Roofing and Waterproofing Construction Defects

$$$$ Decision Tools

Bay Area FM Conference

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- **Education:** B.S., Civil Engineering, Santa Clara University
- **Registration:** P.E., Civil Engineering, California, Washington, Nevada, and Hawaii
- **Certification:** Registered Roof Consultant (RRC), Roof Consultants Institute, and Registered Waterproofing Consultant (RWC)
- **Overview:**
  - CEO and Senior Principal at Allana Buick & Bers.
  - Former Turner Construction Employee (Project Engineering and Superintendent)
  - Over 37 years experience providing superior technical standards in all aspects of building technology and energy efficiency.
  - Principal consultant in forensic investigations of building assemblies, failure analysis, evaluation and design of building infrastructure and building envelope evaluation and design.
  - Expert in all aspects of building envelope technology.
  - Completed numerous new construction, addition, rehabilitation, remodel and modernization projects for public and private sector clients.
  - Specialization in siding, roofing, cement plaster, wood, water intrusion damage, window assemblies, storefronts, below grade waterproofing, energy efficiency, solar engineering and complex building envelope and mechanical assemblies.

ABBAE Firm Overview

- Allana Buick & Bers (ABBAE) is an Architectural Engineering firm specializing in Building Envelope Systems
- ABBAE is one of the 5 largest building envelope consultants in the country
- ABBAE has over 33 years of experience & over 12,500 projects
- ABBAE is also a leading Forensic Defect firm with hundreds of forensic projects (litigation)
- Locations – 16 offices across California, Nevada, North Carolina, Oklahoma, Oregon, Texas, Virginia, Washington, Colorado and Hawaii

Staff & In-House Expertise

- Licensed Professional Engineers – Civil, Structural, and Mechanical
- Registered Architects
- Building Enclosure Commissioning Process Providers (BECxPs)
- Registered Building Envelope Consultant (RBEC)
- Registered Roofing Consultants (RRCs)
- Registered Waterproofing Consultants (RWCs)
- Registered Exterior Wall Consultant (REWCs)
- Registered Roof Observers (RROs)
- Certified Exterior Insulation and Finish System (EIFS) inspectors
- Curtain Wall Specialists
- ICC Certified Building Inspectors
- Quality Assurance Monitors
- Water Testing Experts
- Leak Investigation and Diagnosis Experts
- Infrared Imaging and Nuclear Moisture Scanning Experts

ABBAE Building Expertise

- Building Envelope Systems
  - Roofing Systems
    - High-Slope/Low-Slope Roofs
    - Green/Garden Roofs
    - Drainage Systems
    - Pedestrian Plazas
  - Exterior Wall Systems
    - Wall Cladding/Siding/GFRC/pre-cast
    - EIFS/cement plaster/stucco
    - Sheet Metal Flashings
  - Windows and Glazing Systems
    - Punched Windows
    - Curtain Wall/Window Wall Systems
    - Sliding Glass Doors
    - Skylights

- Building Envelope Systems (cont'd)
  - Roofing & Waterproofing Systems
    - Deck/Balcony/Lanai Waterproofing
    - Podium Waterproofing
    - Pool/Spa Deck Waterproofing
    - Above-Grade/Below-Grade Waterproofing
    - All types of low and steep sloped roofing
  - Commissioning BECx
    - OPR/BOD/Commissioning Plan
- Mechanical/HVAC Systems
  - HVAC design
  - Plumbing systems
  - Commissioning and testing

ABBAE Core Services

- Consulting and third-party peer review services
- Engineer of record for building envelope systems
- Contract administration services
- Inspection services (usually direct with owner)
- Air and water performance testing
- Mock-up design, observation, and testing
- Building assessments and forensic investigations
- Litigation support and expert witness services
- Educational seminars with AIA credits

You Will Learn…

- Common construction defects in roofing, waterproofing and the building envelope
- Your legal protections
- How this means $$ for your company – if caught early enough
- Early recognition of symptoms and problems
- The difference between owner maintenance and contractor repairs
- Added plus: evaluation tool for future work

