Building Envelope

BEST PRACTICES WORKSHOP







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Tom McHale, The HOW Group

Waz Baszta, Parksite Co. C/O DuPont Performance Building Solutions



Speakers

Thanks to these members for their time and expertise putting together this presentation.

Building Envelope Subcommittee:

- Respond to ongoing problems with water intrusion and damage.
- Recognize owners'/renters' health, safety, and equity
- Identify L+I goals to mitigate these issues.
- Improve practices and the adoption of standards beyond code minimums.
- Position the BIA as a trusted resource.
- Monitor proposed changes to regulation, permitting and inspections.

Building Innovation Committee

Promotes the understanding and practice of sustainable building techniques and design strategies in the construction industry that lessen negative impacts on the environment and benefit the health and well-being of occupants.



Building Science

Presented by Karl Feucht, Benjamin Obdyke, Inc.

Building Science

- To understand the impact of physics and material selections on a given structure and how it endures moisture and heat fluctuations.
- Building science is the collection of <u>scientific knowledge</u> that focuses on the analysis of the physical phenomena affecting buildings. *Building physics, architectural science* and *applied physics* are terms used for the knowledge domain that overlaps with building science. wikipedia
- Building science is a field of knowledge that draws upon physics, chemistry, engineering, architecture, and the life sciences. Understanding the physical behavior of the building as a system and how this impacts <u>energy efficiency</u>, durability, <u>comfort</u> and <u>indoor air quality</u> is essential to innovating high-performance buildings. Modern building science attempts to work with models of the *building as a system*, and to apply empirical techniques to the effective solution of design problems. wdbg.org

Considerations for Wall Design

ENERGY

MOISTURE



Driving Forces of Moisture

- Air Pressure
- Hydrostatic Pressure
- Gravity
- Concentration Gradients
- Capillarity
- Momentum
- Surface Tension









CONTINUITY

There are multiple ways to install all layers depending on climate and products being used, but the most important aspect is continuity. The control layers are made up of several different components linked together to create a continuous barrier.



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Building Envelope Control Layers Order of importance

Water Control Layer:

Manage liquid water by directing it away from structure after rain events

• Air Control Layer:

Manage pressure differences between the inside and outside of the structure

Vapor Control Layer:

Manage water in a gas form as it moves inside and outside of the structure

Thermal Control Layer:

Manage temperature differences between the inside and outside of the structure

Basic Principles of Moisture Control

"The control of moisture in buildings is key to their durability, functionality, health, and efficiency.

Understanding the sources of moisture and the mechanisms by which they move within the building and the building enclosure allows professionals to design better buildings and conditioning systems."

John Straube, ASHRAE Journal Jan 2002



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wetting

Moisture Management Methods



Check claddings and flashings for **deflection** (aim to keep water out)

Arrange for **drainage** paths to outside (should water get in)

Arrange for ventilation and vapour diffusion **drying** (to eliminate remaining water)

Choose components that are **durable** for conditions (to avoid damage while drying) D1 Deflection by eaves and cladding

D3 Drying by diffusion and ventilation D4 Durable materials for the conditions

INSIDE

D2 Drainage of water from behind cladding

http://www.weepa.com.au/ dbase upl/4Ds lg.jpg

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11/3/2021

Manage the Moisture Balance to Avoid Potential Long Term Durability Risks



Managing Bulk Water

Redundancy – Cladding + Second Line of Defense

- Water-resistive barriers
- Flashing

Material Choice

- Performance Water & Resistance
- Allow Drying
- Durability

Installation -- Continuity

- Shingling correctly
- Beware of hidden water traps



Stucco Over Flat Wrap and Insufficient Drainage



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Stucco Remediation

- Improper window flashing details
- Lack of rainscreen installation



Reverse Flashing



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Critical Details

- Exterior foam/WRB not taped.
- Bottom plate below grade.



Critical Details





Foundations

Presented by Chris Stigler, Blackney Hayes Architects

Protecting the Foundation

Tie weather barrier to damp proofing/waterproofing



Poorly sealed below slab vapor barrier



Protecting the Foundation

Improper Grading



Protecting the Foundation

Discontinuous damp proofing







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Wall Assembly

Presented by Chris Stigler, Blackney Hayes Architects and Waz Baszta, Parksite Co. C/O DuPont Performance Building Solutions

Historical Robust Overhangs Very "Rare" today

The Four Ds of Moisture Management



Proper Water Management

Typical Roof-Wall-Foundation

Air & Water Barrier (WRB), Rainscreens with selected Façade choices as the First Line of Defense draining.



