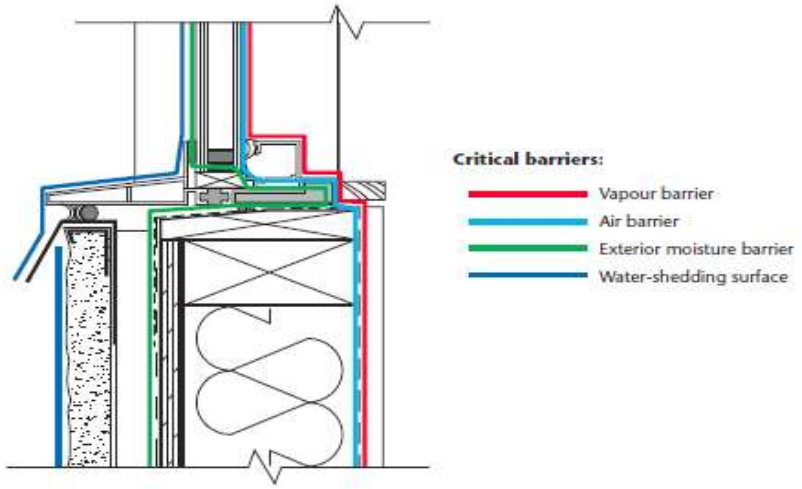
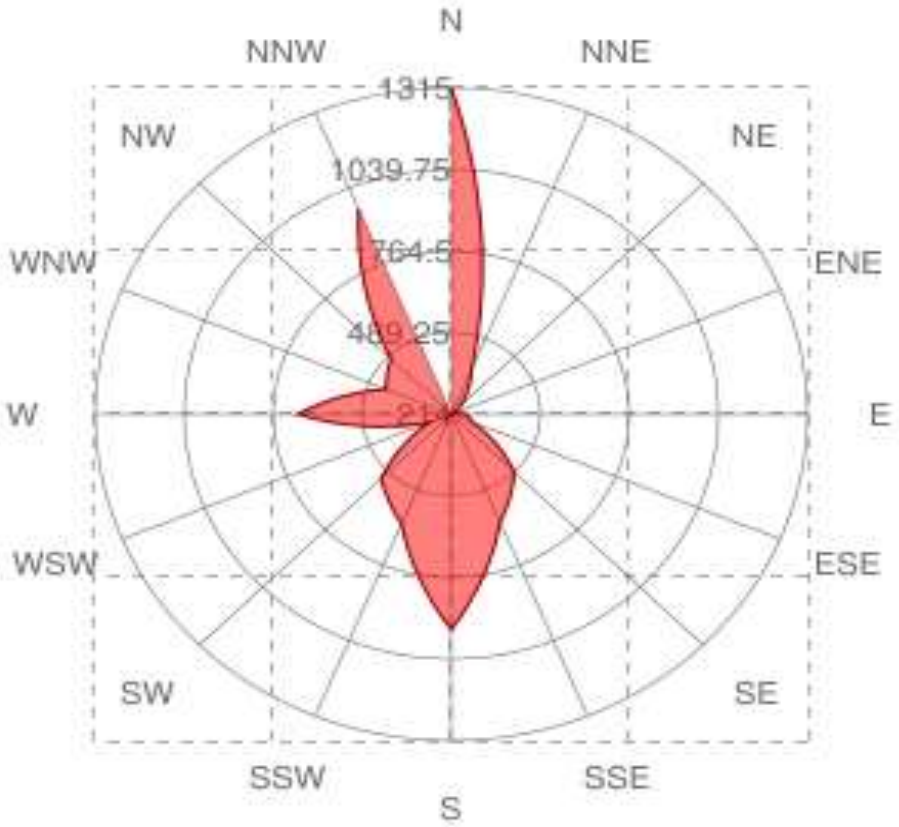


Figure A.3
Critical barriers at a window to rainscreen wall interface
(See Clause A.2.4.4.)

