



ALLANA BUICK & BERS

Making Buildings  
Perform Better

# Water Damage & Repair

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Chinatown  
Preservation  
Talks 2015



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Mason Architects

# Program Outline

- Terminology & Waterproofing Basics
- Discussion of why this is important
- Below Grade Waterproofing
  - Dampproofing vs. Waterproofing
  - Foundations & Plazas
- Above Grade Waterproofing
  - Roofing, Walls, Windows, Sealants, Coatings
  - Concrete Protection
- Condensation & Thermal Control
- Case Studies
- Questions

# Why is moisture protection important?

- Keep the elements (rain, wind) out
- Control climate / occupant comfort
  - Not just a function of HVAC Systems
- Depending on use of structure:
  - Keep heat in or out
  - Keep cold in or out
- Create sustainable / durable structures



# Importance of Protection

Why is thermal and moisture protection more important today than in past?

- Energy costs
- Life Cycle Costs
- Litigation
- Insurance
- Repair or Preservation Costs
- Advances in Material Science

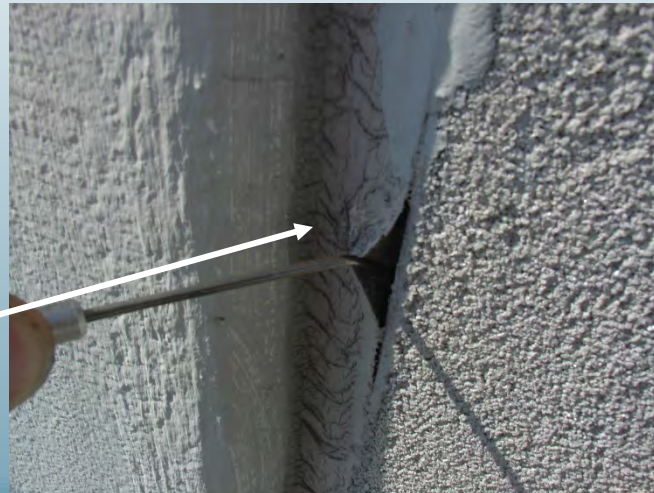
# Thermal and Moisture Protection Basics

- ***Permeability:*** The ability of a material or substrate to allow the passage of water or vapor through itself without failure.
- ***Building envelope:*** Combination of roofing, waterproofing, dampproofing, and flashing systems that act cohesively as a barrier, protecting interior areas from water and weather intrusion. These systems envelope a building from below grade to the roof.
- ***Accelerated weathering:*** Controlled conditions applied in lab testing to condense the weathering of waterproofing material would experience over a long life cycle.
- ***Capillary Action:*** A wick-like migration of water created by surface tension or molecular attraction.
- ***Flashing:*** Material or system installed to redirect water entering through the building skin to the exterior.

# Thermal and Moisture Protection Basics

- *Positive Waterproofing System:* Systems applied to substrate side with direct exposure to water.
- *Negative Waterproofing System:* Below grade system applied to interior or negative side of structure.
- *Sealant:* Material applicable to exterior building envelope joints. Capable of withstanding continuous joint movement during weathering without failing.