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Wall Assembly



Poorly installed flashing

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Wall Assembly

Damaged/improperly installed weather barrier



Mechanically Fastened Water Resistance Barrier

Improper installation and detailing needed

"Reverse flashing" repairs

Incomplete wall protection prior to siding installation







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Mechanically Fastened Water Resistance Barrier

Incomplete and careless installation detailing/tapping

"Reverse shingle"

Incomplete installation and termination







Coated Sheathing Water Resistance Barrier

Improper installations. Emphasize it's critical to follow manufacturer's installation guidelines. Very little room for installation errors.


Fluid Applied Liquid Weather Resistant Barrier

Improper installation, incomplete wall coverage per manufacturer's installation for specified performance.

Seams not treated properly



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Mechanically Installed Building Wrap

- Follow manufacturer's installation guide
- Maintain continuity and proper terminations



Windows and Doors

Presented by Chris Stigler, Blackney Hayes Architects and Waz Baszta, Parksite Co. C/O DuPont Performance Building Solutions

Window & Door "Fenestrations" Installation



- Air & Water Barrier of choice
- Window/Door "Follow Install Pay attention to Type integral vs. non integral
- Sill Pan
- Jamb & Head Flashing
- Seal all terminations
- Create interior perimeter seal sealant /foam

Window & Door "Fenestrations" Installation





Missing Pan and Threshold



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Window Flashing Improper Installation

Peel and stick flashing not properly adhering and sealing.

Will this work?



Window Flashing Improper Installation

Peel and stick flashing not properly adhering and sealing



Flashing not completely installed correctly



Wall Plane Transitions

Presented by Chris Stigler, Blackney Hayes Architects and Waz Baszta, Parksite Co. C/O DuPont Performance Building Solutions

Kick Out Flashing Details

Improper detailing leads to major damage



Proper robust detailing



Flashing Beam Pockets, Deck

Beam pockets critical to detail with flashing



Deck to wall flashing detail critical



Penetrations HVAC, Electrical, Plumbing, Hose Bibs, Scuppers

Presented by Chris Stigler, Blackney Hayes Architects and Waz Baszta, Parksite Co. C/O DuPont Performance Building Solutions

Improper Penetration Detailing

Penetration system not correctly sized or selected for appropriate PVC Pipe. "Note gap."

Additional manufacturer product added to alleviate water intrusion



Improper Penetration Detailing

No flashing or sealing. High risk of water intrusion.

Scuppers must have robust detailing. Can be a major risk of water intrusion.



Improper Penetration Detailing

Not sealed. High risk of water intrusion.

Improper use of product and selected field modification. Not correctly sized. Very high risk of water intrusion.



Penetration Treatment Methods



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Best Practices

Presented by Chris Stigler, Blackney Hayes Architects and Waz Baszta, Parksite Co. C/O DuPont Performance Building Solutions

Proper Sequencing is Critical



- Wall Cap flashing should have been installed prior to masonry on perpendicular wall.
- No way to properly flash the cap flashing to the weather barrier

Project Management Best Practices



- Mockup panel
- Preconstruction meeting
- Involve your product reps
- Involve your architect.
- Project manager knowledge and oversight
- Proper coordination and sequencing
- Follow manufacturers' instructions

Roofs and Decks

Presented by Brian Spanier and Alexandra Jelencovich, Philadelphia Roof Management



Philadelphia Roofs



Low Slope, Flat, & Walkable Roofs/Decks

- Roof deck waterproofing protects the roof substrate & other aspects of the building envelope.
- The City of Philadelphia has limited building code regarding flashing, drainage & waterproofing systems. Coordination between the architect, builder site manager & sub-contractor is essential.
- Philadelphia is experiencing a surplus of failed roof deck waterproofing systems.
 Mostly due to improper flashing of the building envelope built between 2010-2020.
- Education is vital for the city inspectors & builders' site management on roof deck flashing & waterproofing.

Most Common Waterproofing Systems

Non-Walkable

- **TPO**
- EPDM
- Torchdown/Bitumen

Walkable

- Fiberglass
- Hybrid Polyurea/MMA/PMMA (Ultraflex/Endurit/Soprema)
- Rolled PVC (Duredek/Dec Tec)



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Roof Drainage

Oversite of Construction Manager

- Confirming pitch is correct prior to waterproofing being installed
- Ensuring drain is placed correctly
- Ensuring overflow is installed
- Placing crickets appropriately
- Ensuring drip edge is dry & swelling of the subfloor does not exists

Top Drainage Priorities

- Framers: accurate roof slope pitched towards the drain
- **Roofers:** proper seal of the main drains + overflows
- Siding: proper install of façade material around scupper box to ensure downward pitch exists + proper seal of scupper box on exterior

Drainage Deficiencies

Can you identify the deficiency & responsible party?



Drainage Deficiencies

Can you identify the deficiency & responsible party?



Roofer: incorrect scupper drain + missing overflow drain.