WINDOWS

- Window or installation? Or BOTH?
- Don’t assume
- Need confirmation for proper repair
- Basements don’t have moisture barrier, can’t do subsill drainage
- Not all windows have flanges

WINDOWS


N
NNW
NNE
1315
NW
NE
1039.75
WNW
ENE
764.5
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W
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WSW
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SW
SE
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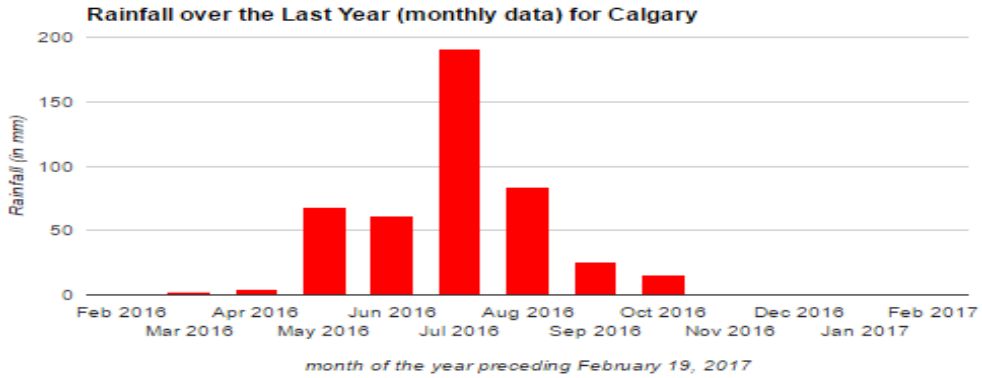
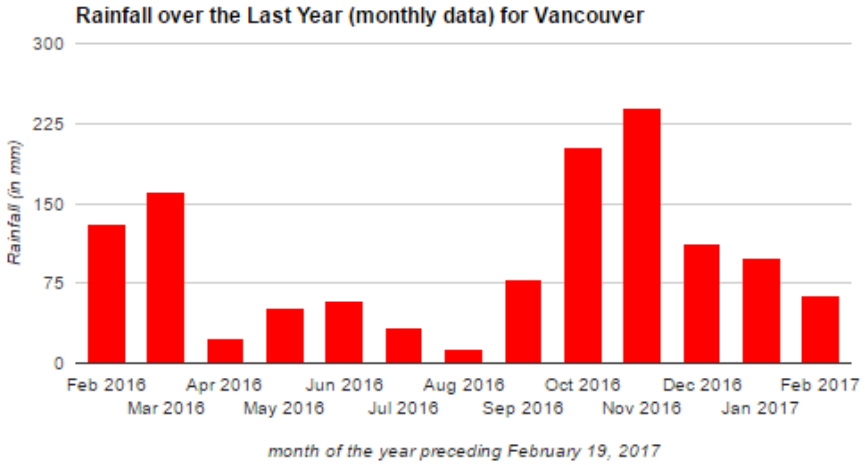
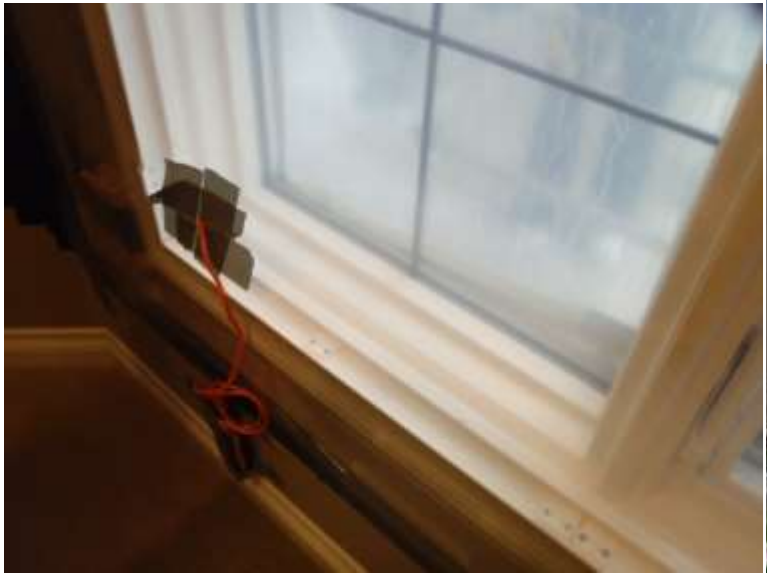
WINDOWS