Sealant adhesion failure





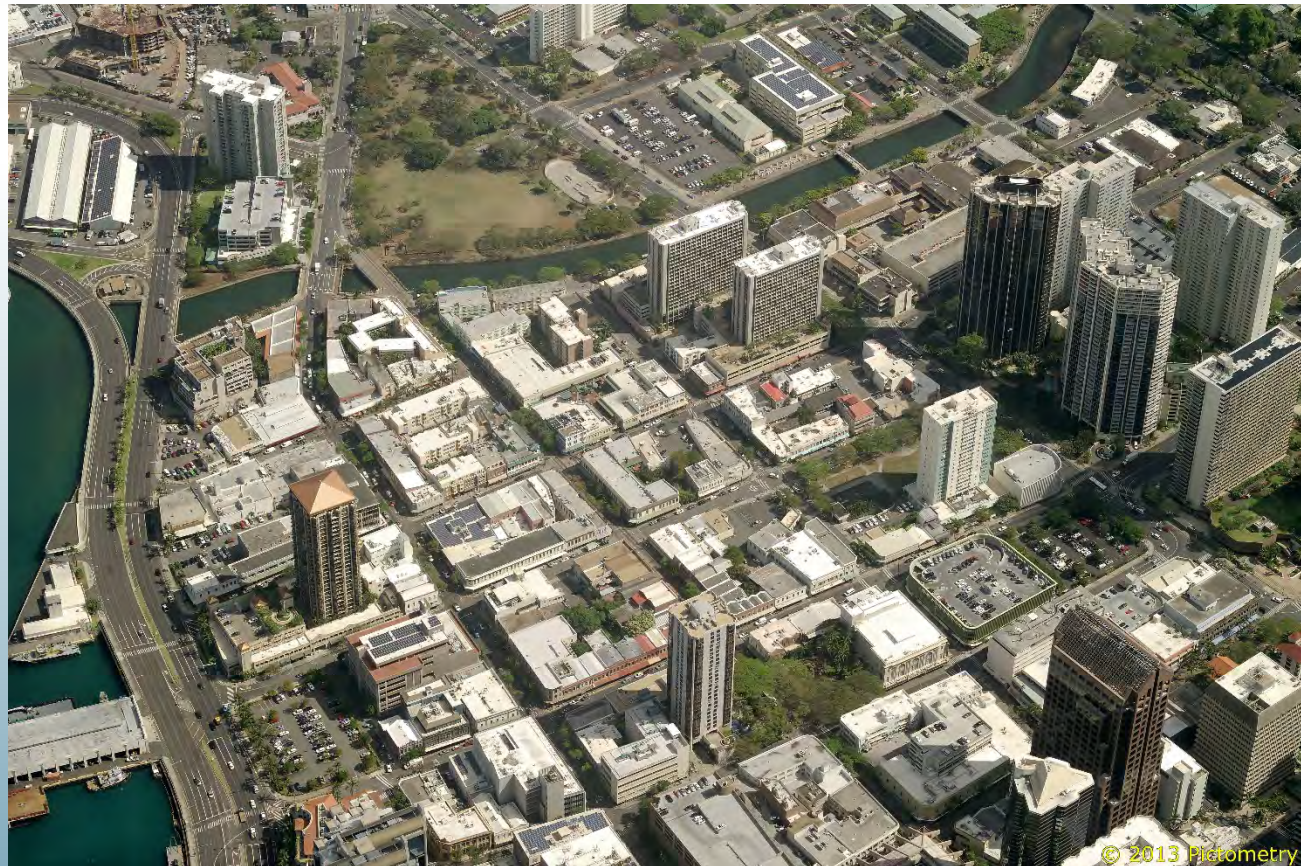
# Understand the Components

- Water protection in a structure
  - Below Grade
    - Capillary action
    - Hydrostatic pressure
  - Above Grade (Precipitation)
    - Fog, drizzle, rain
  - Water Vapor
    - Condensation
- Elemental protection in a structure – steel rebar (spalling)
  - Airborne Attack
    - Chlorides are one example
  - UV Radiation (solar)
    - Product Deterioration



# Ground Water Control

- Capillary Action vs. Hydrostatic Pressure
  - Much of Chinatown is above water table except for along Nuuanu Stream and along the harbor.





# ABOVE GRADE: Precipitation Management

- Walls
  - Stucco/Cladding
  - Brick, Masonry
  - Concrete
- Fenestration/Openings
  - Windows/Doors
  - Pans, Flashing,
  - Thresholds
- Secondary Materials:
  - Sealants: Polyurethanes, Silicones, Sulfides, Etc.
  - Coatings: Coatings vs. Paint
  - Gaskets, Preformed Joints, Joint Covers



# Above Grade: Roofing

- Roofing Basics
  - Square
  - Weight
  - Durability
  - Cost
  - Personal preference
- Roofing Materials
  - Asphalt
  - Wood
  - Metal
  - Clay, cement, and slate – tiles
  - Plastic – liquid coatings
  - Resins



# Condensation Control

- Vapor can cause problems:
  - When air containing moisture cools, some of the moisture is released – it condenses into liquid water.
  - The temperature at which this occurs is the “dew point”.
  - This temperature is relatively high in humid Hawaii.
  - Condensation occurs when humid air meets cold surfaces such as air conditioned walls, chilled water lines, indoor pools.