Construction Manager also responsible.



Framer: pitch is less than .125:12 (<1/8 per 1 linear ft)

Ideal pitch is .25:12 (1/4" per 1 linear ft)

Construction Manager also responsible.



Back Pitched Scupper: water shed cannot completely evacuate into the drainage system, creating ponding on the roof floor.

Back pitching can allow water intrusion under the membrane if not properly sealed.

The drainage point must exist at the absolute lowest point of the drainage plane.

It is essential for construction sequencing to occur quickly to avoid deformation of the roof sub floor.

Swelling results quickly & has a dramatic affect on the overall pitch of the finish plywood.

Flashing

Oversite of Construction Manager

- Coordination of subs & sequencing of materials installed
- Knowledge of building materials
- Knowledge of best practice installation
- Identifying deficiencies prior to CO



Pack out allows siding to tuck under PVC



Siding termination properly tucked up & under PVC

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Top Flashing Priorities

- Framers: accurate pack out on parapet wall caps, pilot house roof, & drip edges for selected façade material
- Roofers: utilizing non-rot material on interior/exterior of parapet walls, pilot roof perimeter, & drip edges
- Siding: precise tuck of façade termination up & under non-rot material on parapet walls, pilot house roof perimeter, & drip edges

Flashing Deficiencies

Can you identify the deficiency & responsible party?



Flashing Deficiencies

Can you identify the deficiency & responsible party?



Framer: incorrect pack out on exterior side wall; brick could not fit behind; brick sub cut the PVC & waterproofing.

Construction Manager also responsible.



Roofer: pack out is correct; incorrect size of vertical cap.

Siding: stucco termination exposed causing entry point for moisture; stucco not properly tucked up & under vertical cap.

Construction Manager also responsible.



Sider: pack out is correct; vertical drip edge properly counter flashing siding termination; corner piece of siding is not properly tucked up & under vertical drip edge.

Construction Management also responsible.

Best practice flashing starts with the pack out & drip edge size. If pack out is insufficient, the roofer cannot obtain the proper counter flashing with the vertical cap; the sider cannot properly tuck the siding up & under vertical cap.

All parties responsible for not flagging deficiency at each phase of installation.

Flashing Deficiencies

Flashing Deficiency Results

- Once the parapet wall coping takes on moisture, the moisture travels down behind the façade (siding/stucco) & under the waterproofing membrane on the floor.
- The wood substrate holds moisture & tries to evaporate causing seams to open & crack.
- The open seams/cracks becomes another area of water penetration.
 Wood substrate begins to rot.



Door Flashing

Oversite of Construction Manager

- Coordination of subs & sequencing of materials installed
- Knowledge of building materials
- Knowledge of best practice installation
- Identifying deficiencies prior to CO

Top Door Flashing Priorities

- Framers: accurate wrapping & layering of weather resistant barrier over sheathing; OR proper sealing of zip system seams, corners & terminations; in addition, accurate installation door/sill pan flashing
- Roofers: precise application of waterproofing system up & over door sill/threshold
- Siding: overhead flashing of door; proper layering of moisture barrier wrap

Door Flashing Deficiencies

Can you identify the deficiency & responsible party?



Door Flashing Deficiencies

Can you identify the deficiency & responsible party?



Framer: improper installation of weather barrier around door threshold.

Construction Manager also responsible.



Framer: lack of sill pan installation

Roofer: lack of waterproofing installed up & over threshold

Construction Manager also responsible.



Framer: improper layering of weather barrier; weather barrier should overlap sill pan to delivery water into pan.

Construction Manager also responsible.

Door Flashing Deficiencies

Door Flashing Deficiency Results

- Water sheds down the face of the door & funnels in the lower corners of the exterior door. Without proper sill pan flashing, the moisture can overcome the door weather stripping and travel into the home.
- Moisture can travel under the membrane, causing cracks and fissures on the roof deck floor, resulting in additional areas for water to penetrate.
- Sill pans are required to properly waterproof the threshold, in addition to the waterproofing membrane.
- A properly rated storm door can also alleviate this area of water intrusion.

Proper sequencing & coordination of the rough opening wrap, sill pan, and securing of door is paramount.

Knowledge of waterproofing materials and installation best practices are vital to keep water intrusion out of the home.

Takeaways

- Adopt standards and practices that exceed code
- Site supervision/communication is critical
- Proper sequencing is key
- Follow manufacturer installation instructions
- Benefits for air barrier
- All in this together

Builder Warranties

Presented by Phil Dunlevy, 2-10 Home Buyers Warranty



Are you protected?