Our Objective Today:

- Introduce you to common construction defects
- Describe early detection techniques
- Give pointers on how to work with the contractor/builder
- What to do if you have waited too long

Common Construction Defects

- Roofs, building envelope and waterproofing issues are complex – every facility is different
- We have selected these systems to review:
  - Roofs
  - Walls
  - Windows
  - Chilled water lines
  - Exterior concrete surfaces

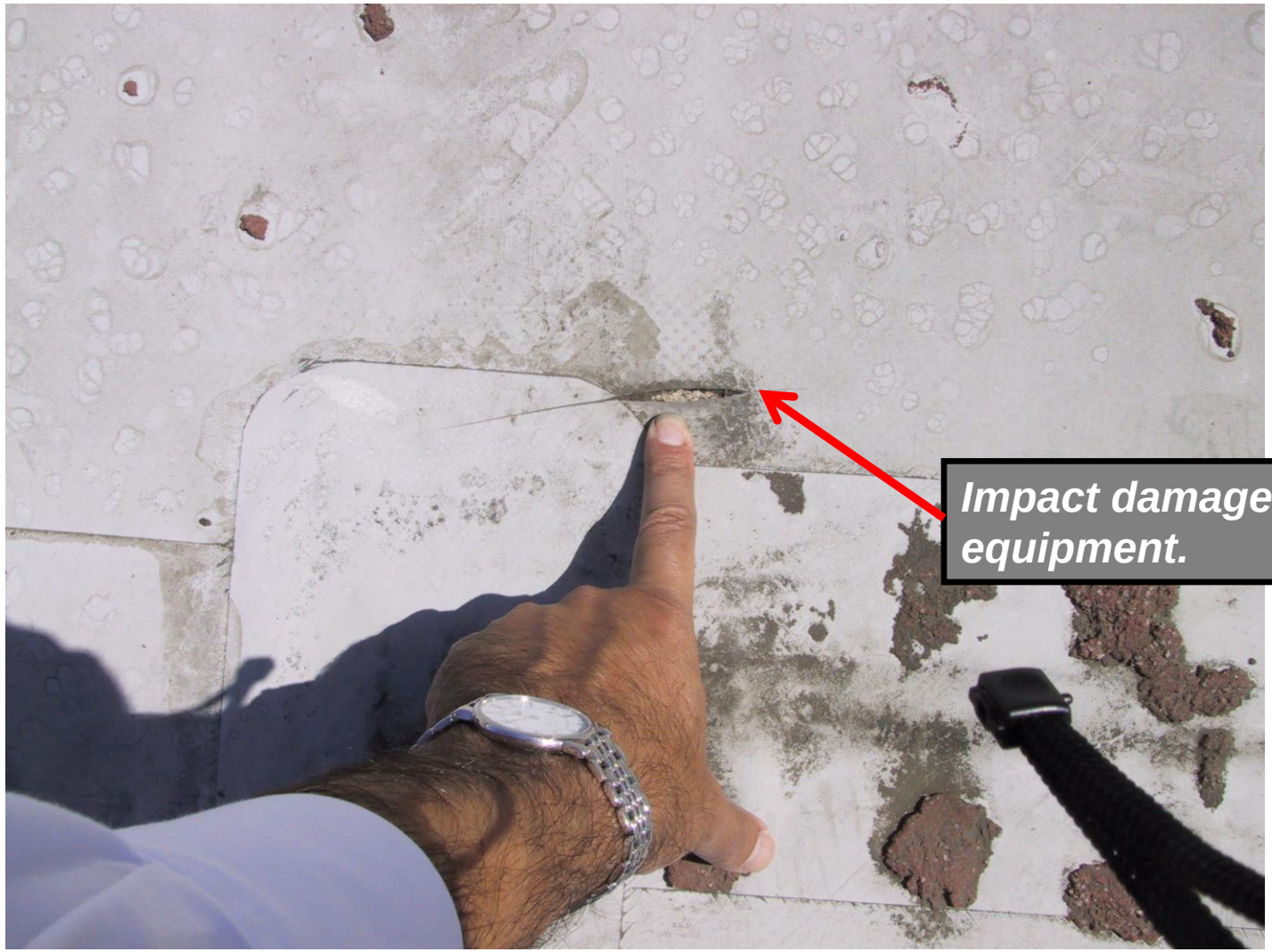
In built up roofs, bitumen is more than just adhesive – it should flow through pores in felt, to form a system.