# Water Vapor Pressure

- Gases, including water vapor, exert pressures
- The amount of pressure that water vapor exerts is a function of temperature and relative humidity.
- Water vapor will flow from the place of higher vapor pressure, to the place where the vapor pressure is lower.
- In Hawaii, this occurs in two typical conditions:
  - Through exterior walls (outside high vapor pressure, inside low vapor pressure).
  - Through a bathroom or other wet condition to a cooler and drier condition such as a bedroom.



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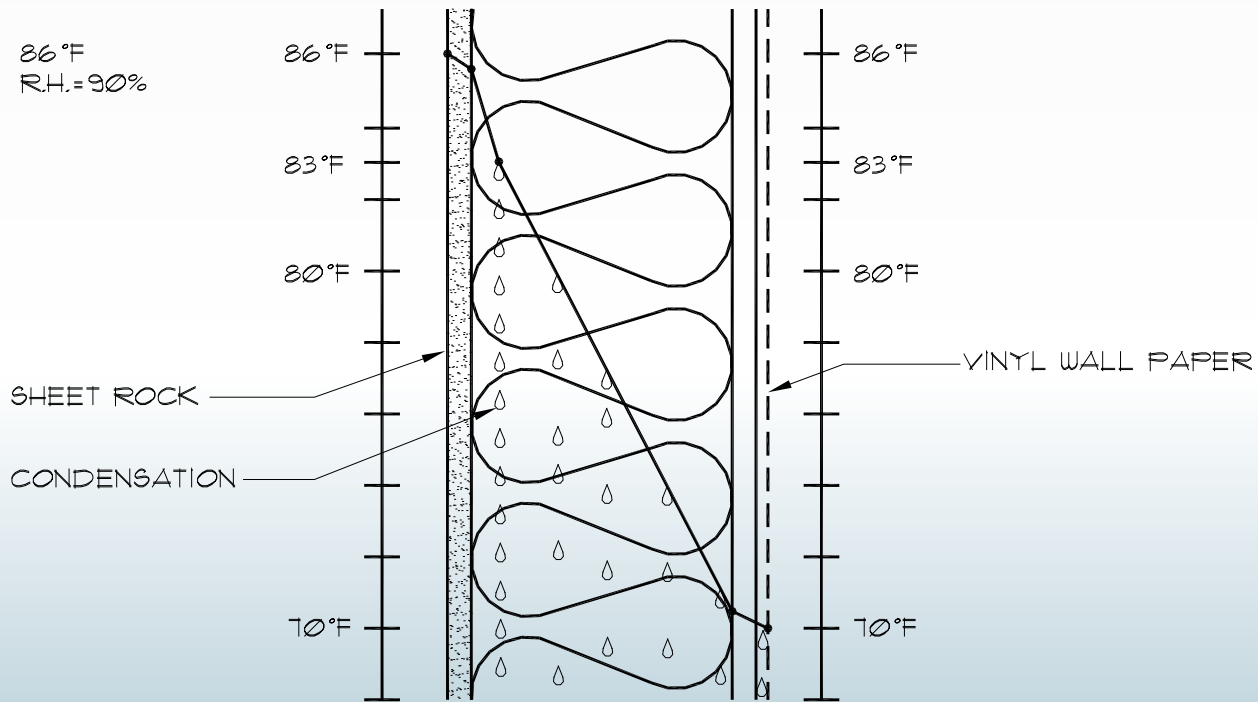
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# Condensation in Wall Assemblies