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Managing Moisture: Legal Strategies for Addressing Water Infiltration

Presented by Lane F. Kelman and Matthew R. Skaroff from Cohen Seglias

Meet the Presenters

- Lane Kelman is a partner in the Construction Group at Cohen Seglias
- Matt Skaroff is an associate in the Construction Group at Cohen Seglias
- We are construction litigators
- We represent contractors, subcontractors, developers, and design professionals
- We typically get involved when there are issues and claims
- In this presentation, we will address what happens once a claim arises and work backwards

When a Water Infiltration Claim Arises

We will discuss:

- Time limits for claims
- Responsibility for defects
- Strategies when water infiltration claims arise
- Risks of consumer lawsuits

Statutes of limitations & Statutes of Repose

- A lawsuit must be initiated within the statute of limitations (SOL)
- SOL for Breach of Contract in Pennsylvania = 4 years
- SOL for Professional Negligence in Pennsylvania = 2 years
- However, SOLs do not start running until the defect has been discovered or reasonably should have been discovered

Statutes of limitations & Statutes of Repose

- Discovery Rule:
 - If a defect in workmanship is discovered 4 years after completion, a party will have 4 years from that point to bring a breach of contract action
- Statute of Repose for construction defects is 12 years
 - This trumps everything
 - No matter when a construction defect discovered, a lawsuit cannot be filed after 12years from the date of construction or design

Types of Defects and Responsibility

Cause of Defect	Responsible Party
Design Deficiency	
Product/Material Insufficiency	
Construction Process Failure	
Operations/Maintenance Issue	

Types of Defects and Responsibility

Cause of Defect	Responsible Party
Design Deficiency	Designer
Product/Material Insufficiency	Supplier
Construction Process Failure	Contractor/Subcontractor
Operations/Maintenance Issue	Owner

Holding a Party Responsible

- Responsibility will flow through contractual relationships
- Example: a supplier may bear ultimate responsibility for water infiltration, but the liability should flow through the contractual chain to get there
- Homeowner > Developer > GC > Subcontractor > Supplier
- Contracting with good companies reduces risk
 - Less risk of defective work
 - Less risk of "weak link" in the chain

What To Do When a Defect Claim Arises

- Put parties with whom you contracted on notice
- Thoroughly document the defects
- Evaluate cause and establish strategy
- Invoke contractual remedies
- Submit claim to insurance carrier

Notice and Documenting Claims

- Notice and documentation are essential for:
 - Avoiding spoliation
 - Meeting contract requirements
- Spoliation = the destruction of evidence
- Parties have remedies when evidence is spoliated
 - Dismissal of claim
 - Adverse inference

Notice and Documenting Claims

- Notice should invite party to investigate the defect
- Notice should come early
- You should document the claimed defect yourself
 - Videos
 - Photographs
- Consider engaging an expert to investigate and opine
 - Can provide testimony during trial

Invoking Contractual Protections

- You should include strong indemnification clauses in your contracts
 - *E.g.*, a subcontractor agrees to indemnify and defend contractor for all claims relating to subcontractor's work
- Upon notice of defect, parties should invoke clauses and demand indemnification and defense
- A strong clause should require reimbursement of damages, claims, attorneys' fees, and professional/expert fees

Other Contractual Protections

- Eliminate liability caps in contracts
 - Design professional contracts often include these
 - Supplier purchase orders often include these
- Insurance
 - Notify your carrier, along with any policy where you are an Additional Insured

Steps After Determining Cause of Defect

- Are you in the chain of liability?
 - E.g., contractor is in the chain if subcontractor responsible
 - *E.g.*, contractor is in the chain if supplier is responsible
- If so, notify and demand the responsible party to fix it
 - Cite indemnification provisions
 - Cite other contractual responsibility

Steps After Determining Cause of Defect

- What if the responsible party refuses to address the issue?
 - Deny responsibility, wait for a lawsuit, and file a third-party claim against the responsible party
 - Fix the issue and pursue the responsible party in a lawsuit
- What are the pros and cons of fixing the defect?

The Risks of a Consumer Lawsuit

- Pennsylvania has the Unfair Trade Practices and Consumer Protection Law (UTPCPL)
- "Making repairs, improvements, or replacements on real property of a nature or quality inferior to or below the standard agreed to in writing"
 - This constitutes a violation of the UTPCPL
- The UTPCPL provides for:
 - Punitive damages (damages x3)
 - Attorneys' fees

The Risks of a Consumer Lawsuit

- If a homeowner has been egregiously harmed, a court may be compelled to do justice
- If liability is clear and the damage serious, it may be a wise strategy move to remove the homeowner from the occasion
- Concern about veil piercing

Takeaways

- Be proactive in contract negotiation, addressing claims as they arise, and property pursuing/defending
- When a defect arises:
 - Put parties on notice
 - Document the defects
 - Invoke contractual protections
 - Put your carrier on notice
 - Develop a game plan

Questions?



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