Roof Defects

Lack of brooming results in poor adhesion.

Improper application of roofing courses

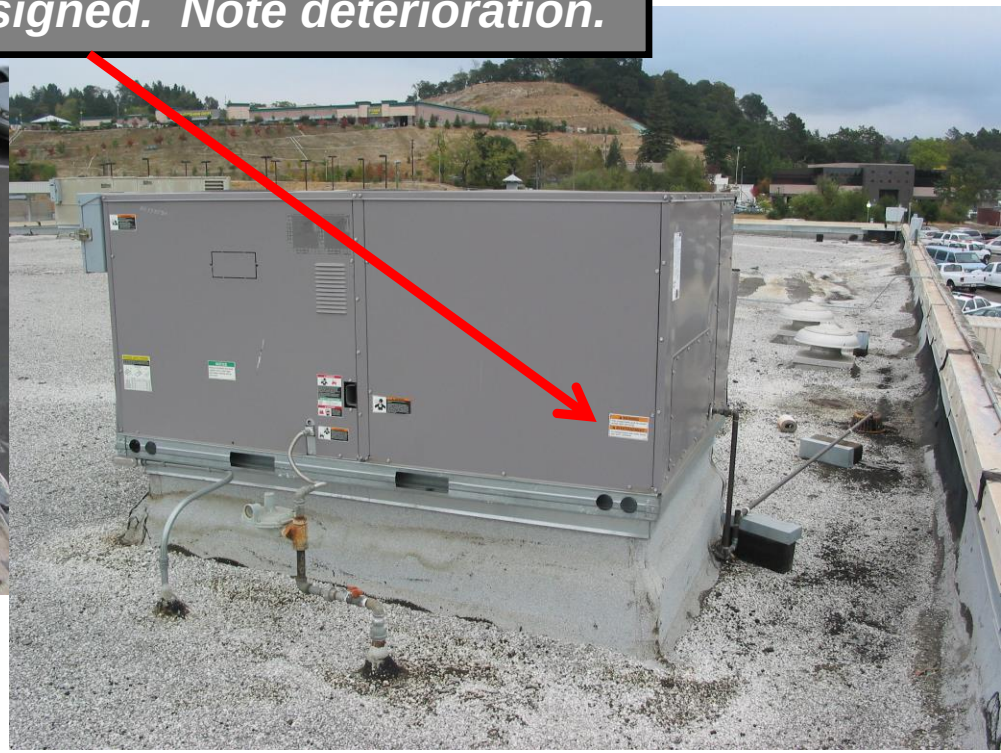
Roof Defects



Roof Defects – whose responsibility?

Roof Defects – whose responsibility?

Crickets are undersized in some locations, or not provided at all. Need to be deeper and redesigned. Note deterioration.