DEW POINT = 83°F

← BREEZEWAY/HALLWAY  
COVERED EXTERIOR  
SPACE →

← AIR CONDITIONED  
SPACE →

## WHERE CONDENSATION OCCURS

# Areas Susceptible to Condensation

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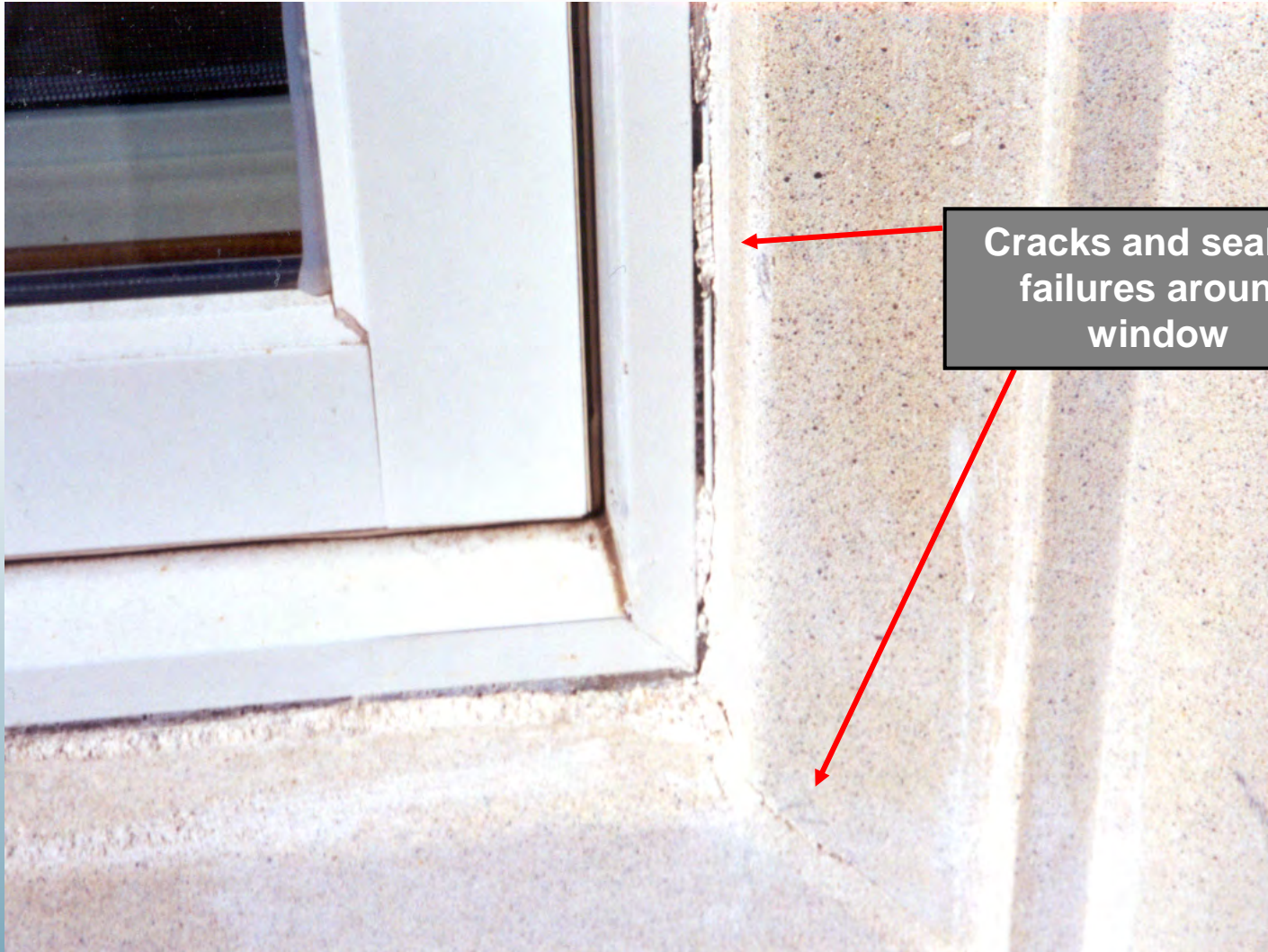
- Exterior wall assemblies
- Interior wall assemblies
- Chilled water line insulation
- Indoor pools
- Health clubs and spas

# Case Study #1: Window Installation Incorrect

- Multi-Family Residential Building
- Unknown if details were wrong or installer modified details
- Improper Sealant Geometry
- Window Flashings are missing or improperly lapped.
- No sill pans to promote drainage
  - Belt and Suspenders!
- **RESULT = Severe water intrusion into wall cavity.**



# Window Issues



**Cracks and sealant failures around window**

# Window Issues

All window-to-exterior cladding needs to be closely inspected, especially EIFS.