Rainfall over the Last Year (monthly data) for Calgary
Rainfall (in mm)
200
150
100
50
0
Feb 2016
Mar 2016
Apr 2016
May 2016
Jun 2016
Jul 2016
Aug 2016
Sep 2016
Oct 2016
Nov 2016
Dec 2016
Jan 2017
Feb 2017
month of the year preceding February 19, 2017


Rainfall over the Last Year (monthly data) for Vancouver
Rainfall (in mm)
300
225
150
75
0
Feb 2016
Mar 2016
Apr 2016
May 2016
Jun 2016
Jul 2016
Aug 2016
Sep 2016
Oct 2016
Nov 2016
Dec 2016
Jan 2017
Feb 2017
month of the year preceding February 19, 2017

WINDOWS

- Simple hose test first
- More complex spray rack
- Isolate window and perimeter



WINDOWS

- Factors
  - Installation detail
  - Confirm window has NAFS rating
  - Not all windows tested
  - Drainage path(s)
  - Exposure
  - Defects-factory or site, window or install
  - Pay attention at design stage
  - Site modifications or product changes
    - Not all windows are the same

MOISTURE BARRIER

MOISTURE BARRIER

- Typical suburban home
- Builder installed peel and stick membrane under windows
- First rainfall after moving in, homeowner noticed wet carpet under back windows in deck area

MOISTURE BARRIER

- Drywall opened
- Water test, window was ok
- Window taped off, and area under window spray, water poured in

MOISTURE BARRIER

- Mason thought window needed to be sealed
- Covered bottom flanged and put housewrap over membrane
- Water pour in between bottom of window and bottom flashing, behind moisture barrier, behind deck membrane
- Caught before too much structural damage

MOISTURE BARRIER

- Typical infill duplex with modern lines, acylic stucco, flat roof

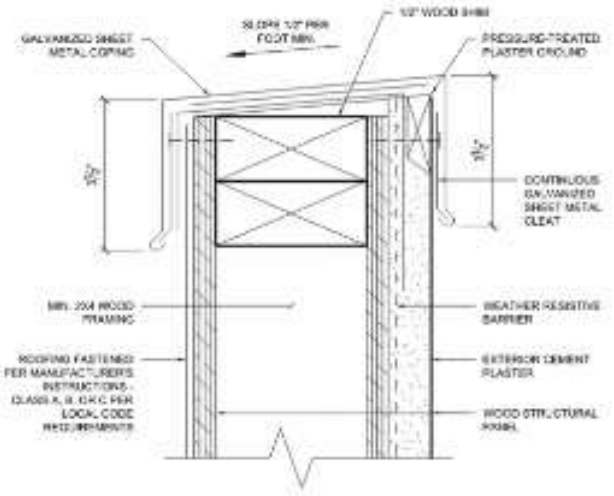
- Water leakage noticed multiple areas on north and west elevations

MOISTURE BARRIER

- Exterior wall surface measured at 40°C
- Interior temperature 19°C
- Condensation all over interior poly likely contributing to deterioration
- Extensive damage
- During flood testing water from top parapet, once behind paper, through staples