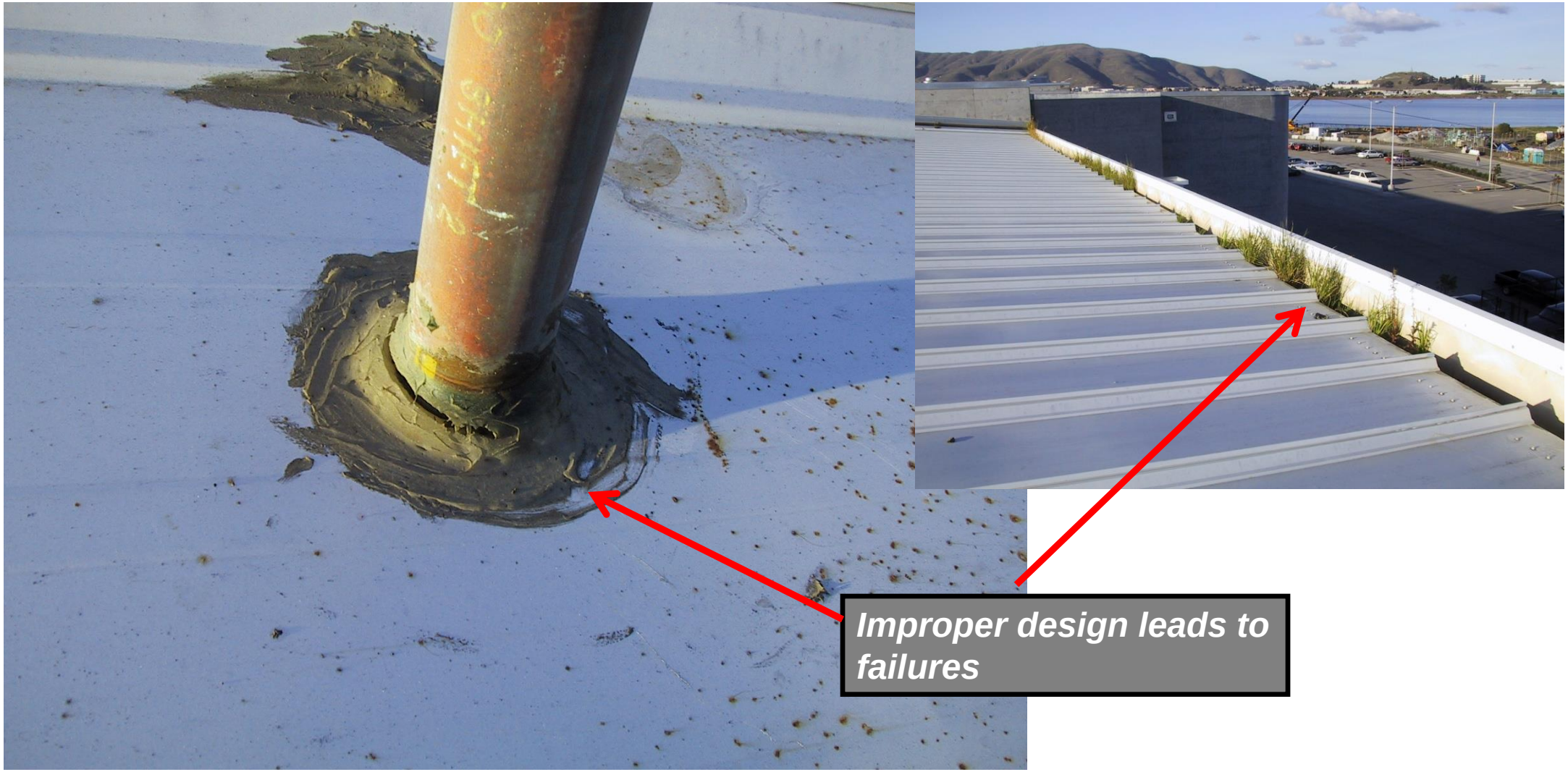
Roof Defects – whose responsibility?

Two examples of conduits installation s that were not designed – installed without proper flashing.

Roof Defects –whose responsibility?

Roof Defects

An example of a pipe penetration system that was not designed properly.



Roof Defects – whose responsibility?

Base flashings were not surfaced with a protective layer or cap sheet. Granules on the cap sheet protect the membrane from UV rays. Base flashings are also exhibiting signs of deterioration. See photo below.

Congested foam roof

Roof Defects

Roof Defects

Roof Defects

An example of a premature coating failure – a persistent problem with foam.

Coating has delaminated after only a few years, exposing the foam to water intrusion.