Seal perimeter of windows openings with sealant.





# System Failure

Gypsum wall board holds water, promotes mold growth and corrodes fasteners



# Case Study #2: Roofing

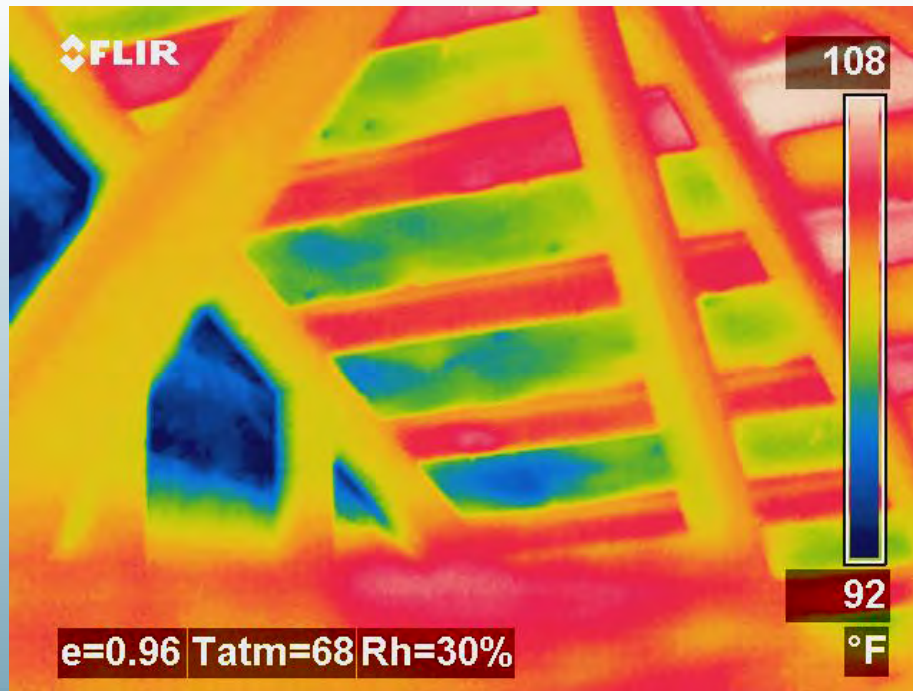
## Various

- Wrong Edge Details
- Backwards Laps in Building Paper
- Wind Driven Rain Entering Building
- Multiple Repair Attempts Failed
- Mold in Lower Units
- No Means of Drainage at Story Transitions
- Improperly flashed or sealed penetrations, deteriorating roof mounted equipment



# Roofing

- **RESULT = Rakes and Eaves were properly detailed and a “z flashing” was added at the stucco/roof terminations to allow for drainage. Problem was solved.**








Penetrations and equipment stands and mounts





Corroded or non-existing AC  
equipment condensate pans and  
drainage piping

# Case Study #3: Interior Example

- Hotel
- Wrong Type of Insulation
- Wrong Size of Insulation
- Missing Insulation
  - No Insulation at Penetrations
- Improperly Installed Insulation
  - Leaks associated with old Fan Coil Units (FCUs)
- **RESULT = Entire Mechanical System (and insulation) was Replaced**





Older building – fan coil unit created condensation, rust and mold.







Mold on interior wall of same building, caused by failed chilled water insulation.

## Various

- Flashed integration between existing buildings.
- Integrated downspouts and drains
- Gutters and maintenance, vegetation growth and root infiltration/damage





Old building wall at intersection between old and new roofs





Drain pipe from new roof behind this.





Basement wall where water migrated downward.





Existing roof at new roof interface and flashing.

HIS  
HA  
FOU











Interior water damage





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Historic Hawai'i Foundation and Chinatown Preservation Talks

# Case Study #5: Belt and suspenders

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## Commercial

- Interior Water Damage
- Historic materials and building





Coral Masonry from  
Monarchy Period





Basement water damage at walls and younger supports



Source?