MOISTURE BARRIER

- Continuity of moisture barrier at parapet
- Sequencing
- Common issue



MOISTURE BARRIER

- Extensive damage

MOISTURE BARRIER

- Look for continuity and upward laps
- Think like water
- Attention to high risk locations
- Wind
- Especially at penetrations
- Roof to wall joints
- Deck to wall joints

EIFS AND STUCCO

EIFS AND STUCCO

- Starts with correct system selection
- Details
- Installation and sequencing
- Manage expectations
- Maintenance
- Costly to redo, deficient, claim
- Potential for damage

EIFS AND STUCCO

Climate Arizona - Phoenix °C | °F

	Jan	Feb	Mar	Apr	May	Jun
Average high in °C:	19.6	21.5	24.9	29.6	34.9	39.9
Average low in °C:	7.6	9.3	11.9	15.7	20.8	25.4
Av. precipitation in mm:	23	23	25	7	3	1
Days with precipitation:	4	4	3	2	1	1
Hours of sunshine:	248	244	314	346	404	404

	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °C:	41.2	40.2	37.7	31.4	24.2	18.9
Average low in °C:	28.6	28.2	24.9	18.2	11.5	7.1
Av. precipitation in mm:	27	25	16	15	17	22
Days with precipitation:	4	5	3	3	2	4
Hours of sunshine:	377	351	334	307	267	236

EIFS AND STUCCO

Month	Total
Feb 2016	2.20 mm
Mar 2016	4.60 mm
Apr 2016	4.00 mm
May 2016	68.30 mm
Jun 2016	61.60 mm
Jul 2016	206.10 mm
Aug 2016	84.40 mm
Sep 2016	25.30 mm
Oct 2016	27.60 mm
Nov 2016	2.70 mm
Dec 2016	22.60 mm
Jan 2017	10.50 mm
Feb 2017	22.00 mm

Month	Total
Feb 2016	151.40 mm
Mar 2016	161.60 mm
Apr 2016	24.20 mm
May 2016	52.00 mm
Jun 2016	58.20 mm
Jul 2016	35.40 mm
Aug 2016	13.80 mm
Sep 2016	78.40 mm
Oct 2016	203.40 mm
Nov 2016	240.20 mm
Dec 2016	159.70 mm
Jan 2017	98.80 mm
Feb 2017	112.40 mm

EIFS AND STUCCO

- Limitations on these systems
- Sometimes not appropriate
- Clients need to understand
- Will be worse with increased air tightness

EIFS AND STUCCO

- 1910 house
- Old sheathing in good condition
- Stained was getting wet
- Wanted more insulation-eifs
- How to fastened?
- Choose adhered - CCMC
- Should mechanically fastened or new sheathing

EIFS AND STUCCO

EIFS AND STUCCO

- Moisture barrier and cladding
- All in one = hard for quality control
- Gets covered quickly
- Need qa/qc program
- Take photos
- Request photos

EIFS AND STUCCO

- Stucco and EIFS
  - Temperature and curing requirements
- Different elevations = different temperatures
- 12°C day, -5 at night
- Make sure!
- Redoing = $$$, time, compromised envelope

EIFS AND STUCCO

- Stucoo and EIFS are not waterproof
- Need proper drainage
- Not designed for horizontal surfaces
- Includes window ledges
- Cover with flashing, waterproof sealer
- Avoid in initial design
- Acrylic, better, but will crack, bubble, peel

EIFS AND STUCCO

- Stains
- Reduce with good design
- Manage expectations
- Stucco/EIFS WILL stain
- Can clean
- Stains a sign of poorly managed water
  - investigate
- Reduce, can’t eliminate

EIFS AND STUCCO

DON’T PAINT!

WHAT WE LEARNED

LESSONS

- Don’t ignore initial problems
- Fix it sooner, less damage
- Don’t make assumptions
- Everyone has some responsibility
- Redundancy, can’t expect perfection
- Risk management

LESSONS

LESSONS

- Questions

THANK YOU

If you have any further questions please contact us.

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