Roof Defects

Roof Defects

Hidden Mold

Walls

Walls

Walls

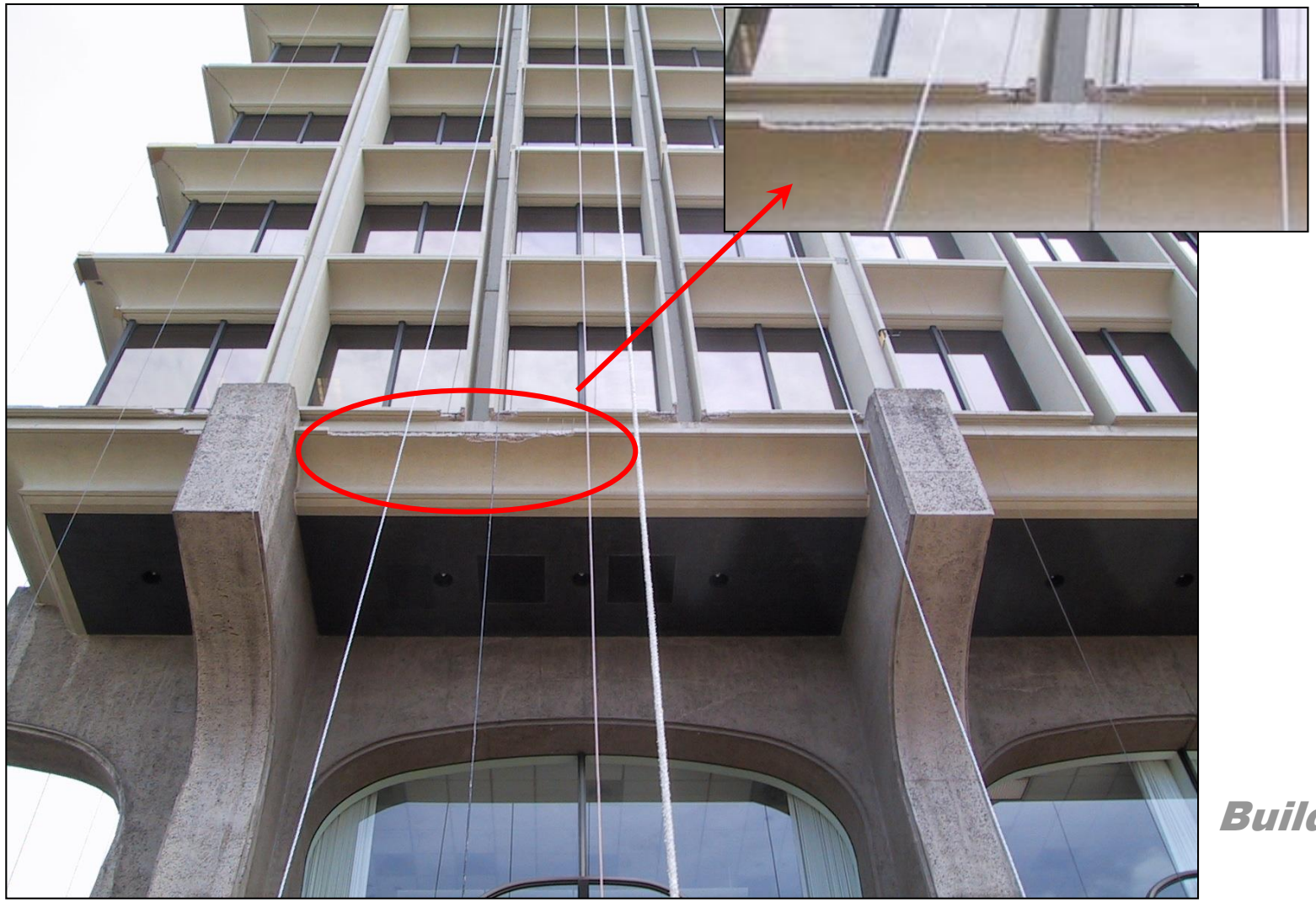
Window Defects

Chilled Water Line Leaks

Mechanical Defects

Mechanical Defects

Concrete Spalling



Building Envelope

Building Envelope

Building Envelope

Legal Protection Against Construction Defects

- California law holds contractors responsible for construction defects, for 10 years after completion of construction
- Includes: new buildings and major capital projects such as roofing and waterproofing
- Once a defect is known, the statue of limitation runs for 3 years more, *NOT 10!!*
- After either time runs out, the contractor can not be held responsible!!!