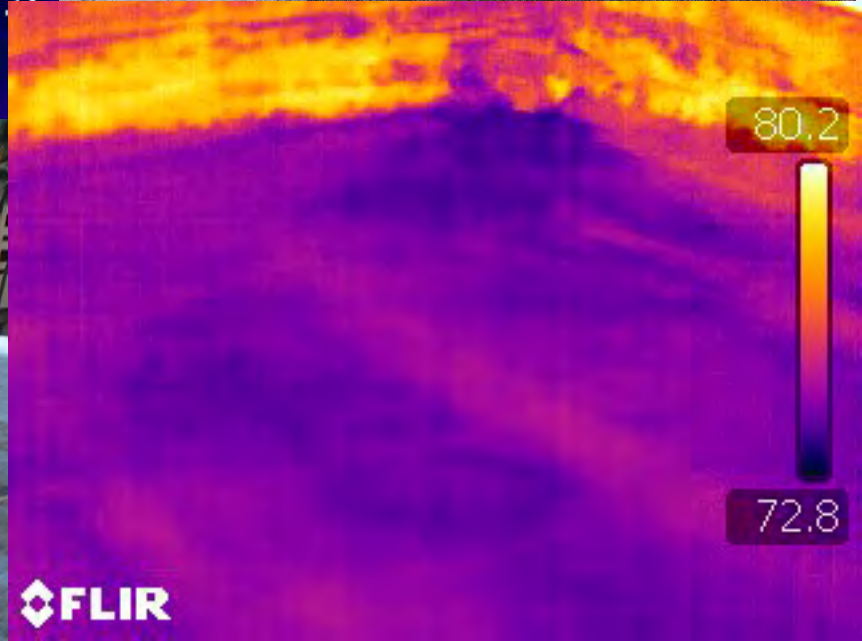
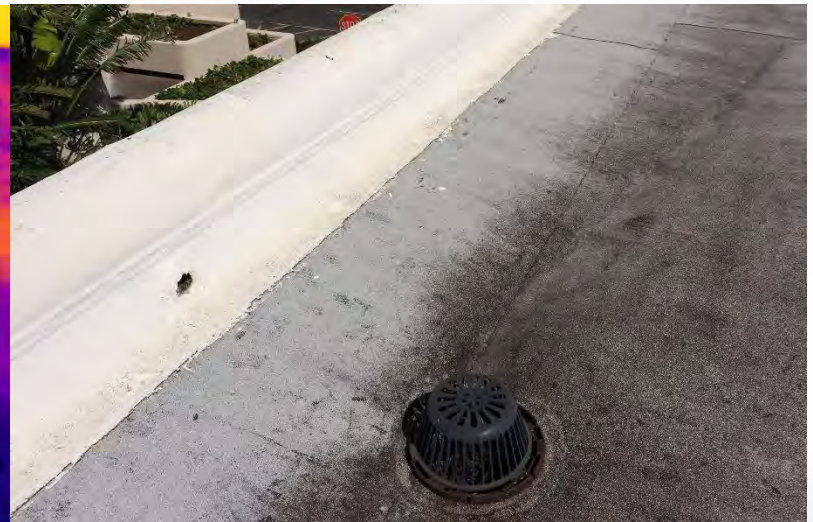
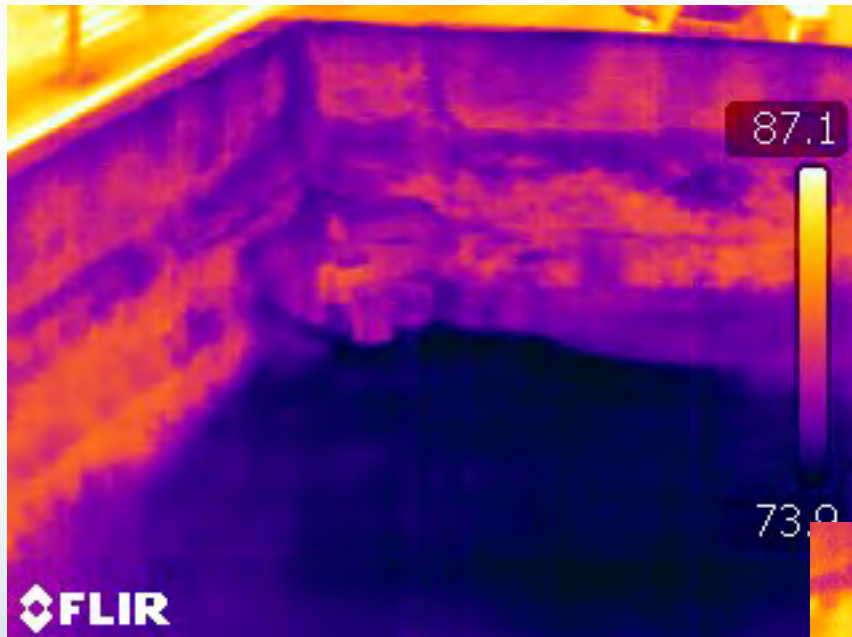




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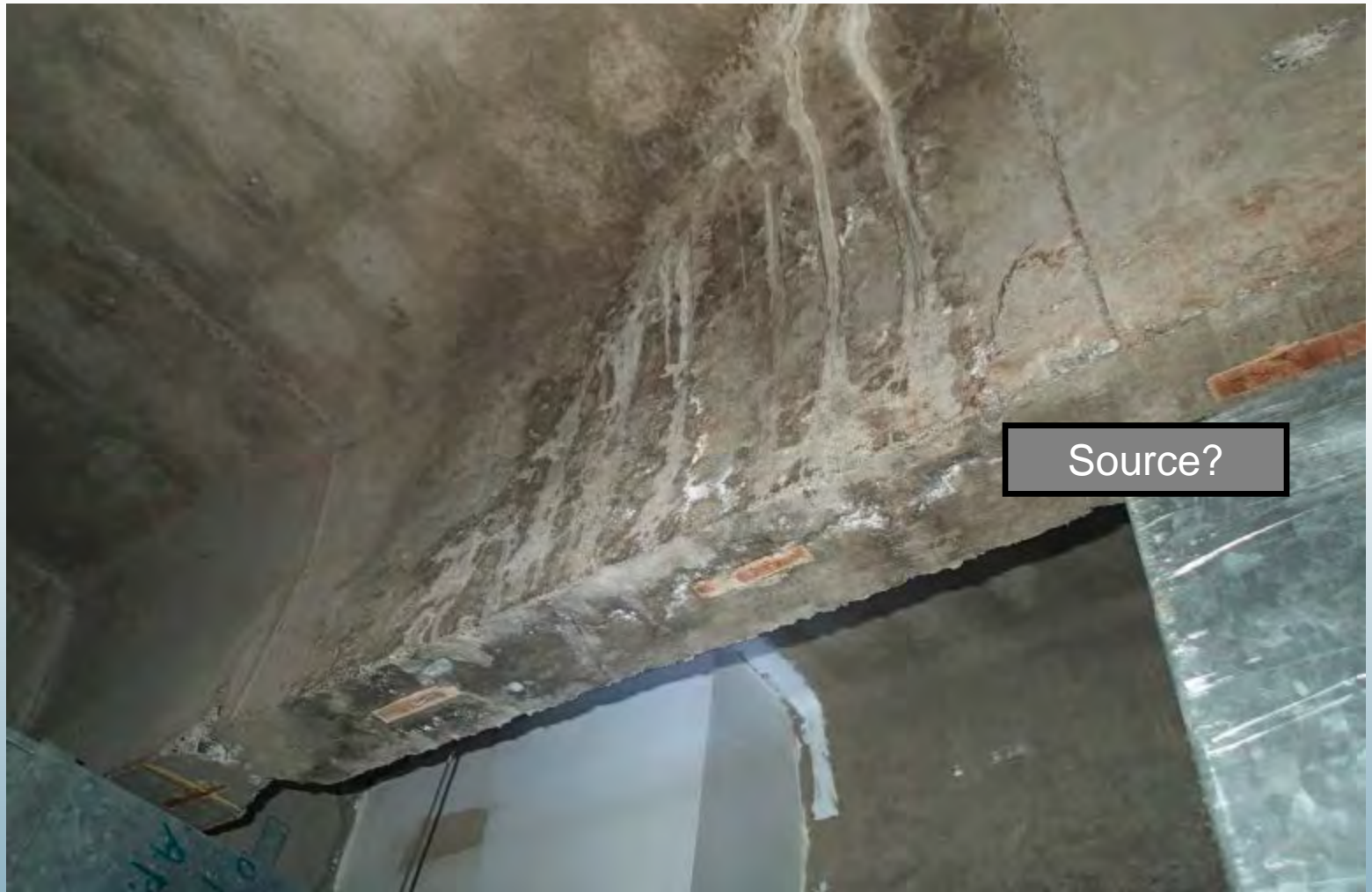
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Source?