$$$$

- Roofing and waterproofing repair is expensive
- Avoid problems by evaluation and knowing the life expectancy of materials
- Know who/what caused damages
- The Contractor is responsible for construction defects, NOT YOU!!!!

Maintenance Vs. Repairs

- Inherent construction defects, requiring repairs, are not regular maintenance!
- Construction defects are the responsibility of the builder/contractor
- Know what falls outside of regular maintenance

In Order To Define What is Maintenance and What Is A Defect:

1. Define life expectancy of roofing, sealants, windows, walls, waterproofing, painting, etc.
2. Define what is maintenance and what is contractor repair
3. Repair, required of roofing, sealants, waterproofing, building exteriors, windows, within ten years of completion = construction defect

Life Expectancies…

- Sealants: 10 to 25 years
- Roofs: 20 to 30 years
- Below grade waterproofing: Life of the building
- Windows: Life of the building
- Window gaskets: 15 to 20 years
- Stucco: Life of the building
- Painting: 5 to 7 years
- Hardboard siding: 25 years

Owner Responsibility for Ongoing Maintenance

- Frequently Occurring Items Like
  - Gutter cleaning
  - Debris cleaning
  - Annual inspection of roofs, sealants, windows, walls and exterior façade
  - Tree trimming
  - Low pressure power washing exteriors of building

Owner Responsibility For One Time Repairs

- Damage from trees and roots
- Damage from cars and foot traffic
- Damage from vandalism or abuse
- Severe storm, earthquake, hail, hurricane, and other natural phenomena
- Damage from oil and chemicals

Contractor Responsibility for Defective Construction

- If a 20 year type roofing system needs “repairs” other than items on two previous slides, within the first ten years
- If 10 year sealant types need replacement or fail in less than their life expectancy
- If windows leak in fewer than 10 years
- If other materials that do not last their normally expected lives, and fail within the first ten years

Evaluation

- Study historic leak and repair patterns
- Record when seen
- Visual observation by a trained eye
- Leak testing, non-destructive moisture testing
- Destructive testing

Recognizing Leaks and Distress

- Water stains
- Where to look
- What to look for
- Signs of leaks
- Signs of distress

Thank you!!

Evaluation

Look for Stains, No Matter How Minor or Small

Evaluation

Investigate: Roof leak or HVAC Condensation?