# Strategy?

1. Remove/prepare the existing plaster that is covering the interior masonry wall surfaces. Removal or preparation of the existing plaster will depend on the integrity of the plaster to masonry interface and the recommendation of the manufacturer.
2. Apply floor to ceiling mock-ups of three manufacturer's cementitious waterproof coatings four feet wide to the masonry wall surface.
3. Monitor the performance of the coatings and select the preferred product for the completion of the remaining basement walls.
4. If unsuccessful, consider building a new waterproofed interior wall and abandon waterproofing of exterior structural wall.



# Case Study #6: Metal Roofs

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## Various

- Interior Water Damage
- Historic materials and building

# Case Study #6: Metal Roofs



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# Case Study #6: Metal Roofs



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# Case Study #7: Inappropriate Roof Details

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## Various

- Interior Water Damage
- Historic materials and building

# Case Study #7: Inappropriate Roof Details



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# Case Study #7: Inappropriate Roof Details



# Case Study #8: Masonry Walls & Joints

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## Commercial

- Interior Water Damage
- Historic materials and building



# Case Study #8: Masonry Walls & Joints



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# Case Study #9: Crawlspace

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## Commercial

- Water Intrusion?
- Smells?
- Historic materials and building











# Case Study #10: Stucco Walls

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## Commercial

- Interior Water Damage
- Historic materials and building

# Case Study #11: Stucco Walls



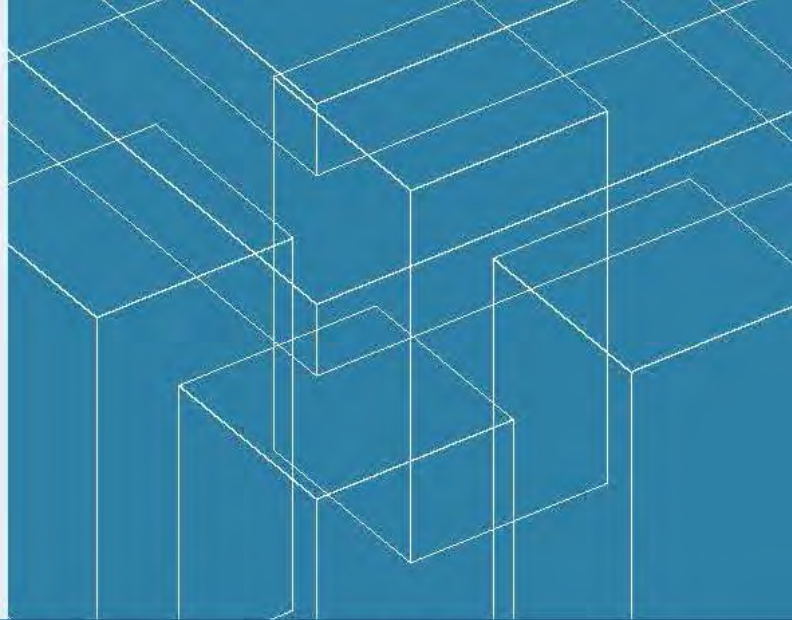
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# Moral of the Story?

1. Yes, it is that complicated! It's no longer a world of just concrete, shingles, and paint.
2. Hire a knowledgeable building envelope consultant or similar design professional.
3. Make sure Developers and Owners are aware of risks. Have them sign off when important systems are "VE'd" out.
4. Conformance observations protect Owners investments and Architects okole's.
5. Cheaper does not = Better.
  1. Reserve Studies & Operating Costs?
  2. Contractors – VE or PE?
6. Do the right thing. Pennywise is pound foolish.



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**Mahalo!**

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May we take any further questions?



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