Evaluation

Leak Detection…Carpet Tack Strip Tells the Story

Evaluation

Non-Destructive Testing

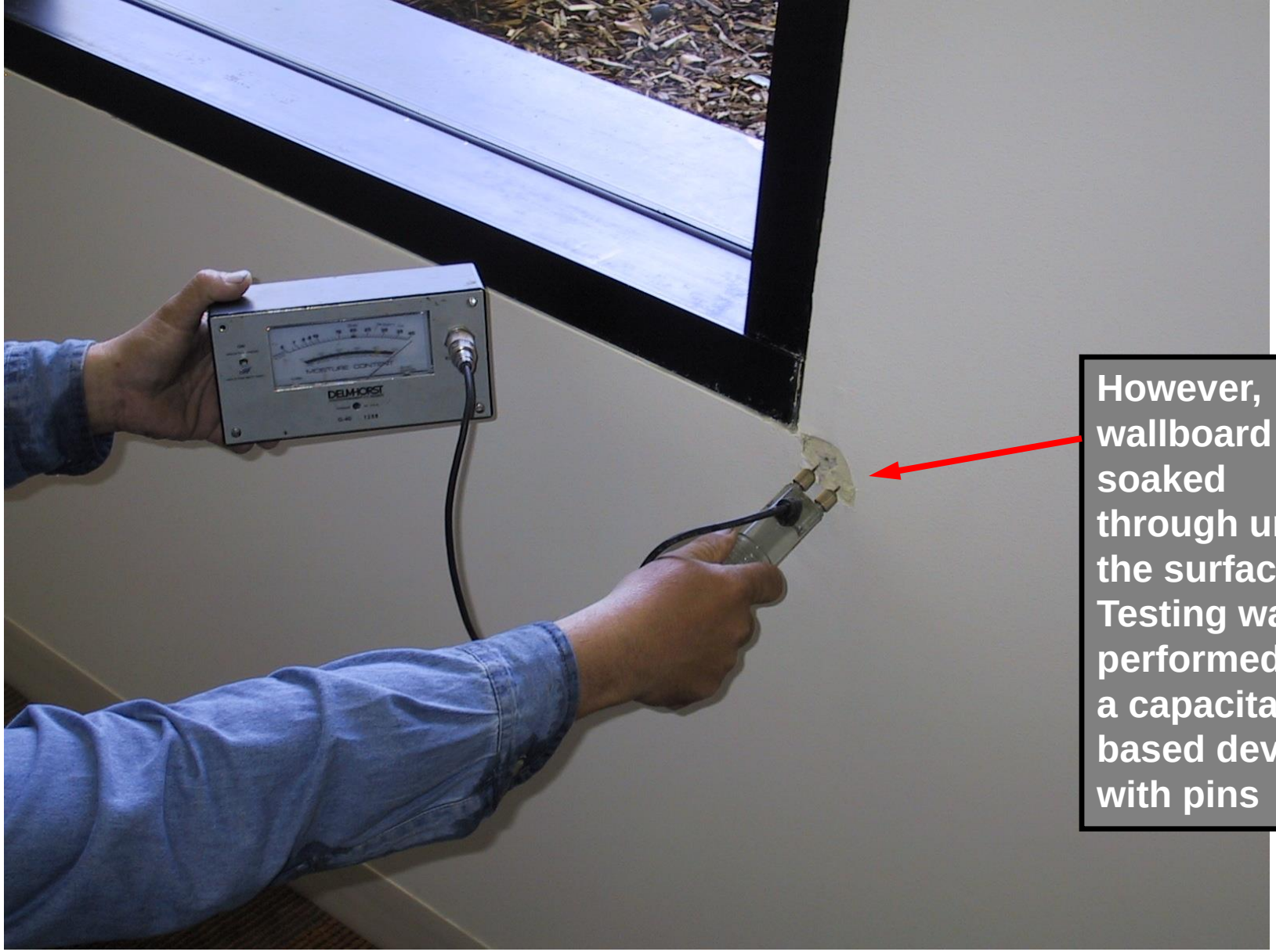
- Water testing, various protocols
- Nuclear troxler gauge
- Tramex non-penetrating capacitance gauge
- Delmhorst pin based capacitance gauge


Testing started at the sill and worked up. Interior leaks began to develop

Evaluation

During one test, water appeared on carpet, but was not visible on wall.

Evaluation



However, wallboard was soaked through under the surface. Testing was performed with a capacitance based device with pins

Evaluation

Nuclear Troxler Testing Equipment

Left: Taking Measurements
Right: Test cuts to corroborate result of saturated insulation

Evaluation

If You Identify Defective Construction……..

- Immediately notify a supervisor or principal of the company
- For re-roofing, re-painting, replacement sealants, etc., 10 Year construction statues may apply
- Approach the contractor and
  - Work with them for repairs/replacement
  - Use the services of a consultant
  - Have your attorney become involved if necessary

Design Rules of Thumb

- Use appropriate details
- Specify and install flexible flashings and underlayments.
- Properly select trim materials
- Provide constructability reviews
- Specify sealants that are appropriate for the use